28ºS ENVIRONMENTAL

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Acronyms, Abbreviations & Definitions

28 South	28 South Environmental Pty Ltd
ACHA	Aboriginal Cultural Heritage Assessment
AHD	Australian Height Datum
ALA	Atlas of Living Australia
AU	Assessment Unit
BPA	Biodiversity Planning Assessment. A Biodiversity Planning Assessment identifies the terrestrial ecological values in a region, or bioregion, according to their conservation significance. BPAs are used by governments, members of the community and landholders to make planning decisions about appropriate land use. https://www.qld.gov.au/environment/plants-animals/biodiversity/planning
Bushfire Management Zone	The Bushfire Management Zone comprising 1.4 ha occupies the northeast corner of the Impact Site and is comprised of Category B (Remnant) and Category C (High Value Regrowth) vegetation types. This is an area of ongoing bushfire management intended to reduce risk to nearby (proposed) residential development through maintenance of the ground and near ground parts of the community in a fuel reduced state.
CAR	Controlled Action Referral
CBD	Central Business District
CEMP	Construction Environmental Management Plan
Cherish	Cherish the Environment Foundation Limited
Concept RMP	Conceptual Rehabilitation Management Plan
Conservation Area 1	has the same meaning as Eastern (Enhancement) Corridor.
Conservation Area 2	has the same meaning as Northern (Enhancement) Corridor.
Conservation Area 3	has the same meaning as Western (Enhancement) Corridor.
Covenant (Statutory Covenant)	means the enduring protection mechanism to provide ongoing conservation protection, on the title of the land under Chapter 6 Part 4 Division 8A of the *Land Act 1994* (Qld)
CREVNT	Critically Endangered, Endangered, Vulnerable or Near Threatened species listed under the *Nature Conservation Act 1992* (Qld)
DBH	Diameter at Breast Height
DEECCW	Department of the Environment, Energy, Climate Change and Water, formerly DAWE (Commonwealth)
Directional fencing	Koala Exclusion Fencing installed around the entrances to underpasses to guide animals to the underpass portals.
Disturbance footprint	The permanent disturbance footprint to be occupied by detached residential dwellings (294 residential lots), medium density residential (2 lots) commercial facilities, roads and infrastructure, parks and multifunction spine is 27.49 ha.

Eastern Enhancement Corridor (eastern corridor)	Totalling 5.65 ha, this is the primary ecological corridor along Moogurrapum Creek containing riparian habitats and wetlands, affording north-south landscape linkages. Minor disturbance will occur in this area for grade changes along the interface with urban dedication, and establishment of WSUD stormwater management infrastructure. This area is largely vegetated with remnant and young regrowth. Ecological restoration will focus upon retaining existing elements and enhancing values through extensive plant-out. The restoration goal is to reinstate the pre-clear regional ecosystem mostly through assisted regeneration and reconstruction techniques. Wildlife management infrastructure will feature a 2.4 m x 3.0 m underpass beneath an internal road and exclusion/directional fencing to facilitate faunal movement between Conservation Area 1 (Eastern Enhancement Corridor) and Conservation Area 2 (Northern Enhancement Corridor). Safe movement solutions include the dry cell fauna underpass (affording connectivity to the northern corridor) and exclusion fencing along the residential boundary which are the primary Wildlife Management Infrastructure to be installed. A dry cell underpass (three 2.4 m X 2.4 m RCBC) was proposed for Double Jump Road however final configuration is pending detailed engineering evaluation presently being undertaken. Upgrading would be undertaken by Redland City Council when that road is upgraded. No date has been confirmed at this time.
EDL	Ecologically Dominant layer
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Cth)
EPZ	Environmental Protection Zone
ESD	Ecologically Sustainable Development, as defined by Section 3A of the EPBC Act
Fauna Management Action Plan	The Fauna Management Action Plan is an operational document to be prepared by the appointed spotter catcher. It is to be prepared following site specific diurnal and nocturnal field assessments of site conditions to determine the suite of species present, potentially present, and documentation of appropriate methods for minimising harm. The Fauna Action Management plan will consider terrestrial fauna, and on account of the presence of farm dams to be dewatered, aquatic species as well.
Fauna Spotter Catcher	means a person holding an appropriate license issued under the *Nature Conservation Act 1992* (Qld) to detect, capture, care for, assess, and release wildlife disturbed by vegetation clearance activities who have at least three years' experience undertaking this work with Protected Matters
FTE	Full-time equivalent
Grey-headed Flying-fox	refers to the EPBC Act listed threatened species *Pteropus poliocephalus*.
Grey-headed Flying-fox camp	means any area that provides roosting requirements of the Grey-headed Flying-fox, as described in DAWE 2021, National Recovery Plan for the Grey-headed Flying-fox '*Pteropus poliocephalus*', Department of Agriculture, Water and the Environment, Canberra.
Grey-headed Flying-fox habitat	means any area that provides or is likely to provide foraging and roosting habitat of the Grey-headed Flying-fox, as described in Department of Agriculture, Water and the Environment (2021) National Recovery Plan for the Grey-headed Flying-fox *Pteropus poliocephalus*. Canberra: Commonwealth of Australia.
ha	hectare
Information Request	The DCCEEW letter dated 5 July 2024 outlining the additional information required for the Preliminary Documentation.

In-stream (farm) dams	Water retention structure created by installing an earthen weir over drainage lines and lower order waterways to allow water to pool.
JER	Joint Expert Report
KHT	Koala Habitat Trees
km	kilometre
km/hr	kilometres per hour
KMP	Koala Management Plan
Koala Escape / Dispersal Pole(s)	means timber posts securely erected to remain in a vertical position at least until this approval expires, each at least 4 metres in height and 125 mm diameter and each with at least one fork large enough to enable an adult Koala to sit and rest at least 3 metres above the ground surface as described in the Koala Sensitive Design Guideline: Department of Environment and Science (State of Queensland 2022).
Koala Exclusion Fencing	is exclusion fencing as described in Table 4.2 of the Koala-Sensitive Design Guideline: A guide to Koala sensitive designed measures for planning and development activities 2022 (State of Queensland 2022)
Koala Habitat	means any area that provides or is likely to provide the essential life cycle requirements of the Koala, including dispersal, foraging and or breeding habitat as described in: i. Conservation Advice for Phascolarctos cinereus (Koala) combined populations of Queensland, New South Wales and the Australian Capital Territory (Commonwealth of Australia 2022), ii. National Recovery Plan for the Koala Phascolarctos cinereus combined populations of Queensland, New South Wales and the Australian Capital Territory, (Commonwealth of Australia 2022), iii. A review of Koala Habitat assessment criteria and methods, Youngentob et al. (2021).
Koala Sensitive Design Guideline	means Koala Sensitive Design Guideline: Department of Environment, Science and Innovation (State of Queensland 2022).
Koala	means the EPBC Act listed threatened species *Phascolarctos cinereus* (combined populations of Queensland, New South Wales and the Australian Capital Territory).
LGA	Local Government Area
Locality	the wider suburb of Victoria Point, within 3 km of the Project Area. Refer Figure 1.
m	metre
m^2	square metre
MHQA	Modified Habitat Quality Assessment
Mitigation Area	The projects mitigation area consisting of Conservation Area 1 (5.65 hectares), Conservation Area 2 (2.44 hectares) and Conservation Area 3 (plus local park – 3.17 hectares). Conservation Area 1 adjoins Moogorupum Creek and forms a viable area of koala habitat and corridor. Conservation Areas 1 and 2 will undergo ground disturbance and as they are less than 100 m wide are considered compromised habitat. Notwithstanding, these areas will be ecologically restored to pre-clearance Regional Ecosystem structure and floristics to support biodiversity. It is not unreasonable therefore to assume that approaching maturity these areas could be used by Grey-headed Flying-fox for foraging) and Koala for foraging and local movement. Koala exclusion fencing will be installed around the perimeter of the Eastern Corridor ~~all areas~~ to restrict; Koala (and other fauna) from straying into residential area / domestic dogs from straying into the corridor.

MNES	Matter(s) of National Environmental Significance. Under the EPBC Act there are nine defined matters the require consideration when proposing to undertake an 'Action'. One of these matters is Nationally listed threatened species and ecological communities (S18 of the EPBC Act). MNES relevant to the Double Jump Road Residential Development are identified and described herein.
NEPA	National Environmental Protection Agency. NEPA commenced operation 1 July 2026 and assumed responsibility of approvals and permitting under the EPBC Act (amongst other functions) from DCCEEW.
NIAA	National Indigenous Australians Agency
NIC	Nationally Important Camp
Northern Enhancement Corridor (northern corridor)	Totalling 2.44 hectares, this is the secondary east-west ecological linkage along the northern boundary of the Project Area connecting the Moogurrapum Creek Corridor with retained remnant and regrowth (Koala) habitat immediately adjoining to the north-west. This retained remnant and regrowth habitat area is identified in the 2018 Structure Plan as a retention area. The northern corridor is lightly vegetated with sparse disturbed woodland and young regrowth. Minor works will occur within the area. Ecological restoration will focus upon retaining existing elements and enhancing values through extensive plant-out. The restoration goal is to reinstate the pre-clear Regional Ecosystem mostly through reconstruction techniques and facilitate east – west habitat linkages for a full suite of fauna. Safe movement solutions include the dry cell fauna underpass (affording connectivity to the eastern corridor).
(Thagoona) Offset Area	The location of the Thagoona Offset Area to acquit residual impacts; 160 Mcgearys Road Thagoona, known as Lot 1 on RP190542 held in freehold title. This is an area of additional offset added to the project to demonstrate habitat ecological gain following discussions with the Department. The Offset area is a 17.68 ha of the larger 25.21 ha cadastral title.
(Woolshed) Offset Area	The location of the Woolshed Offset Area to acquit residual impacts; 528-530 Woolshed Creek Road, Woolshed, Queensland 4340, also known as Lot 236 on CH 312334 held in freehold title and totalling an area of 88.63 ha.
Offset Management Plan (OMP)	The practical document that outlines what must be done to manage the offset site for the duration of the approval. The plan must detail all the management activities at the offset site and how progress will be monitored and reported. The OMP provides confidence that the outcomes described in an offset proposal can and will be achieved. The OMP is attached to this PD Report as Attachment 12.
PD Report	Preliminary Documentation Report (this document)
Planning Act	*Planning Act 2016* (Qld)
Planning Regulation	*Planning Regulation 2017* (Qld)
Project Area	The location of the proposed action; 42-44, 48, 50, 52, 56 Double Jump Road, Victoria Point, Queensland, 4165, also known as Lot 1 on RP86773 (Lot 1), Lot 2 on RP86773 (Lot 2), Lot 5 on SP293881 (Lot 5), Lot 23 on SP325035 (Lot 23) and Lot 2 on RP165178 (Lot 2)). The Impact Site includes a disturbance footprint of 32.57 hectares of permanent disturbance / functionally compromised land. Excludes Conservation Area 1 (Eastern Enhancement Corridor).
Proponent	Sutgold Pty Ltd (Sutgold)
Proposed Action	Development of a master planned residential community known as Double Jump Road Residential Estate Development.

Protected Matter(s)	means a matter protected under a controlling provision in Part 3 of the EPBC Act for which this Preliminary Documentation Report has effect (Koala and Grey-headed Flying-fox).
QYAC	Quandamooka Yoolooburrabee Aboriginal Corporation
RCC	Redland City Council (the local government authority)
RE	Regional Ecosystem
REDD	Regional Ecosystem Description Database
Redland Planning Scheme	Redland City Plan 2018
Regional area	South East Queensland area.
Regional Ecosystem (RE)	means vegetation communities in a bioregion that are consistently associated with a particular combination of geology, landform and soil (Sattler and Williams 1999, *Vegetation Management Act 1999* (Qld)).
Rehabilitation / Restoration	The ecological restoration of the Site. Restoration work will follow the South-East Queensland Ecological Restoration guideline with the tiered response comprising increasing intensity of effort being; 1. Natural Regeneration, 2. Assisted Natural Regeneration, 3. Ecological Reconstruction, 4. Fabrication.
Residential Area	The location of the Proposed Action's urban development including; residential dwellings, road infrastructure, services (electricity, sewer, water), neighbourhood hub (commercial) and childcare centre.
Retention area	A retention area is retained to provide current and future habitat for the specified protected matters and may be protected with a conservation agreement. Conservation Zone 1 is the Project Areas primary north-south habitat linkage along Moogurrapum Creek totally 5.65 hectares.
Safe movement solution(s)	means measures to minimise the risk of injury or deaths to fauna, especially Koala from vehicle strike, interaction with domestic pets and wild dogs. specifically including Koala Exclusion Fencing, fauna underpasses or overpasses, and/or bridges and other measures described in the Koala-sensitive design guidelines.
Sequential Clearing Conditions	as the same meaning as Sequential Clearing Conditions in the *Nature Conservation (Koala) Conservation Plan 2017* (Qld) under the Nature *Conservation Act 1992* (Qld). Requirements are outlined in the document found here (current at the date of publishing): https://environment.des.qld.gov.au/__data/assets/pdf_file/0022/255460/is-Koala-conservation-plan-clearing-requirements.pdf
SEQ Regional Plan	ShapingSEQ South East Queensland Regional Plan 2023
Significant Residual Impact	The area of enduring habitat loss at the Impact Site after all avoidance and mitigation strategies have been deployed as a result of direct impacts associated with the Proposed Action.
South-eastern Glossy Black Cockatoo	refers to the EPBC Act listed threatened species South-eastern Glossy Black Cockatoo *Calyptorhynchus lathami lathami*.
Sub-regional area	nominally 3-25 kilometres from a site
Suitable habitat	means habitat featuring ecological characteristics that may provide for the breeding, feeding, resting, or sheltering of any endangered and/or threatened wildlife species.

Suitably Qualified Ecologist	means a person who has professional qualifications, training, skills and/or experience related to the nominated ecological subject matter and can give authoritative independent assessment, advice and analysis on performance relative to the ecological subject matter using the relevant protocols, standards, methods and/or literature.
SWMP	Stormwater Management Plan
TECs	Threatened Ecological Communities
Thagoona Offset Area	See 'Offset Area'
VDEC (Voluntary Declaration)	Declaration of an area by the Chief Executive of the Department of Resources as possessing high nature conservation value in accordance with s19F(1)(a) of the *Vegetation Management Act 1999* (Qld) and in consideration of the voluntary implementation of a management plan (Offset Management Plan) for the declared area which will help the area to achieve a high nature conservation value in accordance with s19G(1)(a) of the *Vegetation Management Act 1999* (Qld)
VMP	Vegetation Management Plan. The VMP is an operational document that outlines the vegetation to be retained and removed and the measures to be enacted to ensure protected areas identified by the approval are not cleared, and clearing is undertaken in such a way as minimise harm to resident fauna.
VPSP	Victoria Point Structure Plan
Western Enhancement Area (western area)	totalling 2.64 hectares, the western area is an area of retained trees and restored habitat situated along an existing ephemeral, overland flow path which will undergo earthworks and engineering during construction. The area will be extensively earth worked to achieve desired drainage and Water Sensitive Urban Design (WSUD) Features. Mitigation measures in this area include canopy tree retention and restoration and reinstatement of canopy / subcanopy species characteristic of pre-disturbance Regional Ecosystem through fabrication. The primary ecological outcome for this is however as a canopy landscape linkage to support local biodiversity.
Wildlife Management Infrastructure	specific infrastructure constructed to ensure the safe movement of wildlife, specifically Koala. Measures include (Koala) exclusion fencing, fauna underpasses or overpasses, and/or bridges, raised traffic platforms to slow traffic on roads and other infrastructure described in the Koala-sensitive design guidelines.
WoNS	Weeds of National Significance
Woolshed Offset Area	See 'Offset Area'
WSUD	Water Sensitive Urban Design

Executive Summary

This Preliminary Documentation Report has been prepared on behalf of the proponent, Sutgold Pty Ltd (**Sutgold**) in direct response to additional information requested by the National Environmental Protection Agency (**NEPA**) theas part of the 'controlled action' assessment by 'preliminary documentation' determination for the Double Jump Road Residential Estate Development, Victoria Point (EPBC 2024/09825).

Note that NEPA commenced operation 1 July 2026 and assumed responsibility of approvals and permitting under the EPBC Act (amongst other functions) from Department of the Environment, Energy, Climate Change and Water (**DCCEEW**). All Commonwealth Government correspondence relating to this Preliminary Documentation Report issued prior to 1 July 2026 is issued by DCCEEW.

The controlled action decision is based upon **DEECCW**s assessment of the project as potentially resulting in a Significant Impact on the following Matters of National Environmental Significance (MNES):

- Listed Threatened Species & Communities (Sections 18 & 18A) of the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act), more specifically defined in the request for further information on the:
    - *Phascolarctos cinereus* (Koala) combined populations of QLD, NSW and the ACT, listed as Endangered.
    - *Pteropus poliocephalus* (Grey-headed Flying-fox) listed as Vulnerable.
    - *Calyptorhynchus lathami lathami* (Glossy Black-cockatoo) listed as Vulnerable.

Koala (*Phascolarctos cinereus*)

The Koala (*Phascolarctos cinereus*) is listed as an 'Endangered' species under the EPBC Act. A significant proportion of Queensland's native vegetation, especially in South East Queensland, is identified under the National Recovery Plan for the Koala *Phascolarctos cinereus* (combined populations of Queensland, New South Wales and the Australian Capital Territory) (DAWE 2022b) as critical habitat for Koala (*Phascolarctos cinereus*) due to the prevalence of recognised Koala food tree species across most landscapes.

The Double Jump Road Residential Estate Development referral area predominantly maintains disturbed open paddock sparse mature canopy trees within an open woodland assemblage. Regrowth and remnant open forest occurs along Moogurrapum Creek. However, the canopy species that are present do afford low-quality forage and shelter habitat, and the Site can be considered as dispersal habitat with respect to the statutory documentation – habitat critical to the survival of Koala (*Phascolarctos cinereus*). This is a primary consideration for the DEECCW determination.

Koala (*Phascolarctos cinereus*) has regularly been recorded, both directly and indirectly both on the Project Area of the 'Proposed Action' and nearby.

The proposed action will result in the removal and functional loss of 'critical habitat' for Koala (*Phascolarctos cinereus*) that has the potential to have a 'significant impact' on the species based on utilisation of the Project Area by Koala (*Phascolarctos cinereus*) and knowledge of their broader population dynamics.

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

The Grey-headed Flying-fox (*Pteropus poliocephalus*) is listed as a 'Vulnerable' species under the EPBC Act. It is considered highly mobile and able to utilise a wide range of floral food resources, including flowering eucalypts predominantly in the winter, across relatively expansive foraging areas. For this reason, it periodically displays overlap with Koala habitat in South East Queensland when foraging for eucalypt nectar, with suitable foraging habitat widespread in the Redland Bay area.

The referral guidelines for Grey-headed Flying-fox (*Pteropus poliocephalus*) focus on the assessment of potential impacts on roosting camps, with relatively minor provisions for the consideration of important winter flowering foraging habitat. Where presence occurs, this habitat is considered critical habitat to the survival of the species.

Not Grey-headed Flying-fox were observed; however critical habitat is present. This area contains many mature Queensland Blue Gum (*Eucalyptus tereticornis*) a known winter flowering species affords foraging habitat during known foraging resource bottleneck periods (i.e. winter). No roosting camps were recorded on the Project Area, nor were any historic records of past encampment detected.

Potential foraging habitat within the disturbance footprint includes sparsely distributed paddock trees (open woodland). Few if any of the trees present are winter forage species. Important winter forage species being Broad-leaved Paperbark (*Melaleuca quinquenervia*) and Queensland Blue Gum (*Eucalyptus tereticornis*) are present within avoidance areas.

Given the widespread distribution of the species across South East Queensland, the availability of habitat throughout the Redland Bay area and temporal dynamic of the overlap with Koala (*Phascolarctos cinereus*) habitat, potential impacts on the latter matter by default are presumed to be considered by DEECCW to significantly impact on the Grey-headed Flying-fox (*Pteropus poliocephalus*).

South-eastern Glossy Black Cockatoo (*Calyptorhynchus lathami lathami)*

The South-eastern Glossy Black-cockatoo (*Calyptorhynchus lathami lathami*) is listed as a 'Vulnerable' species under the EPBC Act. It is highly mobile species. Suitable habitat for South-eastern Glossy Black Cockatoo (*Calyptorhynchus lathami lathami*) consists of two discrete elements, suitable hollows and abundant foraging resources. While detailed studies are somewhat limited, current knowledge suggests breeding occurs in proximity to abundant resources, most hollows are within 1.5 kilometres of She-oak (*Allocasuarina* spp. and *Casuarina* spp.) stands though birds may commute up to 15 kilometres. Many populations are restricted to remnant vegetation within hills and gullies surrounded by agricultural land; however, some populations move through artificial landscapes such as semi-urban parks, gardens and golf courses to access favoured food resources. Typically encountered in small family parties, they are never far from waterbodies, which are visited daily.

The Conservation Advice (Commonwealth of Australia 2022c) identifies that where potential habitat is present, a precautionary approach is adopted and identified habitat is considered to be habitat critical for the survival of the species, as there is opportunity to exploit this habitat at some point in the future.

The referral guidelines for South-eastern Glossy Black Cockatoo (*Calyptorhynchus lathami lathami*) focus upon the assessment of potential impacts on forage habitat, nesting habitat and waterbodies. Given the widespread distribution of the species across South East Queensland, the availability of habitat throughout the Redland Bay area, potential impacts may occur.

Impacts

Unmitigated, the Proposed Action will:

- impact 32.57 ha (27.87 ha of direct foraging and dispersal habitat loss, and 4.95 ha of indirect (compromised foraging and dispersal) habitat loss), defined by NEPA conservation advice as 'critical habitat' for the Koala.
- impact 32.57 ha direct habitat loss considered to support vegetation defined by NEPA as foraging habitat for Grey-headed Flying-fox.

Approximately 0.67 ha of the Moogurrapum Creek Corridor will be subjected to minor earthworks for the establishment of fauna underpass, installation of koala exclusion fencing, establishment water sensitive urban design features and embankments. The entirety of these disturbance elements and the entire 5.65 ha of the corridor will undergo ecological restoration and fauna movement, and utilisation of this area (including Koala) will not be impinged upon and habitat quantity and quality will be enhanced.

Measures to mitigate the effects of the development include functional ecological restoration of riparian habitat along Moogurrapum Creek (Eastern Enhancement Corridor), ecological restoration along the east-west corridor (the local Northern Enhancement Corridor) along the northern boundary of the Project Area, installation of wildlife management infrastructure beneath Double Jump Road and the main collector road bisecting the reinstated east-west corridor, and supplementary planting within an area of rehabilitated habitat in the western part of the development area. (Western Enhancement Area).

Supplementary planting will be undertaken within both the multifunction spine and habitat retention areas to establish a species composition reflective of REs 12.3.6 and 12.9-10.4, communities dominated by both Koala (*Phascolarctos cinereus*) and Grey-headed Flying-fox (*Pteropus poliocephalus*) forage species.

Residual Impacts

Assessments undertaken and reported on in this document have identified:

- There will be a lasting significant residual impact equating to the loss of 32.57 hectare critical to the survival for Koala (*Phascolarctos cinereus*).
- There will be a lasting significant residual impact equating to the loss of 32.57 hectare critical to the survival for Grey-headed Flying-fox (*Pteropus poliocephalus*) equating to the loss of canopy species flowering during the winter resource bottleneck, breeding birth and gestation periods.
- Significant impact to South-eastern Glossy Black Cockatoo (*Calyptorhynchus lathami lathami*) has been tested against the MNES Significant impact guidelines 1.1 and it has been concluded that there will be no significant impact to this species.

Environmental Offsets

The Significant Residual Impact to Koala (*Phascolarctos cinereus*) and Grey-headed Flying-fox (*Pteropus poliocephalus*) arising as a result of undertaking the proposed action will be resolved by providing an environmental offset on land external to the Project Area. The proponent has entered into a Heads-of-Agreement with a third party offset provider **Cherish the Environment Foundation** Limited to deliver and manage the offset for a 20-year period at two separate Offset within the Ipswich City Council Local Government Area.

- Woolshed Offset Area: 74 kilometres north-west of the Proposed Action
- Thagoona Offset Area: 63 kilometres south-west of the Proposed Action.

Woolshed

The Woolshed Offset Area is located 25 kilometres to the west of Ipswich, 8 kilometres to the north-west of Rosewood, 52 kilometres to the south-west of Brisbane and 55 kilometres to the east of Toowoomba. Contextually, the Offset Area lies is strategically situated on the Little Liverpool Range which traverses from Minden to Main Range (west of Aratula) a distance of 58 kilometres.

The Site lies within an area of ecological importance identified by State conservation[1] and regional[2] planning assessments as possessing important regional biodiversity values within a mapped State mapped Regional Biodiversity Corridor and SEQ Regional Plan Biodiversity Corridor. Conservation estate; Mount Grandchester Conservation Estate and maintained by Ipswich City Council adjoins to the south. Further afield (and within the mapped bioregional corridors) lies Mount Beau Brummell Conservation Park and Main Rainge National Park, and Old Hiddenvale Nature Refuge, Aroona Nature Refuge, Shingle Hut Creek Nature Refuge and Thornton View Nature Refuge, all south.

Bio-regionally, the Impact Site and Offset Site are situated in the South East Queensland Bioregion, lying within the Sunshine Coast – Gold Coast Lowlands and the Moreton Basin sub-regions respectively.

Matters of National Environmental Significant known from the locality include both Koala and Gey-headed Flying-fox.

The total site area is 88.63 ha of habitat for Koala and Grey-headed Flying-fox comprising 87.01 ha (98%) remnant vegetation and 1.62 ha (2%) young regrowth both requiring assisted regeneration on account of infestation of the understorey by Lantana (*Lantana camara*) a weed of national significance (WoNS). Presently, the eastern parts of

1. Department of Environment and Science (*Biodiversity Planning Assessment*)
2. SEQ Regional Plan (*Shaping SEQ 2023*)

the offset particularly on steeper igneous geology, Lantana forms a dense impenetrable thicket that supresses native understorey (sub-canopy, shrub and groundcover recruitment) and prevents ground fauna movement.

Thagoona

The Thagoona Offset Area is located 63 km to the east of the Impact Site at 160 McGearys Road, Thagoona QLD 4306, described as Lot 1 on RP190542, and comprises a total area of 25.21 ha. Of this, 17.68 ha will be utilised as the Thagoona Offset Area to acquit the Significant Residual Impacts associated with the Proposed Action, with the remaining portion of the lot retained as a rural residential allotment. The Thagoona Offset Area is situated approximately 2 km to the south of Thagoona and 4 km to the south-east of Rosewood.

The Thagoona Offset Area will be secured and managed by the same offset provider, Cherish engaged for the Offset Area described in **Section 7.2.1**, with management implemented for a period of 20 years in accordance with the requirements of the EPBC Act Environmental Offsets Policy.

The Thagoona Offset Area is situated on the Bremer River floodplain and exhibits moderate landscape connectivity, with linkages to significant known Koala *(Phascolarctos cinereus)* habitat within the Amberley area. Importantly, Koala *(Phascolarctos cinereus)* have been recorded within the immediately adjoining EPBC Act approved offset to the south, which also provides habitat for Grey-headed Flying-fox *(Pteropus poliocephalus)*. The proximity and direct adjacency of the Thagoona Offset Area to these established offset sites reinforces the ecological value of the locality and supports the suitability of the Thagoona Offset Area to contribute to a broader, contiguous network of habitat for the relevant MNES.

Strategically, the Thagoona Offset Area is positioned to directly extend an existing cluster of lands already secured for conservation, including adjoining offset areas associated with EPBC 2013 / 6941. This location is a key strength of the proposed offset, as it builds upon a verified and functioning ecological setting rather than introducing an isolated parcel. In practical terms, the Thagoona Offset Area will infill and broaden the current extent of protected habitat, increasing its overall size and coherence.

Environmental offsets have been calculated and will be delivered in accordance with the EPBC Act Environmental Offset Policy.

How the Proposed Action will achieve a net benefit for MNES

To date the proponent has implemented the following measures, in relation to the Project Area to demonstrate avoidance, minimisation and mitigation principles to achieve a net benefit to MNES impacted by the Proposed Action (Impact Site):

- Site selection is determined based on the absence of mapped biodiversity corridors and the presence of historical disturbances (i.e. agricultural activities).
- Commitment to water-sensitive urban design and no worsening of water quality or quantity into Moogurrapum Creek and its associated tributaries for water that is not retained on the Site.
- Iterative design based on ground-truthed ecological values (including Koala bushland habitat), where the more intact habitats are avoided by, and excluded from, the proposed residential uses.
- Consolidation, enhancement and dedication to RCC of a 5.65 hectare of ecological linkages along Moogurrapum Creek.
- Re-establish an east-west vegetated corridor (2.44 hectares) along the northern boundary of the Project Area to provide linking vegetation between the north-south Moogurrapum Creek Riparian corridor and remnant (offsite) habitat to the north-west of the Project Area.
- Retention, dedication and ecological enhancement of 2.64 hectare area presently comprising open woodland situated along a north-west to south-east tending, broad overland flow path.

The proponent will implement, following approval, a number of measures to offset significant residual impacts on the MNES species of interest:

- Declaration of the Offset Site under Statutory Covenant[3], Voluntary Declaration[4] or both prior to the Action commencing.
- Implementation of an ecological restoration and management process commencing concurrent to the operational and construction works associated with the Proposed Action. This will retain and enhance the highest quality habitat values within the Site that form habitat, resources and safe movement opportunities for MNES that are impacted by the Proposed Action (i.e. Koala, Grey-headed Flying-fox).
- Delivery of an off-site offset (located within a strategically important area) to counterbalance any residual adverse impacts on Koala and Grey-headed Flying-fox and described within an Offset Management Strategy. Investigations to locate and secure an appropriate Offset Site are near-complete, with the Proponent having entered into a Heads of Agreement with a prominent reputable offset provider to ensure a net environmental gain is achieved.
- Management measures remain preliminary to provide DEECCW with some certainty that potential impacts can be mitigated and managed. Vegetation, Fauna, Stormwater, Erosion and Sediment Control issues will all be managed through a mandatory need to deliver management plans to RCC through compliance assessment.

It has been concluded that by implementation of the above measures (described in more detail in this report), the Proposed Action will have no net detrimental impact, and wholistically lead to a net benefit, for Koala (*Phascolarctos cinereus*) and Grey-headed Flying-fox (*Pteropus poliocephalus*).

3. enduring protection mechanism to provide ongoing conservation protection, on the title of the land under Chapter 6 Part 4 Division 8A of the *Land Act 1994* (Qld)
4. declaration of an area by the Chief Executive of the Department of Resources as possessing high nature conservation value in accordance with s19F(1)(a) of the *Vegetation Management Act* (1999) and implementation of a management plan to assist the area to achieve and maintain high nature conservation value (s19G(1)(a) of the *Vegetation Management Act* (1999).

1. Introduction

1.1 Overview

In March 2024, 28 South Environmental Pty Ltd (**28 South**) submitted a Controlled Action Referral (**CAR**) to the National Environmental Protection Agency (**NEPA**) on behalf of Sutgold Pty Ltd (**Sutgold**) (the **Proponent**). The CAR was lodged in regard to the proposed Double Jump Road Residential Estate Development (the **Proposed Action**) which is situated in the Victoria Point area, wholly located in the in the Redland City Council (**RCC**) Local Government Area (**LGA**) of South East Queensland.

Note that NEPA commenced operation 1 July 2026 and assumed responsibility of approvals and permitting under the EPBC Act (amongst other functions) from Department of the Environment, Energy, Climate Change and Water (**DCCEEW**). All Commonwealth Government correspondence relating to this Preliminary Documentation Report issued prior to 1 July 2026 is issued by DCCEEW.

The Proposed Action is located over five properties situated at 42-44, 48, 50, 52, 56 Double Jump Road, Victoria Point, Queensland, more properly described as Lot 1 on RP86773, Lot 2 on RP86773, Lot 5 on SP293881, Lot 23 on SP325035 and Lot 2 on RP165178. The total Project Area is 38.22 hectares (**ha**). The locality and context of the Project Area is presented in **Figure 1** and **Figure 2**, respectively. Property details of the Project Area is presented **Figure 3**.

The Project Area's location within the Emerging Communities zone of the Redland City Plan 2018 (**Redland Planning Scheme**) (RCC 2018)[5] (**Figure 4**) and the urban footprint of the South East Queensland Regional Plan (**SEQ Regional Plan**)[6] (**Figure 5**) is a strategic location for the sequential expansion of existing urban development.

On 5 July 2024, NEPA issued a referral decision notice notifying that the Proposed Action was a Controlled Action, and that it would require further assessment and approval under the *Environment Protection and Biodiversity Conservation Act 1999* (**EPBC Act**) before it could proceed. The decision notice identified the relevant controlling provision as listed threatened species and communities, with the Proposed Action considered likely to have a significant impact on two (2) Matters of National Environmental Significance (**MNES**) – Koala (*Phascolarctos cinereus* (Koala – combined populations of Queensland, New South Wales and the Australian Capital Territory)), and Grey-headed Flying-fox (*Pteropus poliocephalus*).

Furthermore, DEECCW has requested the proponent consider whether the Proposed Action has the potential to have a significant impact on South-eastern Glossy Black Cockatoo (*Calyptorhynchus lathami lathami*) on account of the presence of possible foraging habitat, breeding habitat and watering points.

The decision notice identified that further assessment was to be undertaken along the Preliminary Documentation pathway. The decision notice is provided in **Appendix 1**. There have not been any changes to the Proposed Action / Project Area since the Controlled Action Referral.

1.2 Project Area Context

The Project Area for the Proposed Action which encompasses the Project Area (both permanent and temporary), Avoidance Area and Retention Areas, is located approximately 8.5 kilometres (**km**) to the south of the RCC Chambers (**Figure 1**) and 29 km to the south-east of the Brisbane Central Business District. The Project Area is situated in a landscape transitioning from rural to residential landuse.

Redland Planning Scheme (RCC 2018) identifies the Project Area, and surrounding land to the north of Double Jump Road as Emerging Community. Double Jump Road represents the boundary between urban development

[5] Redland City Council Planning Scheme
[6] ShapingSEQ 2023
https://www.planning.qld.gov.au/planning-framework/plan-making/regional-planning/south-east-queensland-regional-plan

to the north and recreation and open space to the south. The Project Area and adjoined to the south by rural activities to the west and east by residential and rural landuse and residential development to the north.

The Project Area is largely devoid of native vegetation having historically been cleared for rural agricultural pursuits; grazing, agistment and poultry and now comprises sparse relict canopy trees over a modified, exotic pastural grassland. Structurally, the area can be described as open woodland to exotic grassland. Mapped native vegetation comprising Least Concern RE 12.3.6 is present along Moogurrapum Creek. For the purpose of the Proposed Action (**Table 1**), the Project Area is 38.22 ha. The Proposed Action comprises a permanent Project Area of 27.49 ha and a Retention Area of 5.65 ha set aside as habitat and fauna movement corridor.

Table 1: Area of Development and Land Use Themes

Impact type	Future Landuse	Area (ha)	Proportion of Project Area (%)
Urban Dedication *(Disturbance Area)*	294 Residential Lots, 2 Medium Density Residential Lots, 2 Local parks, Business and retail centre, Multi-function spine, roads and services	27.49	71.9
Habitat Dedication *(Retention Area)*	Conservation Area 1 (5.65 ha) – is the primary ecological corridor along Moogurrapum Creek containing riparian habitats and wetlands, affording north-south landscape linkages. Minor works will occur within the area with the undisturbed of retention area. Conservation Area 1 (including those parts affected by minor works) will be ecologically restored through weeding, assisted regeneration and planting to a relevant pre-clearing Regional Ecosystem prescription. Conservation Area 1 will be referred to from hereon as the Eastern (Moogurrapum Creek) enhancement corridor.	5.65	14.8
Habitat / Open Space Dedication *Temporary Disturbance and Reinstatement* *(Disturbance Area)*	Conservation Area 2 (2.44 ha) is the secondary east-west ecological linkage along the northern boundary of the Project Area. This area is lightly vegetated with sparse disturbed woodland and young regrowth. Minor works will occur within the area with the un-disturbed of retention area being 1.97 ha. Ecological restoration will focus upon retaining existing elements and enhancing values through extensive plant-out to a relevant pre-clearing Regional Ecosystem prescription. This area will be referred to from hereon as the Northern restoration corridor.	2.44	6.4
	Conservation Area 3 (2.64 ha) is situated along an existing ephemeral, overland flow path. The area will be extensively earth worked to achieve desired drainage and Water Sensitive Urban Design Features. Mitigation measures in this area include canopy tree retention and restoration and reinstatement of canopy / subcanopy species characteristic of pre-disturbance REs through fabrication. The primary ecological outcome for this is however as a canopy landscape linkage. This area will be referred to from hereon as the Western restoration corridor.	2.64	6.9
Total		38.22	100.0

1.3 Proposed Action

Whilst the final development may be subject to minor modifications during the detailed design phase, an indication of the type and extent of the development as approved through the RCC development assessment process is contained in **Appendix 2.1** (Development Layout)**, Appendix 2.2** (Staging Plan), **Appendix 2.3** (Earthworks Plans) and **Appendix 3.1** (Structure Plan).

The Proponent has a development approval (**Appendix 3.1**) from RCC for the development of a 294 lot, residential development, (refer **Figure 6**), two medium density residential areas, a small commercial and retail zone, two local parks, road and infrastructure and development of ecological enhancement corridors and wildlife management infrastructure. At this stage, the Proposed Action will occur over **11** stages, with protection and ecological restoration / reconstruction of conservation areas occurring within **Stage 3.4**.

The anticipated timeframe (to be determined though sales progress) is three years. Subject to approvals The following timeframes are currently targeted for each corresponding milestone:

- All approvals in place: mid to late 2025
- Commencement of operational works: late 2026 – early 2027
- Plan sealing: late 2027
- First residential occupancy: mid 2027
- Full occupancy of development: ca. 2033.

For the purposes of this Preliminary Documentation Report (**PD Report**), the Proposed Action is described as the Residential Area, the Ecological Corridors (linear movement corridors comprising Conservation Areas 1 and 2) and the Western Enhancement Corridor and multi-function spine.

Construction Activities will include:

- Removal of vegetation within the Project Area for the development footprint of the Proposed Action
- Bulk earthworks and associated civil works to create appropriate levels and lot areas, and
- Services, roads and other infrastructure for establishing the proposed childcare centre and ancillary infrastructure.

Stockpiling of stripped topsoil, subgrade, fill and felled vegetative material will be required during the earthworks and construction activities and stockpiling will occur within the areas of identified permanent disturbance. No material shall be stored within avoidance / retention areas.

The project will be staged and noting the above necessary limitations, stockpiling within the impact footprint will be approved as part of any relevant site management plans prior to work commencing. During construction the avoidance / retention areas shall be fenced with temporary construction / Koala Exclusion Fencing (**exclusion fencing**). Stockpiled vegetative material will be utilised in ecological restoration / reconstruction works where appropriate (i.e. as coarse woody debris or as site mulch), and any excess topsoil will be removed from the Project Area.

The Proposed Action will assume the loss of all vegetation and fauna habitat within the Project Area. Efforts have been made to minimise the disturbance footprint and maximise the footprint of the ecological corridors and to avoid impacts to the Project Area's highest quality and intact native vegetation, and fauna habitat.

1.4 Purpose of this Preliminary Documentation Report

The primary purpose of this PD Report is to adequately respond to NEPA's Information Request (**Appendix 1**). Therefore, this PD Report aims to:

1. provide relevant information from the CAR
2. provide further details in relation to the Project Area's ecological values
3. analyse the potential impacts of the Proposed Action on the MNES of interest

4. propose measures to avoid, minimise and mitigate the potential impacts of the Proposed Action
5. describe the residual impacts of the Proposed Action on the MNES of interest
6. demonstrate that the Proponent has no history of environmental offences, and is a responsible corporate entity whose track record provides confidence that purported mitigation measures will be achieved
7. describe the beneficial social and economic impacts of the Proposed Action, and
8. demonstrate how the Proposed Action achieves the principles of Ecologically Sustainable Development (**ESD**)

This PD Report achieves these aims through:

- evidence-based conclusions based on the best available scientific literature and/or by peer reviewed literature, with supporting references cited or expert opinion provided
- maps, plans, diagrams and technical information
- scientifically robust methodologies appropriate to the purpose and justifications for selected methodologies
- risk assessment of scientific/ecological uncertainties associated with the potential impacts, and
- relevant Approved Conservation Advice, Recovery Plans, or comparable policy guidelines for all species, and explanation of how these have been considered.

Preparation of this PD Report has been guided by:

- 28 South Technical Ecologists and Environmental Planning Team:
  - Wayne Moffitt, Director, Ecologist
  - Andrew Dickinson, Senior Principal Ecologist
  - Bianca Staker, Senior Ecologist
  - Chris Hansen, Senior Botanist
  - Gordan Morris, Environmental Consultant
  - Sally Thompson, Botanist
  - Jack Merigan, Botanist
  - Mitch Oxley, Geospatial Analyst
  - Chris Huff, Environmental Consultant.

1.5 Reference Table for Information Request Response

Table 2 provides a summary of the key ecological issues identified in the NEPA Information Request on 5 July 2024 (Attachment A to the departments information request) and the section within the PD Report where the requested information is provided. **Table 3** provides a summary of the key offsetting and offset management issues identified in the NEPA Information Request (Attachment B to the departments information request) on 5 July 2024 and the section of the OMP in which the requested information is provided.

Table 2: Reference Table for Information Request Response

Requested Information	Response Section
2. Description of the action	
2.1. The Preliminary documentation must include: a) An overarching description of all components of the proposed action (such as pre-construction/early works, construction and operational), including the staging, sequencing, duration and timing). b). A detailed description of the anticipated start and completion dates of all actions, such as the extent, staging and timing of clearing undertaken over the construction period. c). The location, extent, and size (in ha) of the total proposed action footprint, disturbance/impact footprint, and of any adjoining areas (beyond the Project Area) that may be subject to indirect or facilitated impacts, including edge effects, noise or light spill, person or vehicle access, or other associated activities. Provide detailed maps of these areas. d). A description, with supporting spatial information, detailing all site access roads and any other shared infrastructure with adjacent projects/areas to be constructed to facilitate the proposed action. *Please Describe any changes to proposed action or disturbance footprints that may have occurred since the original referral and note whether these changes may require a formal variation request.*	Items a and b are covered in **Section 2.5** Item c is addressed in **Sections 2.1** and **2.5** Item d is addressed in **Section 1.1**
2.2. Provide a description of the intended land uses proposed as part of the completed development, including of any proposed open space and/or conservation areas and associated ongoing activities, and details of the intended party that would be responsible for future management activities.	Addressed in **Section 2.5.1** and **Section 2.5.7**
2.3. Details of any local or State Government planning scheme, or plan or policy under any local or State Government planning system that applies or is likely to apply to the proposed action. Details should include (but are not limited to): a). The development applications (including reference numbers) relevant to the proposed action, made to the state and local governments, and if made, the finalised outcomes of those applications. b). a summary description of the relevant environmental matters assessed at the state and/or local government levels. c) a description of any environmental compliance actions or ongoing investigations undertaken by the state and local governments, that are relevant to the proposed action.	Addressed in **Section 2.4** Item a is addressed in **Section 2.4.4** Item b is addressed in **Sections 2.4.1 - 2.4.3** Item c is addressed in **Section 2.4.5**
3. Description of the action	
The preliminary documentation must provide a description of the environment affected by and	Addressed in **Section 2** and **3**

Requested Information	Response Section
surrounding the proposed action area, over both the short and long term, including:	
3.1. A description of the environment more broadly including previous and current land use within and surrounding the proposed action area.	Historical land use and land patterning changes are identified in **Section 2.3** Characteristics of the Project Area and the broader locality are identified in **Sections 2.2** and **3.3.**
3.2. A description of any potential listed threatened species or ecological community (including but not limited to those listed in this request for information) that occur in the proposed action area and adjacent areas. Please ensure that a recent Protected Matters Search Tool report is generated and used during the assessment before finalising the draft preliminary documentation to identify any additional species (listed at the time of the controlled action area) that may be affected by the proposal.	Details of relevant MNES are addressed **in Sections 3.1** and **3.4** The PMST can be found in **Appendix 5.1**.
3.3. For listed threatened species and ecological communities that have the potential or are likely to be present at and within the vicinity of the project site, including but not limited to those listed in this request, please provide a likelihood of occurrence assessment including the following: a). Information on the abundance, distribution, ecology and habitat preference of the species or communities. b). Quantification of the extent of habitat (including maps identifying known or potential habitat) on site and, where feasible, in the broader landscape. c). Quality and importance of known or potential habitat for the species or communities on site. d). Information detailing known populations or records within at least five km of the development footprint and (if known), the size of these populations. e). Conclusions on the likelihood of occurrence of listed threatened species and ecological communities within the proposed action, or within an area of impacts outside the proposed action. *Likelihood of occurrence and habitat assessments must be informed by up-to-date desktop and field surveys and informed by relevant departmental documents (e.g., approved Conservation Advice, Recovery Plans, draft referral guidelines and Listing Advice, and SPRAT Database) and/or species experts.*	Information relevant to items a-e are included in **Section 3.4.1** (Koala), **Section 3.4.2** (Grey-headed Flying-fox) and **Section 3.4.3** (Glossy Black-cockatoo). In relation to d, searches have been conducted over an area of 25 km, with information on abundance / numbers etc, expressed in terms o 0-5 km and 5-25 km from the Project Area.
3.4. Up to date baseline and survey data at the impact site(s), including: a). Information on the survey methodology or technique used (e.g. thermal image detection, dog detection, environmental DNA methods, camera trapping, tree hollow search, scat surveys etc). b). When surveys were conducted (e.g., dates, time of day, season, etc.) and survey effort (e.g., two hours for every one hectare within a 5-hectare area)	Methods used to assess habitat condition BioCondition and justification of the sampling locations is discussed in **Section 3.3.4.** Methods used to assess habitat condition and presence of Koala, Grey-headed Flying-fox and Glossy Black Cockatoo within the Project Area are discussed in **Sections 3.4.1.2 and 3.4.1.3** (Koala), Section **3.4.2.4** and **3.4.2.5** (Grey-headed Flying-fox) and **3.4.3.4 and 3.4.3.5** (South-eastern Glossy Black Cockatoo).

Requested Information	Response Section
c). Map/s of survey points or transects and how the survey points or transects were selected. d). An assessment of the adequacy of any surveys undertaken with reference to any relevant scientific literature and/or statutory documents. In particular, the extent to which these surveys were appropriate for the species and undertaken in accordance with relevant survey guidelines. e). Results of all surveys undertaken.	
3.5 Based on survey data and with reference to relevant statutory documents, provide a clear description of the total extent and quality of habitat present within and surrounding the proposed action area for each species or ecological community potentially present or impacted by the action. For all species with residual significant impacts the method used to quantitatively assess the quality of habitat must be discussed and endorsed by the department before being applied.	A clear statement with respect to relevant statutory documentation outlining the total area of impacts and residual impact is addressed in **Section 4.2** (Koala), **Section 4.3** (Grey-headed Flying-fox) and **Section 4.4** (South-eastern Glossy Black Cockatoo). A summary of the residual impacts to each species assessed by the PD Report to be affected is summarised with **Section 6** which acts as a preamble to the Proposed offsets Section. The method used to assess quantitatively the habitat quality for both koala and Grey-headed Flying-fox are methods previously accepted by the Department (e.g. EPBC Referrals 2020/8615, and 2022/09304).
4. Impact assessment	
The preliminary documentation must include an up-to-date assessment of potential impacts that may occur as a result of the proposed action. Consideration of impacts must not be confined to the immediate area of the proposed action but must also consider the potential of the proposed action to impact on adjacent areas that are likely to contain populations and/or habitat for MNES. Based on the information available in the referral, matters of national environmental significance including but not limited to the following may be impacted and are to be assessed: ▪ Koala (Phascolarctos cinereus (Combined populations QLD, NSW, and the ACT)) – endangered ▪ Grey-headed Flying-fox (*Pteropus poliocephalus*) – vulnerable ▪ South-eastern South-eastern Glossy Black Cockatoo (*Calyptorhynchus lathami lathami*) – vulnerable.	A clear statement with respect to relevant statutory documentation outlining impacts and residual impact is addressed in **Section 4.2** (Koala), **Section 4.3** (Grey-headed Flying-fox) and **Section 4.4** (South-eastern Glossy Black Cockatoo).
4.1. Include a clear description of the total extent and quality of the following: a). Proposed action disturbance footprint. b). Direct and indirect habitat Project Areas (including the total extent of habitat for each relevant protected matter to be impacted).	Direct and Indirect impact, temporary impacts, retention areas and mitigation areas are discussed in **Section 4.1**(Generalised Assessment of Impacts).

Requested Information	Response Section
c). Total areas proposed to be retained/avoided (including the total extent of habitat present for each relevant protected matter to be avoided).	
4.2. To inform point 4.1, please provide an assessment of the direct, indirect, facilitated and cumulative impacts that may occur as a result of the proposed action at a local and regional scale. The assessment should include consideration of: a). The nature, likelihood, significance, and extent of impacts and whether any relevant impacts are likely to be unknown, unpredictable or irreversible. b). Timing and whether the impact/s are temporary or permanent (provide duration of impact) c). Species specific habitat requirements such as hollow bearing trees, nest trees, refuge habitat, foraging and breeding habitat, sheltering or other microhabitat features relevant to the species within and surrounding the development footprint. d). Whether connectivity and movement opportunities within the proposed action and surrounding area may be retained, removed, functionally lost or compromised. e). Adjacent areas of habitat that may or will be subject to intensification of ongoing impacts (for example, through increased human and vehicle presence) f). Indirect or facilitated impacts that may result from the proposed action, including but not limited to the following: i. Edge effects - such as the potential for the introduction of public access, weed species and pathogens in the proposed action area and adjacent environment. ii. Vehicle movement - increased vehicle traffic, speed or access and associated increased likelihood of fauna strike in the pre-construction, construction, and operation phase of the proposed action. iii. Increased presence of dogs during pre-construction, construction and operational phases. iv. Earthworks - potential to generate dust emissions from the removal of vegetation and movement of soil in the pre-construction and construction phase of the proposed action. v. Disturbance from increased noise, artificial light, sediment generation and other relevant stressors during construction and operation of the residential development. g) Cumulative impacts, where potential proposed action impacts on MNES are in addition to existing impacts of other activities (including current or future developments by the proponent and other proponents in the region and vicinity). *Please review the following policy statement, providing guidance on what impacts constitute a 'indirect consequences(s)', under paragraph 527E(1)(b) of the EPBC Act.*	Items a-g area addressed in **Section 4**.

Requested Information	Response Section
Facilitated impacts may include (but are not limited to) the risk of injury or mortality to MNES as a result of the introduction of domestic dogs in a residential area, vehicle strike as a result of increased residential car use and/or the development of swimming pools.	
4.3. Include current maps and coordinates/shapefiles showing the total proposed action footprint, total disturbance/direct and indirect Project Areas, areas of habitat for MNES proposed to be retained.	Mapping of these features are contained in **Figure 6** and **Figure 9.**
4.4. Include details of any policy guidelines, relevant studies, surveys, or consultations with species experts/field specialists, which were not included in the referral or additional information provided in support of the referral.	All relevant materials relating to the assessment of MNES habitat relied upon to prepare this PD Report are discussed in **Section 3.4** and **Section 4** and appended as **Appendices 5**, **6** and **10**.
5. Avoidance, mitigation and management measures	
The information available in the referral indicates that there is substantial area within the proposed action footprint with protected matters present or likely to be present. The mitigation hierarchy is a process that is used to limit the amount of damage an action, such as a development, will have on the environment. There are three steps, and each step must be followed in order and to the greatest extent possible before moving on to the next. These steps are: 1. avoid harm to the environment within and surrounding the proposed action area. 2. reduce or mitigate environmental damage within and surrounding the proposed action area. 3. identify offsets within the region that compensate for the significant residual impacts to listed species or ecological communities. The preliminary documentation must provide information on proposed avoidance, safeguards and mitigation measures to deal with the relevant impacts of the proposed action on MNES.	Details of Impact Avoidance and Impact Mitigation are described in **Section 5.**
5.2. Provide details (including a summary list or table) of avoidance and mitigation measures proposed to be undertaken to prevent or minimise impacts on protected matters (or their habitat) from the proposed action area, including: a). a description of avoidance measures that have been considered and applied. For example, proposed action site selection to avoid valuable habitat, micro-siting of infrastructure to avoid impacts on habitat on site, or avoidance of any activity that may indirectly impact on essential lifecycle processes for species. b). a description of proposed safeguards and mitigation measures to minimise and manage relevant impacts of the action, with reference to relevant statutory or policy documents at the Commonwealth and State level (e.g.,	Details of Impact Avoidance and Impact Mitigation are described in **Section5.2** and **5.3**, respectively. Targeted management measures relating to pre-clearance, clearance, construction and operation are identified within **Section 5.4.**

Requested Information	Response Section
Guideline: State Development Assessment Provisions (State Code 25)) c). pre-clearance and clearance procedures to ensure that species are detected and managed to minimise mortality, stress, injury, or introduction of disease. d). measures to address the risk of listed threatened species, such as the Koala, entering the residential area and becoming trapped/isolated without resources for shelter whilst in the residential area and safe movement opportunities to get out of the residential area, along with sufficient information on the location and design of these measures. e). ongoing management of direct and indirect impacts due to increased likelihood of human presence, attacks by domestic dogs, increased heat stress, as a result of the 'urban-heat effect', introduced or exacerbated weed incursion to remaining Koala habitat, increased stress and disturbance from dust, light and sound pollution and injury caused by negotiating various fence types and risk of residential swimming pools. f). details of how speed reduction is to be achieved (e.g., traffic calming devices) and plans showing the locations of each of these features and the manner in which they will be implemented). g). information on safe road design and placement, including installation of crossing warning signs, wildlife threshold marking on road (include maps and imagery). h). the locations and size of any proposed fauna movement solutions, fire breaks, no-go or buffer zones (including buffers between the construction footprint or remaining habitat in the referral area and adjacent to the site), and potential fencing, including: i. the location of any movement solutions, fire breaks, buffer zones, or fencing. ii. the characteristics of the fauna movement solutions, fire breaks, buffer zones and fencing, (i.e., height, length, wildlife proof measures etc) iii. whether the proposed measures, such as fencing will provide a wildlife barrier to/from/within the proposed action area. i). a discussion on how to minimise the risk of presence of residential/commercial swimming pools in the proposed area. j). a description of the environmental outcomes the measures are expected to achieve including details of any baseline data or proposed monitoring to demonstrate progress towards achieving these outcomes. k). information on the timing, frequency, and duration of the measures to be implemented. l). an actual or estimated cost of the mitigation measures.	
5.3. Provide an assessment of the predicted effectiveness/limitations of each proposed avoidance or mitigation measure, noting that the effectiveness of a particular measure is a reflection of confidence in the anticipated outcome. The assessment of effectiveness	Addressed in **Sections 5.3 and 5.4** and with respect to effectiveness, particularly *Section 5.4.8* Effectiveness of measures proposed is further addressed in **Table 24.**

Requested Information	Response Section
should be evidence based and include examples of demonstrated success of a particular measure to achieve the desired avoidance/mitigation outcome.	
5.4. For each measure proposed, indicate the: a). impacts that are being avoided and/or the significance of impacts being reduced through mitigation. b). scientific basis for conclusions being drawn. c). an evidence-based likelihood of success/risk assessment. d). responsible party. e). milestones/ performance/ completion criteria. f). proposed monitoring and evaluation program.	Addressed in **Sections 5.3 and 5.4.**
5.5. Describe any statutory or policy basis for the proposed measures, including reference to the SPRAT Database and relevant approved conservation advice, recovery plan or threat abatement plan, and a discussion on how the proposed measures are not inconsistent with relevant plans. For example, the National Recovery Plan for the Grey-headed Flying-fox states an objective to: *'To improve the* Grey-headed Flying-fox*es national population trend by reducing the impact of the threats outlined in this plan on* Grey-headed Flying-fox*es through habitat identification, protection, restoration and monitoring'.* Please provide a discussion on how the proposed action is not inconsistent with relevant species' objectives and associated action items, or alternatively, how the proposed avoidance, mitigation/management and offsetting actions will compensate for any residual significant impacts, thereby ensuring consistency with the objective for relevant EPBC Act species.	Addressed in **Sections 5.3 and 5.4.**
5.6. All proposed measures must consider the 'S.M.A.R. T' principle: S- Specific (species-specific objectives, methods, outcomes, and repeatability). M - Measurable (baseline information, quantifiable, auditable). A-Achievable (timeframes, financial and human resources). R- Relevant (conservation advice, recovery plans, threat abatement plans). T - Time-bound (set implementation, performance and completion timeframes).	Addressed in **Table 24.**
6. Proposed Offsets	
Where residual significant impacts to listed threatened species or ecological communities remain after application of all reasonable avoidance and mitigation	The proposed project will result in residual impacts to Koala and Grey-headed Flying-fox.

Requested Information	Response Section
measures, a compensatory environmental offset in accordance with the Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy (EPBC Offsets Policy) 1 is required. Offsets must be specific to the species or ecological community being impacted, must address the attribute of the protected matter that is impacted, and must deliver an outcome for the protected matter that is demonstrably equal or better than if neither the impact nor the offset occurred. Offsets are not intended to make proposed actions with unacceptable impacts, acceptable. If an offset is required, prior to publication, the preliminary documentation must include an: **1. Offset Proposal** - The Offset Proposal must provide detail about the proposed offset site or sites including baseline survey information, habitat or vegetation quality scores, how the offset will be managed, and evidence that the protected matter is present or uses the offset site. The Offset Proposal must demonstrate how the proposed offset is suitable and meets the principles of the EPBC Offsets Policy and must include sufficient information for the department to assess it using the EPBC Offsets Assessment Guide. **2. Offset Management Plan (OMP)** -The OMP supports the Offset Proposal and must detail all the management activities to be undertaken at the offset site including setting environmental objectives, milestones, monitoring and reporting measures. Management plans and activities must be targeted towards the specific plant, animal, ecological community, or place (protected matter) that is being offset. If there is more than one offset site, then a separate OMP must be prepared for each site.	Two distinct Offset Areas are proposed – Woolshed and Thagoona. The Offset Proposal for Woolshed is discussed in **Section 7.2.1**, and Offset Proposal for Thagoona is discussed in **Section 7.2.2.** How the offsets directly deliver outcomes for the protected matters relevant to this report is further detailed in Sections **7.5 - 7.10.** Analysis of how the Offset Proposals respond to the policy principles (and how they are met) described in **Section 7.3** (summarised in **Table 50**) Both Offset Management Plans support the Offset Proposal and provides SMART management measures to achieve the environmental outcome. The OMP is presented as **Appendix 12** (**Appendix 12.1** – Woolshed, and **Appendix 12.2** - Thagoona).
7. Habitat Quality Assessments	
A methodology that is suitable for each listed threatened species or threatened ecological community (i.e., endorsed by the department or supported by literature) where there is a residual significant impact must be used to assess habitat quality, noting the same scoring mechanism must be used at both impact and offset sites. The department encourages proponents to consult and seek endorsement from the department on a proposed method prior to undertaking any habitat quality assessment at both impact and offset site(s). The department currently prefers habitat quality scoring methods for each prescribed matters to be consistent with the Modified Habitat Quality Assessment (MHQA) method. The MHQA tool derives habitat quality scores using an adaptation of the Queensland Government's ' Guide to determining terrestrial habitat quality version 1.2 (DEHP Guide). The MHQA aligns, as far as possible the DEHP Guide with the requirements of the EPBC Act Environmental Offsets Policy for determining habitat quality scores. In aligning with this policy, all habitat quality scoring methods are required to generate future scores for 'with' and without' offset scenarios. Forecast gains or loss in habitat quality score must be substantiated by scientific	The method used to assess habitat quality for Koala is based upon the MHQA tool. The method used to assess habitat quality for Grey-headed Flying-fox, that has been accepted by the Department on other projects recently undertaken by 28 South (e.g. EPBC Referrals 2020/8615, and 2022/09304). A detailed outline of this alternate HQA method for the Project Area and Offset Site established by 28 South is presented as **Appendix 11** (**Appendix 11.1** - Modified HQA Koala **and Appendix 11.**2 – Alternative HQA Grey-headed Flying-fox) and **Appendix 15** (**Appendix 15.1** Woolshed Koala MHQA, **Appendix 15.2** – Woolshed Grey Headed Flying-fox Alternate HQA, **Appendix 15.3** - Thagoona Koala MHQA and **Appendix 15.4** – Thagoona Grey Headed Flying-fox Alternate HQA), respectively.

Requested Information	Response Section
information and via the endorsed MHQA (or alternative) method.	
8. Economic and Social Matters	
8.1. Provide details on the social and economic costs and/or benefits of undertaking the proposed action, including the basis for any estimations of costs and/or benefits. Where possible, please include the total economic capital investment and economic ongoing value of the project.	Consideration of social matters are identified in **Section 8.**
8.2. Identify if economic benefits and employment opportunities are in addition to what would have been expected if the action were not to take place.	Consideration of social matters are identified in **Section 8.2.1**
8.3. Provide details of any public stakeholder consultation activities, including the outcomes of those consultations.	Considerations of social matters are identified in **Section 8.2.2**. Relevant documentation is contained in **Appendix 18**.
8.4. Provide details of any consultation with Indigenous stakeholders. Identify existing or potential native title rights and interests, including any areas and objects that are of particular significance to Indigenous peoples and communities, possibly impacted by the proposed action and the potential for managing those impacts. Describe any Indigenous consultation that has been undertaken, or will be undertaken, in relation to the proposed action and their outcomes. This should include: a). details regarding the specific Indigenous groups and Traditional Owners consulted and an indication of the areas, both tangible and intangible, of cultural significance across the proposed action site; and b). a discussion about how impacts to areas and/or objects of Indigenous cultural significance (tangible and intangible) are avoided, mitigated or minimised. The department considers that best practice consultation, in accordance with the *Guidance for proponents on best practice Indigenous engagement for environmental assessments under the EPBC Act* (2016) includes: a). identifying and acknowledging all relevant affected Indigenous peoples and communities. b). committing to early engagement. c). building trust through early and ongoing communication for the duration of the proposed action, including approvals, implementation and future management. d). setting appropriate timeframes for consultation. e). demonstrating cultural awareness. Describe any state requirements for approval or conditions that apply, or that the proponent reasonably believes are likely to apply, to the proposed action with regards to Indigenous peoples and communities.	Considerations of indigenous stakeholder consultation and site based investigations is addressed in **Section 8.1**Reporting of Cultural Heritage Assessment and commitments for future assessment is presented as **Appendix 17**.

Requested Information	Response Section
9. Ecologically Sustainable Development	
9.1. Provide a description of how the proposed action meets the principles of ecologically sustainable development, as defined in section 3A of the EPBC Act, which are as follows: a). decision making processes should effectively integrate both long-term and short-term economic, environmental, social and equitable considerations. b). if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. c). the principle of inter-generational equity - that the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations. d). the conservation of biological diversity and ecological integrity should be a fundamental consideration in decision making.	A discussion of how the Proposed Action responds to these ESD principles is contained in **Section 9**
10. Environmental Record of the Person Proposing to Take the Action	
Include details of any past or present proceedings under a Commonwealth, State or Territory law for the protection of the environment or the conservation and sustainable use of natural resources against: a). the person proposing to take the action. b). for an action for which a person has applied for a permit, the person making the application. c). if the person is a body corporate-the history of its executive officers in relation to environmental matters. d). if the person is a body corporate that is a subsidiary of another body or company (the parent body)-the history in relation to environmental matters of the parent body and its executive officers.	The environmental record and declaration of the Entity Proposing to Undertake the Action is contained in **Section 8.3.**

Table 3: Reference Table for Information Required for Offset Proposals and Offset Management Plans

Requested Information	Response Section
1. General content, format and style	
An EPBC Act offset proposal must demonstrate that the relevant species or ecological communities significantly impacted by the proposed action is not worse-off when compared to a situation where neither the impact nor the offset occurred. Further to Section 6 of the PD request, the offset proposal must include, but not be limited to, the following:	Addressed in **Appendix 12** (**Appendix 12.1** – Woolshed, and **Appendix 12.2** - Thagoona).

Requested Information	Response Section
1.1. A detailed proposed action description, including a site description and how and to what extent your action will impact on protected matters.	Addressed in **Appendix 12** (**Appendix 12.1** – Woolshed, and **Appendix 12.2** - Thagoona).
1.2. Details of the protected matters being impacted by the proposed action, including the total number of individuals or extent of habitat being impacted.	Addressed in **Appendix 12** (**Appendix 12.1** – Woolshed, and **Appendix 12.2** - Thagoona).
1.3. Details about the offset proposal/offset site, including: a). a description of the proposed offset site(s) including location, size, and relevant ecological/species habitat features, landscape context and cadastre boundaries of the offset site(s) (supported by mapping). b). information about how the proposed offset/s area will provide connectivity with other relevant habitats and biodiversity corridors. c). information how the proposed offset site/s contribute to relevant State and/or regional plan/s or initiatives for the conservation of the protected matter. d) evidence of the presence of, or usage by, relevant MNES on, or adjacent to the proposed offset site(s). e) evidence that the location of the offset site is suitable and provides a conservation benefit to the impacted protected matter. Note: The EPBC Offsets Policy states that in most cases, the offset site should be as close to the impact as possible. f) up to date surveys and baseline data confirming the current condition/quality of vegetation on site (including number of hollow bearing trees if relevant), the extent and presence of weeds, and the extent of threats. g) information about the ecosystems present, current usage of the site, its general condition and location in the landscape/region h) an assessment of how the offset and impacts sites are like-for-like, i.e., the environmental values for the MNES at the offset are of the same type or equivalent to that affected by the proposed action. i) the methodology, with justification and supporting evidence, used to inform the inputs of the Offsets Assessment Guide in relation to the offset site for each relevant MNES, including: i. total area of habitat (in ha) ii. habitat quality (as discussed in section 8) iii. time over which loss is averted (max. 20years) iv. time until ecological benefit v. risk of loss (%) without offset vi. risk of loss (%) with offset vii. confidence in result (%). j). details and execution timing of the mechanism to legally secure the environmental offset/s (under Queensland legislation or equivalent) to provide enduring protection for the potential offset area/s against development incompatible with conservation.	Addressed in **Appendix 12** (**Appendix 12.1** – Woolshed, and **Appendix 12.2** - Thagoona).
1.4. The Offset Proposal must demonstrate how the offset meets the principles of the EPBC Offsets Policy and EPBC Offsets Assessment Guide to inform the	Addressed in **Appendix 12**

Requested Information	Response Section
Minister's decision on whether or not the proposed action should be approved under the EPBC Act.	(**Appendix 12.1** – Woolshed, and **Appendix 12.2** - Thagoona).
1.5. Details of the actual or estimated cost of the offset proposal including costs associated with proposed mitigation and management measures onsite.	Addressed in **Appendix 12** (**Appendix 12.1** – Woolshed, and **Appendix 12.2** - Thagoona).
2.6. Details of the protective mechanism proposed to be applied at any offset site/s to provide enduring protection to the site for at least the duration of the impact, including a draft of the protective mechanism and its terms.	Addressed in **Appendix 12** (**Appendix 12.1** – Woolshed, and **Appendix 12.2** - Thagoona).
2. Offset Management Plan requirements	
An offset management plan is a practical document that outlines what must be done to manage an offset site. A plan must detail all the management activities at the offset site and how progress will be monitored and reported. An OMP provides confidence that the outcomes described in an offset proposal can and will be achieved. The OMP must include, but may not be limited to:	Addressed in **Appendix 12** (**Appendix 12.1** – Woolshed, and **Appendix 12.2** - Thagoona).
2.1. A description of the proposed offset site(s) including location, size, condition, existing and future tenure, and relevant ecological/species values present and surrounding land uses.	Addressed in **Appendix 12** (**Appendix 12.1** – Woolshed, and **Appendix 12.2** - Thagoona).
2.2. Maps and shapefiles to clearly define the location and boundaries of the offset area/s, accompanied by the offset attributes (e.g., physical address of the offset area/s, coordinates of the boundary points in decimal degrees, the relevant MNES that the environmental offset/s compensates for, and the size of the environmental offset/sin ha).	Addressed in **Appendix 12** (**Appendix 12.1** – Woolshed, and **Appendix 12.2** - Thagoona).
2.3. Baseline survey information showing MNES presence and the extent and quality of the respective habitat(s) at the proposed offset site(s) in accordance with the relevant survey guidelines or using a scientifically robust and repeatable methodology.	Addressed in **Appendix 12** (**Appendix 12.1** – Woolshed, and **Appendix 12.2** - Thagoona).
2.4. Summarised details of the nature of the conservation gain to be achieved for relevant MNES, including the creation, restoration and revegetation of habitat in the proposed offset area/s.	Addressed in **Appendix 12** (**Appendix 12.1** – Woolshed, and **Appendix 12.2** - Thagoona).
2.5. Information about how the proposed offset area/swill provide connectivity with other habitats and biodiversity corridors and/or will contribute to a larger strategic offset for the relevant MNES. This should include information about how the proposed offset/s area contributes to any state and/or regional plan/s for the conservation of the protected matter.	Addressed in **Appendix 12** (**Appendix 12.1** – Woolshed, and

Requested Information	Response Section
	Appendix 12.2 - Thagoona).
2.6. Mechanisms for protection, for at least the full duration of the impact, under a conservation covenant or otherwise accepted method, noting that protection mechanisms for permanent impacts should continue in perpetuity.	Addressed in **Appendix 12** (**Appendix 12.1** – Woolshed, and **Appendix 12.2** - Thagoona).
2.7. Completion criteria and, if necessary, performance targets that evidence protection or improvement of EPBC Act listed communities, species and their habitat. For the purpose of the plan: a). completion criteria are longer term time-bound values, specified for measurable parameters, that if attained and maintained ensure the plan's environmental objectives are achieved; and For example: 'By Year 20, the approval holder must reduce non-native plant cover to within 5% of the benchmark value associated with each Regional Ecosystem.' b.) performance targets are time-bound short and medium term targets, for management interventions and environmental condition, that are used to monitor, evaluate, review and improve the effectiveness of the plan to offset impacts. For example: 'By Year 10, the approval holder must reduce non-native plant cover to within 10% of the benchmark value associated with each Regional Ecosystem.'	Addressed in **Appendix 12** (**Appendix 12.1** – Woolshed, and **Appendix 12.2** - Thagoona).
2.8. The plan includes management measures that will protect or improve EPBC Act listed threatened ecological communities and/or species and their habitat. Each management measure: a). is specifically linked to the attribute of the protected matter for which the management measure applies. b). has timeframes for implementation. c). is described sufficiently to avoid ambiguity and to inform plan implementation. d). is related to attaining/maintaining completion criteria and/or performance targets. e). is derived from recognised principles, practice, or guidelines, and is justified - technically, scientifically and legally (e.g. by recommendation in a national recovery plan) - as an effective and appropriate measure to attain and/or maintain the plan's completion criteria and/or performance targets. Management activities must be targeted towards the needs of the protected matter that is offset, and must align with the recovery objectives for the species as identified in relevant National Recovery Plans or Conservation Advices.	Addressed in **Appendix 12** (**Appendix 12.1** – Woolshed, and **Appendix 12.2** - Thagoona).
2.9. The plan identifies and manages uncertainty. To this end the plan specifies: a). key data/information used to formulate the plan. b). the limitations and/or uncertainty associated with the use of that data/information. c). the risks that limitation and/or uncertainty represents for plan failure. d). how limitations and/or uncertainty, and associated risks, are mitigated during plan implementation. For example, where a margin of safety is applied to management measures until uncertainty is reduced to an acceptable level or performance targets/completion criteria are attained/maintained.	Addressed in **Appendix 12** (**Appendix 12.1** – Woolshed, and **Appendix 12.2** - Thagoona).

Requested Information	Response Section
2.10. The plan assesses the risk of failure to achieve the plan's performance targets and/or completion criteria. To this end the plan: a) states the plan's performance targets and/or completion criteria. b) identifies events or circumstances that prejudice attainment/maintenance of performance targets and/or completion criteria. The events or circumstances must address scientific/ecological uncertainty, stochastic events and legal/land use planning factors that may represent risks. c) includes a qualitative assessment of the likelihood and consequence of those events or circumstances, and the residual risk of failure to achieve those criteria due to identified events or circumstances (assuming management measures will be implemented). d) characterises risk as low, medium, high or severe, and derived from likelihood (highly likely, likely, possible, unlikely, rare) and consequence (minor, moderate, high, major and critical). e) outlines how consequence, likelihood and risk level for each risk have been determined.	Addressed in **Appendix 12** (**Appendix 12.1** – Woolshed, and **Appendix 12.2** - Thagoona).
2.11. The plan manages the risk of failure to achieve performance targets and/or completion criteria by: a). specifying management measures that will be implemented to attain/maintain the completion criteria and/or performance targets. b). enhancing monitoring and management measures for high risk events or circumstances, thereby providing a 'margin of safety' to detect, avoid or mitigate the likelihood and/or impacts of the event or circumstance. c). specifying measurable events or circumstances (management triggers) that detect actual or potential issues in a timely manner to avoid, minimise or mitigate adverse impacts. d). ensuring the monitoring program includes activities to detect management triggers, and explains how monitoring activities may inform the selection and implementation of corrective actions. e). specifying methods to be used to determine whether the management trigger is proposed action attributable. f). specifying effective and appropriate corrective actions that may be implemented if a management trigger is realised. g). monitoring the effectiveness of corrective actions and implementing appropriate responses in the event corrective actions are not effective.	Addressed in **Appendix 12** (**Appendix 12.1** – Woolshed, and **Appendix 12.2** - Thagoona).
2.12. The plan assesses the risk of failure to achieve the plan's performance targets and/or completion criteria. To this end the plan: a) states the plan's performance targets and/or completion criteria. b). identifies events or circumstances that prejudice attainment/maintenance of performance targets and/or completion criteria. The events or circumstances must address scientific/ecological uncertainty, stochastic events and legal/land use planning factors that may represent risks. c). includes a qualitative assessment of the likelihood and consequence of those events or circumstances, and the residual risk of failure to achieve those criteria due to identified events or circumstances (assuming management measures will be implemented). d). characterises risk as low, medium, high or severe, and derived from likelihood (highly likely, likely, possible, unlikely, rare) and consequence (minor, moderate, high, major and critical).	Addressed in **Appendix 12** (**Appendix 12.1** – Woolshed, and **Appendix 12.2** - Thagoona).

Requested Information	Response Section
e). outlines how consequence, likelihood and risk level for each risk have been determined.	
2.13. The plan describes the monitoring methods that will be implemented, and: a). demonstrates the relevance of the monitoring methods to the protection of the relevant aspect of the protected matter(s) for which the offset is implemented. b). includes quantitative (e.g. on-ground survey results) and qualitative baseline data (e.g. photo-point monitoring sites) that establish the start quality/condition of the environment and which can be used to measure performance against. c). describes the sampling strategy (including monitoring area, site selection and sampling intensity over space and time) and statistical analyses to be employed. d). justifies the sampling strategy/monitoring methods, including through: i. an assessment of effectiveness and constraints to use. ii. capacity to detect change in environmental condition due to management interventions. iii. capacity to demonstrate attainment of performance targets and/or completion criteria. iv. the statistical power of the strategy/method. v. commits to engage appropriately qualified experts to design and conduct monitoring and survey activities, and analyse monitoring results. j). accounts for seasonal/climatic variability. k). details the location, nature and number of monitoring sites, including benchmark/reference sites to evaluate management performance.	Addressed in **Appendix 12** (**Appendix 12.1** – Woolshed, and **Appendix 12.2** - Thagoona).
2.14. The plan includes commitments to report on plan implementation and success as well as opportunities for improvement. This is achieved by: a) if the proposed action is approved, identifying relevant reporting obligations under the EPBC approval, or otherwise proposing appropriate regular reporting intervals, objectives and methods. b) specifying how plan/strategy implementation will be reported in accordance with those obligations. c) including a reporting template specifying key risk management, management measures, monitoring and adaptive implementation outcomes for the reporting period. d) including a schedule and triggers for reporting types (e.g. annual compliance, incident, non-compliance, contingency).	Addressed in **Appendix 12** (**Appendix 12.1** – Woolshed, and **Appendix 12.2** - Thagoona).

2. Proposed Action

2.1 Project Area Details

The Proposed Action occurs over five (5) consolidated lots in the suburb of Redland Bay. The lots, all held in freehold title, have a registered area of 38.22 ha (refer **Figure 3**, and **Table 4**). The Project Area is situated approximately 8.5 km to the south of the RCC chambers. The Project Area is currently utilised for the agistment of horses and rural residential activity.

Table 4: Project Area Details

Lot / Plan	Address	Area (ha)	Total area (ha)
Lot 5 SP293881	52 Double Jump Road, Victoria Point	12.40	38.22
Lot 2 RP165178	56 Double Jump Road, Victoria Point	0.18	
Lot 2 RP86773	50 Double Jump Road, Victoria Point	5.03	
Lot 1 RP86773	48 Double Jump Road, Victoria Point	5.03	
Lot 23 SP325035	42-44 Double Jump Road, Victoria Point	15.58	

2.2 Locality and Project Area

The landscape within the surrounding locality are dominated by rural landuse to the south of Double Jump Road, and a zone transitioning from rural pursuits to residential, broadly consistent with the Redland Planning Scheme (RCC 2018). This locality represents the southern extent of development envisaged by the Redland Planning Scheme (RCC 2018) and the SEQ Regional Plan (State of Queensland 2023).

Figure 4 shows that presently, the zone between Double Jump Road and Bunker Road (north) and Old Cleveland Road (east) shows a zone subject to various construction activities and surrounding parcels of land currently in operational works or building phases for residential development.

The patterning and context of development as represented by recent approvals is represented in **Figure 7**.

2.3 Historical Context of the Project Area

The Project Area has generally been subjected to disturbance associated with historical broad-scale clearing and selective thinning associated with rural-agricultural pursuits to facilitate a pastural (grazing) landscape, with historical aerial photography showing the Project Area having been extensively cleared for 50-60 years.

Historical aerial photographs were obtained for the years 1955, 1964, 1968, 1970, 1974, 1978, 1987, 1997, 2002 and 2011. It can be inferred that from the historical aerial photography and from a landscape ecological perspective, the Project Area has limited habitat functionality on account of past disturbance. The earliest photograph, taken in 1955 (**Figure 8a**), displays an area that is densely vegetated. A portion of Lot 23 SP325035 has been cleared in the south and some structures and vehicle tracks are visible within the cleared section.

The 1964 (**Figure 8b**) imagery shows land clearing has continued on Lot 23 SP325035 in the northeastern portion with vehicle tracks and plantings visible in the cleared plot. Lot 5 SP293881 also contains land clearing in its western portion, with rows of crops planted and several buildings including dwellings present and a farm dam.

The 1968 and 1970 imagery (**Figure 8c** and **Figure 8d**) depicts extensive land clearing has occurred after 1968 across the Project Area, including earthworks and the construction of a water reservoir in Lot 2 RP86773. Imagery

from 1974 and 1978 (**Figure 8e** and **Figure 8f**) shows extensive works across the Project Area, including further clearing and vegetation regrowth, the creation of a farm dam on Lot 5 SP293881 and in the northernmost section of Lot 1 RP86773, and construction of several buildings including dwellings and large sheds, particularly Lot 1 on RP86773.

The 1987 (**Figure 8g**) aerial illustrates there has been little material change to the overall search area, with some land clearance occurring in the eastern portion and continued use of the western portion for crop farming, and several more buildings constructed. Similarly, the 1997 (**Figure 8h**) imagery depicts land clearing, particularly in Lot 2 RP86773, and vegetation regrowth in the eastern portion of the Project Area, and continued construction of buildings with the expansion of the cleared area in the western portion of Lot 23 SP325035 and another large shed in Lot 1 RP86773.

The 2002 and 2011 imagery (**Figure 8i** and **Figure 8j**) imagery indicates that the search area has largely ceased being used for crop farming, and features many of the buildings constructed from the 1970s imagery. Land clearing has continued to occur across the search area, particularly in Lot 23 SP325035, while some vegetation regrowth has occurred in the western portion of the Study Area. The water reservoirs remain in Lot 5 SP293881 and Lot 2 RP86773, with vehicle tracks shown running throughout the properties. Anthropogenic dams are present in the central-west and central north section of the Project Area, with livestock (horses and cattle) still actively occupying these areas.

2.4 Planning Framework

The Project Area's location within the Emerging Communities zone of the Redland Planning Scheme (RCC 2018) and the urban footprint of the SEQ Regional Plan (State of Queensland 2023) is a strategic location for the sequential expansion of existing urban development.

Within the emerging community, bounded by Double Jump Road (south), Bunker Road (north-east) and Old Cleveland Road (east), the Proponent defined development area through (a) involvement of receptive landowners, and (b) identification of those parts of the Project Area with fewer constraints.

2.4.1 Regional Scale

The State's Department of State Development, Infrastructure, Local Government and Planning administers the SEQ Regional Plan (State of Queensland 2023). Under the SEQ Regional Plan, the Project Area is within the urban footprint, as are surrounding sites and the expanding urban front at the southern urban development extent of Redland City.

The SEQ Regional Plan encourages growth within the urban footprint help reduce our impact on the environment, reduce urban sprawl and reduce the carbon footprint. The SEQ Regional Plan notes that the urban footprint is not an urban zone and does not imply that all land can be developed for urban purposes other more refined land use planning in this locality has established the Project Area's suitability for the intended development.

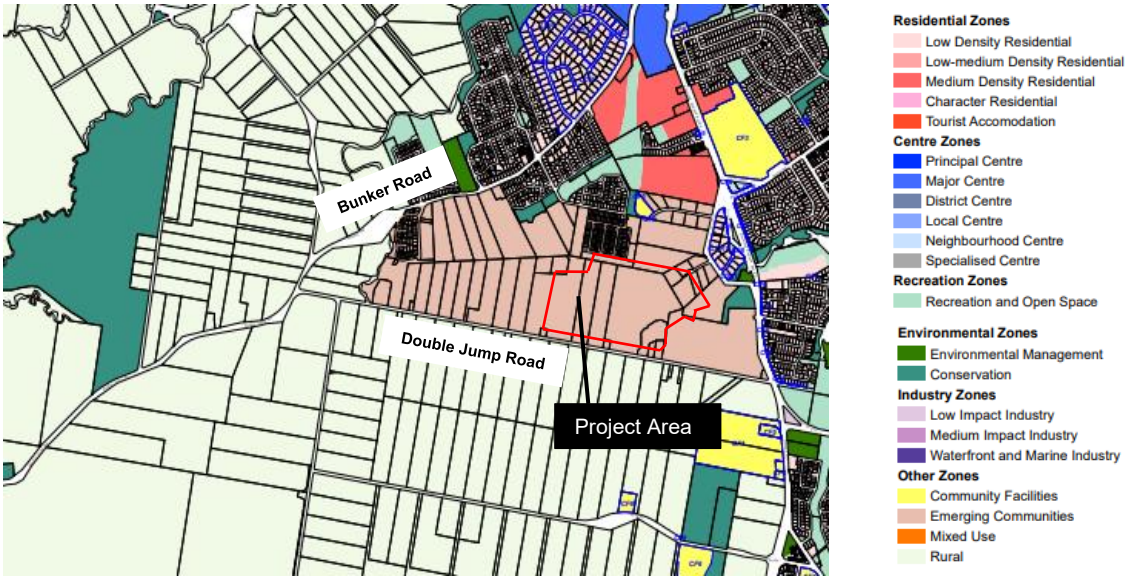
In the context of the SEQ Regional Plan (State of Queensland 2023) (**Inset 1**), areas of identified biodiversity value are situated adjoining the Project Area south of Double Jump Road, along waterways (Moogurrapum Creek (south) and Eprapah Creek (west) and to the west in the vicinity of Mount Cotton, where a significant regional biodiversity Corridor is identified. Regionally significant greenspace, and biodiversity values are avoided.

Inset 1. SEQ Regional Plan (ShapingSEQ 2023)

2.4.2 Redland Planning Scheme

The Redland Planning Scheme (RCC 2018) has been prepared as a framework for managing development in a way that advances the *Sustainable Planning Act 2009*. To achieve this purpose, the Redland Planning Scheme (RCC 2018) identifies RCC's intention for the LGA's future development over the next 25 years. The planning scheme seeks to advance state and regional policies through more detailed local responses, taking into account the local context.

This initial Project Area identification process has achieved significant avoidance of ecological values that are present within the broader locality. The Proponent has designed the Proposed Action in consideration with its mapped ecological values specifically Significant Vegetation and in consideration of enhancing habitat connectivity. Major considerations for the Proponent were targeting those locations within the Emerging Community zone of the Redland Planning Scheme (RCC 2018) that were subject to historic urban and agricultural degradation and achieving a consolidated collection of properties in an appropriate and logical location. (recognised at both local and regional levels) is identified by **Inset 2**.



Inset 2. Redland Planning Scheme (RCC 2018)

2.4.3 Draft Victoria Point Structure Plan

Following adoption of the Redland Planning Scheme in 2018, the Draft Victoria Point Structure Plan (**VPSP**) (**Appendix 3.1**) was prepared on behalf of RCC for the Victoria Point Emerging Community area bounded by Cleveland – Redland Bay Road (east), Double Jump Road (south), Little Eprapah Creek (west), Bunker Road (north-west) and Prospect Crescent / Brendan Way / Barcrest Drive (north) (**Inset 3**). The VPSP, compiled by a number of professional consultancies with expertise in balancing urban land use demands, was released for Public Comment in June 2019.

Inset 3. Victoria Point Structure Plan Area

The VPSP (supported by rigorous site-based technical studies and analysis), which is part of the Redland Planning Scheme, is a strategic document intended to flexibly guide delivery of a quality urban environment in accordance with Queensland Government and RCC planning policy and guidelines. The primary purpose of Structure Plans are to:

- Facilitate the transition of non-urban land to urban land in a manner that is efficient, and which is responsive to the Project Area and context's characteristics, opportunities and constraints.

- Provide the basis for the use and development controls that apply under the relevant Redlands Planning Scheme.
- Provide the State Government, Redland City Council, developers, investors and local communities with guidance and certainty about the future development of the area.

The Draft Victoria Point Structure Plan is represented in **Inset 4**.

2.4.4 Planning and Environment Court Appeal

In 2019, In early 2019, Sutgold teamed up with local residents to help create a shared vision for the new community at Victoria Point, Woodbury. The Community Engagement Program actively sought input from the community, focussing on families, teens and children. Subsequent to this consultation, Sutgold lodged a development application with RCC in 2020.

In 2021, RCC refused the application to reconfigure the Project Area on a number of grounds including ecology. Sutgold contested the refusal in the Planning and Environment, Queensland (1612/20) with 28 South providing Ecological Expert Witness services to the proponent. 28 South (and other experts) commenced mediation with RCC's appointed experts. A number on conclaves were held and a Joint Expert Report (**JER**) which assessed the relevant components and merits of the RCC's Consolidated Reasons for Refusal and to identify areas of agreement and disagreement.

Inset 4. Draft Victoria Point Structure Plan

Following identification of a number of matters of continuing disagreement between experts for the Appellant and the Respondent[7] a hearing before Judge Williamson QC where matters of dispute were tested, His Honour passed judgement with conditions of approval for the development on 15 October 2021 (**Appendix 3.2**).

The outcomes of this PD Report reflect the requirements specific to the management of the Project Area's biodiversity and management of landscape connectivity in line with the structure plan and the Court ruling.

[7] Ecology being one such matter of contention

2.4.5 Compliance Matters

There are no environmental compliance actions or ongoing investigations undertaken by the state and local governments, that are relevant to the proposed action.

2.5 Details of the Proposed Action

The Proposed Action encompasses the development envisaged by the Development Layout Plan as being an integrated neighbourhood of high – low and medium density residential areas, parks, conservation areas, recreation facilities and commercial development. It also encompasses measures and strategies that ensure development areas are buffered by, and interspersed with, waterway, natural drainage features, wildlife corridors, wildlife habitat features and areas of conservation.

2.5.1 Final Form

The Proposed Action involves the construction of a residential subdivision (with provision for approximately 294 residential allotments (delivered over two phases) an Environmental Protection Zone (**EPZ**), waterway/wildlife corridors, local parks and open space, small scale shopping facilities and neighbourhood centre, stormwater and road infrastructure along with road and utility improvements.

The Proposed Action will require the permanent clearing of vegetation for the construction and post-construction use of residential and commercial allotments. It is expected that all land within the permanent development footprint will be cleared and subject to civil earthworks (including the infill of farm dams) to establish the necessary landform. In addition to this, selective clearing and earthworks will be required within Conservation Areas though the extent and magnitude varies greatly within the three area. Works also make allowance for Water Sensitive Urban Design (**WSUD**)[8] stormwater management devices and establishment of wildlife management infrastructure (dedicated dry-cell fauna underpass) where an internal road bisects Conservation Areas 1 and 2. Significant earthworks will be required to ensure that Western Enhancement Corridor (**Figure 6**) can accommodate the flood and stormwater capacity required for the western parts of the Project Area.

The following key actions are necessary:

- Removal of woody vegetation within the development footprint of the Proposed Action
- Clear and grub of vegetated components of the development footprint
- Installation of erosion and sediment controls
- Removal of existing farm dams established on overland flow paths
- Bulk earthworks and associated civil works to create appropriate levels and lot areas
- Installation of services, roads and grey, green and blue infrastructure
- Subdivision of land into individual lots according to the approved design plan, including boundary markers and individual lot access
- Installation of landscaping features, community amenities (such as parks and recreational areas) and signage to enhance the appeal and functionality of the subdivision
- Ecological restoration within Conservation Areas, and
- Construction of residential properties.

The proposed plan of development (**Appendix 2.1**) and layout associated with the Proposed Action is included as **Figure 6**. Of the Project Area's 38.22 ha, areas of permanent disturbance comprising roads, services, residential

[8] https://waterbydesign.com.au/download/water-sensitive-urban-design-technical-design-guidelines-for-south-east-queensland

and commercial area occupy 71.9% of the project area. Conservation Areas (1-3) affording habitat and landscape connectivity (corridors) account for 28.1% of the Project Area area. Within the 10.73 ha of land dedicated for habitat conservation, some areas will undergo ecological restoration to improve habitat utility and functionality post development.

The Proposed Action will result in the delineation and establishment of three predominant land uses within the Project Area. These are:

- **Residential Areas** – 27.49 ha, is the proposed location of urban development including residential dwellings, road infrastructure, services (electricity, sewer, water), neighbourhood hub (commercial) and stormwater / drainage. Although dedicated as stormwater management infrastructure, can provide useful habitat (and afford a mitigatory / interface functionality between the development and the avoided habitat) as they will be rehabilitated. This is the disturbance footprint of the proposed action.

- **Enhancement Areas**

  For the purpose of Preliminary Documentation Reporting the Conservation Areas identified by the Development Layout will be referred to from hereon in as:

  - Eastern Enhancement Corridor (Conservation Area 1) – 5.65 ha, is a corridor and habitat area subjected to ecological restoration to facilitate habitat consolidation, ecological connectivity and safe faunal movement north to south along Moogurrapum Creek and east-west between nodes of habitat offsite and the creek corridor. The total eastern corridor area includes 4.98 ha of retained habitat; with 0.67 ha disturbed for construction of necessary environmental management infrastructure; safe wildlife movement infrastructure and stormwater management. The fundamental underpinning for the design of the corridor is outlined in **Section 2.5.1.1**.

  - Northern Enhancement Corridor – 2.44 ha is a corridor and habitat area subjected to ecological restoration to facilitate habitat consolidation, ecological connectivity and safe faunal movement east-west between the Moogurrapum Creek corridor and remnant / regrowth bushland habitats to the north-west of the Project Area. The total northern corridor area includes a retention area of 2.20 ha with 0.24 ha disturbed for construction of necessary environmental management infrastructure. For the purpose of surveillance and establishing “a connection to nature” for the residents of the development, paths and breakout spaces will be established at the edge of the northern corridor. These small breakout areas will not significantly affect the ecological values of the corridor. The fundamental underpinning for the design of the corridor is outlined in **Section 2.5.1.2**.

  - Western Enhancement Area – 2.64 ha is an Open Space area dedicated for habitat, pedestrian, cycle way and stormwater infrastructure along an existing ephemeral, overland flow path. Mitigation measures in this area include canopy tree retention and restoration and reinstatement of canopy / subcanopy species characteristic of pre-disturbance Regional Ecosystems (REs). It will be dedicated to RCC for management in perpetuity. The fundamental underpinning for the design of the area is outlined in **Section 2.5.1.3**.

Mapping showing the footprint of the Proposed Action, development footprint, avoidance and retention areas is shown as **Figure 9**. The Proposed Action will result in direct impact (i.e. the Project Area) to 32.57 ha. Temporary Project Areas (i.e. the Avoidance Area) will be reinstated for habitat. Avoidance Areas include all of Western Enhancement Corridor, and parts of the northern corridor. Minor works within the eastern corridor will arise from construction of necessary environmental management infrastructure; stormwater infrastructure (designed to WSUD Principles[9]), and Wildlife Management Infrastructure (underpasses and directional fencing) and some minor filling for the establishment of roads. Conservation Area 1 (5.65 ha) forms the Retention Area for the Project.

2.5.1.1 Eastern Enhancement Corridor

The Eastern Corridor is one of three corridors defined for the site by the Redlands Wildlife Connections Plan (**WCP**) over the Double Jump Road Residential development area and follows Moogurupum Creek through the eastern part of the site. It is generally greater than 100 m in width) and is identified in the WCP as part of the Eprapah Creek Corridor to Giles Road Conservation Area Enhancement Corridor. Unlike the largely cleared Northern Enhancement Corridor (see **Section 2.5.1.2**), the corridor is anchored on an existing waterway: the riparian vegetation along Moogurupum Creek is mapped as a Matter of State Environmental Significance, carries a Category B regulated vegetation designation (Regional Ecosystem 12.3.6), and, in the south-east, falls within the

[9] https://waterbydesign.com.au/download/water-sensitive-urban-design-technical-design-guidelines-for-south-east-queensland

Waterway Corridors and Wetlands designation. The vegetation is generally young regrowth, with degraded remnant confined to the immediate edge of the waterway.

South of Double Jump Road the corridor follows the eastern tributary of Moogurupum Creek. After crossing the road its alignment deviates to the western tributary, then follows the common channel below the confluence of the two tributaries near the eastern site boundary. The proposed development maintains a buffer to the creek — the Moogurupum Creek Conservation Area — with an esplanade road forming a favourable management edge to that buffer.

The WCP corridor's integrity was improved through progressive site informed amendments. Which produced better habitat consolidation and a more direct and logical connection between the Eastern and Northern corridors than the WCP alignment had contemplated — an outcome understood to be supported by the Council during Site planning for the Development Approval.

In intent, the Eastern Corridor is the primary alternate north–south habitat connection, working in concert with the Northern Corridor. Its principal advantage over the compromised Western Enhancement Corridor is certainty: it resolves the barrier and road-strike threat of Double Jump Road through a dedicated fauna underpass, whereas investigations indicated that a functioning underpass for the western link could not be readily achieved. The southern route through the corridor takes in several large bushland patches on its way to Bayview Conservation Reserve and connects to the Moogurupum Creek to Kindilan/Days Road Established Corridor.

The Applicant will fully rehabilitate the Moogurupum Creek Conservation Area. This work partly discharges the development's State and Local Government offset approvals obligation while delivering substantial additional habitat restoration; the Eastern Corridor is the primary focal area for Kola and Grey-headed Flying-fox habitat restoration.

Where the corridor crosses Double Jump Road, a dedicated fauna underpass is proposed. The preferred location is the western tributary, where the northern approach land is under the appellant's control and can be delivered with the development, and where dwellings set close to the eastern tributary crossing would otherwise reduce effectiveness. The concept design (see also **Section 5.3.2.2.2**) provides a bank of three culverts — the central culvert conveying low flow — with dry-passage culverts to achieve Q2 flood immunity, together with fauna furniture and exclusion and directional fencing. Recreation and stormwater elements are integrated so as to preserve corridor function: naturalistic, fully revegetated biobasins near the esplanade road, a single formed path within a narrow footprint, a limited number of naturalistic breakout spaces, and a single sensitively positioned outlook point.

2.5.1.2 Northern Enhancement Corridor

The Northern Corridor is identified in the Redlands WCP as part of the Double Jump Road to Sandy Creek Conservation Area (Priority) Enhancement Corridor, running along the northern boundary of the site over land that is at present largely cleared. The Council's stated preference was for enhancement corridors of the order of 100 m in width.

The 80 m width ultimately adopted for the Northern Corridor was set by the Council through its dealings to resolve the adjoining Urbex Planning and Environment Court appeal to the north. Under that arrangement, Urbex was required to dedicate a 40 m revegetated strip along the southern boundary of its site — half of the desired corridor — leaving the Applicant to provide the remaining 40 m along its own northern boundary so that, in combination, the two dedications would complete an 80 m corridor.

The corridor as originally proposed did not achieve this outcome. The Initial Proposal offered only a 30 m dedication along the northern boundary. To meet the width the Council required, the Amended Proposal (dated 25 November 2020) increased the east-west link along the northern boundary from 30 m to 40 m, so that the combined Urbex–Sutgold corridor would achieve the desired total width of 80 m.

The amendment did more than widen the dedication. It also removed development from the north-eastern corner of the site — an outcome sought under the Initial Proposal — redistributing that development into the main body of the estate. This achieved better habitat consolidation in the eastern parts of the site and improved corridor function around the north-eastern corner, creating a more direct and logical connection between the Eastern

(Moogurupum Creek) and Northern corridors. The integrity of the corridor was to be further enhanced by the dedication of urban-zoned land at the southern end of Lot 801 for conservation purposes.

In functional terms, the Northern Corridor is intended to close an existing gap of approximately 500 m between bushland to the north west which is dedicated for conservation by another approved residential development and the Moogurupum Creek Conservation Area. The Northern Corridor was identified as the first focal area for the establishment of Local Government offsets. Where the road connection between the proposed development and the Urbex development crosses the corridor, a fauna underpass with associated exclusion and directional fencing was proposed to maintain safe passage along the corridor (the concept design is represented in **Section 5.3.2.2.2**). Construction costs to be shared with Urbex.

2.5.1.3 Western Enhancement Area

The Western Enhancement Area is a multi-function spine that originated as a discrete lot within the reconfiguration of a subdivision lodged with the Redland City Council on 9 October 2018. Its alignment and purpose were shaped by the corridor framework of the Redlands WCP, which mapped three corridors across the site: one along the northern boundary, one following Moogurupum Creek to the east, and one traversing the western parts of the site (the Western Enhancement Area).

The final north-western leg of the mapped Western Enhancement Area had, however, been severed by a 2018 approval for a dressage arena located squarely within the corridor alignment. With the western link significantly compromised — and its Double Jump Road crossing point technically difficult to resolve — an alternate connection to the north-west was required. The multi-function spine was proposed as that alternate connection, centred on an existing overland flow path (gully) in the western part of the site.

The Western Area is conceived as a genuinely multi-functional asset, intended to accommodate stormwater conveyance, local park and recreation, and wildlife movement within a single corridor. Its habitat and connectivity role was always intended to be secondary and subordinate to the two major corridors bounding the development to the east (Moogurupum Creek) and north. It is not represented as delivering the connectivity of a wide, fully vegetated corridor; rather to provide living and stepping-stone habitat and to improve local connectivity principally for more mobile species, especially birds and bats.

Notwithstanding its secondary role, the design intent is that, with appropriate enhancement, it will support more than the most generic urban-adapted fauna and is expected to provide habitat and movement opportunity for a more diverse assemblage, including conservation-significant species such grey-headed flying-fox, together with new or improved habitat for nectarivorous birds. A 35 m wide secondary fauna movement linkage was proposed to connect the spine south to land beyond Double Jump Road, positioned to infill an approximately 115 m gap between two large sentinel trees already functioning as stepping stones for birds and bats.

During the joint expert process, the Council's ecologist proposed an alternate 80 m connection through the south-western corner of the site, the principal merit of which was the avoidance of a road crossing. That merit was recognised, and the layout was amended in consultation with the urban designer (Tract) to “flip” the access road and revegetated link so as to remove the road crossing through the part of the spine most important for fauna movement.

The intent for the spine was to be realised through a suite of enhancements: retention of edge and batter trees (using retaining walls in lieu of batters), bushland-style vegetated biobasins, construction of the low-flow path to Natural Channel Design principles, retention of a group of Scribbly gums at the eastern end, and provision of low-key paths for nature appreciation rather than higher-impact recreational infrastructure.

2.5.2 Layout and Lot Configuration

The layout of the Proposed Action will reflect the intent of the two land uses described in **Section 1.3** and shown in **Appendix 2.1**. The direct impact from the Proposed Action includes all residential uses, local parks and proposed stormwater solutions. It is also noted that local parks and stormwater solution areas will be subject to plantings of native endemic flora species, contributing to foraging habitats for common and conservation significant fauna alike.

Lot configuration will be standard and in line with requirements of the Redland Planning Scheme (RCC 2018). Staging of the Proposed Action is represented in **Appendix 2.2**.

2.5.3 Access and Traffic

The Proposed Action represents new development into a designated expansion area for which all traffic requirements are internalised or conveyed to the arterial road network which has greater capacity (when compared with local roads) to manage the increases attributable to the Proposed Action.

The traffic investigation for the Proposed Action is considering, among other items:

- Local road network – upgrading sections to enhance traffic capacity and safety through new or improved intersections, street lighting and pedestrian cyclist facilities where applicable.
- Public transport – the new community will provide a critical population mass and improved road network that could support an expansion of the current bus services, subject to State Government planning.
- Active transport – the proponent will provide a network of pedestrian and cycle paths along roads and through the parks and bushland, ensuring a community that is connected within the Project Area and to the surrounding areas.

Any roads within the Project Area which traverse important ecological features will be constructed in a way that promotes fauna passage across these potential barriers. These impacts can be dealt with at the latter stages of the development approval process; however, wildlife management infrastructure approaches to these matters are described in **Section 5.3**.

2.5.4 Stormwater Management

Importantly, the design of the Proposed Action includes WSUD elements within the streetscape. All areas of WSUD will be revegetated for the benefit of wildlife as habitat.

The Proposed Action will increase impervious surfaces and introduce uses that have the potential to increase nutrient, chemical and micropollutant input to local waterways (Moogurrapum Creek and Eprapah Creek tributaries). Impacts and mitigation measures will be outlined in stormwater management plans (**SWMPs**) prepared for the various stages of the Proposed Action.

SWMPs will outline how contemporary stormwater management practices will be used to polish stormwater by passing it through bioretention systems to achieve State-mandated water quality objectives. The bioretention areas will be integrated with the Drainage Reserve and Residential Area. Gross pollutant traps will likely be included in the treatment train to remove macro-pollutants such as plastics.

Detailed SWMPs design will be submitted as part of the operational works applications. The SWMPs will be assessed against the stormwater management strategies identified within Redland Planning Scheme Policies (RCC 2018). Hard infrastructure (pipes and bioretention basins) will be installed and deemed to be in suitable working order before being accepted as “off maintenance”. Monitoring the effectiveness of the infrastructure will proceed as per approval conditions.

2.5.5 Erosion and Sediment Control

The construction phase of the Proposed Action requires earthworks, which if improperly managed have the potential for deposition of sediment within Moogurrapum Creek. However, before the commencement of construction, operational works applications will be submitted to RCC outlining proposed civil works and associated erosion and sediment control measures in accordance with accepted practice (i.e. the International Erosion Control Association Guidelines). The Proponent will be responsible for ensuring that the approved contractor implements the approved plans so that erosion and sediment are appropriately managed within the Project Area.

2.5.6 Services

Services necessary to support the Proposed Action include water, sewerage and electricity. These services will be established within the Project Area with connection to existing reticulated service networks. These services will be undergrounded and will not require additional removal of vegetation outside of that already envisaged within the development footprint. Where services traverse retained vegetation Drainage Reserve and the EPZ, this may necessitate the removal of a small number of trees/shrubs to facilitate service connections. These areas are shown within the Vegetation and Fauna Management Plan (**VFMP**) (**Appendix 7**), prepared for the Proposed Action.

2.5.7 Restoration and Enhancement

The Proposed Action will involve two main types of land restoration as outlined within the Concept Rehabilitation Management Plan (**Concept RMP**) included in **Appendix 4**:

- Northern and Eastern Enhancement Corridor. The eastern corridor comprises 5.65 ha total area. The eastern corridor is set aside for habitat and landscape corridor functionality, primarily for Koala (*Phascolarctos cinereus)* but for Grey-headed Flying-fox (*Pteropus poliocephalus*) as well as other fauna. The northern corridor comprises 2.44 ha. The northern corridor is set aside for biodiversity and management of local connectivity in line with the structure plan and the Court ruling. It is a canopy linkage (bushfire management requirements stipulate managed fuel reduced understorey requirements. It provides local east to west linkages between Moogurrupun Creek and retained remnant vegetation adjoining to the north-west (**Figure 9**).
    - For the purpose of surveillance and establishing “a connection to nature” for the residents of the development, paths and breakout spaces will be established at the edge of the northern corridor. These small breakout areas will not significantly affect the ecological values of the corridor and are located on the residential side of proposed exclusion fencing.
    - Stormwater infrastructure is located within the buffer of the eastern corridor. Vegetated bio-basins can be established in corridors if they are naturalistic and achieve a similar form to the Water by Design Bioretention Technical Design Guidelines[10]. The approach has recently been accepted by NEPA through approval for Referral 2020/8615.
    - The corridors will be dedicated to RCC for management in perpetuity. The conservation areas are Retention Areas subject to ecological restoration to facilitate habitat consolidation, ecological connectivity and safe faunal movement north to south along Moogurrapum Creek and east-west between nodes of habitat offsite and the creek corridor. Mitigation measures in this area include canopy tree retention, consolidation and enhancement of existing habitat patches through restoration and reinstatement of canopy / subcanopy species characteristic of pre-disturbance REs and installation of wildlife management infrastructure including dedicated Koala (*Phascolarctos cinereus*)(and other fauna) underpasses beneath Double Jump Road and another beneath an internal road bisecting the northern corridor, the construction of direction / exclusion fencing along the Eastern Corridor only and installation of fauna furniture. This is the primary means of mitigating possible on-site primary and secondary development effect on-site.
- Western Enhancement Area – is a multi-function Spine is an area of Open Space dedicated for canopy habitat, pedestrian, cycle way and stormwater infrastructure along an existing ephemeral, overland flow path. Mitigation measures in this area include canopy tree retention and restoration and reinstatement of canopy / subcanopy species characteristic of pre-disturbance REs. It will be dedicated to RCC for management in perpetuity.
    - The pre-clear RE mapping will represent the most appropriate vegetation community to guide the land restoration activities. Further information on the proposed land restoration is included in Concept RMP (**Appendix 4**).

This restoration work will follow the South East Queensland Ecological Restoration guideline with the tiered response comprising increasing intensity of effort being:

- **Natural Regeneration** - resilience is intact and recovery is automatic with the removal of the cause of the damage e.g. removal of stock and erection of exclusion fencing.

[10] https://waterbydesign.com.au/download/water-sensitive-urban-design-technical-design-guidelines-for-south-east-queensland

- **Assisted Natural Regeneration** - Where degrees of resilience exist and “triggering” interventions, either disturbance or resource provision can affect recovery by natural regeneration e.g. removal of weeds to remove competition and facilitate recovery of recruitment.

- **Ecological Reconstruction** – where resilience is depleted, and abiotic or biotic elements need wholesale importation or major amendment before recovery can commence e.g. where native vegetation has been removed and is not naturally recruiting, but site topography remains unchanged.

- **Fabrication** – where conditions are permanently changed and better-adapted local systems can be regenerated or constructed to restore integrity to the landscape e.g. Where topography has changed so drastically, that the original ecosystem can no longer be re-established on the site.

3. Description of the Environment and MNES of Interest

3.1 Description of Potential MNES

28 South conducted likelihood of occurrence assessments of MNES that may occur on, or adjacent to the Project Area for the CAR. That assessment was informed by previous assessment of values within the Project Area, vegetation communities, habitat, habitat quality and desktop analysis of species. It confirmed suitable habitat for, and presence of Koala (*Phascolarctos cinereus)* and Grey-headed Flying-fox (*Pteropus poliocephalus*).

The NEPA Information Request of 5 July 2024 stated that the Department considered that the matters that may or were likely to be significantly impacted by the proposed action include, but are not limited to:

- Koala (*Phascolarctos cinereus*) (combined populations of Queensland, New South Wales and the Australian Capital Territory) – Endangered (**E**); forage, shelter and dispersal habitat affected.
- Grey-headed Flying-fox (*Pteropus poliocephalus*) – Vulnerable (**V**); forage habitat affected.

The documentation also noted that based on all the information available to the department (including the Protected Matters Search Tool) and based on the material provided in the CAR, the department considers that the proposed action may significantly impact on other listed threatened species including but not limited to the South-eastern Glossy Black Cockatoo (*Calyptorhynchus lathami lathami*) – Vulnerable; as elements of significant forage, nesting and watering habitat may be present.

The following table (**Table 5**) provides a summary assessment of these species in the context of the surrounding landscape and the Project Area. This assessment built upon material drawn from CAR and further analysis. Greater detail for these species is presented in **Sections 3.4.1-3.4.3**.

Table 5: Likelihood of Occurrence

MNES	Legislative Status		Habitat (foraging and resting) preferences, breeding/nesting and seasonal influences	Species distribution	Predicted presence on Site prior to further EPBC survey^
	EPBC Act	NC Act			
Koala (*Phascolarctos cinereus*)	E	E	Koala (*Phascolarctos cinereus*) inhabits a range of temperate, sub-tropical and tropical forest, woodland and semi-arid communities dominated by species from the genus *Eucalyptus*. The Koala (*Phascolarctos cinereus*) is a leaf-eating specialist. Its diet is restricted mainly to foliage of *Eucalyptus* spp. It may also consume foliage of related genera, including *Corymbia* spp., *Angophora* spp. and *Lophostemon* spp. and at times supplement its diet with other species, including *Leptospermum* spp. and *Melaleuca* spp. Koala (*Phascolarctos cinereus*) are able to disperse significant distances across open ground with animals considered capable of dispersing up to 2 km in the absence of barriers to movement and low threats.	The Koala (*Phascolarctos cinereus*) is endemic to Australia and is widespread in coastal and inland areas from north-east Queensland to Eyre Peninsula, South Australia. Koalas (*Phascolarctos cinereus*) have been known to occur within the locality and proximal to the Project Area with 615 WildNet and Atlas of Living Australia (ALA) records within a 5 km radius of the Project Area, since 2015. ALA records identify seven (7) records from the Project Area, or in habitat connected to the Project Area since 2004.	**Likely** 98.3% of the Project Area is mapped as Category X (non-remnant) under the *Vegetation Management Act 1999* (Qld) (VM Act), with a small portion in the northwest of Project Area mapped as Category B remnant 'least concern' RE 12.3.6. This represents higher quality foraging and shelter habitat. A larger area of young regrowth comprising 6.81 ha representative of moderate foraging habitat is present; however, the bulk of the Project Area (>30 ha) consists of modified open woodland of mature paddock trees with exotic pasture understorey. This is representative of dispersal habitat of low-quality forage and shelter habitat. Canopy species are representative of former vegetation coverage and are known Koala habitat trees (**KHTs**). There is a patchy distribution of regulated remnant and regrowth vegetation, and vegetation that is not regulated (young regrowth) adjoining the Project Area. The existence of this surrounding vegetation increases the potential for transient Koalas to occur on-site.

MNES	Legislative Status		Habitat (foraging and resting) preferences, breeding/nesting and seasonal influences	Species distribution	Predicted presence on Site prior to further EPBC survey^
	EPBC Act	NC Act			
					Habitats are broadly suitable for Koala *(Phascolarctos cinereus)* and mapped RE presence (both remnant and regrowth) contain canopy species and REs recognised as supporting Koala (*Phascolarctos cinereus*) habitat.
Grey-headed Flying-fox (*Pteropus poliocephalus*)	V	C	The Grey-headed Flying-fox (*Pteropus poliocephalus*) requires foraging resources and roosting sites. It is a canopy-feeding frugivore and nectarivore, which utilises vegetation communities including rainforests, open forests, closed and open woodlands, *Melaleuca* swamps and *Banksia* woodlands. It also feeds in introduced tree species in urban areas and in commercial fruit crops. The primary food source is blossom from *Eucalyptus* and related genera but in some areas, it also utilises a wide range of rainforest fruits. None of the vegetation communities used by the Grey-headed Flying-fox (*Pteropus poliocephalus*) produces continuous foraging resources throughout the year, and the species has adopted complex migration traits in response to ephemeral and patchy food resources. The Grey-headed Flying-fox (*Pteropus poliocephalus*) roosts in aggregations of various sizes on exposed branches, commonly of emergent trees. Roost sites are typically located near water, such as	**Queensland:** Black Swamp, Caboolture (Wararba Creek), Camira, Canungra (Gold Coast), Cascade Gardens (Gold Coast), Curlew Park (Sandgate), Dayboro (Strong Road), Eerwahvale, Esk, Giffin Park (Norman Creek), Goat Island (Noosaville), Gympie, Helensvale (Gold Coast), Hervey Bay, Indooroopilly, Kandanga, Kinmong Creek, Lytton Road, Meakin Park, Parklands, Peachester, Samford (Days Road) Sandstone Point, Sparkes Hill, State Forest 38, Stradbroke Island, Tallebudgera, Upper Rocky Creek/Murphys Creek, Victoria Point (Egret Drive), Woodend and Woodford. There are no observed roosts on-site, with the nearest active roost sites being Junee Street Wetlands (430), located approximately 5 km south-east of the Project Area. This roost was last assessed in 2021 as a category 3 camp for Grey-headed Flying-fox (*Pteropus poliocephalus*). There are 36 records of the species within a 5 km radius of the Project Area according to Queensland WildNet and ALA sightings data, with the closest record on these databases	Camps – **Unlikely** Individuals – **Likely** Highly vagile aerial species with known camps within 25 km of the Project Area. While vegetation values on-site have been previously impacted, some suitable foraging habitat exists mostly in the form of regrowth. Additionally, as previous assessments have recorded the species on Project Area, the species is known to occur, though this will likely present as a flyover occurrence or for opportunistic foraging. 98.3% of the Project Area is mapped as Category X (non-remnant) under the *Vegetation Management Act 1999* (Qld), with a small portion in the northeast of site (0.63 ha) mapped as Category B remnant 'least concern' RE 12.3.6. This RE contains known winter and spring flowering forage species. Outside of these remnant patches, regulated (High Value) and (low value)

MNES	Legislative Status		Habitat (foraging and resting) preferences, breeding/nesting and seasonal influences	Species distribution	Predicted presence on Site prior to further EPBC survey^
	EPBC Act	NC Act			
			lakes, rivers or the coast. Roost vegetation includes rainforest patches, stands of Melaleuca, mangroves and riparian vegetation, but colonies also use highly modified vegetation in urban and suburban areas. The species can maintain fidelity to roost sites for extended periods, although new sites have been colonised in recent times.	observable as a number of records from nearby camps which have not contained an Grey-headed Flying-fox (*Pteropus poliocephalus*) activity in the past four years. Suitable forage habitat for the species is present (including winter flowering species) and given Grey-headed Flying-fox (*Pteropus poliocephalus*) may travel up to 50 km round trip in a single night, presence on-site is expected.	young regrowth contains Broad-leaved Paperbark (*Melaleuca quinquenervia*) an important winter/spring flowering resource. The existence of surrounding intact vegetation increases the potential for flyover Grey-headed Flying-fox (*Pteropus poliocephalus*) individuals to occur through the Project Area.
South-eastern Glossy Black Cockatoo (*Calyptorhynchus lathami lathami*)	E	E	South-eastern Glossy Black Cockatoo (*Calyptorhynchus lathami lathami*) is an uncommon but widespread species occupying Eucalypt forests and feeding almost exclusively on the seeds of she-oaks (*Casuarina* and *Allocasuarina*). These birds show a strong preference for individual feed trees and will not feed on many other proximate trees of the same species. South-eastern Glossy Black Cockatoo (*Calyptorhynchus lathami lathami*) is a tree hollow nesting species, reliant on large hollows in living and dead eucalypt trees. Review of RE Mapping identified plant communities in which both *Casuarina* and *Allocasuarina* sp. occur.	The South-eastern Glossy Black Cockatoo (*Calyptorhynchus lathami lathami*) has been known to occur within the broader locality, though past ecological assessments do not provide evidence of their presence on Project Area. There are 15 records within a 5 km radius of the Project Area since 2015. All are associated with extensive tracts of habitat to the south-west and west (i.e. Mount Cotton).	**Unlikely** Review of RE Mapping identified plant communities in which both *Casuarina* and *Allocasuarina* occur are present within 5 km of the Project Area. On-site investigation identified a distinct lack of mature forage trees, signs of foraging or presence. Hollow bearing trees are present, however the context; exposed paddock trees on a peri-urban fringe ensures these hollows are exploited by more gregarious edge specialists (e.g. possums and *Cacatua* spp) species, which are hollow competitors.

Notes: **Legislative status:** *Environment Protection and Biodiversity Conservation Act 1999* (Cth) - Critically Endangered (**CE**), Endangered (**E**), Vulnerable (**V**); *Nature Conservation Act 1992* (Qld) - Critically Endangered (**CR**), Endangered (**E**), Vulnerable (**V**), Near Threatened (**NT**), Conservation Dependent (CD), Common (C).
^ refer **Appendix 5.3** for Likelihood of occurrence assessment criteria

3.2 Landscape Context and Connectivity of the Project Area

Biodiversity context of the Project Area is outlined by mapping of regional corridors and conservation area mapping (**Figure 10**), and Regulated Remnant and High Value Regrowth Vegetation shows the contiguous landscape, connectedness and patch features of the landscape within the broader locality. Presently there is 38.8% regulated vegetation cover (33.3% remnant, 4.5% regrowth) within 25 km of the Project Area. The balance (61.2%) comprises modified or cleared vegetation types.

The majority of these corridors and conservation areas is situated to the south-west of the Project Area associated with more vegetated foothills and hills associated with Mount Cotton. Vegetation is situated to the north-west to south-east Regionally Significant Biodiversity Corridor (**ecological corridor**) which frames the area to the west.

Connectivity between these areas and the Project Area is limited. What opportunities exist for vagile species to move through the landscape is limited by patchily distributed remnant and regrowth habitat. **Figure 11** reveals a patch discontinuous connectivity to the south along Moogurrapum Creek through remnant, regrowth and predominantly cleared rural landscape. To the north-east, Moogurrapum Creek which maintains near continuous vegetation coverage, provides greater opportunity for dispersal. Habitat to the north-west of the Project Area (to the south of Bunker Road, includes extensive regrowth that retains connectivity with the Eprapah Creek Corridor (a State Significant Riparian Corridor) and in turn affords dispersal opportunities with the Regionally Significant Corridor associated with Mount Cotton (refer **Figure 10**). Reinstatement of open forest habitat along the northern boundary of the Project Area presents an opportunity to reinstate east-west connections between Moogurrapum and Eprapah Creeks.

Within the Project Area, mapped regional ecosystems include 0.63 ha of Category B (Least Concern) vegetation, with the remaining 37.47 ha mapped as Category X (non-remnant). The Category X designation is reflective of the extensive historic clearing on the Project Area and surrounds. Approximately 6.81 ha of the Category X vegetation consists of young regrowth (mostly within the Moogurrapum Creek corridor (Eastern Conservation Corridor) with the balance 30.66 ha comprising pastural grassland +/- open woodland.

3.3 Project Area Characteristics and Natural Values

3.3.1 Surveys Undertaken

Extensive ecological surveys of the Project Area have been undertaken by 28 South and others over the period 2018 to 2023 to characterise the ecological values of the Project Area. The ecological surveys have included botanical and vegetation community assessments, tree surveys, specifically in relation to KHTs and important winter flowering species alongside general and targeted fauna surveys and habitat assessments.

Surveys have been conducted by and under the supervision of staff recognised as suitably qualified and experienced to undertake assessments under the EPBC Act. The full body of knowledge accumulated for the site has been drawn from ecological assessments conducted over the period 2018-2024. Documentary evidence of the studies can be found in **Appendix 6** with summary outlines below.

- Baseline ecological assessment (**Appendix 6.1**) of the Project Area (supported by botanical, vegetation community, terrestrial fauna and habitat survey) by BAAM Ecological Consultants (**BAAM**) in 2018. This work was relied upon and built upon by more focused assessments undertaken for the Planning and Environment Appeal. The Project Area is substantially unchanged since BAAMs assessment and is considered relevant.

- Ecological Assessment Report (**Appendix 6.2**) produced by 28 South. This was a comprehensive summation of knowledge developed from desktop and field-based assessments for the Project Area 2018-2024.

- Black Sheoak assessment for the Eastern Enhancement Corridor (**Appendix 6.3**) prepared by 28 South to inform development of protection, restoration and corridor enhancement strategies for the Proposed Action. It is specifically included as it lends evidence to the discussion of potential Glossy Black Cockatoo presence and utilisation.

- JER (**Appendix 6.4**) produced by Expert Witnesses for the Appellant (Sutgold) and Respondent (Redland City Council). The primary author is Wayne Moffitt (28 South). The report outlines all matters of agreement (with resolution) and disagreement relevant to the outstanding ecological matters. Materials, mapping and strategies produced, relied upon field assessment undertaken by 28 South personnel and others (including arboriculture consultants).

- Statement of Evidence (**Appendix 6.5**) produced by Wayne Moffitt (28 South) as expert witness for Sutgold. This document outlined the grounds for disagreement, outcomes and potential solutions as far as the appellant was concerned and suggested development approval conditions for those matters.

The studies have resulted in a comprehensive understanding of the Project Area's ecological values to inform development of pertinent fauna management strategies for the retention and restoration of the best quality habitat within the Project Area. It is held that the design in concert with other green infrastructure measures put in place within the locality will adequately cater for the long-term sustainability of Koala (*Phascolarctos cinereus*) and other riparian / forest dependent fauna which would normally be expected to reside in retained and enhanced habitat within the riparian reserve.

3.3.2 Physical Characteristics of the Project Area

3.3.2.1 Landform, Topography and Drainage

The Project Area comprises a rolling terrain with a generally south-easterly aspect, which encompasses ca. 80% of the Project Area. The exception is along the central northern portion of the Project Area in the vicinity of a flattened plateau. North of this plateau, the aspect is northerly. Topography increases across the Project Area ranging from 9 metre (**m**) Australin Height Datum (**AHD**) along the eastern boundary (associated with an unnamed tributary of Moogurrapum Creek) to 43 m AHD in the north-western corner of the property (**Figure 12**).

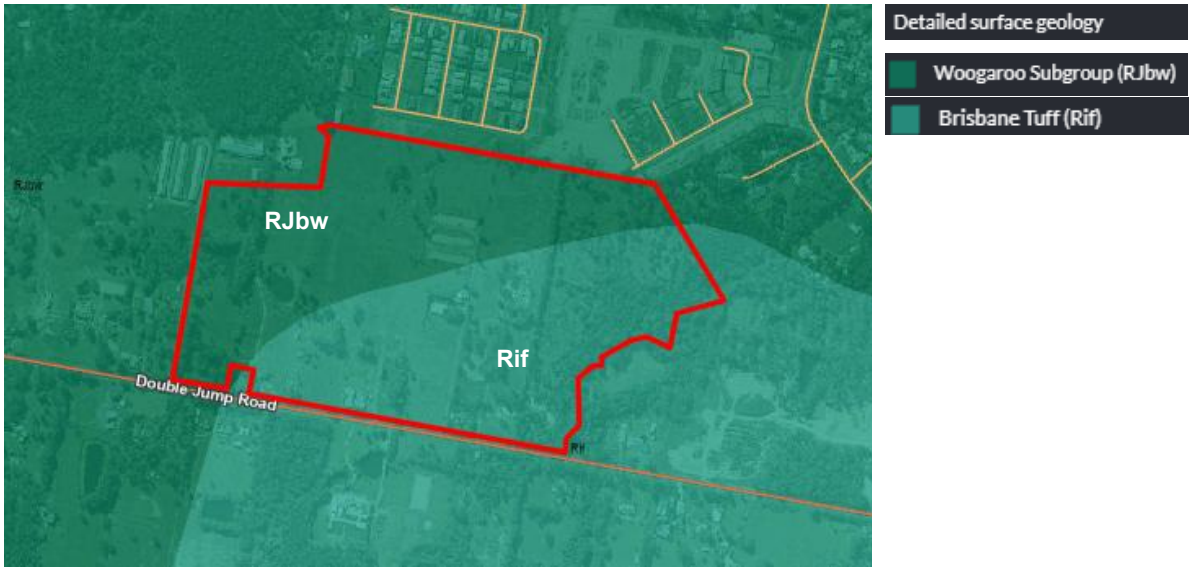
The project area is situated on the coastal plain within 3 km of Moreton Bay (east) and the foothills of Mount Cotton (south-west). In this locality, the terrain consists of a rolling landscape of broad, flattened crests intersected by incised stream channels. Elevations throughout this area are similar to that found on the Project Area, though gradually decreasing easterly towards the bay. Land greater than 50 m AHD is not generally encountered until 3 km to the south and west, though there is a localised high point of 50 m AHD, 130 m to the west of Project Area eastern boundary. Beyond and to the west of this 3 km extent lies steeper terrain with high points of around 250 ms AHD elevation.

Hydrologically, the Project Area is situated within the Logan-Albert Drainage Basin. All overland flow and drainage line report to a tributary of Moogurrapum Creek a drainage feature under the *Water Act 2000* (Qld), which also forms the eastern boundary. A number of agricultural (farm) dams have been created in the Project Area by constructing bunds across broad, flattened overland flow paths with material won by excavating material from within the overflows to form basins and achieve additional storage. These waterbodies together with the tributary of Moogurrapum Creek afford permanent water availability.

3.3.2.2 Geology and Soils

Regional Moreton Region Surface Geology (**Inset 5**) indicates that surface geology of the western and northern parts of the Project Area comprises Woogaroo Subgroup (RJbw) of the late Triassic / early Jurassic geological era, consisting of sublabile to quartzose sandstone, siltstone, quartz-rich granule to cobble conglomerate and coal. The rock type is a stratified unit including volcanic and metamorphic intrusions.

The southern and eastern portions of the Project Area comprise Brisbane Tuff (RiF) of the Late Triassic geological era, which is a stratified unit, including volcanic and metamorphics consisting of rhyolitic tuff, ignimbrite, agglomerate, conglomerate, sandstone and shale. Recent (Quarternary era) alluvial deposits associated with Moogurrapum Creek have accumulated over this geology.



Inset 5. Surface Geology of the Project Area and Locality

3.3.2.3 Landzones and Soils

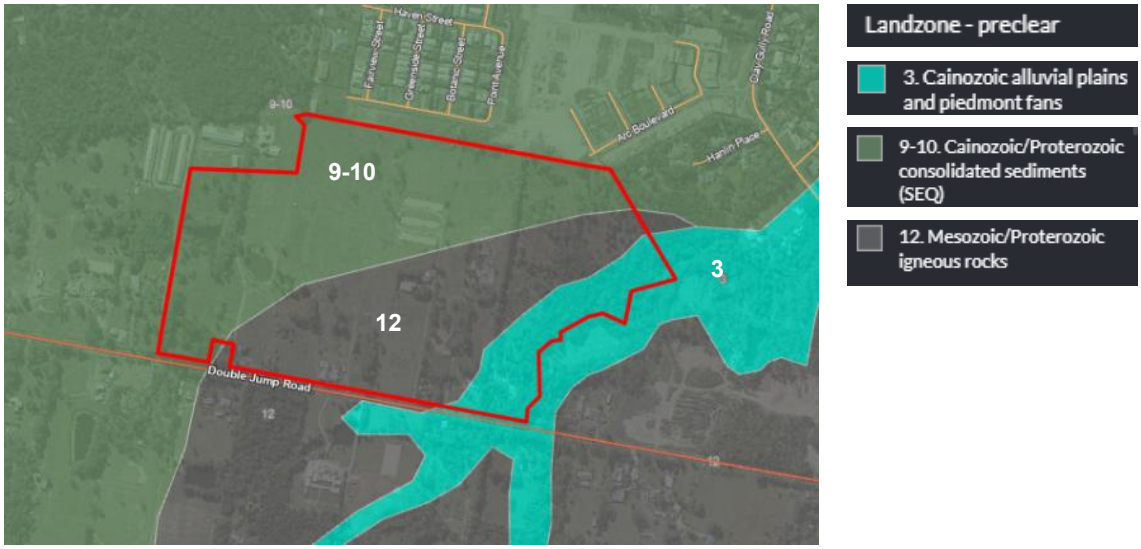
With respect to the major geological structures, the Project Area overlays three land zones[11] (**Inset 6**):

- Land Zone 3: Quaternary alluvial systems comprising alluvial river and creek flats. Recent Quaternary alluvial systems, including closed depressions, paleo-estuarine deposits currently under freshwater influence, inland lakes and associated wave built lunettes. Excludes colluvial deposits such as talus slopes and pediments. Includes a diverse range of soils, predominantly Vertosols and Sodosols; also with Dermosols, Kurosols, Chromosols, Kandosols, Tenosols, Rudosols and Hydrosols; and Organosols in high rainfall areas. This land zone is represented along Moogurrapum Creek.

- Land zone 9-10: Cainozoic / Proterozoic consolidated sediments of undulating country and uplifted ranges. These are fine / coarse grained sedimentary rocks comprising siltstones, mudstones, shales, calcareous sediments, labile to quartzose sandstones, concglomerate and minor interbedded volcanics. Soils are fine textured predominantly shallow Rudosols and Tenosols of varying fertility, but include sandy surfaced Kandosols, Kurosols, Sodosols and Chromosols.

- Land Zone 12: Mesozoic/Proterozoic igneous geologies comprising hills and lowlands on granitic rocks. These are acid, intermediate and basic intrusive and volcanic rocks such as granites, granodiorites, gabbros, dolerites, andesites and rhyolites, as well as minor areas of associated interbedded sediments. Excludes serpentinites (land zone 11) and younger igneous rocks (land zone 8). Soils are mainly Tenosols on steeper slopes with Chromosols and Sodosols on lower slopes and gently undulating areas. Soils are typically of low to moderate fertility.

[11] https://www.qld.gov.au/environment/plants-animals/plants/ecosystems/descriptions/land-zones\



Inset 6. Land Zones of the Project Area and Locality

3.3.3 Bioregional Characteristics of the Project Area

3.3.3.1 Bioregional Context

Biogeographically, the Project Area overlays two Interim Biogeographic Regionalisation for Australia (**IBRA** v7) subregions[12] (refer **Inset 7**). The Land Zone boundary between Land Zone 9-10 and Land Zone 12 demarcates the boundary; land to the north of the Project Area (Land Zone 9-10) is encompassed within the Sunshine Coast – Gold Coast Lowlands, land to the south (Land Zone 12) encompasses the Burringbar - Conondale Ranges subregion.

The Project Area falls outside of mapped Regional Biodiversity Corridors and recognised bioregional corridors of Regional and State significance (**Figure 10** and **Figure 11**), as defined within the Queensland Government's Statewide Biodiversity Planning Assessment (**BPA**)[13] mapping. The majority of this vegetation is situated to the south-west (3-5 km form the Project Area) and is associated with the Mount Cotton to Bay Islands Regional Biodiversity Corridor.

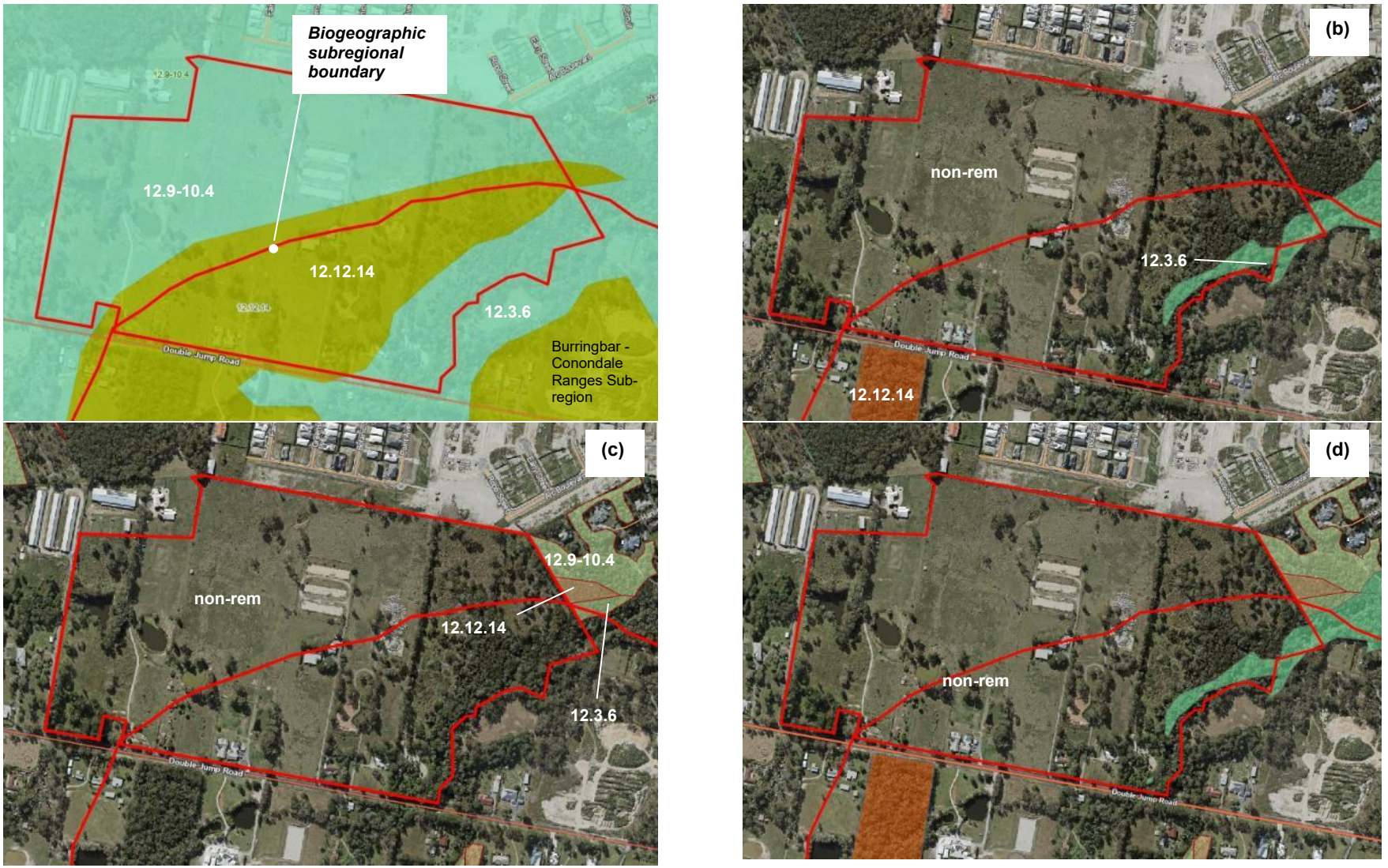
3.3.3.2 Regulated and Pre-clearing Vegetation

The extent and status of the current areas of mapped Regulated Vegetation are illustrated in **Inset 7**, with Queensland Government Vegetation Management Reports appended as **Appendix 9**.

Queensland Herbarium pre-clear RE mapping shows that the majority of the Project Area (51.7%) supported RE 12.9-10.4. The remainder comprised RE12.12.14 (37.5%) and RE12.3.6 (23.6%).

[12] Refer Thackway and Cresswell (1995) for a description of the IBRA and https://www.dcceew.gov.au/environment/land/nrs/science/ibra#ibra

[13] https://www.qld.gov.au/environment/plants-animals/biodiversity/planning. A Biodiversity Planning Assessment (BPA) identifies the terrestrial ecological values in a region, or bioregion, according to their conservation significance. BPAs are used by governments, members of the community and landholders to make planning decisions about appropriate land use.



Inset 7. (a) Preclear Regional ecosystems, top left; (b) Remnant Regional Ecosystems, top right; (C) High Value Regrowth Regional Ecosystems, bottom left; (c) Regrowth, bottom Composite remnant; and (d) Composite High Value Regrowth and Remnant Regional Ecosystems

3.3.3.3 Ground-truthed Vegetation Communities

The vegetation supported by the Project Area has been subjected to historic broad-scale and selective clearing and indicates vegetation communities of various age cohorts including scattered remnant canopy retained in open paddocks, advanced regrowth and regrowth areas. A summary description of REs believed to be represented on the Project Area, as reconstructed from State pre-clearance mapping and botanical observation of relict canopy and regrowth vegetation (derived by quaternary site assessment, tree survey and bio-condition assessment) is provided in **Table 6**.

These surveys generally found that the most advanced habitat within the Project Area is associated with remnant and regrowth vegetation adjoining Moogurrapum Creek (eastern portion of the Project Area). The balance comprises exotic grassland +/- scattered mature and over mature paddock trees structurally forming an open grassland. Significant paddock trees include Scribbly Gum (*Eucalyptus racemosa*), Broad-leaved Paperbark (*Melaleuca quinquenervia*), and to a lesser extent, Pink Bloodwood (*Corymbia intermedia*), Queensland Blue Gum *(Eucalyptus tereticornis*), Brown Bloodwood (*Corymbia trachyphloia*), Swamp Mahogany (*Lophostemon suaveolens*), Narrow-leaved Red Gum (*Eucalyptus seeana*).

Table 6: Regional Ecosystems Represented

RE	VM Act* Status	Short Description	Pre-clear RE Map	Current RE Map	Former presence supported by relictual vegetation
12.3.6[14]	Least Concern	Broad-leaved Paperbark (*Melaleuca quinquenervia*) +/- Queensland Blue Gum (*Eucalyptus tereticornis*), Swamp Mahogany (*Lophostemon suaveolens*), Pink Bloodwood (*Corymbia intermedia)* open forest on coastal alluvial plains	Yes	Yes	Yes
12.12.14[15]	Of Concern	Scribbly Gum (*Eucalyptus racemosa subsp. racemosa*) +/- Broad-leaved Paperbark (*Lophostemon confertus),* Turpentine Tree (*Syncarpia glomulifera*), White Mahogany (*Eucalyptus acmenoides*) *woodland to open forest usually on rocky near coastal areas on Mesozoic to Proterozoic igneous rocks*	Yes	No	Yes
12.9-10.4[16]	Least Concern	Scribbly Gum *(Eucalyptus racemosa subsp. racemosa)* woodland on sedimentary rocks	Yes	No	No

* *Vegetation Management Act 1999* (Qld)

3.3.3.4 Threatened Flora and Ecological Community Searches

Targeted botanical surveys undertaken failed to record any species listed as MNES species or Threatened Ecological Communities (**TECs**) under the EPBC Act, or any state listed Critically Endangered, Endangered, Vulnerable and Near Threatened (**CREVNT**) species listed under the *Nature Conservation Act 1992* (Qld) (**NC Act**). Surveys have found that tree species supported on Project Area are generally consistent with the State Mapping.

[14] https://apps.des.qld.gov.au/regional-ecosystems/details/?re=12.3.6
[15] https://apps.des.qld.gov.au/regional-ecosystems/details/?re=12.12.14
[16] https://apps.des.qld.gov.au/regional-ecosystems/details/?re=12.9-10.4

3.3.3.5 *Tree Survey*

A tree survey utilising differential GPS to pick up native tree species greater than 100 mm DBH[17] and 4 m height for KHT[18] species and >200 mm DBH for all other species. The location of trees in relation to the Proposed Action have been plotted and a detailed plan and tree schedule of tree details is presented in **Appendix 7** – Vegetation and Fauna Management Plan.

3.3.4 Habitats for MNES Fauna Species

For the purpose of conducting habitat quality assessments, the Project Area can be broadly separated into three habitat Assessment Units (**AUs**) based upon vegetation and vegetation communities present (as influenced by present and historic land uses), land zones and pre-clear REs.

These vegetation communities and land zones / pre-clear REs have been used to identify the Modified Habitat Quality (**MHQA**) AUs outlined in **Table 7** below. These are mapped as **Figure 13**. Within each of these areas there remain sub-areas and ecotonal changes which alter the balance of features based on factors including topography, drainage, aspect, level of ongoing maintenance, grazing by horses, weeds and weed distribution vectors.

The habitat quality at the Project Area has been assessed using a modified version of the Queensland Government's Guide to Determining Terrestrial Habitat Quality: *A toolkit or assessing land-based offsets under the Queensland Environmental Offsets Policy Version 1.2* (Queensland Government 2017). The relationship between REs, AUs, Vegetation Communities and MHQA sites is outlined in **Table 7** with sampling effort compliance against the requirements of HQA version 1.2 shown in **Table 8**. MHQA assessment sites and AUs are presented as **Figure 13**.

Table 7: Relationship between Regional Ecosystems, Assessment Units, Vegetation Communities and MHQA Assessment Sites – Project Area (IA)

Description	Site		
Project Area Assessment Unit (IA AU)	IA AU1	IA AU2	IA AU3
Assessment Unit Description	Mixed Patchy Regrowth and Remnant Broad-leaved Paperbark (*Melaleuca quinquenervia*) open forest	Exotic dominated pastural grassland with scattered relict paddock trees	Exotic dominated pastural grassland with scattered relict paddock trees (+/- veteran Scribbly Gum (*Eucalyptus racemosa*))
Pre-clear Regional Ecosystem	12.3.6	12.12.14	12.9-10.4
Analogous Ground-truthed RE	12.3.6*	12.12.14*	12.9-10.4*
Current regulated vegetation status	Category B and Category X	Category X	Category X
Number of BioCondition Plots	3	4	6

[17] Diameter at breast height, measured 1.3 m above natural ground.
[18] Comprising species of the genera *Eucalyptus, Corymbia, Lophostemon, Angophora* and *Melaleuca*

Description	Site		
MHQA Sites	Transects 1, 2 and 5	Transects 3, 6, 8 and 11	Transects 4, 7, 9, 10, 12, 13 and 14
Notes	Contains Remnant and moderate age (ca 10 year old based upon aerial photograph interpretation) regrowth with mature trees providing seed for recruitment.	Predominantly exotic pastoral grassland with a sparse relict canopy of veteran Scribbly Gum (*Eucalyptus racemosa*).	Predominantly exotic pastoral grassland with a sparse relict canopy of veteran Scribbly Gum (*Eucalyptus racemosa*). Patchy regrowth particularly comprising Black Oak (*Allocasuarina littoralis*) is present in the east adjacent to Moogurrapum Creek.

Notes:
* Derived from presence of relict canopy trees species and canopy tree recruitment
^ No relict canopy species or canopy recruitment. Analogous RE derived from pre-clear RE.

Table 8: MHQA Sampling for Each AU Expressed as Total Area of Assessment Units Sampled

IA AU	Area (ha)	% of total Site Area	Number of plots	Total Plot Area* (ha)	% of AU sampled	HQA version 1.2 Notes
1	4.27	11.16	3	1.5	35.13	Suggested minimum number of sampling sites for units of 0-50 ha is 'at least 2. This may be streamlined if it can be demonstrated a polygon is uniform in condition
2	14.38	37.64	4	2.0	13.91	
3	19.57	51.20	7	3.5	17.88	

Notes:
* number of plots in IA AU x bio-condition plot area (std. = 0.5 ha)

BioCondition assessments at each of the identified Assessment Unit is better than the minimum standard identified by HQA version 1.2. Data sheets are found in **Appendix 8**. The location of AU and BioCondition transects are represented on **Figure 13**.

*3.3.4.1 AU 1 - Mixed Patchy Regrowth and Remnant Broad-leaved Paperbark (*Melaleuca quinquenervia*) open forest*

AU 1 (4.27 ha, 11.16% of the project area) encompasses both mapped remnant vegetation and unmapped (regrowth). On account of the thin linear extent mapped remnant vegetation in this locality, the extent of canopy disturbance and canopy weed species, and the patchy nature of the regrowth (advanced but not mapped) this area has been mapped as a single unit representative of RE12.3.6. The majority of this AU; 3.47 ha (61.43% of the total AU extent) is retained within the Eastern Enhancement Corridor.

The canopy is characterised by mature canopy of Broad-leaved Paperbark (*Melaleuca quinquenervia*) and occasionally Red Mahogany *(Eucalyptus resinifera*), Queensland Blue Gum (*Eucalyptus tereticornis*), 16-22 m in height. Overall species distribution and abundance of canopy species is distributed along an available soil moisture gradient with Broad-leaved Paperbark dominated along the Moogurrapum Creek waterway and drier species along drier edges. Endemic canopy species along the waterway also include Pink Doughwood (*Melicope elleryana*), Cheesetree (*Glochideon ferdinandi*), Tuckeroo (*Cupaniopsis anacardioides*) and Swamp Mahogany (*Lophostemon suaveolens*). Canopy of elevated terraces, banks and drier / interface areas with AU2 include Scribbly Gum (*Eucalyptus racemosa*), Broad-leaved Paperbark (*Melaleuca quinquenervia*), Pink Bloodwood (*Corymbia intermedia*), and Swamp Mahogany (*Lophostemon suaveolens*).

Owing to the extent of historic and repeated disturbance events and fire frequency, it is somewhat difficult to identify an ecotone in the field between AU1 and AU2.

Prominent canopy weeds include Slash Pine* (*Pinus elliottii*), African Tulip Tree* (*Spathodea campanulata*), Weeping Fig* (*Ficus benjamiuna*), Cocos Palm* (*Syagrus romanzoffiana*), Camphor Laurel* (*Cinnamomum camphora*) and Tipuana* (*Tipuana tipu*).

The understorey and shrub layer contains a variety of endemic and exotic weeds. Again, distribution of species is along a decreasing moisture gradient with moisture availability decreasing with distance from the waterway. The vast majority of the exotic species present are garden escapes. Endemic species include Broad-leaved Paperbark (*Melaleuca quinquenervia*) Tantoon (*Leptospermum polygalifolium*), Black Wattle (*Acacia leiocalyx*), Hickory Wattle *(Acacia disparrima*), Red Ash (*Alphitonia excelsa*) and Black She-oak (*Allocasuarina littoralis*) which forms dense thickets along the edges of the unit (refer to biocondition datasheets for AU2 and AU3). Prominent and problematic weeds include Inch Plant* (*Callisia repens*), Lantana*[W] (*Lantata camara*), Polka Dot Plant* (*Hypoestes phyllostachya*), Arrowhead Plant* (*Syngonium podophyllum*), Fishbone Fern* (*Nephrolepsis cordifolia*), Easter Cassia* (*Cassia pendula var glabrata*), Signal Grass* (*Urochloa decumbens*), Blue Billygoat Weed* (*Ageratum houstonianum*), Rhodes Grass* (*Chloris gayana*), Whorled Pigeon Grass (*Setaria sphacelata*) and Molasses Grass* (*Melinis minutifllora*).

The character of AU1 – Transect 1, AU1 – Transect 2 and AU1 – Transect 3 are shown in **Plates 1-3** below.

Plate 1: Representative habitat condition of IA AU1 Transect 1

Plate 2: Representative habitat condition of IA AU1 Transect 2

* Exotic naturalised species with reference to (State of Queensland 2024)
[W] Weed of National Significance https://weeds.org.au/

Plate 3: Representative habitat condition of IA AU1 Transect 3

3.3.4.2 AU 2 - Exotic Dominated Pastural Grassland with Scattered Relict Paddock Trees

AU 2 (14.38 ha, 37.64% of the project area) overlays both Eastern Enhancement Corridor and Western Enhancement Corridor. This AU encompasses entirely non-remnant vegetation on former (pre-clear) RE12.12.14. There are dense patched of regrowth Broad-leaved Paperbark (*Melaleuca quinquenervia*) along fencelines and patches of Black She-oak (*Allocasuarina littoralis*) within Eastern Enhancement Corridor. The total extent of this AU within the development footprint is 12.94 ha (89.99% of the AU). The remainder occurs within Eastern Enhancement Corridor.

The canopy is sparse, comprising include Scribbly Gum (*Eucalyptus racemosa*), Broad-leaved Paperbark (*Melaleuca quinquenervia*), Pink Bloodwood (*Corymbia intermedia*), Queensland Blue Gum *(Eucalyptus tereticornis*) and Swamp Mahogany (*Lophostemon suaveolens*) 15-23 m in height.

The understory is also sparse comprising (*Melaleuca quinquenervia*), Snow-in-Summer (*Melaleuca sieberi*), Tantoon (*Leptospermum polygalifolium*), Early Flowering Black Wattle (*Acacia concurrens*), Wattle (*Acacia leiocalyx*), Hickory Wattle (*Acacia disparrima*), Red Ash (*Alphitonia excelsa*). Black She-oak (*Allocasuarina littoralis*) forms dense thickets within the eastern parts of the within the Eastern Enhancement Corridor (see especially 'plot-based tree data' of BioCondition data sheets for Transects 3 and 6). Mid-storey and problematic weeds include, Lantana* (*Lantata camara*), Easter Cassia* (*Cassia pendula var glabrata*), Blue Billygoat Weed* (*Ageratum houstonianum*), Fireweed* (*Senecio madagascarensis*) and Giant Devils Fig (*Solanum torvum*).

The ground layer is grassy and dominated by exotic pasture grasses including Signal Grass* *(Urochloa decumbens*), Whorled Pigeon Grass* (*Setaria sphacelata*), Whiskey Grass* (*Andropogon virginicus*) and Molasses Grass* (*Melinis minutifllora*), Pyramid Grass* (*Sporobolus natalensis*), Kikuyu* (*Cenchrus clandestinus*). The coverage and biomass present is dependent upon the intensity of herbivory by horses and cattle. The character of IA AU2 representing the range of conditions present are outlined in IA AU2 – Transect 3, IA AU2 – Transect 6 and AU1 – Transect 8 are shown in **Plates 4-6** below.

Plate 4: Representative habitat condition of IA AU2 Transect 3

Plate 5: Representative habitat condition of IA AU2 Transect 6

Plate 6: Representative habitat condition of IA AU2 Transect 8

3.3.4.3 *AU 3 - Exotic Dominated Pastural Grassland with Scattered Relict Paddock Trees (+/- veteran Scribbly Gum (*Eucalyptus racemosa*))*

AU 3 (19.57 ha, 51.20% of the project area) overlays the retention area of Eastern Enhancement Corridor and Northern Enhancement Corridors; with 18.83 ha (96.22% of the total AU area) being within the Project Area. This AU encompasses entirely non-remnant vegetation on former (pre-clear) RE12.9-10.4, with the characteristic canopy species of that RE, Scribbly Gum (*Eucalyptus racemosa*), retained as paddock trees. Many of these are large trees (with respect to BioCondition thresholds) in the veteran tree category (large overmature and senescing, many with habitat hollows in the 600-900 mm DBH range).

Other canopy species occasionally present include Pink Bloodwood (*Corymbia intermedia*), Brown Bloodwood (*Corymbia trachyphloia*), Swamp Mahogany (*Lophostemon suaveolens*) and Narrow-leaved Redgum (*Eucalyptus seeana*).

Outside of Eastern Enhancement Corridor, where grazing by livestock has been excluded, and where understorey management (slashing) has not been practiced, the understorey is very sparse. The exception to this is where understory species have established along fencelines, beneath the dripline of paddock trees and low points of the site where slashing cannot reach. The understorey includes (*Melaleuca quinquenervia*), Snow-in-Summer (*Melaleuca sieberi*), Tantoon (*Leptospermum polygalifolium*), Early Flowering Black Wattle (*Acacia concurrens*), Wattle (*Acacia leiocalyx*), Hickory Wattle (*Acacia disparrima*) and Red Ash (*Alphitonia excelsa*). Black She-oak (*Allocasuarina littoralis*) is prominent within Eastern Enhancement Corridor (see especially 'plot-based tree data' of BioCondition plot data sheet for Transect 4).

Mid-storey and problematic weeds include Lantana* (*Lantata camara*), Blue Billygoat Weed* (*Ageratum houstonianum*), Fireweed* (*Senecio madagascarensis*), Arrowhead Sida (*Sida rhombifolia*) and Wild Tobacco* (*Solanum mauritianum*).

The groundlayer is grassy and heavily grazed / managed. Exotic pasture grasses include Signal Grass* *(Urochloa decumbens*), Whorled Pigeon Grass* (*Setaria sphacelata*), Green Couch (*Cynodon dactylon*), Carpert Grass* (*Axonopus compressus*), Love Grass* (*Eragrostis* sp.), Mullumbimby Couch (*Cyperus brevifolius*) and Kikuyu* (*Cenchrus clandestinus*). The coverage and biomass present is dependent upon the intensity of herbivory by horses and cattle. The character of IA AU3 – Transect 7, IA AU3 – Transect 9 and IA AU3 – Transect 12 are shown in **Plates 7-9** below.

Plate 7: Representative habitat condition of IA AU3 Transect 7

Plate 8: Representative habitat condition of IA AU3 Transect 9

Plate 9: Representative habitat condition of IA AU3 Transect 3

3.4 Details of the Species

3.4.1 Koala (*Phascolarctos cinereus*)

3.4.1.1 Distribution, Ecology and Habitat Preferences

The Project Area is situated within the South East Queensland Bioregion, one of the three bioregions in the state where estimated Koala *(Phascolarctos cinereus)* populations were highest (Commonwealth of Australia 2022a).

The *Conservation Advice for Phascolarctos cinereus (*Koala*) combined populations of Queensland, New South Wales and the Australian Capital Territory* (Commonwealth of Australia 2022a) identifies that "Koala habitat" includes both coastal and inland areas typically characterised by *Eucalyptus* forests and woodlands.

The Koala (*Phascolarctos cinereus)* is known to occur over much of eastern and central Queensland, New South Wales, Victoria and some areas of South Australia. Whilst the overall extent of Koala (*Phascolarctos cinereus)* distribution has remained largely unchanged, over the past 200 years populations have declined and local extinctions, largely due to clearing and fragmentation of eucalypt woodland and forest (McAlpine et al. 2015), have occurred. Koala (*Phascolarctos cinereus)* occurs across much of Queensland including its islands and, the south-east corner of the state has historically hosted populations of the highest density.

Koala (*Phascolarctos cinereus)* lives in a range of open forest and woodland communities; however, its habitat is determined by the presence of their preferred food trees (*Eucalyptus*, *Corymbia*, *Angophora*, *Lophostemon* and *Melaleuca*). Koala (*Phascolarctos cinereus)* can occur in higher population densities in environments where these food trees grow on more fertile soils and within riparian areas; however, they are also found within partially cleared habitat, utilising scattered paddock trees and roadside vegetation and in urban areas where suitable food trees are present (Barth et al 2020).

The distribution of Koala (*Phascolarctos cinereus)* is influenced by altitude, temperature and leaf moisture. The density of the Koala *(Phascolarctos cinereus)* population in coastal regions is generally greater than inland areas. In South East Queensland, a recent study completed by Rhodes et al. (2015) indicates that the average Koala (*Phascolarctos cinereus)* density across the region is estimated to be 0.04 Koalas/ha. The majority of the region is predicted to have low population densities, suggesting that Koala (*Phascolarctos cinereus)* in SEQ may be relatively widely distributed, but of low density in most areas (Rhodes et al. 2015). Rhodes et al. (2015) found a negative relationship between temperature and Koala densities, which is associated with low Koala densities. Habitat suitability models indicate that Koala (*Phascolarctos cinereus)* is best suited to locations where the mean maximum summer temperatures are 23-26ºC and mean annual rainfall ranges from 700-1500 mm (Adams-Hosking et al. 2011).

Home range size varies across mainland Queensland, with reported ranges exceeding 100 ha in central Queensland (Ellis et al. 2002) and less than 8ha in the south-east (Dique 2004). Although Koalas (*Phascolarctos cinereus)* are known to be highly selective in their diet (Moore & Foley 2000), recent work suggests that they have adapted to regional food sources over time (Kjeldsen et al. 2019). Home ranges are also known to vary considerably due to a variety of factors including location (e.g. home ranges in habitats of lower productivity being larger than those within higher quality habitats) and availability of preferred forage trees, though typically, males have larger home ranges on average than females.

In South East Queensland, Koala Coast home range were found to vary between 2-20 ha (Thomson 2006), whilst in rural South East Queensland, home ranges varied between 5.3-91.4 ha (White 1999). Koalas (*Phascolarctos cinereus)* successfully use highly fragmented habitats that have only small remnants of the original vegetation (White 1999 and references cited therein). They also use young forest and highly modified vegetation such as grazed, disturbed or thinned forest and regrowth areas, moving significant distances across the ground between preferred trees (e.g. White 1999).

Current data indicate that Koalas (*Phascolarctos cinereus)* in South East Queensland are subject to substantial declines (Dique et al. 2004; DERM 2009). The 'Koala Coast' (which includes the Redland City Council Local Government Area) has been the subject of long-term monitoring of Koala ecology and population dynamics and the data derived from the area have been widely used as an important reference to assess the overall health of the Koala population of South East Queensland, as well as provided reference points for assessments of Koala elsewhere in the bioregion.

The 2008 Koala Coast population survey by DERM (now the Department of the Environment, Science, Tourism and Innovation (**DETSI**)) identified a 51% decline in Koala (*Phascolarctos cinereus)* numbers in less than three years (half a generation and a 64% decline in the decade following the original 1996-1999 estimate of Koala (*Phascolarctos cinereus)* numbers (see data cited in Dique et al. 2004 and DERM 2009). In 2012, it was estimated that Queensland's Koala populations had declined over the three preceding generations (15 to 21 years) by an average of 53 % (Adams-Hosking et al. 2016).

DERM (ibid) identified that the largest declines occurred in bushland areas which showed a 59% reduction in Koala (*Phascolarctos cinereus)* numbers compared with a 30% reduction in urban areas. The large reduction of Koalas (*Phascolarctos cinereus)* in otherwise secure bushland was thought to be a flow on effect from excessive habitat loss and mortality in peri-urban areas (DERM ibid). DERM (ibid) concluded that the reduction in adequate recruitment to apparently secure bushland habitat areas is likely to be evidence of a dynamic process operating between the urban and bushland Koala (*Phascolarctos cinereus)* populations.

The main identified threats to the Koala (*Phascolarctos cinereus)* are loss and fragmentation of habitat, vehicle strike, disease, and predation by dogs (*Canis lupus familiaris*) (DERM 2009). Studies completed as part of the Moreton Bay Rail Project (DTMR 2016) found that between 2013 and 2016, 113 Koalas (*Phascolarctos cinereus)* had been killed by wild dogs with an additional 38 deaths suspected as wild dog predation, 82 deaths caused by illness and nine (9) vehicle strike deaths. These figures indicate that the threat of wild dog predation is at the forefront, while disease and vehicle strikes are also ongoing contributors to Koala (*Phascolarctos cinereus)* deaths.

While Koalas (*Phascolarctos cinereus)* choose their habitat based on the suitability of food trees, the reasons for choosing these trees are not well understood. Soil fertility is thought to strongly influence the acceptability, palatability and nutritional content of selected browse species, whilst chemical composition is also suspected as a major factor determining the acceptance of selected foliage (Cork & Sanson 1990, Cork & Braithwaite 1996; Moore & Foley 2000; Moore & Foley 2005). Collectively, the suite of tree species considered to be of primary and/or secondary importance to Koalas within South East Queensland include the following (after: Pahl 1993): White Mahogany (*Eucalyptus acmenoides*), Thick-leaved Mahogany (*Eucalyptus carnea*), Narrow-leaved Ironbark (*Eucalyptus crebra*), Queensland Peppermint (*Eucalyptus exserta*), Red Ironbark (*Eucalyptus fibrosa*), Flooded Gum (*Eucalyptus grandis*), Grey Gum (*Eucalyptus moluccana*), Large-fruited Grey Gum (*Eucalyptus major*), Poplar Box (*Eucalyptus populnea*), Small-fruited Grey Gum (*Eucalyptus propinqua*), Scribbly Gum (*Eucalyptus racemosa*), Red Mahogany (*Eucalyptus resinifera*), Swamp Messmate (*Eucalyptus robusta*), Narrow-leaved Red Gum (*Eucalyptus seeana*), Queensland Blue Gum (*Eucalyptus tereticornis*), Tindale's Stringybark (*Eucalyptus tindaliae*), Tallowwood (*Eucalyptus microcorys*), Broad-leaved White Mahogany (*Eucalyptus umbra*), Lemon-scented Gum (*Corymbia citriodora var citriodora*), Spotted Gum (*Corymbia citriodora var variegata*), Pink Bloodwood (*Corymbia intermedia*), Queensland Box (*Lophostemon confertus*) and Broad-leaved Paperbark (*Melaleuca quinquenervia*).

Biophysical habitat attributes for the Koala (*Phascolarctos cinereus)* includes places that contain the resources necessary for individual foraging, survival (including predator avoidance), growth, reproduction and movement. The total amount of resources (including habitat attributes) and how they are arranged in the landscape influence the viability of metapopulations and processes (Commonwealth of Australia 2022a). For an individual Koala (*Phascolarctos cinereus)*, these resources include access to sufficient quality food and shelter trees to meet their daily energetic requirements and reproductive needs, and a place to avoid predators. This includes forests or woodlands, roadside and rail vegetation and paddock trees, safe intervening ground matrix for travelling between trees and patches to forage and shelter and reproduce and access to vegetated corridors or paddock trees to facilitate movement between patches.

A population of Koalas (*Phascolarctos cinereus)* requires a sufficient total amount of resources within their habitat of adequate quality to support a viable biological population where mortality, survival, and recruitment are balanced or recruitment increasing to optimal carrying capacity and within the bounds of natural fluctuations. Crucial habitat elements include patches and corridors for gene flow. Over longer-time frames habitat critical includes climate refugia such as drainage lines, riparian zones and patches that are resilient to drying conditions due to favourable hydrological systems. Additionally, it includes areas that may be temporarily unoccupied, because of seral (maturity or time) changes to habitat quality that arise through processes such as fire, drought, timber harvesting or disease (shifting habitat mosaic) or degradation and are available for future recolonisation.

3.4.1.2 Abundance within Surrounding Habitat

The Project Area occurs within the 'Koala Coast' area, so called because it has some of the highest densities of Koala (*Phascolarctos cinereus)* within of South East Queensland. On account of this Contemporary post 2015 was selected as a threshold. Koala (*Phascolarctos cinereus)* records within 25 km of the Project Area (**Figure 14**) show close to 13,500 records within many in close proximity to urban development associated with the expanding urban fringe. Comparatively there are fewer records within the larger blocks of contiguous vegetation to the south-west.

This should not be viewed as an indicator habitat preference, rather it is a function of observer numbers and searching / encounter rates.

3.4.1.3 Abundance within the Project Area

Section 3.3.1 identifies the timing of full ecological and supplementary assessments undertaken on Project Area to date. Surveys undertaken and their adequacy are discussed below.

Two targeted assessment campaigns for Koala (*Phascolarctos cinereus)* and South-eastern Glossy Black Cockatoo (*Calyptorhynchus lathami lathami*) have been undertaken by 28 South since 2021 (one in 2021 and the second in 2023). Survey included opportunistic diurnal scanning of the canopy whilst undertaking searches for indirect signs of presence (searching for scratches on smooth barked habitat trees and scats) and assessments of the KHTs.

BAAM undertook assessments for both species in 2018. The BAAM surveys are considered valid on account of Project Area values have not changed since the time of the 2018 assessments.

A summary of sampling efforts undertaken for Koala (*Phascolarctos cinereus*) in 2015 and 2021 can be found in **Table 9**.

Table 9: Targeted Assessments for Koala (*Phascolarctos cinereus*)

Method	Description
2018	**BAAM (26 February – 2 March 2018)**
Diurnal Searches	Intensive investigation of ground layer (under logs, rocks and leaf litter), low vegetation (under bark and in tree stumps) for amphibians, reptiles, bats and animal signs, e.g. scats, owl pellets, remains and tracks.
Spotlighting	Traverse through representative habitats, at a leisurely pace using hand-held spotlights and/or head torches. This method samples nocturnal mammals (flying, arboreal and terrestrial), birds (owls and nightjars), reptiles (geckos) and frogs.
Targeted Feed Tree Search	Intensive investigation of the Project Area for isolated specimens and groves of feed trees for South-eastern Glossy Black Cockatoo (*Calyptorhynchus lathami lathami*) and/or Koala (*Phascolarctos cinereus*).
Targeted Spotlighting	Walked traverse through representative habitats, using hand-held spotlights and/or head torches to search for target fauna. Intermittent nocturnal voice playback to elicit a response from target species undertaken.
Opportunistic records	observations outside of systematic and targeted survey methodologies (outlined above).
2021	**28 South**
Feature inspections	Project Area inspection and familiarisation, numerous dates during 2021 in preparation for and in response to Joint Expert conclaves. Estimated 35 person hour of inspections.
Diurnal canopy searches	July-August 2021 (60 person hours). Opportunistic searching of canopy for presence and signs (scratches on smooth barked eucalypts, scats), conducted whilst undertaking detailed tree survey. 31 August 2021 (10 person hours). Opportunistic searching of canopy for presence and signs (scratches on smooth barked eucalypts, scats) conducted whilst undertaking assessment of regeneration and extent of Black Sheoak (*Allocasuarina littoralis*) regrowth within the Eastern Enhancement Corridor.
2023	**28 South**

Method	Description
Diurnal canopy searches	20-22 June and 26 June 2023. Conducted whilst undertaking botanical and habitat quality assessments. Opportunistic searching of canopy for presence and signs (scratches on smooth barked eucalypts, scats). 48 person hours.
SAT	20-22 June and 26 June 2023. Trees within the vicinity of bicondition transects undertaken.

The spot assessment technique (Philips and Callaghan 2011) was used to further gather information on the potential utilisation across the Project Area (see **Text box 1**).

Text Box 1: SAT method

The Spot Assessment Technique (**SAT**) method is an assessment of Koala (*Phascolarctos cinereus*) activity involving a search for any Koala *(Phascolarctos cinereus)* and signs of Koala *(Phascolarctos cinereus)* usage. The SAT involves identifying a focal tree where a Koala *(Phascolarctos cinereus)* or scats are found. The next closest habitat tree to the first tree is then assessed and so on until the 30 closest trees to the original focal tree have been recorded. The number of trees showing evidence of Koala (*Phascolarctos cinereus*) is expressed as a percentage of the total number of trees sampled to indicate the frequency of Koala (*Phascolarctos cinereus*) usage. Assessment of each tree involves a systematic search for Koala (*Phascolarctos cinereus*) scats beneath the tree within a 1 m radius of the trunk. After approximately two minutes of searching for scats, the base of the trunk is observed for scratches and the crown for potential Koala *(Phascolarctos cinereus)* presence. A Koala (*Phascolarctos cinereus*) scat meander is a method used to identify a Koala habitat focal tree for use in a SAT survey.

Each scat meander consists of searching for Koala (*Phascolarctos cinereus*) scats under tree species likely to be utilised by Koala (*Phascolarctos cinereus*). A search for Koala (*Phascolarctos cinereus*) scats at the base of the tree is undertaken and where none are found the trunk is observed for scratches and the crown of the tree for potential Koala (*Phascolarctos cinereus*) as present. If no scats, indicators of presence/utilisation or Koala (*Phascolarctos cinereus*) are observed, another nearby tree is chosen and the search is repeated. The process continues until a scat, indicator or Koala (*Phascolarctos cinereus*) is found or 30-minutes has expired.

During 2023, 14 SAT assessments were undertaken at all BioCondition Transects to sample habitats within the Project Area. **Table 10** presents the Koala (*Phascolarctos cinereus*) usage scores for the six (6) SAT surveys (**Figure 15**) completed at BioCondition plots.

Koala (*Phascolarctos cinereus*) utilisation within the Project Area has been confirmed indirectly through detection of scats and scratches. Although not observed directly on Project Area, records of presence have been confirmed through data base records. These are discussed below.

Table 10: Summary of SAT Results

SAT Site Number	Evidence of Koala Use (%)	Koala Use (high / medium / low)
2023 (21, 22 and 26 June)		
IA AU1 – Transect 1	13.33	Low
IA AU1 – Transect 5	3.33	Low
IA AU2 – Transect 8	6.66	Low
IA AU2 – Transect 11	3.33	Low

SAT Site Number	Evidence of Koala Use (%)	Koala Use (high / medium / low)
IA AU3 – Transect 9	0.00	Low
IA AU3 – Transect 14	0.00	Low

The SAT[19] provides an estimate of Koala (*Phascolarctos cinereus*) utilisation based on defined Activity Categories. The East Coast (Low) Activity Category is appropriate for the Project Area. The evidence suggests that while the Project Area is utilised by Koala (*Phascolarctos cinereus*), utilisation is likely to be transitory (after Phillips and Callaghan 2011, p776).

The low transitory levels within the Project Area are likely the result of historic clearing presence of roads flanking the Project Area, intensification of residential land use and discontinuous habitat connectivity through rural residential land to the north and beyond. The evidence suggests that while the Project Area is utilised by Koala (*Phascolarctos cinereus*), it is considered relatively poor habitat for the species.

Koala (*Phascolarctos cinereus*) has not been observed on the Project Area during field inspection. However, ALA records identify presence from 2000, 2004 and 2011. The SAT methodology is considered to be an accurate technique for estimating low-density Koala (*Phascolarctos cinereus*) populations and further, is considered to provide an accurate determination on the activity levels (Mossaz 2010). Therefore, in consideration of SAT technique accuracy, and the absence of other evidence of utilisation or direct observation, it is considered that the field surveys undertaken to date have been sufficient in establishing a baseline of Koala (*Phascolarctos cinereus*) utilisation of the Project Area.

3.4.1.4 Extent Quality and Importance of Habitat Surrounding the Project Area

Though historically disturbed, critical habitat critical to survival, as defined by the Conservation Advice (Commonwealth of Australia 2022a), is located across the Region. The Koala (*Phascolarctos cinereus*) is listed as an 'endangered' species under the EPBC Act. A significant proportion of Queensland's native vegetation, especially in South East Queensland, can be under the National Recovery Plan for the Koala *Phascolarctos cinereus* (combined populations of Queensland, New South Wales and the Australian Capital Territory) (Commonwealth of Australia 2022b) as critical habitat for Koala (*Phascolarctos cinereus*). Koala (*Phascolarctos cinereus*) habitat[20] will often include:

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

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

The Project Area is considered habitat critical to survival as:

- it is likely that the Project Area provides riparian habitat along Moogurrapum Creek during periods of stress
- contains known forage species within an open albeit modified, woodland matrix

[19] The SAT technique does not provide any information on the period of Koala presence (or absence) or the level of actual site activity (abundance)
[20] https://www.dcceew.gov.au/environment/epbc/publications/identifying-habitat-for-the-endangered-Koala accessed 12/9/2024

- contains habitat considered to be used by Koala *(Phascolarctos cinereus)* to meet essential life cycle requirements and it contains known forage species within an open albeit modified, woodland matrix, and
- it affords vegetated corridors or paddock trees to facilitate movement between patches.

Koala (*Phascolarctos cinereus*) habitat comprising Remnant and High Value Regrowth REs comprised of known habitat and forage trees, within 25 km of the Project Area has been derived from Queensland RE datasets and is mapped as **Figure 16**. Within this area there is 720.9 ha of remnant and 1,605.1 ha of regrowth vegetation within 5 km, and 32,617.3 ha of Remnant and 5,388.8 ha of regrowth vegetation between 5 and 25 km of the Project Area (28.7% of the total land area within the 25 km radius search). The mapping shows extensive habitat to the south-west (Mount Cotton and associated conservation areas).

Mapped Koala *(Phascolarctos cinereus)* REs comprising Remnant and High Value Regrowth Communities within the 25 km search area are identified within **Table 11**.

Table 11: Extent of State mapped remnant and regrowth Koala *(Phascolarctos cinereus)* REs within 25 km of the Project Area

RE	Short Description	Remnant Extent (ha)	High Value Regrowth Extent (ha)
12.1.1	*Casuarina glauca* woodland +/- *Eucalyptus tereticornis* on margins of marine clay plains	30.1	-
12.2.5	*Corymbia intermedia* +/- *Lophostemon confertus* +/- *Banksia* spp. +/- *Callitris columellaris* open forest on beach ridges	1,333.1	65.9
12.2.6	*Eucalyptus racemosa* subsp. *racemosa* open forest on dunes and sand plains	4,213.9	677.8
12.2.7	*Melaleuca quinquenervia* open forest on sand plains	1,055.5	27.3
12.2.7a	*Melaleuca quinquenervia* low woodland with *Gahnia sieberiana* ground layer on sand plains	316.0	-
12.2.8	*Eucalyptus pilularis* open forest on parabolic high dunes	1,488.4	65.4
12.2.10	*Eucalyptus planchoniana* +/- *Corymbia gummifera*, *E. racemosa* subsp. *racemosa, Banksia aemula* low woodland on dunes / plains	3,941.6	343.5
12.3.3	*Eucalyptus tereticornis* woodland on Quaternary alluvium	4.2	26.8
12.3.3d	*Eucalyptus moluccana* woodland on Quaternary alluvium	34.4	93.5
12.3.4	*Melaleuca quinquenervia*, *Eucalyptus robusta* woodland on alluvium	21.9	0.9
12.3.5	*Melaleuca quinquenervia* open forest on coastal alluvium	774.3	78.2
12.3.6	*Melaleuca quinquenervia* +/- *Eucalyptus tereticornis, Lophostemon suaveolens, Corymbia intermedia* open forest on alluvial plains	1,209.2	332.3
12.3.7	*Eucalyptus tereticornis, Casuarina cunninghamiana* subsp. *cunninghamiana* +/- *Melaleuca* spp. fringing woodland	175.6	81.4
12.3.7a	*Melaleuca bracteata* open forest +/- emergent *Eucalypts tereticornis.* in drainage depressions on Quaternary alluvial plains	3.1	-

RE	Short Description	Remnant Extent (ha)	High Value Regrowth Extent (ha)
12.3.7c	Billabongs and ox-bow lakes containing either permanent or periodic water bodies. Often fringed with *Eucalyptus tereticornis*	11.5	1.5
12.3.11	*Eucalyptus tereticornis* +/- *Eucalyptus siderophloia*, *Corymbia intermedia* open forest on alluvial plains	1,365.9	534.0
12.3.11a	Open forest of *Eucalyptus tereticornis* and/or *E. siderophloia*, *Lophostemon confertus* with vine forest understorey	56.7	5.4
12.3.11b	*Eucalyptus tereticornis* and/or *E. racemosa* subsp. *racemosa* open forest	70.0	133.5
12.3.19	*Eucalyptus moluccana* and/or *Eucalyptus tereticornis* and *E. crebra* open forest to woodland, with a sparse to mid-dense understorey of *Melaleuca irbyana*	13.2	19.3
12.3.20	*Melaleuca quinquenervia, Casuarina glauca* +/- *Eucalyptus tereticornis, E. siderophloia, M. styphelioides* open forest on low coastal alluvial plain	410.6	82.6
12.5.1	Open forest complex with Corymbia citriodora subsp. variegata on subcoastal remnant Tertiary surfaces.	12.7	0.6
12.5.1g	*Eucalyptus planchoniana* and/or *E. baileyana* woodland to open forest on remnant Tertiary surfaces	4.0	2.5
12.5.2a	*Corymbia intermedia*, *Eucalyptus tereticornis* woodland on remnant Tertiary surfaces	481.8	169.4
12.5.3	*Eucalyptus racemosa* subsp. *racemosa* woodland on remnant Tertiary surfaces	303.4	302.9
12.5.3a	Mixed woodland to open forest usually containing *Corymbia intermedia, Eucalyptus racemosa* subsp. *racemosa* and at least a presence of *Eucalyptus seeana* on remnant Tertiary surfaces	269.9	70.5
12.5.4a	Woodland of *Melaleuca quinquenervia* and/or *M. viridiflora* var. *viridiflora* +/- *Eucalyptus latisinensis, Corymbia intermedia, Angophora leiocarpa, E. exserta, Lophostemon suaveolens*	11.8	3.8
12.5.6c	*Eucalyptus pilularis* open forest +/- *E. siderophloia, E. propinqua*, *Corymbia intermedia, E. microcorys, E. acmenoides, E. tereticornis* on remnant Tertiary surface	41.0	64.6
12.5.7	*Corymbia citriodora* subsp. *variegata* +/- *Eucalyptus portuensis* or *E. acmenoides, E. fibrosa* subsp. *fibrosa* open forest on remnant Tertiary surfaces	9.8	5.7
12.5.7b	*Eucalyptus moluccana* +/- *Corymbia citriodora* subsp. *variegata* open forest on remnant Tertiary surfaces	6.5	6.3
12.5.7c	*Corymbia henryi* and/or *Eucalyptus fibrosa* subsp. *fibrosa* woodland +/- *C. citriodora* subsp. *variegata, C. intermedia* and *E. moluccana*.	7.6	2.0

RE	Short Description	Remnant Extent (ha)	High Value Regrowth Extent (ha)
12.9-10.2	*Corymbia citriodora* subsp. *variegata* +/- *Eucalyptus crebra* open forest on sedimentary rocks	22.2	33.1
12.9-10.3	*Eucalyptus moluccana* open forest on sedimentary rocks	47.2	0.7
12.9-10.4	*Eucalyptus racemosa* subsp. *racemosa* woodland on sedimentary rocks	2348.4	1,300.8
12.9-10.4a	*Eucalyptus racemosa* subsp. *racemosa* woodland to open woodland with a wet ground layer often dominated by *Ptilothrix deusta*, *Lepidosperma laterale* and other sedges and grasses	80.6	14.4
12.9-10.7a	*Eucalyptus siderophloia, Corymbia intermedia* +/- *E. tereticornis* and *Lophostemon confertus* open forest on sedimentary geology	111.5	29.3
12.9-10.12	Mixed woodland usually containing *Corymbia intermedia, Angophora leiocarpa* and at least the presence of *Eucalyptus seeana* on sedimentary rocks	342.3	98.0
12.9-10.14	*Eucalyptus pilularis* tall open forest on sedimentary rocks	4.5	0.0
12.9-10.17	*Eucalyptus acmenoides, E. major, E. siderophloia* +/- *Corymbia citriodora* subsp. *variegata* open forest on sedimentary rocks	115.2	231.2
12.9-10.17a	Lophostemon confertus or L. suaveolens dominated open forest usually with emergent Eucalyptus and/or Corymbia species	23.1	0.5
12.9-10.17b	*Corymbia citriodora* subsp. *variegata* mixed open forest to woodland.	29.0	3.6
12.9-10.17c	Open forest of *Eucalyptus carnea* and/or *E. tindaliae* and/or *E. helidonica* +/- *Corymbia citriodora* subsp. *variegata, Eucalyptus crebra,* with *Lophostemon confertus* often present as a sub-canopy	635.7	48.6
12.9-10.17d	Open forest generally containing *Eucalyptus siderophloia*, *E. propinqua* or *E major, Corymbia intermedia*	229.3	20.5
12.9-10.19a	Corymbia henryi and/or Eucalyptus fibrosa subsp. fibrosa open forest	673.6	54.0
12.9-10.26	*Eucalyptus baileyana* and/or *E. planchoniana* woodland to open forest on sedimentary geology	230.5	37.0
12.9-10.27	*Corymbia* and/or *Eucalyptus* dominated open forest with a very sparse to mid-dense understorey of *Melaleuca irbyana* on sedimentary geology	7.7	0.3
12.11.3	*Eucalyptus siderophloia, E. propinqua +/- E. microcorys, Lophostemon confertus, Corymbia intermedia, E. acmenoides* open forest on metamorphics +/- interbedded volcanics	567.5	131.6
12.11.3a	*Lophostemon confertus +/- Eucalyptus microcorys, E. carnea, E. propinqua, E. major, E. siderophloia* woodland occurring in gullies and ridges; metamorphosed sediments and interbedded volcanics.	337.7	30.6

RE	Short Description	Remnant Extent (ha)	High Value Regrowth Extent (ha)
12.11.5	*Corymbia citriodora* subsp. *variegata woodland* to open forest on metamorphics +/- interbedded volcanics	2,195.9	475.0
12.11.7	*Eucalyptus crebra* woodland on metamorphics +/- interbedded volcanics	1.8	1.8
12.11.9	*Eucalyptus tereticornis* subsp. *tereticornis* or *E. tereticornis subsp. basaltica* open forest on metamorphics +/- interbedded volcanics, usually on ridges, crests and upper slopes	83.8	54.9
12.11.14	*Eucalyptus crebra, E. tereticornis, Corymbia intermedia* woodland on metamorphics +/- interbedded volcanics	5.2	0.7
12.11.18	*Eucalyptus moluccana* woodland on metamorphics +/- interbedded volcanics	62.4	8.8
12.11.23	*Eucalyptus pilularis* open forest on coastal metamorphics and interbedded volcanics	1147.4	142.3
12.11.24	*Eucalyptus carnea or E. tindaliae, Corymbia intermedia* woodland on metamorphics +/- interbedded volcanics	2,229.5	307.5
12.11.25	*Corymbia henryi* and/or *Eucalyptus fibrosa* subsp. *fibrosa* woodland on metamorphics +/- interbedded volcanics	1,872.0	219.6
12.11.26	*Eucalyptus baileyana* and/or *E. planchoniana* woodland to open forest on metamorphics +/- interbedded volcanics	94.8	11.9
12.11.27	*Eucalyptus racemosa* subsp. *racemosa* and/or *E. seeana* and *Corymbia* intermedia woodland on metamorphics +/- interbedded volcanics	2,108.3	505.9
12.12.3	Open forest complex with *Corymbia citriodora* subsp. *variegata, Eucalyptus siderophloia* or *E. crebra* on Mesozoic to Proterozoic igneous rocks	2.1	0.7
12.12.12	*Eucalyptus tereticornis, Corymbia intermedia, E. crebra +/- Lophostemon suaveolens* woodland on Mesozoic to Proterozoic igneous rocks	10.2	5.7
12.12.14	*Eucalyptus racemosa* subsp. *racemosa +/- Lophostemon confertus, Syncarpia glomulifera, Eucalyptus acmenoides* woodland to open forest usually on rocky near coastal areas on Mesozoic to Proterozoic igneous rocks	37.3	26.7
12.12.15	Mixed open forest including combinations of *Eucalyptus propinqua, E. siderophloia, Corymbia intermedia, E. microcorys, Lophostemon confertus* open forest on Mesozoic to Proterozoic igneous rocks	1.0	-
12.12.15b	*Lophostemon confertus open forest +/- Eucalyptus microcorys, E. siderophloia, E. carnea, E. propinqua* and vine forest species often present in understorey	2.8	0.3
Total		33,338.2	6,993.9

RE	Short Description	Remnant Extent (ha)	High Value Regrowth Extent (ha)
Proportion of all habitat in search area		82.7%	17.3%
Proportion of total search area (140,708.0 ha)		23.7%	5.0%

This mapped extent of higher value mapped Koala (*Phascolarctos cinereus*) habitat within 25 km of the does not include isolated unmapped patches of vegetation within the landscape, nor does it consider connectivity.

Considering Koala (*Phascolarctos cinereus*) habitat within the context of the immediate locality, the Project Area is located within the southern reaches of the Redland LGA urban footprint and is enveloped by emerging residential areas to the north and west and established urban residential areas to the north-east. Patchy disjunct habitat occurs principally within 3 km of the Project Area.

Extensive areas of contiguous extant habitat occur to the south and west (between 3 and 10 km) associated with Mount Cotton, a large number of Conservation Reserves and State mapped biodiversity corridors extending from Burbank through MacKenzie, Sheldon, Mount Cotton Redland Bay and Victoria Point to Moreton Bay islands at the mouth of the Logan River.

The Mount Cotton / Daisy Hill block of potential habitat consists of contiguous remnant and regrowth vegetation that extends from the Belmont Rifle range in the north-east (in the vicinity of the intersection of Gateway Motorway and Old Cleveland Road, Chandler), southwards of Tingalpa Reservoir and extending south-east to Cornubia Forest Nature Reserve, Cornubia (a distance of 15 km). The total area of potential habitat is ~5,000 ha. At its closest point, the habitat is 5 km to the south-west of the Project Area. Conservation reserves within the block include Brisbane Koala Bushlands, Daisy Hill Conservation Park, Venman Bushland National Park and Cornubia Forest Nature Reserve. This area contains the topographic high points of Mount Cotton and Daisy Hill.

A second large, contiguous block of potential habitat (15 km to the south-east of the Project Area) of ~1,500 ha, occurs between Mount Cotton Road and Beenleigh - Redland Bay Road in the vicinity of Native Dog Conservation Area. Habitat here consists of lowland open forest including seasonally inundated (palustrine) freshwater wetlands. Conservation areas here include Native Dog Conservation Area, Serpentine Creek Conservation Area, Carbrook Wetlands Conservation Area, Sandy Creek Conservation Area, Kidd Street Conservation Area, Bayview Conservation Area and Days Road Conservation Area.

Beyond this extent, the Logan River (south) and The Pacific Highway (west) create landscape barriers.

3.4.1.5 Extent of Quality and Importance of Habitat within the Project Area

Vegetation surveys conducted across the Project Area determined the property is dominated by anthropogenically derived woodland and open forest dominated by species which characterise the Project Area as habitat as referenced by the Conservation Advice (DAWE 2022a).

Ecological survey of the Project Area shows the referral area is predominately dominated by *Eucalyptus* and *Corymbia* species, with *Melaleuca* and *Lophostemon* species also present. Specifically, naturally occurring species included Scribbly Gum (*Eucalyptus* racemosa), Broad-leaved Paperbark (*Melaleuca quinquenervia),* Queensland Blue Gum (*Eucalyrptus tereticornis*), Pink Bloodwood (*Corymbia intermedia*), Swamp Mahogany (*Lophostemon suaveolens*) Red Mahogany (*Eucalyptus resinifera*) and Narrow-leaved Red Gum (*Eucalyptus seeana*). KHTs greater than 100 mm DBH have been plotted and are shown as **Figure 17**.

Three Pre-clear REs have been identified as occurring over the Project Area, either as remnant or regrowth patches. All are considered to be Koala (*Phascolarctos cinereus*) RE on account of the forage and shelter habitat they provide:

- 12.3.6 (IA AU1)
- 12.12.14 (IA AU2)
- 12.9-10.4 (IA AU3).

Habitat of the Project Area and within 3 km of the Project Area consists of sparse scattered remnant vegetation, high value regrowth and anthropogenically derived woodland and open forest dominated by species which characterise the Project Area as habitat. At best much of paddock trees affording broad areas of dispersal habitat (paddock trees) affording movement between regrowth and remnant patches.

3.4.1.6 Extent of Habitat Loss within the Project Area

Extent of The Proposed Action when avoidance and mitigation measures are taken into account will result in the loss of 32.57 ha of lower quality forage and shelter habitat of importance to Koala (*Phascolarctos cinereus*) as movement habitat directly lost or indirectly compromised.

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

3.4.2.1 Distribution, Ecology and Habitat Preferences

The Grey-headed Flying-fox (*Pteropus poliocephalus*) occurs in coastal and sub-coastal areas from Rockhampton in central Queensland to Melbourne in Victoria. Within this distribution, patterns of occurrence and relative abundance fluctuate significantly across seasons and between years, as the species selectively forages where its food is available within the landscape. The cities of Brisbane, Newcastle, Sydney and Melbourne are continuously occupied by the Grey-headed Flying-fox (*Pteropus poliocephalus*), with use of roost sites varying within these locations (Commonwealth of Australia 2021).

Grey-headed Flying-fox (*Pteropus poliocephalus*) requires foraging resources and roosting sites to persist. The species is known to use a wide variety of habitats including subtropical and temperate rainforests, tall sclerophyll forest and woodlands, heaths, swamps and also urban and agricultural areas where food trees have been cultivated. The species is highly adaptive with its diverse native diet, which it can supplement with introduced species. It is known to forage within a variety of habitat areas as each resource does not produce food throughout the entire year.

Grey-headed Flying-fox (*Pteropus poliocephalus*) roost in temporary or permanent camps during the day and traverses up to 50 km (round trip) at night in search of foraging resources.

This species prefers to feed on eucalypt blossom, followed by the blossom of other native tree species such as *Melaleuca* and *Banksia* inflorescence and native fruits. They will take exotic fruits, but these are less favoured. In South East Queensland flowering Queensland Bue Gum (*Eucalyptus tereticornis*) seem to be particularly important, providing a valuable resource during periods food scarcity (winter) and early spring (gestation) periods. The loss of large Queensland Blue Gum (*Eucalyptus tereticornis*) stands from low-lying flood plains have caused many camps to become temporary and transient or resulted in individuals needing to traverse larger distances to forage.

3.4.2.2 Abundance within Surrounding Habitat

3.4.2.2.1 Records

In an effort to elucidate a more contemporary understanding of Grey-headed Flying-fox (*Pteropus poliocephalus*) presence, analysis of (DETSI) Wildlife Online and ALA records for the period 1990-present has been undertaken. Records without a date have been omitted. Grey-headed Flying-fox (*Pteropus poliocephalus*) records within 25 km of the Project Area (**Figure 18**).

These data show two records within 5 km of the Project Area, with a pattern of consistent utilisation in the broader locality (5-25 km). Most nearby records correspond with Flying Fox roosts in the broader area (refer **Figure 19**).

3.4.2.2.2 Roosts (Camps)

Grey-headed Flying-fox (*Pteropus poliocephalus*) roost in temporary or permanent camps during the day and traverses up to 50 km at night (round trip) in search of food. Camps within 25 km of the Project Area representing the maximum foraging distance for a Grey-headed Flying-fox (*Pteropus poliocephalus*) leave and return to an established camp were identified (**Figure 19**).

Fifty-two (52) Flying-fox roosts have been recorded within 25 km of the Project Area[21], however not all have been recently utilised or occupied by Grey-headed Flying-fox (*Pteropus poliocephalus*). Active roosts with Grey-headed Flying-fox (*Pteropus poliocephalus*) within the last four years, camp size (by number category) and year of last occupation recorded by census are outlined in **Table 12**.

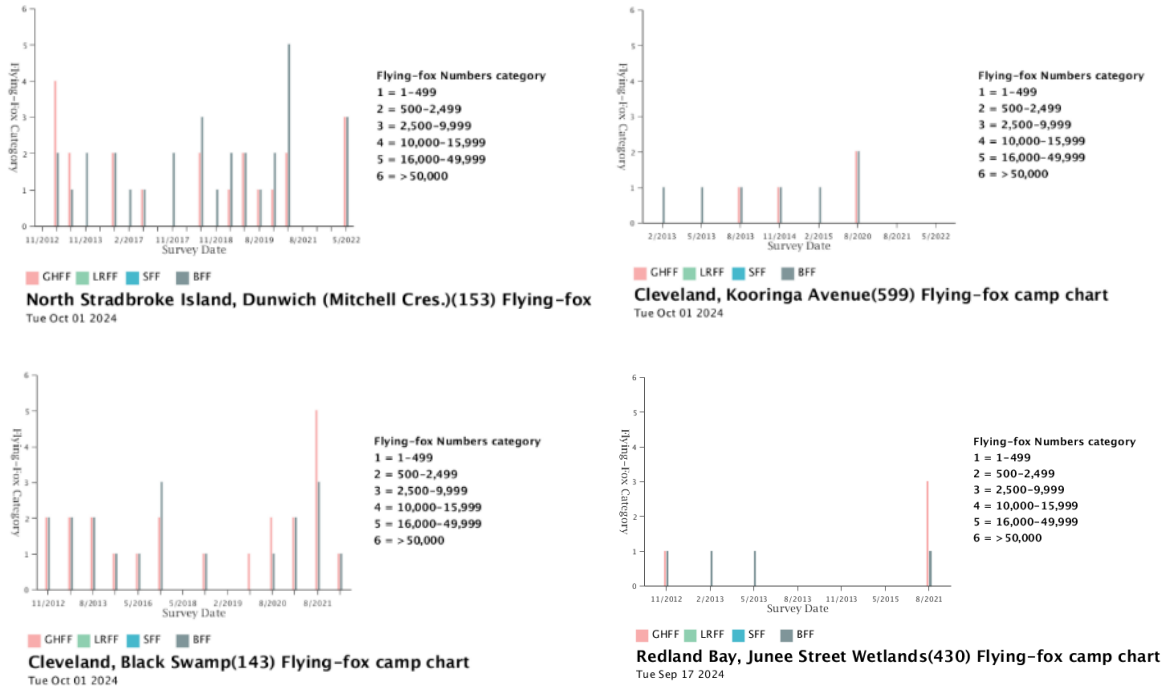
Table 12: Grey-headed Flying-fox (*Pteropus poliocephalus*) Camps within 25 km of the Project Aea Occupied Within past 4 Years

Camps	Size*	Year of last recorded Grey-headed Flying-fox occupation
North Stradbroke Island, Dunwich (Mitchell Cres.) (153)	3	2022
North Stradbroke Island, Point Lookout (412)	1	2021
Redland Bay, Junee Street Wetlands (430)	3	2021
Cleveland, Black Swamp (143)	3	2021
Cleveland, Kooringa Avenue (599)	2	2022
Alexandra Hills, Lawn Terrace (270)	4	2021
Birkdale, Collingwood Rd (1150)	1	2021
Wynnum Creek (531)	1	2020
Brisbane, Giffin Park (159)	1	2022
Jacobs Well, Kumgum Street (715)	1	2021
Pimpama, Mirambeena Drive (851)	1	2022
Coopers Plains, Beryl Roberts Park, Barham St (745)	2	2021
Sunnybank (Les Atkinson Park) (452)	1	2012
Calamvale, Gloden Ave (744)	2	2022
Regents Park, Emerald Drive (433)	6 **(NIC)**	2021
Loganholme, Timor Avenue (377)	1	2022
Beenleigh, Lincoln St (281)	4	2022

* 1-499 (1), 500-2,499 (2), 2,500-9,999 (3), 10,000-15,999 (4), 16,000-49,999 (5), >50,000 (6), Nationally Important Camp (**NIC**)

[21] National flying fox monitoring program (DCCEEW): "National Flying fox monitoring viewer" http://www.environment.gov.au/webgis-framework/apps/ffc-wide/ffc-wide.jsf: Accessed 21 August 2024

There is one Nationally Important Camp (**NIC**) situated 25 km to the west of the Project Area at Regent's Park. Nearest roosts sites with occupancy by Grey-headed Flying-fox (*Pteropus poliocephalus*) in the past 4 years include Junee Street Wetlands (5 km) to the south-east, Kooringa Avenue (7 km) to the north, Black Swamp (8.7 km to the north, Dunwich (17 km) to the north-east (**Inset 8**).



Inset 8: Yearly maximum counts of Grey-headed Flying-fox numbers for four nearest roosts utilised by the species, between 2012 and February 2022. (Source: Commonwealth of Australia (Geoscience Australia) 2015: National Flying Fox monitoring viewer: https://www.environment.gov.au/webgis-framework/apps/ffc-wide/ffc-wide.jsf

3.4.2.3 Abundance within the Project Area

The Grey-headed Flying-fox (*Pteropus poliocephalus*) has not been detected within the Project Area. On the basis of its presence in the landscape, and the extent of suitable foraging habitat, including important winter and spring flowering canopy species, a precautionary approach is adopted, and presence is assumed.

There are no known camps either on-site, or in proximity to the Project Area.

3.4.2.4 Extent of Quality and Importance of Habitat Surrounding the Project Area

South East Queensland has a permanent and abundant population of Grey-headed Flying-fox (*Pteropus poliocephalus*) and available habitat is spread throughout the region given the high prevalence of eucalypts.

Resources for the Grey-headed Flying-fox (*Pteropus poliocephalus*) are most critical during two key periods within their life cycle; winter when other resources are scarce, and during the breeding season between late gestation and early lactation (Commonwealth of Australia 2021). The extent of Regional Ecosystems (remnant and regrowth) with two key significant South East Queensland winter flowering species; Broad-leaved Paperbark (*Melaleuca quinquenervia*) and Queensland Blue Gum (*Eucalyptus tereticornis*) where either are Dominant, Co-dominant, Subdominant and Associated canopy species (refer **Table 13** for definitions) within 25 km of the Project Area has been analysed.

Potential high-quality winter and spring flowering forage habitat (Dominant and Co-dominant REs) comprises 7,599 ha (refer **Table 14**); 590 ha within 5 km, and 7,009 ha between 5 and 25 km from the Project Area. Potential low-moderate quality winter and spring flowering forage habitat (Sub-dominant and Associated REs) comprises 12,191 ha (**Table 15**); 514 ha within 5 km, and 11,676 ha between 5 and 25 km from the Project Area.

The extent of this potential foraging habitats is presented as **Figure 20** (Dominant and Co-dominant REs representing higher quality winter and spring flowering forage habitat) and **Figure 21** (Subdominant and Associated REs representing lesser quality winter and spring flowering forage habitat).

Table 13: Determining level of dominance for canopy species within regional ecosystems as described by REDD[22] (after Eyre 2022)

Level of Dominance	Description
Dominant	Species listed first in REDD unless followed by 'and/or'. If first listed is one of 2 species e.g. *Eucalyptus saligna* OR *Eucalyptus grandis*; *Eucalyptus acmenoides* OR white mahogany (*Eucalyptus portuensis*), then use the first species of these species listed only
Co-dominant	Species listed in REDD as second, third etc. in list if separated by comma or 'and/or' or 'with'
Sub-dominant	Species listed in REDD as (+/-)
Associated	These species are listed in REDD as 'other species include' or 'characteristic species' or 'emergent'. If numerous species are listed in REDD, include up to maximum of 5 species

Table 14: Extent of State mapped remnant and regrowth REs with *E. tereticornis* and/or *M. quinquenervia* as a dominant or co-dominant canopy species within 25 km of the Project Area

RE	Short Description	Remnant Extent (ha)	High Value Regrowth Extent (ha)
12.2.7	*Melaleuca quinquenervia* open forest on sand plains	1,055.5	27.3
12.2.7a	*Melaleuca quinquenervia* low woodland with *Gahnia sieberiana* ground layer on sand plains	316.0	-
12.3.3	*Eucalyptus tereticornis* woodland on Quaternary alluvium	4.2	26.8
12.3.3d	*Eucalyptus moluccana* woodland on Quaternary alluvium	34.4	93.5
12.3.4	*Melaleuca quinquenervia*, *Eucalyptus robusta* woodland on alluvium	21.9	0.4
12.3.5	*Melaleuca quinquenervia* open forest on coastal alluvium	774.3	78.2
12.3.6	*Melaleuca quinquenervia +/- Eucalyptus tereticornis, Lophostemon suaveolens, Corymbia intermedia* open forest on alluvial plains	1,209.2	332.3
12.3.7	*Eucalyptus tereticornis, Casuarina cunninghamiana* subsp. *cunninghamiana +/- Melaleuca* spp. fringing woodland	183.4	82.9

[22] https://apps.des.qld.gov.au/regional-ecosystems/

RE	Short Description	Remnant Extent (ha)	High Value Regrowth Extent (ha)
12.3.11	*Eucalyptus tereticornis* +/- *Eucalyptus siderophloia*, *Corymbia intermedia* open forest on alluvial plains	1,365.9	534.0
12.3.11a	Open forest of *Eucalyptus tereticornis* and/or *E. siderophloia*, *Lophostemon confertus* with vine forest understorey	56.7	5.4
12.3.11b	*Eucalyptus tereticornis* and/or *E. racemosa* subsp. *racemosa* open forest	70.0	-
12.3.19	*Eucalyptus moluccana* and/or *Eucalyptus tereticornis* and *E. crebra* open forest to woodland, with a sparse to mid-dense understorey of *Melaleuca irbyana*	13.2	19.3
12.3.20	*Melaleuca quinquenervia, Casuarina glauca* +/- *Eucalyptus tereticornis, E. siderophloia, M. styphelioides* open forest on low coastal alluvial plain	410.6	82.6
12.5.2a	*Corymbia intermedia*, *Eucalyptus tereticornis* woodland on remnant Tertiary surfaces	481.8	169.4
12.12.12	*Eucalyptus tereticornis, Corymbia intermedia, E. crebra* +/- *Lophostemon suaveolens* woodland on Mesozoic to Proterozoic igneous rocks	10.2	5.7
Total		6,007.3	1,591.8
Proportion of all habitat in search area		79.1%	20.9%
Proportion of total search area (140,708.0 ha)		4.3%	1.1%

Table 15: Extent of State mapped remnant and regrowth REs with *E. tereticornis* and/or *M. quinquenervia* as a subdominant or associated canopy species within 25 km of the Project Area

RE	Short Description	Remnant Extent (ha)	High Value Regrowth Extent (ha)
12.2.5	*Corymbia intermedia* +/- *Lophostemon confertus* +/- *Banksia* spp. +/- *Callitris columellaris* open forest on beach ridges	1.1	3.1
12.2.10	*Eucalyptus planchoniana* +/- *Corymbia gummifera*, *E. racemosa* subsp. *racemosa, Banksia aemula* low woodland on dunes / plains	3,941.6	343.5
12.5.3	*Eucalyptus racemosa* subsp. *racemosa* woodland on remnant Tertiary surfaces	303.4	302.9
12.5.3a	Mixed woodland to open forest usually containing *Corymbia intermedia, Eucalyptus racemosa* subsp. *racemosa* and at least a presence of *Eucalyptus seeana* on remnant Tertiary surfaces	269.9	70.5

RE	Short Description	Remnant Extent (ha)	High Value Regrowth Extent (ha)
12.5.4a	Woodland of *Melaleuca quinquenervia* and/or *M. viridiflora* var. *viridiflora* +/- *Eucalyptus latisinensis, Corymbia intermedia, Angophora leiocarpa, E. exserta, Lophostemon suaveolens*	11.8	3.8
12.9-10.4	*Eucalyptus racemosa* subsp. *racemosa* woodland on sedimentary rocks	2,348.4	1,300.8
12.9-10.4a	*Eucalyptus racemosa* subsp. *racemosa* woodland to open woodland with a wet ground layer often dominated by *Ptilothrix deusta*, *Lepidosperma laterale* and other sedges and grasses	80.6	14.4
12.9-10.7a	*Eucalyptus siderophloia, Corymbia intermedia* +/- *E. tereticornis* and *Lophostemon confertus* open forest on sedimentary geology	111.5	29.3
12.9-10.12	Mixed woodland usually containing *Corymbia intermedia, Angophora leiocarpa* and at least the presence of *Eucalyptus seeana* on sedimentary rocks	342.3	98.0
12.11.27	*Corymbia trachyphloia, Eucalyptus crebra* and *Callitris endlicheri* woodland on Mesozoic to Proterozoic igneous rocks	2,108.3	505.9
Total		9,519.0	2,672.3
Proportion of all habitat in search area		78.1%	21.9%
Proportion of total search area (140,708.0 ha)		6.8%	1.9%

3.4.2.5 Extent of Quality and Importance of Habitat Within the Project Area

The spatial distribution and abundance of important forage species identified by tree surveys has been assessed and plotted as **Figure 22**. In identifying suitable species, reference was made to Commonwealth of Australia (2021) and Eby and Law (2008) to identify important forage candidates. This revealed nine species considered as important flowering forage species (ibid) are present on the Project Area.

Commonwealth of Australia (p.15, 2021) states the 'where the existence of these important winter and spring flowering vegetation communities is verified in the field, they are considered habitat critical to the survival of Grey-headed Flying-fox'. Reference was then made to Stanley and Ross (2002) to identify winter and spring flowering species important as foraging resources. This delineated Scribbly Gum (*Eucalyptus racemosa*), Broad-leaved Paperbark (*Melaleuca quinquenervia*), and to a lesser extent Queensland Blue Gum (*Euclayptus tereticornis*), Swamp Mahogany (*Lophostemon suaveolens*) and Narrow-leaved Red Gum (*Eucalyptus seeana*) as important winter and spring flowering species (**Table 16**).

Table 16: Seasonality of flowing by important forage species

Species	Seasonal Flowering				Cultivation notes
	Sum	Aut	Win	Spr	
Banksia integrifolia	X	X	X		Wild germination
Corymbia citriodora variegata		x	X	X	Wild germination

Species	Seasonal Flowering				Cultivation notes
	Sum	Aut	Win	Spr	
Eucalyptus microcorys			X	X	Wild germination
Eucalyptus racemosa			X	X	Wild germination
Eucalyptus robusta		X	X		Wild germination
Eucalyptus seeana	X			X	Wild germination
Eucalyptus tereticornis			X	X	Wild germination
Grevillea robusta	X			X	Cultivated ornamental
Lophostemon suaveolens	X			x	Wild germination
Macadamia tetraphylla			X	X	Cultivated ornamental
Melaleuca linariifolia				X	Wild germination
Melaleuca quinquenervia	x	X	x	X	Wild germination
Melaleuca salicina				X	Wild germination
Melaleuca viminalis	x			X	Cultivated ornamental
Melaleuca viridiflora	X			X	Cultivated ornamental

Key: major flowering period (X), minor flowering period (x), Summer (Sum), Autumn (Aut), Winter (Win), Spring (Spr). Sources - Stanley and Ross *Flora of South East Queensland* volume 2 (2002)

Representation of winter flowering species within the Assessment Units was determined through cross-checking BioCondition (HQA) data sheets (**Appendix 8**) and is presented in **Table 17**.

Table 17: Winter and spring flowering species characteristic of pre-clear REs by assessment unit (AU)

Species	IA AU1 (RE12.3.6)	IA AU2 (RE12.12.14)	IA AU3 (RE12.9-10.4)
Banksia integrifolia			X
Corymbia citriodora variegata			X
Eucalyptus microcorys			X
Eucalyptus racemosa	X	X	X
Eucalyptus robusta	X		
Eucalyptus seeana			X
Eucalyptus tereticornis		X	
Lophostemon suaveolens	X	X	X
Melaleuca linariifolia		X	

Species	IA AU1 (RE12.3.6)	IA AU2 (RE12.12.14)	IA AU3 (RE12.9-10.4)
Melaleuca quinquenervia	X	X	X
Melaleuca salicina	X		X

In accordance with the National Recovery Plan for the Grey-headed Flying-fox (*Pteropus poliocephalus*), where the existence of these important winter and spring flowering vegetation communities is field verified, they are considered habitat critical to the survival of the Grey-headed Flying-fox (*Pteropus poliocephalus*). These resources will become increasingly important in a landscape that is experiencing expanding urban development. Habitat on-site affording these winter-flowering (and spring-flowering) resources is considered critical habitat.

The distribution of winter and spring flowering forage species within the Project Area (**Figure 22**) shows that distribution of trees is sparse and clustered along fencelines or occurring as isolated paddock trees within the development footprint. The Eastern and Northern Enhancement Corridors feature a large number of winter flowering species that will be retained; within the Eastern Enhancement Corridor almost exclusively comprised of Broad-leaved Paperbark (*Melaleuca quinquenervia*).

3.4.2.6 Extent of Habitat Loss within the Project Area

Extent of The Proposed Action when avoidance and mitigation measures are taken into account will result in the canopy loss of 4.2 ha (equivalent area) of important winter and spring flowering forage species (1,054 stems) which aligns with the definition of 'habitat critical to the survival of the species'.

3.4.3 South-eastern Glossy Black Cockatoo (*Calyptorhynchus lathami lathami*)

3.4.3.1 Distribution, Ecology and Habitat Preferences

Glossy Black Cockatoo (*Calyptorhynchus lathami*) have a patchy distribution along the east coast and ranges south from near the Paluma Range in north Queensland to the Gippsland region in Victoria. An isolated population is located on Kangaroo Island in South Australia. Three subspecies are recognised throughout this range, the south-eastern subspecies (*Calyptorhynchus lathami lathami*) occurs from around Bundaberg south into Victoria. This subspecies was listed as Vulnerable on the 10 August 2022 (Commonwealth of Australia 2022c) due to substantial declines (30-50%) in the last three generations (Cameron et al 2021, Commonwealth of Australia 2022c). While declines are mostly attributed to the 2019-20 bushfires, historical and contemporary habitat loss has resulted in a retraction in both Area of Occupancy and Extent of Occurrence. The species is modelled to have declined by 16% in three generations had the fires not occurred (Commonwealth of Australia 2022c).

These birds inhabit woodlands and forests that have abundant *Allocasuarina* trees and abundant large hollows suitable for nesting. Many populations are restricted to remnant vegetation within hills and gullies surrounded by agricultural land (Higgins 1999); however, some populations move through artificial landscapes such as semi-urban parks, gardens and golf courses to access favoured food resources (Higgins 1999, M. Sanders pers. comm.). Groups are never far from waterbodies, which are visited daily.

Typically encountered in small family parties, the South-eastern Glossy Black Cockatoo (*Calyptorhynchus lathami lathami*) is a dietary specialists, feeding exclusively on the seeds in *Allocasuarina* and Casuarina spp. Typically birds rely on one or two species within a region (Higgins 1999) and in South East Queensland this includes Baker's Oak (*Allocasuarina torulosa*) and Black She-oak (*Allocasuarina littoralis*) (Glossy Black Conservancy 2022); other species that are taken infrequently include *Corymbia equisetifloia*, River She-oak (*Corymbia cunninghamiana*), and *Corymbia glauca* (Commonwealth of Australia 2022). Observations of the species feeding on other resources (e.g., *Callitris* and *Banksia*) are likely to represent food switching during periods of poor *Allocasuarina* cone production (Chapman 2007).

Thes species show a preference for productive trees (e.g., higher seed/fruit weight ratio), notwithstanding the influence of other factors such as distance from water or breeding hollows (Clout 1989; Pepper et al. 2000; Crowley

and Garnett 2001; Cameron and Cunningham 2006; Chapman and Paton 2006; Chapman 2007). Stands of *Allocasuarina* are therefore not of uniform value, and the loss of individual stands or trees may have disproportionate impacts. The production of cones by *Allocasuarina* trees closely tracks rainfall (Cameron 2006), and hence the availability of resources for resident South-eastern Glossy Black Cockatoo (*Calyptorhynchus lathami lathami*) fluctuates between years. While resources may be sufficient to support existing birds, drought is likely to reduce breeding success (Cameron 2009).

The movement patterns and ranging behaviour of Glossy Black Cockatoo (*Calyptorhynchus lathami*) are poorly known. Glossy Black Cockatoo (*Calyptorhynchus lathami*) are often considered to be seasonal in several locations within SEQ, which suggests the birds are moving around the region in response to resource (Glossy Black Conservancy 2022 and citations therein). Glossy Black Cockatoo (*Calyptorhynchus lathami*) are present throughout the year in many areas, and groups reportedly occupy areas permanently, though with some local movement. In Queensland, the species is often recorded in mountainous regions, and is said to make irregular visits, probably in search of food, to surrounding lowlands, including coastal areas (*ibid*).

Glossy Black Conservancy (2022) notes that urbanised areas can retain important habitat values and the species is known to use small pockets of feed trees or individual trees in urban areas.

Pairs breed during winter, mainly from April to July, although breeding has been recorded as late as August or as early as March (Beruldsen 2003). Nests are located in a large hollow typically with the following features: (i) > 8 m above the ground, (ii) in branches >300 mm in diameter, (iii) branch no more than 45º from vertical and (iv) minimum hollow entrance of >150 mm (Cameron 2006). Glossy Black Conservancy (2022) notes nesting trees usually occur within remnant woodland, but nests have also been found in ringbarked eucalypts in cleared country.

Hollows may be reused over many years (Beruldsen 2003). On Kangaroo Island (*Calyptorhynchus lathami halmaturinus* subspecies) nest trees are within 1.5 km (average 200 m) of food resources and 200 m of water, though birds can commute up to 14 km (28 km round-trip) between primary feeding and nesting areas, although the average is average 2.9 km (Garnet et al 1999, Mooney and Pedler 2005). This longer distance travel behaviour has not been observed for South-eastern Glossy Black Cockatoo (*Calyptorhynchus lathami lathami*) however this may be related to the Kangaroo Island population being a 'contained' population and easily observed.

Females incubate and care for the young alone but are regularly attended and fed by the male. Only one egg is produced, which hatches in about 30 days. Once hatched the chick fledges in around 60 days but remains with its parents and is fed for another three months (Garnett et al. 1999).

3.4.3.2 Abundance within Surrounding Habitat

Within South East Queensland, areas that the Glossy Black Conservancy (2022) currently consider to be local hotspots for South-eastern Glossy Black Cockatoo (*Calyptorhynchus lathami lathami*): (1) the southern Moreton Bay Islands; (2) the hinterland of the Gold Coast; (3) the Noosa area; and (4) the Scenic Rim (Glossy Black Conservancy 2022).

The Glossy Black Conservancy 2022 has mapped historic records within the South East Queensland and Northern New South Wales Region (Byron and Tweed Shires). No date is given for these records. Sightings nearby to the Project Area include the Mount Cotton Area and nearby Moreton Bay Islands (Stradbroke, Russell, Karragrra and Macleay Islands).

In an effort to elucidate a more contemporary understanding of South-eastern Glossy Black Cockatoo (*Calyptorhynchus lathami lathami*) presence, analysis of (DETSI) Wildlife Online and ALA records for the period 1990-present has been undertaken. Records without a date have been omitted. South-eastern Glossy Black Cockatoo (*Calyptorhynchus lathami lathami*) records within 25 km of the Project Area (**Figure 23**).

These data show two records within 5 km of the Project Area, with a pattern of consistent utilisation in the broader locality (5-25 km).

3.4.3.3 Abundance within the Project Area

Section 3.3.1 identifies the timing of full ecological and supplementary assessments undertaken within the Project Area to date. Surveys undertaken and their adequacy are discussed below.

Assessments for South-eastern Glossy Black Cockatoo (*Calyptorhynchus lathami lathami*) were undertaken concurrent to other assessments during 2021 and 2023. This included opportunistic diurnal scanning of potential nesting sites and forage trees, listening for characteristic calls and subdued forage behaviour and searches for signs of feeding (orts). Tree surveys were conducted between 7 am and 5 pm in a landscape with hollow bearing trees, potential forage resources Black She-oak (*Allocasuarina littoralis*) and permanent water source. A summary of sampling efforts undertaken for South-eastern Glossy Black Cockatoo (*Calyptorhynchus lathami lathami*) in 2015 and 2021 can be found in **Table 18**.

Table 18: Targeted Assessments for South-eastern Glossy Black Cockatoo (*Calyptorhynchus lathami lathami*)

Method	Description
2018	**BAAM (26 February – 2 March 2018)**
Targeted Feed Tree Search	Intensive investigation of the Project Area for isolated specimens and groves of feed trees for Glossy Black Cockatoo (*Calyptorhynchus lathami*).
Opportunistic records	Observations outside of systematic and targeted survey methodologies (outlined above).
2021	**28 South**
Feature inspections	Project Area inspection and familiarisation, numerous dates during 2021 in preparation for and in response to Joint Expert conclaves. Estimated 35 person hour of inspections.
Diurnal canopy and Ort searches	▪ July-August 2021 (60 person hours). Opportunistic searching of canopy for presence and signs (scratches on smooth barked eucalypts, scats), conducted whilst undertaking detailed tree survey. ▪ 31 August 2021 (10 person hours). Opportunistic searching of canopy for presence and signs (scratches on smooth barked eucalypts, scats) conducted whilst undertaking assessment of regeneration and extent of Black Shea oak (*Allocasuarina littoralis*) regrowth within Eastern Enhancement Corridor.
2023	**28 South**
Diurnal canopy searches	20-22 June and 26 June 2023. Conducted whilst undertaking botanical and habitat quality assessments. Opportunistic searching of canopy for presence and signs (scratches on smooth barked eucalypts, scats). 48 person hours.

Unlike other black-cockatoo species, they are relatively inconspicuous when feeding, giving soft contact calls (Pepper 1996; Teixeira et al. 2020). For this reason, they can easily be overlooked. Usually, their presence is detected by hearing the soft clicking action of the bill on the cones as they feed. Presence can be inferred from the the species' characteristic feeding remains of *Casuarina* and *Allocasuarina* spp. fruits ("orts"). See **Inset 9**.

Glossy Black Cockatoos (*Calyptorhynchus lathami*) are relatively tolerant of human presence and are generally less skittish than other black cockatoos. Glossy Black Cockatoos (*Calyptorhynchus lathami*) are highly vocal at nests, where they exhibit various call types that represent six behavioural situations: in flight; while perched; during begging (adult females); during courtship displays (adult males); when entering or sitting near to the nest hollow entrance (adult females); and in or at the nest (nestlings) (Teixeira et al. 2020). Nestlings become increasingly

vocal as they grow older, and large nestlings frequently give distinctive, loud vocalisations that have been used as bioacoustic indicators of nesting activity (Teixeira et al. 2021).

The highly detailed (tree-to-tree) traverse of the Project Area afforded by the Tree Surveys (July – August 2021) and the targeted tree-to-tree assessment within the Moogurrapum Creek corridor provided an opportunity to locate, and map stands of the Glossy black cockatoo feed trees; Black She-oak (*Allocasuarina littoralis*). These surveys also provided opportunity to locate foraging individuals, those flying overhead and signs of feeding (orts). No direct observations of this readily identifiable species (**Inset 9**) were made despite considerable person hours spent engaged in diurnal survey.

No South-eastern Glossy Black Cockatoo (*Calyptorhynchus lathami lathami*) were detected despite over 130 hours of on-site ecological assessments in which presence could be detected. The timing of assessments during breeding season, duration of on-site presence during survey (7am to 5pm) is considered sufficient to detect any birds moving between roosts, forage habitat and water sources, if they were indeed present.

Inset 9. Glossy black cockatoo is a distinctive and readily identified species. The bottom left image shows the characteristic signs of Glossy black cockatoo foraging activity ('orts') (Source imagery: Glossy Black Conservancy, 2022)

The primary food tree Black She-oak (*Allocasuarina littoralis*) is present; however, the majority of stands are immature and there were few cones on or under these trees. There are a smaller number mature Black She-oak (*Allocasuarina littoralis*) present and there was no cockatoo feeding sign (chewed cones) observed under these or even under the younger trees which had the largest cones on and under it.

3.4.3.4 Extent of and Quality of Habitat Surrounding the Project Area

South-eastern Glossy Black Cockatoo (*Calyptorhynchus lathami lathami*) have the potential to occur in any remnant vegetation containing *Casuarina* or *Allocasuarina* spp. for feeding, as well as any remnant vegetation containing large, mature eucalypts with hollows for sheltering and breeding, specifically eucalypt-dominated woodland and/or open forest. REs within 25 km of the Project Area have been mapped and considered as one of the following: (a) high value foraging habitat, if the RE description for remnant includes *Allocasuarina* spp., notably Black She-oak (*Allocasuarina littoralis*) and/or Baker's Oak (*Allocasuarina torulosa*) and the vegetation is Remnant (b) low-moderate value foraging habitat, if the RE description includes *Allocasuarina* spp., notably Black She-oak

(*Allocasuarina littoralis*) and/or Baker's Oak (*Allocasuarina torulosa*) and the vegetation is High Value Regrowth (c) low value foraging habitat if the RE description includes Casuarina spp., and (d) shelter and breeding habitat if the RE description includes eucalypt-dominated "woodland" or "open forest".

If a heterogeneous polygon included a combination of two or more of high value foraging habitat, low-moderate value foraging habitat or shelter and breeding habitat, the area of that polygon was attributed to habitat in that order i.e., if a polygon consisted of both high and low-moderate foraging habitat, the entire polygon was attributed to high value habitat. Given the requirements of South-eastern Glossy Black Cockatoo (*Calyptorhynchus lathami lathami*) for large and mature trees both for breeding, only remnant vegetation is considered here as providing breeding habitat for the species. High value regrowth and remnant habitat is considered suitable for foraging habitat, as regrowth vegetation has not reached sufficient age to develop hollows.

Within 25 km of the Project Area, 40,332 ha of remnant vegetation provides habitat amenity for South-eastern Glossy Black Cockatoo (*Calyptorhynchus lathami lathami*). High value foraging habitat comprises 4,104 ha (336 ha within 5 km and 3,768 ha between 5 and 25 km of the Project Area) and low-moderate value foraging habitat comprises 6,926 ha (71 ha within 5 km and 6,855 ha between 5 and 25 km of the Project Area). Refer **Figure 24** and **Table 19** and **Table 20** for RE details. Shelter and breeding habitat (refer **Figure 25 and Table 21)** comprises 33,402 ha of remnant vegetation (1,591 ha within 5 km and 31,811 ha between 5 and 25 km of the Project Area).

It is noted that the true extent of suitable habitat is likely less than these values given (a) RE polygons may be heterogeneous and only include a small percentage of high amenity REs, (b) not all large, mature trees within an RE will be hollow-bearing and, (c) South-eastern Glossy Black Cockatoo (*Calyptorhynchus lathami lathami*) have preferential *Casuarina*/*Allocasuarina* spp. as well as preferential individual trees on which they return feed across years, so high amenity foraging habitat is unlikely not to be evenly distributed throughout the landscape.

Further, the extent of available records of the species within 25 km of the Project Area does not show correlation to the above mapping suggesting other factors may influence occurrence, or the RE mapping is too coarse for practical use. This indicates that additional resources, whether shelter or foraging, exist throughout the landscape in areas that are not adequately captured using the above method.

More detailed habitat mapping than the above is possible using mapping rules for habitat mapping contained in SEQ Catchments (2016) and the Glossy Black Conservancy (2022); however, the spatial data that support this mapping is not publicly available.

Table 19: Extent of Potential South-eastern Glossy Black Cockatoo (*Calyptorhynchus lathami lathami*) High Value Forage Habitat within 25 km

RE	Short Description	Remnant Extent (ha)	High Value Regrowth Extent (ha)
12.2.10	*Eucalyptus planchoniana* +/- *Corymbia gummifera*, *E. racemosa* subsp. *racemosa, Banksia aemula* low woodland on dunes / plains	192.0	-
12.5.4a	Woodland of *Melaleuca quinquenervia* and/or *M. viridiflora* var. *viridiflora* +/- *Eucalyptus latisinensis, Corymbia intermedia, Angophora leiocarpa, E. exserta, Lophostemon suaveolens*	11.8	3.8
12.9-10.4	*Eucalyptus racemosa* subsp. *racemosa* woodland on sedimentary rocks	2,348.4	1,300.8
12.9-10.4a	*Eucalyptus racemosa* subsp. *racemosa* woodland to open woodland with a wet ground layer often dominated by *Ptilothrix deusta*, *Lepidosperma laterale* and other sedges and grasses	80.6	14.4

RE	Short Description	Remnant Extent (ha)	High Value Regrowth Extent (ha)
12.9-10.12	Mixed woodland usually containing *Corymbia intermedia, Angophora leiocarpa* and at least the presence of *Eucalyptus seeana* on sedimentary rocks	2.7	10.3
12.11.9	*Eucalyptus tereticornis* subsp. *tereticornis* or *E. tereticornis* subsp. *basaltica* open forest on metamorphics	83.8	54.9
Total		2,719.3	1,329.5
Proportion of all habitat in search area		67.2%	32.8%
Proportion of total search area (140,708.0 ha)		1.9%	0.9%

Table 20: Extent of Potential Glossy Black Cockatoo Low Value Forage Habitat within 25 km

RE	Short Description	Remnant Extent (ha)	High Value Regrowth Extent (ha)
12.1.1	*Casuarina glauca* woodland on margins of marine clay plains	520.6	68.3
12.2.10	*Eucalyptus planchoniana* +/- *Corymbia gummifera*, *E. racemosa* subsp. *racemosa, Banksia aemula* low woodland on dunes / plains	3,941.6	343.5
12.2.13	Open or dry heath on dunes and beaches	107.6	-
12.2.14	Foredune complex	268.8	0.9
12.3.5	*Melaleuca quinquenervia* open forest on coastal alluvium	774.3	78.2
12.3.7	*Eucalyptus tereticornis, Casuarina cunninghamiana* subsp. *cunninghamiana* +/- *Melaleuca* spp. fringing woodland	185.5	82.9
12.3.16	Complex notophyll to microphyll vine forest on alluvial plains (containing *Casuarina cunninghamiana* subsp. *cunninghamiana*)	40.5	15.4
12.3.20	*Melaleuca quinquenervia, Casuarina glauca* +/- *Eucalyptus tereticornis, E. siderophloia, M. styphelioides* open forest on low coastal alluvial plain	410.6	82.6
Total		6,254.2	671.8
Proportion of all habitat in search area		90.3%	9.7%
Proportion of total search area (140,708.0 ha)		4.4%	0.5%

Table 21: Extent of Potential Glossy Black Cockatoo Shelter and Breeding Habitat within 25 km

RE	Short Description	Remnant Extent (ha)
12.2.5	*Corymbia intermedia* +/- *Lophostemon confertus* +/- *Banksia* spp. +/- *Callitris columellaris* open forest on beach ridges	1,333.1
12.2.6	*Eucalyptus racemosa* subsp. *racemosa* open forest on dunes and sand plains.	4,213.9
12.2.7	*Melaleuca quinquenervia* open forest on sand plains	1,055.5
12.2.7a	*Melaleuca quinquenervia* low woodland with *Gahnia sieberiana* ground layer on sand plains	316.0
12.2.8	*Eucalyptus pilularis* open forest on parabolic high dunes	1,488.4
12.2.9	*Banksia aemula* low open woodland on dunes and sand plains	370.8
12.2.10	*Eucalyptus planchoniana* +/- *Corymbia gummifera*, *E. racemosa* subsp. *racemosa, Banksia aemula* low woodland on dunes / plains	3,941.6
12.2.14	Foredune complex	268.8
12.3.3	*Eucalyptus tereticornis* woodland on Quaternary alluvium	4.2
12.3.3d	*Eucalyptus moluccana* woodland on Quaternary alluvium	93.5
12.3.4	*Melaleuca quinquenervia*, *Eucalyptus robusta* woodland on alluvium	21.9
12.3.5	*Melaleuca quinquenervia* open forest on coastal alluvium	774.3
12.3.6	*Melaleuca quinquenervia* +/- *Eucalyptus tereticornis, Lophostemon suaveolens, Corymbia intermedia* open forest on alluvial plains	1,209.2
12.3.7	*Eucalyptus tereticornis, Casuarina cunninghamiana* subsp. *cunninghamiana* +/- *Melaleuca* spp. fringing woodland	190.2
12.3.11	*Eucalyptus tereticornis* +/- *Eucalyptus siderophloia*, *Corymbia intermedia* open forest on alluvial plains	1,365.9
12.3.11a	Open forest of *Eucalyptus tereticornis* and/or *E. siderophloia*, *Lophostemon confertus* with vine forest understorey	56.7
12.3.11b	*Eucalyptus tereticornis* and/or *E. racemosa* subsp. *racemosa* open forest	70.0
12.3.19	*Eucalyptus moluccana* and/or *Eucalyptus tereticornis* and *E. crebra* open forest to woodland, with a sparse to mid-dense understorey of *Melaleuca irbyana*	13.2
12.3.20	*Melaleuca quinquenervia, Casuarina glauca* +/- *Eucalyptus tereticornis, E. siderophloia, M. styphelioides* open forest on low coastal alluvial plain	410.6
12.5.1	Open forest complex with Corymbia citriodora subsp. variegata on subcoastal remnant Tertiary surfaces.	12.7
12.5.1g	*Eucalyptus planchoniana* and/or *E. baileyana* woodland to open forest on remnant Tertiary surfaces	4.0

RE	Short Description	Remnant Extent (ha)
12.5.2a	*Corymbia intermedia*, *Eucalyptus tereticornis* woodland on remnant Tertiary surfaces	481.8
12.5.3	*Eucalyptus racemosa* subsp. *racemosa* woodland on remnant Tertiary surfaces	303.4
12.5.3a	Mixed woodland to open forest usually containing *Corymbia intermedia, Eucalyptus racemosa* subsp. *racemosa* and at least a presence of *Eucalyptus seeana* on remnant Tertiary surfaces	269.9
12.5.4a	Woodland of *Melaleuca quinquenervia* and/or *M. viridiflora* var. *viridiflora* +/- *Eucalyptus latisinensis, Corymbia intermedia, Angophora leiocarpa, E. exserta, Lophostemon suaveolens*	11.8
12.5.6c	*Eucalyptus pilularis* open forest +/- *E. siderophloia, E. propinqua*, *Corymbia intermedia, E. microcorys, E. acmenoides, E. tereticornis* on remnant Tertiary surface	41.0
12.5.7	*Corymbia citriodora* subsp. *variegata* +/- *Eucalyptus portuensis* or *E. acmenoides, E. fibrosa* subsp. *fibrosa* open forest on remnant Tertiary surfaces	9.8
12.5.7b	*Eucalyptus moluccana* +/- *Corymbia citriodora* subsp. *variegata* open forest on remnant Tertiary surfaces	6.5
12.5.7c	*Corymbia henryi* and/or *Eucalyptus fibrosa* subsp. *fibrosa* woodland +/- *C. citriodora* subsp. *variegata, C. intermedia* and *E. moluccana*.	7.6
12.9-10.2	*Corymbia citriodora* subsp. *variegata* +/- *Eucalyptus crebra* open forest on sedimentary rocks	22.2
12.9-10.3	*Eucalyptus moluccana* open forest on sedimentary rocks	47.2
12.9-10.4	*Eucalyptus racemosa* subsp. *racemosa* woodland on sedimentary rocks	2,348.4
12.9-10.4a	*Eucalyptus racemosa* subsp. *racemosa* woodland to open woodland with a wet ground layer often dominated by *Ptilothrix deusta*, *Lepidosperma laterale* and other sedges and grasses	80.6
12.9-10.7a	*Eucalyptus siderophloia, Corymbia intermedia* +/- *E. tereticornis* and *Lophostemon confertus* open forest on sedimentary geology	111.5
12.9-10.12	Mixed woodland usually containing *Corymbia intermedia, Angophora leiocarpa* and at least the presence of *Eucalyptus seeana* on sedimentary rocks	342.3
12.9-10.14	*Eucalyptus pilularis* tall open forest on sedimentary rocks	4.5
12.9-10.17	*Eucalyptus acmenoides, E. major, E. siderophloia* +/- *Corymbia citriodora* subsp. *variegata* open forest on sedimentary rocks	115.2
12.9-10.17a	*Lophostemon confertus* or *L. suaveolens* dominated open forest usually with emergent *Eucalyptus* and/or *Corymbia* species	23.1
12.9-10.17b	*Corymbia citriodora* subsp. *variegata* mixed open forest to woodland.	29.0
12.9-10.17c	Open forest of *Eucalyptus carnea* and/or *E. tindaliae* and/or *E. helidonica* +/- *Corymbia citriodora* subsp. *variegata, Eucalyptus crebra,* with *Lophostemon confertus* often present as a sub-canopy	635.7

RE	Short Description	Remnant Extent (ha)
12.9-10.17d	Open forest generally containing *Eucalyptus siderophloia*, *E. propinqua* or *E major, Corymbia intermedia*	229.3
12.9-10.19a	Corymbia henryi and/or Eucalyptus fibrosa subsp. fibrosa open forest	673.6
12.9-10.26	*Eucalyptus baileyana* and/or *E. planchoniana* woodland to open forest on sedimentary geology	230.5
12.9-10.27	*Corymbia* and/or *Eucalyptus* dominated open forest with a very sparse to mid-dense understorey of *Melaleuca irbyana* on sedimentary geology	7.7
12.11.3	*Eucalyptus siderophloia, E. propinqua +/- E. microcorys, Lophostemon confertus, Corymbia intermedia, E. acmenoides open forest on metamorphics*	27.0
12.11.3a	*Lophostemon confertus +/- Eucalyptus microcorys, E. carnea, E. propinqua, E. major, E. siderophloia* woodland in gullies and on exposed ridges	337.7
12.11.5	*Corymbia citriodora subsp. variegata woodland to open forest +/- Eucalyptus siderophloia/E. crebra, E. carnea, E. acmenoides, E. propinqua* on metamorphics	2,195.9
12.11.7	*Eucalyptus crebra* woodland on metamorphics +/- interbedded volcanics	1.8
12.11.9	*Eucalyptus tereticornis subsp. tereticornis* or *E. tereticornis subsp. basaltica* open forest on metamorphics +/- interbedded volcanics	83.8
12.11.18	*Eucalyptus moluccana woodland* on metamorphics +/- interbedded volcanics	62.4
12.11.23	*Eucalyptus pilularis* on metamorphics +/- interbedded volcanics	1,147.4
12.11.24	*Eucalyptus carnea* or *E. tindaliae, Corymbia intermedia +/- E. siderophloia* or *E. crebra* woodland on metamorphics +/- interbedded volcanics	2,229.5
12.11.25	*Corymbia henryi* and/or *Eucalyptus fibrosa subsp. fibrosa +/- E. crebra, E. carnea, E. tindaliae* woodland on metamorphics +/- interbedded volcanics	1,872.0
12.11.26	*Eucalyptus baileyana* and/or *E. planchoniana* woodland to open forest on metamorphics +/- interbedded volcanics	94.8
12.11.27	*Eucalyptus racemosa subsp. racemosa* and/or *E. seeana* and *Corymbia intermedia* woodland on metamorphics +/- interbedded volcanics	2,108.3
12.12.3	Open forest complex with *Corymbia citriodora subsp. variegata, Eucalyptus siderophloia* or *E. crebra* or *E. decolor, E. major and/or E. longirostrata, E. acmenoides* or *E. portuensis* on Mesozoic to Proterozoic igneous rocks	2.1
12.12.12	*Eucalyptus tereticornis, Corymbia intermedia, E. crebra +/- Lophostemon suaveolens* woodland on Mesozoic to Proterozoic igneous rocks	10.2
12.12.14	*Eucalyptus racemosa subsp. racemosa +/- Lophostemon confertus, Syncarpia glomulifera, Eucalyptus acmenoides* woodland to open forest	37.3
12.12.15	Mixed open forest including combinations of *Eucalyptus propinqua, E. siderophloia, Corymbia intermedia, E. microcorys, Lophostemon confertus* open forest on Mesozoic to Proterozoic igneous rocks	1.0

RE	Short Description	Remnant Extent (ha)
12.12.15b	*Lophostemon confertus* open forest +/- *Eucalyptus microcorys, E. siderophloia, E. carnea, E. propinqua* and vine forest species often present in understorey.	2.8
Total		33,338.2
Proportion of all habitat in search area		82.9%
Proportion of total search area (140,708.0 ha)		23.7%

3.4.3.5 Extent of and Quality of Habitat Within the Project Area

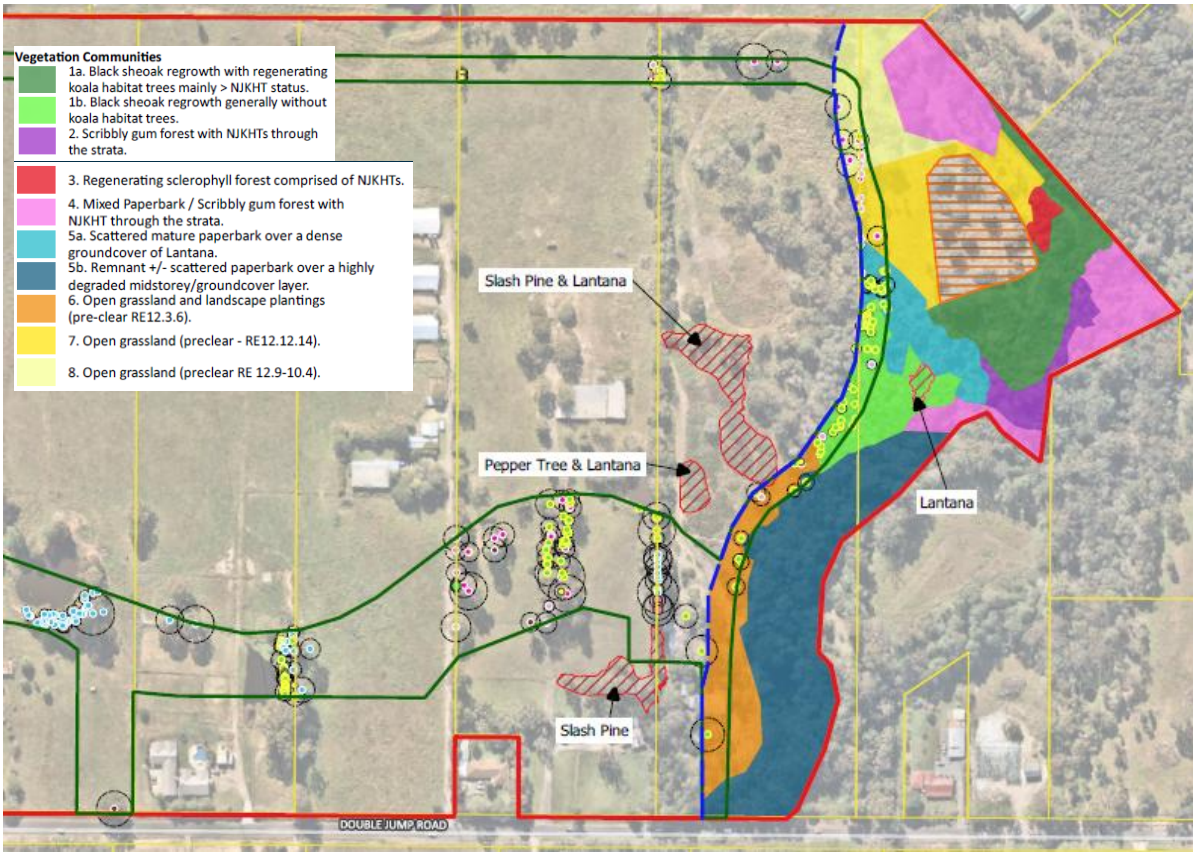
The primary food tree Black She-oak (*Allocasuarina littoralis*) is present within and adjoining the project area. Within the Project Area, all preclear REs are described as containing *Casuarina* and/or *Allocasuarina* spp. *Allocasuarina littoralis* is occasionally and sparsely present within the Project Area where grazing and slashing frequently occur. In eastern parts of the Project Area adjoining Moogurrapum Creek, where maintenance and grazing has ceased, regrowth patches of mainly young (<150 mm DBH) regrowth occur as mixed and mono-specific stands.

Within this location there are also a larger number of mature (>300 mm DBH) parent trees. In accord with the framework for habitat quality identified for **Section 3.4.3.5**, habitat quality can be considered to be low.

BioCondition transects in which the greatest diversity of size and numbers of *Allocasuarina littoralis* are present include:

- Transect 2 – AU 1 (RE12.3.6), some large >300mm DBH trees
- Transect 5 – AU 1 (RE12.3.6), extensive younger regrowth following disturbance events and some large >300mm DBH trees present
- Transect 3 – AU 2 (RE12.12.14), extensive younger (<200m DBH) regrowth following disturbance event
- Transect 4 – AU 3 (RE12.9-10.4), small number of trees median 170 mm DBH.

All these locations occur within the Eastern Enhancement Corridor and will be retained. The extent of Black She-oak (*Allocasuarina littoralis*) development within the Eastern Enhancement Corridor was mapped for the Joint Environmental Report. Mapping of the extent is presented as **Inset 10**.



Inset 10. Vegetation Community Mapping for the Eastern Corridor (Joint Environmental Report 2021)

3.4.3.6 Extent of Habitat Loss within the Project Area

Extent of The Proposed Action when avoidance and mitigation measures are taken into account will result in the loss of 672 m^2 of young (low quality) forage habitat. Trees with hollows of a size potentially suitable for breeding are identified in **Figure 26**.

4. Assessment of Impacts

4.1 Generalised Assessment of Impacts

4.1.1 Direct Impacts

Direct impacts will arise from the loss of habitat associated with the Proposed Action.

The Proposed Action will involve direct impacts arising from the removal of 32.57 ha (86.2% of Project Area) of mainly pastural grassland and open woodland for the establishment of the Proposed Action (**Figure 9**). Functional Habitat Retention within the Project Area comprises 5.65 ha or 17.6% of Project Area. **Table 22** provides an analysis of habitat loss and retention by AUs. Direct loss of habitat will be mitigated through measures described in **Section 5**.

Table 22: Impact and Retention Areas by Assessment Unit (AU)

Assessment Unit	Impact Area		Retention Area		Total Area (ha)
	Direct Project Area (ha)	Proportion of Total AU	Retention Area (ha)	Proportion of Total AU	
1	0.79	18.62%	3.47	81.38%	4.27
2	12.94	89.99%	1.44	10.01%	14.38
3	18.83	96.22%	0.74	3.78%	19.57
Total	**32.57**	**85.19%**	**5.65**	**14.78%**	**38.22**

4.1.2 Indirect Impacts

Indirect impacts occur when project related activities affect vegetation or habitats in a manner other than a direct loss or clearing. Examples of indirect impacts include promotion of soil erosion, sedimentation of waterways, dust inhibiting plant pollution, provision of suitable seed bed for invasive plants, altered surface and groundwater conditions effecting long term habitat change, interspecific competition on forest dwelling species from edge specialist species, light throw from urban areas, or increased noise activity within of directly adjacent to sensitive habitat areas.

The potential indirect impacts that may potentially result from pre-construction, construction activities and/or the operational phase of the Proposed Action has been identified below.

4.1.2.1 Pre-construction

Prior to clearing activities, a suitably qualified, experienced spotter catcher, appropriately registered (in possession of a Rehabilitation Permit under the NC Act) will be appointed to manage fauna during pre-construction and construction phases. The Spotter Catcher will be required to prepare a Fauna Management Action Plan, following site survey and assessment, and immediately prior to commencement of the Action in accordance with the requirements of the *Nature Conservation (Koala) Conservation Plan 2017*, and Commonwealth conditions of approval.

A key feature of fauna management during pre-construction and construction will be the installation and maintenance of temporary fauna exclusion fencing to be erected around the perimeter of Project Areas to:

1. demarcate construction areas and habitat protection areas
2. manage fauna displaced by habitat clearing activities, and
3. management of mobile / transient fauna, to ensure encroachment into work zones does not occur.

All clearing and construction will be staged and undertaken in line with the requirements of Queensland's Nature Conservation (Koala) Conservation Plan 2017 and the *Code of Practice* (State of Queensland 2016). As such, clearing will be completed slowly and sequentially and in a direction that directs any vacating fauna towards retained corridor areas and in the presence of a qualified fauna spotter catcher.

4.1.2.2 Construction

4.1.2.2.1 Weeds

Increased vehicle movement during the construction phase has the potential to increase the spread of weeds in the area, particularly during the vegetation clearing phase. With implementation of standard mitigation measures, the Proposed Action is likely to result in a negligible impact to ecological values due to the potential introduction/spread of weeds.

4.1.2.2.2 Vehicle Movement

During construction, a number of vehicles will be required within the Project Area. Direct impacts from vehicle movements on threatened species and vegetation communities include:

- damage or destruction of vegetation or fauna habitat by vehicles traversing these areas
- fauna strike.

4.1.2.2.3 Earthworks

Construction activities have the potential to generate dust emissions. Dust emissions during construction will be temporary. The main sources of dust will be generated via:

- wheel-generated dust from the haul roads created for the construction phase
- dust lift-off from exposed surfaces (e.g. construction roads and pads)
- earthworks, including construction of the embankments, and moving, dumping and shaping material
- vegetation and soil clearing of the land.

Excessive deposition of dust on leaves of plants can suppress the growth and photosynthesis, resulting in reduced habitat quality for fauna. High levels of airborne dust can irritate the respiratory systems of fauna and potentially result in ingestion of dust-coated seeds and other foods. Excessive deposition of dust on open water bodies may also degrade water quality and overall habitat quality for fauna.

With implementation of standard mitigation measures, the Proposed Action is likely to result in a temporary and minor impact to ecological values due to the generation of dust.

4.1.2.2.4 Light Emissions during Construction

Artificial light can affect both nocturnal and diurnal animals by disrupting behavioural patterns, with quality of light (e.g. wavelength, colour), intensity and duration potentially evoking different faunal responses. Impacts from increased light levels include disorientation from, or attraction toward, artificial sources of light; mortality from collisions with structures; and effects on light-sensitive cycles of species (e.g. breeding and migration for fauna and flowering in plants). An artificial increase in lighting can also affect abundance of predators.

Presence and intensity of artificial light in the Project Area will temporarily increase during the construction phase; however, night works will not be common. Lighting will be directed to construction areas within the Project Area.

Some light spillages will be inevitable and is likely to be contained. Potential impacts associated with light emissions will be temporary and unlikely to be significant.

With implementation of standard mitigation measures, the Proposed Action is likely to result in a negligible impact to ecological values due to the use of light pollution during construction.

4.1.2.2.5 Noise and Vibration

Noise levels greater than existing ambient noise levels are expected during the construction within the Project Area. Sources of noise are likely to consist of noise in short, intense pulses from mobile plant equipment, and more prolonged noise, with consistent vibration, pitch and volume from generators, excavators and pumps, in addition from noise from vehicles.

Both steady continuous and single noise events have the potential to lead to ecological impacts. Construction noise is expected to elicit some avoidance response from fauna using the surrounding vegetation though, with consideration of the extent of habitat available in the Project Area, this is likely to be a temporary and negligible to minor impact.

4.1.2.2.6 Increased Human Presence

Increased human activity during construction has the potential to disturb fauna within adjacent habitat areas.

Resulting impacts to fauna include heightened vigilance and predator avoidance, which can disrupt foraging and roosting efficiency or deter wildlife from using particular areas. Impacts essentially represent a reduction in core habitat due to edge effects. The Proposed Action is likely to result in a temporary and minor impact to ecological values due to increased human presence on Project Area during the construction period.

4.1.2.3 Post-construction

4.1.2.3.1 Traffic

The new lots will result in a small increase in traffic however effects of this will be mitigated and ameliorated by:

- 50 km/h speed limit on internal roads.
- construction of fauna exclusion / directional fencing around the internal Eastern Enhancement Corridor perimeter.

Fauna exclusion fencing will greatly limit fauna access to the Residential, commercial and business zones and therefore likelihood of fauna vehicle strike of entrapped animals at this location is reduced.

4.1.2.3.2 Light Emissions during Operation

Artificial light can affect both nocturnal and diurnal animals by disrupting behavioural patterns, with quality of light (e.g. wavelength, colour), intensity and duration potentially evoking different faunal responses. Impacts from increased light levels include disorientation from, or attraction toward, artificial sources of light; mortality from collisions with structures; and effects on light-sensitive cycles of species (e.g. breeding and migration for fauna and flowering in plants). An artificial increase in lighting can also affect abundance of predators.

Without additional directed lighting measures and low lux lighting (whilst maintaining visibility and safety) some light spillage will be inevitable. With light shrouding and shielding / direction measures light glow and spillage can be successfully reduced.

The ecological restoration of parts of the Project Area within Conservation Areas and Muti-function Spine will result in a transitional / interface zone being formed between the residential components and the retained / enhanced habitat. As the vegetation matures it will further screen any light throw generated.

With implementation of standard mitigation measures, the Proposed Action is likely to result in a negligible impact to ecological values due to the use of light pollution during operation.

4.1.2.3.3 Noise and Vibration

Operational noise is expected to be minor and in line with existing backgrounds noise levels and as such is unlikely to elicit avoidance responses such that habitat utility is lost. The risk of operational noise affecting night-time animal behaviour within the Conservation Areas is considered very low.

4.1.2.3.4 Waste Disposal

Inappropriate disposal of non-hazardous wastes can attract vermin and other wildlife to Project Area. This may exacerbate potential impacts (e.g. road mortality). Litter may also enter surrounding environments. With implementation of standard mitigation measures, the Proposed Action is likely to result in a negligible impact to ecological values due to the generation and handling of waste.

4.1.2.3.5 Hazardous and Dangerous Goods

Spills and leaks from transfers (e.g. fuel and/or chemicals) and inadequate storage of dangerous goods and hazardous wastes could result in point-source contamination of surrounding land. Direct adverse impacts could include toxic impacts on vegetation (resulting in degradation or loss of vegetation and habitats), direct toxic impacts on fauna (from contact, inhalation or ingestion) or indirect impacts on threatened and migratory species from habitat loss. Direct adverse impacts on surface and groundwater quality are also possible.

With the application of standard mitigation and management measures, impacts from liquid and solid waste disposal will be avoided or localised and small in scale. Further to this, end of train WSUD (stormwater reserve) measures are highly unlikely to result in the release of spillages. The risk is considered is considered extremely low. Therefore, the Proposed Action is likely to result in a negligible impact to ecological values due to potential spills and leaks.

4.1.2.3.6 Increased Human Presence and Interaction with Dogs

Increased human activity after completion of construction has the potential to disturb fauna within adjacent habitat areas.

Resulting impacts to fauna include heightened vigilance and predator avoidance, which can disrupt foraging and roosting efficiency or deter wildlife from using particular areas. Impacts essentially represent a reduction in core habitat due to edge effects. The Proposed Action is likely to result in a minor impact on Project Area and adjacent ecological values due to increased human presence. Access to the EPZ will be discouraged through internally facing development.

The Proposed Action has the potential to increase the occurrence of dogs at the Project Area, but the significance of this outcome needs to be considered in light of: (i) the existing occurrence of wild dogs in the locality; and (ii) the relative contribution made by wild and domestic dogs to Koala *(Phascolarctos cinereus)* attack, particularly in new development.

In South East Queensland, wild dog populations exist on the outskirts of suburbs within Brisbane, Logan, Gold Coast and Sunshine Coast. These dogs often go un-noticed, and residents regularly mistake them for domestic dogs without collars. Australian Koala Foundation and Queensland Parks and Wildlife data on Koala *(Phascolarctos cinereus)* deaths from these areas show that mortality due to dog attack is far more frequent in the greater Brisbane area where wild dogs are prevalent.

In the shorter term, prior to dedication of Conservation Areas and Multi-function Spine to public ownership (refer to **Section 2.3.9** of this report), the proponent will actively manage wild dogs. In the longer term, as the area is transferred to Council ownership, Redland City Council will inherit the general biosecurity obligation established by the *Biosecurity Act (Qld) 2014*. Dedication to public ownership will therefore create focal points for the management of wild dogs in line with Redland City Council's established wild dog management protocols.

4.2 Koala (*Phascolarctos cinereus*)

4.2.1 Direct Impacts

The Proposed Action will involve direct impacts to the Koala (*Phascolarctos cinereus*) through the removal of vegetation within the Project Area (for residential, open space and stormwater management uses). Although retained and avoided habitat will be ecologically restored and afford movement habitat, Northern Enhancement Corridor and the Multi-function Spine (Western Enhancement Corridor) are considered compromised habitat[23] on account of their narrow width (<100 m) and are included in the total Project Area of 32.57 ha.

The direct loss of Koala (*Phascolarctos cinereus*) habitat will be mitigated through numerous measures described in **Section 5**. Outside of the development footprint, the Proposed Action will be retaining and ecologically restoring (through assisted regeneration, reconstruction and fabrication) movement and habitat corridor for Koala *(Phascolarctos cinereus)* through the retention of mature, intact vegetation within Conservation Areas and Multi-function Spine. Eastern Enhancement Corridor contains the highest quality and mature habitat. Proposed ecological restoration is outlined in the Concept RMP (**Appendix 4**). The Proponent has also committed to undertaking an offset to acquit any remaining significant residual impact to Koala *(Phascolarctos cinereus)* outside of these mitigation measures.

4.2.2 Indirect Impacts

Potential indirect impacts on the Koala (*Phascolarctos cinereus*) associated with the Proposed Action are described below.

4.2.2.1 Increased Noise, Artificial Light, Dust, Sediment Generation, Other Stressors During Construction

Construction activities have the potential to increase stress on the Koala (*Phascolarctos cinereus*) within the Project Area through machinery, construction noise and dust generation. These elements will be addressed within a *Construction Environmental Management Plan* (**CEMP**) (**Section 5.3.2.5.4**) to be prepared as part of operational works application for the Proposed Action. It is noted that all clearing and construction will be staged and undertaken in line with the requirements of Nature Conservation (Koala) Conservation Plan 2017, as such, will be completed slowly and sequentially and in a direction that directs any vacating fauna towards retained corridor areas and in the presence of a qualified fauna spotter catcher.

4.2.2.2 Habitat Fragmentation and Barriers to Dispersal (Including Dispersal of Seeds or Pollen via Faunal Vectors)

The Project Area currently comprises Koala (*Phascolarctos cinereus*) habitat characterised by vegetation of varying age and quality. Through the avoidance (**Section 5**), mitigation by virtue of the consolidation and linking of Koala (*Phascolarctos cinereus*) habitat (**Section 5.3.2**) and the establishment of fauna movement infrastructure and road crossings (**Section 5.4.2**), the Proposed Action will enhance, expand upon and consolidate Koala (*Phascolarctos cinereus*) habitat and reduce its fragmentation as well as any future edge effects.

As existing barriers to Koala (*Phascolarctos cinereus*) movement exist to the north-west and north, the Proposed Action is unlikely to create new barriers to dispersal; the Koala (*Phascolarctos cinereus*) will be freely able to reside and move within and through retained, consolidated and restored habitat areas. Within these areas KHTs will proliferate and connect into adjoining areas of similar habitat.

4.2.2.3 Increased Vehicle Strike (Construction and Operation)

During clearing and construction activities, the Proposed Action will increase the potential for machinery and vehicles to interact with Koalas (*Phascolarctos cinereus*). These risks will be appropriately managed through

[23] In accordance with the DES Guideline: State Development Provisions, literature recommends that Koala movement corridors should seek to be at least 100 m wide to function effectively and to minimise edge effects.

standard measures to be outlined within a CEMP (**Section 5.3.2.5.4**) and a Koala Management Plan to be prepared as part of detained design and operational works stage of the Proposed Action.

During operation, the Proposed Action will increase traffic generation within the Project Area, leading to potential for increased Koala (*Phascolarctos cinereus*) collisions (a) on roads within the Project Area, and (b) on roads intersecting Koala (*Phascolarctos cinereus*) movement corridors beyond the Project Area. Barriers such as construction exclusion fences (around construction works (e.g. a stage of development)), fauna friendly fencing and aprons extending out from the fauna crossings at road intersections and retaining walls will be designed to prevent the species from entering roadways and the Residential Precinct.

4.2.2.4 Increased Risk of Attack from Domestic Animals, in Particular Dog Attack on the Koala *(Phascolarctos cinereus) from both Domestic and Wild Dogs*

The Proposed Action will potentially increase the occurrence of domestic dogs on the Project Area, but it is difficult to disentangle the potential impact of new domestic dogs from the likely existing impact of wild dogs and roaming domestic dogs that already occur in the landscape. The vulnerability of the Koala (*Phascolarctos cinereus*) to predation is exacerbated where portions of the Project Area currently contain widely-scattered trees, requiring them to make long movements across open ground.

Through the avoidance (**Section 6.1**) and the consolidation and linking (**Section 6.2.1**) of habitat, the establishment of fauna movement infrastructure and road crossings (**Section 6.1**) and the installation of barriers to Koala (*Phascolarctos cinereus*) movement into the Residential Precinct, the Proposed Action will reduce the prevalence of the Koala (*Phascolarctos cinereus*) within residential areas of the Proposed Action.

The potential remains however for dogs at-large (domestic or wild) to interact with the Koala (*Phascolarctos cinereus*) in the Eastern Enhancement Corridor. Specific mitigation measures to address the potential impact of dogs on Koala (*Phascolarctos cinereus*) within the Project Area are discussed in **Section 6.2.1**

4.2.2.5 Introduction / Proliferation of Weeds of Pathogens into Habitat

Through the ecological restoration works within Conservation Areas (including the Multi-function Spine), the Proposed Action will result in a considerable reduction of weeds within retained and restored Koala (*Phascolarctos cinereus*) habitat.

Once the Conservation Areas (including the Multi-function Spine), reach off-maintenance status, this land will be transferred to Redland City Council. This custodian will be responsible for ensuring the provisions of the Queensland *Biosecurity Act 2014* are upheld through regular weed inspections (and removal if necessary).

The potential for the introduction of weeds within Koala (*Phascolarctos cinereus*) habitat during construction will be minimised and managed through appropriate controls within a CEMP (refer **Section 6.2.5**).

With respect to pathogens, it is not envisaged that the Proposed Action will in any way increase the species' exposure to Chlamydia or Koala retrovirus (KoRV), as no additional exposure to affected populations or individuals will result from the Proposed Action.

4.2.2.6 Risk of Entanglement in Wire Fencing, Electrical Wires or Other Infrastructure

Environmental risks to Koala (*Phascolarctos cinereus*) associated with fencing and electrical services have been engineered to reduce risks to as low as possible. All electrical services will be undergrounded. Barbed wire fencing will not be used for the Proposed Action. Therefore, they cannot become entangled in any infrastructure associated.

Further, the existing barbed wire structures within the Project Area will be removed as part of both construction works and ecological restoration efforts. Barriers to prevent Koala (*Phascolarctos cinereus*) movement into the residential areas will include retaining walls and exclusion fencing between esplanade roads and primary enhancement corridor where practicable, and exclusion fencing / directional fencing will allow for safe movement under the proposed road crossing through the use of culverts and aprons extending out from identified fauna crossings.

4.2.2.7 Reduction in Habitat Connectivity to Surrounding Habitats and any Potential Edge Effects

The Proposed Action will have a limited impact on habitat connectivity for the Koala (*Phascolarctos cinereus*) within the Project Area and to surrounding habitats when considering the existing barriers or future uses. Currently through the patchwork of cleared, regrowth and remnant habitats the Project Area provides for informal and disaggregated Koala (*Phascolarctos cinereus*) movement opportunities within and through the landscape. Connection to other areas of habitat will be retained and restored through ecological restoration within Conservation Area (including the multi-function spine) and deployment of Koala (*Phascolarctos cinereus*) management and movement infrastructure.

The direct and indirect loss of 32.57 ha of mostly dispersal habitat for urban residential purposes areas will alter Koala (*Phascolarctos cinereus*) movement patterns through the Project Area. However, the Proponent has sought to incorporate the majority of the mature, densely vegetated and higher quality KHTs and enhance a key movement corridor and habitat linkage for this species (see **Section 6.2.1**).

The formalisation of Conservation Areas results in a more formalised and legible network of Koala (*Phascolarctos cinereus*) habitat. Ecological restoration (comprising assisted natural regeneration, recreation and fabrication) and installation of wildlife management infrastructure, including dedicated underpasses, will enhance, expand and consolidate available habitat (see **Section 5.4.5**), ensures that connectivity with habitats beyond the Project Area is maintained and are reflective of locally important biodiversity connections along Moogurrapum Creek and with High Value Regrowth habitat to the north-west.

Edge effects are currently evident within Koala (*Phascolarctos cinereus*) habitat throughout the Project Area, largely due to the historical degradation associated with agricultural / pastural landuses, a lack of coordinated land management practices, and a poorly defined Koala (*Phascolarctos cinereus*) habitat network. Through the avoidance (**Section 5**) and the consolidation and linking of Koala (*Phascolarctos cinereus*) habitat, the establishment of fauna movement infrastructure and road crossings (**Section 5.3.3**) combined with the buffering function of the esplanade roads, drainage reserves and local parks to the Eastern Enhancement Corridor, the Proposed Action is expected to decrease edge effects on Koala (*Phascolarctos cinereus*) habitat within the Project Area.

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

4.3.1 Direct Impacts

4.3.1.1 Loss of Roost Habitat

The Proposed Action will not affect any existing Grey-headed Flying-fox (*Pteropus poliocephalus*) camps. It will not lead to loss of roost trees or an increase in disturbance to roosting Grey-headed Flying-fox (*Pteropus poliocephalus*).

4.3.1.2 Loss of Forage Habitat

The Proposed Action will involve direct impacts to the Grey-headed Flying-fox (*Pteropus poliocephalus*) through the removal of vegetation within the Project Area for residential, open space and stormwater management uses comprises the loss of general forage habitat which includes 32.57 ha of foraging resource habitat.

Flowering trees which provide key resources during critical times in the Grey-headed Flying-fox (*Pteropus poliocephalus*) lifecycle are located within the Moogurrapum Creek Corridor (generally Broad-leaved Paperbark (*Melaleuca quinquenervia*) with minor Queensland Blue Gum (*Eucalyptus tereticornis*) and Narrow-leaved Red Gum (*Eucalyptus seeana*). Although identified as a winter flowering species (Stanley and Ross 2002) Scribbly Gum (*Eucalyptus racemosa*), which occurs as paddock trees over much of the Project Area, is not considered by Eby and Law (2008) to be a reliable or valuable forage. Better quality forage habitat will be retained within Conservation Areas and impacts associated with loss mitigated through ecological restoration within these areas to re-establish preclear REs.

All native trees within Conservation Areas 1 and 2 will be retained where practicable. Many are important blossoming resources during the winter bottlenecking period particularly as these areas support the highest abundance of mature and intact Broad-leaved Paperbark (*Melaleuca quinquenervia*) with sporadic Queensland Blue Gum (*Eucalyptus tereticornis*).

Whilst the Multi-function Spine will also be ecologically restored reflective of pre-clear RE communities (this will include with suitable foraging species) the planted resources will not be of value to Grey-headed Flying-fox (*Pteropus poliocephalus*) for some years. Details for these revegetation areas are described in further detail in the Concept RMP (**Appendix 4**).

Given Grey-headed Flying-fox (*Pteropus poliocephalus*) are not considered to be heavily reliant on the foraging resources present within the Project Area, in particular the development footprint (see **Section 3.4.2.5**), and similar habitats with suitable flowering trees are widespread within the locality (see **Section 3.4.2.4**), impacts from the Proposed Action on this species are not expected to be severe. However, as there has been considerable historical habitat loss in South East Queensland (Commonwealth of Australia 2021), it is recognised that urban developments can contribute to cumulative habitat loss. Residual impacts, although minor, will be addressed by supplementary planting of key winter/spring flowering tree species, such as Queensland Blue Gum (*Eucalytpus tereticornis*), Broad-leaved Paperbark (*Melaleuca quinquenervia*) and to a lesser extent Narrow-leaved Red Gum (*Eucalyptus seeana*) and Scribbly Gum (*Eucalyptus racemosa*). These plantings will occur both within the Project Area and on an off-site offset.

The Concept RMP (**Appendix 4**) provide details regarding planting density and species, responsibilities, timelines, milestones/targets and triggers for corrective measures. Monitoring, which is also included within the above plans, will be undertaken to ensure these actions equal or exceed tree loss.

The implementation of these plans in conjunction with the off-site offset is expected to result in no net loss of Grey-headed Flying-fox (*Pteropus poliocephalus*) foraging resources.

4.3.2 Indirect Impacts

As described below, there are no indirect impacts expected to result from the Proposed Action on Grey-headed Flying-fox (*Pteropus poliocephalus*).

4.3.2.1 Increased Noise, Artificial Light, Dust, Sediment Generation, Other Stressors During Construction

With no Flying-fox camps within the immediate proximity of the Project Area, there is little concern for impacts from construction noise and dust generation. Further, construction and associated activities are not proposed to occur at night and foraging bats would not be affected either.

Grey-headed Flying-fox (*Pteropus poliocephalus*) seem undisturbed by night lights and nocturnal movement associated with urban housing and can readily move across modified landscapes. The Proposed Action will not affect Flying-fox activity or movements through the landscape.

4.3.2.2 Habitat Fragmentation and Barriers to Dispersal (Including Dispersal of Seeds or Pollen via Faunal Vectors)

Considering Grey-headed Flying-fox (*Pteropus poliocephalus*) do not appear to be abundant within the local area during key stages of their life cycle (see **Section 3.3.1**), and similar habitats with flowering trees are widespread within the local area (see Section **3.3.2**), impacts from the Proposed Action on this species are not expected to be severe. Given Grey-headed Flying-fox (*Pteropus poliocephalus*) readily reside and forage within urban areas, as exampled by the location of the camps in the locality, it is expected that the Proposed Action will not result in significant fragmentation or barriers to dispersal of Grey-headed Flying-fox (*Pteropus poliocephalus*).

4.3.2.3 Increased Vehicle Strike (Construction and Operation)

No Flying-fox roosts are present within the Project Area; therefore, there is minimal chance of vehicle strike during construction or operation activities. Further, the retained foraging habitat present within the Project Area for Grey-headed Flying-fox (*Pteropus poliocephalus*) is largely limited to winter-flowering species within Conservation Areas.

It is expected that the restoration of the Eastern Enhancement Corridor will further enhance and strengthen the foraging habitat for the Grey-headed Flying-fox (*Pteropus poliocephalus*) potentially occurring within in the landscape. These areas will be located away from most urban activities, with only one road crossings passing through Conservation Area. This central road crossing and all other esplanade roads adjoining the broader Eastern Enhancement Corridor will be low speed environments and trees boarding these areas large in stature (meaning foraging occurs at a much higher level then vehicular traffic). The likelihood that a Grey-headed Flying-fox (*Pteropus poliocephalus*) might be foraging within this area and is struck by a vehicle is very low.

4.3.2.4 Introduction / Proliferation of Weeds of Pathogens into Habitat

Through the ecological restoration within Conservation Areas and associated weed removal and management, the Proposed Action will result in a considerable reduction of weeds within retained and restored habitat within the Project Area.

Once the Conservation Areas (including the Multi-function Spine) achieve off-maintenance status, this land will be transferred to RCC who will be responsible for ensuring the provisions of the Queensland *Biosecurity Act 2014* (Qld) are upheld through regular weed inspections (and removal if necessary).

The potential for the introduction of weeds within habitat during construction will be minimised and managed through appropriate controls within a CEMP (**Section 5.3.2.5.4**).

4.3.2.5 Risk of Entanglement in Wire Fencing, Electrical Wires or Other Infrastructure

Environmental risks to Grey-headed Flying-fox (*Pteropus poliocephalus*) associated with fencing and electrical services have been engineered to reduce risks to as low as possible.

All electrical services for the Proposed Action will be located underground. Barbed wire fencing will not be used for the Proposed Action and Grey-headed Flying-fox (*Pteropus poliocephalus*) are unlikely to become entangled in any infrastructure associated with the Proposed Action. Further, the existing barbed wire structures within the Project Area will be removed as part of both construction works and ecological restoration.

4.3.2.6 Reduction in Habitat Connectivity to Surrounding Habitats and any Potential Edge Effects

The Proposed Action involves the avoidance of the higher quality ecological values and will result in further enhancement and consolidation of this habitat.

Significant edge and deleterious landscape ecological effects are currently evident within vegetation communities throughout the Project Area, largely due to the historical degradation and a lack of coordinated land management practices. Through the avoidance (**Section 5.1**) and the consolidation and linking (**Section 5.2**) of higher quality foraging resources for Grey-headed Flying-fox (*Pteropus poliocephalus*), combined with the buffering function of the esplanade roads, drainage reserves, overland flow path and local parks landscaped with native species, and ecological restoration within Conservation Areas and Multi-function Spine, the Proposed Action is expected to decrease edge effects on Grey-headed Flying-fox (*Pteropus poliocephalus*) foraging resources within the Project Area.

4.4 South-eastern Glossy Black Cockatoo (*Calyptorhynchus lathami lathami*)

Documented threats to the South-eastern Glossy Black Cockatoo (*Calyptorhynchus lathami lathami*) such as grazing, inappropriate fire regimes and climate change. are not associated with the Proposed Action. Impact pathways that may pose a threat are discussed below.

4.4.1 Direct Impacts

4.4.1.1 Habitat Loss Associated with Mortality and Displacement

Suitable habitat for South-eastern Glossy Black Cockatoo (*Calyptorhynchus lathami lathami*) consists of two discrete elements, suitable hollows and abundant foraging resources. While detailed studies are somewhat limited, current knowledge suggests breeding occurs in proximity to abundant resources, most hollows are within 1.5 km of *Allocasuarina* stands though birds may commute up to a 30 km round trip (Mooney and Pedler 2005, Commonwealth of Australia 2022c). Proximity to water also seems to be important.

Based on BioCondition data and field observations, possible foraging resources (Black Shea-oak (*Allocasuarina littoralis*) in the T1 or T2 canopy layers) is restricted to regrowth within AU1 (RE 12.3.6). The Proposed Action will result in the loss 672 m^2 (0.07 ha) of this habitat.

Based on this assessment, foraging resources are generally sparse, and no evidence has been sighted to indicate previous utilisation of the Project Area by this species. Paddock trees supporting hollows with the necessary attributes for breeding are present, however interspecific competition for hollow occupancy in what is now the edge of urban development would exclude breeding. Therefore, the cockatoo is not expected to occur within the Project Area and mortality, or displacement of the species is unlikely.

4.4.1.2 Habitat Fragmentation

The Proposed Action is situated in an existing fragmented landscape. The proposed vegetation clearing will not increase fragmentation or lead to habitat isolation, especially for a highly vagile species such as the South-eastern Glossy Black Cockatoo (*Calyptorhynchus lathami lathami*), which is known to move readily through such landscapes.

South-eastern Glossy Black Cockatoo (*Calyptorhynchus lathami lathami*) cannot be completely dismissed as a potential occurrence within the Project Area, but surveys show that the development footprint lacks important habitat relied upon by this species. Nonetheless, it is relevant to pursue some mitigation for any relevant habitat that may be lost. This retention is illustrated in **Section 3.4.3.5**.

4.4.1.3 Exotic Weeds

Exotic weed species, such as Lantana* (*Lantana camara*), which have the potential to indirect affect habitats either through reduced *Allocasuarina* rigor/recruitment or through altering fire regimes are already present. The Proposed Action will not introduce any new weeds, or lead to an increase in existing weeds, that might affect the South-eastern Glossy Black Cockatoo (*Calyptorhynchus lathami lathami*) habitat.

4.4.1.4 Significant Impact Assessment

Assessment of impacts against the MNES Significant Impact Guidelines 1.1 (Commonwealth of Australia 2013) was conducted (**Table 23**). This assessment concluded there would be no significant residual impact to South-eastern Glossy Black Cockatoo (*Calyptorhynchus lathami lathami*).

Table 23: Significant Impact Assessment for South-eastern Glossy Black Cockatoo (*Calyptorhynchus lathami lathami*)

Guideline	Justification
Lead to a long-term decrease in the size of a population	**No.** There is currently no evidence the Project Area is used for breeding or foraging by the species. Potential breeding habitat which resides within hollow bearing paddock trees are subjected to denning and breeding pressures by Brushtail Possum and other, large *Cacatuiids.* There is currently no evidence Black She-oak (*Allocasuarina littoralis*) trees in the Project Area are used by South-eastern Glossy Black Cockatoo (*Calyptorhynchus lathami lathami*).

Guideline	Justification
	A number of Black She-oak (*Allocasuarina littoralis*) may be lost due to the clearing along the edge of Eastern Enhancement Corridor to establish road and other infrastructure. Black She-oak (*Allocasuarina littoralis* is considered a primary forage species and immature regrowth stands of this species, occurring as mixed and monospecific stands, exist within parts of the Project Area, adjacent to Moogurrapum Creek, and occur in areas not subjected to grazing or slashing. Ecological assessment undertaken at the early project stage identified these areas as having some of the highest ecological values on the within the Project Area, and these areas was retained for conservation (Eastern Enhancement Corridor). The subsequent Planning and Environment Court Appeal of 2021 endorsed this finding. Database records, which indicate these birds are infrequently recorded within 5 km of the Project Area, suggest the Project Area is not important for local populations. Hence the removal of these trees will not lead to a decline in the species.
Reduce the area of occupancy of the species	**No.** There is no evidence to suggest the Project Area is used by the species, either for foraging or breeding (refer Section 3.5.3.3).
Fragment an existing important population into two or more populations	**No.** The Project Area is already heavily fragmented and occurs within an already fragmented landscape. The Proposed Actions will not increase fragmentation further, especially for a highly vagile species which is known to move though semi-rural areas.
Adversely affect habitat critical to the survival of a species	**No.** There is no evidence that the habitat at this Project Area is used by this species for activities such as foraging, breeding, roosting, or dispersal. The greatest extent of low value forage habitat present, occurs with the Moogurrapum Creek (eastern enhancement) corridor, which will be retained and enhanced by the project. This corridor also affords landscape movement opportunities. Noting the low quality habitat and the absence of on-site observations of historic records it is likely that the Project Area is: ▪ not necessary for the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators) ▪ not necessary to maintain genetic diversity and long-term evolutionary development; or ▪ not necessary for the reintroduction of populations or recovery of the species or ecological community. On this basis, the Project Area does not contain habitat critical for the survival of the species.
Disrupt the breeding cycle of a population	**No.** Breeding has not been recorded at the Site and is unlikely (refer Section 3.5.3.3 and 3.5.3.5). Trees with hollows of suitable size for South-eastern Glossy Black Cockatoo (*Calyptorhynchus lathami lathami*), occur as exposed paddock trees, and the South-eastern Glossy Black Cockatoo (*Calyptorhynchus lathami lathami*) is exposed to high degrees of interspecific competition for such resources by other gregarious species with more flexible lifestyles and capable of exploiting edge and disturbed habitats. The breeding habitat is considered low quality habitat as the species preferentially selects forested settings for nesting.
Modify, destroy, remove or isolate or decrease the availability or	**No.** Retained forage habitat within the Moogurrapum Creek Corridor will be retained by the Proposed Action. This area will be retained and ecologically enhanced to re-establish preclear REs. While there is the potential for minor loss of low value foraging resources, there is no

Guideline	Justification
quality of habitat to the extent that the species is likely to decline	evidence these are or have historically important for local populations and the major forage species Black She-oak (*Allocasuarina littoralis*) will be a component of replanting.
Result in invasive species that are harmful to an endangered or critically endangered species becoming established in the endangered or critically endangered species' habitat	**No.** No new invasive species will be introduced.
Introduce disease that may cause the species to decline	**No.** No known diseases are currently recognised as a threat to South-eastern Glossy Black Cockatoo (*Calyptorhynchus lathami lathami*).
Interfere with the recovery of the species	**No.** The Project Area does not provide important refuge or genetic diversity to support recovery of the species. Existing fragmentation of the local area and ongoing land-use considerably restrict the likelihood the surrounding landscape will recover to a degree that the Project Area will provide a suitable refuge or source population to aid recovery of the species.

4.4.1.5 Conclusion

South-eastern Glossy Black Cockatoo (*Calyptorhynchus lathami lathami*) cannot be completely dismissed as a potential occurrence at the Project Area, but our assessment show that the development footprint lacks important habitat relied upon by this species. Nonetheless, it is relevant to pursue some mitigation for any relevant habitat that may be lost.

5. Avoidance and Mitigation Measures

5.1 Overview

The mitigation hierarchy is a tool that is used to limit the amount of damage an action, such as a development, will have on the environment. There are three steps, and each step must be followed in order and to the greatest extent possible before moving on to the next. These steps are:

1. Avoid
2. Mitigate
3. Offset.

This section provides discussion on the measures that have been adopted to avoid, in the first instance, then minimise potential impacts to MNES and their habitat. Discussion of offsets is provided separately in **Section 7**.

5.2 Impact Avoidance

Avoidance of impacts to environmental values has been a central element to the Proposed Action in both the initial planning process and the refined design process. The ways through which the Proposed Action demonstrates adoption of such avoidance measures are further described in the following sections.

5.2.1 Project Area Identification

The Project Area location within the South East Queensland Regional Footprint, Emerging Community zoning under RCC and its strategic location for the sequential expansion of existing urban development (recognised at both local and regional levels) is described within **Section 2.1**.

Within the Draft Victoria Point Emerging Community Structure Plan area the Proponent defined the Project Area through (a) involvement of receptive landowners, and (b) identification of those parts of the LSPA with fewer constraints. The Proponent has designed the Proposed Action in consideration with its mapped ecological values highlighted by site-based ecological assessments undertaken by BAAM and 28 South (refer **Section 3.3.1** for detail), Planning and Environment Court Joint Experts elicitation of values, avoidance and mitigation measures.

Major considerations for the Proponent were targeting those locations within the Project Area subject to historic urban and agricultural degradation and achieving a consolidated collection of properties in an appropriate and logical location.

This initial Project Area identification process has achieved significant avoidance of ecological values that are present within the Emerging Community area bounded by Bunker, Double Jump and Cleveland – Redland Bay Roads.

5.2.1.1 Regional Scale

The State's Department of State Development, Infrastructure, Local Government and Planning administers SEQ Regional Plan [24]. Under this Regional Plan, the Project Area is within the SEQ Regional Plan urban footprint, as are surrounding sites and the emerging suburb of Victoria Point. Regionally, significant greenspace, and biodiversity values are avoided (**Inset 1** above).

The SEQ Regional Plan encourages growth within the current urban footprint the Regional Plan notes that the urban footprint is "*not an urban zone and does not imply that all land can be developed for urban purposes*" (p152), other more refined land use planning in this locality has established the Project Area's suitability for the intended

[24] https://www.planning.qld.gov.au/planning-framework/plan-making/regional-planning/south-east-queensland-regional-plan

development. At a closer scale, this development intent is further delineated in the SEQ Regional Plan which identifies the Project Area at the southern extent of the Development Footprint within Redlands.

5.2.1.2 Local Scale

Major considerations for the Proponent were targeting those locations within the Emerging Community zone of the Redland Planning Scheme (RCC 2018) that were subject to historic urban and agricultural degradation and achieving a consolidated collection of properties in an appropriate and logical location. (recognised at both local and regional levels) is identified by **Inset 2** above.

5.2.1.3 Conditions of Approval

His Honour Judge Williamson KC granted the following relevant conditions 15 October 2021 (full details of conditions may be found in **Appendix 3.2**).

- **2.** Undertake the development in accordance with the approved plans:
  - Fauna Crossing Layout Plan B18480-CSK260, Rev. B, Lambert and Rehbein, 17 July 2021
  - Fauna Crossing Longitudinal Sections & Detail B18480 - CSK261, Rev. A, Lambert and Rehbein, 17 Febraury 2021
  - Nature Corridor Road Treatments 715-0859-00-D001 Rev 6, Tract Consultants, 23 September 2021
  - Vegetation Impacts 2019-100(b), 28 South, 15 October 2021
  - Moogurrapum Creek Offset Planting Capacity, Extract from ecology JER appeal 1612/20, Andrew Damiel and Wayne Moffitt
  - Conservation Area 3 Management Zones 2019-100(b), 28 South, 13 October 2021.
- **11.** Transfer the land shown as "Conservation" on the approved plans to Council in fee simple (on trust).
- **12.** Transfer the land to Council in fee simple (on trust) as park in accordance with the approved Plans and Document the land identified for stormwater (multi-function spine) and park purposes.
- **38.** Submit to Council and receive Operational Work approval for a Vegetation Management Plan which seeks to minimise vegetation clearing.
- **39.** Conservation Area 1 (Moogurrapum Creek Corridor) Rehabilitate the area identified as "Conservation 1", in accordance with an approved rehabilitation management plan.
- **40.** Double Jump Road Fauna Underpass (trunk works) Construct a fauna underpass under Double Jump Road.
- **41.** Conservation 2 - Northern Corridor Rehabilitate the area identified as Conservation 2 as shown on the approved plans, in accordance with an approved rehabilitation plan.
- **42.** Northern fauna crossing - construct a minimum 2.4 m high x 3.0 m wide fauna underpass, at the road connection between the site and the land described as Lot 1 on RP 95513 developed pursuant to approval of the Planning and environment court of 1 April 2021 in appeal 566/20 generally in accordance with plan "Fauna Crossing Layout Plan" drawing no B18480-CSK260, rev B dated 16.07.21 and Fauna Crossing longitudinal Sections and Detail Plan drawing no. B18480-CSK261, Rev A, prepared by Lambert & Rehbein and is to; (a) Incorporate fauna exclusion / directional fencing to direct fauna to the underpass; and (b). Structures to assist in the movement of fauna, for instance raised timber fauna crawl bars.
- **43.** Conservation Area 3 - Western corridor Rehabilitate the area identified as Conservation 3 as shown on the approved plans, in accordance with an approved rehabilitation plan.
- **48.** Any clearing of native vegetation must be undertaken under the guidance of a certified Fauna Spotter.

5.2.1.4 Alternative Sites

The preceding discussion demonstrates that the Proposed Action is appropriately positioned in regard to the land use planning intent for the region, locality, and area. Therefore, it is an appropriately positioned development, and the Proponent need not seek alternative sites. The Planning and Environment Court approval confers this suitability. Nonetheless, further information on why this particular Project Area has been chosen for the Proposed Action rather than other sites that might be available in the region follows.

In assessing the viability of the Project Area, we considered many other sites across South East Queensland however the factors noted below outweighed the potential of other options.

The Project Area is located within the emerging development front within the Victoria Point Development area of the Redland LGA. The Redland Planning Scheme (RCC 2018) designates this site and surrounding land specifically for redevelopment to facilitate residential development activities which provide dormitory residences for emerging employment opportunities locally. The development is well positioned to take advantage of tertiary and secondary public hospital facilities and primary and secondary education facilities within Victoria Point, Cleaveland and nearby. Construction within the Project Area will also create immediate employment opportunities during delivery of the Proposed Action.

28 South also notes that, while other recently developed residential sites might be available to accommodate the Proposed Action (subject to the Proponent's locational imperatives) these have (in most cases) required clearing of native vegetation providing habitat for MNES; see also **Figure 7** for a location of approvals relevant to the Project Area.

5.2.1.5 Mitigating Development Impacts through Site Scale Planning

5.2.1.5.1 Consolidation of Development within Areas of Historical Disturbance

As identified in **Section 2.3** the disturbance history of the Project Area and immediate locality is illustrated in **Figure 8a-j**. Historically, land use within the Project Area and the broader locality has been influenced by agricultural pursuits; broadscale clearing for orcharding, cropping, livestock production, agistment of horses, poultry rearing (shed), selective clearing and rural residential development. This rural activity continues to influence the locality, despite landuse transition to residential development evidenced nearby.

The impact of historic clearing remains evident on ground today, most notably in the form of disturbed pastural grassland with scattered overmature and senescing relict canopy 'paddock' trees which however do contain hollows. However, the lack of connectivity of these trees to the broader landscape and extent of disturbance and progressing urban development front, promote the proliferation of larger and gregarious 'edge and disturbance specialist' fauna (e.g. Brushtail Possums, Sulphur Crested Cockatoo, Corella). These species afford interspecific competition to smaller species and less gregarious 'forest' species which they can outcompete, and this has an implication for conservation-significant species that might occur (e.g. South-eastern Glossy Black Cockatoo (*Calyptorhynchus lathami lathami*). The Proposed Action is focused on the historically disturbed areas.

5.2.1.5.2 Position in Relation to Adjoining Development

When considered in context of approved and likely development on adjoining sites, there is a clear logic to positioning development in this location.

5.2.1.5.3 Development Form

Residential development has been maximised in parts of the Project Area with lower ecological values (as identified by MHQA Site Condition Scores) with higher quality values retained biodiversity protection and connectivity (viz-a-viz Eastern Enhancement Corridor). Vehicular connectivity across Conservation Areas affording landscape connectivity have been minimised to a single raised crossing which will feature a dedicated dry fauna underpass (one cell).

5.2.2 Single Proponent Co-ordination

The coordinated establishment of the Proposed Action over the collection of properties that make up the Project Area has significant advantage over a piecemeal development approach for the individual lots. Development of individual properties, by different proponents, is unlikely to involve a coordinated consideration of ecological and environmental impacts across the broader Redland LGA.

A piecemeal approach may result in the cumulative impact of the developments being at least the same as (and most likely greater) the Proposed Action; however, this would result in there being a limited requirement for assessment and approval of the individual projects under the EPBC Act. Differing interests of the various landowners could create greater constraint or opportunity over individual sites (e.g. location of retained fauna movement corridors would be disaggregated and potentially ineffective at a broader scale if established individually for each property).

In comparison, the Proposed Action will be subject to holistic (landscape-scale) impact assessment and consideration of the measures needed to avoid, minimise and mitigate any identified impacts. The Proponent, through the Proposed Action, can also achieve:

- a coordinated conservation outcome (e.g. through the establishment of the Eastern Enhancement Corridor)
- coordinated sequential clearing to minimise impacts on fauna (to encourage them to retreat to the identified and protected Eastern Enhancement Corridor)
- delivery of critical infrastructure such as underpasses to retain and enhance corridor functionality, and
- coordinated delivery of development infrastructure such as water and sewer infrastructure.

Furthermore, the Proponent will be the sole entity responsible for delivering the development on these parcels. In this way, the Proposed Action avoids some of the Local and Regional impacts that may otherwise result in an uncoordinated approach to the future development of this land if undertaken for each individual property.

5.2.3 Iterative Design Based Upon Ground-truthed Ecological Values

The iterative design process has been an important process for the consideration and review of constraints and opportunities available over the Project Area to accurately capture and protect the relevant environmental values where practicable. The design process was iterative by nature and was informed by ongoing accumulation of desktop and Site-based data. This iterative process of informing design has occurred through:

1. Desktop assessments
2. Site-based surveys
3. Review and workshop of Site-based survey results
4. Review and testing of Proposed Action design
5. Review of the LSPA
6. Review of Redland Planning Scheme 2018 and Codes
7. Refinement of the Proposed Action.

The aspects of the Project Area that were determined to provide critical ecological functions have been retained and enhanced through the design of the Proposed Action. This approach is consistent with the SEQ Regional Plan (**Text Box 2**), which identifies the need to recognise, consider and balance biodiversity values with development to achieve sustainable use, sustainable development goals and human health and wellbeing.

Text Box 2 – Biodiversity Outcomes in Growth Areas

Transformational change is needed in how biodiversity and nature are considered and managed to meet international and national ambitions to halt and reverse biodiversity loss and to achieve sustainable use, sustainable development goals and human health and wellbeing.

The protection of biodiversity should consider biodiversity values at a landscape scale and how those values contribute to the holistic biodiversity of the area. Ultimately, bioregional planning aims to achieve better biodiversity outcomes and greater development certainty in Queensland by providing clear guidance on areas to be protected from development, areas that may be prioritised for development, and areas where development can proceed if it will appropriately protect biodiversity values. This approach will be used across PFGAs in SEQ.

More broadly across the region, a priority is to protect, restore and promote biodiversity, balancing growth needs with achieving better biodiversity outcomes. This is aligned with the Australian and Queensland government's bioregional planning approach, the South East Queensland Koala Conservation Strategy 2020-2025 and Conserving Nature – A Biodiversity Conservation Strategy for Queensland.

Source: Shaping SEQ 2023, p28.

5.2.4 Determination and Delineation of Proposed Action Precincts

The guiding principles for the location of the overarching land uses in the Proposed Action are to:

- **Avoid impacts on areas with higher ecological values by locating the residential uses outside of the mapped and identified higher ecological values.**

Minimise/mitigate impacts by limiting the type and scale of uses that can occur in areas adjoining components of the Project Area with higher ecological importance. Eastern Enhancement Corridor will be permitted to contain minor stormwater infrastructure and wildlife management infrastructure. Northern Enhancement Corridor will contain wildlife management infrastructure and Western Enhancement Corridor, although significantly earth worked for stormwater conveyance and quality / quantity improvement (water sensitive urban design). All will undergo ecological restoration to achieve pre-clear RE coverage) with a focus on including KHT or Grey-headed Flying-fox (*Pteropus poliocephalus*) forage target species from pre-clearing vegetation communities (all conservation areas) whilst also meeting the requirements for suitable water conveyance (Western Enhancement Corridor, only).

- **Protect, enhance and expand areas with higher ecological value (i.e. the identified Significant Vegetation and higher ecological and habitat values within the Moogurrapum Creek Tributary corridor.**

The establishment of these key elements within Eastern Enhancement Corridor will result in the Proposed Action avoiding impacts to the Project Areas most significant vegetation and habitat. The iterative design process allowed for the establishment of an exclusion zone for the Significant Vegetation and other mature vegetation within the corridor. Further, the Proposed Action will provide opportunity for these higher values to be enhanced and expanded upon and to establish environmental corridors facilitating landscape connections.

Active open space, parkland and street frontages will be subject to sensitive landscaping embellishments in accordance with the requirements of the RCC Development Scheme and RCC Planning Scheme Policy for establishing such uses.

5.2.5 Retention and Enhancement of Higher Quality Habitat

Baseline ecological assessment identified habitat suitable for Koala *(Phascolarctos cinereus)* throughout the Project Area, particularly within the Moogurrapum Creek Corridor. Across the northern property boundary.

SAT survey results noted low Koala (*Phascolarctos cinereus*) usage occurred across the Project Area in all assessment units including mature vegetation along Moogurrapum Creek. These areas are also considered to support the most mature and extensive habitats which provide a higher level of foraging resources for the Grey-headed Flying-fox (*Pteropus poliocephalus*), with notably mature, winter and spring flowering high quality forage species.

Retention of this habitat and ecological enhancement to improve habitat quality and landscape connectivity within and through the Project Area, and installation of wildlife management infrastructure is the primary mean the Proposed Action avoids impacts on Koala (*Phascolarctos cinereus*) and Grey-headed Flying-fox (*Pteropus poliocephalus*).

Although considered unlikely to visit the Project Area, this proposed retention, and enhancement will retain the greatest extent of potential (albeit low-value) forage habitat for South-eastern Glossy Black Cockatoo (*Calyptorhynchus lathami lathami*) within the Project Area.

5.3 Impact Minimisation Through Mitigation

5.3.1 Mitigation Measures Adopted by Planning and Environment Court Appeal

Council Approval (**Appendix 3.2**) requires the Proponent to implement a range of mitigation measures of relevance to avoiding or minimising impacts to biodiversity (including MNES). Specific conditions relevant to impact minimisation through mitigation are discussed herein.

- **Condition 38**

Submit to Council and receive Operational Work approval for a VMP which seeks to minimise vegetation clearing. The VFMP submitted to Council for Operational Works Approval is contained in **Appendix 7**.

- **Condition 39**

Conservation Area 1 (Moogurrapum Creek Corridor / Eastern Enhancement Corridor); rehabilitate the area identified as "Conservation 1", in accordance with an approved Concept RMP. The Concept RMP is shown in **Appendix 4**.

- **Condition 40**

Double Jump Road Fauna Underpass (trunk works) Construct a fauna underpass under Double Jump Road. Details of how this condition have been addressed are outlined in **Section 5.4.5**. The location of the underpass is represented on **Figure 9**.

- **Condition 41**

Conservation 2 - Northern Enhancement Corridor; rehabilitate the area identified as Conservation 2 as shown on the approved plans, in accordance with an approved rehabilitation plan. Objectives for the retention and ecological restoration are discussed in **Section 2.5.1**, **Section 5.3**, and the Concept RMP is attached (**Appendix 4**). The location of the northern corridor is represented on **Figure 6** and **Figure 9**.

- **Condition 42**

Northern fauna crossing - construct a minimum 2,400 mm high x 3,000 mm wide fauna underpass, at the road connection between the site and the land described as Lot 1 on RP 95513. Details of how this condition has been addressed are outlined in **Section 5.3.2** and **Section 5.4.5**. The location of the underpass is represented on **Figure 9**.

- **Condition 43**

Conservation Area 3 - Western Enhancement Corridor; rehabilitate the area identified as Conservation 3 as shown on the approved plans, in accordance with an approved rehabilitation plan. Objective for the retention and ecological restoration is discussed in **Section 2.5.1**, **Section 5.3.2** and **Section** 5**.3.3**, and the Concept RMP is attached (**Appendix 4**).

- **Condition 48**

Any clearing of native vegetation must be undertaken under the guidance of a certified Fauna Spotter Catcher. The use of Spotter Catchers is embedded in strategies to be deployed during clearing to minimise impacts to MNES and other fauna. This is outlined in **Section 5.3.2** and **Section 5.4**.

5.3.2 Mitigation Measures for Koala (*Phascolarctos cinereus*)

5.3.2.1 Consolidating and Linking Retained Koala *(Phascolarctos cinereus) Bushland Habitat*

5.3.2.1.1 Description

Koala (*Phascolarctos cinereus*) bushland habitat will be protected, consolidated and ecologically enhanced through dedication of the three enhancement corridors. The restoration goal for the Eastern Enhancement Corridor area is the enhancement and re-establishment of pre-clearance RE vegetation communities.

Ecological resilience of these three areas varies on account of past landuse and proposed earthworks. Restoration within the Eastern Enhancement Corridor will be ecologically restored through assisted natural regeneration, focussing upon weed removal to facilitate natural regeneration, and infill planting. The Northern enhancement Corridor retains few canopy and understorey trees on account of past disturbance; ecological restoration will involve reconstruction. Ecological restoration within the Western Ecological Corridor will focus on fabrication techniques.

Whilst restoration of all three area will afford protection and enhancement of Koala (*Phascolarctos cinereus*) forage and shelter habitat, only the eastern and northern enhancement areas will count towards reducing the extent of habitat loss. This is because it is only those areas which will feature exclusion fencing to restrict access to these areas and prevent Koala (*Phascolarctos cinereus*) straying into residential areas. These areas are exclusively retained for Koala (*Phascolarctos cinereus*) habitat purposes.

The Concept RMP which provides detail regarding the ecological restoration rehabilitation within the enhancement corridors is attached (**Appendix 4**). This represents the Proposed Action's primary mitigation measure to improve and expand upon habitat connectivity and achieve a suitable ecological outcome within the Project Area.

5.3.2.1.2 Effectiveness

Ecological restoration will achieve a significant ecological outcome. The goal of the RMP is to reinstate the pre-clear RE which will enhance and expand on the existing vegetation / habitat. Where areas within the enhancement corridors are devoid of any of the vegetation stratum that characterise the pre-clear REs, tubestock planting densities in the initial establishment phase of the RMP phase allow for the achievement of natural and woodland to open forest communities at maturity. Maintenance will be provided throughout the life of the Proposed Action and will continue until the targets under the RMP have been achieved; or, when it is handed to RCC for ongoing maintenance and management.

Once the ecological restoration works reaches off-maintenance status, this land will be transferred to the custodian through statutory environmental covenant or similar and the custodian will be responsible for ensuring the provisions of the *Biosecurity Act 2014* (Qld) are upheld through regular weed inspections (and removal if necessary).

The loss, fragmentation and degradation of habitat, including dispersal habitat as a primary threat to Koala (*Phascolarctos cinereus*) in the coastal context. Logically, a mitigation measure that retains, consolidates and links Koala (*Phascolarctos cinereus*) habitat is an effective means of reducing such a threat.

5.3.2.1.3 Performance and Completion Criteria

If the Proposed Action is approved under the EPBC Act, approval conditions reflective of performance and completion criteria established by this PD (**Table 24** for Construction and Operation Avoidance and Mitigation Measures, and the Concept RMP (**Appendix 4**)) and the Compliance Endorsement which formalise performance and completion criteria.

5.3.2.1.4 Risks and Contingency Measures

Monitoring and adaptive maintenance of the ecological restoration area during the initial establishment phase will ensure that there is sufficiently robust plant health and a trajectory towards the target plant community at the end of the maintenance period. Development bonds are taken by RCC to ensure that revegetation works achieve acceptable standards. There is a very low risk that the restoration works will not be provided, but as a contingency RCC retains development bonds to remedy non-compliant works.

The enhanced habitat in the Ecological Corridor and established future foraging opportunities within the drainage reserves and overland flow path will be transferred to RCC, for environmental conservation purposes in perpetuity. This would allow, for example, RCC to then undertake a statutory amendment process to the planning scheme to change the zoning of that land from its current zoning to an environmental management designation.

Once the zone has been changed, the provisions of the Redlands Planning Scheme (RCC 2018) will apply. Any future development of that land would require either an amendment to the planning scheme, following the statutory process, or the approval of an impact assessable development application for a variation request under the *Planning Act 2016* (Qld) to seek to vary the effect of development scheme with respect to the zoning of that land. This mechanism is sufficient to ensure appropriate conservation of the land into the future; therefore, no contingency measures are proposed.

5.3.2.2 Movement

The primary ecological design measures to mitigate impacts to Koala are identified in **Figure 9**. In summary they are:

- Retention and ecological restoration of landscape linkages (Eastern Enhancement Corridor)
- Retention and ecological restoration of local linkages (Northern Enhancement Corridor)
- Provision of a fauna underpass beneath Double Jump Road to facilitate landscape linkage maintain safe passage and connectivity
- Provision of a fauna underpass beneath the north-south esplanade road to facilitate local linkages and maintain safe passage and connectivity between the eastern and northern corridors
- Installation of permanent koala exclusion fencing along the western boundary of the eastern corridor which would tie into the two underpasses guiding fauna to safe passage
- Installation of exclusion fencing at the eastern end of the northern corridor to functionally guide fauna into the underpass beneath the esplanade road.
- Installation of exclusion fencing at the interface between the Western Enhancement Area and Double Jump Road to prevent Koala and other fauna straying on to the road.

5.3.2.2.1 Corridors and Habitat Connectivity

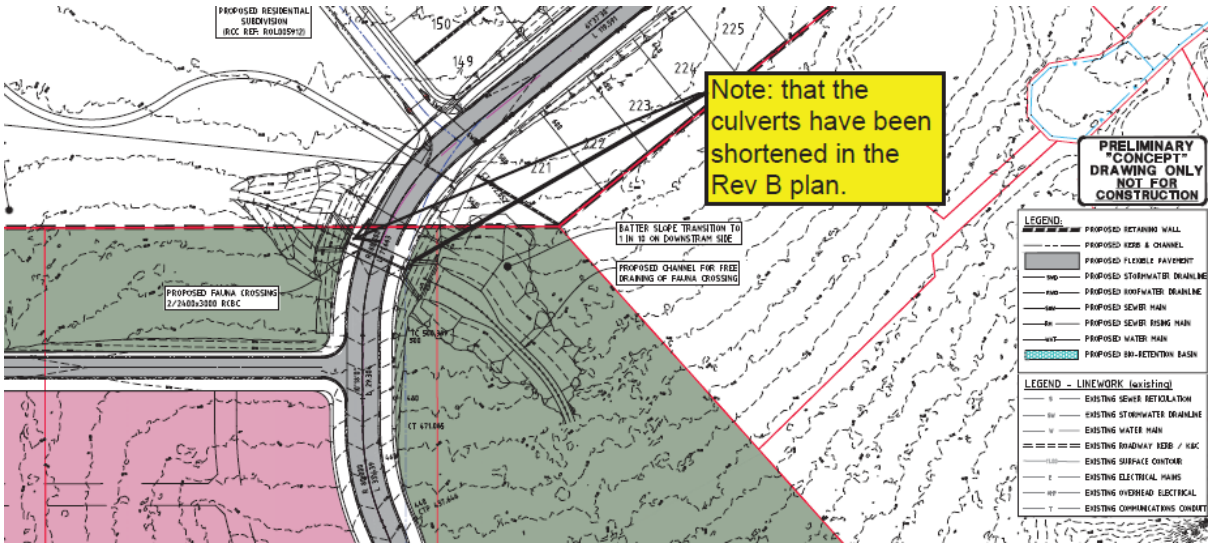
The provision of retained and enhanced habitat within the eastern and northern enhancement corridors is the key strategy for ensuring ongoing opportunities for exploiting open forest resources along the waterway corridor and conveying animals through the landscape. Further justification of this approach, discussing the planning and ecological contexts and evaluation of connectivity and potential ‘pinch-points’ is provided below.

5.3.2.2.2 Infrastructure and Road Treatments

(a) Description

The Proposed Action has been developed in recognition of the will retain and enhance the ecological value and functionality within the Eastern and Northern Enhancement Corridor network. The Proposed Action design therefore relies on the provision of fauna underpasses at each of the roads that it crosses.

The internal esplanade (south – north) road adjoining the Eastern Enhancement Corridor which bisects the northern corridor at its confluence with the eastern corridor is one such barrier. A fauna underpass and associated exclusion/directional fencing (refer **Section 5.3.2.3**) is required to ensure safe fauna passage along the corridor. The Proponent has entered into a binding agreement with the developer to the north to deliver the road and a dedicated dry passage fauna underpass (refer **Figure 9**) to facilitate safe fauna (specifically Koala) movement. Preliminary design makes provision for a 30 m long dry underpass comprising two 2400 mm X 3000 mm culverts (see **Inset 11**).



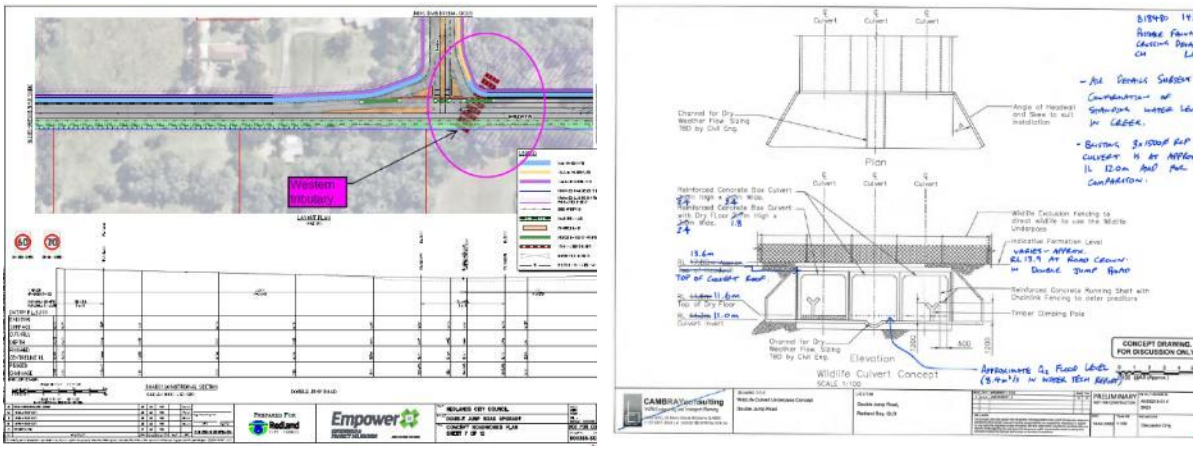
Inset 11. Fauna underpass design drawing Revision B (source: Statement of Evidence, 28 South – Appendix 6.5)

The location of the dry-cell underpass is shown on **Figure 9**. The apron, climbing rail and tie-in exclusion fencing will be detailed as required by Operational Works approvals at the Local Government level. It will be positively graded to minimise settling of mud on the culvert floor (refer **Inset 12**). Revegetation on either side of the culvert will be provided to establish (i) cover from predators at the culvert portals (thereby minimising the predator funnel effect); and (ii) a canopy over the road that is sufficiently spaced to allow transit by gliders and woodland birds. Key features of a dry fauna passage layout are represented in **Inset 12**. Revegetation at the fauna crossings will be as the specifications of the Concept RMP (**Appendix 4**).

Inset 12. Indicative example of a fauna underpass with fauna furniture (note the Proponent's proposal will attach the poles to the wall of the culvert and will use a much smaller concrete apron to allow more planting around the portal). Further, rocks will be provided within the culvert to provide cover for small terrestrial species. Note this image shows only one RCBC cell. Two RCBCs are proposed.

Exclusion fencing will be installed around interface areas with the Proposed Action, tying back into the underpass to direct fauna. The details of the fencing are outlined in **Section 5.3.3.3**.

A second dry passage underpass is proposed at the southern end of the Eastern Enhancement Corridor (at its crossing by Double Jump Road). Upgrading of Double Jump Road is not a component of the Proposed Action and will be undertaken by RCC. The underpass, conceptually shown in **Figure 9**, will comprise reinforced concrete box culver array of three 2400 mm x 2400 mm cells[25], with a single central wet culvert on the western tributary of Moogurrapum Creek (**Inset 13**). Key features of the array include timber climbing rails, running shelf, Q2 flood level protection (one cell) and wildlife exclusion fencing (**Inset 13**).



Inset 13. Indicative location of fauna underpass on Double Jump Road, with fauna furniture shown

Vehicle speed is a significant threat to Koalas (*Phascolarctos cinereus*), with survivability for Koalas (*Phascolarctos cinereus*) entering road networks decreasing drastically as speed limits increase above 60 km/h. All internal roads will have a maximum posted speed of no greater than 50 km/h.

Directional street lighting to improve night-time visibility on the road surface whilst reducing light spill into the adjoining Open Space and Conservation Corridor by utilising directional lighting and/or shields.

[25] Final configuration pending detailed engineering evaluation presently being undertaken

(b) Effectiveness

The Koala (*Phascolarctos cinereus*) statutory documentation identifies underpasses with wildlife furniture as a moderately effective for mitigating vehicle strike on the Koala (*Phascolarctos cinereus*), but experience with nearby locations shows that the combination of underpasses and exclusion fencing has been very effective for reducing vehicle strike. Other mitigation measures described above are not assigned a level of "mitigation effectiveness" by the Koala (*Phascolarctos cinereus*) National Recovery Plan , but they will achieve a level of benefit well-above doing nothing.

The effectiveness of underpasses in facilitating Koala (*Phascolarctos cinereus*) and other fauna movement when is now well understood; rather than creating a barrier to movement these structures when combined with exclusion fencing are effective in directing fauna. In addition to the proposed dry-cell dedicated fauna underpass, fauna will be able to use the low flow array.

Presently Koala (*Phascolarctos cinereus*) occur in low numbers within the locality, and a potential vector for movement in a north-south direction is Moogurrapum Creek and east – west through the Project Area. Koala (*Phascolarctos cinereus*) movement to the north is already constrained by residential development. Development of the Double Jump Road Residential Subdivision, with dedicated Koala (*Phascolarctos cinereus*) underpass and protected enhancement corridors will maintain the status-quo and not restrict utilisation of Koala (*Phascolarctos cinereus*) habitat along the Moogurrapum Creek waterway.

5.3.2.2.3 Performance and Completion Criteria

Provision of underpass structures and directional fencing can be an EPBC approval condition. More detailed designs will be assessed as part of the development application to RCC, and then the detailed design as part of the operational works phase of the Proposed Action.

Performance of the underpass structures and directional fencing can be measured in two main ways:

- temporal increase in use of the underpass structures by Koala (*Phascolarctos cinereus*); and
- no increase in Koala (*Phascolarctos cinereus*) injury/mortality numbers within the Project Area.

The use of underpasses by fauna is well known and understood. Many studies undertaken within South East Queensland on behalf of Local Governments and the State have shown this. Therefore, the monitoring of underpass use at Double Jump Road Residential Estate is considered to be unnecessary. However, the Proponent is willing to undertake monitoring if required to satisfy approval conditions if such a condition were necessary.

5.3.2.2.4 Risks and Contingency Measures

Risks that the infrastructure will not be maintained are low because it will become RCC infrastructure. No contingency is required.

5.3.2.3 Exclusion Fencing

5.3.2.3.1 Description

The proponent proposes to retain Koala (*Phascolarctos cinereus*) habitat within the enhancement corridors and dedicated these areas to RCC for environmental management purposes. The Court Order only identified the need to provide directional fencing around (ca. 50 m) the underpass on the internal road bisecting the northern and eastern corridors. In recognition of the threats posed by motor vehicles specifically, and stress induced illness potential for wildlife becoming disoriented in urban areas, exclusion / directional fencing will be constructed along the interface between the eastern corridor and the Esplanade Road (western boundary of the eastern corridor) / residential areas.

The purpose of the fencing is therefore to ensure Koalas (*Phascolarctos cinereus*) do not enter areas where they may become isolated from shelter and on account of the design, allow Koala (*Phascolarctos cinereus*) a one-way

access back into the enhancement corridors should they find their way into residential areas[26]. The fencing will also serve to exclude pets and access by residents into these areas.

The (exclusion / directional) fencing is to span the perimeter of the eastern corridor features 1.8 m high aluminium perimeter / pool fencing (which is compliant with the Koala Sensitive Design Guidelines[27] (State of Queensland 2022)), with no gaps at the base. An example of the typical fencing is shown in **Inset 14**.

Inset 14. An example of Koala (*Phascolarctos cinereus*) exclusion fencing similar to that proposed (a) with detail of treatments to allow Koala (*Phascolarctos cinereus*) to climb to safety (b) with the aluminium shroud identified (red arrow).

5.3.2.3.2 Performance and Completion Criteria

Installation of exclusion / directional fencing can be an EPBC approval condition. More detailed designs will be assessed as part of compliance plans for parks submitted to RCC, and then the detailed design as part of the park's compliance phase of the Proposed Action.

Performance of directional fencing can be measured in one main way, no occurrence of Koala (*Phascolarctos cinereus*) within the Project Area (the area of exclusion).

5.3.2.3.3 Risks and Contingency Measures

Risks that Conservation Areas will not be maintained are low because they will become RCC infrastructure. No contingency is required.

5.3.2.4 Management of Domestic and Wild Dogs

5.3.2.4.1 Description

The Proposed Action will improve opportunities for north south and east-west Koala (*Phascolarctos cinereus*) movement through establishment of enhanced landscape connectivity within ecologically restored Conservation Areas along the eastern boundary (Moogurrapum Creek corridor) and along the northern boundary by ecologically restoring contiguous vegetation and habitat. This contiguous vegetation and habitat will minimise the time spent on ground when Koala (*Phascolarctos cinereus*) are moving from tree to tree within the Conservation Area and will provide greater opportunity for inter-canopy movements given the current higher quality of the vegetation and the enhancement works that are proposed.

In suburban areas, the greatest morbidity and mortality of Koala (*Phascolarctos cinereus*) due to dog attack occurs in backyards. There is also a correlation between dog size and the risk of Koala (*Phascolarctos cinereus*) injury or death (larger dogs being implicated in a greater risk of death or injury) (Pers. comm Dr. Frank Carrick). In this

[26] A feature of the design is the attachment of an aluminium (or another non-climb material) shrouds on the habitat side of the fence which prevent koala climbing into unsafe environments, whilst allowing Koala to climb the hardwood posts back to safety.
[27] https://environment.des.qld.gov.au/__data/assets/pdf_file/0025/102859/Koala-sensitive-design-guideline.pdf

regard, it is relevant to consider the size of lots to be created by the Proposed Action, and the potential for interaction between dogs and Koala (*Phascolarctos cinereus*).

In rural-residential and large urban lot development, where tree retention is sometimes proposed to achieve habitat and greenspace outcomes in the balance of new lots, there is clear potential for interaction between domestic dogs and Koala (*Phascolarctos cinereus*). However, in more tightly configured development (as proposed by the Proponent) (**Figure 6**) the potential for interaction between the two species is reduced, because:

- bulk earthworks requirements have limited the ability to retain trees within the development footprint;
- the small backyards are typically landscaped with small-statured shrubs and groundcovers rather than trees and shrubs that would attract Koala *(Phascolarctos cinereus)*
- the small backyards reduce the likelihood of residents owning larger dogs capable of inflicting mortality
- the backyards are typically fenced with 1,800 mm tall fencing, which create a significant barrier to movement (and thus access by Koala *(Phascolarctos cinereus)*).
- Pools within residential properties are typically fenced with a fence type that is not conducive to climbing

Potential remains for dogs at large to interact with Koalas (*Phascolarctos cinereus*) in open space and conservation corridor. This will also be addressed through:

- provision of barriers (exclusion fencing) around the Eastern Enhancement Corridor to prevent domestic dogs from entering and Koala (*Phascolarctos cinereus*) accessing residential areas, consolidating Koala (*Phascolarctos cinereus*) movement through the corridors and underpasses and minimising the potential for interface between Koala (*Phascolarctos cinereus*) and dogs.
- community awareness and education programs for new residents moving into the Project Area. These programs will reinforce the threats that dogs present for Koala (*Phascolarctos cinereus*) populations and will outline dog owners' responsibilities for maintaining control of their dogs.

Awareness raising within the local community of the effectiveness in reporting sightings of Wild Dog to RCC to elicit action.In the context of a longitudinal study of >500 koala over 4 years (Beyer et al., 2017) it was identified that Wild Dogs ((Dingoes or Dingo-hybrids: *Canis dingo*, *C. dingo* × *Canis familiaris*) were a significant threat to Koala. Predation accounted for at least 49.5% to 62.5% if the suspected (but unconfirmed) predation deaths were included. Predation by Wild Dogs accounted for 81.3% of deaths, with Carpet Pythons 14.6% and Domestic Dogs 4.2% of deaths by predation.

Wild Dog and pest animal management in RCC is a coordinated biosecurity effort focused on protecting the region's biodiversity, particularly the local koala populations. Council operates targeted removal program in high risk areas. As future owner of the open space and enhancement corridors, RCC as custodian will be obliged to manage Wild Dogs in accordance with obligations established by the *Biosecurity Act 2014* (Qld).

5.3.2.4.2 Effectiveness

It is also relevant to consider the benefit of ecological restoration and enhancement of the Eastern Enhancement Corridor, particularly areas currently disturbed and devoid of vegetation will aid in the establishment of more closely spaced trees that will reduce the time that Koalas (*Phascolarctos cinereus*) spend on the ground moving between trees, and thus exposure to dog attack.

Beyer et al. (2017) note that, even within a declining Koala population, targeted management actions including the installation of fauna underpasses, exclusion fencing, and ecological restoration can deliver meaningful conservation outcomes. However, the authors also emphasise that such benefits may be short-lived in the absence of long-term strategies to manage ongoing threats.

The dedication of the land to RCC is expected to provide substantially greater opportunities for threat management than the current arrangement. In particular, public ownership is likely to deliver improved conservation outcomes compared with private ownership of largely unmanaged former rural land. This would be achieved through a

combination of passive community surveillance, with a greater number of people present to observe and report Wild Dog activity, and access to a coordinated and systematic biosecurity management framework. Collectively, these measures would improve the capacity to identify, monitor, and respond to threats affecting Koala populations over the long term.Performance and Completion Criteria

RCC Animal Management subordinate local laws are already in operation and will apply to all future residential areas. The future custodian of the Open Space and Conservation Corridor will be required to manage wild dogs in accordance with obligations established by the Queensland *Biosecurity Act 2014*. The performance criterion for this mitigation measure is:

- in the unlikely event that Koala (*Phascolarctos cinereus*) mortality does occur as a result of attack by domestic dog/s whilst Sutgold retain ownership of the land, a situation analysis will be conducted to discover the cause of the interaction (eg. was it; a failure of design, deliberate or accidental breach of controls; a failure of administrative controls / education) and SMART corrective measures implemented to redress the cause / causes of the incident.

5.3.2.4.3 Risks and Contingency Measures

The structure and configuration of the residential areas in the Proposed Action (as discussed in **Section 2.4**) will be set by RCC development approval conditions. Both RCC and the Proponent seek to establish this form of development at the Project Area. It is highly unlikely that the development layout would be amended to a large-lot style of development.

There is very little risk that RCC domestic animal local laws will change in a way that reduces controls on wandering domestic dogs. There is also little risk that the custodian will abandon its legal obligation to manage wild dogs in accordance with *the Biosecurity Act 2014* (Qld). Therefore, no contingency measures are proposed.

5.3.2.5 Clearing and Construction Environmental Management

5.3.2.5.1 Description

The Information Request (**Appendix 1**) indicates that construction activities may result in direct mortality to Koalas (*Phascolarctos cinereus*). However, it is contemporary practice for LGAs within South East Queensland (including RCC) to require the submission of a Vegetation and Fauna Management Plan (**VFMP**) prior to commencement of construction works for development projects affecting Koala (*Phascolarctos cinereus*) habitat. The VFMP submitted to RCC for Operational Works Approval is contained in **Appendix 7**. The VFMP identifies measures that reduce the risk of death or injury during the clearing and construction works to establish the Proposed Action (e.g. pre-clearance surveys; use of spotter-catchers; identification of relocation habitat; and stop-work procedures).

5.3.2.5.2 Effectiveness

The development of fauna management plans including Koala (*Phascolarctos cinereus*) management requirements aligns with the State's requirements under the Planning Regulation 2017 (Qld) and the *Nature Conservation Act 1992* (Qld). Such measures are considered effective in minimising the risk of death or injury resulting from construction activity (primarily removal of habitat).

Fauna management plans (including plans to deal with potential impacts on specific listed species) prepared for various controlled actions in South East Queensland have proven to be effective at managing impacts during construction. It is expected that a fauna management plan will be similarly effective for the Proposed Action. Key features of the plan will be:

- As the clearing area is greater than 3 ha in area, adherence to the States 'Sequential Clearing Conditions' in the Nature Conservation (Koala) Conservation Plan 2017[28]

- Clearing procedures that avoid the fragmentation of vegetation will be adopted within the Construction Management Plan and informed by the Fauna Spotter Catcher a condition of the approval

[28] https://environment.des.qld.gov.au/__data/assets/pdf_file/0022/255460/is-Koala-conservation-plan-clearing-requirements.pdf

- Clearing will be undertaken in a way that flushes fauna into connected areas of habitat and will avoid flushing fauna into fragmented or hostile areas. Specifically:
    - Koala (*Phascolarctos cinereus*) are not required to cross roads or move through developed or disturbed areas, such as residential areas of areas that require movement greater than 100 m over cleared ground to reach suitable habitat
    - Fauna are not left occupying an 'island' of habitat between hostile environments, such as road and cleared areas
    - Fauna can safely leave the site of clearing and relocate to adjacent habitat
    - Demarcation fencing will be fauna friendly to ensure fauna are not trapped within the proposed cleared extent; and
    - Cleared vegetation is to be stockpiled as to not impede fauna movement
- Additionally, proposed construction roads will be subject to design treatments to ensure safe fauna crossing opportunities are maintained to vegetated areas and impose low vehicle speeds within construction areas, and
- Construction traffic speeds will be limited to 40 km/hr.

5.3.2.5.3 Performance and Completion Criteria

A fauna management plan (including Koala (*Phascolarctos cinereus*) management requirements) will be prepared for submission to RCC as part of the operational works phase of the Proposed Action. Requirements for the plan's implementation will be identified as a condition of development approval. The performance criterion related to this mitigation measure is:

- No Koala (*Phascolarctos cinereus*) mortality attributable to the construction of the Proposed Action
- Clearing to be undertaken in compliance with the 'Sequential Clearing Conditions' in the Nature Conservation (Koala) Conservation Plan 2017, as such, will be completed slowly and sequentially and in the direction that directs any vacating fauna towards retained corridor areas, and
- Any Koala (*Phascolarctos cinereus*) injured or believed injured on account of clearing are to be rendered assistance and taken for veterinary care.

A dedicated monitoring program will be implemented by the Proponent to enable the tracking of their performance criteria.

5.3.2.5.4 Risks and Contingency Measures

The requirement to prepare a construction environmental management plan incorporating Koala (*Phascolarctos cinereus*) management measures (spotter-catchers, etc.) is a commonly applied condition of development consent within the RCC LGA and readily accepted by contractors. There is a very small risk that a condition will not be applied by RCC. As such, an acceptable contingency measure could be that a fauna management plan (MNES) is required as a condition of approval by the DEECCW.

5.3.3 Mitigation Measures for Grey-headed Flying-fox (*Pteropus poliocephalus*)

5.3.3.1 Retaining, Consolidating and Linking Grey-headed Flying-fox *Resources*

5.3.3.1.1 Description

Section 3.4.2 identifies that the Project Area's most significant habitat for the Grey-headed Flying-fox (*Pteropus poliocephalus*) occurs within the Eastern Enhancement Corridor. This area supports a relatively large area of intact, mature/relict habitats dominated by winter-flowering Eucalypts and Paperbarks. Clearing of winter and spring forage is a particular key threat for the species with foraging resource reliability and availability during winter

resource bottleneck, critical reproductive periods (e.g. mating (March-April), birth and gestation (Oct-Nov)) especially important to the species (Commonwealth of Australia 2021, p18)[29].

The National Recovery Plan (ibid) identifies few foraging resources that flower in winter and those that do flower reliably occur on coastal lowlands in northern New South Wales and southern Queensland. Queensland Blue Gum (*Eucalyptus tereticornis)* is a key winter flowering species on site and the identification and retention of this large area of winter flowering resource is a key mitigation measure of the Proposed Action.

Given its intact, mature and connective nature, the Moogurrapum Creek Corridor represents the highest quality habitat within the Project Area and immediate area, theoretically requiring a lower energy output for the purposes of Grey-headed Flying-fox (*Pteropus poliocephalus*) foraging purposes than the smaller regrowth (lower flower levels) and more widely-scattered paddock trees (more energy required to move for lower resources/higher competition). As such, this corridor is likely to play a minor role in supporting the fluctuating local population of Grey-headed Flying-fox (*Pteropus poliocephalus*) (see **Section 3.4.2**).

As described in **Section 4.3,** the Proposed Action will impact some lower-quality scattered woodland foraging habitat for the Grey-headed Flying-fox (*Pteropus poliocephalus*); however, these scattered trees occur largely as regrowth specimens in the south-east of the Project Area or as scattered individuals throughout paddock areas. As such, theoretically performing a lower ecological function than those mature trees within the intact conservation areas.

Similar to the consolidation and linkage of Koala (*Phascolarctos cinereus*) habitat values, the retained habitat will be consolidated and linked as component of the Proposed Action. These methods of ecological restoration are described within the Concept RMP (**Appendix 4**). It is important to note that the restoration of habitat for the Koala (*Phascolarctos cinereus*) will be of direct benefit to the Grey-headed Flying-fox (*Pteropus poliocephalus*) due to the overlap of key feed tree species.

5.3.3.1.2 Effectiveness

The National Recovery Plan for Grey-headed Flying-fox (*Pteropus poliocephalus*) (Commonwealth of Australia 2021) notes that habitat loss and degradation pose the most significant threat to the Grey-headed Flying-fox (*Pteropus poliocephalus*). Reduction of winter foraging habitat is of particular concern. Evidence of repeated food shortages during winter and spring indicates that inadequate productive foraging habitat exists in these seasons to sustain the current Grey-headed Flying-fox (*Pteropus poliocephalus*) population (p. 18). DAWE (2021) goes on to note under Recovery Objective 1 (action 1.4) that increasing the extent and viability of forage habitat for the Grey-headed Flying-fox (*Pteropus poliocephalus*) that is productive during winter and spring is an important conservation outcome for this species (p. 21). Therefore, the protection and retention of productive foraging habitat in the Eastern Enhancement Area and restoration of habitat featuring winter and spring flowering species can be reasonably identified as an effective mitigation measures.

5.3.3.1.3 Performance and Completion Criteria

If the Proposed Action is approved under the EPBC Act, approval conditions reflective of performance and completion criteria established by this PD (**Table 24** for Construction and Operation Avoidance and Mitigation Measures, and the Concept RMP (**Appendix 4**)) and the Compliance Endorsement which formalise performance and completion criteria.

5.3.3.1.4 Risks and Contingency Measures

Monitoring and adaptive maintenance of the ecological restoration area during the initial establishment phase will ensure that there is sufficiently robust plant health and a trajectory towards the target plant community at the end of the maintenance period. Development bonds are taken by RCC to ensure that revegetation works achieve

[29] *National Recovery Plan for the* Grey-headed Flying-fox *'Pteropus poliocephalus',* Department of Agriculture, Water and the Environment, Canberra, March. https://www.dcceew.gov.au/sites/default/files/documents/recovery-plan-grey-headed-Flying-fox.pdf

acceptable standards. There is a very low risk that the restoration works will not be provided, but as a contingency RCC retains development bonds to remedy non-compliant works.

The enhanced habitat in the enhancement areas and established future foraging opportunities within the drainage reserves and overland flow path will be transferred to RCC, for environmental conservation purposes in perpetuity. This would allow, for example, RCC to then undertake a statutory amendment process to the planning scheme to change the zoning of that land from its current zoning to an environmental management designation.

Once the zone has been changed, the provisions of the Redlands Planning Scheme will apply. Any future development of that land would require either an amendment to the planning scheme, following the statutory process, or the approval of an impact assessable development application for a variation request under the *Planning Act 2016* (Qld) to seek to vary the effect of development scheme with respect to the zoning of that land. This mechanism is sufficient to ensure appropriate conservation of the land into the future; therefore, no contingency measures are proposed.

5.3.3.2 Clearing and Construction Environmental Management

5.3.3.2.1 Description

The Information Request (**Appendix 1**) indicates that construction activities may result in direct mortality to Grey-headed Flying-fox (*Pteropus poliocephalus*). However, it is common practice for RCC to require the submission of a Vegetation Fauna Management Plan (**Appendix 7**) prior to commencement of construction works for development projects affecting Grey-headed Flying-fox (*Pteropus poliocephalus*) habitat. The VFMP submitted to RCC for Operational Works Approval is contained in **Appendix 7**.The VFMP identifies measures that reduce the risk of death or injury during the clearing and construction works to establish the Proposed Action (e.g. pre-clearance surveys; use of spotter-catchers; identification of relocation habitat; and stop-work procedures).

Reliability of foraging resource, particularly during critical reproductive periods is of importance to Grey-headed Flying-fox (*Pteropus poliocephalus*) (Commonwealth of Australia 2021, p18). Vegetation will be cleared sequentially to avoid, minimise and mitigate risk of disturbance to Grey-headed Flying-fox (*Pteropus poliocephalus*) when foraging in habitat during construction, specifically conducting clearing and construction during daylight hours between 7am - 6pm.

The sequential clearing of vegetation will allow for the gradual loss of vegetation, giving fauna time to naturally disperse away from the disturbance. The use of fauna exclusion fencing around construction areas will ensure fauna do not disperse into unsafe, hostile areas, again minimising the risk of injury of death.

Each of these measures will ensure that the risk of injury or death to Grey-headed Flying-fox (*Pteropus poliocephalus*) as a result of construction are avoided and mitigated. The aim of these procedures is to support zero injuries or death to Grey-headed Flying-fox (*Pteropus poliocephalus*) as a result of construction.

5.3.3.2.2 Effectiveness

The development of fauna management plans including Grey-headed Flying-fox (*Pteropus poliocephalus*) management requirements align with the State's requirements under the Planning Regulation 2017 (Qld) and the *Nature Conservation Act 1992* (Qld). Such measures are considered effective in minimising the risk of death or injury resulting from construction activity (primarily removal of habitat).

Fauna management plans (including plans to deal with potential impacts on specific listed species) prepared for various controlled actions in South East Queensland have proven to be effective at managing impacts during construction. It is expected that a fauna management plan will be similarly effective for the Proposed Action.

The Fauna Management Plan will also include provisions for the proponent to appoint a suitably qualified, experienced Fauna Spotter Catcher, licenced under the *Nature Conservation Act 1992* (Qld). Fauna Spotter Catchers have a primary role to ensure no fauna are in vegetation before it is cleared. Given Grey-headed Flying-fox (*Pteropus poliocephalus*) are nocturnal, there is minimal risk of mortality from vehicle collision. Restricted operation hours (i.e. daylight hours) is considered an effective mitigation measure to minimise this risk and allows a 13-hour period for safe dispersal and foraging to occur.

Working hours on construction sites for the types of machinery used for construction purposes are regulated by the environmental noise provisions of the *Environmental Protection Act 1994* (Qld). A site-based CEMP will be a condition of development. The plan will outline working hours, clearing sequencing plan, upholding fauna management measures outlined in the fauna management plan.

Ecological restoration measure to be employed within Ecological Corridor will enhance the quality of the remaining habitat on the Site.

5.3.3.2.3 Performance and Completion Criteria

A fauna management plan (including Grey-headed Flying-fox (*Pteropus poliocephalus*) management requirements) will be prepared for submission to RCC as part of the operational works phase of the Proposed Action. Requirements for the plan's implementation will be identified as a condition of development approval. The performance criterion related to this mitigation measure is:

- no Grey-headed Flying-fox (*Pteropus poliocephalus*) mortality attributable to the construction of the Proposed Action.

A dedicated monitoring program will be implemented by the Proponent to enable the tracking of this performance criterion.

5.3.3.2.4 Risks and Contingency Measures

The requirement to prepare a construction environmental management plan incorporating Koala *(Phascolarctos cinereus)* management measures (spotter-catchers, etc.) is a condition of approval. As such, an acceptable contingency measure could be that a fauna management plan (MNES) is required as a condition of approval by the DEECCW. With appropriate monitoring of observed feed trees by the Fauna Spotter Catcher no residual impacts are expected to occur.

5.3.3.3 Operational Aspects

5.3.3.3.1 Electrocution on Overhead Wires

(a) Description

Electrocution on powerlines, particularly in urban areas and as a result of increasing urbanisation is a known threat for the Grey-headed Flying-fox (*Pteropus poliocephalus*) (Commonwealth of Australia 2021, p24). The Proposed Action will supply power to all households via an underground service and will not bring any new overhead cables into the locality.

(b) Effectiveness

Although the impacts of electrocution are as of yet unquantified (Commonwealth of Australia 2021, p6), reducing electrocution on powerlines is identified as a recovery objective (Recovery Objective 9, Commonwealth of Australia 2021, p31) for the Grey-headed Flying-fox (*Pteropus poliocephalus*). Ensuring that all new power supply is provided by underground cable will ensure that the Proposed Action does not contribute to this threat. Therefore, the proposed measure will be highly effective.

(c) Performance and Completion Criteria

The requirement to supply power via underground cables will be a condition of development consent. A measurable performance indicator will be no new overhead powerlines within the Project Area.

(d) Risks and Contingency Measures

There is a low risk that the measure will not be implemented, and so no contingency measures are proposed.

5.3.3.3.2 Entanglement

(a) Description

Entanglement on barbed wire and netting is a known threat for the Grey-headed Flying-fox (*Pteropus poliocephalus*) (Commonwealth of Australia 2021, p24) with entanglement in fruit netting the most significant risk for bats (36.8%) resulting in admissions to wildlife care/veterinary facilities). Barbed wire is a major hazard for Flying-foxes with thousands of animals each year facing death or permanent injury from entanglement on barbs, usually on the top strand (Commonwealth of Australia 2021, p22).

The Proposed Action will result in all barbed wire fencing already on-site being removed and not replaced. Fruit trees do not form a component of planting prescriptions in landscaped areas and therefore netting will not be used.

(b) Effectiveness

Although the impacts of entanglement are yet unquantified (Commonwealth of Australia 2021, p6), reducing opportunities for entanglement is identified as a recovery objective (Recovery Objective 9, Commonwealth of Australia 2021, p31) for Grey-headed Flying-fox (*Pteropus poliocephalus*). The recovery objective states that barbed wire and netting that does not comply with wildlife friendly netting guidelines should not be used. No barbed wire or netting will be used by the development. Any fencing used will be wildlife friendly (and this will benefit other species especially gliders).

(c) Performance and Completion Criteria

The requirement for netting or barbed wire to not be used will be a condition of development consent. A measurable performance indicator will be no barbed wire or netting in public areas of the Project Area.

(d) Risks and Contingency Measures

There is a very low risk that the measure will not be implemented, and so no contingency measures are proposed.

5.3.3.4 Disturbance to Grey-headed Flying-fox *Habitat in Retained Corridors During Operation*

5.3.3.4.1 Description

Light and noise disturbance are identified as potential issues for Grey-headed Flying-fox (*Pteropus poliocephalus*). In response, the Proposed Action has placed esplanade roads adjoining the eastern and northern Enhancement Corridors and retained vegetation along and waterways to minimise edge effects. Rehabilitated batters adjoining enhancement corridors is the primary means by which light spill is mitigated. The added distance between dwellings and corridor (buffered by esplanade roads and revegetation of batters) will assist with attenuation of residential noise. Directional street lighting on esplanade roads will be configured to ensure light throw will be away from the Ecological Corridor and shrouds will be used as necessary.

Esplanade roads to adjoin Ecological Corridors and retained vegetation along and waterways to minimise edge effects. The primary road network will be designed to support speed limits no greater than 50 km/h.

Grey-headed Flying-fox (*Pteropus poliocephalus*) will undoubtably utilise the Conservation Areas post development and possibly residential areas. This activity will inevitably result in negative attitudes and responses from some members of the community, largely as a result of perceptions of bats as sources of some diseases that can affect humans (Commonwealth of Australia 2021, p24) and a lack of understand of the important ecosystem services provided by flying foxes. Lifestyle guidelines and awareness signage with the purpose of instilling awareness of the issues and stewardship amongst residents encouraging them to actively protect native wildlife, including Grey-headed Flying-fox (*Pteropus poliocephalus*).

5.3.3.4.2 Effectiveness

The development, once in operation, has the potential, (although minimal compared to construction) to cause disturbance. Adopting fauna sensitive urban design principles, including esplanade roads to mitigate edge effects, will result in minimised light and noise disturbance from the proposed development relative to allotments being adjacent. Revegetation of batters formed within the Ecological Corridor will focus on restoring native species appropriate to pre-disturbance REs/post development ecological conditions.

Installing ecological stewardship are effective management measures to see long term protection of native fauna and biodiversity and such measures are consistent with Recovery Objectives 4 and 5 of the Grey-headed Flying-fox (*Pteropus poliocephalus*) Recovery Plan (Commonwealth of Australia 2021).

5.3.3.4.3 Performance and Completion Criteria

The requirement for the Ecological Corridor and development layout will be a condition of development consent. Ecological restoration within the Ecological Corridor will be a requirement of the Concept RMP a condition of the development consent.

Directional lighting and awareness signage will be a requirement of the Landscape Design.

5.3.3.4.4 Risks and Contingency Measures

There is a very low risk that the measure will not be implemented, on account of the vegetation management controls which have been put into effect by Development Approvals and reflected in Compliance Plans (i.e. VFMP).

The VMP mandates the installation of temporary arboriculture exclusion fencing around areas of retention, demarcating these areas as 'tree protection – no go' areas and the subsequent timely monitoring of exclusion areas by the Project Arborist during vegetation clearing and construction.

Any breaches would be the subject of stop-work orders and investigation of the reasons behind and implementation of corrective actions, further and better controls, toolbox talks, further training of workforce. Breaches of the VMP resulting in clearing (of retained Grey-headed Flying-fox (*Pteropus poliocephalus*) habitat) are subjected to mandatory reporting to RCC and this will also apply to reporting of non-conformance with EPBC Approvals to NEPA.

5.3.3.5 Risk of Injury or Death from Vehicle Strike

5.3.3.5.1 Description

Vehicle strike is a risk for Grey-headed Flying-fox (*Pteropus poliocephalus*) during operation. Although the risk to vehicle strike is low, a number of measures will be imposed to avoid and mitigate the risk of Grey-headed Flying-fox (*Pteropus poliocephalus*) being struck by vehicles.

Grey-headed Flying-fox (*Pteropus poliocephalus*) food trees will not form part of the primary landscaping of the development footprint so that Grey-headed Flying-fox (*Pteropus poliocephalus*) are not enticed to enter residential areas. Imposition of low vehicle speeds to reduce the risk of collisions. Vehicle speed limits are restricted to 50km/h on built up residential roads.

5.3.3.5.2 Effectiveness

The purpose of these measures is to enable the objective of no injury or death to Grey-headed Flying-fox (*Pteropus poliocephalus*) as result of vehicle strike. Overall, these tools are considered to be effective measures to reduce the risk of injury or death.

5.3.3.5.3 Performance and Completion Criteria

The purpose of these avoidance and mitigation measures is to minimise the risk of injury or death to Grey-headed Flying-fox (*Pteropus poliocephalus*) from vehicle strike. To achieve this the incentive, for Grey-headed Flying-fox (*Pteropus poliocephalus*) to enter residential areas will be achieved by restricting the availability of habitat in these areas.

As such, street scaping will not be planted with suitable Grey-headed Flying-fox (*Pteropus poliocephalus*) habitat, which will in turn encourage Grey-headed Flying-fox (*Pteropus poliocephalus*) to stay away from the Project Area. Importantly, low vehicle speeds will be imposed along residential roads, minimising the risk of high-speed vehicle strikes which were identified in the literature review as accounting for a large proportion of vehicle related deaths.

5.3.3.5.4 Risks and Contingency Measures

Risks include vehicle speeding and forage trees included in primary landscaping. With low imposed vehicle speeds will be signed and enforced as for public roads and residential development landscape plans ensuring tall statured prolifically blossoming species or fruit trees are not used, it is considered that there is no residual risk. No contingency measures are proposed.

5.3.4 Mitigation Measures South-eastern Glossy Black Cockatoo

As described in **Section 4.4**, the Proposed Action will have no direct or indirect impacts on this species. The retention, and restoration of important habitat supporting low quality (young) Black She-oak (*Allocasuarina littoralis*), can be reasonably identified as a measure that will ultimately improve the Project Area's provision of habitat for this species.

5.4 Action Management Plan

In addition to mitigation outcomes incorporated in the design process, a number of management measures are proposed to ensure impacts are avoided and or minimised through the construction and operational phases.

To avoid and mitigate the direct and indirect impact from the proposed action on the Koala (*Phascolarctos cinereus*) and Grey-headed Flying-fox (*Pteropus poliocephalus*), an Action Management Plan (**AMP**) will be prepared. The AMP will act as the master Environmental Management Plan for the project (with respect to MNES) and will inform the Contractor's CEMP. In relation to MNES, key outcomes within the AMP will include:

- Koala (*Phascolarctos cinereus*) and Grey-headed Flying-fox (*Pteropus poliocephalus*) are protected within the Project Area
- The abilities for Koala (*Phascolarctos cinereus*) and Grey-headed Flying-fox (*Pteropus poliocephalus*) to move into, within and out of the Conservation Areas are maintained
- Potential risks to Koala (*Phascolarctos cinereus*) and Grey-headed Flying-fox (*Pteropus poliocephalus*) (e.g. vehicle strike, entanglement, fragmentation of habitat / becoming stranded, noise/light pollution etc.) are identified and appropriately managed
- All personnel involved in construction and operation of the development are aware of the Project Area's values, their potential to impact on Koala (*Phascolarctos cinereus*) and Grey-headed Flying-fox (*Pteropus poliocephalus*) and their habitats, and their responsibilities in regard to procedures and strategies with the contractors CEMP
- The AMP will outline construction measures to manage and mitigate impacts on native flora, and fauna, specifically the Koala (*Phascolarctos cinereus*) and Grey-headed Flying-fox (*Pteropus poliocephalus*) and will include details on:
    - Project Description, Site design and identification of conservation areas.
    - Ecological Values of the Project Area, including:
        - Existing flora and fauna values on the Project Area and in surrounding areas
        - Key results from survey data, including Koala (*Phascolarctos cinereus*) and Grey-headed Flying-fox (*Pteropus poliocephalus*) occurrence and the availability and quality of habitat.
    - Environmental Objectives
    - Quantification of objectives
    - Identification of key environmental strategies
    - Assessment of Risks:

- Risks to achieving objectives
- Risk management

- Environmental Management, including:
  - Identification of key personnel
  - Roles and Responsibilities
  - Environmental awareness and compliance training for all contractors and sub-contractors
  - Adaptive management
  - Statutory requirements.
- Pre-Clearance Requirements – Fauna Management, including:
  - Pegging of approved clearing areas
  - Vegetation management (clearing and protection),
  - Protection of MNES Fauna (Koala (*Phascolarctos cinereus*) and Grey-headed Flying-fox (*Pteropus poliocephalus*)) and Native Wildlife, including:
    - Specifications for and Installation of Temporary Fauna Exclusion Fencing
    - Installation of no-go signage
  - Engagement of a suitably qualified, experienced and permitted DES approved Fauna Spotter/Catcher
  - Impacts in pre-clearance surveys, reporting and monitoring
    - Staged sequential clearing plan and clearing restrictions
- Maintenance of Safe Wildlife Movement Opportunities (during Construction) including:
  - Objectives
  - Management Strategy:
    - Loss of habitat and its avoidance
    - Mortality due to Clearing by Machinery or Tree Felling and its Avoidance
    - Increased vehicle strike during clearing and construction
    - Risk of entanglement
    - Dog Management
    - Temporary fencing
    - Hours of operation
    - Fauna awareness signage
    - Vehicle movement controls.
  - Performance Indicators and Environmental Outcomes
  - Riparian Reserve Rehabilitation, including:
    - Planting and rehabilitation

- Reporting and Monitoring

- Education and Awareness, and
- Monitoring and Adaptive Management.

5.4.1 Pre-clearance Actions

Each clearing phase will be subject to issue of an Environmental Pre-Clearance Checklist and Environmental Pre-Clearance Package to ensure all approval requirements are met prior to vegetation clearing.

Environmental Pre-Clearance Checklists are designed to easily show compliance for approval requirements, including EPBC approval requirements, in a format where they can be 'ticked off' prior to vegetation clearing.

All relevant parties (e.g. civil contractor, clearing contractor, Fauna Spotter Catcher, environmental coordinator, superintendent and client) must sign the checklist prior to clearing, acknowledging that they have reviewed all, and will undertake the works in accordance with, approved procedures and reporting.

As way of acknowledgement, the Environmental Pre-Clearance Checklist will be run through at a project pre-start meeting with all personnel and relevant parties required to sign the checklist. No clearing can commence for a specific phase of works until the checklist has been completed and signed off by the Environmental Coordinator.

5.4.2 Pre-construction Actions

The Proponent / Proponents Representative must ensure adequate mitigation measures are put in place during the clearing and construction phases of the Proposed Action to avoid the loss of Koala (*Phascolarctos cinereus*) habitat beyond that which is approved under the EPBC approval.

The key risk management measures and strategies to avoid the risk of death or injury to Koala (*Phascolarctos cinereus*) due to loss of Koala (*Phascolarctos cinereus*) Habitat include:

1. pegging out of the approved clearing areas by a registered surveyor to accurately demarcate the approval footprint
2. installation of highly visible fencing and no-go signage along the demarcated boundary to the approved clearing and construction areas
3. implementation of the slow, sequential clearing conditions[30] outlined by the Nature Conservation (Koala) Conservation Plan 2017
4. implementation of Clearing and CEMP to deal with secondary impacts to Koala (*Phascolarctos cinereus*) Habitat (e.g. dust, hydrology, bushfire).

Land management activities will be undertaken in a gradual and sequential manner and are underpinned by:

1. slow, incremental reduction of Koala (*Phascolarctos cinereus*) foraging resources from the peripheries of the development footprint in a staged manner reflective of the staged development sequencing[32] outlined by the Nature Conservation (Koala) Conservation Plan 2017
2. fencing lands off once the staged augmentation and removal of habitat amenity has been completed to minimise the opportunity for Koala (*Phascolarctos cinereus*) to move through cleared land prior to, and during civil activities.

[30] Sequential Clearing Conditions in the Nature Conservation (Koala) Conservation Plan 2017 (Qld) under the *Nature Conservation Act 1992* (Qld). Requirements are outlined in the document found here (current at the date of publishing): https://environment.des.qld.gov.au/__data/assets/pdf_file/0022/255460/is-Koala-conservation-plan-clearing-requirements.pdf

Work to remove vegetation will be undertaken slowly, and prior to commencement of clearing. The initial works will be undertaken by a small team of tree loppers and DETSI Permitted Spotter Catchers. Tree removal will occur sequentially in discrete areas and will be confined to the initial stages of the development.

Temporary Koala exclusion fencing (e.g. construction exclusion fencing with hoarding – refer **Inset 15**) will be formed around any area of construction works, post clearing.

Type 1: Standard construction exclusion fencing with panel fitted

Type 2: Three strand straight cage wire with floppy top wire mesh

Inset 15. Examples of temporary fauna exclusion fencing installed on an active construction sites

Temporary Koala *(Phascolarctos cinereus)* exclusion fencing must be installed immediately after completion of vegetation removal and prior to the commencement of construction, so as to prevent Koala (*Phascolarctos cinereus*) entering any construction areas. Temporary Koala (*Phascolarctos cinereus*) exclusion fencing must remain in place around any construction area until all construction activities within that fenced area are completed.

5.4.3 Fauna Management Roles and Responsibilities

As will be required by the Project Specific Environmental Management Plan, a DETSI registered Fauna Spotter Catcher must be appointed to ensure fauna management, specifically Koala (*Phascolarctos cinereus*) and Grey-headed Flying-fox (*Pteropus poliocephalus*) management, prior to, during and post clearing (this is also a condition of the MEDQ Approval – condition 40). This role is mandated for any clearing of native vegetation in Queensland. The role of the Fauna Spotter Catcher is to complete an assessment of the works area no more than 2 weeks prior to clearing and present a short report to the proponent on the findings and how the proposed clearing is to be managed.

The spotter catcher will undertake pre-clearing inspections and supervise all vegetation clearing works in line with the following:

1. No vegetation clearing is to commence or continue without the presence of a person licenced under the Queensland *Nature Conservation Act 1992* (Qld) to detect, capture, care for, assess, and release wildlife

disturbed by vegetation clearance activities who has at least three years' experience undertaking this work with Koalas (*Phascolarctos cinereus*) (Fauna Spotter Catcher).

2. Undertaking wildlife load reduction measures through the pre-clearing trapping and relocation of wildlife within 1-2 weeks prior to the approved clearing being conducted. Sequential clearing cannot be used as a primary fauna management measure.

3. All trees scheduled for removal will be checked on the day of their removal (prior to the start of operations) for the presence of Koala (*Phascolarctos cinereus*) by the appointed Fauna Spotter Catcher.

4. Clearly marking (flag) vegetation found to contain fauna or fauna habitat (such as tree hollows, arboreal termite mounds, stick nests or possum drays with flagging tape) and visually and verbally communicate this information to the tree feller to ensure flagged trees are not felled until authorised by the fauna manager.

5. Manage any Koala (*Phascolarctos cinereus*) identified on Site in accordance with the Nature Conservation (Koala) Conservation Plan 2017 and manage any Grey-headed Flying-fox (*Pteropus poliocephalus*) identified in the Project Area in accordance with the protocols discussed in **Table 24**.

6. The appointed Spotter Catcher is responsible for ensuring, throughout the duration of the clearing operations, that no tree in which a Koala (*Phascolarctos cinereus*) is present, or a tree with a crown overlapping a tree in which a Koala (*Phascolarctos cinereus*) is present, or a tree identified as being a risk to Koala (*Phascolarctos cinereus*), should not be felled, damaged or interfered with until the Koala has moved from the clearing zone or its own volition.

7. Where a Koala (*Phascolarctos cinereus*) is present within a clearing zone, the tree will be marked with distinctive flagging (and other advisory means as required) and chainsaw or machinery operators will be briefed on the location of the area. No clearing works can occur within 20 m of the tree retaining a Koala (*Phascolarctos cinereus*) until the animal has moved on of its own volition (where the strategy is to allow the Koala (*Phascolarctos cinereus*) to move of its own accord, overnight). On the following day, the tree and retained area, are to be checked again prior to their removal. If necessary, the procedure is repeated until the Koala (*Phascolarctos cinereus*) has moved.

8. In the event that a Koala (*Phascolarctos cinereus*) or other fauna is sick or injured and needs medical attention, DETSI will be contacted and trapping by the Fauna Spotter Catcher may be required to allow the Koala (*Phascolarctos cinereus*) to receive medical attention.

   i. Ensuring vegetation and rubbish piles are not left to serve as refuge for displaced or roaming wildlife through the implementation of the following measures:

   ii. immediately (within 12 hours) remove or destroy such material

   iii. erect wildlife proof barriers. Fencing surrounding stockpiles to prevent wildlife use

   iv. ensure old (>12 hours) piles of felled vegetation are treated as potential wildlife habitat and inspected by a wildlife spotter/catcher prior to removal or destruction.

9. Limiting the felling of habitat and hollow bearing trees to the following methods:

   i. Segmental removal of tree, with hollow bearing limbs being checked by the Fauna Spotter Catcher and cleared of fauna using a cherry picker or suitable means determined by the Fauna Spotter Catcher.

   ii. Segmental removal of the tree, with hollow bearing limbs plugged and lowered to the ground for inspection by wildlife spotter.

   iii. Use of an excavator with vertical grab to lower the main trunk (only after the removal of lateral limbs).

   iv. A combination of the above methods.

5.4.4 Proposed Koala (*Phascolarctos cinereus*) Exclusion Fencing – Operation

The proponent proposes to retain and enhance Koala (*Phascolarctos cinereus*) and potential Grey-headed Flying-fox (*Pteropus poliocephalus*) habitat within the three enhancement areas with species appropriate to the Project

Area context, and canopy species suitable as forage habitat for both. With time as this vegetation matures int will become increasingly useful as habitat. The applicant has committed to Koala (*Phascolarctos cinereus*) exclusion fence installation around the perimeter of the Eastern Enhancement Corridor as directional fencing around the dedicated fauna underpass (refer also **Section 5.4.5**) between the eastern and northern enhancement area, and at the southern extent of the Western Enhancement Corridor to prevent Koala (*Phascolarctos cinereus*) accessing Double Jump Road (refer **Figure 9**).

The purpose of the fencing is to compliment the corridor and underpasses and to ensure a consistent conservation outcome at a landscape scale through risk reduction. Fencing will ensure Koala (*Phascolarctos cinereus*) do not enter areas where they would be prone to vehicle strike or attack by dogs. Similarly, fencing is to keep domestic and wild dogs straying into these areas.

Exclusion and directional fencing will be 1.8 m high aluminium perimeter / pool fencing with no gaps at the base. Timber posts are used to allow animals to climb the posts and escape back into the Eastern Enhancement Corridor in the unlikely instance they enter the residential area; aluminium sleeves (or similar non-climbable material) on enhancement corridor side of the fence prevent animals moving out of the enhancement areas. An example of the typical conservation area fencing, which is both effective and aesthetically pleasing, and therefore useful in urban setting is shown in **Inset 14** above.

5.4.5 Koala (*Phascolarctos cinereus*) and Fauna Underpasses

The Proposed Action has been developed in recognition of the will retain and enhance the ecological value and functionality within the Eastern and Northern Enhancement Corridor network. Proposed Action design therefore relies on the provision of a fauna underpass on the internal esplanade (south – north) road adjoining the eastern corridor which bisects the northern corridor at its confluence with the eastern corridor is one such barrier. The Proponent has entered into a binding agreement with the developer to the north to deliver the road and a dedicated dry passage fauna underpass (refer **Figure 9**) to facilitate safe fauna (specifically Koala (*Phascolarctos cinereus*)) movement. Preliminary design makes provision for a 30 m long dry underpass comprising two 2400 mm X 3000 mm culverts (see **Section 5.3.3**).

The apron, climbing rail and tie-in exclusion fencing will be detailed as required by Operational Works approvals at the Local Government level. The culvert underpass will be positively graded to minimise settling of mud on the culvert floor and forest litter, coarse woody debris and rocks will be installed to create a natural surface and shelter habitat for smaller ground fauna. Revegetation on either side of the culvert will be provided to establish (i) cover from predators at the culvert portals (thereby minimising the predator funnel effect); and (ii) a canopy over the road that is sufficiently spaced to allow transit by gliders and woodland birds.

5.4.6 Weed Management in the Conservation Areas

Within conservation areas, Weeds of National Significance (**WoNS**) and other environmental weeds will be treated in accordance with the control methods provided in *South East Queensland Restoration Framework (2012) – Manual – Attachment C*[31] unless it can be demonstrated that there is an overriding need to utilise another method which deviates from the recommended methods (e.g. if a woody weed is specifically left in-situ but killed and planted into with native figs for soil retention and visual amenity). The Rehabilitation Contractor will undertake detailed site inspections prior to works commencing to identify target weed species, their location and extent for treatment.

Herbicides must be applied by appropriately qualified/supervised persons in accordance with the *Agricultural Chemicals and Distribution Control Act 1966* (Qld) at rates identified on registered product labels, or on an Australian Pesticides and Veterinary Medicines Authority issued off-label permit where applicable. Refer to South East Queensland Ecological Restoration Framework for additional guidance.

[31] South East Queensland Ecological Restoration Framework (2012)

The Rehabilitation Contractor is to ensure herbicides are applied under appropriate environmental conditions to minimise the likelihood of spray drift and damage to native vegetation outside of the treatment area.

5.4.7 Ecological Restoration Measures

Ecological restoration within the three Enhancement Corridors will be carried out with the aim of improving habitat and ecological values were all native fauna and flora within this area, with a particular focus on improving habitat values for the Koala (*Phascolarctos cinereus*) and Grey-headed Flying-fox (*Pteropus poliocephalus*). These efforts will focus on the removal of introduced flora and fauna species from the retained conservation area and infill planting of bare and denuded areas to ensure the conservation area meets the pre-clear REs mosaic vegetation community structure. An RMP will form part of the broader management document submitted as part of supporting documentation for the Compliance Reporting will be broadly in accord with the Concept RMP contained within **Appendix 4**.

5.4.8 Effectiveness of Measure to be Implemented

Table 24 details the avoidance and mitigation measures and their effectiveness that will be documented by the AMP, and which will be implemented by the Proposed Action through the Civil Contractors' CEMP (or equivalent).

Table 24: Construction and Operation, Avoidance and Mitigation Measures for Koala (Phascolarctos cinereus) and Grey-headed Flying-fox (Pteropus poliocephalus)

Avoidance and Mitigation Measures	Impact	Evaluation of the Effectiveness of Measures	Mitigation	Timeline	Risk Assessment	Milestone	Residual Impact
Habitat to be cleared within the Project Area is largely non-remnant pastoral grassland with paddock trees disturbed and degraded through historical land uses. The residual, better quality habitat on the Project Area (Moogurrapum Creek corridor) will be protected and all areas identified for enhancement will be ecologically restored to pre-clear RE prescriptions. No more than 32.57 ha of vegetation identified as habitat critical to the survival of the Koala (*Phascolarctos cinereus*) and 32.57 ha of vegetation identified as habitat critical to the survival of the Grey-headed Flying-fox (*Pteropus poliocephalus*) will be permanently lost to facilitate the development; this removal is considered unavoidable. Clearance limits will be demarcated prior to the commencement of works to ensure "No Go" areas are recognised and protected.	Pre-construction and Construction Impacts	Ecological surveys and habitat assessment conducted across the Project Area led to the precise spatial analysis of vegetation and habitat qualities. The Proposed Action will result in the unavoidable loss of 32.57 ha of critical foraging and movement habitat for Koala (*Phascolarctos cinereus*), and 32.57 ha of vegetation identified as habitat critical to the survival of the Grey-headed Flying-fox (*Pteropus poliocephalus*).	Avoiding high value areas at development.	Works complete.	The field survey applied has accurately mapped the features that are to be avoided and retained within the eastern enhancement area. The development area is largely contained within non-remnant vegetation.	All Enhancement Areas (eastern northern and western) are enhanced and intact at the completion of work; restoration work complete with mitigating factors (outlined below) effectively applied. At plan sealing it will be transferred to public ownership. The Project Area is cleared and developed.	Loss of 32.57 ha of critical habitat for the Koala (*Phascolarctos cinereus*) and 32.57 ha critical habitat to Grey-headed Flying-fox (*Pteropus poliocephalus*).
All clearing will be undertaken in accordance with a stage specific CEMP. This will include: ▪ Provisions for the proponent to engage a qualified Fauna Spotter Catcher to participate in all stages of vegetation clearing. The role of the Fauna Spotter Catcher is to ensure that no injury or deaths occur to Koalas (*Phascolarctos cinereus*) or other fauna species. ▪ Vegetation will be cleared sequentially in accordance with the *Nature Conservation (Koala) Conservation Plan 2017* requirements. Clearing will be conducted so that fauna are flushed into safe, vegetated areas and will avoid pushing fauna into fragmented areas. ▪ Temporary fauna friendly fencing will allow fauna to safely disperse into vegetated areas away from construction, ▪ Temporary fauna exclusion fencing will then be erected to prevent fauna dispersing into construction areas. ▪ Restricted construction hours (i.e. daylight 6am -6pm) ▪ Prohibition of companion/security animals (e.g. dogs). ▪ Restricted vehicle speeds (e.g. max 40km/h) within construction areas.	Permanent loss of approximately 32.57 ha of critical habitat for the Koala (*Phascolarctos cinereus*), and 32.57 ha of habitat critical to Grey-headed Flying-fox (*Pteropus poliocephalus*).	The use of a Fauna Spotter Catcher throughout clearing is an effective tool to: ▪ Identify they types of species on Site prior to clearing; and ▪ Identify and flag habitat features that require thorough examination before clearing. Fauna Spotter Catchers have a primary role to ensure no fauna are in vegetation before it is cleared. Given the size of Koalas (*Phascolarctos cinereus*) and their utilisation of tree branches, they can quite easily be observed from the ground. As such, it is extremely unlikely that a Koala (*Phascolarctos cinereus*) will be killed or injured during vegetation clearing, particularly given the onerous and thorough procedures set out The Draft Code. Given Grey-headed Flying-fox (*Pteropus poliocephalus*) is nocturnal, there is minimal risk of mortality from vehicle collision. Restricted operation hours (i.e. daylight hours) is considered an effective mitigation measure to minimise this risk. The sequential clearing of vegetation will allow for the gradual loss of vegetation, giving fauna time to	Fauna Spotter	Present at all times during clearing works	Fauna Spotter not present and Koala (*Phascolarctos cinereus*) injured or killed.	No injury or death to Koalas (*Phascolarctos cinereus*) during clearing.	The use of a Fauna Spotter is mandated. No residual impact
	Risk of injury or mortality to Koala (*Phascolarctos cinereus*) and Grey-headed Flying-fox (*Pteropus poliocephalus*) from vegetation clearing and construction		Sequential clearing	At all times during construction.	Sequential clearing not undertaken, and fragmentation induced.	Clearing completed as per sequential clearing	Sequential clearing is mandated and guided by CEMPs and pre-clearance checklists and pre-starts No residual Impact
			Temporary fauna fencing	At all times during construction.	Temporary fencing not applied, and Koala (*Phascolarctos cinereus*) are injured or killed.	Temporary fencing utilised at all times during the clearing process	Temporary Fencing is mandated, installed and guided by the CEMP. No residual impact
			Restricted construction hours	At all times during construction.	Works outside of hours.	Works area completed within mandated hours	Speed limits are mandated and guided by the CEMP. No residual impact
			Dog prohibitions	At all times during construction.	No companion and security dogs on-Site	Construction completed without dogs on-Site	Dog controls are mandated and guided by the CEMP. No residual impact

Avoidance and Mitigation Measures	Impact	Evaluation of the Effectiveness of Measures	Mitigation	Timeline	Risk Assessment	Milestone	Residual Impact
		naturally disperse away from the disturbance. The use of temporary fauna exclusion fencing around construction areas will ensure fauna do not move into unsafe, hostile construction area where the risk of injury (or death) is high. Each of these measures will ensure that the risk of injury or death to Koalas (*Phascolarctos cinereus*) or Grey-headed Flying-fox (*Pteropus poliocephalus*) as a result of construction are avoided and mitigated. The aim of these procedures is to support zero injuries or death to Koalas (*Phascolarctos cinereus*) or Grey-headed Flying-foxes (*Pteropus poliocephalus*) as a result of construction.	Low vehicle speeds	At all times during construction	Speeds are exceeded resulting in fauna strike.	Construction completed without vehicle strike	Speed limits are mandated and guided by the CEMP. No residual impact
In addition to this, all construction personnel shall attend environmental training as part of the site induction process prior to entering the work site. As part of this training all personnel will be instructed on their obligations in regard to vehicle movement and construction speed limits.			Site inductions	At all times during construction	Inductions avoided	Construction completed without inductions being breached	Inductions are mandated and guided by the CEMP. No residual impact
The CEMP will include controls to avoid, minimise and mitigate risk of disturbance to Grey-headed Flying-fox (*Pteropus poliocephalus*) when foraging in habitat during construction, specifically: ▪ Avoiding clearing between 6am-6pm ▪ Monitoring of foraging trees by the fauna Spotter Catcher and including appropriate clearing controls/management where required to minimise disturbance. ▪ Staged clearing of vegetation will allow for the gradual loss of vegetation, giving fauna time to naturally disperse away from the disturbance.		Construction management and clearing controls implemented through the contractor CEMP are considered to be able to effectively avoid, minimise and mitigate risk of disturbance to Grey-headed Flying-fox (*Pteropus poliocephalus*) foraging regimes during construction, and allow for adaptive management where required. Limiting hours of construction and clearing to daylight hours only (e.g. 6am-6pm), allows a 12-hour period for safe dispersal and foraging to occur. With appropriate monitoring of observed feed trees by the Fauna Spotter Catcher, no residual impact is expected to occur.					No residual impact
Vegetation clearing has the risk of fragmenting habitat areas during the construction phase. To avoid this impact, vegetation will be undertaken sequentially to allow fauna to disperse from construction areas. Clearing procedures that avoid the fragmentation of vegetation will be adopted within the AMPs and informed by the Fauna Spotter Cather. Clearing will be undertaken in a way that flushes fauna into connected areas of habitat and will avoid flushing fauna into fragmented or hostile areas. Specifically: ▪ Fauna are not required to cross roads or move through developed or disturbed areas, such as areas that require movement greater than 100 m over cleared ground to reach suitable habitat	Risk of injury or mortality to Koalas (*Phascolarctos cinereus*) and Grey-headed Flying-fox (*Pteropus poliocephalus*) from vegetation clearing and construction	Habitat isolation and fragmentation is a primary concern due to its impacts on fauna. Koalas (*Phascolarctos cinereus*) and Grey-headed Flying-fox (*Pteropus poliocephalus*) are able to disperse through a variety of environs, including bushland and cleared areas. The direction of clearing of vegetation in accordance with the contractors CEMP (informed by the AMP) will ensure that clearing does not create fragmented habitat islands that could trap fauna. Procedures will be in place to ensure clearing flushes fauna away from construction areas into the Riparian Reserve that is connected to the wider landscape.	Fauna not fragmented from adjoining habitat during clearing	Fauna are not fragmented from habitat during clearing with sequential clearing undertaken at all times during clearing	Fauna are fragmented by clearing activities	Clearing completed without fauna being fragmented.	Sequential clearing is mandated and guided by CEMP and pre-clearance checklists and pre-starts No residual impact
	Fragmentation of habitat for Koala (*Phascolarctos cinereus*) and Grey-headed Flying-fox (*Pteropus poliocephalus*) during construction		Temporary fauna fencing	At all times during construction	Temporary fences are not applied.	Temporary fencing utilised at all times during construction	Temporary fauna fencing is mandated and guided by CEMP and pre-clearance checklists and pre-starts No residual impact
			Stockpiling of cleared vegetation ensures safe fauna movement	At all times during construction	Stockpiling creates a barrier to fauna	Stockpiling is undertaken as guided by civil contractors CEMP	Safe stockpiling is mandated and guided by CEMP and pre-

Avoidance and Mitigation Measures	Impact	Evaluation of the Effectiveness of Measures	Mitigation	Timeline	Risk Assessment	Milestone	Residual Impact
▪ Fauna are not left occupying an 'island' of habitat between hostile environments, such as road and cleared areas; ▪ Fauna can safely leave the site of clearing and relocate to adjacent habitat; ▪ Demarcation fencing will be fauna friendly to ensure fauna are not trapped within the proposed cleared extent; and ▪ Cleared vegetation is to be stockpiled as to not impede fauna movement. Additionally, proposed construction roads will be subject to design treatments to ensure safe fauna crossing opportunities are maintained to vegetated areas and impose low vehicle speeds within construction areas.		The designated enhancement areas will accommodate fauna habitat into the future and thus will not be subject to fragmentation in the future. As such. No residual impacts are anticipated.					clearance checklists and pre-starts No residual impact
			Safe fauna crossings during construction	At all times during construction	Fauna strike occurs at crossing location	No fauna strikes during construction.	Fauna go slow and fencing measures are applied at corridor crossings as per the CEMP and pre-clearance checklists and pre-starts. No residual impact
			Low vehicle speeds	At all times during construction	Speed limits are breached resulting in fauna strike	No speed limit breaches during construction	Speed limits are mandated and guided by the CEMP. No residual impact.
The CEMP will include controls to avoid, minimise and mitigate risk of disturbance to Koala (*Phascolarctos cinereus*) and Grey-headed Flying-fox (*Phascolarctos cinereus*) habitat during construction, specifically light and noise disturbance. Construction of the project will result in increased noise and light disturbance. These impacts may disturb fauna and disrupt foraging, reproduction or movement behaviours. Restricted construction hours (e.g. 6am-6pm) will limit disruption from light and noise impacts, as well as allow a 12-hour period for fauna to disperse and forage. **Contamination, weeds and pathogens** Construction activities increase the risk of weeds, pathogens and contamination into the Project Area. To manage these impacts, a Weed Management Plan will be prepared to identify potential weed species, and include appropriate controls for weed and pathogen management, disposal and monitoring. Weeds will be actively managed within the construction footprint and disposed of appropriately. No companion animals (e.g. dogs) will be allowed within construction areas. **Vehicle disturbance** Reduced vehicle speeds will be implemented throughout the construction area to minimise vehicle disturbances. Further, proposed construction roads will be subject to design treatments to ensure safe fauna crossing opportunities are maintained to vegetated areas and impose low vehicle speeds within construction areas. **Barriers to dispersal**	Disturbance to Koala (*Phascolarctos cinereus*) and Grey-headed Flying-fox (*Phascolarctos cinereus*) during construction	Construction management and clearing controls implemented by the CEMP are considered to be able to effectively avoid, minimise and mitigate risk of disturbance to Koala (*Phascolarctos cinereus*) activities during construction, and allow for adaptive management where required. Limiting hours of construction and clearing to daylight hours, allows a 12-hour period for safe dispersal. With appropriate monitoring, pre, during and post construction by the Fauna Spotter Catcher, no residual impacts area expected to occur.	Minimising light and noise disturbance.	At all times during construction	Light and noise impacts on fauna	Light and noise disturbance is limited to daylight hours	Light and noise restrictions mandate works between 7am and 6pm Monday to Saturday in the CEMP. No residual impact
			The risk of contamination and exacerbating weeds and pathogens is minimised.	At all times during construction	Contamination, weed and pathogen incursion	Contamination, weed and pathogen incursions do not occur.	The CEMP will mitigate the risk of contamination and weed, pathogen incursion. No residual impact
			Vehicle disturbance is minimised	At all times during construction	As above	As above	As above No residual impact
			Barrier's dispersal not created.	At all times during construction	As above	As above	As above No residual impact
			Temporary fauna exclusion fencing	At all times during construction	As above	As above	As above No residual impact
			Inductions and training	At all times during construction	As above	As above	As above No residual impact
			Adaptive management	At all times during construction	Adaptive management not applied	Adaptive management utlised if required.	The CEMP will include adaptive management strategies to avoid recurrence of adverse incidents should they occur. No residual impact

Avoidance and Mitigation Measures	Impact	Evaluation of the Effectiveness of Measures	Mitigation	Timeline	Risk Assessment	Milestone	Residual Impact
Vegetation will be cleared sequentially. Clearing will be conducted so that fauna are flushed into safe, vegetated areas and it will avoid pushing fauna into fragmented areas. Temporary fauna friendly fencing will allow fauna to safely disperse into vegetated areas while clearing. Temporary fauna exclusion fencing will then be erected to prevent fauna dispersing into construction areas. **Contractor management** All construction personnel shall attend environmental training as part of the site induction process prior to entering the work site. As part of this training, all personnel will be instructed on their obligations in regard to vegetation clearing protocols and to protect native fauna. Additional controls for Koala (*Phascolarctos cinereus*) and Grey-headed Flying-fox (*Pteropus poliocephalus*) will be presented in a toolbox talk.							
Stormwater detention technologies will be utilised to minimise the effects of excess rainwater flowing into catchments caused by the creation of hardstand areas. All work will be undertaken in accordance with appropriate management plans to ensure the hydrological changes on the Project Area do not impact on surrounding vegetation.		The implementation of a project wide SMP as designed by certified engineers ensures that hydrological change area appropriately accounted for and managed. These management measures will reduce impacts from higher levels of surface water flow caused by hardstand areas and ensures natural drainage lines continue to function as they naturally would have. Stormwater detention basins prevent localised flooding of drainage lines and waterways caused by increased runoff over hardstand areas and also contribute to maintaining water quality levels.	Hydraulic and Stormwater Management Plan.	To be approved prior to works.	Unforeseen hydrological changes	No worsening of hydrological impacts as a result of the development	A Hydraulic and Stormwater Management Plan is prepared by Hydraulic Engineers and Approved by RCC. No residual Impact.
A number of measures will be imposed to avoid and mitigate the risk of Koalas (*Phascolarctos cinereus*) being struck by vehicles. Although the risk to vehicle strike is low, these measures will be concurrent for Grey-headed Flying-fox (*Pteropus poliocephalus*). These measures include: No Koala (*Phascolarctos cinereus*) or Grey-headed Flying-fox (*Pteropus poliocephalus*) food trees will form part of the primary landscaping of the development footprint so that Koalas/Grey-headed Flying-fox (*Pteropus poliocephalus*) are not enticed to enter the industrial precinct. Owing to the presence of exclusion fencing along the Eastern Enhancement Corridor, around dedicated fauna underpasses and the southern extent of the western corridor it is unlikely that Koala will enter higher order (higher speed / higher volume) traffic environments where they will be at risk of	Hydrological changes	The purpose of these avoidance and mitigation measures is to minimise the risk of injury or death to Koala (*Phascolarctos cinereus*) from vehicle strike. These measures will also mitigate risks for Grey-headed Flying-fox (*Pteropus poliocephalus*). It will be important to minimise the incentive for Koala (*Phascolarctos cinereus*) and Grey-headed Flying-fox (*Pteropus poliocephalus*) to enter Residential areas by restricting the availability of habitat in these areas. As such, landscaping will not be planted with suitable Koala Koala (*Phascolarctos cinereus*) or Grey-headed Flying-fox (*Pteropus poliocephalus*) habitat, which will in turn encourage Koala (*Phascolarctos cinereus*) to stay away from the development area. Importantly, low vehicle speeds will be imposed within the Residential estate,	Open space buffer (bioretention basins) between Residential development and Environmental Protection Area	To be delivered with adjoining development	Open space buffer not delivered	Open space buffers delivered	No residual impact
	Operational Impacts		Landscaping does not include forage species	On construction of roads	Habitat / forage trees used in high density Residential areas	Urban landscaping delivered with non-Koala native species	No residual impact
	Risk of injury of death to Koala (*Phascolarctos cinereus*) and Grey-headed Flying-fox (*Pteropus poliocephalus*) from vehicle strike.		Installation of exclusion fencing	Prior to on-maintenance	Exclusion fencing not installed	Exclusion fencing installed	No residual impact
			Low vehicle speeds	On construction of roads	Vehicles speeding	No Koala (*Phascolarctos cinereus*) deaths from vehicle strikes in Residential areas	Low vehicle speeds will be signed and enforced as for internal driveways

Avoidance and Mitigation Measures	Impact	Evaluation of the Effectiveness of Measures	Mitigation	Timeline	Risk Assessment	Milestone	Residual Impact
vehicle strike. Imposition of low vehicle speeds to reduce the risk of collisions. Vehicle speed limits within the Proposed action will be restricted to 50 km/h on internal roads. Erection of Koala (*Phascolarctos cinereus*) and Grey-headed Flying-fox (*Pteropus poliocephalus*) awareness signage in parks and pedestrian links along the verge of the enhancement corridors to raise awareness of the species' presence in the area. New tenants and owners will be issued with a "Operational Guideline" to raise awareness about local wildlife and to educate workers about the protection of Koalas (*Phascolarctos cinereus*) and Grey-headed Flying-fox (*Pteropus poliocephalus*) in the area.		minimising the risk of high-speed vehicle strikes which were identified in the literature review as accounting for a large proportion of vehicle related deaths. In addition, awareness signage will ensure motorists are aware that Koalas (*Phascolarctos cinereus*) have potential to occur in the area, making them more conscious of potentially dispersing Koala (*Phascolarctos cinereus*) and encouraging them to maintain a low vehicle speed. The implementation and distribution of "Operational Guidelines" has the purpose of instilling stewardship of the issue amongst workers, encouraging them to actively protect native wildlife and making them aware of the types of fauna that could disperse onto roads. In essence, wildlife crossings will include the following elements: ▪ Reduced vehicle speed limits on roads internal to the development (≤20 km/h) ▪ Demarcated driveway treatment surface and signage to raise driver awareness.					No residual impact
			Educational guidelines/ markings	On creating internal driveways	Signage not installed	Upon completion of driveway construction	Vehicle speeds will be signed and enforced as for internal driveways Minor residual impact
			Signage.	Prior to on-maintenance	Signs not installed	Signs installed	No residual impact
			Operational guidelines.	On purchase / commencement of tenancy.	Operational guidelines not delivered	Operational guidelines in purchase package	No residual impact
			Escape measure incorporated into exclusion fencing installed	Prior to on-maintenance	Escape measures not installed	Escape posts installed	No residual impact
In peri-urban development, where tree retention is sometimes proposed to achieve habitat and greenspace outcomes, there is clear potential for interaction between domestic dogs and Koalas (*Phascolarctos cinereus*). However, for Residential development (as proposed by the Proponent), the potential for interaction between the two species is reduced, because: ▪ bulk earthworks requirements have limited the ability to retain trees within the development footprint ▪ small garden areas incorporated into the Residential precinct will be landscaped with small-statured shrubs and groundcovers rather than trees and shrubs that would attract Koala *(Phascolarctos cinereus)* ▪ the Residential nature of the land use reduces the likelihood of occupants owning larger dogs capable of inflicting mortality, and ▪ commercial operations in Residential precincts are typically fenced with 1,800 mm tall fencing, or greater, which creates a significant barrier to movement (and thus access by Koala (*Phascolarctos cinereus*)).		The Koala recovery plan (DAWE 2022b) does not discuss the effectiveness of governance measures, but enforced local laws have a degree of efficacy that extends beyond doing nothing. This is implicit in the NEPA decision regarding the suitability of governance measures under Referral 2016/7723, Referral 2017/8095, Referral 2020/8615 and Referral 2021/9130. It is also relevant to consider the benefit of rehabilitation and enhancement of the Environmental Protection Zone (EPZ), and thus exposure to dog attack.	Dog restrictions	At delivery of open space areas	Dogs are not managed	Dog signage delivered. Council controls on dog ownership imposed	Dogs will be managed to Council specifications. No residual impact.
			Absence of habitat trees in the development footprint.	As above	Koala (*Phascolarctos cinereus*) are incentivised to enter the residential precinct	Koala (*Phascolarctos cinereus*) are not incentivised to enter the residential precinct	No residual impact

Avoidance and Mitigation Measures	Impact	Evaluation of the Effectiveness of Measures	Mitigation	Timeline	Risk Assessment	Milestone	Residual Impact
This will also be addressed through: ▪ Provision of barriers around the eastern corridor to prevent domestic dogs from entering these corridors and Koala (*Phascolarctos cinereus*) accessing developed areas, consolidating Koala (*Phascolarctos cinereus*) movement through them minimising the area for interface between Koala (*Phascolarctos cinereus*) and dogs. ▪ Community awareness and education programs for new commercial tenants moving into the Project Area. These programs will reinforce the threats that dogs present for Koala (*Phascolarctos cinereus*) populations and will outline dog owners' responsibilities for maintaining control of their dogs. ▪ Additional appropriate solutions may include but not be limited to awareness and dog on-leash signage and passive educational documentation.							
To mitigate this associated development, habitats within the three enhancement areas will be retained and enhanced through restoration. The construction of exclusion fencing along interface areas of Eastern Enhancement Corridor and dedicated underpasses maintains connectivity with other habitats beyond the Project Area. The location of the Koala (*Phascolarctos cinereus*) Habitat, will be subject to assisted natural regeneration efforts to enhance, expand and consolidate the available habitat and fabrication within previously cleared components.	Risk of injury or death from dog attack	The development of the Residential areas across the estate will accommodate and facilitate fauna movement. The extent of establishment of fauna movement infrastructure, construction of exclusion fencing along interface areas and ecological restoration of Koala *(Phascolarctos cinereus)* habitat within corridors maintains connectivity with other habitats beyond the Project Area. The location of the Koala (*Phascolarctos cinereus*) Habitat, will be subject to assisted natural regeneration efforts to enhance, expand and consolidate the available habitat and fabrication within previously cleared components.	Provision of Open Space area and Environmental and Conservation Precinct	As above	As above	No fauna stuck in Residential area	No residual impact
The Proposed Action has designed controls to avoid, minimise and mitigate risk of disturbance to Koala *(Phascolarctos cinereus)* and Grey-headed Flying-fox (*Pteropus poliocephalus*) habitat during operation, specifically: **Light and noise disturbance** Detailed layout will adopt fauna sensitive design measures, specifically adjoining EPZ including, avoiding open parking and open space areas backing on to EPZ **Contamination, weeds and pathogens**	Creation of barriers to dispersal/fragmentation of habitat	The development, once in operation, has the potential, (although minimal compared to construction) to cause disturbance to Koala (*Phascolarctos cinereus*) and Grey-headed Flying-fox (*Pteropus poliocephalus*) habitat. Adopting fauna sensitive design, including lot design to avoid and minimise light and noise disturbance from the proposed development relative to allotments being adjacent (e.g. rear of large buildings facing the EPZ.	No open space / car parking facing Environmental Protection Zone	On construction	Directional lighting not delivered	Directional lighting installed	Directional lighting to minimise light impacts on the Environmental Protection Zone will be a requirement of the Landscape Design. No residual impacts
			Open space and appropriate landscaping to buffer Environmental Protection Zone with	On construction	Landscaping and revegetation of bioretention basins not delivered	Landscaping to be delivered	No residual impacts

Avoidance and Mitigation Measures	Impact	Evaluation of the Effectiveness of Measures	Mitigation	Timeline	Risk Assessment	Milestone	Residual Impact
Landscaping mix to be primarily native species Lifestyle guidelines to include information on suggested planting mix and weed management Tracing risk of pathogens to Koala (*Phascolarctos cinereus*) arising from development		Landscaping within the development will include a primary mix of native species and be subject to a Council on/off maintenance period. In addition to this, the Operational Guidelines will include information on suggested planting mixes for tenants to encourage the use of native species, as well as appropriate controls for weed management. These measures are effective in discouraging Koalas (*Phascolarctos cinereus*) and Grey-headed Flying-fox (*Pteropus poliocephalus*) to enter the development. The distribution of "Lifestyle Guidelines" has the purpose of instilling stewardship of the issue amongst residents encouraging them to actively protect native wildlife, including Koala (*Phascolarctos cinereus*) and Grey-headed Flying-fox (*Pteropus poliocephalus*), raising awareness of the types of fauna that could disperse onto roads, suggested landscaping tree types to discourage Koalas (*Phascolarctos cinereus*) and Grey-headed Flying-foxes (*Pteropus poliocephalus*) into Residential areas or the spread of weeds and how to appropriately manage domestic pets. Education of the community and installing ecological stewardship are effective management measures to see long term protection of native fauna and biodiversity. Diseases such as Chlamydia and Koala Retrovirus (KoRV) are considered inherent in South East Queensland Koala (*Phascolarctos cinereus*) populations; the proposed development is not considered likely to introduce pathogens that would negatively impact any Koalas (*Phascolarctos cinereus*) that could utilise the area. With resident awareness training, passive and active surveillance and reporting can assist with the identification, tracing and ultimately treatment of diseased animals. Animal stress is implicated as a key contributor to exacerbating disease in Koalas (*Phascolarctos cinereus*). Stress has been shown to be heightened in Koalas (*Phascolarctos cinereus*) as a result of interaction with vehicles, dogs, intraspecific competition / normal species interactions, limited forage habitat and spending long periods on the ground moving between forage / shelter habitat. The retention,	no open space/ lighting facing into this area. Operational guidance to recommend appropriate species	 On purchase of property	 Operational guidelines not delivered	 Operational guidelines in purchase package	 No residual impact
	Disturbance to Koala *(Phascolarctos cinereus)* or Grey-headed Flying-fox (*Pteropus poliocephalus*) habitat in retained EPZ during operation						

Avoidance and Mitigation Measures	Impact	Evaluation of the Effectiveness of Measures	Mitigation	Timeline	Risk Assessment	Milestone	Residual Impact
		restoration and enhancement of habitat corridor functionality, provision of safe movement infrastructure, limiting access to the eastern corridor (primary movement corridor) and establishment of directional lighting to limit light spill will all assist in reducing stressors to the lowest extent practicable. Loss of Koala (*Phascolarctos cinereus*) and Grey-headed Flying-fox (*Pteropus poliocephalus*) habitat is limited to direct impacts arising from clearing, with indirect impacts especially arising through operation considered by the applicant to be appropriately managed. No residual impacts are anticipated outside the development footprint.					

6. Residual Impacts

The Proponent is required to confirm the quality of habitat to be impacted within the Project Area. To ensure that the Proponent can adequately address this, in a consistent manner to which habitat quality will be assessed at a suitable Offset Area, 28 South has utilised the *Queensland Government Guide to Determining Terrestrial Habitat Quality: A toolkit for assessing land based offsets under the Queensland Environmental Offsets Policy* (Version 1.2 2017)[32] (**HQA Guide**) (State of Queensland 2017) as the basis for determining habitat quality scoring over the impacted areas of the Project Area (i.e. the Residential Precinct, Local Parks, infrastructure and Stormwater Management Areas). This methodology is well recognised, robust, repeatable and a standard by which most large-scale assessments are measured.

This methodology collects relevant ecological data and reviews it against known benchmarks for remnant (or pre-clearing) data for the individual RE and produces a weighted score for each "Assessment Unit". Assessment Units (**AUs**) are derived from areas of similar habitat types (e.g. REs, cleared paddocks, stands of weed, regrowth vegetation etc.).

The Project Area has been divided into three (3) AUs to reflect the different states of the vegetation onsite (refer **Figure 13**). For the purpose of quantifying impacts, contiguous habitat (patch size and context) associated with the development and landscape connectedness are assessed.

Landscape context showing the extent of Remnant and High Value Regrowth within the region is presented as **Figure 27**; landscape connectedness within the region is represented in **Figure 28**.

In relation to the Project Area Context assessment outlined in the HQA Guide, Patch Size, Connectedness and Context mapping, illustrative of the relevant calculations and scoring are identified by **Figure 29**, **Figure 30** and **31**, respectively.

6.1 Koala (*Phascolarctos cinereus*)

6.1.1 Direct Impacts

The Proposed Action will involve direct impacts to the Koala (*Phascolarctos cinereus*) through the removal of vegetation within the Project Area (for residential, open space and stormwater management uses). Although retained and avoided habitat will be ecologically restored and afford movement habitat, Northern Enhancement Corridor and the Western Enhancement Corridor and Multi-function Spine are considered compromised habitat[33] on account of their narrow width (<100 m). The direct / indirect loss of 32.57 ha will arise on account of undertaking the Proposed Action. The majority of this loss consists of dispersal area and lower value forage and shelter habitat. Significant Residual Impacts associated with the of will offset through the provisions described in **Section 7**.

Taking into consideration the avoidance measures in **Section 5.2** and the mitigation measures in **Section 5.3** and referencing the Koala (*Phascolarctos cinereus*) National Recovery Plan , the Proposed Action will have a residual impact on the Koala (*Phascolarctos cinereus*). This residual impact is quantified as the removal of no more than 32.57 ha[34] of habitat for urban purposes, even though much of this land presently exists as historically cleared paddocks. Western Enhancement Corridor is considered to be an affected habitat (despite future restoration to enhance Koala *Phascolarctos cinereus*) habitat coverage) on account its multi-use status. Conservation Areas (including the Multi-function Spine) will undergo ecological restoration.

Some residual effects are likely to be attributable to Koala (*Phascolarctos cinereus*) interaction with people, dogs and vehicles associated with the Proposed Action. However, it is considered that the measures outlined in

[32] https://environment.des.qld.gov.au/__data/assets/pdf_file/0015/90312/habitat-quality-assessment-guide.pdf
[33] In accordance with the DES Guideline: State Development Provisions, literature recommends that Koala movement corridors should seek to be at least 100 m wide to function effectively and to minimise edge effects.
[34] Equivalent to the Project Area (38.22 ha) less the area of land set aside for Conservation Area 1 (5.65 ha).

Section 5.3 will effectively reduce these residual impacts to a level that is as low as practicable within an urban environment.

6.1.2 Quantum of Impact

The total quantum of impact to be offset is therefore calculated as 32.57 ha. This will be offset through the provisions described in **Section 7**.

6.1.3 Habitat Quality Assessment

For the purposes of the habitat quality assessment, the Project Area was stratified into 3 AUs to reflect differences in vegetation condition across the site. To quantify the quality and functional value of Koala *(Phascolarctos cinereus)* habitat within the Project Area, vegetation condition was assessed using a modified application of the Queensland State Government's Guide to determining terrestrial habitat quality: A toolkit for assessing land-based offsets under the Queensland Environmental Offsets Policy Version 1.2 (April 2017) (Department of Environment and Heritage Protection 2017) (Guide to determining terrestrial habitat quality).

The Guide to determining terrestrial habitat quality provides a consistent and repeatable methodology for evaluating and comparing habitat quality under the Queensland Environmental Offsets framework and sets out a structured, step-by-step process for assessing land-based Offset Areas. This methodology has been adopted and tailored to assess the suitability and quality of habitat specific to Koala *(Phascolarctos cinereus)*. The approach is underpinned by BioCondition: A Condition Assessment Framework for Terrestrial Biodiversity in Queensland Version 2.2 (February 2015), which forms the basis of the guide and has been selectively applied within the MHQA Tool where relevant.

6.1.4 Assessment units

Within the offset assessment framework, variability in habitat quality across a Protected Matter area is addressed through the delineation of Assessmetn Units (AUs). The Project Area has been subdivided into 3 AUs to represent areas of relatively uniform vegetation type and condition, enabling a robust and transparent assessment of habitat values. Each AU was mapped to inform the placement and number of sample locations required to adequately characterise habitat condition. Assessment Units were initially defined using desktop data and subsequently reviewed and refined during field investigations where necessary. In general, AUs comprise relatively homogenous vegetation areas, typically aligned with a distinct regional ecosystem or habitat type, and are clearly differentiated from adjacent vegetation within the Project Area. The AUs identified form the basis for the assessment of habitat values relevant to both Koala *(Phascolarctos cinereus)* and Grey-headed Flying-fox *(Pteropus poliocephalus)*, where applicable.

6.1.5 Modified Habitat Quality Assessment - Method

The Guide to determining terrestrial habitat quality methodology recognises the following three (3) key indicators:

1. site condition – a general condition assessment of vegetation compared to a benchmark;
2. site context – an analysis of the site in relation to the surrounding environment; and
3. species habitat index – the ability of the site to support a species.

For the Project Area, the MHQA applied for Koala *(Phascolarctos cinereus)* integrates these indicators into a tailored scoring framework. Site condition and site context are each weighted at 30% of the overall MHQA score. The remaining 40% weighting is assigned to species stocking rate, which sits outside the Guide to determining terrestrial habitat quality and has been incorporated to fit into the Commonwealth Offsets Framework. This modification ensures the assessment appropriately captures species-specific habitat suitability as well as habitat usage of the Protected Matter.

A total of 14 MHQA transects were undertaken across the Project Area. The sections that follow describe the methodology applied to evaluate site condition, site context and species stocking rate for the Project Area under the MHQA framework.

6.1.5.1 Site Condition (30%)

The assessment of site condition is made-up of two ecological components which total a score out of 100:

- BioCondition score (out of 80) – the assessment of vegetation structure and function; and,
- Fauna species habitat quality assessment (out of 20) – the assessment of specific habitat characteristics unique to the protected matter.

In Queensland, vegetation Condition is measured and assessed under the Regional Ecosystem and BioCondition framework. The Regional Ecosystem (RE) framework is Queensland's vegetation classification system, which identifies vegetation communities that are consistently associated with a particular combination of geology, landform and soil within a bioregion. Each RE is assigned a unique identifier and provides the basis for vegetation mapping, condition assessment and biodiversity management across Queensland. BioCondition is an assessment framework designed for measuring the order of biodiversity functioning of REs. It provides quantitative, site-based results for any vegetation type or state, classifying from functional to dysfunctional condition for biodiversity. Classification occurs by measuring structural and functional ecosystem attributes and to what degree these differ from a healthy, functioning reference of the same vegetation type. Assessment sites are scored in comparison of a benchmark remnant ecosystem score for each measurable attribute. Benchmarks are specific to each regional ecosystem or vegetation community in Queensland and are based on the average or median value of condition attributes assessed at reference and best-on-offer (BOO) sites.

BioCondition surveys are undertaken generally in accordance with the DETSI framework document; BioCondition: A condition assessment framework for terrestrial biodiversity in Queensland, (The State of Queensland (Department of Science, Information Technology, Innovation and the Arts), 2015) , however, some attributes are adapted and introduced by 28 South Environmental to provide a quantitative platform which is adaptable to the habitat quality assessment of protected matters under both Commonwealth and Queensland State legislation. To quantify the quality and functional value of protected matter habitat within an area, vegetation condition is assessed using a modified application of the Queensland State Government's Guide to determining terrestrial habitat quality: A toolkit for assessing land-based offsets under the Queensland Environmental Offsets Policy Version 1.2 (April 2017) (Department of Environment and Heritage Protection 2017) (Guide to determining terrestrial habitat quality). This assessment framework combines the Queensland BioCondition Assessment method (site condition), site context, and species stocking rate considerations, to derive habitat quality scores for offset suitability and performance.

Site condition is assessed using a suite of 13 measurable attributes to describe the structure and function of the vegetation community and is benchmarked against the expected range for a relatively undisturbed community. The Regional Ecosystem Database Description (REDD) describes the remnant state of Regional Ecosystems in terms of floristic variably and vegetation structure, for which a corresponding benchmark value exists for each of the 13 measurable attributes. The maximum BioCondition score for a wooded ecosystem is 80. Each attribute and their corresponding maximum score are detailed below:

- **recruitment of dominant canopy species (score out of 5) –** Across the entire 100*50m plot area, the presence of recruitment from the ecological dominant layer (EDL) is measured through the observation of individuals of the EDL that have a DBH smaller than 50mm. This data is recorded as a percentage of the number of species present in the EDL that are found to be regenerating. Recruitment data allows a visual representation of how the vegetation on site may be changing and progressing.
- **native plant species richness – trees (score out of 5) –** Native tree richness species is measured by recording each tree species that is present within the entire 100*50m plot area. A list of all species, and a total richness count is produced from this. Richness data for native plants gives an assessment of biodiversity and can give a reflection of what fauna species may be present due to unique habitat preferences and needs.
- **native plant species richness – shrubs (score out of 5) -** Native shrub richness species is measured by recording each native shrub species that is present within the smaller 50*10m plot area. A list of all species,

and a total richness count is produced from this. Richness data for native plants gives an assessment of biodiversity and can give a reflection of what fauna species may be present due to unique habitat preferences and needs

- **native plant species richness – grasses (score out of 5) -** Native grass richness species is measured by recording each native shrub species that is present within the smaller 50*10m plot area. A list of all species, and a total richness count is produced from this. Richness data for native plants gives an assessment of biodiversity and can give a reflection of what fauna species may be present due to unique habitat preferences and needs.

- **native plant species richness – forbs (score out of 5) -** Native forb richness species is measured by recording each native shrub species that is present within the smaller 50*10m plot area. A list of all species, and a total richness count is produced from this. Richness data for native plants gives an assessment of biodiversity and can give a reflection of what fauna species may be present due to unique habitat preferences and needs.

- **tree canopy height (score out of 5) –** Tree canopy height is measured by estimating the mean height of the ecological dominant layer (EDL) or canopy inside the 100*50m plot. If the benchmark document has a distinct value for an emergent or subcanopy layer, these values are also estimated for the plot area. Tree height and cover are both used to define vegetation classes for regional ecosystem mapping.

- **tree canopy cover (score out of 5) –** The tree canopy cover is measured by recording each stem and species of tree, native or exotic, which intersect with the 100m transect line and contribute to the EDL (ecologically dominant layer), subcanopy, or emergent layer. A total measurement of intersecting cover is calculated and converted to a percentage of estimated canopy cover. The collection of tree species data is beyond that which the BioCondition assessment framework instructs, however, creates a more detailed dataset which awards the power to calculate tree species dominance. Detailed data pertaining to canopy species' dominance allows measurable conclusions to be drawn regarding species habitat suitability and subsequent habitat quality scoring. An example of this is the distinction between listed LIKTs (Locally important Koala trees), koala ancillary trees (as per Youngentob *et al.*, 2022), and other species of tree outside of the Myrtaceae family. This measurable attribute is included in the MHQA method in the calculation of *Quality and availability of food and foraging habitat,* and *Quality and availability of shelter.*

- **shrub cover (score out of 5) –** The methodology for the above tree canopy intercept is repeated for the shrub layer. Both methods include recording the intercept of exotic species, which are otherwise excluded from traditional BioCondition methods and analysis. This inclusion is incorporated into the MHQA assessment in the calculation of *Species Mobility Capacity*.

- **native perennial grass cover (score out of 5) –** Native grass cover is measured within five 1*1m quadrats along the transect line in the 50*10m plot. Native grass cover is assessed by a downward vertical observation of the quadrat, where the percentage cover is estimated for each quadrat placed, then averaged across the plot to give a total estimate to compare against the benchmark value. The entire ground cover within the quadrat is estimated into categories within a set table, but only native grass cover and organic litter are compared against benchmark values. Each quadrat table result should equal 100% of cover. 1x1m quadrats are placed on alternate sides of the quadrat tape each time, every 10m, creating 5 five sites of recording within the 50m plot.

- **organic litter (score out of 5) –** Organic litter is measured the same way as the above ground cover attribute, native perennial grass. Organic litter provides habitat for ground dwelling wildlife and is a factor in erosion prevention and the carbon cycle.

- **large tree measures (score out of 15) –** The number of large trees, defined by the DBH (diameter at breast height) outlined per Regional Ecosystem in the BioCondition benchmark document, are measured in the total 100*50m plot area. Both eucalypt and non-eucalypt species may be recorded depending on the RE benchmark value. A total large tree score is derived as a per hectare value. The number of large trees may be used as a proxy for tree-hollows for the measure and assessment of habitat suitability and quality for relevant protected matters e.g. Greater Glider (*Petauroides volans*). This measurable attribute may therefore be included in the MHQA method in the calculation of *Quality and availability of food and foraging habitat,* and *Quality and availability of shelter.*

- **coarse woody debris (score out of 5) –** Within the 50*20m plot area, coarse woody debris (CWD), defined by the BioCondition Assessment Framework as logs or dead timber that is larger than 100mm in diameter and greater 50cm in length, is tallied then multiplied by 10 to produce a per hectare value for benchmark comparison. The measure of CWD may be used as a proxy for the assessment of habitat suitability and quality for relevant protected matters, especially those which are obligate ground dwellers e.g. Dunmall's snake

(*Furina dunmalli*). This measurable attribute may therefore be included in the MHQA method in the calculation of *Quality and availability of food and foraging habitat,* and *Quality and availability of shelter.*

- **non-native plant cover (score out of 10) –** A species count of all non-native flora is completed within the 50*10m plot, alongside the native shrub, grass and forb richness recordings. The measure of non-native plant cover is representative of the cumulative non-native biomass at each structural layer. However, the BioCondition manual does not prescribe the method by which to estimate non-native plant cover. To achieve a methodical and repeatable estimate of non-native plant cover, the 50*10 m plot is divided into five 10*10 subplots. Within each subplot, the cover of each non-native species is estimated according to each species which contributes to greater than 2% of cover. The exclusion of species which occur in less than 2% of area is based on the practicality of undertaking the assessment and the assumption that the proportion of species which are either small, inconspicuous, or low in abundance, are of less relevance to the intention of the scoring and subsequent application to MHQA methods. The average estimated cover of each non-native flora species is found for the greater 50*10 m plot. Detail of exotic flora species cover may be used in the interpretation of habitat suitability and quality. This measurable attribute may therefore be included in the MHQA method in the calculation of *Quality and availability of food and foraging habitat,* and *Quality and availability of shelter.*

For the assessment of fauna habitat, an additional two (2) site-based ecological attributes are measured using a series of specifically designed ecological indicators. Each attribute contributes a score of 10 to overall site condition.

- quality and availability of food and foraging habitat – 10
- quality and availability of shelter – 10

Ecological indicators have been designed and ecologically justified based on the review and consideration of relevant information in the following documents:

- Department of Agriculture, Water and the Environment (2022). Conservation Advice for *Phascolarctos cinereus* (Koala) combined populations of Queensland, New South Wales and the Australian Capital Territory. Canberra: Department of Agriculture, Water and the Environment.
- DAWE 2022, National Recovery plan for the Koala *(Phascolarctos cinereus)*: *Phascolarctos cinereus* (combined populations of Queensland, New South Wales and the Australian Capital Territory). Department of Agriculture, Water and the Environment, Canberra. March 2022. CC BY 4.0.
- Youngentob, K.N, Marsh, K.F., Skewes, J., (2021) A review of Koala *(Phascolarctos cinereus)* habitat assessment criteria and methods, report prepared for the Department of Agriculture, Water and the Environment, Canberra, November. CC BY 4.0.
- Information and documents have been accessed from the Species Profile and Threats Database, available at http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl

The calculation of habitat quality has been undertaken in accordance the Guide to determining terrestrial habitat quality version 1.2. (Department of Environment and Heritage Protection, 2017). Ecological indicators are listed and justified in **Table 25** and **Table 26**.

The total score for each ecological attribute is converted to a score out of 100, and then scored in accordance with "*Table 4: Species Habitat Index Scoring Guide*" from the Guide to determining terrestrial habitat quality version 1.2. (Department of Environment and Heritage Protection, 2017). **Table 27** below describes the scoring scale applied to achieve this.

6.1.5.1.1 Limitations to the methodology

It is recognised that Youngentob et al. (2021) specifically recommends against excluding Koala *(Phascolarctos cinereus)* forage trees which are 100 mm DBH and less. The following ecological metrics strictly consider trees of 100 mm DBH and more, and do not consider height. The following methodology operates under the assumption that a tree of 100 mm DBH will typically be of a suitable height to Koala *(Phascolarctos cinereus)*, i.e. greater than four metres. The collection of stem count information within a BioCondition plot, as well as other Koala *(Phascolarctos cinereus)* habitat metrics, contributes to the accumulation of significant additional survey effort. The further collection of DBH and height information of stems less than 100 mm DBH would result in even more time spent undertaking data collection and data processing post-field survey. In the interest of collecting meaningful

data and being cognisant of reasonable time spent undertaking data collection and processing and using that data to demonstrate ecological change over time, trees are considered to be available to Koala *(Phascolarctos cinereus)* where they exceed 100 mm DBH.

Given habitat can be suitable to Koala *(Phascolarctos cinereus)* where it is in relatively poor ecological condition, i.e. small and infrequent trees, an effective habitat scoring method should be designed in such a way that it can demonstrate improvement over time. Suitable forage trees which occur within the plot but are less than 100 mm DBH, will theoretically become available and contribute to scoring over time.

Furthermore, vegetation condition as per the BioCondition assessment will capture all trees which are relevant to the 13 measurable attributes. Average stem count information relating to individual REs is used to score specific ecological indicators of Koala *(Phascolarctos cinereus)* habitat, as described in **Table 25** below. Information was obtained from the either the latest publication of the Regional Ecosystem Database Description (REDD) version 13.1, or through direct consultation with the Queensland Herbarium (State of Queensland as represented by the Queensland Herbarium, Department of Environment, Science and Innovation) who have provided draft technical descriptions of relevant REs.

Table 25: Koala *(Phascolarctos cinereus)* scoring indices

Attribute	Ecological Indicator	Scoring Metric	Justification for inclusion
1. Quality and availability of food and foraging habitat	(1.a) Proportion of canopy cover of LIKT trees within the 100x50 metre BioCondition plot	**0** - Site is absent of trees i.e. entirely cleared 1 - 1-5% of extant tree canopy cover (cumulative T1 and T2, where trees reach/exceed 100 mm DBH) belongs to LIKT species **5** - 6-15% of extant tree canopy cover (cumulative T1 and T2, where trees reach/exceed 100 mm DBH) belongs to LIKT species **10** - 16-25% extant tree canopy cover (cumulative T1 and T2, where trees reach/exceed 100 mm DBH) belongs to LIKT species **15** - 26-50% extant tree canopy cover (cumulative T1 and T2, where trees reach/exceed 100 mm DBH) belongs to LIKT species **20** - >50% extant canopy cover (cumulative T1 and T2, where trees reach/exceed 100 mm DBH) belongs to LIKT species	This ecological indicator is indicative of the availability of forage resources i.e. palatable foliage. This indicator looks at the proportion of canopy which is available for Koala *(Phascolarctos cinereus)* to forage on. Given the number of trees required to sustain a single Koala *(Phascolarctos cinereus)* or a population is not well understood in literature and likely varies significantly between locations based on the nutritional quality and palatability of the browse, a conservative approach is taken through the adoption of a high score being assigned to as >50% proportional canopy is palatable. The percentage of cumulative canopy cover (trees greater than 100 mm DBH) measured along the 100m transect line which is made-up of LIKT (Youngentob *et al*., 2021) species is scored to assign a high score where a greater proportion of the canopy within a habitat belongs to that of foraging resources. This is justified through evidence-based discussion in Youngentob *et al*. (2021) which states that research has demonstrated that increasing the relative abundance of less palatable browse in a landscape reduces the density and likelihood of Koalas *(Phascolarctos cinereus)* occurring in that landscape. A high score (20) is assigned if a site contains majority LIKT species within the cumulative canopies. A Eucalyptus woodland which is analogous to benchmark standards typically supports a majority LIKT canopy (i.e. >50% of trees are LIKTs). Circumstances under which this might not occur, are where a canopy may be Eucalyptus dominant but not made up of listed LIKT for the specific region e.g. Eucalyptus melliodora. In this case the site would score lower and therefore be accurately indicative of less available foraging resources.
	(1.b) Tree density of listed LIKT species (per hectare stem count of LIKT species within the 100x 50 metre BioCondition plot)	**0** - 0% **5** - 1-25% of RE technical description stem count average (T1/T2) belongs to LIKT species **10** - 26-50% of RE technical description stem count average (T1/T2) belongs to LIKT species	This attribute looks at the stem count (sum of T1 and T2 average taken from the relevant Regional Ecosystem technical description) of LIKTs within the BioCondition plot. The inclusion of this attribute aims to capture the density of foraging resources and provide a balance to the measure of *proportion of canopy cover*. Although a canopy may predominantly belong to LIKT species, the quantity of those resources is not captured in the above metric. The availability of forage habitat is inherently correlated with the density of suitable foraging trees, i.e. more trees => more foliage => more forage resources. Koala *(Phascolarctos cinereus)* is known to favour small to medium-size trees for foraging, and large trees for sitting, hence stem count opposed to large tree counts are built upon to capture forage habitat

Attribute	Ecological Indicator	Scoring Metric	Justification for inclusion
		15 - 51-75% of RE technical description stem count average (T1/T2) belongs to LIKT species **20** - >75% of RE technical description stem count average (T1/T2) belongs to LIKT species	*availability*. All LIKT stems >100mm DBH are counted within the 50x20m plot and extrapolated to find the per hectare value. Only listed feed trees (LIKT) in Youngentob *et al*. (2021) for the relevant region are included in this attribute.
	(1.c) Forage tree species richness (LIKTs per Youngentob *et al*., 2021) (Only trees >100 DBH)	**0** - 0 Locally Important Koala Tree species **5** - 1-3 Locally Important Koala Tree species **10** - 4+Locally Important Tree species	Although Koala *(Phascolarctos cinereus)* can sustainably occupy monoculture habitats and not experience a decrease in condition / fitness, a more diverse habitat will inherently be more resilient to habitat/climate stressors. Habitat is arguably of higher quality where it is more resilient, which is especially relevant in the current climate *change* scenarios. Therefore, a site will score higher where there is more diversity of LIKTs. Further, tree species will likely experience new growth during different months. By extension, a more diverse habitat has the potential to offer young and more palatable growth for a greater portion of time compared with dominant canopy of a single LIKT. Because Koala *(Phascolarctos cinereus)* is not known to select habitat based on tree heterogeneity, this indicator contributes a smaller score 'weighting' for the overall score of Quality and availability of food and foraging habitat.
	(1.d) Recruitment of T1 and T2 layer LIKT species (% of total LIKT species diversity within plot).	**0** - 0 **1** - 1-33% **5** - 34-66% **10** - 67-100%	This ecological indicator captures the health of foraging resources, i.e. the quality, through the consideration of species regeneration. A species is considered a component of the T1 and T2 layer where it exceeds 100 mm DBH, irrespective of height. The measure of recruitment is the proportion of species in the T1 and T2 layer which have sapling regrowth. Given good quality Koala *(Phascolarctos cinereus)* habitat can occur as single species' dominant woodland, this attribute is weighted lower than others.
2. Quality and availability of shelter	(2.a) Presence of preferred ancillary trees within the 100x50 metre BioCondition plot (listed for relevant Bioregion in Youngentob *et al*., 2021)	**0** - no observed listed ancillary trees within direct landscape, OR, ancillary trees are less than 100 mm DBH and therefore are not considered available as sitting trees. **1** - 1 or more species of listed ancillary trees within plot, tree/s are between 100-300mm DBH.	Ancillary trees are important habitat for Koala *(Phascolarctos cinereus)* as day-time rest sites, as well as mobility aids in-between patches of more preferrable forage trees (Youngentob *et al.,* 2021). The diversity of ancillary tree species is not yet demonstrated to be an important factor to Koala *(Phascolarctos cinereus)* habitat selection, rather, certain species of trees are observed to be favoured as sitting trees due to thermal regulation properties (Youngentob *et al.,* 2021). Large ancillary trees typically have an infrequent distribution in a landscape. Species abundance and diversity within a BioCondition plot therefore does

Attribute	Ecological Indicator	Scoring Metric	Justification for inclusion
		5 - 1 or more species of listed ancillary trees within plot, at least one tree is >300mm DBH. **10** - 1 or more species of listed ancillary trees within plot, with variable DBH measures: at least one tree exceeds 450mm.	not necessarily correlate with *quality and availability of shelter*. The number of species is not a product of this score. Instead, the score captures the quality of ancillary or other "sitting" trees within the local landscape by means of tree size. Koala *(Phascolarctos cinereus)* are known to forage in small trees (100 mm DBH) but day-time rest sites are often in larger trees (Youngentob *et al.,* 2021).; therefore, ancillary trees could be expected to have greater habitat value where they are larger. A DBH of 450 mm is used as a surrogate for a 'large tree threshold'. As large tree threshold for Koala *(Phascolarctos cinereus)* habitat REs in SEQ are often greater than 450 mm DBH, 450 has been adopted as a fair but conservative benchmark for the metric. A single large tree will attain the high score. This metric is effective in the scaling of habitat condition on the basis that it is likely a habitat patch will contain ancillary trees, however, it is less likely a patch will contain a very large ancillary tree, which is suggested in literature to be preferred.
	(2.b) Canopy cover of all native trees within the 100x50 metre BioCondition plot	**0** - Site is absent of trees i.e. entirely cleared **1** - 1-10% of benchmark canopy cover value for corresponding RE **5** - 11-30% of benchmark canopy cover value for corresponding RE **10** - 31-50% of benchmark canopy cover value for corresponding RE **15** - 50-89% of benchmark canopy cover value for corresponding RE **20** - >90% of benchmark canopy cover value for corresponding RE	This score is designed to capture the ability of a habitat (referencing extant BioCondition benchmark values) to provide general shelter to Koala *(Phascolarctos cinereus)*. A high score is achieved where the canopy cover of the habitat is within 90% of benchmarked RE values. Only native trees are scored for this indicator so that the infestation of weeds may incidentally result in a reduced score. This ensures habitat quality is not falsely inflated.
	(2.c) Tree density (per hectare stem count) of all native tree species which contribute to the emergent, canopy, and subcanopy layers and exceed 100mm DBH. Stem counts are	**0** - 0% **5** - 1-25% of technical description stem count average (cumulative T1/T2) **10** - 26-50% of technical description stem count average (cumulative T1/T2)	The availability of shelter is inherently correlated with the density of suitably sized trees. All stems >100mm DBH within the T1 and T2 canopy layers are counted within the 50x20m plot and extrapolated to find the per hectare value. The total stem count number is compared to that of the corresponded RE technical description (latest version). Only stems greater than 100 mm

Attribute	Ecological Indicator	Scoring Metric	Justification for inclusion
	compared against the cumulative T1 and T2 stem count averages (average T1 + average T2) for the relevant RE (as per the REDD technical descriptions).	**15** - 51-75% of technical description stem count average (cumulative T1/T2) **20** - >75% of technical description stem count average (cumulative T1/T2)	DBH are considered to contribute to the T1 or T2 layer, irrespective of height.
	(2.d) Recruitment of listed LIKT and Ancillary trees species which contribute to the T1 and T2 layers	**0** - 0 **1** - 1-33% **5** - 34-66% **10** - 67-100%	This ecological indicator captures the health of the habitat, i.e. the quality, through the consideration of species regeneration for trees listed as either LIKT or ancillary under the relevant table in Youngentob et al. (2022). A species is considered a component of the T1 and T2 layer where it exceeds 100 mm DBH, irrespective of height and species. The measure of recruitment is the proportion of species in the T1 and T2 layer which have sapling regrowth. Given good quality Koala *(Phascolarctos cinereus)* habitat can occur as single species' dominant woodland, this attribute is weighted lower than others.
	(2.e) Proximity to habitat refugia	**1** - located >1,000m from watercourses of stream order 2 and higher **5** - located between 1,000m and 300 m from watercourses of stream order 2 and higher **10** - located <300 m from of watercourses of stream order 2 and higher	The quality of habitat to support Koala *(Phascolarctos cinereus)* during climatic stressors is a product of foliage nutrition and moisture content. Youngentob *et al.* (2021) state that soil quality is not indicative of nutritional value within feed tree foliage. Tree access to water (through watercourse/dam/high water table) is more indicative of foliage quality within a given habitat. Habitat refugia is habitat which can continue to support Koala *(Phascolarctos cinereus)* during periods of climatic stress such as heatwaves and drought. Habitat refugia is therefore scored according to a sites proximity to a water source which would theoretically improve the quality of foliage and thereby act as refuge during climate stresses which otherwise result in Matter-area quality reduction. This ecological indicator is scored according to the location of each unique BioCondition transect. The distance from the 50 m point is measured to the nearest suitable water source.

Table 26: Ecological attribute scoring scale

Scale applied to resulting score out of 100	Score adopted from "*Table 4: Species Habitat Index Scoring Guide*"	
between 0 and 30% of total attribute score	1	poor
between 31 and 79% of total attribute score	5	moderate
greater than 80% of total attribute score	10	high

6.1.5.2 Site Context (30%)

The site context assessment deals with the site and its adjacent surroundings. Site context is measured using a suite of attributes to describe the location of the habitat within the surrounding landscape and the influence of its associated threats. The suite of attributes measured to score site context is initially determined according to whether the subregion is either fragmented or in-tact. An in-tact subregion is defined as containing less than 30% non-remnant vegetation, whereas fragmented subregions, are defined as containing 30-95% non-remnant vegetation. Majority of subregions within the South-East Queensland Bioregion are considered to be fragmented, with the exception of Great Sandy (SEQ09) subregion.

The Project Area is situated within the Moreton Basin (SEQ02) subregion, and as such has been assessed as fragmented according to the *Guide to Determining Terrestrial Habitat Quality (v1.2)* (DEHP, 2017). The assessment therefore considers the influence of adjacent vegetated areas and ecological corridors. The following four landscape scale attributes are measured and scored in accordance with *Section 6* and *Table 3 Context Scoring Sheet Guide* of the *Guide to Determining Terrestrial Habitat Quality (v1.2)* (DEHP, 2017):

- Size of patch
- Connectedness
- Context
- Ecological corridors

A reproduction of the table is included as **Table 27** below. The attribute of '*distance to permanent water*' is scored in replacement of attributes one, two, and three where a subregion is determined to be in-tact.

Table 27: Reproduction of *Table 3 Context scoring sheet guide* from the Guide to determining terrestrial habitat quality v1.2

Attribute	Scoring metrics / scale					
Size of Patch	Score	0	2	5	7	10
	Description	<5 ha	2-25 ha	26-100 ha	101-200 ha	>200 ha
Connectedness	Score	0	2	4	5	
	Description	0%-10%	>10%-50%	50%-75%	>75% or >500 ha	
Context	Score	0	2	4	5	
	Description	<10%	>10%-30%	>30%-75%	>75%	
	Score	0	2	5	10	20

Attribute	Scoring metrics / scale					
Distance to permanent watering point (in-tact landscapes only)	Description	0-500 m	>500 m – 1 km	>1 km – 3 km	>3 km – 5 km	>5 km
Ecological corridors	Score	0	4	6		
	Description	Not within	Sharing a common boundary	Within (whole or part)		

An additional three attributes are adopted and scored under the commonwealth Modified Habitat Quality Assessment (MHQA) method. These include the following:

- role of site location to species overall population in the state
- threats to the species
- species mobility capacity.

Unlike the traditional habitat quality assessment methodology where landscape attributes are assessed against the surrounding remnant vegetation only, the MHQA assesses the surrounding vegetation mapped as either Category A, B, or C under the latest version of the Regulated Vegetation Management Map v7.2[35]. Ecological survey effort associated with the project did not extend outside of the referral area, and as such the extent and quality of broader landscape habitat cannot be accounted for. Given Koala *(Phascolarctos cinereus)* are known to move through and utilise habitats of variable quality, such as agricultural paddocks and rest in non-feed trees, the quality of connected habitat is not considered.

For the purposes of landscape analysis and the contextual consideration of connected Koala *(Phascolarctos cinereus)* habitat, all wooded vegetation communities are considered to serve as connective habitat. Non-wooded areas, i.e. non-remnant areas, are excluded from the analysis as their condition and suitability to even that of dispersal function cannot be guaranteed. All relevant Regulated Vegetation polygons which are directly and continuously connected with the entire mapped matter area contribute towards to scoring of landscape attributes.

6.1.5.2.1 Patch Size

The calculation of the area of the patch size generally applies the method outlined in the BioCondition assessment manual v2.2 that considers the patch to be areas connected by corridors greater than 200 m wide within a 1 km radius of the site. For the calculation of patch size, vegetation mapped as either Category A, B, or C under the latest version of the Regulated Vegetation Management Map v7.2 is considered to contribute to the *patch*. All state mapped polygons which are directly and continuously connected with the boundary of the matter area contribute towards to accumulation of patch size. A single patch size score is assigned for the matter area.

6.1.5.2.2 Connectedness

Connectivity relates to the capacity that the species have to disperse through the landscape. The attribute is calculated using GIS by measuring the length of Koala *(Phascolarctos cinereus)* habitat that is along the boundary of the site. As discussed above, Koala *(Phascolarctos cinereus)* habitat is considered to be all wooded regional ecosystems mapped as either Category A, B, or C under the Regulated Vegetation Management Map. A single connectedness score is assigned for the matter area

6.1.5.2.3 Context

The context score is calculated by GIS to quantify the amount of vegetation immediately surrounding the assessment site. The attribute is measured by the percentage of Koala *(Phascolarctos cinereus)* habitat within a 1 km buffer of the Referral Area boundary. As discussed above, Koala *(Phascolarctos cinereus)* habitat is considered

[35] The regulated vegetation management map as defined by s20A of the Vegetation Management Act 1999.

to be all wooded regional ecosystems mapped as either Category A, B, or C under the Regulated Vegetation Management Map. A single context score is assigned for the matter area.

6.1.5.2.4 Ecological Corridors

This attribute is scored in accordance with the *Guide to Determining Terrestrial Habitat Quality (v1.2)* (DEHP, 2017) and is used to determine if a site is located within or shares a boundary with an ecological corridor that facilitates long term ecosystem function by connecting large patches of remnant vegetation with sufficient tract size (corridor width in relation to the fragmentation of the landscape) (EHP 2014). These corridors are relevant to the quality of a habitat patch by means of aiding in widespread connectivity, which is especially relevant in a landscape such as South-East Queensland which is increasingly fragmented.

Widespread connectivity facilitates the dispersal of individuals, thereby contributing to the maintenance of genetic variability within the species' population and ultimately species fitness and adaptability in a continuously changing environment. Ecological corridors have been mapped by the Queensland State Government under the 'CORR_TYPE' attribute table. The mapping can also be viewed on Queensland Globe in the 'Statewide Biodiversity Corridors' layer. A single corridor score is assigned for the matter area.

6.1.5.2.5 Role of site location to species overall population in the state

This attribute is based on the observed role of the site in relation to the overall population of the species. The scoring table considers the species' use of the site – such as whether it is used for feeding and/or nesting and the effect that damage to or removal of the site would have to the likelihood of the species' overall population survival. As surrogate for scoring this attribute, the MHQA requests habitat critical to the survival of the species be assessed. Critical habitat is assessed in accordance with species specific conservation advice, national recovery plan, or other relevant available literature cited by NEPA on the SPRAT database. A score is then produced in accordance with *Table 4 – species habitat index scoring guide* from the *Guide to Determining Terrestrial Habitat Quality (v1.2)* (DEHP, 2017).

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. 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.

Habitat critical to the survival of Koala *(Phascolarctos cinereus)* was scored in accordance with **Table 28** below.

Table 28: Reproduction of *Table 4 Species habitat index scoring guide* from the Guide to determining terrestrial habitat quality v1.2

Attribute	Score			
Role of site location to species overall population in the state	**Score Description**	1	4	5
		Not or unlikely to be critical to species' survival	Likely to be critical to species' survival	Critical to species survival

6.1.5.2.6 Threats to species

The assessment of threats has been undertaken on the matter area scale, i.e. the MNES impact or offset area subject of this report. Threatening processes considered and adopted in the assessment of threats specific to Koala are taken from the following approved literature:

- DAWE (2022), *National Recovery plan for the Koala: Phascolarctos cinereus (combined populations of Queensland, New South Wales and the Australian Capital Territory).* Department of Agriculture, Water and the Environment, Canberra.
- DAWE (2022), *Conservation Advice for Phascolarctos cinereus (Koala) combined populations of Queensland, New South Wales and the Australian Capital Territory*. Department of Agriculture, Water and the Environment, Canberra.

The complete list of identified threatening processes to Koala are detailed in Table 1 of the approved Conservation Advice (DAWE, 2002a). Listed threatening processes which are considered to be present within the subject area (i.e. the impact or offset area subject of this report) and which are appropriately measurable are assessed as a component of habitat quality scoring. A subset of relevant threatening processes are therefore considered and listed below, with detailed described and scoring metrics provide in **Table 29**:

- Altered fire regimes;
- mortality from dogs;
- mortality from vehicles; and,
- habitat loss, fragmentation, and degradation.

Threatening processes to MNES are rarely spatially or temporally restricted, thus are inherently difficult to accurately capture and quantifiably measure. Each assessable threatening process is scored on the scale adopted from *Table 4 – species habitat index scoring guide* from the *Guide to Determining Terrestrial Habitat Quality (v1.2)* (DEHP, 2017), which assigns a score of either 1 (high level of threats), 7(moderate level of threats), or 15 (low level of threats). Unique scoring metrics are designed to establish a measurable and repeatable framework for the comparison of threatening processes over time.

Table 2 from the Approved Conservation Advice for the Koala (DAWE, 2022a) identifies substantial differences in the relative risk posed by individual listed threatening processes. Landscape level threatening processes such as habitat loss, habitat fragmentation, and increased frequency of high-intensity bushfire, are ranked with higher severity, reflecting their broad spatial extent and capacity to cause widespread population decline. In contrast, encounter mortality from vehicles and dogs is ranked lower, recognising impacts are incurred on an individual scale opposed to population scale. The scoring of site-based threats has therefore adopted a proportional weighting system, reflective of the risk matrix results presented in Table 2 of the Conservation Advice. Six ecological indicators are designed and scored to inform the measure of the four assessable threatening processes to Koala. **Table 29** below details each assessed threatening process, their justification for inclusion, relative scoring weight, and unique scoring metrics. **Table 30** illustrates the supplementary scoring table which is used to assess the measurable threatening processes within the MHQA scoring spreadsheets. A final score of 15 results from the scoring of the six ecological indicators, which is then scaled to fit into *Table 4 – species habitat index scoring guide* from the *Guide to Determining Terrestrial Habitat Quality (v1.2)* (DEHP, 2017).

Table 29: Threatening processes scoring method

Listed threatening process	Justification for inclusion in accordance with description under the conservation advice	indicator weighting	indicator description	Indicator scoring method	Indicator scoring metric
Altered fire regime	Altered fire regimes have been considered in the Koala MHQA threat score because inappropriate fire frequency, severity, extent and season can directly affect Koala survival, habitat condition and local population recovery. The approved conservation advice identifies increased intensity and frequency of bushfire as a known, severe and increasing threat to the listed Koala, with high-severity fire associated with canopy scorch, post-fire absence or reduced occupancy, and extended recovery timeframes. Fire can also reduce food and shelter availability, alter vegetation structure and forage quality, and compound other threats including drought, fragmentation, predation and disease.	30%	**Fuel hazard rating** Fuel hazard monitoring will be undertaken in accordance with the *Overall Fuel Hazard Assessment Guide* (Hines et al. 2010). The methodology provides a rapid, standardised approach for assessing the structure and arrangement of combustible vegetation that influences bushfire behaviour and allows fuel hazard to be monitored consistently over time. At each monitoring site, fuel hazard will be visually assessed within each of the four fuel strata defined by Hines et al. (2010): ▪ **Surface fuels** – comprising leaf litter, bark, twigs and fine woody debris on the ground; ▪ **Near-surface fuels** – including grasses, herbs and low shrubs immediately above the litter layer; ▪ **Elevated fuels** – consisting of shrubs, suspended dead material and vegetation extending above the near-surface layer but below the canopy; and ▪ **Bark fuels** – assessing the quantity, type and continuity of bark retained on standing trees.	Fuel hazard monitoring will be undertaken in accordance with the *Overall Fuel Hazard Assessment Guide* (Hines et al. 2010). Permanent fuel hazard monitoring sites will be co-located with habitat quality monitoring sites. Hazard ratings for each fuel stratum (surface, near-surface, elevated and bark fuels) will be assigned by comparing field observations with the descriptive criteria and photographic standards presented in *Table 8.1* of the *Overall Fuel Hazard Assessment Guide*. Individual hazard ratings will then be combined, in accordance with the guide, to derive an overall fuel hazard rating for each monitoring site, classified as *Low*, *Moderate*, *High*, *Very High* or *Extreme*	**1 –** Extreme or Very High fuel hazard rating **7 –** Moderate or High fuel hazard rating **15 –** Low fuel hazard rating

Listed threatening process	Justification for inclusion in accordance with description under the conservation advice	indicator weighting	indicator description	Indicator scoring method	Indicator scoring metric
			Each fuel stratum will be assigned a hazard rating using the assessment criteria provided in the *Overall Fuel Hazard Assessment Guide*, considering attributes such as fuel quantity, continuity, cover, height and arrangement.		
Mortality from dogs	Mortality from dogs has been considered in the Koala MHQA threat score because dog attack is a recognised cause of Koala injury and mortality, particularly where habitat occurs in or near peri-urban, rural-residential or fragmented landscapes. The approved conservation advice identifies dog attacks as a significant cause of death and injury for Koalas, particularly in areas within and adjacent to residential development, and notes that individuals killed by vehicles or dogs are often otherwise healthy breeding animals. Dogs also present a higher risk where Koalas are required to move across open ground between habitat patches, through backyards, along access tracks or near areas of human activity.	15% (calculated from equal weighting of each indicator)	**Wild dog activity index** This indicator is adopted from the Vertebrate Pest Management Plan (VPMP). Results of vertebrate pest monitoring, specifically wild/domestic dog, will be used to score 'mortality from dogs' to Koala. A detailed methodology and data analysis description can be found within the VPMP and Section 6.8.2 in the Woolshed OMP, and Section 6.6.2 of the Thagoona OMP.	Camera trap data will be analysed to record each encounter with wild/domestic dog. The results provide a species-specific *activity index* which allows for a comparative platform between monitoring events. The activity index will be categorised into an activity scale; absent 0, very low 1-15, low 16-38, moderate 39-75, high 76-113, and very high ≥114.	**1 –** An activity index score of very high or high **7 –** An activity index score of low or medium **15 –** An activity index score of absent or very low
			Evidence of wild dog (evidence includes tracks, scats, incidental observations, and anecdotal evidence such as landholder discussion) This indicator is more qualitative and takes into consideration that credible evidence of wild dog may be difficult to collect during limited ecological survey effort. Often landholder discussion provides valuable insight into property history, however, is not always demonstrated through data.	This indicator is scored post ecological survey. A low score is awarded where credible traces of wild/domestic dog are detected on site, as this is likely indicative of the site forming a component of territory. A moderate score is awarded where evidence is largely anecdotal i.e. discussion based with landholders. A high score is awarded where no traces of wild dog are detected on site,	**1 -** Traces of dogs detected through scats and/or tracks **7 –** Anecdotal evidence (i.e. landholder and/or local community discussion) **15 -** No traces of wild dog are detected on site / no anecdotal evidence

Listed threatening process	Justification for inclusion in accordance with description under the conservation advice	indicator weighting	indicator description	Indicator scoring method	Indicator scoring metric
			The inclusion of this second metric to score risk of mortality from dogs, is to capture evidence that can be easily missed through more quantifiable survey methods (i.e. camera survey).	and landholders are not aware of their presence in the area.	
Mortality from vehicles	Mortality from vehicles has been considered in the Koala MHQA threat score because road collisions are a significant source of injury and death for Koalas, particularly in areas where transport infrastructure intersects occupied habitat. The approved conservation advice identifies vehicle strike as a known and ongoing threat, with mortality increasing as urban development and road networks expand into Koala habitat. Vehicle collisions disproportionately remove otherwise healthy individuals, including breeding adults and dispersing juveniles, reducing population viability and genetic connectivity. This threat is particularly significant during post-weaning dispersal and the breeding season, when Koalas undertake greater movements and are more likely to encounter roads.	15% (calculated from equal weighting of each indicator)	**Percentage (%) of site bounded by roads.** This indicator assesses the degree of property edges which are either intersected by a road or run parallel with a road. It is recognised that this indicator may not change between offset monitoring years, however, will theoretically capture where new developments may affect the risk of vehicle interactions with koala which occupy habitat within the site. Queensland planning guidelines, including the Queensland Koala-sensitive Design Guideline (DES, 2022), adopts a 200 m threshold to define highly connected habitat patches. This value appears to represent a planning proxy based on the upper limit of typical daily movement distances reported for Koalas in radio-telemetry studies (McAlpine et al., 2007). Koala habitat patches which are within 200 metres of one another are considered to be highly connected. A road is therefore considered to pose a risk where it is situated within 200 metres from the Site edge. A 200 m threshold has therefore been adopted for the consideration of where a resident koala may interact with a near-by road.	The presence of and distance to roads is measured using appropriate spatial software which can view and interrogate the most up to date spatial layers available from the Queensland Spatial Catalogue. In the absence of updated *Queensland Roads and Tracks* data, new roads will be ground-truthed during ecological survey.	**1 -** >75% of Site boundary is either bounded by roads (within 200 meters) or intersects with roads **7 -** 16-75% of Site boundary is either bounded by roads (within 200 meters) or intersects with roads. **15 -** <15% of Site boundary is either bounded by roads (within 200 meters) or intersects with roads.

Listed threatening process	Justification for inclusion in accordance with description under the conservation advice	indicator weighting	indicator description	Indicator scoring method	Indicator scoring metric
			Type of road The type of road, which is situated within 200 of the Site boundary, is relevant to the degree of risk incurred to resident Koala. The assumption is made that increased volume of traffic is positively correlated with risk of vehicle strike and subsequent mortality risk to Koala. The scoring metrics have be designed to reflect this scale.	Scored based on ground-truthed inspection on relevant roads, spatial data information, or traffic information sourced from relevant local Councils. Score decision should be justified within reports, with corresponding scores reflected throughout HMQA scoring spreadsheets.	**1 -** Highway / motorway / predictable high traffic **7 –** Street / main road / moderate traffic and/or busy during peak hour **15 –** Unsealed / low and/or occasional traffic
Habitat loss, fragmentation, and degradation	Habitat loss, fragmentation and degradation have been considered in the Koala MHQA threat score because they reduce the extent, quality and connectivity of habitat required to support Koala populations and movement. The approved conservation advice identifies habitat clearing associated with agriculture, grazing, urbanisation, timber harvesting and mining as one of the primary drivers of Koala decline across the species' range. More than 10,000 km² of forest and woodland within the Koala distribution was cleared between 2000 and 2017, with clearing for grazing accounting for the majority of habitat loss. Ongoing urban expansion, agricultural development and localised mining and energy projects continue to fragment habitat, reduce landscape connectivity and limit the availability of suitable foraging	40%	**Proportion of wooded vegetation** The proportion of wooded vegetation within the target Site is measured as a direct indicator of area subject to habitat loss, fragmentation, and degradation. For the purposes of this assessment, wooded vegetation is considered to be that which includes treed-habitat, where trees are 4 metres in height or greater. This indicator should not reflect regulated vegetation or council spatial mapping, it should be a product of ground truthed vegetation mapping at the time of survey.	Percentage of wooded vegetation within the subject site should reflect post survey ground-truthed vegetation mapping. Wooded areas should be the sum of assessment units which are categorised as either regrowth, advanced regrowth, or remnant condition wooded vegetation. The proportion of area, represented by percentage (%), is assessed against the scoring metrics.	**1 -** 0-25% wooded vegetation occupies the site **7 -** 26-75% wooded vegetation occupies the site **15 -** >75% wooded vegetation occupies the site

Listed threatening process	Justification for inclusion in accordance with description under the conservation advice	indicator weighting	indicator description	Indicator scoring method	Indicator scoring metric
	and shelter resources, particularly within regions that support significant Koala populations.				

Table 30: Threats - supplementary scoring table

Listed threatening process	Scoring indicator	Score		
		1	7	15
Altered fire regimes	Fuel hazard rating	Extreme or Very High fuel hazard rating	Moderate or High fuel hazard rating	Low fuel hazard rating
Mortality from dogs	Wild/domestic dog activity index	An activity index score of very high or high	An activity index score of low or medium	An activity index score of absent or very low
	Evidence of wild dog	Traces of dogs detected through scats and/or tracks	Anecdotal evidence (i.e. landholder and/or local community discussion)	No traces of wild dog are detected on site / no anecdotal evidence
Mortality from vehicles	Percentage of site bounded by roads.	>75% of Site boundary is either bounded by roads (within 200 meters) or intersects with roads	16-75% of Site boundary is either bounded by roads (within 200 meters) or intersects with roads.	<15% of Site boundary is either bounded by roads (within 200 meters) or intersects with roads.
	Type of road	Highway / motorway / high traffic	Street / main road / moderate traffic and/or busy during peak hour	Unsealed / low and/or occasional traffic
Habitat loss, fragmentation, and degradation	Proportion of wooded vegetation	0-25% wooded vegetation occupies the site	26-75% wooded vegetation occupies the site	>75% wooded vegetation occupies the site
Threats score out of 15				
Scaled score (1-5=1; 6-10=7; 11-15=15)				

6.1.5.2.7 Species' mobility capacity

The assessment on ground habitat is captured through the scoring of 'Species mobility capacity', which contributes 17% to the scoring component of site context. Koala move between trees and habitat by walking on the ground, and as such, the ground itself is considered to be an essential component of habitat quality scoring. The measure of species' mobility is assessed at the assessment unit scale, where each BioCondition transect site and corresponding vegetation patch (delineated by spatial ground-truthed vegetation mapping) are assessed for their capacity to facilitate species movement through the landscape.

In general, the approach to the scoring of Koala mobility has been designed to capture the variety of ground based barriers which often occur within a natural landscape, with specific consideration of urban and semi-rural lots within South East Queensland. Often, these semi-rural lots involve a variety of barriers, which may collectively contribute to mobility impacts. However, Koala is known to be resilient and resourceful in terms of movement and may climb fences, move under fences, between small spaces, cross roads, and more (Youngentob et al., 2022). With this in mind, it is difficult to develop quantifiable metrics to measure where a barrier impedes mobility too much. The assessment of species' mobility has therefore adopted both a qualitative and quantitative approach.

The following types of physical barriers are considered in the assessment of mobility, however, are not a complete and exhaustive list:

- Fencelines – Often barbed wire fences are used to border property or subdivide paddocks. Old and unmaintained fencing often falls, gets tangled, and vegetation grows into and through it creating a more solid and difficult barrier. In these circumstances, this is considered to be a barrier to koala movement more so than a maintain fenceline which koala are known to easily move under. Other fencelines which are considered to be barriers to Koala movement include pool fencing, brick fencing, or any structure which koala can move under, over, and around. The assessment of whether or not a fenceline acts as a barrier to Koala movement should be determined in-situ during ecological survey, and justified in the corresponding results section of the report.

- Watercourses – A watercourse may be considered a barrier where it is either improbable that a koala could cross, or crossing would at the very least be difficult and involve some degree of fitness loss based on the assumption of increase effort and energy expenditure to achieve a safe crossing. An example of a difficult to cross watercourse may include severely eroded and steep banks, deep and/or fast flowing water.

- Structural barriers – A structural barrier is inclusive of all physical human-made obstacles within an environment which are not naturally occurring. This is inclusive of structures such as houses/dwellings, old and abandoned buildings, agricultural sheds and pens, and more.

- Dams – Dams are not typically crossable by Koala, and thus do not contribute to crossable ground area. In the assessment of small semi-rural lots, dams may occupy a proportionally large space. For example, if ~80% of an assessment unit is attributed to either a large dam or multiple small dams, the percentage of usable area by Koala and/or number of natural pathways a Koala may use is reduced. For this reason, the presence of dams are considered a to be an example of a physical barrier to Koala movement within habitat.

- Exotic vegetated barriers – Vegetated barriers may include any non-indigenous flora which has become prolific in nature and has the ability to form physical barriers and impede koala movement on the ground. In South East Queensland this often includes *Latana camara*, which forms thick and impenetrable barriers through a landscape.

Two measurable ecological indicators have been described to be representative of the above listed common barriers to koala movement within South East Queensland. The measure of physical barriers such as fences, watercourses, structures, and dams, retains a high degree of qualitative assessment, whereby the assessor will make an observation based assessment at the time of survey.

Due to the innate difficulty in the repeatable measure of barriers of this nature, the metric is assigned a lower weighting compared with that of exotic vegetation barriers. Exotic vegetation cover is captured through two measures within the 28 South adapted BioCondition method (see **Section 6.1.5.1**), this includes the shrub layer intersect along the 100 m transect, and the non-native shrub cover within the 50x20 metre plot. The scoring of 'exotic vegetated barriers' against other listed barriers is assigned 67% compared with 33%. The weighting difference is justified through the measurability and repeatability of exotic vegetation cover, fostering a scoring

platform to demonstrate ecological change within a landscape as it relates to barriers which may prevent or impede koala movement.

The reduced weighting in comparison to that of 'exotic vegetated barriers' achieves an inflation effect on the scoring of mobility, whereby the majority of mobility score is a product of the measurable and repeatable assessment of vegetated barriers, and the score is inflated or deflated based on the presence and absence of general barriers to movement (assessed as 'Human made and biophysical barriers). Despite a qualitative scoring approach, the inclusion of the metric is considered to be of importance in the capture of human-influenced components in nature, which are difficult to systematically measure.

Table 31 below table details each barrier type (indicator) with contextual ecological description, as well as the corresponding specific scoring metrics and description (e.g. 1, 5, and 10). The combination of the two described ecological indicators in the measure of Koala mobility awards a maximum score of 30. The total mobility score is converted to a score out of 100, and then scored in accordance with "*Table 4: Species Habitat Index Scoring Guide*" from the Guide to determining terrestrial habitat quality version 1.2. (Department of Environment and Heritage Protection, 2017) (depicted in **Table 32** below). **Table 33** describes all possible scoring outcomes and subsequent scaling into one of the four mobility restriction categories.

Table 31: Koala *(Phascolarctos cinereus)* scoring indices for the measure of species' mobility

Ecological indicator	Weighting	Ecological reasoning	Scoring metrics
Human made and biophysical barriers – structures / fences / dams / watercourses	33%	Urban and semi-rural sites within South East Queensland are often subject to numerous human influenced barriers to Koala movement, or the exacerbation of other biophysical barriers. Where various types of barriers are either numerous or proportionally large through a site, Koala movement may be impeded. This ecological indicator should be scored unique to each assessment unit, and is designed to capture the mobility character of a habitat patch. Types of barriers include, but may not be entirely limited to, the following: - Various types of fencing which koala cannot climb or navigate e.g. barbed wire or smooth vertical bars. The condition of fences may also have effect, such as fallen barbed wire fencing which often becomes tangled with vegetation and forms larger barriers - Structural waste e.g. old buildings, sheds, cattle yards, or various agricultural equipment - Dams, particularly large dams - Watercourses which have become severely eroded and are no longer accessible for crossing - Watercourses which are permanent and moderate to high flowing - Other barriers to movement which are comparable to the above listed barriers. This ecological indicator is weighted 33% in the scoring of Koala mobility. A reduced weighting reflects the more qualitative structure of this metric, and the acceptance that the presence of the above mentioned barriers is unlikely to entirely prevent Koala movement through a site. The Metric is designed and included to capture the presence of barriers to koala movement, and categorise their impact into three broad categories: poor, moderate, and good. A result of poor mobility is depicted as a score of one, which is anticipated to translate to an assessment unit which is subject to an obvious and/or proportionally large barrier to movement.	**1** – A barrier occurs and occupies majority of the assessment unit (>50% of area), or the assessment unit by nature acts as a barrier to movement. A score of one is assigned where movement is impeded within the assessment unit beyond reasonable doubt. An example of this may be a large dam, a heavily eroded watercourse with steep banks, or an area which is subject to impassable fencing. **5** – A barrier occurs within a portion (less than 50% of the area) of an assessment unit, but does not impede movement entirely. A score of 5 should be assigned where it is probable that movement is impeded to some degree, however, the area of habitat is still usable by Koala in terms of movement between habitat trees, and in and out of the site. An example of score 5 is where an assessment unit may be subject to internal fencing, or small structures or physical barriers e.g. abandoned cattle processing pens and sheds **10** – No credible barriers occur within the assessment unit. The assessment unit reflects habitat which can be easily navigated by Koala.

Ecological indicator	Weighting	Ecological reasoning	Scoring metrics
		A result of moderate mobility is depicted as a score of 5, which is anticipated to translate to an assessment unit which is subject to less obvious barriers, but is similarly not representative of unimpeded habitat. Thus, a score of five is intended to capture all that is in-between 'very impeded' and 'not impeded at all' habitats. A result of high mobility is depicted as a score of 10, which is representative of habitat which is unaffected by barriers to Koala movement. Scoring metrics are described in more tangible detail in the following column.	
Exotic vegetated barriers	67%	Numerous exotic flora species proliferate throughout natural environments within South East Queensland. Specific species, such as *Lantana camara*, establish so severely that they can alter the structural formation of natural environments. Dense infestations of *Lantana camara* can impede koala movement by creating a thick understory which restricts access between habitat trees and reduces the ease with which koalas can move across the landscape. While koalas are capable of traversing areas containing lantana, extensive or dense thickets may increase energetic costs associated with ground movement and limit connectivity between habitat patches. Consequently, areas with high lantana cover may function as a partial barrier to movement, particularly where alternative movement pathways are limited. This ecological indicator is weighted 67% in the scoring of Koala mobility. An increased weighting reflects the more quantitative structure of this metric, which is a measurable site-based attribute imbedded within the BioCondition assessment methodology. This Metric is designed and included to capture the presence of more tangible barriers to koala movement which are measurable and practically remediable. The assessment of vegetated barriers (which is typically *Lantana camara* within SEQ environments) is therefore a measurable and repeatable metric in the assessment of Koala mobility scoring.	**1** - Greater than 80% cover of exotic shrub along the 100 metre BioCondition transect line. **7** - Between 51% and 80% cover of exotic shrub along the 100 metre BioCondition transect line. **15** - Between 11% and 50% cover of exotic shrub along the 100 metre BioCondition transect line. **20** - Equal to or less than 10% cover of exotic shrub along the 100 metre BioCondition transect line.

Table 32: Ecological attribute scoring scale

Scale applied to resulting score out of 100	Score adopted from "*Table 4: Species Habitat Index Scoring Guide*"	
0-25% of total Species mobility score	1	Severely restricted
26-50% of total Species mobility score	4	Highly restricted
51-75% of total Species mobility score	7	Moderately restricted
76-100% of total Species mobility score	10	Minor restriction

Table 33: Mobility scoring outcome matrix

Mobility scoring		Human made and biophysical barriers		
		1	**5**	**10**
Vegetated barriers	**1**	2 (6.7%)	6 (20.0%)	11 (36.7%)
	7	8 (26.7%)	12 (40.0%)	17 (56.7%)
	15	16 (53.3%)	20 (66.7%)	25 (83.3%)
	20	21 (70.0%)	25 (83.3%)	30 (100%)

6.1.5.3 Species Stocking Rate (40%)

The MHQA incorporates species stocking rate as an attribute not discussed under the traditional terrestrial habitat assessment methodology. Species stocking rates are estimates of the Koala *(Phascolarctos cinereus)* carrying capacity of the site at the time of undertaking the survey. Given the discreet nature of the Koala *(Phascolarctos cinereus)* and limited to no published literature on habitat carrying capacity of the species, 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 – evidence of Koala *(Phascolarctos cinereus)* in the form of scats or direct observation on or adjacent to the site.
- Species usage of the site (habitat type and evidenced usage) – in accordance with the definition of habitat critical to the survival of Koala (*National Recovery Plan for the Koala (Phascolarctos cinereus)* and whether utilisation was observed directly or inferred, from the presence of scats. Approximate density of the species on the site – 'non-habitat' or 'low', 'medium' or 'high' activity on-site as determined by Koala *(Phascolarctos cinereus)* SAT surveys.
- Role/importance of species population on site – considers whether the site is a key source population for breeding, dispersal, is necessary for maintaining genetic diversity or near the limit of the species' range.

Baseline Koala (*Phascolarctos cinereus*) activity levels were determined through utilising the Spot Assessment Technique (SAT) (Phillips et al. 2011). The SAT method is an industry recognised technique for identifying presence/absence of Koala *(Phascolarctos cinereus)* at a site. Results from the SAT surveys are compared against current available published scientific literature to identify an estimated Koala (*Phascolarctos cinereus*) carrying capacity (stocking rate) to be determined. The SAT methodology is explained in further detail in **Section 3.4.1.3**. **Table 34** outlines the attributes utilised to assess species stocking rate and supplementary scoring.

Table 34: Koala (*Phascolarctos cinereus*) – Species Stocking Rate

Attribute	Possible maximum score
Species Stocking Rate Table	
Presence detected on or adjacent to Site (neighbouring property with connecting habitat)	Score out of 10
Species usage of the Site (habitat type and evidenced usage)	Score out of 15
Approximate density (per ha)	Score out of 30
Species stocking rate supplementary table	
Key source population for breeding (/10)	
Key source population for dispersal (/5)	
Necessary for maintaining genetic diversity (/15)	
Near the limit of the species range (/15)	
SSR Supplementary Table Score (from the four features above)	Score out of 15
Total Species Stocking Rate Score	Score out of 70
Species stocking rate	Score out of 4

6.1.5.4 Scoring Weight Justification

For this development, Site Condition and Site Context were each assigned a weighted score out of three (3), while Species Stocking Rate was assigned a weighted score out of four (4).

Species Stocking Rate was given the greatest weighting as it is considered the primary determinant of site suitability for the Koala *(Phascolarctos cinereus)*. This parameter provides a direct measure of current species usage and therefore offers the most reliable indication of whether an Area can support viable and functioning populations over time.

Site Condition and Site Context were allocated equal weighting due to their combined influence on the long-term ecological sustainability of Koala (*Phascolarctos cinereus*) habitat. The Koala (*Phascolarctos cinereus*) is known to inhabit a broad range of environments, from non-remnant regrowth eucalypt forest and woodland through to mature remnant forest systems. However, the structural integrity and ecological condition of these habitats directly influence long-term carrying capacity, particularly through effects on food availability, shelter structure and resilience to disturbance.

Site Context is equally important as it reflects the relationship between an Area and the surrounding landscape. This includes proximity to other areas of suitable habitat, continuity of vegetation corridors, patterns of movement across the landscape and the presence of barriers or threats that may inhibit dispersal. These factors are critical when considering the long-term viability and population stability of the Koala *(Phascolarctos cinereus)* beyond the boundaries of the subject Area.

6.1.5.5 Limitations

As the MHQA methodology was progressively refined during the preparation of this report, some assessment components were derived from existing ecological datasets that were retrospectively aligned with the final scoring framework. Where available, raw ecological data were adapted to the revised methodology. Where existing data were not suitable for direct application, scores were assigned in accordance with the precautionary principle. Depending on the assessment context, this involved the application of either conservative upper or lower scoring thresholds to avoid over- or underestimating habitat quality.

The *Species Mobility* and *Threats to Species* attributes were assessed retrospectively using a combination of existing ecological survey data, recent satellite imagery, and professional knowledge of the Site and surrounding landscape.

6.1.6 Modified Habitat Quality Assessment -Results

The overall MHQ analysis for Koala (*Phascolarctos cinereus*) is contained within **Appendix 11.1**.

6.1.6.1 Site Condition

Site condition scoring results at the Project Area are summarised and presented in **Table 35** below. The calculation of site condition results in an averaged score (out of 80) for each Assessment Unit. All three (3) AUs scored characteristic of the general condition of the Project Area – which is a historically disturbed subject to repetitive land use and modification. Scores ranged between 3 and 51 out of 80, which can be interpreted as poor to moderately functional habitat. **Table 35** below summaries the averaged scaled scores for each of the 13 measurable attributes under the BioCondition assessment method.

Table 35: Site Condition scoring results at the Project Area

BioCondition attribute	AU1	AU2	AU3
Recruitment of woody perennial species in EDL	3.3	5.0	0.7
Native plant species richness - trees	2.5	2.5	1.8

BioCondition attribute	AU1	AU2	AU3
Native plant species richness - shrubs	1.7	0.6	0.7
Native plant species richness - grasses	2.5	3.1	0.4
Native plant species richness - forbs	1.7	1.9	0.7
Tree canopy height (average of emergent, canopy, sub-canopy)	5.0	4.5	2.6
Tree canopy cover (average of emergent, canopy, sub-canopy)	5.0	5.0	2.9
Shrub canopy cover	2.7	2.5	1.1
Native grass cover	0.0	1.0	0.4
Organic litter	4.3	4.5	3.6
Large trees (euc plus non-euc)	5.0	5.0	2.9
Coarse woody debris	2.3	1.8	1.4
Non-native plant cover	1.7	0.8	0.0
Total site condition score (/80)	**37.7**	**38.1**	**19.14**

6.1.6.2 Habitat index

Habitat index scoring results at the Project Area are summarised and presented in **Table 36** below. The table summarises the averaged scaled scores for each of the ten measurable ecological indicators for the assessment of quality and availability of food and foraging habitat, and quality and availability of shelter habitat.

Table 36: Habitat index scoring results at the Project Area

Habitat index attributes	AU1	AU2	AU3
Quality and availability of food and foraging habitat			
Proportion of canopy cover of LIKT trees within the 100x50 meter BioCondition plot (/20)	6.67	10.00	2.50
Forage tree species richness (LIKTs as per Youngentob et al., 2022) (Only trees >100 DBH) (/10)	3.33	3.75	2.50
Tree density (per hectare stem count) of LIKT species >100 mm DBH (/20)	3.33	3.75	2.50
Recruitment of LIKT species only (/10)	0.00	1.25	0.00
Total scaled score (/10)	**1.00**	**5.00**	**1.0**
Quality and availability of Shelter habitat			
Presence of preferred ancillary trees (listed in Youngentob et al.) (/10)	3.33	6.25	5.00

Habitat index attributes	AU1	AU2	AU3
Canopy cover of all trees within the 100x50 meter BioCondition plot (/20)	13.67	18.75	7.50
Recruitment of all Forage/Shelter tree species (/10)	3.67	6.5	0.25
Tree density (per hectare stem count) of all trees >100 mm DBH (/20)	8.33	10.00	2.50
Proximity to habitat refugia (/10)	10.00	10.00	5.00
Total scaled score (/10)	**5.00**	**5.00**	**1.0**

6.1.6.3 Site Context

Site context scoring results for the Project Area are summarised and presented in **Table 37** below. Results are illustrated through the following figures: **Figure 29** displaying patch size, **Figure 30** displaying connectedness and **Figure 31** displaying context. Landscape scoring analysis is described below.

Table 37: Site Context scoring results at the Project Site

Attribute	Result	Scaled Score
Patch size	**2-25 ha** of vegetation mapped as either Cat A, B, or C under the regulated Vegetation Management Act is directly connected with Koala *(Phascolarctos cinereus)* habitat contained within the Project Area.	2 (/10)
Connectedness	**13.4%** of the Project Area perimeter is connected with vegetation mapped as either Cat A, B, or C under the regulated Vegetation Management Act.	**2** (/5)
Context	**22%** of area within a 1 km buffer from the perimeter of the Project Area is mapped as either Cat A, B, or C vegetation under the regulated Vegetation Management Act.	**2** (/5)
Ecological Corridors	The Project Area is **not located within** an ecological corridor mapped as either a state significant, bioregional, regional, or sub-regional.	**0** (/6)
Role of site location	The Project Area is determined to support habitat which is considered to be critical to the survival of Koala.	**5 (5/)**
Threats to the species	High level threats. See detailed scoring outcomes in **Appendix 11**.	**1** (/15)
Species mobility capacity	High mobility results. See detailed scoring outcomes in **Appendix 11**.	**Average 10** (/10)

6.1.6.4 Species Stocking Rate

Evidence of Koala *(Phascolarctos cinereus)* occupancy within the Project Area was confirmed through the detection of scat during SAT survey. **Figure 14** illustrates the spatial distribution of Koala *(Phascolarctos cinereus)* observations.

The estimation of Koala *(Phascolarctos cinereus)* density is informed through the comparison of site records with relevant ecological studies which speak to the estimated density of the Koala *(Phascolarctos cinereus)* population

within the locality or South East Queensland. *The South East Queensland Koala Population Modelling Study* (Rhodes *et al.*,2015) looked at Koala *(Phascolarctos cinereus)* population densities within a suite of connected Local Government Areas (LGAs) that make up the 'Koala Coast' – Moreton Bay Regional Council, Noosa Shire Council, Ipswich City Council, Brisbane City Council, Redland City Council, Logan City Council and Gold Coast City Council.

Across the Koala Coast region, Rhodes *et al.* (2015) population modelling estimated the average Koala *(Phascolarctos cinereus)* density to be 0.04 Koalas/ha (ranging from 0 to 6.54 Koalas/ha). The study makes comment that the upper bound of the density range (6.54), which is partly attributed to populations within the Redlands, is unlikely to be realistic as a result of modelling and input data limitations (Rhodes *et al.*, 2015). In general, Rhodes *et al*. (2015) predict the vast majority of areas within the study to have low population density.

Of the 14 habitat quality survey sites, six (6) were surveyed for koala sat using the described SAT approach. Of these six sites, four detected koala scat with an average utilisation rate of 4.4. If the average density score of 0.04 Koalas/ha is adopted, the Project Area (38 ha) should theoretically support 1.5 individual Koalas (*Phascolarctos cinereus*). If the average density score of 0.04 Koalas/ha is adopted, the Project Area (38 ha) should theoretically support 1.5 individual Koalas (*Phascolarctos cinereus*).

The Project Area likely supports a low population density at the time of baseline ecological survey. The species stocking rate score reflects habitat value of foraging and breeding, with a low density. Results of species stocking rate are presented in **Table 38** below.

Table 38: Species Stocking Rate results at the Project Area

Attribute	Score
Species Stocking Rate Table	
Presence detected on or adjacent to Site (neighbouring property with connecting habitat)	**10** (/10)
Species usage of the Site (habitat type and evidenced usage)	**15** (/15)
Approximate density (per ha)	**10** (/30)
Species stocking rate supplementary table	
Key source population for breeding	**0** (/10)
Key source population for dispersal	**5** (/5)
Necessary for maintaining genetic diversity	**0** (/15)
Near the limit of the species range	**0** (/15)
SSR Supplementary Table Score (from the four features above)	**5** (/15)
Total Species Stocking Rate Score	**40** (/70)
Species stocking rate	**2.29** (/4)

6.1.6.5 Habitat Quality Score

Three AUs, reflective of historic Project Area disturbance have been identified. Their typology and extent are:

- Impact Assessment Site, Assessment Unit 1 (IA AU1 – 3 BioCondition transects) – Mixed Patchy Regrowth and Remnant Broad-leaved Paperbark (*Melaleuca quinquenervia*) woodland to open forest; pre-clear, regrowth and remnant RE 12.3.6.
    - Total AU area – 4.27 ha (11.16% of Project Area)
    - Total disturbed AU area – 0.79 ha (18.62% of AU; 2.08% of total Project Area)
- Impact Assessment Site, Assessment Unit 2 (IA AU2 – 4 BioCondition transects) Exotic dominated pastural grassland with scattered relict paddock trees open woodland; pre-clear RE 12.12.14.
    - Total AU area – 14.38 ha (37.64% of Project Area)
    - Total disturbed AU area – 12.94 ha (89.99% of AU; 33.87% of total Project Area).
- Impact Assessment Site, Assessment Unit 3 (IA AU3 – 7 BioCondition transects) – Exotic dominated pastural grassland with scattered veteran paddock trees forming open woodland dominated by Scribbly Gum (*Eucalyptus racemosa*); pre-clear 12.9-10.4.
    - Total AU area – 19.57 ha (51.2% of Project Area)
    - Total disturbed AU area – 18.83 ha (96.22.0% of AU; 49.27% of total Project Area).

Refer to **Section 3.4.1** for a description of the habitats present.

The habitat quality scores for each assessment unit, combining Site Condition, Site Context and Species Stocking Rate are reported in **Appendix 11.1** with a summary presented as **Table 39**. The scores for Site Condition are derived directly from the MHQA Tool outputs and subsequently used to inform the assessment of Quality and Availability of Food and Foraging Habitat, and Quality and Availability of Shelter for the Koala *(Phascolarctos cinereus)*.

The results of the proposed Project Area MHQA are detailed for each assessment unit. The site condition score across the entirety of the Project area averaged 1.14 out of 3; site context score averaged 1.16 out of 3; and species stocking rate was scored 2.29 for the matter area. The results of the MHQA undertaken for the Project Area demonstrate moderate baseline habitat quality.

Table 39: Koala *(Phascolarctos cinereus)* – Project Area Modified Habitat Quality Assessment Weighted Scores

Attribute	IA AU1	IA AU2	IA AU3	Total
Site condition score (out of 3)	1.31	1.38	0.74	1.14
Site context score (out of 3)	1.13	1.18	1.18	1.16
Species Stocking Rate Score (out of 4)	2.29	2.29	2.29	2.29
Habitat Quality score (out of 10)	4.72	4.85	4.20	4.59
Habitat Quality score (Rounded out of 10)	5.00	5.00	4.00	5.00
Assessment Unit area (ha) in disturbance footprint	0.79	12.94	18.83	32.57
Total Project Area (ha) for this MNES	32.57	32.57	32.57	32.57
Size Weighting	0.02	0.40	0.58	1.00
Weighted Habitat Quality Score	0.12	1.93	2.43	4.47
Total Weighted Habitat Quality Score	4.47			

The Project Area was given an overall weighted habitat quality score of '4.47' out of the total of 10 which rounds to a score of '4' out of 10. This is considered a moderate habitat quality score.

6.1.6.6 Project Area and EPBC Impact Calculator

To define a 'total quantum of impact', it is necessary to achieve a Koala (*Phascolarctos cinereus*) habitat quality score out of 10. As such, the above provides a measurable method for arriving at a qualified score to input into the EPBC Offset Calculator. The final score assigned to the Project Area has been determined through the MHQA as it provides a scientifically robust and accepted scoring method for habitat and ecological qualities of an area. This supports the original ecological assessments conclusion that habitats within the Project Areas were of relatively low ecological quality.

The total defined Residual Significant Project Area equates to 32.57 ha with a total weighted MHQA adjusted to 4. The EPBC Calculator then adjusts the 'total quantum of impact' based on an internal equation which defines the Project Areas of the Site as having a 13.03 ha 'total quantum of impact' as shown in **Inset 16**.

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

Impact calculator

Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
Ecological communities						
Clear row ommunity	No		**Area**			
			Quality			
			Total quantum of impact	0.00		
Threatened species habitat						
Clear row habitat	Yes	Koala	**Area**	32.6	Hectares	PD Report
			Quality	4	Scale 0-10	
			Total quantum of impact	13.03	Adjusted hectares	

pact calculator

Inset 16. Commonwealth Impact Calculator Inputs - Koala (*Phascolarctos cinereus*)

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

6.2.1 Direct Impact

The Proposed Action will involve direct impacts to 32.57 ha of Grey-headed Flying-fox (*Pteropus poliocephalus*) habitat affected by vegetation removal to give effect to the development (for residential, open space and stormwater management uses). Retained foraging habitat exploitable by Grey-headed Flying-fox (*Pteropus poliocephalus*) accounts for the 5.65 ha Moogurrapum Creek / Eastern Enhancement Corridor (Conservation Area 1).

Significant Residual Impacts associated with the action will offset through the provisions described in **Section 7**.

The Project Area consists of 4.20 ha of high value winter and spring flowering forage species and generalised forage habitat containing native species that are known to be productive as foraging habitat during the final weeks of gestation, and during the weeks of birth, lactation and conception; August to May (DAWE 2021, p.15).

Much of the higher value winter and spring flowing trees affording forage habitat during spring gestation (*viz-a-viz* Broad-leaved Paperbark (*Melaleuca quinquenervia*)), are protected within Eastern Enhancement Corridor (Conservation Area 1). High-quality winter and spring blossoming forage resource for Grey-headed Flying-fox (*Pteropus poliocephalus*) will be enhanced through assisted natural regeneration and restoration measure within the Eastern Conservation Areas to maintain and expand the area of useful high-quality forage habitat for the species.

Some residual impacts are likely to be attributable to Grey-headed Flying-fox (*Pteropus poliocephalus*) interaction with people, lighting and noise. However, it is considered that the measures outlined in **Sections 5.3** will effectively reduce these residual impacts to a level that is as low as practicable within an urban environment.

6.2.2 Quantum of Impact

The total quantum of impact to be offset is therefore calculated as 32.57 ha. This will offset through the provisions described in **Section 7**.

6.2.3 Modified Habitat Quality Assessment – Method

The traditional terrestrial habitat quality assessment assesses three core indicators—site condition, site context and species habitat index.

The revised Grey-headed Flying-fox (*Pteropus poliocephalus*) methodology combines the aspects of the three core indicators and published scientific literature into two (site condition and site context) with site condition being weighted with 40% and site context weighted at 30 % of the final score. The balance of the weighting (30 %) has been attributed to the third indicator which is independent of the traditional habitat quality assessment, being species stocking rate. The species stocking rate assessment incorporated in the Grey-headed Flying-fox (Pteropus poliocephalus) methodology is focussed on the stocking rate of 'foraging habitat' rather than stocking rate of the species itself (presence/absence of the species).

Table 40 below describes the breakdown of scoring and the proportional weights for each component and their scored ecological attributes. The following sections detail the methodology utilised to assess the site condition, site context and species stocking rate under the Grey-headed Flying-fox *(Pteropus poliocephalus)* Habitat quality method.

Table 40: Grey-headed Flying-fox scoring summary

Ecological Attribute	Ecological Indicator	Max score	% Contribution
Habitat quality (BioCondition + habitat quality indices)	Site condition (BioCondition Score)	10 (converted from 80)	40% (total score out of 100)
	Species richness	20	
	Flower score	10	
	Timing of Biological shortages	10	
	Quality of foraging habitat	20	
	non-native plant cover	20	
Site Context	Size of patch	10	30% (total score out of 60)
	Connectedness	10	
	Context	10	
	Ecological Corridors	10	
	Role of site location to species overall population in the state	10	
	threats to the species	10	
Species Stocking Rate	GHFF forage tree density (per/ha)	10	30% (total score out of 10)

6.2.3.1 Site Condition (40%)

The assessment of site condition is made-up of two ecological components which total a score out of 90:

- BioCondition score (out of 20) – the assessment of vegetation structure and function; and,
- Fauna species habitat quality assessment (out of 80) – the assessment of specific habitat characteristics unique to the protected matter.

A unique site condition score is developed for each transect site and then averaged to produce a single score for each Assessment Unit. Assessing Site condition is an integral step in determining specific quantification of impacts, while also determining whether an Offset Area is suitable to establish a desired capacity to support the prescribed environmental matters being offset. The on-Site condition is a key element of habitat quality and has a direct influence on the biodiversity it supports.

Vegetation scoring is undertaken in accordance with the *BioCondition Assessment Manual – A condition Assessment Framework for Terrestrial Biodiversity in Queensland* (Eyre *et al.,* 2015). Site condition is assessed using a suite of 13 measurable attributes to describe the structure and function of the vegetation community and is benchmarked against the expected range for a relatively undisturbed community. The Regional Ecosystem Database Description (REDD) describes the remnant state of Regional Ecosystems in terms of floristic variably and vegetation structure, for which a corresponding benchmark value exists for each of the 13 measurable attributes. The maximum BioCondition score for a wooded ecosystem is 80, which is later converted to a score out of 20. Each attribute and their corresponding maximum score are listed below:

- recruitment of woody perennial species in the ecologically dominant layer (EDL) - 5
- native plant species richness – trees - 5
- native plant species richness – shrubs - 5
- native plant species richness – grasses - 5
- native plant species richness – forbs - 5
- tree canopy height - 5
- sub-canopy cover - 5
- tree canopy cover - 5
- native grass cover - 5
- organic litter - 5
- large trees - 15
- coarse woody debris - 5
- non-native plant cover - 10

For the assessment of fauna habitat, an additional two (2) site-based ecological attributes are measured using a series of specifically designed ecological indicators. For the purposes of habitat assessment for the Grey-headed Flying-fox (*Pteropus poliocephalus*), these attributes have been combined and their ecological indicators are described below.

- quality and availability of food and foraging habitat
- quality and availability of shelter

Ecological indicators have been designed and ecologically justified based on the review and consideration of relevant information in the following documents:

- Eby and Law (2008) Ranking the feeding habitats of Gey-headed flying foxes for conservation management – a report for the Department of Environment and Climate Change (NSW) and the Department of Environment, Water, Heritage and the Arts
- DAWE (2021) National Recovery Plan for the Grey-headed Flying-fox 'Pteropus poliocephalus', Department of Agriculture, Water and the Environment, Canberra

The calculation of habitat quality has been undertaken in accordance with the Guide to determining terrestrial habitat quality version 1.2. (Department of Environment and Heritage Protection, 2017). Ecological indicators are listed below, and justified with scoring assignments in **Table 41**.

- Vegetation condition
- Species richness (canopy trees)
- Flower scores (average)
- Timing of biological shortages
- Quality of foraging habitat (trees >0.65 wt p*r), and
- Non-native plant cover.

Table 41: GHFF Project Area Condition Scoring

Ecological indicator	Weighting	Max score	Scoring metric	Justification for inclusion
Vegetation description	20.00%	20	BioCondition result converted to a score out of 20. (from 80)	Vegetation condition as a direct result of vegetation condition assessment. Vegetation condition is measured and calculated in general accordance with the BioCondition Manual (Neldner et al., 2015).
Canopy species richness	20.00%	20	**0** - zero GHFF foraging tree species **5** - 1-3 GHFF foraging tree species **10** - 4-6 GHFF foraging tree species **20** - >6 GHFF foraging tree species	Species richness (canopy trees) – This condition characteristic is assessed using the transect area 100 m X 50 m plot following the contour of the land when possible. Within the plot, all canopy tree and subcanopy tree specimens are recorded where they are greater than 300 mm DBH. GHFF foraging tree species are listed in Eby and Law (2008), and include nectar and fruit trees.
Flowering score	10.00%	10	**0** - 0 **2** - 0.01-0.25 **5** - 0.26-0.50 **8** - 0.51-0.75 **10** - 0.76-1.00	Flower scores (average) – This condition characteristic is assessed by analysing and cross-referencing the species recorded in the 'species richness (canopy trees)' characteristic with the published literature, specifically the information within Ranking the feeding habitat of Grey-headed flying foxes for conservation management (Eby and Law 2008) and the Draft Recovery Plan for the Grey-headed Flying fox (DoEE 2017) and determining the flower score of the recorded canopy species. The individual score for each flowering GHFF foraging tree is then divided by the number of species recorded (GHFF foraging and non-GHFF foraging trees) to produce an average. The benchmark values for this condition characteristic have been derived from the findings published by Eby and Law (2008) (Ranking the feeding habitat of Grey-headed flying foxes for conservation management). Refer to Table 'Flowering Score' for the benchmark scoring values for this condition characteristic.
Quality of foraging species	20.00%	20	**0** - zero significant foraging tree species **5** - 1-3 significant foraging tree species **10** - 4-6 significant foraging tree species **20** - >6 significant foraging tree species	This condition characteristic is assessed by analysing and cross-referencing the species recorded in the 'species richness (canopy trees)' characteristic with the published literature, specifically the information within Ranking the feeding habitat of Grey-headed Flying foxes for conservation management (Eby and Law 2008) and the Draft Recovery Plan for the Grey-headed Flying-fox (DoEE 2017) and determining which canopy species recorded contain a flower score greater than 0.65 wt p*r and is recognised as a significant food plant by Eby and Law (2008). It should be noted that species recorded that are not prescribed a value by Eby and Law (2008) but are recognised as GHFF foraging trees, have been given an average weighted value of related species or, in the case of *Eucalyptus crebra* (Narrow-leaved Ironbark) been prescribed a value of 0.65 and classified as a

Ecological indicator	Weighting	Max score	Scoring metric	Justification for inclusion
				significant food plant given its importance as a winter flowering species as acknowledged in the Draft Recovery Plan for the Grey-headed Flying-fox (DoEE 2017). Refer to Table 'quality of foraging species' for the benchmark scoring values for this condition characteristic.
Non-native plant cover	20.00%	20	**1** - >50% non-native plant cover **5** - 25-50% non-native plant cover **10** - 5-25% non-native plant cover **20** - <5% non-native plant cover	The measure of non-native plant cover within the 100 x 50 m BioCondition plot.
Timing of biological shortages	10.00%	10	sum of all time periods met through available foraging tree species	Timing of biological shortages – This condition characteristic is assessed by analysing and cross-referencing the species recorded in the 'species richness (canopy trees)' characteristic with the published literature, specifically the information within Ranking the feeding habitat of Grey-headed flying foxes for conservation management (Eby and Law 2008) and the Draft Recovery Plan for the Grey-headed Flying-fox (DoEE 2017) and determining the ability of the canopy species in the vegetation community to produce foraging habitat during biological shortages (food shortages, pregnancy and birthing, lactation, mating and conception, migration paths and fruit industries). It should be noted that this condition characteristic is weighted and 'food shortages' has been weighted heavier than the balance of the characteristics which are equal, as 'food shortages' is recognised as a major issue. Refer to Table 'timing of biological shortages' for the benchmark scoring values for this condition characteristic.

6.2.3.2 Site Context (30%)

The site context assessment deals with the site and its adjacent surroundings. Site context is measured using a suite of attributes to describe the location of the habitat within the surrounding landscape and the influence of its associated threats. This assessment also considers the influence of adjacent vegetated areas and ecological corridors. Under the Grey-headed Flying-fox *(Pteropus poliocephalus)* FHA, site context is measured using the following six characteristics:

- Size of patch - refer to **Figure 29** due to Grey-headed Flying-fox *(Pteropus poliocephalus)* habitat being analogous with Koala *(Phascolarctos cinereus)* habitat
- Connectedness (active Grey-headed Flying-fox *(Pteropus poliocephalus)* roost camps (camps) in a 20 km radius) - refer to **Figure 19**
- Context (percentage of Grey-headed Flying-fox *(Pteropus poliocephalus)* foraging habitat in a 25 km radius) - refer to **Figure 20** and **Figure 21**
- Role of site location to species overall population in the state (active Grey-headed Flying-fox *(Pteropus poliocephalus)* Nationally Important Camp (as defined by the Grey-headed Flying-fox *(Pteropus poliocephalus)* Recovery Plan) within a 25 km radius) (refer to **Figure 19**), and
- Threats to the species.

Assessment methodology of the above context characteristics is outlined below. Refer to **Table 42** for the benchmark scoring values for this condition characteristic.

- Size of patch – This context characteristic is assessed using a modified version of the traditional habitat quality assessment with the directly connected patch of Grey-headed Flying-fox *(Pteropus poliocephalus)* foraging habitat to site measured. This context characteristic is measured using GIS.
- Connectedness – This context characteristic is assessed by analysing the number of active Grey-headed Flying-fox *(Pteropus poliocephalus)* roost camps (over the most recent monitoring period within a 20 km radius of the site. For consistency purposes this assessment is to utilise the data provided on the national flying-fox monitoring viewer (Australian Government).
- Context – This context characteristic is assessed using a modified version of the traditional habitat quality assessment with the percentage of Grey-headed Flying-fox *(Pteropus poliocephalus)* foraging habitat within a 20 km buffer of the site measured. This context characteristic is measured using GIS.
- Ecological corridors – This context characteristic is assessed using the traditional habitat quality assessment methodology which involves determining the proximity of the site to state, bioregional, regional or sub-regional corridors.
- Threats to species – This context characteristic is assessed by analysing the published scientific literature regarding threats to Grey-headed Flying-fox *(Pteropus poliocephalus)* and determining the number and severity of the threatening processes observed at or adjacent to the site.
- Role of site location to species overall population in the state (active Grey-headed Flying-fox *(Pteropus poliocephalus)* national flying-fox monitoring viewer 'level 3' roost camps in a 20 km radius) – This context characteristic is assessed by determining the number of active Grey-headed Flying-fox *(Pteropus poliocephalus)* roost camps level 3 or greater (over the most recent monitoring period within a 20 km radius of the site. For consistency purposes this assessment is to utilise the data provided on the national flying-fox monitoring viewer (Australian Government). A nationally important GHFF camp is one that has contained equal to or greater than 10,000 GHFF in more than one year in the last 10 years, OR have been occupied by more than 2,500 GHFF permanently or seasonally every year for the last 10 years[36].

[36] Camp data is obtained from CSIRO, https://data.csiro.au/collection/csiro%3A64370v3. The data, however, has not been updated since 2022.

Table 42: GHFF Project Area Context Scoring

Measurable Attribute	Score Category	Score
Size of Patch	<5 hectares	0
	5 – 25 hectares	2
	26 – 100 hectares	5
	101 – 200 hectares	7
	> 200 hectares	10
Connectedness	Active Grey-headed Flying-fox *(Pteropus poliocephalus)* camps within 20 km	
	<1 camps	0
	1 – 3 camps	3
	4 – 6 camps	6
	> 6 camps	10
Context	% Grey-headed Flying-fox *(Pteropus poliocephalus)* Foraging habitat within 20 km	
	< 10%	0
	10 – 30 %	3
	31 – 75 %	6
	>75 %	10
Ecological Corridors	Not within ecological corridor	0
	Sharing a common boundary	6
	Within an ecological corridor	10
Threats to species	High level threat	1
	Moderate level threat	5
	Low level threat	10
Role of site location to overall population	Active Nationally Important Camp within 20km	
	1 – 2 camps	1
	3 – 4 camps	6
	> 5 camps	10

6.2.3.3 Threats to species

The assessment of threats has been undertaken on the matter area scale, i.e. the MNES impact or offset area subject of this report. Threatening processes considered and adopted in the assessment of threats specific to Grey-headed Flying-fox (*Pteropus poliocephalus*) are taken from the following approved literature:

- DAWE (2021) National Recovery Plan for the Grey-headed Flying-fox 'Pteropus poliocephalus', Department of Agriculture, Water and the Environment, Canberra

Threatening processes to MNES are rarely spatially or temporally restricted, thus are inherently difficult to accurately capture and quantifiably measure. Each assessable threatening process is scored generally in accordance with the scale adopted from *Table 4 – species habitat index scoring guide* from the *Guide to Determining Terrestrial Habitat Quality (v1.2)* (DEHP, 2017), which assigns a score of either high, moderate, or Low. However, the score scale to adapted to reflect a numerical value of either one, five, or ten, to fit into the adapted MHQA method unique to Grey-headed Flying-fox (*Pteropus poliocephalus*). This is reflected in **Table 43** below. Unique scoring metrics are designed to establish a measurable and repeatable framework for the comparison of threatening processes over time.

The scoring of site-based threats in comparison to landscape-level threats are assigned a proportional weighting system. **Table 44** below details each assessed threatening process, their justification for inclusion, relative scoring weight, and unique scoring metrics. **Table 45** illustrates the supplementary scoring table which is used to assess measurable threatening processes within the MHQA scoring spreadsheets. A final matter area score is assigned through the adoption of the below scoring scale in (**Table 43**)

Table 43: Threats scoring scale

Score	Scaled score
0-5	1 – High level threats
6-10	5 – Moderate level threats
11-15	10 – Low level threats

Table 44: Threats scoring metrics

Listed threatening process	Justification for inclusion in accordance with description under the conservation advice	Indicator weighting	Indicator description	Indicator scoring method	Indicator scoring metric
Altered fire regime	Increasing bushfire severity and frequency have the potential to adversely affect grey-headed flying-fox habitat by reducing the extent, condition and productivity of native vegetation. High-intensity fires can destroy or damage flowering and fruiting trees, limiting the availability of food resources both immediately following fire and during subsequent recovery periods. Where fires occur across extensive areas, reductions in forage availability may influence the distribution, movement and foraging behaviour of grey-headed flying-foxes.	30%	**Fuel hazard rating** Fuel hazard monitoring will be undertaken in accordance with the *Overall Fuel Hazard Assessment Guide* (Hines et al. 2010). The methodology provides a rapid, standardised approach for assessing the structure and arrangement of combustible vegetation that influences bushfire behaviour and allows fuel hazard to be monitored consistently over time. At each monitoring site, fuel hazard will be visually assessed within each of the four fuel strata defined by Hines et al. (2010): ▪ **Surface fuels** – comprising leaf litter, bark, twigs and fine woody debris on the ground; ▪ **Near-surface fuels** – including grasses, herbs and low shrubs immediately above the litter layer; ▪ **Elevated fuels** – consisting of shrubs, suspended dead material and vegetation extending above the near-surface layer but below the canopy; and ▪ **Bark fuels** – assessing the quantity, type and continuity of bark retained on standing trees.	Fuel hazard monitoring will be undertaken in accordance with the *Overall Fuel Hazard Assessment Guide* (Hines et al. 2010). Permanent fuel hazard monitoring sites will be co-located with habitat quality monitoring sites. Hazard ratings for each fuel stratum (surface, near-surface, elevated and bark fuels) will be assigned by comparing field observations with the descriptive criteria and photographic standards presented in *Table 8.1* of the *Overall Fuel Hazard Assessment Guide*. Individual hazard ratings will then be combined, in accordance with the guide, to derive an overall fuel hazard rating for each monitoring site, classified as *Low*, *Moderate*, *High*, *Very High* or *Extreme*	**1 –** Extreme or Very High fuel hazard rating **7 –** Moderate or High fuel hazard rating **15 –** Low fuel hazard rating

Listed threatening process	Justification for inclusion in accordance with description under the conservation advice	Indicator weighting	Indicator description	Indicator scoring method	Indicator scoring metric
			Each fuel stratum will be assigned a hazard rating using the assessment criteria provided in the *Overall Fuel Hazard Assessment Guide*, considering attributes such as fuel quantity, continuity, cover, height and arrangement.		
Entanglement in netting and barb wire fences	Entanglement in barbed wire fencing is recognised as a source of human-induced mortality of grey-headed flying-fox. Individuals may become caught while commuting or foraging within agricultural and peri-urban landscapes, often resulting in severe injury or death if not rescued. The presence of barbed wire fencing within or adjacent to suitable foraging habitat therefore represents a localised threat that may reduce the functional value of habitat.	15%	**Presence of barbed wires fencing or similar** The presence of top-strand barbed-wire fencing is measured where it occurs within and surrounding the site.	This indicator is scored based on observations made during baseline ecological assessment. Observation data is collected spatially to represent the location and spread of barb-wire fencing.	**1 –** Site is entirely bounded by top-strand barbed-wire fencing **7 –** Top-stand barbed-wire fencing in present on at least one fence boundary or internal fenceline **15 –** Site is absent of top-strand barbed-wire fencing
Electrocution on powerlines	Electrocution on powerlines is a documented source of mortality for grey-headed flying-fox, particularly where power infrastructure intersects commuting routes or foraging habitat. Contact with exposed electrical infrastructure can result in fatal injury and contributes to ongoing anthropogenic mortality across the species' range. The proximity of powerlines to suitable	15%	**Presence of powerlines** The presence of powerlines is measured where it occurs within and surrounding the site.	This indicator is scored based on observations made during baseline ecological assessment. Observation data is collected spatially to represent the location and relevant distance to powerlines.	**1 –** Powerline/s intersect site **7 –** Powerline/s run parallel with a site boundary (within 100 metres) **15 –** Powerlines are not present as per the above

Listed threatening process	Justification for inclusion in accordance with description under the conservation advice	Indicator weighting	Indicator description	Indicator scoring method	Indicator scoring metric
	habitat is therefore an important consideration when assessing habitat quality and associated risks to the species.				
Habitat loss, fragmentation, and degradation	Habitat loss is recognised as the primary threat to the grey-headed flying-fox, resulting in the ongoing reduction, degradation and fragmentation of native foraging habitat throughout the species' range. The loss of flowering and fruiting vegetation reduces the availability and reliability of food resources, increasing foraging distances and energetic demands while contributing to greater reliance on urban landscapes.	40%	**Proportion of wooded vegetation** The proportion of wooded vegetation within the target Site is measured as a direct indicator of area subject to habitat loss, fragmentation, and degradation. For the purposes of this assessment, wooded vegetation is considered to be that which includes tree-habitat, where trees are 4 metres in height or greater. This indicator should not reflect regulated vegetation or council spatial mapping, it should be a product of ground-truthed vegetation mapping at the time of survey.	Percentage of wooded vegetation within the subject site should reflect post survey ground-truthed vegetation mapping. Wooded areas should be the sum of assessment units which are categorised as either regrowth, advanced regrowth, or remnant condition wooded vegetation. The proportion of area, represented by percentage (%), is assessed against the scoring metrics.	**1 -** 0-25% wooded vegetation occupies the site **7 -** 26-75% wooded vegetation occupies the site **15 -** >75% wooded vegetation occupies the site

Table 45: Threats - supplementary scoring table

Listed threatening process	Scoring indicator	Score		
		1	7	15
Altered fire regimes	Fuel hazard rating	Extreme or Very High fuel hazard rating	Moderate or High fuel hazard rating	Low fuel hazard rating
Entanglement in netting and barb wire fences	Presence of top-strand barbed-wire fencing or similar	Site is entirely bounded by top-strand barbed-wire fencing	Top-stand barbed-wire fencing in present on at least one fence boundary or internal fenceline	Site is absent of top-strand barbed-wire fencing
Electrocution on powerlines	Presence of powerlines	Powerline/s intersect site	Powerline/s run parallel with a site boundary (within 100 metres)	Powerlines are not present as per the above
Habitat loss, fragmentation, and degradation	Proportion of wooded vegetation	0-25% wooded vegetation occupies the site	26-75% wooded vegetation occupies the site	>75% wooded vegetation occupies the site
Threats score out of 15				
Scaled score (1-5=1; 6-10=5; 11-15=10)				

6.2.3.4 Species Stocking Rate (30%)

This report measures the species stocking rate for Grey-headed Flying-fox *(Pteropus poliocephalus)* based on the density and distribution of foraging habitat present at the site at the time of survey, rather than direct observations of individuals or roosting activity. This attribute is therefore designed to capture the abundance of available foraging resources, i.e. the stem count of foraging trees within the 100x50 m BioCondition plot. Only tree species cited as known foraging tree species in Eby and Law (2008) contribute to this score. Further, only trees greater than 300 mm DBH are considered available for foraging to the Grey-headed Flying-fox *(Pteropus poliocephalus)*. This is in consideration of the physical weight of the animal, and the practicality of the animal landing and manoeuvring through tree branches to access flowers/fruit, as well as the likelihood of an individual selecting a favourable foraging tree within a landscape i.e. it is assumed that an individual is more likely to select for a larger tree.

The stem count methodology is undertaken in general accordance with the *Methodology for surveying and mapping regional ecosystems and vegetation communities in Queensland* (version 7.0) (Neldner *et al.* 2023). Tree stems are, however, not measured for height, nor differentiated into strata layers. As a surrogate for strata differentiation, a 300 mm DBH is used as the minimum benchmark measure for Grey-headed Flying-fox *(Pteropus poliocephalus)* foraging trees. It is assumed that any tree with a DBH greater than 300 mm would occupy the canopy (T1) or subcanopy (T2) layers.

Traditionally. all tree stems are counted within the 50 x 20 m plot and extrapolated to find the cumulative (combined T1/T2) per hectare stem count. Stems below 300 mm are counted into categories of 0-50 mm, 50-100 mm, and 100-299 mm, while all stems greater than 300 mm DBH area measured for accurate DBH. The additional collection of stem count data from 0-300 mm allows for more accurate prediction and consideration of upcoming foraging habitat, this is especially relevant for the development of vegetation condition interim performance targets for the proposed biodiversity Offset Area. This data is collected at the time of baseline BioCondition vegetation survey and provides a consistent and repeatable approach to quantifying the availability of flowering resources critical to the species.

The T1 per hectare stem count of cited foraging tree species is scored against the T1 benchmark stem count (to account for trees >300 mm DBH) of the corresponding RE for the BioCondition site. Stem count information of all relevant REs is obtained through technical descriptions publicly available through the Queensland Government publications portal, or through direct consultation with the Queensland Herbarium. A bell-curve scoring metric is designed to award the highest score when stem counts correspond to the benchmark, with scores declining as stem counts diverge above or below this value. This approach provides a quantitative representation of the capacity of the vegetation community to support Grey-headed Flying-fox *(Pteropus poliocephalus)* foraging activity.

The collection of Project Area ecological data was undertaken prior to the adaptation of the described methodology, and as such an alternative and conservative approach has been undertaken for the Project Area. In the interest of consistency of scoring methodologies between the impact and offset sites, a precautionary approach has been adopted through the adoption of stocking rate scores based on BioCondition data. Where wooded vegetation occurs, as evidenced through BioCondition data and results, a high score of ‘10’ is adopted. Where wooded vegetation is recorded as absent, a low score of ‘2’ is adopted.

6.2.3.5 Limitations

As the MHQA methodology was progressively refined during the preparation of this report, some assessment components were derived from existing ecological datasets that were retrospectively aligned with the final scoring framework. Where available, raw ecological data were adapted to the revised methodology. Where existing data were not suitable for direct application, scores were assigned in accordance with the precautionary principle. Depending on the assessment context, this involved the application of either conservative upper or lower scoring thresholds to avoid over- or underestimating habitat quality.

The *Species Stocking Rate* attribute was scored in retrospect due to absence of sufficient stem count data, in accordance with **Section 6.2.3.4** above. Scores were derived through the adoption of upper limit values (10) for all wooded sites, and lower limit values (0) for all entirely cleared sites. The *Threats to Species* attribute was similarly assessed retrospectively using a combination of existing ecological survey data, recent satellite imagery, and professional knowledge of the Site and surrounding landscape.

6.2.4 Modified Habitat Quality Assessment -Results

Three assessment units, reflective of historic Site disturbance have been identified. Their typology and extent are:

- Impact Assessment Site, Assessment Unit 1 (IA AU1 – 3 BioCondition transects) – Mixed Patchy Regrowth and Remnant Broad-leaved Paperbark (*Melaleuca quinquenervia*) woodland to open forest; pre-clear, regrowth and remnant RE 12.3.6
    - Total AU area – 4.27 ha (11.16% of Project Area)
    - Total disturbed AU area – 0.79 ha (18.62% of AU; 2.08% of total Project Area)
- Impact Assessment Site, Assessment Unit 2 (IA AU2 – 4 BioCondition transects) Exotic dominated pastural grassland with scattered relict paddock trees open woodland; pre-clear RE 12.12.14.
    - Total AU area – 14.38 ha (37.64% of Project Area)
    - Total disturbed AU area – 12.94 ha (89.99% of AU; 33.87% of total Project Area).
- Impact Assessment Site, Assessment Unit 3 (IA AU3 – 7 BioCondition transects) – Exotic dominated pastural grassland with scattered veteran paddock trees forming open woodland dominated by Scribbly Gum (*Eucalyptus racemosa*); pre-clear 12.9-10.4.
    - Total AU area – 19.57 ha (51.2% of Project Area)
    - Total disturbed AU area – 18.83 ha (96.22.0% of AU; 49.27% of total Project Area).

Refer to **Section 3.4.1** for a description of the habitats present.

The overall MHQ analysis for Grey-headed Flying-fox *(Pteropus poliocephalus)* is contained within **Appendix 11.2**.

6.2.4.1 Site Condition

Site condition scoring results at the Project Area are summarised and presented in **Table 46** below. The calculation of site condition results in an averaged score (out of 80) for each Assessment Unit. All three (3) AUs scored characteristic of the general condition of the Project Area – which is a historically disturbed subject to repetitive land use and modification. Scores ranged between 19 and 51 out of 80, which can be interpreted as poor to moderately functional habitat. **Table 47** below summaries the averaged scaled scores for each of the 13 measurable attributes under the BioCondition assessment method.

Table 46: Site Condition scoring results at the Project Area

BioCondition attribute	AU1	AU2	AU3
Recruitment of woody perennial species in EDL	3.3	5.0	0.7
Native plant species richness - trees	2.5	2.5	1.8
Native plant species richness - shrubs	1.7	0.6	0.7
Native plant species richness - grasses	2.5	3.1	0.4
Native plant species richness - forbs	1.7	1.9	0.7
Tree canopy height (average of emergent, canopy, sub-canopy)	5.0	4.5	2.6
Tree canopy cover (average of emergent, canopy, sub-canopy)	5.0	5.0	2.9
Shrub canopy cover	2.7	2.5	1.1

BioCondition attribute	AU1	AU2	AU3
Native grass cover	0.0	1.0	0.4
Organic litter	4.3	4.5	3.6
Large trees (euc plus non-euc)	5.0	5.0	2.9
Coarse woody debris	2.3	1.8	1.4
Non-native plant cover	1.7	0.8	0.0
Total site condition score (/80)	**37.7**	**38.1**	**19.14**

Table 47: Summary average habitat quality scores

Ecological Indicator	AU1	AU2	AU3
Species richness	5.0	5.0	2.9
Flower score	9.3	7.75	4.9
Timing of Biological shortages	8.5	7.75	3.9
Quality of foraging habitat	5.0	5.0	2.9
Non-native plant cover	4.0	2.0	1.0

6.2.4.2 Site Context

Site context scoring results for the Project Area are summarised and presented in **Table 48** below. Results are illustrated through the following figures: **Figure 29** displaying patch size, **Figure 19** displaying connectedness, and **Figure 20** and **Figure 21** displaying context. Landscape scoring analysis is described below.

Table 48: Site Context scoring results at the Project Area

Attribute	Result	Scaled Score
Patch size	**2-25 ha** of vegetation mapped as either Cat A, B, or C under the regulated Vegetation Management Act is directly connected with the matter area contained within the Project Area.	2 (/10)
Connectedness	**36** Grey-headed flying-fox camps are mapped within 20 km of the Project Area.	10 (/10)
Context	**22%** of area within a 20 km buffer from the perimeter of the Project Area is mapped as either Cat A, B, or C vegetation under the regulated Vegetation Management Act.	3 (/10)
Ecological Corridors	The Project Area is **not located within** an ecological corridor mapped as either a state significant, bioregional, regional, or sub-regional.	0 (/10)
Role of site location	Four significant camps are identified to occur within 20km from the Project Area.	6 (/10)

Attribute	Result	Scaled Score
Threats to the species	High level threats	1 (/10)

The habitat quality scores for each assessment unit, combining Site Condition, Site Context and Species Stocking Rate are reported in **Appendix 11.2** with a summary presented as **Table 49**. The results of the Project Area MHQA are detailed for each assessment unit. The site condition score across the entirety of the Project Area averaged 1.22 out of 4; site context score averaged 1.1 out of 3; and species stocking rate was scored 2.66 for the matter area.

Table 49: Grey-headed Flying-fox *(Pteropus poliocephalus)* – Impact Site Modified Habitat Quality Assessment Weighted Scores

Attribute	IA AU1	IA AU2	IA AU3	Total
Habitat Quality (out of 4)	1.41	1.45	0.81	1.22
Site Context Score (out of 3)	1.10	1.10	1.10	1.10
Species Stocking Rate Score (out of 3)	3.00	3.00	1.97	2.66
Habitat Quality score (out of 10)	5.51	5.55	3.88	4.98
Habitat Quality score (Rounded out of 10)	6.00	6.00	4.00	5.00
Assessment Unit area (ha) in disturbance footprint	0.79	12.94	18.83	32.57
Total Project Area (ha) for this MNES	32.57	32.57	32.57	32.57
Size Weighting	0.04	0.42	0.54	1.00
Weighted Habitat Quality Score	0.13	2.21	2.24	4.58
Total Weighted Habitat Quality Score	4.58			

The Site was given an overall weighted habitat quality score of 4.58 out of the total of 10 which rounds to a score of 5 out of 10. This is considered a moderate habitat quality score.

6.2.4.3 Impact Site Area and EPBC Impact Calculator

To define a 'total quantum of impact', it is necessary to achieve a Grey-headed Flying-fox *(Pteropus poliocephalus)* foraging resource score out of 10. As such, the above provides a measurable method for arriving at a qualified score to input into the EPBC Offset Calculator. The final score assigned to the Project Area has been determined through the MHQA and Foraging Scoring methodologies as it provides a scientifically robust and accepted scoring method for habitat and ecological qualities of an area. This supports the original ecological assessments conclusion that habitats within the Project Areas were of relatively low ecological quality.

The total defined Residual Significant Project Area equates to 32.57 ha with a matter area weighted Grey-headed Flying-fox *(Pteropus poliocephalus)* habitat quality score of 5. The EPBC Calculator then adjusts the 'total quantum of impact' based on an internal equation which defines the Project Areas of the Site as having a 16.29 ha 'total quantum of impact' as shown in **Inset 17**.

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

Impact calculator

Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
Ecological communities						
Area of community	No		**Area**			
			Quality			
			Total quantum of impact	0.00		
Threatened species habitat						
Area of habitat	Yes	Koala	**Area**	32.57	Hectares	PD Report
			Quality	**5**	Scale 0-10	
			Total quantum of impact	16.29	Adjusted hectares	

Inset 17. Commonwealth Impact Calculator Inputs - Grey-headed Flying-fox (*Pteropus poliocephalus*)

7. Offset Proposal

7.1 Significant Residual Impacts

Despite the avoidance, and proposed mitigation measures (i.e. restoration of habitat utility), the Proposed Action will result in a Significant Residual Impact of 32.57 ha of habitat critical to the survival of Koala *(Phascolarctos cinereus)* and 32.57 ha critical habitat of Grey-headed Flying-fox *(Pteropus poliocephalus)* arising from direct impacts associated with Proposed Action undertaken by the proponent. The proponent proposes an environmental, Direct Offset to acquit the residual impact.

7.2 Offset Receiving Areas

7.2.1 Woolshed Offset Area

The Proponent has entered into a Heads-of-Agreement with a third party offset provider Cherish the Environment Foundation Limited (**Cherish**) to deliver and manage the offset for a 20-year period at the Woolshed Offset Area located 74 km to the west of the Proposed Action (**Figure 32**), located at 528-530 Woolshed Creek Road, Woolshed (**Figure 33**), within the Ipswich City Council (**ICC**) LGA.

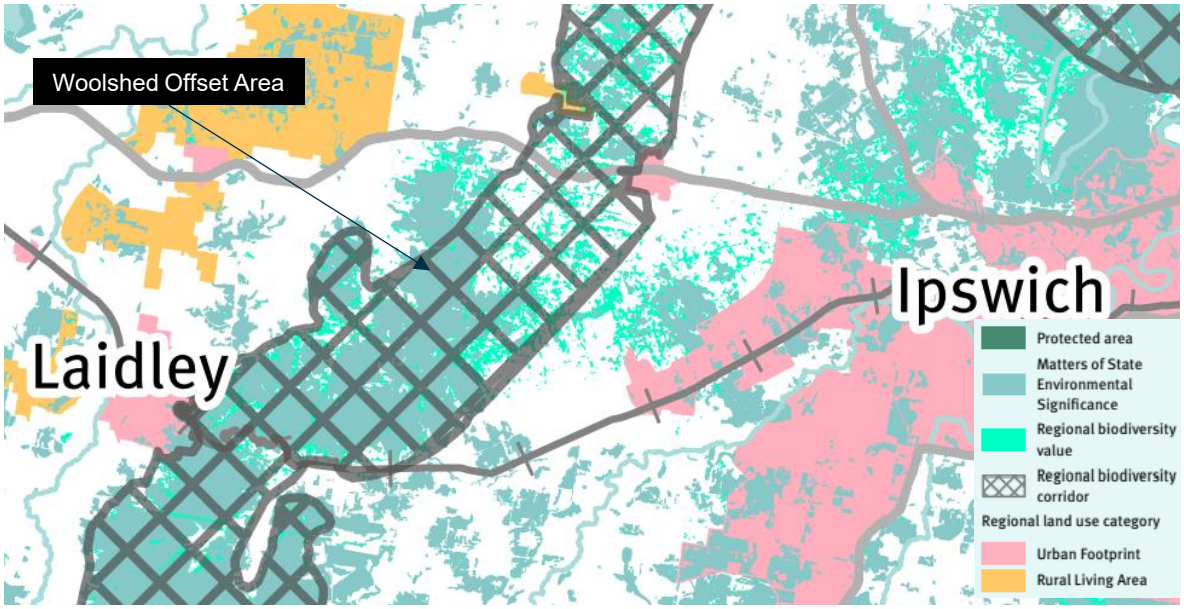
The Woolshed Offset Area is situated 25 km to the west of Ipswich, 8 km to the north-west of Rosewood, 52 km to the south-west of Brisbane and 55 km to the east of Toowoomba. Contextually, the Woolshed Offset Area lies is strategically situated on the Little Liverpool Range which traverses from Minden to Main Range (west of Aratula) a distance of some 58 km.

From a landuse planning perspective, the Woolshed Offset Area is in located within the ICC City Plan 2025 (**Ipswich Planning Scheme**) Rural Zone (**Inset 18**), and outside of the SEQ Urban Footprint (**Inset 19**). Both the Ipswich Planning Scheme and the State Government's SEQ Regional Plan impose restrictions on development with in the Rural Zone.

Inset 18. Ipswich Planning Scheme 2024

Bio-regionally, the Woolshed Offset Area is situated in the South East Queensland Bioregion, lying within the Moreton Basin sub-region. The Woolshed Offset Area lies within an area of biodiversity importance and is identified

by State conservation and regional planning assessments as possessing important regional biodiversity values within a mapped State mapped Regional Biodiversity Corridor and SEQ Regional Plan Biodiversity Corridor. Conservation estate (Mount Grandchester Conservation Reserve) owned and maintained by ICC adjoins to the south. Further afield (and within the mapped bioregional corridors) lies Old Hidden Vale Nature Refuge (14 km), Mount Beau Brummell Conservation Park (25 km) and Main Rainge National Park (36 km), to the south.



Inset 19. SEQ Regional Plan - Regional Biodiversity Network

MNES known from the locality include both Koala *(Phascolarctos cinereus)* and Gey-headed Flying-fox (*Pteropus poliocephalus*). The total site area is 88.63 ha of habitat for Koala *(Phascolarctos cinereus)* and Grey-headed Flying-fox *(Pteropus poliocephalus)* comprising 98% (87.01 ha) of Remnant vegetation and 2% (1.62 ha) young regrowth both requiring assisted regeneration on account of infestation of the understorey by Lantana* (*Lantana camara*) a WoNS.

Historically the Woolshed Offset Area was subjected to selective timber cutting as evidenced by disused tracks, a number of stumps and a disproportionately low proportion of ironbarks within the canopy relative to benchmarks for this community. Ironbarks in this area were selectively harvested for durable construction timber and fenceposts. Refer to **Table 50**, Item 1 for a description of permissible clearing exemptions for rural zoned properties under the exemptions within the *Planning Act 2016* (Qld).

Presently, the eastern parts of the offset particularly on steeper igneous geology, Lantana* (*Lantana camara*) forms a dense impenetrable thicket that supresses native understorey (sub-canopy, shrub and groundcover recruitment) and inhibits ground fauna movement.

Environmental offsets have been calculated and will be delivered in accordance with the EPBC Act Environmental Offset Policy (**DSEWPC**[37]).

7.2.1.1 Topography, Terrain and Aspect and Waterways

The Woolshed Offset Area is situated on the in the western slopes of the Little Liverpool Range which extends from Lowood to the north (containing the southern migration of the Brisbane River) to the Border Ranges east of Aratula. The Woolshed Offset Area itself consists hilly terrain with a series of steep (15-20%) to very steep (20-25%) terrain rising from 113 m AHD in the west, to 360 m AHD in east (**Figure 34**). There is a line of high points connected by

[37] Department of Sustainability, Environment, Water, Population and Communities (former), now DCCEEW.

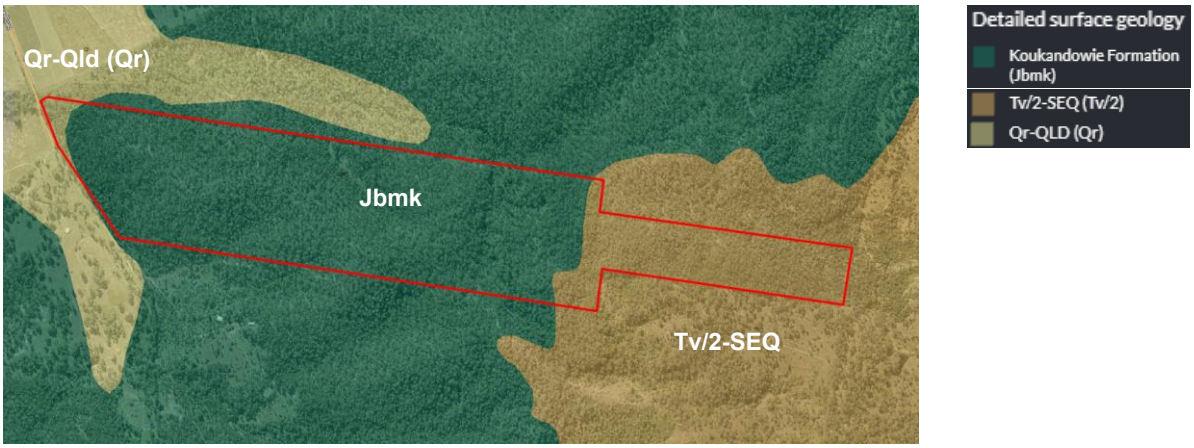
spurs in the eastern portion of the Woolshed Offset Area. These tend to align north-west to south east. The eastern (narrow) portion of the Woolshed Offset Area occupies topographically steep terrain with a northerly aspect.

The Woolshed Offset Area lies within the Woolshed Creek subcatchment of Lockyer Creek, Brisbane River Catchment. Two minor drainage features (unmapped by *Water Act 2000* (Qld) drainage feature mapping) bisect the Woolshed Offset Area traversing north-westerly to Woolshed Creek, 2.5 km distant.

7.2.1.2 Geology, Soils and Landzones

The 1:100,000 detailed surface geology (**Inset 20**) across the western part of the Woolshed Offset Area is dominated by early Jurassic to Middle Jurassic sedimentary geology of the rocks of the Koukandowie Formation (Jbmk). Lithology includes lithofeldspathic labile and sublabile to quartzose sandstone, siltstone, shale, minor coal, ferruginous oolite. This equates to Landzone 9-10 - fine to coarse grained sedimentary geology (**Inset 21**), with respect to the categorisation framework for Queensland's Landzones (Wilson and Taylor 2012)[38]. Spotted Gum (*Corymbia citriodora* subsp. *variegata*) and Narrow-leaved Red Ironbark (*Eucalyptus crebra*) woodlands and open forests are strongly associated with the deeper loamy soils of the Woogaroo Subgroup (Harms 1999).

The 1:100,000 detailed surface geology across the eastern part of the Woolshed Offset Area is a stratified and volcanic metamorphic unit TV/2-SEQ (Tv/2). Lithographically the dominant rock is basalt with minor volcanic breccia. This equates to Landzone 8 - Cainozoic igneous rocks (after Wilson and Taylor 2012).



Inset 20: Surface Geology of the project Area and Locality

Inset 21: Land Zones of the Woolshed Offset Area and Locality

[38] https://environment.des.qld.gov.au/__data/assets/pdf_file/0038/89669/land-zones-queensland.pdf

There is a minor representation of Colluvium (arising from gravitational and downslope wash) in the north-west corner of the Woolshed Offset Area.

7.2.1.3 Land Patterning Change

Historical aerial photography from 1944 – 2002 **(Figures 35a-g**) shows that with the exception of 1944 photography, the Woolshed Offset Area has predominantly open forest coverage throughout this period. 1944 photography does show that central parts of the site had been cleared presumably for grazing. Within the Woolshed Offset Area and nearby, there were a number of bush huts that may have been associated with agricultural or timber production. The patterning within the photography indicates a thinned canopy with a grassy understory lending weight to likely selective timber cutting and somewhat regular fire regimens

1963 photography shows a general thickening of the canopy within the Woolshed Offset Area and locality, with the patterns of past thinning and fire regimes apparent. This observed pattern of canopy thickening and regeneration can be seen to have been continuing in 1971, 1982 and 1992 images implying that by this time selective logging had ceased, and the duration between burns had increased. By 2002, the tell-tale signs bright green signature of Lantana colonisation of waterways, drainage lines and sheltered areas, especially on southern slopes, is apparent. The historic patterning showing woodland-open forest with a grassy understorey, seen in 1944-1962, believed to be a consequence of less frequent burns, is all but absent and this has contributed to vegetation thickening, and Lantana ingress.

7.2.1.4 Bioregional Characteristics of the Woolshed Offset Area

7.2.1.5 Bioregional Context

Biogeographically, the Woolshed Offset Area overlays the Moreton Subregion of the IBRA v7 subregions. The Woolshed Offset Area lies entirely within mapped Regional and State significance corridor (**Figure 36**), as defined within the Queensland Government's Statewide BPA mapping, and Regional Biodiversity Corridors as defined by SEQ Regional Plan (**Figure 37**).

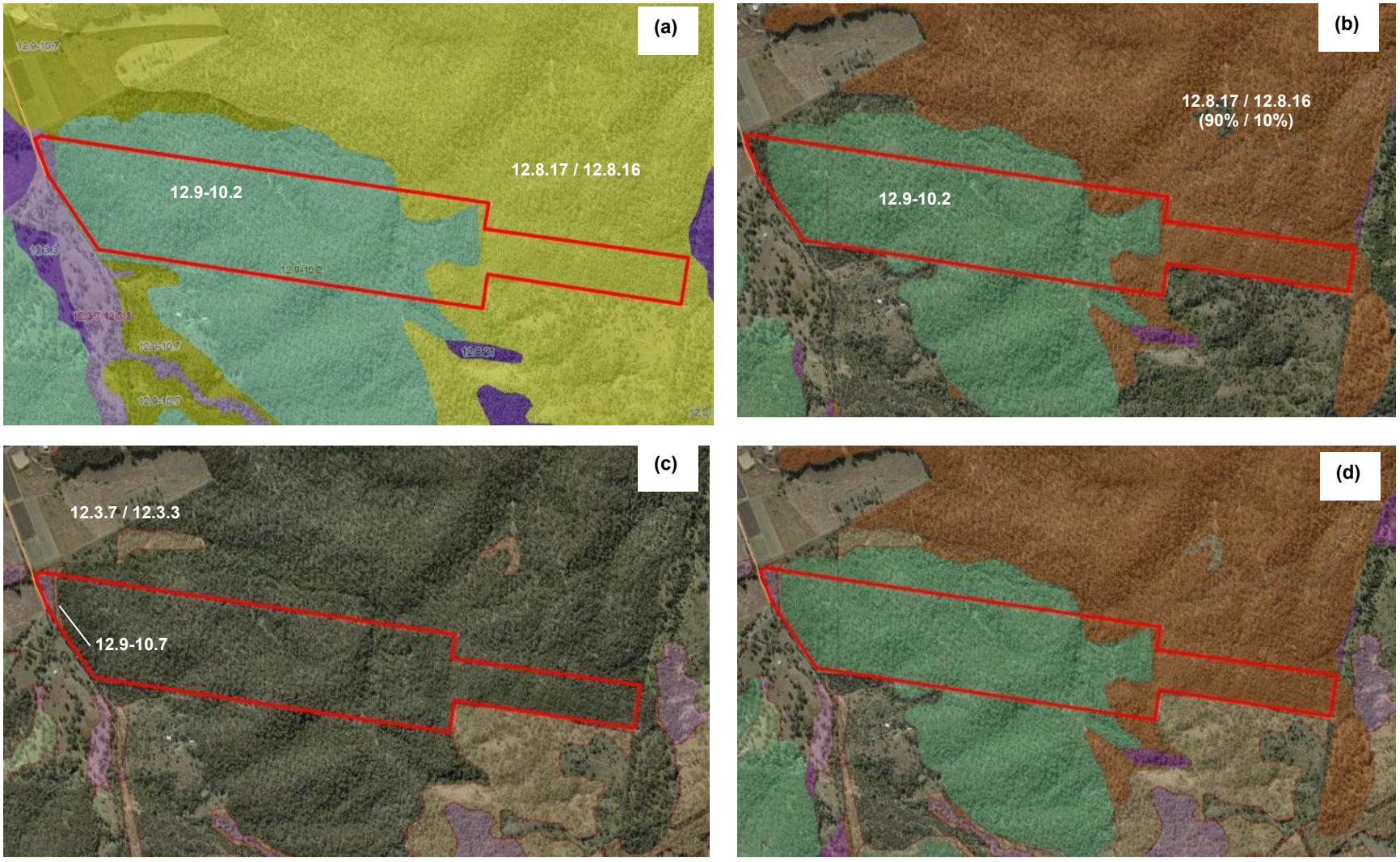
7.2.1.6 Regulated and Pre-clearing Vegetation

Mapped per-clear vegetation of the Offset Area comprised:

- RE 12.9-10.2[39] *Corymbia citriodora* subsp. *variegata* +/- *Eucalyptus crebra* open forest (approx. 72.7%)
- RE12.8.17[40] / 12.8.16[41] mixed polygon of either *Eucalyptus crebra*, *E. melanophloia, E. tereticornis*, *Corymbia tessellaris, C intermedia* woodland with minor inclusions of *Eucalyptus crebra +/- E. melliodora, E. tereticornis* subsp. *Basaltica* woodland (approx. 25.8%)
- RE 12.3.7[42] /12.3.3[43] mixed polygon of predominantly *Eucalyptus tereticornis*, *Casuarina cunninghamiana* subsp. *cunninghamiana* +/- Melaleuca spp. fringing woodland and / or *Eucalyptus tereti*cornis woodland (approx. <1%)
- RE12.9-10.7[44] *Eucalyptus crebra* +/- *E. tereticornis*, *Corymbia tessellaris*, *Angophora* spp. and *E. melanophloia woodland* (approx. <1%).

The extent and status of the current areas of mapped Regulated Vegetation are illustrated in **Inset 22**, with Queensland Government Regulated Vegetation Management Reports appended as **Appendix 13** (**Appendix 13.1** – Woolshed and **Appendix 13.2** – Thagoona).

[39] https://apps.des.qld.gov.au/regional-ecosystems/details/?re=12.9-10.2
[40] https://apps.des.qld.gov.au/regional-ecosystems/details/?re=12.8.17
[41] https://apps.des.qld.gov.au/regional-ecosystems/details/?re=12.8.16
[42] https://apps.des.qld.gov.au/regional-ecosystems/details/?re=12.3.7
[43] https://apps.des.qld.gov.au/regional-ecosystems/details/?re=12.3.3
[44] https://apps.des.qld.gov.au/regional-ecosystems/details/?re=12.9-10.7



Inset 22. (a) Preclear Regional ecosystems, top left; (b) Remnant Regional Ecosystems, top right; (c) High Value Regrowth Regional Ecosystems, bottom left; (d) Composite High Value Regrowth and Remnant Regional Ecosystems, bottom right

Note: - Woolshed Offset Area denoted by red wire frame
Source Qld Globe https://qldglobe.information.qld.gov.au/ accessed 24 September 2023, Queensland Herbarium RE Mapping v.13

7.2.1.7 Biodiversity Planning Context

7.2.1.7.1 Regional

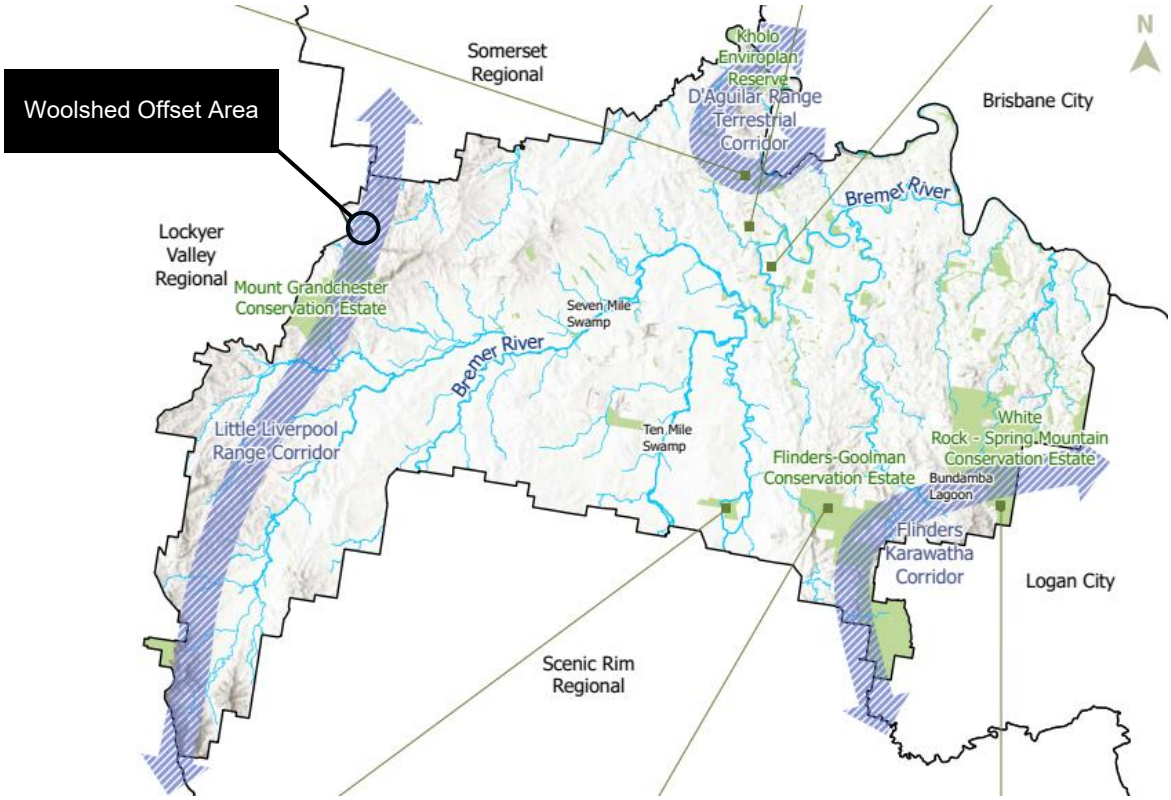
The Woolshed Offset Area is identified as occurring within an area identified by the State's BPA as being strategically located within regionally significant Statewide Biodiversity Corridor (**Figure 36**). Under SEQ Regional Plan, the Woolshed Offset Area is located within the Regional Landscape and Rural Production Area and within corridors and habitats of regional biodiversity value (**Figure 37**).

7.2.1.7.2 Local

From a Local Government perspective **Figure 38** and **Figure 39** present the context of the Woolshed Offset Area in relation to planning instruments of the Ipswich Planning Scheme. From a Local perspective the Ipswich *Natural Environment Strategy 2023*[45] identified that the Woolshed Offset Area is strategically positioned within a broad swathe of Natural Habitat (**Figure 40**). comprising important strategic corridor linkages the Little Liverpool Range Corridor (**Inset 23**).

Contextually, the Woolshed Offset Area lies within a landscape in which Koala *(Phascolarctos cinereus)* and Grey-headed Flying-fox *(Pteropus poliocephalus)* are known, and the vegetation of the Woolshed Offset Area affords habitat for both. It adjoins existing protected areas estate Situated at the northern extent of Natural Area Estate (the Mount Grandchester Conservation Estate) owned by ICC (**Figure 36**). The offset will simultaneously strengthen existing habitat by improving quality of existing and expanding and enhancing available protected habitat consistent with the Ipswich LGA natural area planning framework.

Consideration of Landscape Context and in this regard State biodiversity corridor mapping reveals the Woolshed Offset Area is both contextually and strategically well positioned.



Inset 23. Ipswich Natural Environment Strategy 2023 key feature map

Strategically, the nested location alongside protected area estate is an important feature of the offset; as it, and other parcels being investigated by Cherish as offset in the Woolshed and The Bluff, stand to contribute significantly to State and local biodiversity outcomes of the locality. Further, its dedication averts potential degradation as an

[45] https://www.ipswich.qld.gov.au/__data/assets/pdf_file/0006/237903/Natural-Environment-Strategy-2023.pdf

offset will protect habitat which could otherwise be subjected to existing rural land management vegetation clearing exemptions (e.g. farm forestry, clearing fencelines, single lot rural dwelling / built infrastructure) and therefore will consolidate habitat, contribute to connectivity and contribute visually (to the cultural landscape) through retention of a 'green frame' on the elevated western border of the Ipswich LGA.

7.2.1.8 Statutory Measures

Prior to commencing the Action, the Approval Holder will place a Voluntary Declaration (**VDEC**) under the *Vegetation Management Act 1999* (Qld) over the Woolshed Offset Area to statutorily secure it as an offset under State vegetation management legislation and registered on title (under the *Land Titles Act 1994* (Qld) or *Land Act 1994* (Qld)). The Woolshed Offset Area will then be assigned a Regulated Category A designation, the same category as National Parks over the site. The Offset Management Plan (**OMP**) prepared in support of this PD Report will be the management document for achieving the ecological benefit under State legislation. Within 18 months of the Commencement of the Proposed Action, the Approval Holder will propose to NEPA to place a covenanted biodiversity offset area, registered on title (under the *Land Titles Act 1994* (Qld) or *Land Act 1994* (Qld)) over the Woolshed Offset Area.

VDECs afford protection of the offset until the ecological benefit prescribed by the management is achieved (i.e. they 'time oft'). Beyond this, the offset is transferred to Regulated Category B vegetation, to which all management exemptions and accepted clearing provisions under State Regulations would apply. To ensure the Offset is preserved in perpetuity for ecological benefit, a Covenant is necessary.

VDECs whilst current and Covenants afford the same protection level as National Park in Queensland and provide NEPA with a higher level of confidence that the offset will be protected for the duration of the impacts associated with the proposed action.

The Approval Holder or their engaged provider will be responsible for the delivery and management of offset works during the establishment and through the 10-year maintenance period and per any other Conditions of Approval. Upon the completion of works the offset will be retained in perpetuity; or, if desired by ICC (or the Queensland Government), the land may be gifted back for protection and environmental conservation purposes upon successful completion of relevant offset goals and requirements outline.

7.2.1.9 Offset Management Plan

The Proponent will contract Cherish to manage the Woolshed Offset Area for the duration of the approval.

The Proponent proposes to deliver its offset obligations for Residual Impacts to MNES arising through a Direct Offset by way of rehabilitation contractor. The governing mechanism / methods as to how the Direct Offset will be established, managed and maintained are detailed within the attached Woolshed OMP (see **Appendix 12.1**). Primary means of establishing and maintaining the ecological restoration will be:

- Assisted regeneration comprising weed removal (principally Lantana* (*Lantana camara*), a WoNS) and infill planting where parts of the Woolshed Offset Area currently support Remnant (Regulated Category B) and HVR (Regulated Category C).

The Woolshed Offset Area will be subject to detailed offset delivery works, which will fully revegetate the existing cleared paddocks and regrowth areas. Works will be in-line within the South East Queensland Ecological Restoration Framework[46]. Revegetation works will achieve a diverse vegetative structure in line with the pre-clearing REs and meet the BioCondition metrics outlined in the Woolshed OMP and completion criteria outlined in the concept Offset Rehabilitation Management Plan (Attachment 4 of **Appendix 12.1**).

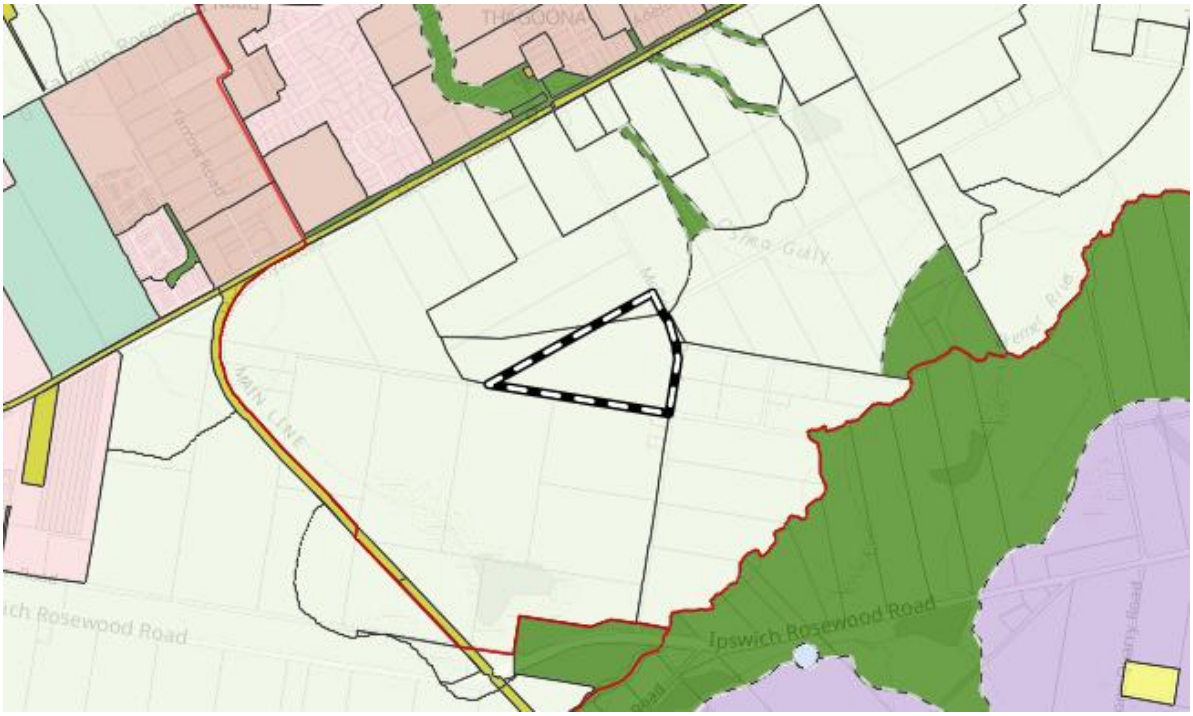
[46] Chenoweth EPLA and Bushland Restoration Services (2012) *South East Queensland Ecological Restoration Framework: Manual.* Prepared on behalf of SEQ Catchments and South East Queensland Local Governments, Brisbane

7.2.2 Thagoona Offset Area

The Thagoona North Offset Area (Thagoona Offset Area) is located at 160 McGearys Road, Thagoona QLD 4306, described as Lot 1 on RP190542, and comprises a total area of 25.21 ha (see **Figure 41**). Of this, 17.68 ha will be utilised as the Thagoona Offset Area to acquit the Significant Residual Impacts associated with the Proposed Action, with the remaining portion of the lot retained as a rural residential allotment. The Thagoona Offset Area is situated approximately 2 km to the south of Thagoona and 4 km to the south-east of Rosewood, within the ICC LGA.

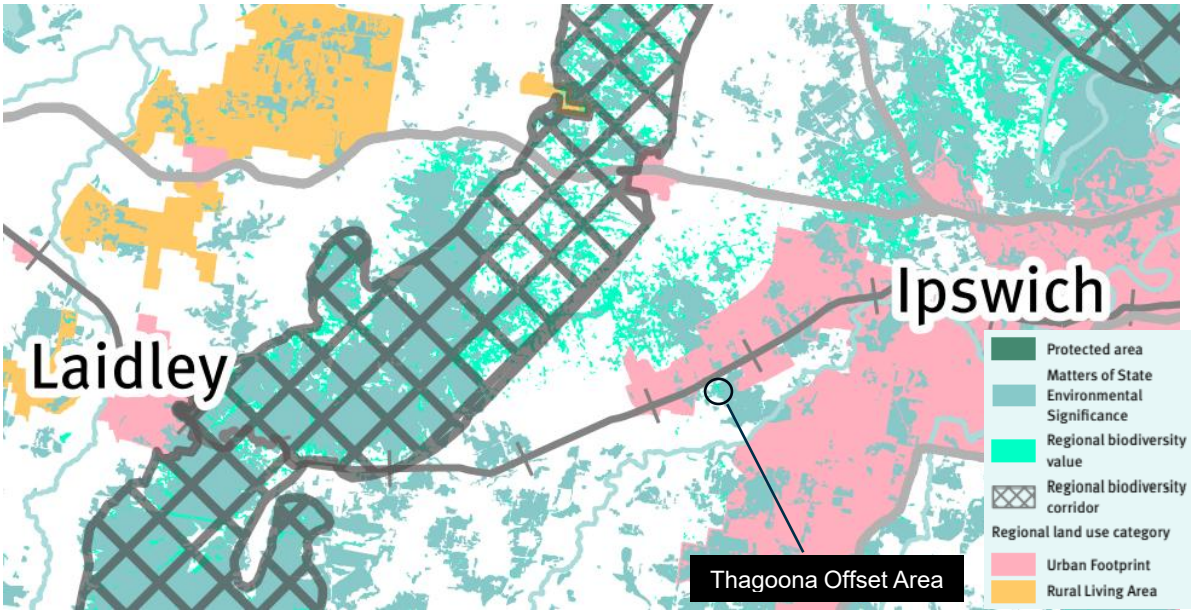
The Thagoona Offset Area will be secured and managed by the same offset provider, Cherish engaged for the Offset Area described in **Section 7.2.1**, with management implemented for a period of 20 years in accordance with the requirements of the EPBC Act Environmental Offsets Policy (DSEWPC 2012). Notably the lots immediately adjoining to the south of the Thagoona Offset Area are already established and secured as EPBC Act environmental offsets for the same MNES, thereby contributing to an existing offset network within the locality.

This Thagoona Offset Area is in located within the Ipswich Planning Scheme Rural Zone Code (**Inset 24**) and bordering the SEQ Urban Footprint (**Inset 25**). Rural Zones under the Ipswich Planning Scheme and the State Government's SEQ Regional Plan have restrictions on development.



Inset 24. Ipswich City Plan 2025 Zoning

Bio-regionally, the Thagoona Offset Area is situated in the South East Queensland Bioregion, lying within the Moreton Basin sub-region. The lots immediately adjoining to the south of the Thagoona Offset Area have been previously identified as having ecological value and are classified as RVM Category A – vegetation offsets; compliance notices; VDECs, indicating that they are already secured and managed as environmental offsets under the EPBC Act. This established offset presence demonstrates that the locality has been independently verified as supporting habitat values relevant to the MNES addressed in this PD Report. Accordingly, the proposed Thagoona Offset Area will complement and consolidate these existing offset areas, contributing to a broader, contiguous network of protected habitat and enhancing landscape-scale ecological function and connectivity for the relevant MNES.



Inset 25: SEQ Regional Plan – Regional Biodiversity Network

MNES known from the locality include both Koala *(Phascolarctos cinereus)* and Grey-headed Flying-fox *(Pteropus poliocephalus)*. The Thagoona Offset Area comprises 17.68 ha of habitat, predominantly characterised by grassland with 11.84 ha of regrowth vegetation associated with RE 12.3.3. The site supports strong regrowth of Queensland Blue Gum (*Eucalyptus tereticornis*), a key forage species for both Koala *(Phascolarctos cinereus)* and Grey-headed Flying-fox *(Pteropus poliocephalus)*, providing a high level of confidence in the capacity of the Thagoona Offset Area to achieve measurable habitat quality improvements over the management period.

The Thagoona Offset Area is situated on the Bremer River floodplain and exhibits moderate landscape connectivity, with linkages to significant known Koala *(Phascolarctos cinereus)* habitat within the Amberley area. Importantly, Koala *(Phascolarctos cinereus)* have been recorded within the immediately adjoining EPBC Act approved offset to the south, which also provides habitat for Grey-headed Flying-fox *(Pteropus poliocephalus)*. The proximity and direct adjacency of the Thagoona Offset Area to these established offset sites reinforces the ecological value of the locality and supports the suitability of the Thagoona Offset Area to contribute to a broader, contiguous network of habitat for the relevant MNES.

The application of the MHQA indicates a baseline score of 5, with a projected improvement to a score of 8 over a 20-year rehabilitation period, reflecting achievable gains through targeted management actions. The Thagoona Offset Area contributes approximately 16.98% towards the total offset requirement for the Proposed Action. Environmental offsets have been calculated and will be delivered in accordance with the EPBC Act Environmental Offsets Policy (DSEWPC 2012).

7.2.2.1 Topography, Terrain and Aspect and Waterways

The Thagoona Offset Area is situated on the Bremer River floodplain and is characterised by low-lying, gently undulating terrain. Elevation across the Thagoona Offset Area is relatively uniform, with only minor local variation associated with subtle drainage lines and overland flow paths. The landform comprises predominantly flat to very gently sloping ground consistent with alluvial floodplain environments (see **Figure 42**).

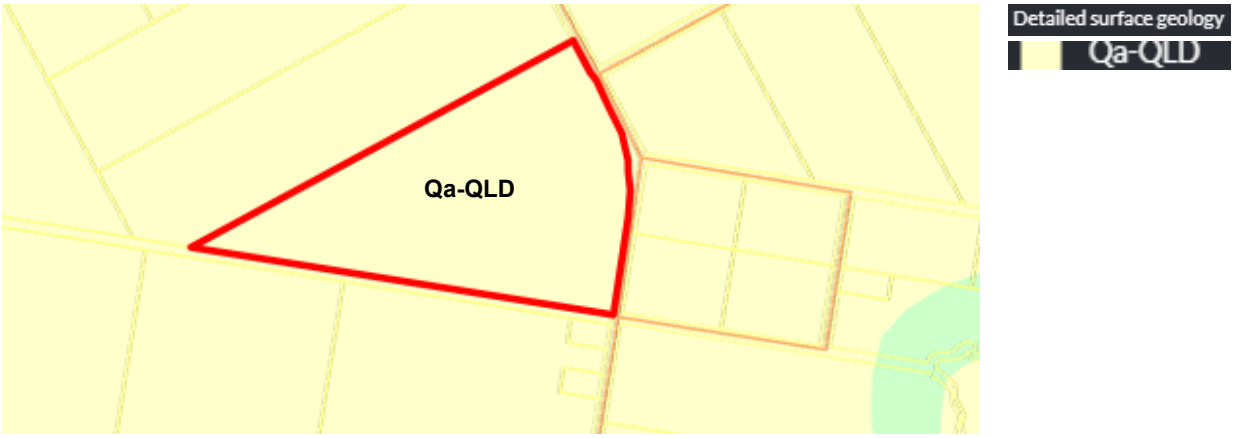
The Thagoona Offset Area lies within the Bremer River catchment, a sub-catchment of the Brisbane River system. Local drainage within the Offset Area is associated with ephemeral overland flow paths and minor drainage depressions that convey water toward the Bremer River during rainfall events. These features contribute to localised variations in soil moisture and vegetation structure across the Thagoona Offset Area and provide minor habitat heterogeneity within an otherwise predominantly grassland and regrowth-dominated landscape.

Zero water drainage features run through the Thagoona Offset Area, so water will likely spread across the level surface with localised pooling after rain events (State of Queensland, 2026).

7.2.2.2 Geology, Soils and Landzones

The 1:100,000 detailed surface geology (**Inset 26**) indicates that the Thagoona Offset Area is underlain by alluvial deposits associated with the Bremer River floodplain. These deposits are typically characterised by unconsolidated to weakly consolidated sediments comprising silts, clays and minor sands derived from upstream catchment processes. The alluvial nature of the geology supports the development of relatively fertile soils with moderate to high moisture-holding capacity, which are conducive to the establishment and regeneration of riparian and floodplain vegetation communities.

In accordance with the Queensland Landzone framework, the Thagoona Offset Area is consistent with Landzone 3 – alluvial plains and river flats (**Inset 27**). Soils within this landzone are generally deep, fine-textured and periodically influenced by flooding, resulting in variable soil moisture regimes across the Thagoona Offset Area. These conditions support the establishment of floodplain-associated vegetation communities, including regrowth dominated by Queensland Blue Gum (*Eucalyptus tereticornis*), which is a characteristic species of alluvial landscapes and provides important habitat values for the MNES addressed in this PD Report.



Inset 26. Surface Geology of the Project Area and Locality

Inset 27. Land Zones of the Project Area and Locality

7.2.2.3 Land Patterning Change

Historical aerial imagery indicates that the Thagoona Offset Area has been subject to progressive clearing and land use modification associated with rural agricultural activities (see **Figure 43a-f**). Imagery from the 1940s shows that while clearing had occurred, scattered remnant trees were still present across the landscape. By the 1970s, the majority of woody vegetation had been removed, resulting in a largely cleared landscape dominated by pasture.

From the 1990s onwards, a pattern of natural regrowth is evident across the Thagoona Offset Area, with the establishment of regenerating woodland communities, particularly associated with *Eucalyptus* species. This regrowth reflects a transition away from intensive agricultural use and has resulted in the re-establishment of vegetation structure and function across parts of the Thagoona Offset Area. The current vegetation condition is therefore representative of a regenerating system, with demonstrated capacity for further ecological recovery under appropriate management.

7.2.2.4 Bioregional Characteristics of the Offset Area

7.2.2.5 Bioregional Context

Biogeographically, the Thagoona Offset Area is situated within the South East Queensland Bioregion, specifically within the Moreton Basin subregion of the IBRA v7. The Thagoona Offset Area is located within a landscape that supports regional habitat connectivity, with moderate linkages across the Bremer River floodplain and surrounding areas. While not mapped as a core biodiversity corridor at the State or regional scale, the Thagoona Offset Area occurs in proximity to established areas of ecological value and contributes to local-scale connectivity between patches of remnant and regrowth vegetation.

7.2.2.6 Regulated and Pre-clearing Vegetation

Mapped per-clear vegetation of the Offset Area comprised:

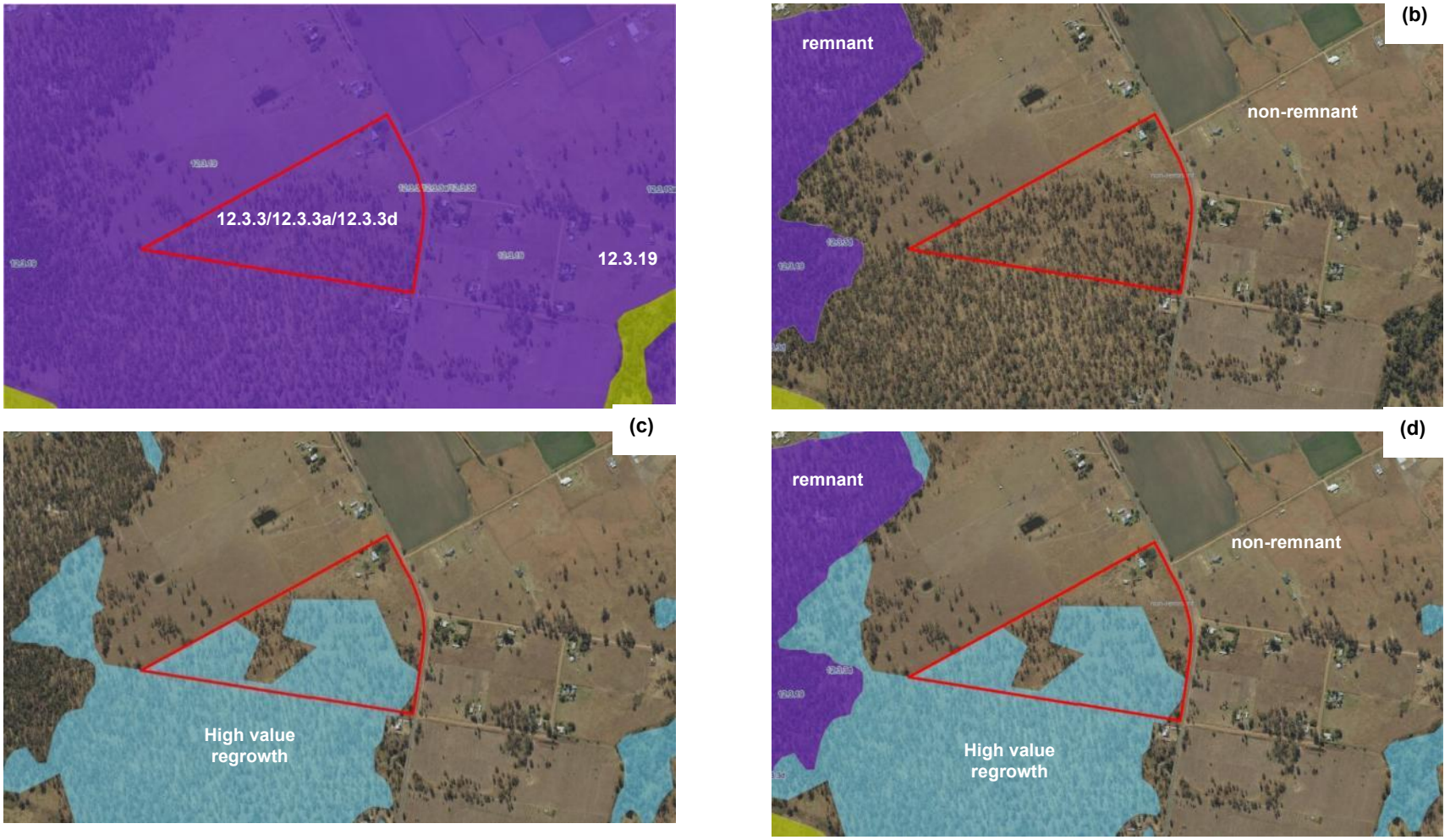
- RE 12.3.3[47] Queensland Blue Gum (*Eucalyptus tereticornis*) woodland on Quaternary alluvium
- RE 12.3.3a[48] Queensland Blue Gum (*Eucalyptus tereticornis*) woodland on Quaternary alluvium
- RE 12.3.3d[49] Queensland Blue Gum (*Eucalyptus tereticornis*) woodland on Quaternary alluvium

The extent and status of the current areas of mapped Regulated Vegetation are illustrated in **Inset 28**, with Queensland Government Regulated Vegetation Management Reports appended as **Appendix 13.2**.

[47] https://apps.des.qld.gov.au/regional-ecosystems/details/?re=12.3.3

[48] https://apps.des.qld.gov.au/regional-ecosystems/details/?re=12.3.3

[49] https://apps.des.qld.gov.au/regional-ecosystems/details/?re=12.3.3



Inset 28. (a) Preclear Regional ecosystems, top left; (b) Remnant Regional Ecosystems, top right; (c) High Value Regrowth Regional Ecosystems, bottom left; (d) Composite High Value Regrowth and Remnant Regional Ecosystems, bottom right

Note: - Thagoona Offset Area denoted by red wire frame
Source Qld Globe https://qldglobe.information.qld.gov.au/ accessed 8 April 2026, Queensland Herbarium Regional Ecosystem Mapping version 13

7.2.2.7 Biodiversity Planning Context

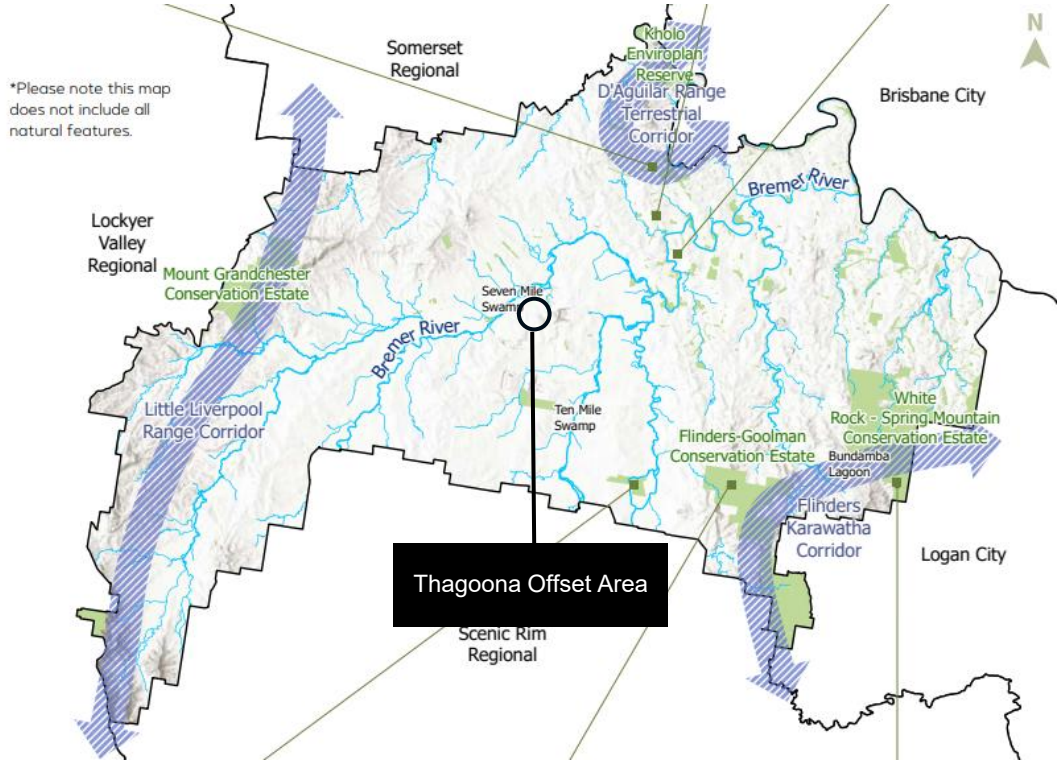
7.2.2.7.1 Regional

The Thagoona Offset Area is partially located within a regionally significant biodiversity corridor buffer as identified by the and occurs in close proximity to a State-level biodiversity corridor buffer (see **Figure 44**). Under the SEQ Regional Plan, the Thagoona Offset Area is situated within the Regional Landscape and Rural Production Area and lies within, and adjacent to, areas identified as supporting regional biodiversity values and connectivity (see **Figure 45**).

7.2.2.7.2 Local

From a Local Government planning perspective, the Thagoona Offset Area is situated within a landscape that is formally recognised for its environmental values under the Natural Environment Strategy. The Thagoona Offset Area positioned between three recognised corridors under the Strategy, being the Little Liverpool Ranger Corridor, D'Aguilar Range Terrestrial Corridor and Flinders Karawatha Corridor, all of which are connected via the tributaries of the Bremer River (**Inset 29**). See **Figures 46, 47** and **48** for illustration of the Thagoona Offset Area's location in context of the Ipswich Nature Conservation Strategy.

The Thagoona Offset Area occurs within a broader landscape known to support Koala *(Phascolarctos cinereus)* and Grey-headed Flying-fox *(Pteropus poliocephalus)*, and the existing vegetation communities provide habitat attributes relevant to both MNES. Its position directly adjacent to lands managed for conservation outcomes enhances its functional role within the landscape, enabling the expansion of habitat extent and the improvement of ecological condition across a contiguous area. This adjacency also supports the consolidation of habitat values and reduces fragmentation, which is a key consideration for both species. In this context, the Thagoona Offset Area represents a logical and strategically aligned extension of the existing conservation framework. By increasing the area of land under active ecological management and improving habitat quality over time, the Offset will contribute to strengthening local habitat networks and enhancing landscape-scale ecological resilience within the Ipswich LGA.



Inset 29. Ipswich Natural Environment Strategy 2023 key feature map

Strategically, the Thagoona Offset Area is positioned to directly extend an existing cluster of lands already secured for conservation, including adjoining offset areas associated with EPBC 2013 / 6941. This location is a key strength

of the proposed offset, as it builds upon a verified and functioning ecological setting rather than introducing an isolated parcel. In practical terms, the Thagoona Offset Area will infill and broaden the current extent of protected habitat, increasing its overall size and coherence.

The formal dedication of the Thagoona Offset Area will also secure regrowth vegetation that, while currently recovering, remains susceptible to decline under typical rural land uses. Without offset protection, ongoing activities such as pasture management, selective clearing, or incremental infrastructure could limit its ecological trajectory. By contrast, active management under the offset framework will direct this regrowth toward higher quality habitat outcomes, improving structural complexity and resource availability for MNES.

As a result, the Thagoona Offset Area will not only increase the extent of protected land but will also enhance the functionality of the surrounding network, improving continuity of habitat across the floodplain and reinforcing the broader ecological system within the Ipswich LGA.

7.2.2.8 Statutory Measures

The statutory mechanism and process for securing the Thagoona Offset Area will be consistent with that described for the Thagoona Offset Area in **Section 7.2**. Prior to commencing the Proposed Action, the Approval Holder will place a VDEC under the *Vegetation Management Act 1999* (Qld) over the Thagoona Offset Area to statutorily secure it as an offset under State vegetation management legislation and registered on title (under the *Land Titles Act 1994* (Qld) *or Land Act 1994* (Qld)). The Offset Area will then be assigned a Regulated Category A designation, the same category as National Parks over the site. The OMP prepared in support of this PD Report will be the management document for achieving the ecological benefit under State legislation. Within 18 months of the Commencement of the Proposed Action, the Approval Holder will propose to NEPA to place a covenanted biodiversity offset area, registered on title (under the *Land Titles Act 1994* (Qld) or *Land Act 1994* (Qld)) over the Woolshed Offset Area.

VDECs afford protection of the offset until the ecological benefit prescribed by the management is achieved (i.e. they 'time oft'). Beyond this, the offset is transferred to Regulated Category B vegetation, to which all management exemptions and accepted clearing provisions under State Regulations would apply. To ensure the Offset is preserved in perpetuity for ecological benefit, a Covenant is necessary.

VDECs whilst current and Covenants afford the same protection level as National Park in Queensland and provide NEPA with a higher level of confidence that the offset will be protected for the duration of the impacts associated with the proposed action.

The Approval Holder or their engaged provider will be responsible for the delivery and management of offset works during the establishment and through the 20-year maintenance period and per any other Conditions of Approval. Upon the completion of works the offset will be retained in perpetuity; or, if desired by ICC (or the Queensland Government), the land may be gifted back for protection and environmental conservation purposes upon successful completion of relevant offset goals and requirements outline.

7.2.2.9 Offset Management Plan

The Proponent will contract Cherish to manage the Thagoona Offset Area for the duration of the approval.

The Proponent proposes to deliver its offset obligations for Residual Impacts to MNES arising through a Direct Offset implemented by a rehabilitation contractor. The framework and methodology for establishment, management and ongoing maintenance of the Direct Offset are detailed within the OMP (**Appendix 12.2**). For this Thagoona Offset Area, restoration will be primarily achieved through the improvement and maturation of existing regrowth vegetation, supplemented by targeted revegetation activities where required. Key measures will include assisted regeneration through weed management and strategic infill planting to increase canopy cover and structural complexity across the Thagoona Offset Area.

Offset delivery works will focus on enhancing the condition of the existing regrowth-dominated landscape and establishing additional vegetation within grass-dominated areas of the Thagoona Offset Area. All works will be undertaken in accordance with the South East Queensland Ecological Restoration Framework and will be directed

toward achieving a vegetation community consistent with the pre-clearing REs. The implementation of these measures will support progression toward the BioCondition targets specified in the OMP and the completion criteria outlined in the Offset Rehabilitation Plan (**Attachment 3** of **Appendix 12.2** – Thagoona OMP).

7.3 Policy Principles

The EPBC Act Environmental Offsets Policy details a number of principles that a suitable offset will achieve. The OMP demonstrates how the two Offset Areas meet and exceed the Policy Principles; a synopsis is outlined by **Table 50**.

Table 50: Performance of the Offset Areas against EPBC Offset Suitability Criteria

EPBC Offset Suitability Criteria	Response
1. Suitable offsets must deliver an overall conservation outcome that improves or maintains the viability of the protected matter	The proposed management measures will deliver an upswing in vegetation quality, within the Offset Area. **<u>Woolshed Offset Area</u>** Further, the Woolshed Offset Area will increase availability of foraging resources for Koala *(Phascolarctos cinereus)* otherwise excluded on account of extensive impenetrable Lantana* (*Lantana camara*) thickets. Lantana* (*Lantana camara*) is a Transformer Weed[50] and WoNS. Without removal of this dense thicket, ecosystem changes will result on account of smothering, of recruitment, allelopathic chemical releases by dense lantana stands which also affect the health and recruitment of native species and enhanced bush fire threats. The site has historically been subjected to logging and forest grazing and in combination with the Lantana* (*Lantana camara*) recovery has been suppressed. Active assisted regeneration focussing on weed reduction will assist in improving canopy and understorey recruitment and re-establishment of more floristically diverse and structurally appropriate understorey for the REs identified as being present within the Woolshed Offset Area: ▪ RE12.9-10.2 - containing Spotted Gum (*Corymbia citriodora* subsp. *variegata*) and Narrow-leaved Red Ironbark (*Eucalyptus crebra*) open forest. The undestorey of this RE may be shrubby or grassy dependent on soils, aspect and fire regimes. Queensland Blue Gum (*Eucalyptus tereticornis*) is present as a subdominant canopy species becoming dominant canopy species on lower slopes. ▪ 12.8.17 – containing a canopy with combinations of Narrow-leaved Red Ironbark (*Eucalyptus crebra*), Silver-leaved Ironbark (*Eucalyptus melanophloia*), Queensland Blue Gum (*Eucalyptus tereticornis*), Moreton Bay Ash (*Corymbia tessellaris*), Pink Bloodwood (*Corymbia intermedia*), and commonly containing Broad-leaved Apple (*Angophora subvelutina*) with a grassy ground layer. ▪ RE12.8.24[51] – containing Spotted Gum (*Corymbia citriodora* subsp. *variegata*) and Narrow-leaved Red Ironbark (*Eucalyptus crebra*) open forest. Both REs contain KHTs and important winter and spring flowering forage species for Grey-headed Flying-fox *(Pteropus poliocephalus)*.

[50] A transformer weed is an invasive plant that can change the nature of an ecosystem over a large area. These weeds can harm the habitats of native plants and animals.
[51] RE12.8.24, is not identified by State Government RE mapping for the local area. However, on account of the presence of Spotted Gum (*Corymbia citriodora* subsp *variegata*) and Narrow Leaved Red Ironbark (*Eucalyptus crebra*) on Land zone 8 this is the best fit.

EPBC Offset Suitability Criteria	Response
	Targeted infill planting will occur within disturbed parts of the Woolshed Offset Area and where floristically and structurally, understorey recovery has been impaired. Both REs are already reach Regulated remnant (Category B) status, however an upswing in the quality of habitat and tangible reduction in the Transformer Weed Lantana* (*Lantana camara*) resulting in a conservation outcome that arrests further ecosystem decline and improves habitat access (the quality and availability of food and shelter) and quality of Koala *(Phascolarctos cinereus)* habitat, reduction in predators and an upswing in the recruitment of canopy species. Indicators such as improvements in the diversity and abundance and coverage of ground covers, grasses shrubs and trees indicate an 'unlocking' of the site from the effects of Lantana* (*Lantana camara*), and by default improved penetration and movement opportunity for Koala *(Phascolarctos cinereus)*. An upswing of '2' is expected over 20 years (time to acquittal of the matter). The total offset area will be 88.63 ha. When considered in the context of the Woolshed Offset Area directly combining with adjoining ICC Conservation Estate (975 ha) and offset lands under future ownership by Cherish (284 ha) to the south, the total area of land actively managed to habitat protection will be 1,350 ha. Furthermore, it will enhance consolidation of a regionally significantly area of important foraging habitat and landscape connections within a recognised Regional and Local Biodiversity Corridor. Bailey's Cyprus Pine (*Callitris baileyana*), a Near Threatened species in Queensland (with reference to the Nature Conservation (Plants) Regulation 2020 (Qld)) is present within the Woolshed Offset Area. IUCN Red List of Threatened Species notes that across its known range, populations are highly fragmented with ongoing threats being clearing for agriculture and smothering by Lantana (https://www.iucnredlist.org/species/34072/2842980 accessed 25 September 2024). The offset will be maintained in perpetuity as habitat protected by Covenant (or another mechanism suitable to achieve enduring protection e.g. dedication to conservation estate). Dedication of the Woolshed Offset Area under Covenant will remove access to landholder vegetation management rights under Planning Regulation 2017 (Qld) conferred under the Rural designation of the Woolshed Offset Area. **Suitability for Koala *(Phascolarctos cinereus)*** Youngentob et al. (2021) identified locally important food trees for Koala *(Phascolarctos cinereus)* by geography. Four (4) tree species recognised as important food trees for Koala *(Phascolarctos cinereus)* in South East Queensland are present within the Woolshed Offset Area; Spotted Gum (*Corymbia citriodora* subsp. *variegata*), Narrow-leaved Red Ironbark (*Eucalyptus crebra*), Silver-leaved Ironbark (*Eucalyptus melanophloia*) and Queensland Blue Gum (*Eucalyptus tereticornis*). These species will also be included in the planting palette for revegetation across the Woolshed Offset Area. No targeted Koala *(Phascolarctos cinereus)* assessments to determine presence through direct observation have been undertaken. Indirect evidence of presence was observed scat surveys undertaken concurrent to the BioCondition assessments (17 July 2024). It is clear that Koala *(Phascolarctos cinereus)* would benefit significantly from the increase in habitat quality and quantity over the Woolshed Offset Area, particularly considering the wider linkages it would provide for Koala *(Phascolarctos cinereus)*, providing significant corridors for individual home ranges and the ability for uninterrupted dispersal (particularly younger males moving to new ranges attempting to avoid older established males). **Suitability *for* Grey-headed Flying-fox *(Pteropus poliocephalus)***

EPBC Offset Suitability Criteria	Response
	Important winter flowering species (with high productivity and reliability scores) in the blossom diet of Grey-headed Flying-fox *(Pteropus poliocephalus)* (Eby and Law 2008) that occur within the Woolshed Offset Area include five species; Spotted Gum (*Corymbia citriodora* subsp. *variegata*), Pink Bloodwood (*Corymbia intermedia*), Moreton Bay Ash (*Corymbia tessellaris*), Silver-leaved Ironbark (*Eucalyptus melanophloia*) and Queensland Blue Gum (*Eucalyptus tereticornis*). Narrow-leaved Red Ironbark (*Eucalyptus crebra*) can also be added to the list of winter flowering species on account that its winter flowering is noted by Stanley and Ross (2002). All three REs represent high quality winter flowering resource; Spotted Gum (*Corymbia citriodora* subsp. *variegata*) is a dominant canopy species within RE12.9-10.2 (OA AU1) and 12.8.24 (OA AU3), Queensland Blue Gum (*Eucalyptus tereticornis*) is an associated species within RE12.9-10.2 (OA AU1) and a codominant species within RE 12.8.17 (OA AU2) and 12.8.24 (OA AU3), and Pink Bloodwood (*Corymbia intermedia*), Moreton Bay Ash (*Corymbia tessellaris)* and Silver-leaved Ironbark (*Eucalyptus melanophloia*) are all co-dominant species within RE12.8.17 (OA AU2) and ecotones with 12.8.24 (OA AU3). ***Averting the Loss of ecosystem values with the offset and impacts upon MNES*** The National Recovery Plan for Koala (DAWE 2022) identifies that habitat degradation is of significant concern for Koala *(Phascolarctos cinereus)*. It notes a number of threats driving habitat degradation including timber harvesting, agriculture, fire and fire management, climate change, and invasion by weeds synergistically increasing impacts of disturbance. Habitat degradation reduces the availability or increases the mortality of food and shelter trees, reduces the nutrient value and water content of food trees, and changes the configuration and relative abundance of habitat trees. These changes impact Koala *(Phascolarctos cinereus)* by making it more difficult for them to access food and shelter resources, increasing stress levels and disease, and leading to reduced breeding success, increased mortality and predation. It also leads to habitat loss as native vegetation is slowly changed to a composition and structure that no longer resembles the original state (Lindenmayer and Fischer 2006) and reduces availability and quality of resources for species and can drive population declines over the long term (extinction debt, Tilman et al. 1994). Superimposed on these threats is the presence of Lantana* (*Lantana camara*) and Climbing Asparagus Fern* (*Asparagus africanus*) which, as transformer weeds in combination with past timber harvesting, local clearing are driving ecosystem change and reducing the quality and availability of Koala *(Phascolarctos cinereus)* forage and shelter habitat and impairing recruitment of all component species of the ecosystem, but especially canopy species leading to collapse in value as Koala *(Phascolarctos cinereus)* habitat. Many of the species which constitute Koala *(Phascolarctos cinereus)* habitat at the Offset Area; Spotted gum (*Corymbia citriodora* subsp. *variegata*), Narrow-leaved Red Ironbark (*Eucalyptus crebra*)[52], Silver-leaved Ironbark (*Eucalyptus melanopholoia*), Pink Bloodwood (*Corymbia intermedia*), Moreton Bay Ash (*Corymbia tessellaris*) and Queensland Blue Gum (*Eucalyptus tereticornis*) are also key blossom forage species for Grey-headed Flying-fox *(Pteropus poliocephalus)*, representing habitat critical to their survival as they are important winter and spring flowering species forming a significant component of their diet during resource bottlenecking and critical periods in the reproductive cycle of Grey-headed Flying-fox *(Pteropus poliocephalus)* (Commonwealth of Australia 2021, p.15). Implementing the offset will arrest this habitat degradation.

[52] *Eucalyptus crebra* is referenced by the Grey-headed Flying-fox *National Recover plan* (Commonwealth of Australia 2021), as an important winter flowering species but not by Eby and Law (2008), despite it being a known winter flowering species in SEQ

EPBC Offset Suitability Criteria	Response
	Quarantining as of right exemptions to clear vegetation under the Planning Regulation 2017 (Qld) and *Vegetation Management Act 1999* (Qld) There are however a number of vegetation management exemptions for rural lands which although would not exacerbate loss would result in diminished quality and availability of habitat for both matters. These relate to existing vegetation management rights affording clearing exemptions under the *Vegetation Management Act 1999* (Qld), including for farm forestry, clearing along property lines and single lot clearing exemptions for dwellings and other essential management. These are outlined: ▪ Despite the current State mapping designations applied to the Site, existing rights[53] allow a continuation of the Site's current understorey maintenance. Further, there are exemptions under the Planning Regulation 2017 allowing for other clearing to be undertake. ▪ Regarding Koala *(Phascolarctos cinereus)* habitat areas, clearing for exempted development, which includes: ○ essential management, allowing for clearing: • that is necessary to maintain infrastructure, including infrastructure already present on the site (fences) or which could foreseeably be established (e.g., stockyards). A clearing width of 10 m is commonly applied to this infrastructure[54] • by the owner of the land to source construction timber to maintain any land of the owner i.e., the timber can be harvested from the Site for use on other properties owned by landowner. This exemption allows for significant harvesting of valuable middle-aged trees[55] up to a point of the threshold for remnant vegetation cover (>50% of the benchmarked canopy cover of the relevant RE)[56]. • to establish a necessary fire management line which identifies the permissible clearing width necessary to establish a fire management line of 10 m. ○ routine management, which allows for clearing to: • source construction timber for establishing necessary built infrastructure on any land of the owner. ▪ Regarding areas identified as Regulated Vegetation, the following exempt clearing work can be undertaken[57]: ○ Exempt clearing work on land generally: • clearing for establishing a necessary fence, firebreak, road or vehicular track and the clearing cannot reasonably be avoided or minimised. The scope of this exemption is limited by the more restrictive koala provisions in the Planning Reg 2017 ○ Exempt clearing work on freehold and Indigenous land: • clearing to establish a necessary fire management line up to 10m wide

[53] Grazing on rural zoned land is accepted development
[54] Due to the vegetation characteristics, dry sclerophyll forest, almost all tree species encountered, and almost all trees were KHT species.
[55] ~400mm DBH trees that are progressing towards providing future hollows. While veteran trees (providing hollows now) are not targeted for this purpose, they will, in time, fail. Without middle-aged trees coming through to replace them, there is a foreseeable lack of future available hollows.
[56] It is noted that past clearing identified by BioCondition Assessments (discarded crowns and limbs, stumps), appears to be as a result of this exemption.
[57] Based on the DNRMMRRD document - The List of exempt clearing work under the Vegetation Management Framework, A guide to Schedule 21 of the Planning Regulation 2017.

EPBC Offset Suitability Criteria	Response
	• necessary for maintaining existing infrastructure, including infrastructure already present on the Site (fences) or which could foreseeably be established (e.g., stockyards). **<u>Thagoona Offset Area</u>** The Thagoona Offset Area will additionally deliver an overall conservation outcome that improves the viability of MNES, including Koala *(Phascolarctos cinereus)* and Grey-headed Flying-fox *(Pteropus poliocephalus)*, through the enhancement of existing regrowth vegetation and currently grass-dominated areas. The area has been historically subject to clearing and grazing, resulting in a simplified vegetation structure and reduced habitat complexity. In its current state, this limits the availability and accessibility of foraging and shelter resources for MNES. Active assisted regeneration, with a focus on weed management and targeted revegetation, will facilitate the recovery of canopy and understorey layers and support the re-establishment of a more floristically diverse and structurally appropriate vegetation community consistent with the pre-clearing RE. The presence of strong Queensland Blue Gum (*Eucalyptus tereticornis*) regrowth provides a suitable foundation for restoration, with this species representing an important food resource for both Koala *(Phascolarctos cinereus)* and Grey-headed Flying-fox *(Pteropus poliocephalus)*. Targeted infill planting within cleared or sparsely vegetated areas will further increase habitat extent and structural diversity across the Thagoona Offset Area. These measures will result in a demonstrable improvement in habitat quality over the offset period, including increased availability of foraging resources, improved shelter and breeding habitat, and enhanced connectivity across the landscape. The expected uplift in condition, as quantified through the MHQA framework, reflects a measurable conservation gain and supports the progression of the Thagoona Offset Area toward a higher functioning ecological system. In combination with adjoining EPBC Act offset areas and land managed for conservation outcomes, the Thagoona Offset Area will contribute to a broader, contiguous habitat network, thereby strengthening landscape connectivity and supporting the long-term persistence of MNES within the locality. The Thagoona Offset Area will be maintained in perpetuity as habitat protected by a Conservation Covenant (or an alternative mechanism suitable to achieve enduring protection, such as dedication to conservation estate). Dedication of the Offset Area under such mechanisms will remove access to landholder vegetation management rights otherwise available under the Planning Regulation 2017 (Qld), ensuring long-term protection and management of the Thagoona Offset Area for conservation purposes. **<u>Suitability *for* Koala *(Phascolarctos cinereus)*</u>** Youngentob et al. (2021) identified locally important forage species for Koala *(Phascolarctos cinereus)* in South East Queensland. While the Thagoona Offset Area does not support the full suite of remnant REs described for other offset sites, it contains established and regenerating individuals of key forage species, most notably Queensland Blue Gum (*Eucalyptus tereticornis*), which is recognised as an important food tree for Koala *(Phascolarctos cinereus)* within the region. No targeted Koala *(Phascolarctos cinereus)* surveys to confirm presence through direct observation have been undertaken within the Thagoona Offset Area. However, the broader locality supports a high number of Koala *(Phascolarctos cinereus)* records, including records within close proximity and on adjoining lands, confirming that the Thagoona Offset Area occurs within an active Koala *(Phascolarctos cinereus)* landscape and is capable of supporting the species.

EPBC Offset Suitability Criteria	Response
	The Thagoona Offset Area will provide a measurable improvement in both the quality and extent of Koala *(Phascolarctos cinereus)* habitat over time. Enhancement of existing regrowth vegetation and targeted infill planting will increase the density and distribution of suitable forage trees and improve structural complexity, thereby supporting shelter, movement and foraging opportunities. In the context of adjoining offset areas and known Koala *(Phascolarctos cinereus)* habitat within the locality, the Thagoona Offset Area will contribute to improved habitat connectivity and facilitate movement across the landscape, including dispersal of individuals between established home ranges. **Suitability *for* Grey-headed Flying-fox *(Pteropus poliocephalus)*** Important winter and spring flowering species utilised by Grey-headed Flying-fox *(Pteropus poliocephalus)* are present within the Thagoona Offset Area, most notably Queensland Blue Gum (*Eucalyptus tereticornis*), which is recognised as a key forage species within the locality. While the Thagoona Offset Area does not support the full complement of remnant REs described for other offset sites, the existing and regenerating vegetation provides a foundation for the development of flowering resources relevant to Grey-headed Flying-fox *(Pteropus poliocephalus)* over time. Enhancement of canopy species through assisted regeneration and targeted planting will increase the availability and reliability of blossom resources within the Thagoona Offset Area. Habitat degradation is recognised as a key threatening process for MNES, including Koala *(Phascolarctos cinereus)* and Grey-headed Flying-fox *(Pteropus poliocephalus)*, through the reduction in availability, quality and accessibility of foraging and shelter resources. Within the Thagoona Offset Area, historic clearing and grazing have resulted in a simplified vegetation structure, limiting the functional capacity of the site to support these matters. However, the presence of established regrowth, particularly Queensland Blue Gum (*Eucalyptus tereticornis),* demonstrates that the Thagoona Offset Area retains the capacity to recover ecological function under appropriate management. Implementation of the offset will arrest further degradation of habitat values and facilitate ecological recovery. Through active management, including weed control, assisted regeneration and targeted revegetation, the Thagoona Offset Area will progress toward a vegetation community consistent with the pre-clearing RE, resulting in improved habitat condition. These improvements will increase the availability of forage resources, enhance shelter opportunities and support the long-term persistence of MNES within the locality. The formal protection of the Thagoona Offset Area will also remove access to vegetation clearing exemptions otherwise available under the Planning Regulation 2017 (Qld) and the *Vegetation Management Act 1999* (Qld), which could incrementally reduce habitat quality over time. Securing the Thagoona Offset Area for conservation purposes ensures that vegetation is retained and enhanced, rather than subject to ongoing disturbance. In this context, the Thagoona Offset Area will contribute to maintaining and improving the viability of MNES by increasing both the quality and extent of available habitat and supporting connectivity with adjoining areas of known ecological value.
2. Suitable offsets must be built around direct offsets but may include other compensatory measures	The Offset Areas will collectively accommodate direct offsets for Koala *(Phascolarctos cinereus)* and Grey-headed Flying-fox *(Pteropus poliocephalus)*, comprising the 88.63 ha Woolshed Offset Area and the 17.68 ha Thagoona Offset Area, with the express aim of achieving an increase in the quality and cover of habitat for these species over the offset period, including a 20-year timeframe to ecological benefit. Both Offset Areas will deliver direct offset outcomes through the rehabilitation, enhancement and long-term protection of habitat, resulting in measurable improvements in vegetation condition and extent. In addition to benefits for

EPBC Offset Suitability Criteria	Response
	MNES, the Offset Areas will also provide tangible ecological benefits to other species within the locality, including State-listed species such as Bailey's Cypress Pine (*Callitris baileyi*), through improvements in habitat structure, floristic diversity and resource availability. Beyond this, the Direct Offset will have beneficial outcomes to other MNES through the consolidation and expansion of protected habitat and ecological corridors of State and Local significance. The Woolshed Offset Area forms part of the Little Liverpool Range Ecological Corridor, and when considered in combination with the Thagoona Offset Area, these sites will function as a complementary pair, increasing habitat availability and strengthening connectivity across the landscape. In combination with habitat under protected estate management (owned by ICC) and adjoining and proposed offset areas managed by Cherish, the Offset Areas will substantially increase the extent of protected habitat. This integrated approach ensures that the offsets are built around direct offset measures while also delivering broader compensatory outcomes at a landscape scale, consistent with the EPBC Act Environmental Offsets Policy.
3. Suitable offsets must be in proportion to the level of statutory protection that applies to the protected matter	The Offset Areas are in proportion to the level of statutory protection that applies to the protected matter, as the offset assessment guide requires that the appropriate conservation status or extinction risk be applied in determining offset requirements. The combined Offset Areas have been designed and assessed in accordance with these requirements, ensuring that the scale and protection mechanism applied are commensurate with the significance of the MNES being offset. Both Offset Areas will be subjected to a VDEC under the *Vegetation Management Act 1999* (Qld) to register each site as a declared area for high nature conservation value with a Regulated Category A listing. This will remain in place until the conservation outcome prescribed by the OMP is achieved. Long-term perpetual outcomes will be achieved through registration of a Statutory Environmental Covenant under the *Land Title Act 1994* (Qld) or *Land Act 1994* (Qld), ensuring protection in perpetuity across both Offset Areas. Alternatively, designation of the Offset Areas as conservation estate through amalgamation into Ipswich City Council's Mount Grandchester Conservation Estate will be sought where feasible. Covenants afford the same level of protection as National Parks in Queensland and provide NEPA with a high level of confidence that the Offset Areas will be protected for the duration of the impacts associated with the proposed action. In this context, the statutory protection mechanisms applied to the Offset Areas are directly aligned with the conservation significance of the MNES and are therefore proportionate to the level of statutory protection required.
4. Suitable offsets must be of a size and scale proportionate to the residual impacts on the protected matter	The Offset Areas (comprising 88.63 ha and 17.68 ha) will be subject to ecological restoration and enhancement works aimed at improving ecological resilience and habitat quality for MNES. The larger Offset Area includes remnant and regrowth vegetation associated with REs (RE 12.9-10.2, RE 12.8.17 and RE 12.8.24), which are recognised as important habitat resources for Koala (*Phascolarctos cinereus*) and Grey-headed Flying-fox (*Pteropus poliocephalus*). The additional Offset Area will complement these values through the restoration of regrowth vegetation and grass-dominated areas, contributing to an overall increase in habitat extent and function. The proposed offsets collectively represent: ▪ a net gain of habitat substantially exceeding the significant residual impact for Koala *(Phascolarctos cinereus)* (6.52 times the total quantum impact of 16.29 ha),

EPBC Offset Suitability Criteria	Response
	▪ a net gain of habitat substantially exceeding the significant residual impact for Grey-headed Flying-fox *(Pteropus poliocephalus)* (6.52 times the total quantum impact of 16.29 ha), and ▪ an offset outcome that achieves approximately 100% of the required offset for all MNES. When considered together, the Offset Areas provide a scale of offset that is proportionate to, and exceeds, the residual impacts of the Proposed Action. The combined area and associated uplift in habitat quality ensure that the offsets deliver a commensurate conservation outcome, consistent with the EPBC Act Environmental Offsets Policy, through both the extent of habitat secured and the magnitude of ecological improvement achieved over the offset period.
5. Suitable offsets must effectively account for and manage the risks of the offset not succeeding	The Proponent has entered into an in-principal agreement with Cherish to secure and manage the Offset Areas for residual impacts arising from the Proposed Action, including the 88.63 ha Woolshed Offset Area and the 17.68 ha Thagoona Offset Area. All works across both Offset Areas will be actively managed by a dedicated, experienced, proven and reputable offset provider (Cherish). The Offset Areas will be subject to a detailed management program (**Appendix 12.1** and **Appendix 12.2**) to govern and guide success parameters, which the offset provider has had input into. Only contractors with an established track record for establishing and managing offsets for similar periods of time (20 years) will be engaged to deliver the works. The level of statutory protection and active management afforded to the Offset Areas will ensure that they are managed and retained as significant areas of conservation in perpetuity. The Direct Offset will be delivered under the framework of the Offset Management Plan, which sets out a comprehensive program of actions including implementation, management, risk evaluation and management, monitoring, reporting, review and corrective actions. The document clearly identifies: ▪ the environmental offset required to be delivered by the Proponent as a consequence of anticipated residual significant impacts of the Proposed Action. ▪ the nature of the conservation gain, including completion criteria, to be achieved over the nominated offset period for relevant MNES across the Offset Areas. ▪ land management actions required over the offset period to support progress towards achieving the completion criteria. ▪ a monitoring program required to measure progress towards achieving the completion criteria, including corrective actions; and ▪ adaptive management, including corrective actions, and reporting requirements for the duration of the offset period. The OMPs (**Appendix 12.1** – Woolshed and **Appendix 12.2** - Thagoona) incorporate SMART principles and outlines a number of triggers and corrective actions to be implemented in instances of non-compliance or where progress toward the achievement of completion criteria is not being met. These are assessed through annual monitoring and reporting in Annual Compliance Reports, as well as at major milestone monitoring events (every 5 years). This structured, adaptive and performance-based management framework ensures that risks associated with the offset not achieving its intended outcomes are identified, monitored and managed throughout the offset period,

EPBC Offset Suitability Criteria	Response
	thereby providing a high level of confidence in successful delivery of the offset outcomes.
6. Suitable offsets must be additional to what is already required, determined by law or planning regulations, or agreed to under other schemes or programs	Prior to commencing the Action, the Approval Holder will place a VDEC under the *Vegetation Management Act 1999* (Qld) over the Offset Areas to statutorily secure them as offsets under State vegetation management legislation and register them on title (under the *Land Titles Act 1994* (Qld) or *Land Act 1994* (Qld)). Both Offset Areas will then be assigned a Regulated Category A designation; the same category as National Parks. The OMP prepared in support of this PD Report will be the management document for achieving the ecological benefit under State legislation. The Proponent will also, prior to expiry of the VDEC, enter into a Conservation Covenant under the *Land Title Act 1994* (Qld) or *Land Act 1994* (Qld) over the Offset Areas or seek another mechanism to protect the Offset (e.g. incorporation into ICC's conservation estate). VDECs afford protection of the offset until the ecological benefit prescribed by the management is achieved (i.e. they 'time off'). Beyond this, the offset is transferred to Regulated Category B vegetation, to which all management exemptions and accepted clearing provisions under State Regulations would apply. To ensure the Offset is preserved in perpetuity for ecological benefit, a Covenant is necessary. VDECs whilst current and Covenants afford the same protection level as National Park in Queensland and provide NEPA with a higher level of confidence that the Offset Areas will be protected for the duration of the impacts associated with the proposed action. The Offset Areas will protect substantial areas of land that currently provide habitat value to MNES but have been subject to historic clearing and land use practices. Despite ongoing regional growth within South East Queensland, both Offset Areas are located outside of the South East Queensland urban footprint and within a Rural Landscape designation and are therefore at relatively low risk of urban development pressure. However, in the absence of the offset, these lands would remain subject to lawful rural land uses, including grazing and vegetation management activities permitted under applicable planning frameworks. It is important to note that the landholder, Cherish, has secured these properties with the intent of establishing environmental offsets. Without the implementation of the Offset, both sites could be managed for agricultural purposes, including cattle grazing, and could be subject to vegetation clearing activities permissible under accepted development provisions (e.g. clearing for infrastructure, asset protection areas or farm forestry). The implementation of the Offset, including the declaration of a VDEC, will restrict access to these clearing exemptions and prevent incremental degradation of habitat values. The success of the Offset is not dependent on adjoining offset areas or conservation estate; however, both Offset Areas are complementary to nearby lands managed for conservation purposes and contribute to broader landscape outcomes. Each Offset Area will be managed under an intensive works program implemented in accordance with the Offset Management Plan and will be subject to consistent and ongoing monitoring through BioCondition and tertiary site monitoring assessments. The OMP identifies the nature of the conservation gain, including completion criteria, to be achieved over the nominated offset period for relevant MNES across the Offset Areas. It includes a detailed risk assessment focused on identifying and managing threats to achieving the conservation outcome, including fire management, vertebrate pest management, stochastic events and processes contributing to ecosystem decline. The management measures required to achieve the stated conservation gain, including the restoration and enhancement of native vegetation communities, are over and above what would be required to maintain the sites under existing

EPBC Offset Suitability Criteria	Response
	lawful land uses. As such, the Offset Areas represent a conservation outcome that is additional to what is already required under law, planning regulation or other programs.
7. Suitable offsets must be efficient, effective, timely, transparent, scientifically robust and reasonable	The Offset Areas are effective in that they are located in proximity to, and maintain connectivity with, areas of vegetation identified as being of State and Regional significance, including recognised biodiversity corridors. In combination, the Offset Areas contribute to landscape-scale ecological outcomes by strengthening habitat continuity and supporting movement of MNES across the broader locality. This positioning ensures the offsets are efficient in delivering conservation outcomes at a regional scale. The presence of established regrowth vegetation within both Offset Areas, particularly within the 88.63 ha Woolshed Offset Area and the regrowth-dominated portions of the 17.68 ha Thagoona Offset Area, ensures that ecological restoration outcomes can be achieved in a timely manner relative to the residual impacts of the Proposed Action. Existing vegetation provides an immediate foundation for improvement, reducing the time required to achieve measurable ecological benefit. Beyond the protection and enhancement of existing regrowth, both Offset Areas include components that will transition from cleared or grass-dominated areas to structurally complex native vegetation over the offset period. This will result in a substantial increase in habitat availability and quality for MNES, representing a clear and measurable conservation gain. The use of established assessment frameworks, including the NEPA impact and offset calculators and the MHQA methodology, ensures that the offset is transparent, scientifically robust and reasonable. The approach adopted provides a clear, repeatable and evidence-based method for quantifying impacts and demonstrating that the Offset Areas will deliver appropriate and proportionate conservation outcomes.
8. Suitable offsets must have transparent governance arrangements including being able to be readily measured, monitored, audited and enforced	The OMPs (**Appendix 12.1** – Woolshed and **Appendix 12.2** - Thagoona) provide clarity around the environmental objectives proposed, risks and risk management in achieving these goals, and the corrective actions to be implemented should works not meet their envisaged targets across both Offset Areas. This will be achieved through: a) intensive ecological restoration works (i.e. assisted regeneration through weed management and infill planting); and b) annual monitoring (however, see precise monitoring schedule within corresponding OMP) across both Offset Areas for the following: ▪ vertebrate pests. ▪ WoNS and regulated weeds. ▪ MNES monitoring; and ▪ vegetation condition monitoring (BioCondition and tertiary plot monitoring). The OMP will be the responsibility of, and implemented by, suitably qualified and experienced offset practitioners to ensure works meet this policy requirement. Regulators will be informed of ongoing progress in relation to the approved OMP through structured and regular reporting. The offset provider (and rehabilitation contractors, as retained) will be responsible for the preparation and completion of compliance reporting for both Offset Areas. This reporting will clearly demonstrate how the requirements defined in the OMPs (**Appendix 12.1** – Woolshed and **Appendix 12.2** - Thagoona) have been met, including confirmation of the qualifications and experience of personnel undertaking monitoring and reporting. It will be the offset providers responsibility to ensure that reporting is provided to NEPA, published on the website and maintained in a secure and accessible format for auditing purposes. Notwithstanding the delivery mechanism, the

EPBC Offset Suitability Criteria	Response
	Proponent will retain overall responsibility for ensuring compliance with approval conditions and the successful implementation of the OMP.

7.4 Offset Provider

The Proponent has an in-principal agreement with the offset provider Cherish, an unlisted not-for-profit fund and the owner of the Offset Areas, to manage both Offset Areas in perpetuity. Commercial terms are yet to be finalised. A holding fee has been paid to secure the 88.63 ha Woolshed Offset Area, and arrangements for the 17.68 ha Thagoona Offset Area have similarly been progressed to ensure its availability for offset delivery.

These agreements provide a clear pathway for the coordinated management of both Offset Areas by a single, experienced offset provider, ensuring consistency in implementation, monitoring and long-term stewardship across the combined offset package.

7.5 Offset Protected Matters

7.5.1 Koala (Phascolarctos cinereus)

As described in **Section 6.2**, the Proposed Action is expected to have a residual impact on the Koala *(Phascolarctos cinereus)*. The Proponent proposes to deliver a direct offset across both Offset Areas and provide other mitigation measures to achieve its offset obligations under the EPBC Act. This is extensively detailed in the OMPs (**Appendix 12.1** - Woolshed and **Appendix 12.2** - Thagoona).

While this PD Report deals exclusively with offsets for Koala *(Phascolarctos cinereus)* under the EPBC Act, it should be noted that the combined offset package, comprising both Offset Areas, will be sufficient to meet any potential offset obligations at the State and Local Government levels.

7.5.1.1 Woolshed Offset Area

7.5.1.1.1 Landscape Records

In order to determine that the proposed offset is suitable to maintain the viability of the protected matter, the presence of Koala *(Phascolarctos cinereus)* records and habitat within 25 km of the Woolshed Offset Area (1990-present) were assessed through desktop analysis of available databases and reports, supplemented with nocturnal spotlighting both on-site and on lands adjoining the Woolshed Offset Area (**Figure 49**).

ALA and Wildlife Online datasets were inspected to determine local and sub-regional records. Contemporary records (post 1990) show a good distribution of records across the search area, with a concentration, unsurprisingly[58] in proximity to built-up (urban) areas. This is an artefact of the number of observers and observer effort/motivation, rather than any real difference in habitat values or suitability between settlements and rural areas[59].

There are 29 contemporary records within 5 km of the Woolshed Offset Area (with one record on the property) and 3,473 records within 25 km. Significant numbers of records occur in the Rosewood, Thagoona, Walloon, Amberley and Willowbank areas to the south-east, and Vinegar Hill, Spring Creek, Churchable Atkinson Dam and Lowood (west through to north).

[58] records are clustered along points of the landscape (roads and settlements where presence is noted and to a lesser extent recorded by casual observation.
[59] there are few observers to make observations of threatened species, and it is not unreasonable to expect a lack of motivation to report the occurrence of such species.

7.5.1.1.2 Site Records

No direct observation assessments (spotlighting, diurnal walked transects, thermal imaging) were undertaken. Instead, indirect signs of presence (i.e. scats) and casual scanning for presence were undertaken at the time BioCondition transects were conducted.

To determine the occurrence of Koala *(Phascolarctos cinereus)* on the offset site, SAT[60] was undertaken and found low levels of scat evidence in areas of regrowth and remnant open forest. in eucalypt-dominated regrowth areas or open paddocks. SAT surveys undertaken at the three BioCondition transects within Assessment Unit 1 (RE 12.9-10.2) sites indicated a very low density of Koala *(Phascolarctos cinereus)* usage across the site. Derived results are shown in **Table 51**.

Table 51: Summary of SAT Results – Woolshed Offset Area

SAT Site Number	Evidence of Koala *(Phascolarctos cinereus)* Use (%)	Koala *(Phascolarctos cinereus)* Use (high / medium / low)[1]
Offset Area (QA) AU1 – Transect 1	0.00	-
OA AU1 – Transect 2	0.00	-
OA AU1 – Transect 3	6.66	Low
OA AU2 – Transect 4	0.00	-
OA AU3 – Transect 6	0.00	-

[1] With reference to Phillips and Callagham (2011) only, use categories are entirely unrelated to State Koala (*Phascolarctos cinereus*) habitat mapping

Derived Data suggests that the offset site supports a low-density Koala *(Phascolarctos cinereus)* population. This finding does not indicate that the offset site is unsuitable or of low value as a Koala *(Phascolarctos cinereus)* offset, but rather that (in its present weed impacted state) it does not have capacity to support any greater Koala *(Phascolarctos cinereus)* density. DESI spatial modelling identifies that the habitat to be created (RE 12.9-10.2) is (in a South East Queensland Bioregion context) of medium value for Koala *(Phascolarctos cinereus)*.

7.5.1.1.3 Landscape Resources

Figure 50 presents mapping of Koala *(Phascolarctos cinereus)* habitat based upon State identified Koala *(Phascolarctos cinereus)* habitat, shows that within 25 km of the Woolshed Offset Area, there is 26,137 ha Remnant (2,593 ha within 5 km and 23,544 ha between 5 and 25 km of the Woolshed Offset Area). There are and 21,387 ha (1,191 ha within 5 km and 20,196 ha between 5 and 25 km of the Woolshed Offset Area) of Regrowth habitat covering 22.4% of the search area. Details are provided in **Table 52**.

Table 52: Extent of State mapped remnant and regrowth Koala *(Phascolarctos cinereus)* REs within 25 km of the Woolshed Offset Area

RE	Short Description	Remnant Extent (ha)	High Value Regrowth Extent (ha)
12.3.3	*Eucalyptus tereticornis* woodland on Quaternary alluvium	766.4	2,433.5

[60] Phillips, S & Callaghan, J (2011). 'The Spot Assessment Technique: a tool for determining localised levels of habitat use by Koalas Phascolarctos cinereus'. Australian Zoologist Volume 25 (3).

RE	Short Description	Remnant Extent (ha)	High Value Regrowth Extent (ha)
12.3.3a	*Eucalyptus crebra, C. tessellaris* woodland to open forest on Quaternary alluvium	18.3	8.2
12.3.3d	*Eucalyptus moluccana* woodland on Quaternary alluvium	92.6	129.1
12.3.7	*Eucalyptus tereticornis, Casuarina cunninghamiana* subsp. *cunninghamiana +/- Melaleuca* spp. fringing woodland	1,953.4	745.4
12.3.11	*Eucalyptus tereticornis +/- Eucalyptus siderophloia*, *Corymbia intermedia* open forest on alluvial plains	10.5	-
12.3.18	*Melaleuca irbyana* low open forest on alluvial plains	110.8	248.7
12.3.19	*Eucalyptus moluccana* and/or *Eucalyptus tereticornis* and *E. crebra* open forest to woodland, with a sparse to mid-dense understorey of *Melaleuca irbyana*	199.3	330.8
12.5.1	Open forest complex with *Corymbia citriodora* subsp. *variegata* on subcoastal remnant Tertiary surfaces.	41.8	118.6
12.5.1b	Open forest complex with *Corymbia citriodora* subsp. *variegata* on subcoastal remnant Tertiary surfaces	12.5	1.9
12.5.2b	*Eucalyptus tereticornis +/- Corymbia intermedia, Lophostemon suaveolens and C. citriodora subsp. variegata* open forest on remnant Tertiary surfaces, usually near coast on deep red soils	61.5	16.6
12.5.7	*Corymbia citriodora* subsp. *variegata +/- Eucalyptus portuensis* or *E. acmenoides, E. fibrosa* subsp. *fibrosa* open forest on remnant Tertiary surfaces	3.5	3.0
12.8.9	*Lophostemon confertus* open forest on Cainozoic igneous rocks	72.9	6.7
12.8.14	*Eucalyptus eugenioides, E. biturbinata, E. melliodora +/- E. tereticornis, Corymbia intermedia* open forest on Cainozoic igneous rocks	397.7	110.8
12.8.14a	*Eucalyptus moluccana* open forest *+/- E. tereticornis, Eucalyptus siderophloia* or *E. crebra* on Cainozoic igneous rocks	-	4.8
12.8.16	*Eucalyptus crebra +/- E. melliodora, E. tereticornis* subsp. *basaltica* woodland on Cainozoic igneous rocks	804.8	90.1
12.8.17	Mixed woodland with combinations of *Eucalyptus crebra, E. melanophloia, E. tereticornis, Corymbia tessellaris, C intermedia* woodland on Cainozoic igneous rocks	2,625.5	1,185.0
12.8.24	*Corymbia citriodora* subsp. *variegata* open forest on Cainozoic igneous rocks especially trachyte	59.4	65.6
12.9-10.2	*Corymbia citriodora* subsp. *variegata +/- Eucalyptus crebra* open forest on sedimentary rocks	11,699.6	5,654.3
12.9-10.3	*Eucalyptus moluccana* open forest on sedimentary rocks	291.8	315.5

RE	Short Description	Remnant Extent (ha)	High Value Regrowth Extent (ha)
12.9-10.5	Woodland complex often with *Corymbia trachyphloia* subsp. *trachyphloia, C. citriodora subsp. variegata, Eucalyptus crebra, E. fibrosa* subsp. *fibrosa* on quartzose sandstone	142.7	38.6
12.9-10.5a	*Eucalyptus helidonica, Corymbia citriodora subsp. variegata* open forest on quartzose sandstone scarps and crests	789.3	238.0
12.9-10.7	*Eucalyptus crebra +/- E. tereticornis, Corymbia tessellaris, Angophora spp.* and *E. melanophloia* woodland on sedimentary rocks	3,542.9	7,460.0
12.9-10.7a	*Eucalyptus siderophloia, Corymbia intermedia +/- E. tereticornis* and *Lophostemon confertus* open forest on sedimentary geology	58.4	-
12.9-10.8	*E ucalyptus melanophloia* grassy woodland, usually with *E. crebra, Eucalyptus tereticornis +/- Corymbia tessellaris, C. erythrophloia and Angophora spp.* on Cainozoic and Mesozoic sediments.	-	1.2
12.9-10.11	*Melaleuca irbyana* low open forest on sedimentary rock	184.5	301.5
12.9-10.17a	*Lophostemon confertus* or *L. suaveolens* dominated open forest usually with emergent *Eucalyptus* and/or *Corymbia* species	96.5	21.8
12.9-10.17d	Open forest generally containing *Eucalyptus siderophloia*, *E. propinqua* or *E major, Corymbia intermedia*	3.1	21.6
12.9-10.18	*Angophora leiocarpa, Eucalyptus crebra* woodland on sedimentary rocks	123.8	75.3
12.9-10.19	*Eucalyptus fibrosa* subsp. *fibrosa* woodland on sedimentary rocks	605.7	172.8
12.9-10.19a	*Corymbia henryi* and/or *Eucalyptus fibrosa subsp. fibrosa* open forest on sedimentary geology	1.9	-
12.9-10.27	*Corymbia* and/or *Eucalyptus* dominated open forest with a very sparse to mid-dense understorey of *Melaleuca irbyana* on sedimentary geology	314.5	851.4
12.9-10.28	*Angophora leiocarpa, Eucalyptus interstans +/- Corymbia intermedia, E. tereticornis* woodland on sedimentary rocks	229.3	191.2
12.11.3a	*Lophostemon confertus +/- Eucalyptus microcorys, E. carnea, E. propinqua, E. major, E. siderophloia* woodland in gullies and on exposed ridges	1.4	0.3
12.11.6	*Corymbia citriodora* subsp. *variegata, Eucalyptus crebra* woodland on metamorphics +/- interbedded volcanics	726.2	433.8
12.11.7	*Eucalyptus crebra* woodland on metamorphics +/- interbedded volcanics	12.8	8.2
12.11.8	*Eucalyptus melanophloia, E. crebra woodland* on metamorphics +/- interbedded volcanics	-	3.8
12.11.14	*Eucalyptus crebra, E. tereticornis, Corymbia intermedia* woodland on metamorphics +/- interbedded volcanics	28.1	27.9

RE	Short Description	Remnant Extent (ha)	High Value Regrowth Extent (ha)
12.11.15	*Eucalyptus tereticornis, Corymbia intermedia* open woodland with *Xanthorrhoea johnsonii* understorey on serpentinite	-	1.7
12.11.18	*Eucalyptus moluccana woodland* on metamorphics +/- interbedded volcanics	12.2	13.1
12.12.5	*Corymbia citriodora* subsp. *variegata, Eucalyptus crebra* woodland on Mesozoic to Proterozoic igneous rocks	18.9	25.2
12.12.12	*Eucalyptus tereticornis, Corymbia intermedia, E. crebra +/- Lophostemon suaveolens* woodland on Mesozoic to Proterozoic igneous rocks	-	27.8
12.12.15b	*Lophostemon confertus* open forest *+/- Eucalyptus microcorys, E. siderophloia, E. carnea, E. propinqua* and vine forest species often present in understorey.	2.5	0.6
12.12.28	*Eucalyptus moluccana* woodland on Mesozoic to Proterozoic igneous rocks	20.0	3.2
Total		26,137.0	21,387.0
Proportion of all habitat in search area		55.0%	45.0%
Proportion of total search area (211,110.6 ha)		12.4%	10.1%

7.5.1.1.4 Site Resources

The Woolshed Offset Area comprises three Remnant REs (RE 12.9-10.2, RE 12.8.17 and RE 12.8.24), all of which are recognised as ecosystems supporting Koala *(Phascolarctos cinereus)* in South East Queensland. Locally important forage species (Youngentob et al. 2021) present within these ecosystems, known to be present onsite area described.

7.5.1.1.4.1 RE 12.9-10.2

These include Spotted Gum (*Corymbia citriodora* subsp. *variegata*) and Narrow-leaved Red Ironbark (*Eucalyptus crebra*) both of which are dominant canopy species (with respect to **Table 13**). Queensland Blue Gum (*Eucalyptus tereticornis*) and Silver-leaved Ironbark (*Eucalyptus melanophloia*) are a minor component (associated) of the canopy.

7.5.1.1.4.2 RE 12.8.17

These include Queensland Blue Gum (*Eucalyptus tereticornis*) and Narrow-leaved Red Ironbark (*Eucalyptus crebra*) both of which are dominant canopy species (with respect to **Table 13**). Silver-leaved Ironbark is a minor (assocated) component of the canopy. Moreton Bay Ash (*Corymbia tessellaris*) and Pink Bloodwood (*Corymbia intermedia*), both of which are subdominant canopy species are considered to be ancillary habitat species (after Youngentob *et al.* 2021).

7.5.1.1.4.3 RE 12.8.24

These include Spotted Gum (*Corymbia citriodora* subsp. *variegata*) and Narrow-leaved Red Ironbark (*Eucalyptus crebra*) both of which are dominant canopy species (with respect to **Table 13**). Silver-leaved Ironbark (*Eucalyptus melanophloia*) is a minor component (associated) of the canopy.

7.5.1.2 Thagoona Offset Area

7.5.1.2.1 Landscape Records

In order to determine that the proposed offset is suitable to maintain the viability of the protected matter, the presence of Koala *(Phascolarctos cinereus)* records and habitat within 25 km of the Thagoona Offset Area (1990–present) were assessed through desktop analysis of available databases and reports.

ALA and Wildlife Online datasets were inspected to determine local and sub-regional records. Contemporary records (post 1990) show a broad distribution across the search area, with a concentration in proximity to built-up (urban) areas (see **Figure 51**). This reflects observer effort and reporting bias rather than any meaningful difference in habitat suitability between urban and rural landscapes.

There are 3295 records within 25 km of the Thagoona Offset Area, including 265 records within 5 km from the site, indicating that the locality supports a well-established and active Koala *(Phascolarctos cinereus)* population. Significant numbers of records occur in the Rosewood, Thagoona, Walloon, Amberley and Willowbank areas to the south-east, and Vinegar Hill, Spring Creek, Churchable, Atkinson Dam and Lowood (west through to north).

The density and distribution of records confirm that the Thagoona Offset Area is situated within a broader landscape that supports Koala *(Phascolarctos cinereus)*, and that the Thagoona Offset Area has the capacity to contribute to maintaining and enhancing habitat availability and connectivity for the species.

7.5.1.2.2 Site Records

No direct observation assessments (e.g. spotlighting, diurnal walked transects or thermal imaging) were undertaken. Instead, indirect assessment methods and general habitat observations were completed concurrently with BioCondition transects.

To determine the occurrence of Koala *(Phascolarctos cinereus)* within the Offset Site, the SAT was undertaken. No confirmed scat evidence was recorded during surveys. Limited secondary indicators of potential Koala *(Phascolarctos cinereus)* activity were observed, including minor scratch marks on trees; however, these were not sufficient to confirm presence.

Field observations indicate that the site has been subject to recent inundation, with evidence of flood-related debris accumulation (e.g. debris lines and material wrapped around the bases of trees). These conditions may influence the detectability and persistence of indirect evidence such as scats.

SAT surveys undertaken at the BioCondition transects indicate that Koala *(Phascolarctos cinereus)* usage of the Thagoona Offset Area is low or episodic at the time of survey. The absence of confirmed scat records suggests limited current utilisation; however, the presence of suitable regrowth habitat indicates the site retains the capacity to support Koala *(Phascolarctos cinereus)* as habitat condition improves over time (see **Table 53**).

Table 53: Summary of SAT Results – Thagoona Offset Area

SAT Site Number	Evidence of Koala *(Phascolarctos cinereus)* Use (%)	Koala *(Phascolarctos cinereus)* Use (high / medium / low)[1]
SAT survey 1	0.00	-
SAT survey 2	0.00	-

SAT Site Number	Evidence of Koala *(Phascolarctos cinereus)* Use (%)	Koala *(Phascolarctos cinereus)* Use (high / medium / low)[1]
SAT survey 3	0.00	-

[1] With reference to Phillips and Callagham (2011) only, use categories are entirely unrelated to State Koala habitat mapping

Derived data indicates that the Thagoona Offset Area currently may offer support for a low-density Koala *(Phascolarctos cinereus)* population. This finding does not suggest that the Offset Site is unsuitable or of low value as a Koala *(Phascolarctos cinereus)* offset; rather, it reflects the present condition of the Offset Site, which is influenced by past disturbance and current vegetation structure, limiting its capacity to support higher densities of Koala *(Phascolarctos cinereus)* at this time.

The absence of confirmed scat records during field assessment does not preclude Koala *(Phascolarctos cinereus)* presence. Detectability of Koala *(Phascolarctos cinereus)* through indirect signs can be influenced by a range of factors, including recent environmental conditions. Evidence of recent inundation across the Thagoona Offset Area, including debris lines and material accumulation around tree bases, indicates that flood events may have removed or obscured scats, thereby reducing survey detectability. Additionally, low-density or transient use of the site by Koala *(Phascolarctos cinereus)*, particularly in regrowth-dominated or open habitats, can result in limited accumulation of detectable signs.

DESI spatial modelling identifies that the habitat to be established and enhanced within the Thagoona Offset Area is of value for Koala *(Phascolarctos cinereus)* within the South East Queensland Bioregion. As such, the Thagoona Offset Area has the capacity to support increased Koala *(Phascolarctos cinereus)* utilisation over time as habitat condition improves through assisted regeneration and revegetation works.

Accordingly, the Thagoona Offset Area represents a site with the capacity for measurable uplift in habitat quality and function, transitioning from a currently constrained, low-density usage scenario to a more suitable and productive Koala *(Phascolarctos cinereus)* habitat over the offset period.

7.5.1.2.3 Landscape Resources

Figure 52 presents mapping of Koala *(Phascolarctos cinereus)* habitat based upon State identified Koala *(Phascolarctos cinereus)* habitat, shows that within 25 km of the Thagoona Offset Area, there is 34,508 ha Remnant and 20,067 ha of Regrowth habitat covering 17.2% and 10.0% of the search area respectively. Details are provided in **Table 54**.

Table 54: Extent of State mapped remnant and regrowth Koala *(Phascolarctos cinereus)* REs within 25 km of the Thagoona Offset Area

RE	Short Description	Remnant Extent (ha)	High Value Regrowth Extent (ha)
12.3.3	*Eucalyptus tereticornis* woodland on Quaternary alluvium	848.8	2147.1
12.3.3a	*Eucalyptus crebra, C. tessellaris* woodland to open forest on Quaternary alluvium	50.4	32.3
12.3.3d	*Eucalyptus moluccana* woodland on Quaternary alluvium	103.5	138.4
12.3.7	*Eucalyptus tereticornis, Casuarina cunninghamiana* subsp. *cunninghamiana* +/- *Melaleuca* spp. fringing woodland	1458.1	964.3
12.3.7a	*Melaleuca bracteata* open forest +/- emergent *Eucalypts tereticornis* in drainage depressions on Quaternary alluvial plains	15.8	9.4

RE	Short Description	Remnant Extent (ha)	High Value Regrowth Extent (ha)
12.3.7d	Aquatic vegetation usually fringed with *Eucalyptus tereticornis* in closed depressions on alluvial plains	0.6	-
12.3.10	*Eucalyptus populnea +/- E. tereticornis* grassy woodland/tall woodland +/- patches of *Acacia harpophylla* and *Melaleuca bracteata.* Occurs on Quaternary alluvial plain	49.1	46.3
12.3.11	*Eucalyptus tereticornis +/- Eucalyptus siderophloia*, *Corymbia intermedia* open forest on alluvial plains	28.3	18.0
12.3.18	*Melaleuca irbyana* low open forest on alluvial plains	110.0	238.9
12.3.19	*Eucalyptus moluccana* and/or *Eucalyptus tereticornis* and *E. crebra* open forest to woodland, with a sparse to mid-dense understorey of *Melaleuca irbyana*	199.5	330.6
12.5.1	Open forest complex with *Corymbia citriodora* subsp. *variegata* on subcoastal remnant Tertiary surfaces.	10.5	30.5
12.5.1b	Open forest complex with *Corymbia citriodora* subsp. *variegata* on subcoastal remnant Tertiary surfaces	5.2	1.1
12.5.2b	*Eucalyptus tereticornis +/- Corymbia intermedia, Lophostemon suaveolens and C. citriodora subsp. variegata* open forest on remnant Tertiary surfaces, usually near coast on deep red soils	27.2	21.9
12.5.7	*Corymbia citriodora* subsp. *variegata +/- Eucalyptus portuensis* or *E. acmenoides, E. fibrosa* subsp. *fibrosa* open forest on remnant Tertiary surfaces	14.3	4.4
12.5.7c	*Corymbia henryi and/or Eucalyptus fibrosa subsp. fibrosa woodland +/- C. citriodora subsp. variegata, E. major, E. carnea, E. tindaliae, E. siderophloia, Angophora leiocarpa, E. helidonica, E. portuensis, E. latisinensis, C. intermedia and E. moluccana.* on complex of remnant Tertiary surfaces	11.0	2.0
12.8.9	*Lophostemon confertus* open forest on Cainozoic igneous rocks	26.8	5.0
12.8.14a	*Eucalyptus moluccana* open forest +/- *E. tereticornis, Eucalyptus siderophloia* or *E. crebra* on Cainozoic igneous rocks	1.8	4.8
12.8.16	*Eucalyptus crebra +/- E. melliodora, E. tereticornis* subsp. *basaltica* woodland on Cainozoic igneous rocks	667.0	82.9
12.8.17	Mixed woodland with combinations of *Eucalyptus crebra, E. melanophloia, E. tereticornis, Corymbia tessellaris, C intermedia* woodland on Cainozoic igneous rocks	1440.7	-
12.8.20	Mixed woodland with combinations of *Eucalyptus crebra, E. melanophloia, E. tereticornis, Corymbia tessellaris, C intermedia* woodland on Cainozoic igneous rock	10.2	-
12.8.24	*Corymbia citriodora* subsp. *variegata* open forest on Cainozoic igneous rocks especially trachyte	575.4	279.5

RE	Short Description	Remnant Extent (ha)	High Value Regrowth Extent (ha)
12.9-10.2	*Corymbia citriodora* subsp. *variegata* +/- *Eucalyptus crebra* open forest on sedimentary rocks	15655.8	4675.9
12.9-10.3	*Eucalyptus moluccana* open forest on sedimentary rocks	271.5	288.1
12.9-10.5	Woodland complex often with *Corymbia trachyphloia* subsp. *trachyphloia, C. citriodora subsp. variegata, Eucalyptus crebra, E. fibrosa* subsp. *fibrosa* on quartzose sandstone	2.6	
12.9-10.7	*Eucalyptus crebra +/- E. tereticornis, Corymbia tessellaris, Angophora spp.* and *E. melanophloia* woodland on sedimentary rocks	2951.0	6384.5
12.9-10.7a	*Eucalyptus siderophloia, Corymbia intermedia +/- E. tereticornis* and *Lophostemon confertus* open forest on sedimentary geology	8.0	-
12.9-10.8	*E ucalyptus melanophloia* grassy woodland, usually with *E. crebra, Eucalyptus tereticornis +/- Corymbia tessellaris, C. erythrophloia and Angophora spp.* on Cainozoic and Mesozoic sediments.	6.2	15.2
12.9-10.11	*Melaleuca irbyana* low open forest on sedimentary rock	202.7	276.5
12.9-10.12	Mixed woodland usually containing *Corymbia intermedia, Angophora leiocarpa* and at least the presence of *Eucalyptus seeana* on sedimentary rocks	114.8	36.3
12.9-10.17	*Eucalyptus acmenoides, E. major, E. siderophloia +/- Corymbia citriodora subsp. variegata* open forest on sedimentary rocks	56.7	6.8
12.9-10.17a	*Lophostemon confertus* or *L. suaveolens* dominated open forest usually with emergent *Eucalyptus* and/or *Corymbia* species	295.7	58.1
12. 9-10.17b	*Corymbia citriodora subsp. variegata* mixed open forest to woodland	60.6	21.6
12.9-10.17d	Open forest generally containing *Eucalyptus siderophloia*, *E. propinqua* or *E major, Corymbia intermedia*	3.1	21.6
12.9-10.19	*Eucalyptus fibrosa* subsp. *fibrosa* woodland on sedimentary rocks	767.1	231.9
12.9-10.19a	*Corymbia henryi* and/or *Eucalyptus fibrosa subsp. fibrosa* open forest on sedimentary geology	291.1	29.0
12.9-10.27	*Corymbia* and/or *Eucalyptus* dominated open forest with a very sparse to mid-dense understorey of *Melaleuca irbyana* on sedimentary geology	307.2	889.3
12.9-10.28	*Angophora leiocarpa, Eucalyptus interstans +/- Corymbia intermedia, E. tereticornis* woodland on sedimentary rocks		
12.11.3	*Eucalyptus siderophloia, E. propinqua +/- E. microcorys, Lophostemon confertus, Corymbia intermedia, E. acmenoides open forest on metamorphics +/- interbedded volcanics*	188.2	2.3

RE	Short Description	Remnant Extent (ha)	High Value Regrowth Extent (ha)
12.11.3a	*Lophostemon confertus +/- Eucalyptus microcorys, E. carnea, E. propinqua, E. major, E. siderophloia* woodland in gullies and on exposed ridges	1180.8	43.8
12.11.5	*Corymbia citriodora subsp. variegata woodland to open forest +/- Eucalyptus siderophloia/E. crebra, E. carnea, E. acmenoides, E. propinqua* on metamorphics +/- interbedded volcanics	1560.3	76.9
12.11.5m	Rock pavement to open woodland of *Eucalyptus carnea* and *Corymbia citriodora subsp. variegata, Corymbia intermedia* and *Lophostemon confertus*	2.5	-
12.11.6	*Corymbia citriodora* subsp. *variegata, Eucalyptus crebra* woodland on metamorphics +/- interbedded volcanics	3636.6	954.3
12.11.7	*Eucalyptus crebra* woodland on metamorphics +/- interbedded volcanics	434.0	24.0
12.11.8	*Eucalyptus melanophloia, E. crebra woodland* on metamorphics +/- interbedded volcanics	11.3	46.0
12.11.14	*Eucalyptus crebra, E. tereticornis, Corymbia intermedia* woodland on metamorphics +/- interbedded volcanics	54.7	61.2
12.11.15	*Eucalyptus tereticornis, Corymbia intermedia* open woodland with *Xanthorrhoea johnsonii* understorey on serpentinite	-	1.7
12.11.18	*Eucalyptus moluccana woodland* on metamorphics +/- interbedded volcanics	266.7	77.6
12.11.25	*Corymbia henryi* and/or *Eucalyptus fibrosa subsp. fibrosa +/- E. crebra, E. carnea, E. tindaliae woodland* on *metamorphics +/-* interbedded volcanic	217.4	6.1
12.12.3	Open forest complex with *Corymbia citriodora subsp. variegata, Eucalyptus siderophloia or E. crebra or E. decolor, E. major and/or E. longirostrata, E. acmenoides or E. portuensis* on Mesozoic to Proterozoic igneous rocks	57.6	4.9
12.12.5	*Corymbia citriodora* subsp. *variegata, Eucalyptus crebra* woodland on Mesozoic to Proterozoic igneous rocks	56.3	35.1
12.12.7	*Eucalyptus crebra* woodland on Mesozoic to Proterozoic igneous rocks	1.7	0.3
12.12.12	*Eucalyptus tereticornis, Corymbia intermedia, E. crebra +/- Lophostemon suaveolens* woodland on Mesozoic to Proterozoic igneous rocks	28.5	73.0
12.12.15	Mixed open forest including combinations of *Eucalyptus propinqua, E. siderophloia, Corymbia intermedia, E. microcorys, Lophostemon confertus* open forest on Mesozoic to Proterozoic igneous rocks	8.5	-

RE	Short Description	Remnant Extent (ha)	High Value Regrowth Extent (ha)
12.12.15b	*Lophostemon confertus* open forest *+/- Eucalyptus microcorys, E. siderophloia, E. carnea, E. propinqua* and vine forest species often present in understorey.	118.2	13.3
12.12.23	*Eucalyptus tereticornis subsp. tereticornis* or *E. tereticornis subsp. basaltica +/- E. eugenioides* woodland to open forest on crests, upper slopes and elevated valleys and plains on Mesozoic to Proterozoic igneous rocks	3.9	-
12.12.28	*Eucalyptus moluccana* woodland on Mesozoic to Proterozoic igneous rocks	20.0	3.2
Total		34,507.7	20,067.7
Proportion of all habitat in search area		63.2%	36.8%
Proportion of total search area (201,161.9 ha)		17.2%	10.0%

7.5.1.2.4 Site Resources

The Thagoona Offset Area predominantly comprises regrowth vegetation associated with RE 12.3.3, which is recognised as an ecosystem capable of supporting Koala *(Phascolarctos cinereus)* within South East Queensland. The Thagoona Offset Area supports established and regenerating individuals of locally important forage species (Youngentob et al. 2021), most notably Queensland Blue Gum (*Eucalyptus tereticornis*), which is known to occur onsite.

These species provide a suitable foundation for habitat development and will be further enhanced through assisted regeneration and targeted revegetation, increasing the availability and quality of forage resources for Koala *(Phascolarctos cinereus)* over time.

7.5.1.2.5 RE 12.3.3

The canopy of the Offset Site is dominated by Queensland Blue Gum (*Eucalyptus tereticornis*), consistent with the characteristics of RE 12.3.3. Narrow-leaved Red Ironbark (*Eucalyptus crebra*) may also be present and locally abundant, particularly toward the margins of the alluvial plains. Other species may occur as scattered individuals or in small clumps, including Silver-leaved Ironbark (*Eucalyptus melanophloia*), Queensland Blue Gum (*Eucalyptus tereticornis*), and associated *Corymbia* species.

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

As described in **Section 6.3**, the Proposed Action will have a residual impact on Grey-headed Flying-fox *(Pteropus poliocephalus)*. The Proponent proposes to deliver a direct offset and provide other mitigation measures to achieve its offset obligations under the EPBC Act. This is extensively detailed in the OMPs (**Appendix 12.1** - Woolshed and **Appendix 12.2** - Thagoona).

While this PD Report deals exclusively with offsets for Koala *(Phascolarctos cinereus)* under the EPBC Act, it should be noted that the offset package to be delivered by the Proponent in order to meet its obligations for Koala (*Phascolarctos cinereus*) under the EPBC Act, will also be sufficient to meet any potential offset obligation at the State and Local Government levels.

7.5.2.1 Woolshed Offset Area

7.5.2.1.1 Landscape and Site Records

In order to determine that the proposed offset is suitable to maintain the viability of the protected matter, the presence of Grey-headed Flying-fox *(Pteropus poliocephalus)* records (**Figure 53**) and camps (**Figure 54**) within 25 km of the Woolshed Offset Area.

ALA and Wildlife Online datasets were inspected to determine local and sub-regional records. The somewhat limited number of observational records 477 records within the sub-region (3 within 5 km of the Woolshed Offset Area) (restricted to two locations) is unlikely to reflect this species use of the landscape:

- firstly, there is a concentration of records around urban areas and (especially) known, active camps. Two larger camps (Atkinsons Dam (19 km) and Lowood Bend (11 km)) are well within mean forage distances developed by Westcott et al (2015) from telemetry data. Westcott et al (2015) reported the mean distance of a Grey-headed Flying-fox *(Pteropus poliocephalus)* foraging site from the camp in which the animal had roosted and to which it returned was 10.9 km (quartile range from 6.2 - 27.9 km). The Woolshed Offset Area is located within the mean forage range for the species.

- secondly, it is not unusual for there to be an absence of fauna records in a sparsely settled rural landscape. In our experience, Grey-headed Flying-fox *(Pteropus poliocephalus)* is almost invariably recorded from these areas when adequate survey is undertaken.

Seventeen (17) Flying-fox roosts have been recorded within 25 km of the Woolshed Offset Area[61], however not all have been recently utilised or occupied by Grey-headed Flying-fox *(Pteropus poliocephalus)*. Active roosts with Grey-headed Flying-fox *(Pteropus poliocephalus)* occupation within the last four years, camp size (by number category) and year of last occupation recorded by census are outlined in **Table 55**.

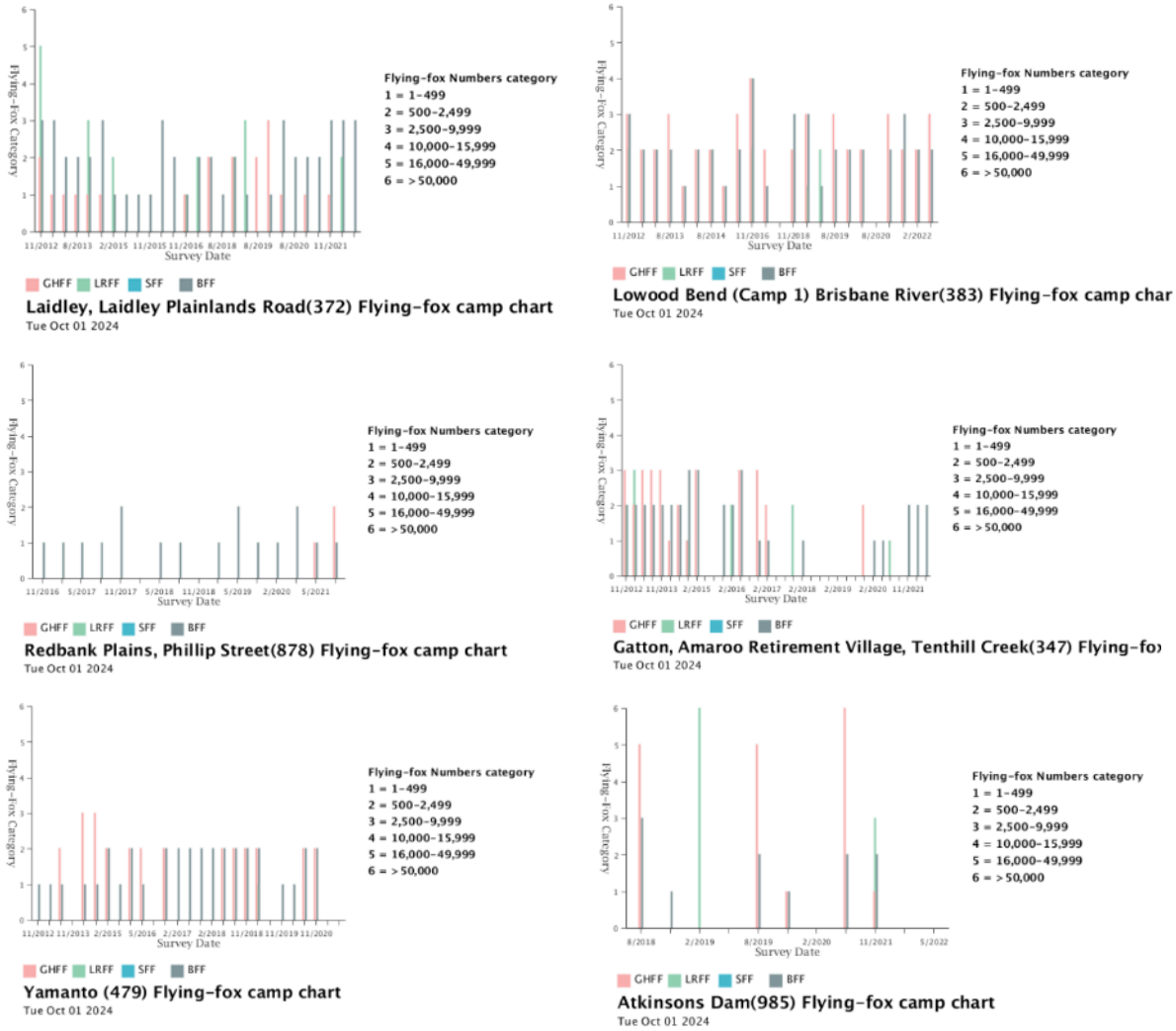
Table 55: Grey-headed Flying-fox *(Pteropus poliocephalus)* Camps within 25 km of the Woolshed Offset Area Occupied Within past 4 Years

Camps	Size*	Year of last recorded Grey-headed Flying-fox *(Pteropus poliocephalus)* occupation
Atkinsons Dam (985)	6 (**NIC**)	2022
Lowood Bend (Camp 1) Brisbane River (383)	3	2022
Yamanto (479)	2	2020
Redbank Plains, Phillip Street (878)	2	2021
Laidley, Laidley Plainlands Road (372)	1	2021
Gatton, Amaroo Retirement Village, Tenthill Creek (347)	2	2020

* 1-499 (1), 500-2,499 (2), 2,500-9,999 (3), 10,000-15,999 (4), 16,000-49,999 (5), >50,000 (6)

There is one NIC situated 19 km to the north of the Woolshed Offset Area at Atkinson's Dam. Nearest roosts sites with occupancy by Grey-headed Flying-fox *(Pteropus poliocephalus)* in the past 4 years include Laidley Plainlands Road (11.4 km), Lowood Bend Camp 1 (16 km) north-east, Redbank Plains Philip Street (21 km) south-east, Gatton (23 km) north-west, south-east, Yamanto (25 km) (**Inset 30**).

[61] National flying fox monitoring program (DCCEEW): "National Flying fox monitoring viewer" http://www.environment.gov.au/webgis-framework/apps/ffc-wide/ffc-wide.jsf: Accessed 21 August 2024



Inset 30: Yearly maximum counts of Grey-headed Flying-fox (Pteropus poliocephalus) numbers for four nearest roosts utilised by the species, between 2012 and February 2022. (Source: Commonwealth of Australia (Geoscience Australia) 2015: National Flying Fox monitoring viewer: https://www.environment.gov.au/webgis-framework/apps/ffc-wide/ffc-wide.jsf)

7.5.2.1.2 Landscape Resources

Resources for the Grey-headed Flying-fox *(Pteropus poliocephalus)* are most critical during two key periods within their life cycle; winter when other resources are scarce, and during the breeding season between late gestation and early lactation over the period September to November (DAWE 2019a).

The extent of state mapped Remnant and High Value Regrowth Regional Ecosystems where two key significant South East Queensland winter and spring flowering species; Broad-leaved Paperbark (*Melaleuca quinquenervia*) and Queensland Blue Gum (*Eucalyptus tereticornis*) are Dominant, Co-dominant, Subdominant and Associated canopy species within 25 km of the Woolshed Offset Area have been mapped as **Figure 55** (high quality forage canopy habitat in which the key forage species are dominant and co-dominant canopy components) and **Figure 56** (low-moderate quality forage habitat in which the key forage canopy species are subdominant or associated). These are representative of high and low-moderate quality winter and spring flowering forage habitat, respectively.

Component Remnant and Regrowth RE for both high and low value habitat area identified in **Table 56** and **Table 57**.

Table 56: Extent of State mapped remnant and regrowth REs with *E. tereticornis / M. quinquenervia* as a dominant or co-dominant canopy species within 25 km of the Woolshed Offset Area

RE	Short Description	Remnant Extent (ha)	High Value Regrowth Extent (ha)
12.3.3	*Eucalyptus tereticornis* woodland on Quaternary alluvium	766.4	2,433.5
12.3.7	*Eucalyptus tereticornis, Casuarina cunninghamiana* subsp. *cunninghamiana* +/- *Melaleuca* spp. fringing woodland	1,634.9	736.0
12.3.11	*Eucalyptus tereticornis* +/- *Eucalyptus siderophloia*, *Corymbia intermedia* open forest on alluvial plains	10.5	-
12.3.19	*Eucalyptus moluccana* and/or *Eucalyptus tereticornis* and *E. crebra* open forest to woodland, with a sparse to mid-dense understorey of *Melaleuca irbyana*	199.3	330.8
12.5.2b	*Eucalyptus tereticornis +/- Corymbia intermedia, Lophostemon suaveolens and C. citriodora subsp. variegata* open forest on remnant Tertiary surfaces, usually near coast on deep red soils	61.5	16.6
12.8.16	*Eucalyptus crebra +/- E. melliodora, E. tereticornis* subsp. *basaltica* woodland on Cainozoic igneous rocks	804.8	90.1
12.8.17	Mixed woodland with combinations of *Eucalyptus crebra, E. melanophloia, E. tereticornis, Corymbia tessellaris, C intermedia* woodland on Cainozoic igneous rocks	2,625.7	1,247.4
12.11.14	*Eucalyptus crebra, E. tereticornis, Corymbia intermedia* woodland on metamorphics +/- interbedded volcanics	28.1	27.9
12.11.15	*Eucalyptus tereticornis, Corymbia intermedia* open woodland with *Xanthorrhoea johnsonii* understorey on serpentinite	-	1.7
12.12.12	*Eucalyptus tereticornis, Corymbia intermedia, E. crebra* +/- *Lophostemon suaveolens* woodland on Mesozoic to Proterozoic igneous rocks	-	27.8
Total		6,131.4	4,911.9
Proportion of all habitat in search area		55.5%	44.5%
Proportion of total search area (211,110.6 ha)		2.9%	2.3%

Table 57: Extent of State mapped remnant and regrowth REs with E. tereticornis / M. quinquenervia as a subdominant or associated canopy species within 25 km of Woolshed Offset Area

RE	Short Description	Remnant Extent (ha)	High Value Regrowth Extent (ha)
12.3.3a	*Eucalyptus crebra, C. tessellaris* woodland to open forest on Quaternary alluvium	18.3	8.2
12.3.3d	*Eucalyptus moluccana* woodland on Quaternary alluvium	92.6	129.1

RE	Short Description	Remnant Extent (ha)	High Value Regrowth Extent (ha)
12.3.7a	*Eucalyptus tereticornis, Casuarina cunninghamiana* subsp. *cunninghamiana* +/- *Melaleuca* spp. fringing woodland	27.5	9.4
12.3.7d	Aquatic vegetation usually fringed with *Eucalyptus tereticornis*. Closed depressions on alluvial plains.	0.6	-
12.3.18	*Melaleuca irbyana* low open forest on alluvial plains	110.8	248.7
12.8.14	*Eucalyptus eugenioides, E. biturbinata, E. melliodora +/- E. tereticornis, Corymbia intermedia* open forest on Cainozoic igneous rocks	397.7	110.8
12.8.14a	*Eucalyptus moluccana* open forest +/- *E. tereticornis, Eucalyptus siderophloia* or *E. crebra* on Cainozoic igneous rocks	-	4.8
12.9-10.2	*Corymbia citriodora* subsp. *variegata* +/- *Eucalyptus crebra* open forest on sedimentary rocks	11,699.6	5,654.3
12.9-10.3	*Eucalyptus moluccana* open forest on sedimentary rocks	291.8	315.5
12.9-10.7	*Eucalyptus crebra +/- E. tereticornis, Corymbia tessellaris, Angophora spp.* and *E. melanophloia* woodland on sedimentary rocks	3,542.9	7,460.0
12.9-10.7a	*Eucalyptus siderophloia, Corymbia intermedia* +/- *E. tereticornis* and *Lophostemon confertus* open forest on sedimentary geology	58.4	-
12.9-10.8	*Eucalyptus melanophloia* grassy woodland, usually with *E. crebra, Eucalyptus tereticornis +/- Corymbia tessellaris, C. erythrophloia and Angophora spp.* on Cainozoic and Mesozoic sediments.	1.2	-
12.9-10.11	*Melaleuca irbyana* low open forest on sedimentary rock	184.5	301.5
12.9-10.18	*Angophora leiocarpa, Eucalyptus crebra* woodland on sedimentary rocks	123.8	75.3
12.9-10.27	*Corymbia* and/or *Eucalyptus* dominated open forest with a very sparse to mid-dense understorey of *Melaleuca irbyana* on sedimentary geology	314.5	851.4
12.9-10.28	*Angophora leiocarpa, Eucalyptus interstans +/- Corymbia intermedia, E. tereticornis* woodland on sedimentary rocks	229.3	191.2
12.11.3a	*Lophostemon confertus +/- Eucalyptus microcorys, E. carnea, E. propinqua, E. major, E. siderophloia* woodland in gullies and on exposed ridges	1.4	0.3
12.11.6	*Corymbia citriodora* subsp. *variegata, Eucalyptus crebra* woodland on metamorphics +/- interbedded volcanics	726.2	433.8
12.11.18	*Eucalyptus moluccana woodland* on metamorphics +/- interbedded volcanics	12.2	13.1
Total		17,832.2	15,808.5

RE	Short Description	Remnant Extent (ha)	High Value Regrowth Extent (ha)
Proportion of all habitat in search area		52.9%	47.0%
Proportion of total search area (211,110.6 ha)		8.4%	7.5%

7.5.2.1.3 Site Resources

DAWE (p.15, 2021) states the 'where the existence of these important winter and spring flowering vegetation communities is verified in the field, they are considered habitat critical to the survival of Grey-headed Flying-fox *(Pteropus poliocephalus)*'.

Important winter flowering species (with high productivity and reliability scores) in the blossom diet of Grey-headed Flying-fox *(Pteropus poliocephalus)* (Eby and Law 2008) that occur within the Woolshed Offset Area include five species; Spotted Gum (*Corymbia citriodora* subsp. *variegata*), Pink Bloodwood (*Corymbia intermedia*), Moreton Bay Ash (*Corymbia tessellaris*), Silver-leaved Ironbark (*Eucalyptus melanophloia*) and Queensland Blue Gum (*Eucalyptus tereticornis*). Narrow-leaved Red Ironbark (*Eucalyptus crebra*) can also be added to the list of winter flowering species on account that its winter flowering is noted by Stanley and Ross (2002).

Both REs represent high quality winter flowering resource; Spotted Gum (*Corymbia citriodora* subsp. *variegata*) is a dominant canopy species within RE12.9-10.2 (OA AU1) and RE12.8.24 (OA AU3), Queensland Blue Gum (*Eucalyptus tereticornis*) is an associated species within RE12.9-10.2 (OA AU1),a codominant species within RE12.8.17 (OA AU2), and Pink Bloodwood (*Corymbia intermedia*), Moreton Bay Ash (*Corymbia tessellaris*) and Silver-leaved Ironbark (*Eucalyptus melanophloia*) are all co-dominant species within RE12.8.17 (OA AU2). Silver-leaved Ironbark is an associated species in 12.8.24 (OA AU3).

7.5.2.2 Thagoona Offset Area

7.5.2.2.1 Landscape and Site Records

In order to determine that the proposed Thagoona Offset Area is suitable to maintain the viability of the protected matter, the presence of Grey-headed Flying-fox *(Pteropus poliocephalus)* records and camps within 25 km of the Thagoona Offset Area was assessed.

ALA and Wildlife Online datasets were inspected to determine local and sub-regional records. A total of 292 records were identified within 25 km of the Thagoona Offset Area, with 12 records occurring in close proximity to the site (5 km) (see **Figure 57**). This relatively low number of records is unlikely to reflect actual utilisation of the landscape by the species and is influenced by observer effort and the distribution of known camps and urban areas.

Records are typically concentrated around urban environments and known roost sites, where monitoring and observation effort is highest. Known camps within the broader locality occur within distances consistent with established foraging ranges for the species (see **Figure 58**). Westcott et al. (2015) reported a mean foraging distance of 10.9 km (quartile range 6.2–27.9 km), placing the Thagoona Offset Area well within the typical foraging range of Grey-headed Flying-fox *(Pteropus poliocephalus)* from known camps in the region (see **Table 58**).

It is also noted that the absence or low density of records within rural landscapes is common for this species and does not indicate a lack of utilisation. Grey-headed Flying-fox *(Pteropus poliocephalus)* are highly mobile and are known to utilise a wide range of foraging habitats, including regrowth and woodland systems such as those present within the Thagoona Offset Area.

Accordingly, the Thagoona Offset Area is considered to occur within an actively utilised foraging landscape and has the capacity to contribute to the availability of foraging resources for Grey-headed Flying-fox (*Pteropus poliocephalus*) within the locality.

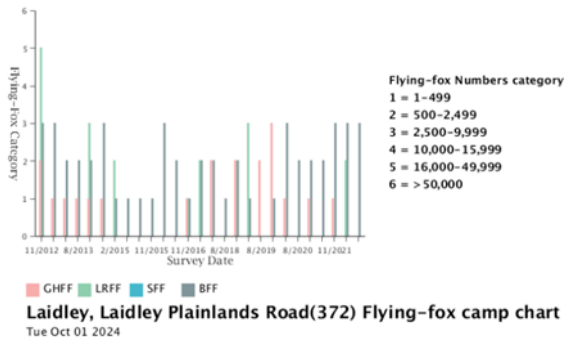
Table 58: Grey-headed Flying-fox *(Pteropus poliocephalus)* Camps within 25 km of the Thagoona Offset Area Occupied Within past 4 Years

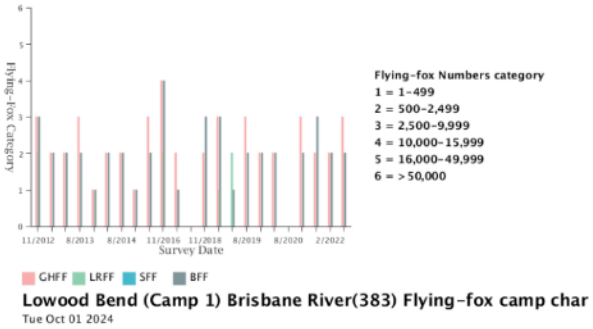
Camps	Size*	Year of last recorded Grey-headed Flying-fox *(Pteropus poliocephalus)* occupation
Lowood Bend (Camp 1) Brisbane River (383)	3	2022
Yamanto (479)	2	2020
Redbank Plains, Phillip Street (878)	2	2021
Laidley, Laidley Plainlands Road (372)	2	2021
Gatton, Amaroo Retirement Village, Tenthill Creek (347)	2	2020

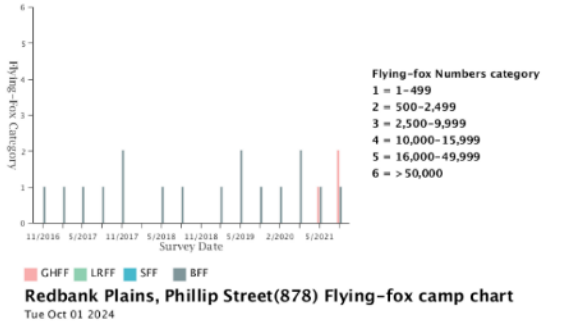
* 1-499 (1), 500-2,499 (2), 2,500-9,999 (3), 10,000-15,999 (4), 16,000-49,999 (5), >50,000 (6)

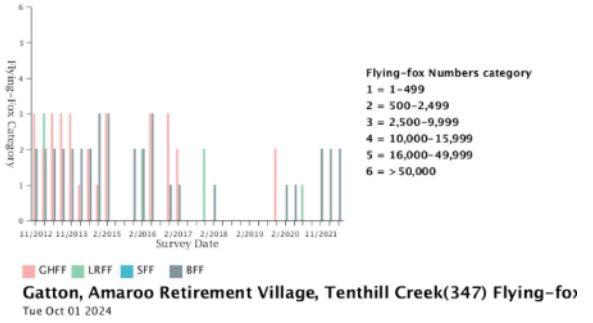
There is one NIC located at Atkinson's Dam, 30 km to the north-west of the Thagoona Offset Area. Additional roost sites with confirmed Grey-headed Flying-fox *(Pteropus poliocephalus)* occupancy within the past four years include Laidley Plainlands Road, Lowood Bend Camp 1, Redbank Plains (Philip Street), Gatton and Yamanto.

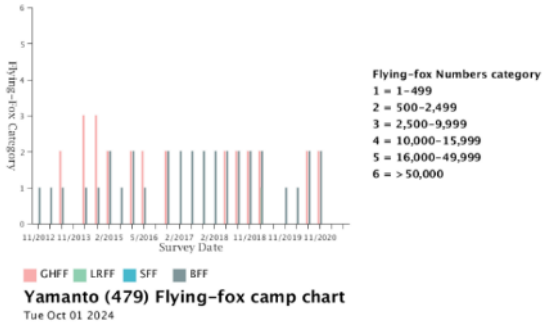
These camps occur within the broader locality and confirm that the Thagoona lies within an actively utilised foraging landscape for the species. (**Inset 31**).











Inset 31: Yearly maximum counts of Grey-headed Flying-fox *(Pteropus poliocephalus)* numbers for four nearest roosts utilised by the species, between 2012 and February 2022. (Source: Commonwealth of Australia (Geoscience Australia) 2015: National Flying Fox monitoring viewer: https://www.environment.gov.au/webgis-framework/apps/ffc-wide/ffc-wide.jsf

7.5.2.2.1 Landscape Resources

Resources for Grey-headed Flying-fox (*Pteropus poliocephalus*) are most critical during two key periods within their life cycle; winter, when alternative food resources are limited, and during the breeding season between late gestation and early lactation (September to November) (DAWE 2019a).

Within the locality of the Thagoona offset Area, the extent of State-mapped Remnant and High Value Regrowth Regional Ecosystems containing key winter and spring flowering forage species has been assessed. Queensland Blue Gum (*Eucalyptus tereticornis*), which is present within the Thagoona Offset Area, is recognised as an important forage species during these critical periods.

Vegetation mapping within 25 km of the Thagoona Offset Area identifies areas of higher quality forage habitat where key species are dominant or co-dominant canopy components, as well as areas of lower to moderate quality habitat where these species occur as subdominant or associated components (see **Figure 59 and 60**). These mapped areas represent the distribution of important seasonal forage resources within the landscape and demonstrate that the Offset Site occurs within a broader network of foraging habitat capable of supporting Grey-headed Flying-fox *(Pteropus poliocephalus)* during critical periods.

Figure 59 presents mapping of Grey-headed Flying-fox (*Pteropus poliocephalus*) habitat based upon State mapping *(Phascolarctos cinereus)* habitat, shows that within 25 km of the site, there is 30,377 ha of Remnant and 19,177 ha of Regrowth habitat containing seasonally important Queensland Blue Gum (*Eucalyptus tereticornis*) and Broad-leaved Paperbark (*Melaleuca quinquenervia*) foraging resource cover 15.1% and 9.5% of the search area respectively. Component Remnant and Regrowth REs comprising high value habitat are identified in **Table 59**.

Table 59: Extent of State mapped remnant and regrowth REs with Queensland Blue Gum and/or Broad-leaved Paperbark within 25 km of the Thagoona Offset Area

RE	Short Description	Remnant Extent (ha)	High Value Regrowth Extent (ha)
12.3.3	*Eucalyptus tereticornis* woodland on Quaternary alluvium	848.8	2147.1
12.3.3a	*Eucalyptus crebra, Corymbia tessellaris* woodland to open forest on Quaternary alluvium	50.4	32.3
12.3.3d	Aquatic vegetation usually fringed with *Eucalyptus tereticornis*. Closed depressions on alluvial plains.	103.5	138.4

RE	Short Description	Remnant Extent (ha)	High Value Regrowth Extent (ha)
12.3.7	*Eucalyptus tereticornis, Casuarina cunninghamiana* subsp. *cunninghamiana* +/- *Melaleuca* spp. fringing woodland	1458.1	964.3
12.3.7c	Billabongs and ox-bow lakes containing either permanent or periodic water bodies. Often fringed with *Eucalyptus tereticornis,* old river beds now cut off from regular flow. Palustrine.	8.4	-
12.3.7d	Aquatic vegetation usually fringed with *Eucalyptus tereticornis*. Closed depressions on alluvial plains. Palustrine.	0.6	-
12.3.11	*Eucalyptus tereticornis* +/- *Eucalyptus siderophloia*, *Corymbia intermedia* open forest on alluvial plains	28.3	18.0
12.3.18	*Melaleuca irbyana* low open forest on alluvial plains	110.0	238.9
12.3.19	*Eucalyptus moluccana* and/or *Eucalyptus tereticornis* and *E. crebra* open forest to woodland, with a sparse to mid-dense understorey of *Melaleuca irbyana*	199.5	330.6
12.5.2b	*Eucalyptus tereticornis +/- Corymbia intermedia, Lophostemon suaveolens and C. citriodora subsp. variegata* open forest on remnant Tertiary surfaces, usually near coast on deep red soils	27.2	21.9
12.8.14a	*Eucalyptus moluccana* open forest +/- *E. tereticornis, Eucalyptus siderophloia* or *E. crebra* on Cainozoic igneous rocks	1.8	4.8
12.8.16	*Eucalyptus crebra +/- E. melliodora, E. tereticornis* subsp. *basaltica* woodland on Cainozoic igneous rocks	667.0	82.9
12.8.17	Mixed woodland with combinations of *Eucalyptus crebra, E. melanophloia, E. tereticornis, Corymbia tessellaris, C intermedia* woodland on Cainozoic igneous rocks	1440.7	1351.4
12.9-10.2	*Corymbia citriodora* subsp. *variegata* +/- *Eucalyptus crebra* open forest on sedimentary rocks	15655.8	4675.9
12.9-10.3	*Eucalyptus moluccana* open forest on sedimentary rocks	271.5	288.1
12.9-10.7	*Eucalyptus crebra +/- E. tereticornis, Corymbia tessellaris, Angophora spp.* and *E. melanophloia* woodland on sedimentary rocks	2951	6384.5
12.9-10.7a	*Eucalyptus siderophloia, Corymbia intermedia +/- E. tereticornis* and *Lophostemon confertus* open forest on sedimentary geology	8	-
12.9-10.8	*Eucalyptus melanophloia* grassy woodland, usually with *E. crebra, Eucalyptus tereticornis +/- Corymbia tessellaris, C. erythrophloia and Angophora spp.* on Cainozoic and Mesozoic sediments.	6.2	15.2
12.9-10.11	*Melaleuca irbyana* low open forest on sedimentary rocks	202.7	276.5
12.9-10.12	Mixed woodland usually containing *Corymbia intermedia, Angophora leiocarpa* and at least the presence of *Eucalyptus seeana* on sedimentary rocks	114.8	36.6

RE	Short Description	Remnant Extent (ha)	High Value Regrowth Extent (ha)
12.9-10.17	*Eucalyptus acmenoides, E. major, E. siderophloia +/- Corymbia citriodora subsp. variegata* open forest on sedimentary rocks	56.7	6.8
12.9-10.17b	*Corymbia citriodora subsp. variegata* mixed open forest to woodland on sedimentary rocks.	60,6	21.6
12.9-10.27	*Corymbia* and/or *Eucalyptus* dominated open forest with a very sparse to mid-dense understorey of *Melaleuca irbyana* on sedimentary geology	307.2	889.3
12.11.3	*Eucalyptus siderophloia, E. propinqua +/- E. microcorys, Lophostemon confertus, Corymbia intermedia, E. acmenoides* open forest on metamorphics +/- interbedded volcanics	188.2	2.3
12.11.5	*Corymbia citriodora subsp. variegata woodland to open forest +/- Eucalyptus siderophloia/E. crebra, E. carnea, E. acmenoides, E. propinqua on metamorphics +/- interbedded volcanics*	1560.3	76.9
12.11.6	*Corymbia citriodora subsp. variegata, Eucalyptus crebra* woodland on metamorphics +/- interbedded volcanic	3636.6	954.3
12.11.14	*Eucalyptus crebra, E. tereticornis, Corymbia intermedia* woodland on metamorphics +/- interbedded volcanics	54.7	61.2
12.11.15	*Eucalyptus tereticornis, Corymbia intermedia* open woodland with *Xanthorrhoea johnsonii* understorey on serpentinite	-	1.7
12.11.18	*Eucalyptus moluccana woodland* on metamorphics +/- interbedded volcanics	266.7	77.6
12.12.3	Open forest complex with *Corymbia citriodora subsp. variegata, Eucalyptus siderophloia or E. crebra or E. decolor, E. major and/or E. longirostrata, E. acmenoides* or *E. portuensis* on Mesozoic to Proterozoic igneous rocks	57.6	4.9
12.12.7	*Eucalyptus crebra* woodland on Mesozoic to Proterozoic igneous rocks	1.7	0.3
12.12.12	*Eucalyptus tereticornis, Corymbia intermedia, E. crebra +/- Lophostemon suaveolens* woodland on Mesozoic to Proterozoic igneous rocks	28.5	73.0
12.12.23	*Eucalyptus tereticornis subsp. tereticornis or E. tereticornis subsp. basaltica +/- E. eugenioides* woodland to open forest on crests, upper slopes and elevated valleys and plains on Mesozoic to Proterozoic igneous rocks	3.9	-
Total		30,377.0	19,177.3
Proportion of all habitat in search area		61.3%	38.7%
Proportion of total search area (201,161.9 ha)		15.1%	9.5%

7.5.2.2.2 Site Resources

DAWE (p.15, 2021) states that where the existence of important winter and spring flowering vegetation communities is verified in the field, they are considered habitat critical to the survival of Grey-headed Flying-fox *(Pteropus poliocephalus)*.

Within the Thagoona Offset Area, vegetation is limited to RE 12.3.3, and field observations confirmed the presence of Queensland Blue Gum (*Eucalyptus tereticornis*) as the primary canopy species providing a food resource for Grey-headed Flying-fox *(Pteropus poliocephalus)*. This species is recognised as an important winter and spring flowering resource (Eby and Law 2008), with relatively high productivity and reliability in the blossom diet of the species.

While the Thagoona Offset Area does not support the diversity of winter flowering species present at other locations, the occurrence of Queensland Blue Gum (*Eucalyptus tereticornis*) provides a relevant and functional forage resource within the local landscape context. As the Offset Site undergoes assisted regeneration and targeted revegetation, the density and distribution of this species will increase, improving the availability and reliability of forage resources over time.

Accordingly, RE 12.3.3 within the Thagoona Offset Area will contribute to the provision of foraging habitat for Grey-headed Flying-fox *(Pteropus poliocephalus)*, particularly when considered in conjunction with surrounding areas of mapped forage habitat within the locality.

7.6 Offset Receiving Areas Suitability Assessment

7.6.1 Woolshed Offset Area

7.6.1.1 BioCondition Assessments

Determination of the Offset Area AUs was informed by inspection and interrogation of State Government remnant vegetation and pre-clear mapping data sets, pre-BioCondition orientation site inspection 10 April 2024 and BioCondition survey work conducted 17 July 2024. BioCondition plots are identified in **Figure 65**.

The habitat quality at the Woolshed Offset Area has been assessed using a modified version of the Queensland Government's *Guide to Determining Terrestrial Habitat Quality: A toolkit or assessing land-based offsets under the Queensland Environmental Offsets Policy* Version 1.2 (State of Queensland 2017). The relationship between REs, AUs, Vegetation Communities and BioCondition Transect sites used to derive Habitat Quality are outlined in **Table 60** with sampling effort compliance against the requirements of HQA version 1.2 shown in **Table 61**.

Table 60: Relationship between Regional Ecosystems, Assessment Units, Vegetation Communities and MHQA Assessment Sites – Woolshed Offset Area

Description	Site		
Offset Receiving Area Assessment Unit (Offset Area AU) (OA AU)	**WSOA AU1**	**WSOA AU2**	**WSOA AU3**
AU Description	Spotted Gum (*Corymbia citriodora* subsp. *variegata*) and Narrow-leaved Red Ironbark (*Eucalyptus crebra*) open forest.	Narrow-leaved Red Ironbark (*Eucalyptus crebra*), Queensland Blue Gum (*Eucalyptus tereticornis*), Pink Bloodwood (*Corymbia intermedia*) woodland / open forest with a dense thicket understorey of	Spotted Gum (*Corymbia citriodora* subsp. *variegata*) and Narrow-leaved Red Ironbark (*Eucalyptus crebra*) woodland, with Silver-leaved Ironbark (*Eucalyptus melanophloia*) and a dense thicket

Description	Site		
		Lantana* (*Lantana camara*).	understorey of Lantana* (*Lantana camara*).
Offset Unit Area	61.35 ha	20.63 ha	6.65 ha
Pre-clear RE	12.9-10.2 (refer Vegetation Management Report – **Appendix 13.1**)	12.8.17 (refer Vegetation Management Report – **Appendix 13.1**)	12.8.24 (refer Vegetation Management Report – **Appendix 13.1**)
Analogous Ground-truthed RE	12.9-10.2	12.12.14	12.8.24
Current regulated vegetation status	Category B and Category R	Category B	Category B and Category R
Number of BioCondition Plots	3	2	2
BioCondition Transects (HQA Sites)	Transects HQP 1, 2 and 3	Transects OA AU2 T4 and T4	Transects OA AU3 T6 and T7
Notes	The field validated boundary between RE 12.9-10.2 and 12.8.17 is different to that represented in Strate mapping. The AU contains area within north-west corner of the Offset Area, mapped by the State as containing HVR (Category C) represented by RE12.3.7 and RE 12.9-10.7. These areas were found by field assessment to comprise RE12.9-10.2. Disturbed by historic forestry (stumps and discarded crowns present).	Owing to the dense impenetrable thicket of Lantana within the understorey, BioCondition assessments were undertaken from the edge of cleared success line, projected into the extant vegetation. Owing to the dense impenetrable thicket of Lantana within the understorey, BioCondition assessments were undertaken from the edge of cleared success line, projected into the extant vegetation; one 100 x 50m (standard) BioCondition plot, and one 50 x 20 m BioCondition on account of site constraints.	Owing to the dense impenetrable thicket of Lantana within the understorey, BioCondition assessments were undertaken from the edge of cleared success line, projected into the extant vegetation. Assessment plots consisted of one 100 x 50 m (standard) BioCondition plot, and one 50 x 20 m BioCondition on account of site constraints.

Table 61: MHQA Sampling for Each AU Expressed as Total Area of Assessment Units Sampled

OAAU	Area (ha)	% of total Site Area	Number of plots	Total Plot Area* (ha)	% of AU sampled	HQA version 1.2 Notes
1	61.35	69.2	3	1.5	2.4	Suggested minimum number of sampling sites for units of 0-50 ha is 'at least 2. This may be streamlined if it can be demonstrated a polygon is uniform in condition
2	20.63	26.3	2	0.6	2.6	
3	6.65	7.5	2	0.6	9.0	

* number of plots in IA AU x bio-condition plot area (std. = 0.5 ha (100m x 50m))

BioCondition assessments at OA AU 1 is compliant with the minimum standard identified by HQA version 1.2. The location of Assessment Units and BioCondition transects are represented on **Figure 65;** data sheets are found in **Appendix 14.1**.

7.6.1.2 Offset Area Assessment Units

Within the offset assessment framework, variability in habitat quality across the Offset Area is addressed through the delineation of AUs. The Offset Areas has been subdivided into AUs to represent areas of relatively uniform vegetation type and condition, enabling a robust and transparent assessment of habitat values. Each AU was mapped to inform the placement and number of sample locations required to adequately characterise habitat condition. Assessment Units were initially defined using desktop data and subsequently reviewed and refined during field investigations where necessary. In general, AUs comprise relatively homogenous vegetation areas, typically aligned with a distinct regional ecosystem or habitat type, and are clearly differentiated from adjacent vegetation on the Offset Area. The AUs identified form the basis for the assessment of habitat values relevant to both Koala *(Phascolarctos cinereus)* and Grey-headed Flying-fox *(Pteropus poliocephalus)*, where applicable.

7.6.1.2.1 WSOA AU 1 – Spotted Gum (*Corymbia citriodora* subsp. *variegata*) and Narrow-leaved Red Ironbark (*Eucalyptus crebra*) open forest

WSOA AU1 comprises 61.35 ha or 69.2% of the proposed Woolshed Offset Area. This AU consists of Remnant RE 12.9-10.2 occurring on a variety of topographic positions and aspects from ridge crests, upper slopes, lower slopes and along incised drainage lines. The canopy (T1) layer is 20-26 m and is dominated by Spotted Gum (*Corymbia citriodora* subsp. *variegata*). Narrow-leaved Red Ironbark (*Eucalyptus crebra*) is subdominant. Other associated tree species in the T2 layer include Moreton Bay Ash (*Corymbia tessellaris*), Queensland Blue Gum (*Eucalyptus tereticornis*) with other subcanopy species including regenerating canopy species with Red Ash (*Alphitonia excelsa*), Sweet Suzie (*Psydrax odorata*), Red Kamala (*Mallotus phillippensis*), Hickory Wattle (*Acacia disparrima*) and Black Wattle (*Acacia leiocalyx*) and occasionally, Quinine Tree (*Petalostigma pubescens*), Gumbi Gumbi (*Pittosporum angustifolium*) and Black She-oak (*Allocasuarina littoralis*). Queensland Bue Gum (*Eucalyptus tereticornis*) is more prevalent on lower slopes and along deeper gully lines.

The canopy and sub-canopy layer is well established, though cover is patchy on account of past thinning / clearing. The assessment unit shows evidence of extensive logging (farm forestry) with numerous stumps and discarded tree crowns present, typically upper slopes of ridges and spurs in more accessible locations. On account, coarse woody debris is excessive. Despite the logging, large (eucalypt) trees (mainly Spotted Gum ((*Corymbia citriodora* subsp. *variegata*)) range 28-56 trees/ha.

Tree canopy species, shrub, graminoid and forb richness are high, as is native grass and shrub cover. Non-native plant coverage range 10-25% with higher levels reflective patchiness in canopy coverage and associated with a variety of weedy gramineous and forb weeds, with Lantana* (*Lantana camara*) a WoNS forming thickets on more fertile soils; lower slope colluvium and along the ecotone with OA AU2. Prickly Pear* (*Opuntia tomentosa*) a WoNS and the environmental weed Climbing Asparagus* (*Asparagus africanus*) can become prominent.

Canopy species recruitment within OA AU1 is in the order of 140-310 stems/ha.

The character of OA AU1 – Transect 1, OA AU1 – Transect 2 and OA AU1 – Transect 3 and logging are shown in **Plates 10-14** below.

Plate 10: Representative habitat condition of OA AU1 Transect 1

Plate 11: Representative habitat condition of OA AU1 Transect 2

Plate 12: Representative habitat condition of OA AU1 Transect 3

Plate 13: Representative evidence of logging (vicinity of OA AU1 Transect 2)

Plate 14: Representative evidence of logging (vicinity of OA AU1 Transect 2)

7.6.1.2.2 WSOA AU 2 – Narrow-leaved Red Ironbark (*Eucalyptus crebra*), Moreton Bay Ash (*Corymbia tessellaris*), Queensland Blue Gum (*Eucalyptus tereticornis*), with Pink Bloodwood (*Corymbia intermedia*) woodland / open forest with a dese thicket understorey of Lantana* (*Lantana camara*)

WSOA AU2 comprises 20.63 ha or 26.3% of the proposed Woolshed Offset Area. This AU consists of Remnant RE12.8.17 occurring elevated (210-340 m AHD) and steeper, eastern portions of the Woolshed Offset Area. The aspect is predominantly northerly to north-easterly at the eastern end of the AU.

This AU occurs on fertile, chocolate brown and black clay soils with dense, impenetrable thickets of Lantana* (*Lantana camara*) a WoNS proliferating. Access to the AU for the purpose of assessing BioCondition was achieved by traversing an internal fire break crated by Cherish and projecting transects off this feature where space permitted. One standard BioCondition plot of 100 x 50 m (OA AU2 Transect 3) and one smaller BioCondition plot of 50 x 20 m (OA AU2 Transect 4) were deployed, the latter on account of much reduced available area. Data informing the structure and floristics was supplemented with data collected from two Tertiary and three Quaternary field survey sites also from vantage points along internal site access trails being cleared of overgrowing Lantana* (*Lantana camara*) by Cherish.

The canopy (T1) layer is 16-21 m and is dominated by Narrow-leaved Red Ironbark (*Eucalyptus crebra*), Moreton Bay Ash (*Corymbia tessellaris*), Queensland Blue Gum (*Eucalyptus tereticornis*), with Pink Bloodwood (*Corymbia intermedia*) and occasionally Silver Leaved Ironbark (*Eucalyptus melanophloia*) and Climbing Asparagus* (*Asparagus africanus*). Large (Eucalypt) trees appear to be in the order of ca 6-18 /ha.

The subcanopy (T2) layer is 12-14 m and consists of canopy species. The T3 layer 4-11 m includes sparse Red Ash (*Alphitonia excelsa*), Sweet Suzie (*Psydrax odorata*), Red Kamala (*Mallotus phillippensis*), Hickory Wattle (*Acacia disparrima*), Maidens Wattle (*Acacia maidenii*), Black Wattle (*Acacia leiocalyx*) and occasionally, Bat's Wing Coral (*Erythrina vespertilio*) and Leichhardt's Ironbark (*Bridelia leichhardtii*).

The understorey is a dense thicket of Lantana* (*Lantana camara*) with Cockspur Thorn (*Maclura cochinchinensis*) occasionally present. The understorey, and canopy recruitment is significantly suppressed by Lantana* (*Lantana camara*).

The character of OA AU2 – Tertiary 1, OA AU2 – Quaternary 2 and OA AU2 – Quaternary 3 are shown in **Plates 15-17** below. The character of BioCondition OA AU2 Transect 4 and Transect 5 are shown in **Plates 18-19** (below).

Plate 15: Representative habitat condition of OA AU2 Tertiary Site 1. Note the Lantana thicket in foreground

Plate 16: Representative habitat condition of OA AU2 Quaternary Site 2 - note dense Lantana thicket understorey

Plate 17: Representative habitat condition of OA AU2 Quaternary Site 3 - note dense Lantana thicket understorey

Plate 18: Representative habitat condition of OA AU2 Transect 4 - note the dense Lantana thicket understorey

Plate 19: Representative habitat condition of OA AU2 Transect 5 - note the dense Lantana thicket understorey

7.6.1.2.3 WSOA AU 3 – Spotted Gum (*Corymbia citriodora* subsp. *variegata*) and Narrow-leaved Red Ironbark (*Eucalyptus crebra*) +/- Silver-leaved Ironbark (*Eucalyptus melanophloia*) woodland with a dense thicket understorey of Lantana* (*Lantana camara*)

WSOA AU3 comprises 6.65 ha or 7.5% of the proposed Woolshed Offset Area. This AU consists of Remnant RE 12.8.24 occurring elevated (340-360 m AHD) and steeper, eastern portions of the Woolshed Offset Area. The aspect is predominantly northerly.

This AU occurs on fertile, chocolate brown and black clay soils with dense, impenetrable thickets of Lantana* (*Lantana camara*) a WoNS proliferating. Access to the AU for the purpose of assessing BioCondition was achieved by traversing an internal fire break crated by Cherish and projecting transects off this feature where space permitted. One standard BioCondition plot of 100 x 5 0m (OA AU3 Transect 6) and one smaller BioCondition plot of 50 x 20 m (OA AU3 Transect 7) were deployed, the latter on account of much reduced available area. Transects were established along the edge of the Lantana thicket with the plot projected into the AU (i.e. the tape measure formed the southern boundary of the plot. Rather than the centreline. Data informing the structure and floristics was supplemented with data collected from one Tertiary and one Quaternary field survey sites also from vantage points along internal site access trails being cleared of overgrowing Lantana* (*Lantana camara*) by Cherish.

The canopy (T1) layer is 15-22 m and is dominated by Spotted Gum (*Corymbia citriodora* subsp. *variegata*), Narrow-leaved Red Ironbark (*Eucalyptus crebra*) and occasionally Silver Leaved Ironbark (*Eucalyptus melanophloia*) and Climbing Asparagus* (*Asparagus africanus*). Large (Eucalypt) trees appear to be in the order of ca 10-12/ha.

The subcanopy (T2) layer is 8-18 m and consists of canopy species. The T3 layer 4-8 m includes sparse Kurrajong (*Brachychyton populneus)* Red Ash (*Alphitonia excelsa*), Hickory Wattle (*Acacia disparrima*), Maidens Wattle (*Acacia maidenii*), and occasionally, Leichhardt's Ironbark (*Bridelia leichhardtii*).

The understorey is a dense thicket of Lantana* (*Lantana camara*). The understorey, and canopy recruitment is significantly suppressed by Lantana. The character of BioCondition OA AU3 Transect 6 and Transect 7 are shown in **Plates 20-21**, below.

Plate 20: Representative habitat condition of OA AU3 Transect 6 - note the dense Lantana thicket understorey

Plate 21: Representative habitat condition of OA AU3 Transect 7 - note the dense Lantana thicket understorey

7.6.1.3 Weed Assessment

7.6.1.3.1 Baseline Study

A comprehensive weed assessment of the Woolshed Offset Area was undertaken in January 2025. The technical note outlining methods, sampling effort and results is found as Attachment 2 and Attachment 3 of the Woolshed OMP (**Appendix 12.1**).

Weed assessment was performed by random meander through the parts of the Woolshed Offset Area which allowed unimpeded foot traverse. In more elevated parts of the site, especially on clay soils derived from basalt (Land Zone 8), access to much of the offset area was not possible on account of a near continuous thicket (refer **Figure 66**). In these areas, assessment was limited to surveying weeds from along the edge of fire breaks established within the Woolshed Offset Area in December 2024. Supplementary weed information was also derived from BioCondition Transects (**Figure 65**).

In the field, three qualitative measures of abundance were applied, being (ranked from lowest to highest); Low (1-5 individual stems at an observation point), Moderate (6-20 individual stems at an observation point) and High (>21 individual stems at an observation point).

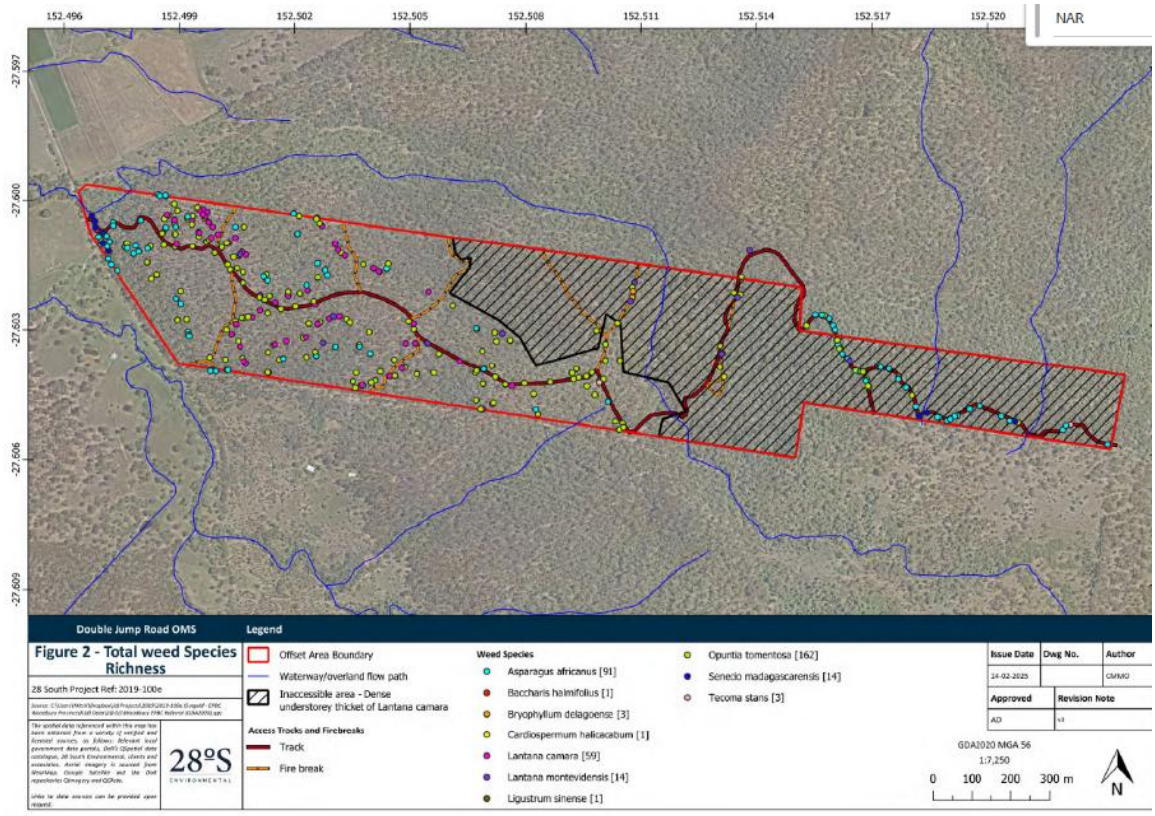
Three (3) WoNS are present within the Woolshed Offset Area:

- Lantana* (*Lantana camara*)
- Velvety Tree Pear* (*Opuntia tomentosa*)
- Fireweed* (*Senecio madagascarensis*).

Ten (10) Category 3 Restricted Matter (*Biosecurity Act 2014* (Qld)) weeds are present:

- Climbing Asparagus* (*Asparagus africanus*)
- Groundsel Bush* (*Baccharis halmifolia*)
- Mother-of-millions* (*Bryophyllum delagoense*)
- Balloon Vine* (*Cardiospermum grandiflorum*)
- Lantana* (*Lantana camara*)
- Creeping Lantana* (*Lantana montevidensis*)
- Chinese Privet* (*Ligustrum sinense*).
- Velvety Tree Pear* (*Opuntia tomentosa*)
- Fireweed* (*Senecio madagascarensis*)
- Yellow Bells* (*Tecoma stans*).

The distribution of weeds encountered in the field are presented in **Inset 32**.



Inset 32. Weed species richness and distribution

Within the Woolshed Offset Area, Lantana* (*Lantana camara*) has a cosmopolitan distribution and is by far the most problematic weed on the site. In western portions of the site (OA AU1) Lantana* (*Lantana camara*) infestations are at their greatest density at lower elevations where water concentrates in the landscape leading to ideal growing conditions for this species. At higher elevations (OA AU1, OA AU2 and OA AU3) Lantana* (*Lantana camara*), forms dense, impenetrable understorey thickets.

The remaining species were somewhat randomly dispersed throughout the site. However, Climbing Asparagus Fern* (*Asparagus africanus*) was found to coincide with dense Lantana* (*Lantana camara*) infestations where it was observed to extend into and smother the canopy of the mature trees.

The majority of these weed infestations were low density with only 1-5 individuals per data point. The predominantly low densities of these other species could be due to the suite of native grasses supressing their germination and competing for resources including soil moisture, nutrients and light in naïve dominated areas and Lantana* (*Lantana camara*) would perform the same suppressing actions as natives where it forms large thickets. Any infestations that were considered to be a high-density infestation typically occurred in and around drainage features and gullies within the Woolshed Offset Area. These areas are where the passage of water is likely to foster the ideal conditions for plant growth, attract animals acting as dispersal vectors for these species and experience movement of plant matter and material by overland flow in extreme weather events.

The highest weed diversity was associated with tracks, drainage features and creek lines within the Woolshed Offset Area. This is due to constant disturbance in these areas promoting weed succession, potential importing of invasive species by vehicles and easy mobility for species that could disperse the seeds of invasive species.

Chinese Privet* (*Ligustrum sinense*) was sporadically distributed throughout the eastern part of the offset however survey bias could be leading to an underestimation of its abundance as access to the remainder of the eastern portion of the offset was significantly reduced due to the high density of Lantana* (*Lantana camara*) preventing further ingress to these locations.

7.6.1.3.2 Justification of Conservation Gain for Koala (Phascolarctos cinereus)

Lantana* (*Lantana camara*) is a rough-textured and usually prickly shrub with oppositely arranged leaves. Its dense flower clusters consist of numerous small tubular flowers. Lantana* (*Lantana camara*) is a habitat transformer (**transformer weed**[62]) because it can change the structure and nature of ecosystems (National Lantana Management Group 2009). It is a highly invasive shrub that can form dense thickets and smother native plants. Transformer weed invasion alters the three-dimensional arrangement, nature and abundance of food resources within an ecosystem and as such can have a profound impact on animal (State of Victoria, 2019). Lantana* (*Lantana camara*):

- **Displaces native species:** Lantana* (*Lantana camara*) can outgrow and shade out native plants, which can impact biodiversity.
- **Alters fire regimes:** Lantana* (*Lantana camara*) has dense stands that can increase the risk of fire.
- **Is toxic to animals:** Lantana* (*Lantana camara)* leaves and seeds can be toxic to many animals, causing gastrointestinal issues, photosensitivity, and death.
- **Affects food resources:** Lantana* (*Lantana camara*) can alter the food resources available to animals.
- **Impedes access to habitat:** dense impenetrable stands limit the ability for mid-to-large sized animals to freely move through dense thickets, leaving animals prone to predation and reducing social interaction.

Because of characteristics, Lantana* (*Lantana camara*) infestations can have a significant impact on protected species within the Woolshed Offset Area.

Based on departmental comments provided by NEPA on 26 March 2025, a specific memo was prepared to better detail the extent of Lantana (*Lantana camara*) throughout the Woolshed Offset Area, and how such extents negatively impact support for MNES (see Attachment 2 of **Appendix 12.1** – Woolshed OMP). Such memo confirmed that Lantana* (*Lantana camara*) is the dominant midstorey species throughout much of the Woolshed Offset Area, and that where such infestations occur, little to no native midstorey species occur. Further, through much of the Woolshed Offset Area, where dense infestations occur, limited (minor and generally supressed) or no native regeneration was observed (see Attachment 3 – Lantana Technical Memo of **Appendix 12.1** – Woolshed OMP).

These findings are consistent with several studies that outline the effects of Lantana* (*Lantana camara*) on native ecosystems. Gooden et al (2009) assessed the condition of native plants in areas infested with Lantana* (*Lantana camara*) and without an infestation. The study showed invasion by Lantana* (*Lantana camara*) led to a reduction in species richness compared to uninvaded areas with lower fern, herb, tree and vine species richness. Additionally, infestation supresses canopy recruitment with juvenile tree densities are lower in areas invaded by Lantana* (*Lantana camara*) compared to uninvaded areas. Adult densities were the same across both conditions, suggesting that Lantana* (*Lantana camara*) supresses the germination of other species to reduce competition with native vegetation to perpetuate their dominance within an invaded area.

It is thought that this dominance within an area is achieved by the secretion of essential oils, leachate, residues and rhizosphere of Lantana* (*Lantana camara*) including phenolic compounds, sesquiterpenes, triterpenes and flavonoid compounds into the soil to supress the germination and growth of other species (Kato-Noguchi & Kurniadie, 2021). Ruwanza (2020) had a similar finding to Gooden et al (2009) showing decreased native species richness with increasing Lantana* (*Lantana camara*) infestation as well as decreases in native species cover and density.

Invasion by Lantana* (*Lantana camara*) and its effects on native vegetation can negatively impact threatened species including Koala (*Phascolarctos cinereus*) and the Grey-headed Flying-fox (*Pteropus poliocephalus*). The proliferation of Lantana* (*Lantana camara*) will affect the Koala *(Phascolarctos cinereus)* habitat and population dynamics through manipulating tree canopy change; by supressing recruitment and skewing canopy population dynamics towards increasingly older age cohorts. In habitat previously considered suitable, KHTs will diminish over

[62] By forming monocultures and dominating ecosystems, driven by an overriding advantage of recruitment success leading to the exclusion of competitors. Sheppard et al, 2010)

time. This will lead to the compounding loss of KHT within Lantana* (*Lantana camara*) infested areas over time with canopy trees being replaced by Lantana* (*Lantana camara*) thicket as the EDL. Gentle et al (2006) found that shading was the greatest limiting factor to the run-away spread and growth of Lantana* (*Lantana camara*), as the canopy becomes increasing 'open', light is no longer a factor limiting Lantana* (*Lantana camara*) growth.

In addition to limiting germination of canopy species, in the case of severe infestations, Lantana* (*Lantana camara*) can grow into the canopy, smother canopy trees and cause the decline of the trees (McKercher, pers. obs. 30 January 2025). The reduction of mature canopy species will reduce the suitability of the property as an offset site for both Koala (*Phascolarctos cinereus*) and Grey-headed Flying-fox (*Pteropus poliocephalus*) due to the gradual reduction in available forage and shelter habitat.

Lantana* (*Lantana camara*) can grow into impenetrable walls of dense vegetation. In addition to preventing significant recruitment of natives, dense infestations of Lantana* (*Lantana camara*) prevent Koala (*Phascolarctos cinereus*) from utilising forage habitat in significant infestations, either as shelter, forage or movement habitat. The NEPA Approved Conservation Advice for the Endangered Koala (*Phascolarctos cinereus*) identifies that for habitat to be considered habitat critical to the survival of the Koala (*Phascolarctos cinereus*) free movement of Koala (*Phascolarctos cinereus*) to both find mates and move between food and shelter resources and to avoid predation is essential.

Koala (*Phascolarctos cinereus*) area most vulnerable to predation by wild dogs (*Canis lupus familiaris*) and Dingo (*Canis lupus dingo*) and other predators while travelling between habitat trees. If movement through habitat becomes impeded or the distance between accessible patches becomes too great due to Lantana* (*Lantana camara*) infestations, local Koala (*Phascolarctos cinereus*) will become more susceptible to attack by predators and extirpation. Additionally, greater investment in travel between patches and to mates reduce foraging time, intake of food resources and decreases mating success.

Within the (see Attachment 3 – Lantana Technical Memo of **Appendix 12.1** OMP), the advice of Dr Bill Ellis (an expert consulted for the purpose of preparing the Commonwealth's 2022 conservation advice for the Koala (*Phascolarctos cinereus*)) is sought out to provide input on the impacts associated with Lantana* (*Lantana camara*) on Koala (*Phascolarctos cinereus*). Dr Bill Ellis outlines the ecological impacts of Lantana* (*Lantana camara*):

- *Lantana prevents recruitment of* Koala *food trees. In areas of heavy infestation it is not common to find food trees regenerating;*
- *Restricts* Koala *movement* – Koala*s primarily move across the ground between trees and dense thickets of lantana make impede this activity.* Koala*s might therefore have to spend more time traversing these obstacles on the ground and hence have increased risk of predation; and*
- *Dense understory can add to dangerous fuel loads, resulting in more intense fires that can engulf canopies and be destructive in* Koala *habitat.*

Another significant weed species identified, Climbing Asparagus Fern* (*Asparagus africanus*), is a long-lived climber or scrambling sub-shrub with woody and prickly stems. It is also considered a transformer weed. Its stems bear short side-branches and with numerous tiny 'leaves' that give them a ferny appearance. It is thought to have the potential to invade rainforests, open woodlands and riparian vegetation throughout the coastal and sub-tropical regions of eastern Australia. Climbing Asparagus Fern* (*Asparagus africanus*) scrambles over other vegetation and climbs up into the canopies of taller trees. It can often completely smother smaller trees, understorey shrubs and ground layer plants and its fibrous roots form dense mats just below the soil surface, which interfere with the establishment and survival of seedlings of native species[63]. It is already impacting the canopies within the Woolshed Offset Area and has the potential to significantly more canopy.

Armstrong et al (2006) states that Climbing Asparagus Fern* (*Asparagus africanus*) can smother native canopy. The smothering, and eventual death, or canopy induced structural failure of canopy species will reduce the available food resources for the Koala (*Phascolarctos cinereus*) and Grey-headed Flying-fox (*Pteropus poliocephalus*). This reduction in the available resources will make the habitat un-useable by these species and

[63] Brisbane City Council Weed Identification Tool - Climbing Asparagus Fern https://weeds.brisbane.qld.gov.au/weeds/climbing-asparagus-fern accessed 4 March 2025).

reduce the suitability of this proposed Woolshed Offset Area with time in the absence of intervention to arrest these species.

7.6.1.3.3 Loss of Ecosystem Values without the Offset and Impacts Upon MNES

The National Recovery Plan for Koala (DAWE 2022) identifies that habitat degradation is of significant concern for Koala *(Phascolarctos cinereus)*. It notes a number of threats driving habitat degradation including timber harvesting, agriculture, fire and fire management, climate change, and invasion by weeds synergistically increasing impacts of disturbance.

Habitat degradation reduces the availability or increases the mortality of food and shelter trees, reduces the nutrient value and water content of food trees, and changes the configuration and relative abundance of habitat trees. These changes impact Koala *(Phascolarctos cinereus)* by making it more difficult for them to access food and shelter resources, increasing stress levels and disease, and leading to reduced breeding success, increased mortality and predation. It also leads to habitat loss as native vegetation is slowly changed to a composition and structure that no longer resembles the original state (Lindenmayer and Fischer 2006) and reduces availability and quality of resources for species and can drive population declines over the long term (extinction debt, Tilman et al. 1994).

Superimposed on these threats is the presence of Lantana* (*Lantana camara*) and Climbing Asparagus Fern* (*Asparagus africanus*) which, as transformer weeds in combination with past timber harvesting, local clearing are driving ecosystem change and reducing the quality and availability of Koala *(Phascolarctos cinereus)* forage and shelter habitat and impairing recruitment of all component species of the ecosystem, but especially canopy species leading to collapse in value as Koala *(Phascolarctos cinereus)* habitat. Many of the species which constitute Koala *(Phascolarctos cinereus)* habitat at the Woolshed Offset Area; Spotted Gum (*Corymbia citriodora subsp variegata*), Narrow-leaved Red Ironbark (*Eucalyptus crebra*)[64], Silver-leaved Ironbark (*Eucalyptus melanopholoia*), Pink Bloodwood (*Corymbia intermedia*), Moreton Bay Ash (*Corymbia tessellaris*) and Queensland Blue Gum (*Eucalyptus tereticornis*) are also key blossom forage species for Grey-headed Flying-fox *(Pteropus poliocephalus)*, representing habitat critical to their survival as they are important winter and spring flowering species forming a significant component of their diet during resource bottlenecking and critical periods in the reproductive cycle of Grey-headed Flying-fox *(Pteropus poliocephalus)* (Commonwealth of Australia 2021, p.15).

In Attachment 3 of **Appendix 12.1**, where the advice of Dr Bill Ellis is sought out, it is stated that:

> *Without any action to reduce the lantana, the site is likely to experience worsening lantana dominance, further delaying recovery and reducing habitat quality. Note: Lantana is recognized nationally as a major biodiversity threat, impacting over 1,300 native species. Its control aligns with obligations under the Biosecurity Act and EPBC offset principles*

And there will be:

- Continued suppression of canopy recruitment, leading to long-term decline in Koala *(Phascolarctos cinereus)* food and shelter resources
- The site could well become a barrier to movement by Koala *(Phascolarctos cinereus)* in the landscape, forcing Koala (*Phascolarctos cinereus*) to spend more time on the ground where they are subject to greater risk
- The bushfire intensity at the site and probability of fire is likely to increase over time, with potentially catastrophic outcomes for wildlife, and
- Spread of this species to adjacent properties, and the ongoing degradation of ecosystem function at the site and surrounds.

The focus on intensive treatment of Lantana* (*Lantana camara*) through the Woolshed OMP (and supporting Biosecurity Management Plan (Attachment 6 of **Appendix 21.1 Woolshed Offset OMP**)), the impacts described

[64] *Eucalyptus crebra* is referenced by the Grey-headed Flying-fox *National Recover plan* (Commonwealth of Australia 2021), as an important winter flowering species but not by Eby and Law (2008), despite it being a known winter flowering species in SEQ

by Dr Bill Ellis will be avoided and if such control is undertaken at this Offset Area, accelerated regeneration of native species and improved Koala *(Phascolarctos cinereus)* habitat is expected through:

- Accelerated forest regeneration, improving forage and shelter resources for Koala (*Phascolarctos cinereus*)
- Better habitat connectivity and hence reduced risk to koalas while moving, and
- Reduced bushfire intensity and improved ecosystem resilience.

7.6.1.4 Vertebrate Pest Assessment

7.6.1.4.1 Methods

This assessment consisted exclusively of a camera trap survey. A total of 16 trail cameras (**Figure 69**) were deployed in a semi-regular grid across the project area, encompassing all assessment units (**Inset 33**). Cameras were deployed on 17 January 2025 and collected on 3 February 2025 (17 consecutive nights). The total survey effort was 260 camera trap-nights. All cameras were set on trees at ~50 cm above the ground.

A technical paper outlining the assessment survey conditions, camera setup, conditions and detailed discussion of results is contained in **Appendix 12.1** – Woolshed OMP, Attachment 1 – Vertebrate Pest Reporting.

7.6.1.4.2 Results

A total of 32 taxa were recorded on camera traps. Of these, 29 were identifiable to species level, one to genus level, and two to family level (**Appendix 12.1** – Woolshed OMP, Attachment 1 – Vertebrate Pest Reporting). Five pest taxa were identified, including one amphibian and four mammals. Native taxa identified included two reptiles, 13 birds, and 12 mammals.

7.6.1.4.2.1 Pest Species

At least two (2), and possibly as many as four (4), wild dogs (*Canis familiaris x C. dingo*) were identified on camera[65] (camera sites 2, 3 15 and 16).

Camera trap locations at the Woolshed Offset Area are displayed with greater detail in **Figure 69**.

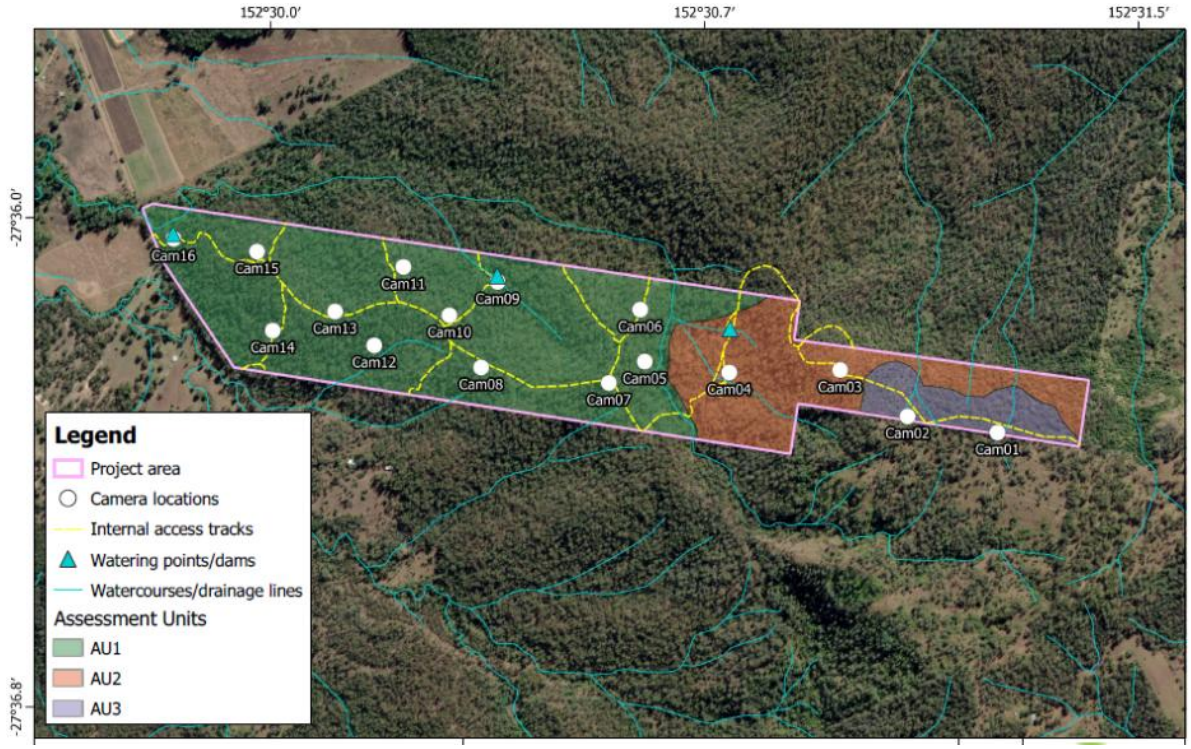
Four other pest species were recorded; Red Fox (*Vulpes vulpes*) at camera 15 and 16, European Rabbit (*Oryctolagus cuniculus*) camera 7, Black Rat (*Rattus rattus*) camera 5 and Cane Toad (*Rhinella marina*) all sites bar cameras 5, 9 and 11.

Although not detected by camera traps, cattle (*Bos taurus*) and deer are present on site, and have been noted on account of tracks around waterbodies, dung (cattle) and calls (cattle).

7.6.1.4.2.2 Endemic Species

Twenty-seven (27) endemic species; 2 reptiles, 13 birds and 12 mammals were recorded. No threatened species under Commonwealth or Queensland legislation were recorded on cameras. One Special Least Concern (SLC) species (*Nature Conservation (Animals) regulation 2020* Qld), the Short-beaked Echidna (*Tachyglossus aculeatus*), was recorded on seven cameras.

[65] While these animals are identified here as wild dogs, some authorities will likely consider them to be true dingoes (*Canis dingo*) following in-depth genetic analysis of over 5000 “wild dogs” (including 356 from Queensland) which showed >98% of animals tested comprised at least 50% dingo ancestry (Cairns et al. 2022).



Inset 33. Location of Camera Traps

7.6.2 Thagoona Offset Area

7.6.2.1 BioCondition Assessments

Determination of the Thagoona Offset Area AUs was informed by inspection and interrogation of State Government remnant vegetation and pre-clear mapping data sets, pre-BioCondition orientation site inspection and BioCondition survey work conducted 21 January 2026.

At the Thagoona Offset Area two (2) BioCondition were applied to the two (2) AUs identified (**Figure 67**). The 2 AUs reflective of historic site disturbance and deviation from baseline ecological condition arising from landscape processes have been identified.

The habitat quality at the Thagoona Offset Area has been assessed using a modified version of the Queensland Government's *Guide to Determining Terrestrial Habitat Quality: A toolkit or assessing land-based offsets under the Queensland Environmental Offsets Policy* Version 1.2 (State of Queensland 2017). The relationship between RE, AUs, Vegetation Communities and BioCondition Transect sites used to derive Habitat Quality are outlined in **Table 62** with sampling effort compliance against the requirements of HQA version 1.2 shown in **Table 63**.

Table 62: Relationship between Regional Ecosystems, Assessment Units, Vegetation Communities and MHQA Assessment Sites – Thagoona Offset Area

Description	Site	
Offset Receiving Site Assessment Unit (OA AU)	**THOA AU1**	**THOA AU2**
Assessment Unit Description	This assessment unit is a matrix of Queensland Blue Gum (*Eucalyptus tereticornis*) canopy with a grassy	This assessment unit is a dominated by mature and semi-mature Queensland Blue Gum (*Eucalyptus tereticornis*) and Moreton

Description	Site	
	understory and open paddock with a mixture of pastural grasses and wetland species within the understory. The shrub layer is significantly impacted with sparse recruitment of canopy species forming the bulk of the sporadic and minimal shrub layer.	Bay Ash (*Corymbia tessellaris*) canopy with a grassy understory with a mixture of pastural grasses and wetland species within the understory. The shrub layer Is significantly impacted with sparse recruitment of canopy species forming the bulk of the sporadic and minimal shrub layer.
Offset Unit Area	5.84	11.84
Pre-clear RE	12.3.3 (refer Vegetation Management Report – **Appendix 13.2**)	12.3.3 (refer Vegetation Management Report – **Appendix 13.2**)
Analogous Ground-truthed RE	Nil	12.3.3
Current regulated vegetation status	Category X	Category C
Number of BioCondition Plots	2	2
BioCondition Transects (HQA Sites)	BC06, BC08	BC05, BC07
Notes		SAT occurred in BC07 with no Koala *(Phascolarctos cinereus)* recorded during surveys.

Table 63: MHQA Sampling for Each AU Expressed as Total Area of Assessment Units Sampled

OA AU	Area (ha)	% of total Site Area	Number of plots	Total Plot Area* (ha)	% of AU sampled	HQA version 1.2 Notes
1	5.84	33.0	2	1.0	17.1	Suggested minimum number of sampling sites for units of 0-50 ha is 'at least 2. This may be streamlined if it can be demonstrated a polygon is uniform in condition
2	11.84	67.0	2	1.0	8.4	

* number of plots in IA AU x bio-condition plot area (std. = 0.5 ha (100m x 50m))

BioCondition assessments at Assessment Unit 1 is compliant with the minimum standard identified by HQA version 1.2. The location of Assessment Units and BioCondition transects are represented on **Figure 67;** data sheets are found in **Appendix 14.2**.

7.6.2.2 Offset Area Assessment Units

Within the offset assessment framework, variability in habitat quality across the Offset Area is addressed through the delineation of AUs. The Offset Areas has been subdivided into AUs to represent areas of relatively uniform vegetation type and condition, enabling a robust and transparent assessment of habitat values. Each AU was

mapped to inform the placement and number of sample locations required to adequately characterise habitat condition. Assessment Units were initially defined using desktop data and subsequently reviewed and refined during field investigations where necessary. In general, AUs comprise relatively homogenous vegetation areas, typically aligned with a distinct regional ecosystem or habitat type, and are clearly differentiated from adjacent vegetation on the Offset Area. The AUs identified form the basis for the assessment of habitat values relevant to both Koala *(Phascolarctos cinereus)* and Grey-headed Flying-fox *(Pteropus poliocephalus)*, where applicable.

7.6.2.2.1 THOA AU 1 – Queensland Blue Gum (*Eucalyptus tereticornis*) Canopy with a Grassy Understory and Open Paddock

The AU covers 5.84 ha (33% of the total Offset Area) and is classified as Category X land occurring on a flat slope. The canopy (T1) layer ranges from 15–16 m in height and is dominated by Queensland Blue Gum (*Eucalyptus tereticornis*). The sub-canopy (T2) layer includes regrowth Queensland Blue Gum (*Eucalyptus tereticornis*) reaching up to 6 m. Maiden's Wattle (*Acacia maidenii*) is present as an associated species within the shrub layer. Groundcover is dominated by Cyperus spp., and Wild Aster* (*Aster subulatus*).

The canopy is patchy due to historical thinning and clearing, with the assessment unit showing evidence of extensive disturbance associated with cropping and grazing. Forb species richness is relatively high, whereas canopy tree and shrub richness are comparatively low. Groundcover structure is characterised by low grass and shrub cover.

Non-native species comprise approximately 50–70% of total cover, with higher levels corresponding to areas of reduced canopy density. These areas are dominated by a range of weedy grasses and forbs, including Giant Sensitive Plan (*Mimosa diplotricha* var. *diplotricha*), which is listed as Category 3 restricted matter under the *Biosecurity Act 2014* (Qld). Canopy species recruitment within AU1 is in the order of 10-200 stems/ha. The character of THOA AU1 – BC06, THOA AU1 – BC08 **Plates 22-23** below.

Plate 22: Representative habitat condition of THOA AU1 BC06

Plate 23: Representative habitat condition of OA AU1 BC08

7.6.2.2.2 THOA AU 2 – Queensland Blue Gum (*Eucalyptus tereticornis*) and Moreton Bay Ash (*Blakella tessellaris*) canopy with a grassy understory with a mixture of pastural grasses

THOA AU2 comprises 11.84 ha (67% of the total Offset Area) and consists of Regrowth RE12.3.3 occurring on a flat slope in the Thagoona Offset Area. This AU is a dominated by mature and semi-mature Queensland Blue Gum (*Eucalyptus tereticornis*) and Moreton Bay Ash (*Blakella tessellaris*) canopy with a grassy understory with a mixture of pastural grasses and wetland species within the understory. The shrub layer Is significantly impacted with sparse recruitment of canopy species forming the bulk of the sporadic and minimal shrub layer.

The canopy (T1) layer ranges from 18–22 m in height and is dominated by Queensland Blue Gum (*Eucalyptus tereticornis*), with Moreton Bay Ash (*Corymbia tessellaris*) and Doolan (*Acacia salicina*) present as associated species. The sub-canopy (T2) layer ranges from 14–16 m and consists primarily of Queensland Blue Gum (*Eucalyptus tereticornis*), with canopy cover ranging from 16.4–18.75%. Recruitment is evident, with all canopy individuals within this layer representing regrowth.

The shrub layer consists primarily of juvenile canopy species and Doolan (*Acacia salicina*), with a height range of 1.3–5 m and canopy cover between 3.3–11.5%.

Regrowth condition is evident, with approximately 0–4 large trees recorded across the two sites. Canopy species recruitment within AU2 is estimated at approximately 20–840 stems per hectare.

The understorey includes occasional thickets of Lantana* (*Lantana camara*), with Cadaghi* (*Corymbia torelliana*) occasionally present.

The character of THOA AU2 – BC05, THOA AU2 – BC07 The character of BioCondition OA AU2 Transect 4 and Transect 5 are shown in **Plates 24-25** below.

Plate 24: Representative habitat condition of OA AU2 BC05

Plate 25: Representative habitat condition of OA AU2 BC07

7.6.2.3 Weed Assessment

7.6.2.3.1 Baseline Study

A comprehensive weed assessment of the Thagoona Offset Area was undertaken in January 28 and 30 of January 2026. The technical note outlining methods, sampling effort and results is found as Attachment 2 of **Appendix 12.2** – Thagoona OMP.

The invasive species survey was undertaken through an informed random meander, parallel traverse assessment. This method was adopted as it is sufficient to develop an understanding of exotic flora population dynamics within the area, as well as obtaining a general inventory of all exotic flora species which occur on site (**Inset 34**). Supplementary weed information was also derived from BioCondition Transects (**Figure 67**).

The informed random meander, parallel traverse method comprised a modified random meander described by Cropper 1993 (Cropper SC 1993, Management of Endangered Plants, CSIRO Publications Victoria). In the project GIS a thirty-metre grid was overlayed onto the survey area and horizontal lines were deleted leaving a series of parallel lines.

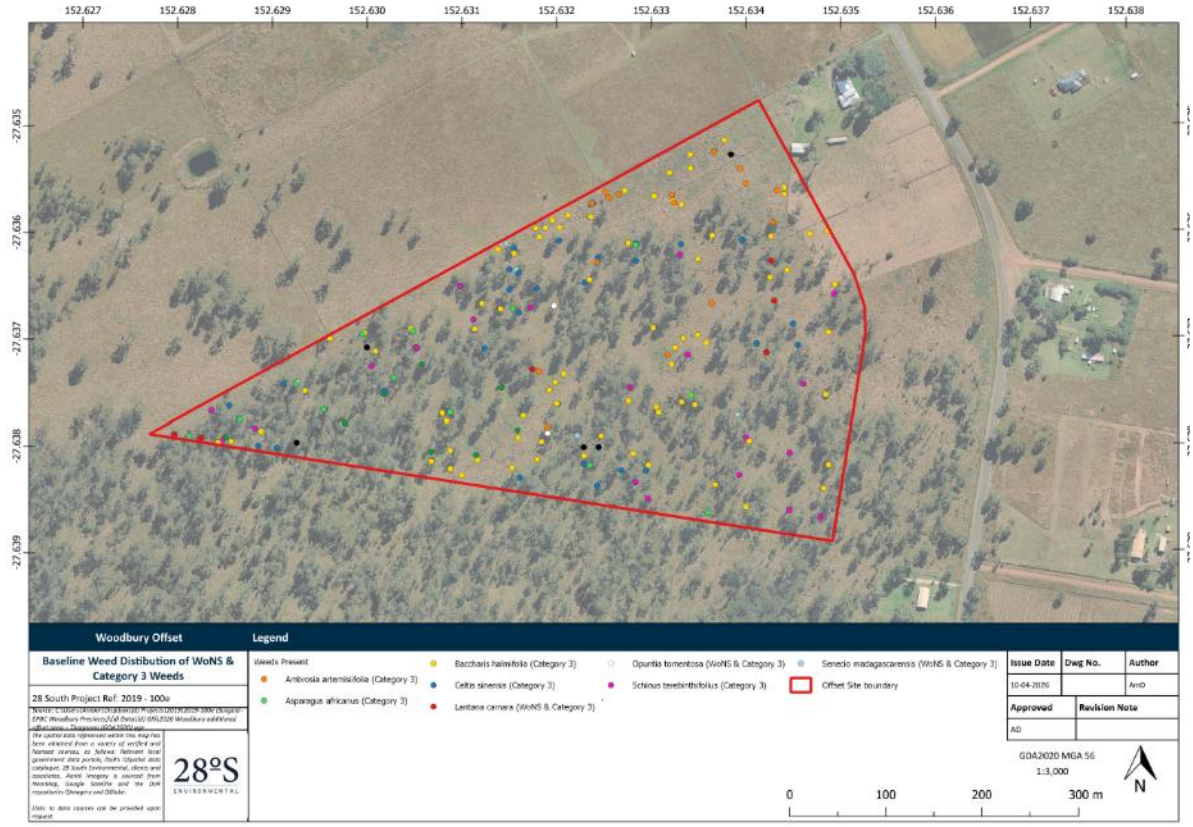
In the field, three (3) qualitative measures of abundance were applied, being (ranked from lowest to highest); Low (1-5 individual stems at an observation point), Moderate (6-25 individual stems at an observation point) and High (>25 individual stems at an observation point).

Three (3) WoNS are present within the Thagoona Offset Area:

- Lantana* (*Lantana camara*)
- Velvety Tree Pear* (*Opuntia tomentosa*)
- Fireweed* (*Senecio madagascarensis*).

Eight (8) Category 3 Restricted Matter (*Biosecurity Act 2014* (Qld)) weeds are present:

- Annual Ragweed* (*Ambrosia artemisiifolia)*
- Climbing Asparagus* (*Asparagus africanus*)
- Groundsel Bush* (*Baccharis halmifolia*)
- Chinese Celtis* (*Celtis sinensis)*
- Lantana* (*Lantana camara*)
- Velvety Tree Pear* (*Opuntia tomentosa*)
- Broad-leaved Pepper Tree* *(Schinus terebinthifolius)*
- Fireweed* (*Senecio madagascarensis*).



Inset 34. Weed species richness and distribution

Weed species richness at the Thagoona Offset Area is displayed with greater detail in **Figure 68**.

Within the Thagoona Offset Area, Groundsel Bush* (*Baccharis halimifolia*) and Broad-leaved Pepper Tree* (*Schinus terebinthifolius*) has a cosmopolitan distribution and is by far the most problematic weed on the site. Across the site, weed density is evenly spread. WoNS were evenly dispersed toward the centre of the Thagoona Offset Area, including species such as Lantana* (*Lantana camara*), Velvety Tree Pear* (*Opuntia tomentosa*), Fireweed* (*Senecio madagascarensis*). The remaining species were somewhat randomly dispersed throughout the site.

The majority of these weed infestations were low density with only 1-5 individuals per data point. The predominantly low densities of these other species could be due to the suite of native grasses suppressing their germination and competing for resources including soil moisture. Any infestations that were considered to be a high-density infestation typically occurred in and around open paddock in the northern corner of the site and one instance of Climbing Asparagus Fern* (*Asparagus africanus*) in the western corner. This is due to constant disturbance in these areas promoting weed succession, potential importing of invasive species by vehicles and easy mobility for species that could disperse the seeds of invasive species.

7.6.2.4 Vertebrate Pest Assessment

7.6.2.4.1 Methods

This assessment consisted of a camera trap survey. A total of four (4) trail cameras were deployed across the Thagoona Offset Area, encompassing the key assessment units representing the range of habitat types and conditions present (**Inset 35**). Cameras were deployed over a 14-day period from 8 March 2026 to 22 March 2026. Due to early saturation of storage capacity, effective sampling duration varied between approximately 3 to 5 days per camera. The total effective survey effort was reduced accordingly but remained sufficient to characterise baseline vertebrate pest activity across the Thagoona Offset Area.

All cameras were mounted on trees or fence posts at approximately 0.5 m above ground level and positioned to target areas of likely fauna movement, including access tracks, fence lines and areas of habitat transition. Cameras were baited to increase detection probability and configured for continuous 24-hour operation.

A technical memorandum outlining the survey methodology, environmental conditions, camera configuration and detailed analysis of results is provided in **Appendix 12.2** – Thagoona OMP, Attachment 1 – Baseline Vertebrate Pest Assessment.

7.6.2.4.2 Results

A total of 12 taxa were recorded during the camera trap survey. These included one amphibian pest species, one pest mammal species, three native bird species, one macropod species and two native reptile species. No threatened species listed under Commonwealth or Queensland legislation were detected during the survey.

7.6.2.4.2.1 Pest Species

Two vertebrate pest species were confirmed within the Thagoona Offset Area: House Mouse (*Mus musculus*) and Cane Toad (*Rhinella marina*). A total of six (6) pest fauna detections were recorded across the survey period, with House Mouse (*Mus musculus*) accounting for the majority of detections and Cane Toad (*Rhinella marina*) recorded at lower frequency.

Inset 35. Location of Camera Traps

Camera trap locations at the Thagoona Offset Area are displayed with greater detail in **Figure 70**.

Although not detected within the Thagoona Offset Area during the survey period, Red Fox (*Vulpes vulpes*) was recorded within close proximity (approximately 1.3 km) and is considered likely to occur within the Thagoona Offset Area due to its mobility and broad home range. Additional pest species commonly associated with rural and peri-

urban environments (e.g. feral cat, feral pig, wild dog and rabbit) were not detected during the survey; however, their absence during this survey does not preclude their occurrence within the Thagoona Offset Area.

7.6.2.4.2.2 Endemic Species

Native fauna recorded on camera traps included a range of bird, reptile and macropod species. While species diversity was moderate, the relatively low level of pest fauna activity observed across the Thagoona Offset Area suggests that current pest pressure is low.

Overall, vertebrate pest activity was limited and relatively uniform across the Offset Site, indicating that pest management requirements are currently low but remain an important consideration for ongoing adaptive management under the OMP.

7.7 Modified Habitat Quality Assessment of Offset Areas

Both Offset Areas have been assessed using a modified version of the Queensland Government *Guide to Determining Terrestrial Habitat Quality: A toolkit or assessing land-based offsets under the Queensland Environmental Offsets Policy Version 1.2* (State of Queensland 2017).

The MHQA assessment methodology used to assess habitat quality for the Offset Sites is identical to that used for the Impact Site, as described in **Section 6.1** for Koala *(Phascolarctos cinereus)* and **Section 6.2** for Grey-headed Flying-fox *(Pteropus poliocephalus)*.

Within the offset assessment framework, variability in habitat quality across the Offset Areas is addressed through the delineation of AUs. The Offset Areas have been subdivided into AUs to represent areas of relatively uniform vegetation type and condition, enabling a robust and transparent assessment of habitat values. Each AU was mapped to inform the placement and number of habitat quality sample locations required to adequately characterise habitat condition. The AUs identified therefore form the basis of the below described habitat quality assessment methodology for both Koala *(Phascolarctos cinereus)* and Grey-headed Flying-fox *(Pteropus poliocephalus)*.

Landscape context showing the extent of Remnant and High Value Regrowth within vicinity of the Woolshed Offset Area is presented as **Figure 61**; landscape connectedness within the region is represented in **Figure 62**.

Landscape context showing the extent of Remnant and High Value Regrowth within vicinity of the Thagoona Offset Area is presented as **Figure 63**; landscape connectedness within the region is represented in **Figure 64**.

7.7.1 Koala MHQA Methodology

To quantify the quality and functional value of Koala *(Phascolarctos cinereus)* habitat within the Offset Areas, vegetation condition was assessed using a modified application of the Queensland State Government's *Guide to determining terrestrial habitat quality: A toolkit for assessing land-based offsets under the Queensland Environmental Offsets Policy Version 1.2* (April 2017) (Department of Environment and Heritage Protection 2017) (Guide to determining terrestrial habitat quality). This involves the assessment of vegetation condition under the Regional Ecosystem and BioCondition framework. BioCondition surveys were undertaken generally in accordance with the DETSI framework document; BioCondition: A condition assessment framework for terrestrial biodiversity in Queensland, (The State of Queensland (Department of Science, Information Technology, Innovation and the Arts), 2015) , however, some attributes are adapted and introduced by 28 South Environmental to provide a quantitative platform which is adaptable to the measure of habitat quality specific to Koala (*Phascolarctos cinereus*).

The Guide to determining terrestrial habitat quality methodology recognises the following three (3) key indicators:

1. site condition – a general condition assessment of vegetation compared to a benchmark;

2. site context – an analysis of the site in relation to the surrounding environment; and

3. species habitat index – the ability of the site to support a species.

For the Offset Area, the MHQA applied for Koala *(Phascolarctos cinereus)* integrates these indicators into a tailored scoring framework. Site condition and site context are each weighted at 30% of the overall MHQA score. The remaining 40% weighting is assigned to species stocking rate, which sits outside the Guide to determining terrestrial habitat quality and has been incorporated to better reflect MNES. This modification ensures the assessment appropriately captures species-specific habitat suitability and offset performance.

The following section details the methodology utilised to assess the site condition, site context and species stocking rate under the MHQA.

7.7.1.1 Site Condition (30%)

The assessment of site condition is made-up of two ecological components which total a score out of 100:

- BioCondition score (out of 80) – the assessment of vegetation structure and function; and,
- Fauna species habitat quality assessment (out of 20) – the assessment of specific habitat characteristics unique to the protected matter.

A unique site condition score is developed for each transect site and then averaged to produce a single score for each Assessment Unit. Assessing Site condition is an integral step in determining specific quantification of impacts, while also determining whether an Offset Area is suitable to establish a desired capacity to support the prescribed environmental matters being offset. The on-Site condition is a key element of habitat quality and has a direct influence on the biodiversity it supports.

Vegetation scoring is undertaken in accordance with the *BioCondition Assessment Manual – A condition Assessment Framework for Terrestrial Biodiversity in Queensland* (Eyre *et al.,* 2015). Site condition is assessed using a suite of 13 measurable attributes to describe the structure and function of the vegetation community and is benchmarked against the expected range for a relatively undisturbed community. The Regional Ecosystem Database Description (REDD) describes the remnant state of Regional Ecosystems in terms of floristic variably and vegetation structure, for which a corresponding benchmark value exists for each of the 13 measurable attributes. The maximum BioCondition score for a wooded ecosystem is 80. Each attribute and their corresponding maximum score are detailed below:

- **recruitment of dominant canopy species (score out of 5) –** Across the entire 100*50m plot area, the presence of recruitment from the ecological dominant layer (EDL) is measured through the observation of individuals of the EDL that have a DBH smaller than 50mm. This data is recorded as a percentage of the number of species present in the EDL that are found to be regenerating. Recruitment data allows a visual representation of how the vegetation on site may be changing and progressing.
- **native plant species richness – trees (score out of 5) –** Native tree richness species is measured by recording each tree species that is present within the entire 100*50m plot area. A list of all species, and a total richness count is produced from this. Richness data for native plants gives an assessment of biodiversity and can give a reflection of what fauna species may be present due to unique habitat preferences and needs.
- **native plant species richness – shrubs (score out of 5) -** Native shrub richness species is measured by recording each native shrub species that is present within the smaller 50*10m plot area. A list of all species, and a total richness count is produced from this. Richness data for native plants gives an assessment of biodiversity and can give a reflection of what fauna species may be present due to unique habitat preferences and needs
- **native plant species richness – grasses (score out of 5) -** Native grass richness species is measured by recording each native shrub species that is present within the smaller 50*10m plot area. A list of all species, and a total richness count is produced from this. Richness data for native plants gives an assessment of biodiversity and can give a reflection of what fauna species may be present due to unique habitat preferences and needs.
- **native plant species richness – forbs (score out of 5) -** Native forb richness species is measured by recording each native shrub species that is present within the smaller 50*10m plot area. A list of all species,

and a total richness count is produced from this. Richness data for native plants gives an assessment of biodiversity and can give a reflection of what fauna species may be present due to unique habitat preferences and needs.

- **tree canopy height (score out of 5) –** Tree canopy height is measured by estimating the mean height of the ecological dominant layer (EDL) or canopy inside the 100*50m plot. If the benchmark document has a distinct value for an emergent or subcanopy layer, these values are also estimated for the plot area. Tree height and cover are both used to define vegetation classes for regional ecosystem mapping.

- **tree canopy cover (score out of 5) –** The tree canopy cover is measured by recording each stem and species of tree, native or exotic, which intersect with the 100m transect line and contribute to the EDL (ecologically dominant layer), subcanopy, or emergent layer. A total measurement of intersecting cover is calculated and converted to a percentage of estimated canopy cover. The collection of tree species data is beyond that which the BioCondition assessment framework instructs, however, creates a more detailed dataset which awards the power to calculate tree species dominance. Detailed data pertaining to canopy species' dominance allows measurable conclusions to be drawn regarding species habitat suitability and subsequent habitat quality scoring. An example of this is the distinction between listed LIKTs (Locally important Koala trees), koala ancillary trees (as per Youngentob *et al.*, 2022), and other species of tree outside of the Myrtaceae family. This measurable attribute is included in the MHQA method in the calculation of *Quality and availability of food and foraging habitat,* and *Quality and availability of shelter.*

- **shrub cover (score out of 5) –** The methodology for the above tree canopy intercept is repeated for the shrub layer. Both methods include recording the intercept of exotic species, which are otherwise excluded from traditional BioCondition methods and analysis. This inclusion is incorporated into the MHQA assessment in the calculation of *Species Mobility Capacity*.

- **native perennial grass cover (score out of 5) –** Native grass cover is measured within five 1*1m quadrats along the transect line in the 50*10m plot. Native grass cover is assessed by a downward vertical observation of the quadrat, where the percentage cover is estimated for each quadrat placed, then averaged across the plot to give a total estimate to compare against the benchmark value. The entire ground cover within the quadrat is estimated into categories within a set table, but only native grass cover and organic litter are compared against benchmark values. Each quadrat table result should equal 100% of cover. 1*1m quadrats are placed on alternate sides of the quadrat tape each time, every 10m, creating 5 five sites of recording within the 50m plot.

- **organic litter (score out of 5) –** Organic litter is measured the same way as the above ground cover attribute, native perennial grass. Organic litter provides habitat for ground dwelling wildlife and is a factor in erosion prevention and the carbon cycle.

- **large tree measures (score out of 15) –** The number of large trees, defined by the DBH (diameter at breast height) outlined per Regional Ecosystem in the BioCondition benchmark document, are measured in the total 100*50m plot area. Both eucalypt and non-eucalypt species may be recorded depending on the RE benchmark value. A total large tree score is derived as a per hectare value. The number of large trees may be used as a proxy for tree-hollows for the measure and assessment of habitat suitability and quality for relevant protected matters e.g. Greater Glider (*Petauroides volans*). This measurable attribute may therefore be included in the MHQA method in the calculation of *Quality and availability of food and foraging habitat,* and *Quality and availability of shelter.*

- **coarse woody debris (score out of 5) –** Within the 50*20m plot area, coarse woody debris (CWD), defined by the BioCondition Assessment Framework as logs or dead timber that is larger than 100mm in diameter and greater 50cm in length, is tallied then multiplied by 10 to produce a per hectare value for benchmark comparison. The measure of CWD may be used as a proxy for the assessment of habitat suitability and quality for relevant protected matters, especially those which are obligate ground dwellers e.g. Dunmall's snake (*Furina dunmalli*). This measurable attribute may therefore be included in the MHQA method in the calculation of *Quality and availability of food and foraging habitat,* and *Quality and availability of shelter.*

- non-native plant cover (score out of 10) – A species count of all non-native flora is completed within the 50*10m plot, alongside the native shrub, grass and forb richness recordings. The measure of non-native plant cover is representative of the cumulative non-native biomass at each structural layer. However, the BioCondition manual does not prescribe the method by which to estimate non-native plant cover. To achieve a methodical and repeatable estimate of non-native plant cover, the 50*10 m plot is divided into five 10*10 subplots. Within each subplot, the cover of each non-native species is estimated according to each species which contributes to greater than 2% of cover. The exclusion of species which occur in less than 2% of area is based on the practicality of undertaking the assessment and the assumption that the proportion of species which are either small, inconspicuous, or low in abundance, are of less relevance to the intention of the scoring and subsequent

application to MHQA methods. The average estimated cover of each non-native flora species is found for the greater 50*10 m plot. Detail of exotic flora species cover may be used in the interpretation of habitat suitability and quality. This measurable attribute may therefore be included in the MHQA method in the calculation of Quality and availability of food and foraging habitat, and Quality and availability of shelter.

For the assessment of fauna habitat, an additional two (2) site-based ecological attributes are measured using a series of specifically designed ecological indicators. Each attribute contributes a score of 10 to overall site condition.

- quality and availability of food and foraging habitat – 10
- quality and availability of shelter – 10

Ecological indicators have been designed and ecologically justified based on the review and consideration of relevant information in the following documents:

- Department of Agriculture, Water and the Environment (2022). Conservation Advice for *Phascolarctos cinereus* (Koala) combined populations of Queensland, New South Wales and the Australian Capital Territory. Canberra: Department of Agriculture, Water and the Environment.
- DAWE 2022, National Recovery plan for the Koala *(Phascolarctos cinereus)*: *Phascolarctos cinereus* (combined populations of Queensland, New South Wales and the Australian Capital Territory). Department of Agriculture, Water and the Environment, Canberra. March 2022. CC BY 4.0.
- Youngentob, K.N, Marsh, K.F., Skewes, J., (2021) A review of Koala *(Phascolarctos cinereus)* habitat assessment criteria and methods, report prepared for the Department of Agriculture, Water and the Environment, Canberra, November. CC BY 4.0.
- Information and documents have been accessed from the Species Profile and Threats Database, available at http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl

The calculation of habitat quality has been undertaken in accordance the Guide to determining terrestrial habitat quality version 1.2. (Department of Environment and Heritage Protection, 2017). Ecological indicators are listed and justified in **Table 64**.

The total score for each ecological attribute is converted to a score out of 100, and then scored in accordance with "*Table 4: Species Habitat Index Scoring Guide*" from the Guide to determining terrestrial habitat quality version 1.2. (Department of Environment and Heritage Protection, 2017). **Table 65** below describes the scoring scale applied to achieve this.

7.7.1.1.1 Limitations to the methodology

It is recognised that Youngentob et al. (2021) specifically recommends against excluding Koala *(Phascolarctos cinereus)* forage trees which are 100 mm DBH and less. The following ecological metrics strictly consider trees of 100 mm DBH and more, and do not consider height. The following methodology operates under the assumption that a tree of 100 mm DBH will typically be of a suitable height to Koala *(Phascolarctos cinereus)*, i.e. greater than four metres. The collection of stem count information within a BioCondition plot, as well as other Koala *(Phascolarctos cinereus)* habitat metrics, contributes to the accumulation of significant additional survey effort. The further collection of DBH and height information of stems less than 100 mm DBH would result in even more time spent undertaking data collection and data processing post-field survey. In the interest of collecting meaningful data and being cognisant of reasonable time spent undertaking data collection and processing and using that data to demonstrate ecological change over time, trees are considered to be available to Koala *(Phascolarctos cinereus)* where they exceed 100 mm DBH.

Given habitat can be suitable to Koala *(Phascolarctos cinereus)* where it is in relatively poor ecological condition, i.e. small and infrequent trees, an effective habitat scoring method should be designed in such a way that it can demonstrate improvement over time. Suitable forage trees which occur within the plot but are less than 100 mm DBH, will theoretically become available and contribute to scoring over time. Furthermore, vegetation condition as per the BioCondition assessment will capture all trees which are relevant to the 13 measurable attributes.

Average stem count information relating to individual REs is used to score specific ecological indicators of Koala *(Phascolarctos cinereus)* habitat, as described in **Table 64** below. Information was obtained from the either the latest publication of the Regional Ecosystem Database Description (REDD) version 13.1, or through direct consultation with the Queensland Herbarium (State of Queensland as represented by the Queensland Herbarium, Department of Environment, Science and Innovation) who have provided draft technical descriptions of relevant Regional Ecosystems.

Table 64: Koala *(Phascolarctos cinereus)* scoring indices

Attribute	Ecological Indicator	Scoring Metric	Justification for inclusion
1. Quality and availability of food and foraging habitat	(1.a) Proportion of canopy cover of LIKT trees within the 100x50 metre BioCondition plot	**0** - Site is absent of trees i.e. entirely cleared 1 - 1-5% of extant tree canopy cover (cumulative T1 and T2, where trees reach/exceed 100 mm DBH) belongs to LIKT species **5** - 6-15% of extant tree canopy cover (cumulative T1 and T2, where trees reach/exceed 100 mm DBH) belongs to LIKT species **10** - 16-25% extant tree canopy cover (cumulative T1 and T2, where trees reach/exceed 100 mm DBH) belongs to LIKT species **15** - 26-50% extant tree canopy cover (cumulative T1 and T2, where trees reach/exceed 100 mm DBH) belongs to LIKT species **20** - >50% extant canopy cover (cumulative T1 and T2, where trees reach/exceed 100 mm DBH) belongs to LIKT species	This ecological indicator is indicative of the availability of forage resources i.e. palatable foliage. This indicator looks at the proportion of canopy which is available for Koala *(Phascolarctos cinereus)* to forage on. Given the number of trees required to sustain a single Koala *(Phascolarctos cinereus)* or a population is not well understood in literature, and likely varies significantly between locations based on the nutritional quality and palatability of the browse, a conservative approach is taken through the adoption of a high score being assigned to as >50% proportional canopy is palatable. The percentage of cumulative canopy cover (trees greater than 100 mm DBH) measured along the 100m transect line which is made-up of LIKT (Youngentob *et al*., 2021) species is scored to assign a high score where a greater proportion of the canopy within a habitat belongs to that of foraging resources. This is justified through evidence-based discussion in Youngentob *et al*. (2021) which states that research has demonstrated that increasing the relative abundance of less palatable browse in a landscape reduces the density and likelihood of Koalas *(Phascolarctos cinereus)* occurring in that landscape. A high score (20) is assigned if a site contains majority LIKT species within the cumulative canopies. A Eucalyptus woodland which is analogous to benchmark standards typically supports a majority LIKT canopy (i.e. >50% of trees are LIKTs). Circumstances under which this might not occur, are where a canopy may be Eucalyptus dominant but not made up of listed LIKT for the specific region e.g. Eucalyptus melliodora. In this case the site would score lower, and therefore be accurately indicative of less available foraging resources.
	(1.b) Tree density of listed LIKT species (per hectare stem count of LIKT species within the 100x 50 metre BioCondition plot)	**0** - 0% **5** - 1-25% of RE technical description stem count average (T1/T2) belongs to LIKT species **10** - 26-50% of RE technical description stem count average (T1/T2) belongs to LIKT species	This attribute looks at the stem count (sum of T1 and T2 average taken from the relevant Regional Ecosystem technical description) of LIKTs within the BioCondition plot. The inclusion of this attribute aims to capture the density of foraging resources, and provide a balance to the measure of *proportion of canopy cover*. Although a canopy may predominantly belong to LIKT species, the quantity of those resources is not captured in the above metric. The availability of forage habitat is inherently correlated with the density of suitable foraging trees, i.e. more trees => more foliage => more forage resources. Koala *(Phascolarctos cinereus)* is known to favour small to

Attribute	Ecological Indicator	Scoring Metric	Justification for inclusion
		15 - 51-75% of RE technical description stem count average (T1/T2) belongs to LIKT species **20** - >75% of RE technical description stem count average (T1/T2) belongs to LIKT species	medium size trees for foraging, and large trees for sitting, hence stem count opposed to large tree counts are built upon to capture forage habitat *availability*. All LIKT stems >100mm DBH are counted within the 50x20m plot and extrapolated to find the per hectare value. Only listed feed trees (LIKT) in Youngentob *et al*. (2021) for the relevant region are included in this attribute.
	(1.c) Forage tree species richness (LIKTs per Youngentob *et al*., 2021) (Only trees >100 DBH)	**0** - 0 Locally Important Koala Tree species **5** - 1-3 Locally Important Koala Tree species **10** - 4+Locally Important Tree species	Although Koala *(Phascolarctos cinereus)* can sustainably occupy monoculture habitats and not experience a decrease in condition / fitness, a more diverse habitat will inherently be more resilient to habitat/climate stressors. Habitat is arguably of higher quality where it is more resilient, which is especially relevant in the current climate *change* scenarios. Therefore, a site will score higher where there is more diversity of LIKTs. Further, tree species will likely experience new growth during different months. By extension, a more diverse habitat has the potential to offer young and more palatable growth for a greater portion of time compared with dominant canopy of a single LIKT. Because Koala *(Phascolarctos cinereus)* is not known to select habitat based on tree heterogeneity, this indicator contributes a smaller score 'weighting' for the overall score of Quality and availability of food and foraging habitat.
	(1.d) Recruitment of T1 and T2 layer LIKT species (% of total LIKT species diversity within plot).	**0** - 0 **1** - 1-33% **5** - 34-66% **10** - 67-100%	This ecological indicator captures the health of foraging resources, i.e. the quality, through the consideration of species regeneration. A species is considered a component of the T1 and T2 layer where it exceeds 100 mm DBH, irrespective of height. The measure of recruitment is the proportion of species in the T1 and T2 layer which have sapling regrowth. Given good quality Koala *(Phascolarctos cinereus)* habitat can occur as single species' dominant woodland, this attribute is weighted lower than others.
2. Quality and availability of shelter	(2.a) Presence of preferred ancillary trees within the 100x50 metre BioCondition plot (listed for relevant Bioregion in Youngentob *et al*., 2021)	**0** - no observed listed ancillary trees within direct landscape, OR, ancillary trees are less than 100 mm DBH and therefore are not considered available as sitting trees. **1** - 1 or more species of listed ancillary trees within plot, tree/s are between 100-300mm DBH.	Ancillary trees are important habitat for Koala *(Phascolarctos cinereus)* as day-time rest sites, as well as mobility aids in-between patches of more preferrable forage trees (Youngentob *et al.,* 2021). The diversity of ancillary tree species is not yet demonstrated to be an important factor to Koala *(Phascolarctos cinereus)* habitat selection, rather, certain species of trees are observed to be favoured as sitting trees due to thermal regulation properties (Youngentob *et al.,* 2021).

Attribute	Ecological Indicator	Scoring Metric	Justification for inclusion
		5 - 1 or more species of listed ancillary trees within plot, at least one tree is >300mm DBH. **10** - 1 or more species of listed ancillary trees within plot, with variable DBH measures: at least one tree exceeds 450mm.	Large ancillary trees typically have an infrequent distribution in a landscape. Species abundance and diversity within a BioCondition plot therefore does not necessarily correlate with *quality and availability of shelter*. The number of species is not a product of this score. Instead, the score captures the quality of ancillary or other "sitting" trees within the local landscape by means of tree size. Koala *(Phascolarctos cinereus)* are known to forage in small trees (100 mm DBH) but day-time rest sites are often in larger trees (Youngentob *et al.,* 2021).; therefore, ancillary trees could be expected to have greater habitat value where they are larger. A DBH of 450 mm is used as a surrogate for a 'large tree threshold'. As large tree threshold for Koala *(Phascolarctos cinereus)* habitat REs in SEQ are often greater than 450 mm DBH, 450 has been adopted as a fair but conservative benchmark for the metric. A single large tree will attain the high score. This metric is effective in the scaling of habitat condition on the basis that it is likely a habitat patch will contain ancillary trees, however, it is less likely a patch will contain a very large ancillary tree, which is suggested in literature to be preferred.
	(2.b) Canopy cover of all native trees within the 100x50 metre BioCondition plot	**0** - Site is absent of trees i.e. entirely cleared **1** - 1-10% of benchmark canopy cover value for corresponding RE **5** - 11-30% of benchmark canopy cover value for corresponding RE **10** - 31-50% of benchmark canopy cover value for corresponding RE **15** - 50-89% of benchmark canopy cover value for corresponding RE **20** - >90% of benchmark canopy cover value for corresponding RE	This score is designed to capture the ability of a habitat (referencing extant BioCondition benchmark values) to provide general shelter to Koala *(Phascolarctos cinereus)*. A high score is achieved where the canopy cover of the habitat is within 90% of benchmarked RE values. Only native trees are scored for this indicator so that the infestation of weeds may incidentally result in a reduced score. This ensures habitat quality is not falsely inflated.
	(2.c) Tree density (per hectare stem count) of all native tree species which contribute to the emergent, canopy, and	**0** - 0% **5** - 1-25% of technical description stem count average (cumulative T1/T2)	The availability of shelter is inherently correlated with the density of suitably sized trees. All stems >100mm DBH within the T1 and T2 canopy layers are counted within the 50x20m plot and extrapolated to find the per hectare value. The total stem count number is compared to that of the corresponded

Attribute	Ecological Indicator	Scoring Metric	Justification for inclusion
	subcanopy layers and exceed 100mm DBH. Stem counts are compared against the cumulative T1 and T2 stem count averages (average T1 + average T2) for the relevant RE (as per the REDD technical descriptions).	**10** - 26-50% of technical description stem count average (cumulative T1/T2) **15** - 51-75% of technical description stem count average (cumulative T1/T2) **20** - >75% of technical description stem count average (cumulative T1/T2)	RE technical description (latest version). Only stems greater than 100 mm DBH are considered to contribute to the T1 or T2 layer, irrespective of height.
	(2.d) Recruitment of listed LIKT and Ancillary trees species which contribute to the T1 and T2 layers	**0** - 0 **1** - 1-33% **5** - 34-66% **10** - 67-100%	This ecological indicator captures the health of the habitat, i.e. the quality, through the consideration of species regeneration for trees listed as either LIKT or ancillary under the relevant table in Youngentob et al. (2022). A species is considered a component of the T1 and T2 layer where it exceeds 100 mm DBH, irrespective of height and species. The measure of recruitment is the proportion of species in the T1 and T2 layer which have sapling regrowth. Given good quality Koala *(Phascolarctos cinereus)* habitat can occur as single species' dominant woodland, this attribute is weighted lower than others.
	(2.e) Proximity to habitat refugia	**1** - located >1,000m from watercourses of stream order 2 and higher **5** - located between 1,000m and 300 m from watercourses of stream order 2 and higher **10** - located <300 m from of watercourses of stream order 2 and higher	The quality of habitat to support Koala *(Phascolarctos cinereus)* during climatic stressors is a product of foliage nutrition and moisture content. Youngetob *et al.* (2021) state that soil quality is not indicative of nutritional value within feed tree foliage. Tree access to water (through watercourse/dam/high water table) is more indicative of foliage quality within a given habitat. Habitat refugia is habitat which can continue to support Koala *(Phascolarctos cinereus)* during periods of climatic stress such as heatwaves and drought. Habitat refugia is therefore scored according to a sites proximity to a water source which would theoretically improve the quality of foliage, and thereby act as refuge during climate stresses which otherwise result in Matter-area quality reduction. This ecological indicator is scored according to the location of each unique BioCondition transect. The distance from the 50 metre point is measured to the nearest suitable water source.

Table 65: Ecological attribute scoring scale

Scale applied to resulting score out of 100	Score adopted from "*Table 4: Species Habitat Index Scoring Guide*"	
between 0 and 30% of total attribute score	1	poor
between 31 and 79% of total attribute score	5	moderate
greater than 80% of total attribute score	10	high

7.7.1.2 Site Context (30%)

The site context assessment deals with the site and its adjacent surroundings. Site context is measured using a suite of attributes to describe the location of the habitat within the surrounding landscape and the influence of its associated threats. The suite of attributes measured to score site context is initially determined according to whether the subregion is either fragmented or in-tact. An in-tact subregion is defined as containing less than 30% non-remnant vegetation, whereas fragmented subregions, are defined as containing 30-95% non-remnant vegetation. Majority of subregions within the South-East Queensland Bioregion are considered to be fragmented, with the exception of Great Sandy (SEQ09) subregion.

The Offset Area is situated within the Moreton Basin (SEQ02) subregion, and as such has been assessed as fragmented according to the *Guide to Determining Terrestrial Habitat Quality (v1.2)* (DEHP, 2017). The assessment therefore considers the influence of adjacent vegetated areas and ecological corridors. The following four landscape scale attributes are measured and scored in accordance with *Section 6* and *Table 3 Context Scoring Sheet Guide* of the *Guide to Determining Terrestrial Habitat Quality (v1.2)* (DEHP, 2017):

- Size of patch
- Connectedness
- Context
- Ecological corridors

A reproduction of the table is included as **Table 66** below. The attribute of '*distance to permanent water*' is scored in replacement of attributes one, two, and three where a subregion is determined to be in-tact.

Table 66: Reproduction of *Table 3 Context scoring sheet guide* from the Guide to determining terrestrial habitat quality v1.2

Attribute	Scoring metrics / scale					
Size of Patch	Score	0	2	5	7	10
	Description	<5 ha	2-25 ha	26-100 ha	101-200 ha	>200 ha
Connectedness	Score	0	2	4	5	
	Description	0%-10%	>10%-50%	50%-75%	>75% or >500 ha	
Context	Score	0	2	4	5	
	Description	<10%	>10%-30%	>30%-75%	>75%	
	Score	0	2	5	10	20

Attribute	Scoring metrics / scale					
Distance to permanent watering point (in-tact landscapes only)	Description	0-500 m	>500 m – 1 km	>1 km – 3 km	>3 km – 5 km	>5 km
Ecological corridors	Score	0	4	6		
	Description	Not within	Sharing a common boundary	Within (whole or part)		

An additional three attributes are adopted and scored under the commonwealth Modified Habitat Quality Assessment (MHQA) method. These include the following:

- role of site location to species overall population in the state
- threats to the species
- species mobility capacity.

Unlike the traditional habitat quality assessment methodology where landscape attributes are assessed against the surrounding remnant vegetation only, the MHQA assesses the surrounding vegetation mapped as either Category A, B, or C under the latest version of the Regulated Vegetation Management Map v7.266. Ecological survey effort associated with the project did not extend outside of the referral area, and as such the extent and quality of broader landscape habitat cannot be accounted for. Given Koala *(Phascolarctos cinereus)* are known to move through and utilise habitats of variable quality, such as agricultural paddocks and rest in non-feed trees, the quality of connected habitat is not considered. For the purposes of landscape analysis and the contextual consideration of connected Koala *(Phascolarctos cinereus)* habitat, all wooded vegetation communities are considered to serve as connective habitat. Non-wooded areas, i.e. non-remnant areas, are excluded from the analysis as their condition and suitability to even that of dispersal function cannot be guaranteed. All relevant Regulated Vegetation polygons which are directly and continuously connected with the entire mapped matter area contribute towards to scoring of landscape attributes.

7.7.1.2.1 Patch Size

The calculation of the area of the patch size generally applies the method outlined in the BioCondition assessment manual v2.2 that considers the patch to be areas connected by corridors greater than 200 m wide within a 1 km radius of the site. For the calculation of patch size, vegetation mapped as either Category A, B, or C under the latest version of the Regulated Vegetation Management Map v7.2 is considered to contribute to the *patch*. All state mapped polygons which are directly and continuously connected with the boundary of the matter area (the entire Offset Areas contribute towards to accumulation of patch size. A single patch size score is assigned for the matter area.

7.7.1.3 Connectedness

Connectivity relates to the capacity that the species have to disperse through the landscape. The attribute is calculated using GIS by measuring the length of Koala *(Phascolarctos cinereus)* habitat that is along the boundary of the site. As discussed above, Koala *(Phascolarctos cinereus)* habitat is considered to be all wooded regional ecosystems mapped as either Category A, B, or C under the Regulated Vegetation Management Map. A single connectedness score is assigned for the matter area

7.7.1.4 Context

The context score is calculated by GIS to quantify the amount of vegetation immediately surrounding the assessment site. The attribute is measured by the percentage of Koala *(Phascolarctos cinereus)* habitat within a 1 km buffer of the Referral Area boundary. As discussed above, Koala *(Phascolarctos cinereus)* habitat is considered

[66] The regulated vegetation management map as defined by s20A of the Vegetation Management Act 1999.

to be all wooded regional ecosystems mapped as either Category A, B, or C under the Regulated Vegetation Management Map. A single context score is assigned for the matter area.

7.7.1.5 Ecological Corridors

This attribute is scored in accordance with the *Guide to Determining Terrestrial Habitat Quality (v1.2)* (DEHP, 2017) and is used to determine if a site is located within or shares a boundary with an ecological corridor that facilitates long term ecosystem function by connecting large patches of remnant vegetation with sufficient tract size (corridor width in relation to the fragmentation of the landscape) (EHP 2014). These corridors are relevant to the quality of a habitat patch by means of aiding in widespread connectivity, which is especially relevant in a landscape such as South-East Queensland which is increasingly fragmented. Widespread connectivity facilitates the dispersal of individuals, thereby contributing to the maintenance of genetic variability within the species' population and ultimately species fitness and adaptability in a continuously changing environment. Ecological corridors have been mapped by the Queensland State Government under the 'CORR_TYPE' attribute table. The mapping can also be viewed on Queensland Globe in the 'Statewide Biodiversity Corridors' layer. A single corridor score is assigned for the matter area.

7.7.1.6 Role of site location to species overall population in the state

This attribute is based on the observed role of the site in relation to the overall population of the species. The scoring table considers the species' use of the site – such as whether it is used for feeding and/or nesting and the effect that damage to or removal of the site would have to the likelihood of the species' overall population survival. As surrogate for scoring this attribute, the MHQA requests habitat critical to the survival of the species be assessed. Critical habitat is assessed in accordance with species specific conservation advice, national recovery plan, or other relevant available literature cited by NEPA on the SPRAT database. A score is then produced in accordance with *Table 4 – species habitat index scoring guide* from the *Guide to Determining Terrestrial Habitat Quality (v1.2)* (DEHP, 2017).

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. 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.

Habitat critical to the survival of Koala *(Phascolarctos cinereus)* is scored in accordance with **Table 67** below.

Table 67: Reproduction of *Table 4 Species habitat index scoring guide* from the Guide to determining terrestrial habitat quality v1.2

Attribute	Score			
Role of site location to species overall population in the state	**Score Description**	1	4	5
		Not or unlikely to be critical to species' survival	Likely to be critical to species' survival	Critical to species survival

7.7.1.7 Threats to species

The assessment of threats has been undertaken on the matter area scale, i.e. the MNES impact or offset area subject of this report. Threatening processes considered and adopted in the assessment of threats specific to Koala are taken from the following approved literature:

- DAWE (2022), *National Recovery plan for the Koala: Phascolarctos cinereus (combined populations of Queensland, New South Wales and the Australian Capital Territory).* Department of Agriculture, Water and the Environment, Canberra.
- DAWE (2022), *Conservation Advice for Phascolarctos cinereus (Koala) combined populations of Queensland, New South Wales and the Australian Capital Territory*. Department of Agriculture, Water and the Environment, Canberra.

The complete list of identified threatening processes to Koala are detailed in Table 1 of the approved Conservation Advice (DAWE, 2002a). Listed threatening processes which are considered to be present within the subject area (i.e. the impact or offset area subject of this report) and which are appropriately measurable are assessed as a component of habitat quality scoring. A subset of relevant threatening processes are therefore considered and listed below, with detailed described and scoring metrics provide in **Table 68**:

- Altered fire regimes;
- mortality from dogs;
- mortality from vehicles; and,
- habitat loss, fragmentation, and degradation.

Threatening processes to MNES are rarely spatially or temporally restricted, thus are inherently difficult to accurately capture and quantifiably measure. Each assessable threatening process is scored on the scale adopted from *Table 4 – species habitat index scoring guide* from the *Guide to Determining Terrestrial Habitat Quality (v1.2)* (DEHP, 2017), which assigns a score of either 1 (high level of threats), 7(moderate level of threats), or 15 (low level of threats). Unique scoring metrics are designed to establish a measurable and repeatable framework for the comparison of threatening processes over time.

Table 2 from the Approved Conservation Advice for the Koala (DAWE, 2022a) identifies substantial differences in the relative risk posed by individual listed threatening processes. Landscape level threatening processes such as habitat loss, habitat fragmentation, and increased frequency of high-intensity bushfire, are ranked with higher severity, reflecting their broad spatial extent and capacity to cause widespread population decline. In contrast, encounter mortality from vehicles and dogs is ranked lower, recognising impacts are incurred on an individual scale opposed to population scale. The scoring of site-based threats has therefore adopted a proportional weighting system, reflective of the risk matrix results presented in Table 2 of the Conservation Advice. Six ecological indicators are designed and scoring to inform the measure of the four assessable threatening processes to Koala. **Table 68** below details each assessed threatening process, their justification for inclusion, relative scoring weight, and unique scoring metrics. **Table 69** illustrates the supplementary scoring table which is used to assess the measurable threatening processes within the MHQA scoring spreadsheets. A final score of 15 results from the scoring of the six ecological indicators, which is then scaled to fit into *Table 4 – species habitat index scoring guide* from the *Guide to Determining Terrestrial Habitat Quality (v1.2)* (DEHP, 2017).

Table 68: Threatening processes scoring method

Listed threatening process	Justification for inclusion in accordance with description under the conservation advice	indicator weighting	Indicator description	Indicator scoring method	Indicator scoring metric
Altered fire regime	Altered fire regimes have been considered in the Koala MHQA threat score because inappropriate fire frequency, severity, extent and season can directly affect Koala survival, habitat condition and local population recovery. The approved conservation advice identifies increased intensity and frequency of bushfire as a known, severe and increasing threat to the listed Koala, with high-severity fire associated with canopy scorch, post-fire absence or reduced occupancy, and extended recovery timeframes. Fire can also reduce food and shelter availability, alter vegetation structure and forage quality, and compound other threats including drought, fragmentation, predation and disease.	30%	**Fuel hazard rating** Fuel hazard monitoring will be undertaken in accordance with the *Overall Fuel Hazard Assessment Guide* (Hines et al. 2010). The methodology provides a rapid, standardised approach for assessing the structure and arrangement of combustible vegetation that influences bushfire behaviour and allows fuel hazard to be monitored consistently over time. At each monitoring site, fuel hazard will be visually assessed within each of the four fuel strata defined by Hines et al. (2010): ▪ **Surface fuels** – comprising leaf litter, bark, twigs and fine woody debris on the ground; ▪ **Near-surface fuels** – including grasses, herbs and low shrubs immediately above the litter layer; ▪ **Elevated fuels** – consisting of shrubs, suspended dead material and vegetation extending above the near-surface layer but below the canopy; and ▪ **Bark fuels** – assessing the quantity, type and continuity of bark retained on standing trees.	Fuel hazard monitoring will be undertaken in accordance with the *Overall Fuel Hazard Assessment Guide* (Hines et al. 2010). Permanent fuel hazard monitoring sites will be co-located with habitat quality monitoring sites. Hazard ratings for each fuel stratum (surface, near-surface, elevated and bark fuels) will be assigned by comparing field observations with the descriptive criteria and photographic standards presented in *Table 8.1* of the *Overall Fuel Hazard Assessment Guide*. Individual hazard ratings will then be combined, in accordance with the guide, to derive an overall fuel hazard rating for each monitoring site, classified as *Low*, *Moderate*, *High*, *Very High* or *Extreme*	**1 –** Extreme or Very High fuel hazard rating **7 –** Moderate or High fuel hazard rating **15 –** Low fuel hazard rating

Listed threatening process	Justification for inclusion in accordance with description under the conservation advice	indicator weighting	Indicator description	Indicator scoring method	Indicator scoring metric
			Each fuel stratum will be assigned a hazard rating using the assessment criteria provided in the *Overall Fuel Hazard Assessment Guide*, considering attributes such as fuel quantity, continuity, cover, height and arrangement.		
Mortality from dogs	Mortality from dogs has been considered in the Koala MHQA threat score because dog attack is a recognised cause of Koala injury and mortality, particularly where habitat occurs in or near peri-urban, rural-residential or fragmented landscapes. The approved conservation advice identifies dog attacks as a significant cause of death and injury for Koalas, particularly in areas within and adjacent to residential development, and notes that individuals killed by vehicles or dogs are often otherwise healthy breeding animals. Dogs also present a higher risk where Koalas are required to move across open ground between habitat patches, through backyards, along access tracks or near areas of human activity.	15% (calculated from equal weighting of each indicator)	**Wild dog activity index** This indicator is adopted from the Vertebrate Pest Management Plan (VPMP). Results of vertebrate pest monitoring, specifically wild/domestic dog, will be used to score 'mortality from dogs' to Koala. A detailed methodology and data analysis description can be found within the VPMP and Section 6.8.2 in the Woolshed OMP, and Section 6.6.2 of the Thagoona OMP.	Camera trap data will be analysed to record each encounter with wild/domestic dog. The results provide a species-specific *activity index* which allows for a comparative platform between monitoring events. The activity index will be categorised into an activity scale; absent 0, very low 1-15, low 16-38, moderate 39-75, high 76-113, and very high ≥114.	**1 –** An activity index score of very high or high **7 –** An activity index score of low or medium **15 –** An activity index score of absent or very low
			Evidence of wild dog (evidence includes tracks, scats, incidental observations, and anecdotal evidence such as landholder discussion) This indicator is more qualitative and takes into consideration that credible evidence of wild dog may be difficult to collect during limited ecological survey effort. Often landholder discussion provides valuable	This indicator is scored post ecological survey. A low score is awarded where credible traces of wild/domestic dog are detected on site, as this is likely indicative of the site forming a component of territory. A moderate score is awarded where evidence is largely anecdotal i.e. discussion based	**1 -** Traces of dogs detected through scats and/or tracks **7 –** Anecdotal evidence (i.e. landholder and/or local community discussion) **15 -** No traces of wild dog are detected on

Listed threatening process	Justification for inclusion in accordance with description under the conservation advice	indicator weighting	Indicator description	Indicator scoring method	Indicator scoring metric
			insight into property history, however, is not always demonstrated through data. The inclusion of this second metric to score risk of mortality from dogs, is to capture evidence that can be easily missed through more quantifiable survey methods (i.e. camera survey).	with landholders. A high score is awarded where no traces of wild dog are detected on site, and landholders are not aware of their presence in the area.	site / no anecdotal evidence
Mortality from vehicles	Mortality from vehicles has been considered in the Koala MHQA threat score because road collisions are a significant source of injury and death for Koalas, particularly in areas where transport infrastructure intersects occupied habitat. The approved conservation advice identifies vehicle strike as a known and ongoing threat, with mortality increasing as urban development and road networks expand into Koala habitat. Vehicle collisions disproportionately remove otherwise healthy individuals, including breeding adults and dispersing juveniles, reducing population viability and genetic connectivity. This threat is particularly significant during post-weaning dispersal and the breeding season, when Koalas undertake greater movements and are more likely to encounter roads.	15% (calculated from equal weighting of each indicator)	**Percentage (%) of site bounded by roads.** This indicator assesses the degree of property edges which are either intersected by a road or run parallel with a road. It is recognised that this indicator may not change between offset monitoring years, however, will theoretically capture where new developments may affect the risk of vehicle interactions with koala which occupy habitat within the site. Queensland planning guidelines, including the Queensland Koala-sensitive Design Guideline (DES, 2022), adopts a 200 m threshold to define highly connected habitat patches. This value appears to represent a planning proxy based on the upper limit of typical daily movement distances reported for Koalas in radio-telemetry studies (McAlpine et al., 2007). Koala habitat patches which are within 200 metres of one another are considered to be highly connected. A road is therefore considered to pose a risk where it is situated within 200 metres from the Site edge. A 200 m threshold has therefore been adopted for	The presence of and distance to roads is measured using appropriate spatial software which can view and interrogate the most up to date spatial layers available from the Queensland Spatial Catalogue. In the absence of updated *Queensland Roads and Tracks* data, new roads will be ground-truthed during ecological survey.	**1 -** >75% of Site boundary is either bounded by roads (within 200 meters) or intersects with roads **7 -** 16-75% of Site boundary is either bounded by roads (within 200 meters) or intersects with roads. **15 -** <15% of Site boundary is either bounded by roads (within 200 meters) or intersects with roads.

Listed threatening process	Justification for inclusion in accordance with description under the conservation advice	indicator weighting	Indicator description	Indicator scoring method	Indicator scoring metric
			the consideration of where a resident koala may interact with a near-by road.		
			Type of road The type of road, which is situated within 200 of the Site boundary, is relevant to the degree of risk incurred to resident Koala. The assumption is made that increased volume of traffic is positively correlated with risk of vehicle strike and subsequent mortality risk to Koala. The scoring metrics have be designed to reflect this scale.	Scored based on ground-truthed inspection on relevant roads, spatial data information, or traffic information sourced from relevant local Councils. Score decision should be justified within reports, with corresponding scores reflected throughout HMQA scoring spreadsheets.	**1 -** Highway / motorway / predictable high traffic **7 –** Street / main road / moderate traffic and/or busy during peak hour **15 –** Unsealed / low and/or occasional traffic
Habitat loss, fragmentation, and degradation	Habitat loss, fragmentation and degradation have been considered in the Koala MHQA threat score because they reduce the extent, quality and connectivity of habitat required to support Koala populations and movement. The approved conservation advice identifies habitat clearing associated with agriculture, grazing, urbanisation, timber harvesting and mining as one of the primary drivers of Koala decline across the species' range. More than 10,000 km² of forest and woodland within the Koala distribution was cleared between 2000 and 2017, with clearing for grazing accounting for the majority of habitat loss. Ongoing urban expansion, agricultural development and localised mining and energy projects continue to	40%	**Proportion of wooded vegetation** The proportion of wooded vegetation within the target Site is measured as a direct indicator of area subject to habitat loss, fragmentation, and degradation. For the purposes of this assessment, wooded vegetation is considered to be that which includes treed-habitat, where trees are 4 metres in height or greater. This indicator should not reflect regulated vegetation or council spatial mapping, it should be a product of ground truthed vegetation mapping at the time of survey.	Percentage of wooded vegetation within the subject site should reflect post survey ground-truthed vegetation mapping. Wooded areas should be the sum of assessment units which are categorised as either regrowth, advanced regrowth, or remnant condition wooded vegetation. The proportion of area, represented by percentage (%), is assessed against the scoring metrics.	**1 -** 0-25% wooded vegetation occupies the site **7 -** 26-75% wooded vegetation occupies the site **15 -** >75% wooded vegetation occupies the site

Listed threatening process	Justification for inclusion in accordance with description under the conservation advice	indicator weighting	Indicator description	Indicator scoring method	Indicator scoring metric
	fragment habitat, reduce landscape connectivity and limit the availability of suitable foraging and shelter resources, particularly within regions that support significant Koala populations.				

Table 69: Threats - supplementary scoring table

Listed threatening process	Scoring indicator	Score		
		1	7	15
Altered fire regimes	Fuel hazard rating	Extreme or Very High fuel hazard rating	Moderate or High fuel hazard rating	Low fuel hazard rating
Mortality from dogs	Wild/domestic dog activity index	An activity index score of very high or high	An activity index score of low or medium	An activity index score of absent or very low
	Evidence of wild dog	Traces of dogs detected through scats and/or tracks	Anecdotal evidence (i.e. landholder and/or local community discussion)	No traces of wild dog are detected on site / no anecdotal evidence
Mortality from vehicles	Percentage of site bounded by roads.	>75% of Site boundary is either bounded by roads (within 200 meters) or intersects with roads	16-75% of Site boundary is either bounded by roads (within 200 meters) or intersects with roads.	<15% of Site boundary is either bounded by roads (within 200 meters) or intersects with roads.
	Type of road	Highway / motorway / high traffic	Street / main road / moderate traffic and/or busy during peak hour	Unsealed / low and/or occasional traffic
Habitat loss, fragmentation, and degradation	Proportion of wooded vegetation	0-25% wooded vegetation occupies the site	26-75% wooded vegetation occupies the site	>75% wooded vegetation occupies the site
Threats score out of 15				
Scaled score (1-5=1; 6-10=7; 11-15=15)				

7.7.1.8 Species' mobility capacity

The assessment on ground habitat is captured through the scoring of 'Species mobility capacity', which contributes 17% to the scoring component of site context. Koala move between trees and habitat by walking on the ground, and as such, the ground itself is considered to be an essential component of habitat quality scoring. The measure of species' mobility is assessed at the assessment unit scale, where each BioCondition transect site and corresponding vegetation patch (delineated by spatial ground-truthed vegetation mapping) are assessed for their capacity to facilitate species movement through the landscape. In general, the approach to the scoring of Koala mobility has been designed to capture the variety of ground based barriers which often occur within a natural landscape, with specific consideration of urban and semi-rural lots within South East Queensland. Often, these semi-rural lots involve a variety of barriers, which may collectively contribute to mobility impacts. However, Koala is known to be resilient and resourceful in terms of movement and may climb fences, move under fences, between small spaces, cross roads, and more (Youngentob et al., 2022). With this in mind, it is difficult to develop quantifiable metrics to measure where a barrier impedes mobility too much. The assessment of species' mobility has therefore adopted both a qualitative and quantitative approach.

The following types of physical barriers are considered in the assessment of mobility, however, are not a complete and exhaustive list:

- Fencelines – Often barbed wire fences are used to border property or subdivide paddocks. Old and unmaintained fencing often falls, gets tangled, and vegetation grows into and through it creating a more solid and difficult barrier. In these circumstances, this is considered to be a barrier to koala movement more so than a maintain fenceline which koala are known to easily move under. Other fencelines which are considered to be barriers to Koala movement include pool fencing, brick fencing, or any structure which koala can move under, over, and around. The assessment of whether or not a fenceline acts as a barrier to Koala movement should be determined in-situ during ecological survey, and justified in the corresponding results section of the report.

- Watercourses – A watercourse may be considered a barrier where it is either improbable that a koala could cross, or crossing would at the very least be difficult and involve some degree of fitness loss based on the assumption of increase effort and energy expenditure to achieve a safe crossing. An example of a difficult to cross watercourse may include severely eroded and steep banks, deep and/or fast flowing water.

- Structural barriers – A structural barrier is inclusive of all physical human-made obstacles within an environment which are not naturally occurring. This is inclusive of structures such as houses/dwellings, old and abandoned buildings, agricultural sheds and pens, and more.

- Dams – Dams are not typically crossable by Koala, and thus do not contribute to crossable ground area. In the assessment of small semi-rural lots, dams may occupy a proportionally large space. For example, if ~80% of an assessment unit is attributed to either a large dam or multiple small dams, the percentage of usable area by Koala and/or number of natural pathways a Koala may use is reduced. For this reason, the presence of dams are considered a to be an example of a physical barrier to Koala movement within habitat.

- Exotic vegetated barriers – Vegetated barriers may include any non-indigenous flora which has become prolific in nature and has the ability to form physical barriers and impede koala movement on the ground. In South East Queensland this often includes *Latana camara*, which forms thick and impenetrable barriers through a landscape.

Two measurable ecological indicators have been described to be representative of the above listed common barriers to koala movement within South East Queensland. The measure of physical barriers such as fences, watercourses, structures, and dams, retains a high degree of qualitative assessment, whereby the assessor will make an observation based assessment at the time of survey. Due to the innate difficulty in the repeatable measure of barriers of this nature, the metric is assigned a lower weighting compared with that of exotic vegetation barriers. Exotic vegetation cover is captured through two measures within the 28 South adapted BioCondition method (see **Section 6.1.5.1**), this includes the shrub layer intersect along the 100 metre transect, and the non-native shrub cover within the 50*20 metre plot (see section xx for method). The scoring of 'exotic vegetated barriers' against other listed barriers is assigned 67% compared with 33%. The weighting difference is justified through the measurability and repeatability of exotic vegetation cover, fostering a scoring platform to demonstrate ecological change within a landscape as it relates to barriers which may prevent or impede koala movement. The reduced weighting in comparison to that of 'exotic vegetated barriers' achieves an inflation effect on the scoring of mobility, whereby the majority of mobility score is a product of the measurable and repeatable assessment of vegetated

barriers, and the score is inflated or deflated based on the presence and absence of general barriers to movement (assessed as 'Human made and biophysical barriers). Despite a qualitative scoring approach, the inclusion of the metric is considered to be of importance in the capture of human-influenced components in nature, which are difficult to systematically measure.

Table 70 below table details each barrier type (indicator) with contextual ecological description, as well as the corresponding specific scoring metrics and description (e.g. 1, 5, and 10). The combination of the two described ecological indicators in the measure of Koala mobility awards a maximum score of 30. The total mobility score is converted to a score out of 100, and then scored in accordance with "*Table 4: Species Habitat Index Scoring Guide*" from the Guide to determining terrestrial habitat quality version 1.2. (Department of Environment and Heritage Protection, 2017) (depicted in **Table 71** below). **Table 72** describes all possible scoring outcomes and subsequent scaling into one of the four mobility restriction categories.

Table 70: Koala *(Phascolarctos cinereus)* scoring indices for the measure of species' mobility

Ecological indicator	Weighting	Ecological reasoning	Scoring metrics
Human made and biophysical barriers – structures / fences / dams / watercourses	33%	Urban and semi-rural sites within South East Queensland are often subject to numerous human influenced barriers to Koala movement, or the exacerbation of other biophysical barriers. Where various types of barriers are either numerous or proportionally large through a site, Koala movement may be impeded. This ecological indicator should be scored unique to each assessment unit, and is designed to capture the mobility character of a habitat patch. Types of barriers include, but may not be entirely limited to, the following: - Various types of fencing which koala cannot climb or navigate e.g. barbed wire or smooth vertical bars. The condition of fences may also have effect, such as fallen barbed wire fencing which often becomes tangled with vegetation and forms larger barriers - Structural waste e.g. old buildings, sheds, cattle yards, or various agricultural equipment - Dams, particularly large dams - Watercourses which have become severely eroded and are no longer accessible for crossing - Watercourses which are permanent and moderate to high flowing - Other barriers to movement which are comparable to the above listed barriers. This ecological indicator is weighted 33% in the scoring of Koala mobility. A reduced weighting reflects the more qualitative structure of this metric, and the acceptance that the presence of the above mentioned barriers are unlikely to entirely prevent Koala movement through a site. The Metric is designed and included to capture the presence of barriers to koala movement, and categorise their impact into three broad categories: poor, moderate, and good. A result of poor mobility is depicted as a score of one, which is anticipated to translate to an assessment unit which is subject to an obvious and/or proportionally large barrier to movement.	**1** – A barrier occurs and occupies majority of the assessment unit (>50% of area), or the assessment unit by nature acts as a barrier to movement. A score of one is assigned where movement is impeded within the assessment unit beyond reasonable doubt. An example of this may be a large dam, a heavily eroded watercourse with steep banks, or an area which is subject to impassable fencing. **5** – A barrier occurs within a portion (less than 50% of the area) of an assessment unit, but does not impede movement entirely. A score of 5 should be assigned where it is probable that movement is impeded to some degree, however, the area of habitat is still usable by Koala in terms of movement between habitat trees, and in and out of the site. An example of score 5 is where an assessment unit may be subject to internal fencing, or small structures or physical barriers e.g. abandoned cattle processing pens and sheds **10** – No credible barriers occur within the assessment unit. The assessment unit reflects habitat which can be easily navigated by Koala.

Ecological indicator	Weighting	Ecological reasoning	Scoring metrics
		A result of moderate mobility is depicted as a score of 5, which is anticipated to translate to an assessment unit which is subject to less obvious barriers, but is similarly not representative of unimpeded habitat. Thus, a score of five is intended to capture all that is in-between 'very impeded' and 'not impeded at all' habitats. A result of high mobility is depicted as a score of 10, which is representative of habitat which is unaffected by barriers to Koala movement. Scoring metrics are described in more tangible detail in the following column.	
Exotic vegetated barriers	67%	Numerous exotic flora species proliferate throughout natural environments within South East Queensland. Specific species, such as *Lantana camara*, establish so severely that they can alter the structural formation of natural environments. Dense infestations of *Lantana camara* can impede koala movement by creating a thick understory which restricts access between habitat trees and reduces the ease with which koalas can move across the landscape. While koalas are capable of traversing areas containing lantana, extensive or dense thickets may increase energetic costs associated with ground movement and limit connectivity between habitat patches. Consequently, areas with high lantana cover may function as a partial barrier to movement, particularly where alternative movement pathways are limited. This ecological indicator is weighted 67% in the scoring of Koala mobility. An increased weighting reflects the more quantitative structure of this metric, which is a measurable site-based attribute imbedded within the BioCondition assessment methodology. This Metric is designed and included to capture the presence of more tangible barriers to koala movement which are measurable and practically remediable. The assessment of vegetated barriers (which is typically *Lantana camara* within SEQ environments) is therefore a measurable and repeatable metric in the assessment of Koala mobility scoring.	**1** - Greater than 80% cover of exotic shrub along the 100 metre BioCondition transect line. **7** - Between 51% and 80% cover of exotic shrub along the 100 metre BioCondition transect line. **15** - Between 11% and 50% cover of exotic shrub along the 100 metre BioCondition transect line. **20** - Equal to or less than 10% cover of exotic shrub along the 100 metre BioCondition transect line.

Table 71: Ecological attribute scoring scale

Scale applied to resulting score out of 100	Score adopted from "*Table 4: Species Habitat Index Scoring Guide*"	
0-25% of total Species mobility score	1	Severely restricted
26-50% of total Species mobility score	4	Highly restricted
51-75% of total Species mobility score	7	Moderately restricted
76-100% of total Species mobility score	10	Minor restriction

Table 72: Mobility scoring outcome matrix

Mobility Scoring		Human made and biophysical barriers		
		1	**5**	**10**
Vegetated barriers	**1**	2 (6.7%)	6 (20.0%)	11 (36.7%)
	7	8 (26.7%)	12 (40.0%)	17 (56.7%)
	15	16 (53.3%)	20 (66.7%)	25 (83.3%)
	20	21 (70.0%)	25 (83.3%)	30 (100%)

7.7.1.9 Species Stocking Rate (40%)

The MHQA incorporates species stocking rate as an attribute not discussed under the traditional terrestrial habitat assessment methodology. Species stocking rates are estimates of the Koala *(Phascolarctos cinereus)* carrying capacity of the site at the time of undertaking the survey. Given the discreet nature of the Koala *(Phascolarctos cinereus)* and limited to no published literature on habitat carrying capacity of the species, 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 – evidence of Koala *(Phascolarctos cinereus)* in the form of scats or direct observation on or adjacent to the site.
- Species usage of the site (habitat type and evidenced usage) – in accordance with the definition of habitat critical to the survival of Koala (*National Recovery Plan for the Koala (Phascolarctos cinereus)* and whether utilisation was observed directly or inferred, from the presence of scats.
- Approximate density of the species on the site – 'non-habitat' or 'low', 'medium' or 'high' activity on-site as determined by Koala *(Phascolarctos cinereus)* SAT surveys.
- Role/importance of species population on site – considers whether the site is a key source population for breeding, dispersal, is necessary for maintaining genetic diversity or near the limit of the species' range.

Baseline Koala (*Phascolarctos cinereus*) activity levels were determined through utilising the Spot Assessment Technique (SAT) (Phillips et al. 2011). The SAT method is an industry recognised technique for identifying presence/absence of Koala *(Phascolarctos cinereus)* at a site. Results from the SAT surveys are compared against current available published scientific literature to identify an estimated Koala (*Phascolarctos cinereus*) carrying capacity (stocking rate) to be determined. The SAT methodology is explained in further detail in **Section 6.2.5**. **Table 73** outlines the attributes utilised to assess species stocking rate and supplementary scoring.

Table 73: Koala (*Phascolarctos cinereus*) – Species Stocking Rate

Attribute	Possible maximum score
Species Stocking Rate Table	
Presence detected on or adjacent to Site (neighbouring property with connecting habitat)	Score out of 10
Species usage of the Site (habitat type and evidenced usage)	Score out of 15
Approximate density (per ha)	Score out of 30
Species stocking rate supplementary table	
Key source population for breeding (/10)	
Key source population for dispersal (/5)	
Necessary for maintaining genetic diversity (/15)	
Near the limit of the species range (/15)	
SSR Supplementary Table Score (from the four features above)	Score out of 15
Total Species Stocking Rate Score	Score out of 70
Species stocking rate	Score out of 4

7.7.2 Grey-headed Flying-fox MHQA Methodology

The traditional terrestrial habitat quality assessment assesses three core indicators—site condition, site context and species habitat index.

The revised Grey-headed Flying-fox (Pteropus poliocephalus) methodology combines the aspects of the three core indicators and published scientific literature into two (site condition and site context) with site condition being weighted with 40 % and site context weighted at 30 % of the final score. The balance of the weighting (30 %) has been attributed to the third indicator which is independent of the traditional habitat quality assessment, being species stocking rate. The species stocking rate assessment incorporated in the Grey-headed Flying-fox (Pteropus poliocephalus) methodology is focussed on the stocking rate of 'foraging habitat' rather than stocking rate of the species itself (presence/absence of the species).

Table 74 below describes the breakdown of scoring and the proportional weights for each component and their scored ecological attributes. The following sections detail the methodology utilised to assess the site condition, site context and species stocking rate under the Grey-headed Flying-fox *(Pteropus poliocephalus)* Habitat quality method.

Table 74: Grey-headed Flying-fox scoring summary

Ecological Attribute	Ecological Indicator	Max score	% Contribution
Habitat quality (BioCondition + habitat quality indices)	Site condition (BioCondition Score)	20 (converted from 80)	40% (total score out of 100)
	Species richness	20	
	Flower score	10	
	Timing of Biological shortages	10	
	Quality of foraging habitat	20	
	non-native plant cover	20	
Site Context	Size of patch	10	30% (total score out of 60)
	Connectedness	10	
	Context	10	
	Ecological Corridors	10	
	Role of site location to species overall population in the state	10	
	threats to the species	10	
Species Stocking Rate	GHFF forage tree density (per/ha)	10	30% (total score out of 10)

7.7.2.1.1 Site Condition (40%)

The assessment of site condition is made-up of two ecological components which total a score out of 90:

- BioCondition score (out of 20) – the assessment of vegetation structure and function; and,

- Fauna species habitat quality assessment (out of 80) – the assessment of specific habitat characteristics unique to the protected matter.

A unique site condition score is developed for each transect site and then averaged to produce a single score for each Assessment Unit. Assessing Site condition is an integral step in determining specific quantification of impacts, while also determining whether an Offset Area is suitable to establish a desired capacity to support the prescribed environmental matters being offset. The on-Site condition is a key element of habitat quality and has a direct influence on the biodiversity it supports.

Vegetation scoring is undertaken in accordance with the *BioCondition Assessment Manual – A condition Assessment Framework for Terrestrial Biodiversity in Queensland* (Eyre *et al.,* 2015). Site condition is assessed using a suite of 13 measurable attributes to describe the structure and function of the vegetation community and is benchmarked against the expected range for a relatively undisturbed community. The Regional Ecosystem Database Description (REDD) describes the remnant state of Regional Ecosystems in terms of floristic variably and vegetation structure, for which a corresponding benchmark value exists for each of the 13 measurable attributes. The maximum BioCondition score for a wooded ecosystem is 80, which is later converted to a score out of 20. Each attribute and their corresponding maximum score are listed below:

- recruitment of woody perennial species in the ecologically dominant layer (EDL) - 5
- native plant species richness – trees - 5
- native plant species richness – shrubs - 5
- native plant species richness – grasses - 5
- native plant species richness – forbs - 5
- tree canopy height - 5
- sub-canopy cover - 5
- tree canopy cover - 5
- native grass cover - 5
- organic litter - 5
- large trees - 15
- coarse woody debris - 5
- non-native plant cover - 10

For the assessment of fauna habitat, an additional two (2) site-based ecological attributes are measured using a series of specifically designed ecological indicators. For the purposes of habitat assessment for the Grey-headed Flying-fox (*Pteropus poliocephalus*), these attributes have been combined and their ecological indicators are described below.

- quality and availability of food and foraging habitat
- quality and availability of shelter

Ecological indicators have been designed and ecologically justified based on the review and consideration of relevant information in the following documents:

- Eby and Law (2008) Ranking the feeding habitats of Gey-headed flying foxes for conservation management – a report for the Department of Environment and Climate Change (NSW) and the Department of Environment, Water, Heritage and the Arts

- DAWE (2021) National Recovery Plan for the Grey-headed Flying-fox 'Pteropus poliocephalus', Department of Agriculture, Water and the Environment, Canberra

The calculation of habitat quality has been undertaken in accordance with the Guide to determining terrestrial habitat quality version 1.2. (Department of Environment and Heritage Protection, 2017). Ecological indicators are listed below, and justified with scoring assignments in **Table 75**.

- Vegetation condition
- Species richness (canopy trees)
- Flower scores (average)
- Timing of biological shortages
- Quality of foraging habitat (trees >0.65 wt p*r), and
- Non-native plant cover.

Table 75: GHFF Site Condition Scoring

Ecological indicator	Weighting	Max score	Scoring metric	Justification for inclusion
Vegetation Condition	20.00%	20	BioCondition result converted to a score out of 20. (from 80)	Vegetation condition as a direct result of vegetation condition assessment. Vegetation condition is measured and calculated in general accordance with the BioCondition Manual (Neldner et al., 2015).
Canopy species richness	20.00%	20	**0** - zero GHFF foraging tree species **5** - 1-3 GHFF foraging tree species **10** - 4-6 GHFF foraging tree species **20** - >6 GHFF foraging tree species	Species richness (canopy trees) – This condition characteristic is assessed using the transect area 100 m X 50 m plot following the contour of the land when possible. Within the plot, all canopy tree and subcanopy tree specimens are recorded where they are greater than 300 mm DBH. GHFF foraging tree species are listed in Eby and Law (2008), and include nectar and fruit trees.
Flowering score	10.00%	10	**0** - 0 **2** - 0.01-0.25 **5** - 0.26-0.50 **8** - 0.51-0.75 **10** - 0.76-1.00	Flower scores (average) – This condition characteristic is assessed by analysing and cross-referencing the species recorded in the 'species richness (canopy trees)' characteristic with the published literature, specifically the information within Ranking the feeding habitat of Grey-headed flying foxes for conservation management (Eby and Law 2008) and the Draft Recovery Plan for the Grey-headed Flying fox (DoEE 2017) and determining the flower score of the recorded canopy species. The individual score for each flowering GHFF foraging tree is then divided by the number of species recorded (GHFF foraging and non-GHFF foraging trees) to produce an average. The benchmark values for this condition characteristic have been derived from the findings published by Eby and Law (2008) (Ranking the feeding habitat of Grey-headed flying foxes for conservation management). Refer to Table 'Flowering Score' for the benchmark scoring values for this condition characteristic.
Quality of foraging species	20.00%	20	**0** - zero significant foraging tree species **5** - 1-3 significant foraging tree species **10** - 4-6 significant foraging tree species **20** - >6 significant foraging tree species	This condition characteristic is assessed by analysing and cross-referencing the species recorded in the 'species richness (canopy trees)' characteristic with the published literature, specifically the information within Ranking the feeding habitat of Grey-headed flying foxes for conservation management (Eby and Law 2008) and the Draft Recovery Plan for the Grey-headed Flying-fox (DoEE 2017) and determining which canopy species recorded contain a flower score greater than 0.65 wt p*r and is recognised as a significant food plant by Eby and Law (2008). It should be noted that species recorded that are not prescribed a value by Eby and Law (2008) but are recognised as GHFF foraging trees, have been given an average weighted value of related species or, in the case of Eucalyptus crebra (Narrow-leaved

Ecological indicator	Weighting	Max score	Scoring metric	Justification for inclusion
				Ironbark) been prescribed a value of 0.65 and classified as a significant food plant given its importance as a winter flowering species as acknowledged in the Draft Recovery Plan for the Grey-headed Flying-fox (DoEE 2017). Refer to Table 'quality of foraging species' for the benchmark scoring values for this condition characteristic.
Non-native plant cover	20.00%	20	**1** - >50% non-native plant cover **5** - 25-50% non-native plant cover **10** - 5-25% non-native plant cover **20** - <5% non-native plant cover	The measure of non-native plant cover within the 100 x 50 m BioCondition plot.
Timing of biological shortages	10.00%	10	sum of all time periods met through available foraging tree species	Timing of biological shortages – This condition characteristic is assessed by analysing and cross-referencing the species recorded in the 'species richness (canopy trees)' characteristic with the published literature, specifically the information within Ranking the feeding habitat of Grey-headed flying foxes for conservation management (Eby and Law 2008) and the Draft Recovery Plan for the Grey-headed Flying-fox (DoEE 2017) and determining the ability of the canopy species in the vegetation community to produce foraging habitat during biological shortages (food shortages, pregnancy and birthing, lactation, mating and conception, migration paths and fruit industries). It should be noted that this condition characteristic is weighted and 'food shortages' has been weighted heavier than the balance of the characteristics which are equal, as 'food shortages' is recognised as a major issue. Refer to Table 'timing of biological shortages' for the benchmark scoring values for this condition characteristic.

7.7.2.1.2 Site Context (30%)

The site context assessment deals with the site and its adjacent surroundings. Site context is measured using a suite of attributes to describe the location of the habitat within the surrounding landscape and the influence of its associated threats. This assessment also considers the influence of adjacent vegetated areas and ecological corridors. Under the Grey-headed Flying-fox *(Pteropus poliocephalus)* FHA, site context is measured using the following six characteristics:

Woolshed Offset Area

- Size of patch - refer to **Figure 71** (Woolshed Offset Area) due to Grey-headed Flying-fox *(Pteropus poliocephalus)* habitat being analogous with Koala *(Phascolarctos cinereus)* habitat
- Connectedness (vegetation connected to site) - refer to **Figure 72** (Woolshed Offset Area)
- Context (vegetation within 1km radius of site) - refer to **Figure 73** (Woolshed Offset Area)

Thagoona Offset Area

- Size of patch - refer to **Figure 74** (Thagoona Offset Area) due to Grey-headed Flying-fox *(Pteropus poliocephalus)* habitat being analogous with Koala *(Phascolarctos cinereus)* habitat
- Connectedness (active Grey-headed Flying-fox (vegetation connected to site) - refer to **Figure 75** (Thagoona Offset Area)
- Context (vegetation within 1km radius of site) - refer to **Figure 76** (Thagoona Offset Area)

Both Offset Areas

- Role of site location to species overall population in the state (active Grey-headed Flying-fox *(Pteropus poliocephalus)* Nationally Important Camp (as defined by the Grey-headed Flying-fox *(Pteropus poliocephalus)* Recovery Plan) within a 20 km radius) (refer to **Figure 54** (Woolshed Offset Area) and **Figure 58** (Thagoona Offset Area).

Assessment methodology of the above context characteristics is outlined below. Refer to **Table 76** for the benchmark scoring values for this condition characteristic.

- Size of patch – This context characteristic is assessed using a modified version of the traditional habitat quality assessment with the directly connected patch of Grey-headed Flying-fox *(Pteropus poliocephalus)* foraging habitat to site measured. This context characteristic is measured using GIS.
- Connectedness – This context characteristic is assessed by analysing the number of active Grey-headed Flying-fox *(Pteropus poliocephalus)* roost camps (over the most recent monitoring period within a 20 km radius of the site. For consistency purposes this assessment is to utilise the data provided on the national flying-fox monitoring viewer (Australian Government).
- Context – This context characteristic is assessed using a modified version of the traditional habitat quality assessment with the percentage of Grey-headed Flying-fox *(Pteropus poliocephalus)* foraging habitat within a 20 km buffer of the site measured. This context characteristic is measured using GIS.
- Ecological corridors – This context characteristic is assessed using the traditional habitat quality assessment methodology which involves determining the proximity of the site to state, bioregional, regional or sub-regional corridors.
- Role of site location to species overall population in the state (active Grey-headed Flying-fox *(Pteropus poliocephalus)* national flying-fox monitoring viewer 'level 3' roost camps in a 20 km radius) – This context characteristic is assessed by determining the number of active Grey-headed Flying-fox *(Pteropus poliocephalus)* roost camps level 3 or greater (over the most recent monitoring period within a 20 km radius of the site. For consistency purposes this assessment is to utilise the data provided on the national flying-fox monitoring viewer (Australian Government). A nationally important GHFF camp is one that has contained equal

to or greater than 10,000 GHFF in more than one year in the last 10 years, OR have been occupied by more than 2,500 GHFF permanently or seasonally every year for the last 10 years[67].

Table 76: GHFF Site Context Scoring

Measurable Attribute	Score Category	Score
Size of Patch	<5 hectares	0
	5 – 25 hectares	2
	26 – 100 hectares	5
	101 – 200 hectares	7
	> 200 hectares	10
Connectedness	Active Grey-headed Flying-fox *(Pteropus poliocephalus)* camps within 20 km	
	<1 camps	0
	1 – 3 camps	3
	4 – 6 camps	6
	> 6 camps	10
Context	% Grey-headed Flying-fox *(Pteropus poliocephalus)* Foraging habitat within 20 km	
	< 10%	0
	10 – 30 %	3
	31 – 75 %	6
	>75 %	10
Ecological Corridors	Not within ecological corridor	0
	Sharing a common boundary	6
	Within an ecological corridor	10
Threats to species	High level threat	1
	Moderate level threat	5
	Low level threat	10
Role of site location to overall population	Active Nationally Important Camp within 20km	
	1 – 2 camps	1
	3 – 4 camps	6

[67] Camp data is obtained from CSIRO, https://data.csiro.au/collection/csiro%3A64370v3. The data, however, has not been updated since 2022.

Measurable Attribute	Score Category	Score
	> 5 camps	10

7.7.2.1.2.1 Threats to species

The assessment of threats has been undertaken on the matter area scale, i.e. the MNES impact or offset area subject of this report. Threatening processes considered and adopted in the assessment of threats specific to Grey-headed Flying-fox (*Pteropus poliocephalus*) are taken from the following approved literature:

- DAWE (2021) National Recovery Plan for the Grey-headed Flying-fox 'Pteropus poliocephalus', Department of Agriculture, Water and the Environment, Canberra

Threatening processes to MNES are rarely spatially or temporally restricted, thus are inherently difficult to accurately capture and quantifiably measure. Each assessable threatening process is scored generally in accordance with the scale adopted from *Table 4 – species habitat index scoring guide* from the *Guide to Determining Terrestrial Habitat Quality (v1.2)* (DEHP, 2017), which assigns a score of either high, moderate, or Low. However, the score scale to adapted to reflect a numerical value of either one, five, or ten, to fit into the adapted MHQA method unique to Grey-headed Flying-fox (*Pteropus poliocephalus*). This is reflected in **Table 77** below. Unique scoring metrics are designed to establish a measurable and repeatable framework for the comparison of threatening processes over time.

The scoring of site-based threats in comparison to landscape-level threats are assigned a proportional weighting system. **Table 78** below details each assessed threatening process, their justification for inclusion, relative scoring weight, and unique scoring metrics. **Table 79** illustrates the supplementary scoring table which is used to assess measurable threatening processes within the MHQA scoring spreadsheets. A final matter area score is assigned through the adoption of the below scoring scale in (**Table 77**)

Table 77: Threats scoring scale

Score	Scaled score
0-5	1 – High level threats
6-10	5 – Moderate level threats
11-15	10 – Low level threats

Table 78: Threats scoring metrics

Listed threatening process	Justification for inclusion in accordance with description under the conservation advice	Indicator weighting	Indicator description	Indicator scoring method	Indicator scoring metric
Altered fire regime	Increasing bushfire severity and frequency have the potential to adversely affect grey-headed flying-fox habitat by reducing the extent, condition and productivity of native vegetation. High-intensity fires can destroy or damage flowering and fruiting trees, limiting the availability of food resources both immediately following fire and during subsequent recovery periods. Where fires occur across extensive areas, reductions in forage availability may influence the distribution, movement and foraging behaviour of grey-headed flying-foxes.	30%	**Fuel hazard rating** Fuel hazard monitoring will be undertaken in accordance with the *Overall Fuel Hazard Assessment Guide* (Hines et al. 2010). The methodology provides a rapid, standardised approach for assessing the structure and arrangement of combustible vegetation that influences bushfire behaviour and allows fuel hazard to be monitored consistently over time. At each monitoring site, fuel hazard will be visually assessed within each of the four fuel strata defined by Hines et al. (2010): ▪ **Surface fuels** – comprising leaf litter, bark, twigs and fine woody debris on the ground; ▪ **Near-surface fuels** – including grasses, herbs and low shrubs immediately above the litter layer; ▪ **Elevated fuels** – consisting of shrubs, suspended dead material and vegetation extending above the near-surface layer but below the canopy; and ▪ **Bark fuels** – assessing the quantity, type and continuity of bark retained on standing trees.	Fuel hazard monitoring will be undertaken in accordance with the *Overall Fuel Hazard Assessment Guide* (Hines et al. 2010). Permanent fuel hazard monitoring sites will be co-located with habitat quality monitoring sites. Hazard ratings for each fuel stratum (surface, near-surface, elevated and bark fuels) will be assigned by comparing field observations with the descriptive criteria and photographic standards presented in *Table 8.1* of the *Overall Fuel Hazard Assessment Guide*. Individual hazard ratings will then be combined, in accordance with the guide, to derive an overall fuel hazard rating for each monitoring site, classified as *Low*, *Moderate*, *High*, *Very High* or *Extreme*	**1 –** Extreme or Very High fuel hazard rating **7 –** Moderate or High fuel hazard rating **15 –** Low fuel hazard rating

Listed threatening process	Justification for inclusion in accordance with description under the conservation advice	Indicator weighting	Indicator description	Indicator scoring method	Indicator scoring metric
			Each fuel stratum will be assigned a hazard rating using the assessment criteria provided in the *Overall Fuel Hazard Assessment Guide*, considering attributes such as fuel quantity, continuity, cover, height and arrangement.		
Entanglement in netting and barb wire fences	Entanglement in barbed wire fencing is recognised as a source of human-induced mortality of grey-headed flying-fox. Individuals may become caught while commuting or foraging within agricultural and peri-urban landscapes, often resulting in severe injury or death if not rescued. The presence of barbed wire fencing within or adjacent to suitable foraging habitat therefore represents a localised threat that may reduce the functional value of habitat.	15%	**Presence of barbed wires fencing or similar** The presence of top-strand barbed-wire fencing is measured where it occurs within and surrounding the site.	This indicator is scored based on observations made during baseline ecological assessment. Observation data is collected spatially to represent the location and spread of barb-wire fencing.	**1 –** Site is entirely bounded by top-strand barbed-wire fencing **7 –** Top-stand barbed-wire fencing in present on at least one fence boundary or internal fenceline **15 –** Site is absent of top-strand barbed-wire fencing
Electrocution on powerlines	Electrocution on powerlines is a documented source of mortality for grey-headed flying-fox, particularly where power infrastructure intersects commuting routes or foraging habitat. Contact with exposed electrical infrastructure can result in fatal injury and contributes to ongoing anthropogenic mortality across the species' range. The proximity of powerlines to suitable	15%	**Presence of powerlines** The presence of powerlines is measured where it occurs within and surrounding the site.	This indicator is scored based on observations made during baseline ecological assessment. Observation data is collected spatially to represent the location and relevant distance to powerlines.	**1 –** Powerline/s intersect site **7 –** Powerline/s run parallel with a site boundary (within 100 metres) **15 –** Powerlines are not present as per the above

Listed threatening process	Justification for inclusion in accordance with description under the conservation advice	Indicator weighting	Indicator description	Indicator scoring method	Indicator scoring metric
	habitat is therefore an important consideration when assessing habitat quality and associated risks to the species.				
Habitat loss, fragmentation, and degradation	Habitat loss is recognised as the primary threat to the grey-headed flying-fox, resulting in the ongoing reduction, degradation and fragmentation of native foraging habitat throughout the species' range. The loss of flowering and fruiting vegetation reduces the availability and reliability of food resources, increasing foraging distances and energetic demands while contributing to greater reliance on urban landscapes.	40%	**Proportion of wooded vegetation** The proportion of wooded vegetation within the target Site is measured as a direct indicator of area subject to habitat loss, fragmentation, and degradation. For the purposes of this assessment, wooded vegetation is considered to be that which includes treed-habitat, where trees are 4 metres in height or greater. This indicator should not reflect regulated vegetation or council spatial mapping, it should be a product of ground truthed vegetation mapping at the time of survey.	Percentage of wooded vegetation within the subject site should reflect post survey ground-truthed vegetation mapping. Wooded areas should be the sum of assessment units which are categorised as either regrowth, advanced regrowth, or remnant condition wooded vegetation. The proportion of area, represented by percentage (%), is assessed against the scoring metrics.	**1 -** 0-25% wooded vegetation occupies the site **7 -** 26-75% wooded vegetation occupies the site **15 -** >75% wooded vegetation occupies the site

Table 79: Threats - supplementary scoring table

Listed threatening process	Scoring indicator	Score		
		1	7	15
Altered fire regimes	Fuel hazard rating	Extreme or Very High fuel hazard rating	Moderate or High fuel hazard rating	Low fuel hazard rating
Entanglement in netting and barb wire fences	Presence of top-strand barbed-wire fencing or similar	Site is entirely bounded by top-strand barbed-wire fencing	Top-stand barbed-wire fencing in present on at least one fence boundary or internal fenceline	Site is absent of top-strand barbed-wire fencing
Electrocution on powerlines	Presence of powerlines	Powerline/s intersect site	Powerline/s run parallel with a site boundary (within 100 metres)	Powerlines are not present as per the above
Habitat loss, fragmentation, and degradation	Proportion of wooded vegetation	0-25% wooded vegetation occupies the site	26-75% wooded vegetation occupies the site	>75% wooded vegetation occupies the site
Threats score out of 15				
Scaled score (1-5=1; 6-10=5; 11-15=10)				

7.7.2.1.3 Species Stocking Rate (30%)

This report measures the species stocking rate for Grey-headed Flying-fox *(Pteropus poliocephalus)* based on the density and distribution of foraging habitat present at the site at the time of survey, rather than direct observations of individuals or roosting activity. This attribute is therefore designed to capture the abundance of available foraging resources, i.e. the stem count of foraging trees within the 100 x 50 m BioCondition plot. Only tree species cited as known foraging tree species in Eby and Law (2008) contribute to this score. Further, only trees greater than 300 mm DBH are considered available for foraging to the Grey-headed Flying-fox *(Pteropus poliocephalus)*. This is in consideration of the physical weight of the animal, and the practicality of the animal landing and manoeuvring through tree branches to access flowers/fruit, as well as the likelihood of an individual selecting a favourable foraging tree within a landscape i.e. it is assumed that an individual is more likely to select for a larger tree.

The stem count methodology is undertaken in general accordance with the *Methodology for surveying and mapping regional ecosystems and vegetation communities in Queensland* (version 7.0) (Neldner *et al.* 2023). Tree stems are, however, not measured for height, nor differentiated into strata layers. As a surrogate for strata differentiation, a 300 mm DBH is used as the minimum benchmark measure for Grey-headed Flying-fox *(Pteropus poliocephalus)* foraging trees. It is assumed that any tree with a DBH greater than 300 mm would occupy the canopy (T1) layer.

All tree stems are counted within the 50 x 20 m plot and extrapolated to find the cumulative (T1) per hectare stem count. Stems below 300 mm are counted into categories of 0-50 mm, 50-100 mm, and 100-299 mm, while all stems greater than 300 mm DBH area measured for accurate DBH. The additional collection of stem count data from 0-300 mm allows for more accurate prediction and consideration of upcoming foraging habitat, this is especially relevant for the development of vegetation condition interim performance targets for the proposed biodiversity Offset Area. This data is collected at the time of baseline BioCondition vegetation survey and provides a consistent and repeatable approach to quantifying the availability of flowering resources critical to the species.

The T1 per hectare stem count of cited foraging tree species is scored against the T1 benchmark stem count (to account for trees >300 mm DBH) of the corresponding RE for the BioCondition site. Stem count information of all relevant REs is obtained through technical descriptions publicly available through the Queensland Government publications portal, or through direct consultation with the Queensland Herbarium. A bell-curve scoring metric is designed to award the highest score when stem counts correspond to the benchmark, with scores declining as stem counts diverge above or below this value. **Table 80** prescribes the upper and lower percentage bounds used to establish the scoring bell-curve unique to each RE. This approach provides a quantitative representation of the capacity of the vegetation community to support Grey-headed Flying-fox *(Pteropus poliocephalus)* foraging activity.

Table 80: GHFF Species Stocking Rate – Stem density values

Lower value	Upper value	Score
0.00%	12.50%	2
12.92%	54.17%	4
54.58%	91.67%	6
92.08%	97.92%	8
98.33%	102.08%	10
102.50%	108.33%	8
108.75%	145.83%	6
146.25%	187.50%	4
187.50%	-	2

Contemporaneous Queensland Herbarium technical descriptions (sourced July 2025 and March 2026) for the four Regional Ecosystems identified are presented as **Table 81**. Application of the Stem Density Calculation Values (**Table 80**) allows the development of benchmarked scores for each Regional Ecosystem (and therefore AU). These results are shown as **Table 82.** Average stem count information was obtained from the either the latest publication of the Regional Ecosystem Database Description (REDD) version 13.1, or through direct consultation with the Queensland Herbarium (State of Queensland as represented by the Queensland Herbarium, Department of Environment, Science and Innovation) who have provided draft technical descriptions of relevant REs.

Table 81: RE benchmark stem density per hectare based on technical descriptions sourced from Queensland Herbarium

Strata	Number of stems per hectare			
	Woolshed			Thagoona
	RE12.9-10.2	RE12.8.17	RE12.8.28	12.3.3
T1	110	160	213	260
T2	130	420	127	243
Total	240	580	340	495

Table 82: Grey-headed Flying-fox *(Pteropus poliocephalus)* Species Stocking Rate Scoring

Score	Woolshed			Thagoona
	RE12.9-10.2 HQP 01, HQP 02, HQP 03	RE12.8.17 OAT4, OAT5	RE12.8.24 OA T6, OA T7	12.3.3 BC5, BC6, BC7, BC8
2	0 - 14	0 - 20	0 – 27	0 – 63
4	15 – 60	21 – 87	28 – 115	64 – 272
6	61 – 101	88 – 147	116 – 195	273 – 461
8	102 – 108	148 – 157	196 – 209	462 -493
10	109 – 112	158 – 163	210 – 217	494 – 513
8	113 – 119	164 – 173	218 – 231	514 -545
6	120 – 160	174 – 233	232 – 311	546 – 734
4	161 – 206	234 – 300	312 - 399	735 – 943
2	>206	>300	>399	>943

7.8 Modified Habitat Quality Assessment Results

The following subsections detail the results of habitat quality assessment, in accordance with habitat quality methodologies outlined in **Section 7.7** above. Results are summarised to reflect averaged scores according to Assessment Units for each Offset Area and offset protected matter. Comprehensive scoring calculations and

outcomes, including raw data values for each ecological scoring indicator and attribute, are available in **Appendix 15**.

7.8.1 Woolshed Offset Area

7.8.1.1 Koala

7.8.1.1.1 Site Condition

Site condition scoring results at the Offset Area are summarised and presented in **Table 83** and **Table 84** below. Habitat index scoring results are summarised in **Table 83**. A total of nine unique ecological indicators are scored to calculate habitat attributes: *Quality and availability of food and foraging habitat*, and *Quality and availability of shelter*. **Table 84** summaries the averaged scaled scores for each of the 13 measurable attributes under the BioCondition assessment method, as well as total scaled habitat index scores. The calculation of BioCondition results in an averaged score (out of 80) for each Assessment Unit, plus an additional 20 points attributed to habitat index scores, which result in a total score out of 100. The following tables detail scaled (in accordance with **Section 7.7.1.1.1** and **Table 63**) and average scores per each Assessment Unit, raw data values are detailed and available in **Appendix 15**.

Table 83: Habitat Index scoring results - Woolshed Offset Area

Habitat index attributes	AU1	AU2	AU3
Quality and availability of food and foraging habitat			
Proportion of canopy cover of LIKT trees within the 100x50 meter BioCondition plot (/20)	20.00	15.00	20.00
Forage tree species richness (LIKTs as per Youngentob et al., 2022) (Only trees >100 DBH) (/10)	5.00	7.50	5.00
Tree density (per hectare stem count) of LIKT species >100 mm DBH (/20)	18.33	5.00	5.00
Recruitment of LIKT species only (/10)	10.00	0.00	5.00
Total scaled score (/10)	**10.00**	**5.00**	**5.00**
Quality and availability of shelter			
Presence of preferred ancillary trees (listed in Youngentob et al.) (/10)	0.67	3.00	0.00
Canopy cover of all trees within the 100x50 meter BioCondition plot (/20)	18.33	10.00	17.50
Recruitment of all Forage/Shelter tree species (/10)	10.00	5.00	5.00
Tree density (per hectare stem count) of all trees >100 mm DBH (/20)	20.00	5.00	5.00
Proximity to habitat refugia (/10)	5.00	5.00	1.00
Total scaled score (/10)	**5.00**	**5.00**	**5.00**

Table 84: Site Condition scoring results - Woolshed Offset Area

BioCondition attribute	AU1	AU2	AU3
Recruitment of woody perennial species in EDL	**4.33**	**3.00**	**1.50**
Native plant species richness - trees	4.17	5.00	3.75
Native plant species richness - shrubs	5.00	2.50	1.25
Native plant species richness - grasses	5.00	2.50	0.00
Native plant species richness - forbs	4.17	1.25	1.25
Tree canopy height (average of emergent, canopy, sub-canopy)	5.00	4.00	4.00
Tree canopy cover (average of emergent, canopy, sub-canopy)	5.00	5.00	5.00
Shrub canopy cover	5.00	0.00	0.00
Native grass cover	3.00	0.50	0.00
Organic litter	5.00	4.00	0.00
Large trees (euc plus non-euc)	11.67	7.50	7.50
Coarse woody debris	3.00	1.00	1.00
Non-native plant cover	5.0	0.00	0.00
BioCondition score (/80)	**65.3**	**36.25**	**25.25**
Habitat index attribute			
Quality and availability of food and foraging habitat (/10)	10	5	5
Quality and availability of shelter (/10)	6.7	3	5
Total site condition score (/100)	**82.0**	**44.25**	**35.25**

7.8.1.1.2 Site context

Site context scoring results for the Offset Area are summarised and presented in **Table 85** below. Landscape scoring results are illustrated through the following figures: **Figure 71** displaying patch size, **Figure 72** displaying connectedness, and **Figure 73** displaying context. Landscape scoring analysis is detailed in **Appendix 12**.

Table 85: Site Context scoring results at Woolshed Offset Area

Attribute	Result	Scaled Score
Patch size	**>200 ha** of vegetation mapped as either Cat A, B, or C under the regulated Vegetation Management Act is directly connected with Koala *(Phascolarctos cinereus)* habitat contained within the Offset Area.	**10** (/10)

Attribute	Result	Scaled Score
Connectedness	**89.8%** of the Offset Area perimeter is connected with vegetation mapped as either Cat A, B, or C under the regulated Vegetation Management Act.	**5** (/5)
Context	**72.83%** of area within a 1 km buffer from the perimeter of the Offset Area is mapped as either Cat A, B, or C vegetation under the regulated Vegetation Management Act.	4 (/5)
Ecological Corridors	The Offset Area is **located within** an ecological corridor mapped as either a state significant, bioregional, regional, or sub-regional.	**6** (/6)
Role of site location to species overall population in the state	Habitat meets the definition of critical habitat due to the presence of foraging and breeding resources.	**5** (/5)
Threats to the species	Moderate level threats. See detailed scoring outcomes in **Appendix 15**.	**7** (/15)
Species mobility capacity	High to poor mobility results. See detailed scoring outcomes in **Appendix 15**.	**Average 6** (/10)

7.8.1.1.3 Species stocking rate

Given the discreet nature of the Koala (*Phascolarctos cinereus*) and limited to no published literature on habitat carrying capacity of the species, the species stocking rate scoring methodology has been derived through the collation of site-specific surveys and surrounding contextual habitat analysis. As outlined in **Section 7.5.2.1.1.2**, Koala (*Phascolarctos cinereus*) presence and habitat utilisation was confirmed within the Woolshed Offset Area through the detection of scat within AU1.

The MHQA guidance specifies that Species Stocking Rate is generally assessed at the matter area scale, while recognising that exceptions may be appropriate on a case-by-case basis (DCCEEW 2024). For Koala (*Phascolarctos cinereus*), a departure from the default approach has been adopted due to the highly heterogeneous nature of the Woolshed Offset matter area.

Koala (*Phascolarctos cinereus*) stocking rate has subsequently been scored at the Assessment Unit scale, as opposed to the Matter Area scale. The adaptation of this scoring approach is appropriate in consideration of habitat accessibility impacts associated with prolific infestation of *Lantana camara* and the formation of distinct physical barriers within the Site. Due to the presence of these exotic vegetated barriers, the Woolshed Offset Area comprises two AUs that differ substantially in their capacity to support Koala (*Phascolarctos cinereus*). AUs two and three are most affected by *Lantana camara* infestation and are concluded to be entirely inaccessible as habitat. These ecological outcomes are justified and reflected in BioCondition and habitat quality scoring, as well as detailed in the Lantana Technical Memo (**Appendix 12.1** – Woolshed OMP, **Attachment 3**).

Despite the adaptation of scoring method, Species Stocking Rate scoring results reflect a precautionary approach, with results detailed in **Table 86** below. Species Stocking Rate scoring awards higher scores to AU1, reflective of its accessibility to individual Koalas (*Phascolarctos cinereus*) despite evidence of low usage. Koala presence is scored as ‘on site’ for AU1 to reflect the detection of scat, and ‘adjacent’ for AUs two and three to reflect their inaccessibility at baseline survey. Similarly, approximate density is scored as ‘low’ for AU1 and ‘0%’ or absent for AUs 2 and 3. Species habitat usage is scored as ‘foraging and breeding’ for AU1, and ‘dispersal’ for AUs two and three. These assessments are made on the ecological judgement that Koala (*Phascolarctos cinereus*) simply cannot access, and therefore utilise, habitat within these Assessment Units due to severe impacts associated with *Lantana camara* infestation.

Table 86: Koala Stocking Rate Results - Woolshed Offset Area

Species Stocking Rate (SSR)						AU1	AU2	AU3
Presence detected on or adjacent to site (neighbouring property with connecting habitat)	Score	0	5		10	**10**	**5**	**5**
		No	Yes - adjacent		Yes - on site			
Species usage of the site (habitat type & evidenced usage)	Score	0	5	10	15	**15**	**5**	**5**
		Not habitat	Dispersal	Foraging	Breeding			
Approximate density (per ha)	Score	0	10	20	30	**10**	**0**	**0**
		0%	low	medium	high			
Role/importance of species population on site*	Score (*Total from supplementary table)*	0	5	10	15	**5**	**5**	**5**
		0	5 - 15	20 - 35	40 - 45			
Total SRR score (out of 70)						**40**	**15**	**15**
SRR Score (out of 4)						**2.3**	**0.9**	**0.9**

7.8.1.1.4 Habitat Quality

The starting habitat quality scores for each assessment unit, combining Site Condition, Site Context and Species Stocking Rate are reported in **Appendix 15.1**. A summary of the scores is presented as **Table 86**. The scores for Site Condition are derived directly from the MHQA Tool data. These scores are then used to determine the scores for Quality and Availability of Food and Foraging Habitat, and Quality and Availability of Shelter.

This score is calculated based on the combined weighted habitat quality scores for each assessment unit.

Three assessment units, reflective of historic Site disturbance have been identified. Their typology and extent are:

- Offset Area, Assessment Unit 1 (OA AU1 – 3 BioCondition transects) – Spotted Gum (*Corymbia citriodora subsp variegata*) and Narrow-leaved Red Ironbark *(Eucalyptus crebra*) open forest; RE 12.9-10.2.
    - Total AU area – 61.35 ha (69.2% of Project Area).
- Offset Area, Assessment Unit 2 (OA AU2 – 2 BioCondition transects) - Narrow-leaved Red Ironbark (*Eucalyptus crebra*), Queensland Blue Gum (*Eucalyptus tereticornis*), Pink Bloodwood *(Corymbia intermedia*) woodland / open forest with a dese thicket understorey of Lantana (*Lantana camara*); RE 12.8.17.
    - Total AU area – 23.27 ha (26.3% of Project Area).
- Offset Area, Assessment Unit 1 (OA AU3 – 2 BioCondition transects) – Spotted Gum (*Corymbia citriodora* subsp *variegata*) and Narrow-leaved Red Ironbark (*Eucalyptus crebra*) with Silver-leaved Ironbark (*Eucalyptus melanophloia*) woodland / open forest; RE 12.8.24.
    - Total AU area – 6.65 ha (7.5% of Project Area).

Refer to **Section 7.5.5.3** for a description of the habitats present.

The results of the proposed Offset Area MHQA are detailed for each assessment unit below in **Table 87**. The results of the MHQA undertaken for the Offset Area demonstrate moderate baseline habitat quality with clear potential for enhancement through targeted management and restoration. These values reflect a landscape that currently supports functional habitat for the Koala *(Phascolarctos cinereus)*, with strong capacity for measurable improvement under the proposed management framework implemented through the OMP.

Table 87: Woolshed Koala *(Phascolarctos cinereus)* – Offset Site Modified Habitat Quality Assessment

Attribute	OA AU1	OA AU2	OA AU3	Total
Site condition score (out of 3)	2.46	1.33	1.06	1.62
Site context score (out of 3)	2.41	2.20	2.20	2.27
Species Stocking Rate Score (out of 4)	2.29	0.86	0.86	1.33
Habitat Quality score (out of 10)	7.16	4.38	4.11	5.22
Habitat Quality score (Rounded out of 10)	7.00	4.00	4.00	5.00
Assessment Unit area (ha) in disturbance footprint	61.35	20.63	6.65	88.63
Total Project Area (ha) for this MNES	88.63	88.92	88.92	88.82
Size Weighting	0.69	0.23	0.07	1.00
Total Weighted Habitat Quality Score	**6.28**			

The Site was given an overall weighted habitat quality score 6.286 out of the total of 10 which rounds to a score of 6 out of 10. This is considered a moderate-high habitat quality score.

7.8.1.2 Grey-headed Flying-fox

7.8.1.2.1 Site Condition

Site condition scoring results at the Woolshed Offset Area are summarised and presented in **Table 88** and **Table 89** below. Habitat index scoring results, including the five unique ecological indicators, are summarised in **Table 88**. **Table 89** summaries the averaged scaled scores for each of the 13 measurable attributes under the BioCondition assessment method, as well as total scaled habitat index scores. The calculation of BioCondition results in an averaged score (out of 80) for each Assessment Unit, plus an additional 20 points attributed to habitat index scores, which result in a total score out of 100.

Table 88: Habitat index scoring results – Woolshed Offset Area

Habitat index attributes	AU1	AU2	AU3
Quality and availability of food and foraging habitat and quality and availability of shelter			
Species richness	5.00	5.00	5.00
Flower score	8.00	8.00	8.00
Timing of Biological shortages	4.00	5.75	4.00
Quality of foraging habitat	5.00	2.50	5.00

Habitat index attributes	AU1	AU2	AU3
Non-native plant cover	10.00	1.00	1.00
Q+A foraging habitat + Q+A shelter habitat score (/80)	**32**	**22**	**23**

Table 89: Site Condition scoring results – Woolshed Offset Area

BioCondition attribute	AU1	AU2	AU3
Recruitment of woody perennial species in EDL	4.33	3.00	1.50
Native plant species richness - trees	4.17	5.00	3.75
Native plant species richness - shrubs	5.00	2.50	1.25
Native plant species richness - grasses	5.00	2.50	0.00
Native plant species richness - forbs	4.17	1.25	1.25
Tree canopy height (average of emergent, canopy, sub-canopy)	5.00	4.00	4.00
Tree canopy cover (average of emergent, canopy, sub-canopy)	5.00	5.00	5.00
Shrub canopy cover	5.00	0.00	0.00
Native grass cover	3.00	0.50	0.00
Organic litter	5.00	4.00	0.00
Large trees (euc plus non-euc)	11.67	7.50	7.50
Coarse woody debris	3.00	1.00	1.00
Non-native plant cover	5.00	0.00	0.00
Total site condition score (/80)	**65.33**	**36.3**	**25.3**

7.8.1.2.1.1 Site Context

Site context scoring results for the Offset Area are summarised and presented in **Table 90** below. Landscape scoring results are illustrated through the following figures: **Figure 71** displaying patch size, **Figure 72** displaying connectedness, and **Figure 73** displaying context. **Threats score out of 15.** Landscape scoring analysis is detailed in **Appendix 15.1**.

Table 90: Site Context scoring results at Woolshed Offset Area

Attribute	Result	Score
Size of patch	**>200 ha** of GHFF foraging habitat directly connect to the Site	10.00
Connectedness	**>6** active GHFF camps withing a 20 km radius of the Site	10.00
Context	**>75 %** GHFF foraging habitat within a 20 km radius of the Site	10.00

Attribute	Result	Score
Ecological Corridors	The Site is within an ecological corridor	10.00
Role of site location to species overall population in the state	1 significant GHFF camp is located within 20 km of the Site	1.00
Threats to the species	Moderate level threats. See detailed scoring outcomes in Appendix 15.	5.00
Total site context score (/60)		46

7.8.1.2.1.2 Species Stocking Rate

Stocking rate results have been scored in accordance with the methodology outlined in **Section 7.7.2.1.3** and has been based on the stem counts of habitat and foraging trees. This methodology has been utilised due to the mobile nature of the species and limited published literature of carrying capacity of the species. Results are displayed below in **Table 91**. Stem count is recorded for all stems 300 mm or greater DBH and the stocking rate score has been derived from **Table 82**.

Table 91: GHFF Stocking Rate Results - Woolshed Offset Area

AU	BioCondition ID	Stem count >300 mm DBH (stems per ha)	Stocking rate score	Averaged stocking rate score (/10)
1	HQP1a	70	6	6
	HQP3a	68	6	
	HQP2a	66	6	
2	OA AU2 T1	18	2	2
	OA AU2 T2	6	2	
3	OA AU3 T1	16	2	2
	OA AU3 T2	1	2	

7.8.1.2.1.3 Overall Habitat Quality

Three assessment units, reflective of historic Site disturbance have been identified. Their typology and extent are:

- Woolshed Offset Area, Assessment Unit 1 (OA AU1 – 3 BioCondition transects) – Spotted Gum (*Corymbia citriodora subsp variegata*) and Narrow-leaved Red Ironbark *(Eucalyptus crebra*) open forest; RE 12.9-10.2.
    - Total AU area – 61.35 ha (69.2% of Project Area).
- Woolshed Offset Area, Assessment Unit 2 (OA AU2 – 2 BioCondition transects) - Narrow-leaved Red Ironbark (*Eucalyptus crebra*), Queensland Blue Gum (*Eucalyptus tereticornis*), Pink Bloodwood *(Corymbia intermedia*) woodland / open forest with a dese thicket understorey of Lantana (*Lantana camara*); RE 12.8.17.
    - Total AU area – 20.63 ha (23.28% of Project Area).

- Woolshed Offset Area, Assessment Unit 1 (OA AU3 – 2 BioCondition transects) – Spotted Gum (*Corymbia citriodora* subsp *variegata*) and Narrow-leaved Red Ironbark (*Eucalyptus crebra*) with Silver-leaved Ironbark (*Eucalyptus melanophloia*) woodland / open forest; RE 12.8.24.
    - Total AU area – 6.65 ha (7.5% of Project Area).

Refer to **Section 7.5.5.3** for a description of the habitats present.

The habitat quality scores for each assessment unit, combining Site Condition, Site Context and Species Stocking Rate are reported in **Appendix 15.2** with a summary presented as **Table 92**. The scores for Site Condition are derived directly from the MHQA Tool data. These scores are then used to determine the scores for Quality and Availability of Food and Foraging Habitat, and Quality and Availability of Shelter.

Table 92: Woolshed Grey-headed Flying-fox *(Pteropus poliocephalus)* – Offset Site Modified Habitat Quality Assessment

Attribute	OA AU1	OA AU2	OA AU3	Total
Site condition score (out of 4)	1.93	1.25	1.17	1.45
Site context score (out of 3)	2.30	2.30	2.30	2.30
Species Stocking Rate Score (out of 3)	1.80	0.60	0.60	1.00
Habitat Quality score (out of 10)	6.03	4.15	4.07	4.75
Habitat Quality score (Rounded out of 10)	6.00	4.00	4.00	5.00
Assessment Unit area (ha) in disturbance footprint	61.35	20.63	6.65	88.63
Total Project Area (ha) for this MNES	88.63	88.63	88.63	88.63
Size Weighting	0.69	0.23	0.08	1.00
Total Weighted Habitat Quality Score	**5.45**			

The Site was given an overall weighted habitat quality score of 5.45 out of the total of 10 which rounds to a score of 5 out of 10. This is considered a moderate-high habitat quality score.

7.8.2 Thagoona Offset Area

7.8.2.1 Koala

7.8.2.1.1 Site Condition

Site condition scoring results at the Offset Area are summarised and presented in **Table 93** and **Table 94** below. Habitat index scoring results are summarised in **Table 93**. A total of nine unique ecological indicators are scored to calculate habitat attributes: *Quality and availability of food and foraging habitat*, and *Quality and availability of shelter*. **Table 94** summaries the averaged scaled scores for each of the 13 measurable attributes under the BioCondition assessment method, as well as total scaled habitat index scores. The calculation of BioCondition results in an averaged score (out of 80) for each Assessment Unit, plus an additional 20 points attributed to habitat index scores, which result in a total score out of 100. The following tables detail scaled (in accordance with **Section 7.7.1.1.1** and **Table 63**) and average scores per each Assessment Unit, raw data values are detailed and available in **Appendix 15**.

Table 93: Habitat Index scoring results - Thagoona Offset Area

Habitat index attributes	AU1	AU2
Quality and availability of food and foraging habitat		
Proportion of canopy cover of LIKT trees within the 100x50 meter BioCondition plot (/20)	20.00	20.00
Forage tree species richness (LIKTs as per Youngentob et al., 2022) (Only trees >100 DBH) (/10)	5.00	5.00
Tree density (per hectare stem count) of LIKT species >100 mm DBH (/20)	7.50	7.50
Recruitment of LIKT species only (/10)	10.00	10.00
Total scaled score (/10)	**5**	**5**
Quality and availability of shelter		
Presence of preferred ancillary trees (listed in Youngentob et al.) (/10)	0.00	0.50
Canopy cover of all trees within the 100x50 meter BioCondition plot (/20)	7.50	15.00
Recruitment of all Forage/Shelter tree species (/10)	10.00	7.50
Tree density (per hectare stem count) of all trees >100 mm DBH (/20)	7.50	7.50
Proximity to habitat refugia (/10)	5.00	5.00
Total scaled score (/10)	**5**	**5**

Table 94: Site Condition scoring results – Thagoona Offset Area

BioCondition attribute	AU1	AU2
Recruitment of woody perennial species in EDL	5.0	5.0
Native plant species richness - trees	1.3	2.5
Native plant species richness - shrubs	1.3	2.5
Native plant species richness - grasses	0.0	2.5
Native plant species richness - forbs	2.5	2.5
Tree canopy height (average of emergent, canopy, sub-canopy)	4.0	5.0
Tree canopy cover (average of emergent, canopy, sub-canopy)	2.0	5.0
Shrub canopy cover	1.5	3.0
Native grass cover	0.0	0.0
Organic litter	5.0	5.0
Large trees (euc plus non-euc)	2.5	5.0

BioCondition attribute	AU1	AU2
Coarse woody debris	0.0	2.0
Non-native plant cover	1.5	3.0
Total site condition score (/80)	**26.5**	**43**
Habitat index attribute		
Quality and availability of food and foraging habitat (/10)	5	5
Quality and availability of shelter (/10)	5	5
Total site condition score (/100)	**36.5**	**53**

7.8.2.1.1 Site context

Site context scoring results for the Offset Area are summarised and presented in **Table 95** below. Results are illustrated through the following figures: **Figure 74** displaying patch size, **Figure 75** displaying connectedness, and **Figure 76** displaying context. Landscape scoring analysis is detailed in **Appendix 15.3**.

Table 95: Site Context scoring results at the Offset Area

Attribute	Result	Scaled Score
Patch size	**>200 ha** of vegetation mapped as either Cat A, B, or C under the regulated Vegetation Management Act is directly connected with Koala *(Phascolarctos cinereus)* habitat contained within the Offset Area.	**10** (/10)
Connectedness	**35%** of the Offset Area perimeter is connected with vegetation mapped as either Cat A, B, or C under the regulated Vegetation Management Act.	**2** (/5)
Context	**51%** of area within a 1 km buffer from the perimeter of the Offset Area is mapped as either Cat A, B, or C vegetation under the regulated Vegetation Management Act.	**4** (/5)
Ecological Corridors	The Offset Area is **located within** an ecological corridor mapped as either a state significant, bioregional, regional, or sub-regional.	**6** (/6)
Role of site location to species overall population in the state	Habitat meets the definition of critical habitat due to the presence of foraging and breeding resources.	**5** (/5)
Threats to the species	Low level threats. See detailed scoring outcomes in **Appendix 15**.	**15** (/15)
Species mobility capacity	High mobility results. See detailed scoring outcomes in **Appendix 15**.	**10** (/10)

7.8.2.1.2 Species stocking rate

Given the discreet nature of the Koala *(Phascolarctos cinereus)* and limited to no published literature on habitat carrying capacity of the species, the species stocking rate scoring methodology has been derived through the

collation of site-specific surveys and surrounding contextual habitat analysis. As outlined in **Section 7.5.1.2.2**, Koala *(Phascolarctos cinereus)* presence and habitat utilisation was not confirmed within the Thagoona Offset Area.

Species Stocking Rate scoring results reflect a precautionary approach, with results detailed in **Table 96** below. Koala *(Phascolarctos cinereus*) density is presumed to be low based on absence of scat evidence, and as such is awarded a score of 10. However, scratch marks and possible scat suggest koala do utilise the habitat on occasion, and anecdotal evidence through landholder discussion suggests previous survey observed koala and back young. Koala *(Phascolarctos cinereus*) is therefore considered to occur on site and as such is awarded a score of 10, and habitat usage is scored as 15 to reflect both foraging and breeding. A total score of 2.3 out of 4 results and is input into the calculation of Habitat Quality for each Assessment Unit.

Table 96: Koala Stocking Rate Results - Thagoona Offset Area

Species Stocking Rate (SSR)						**Score**
Presence detected on or adjacent to site (neighbouring property with connecting habitat)	Score	0	5		10	**10**
		No	Yes - adjacent		Yes - on site	
Species usage of the site (habitat type & evidenced usage)	Score	0	5	10	15	**15**
		Not habitat	Dispersal	Foraging	Breeding	
Approximate density (per ha)	Score	0	10	20	30	**10**
		0%	low	medium	high	
Role/importance of species population on site*	Score (*Total from supplementary table)*	0	5	10	15	**5**
		0	5 - 15	20 - 35	40 - 45	
Total SRR score (out of 70)						**40**
SRR Score (out of 4)						**2.29**

7.8.2.1.3 Overall Habitat Quality

The starting habitat quality scores for each assessment unit, combining Site Condition, Site Context and Species Stocking Rate are reported in **Appendix 15.3**. A summary of the scores is presented as **Table 97**. The scores for Site Condition are derived directly from the MHQA Tool data. These scores are then used to determine the scores for Quality and Availability of Food and Foraging Habitat, and Quality and Availability of Shelter.

This score is calculated based on the combined weighted habitat quality scores for each assessment unit.

Two assessment units, reflective of historic Site disturbance have been identified. Their typology and extent are:

- Thagoona Offset Area, Assessment Unit 1 (THOA AU1 – 2 BioCondition transects) – pastoral grassland with scattered Queensland Blue Gum (*Eucalyptus tereticornis*); pre-clear RE 12.3.3.
    - Total AU area – 5.84 ha (66% of THOA).

- Thagoona Offset Area, Assessment Unit 2 (THOA AU2 – 2 BioCondition transects) – Regrowth Queensland Blue Gum (*Eucalyptus tereticornis*) woodland; RE12.3.3.
    - Total AU area – 11.84 ha (66% of THOA).

Refer to **Section 7.8.2.2** for a description of the habitats present.

The results of the proposed Offset Area MHQA are detailed for each assessment unit in **Table 97**. The results of the MHQA undertaken for the Offset Area demonstrate moderate baseline habitat quality with clear potential for enhancement through targeted management and restoration. These values reflect a landscape that currently supports functional habitat for the Koala *(Phascolarctos cinereus)*, with strong capacity for measurable improvement under the proposed management framework implemented through the OMP.

Table 97: Thagoona Koala *(Phascolarctos cinereus)* – Offset Site Modified Habitat Quality Assessment

Attribute	TH AU1	TH AU2	Total
Site condition score (out of 3)	1.10	1.37	1.23
Site context score (out of 3)	2.79	2.79	2.79
Species Stocking Rate Score (out of 4)	2.29	2.29	2.29
Habitat Quality score (out of 10)	6.17	6.44	6.31
Habitat Quality score (Rounded out of 10)	6.00	6.00	6.00
Assessment Unit area (ha) in disturbance footprint	5.84	11.84	17.68
Total Project Area (ha) for this MNES	17.68	17.68	17.68
Size Weighting	0.33	0.67	1.00
Total Weighted Habitat Quality Score	**6.35**		

The Site was given an overall weighted habitat quality score of 6.35 out of the total of 10 which rounds to a score of 6 out of 10. This is considered a moderate-high habitat quality score.

7.8.2.2 Grey-headed Flying-fox

7.8.2.2.1 Site Condition

Site condition scoring results at the Thagoona Offset Area are summarised and presented in **Table 98** and **Table 99** below. Habitat index scoring results, including the five unique ecological indicators, are summarised in **Table 98**. **Table 99** summaries the averaged scaled scores for each of the 13 measurable attributes under the BioCondition assessment method, as well as total scaled habitat index scores. The calculation of BioCondition results in an averaged score (out of 80) for each Assessment Unit, plus an additional 20 points attributed to habitat index scores, which result in a total score out of 100.

Table 98: Habitat index scoring results – Thagoona Offset Area

Habitat index attributes	AU1	AU2
Quality and availability of food and foraging habitat and quality and availability of shelter		
Species richness	5.0	5.0

Habitat index attributes	AU1	AU2
Flower score	8.0	8.0
Timing of Biological shortages	8.5	8.5
Quality of foraging habitat	5.0	5.0
Non-native plant cover	3.0	5.0
Q+A foraging habitat + Q+A shelter habitat score (/80)	**29.5**	**31.5**

Table 99: Site Condition scoring results – Thagoona Offset Area

BioCondition attribute	AU1	AU2
Recruitment of woody perennial species in EDL	5.0	2.5
Native plant species richness - trees	1.3	1.3
Native plant species richness - shrubs	1.3	2.5
Native plant species richness - grasses	0.0	2.5
Native plant species richness - forbs	2.5	2.5
Tree canopy height (average of emergent, canopy, sub-canopy)	4.0	5.0
Tree canopy cover (average of emergent, canopy, sub-canopy)	2.0	5.0
Shrub canopy cover	1.5	1.5
Native grass cover	0.0	1.5
Organic litter	5.0	5.0
Large trees (euc plus non-euc)	2.5	2.5
Coarse woody debris	0.0	1.0
Non-native plant cover	1.5	3.0
Total site condition score (/80)	**26.5**	**35.8**

7.8.2.2.1.1 Site Context

Site context scoring results for the Offset Area are summarised and presented in **Table 100** below. Landscape scoring results are illustrated through the following figures: **Figure 74** displaying patch size, **Figure 75** displaying connectedness, and **Figure 76** displaying context. Landscape scoring analysis is detailed in **Appendix 15**.

Table 100: Site Context scoring results at Thagoona Offset Area

Attribute	Result	Score
Size of patch	**>200 ha** of GHFF foraging habitat directly connect to the Site	10.00
Connectedness	**>6** active GHFF camps withing a 20 km radius of the Site	10.00
Context	**26 %** GHFF foraging habitat within a 20 km radius of the Site	3.00
Ecological Corridors	The Site is within an ecological corridor	10.00
Role of site location to species overall population in the state	1 significant GHFF camp is located within 20 km of the Site	1.00
Threats to the species	Moderate level threats. See detailed scoring outcomes in **Appendix 15**.	10.00
Total site context score (/60)		44

7.8.2.2.1.2 Species Stocking Rate

Stocking rate results have been scored in accordance with the methodology outlined in **Section 7.7.2.1.3** and has been based on the stem counts of habitat and foraging trees. This methodology has been utilised due to the mobile nature of the species and limited published literature of carrying capacity of the species. Stem count is recorded for all stems 300 mm or greater DBH and the stocking rate score has been derived from **Table 101**.

Table 101: GHFF Stocking Rate Results - Thagoona Offset Area

AU	BioCondition ID	Stem count >300 mm DBH	Stocking rate score	Averaged stocking rate score (/10)
1	BC06	18	2	2
	BC08	6	2	
2	BC05	58	2	2
	BC07	40	2	

7.8.2.2.1.3 Overall Habitat Quality

Two assessment units, reflective of historic Site disturbance have been identified. Their typology and extent are:

- Thagoona Offset Area, Assessment Unit 1 (THOA AU1 – 2 BioCondition transects) – pastoral grassland with scattered Queensland Blue Gum (*Eucalyptus tereticornis*); pre-clear RE 12.3.3.
    - Total AU area – 5.84 ha (33% of THOA).
- Thagoona Offset Area, Assessment Unit 2 (THOA AU2 – 2 BioCondition transects) – Regrowth Queensland Blue Gum (*Eucalyptus tereticornis*) woodland; RE12.3.3.
    - Total AU area – 11.84 ha (66% of THOA).

Refer to **Section 7.8.2.2** for a description of the habitats present.

The habitat quality scores for each assessment unit, combining Site Condition, Site Context and Species Stocking Rate are reported in **Appendix 15.4** with a summary presented as **Table 102**. The scores for Site Condition are derived directly from the MHQA Tool data. These scores are then used to determine the scores for Quality and Availability of Food and Foraging Habitat, and Quality and Availability of Shelter.

Table 102: Thagoona Grey-headed Flying-fox *(Pteropus poliocephalus)* – Offset Site Modified Habitat Quality Assessment

Attribute	TH AU1	TH AU2	Total
Site condition score (out of 3)	1.45	1.62	1.53
Site context score (out of 3)	2.20	2.20	2.20
Species Stocking Rate Score (out of 4)	0.60	0.60	0.60
Habitat Quality score (out of 10)	4.25	4.42	4.33
Habitat Quality score (Rounded out of 10)	4.00	4.00	4.00
Assessment Unit area (ha) in disturbance footprint	5.84	11.84	17.68
Total Project Area (ha) for this MNES	17.68	17.68	17.68
Size Weighting	1.4	2.96	1.00
Total Weighted Habitat Quality Score	**4.36**		

The Site was given an overall weighted habitat quality score of 4.36 out of the total of 10 which rounds to a score of 4 out of 10. This is considered a moderate-high habitat quality score.

7.9 Offset Calculation

7.9.1 Habitat Quality Gains

The key interim performance targets and completion criteria to be achieved through the delivery of the OMP (**Appendix 12.1** – Woolshed and **Appendix 12.2** – Thagoona) include increases in habitat quality scores for offset matters Koala (*Phascolarctos cinereus*) and Grey-headed Flying-fox (*Pteropus poliocephalus*). Habitat quality scores are calculated by assessing a range of indicators and ecological attributes that measure the overall viability of the offset and its capacity to support given MNES. The modified habitat quality assessment method applied to achieve overall habitat quality scores for Koala (*Phascolarctos cinereus*) and Grey-headed Flying-fox (*Pteropus poliocephalus*) have been adopted.

The management actions described within the Plan will ultimately lead to the general progression of vegetation condition and subsequent habitat quality. The success of management actions are therefore reflected in habitat quality scoring gains. Interim (years 5, 10, 15) and completion (year 20) habitat quality scores are predicted as a surrogate overall indicator of management success, and the overall progression towards the conservation outcomes of the Offset Site.

7.9.1.1 Offset Interim and Completion Targets

7.9.1.1.1 Woolshed Offset

Interim performance targets have been detailed for each MNES across years 5, 10, 15 and 20. This was achieved through the detailed analysis of baseline condition scoring, the habitat quality scoring methodology, and the establishment of ecologically feasible outcomes within a 20-year management period. **Table 103** and **Table 104** presents the start (baseline) and future (completion criteria) habitat quality scores for each MNES and Offset Site.

The start quality score for each MNES was determined as part of baseline surveys and were calculated generally in accordance with the MHQA, replicating the method used to quantify the habitat quality score for those MNES within the Project Area. All future habitat quality scores will also be determined following the same method. The complete MHQA workings for each interim performance year (5, 10 and 15) as well as completion year 20 are provided in **Appendix 15.1** - Koala and **Appendix 15.2** – Grey-headed Flying Fox.

Table 103: Woolshed - Habitat quality interim performance targets and completion criteria

MNES	Baseline Year 0		Interim performance target Year 5		Interim performance target Year 10		Interim performance target Year 15		Completion criteria Year 20	
	Raw	Rounded	Raw	Rounded	Raw	Rounded	Raw	Rounded	Raw	Rounded
Koala *(Phascolarctos cinereus)*	6.28	6	6.36	6	7.00	7	7.59	8	7.85	8
Grey-headed Flying-fox *(Pteropus poliocephalus)*	5.45	5	5.77	6	5.85	6	5.90	6	6.61	7

An estimated upswing of 1.16 points is achieved for Grey-headed Flying-fox *(Pteropus poliocephalus)*, and an upswing of 1.57 points is achieved for Koala *(Phascolarctos cinereus)*. The year-20 completion criteria score has been determined to be an achievable upswing, meanwhile remaining a conservative but informed estimate to maintain confidence of completion. The progression of scored BioCondition metrics and species-specific ecological indicators are demonstrated at each independent Habitat Quality assessment site. This progression of score upswing is predicted for each offset matter for each years 0, 5, 10, 15, and 20. The resulting averaged habitat quality score for each AU is demonstrated and summarised in **Table 104** below. This breakdown supports the framework of adaptive management whereby specific habitat attributes which are not improving, will be identifiable through this process, and subsequently management actions can be adapted accordingly.

Table 104: Woolshed - Summary of habitat quality gains across AUs

Matter	Monitoring year	AU1	AU2	AU3	Average MHQA score	Weighted final score
Koala	Baseline	7.16	4.38	4.11	5.22	6.28
	Year 5	7.16	4.66	4.11	6.35	6.36
	Year 10	7.43	6.07	5.96	7.06	7.00
	Year 15	7.71	7.44	7.08	7.41	7.59
	Year 20	8.03	7.53	7.23	7.60	7.85
GHFF	Baseline	6.03	4.15	4.07	4.75	5.45
	Year 5	6.28	4.63	4.51	5.14	5.77
	Year 10	6.30	4.83	4.88	5.34	5.85
	Year 15	6.34	4.92	4.95	5.40	5.9
	Year 20	6.59	6.99	5.68	6.42	6.61

7.9.1.1.2 Thagoona Offset

Interim performance targets have been detailed for each MNES across years 5, 10, 15 and 20. This was achieved through the detailed analysis of baseline condition scoring, the habitat quality scoring methodology, and the establishment of ecologically feasible outcomes within a 20-year management period. **Table 105** and **Table 106** presents the start (baseline) and future (completion criteria) habitat quality scores for each MNES and Offset Site. The start quality score for each MNES was determined as part of baseline surveys and were calculated generally in accordance with the MHQA, replicating the method used to quantify the habitat quality score for those MNES within the Project Area. All future habitat quality scores will also be determined following the same method. The complete MHQA workings for each interim performance year (5, 10 and 15) as well as completion year 20 are provided in **Appendix 15.3** - Koala and **Appendix 15.4** – Grey-headed Flying-fox.

Table 105: Thagoona - Habitat quality interim performance targets and completion criteria

MNES	Baseline Year 0		Interim performance target Year 5		Interim performance target Year 10		Interim performance target Year 15		Completion criteria Year 20	
	Raw	Rounded	Raw	Rounded	Raw	Rounded	Raw	Rounded	Raw	Rounded
Koala *(Phascolarctos cinereus)*	6.35	6	6.61	7	6.92	7	7.12	7	7.58	8
Grey-headed Flying-fox *(Pteropus poliocephalus)*	4.36	4	4.43	4	4.52	5	5.29	5	6.15	6

An estimated upswing of 1.79 points is achieved for Grey-headed Flying-fox *(Pteropus poliocephalus)*, and an upswing of 1.22 points is achieved for Koala *(Phascolarctos cinereus)*. The year-20 completion criteria score has been determined to be an achievable upswing, meanwhile remaining a conservative but informed estimate to maintain confidence of completion. The progression of scored BioCondition metrics and species-specific ecological indicators are demonstrated at each independent Habitat Quality assessment site. This progression of score upswing is predicted for each offset matter for each years 0, 5, 10, 15, and 20. The resulting averaged habitat quality score for each AU is demonstrated and summarised in **Table 106** below. This breakdown supports the framework of adaptive management whereby specific habitat attributes which are not improving, will be identifiable through this process, and subsequently management actions can be adapted accordingly.

Table 106: Thagoona - Summary of habitat quality gains across AUs

Matter	Monitoring year	AU1	AU2	Average MHQA score	Weighted final score
Koala	Baseline	6.17	6.44	6.31	6.35
	Year 5	6.56	6.64	6.60	6.61
	Year 10	6.83	6.97	6.90	6.92
	Year 15	7.00	7.18	7.09	7.12
	Year 20	7.53	7.61	7.57	7.58
GHFF	Baseline	4.25	4.42	4.33	4.36

Matter	Monitoring year	AU1	AU2	Average MHQA score	Weighted final score
	Year 5	4.33	4.48	4.40	4.43
	Year 10	4.47	4.55	4.51	4.52
	Year 15	5.07	5.39	5.23	5.29
	Year 20	6.11	6.17	6.14	6.15

7.9.2 Woolshed Offset Area

7.9.2.1 Summary of Impact and Offset Results - Habitat

The Offset will be delivered into areas of established vegetation comprising 88.63 ha. Through consideration of the MHQA scoring undertaken on the Project Area (**Section 6.2** and **Section 6.3**), and the Offset Receiving Areas ((**Section 7.5.6.1** and **Section 7.5.6.2**), the proposed Offset Areas and OMP can be assessed using the EPBC Act Offset Calculator. **Table 107** summarises the existing HQA Scores for Koala *(Phascolarctos cinereus)* and Grey-headed Flying-fox *(Pteropus poliocephalus)* at the Impact Site and the starting quality of habitats (HQA scores) for the Offset Receiving Areas.

A 20 year offset is proposed. Habitat Quality gains are underpinned by Habitat Quality calculations for the 20 year offset period, which built upon baseline conditions. Habitat Quality gains are underpinned by specific, measurable, achievable, relevant and time-bound conditions laid out in the **Appendix 12.1** - Woolshed OMP. The habitat quality gains arising from implementation of the OMP are measured against Year 5, Year 10, year 15, and year 20 targets through referencing quality gain (using the MHQA and Alternate HQA framework), referenced against the baseline (start) scores identified by this Preliminary Documentation Report.

Table 107: Summary of Current Woolshed On-ground MHQA Scores (Rounded to Whole Number)

Species	Residual Project Area (ha)	Quantum of Impact (ha)	Baseline Impact Site Score rounded (/10)	Baseline Offset Area Score rounded (/10)	20 Year Offset Area Score without Offset (/10)	20 Year Offset Area Score with Offset (/10)
Koala *(Phascolarctos cinereus)*	32.57	13.03	4[1]	6[2]	6	8[2]
Grey-headed Flying-fox *(Pteropus poliocephalus)*	32.57	16.29	5[3]	5[4]	5	7[4]

Notes:
Notes:
[1]. refer **Appendix 11.1**
[2]. refer **Appendix 15.1**
[3]. refer **Appendix 11.2**
[4]. refer **Appendix 15.2**

7.9.2.2 Offset Assessment Guide Input Values - Habitat

Justification for the scoring used for the Woolshed Commonwealth Offset Assessment Guide is shown as **Table 108**.

Table 108: Justification of Values Used for Woolshed Offset Assessment Guide

Attribute	Value	Justification
Time of which loss is averted	20 years	The highest protection category under the *Vegetation Management Act 1999* (Qld) will legally secure the land and is proposed to be in place for a minimum of ten (10) years. A ten-year period is sufficient time for the large majority of the offset land to return to a self-sustaining habitat area (with assistance).
Time until ecological benefit	20 years – Koala *(Phascolarctos cinereus)* 20 years – Grey-headed Flying-fox *(Pteropus poliocephalus*	Ecological benefit to Koala's *(Phascolarctos cinereus)* ability to move through and access forage trees will occur within the first 5 years of the offset as Lantana* (*Lantana camara*) is systematically suppressed. Lasting gain for both Koala *(Phascolarctos cinereus)* and Grey-headed Flying-fox *(Pteropus poliocephalus)* is anticipated within 20 years as ecological functionality, through vegetative recruitment especially canopy trees is restored.
Start quality	Koala *(Phascolarctos cinereus)*: 6 Grey-headed Flying-fox *(Pteropus poliocephalus)*: 5	Despite the offset area condition having been affected by overstorey removal, the understorey displays a high native biodiversity and recruitment of native trees and shrubs. site context and species stocking rates are high given the proximity of the site to contiguous blocks of native vegetation and Koala *(Phascolarctos cinereus)* and Grey-headed Flying-fox *(Pteropus poliocephalus)* records within the landscape adjoining.
Future quality without offset	Koala *(Phascolarctos cinereus)*: 6 Grey-headed Flying-fox *(Pteropus poliocephalus*: 5	The property containing the Woolshed Offset Area is a working cattle property also used for farm forestry. Without the offset this area will continue to be grazed. There are a number of vegetation management exemptions for rural lands which afford clearing exemptions under the *Vegetation Management Act 1999* (Qld), including farm forestry, clearing along property lines and single lot clearing exemptions for dwellings and other essential management which would contribute to fragmentation and degradation of habitat quality. Further, the present, extensive loading of Lantana* (*Lantana camara)* especially within OA AU3, OA AU2 and along the ecotone with OA AU1 diminishes ecological functionality. Lantana* (*Lantana camara)* is a WoNS and is a threatening process for a number of ecosystems and species because of its smothering of understorey which alters ecological function. It affects Koala *(Phascolarctos cinereus)* by impeding movement through the area within a Regional Ecosystem in which Queensland Blue Gum (*Eucalyptus tereticornis*) a key forage species in South East Queensland is present as a significant component of the canopy. It provides shelter for a number of feral pests including Red Fox (*Vulpes vulpes*), Wild Dog (*Cannis lupus familaris*), Feral Cat (*Felis cattus*) and Feral Pig (*Sus scrofa*) that are threats to Koala *(Phascolarctos cinereus)* and other native fauna. The smothering nature of Lantana* (*Lantana camara)* thickets is such that vegetation recruitment of forest communities is impaired or suppressed such that succession cannot occur. Without (or with limited) recruitment of canopy species forage potential for Koala *(Phascolarctos cinereus)* and Grey-headed Flying-fox *(Pteropus poliocephalus)* is impaired (noting that because of the high proportion of Queensland Blue Gum (*Eucalyptus tereticornis*) in the canopy, RE 12.8.17 is considered a significant ecosystem for Grey-headed Flying-fox *(Pteropus poliocephalus)* during important winter and spring periods). Without removal of Lantana* (*Lantana camara)*, the ecological trajectory of the ecosystem will be on a slow decline.

Attribute	Value	Justification
		There are however a number of vegetation management exemptions for rural lands which although would not exacerbate loss would result in diminished quality and availability of habitat for both matters. These relate to existing vegetation management rights affording clearing exemptions under the *Vegetation Management Act 1999* (Qld), including for farm forestry, clearing along property lines and single lot clearing exemptions for dwellings and other essential management. These are outlined: Despite the current State mapping designations applied to the Site, existing rights[68] allow a continuation of the Site's current understorey maintenance. Further, there are exemptions under the Planning Regulation 2017 (Qld) allowing for other clearing to be undertake. Regarding Koala *(Phascolarctos cinereus)* habitat areas, clearing for exempted development, which includes: ▪ essential management, allowing for clearing: ○ that is necessary to maintain infrastructure (definition (e)), including infrastructure already present on the Site (fences) or which could foreseeably be established (e.g., stockyards). A clearing width of 10 m is commonly applied to this infrastructure[69] ○ by the owner of the land to source construction timber to maintain any land of the owner i.e., the timber can be harvested from the Site for use on other properties owned by landowner. This exemption allows for significant harvesting of valuable middle-aged trees[70] up to a point of the threshold for remnant vegetation cover (>50% of the benchmarked canopy cover of the relevant RE)[71]. ▪ to establish a necessary fire management line which identifies the permissible clearing width necessary to establish a fire management line of 10 m. ▪ routine management, which allows for clearing to: ○ source construction timber for establishing necessary built infrastructure on any land of the owner. ○ Regarding areas identified as Regulated Vegetation, the following exempt clearing work can be undertaken[72]: ▪ Exempt clearing work on land generally: ○ clearing for establishing a necessary fence, firebreak, road or vehicular track and the clearing cannot reasonably be avoided or minimised. The scope of this exemption is limited by the more restrictive koala provisions in the Planning Regulation 2017 ▪ Exempt clearing work on freehold and Indigenous land: ○ clearing to establish a necessary fire management line up to 10m wide ○ necessary for maintaining existing infrastructure, including infrastructure already present on the Site (fences) or which could foreseeably be established (e.g., stockyards).

[68] Grazing on rural zoned land is accepted development
[69] Due to the vegetation characteristics, dry sclerophyll forest, almost all tree species encountered, and almost all trees were KHT species.
[70] ~400mm DBH trees that are progressing towards providing future hollows. While veteran trees (providing hollows now) are not targeted for this purpose, they will, in time, fail. Without middle-aged trees coming through to replace them, there is a foreseeable lack of future available hollows.
[71] It is noted that past clearing identified by BioCondition Assessments (discarded crowns and limbs, stumps), appears to be as a result of this exemption.
[72] Based on the DNRMMRRD document - The List of exempt clearing work under the Vegetation Management Framework, A guide to Schedule 21 of the Planning Regulation 2017.

Attribute	Value	Justification
Future quality with offset	Koala *(Phascolarctos cinereus)*: 8 Grey-headed Flying-fox *(Pteropus poliocephalus)*: 7	Achievement of an upswing in (future) quality of '2' for Grey-headed Flying-fox *(Pteropus poliocephalus)* and '2' for Koala *(Phascolarctos cinereus)* is a modest assessment and demonstrably achieved by practical implementation of cattle exclusion, assisted regeneration and infill planting and extensive weed removal if informed by adaptive management and implementation of covenants to protect the Woolshed Offset Area.
Risk of loss without offset	0%	The Offset Area lies within the Rural Landscape of South East Queensland. As the property is zoned Rural under the ICC Planning Scheme there are few opportunities to advance land uses other than rural activity. There are however a number of vegetation management exemptions for rural lands which although would not exacerbate loss would result in diminished quality and availability of habitat for both matters. Please refer to 'future quality without offsets'.
Risk of loss with offset	0%	The offset land will be legally secured using covenant under the *Land Title Act 1994* (Qld) or *Land Act 1994* (Qld) or a VDEC under the *Vegetation Management Act 1999* (Qld) or these legislative instruments regulate new controls on the land as stipulated in the offset management plan and is attached to the land title. Regardless of owner or zoning, a covenant will legally ensure regenerating and reinstated values are protected and provides NEPAwith a higher level of confidence that the offset will be protected for the duration of the impacts associated with the proposed action. These mechanisms would 'immunise' existing clearing rights under the *Vegetation Management Act 1999* (Qld). See also 'future quality without offsets' above. Active and extensive Lantana* (*Lantana camara*) management would result in significant eradication of Lantana through the reduction in the extent of coverage of 95% measured against the Baseline Lantana extent (**Appendix 12.1** – Woolshed OMP, **Attachment 2 –** Baseline Weed Assessment) within 15 years of the commencement of the Action and improve Koala mobility, reduce threats, increase social interaction, make available forage and shelter resources which presently are inaccessible and facilitate normal ecosystem functioning and canopy forage species recruitment.
Confidence in the result (quality)	Koala *(Phascolarctos cinereus)*: 80% Grey-headed Flying-fox *(Pteropus poliocephalus*: 80%	Implementation of all management actions within the non-remnant area will be documented by the engaged offset provider. Employing a suitably qualified ecologist, zoologist or environmental scientist to complete this work has a positive impact on the confidence in result however this type of work has inherent risks.
Confidence in the result (averted loss to species or matter)	90%	This attribute relates to the confidence associated with whether the offset will avert the loss of habitat for the matter or species at the impact site by way of an offset, and the longevity and permanence of the offset to continue providing habitat. Statutory Covenants are routinely used for the securement of environmental offsets and are approved all over Queensland representing a combination of both State and Commonwealth Government approvals. There is high confidence that the Covenant and resulting restriction placed on title will bring necessary regulation to protect MNES for the duration of the impacts associated with the proposed action.

Attribute	Value	Justification
		The offset site consists of areas of advanced regrowth with Koala *(Phascolarctos cinereus)* confirmed present through direct observation and known winter flowering forage trees for Grey-headed Flying-fox *(Pteropus poliocephalus)* confirmed. As Grey-headed Flying-fox *(Pteropus poliocephalus)* is a highly vagile species and known camps and records are present within 25 km, it can be reliably derived that the species will utilise the Woolshed Offset Area. Noting that the averted loss attribute focusses on the probability the offset achieving a real and tangible benefit to the species or matter, it seems reasonable to take the position that owing to the landscape context and connectivity of the Offset Area, presence of Koala *(Phascolarctos cinereus)* and Grey-headed Flying-fox *(Pteropus poliocephalus)* and mature habitat already present, that the confidence in the result would be higher than would be the case with a fabricated offset (all direct planting). Benefit to be gained is through the assisted regeneration, through removal of Lantana from the site and infill planting as necessary and more appropriate ecological burns to restore ecological functionality through restoration and understorey ecological processes which influence recruitment within the vegetation community. In the case of Grey-headed Flying-fox *(Pteropus poliocephalus)* the mature canopy already affords forage habitat. Movement of Koala *(Phascolarctos cinereus)* is impacted within OA AU2 and OA AU3 on account of dense lantana thickets and only mildly impaired within OA AU1.

7.9.3 Thagoona Offset Area

7.9.3.1 Summary of Impact and Offset Results - Habitat

The Offset will be delivered into areas of established vegetation comprising 17.68 ha. Through consideration of the MHQA scoring undertaken on the Impact Site (**Section 6.2** (Koala *(Phascolarctos cinereus)*) and **Section 6.3** (Grey-headed Flying-fox (*Pteropus poliocephalus*))), and the Offset Receiving Sites ((**Section 7.7.4.1** (Koala (*Phascolarctos cinereus*))) *and* **Section 7.7.4.2** (Grey-headed Flying-fox *(Pteropus poliocephalus)))* the proposed Offset Area and OMP can be assessed using the EPBC Act Offset Calculator. **Table 109** summarises the existing HQA Scores for Koala *(Phascolarctos cinereus)* and Grey-headed Flying-fox *(Pteropus poliocephalus)* at the Impact Site and the starting quality of habitats (HQA scores) for the Thagoona Offset.

A 20 year offset is proposed. Habitat Quality gains are underpinned by Habitat Quality calculations for the 20 year offset period, which built upon baseline conditions. Habitat Quality gains are underpinned by specific, measurable, achievable, relevant and time-bound conditions laid out in **Appendix 12.2** – Thagoona OMP. The habitat quality gains arising from implementation of the Offset Management Plan are measured against Year 5 and Year 10 targets through referencing quality gain (using the MHQA and Alternate HQA framework), referenced against the baseline (start) scores identified by this Preliminary Documentation Report.

Table 109: Summary of Current Thagoona On-ground MHQA Scores (Rounded to Whole Number)

Species	Residual Project Area (ha)	Quantum of Impact (ha)	Baseline Impact Site Score rounded (/10)	Baseline Offset Area Score rounded (/10)	20 Year Offset Area Score without Offset (/10)	20 Year Offset Area Score with Offset (/10)
Koala *(Phascolarctos cinereus)*	32.57	16.29	4[1]	6[2]	6	8[2]

Species	Residual Project Area (ha)	Quantum of Impact (ha)	Baseline Impact Site Score rounded (/10)	Baseline Offset Area Score rounded (/10)	20 Year Offset Area Score without Offset (/10)	20 Year Offset Area Score with Offset (/10)
Grey-headed Flying-fox *(Pteropus poliocephalus)*	32.57	16.29	5[3]	4[4]	4	6[4]

Notes:
[1]. refer **Appendix 11.1**
[2]. refer **Appendix 15.3**
[3]. refer **Appendix 11.2**
[4]. refer **Appendix 15.4**

7.9.3.2 Offset Assessment Guide Input Values – Habitat

Justification for the scoring used for the Thagoona Commonwealth Offset Assessment Guide is shown as **Table 110**.

Table 110: Justification of Values Used for Thagoona Offset Assessment Guide

Attribute	Value	Justification
Time of which loss is averted	20 years	The highest protection category under the VM Act will legally secure the land and is proposed to be in place for a minimum of ten (10) years. A ten-year period is sufficient time for the large majority of the offset land to return to a self-sustaining habitat area (with assistance).
Time until ecological benefit	20 years – Koala *(Phascolarctos cinereus)* 20 years – Grey-headed Flying-fox *(Pteropus poliocephalus)*	Ecological benefit to Koala *(Phascolarctos cinereus)* ability to move through and access forage trees will occur within the first 5 years of the offset as Lantana is systematically suppressed. Lasting gain for both Koala *(Phascolarctos cinereus)* and Grey-headed Flying-fox *(Pteropus poliocephalus)* is anticipated within 20 years as ecological functionality, through vegetative recruitment especially canopy trees is restored. .
Start quality	Koala *(Phascolarctos cinereus)*: 5 Grey-headed Flying-fox *(Pteropus poliocephalus)*: 4	Despite the site condition having historically been affected by overstorey thinning / removal and pasture 'improvement' with exotic pasture grasses, the understorey displays a high native biodiversity and recruitment of native trees and shrubs. site context and species stocking rates are high given the proximity of the site to contiguous blocks of native vegetation and Koala *(Phascolarctos cinereus)* and Grey-headed Flying-fox *(Pteropus poliocephalus)* records within the landscape adjoining.
Future quality without offset	Koala *(Phascolarctos cinereus)*: 6 GHFF: 4	The property containing Offset Area is a working cattle property. It has also been subjected to timber harvesting. Without the offset this area will continue to be grazed. There are a number of vegetation management exemptions for rural lands which afford clearing exemptions under the *Vegetation Management Act 1999* (Qld), including farm forestry, clearing along property lines and single lot clearing exemptions for dwellings and other essential management which would contribute to fragmentation and degradation of habitat quality. Without out the offset or protective mechanisms, the site is unlikely to increase in habitat value; there are however a number of vegetation management exemptions for rural lands which although would not

Attribute	Value	Justification
		exacerbate loss would result in diminished quality and availability of habitat for both matters. These relate to existing vegetation management rights affording clearing exemptions under the *Vegetation Management Act 1999* (Qld), including for farm forestry, clearing along property lines and single lot clearing exemptions for dwellings and other essential management. These are outlined: iDespite the current State mapping designations applied to the Site, existing rights[73] allow a continuation of the Site's current understorey maintenance. Further, there are exemptions under the Planning Regulation 2017 allowing for other clearing to be undertake. Regarding Koala *(Phascolarctos cinereus)* habitat areas, clearing for exempted development, which includes: essential management, allowing for clearing: that is necessary to maintain infrastructure (definition (e)), including infrastructure already present on the Site (fences) or which could foreseeably be established (e.g., stockyards). A clearing width of 10 m is commonly applied to this infrastructure[74] ▪ by the owner of the land to source construction timber to maintain any land of the owner i.e., the timber can be harvested from the Site for use on other properties owned by landowner. This exemption allows for significant harvesting of valuable middle-aged trees[75] up to a point of the threshold for remnant vegetation cover (>50% of the benchmarked canopy cover of the relevant RE)[76]. ▪ to establish a necessary fire management line which identifies the permissible clearing width necessary to establish a fire management line of 10 m. ○ routine management, which allows for clearing to: • source construction timber for establishing necessary built infrastructure on any land of the owner. ▪ Regarding areas identified as Regulated Vegetation, the following exempt clearing work can be undertaken[77]: ○ Exempt clearing work on land generally: • clearing for establishing a necessary fence, firebreak, road or vehicular track and the clearing cannot reasonably be avoided or minimised. The scope of this exemption is limited by the more restrictive koala provisions in the Planning Regulation 2017 ○ Exempt clearing work on freehold and Indigenous land: • clearing to establish a necessary fire management line up to 10m wide • necessary for maintaining existing infrastructure, including infrastructure already present on the Site (fences) or which could foreseeably be established (e.g., stockyards).
Future quality with offset	Koala *(Phascolarctos cinereus)*: 8 GHFF: 6	Achievement of an upswing in (future) quality of '3' for Grey-headed Flying-fox *(Pteropus poliocephalus)* and '3' for Koala *(Phascolarctos cinereus)* is a modest assessment and demonstrably achieved by practical implementation of cattle exclusion, assisted regeneration and weed

[73] Grazing on rural zoned land is accepted development
[74] Due to the vegetation characteristics, dry sclerophyll forest, almost all tree species encountered, and almost all trees were KHT species.
[75] ~400mm DBH trees that are progressing towards providing future hollows. While veteran trees (providing hollows now) are not targeted for this purpose, they will, in time, fail. Without middle-aged trees coming through to replace them, there is a foreseeable lack of future available hollows.
[76] It is noted that past clearing identified by BioCondition Assessments (discarded crowns and limbs, stumps), appears to be as a result of this exemption.
[77] Based on the DNRMMRRD document - The List of exempt clearing work under the Vegetation Management Framework, A guide to Schedule 21 of the Planning Regulation 2017.

Attribute	Value	Justification
		removal if informed by adaptive management and implementation of covenants to protect the offset area.
Risk of loss without offset	0%	The Offset Area lies within the Rural Landscape of South East Queensland. As the property is zoned Rural under the ICC Planning Scheme there are few opportunities to advance land uses other than rural activity. There are however a number of vegetation management exemptions for rural lands which although would not exacerbate loss would result in diminished quality and availability of habitat for both matters. Please refer to 'future quality without offsets'.
Risk of loss with offset	0%	The offset land will be legally secured using covenant under the *Land Title Act 1994* or *Land Act 1994* or a VDEC under the *Vegetation Management Act 1999* or These legislative instruments regulate new controls on the land as stipulated in the offset management plan and is attached to the land title. Regardless of owner or zoning, a covenant will legally ensure regenerating and reinstated values are protected and provides NEPA with a higher level of confidence that the offset will be protected for the duration of the impacts associated with the proposed action. These mechanisms would 'immunise' existing clearing rights under the Vegetation Management Act. See also 'future quality without offsets' above.
Confidence in the result (quality)	Koala *(Phascolarctos cinereus)*: 80% Grey-headed Flying-fox *(Pteropus poliocephalus*: 80%	Implementation of all management actions within the non-remnant area will be documented by the engaged offset provider. Employing a suitably qualified ecologist, zoologist or environmental scientist to complete this work has a positive impact on the confidence in result however this type of work has inherent risks.
Confidence in the result (averted loss to species or matter)	90%	This attribute relates to the confidence associated with whether the offset will avert the loss of habitat for the matter or species at the impact site by way of an offset, and the longevity and permanence of the offset to continue providing habitat. Statutory Covenants are routinely used for the securement of environmental offsets and are approved all over Queensland representing a combination of both State and Commonwealth Government approvals. There is high confidence that the Covenant and resulting restriction placed on title will bring necessary regulation to protect MNES for the duration of the impacts associated with the proposed action. The offset site consists of areas of advanced regrowth with Koala *(Phascolarctos cinereus)* confirmed present through direct observation and known winter flowering forage trees for Grey-headed Flying-fox *(Pteropus poliocephalus)* confirmed. As Grey-headed Flying-fox *(Pteropus poliocephalus)* is a highly vagile species and known camps and records are present within 25 km, it can be reliably derived that the species will utilise the Woolshed Offset Area. Noting that the averted loss attribute focusses on the probability the offset achieving a real and tangible benefit to the species or matter, it seems reasonable to take the position that owing to the landscape context and connectivity of the Offset Area, presence of Koala *(Phascolarctos cinereus)* and Grey-headed Flying-fox *(Pteropus poliocephalus)* and mature habitat already present, that the confidence in the result would be higher than would be the case with a fabricated offset (all direct planting).

Attribute	Value	Justification
		Benefit to be gained is through the assisted regeneration, through removal of Lantana from the site and infill planting as necessary and more appropriate ecological burns to restore ecological functionality through restoration and understorey ecological processes which influence recruitment within the vegetation community. In the case of Grey-headed Flying-fox *(Pteropus poliocephalus)* the mature canopy already affords forage habitat. Movement of Koala *(Phascolarctos cinereus)* is impacted within OA AU2 and OA AU3 on account of dense lantana thickets and only mildly impaired within OA AU1.

7.10 Summary of Impact and Offset Results - Habitat

The proportional acquittal for MNES is outlined in **Table 111**. The completed EPBC Offset Calculators for Koala (*Phascolarctos cinereus*) and Grey-headed Flying-fox (*Pteropus poliocephalus*) have been included in **Appendix 16**.

Table 111: Justification of Values Used for Offset Assessment Guide

Species	Total Acquittal
Koala *(Phascolarctos cinereus)*	
Woolshed (**Appendix 16.1**)	85.75%
Thagoona (**Appendix 16.3**)	17.10%
Total	***102.85%***
Grey-headed Flying-fox *(Pteropus poliocephalus)*	
Woolshed (**Appendix 16.2**)	83.67%
Thagoona (**Appendix 16.4**)	16.69%
Total	***100.36%***

7.11 Offset Management Plans

7.11.1 Woolshed Offset Area

Management Units of the proposed Woolshed Offset Area are represented in **Figure 77**. The Offset Management Plan (**OMP**) is a practical document that outlines what must be done to manage an offset site. It details all management activities at the offset site, risks, how progress will be monitored and reported and how corrective actions will be identified and implemented. The Woolshed OMP can be found as **Appendix 12.1**.

To ensure ready activation of offset actions at the Woolshed Offset Area, the Woolshed OMP is supported by two (2) action management plans:

- Vertebrate Pest Management Plan (**VPMP**) – empowered under Action 1 of the Woolshed OMP.

- The VPVMP sets priorities and methods for pest management. This plan is to be implemented during Year 1 of the Offset and be implemented until Year 20. The plan focuses on combining active management with ongoing and routine monitoring to inform ongoing management methods. The IVPMP relies on baseline pest monitoring to inform priorities for management, though such priorities should adapt over time. Management methods revolves around shooting and baiting in tandem with routine monitoring (as well as pest shooting results). This plan will be subject to annual review in line with annual pest monitoring obligations.

- Biosecurity Management Plan (**BMP**) - empowered under Action 2 of the Woolshed OMP.
  - Like the VPMP and Woolshed OMP as a whole, the BMP combines active management with ongoing and routine monitoring to ensure that control is effective and desired weed reductions will be achieved by Year 20. The primary focus of the BMP is through control of dense Lantana (*Lantana camara*) infestations. This BMP consequently sets out steps to achieve reductions, through establishing management tracks/segments, followed by control, follow up monitoring, follow up control and ultimately infill planting of the understorey. Through initial years, weed control will be adaptive, where multiple methods will be trialled and implemented based on the success of such methods. Whilst mechanical and chemical control is discussed in greater detail through the BMP, methods such as livestock introduction and controlled burns will be investigated and implemented. The BMP requires frequent follow-up monitoring (unattached and more often than monitoring associated with annual reporting) to provide ongoing insight on when follow-up treatment or management adaption is required.

7.11.2 Thagoona Offset Area

Management Units of the proposed Thagoona Offset Area are represented in **Figure 78**. Like the Woolshed OMP, the Thagoona OMP is a practical document that establishes objectives and responsibilities for site management, establishes methods for identifying and managing threats, sets out performance tracking and reporting requirements. The Thagoona OMP is underpinned by adaptive management principles that subject all actions to scrutiny of performance and whether better outcomes can be achieved. The Thagoona OMP can be found as **Appendix 12.2**.

8. Social and Economic Impacts of the Proposed Development

8.1 Indigenous Engagement

The Proponent has considered the comments from the National Indigenous Australians Agency (**NIAA**) in relation to Native Title and Cultural Heritage. The concerns raised by the NIAA in relation to vegetation clearing and ground disturbance and conservation of vegetation within the Conservation Areas of the Project Area.

8.1.1 Engagement

Given this and the cultural sensitivity associated with project effects on land, vegetation and fauna, the Proponent has retained a Cultural Heritage Advisor to work with Traditional Owners to prepare an Aboriginal Cultural Heritage Assessment (**ACHA**) and collaborate to jointly develop protocols for identifying, protecting and managing any identified cultural heritage and ecological impacts. The Project's ACHA has advised that the Registered Aboriginal Party for the area is the Quandamooka Yoolooburrabee Aboriginal Corporation (**QYAC**) the prescribed body corporate working for the Quandamooka People. The following outlines the scope of the engagement:

- Undertaking a desktop assessment including searches of the Department of Seniors, Disability Services and Aboriginal and Torres Strait Islander Partnerships Cultural Heritage Database and other local, state and national registers)
- Initial field survey accompanied by representatives of QYAC
- Preparation of a Duty of Care Assessment Report in consultation with QYAC representatives
- Negotiation of a Cultural Heritage Management Plan, if required.

8.1.2 CHA Outcomes

As a result of the desktop assessment and field survey (**Appendix 17**) the following conclusions can be made regarding cultural heritage values associated with the Project Area:

- A search of the Department of Treaty, Aboriginal and Torres Strait Islander Partnerships, Communities, and the Arts (**DTATSIPCA**) Cultural Heritage Database was conducted on 10 July 2024 for the Project Area and surrounds. The DTATSIPCA search identified no registered Aboriginal cultural heritage sites within 1,000m of a suitable search area ('**Study Area'**).
- A pedestrian survey of the Study Area was completed on 29 and 30 July 2024.
- Ground surface visibility (GSV) was restricted (low 0-5%) throughout the Project Area which limited the ability to identify surface cultural material if present.
- No cultural heritage was identified during the field inspection.
- Significant ground disturbance was identified in areas of the Study Area. This was largely in the south, adjacent to Double Jump Road, where current and previous dwellings exist.
- Several mature trees and minimal to no ground disturbance was identified in the northern and eastern portions of the Study Area.
- The eastern portion of the Study Area (Lot 23SP325035) was identified as being a high potential area to contain both surface and subsurface tangible cultural heritage.
- A two day test excavation program was undertaken on 22 and 23 September 2025.
    - A total of eight test pits and 11 scrape tests were completed
    - No tangible cultural heritage was identified

  - The excavations were generally limited due to increased soil moisture content arising from unseasonally heavy rainfall during the four months preceding the assessment, and dense vegetation which hindered vehicle and machinery access

- The Quandamooka People have assessed the Study Area to hold cultural significance. This is derived from the environmental landforms within the Study Area, archival research, field assessment and consultation.

- The Study Area has been split into risk category areas and management recommendations have been formulated based upon these classifications.

The desktop analysis and field inspection suggest it is likely that surface and subsurface Aboriginal cultural heritage may be located within northern and eastern parts of the Project Area (defined as an 'area where there is high risk of surface and subsurface material being present. Much of this area is located within proposed Conservation Areas 1 and 2. It is recommended that archaeological (test-pit) excavations are undertaken in high-risk areas where the project will result in surface disturbance to confirm surface and subsurface potential.

Consultation with QYAC was undertaken throughout the assessment and field survey. No evidence has been provided to suggest that there is any particular Aboriginal story or history associated with the Study Area. However, the environmental values of the area were identified as being of cultural importance to the Quandamooka People People. The proposed test pit management program in parts of the site not previously exposed to ground disturbing activities (i.e. agricultural production) but which will be disturbed by residential development was undertaken. No tangible cultural heritage was identified. The Proponent has committed to following identified QYAC recommendations:

- Site monitoring in high and moderate risk areas ahead of works

- Cultural Heritage finds procedure

- Cultural Heritage induction for contractors

- Development of an Aboriginal human remains procedure.

8.2 Community and Needs Analysis

Located within the ShapingSEQ Urban Footprint, the Proposed Action is consistent with the growth strategy for South East Queensland; a region that is anticipated to grow in population by approximately 75,000 new residents each year, resulting in the need for 30,000 new dwellings each year. The Proposed Action represents a well-integrated and balanced development that responds to the region's growth pressures, the Queensland Government's growth strategy and RCC's land use planning vision.

The Proposed Action is anticipated to bring about a number of social benefits associated with a diversity of housing choice, local and locally-resourced construction work, long-term benefits for fauna movement corridors, and equity (community access, participation and inclusion). While it is acknowledged that there may be potential adverse impacts associated with loss of locally important green space and character of the Project Area, this will be offset through the creation of a master-planned integrated residential community and short-term impacts on the loss of marginal fauna habitat which will be mitigated through the approaches outlined within this PD Report (e.g. **Appendix 4** – Project Area Concept RMP with significant residual impacts offset as outlined by **Appendix 12.1** – Woolshed OMP and **Appendix 12.2** – Thagoona OMP.

8.2.1 Housing Needs Analysis

In 2018 The Double Jump Road Housing Needs Analysis (**Appendix 18**) was undertaken as an assessment input to the VPSP. This was a pre-emptive study which was drawn upon heavily in the development of the project justification component of the development application to RCC. The assessment investigated:

- The housing context for the proposed draft Structure Plan area

- Statement of the relevant State and RCC planning policies applicable to housing in emerging areas
- Housing needs in the area
- Examination of 'on the ground' local conditions that are relevant to application of the housing policies to the Double Jump Road Structure Plan
- Housing market demand indicators
- Proposed housing mix and densities
- Consideration of the applicability of the State and RCC planning policies to the local conditions including how these are met in the proposed Structure Plan
- Examination of the appropriate timing for the Double Jump Road development, and
- Alignment of the proposed housing mix and density with state and local government housing policies, themes and strategies.

The proposed yield and configuration of residential dwelling types assessed by the report was significantly assessed by RCC and the Appeal Process. Therefore, the findings of that report remain current. It concluded that the housing for the area was planned in accordance with the strategies of the SEQRP based on detailed consideration of future housing requirements as modified to suit local conditions. Furthermore, it stated *'once the planning process is complete, there is no residential demand and supply-based reason to exclude the Double Jump Road development…. and hence delay the normal residential development processes.*

8.2.2 Community Engagement

In early 2019, Sutgold teamed up with local residents to help create a shared vision for the new community at the Double Jump Road Residential Estate, Victoria Point. The Double Jump Road Residential Estate Community Engagement Program actively sought input from the community, focussing on families, teens and children.

Through resident surveys, community and school design workshops, community activities, social media interactions, competitions and a series of one-on-one discussions; Sutgold determined community perspectives on the following topics to help guide the development:

- Homes for Redland's' future
- Protecting Redland's' unique character
- Protecting Redland's' unique environment
- Places to Play and Explore
- Improving Victoria Point's Roads.

8.2.3 Economic Benefits Analysis

An Economic Benefits Analysis has been prepared for the Double Jump Road Residential Estate Development by Econosis (2026). This document is attached as **Appendix 19** of this PD report.

8.2.3.1 Context

The Economic Benefits Analysis assesses the contribution associated with the proposed mixed-use residential and activity centre development to the local economy. It has considered both temporary economic activity generated during construction and longer-term operational economic value generated through employment, business productivity and additional household expenditure.

The purpose of this assessment is to quantify the economic contribution of the project across both its construction and operational phases, and to evaluate the long-term economic benefits associated with population growth and increased economic activity. The assessment adopts an Input-Output (I-O) modelling framework, enabling estimation of direct and indirect economic effects across the regional economy.

The analysis considers three core benefit streams:

- Construction phase economic impacts
- Operational economic activity from non-residential uses
- Household expenditure associated with the residential population.

8.2.3.2 Construction Phase Economic Impact

The proposed Double Jump Road Residential Estate Development will generate significant short-term economic activity during the construction period through direct expenditure on building construction, civil works, professional services, and associated supply chain activity.

Construction phase impacts have been estimated using regional economic multipliers developed by Econisis for the Redland City and Queensland economies. These multipliers capture both direct project expenditure and indirect economic flow-on effects across supply chains and supporting industries.

8.2.3.2.1 Approach

At the core of an Economic Impact Assessment (EIA) are Input-Output (I-O) tables, which form part of the Australian Bureau of Statistics national accounting framework and describe the relationships between industries within the economy.

These tables are converted into a series of economic multipliers that estimate the relationship between direct project expenditure and the broader economic activity generated across supply chains and supporting industries.

Economic impacts are measured across four key indicators:

- Output – total economic activity generated
- Income – wages and salaries generated
- Employment – full-time equivalent (FTE) jobs supported
- Gross Value Added (**GVA**) – additional economic value after accounting for intermediate inputs

Impacts are typically presented as:

- Direct impacts – immediate project expenditure
- Indirect impacts – additional activity generated through supply chains and supporting industries

For this assessment, the following multiplier effects are included:

- Initial direct project expenditure
- First-round supply chain impacts
- Industry support impacts from linked sectors

8.2.3.2.2 Construction Cost Assumptions

Construction costs have been estimated using benchmark development cost assumptions due to the absence of a detailed project-specific cost plan (**Table 112**).

Table 112: Construction Phase Economic and Employment Impacts (Total)

Cost Category	Assumption
Residential Construction Cost	$450,806 per dwelling
Civil and Infrastructure Development Cost	$180,230 per dwelling
Retail / Commercial Construction Cost	$3,000 per m^2
Construction GVA Multiplier	21.8%

8.2.3.2.3 Results

The assessment assumes a five-year staged construction period, reflecting progressive residential delivery, with non-residential components constructed in later stages (**Table 113**).

Table 113: Construction Phase Economic and Employment Impacts, Total Impacts

Indicator	Initial Impact	First Round	Industry Support	Total Impact
Output ($million)	$267.80	$155.55	$104.61	$527.96
Income ($million)	$24.85	$33.75	$25.60	$84.20
Employment (FTEs)	86.45	75.38	217.58	379.42
Gross Value Added	$57.05	$58.10	$44.40	$159.55

Based on the estimated construction expenditure profile, the project is expected to generate approximately $527.96 million in total economic output over the construction period. This includes both direct construction activity and indirect supply chain impacts across supporting industries.

Across the five-year construction phase, economic activity associated with the project is estimated to:

- Support approximately 379 full-time equivalent jobs annually
- Generate approximately $84.20 million in labour income
- Contribute approximately $159.55 million in GVA to the regional economy.

On an annualised basis (**Table 114**), construction activity is estimated to generate approximately:

- $105.59 million in economic output per annum
- $31.91 million in gross value added per annum.

Table 114: Construction Phase Economic and Employment Impacts, Annual Impacts

Indicator	Initial Impact	First Round	Industry Support	Total Impact
Output ($million)	$53.56	$31.11	$20.92	$105.59
Income ($million)	$4.97	$6.75	$5.11	$16.84
Employment (FTEs)	86.45	75.38	217.58	379.42
Gross Value Added	$57.05	$11.62	$8.88	$31.91

8.2.3.2.4 Summary

The construction phase of the Double Jump Road Residential Estate Development represents a substantial short-term economic stimulus, generating significant output, income, and employment throughout the regional economy.

The scale of impact reflects both direct construction expenditure and extensive flow-on effects through supply chains, highlighting the project's importance in supporting economic activity during the development period.

8.2.3.3 Non-Residential Operational Economic Value Add

The proposed Double Jump Road Residential Estate Development will generate ongoing economic activity through its non-residential components, primarily delivered via a neighbourhood-scale activity centre. This centre incorporates a diverse mix of retail, commercial, and community service uses designed to support both the resident population and the surrounding catchment.

The operational phase represents a long-term and sustained economic contribution, driven by employment generation and business productivity associated with these uses.

8.2.3.3.1 Employment Estimates

To estimate employment generation, standard industry workspace ratios have been applied across each land use category. Workspace ratios represent the amount of floorspace typically required per full-time equivalent (FTE) employee and provide a widely adopted method for estimating employment outcomes for mixed-use developments. The proposed activity centre comprises approximately 5,550 m^2 of gross floor area, distributed across six complementary land uses (**Table 115**).

Table 115: Development Size and Workspace Ratios by Land Use

Landuse	Floorspace (m^2)	Approx. Employment
Supermarket	1,800	~60
Specialty Retail	1,250	~42
Commercial / Office	200	~6
Medical Consulting	750	~15
Childcare	1,000	~25
Gym / Recreation	550	~5

Landuse	Floorspace (m^2)	Approx. Employment
Total	**5,500**	~153 FTE

The employment profile indicates that job creation is concentrated within retail uses, reflecting the labour-intensive nature of supermarket and specialty retail operations.

- Supermarket and specialty retail uses generate approximately 102 jobs
- Other service-based uses (childcare, medical, recreation) contribute a further ~52 jobs

Overall, the development is estimated to support approximately 153 direct ongoing FTE jobs.

This employment base underpins the ongoing economic contribution of the activity centre and supports its function as a local service and employment hub

8.2.3.3.2 Worker Productivity

The economic contribution of the operational phase has been estimated by applying industry-specific worker productivity benchmarks to the employment generated across each land use category.

Worker productivity represents the average annual GVA per worker, aligned to relevant ANZSIC industry classifications (**Table 116**).

Table 116: Worker Productivity by Land Use by Associated ANZSIC Level 2 Industry, Redland LGA

Landuse	ANZIC Industry	Worker Productivity ($/worker)
Supermarket	Food Retailing	$94,862
Specialty Retail	Other Store-Based Retailing	$82,363
Commercial / Office	Retail Trade	$88,542
Medical Consulting	Health Care Services	$67,114
Childcare	Education	$79,336
Gym / Recreation	Recreation Activities	$61,663

Applying these productivity benchmarks to the employment estimates provides an indication of the annual economic output associated with the activity centre.

8.2.3.4 Household Expenditure GVA

In addition to the direct economic activity generated by the non-residential components, the Double Jump Road Residential Estate Development will generate broader economic benefits through increased household expenditure associated with population growth.

The residential component of the development will introduce additional households into the local catchment, resulting in increased consumption across a range of sectors including retail trade, hospitality, transport, health services, education, recreation, and other household services. This expenditure represents a significant indirect economic benefit to the regional economy, reflecting increased demand generated by new residents.

8.2.3.4.1 Approach

Household expenditure impacts have been estimated using:

- Projected dwelling delivery and associated population growth
- Average household size assumptions
- Annual per capita retail expenditure benchmarks
- To ensure a conservative and robust estimate, an adjustment factor has been applied to account for:
- Expenditure already captured within the activity centre's operational GVA
- Potential leakage of spending outside the immediate local catchment

This approach reduces the risk of double counting between household expenditure benefits and direct operational economic activity. Household expenditure inputs and results are shown as **Table 117**.

Table 117: Household Expenditure Inputs and Results

Input Assumption	Value
Total Additional Population	1,035 persons
Annual Per Capita Retail Expenditure	$16,084
Adjustment Factor	65%
Adjusted Economic Contribution	$10.82 million
Annual Phased Benefit (during construction)	$2.16 million

As residential development is delivered progressively over the five-year construction period, household expenditure benefits are also expected to increase incrementally:

- In the early stages of development, annual benefits are estimated at approximately $2.16 million
- As additional dwellings are completed and occupied, expenditure increases each year
- Once fully developed, the residential population generates approximately $10.8 million in annual economic contribution.

8.2.3.4.2 Phasing of benefits

As residential development is delivered progressively over the five-year construction period, household expenditure benefits are also expected to increase incrementally:

- In the early stages of development, annual benefits are estimated at approximately $2.16 million
- As additional dwellings are completed and occupied, expenditure increases each year.

Once fully developed, the residential population generates approximately $10.8 million in annual economic contribution.

8.2.3.4.3 Summary

The household expenditure component represents a significant source of indirect economic value, complementing both construction and operational impacts. Key outcomes include:

- Approximately $10.8 million in annual economic contribution at full development
- Progressive growth in benefits aligned with population delivery
- Increased demand across retail, service, and consumer sectors.

Overall, household expenditure plays a critical role in reinforcing the development's long-term economic contribution, supporting local businesses, reducing expenditure leakage, and enhancing economic activity across the broader Redland City region.

8.2.3.5 Benefits Assessment

To assess the long-term economic value generated by the Double Jump Road Residential Estate Development, a discounted economic benefit assessment framework has been applied.

This approach differs from a traditional Cost Benefit Analysis (**CBA**), as it focuses specifically on quantifying the economic benefits generated by the development over time, rather than comparing total project costs and benefits. The analysis provides an indication of the broader contribution of the development to the regional economy over the long term. The assessment incorporates three primary benefit streams:

- Construction Phase GVA, representing economic value generated during the project delivery period
- Non-Residential Operational GVA, reflecting ongoing economic activity associated with employment and business operations within the completed development
- Household Expenditure Contribution, representing additional economic activity driven by population growth and associated consumption

To enable comparison over time, future benefits have been converted into present value terms using standard discounting techniques. This reflects the principle that economic benefits received in the future are valued less than those received in the present.

Consistent with established economic appraisal practice, the following discount rates have been applied over a 20-year assessment period:

- 4% (low scenario)
- 7% (central / standard case)
- 10% (high scenario).

8.2.3.5.1 Assessed Benefits

The benefit streams included in the analysis are summarised in **Table 118** below.

Table 118: Summary of Assessed Economic Benefits

Benefit Category	Assessment Approach
Construction Phase GVA	Economic value generated through construction activity over the five-year development period, including direct expenditure and supply chain effects.

Benefit Category	Assessment Approach
Non-Residential Operational GVA	Ongoing annual economic contribution generated by employment across retail, commercial, and service uses, based on productivity benchmarks.
Household Expenditure Contribution	Additional economic activity generated by increased population and associated household spending, adjusted to avoid overlap with operational impacts.

8.2.3.5.2 Assessed Benefits

The assessment demonstrates that the proposed development will generate significant long-term economic benefits across all three categories.

Over a 20-year period, total economic benefits (in present value terms) are estimated at:

- $309.9 million under a 4% discount rate
- $240.0 million under a 7% discount rate
- $191.8 million under a 10% discount rate.

At the central discount rate of 7%, the total present value of benefits is approximately $240.0 million.

The distribution of benefits indicates that:

- Operational economic activity represents a major component of total value, driven by sustained employment and business productivity
- Household expenditure benefits are similarly significant, reflecting population growth and increased demand for goods and services
- Construction phase impacts, while substantial, are limited to the delivery period and represent a smaller share of long-term value.

Table 119 summarises the present value of economic benefits generated by the development over the 20-year assessment period.

Table 119: Present Value of Economic Benefit Assessment

Benefit Category	Nominal	4%	7%	10%
Construction GVA	$58.1m	$53.8m	$51.0m	$48.5m
Operational GVA	$207.3m	$129.1m	$93.4m	$69.2m
Household Expenditure	$194.7m	$127.0m	$95.7m	$74.1m
Total Benefit	**$460.2m**	**$309.9m**	**$240.0m**	**$191.8m**

In nominal (undiscounted) terms, total economic benefits are estimated at approximately $460.2 million over the 20-year assessment period.

8.2.3.5.3 Summary

The benefits assessment confirms that the Double Jump Road Residential Estate Development will deliver a substantial and sustained economic contribution at both the local and regional level. Key findings include:

- Strong overall economic benefit of approximately $240 million (present value at 7%)
- A balanced mix of short-term (construction) and long-term (operational and household) benefits
- Significant contribution from ongoing business activity and population-driven demand

Overall, the results demonstrate that the development provides enduring economic value, supporting employment, business activity, and long-term economic growth within the surrounding region.

8.2.3.6 Wider Economic and Community Benefits

In addition to the direct economic impacts quantified through construction, operational activity, and household expenditure, the Double Jump Road Residential Estate Development is expected to deliver a range of broader economic and community benefits.

These wider benefits are not easily quantified in monetary terms but represent important outcomes that contribute to the overall economic functioning and liveability of the Victoria Point and broader Redland City catchment.

8.2.3.6.1 Economic Benefit

The development will contribute to strengthening the local economy through several key mechanisms:

- Increased employment self-sufficiency. The provision of local jobs within the activity centre will reduce reliance on external employment centres, enabling a greater proportion of residents to work within the local area.
- Reduced expenditure leakage. By delivering a range of retail and service-based uses, the development will retain a greater share of household spending within the local economy, reducing the need for residents to travel to competing centres.
- Business formation and investment opportunities. The introduction of commercial and service tenancy space will create opportunities for new businesses to establish within the precinct, supporting local entrepreneurship and investment.
- Economic diversification. The inclusion of retail, health, childcare, and recreation services will broaden the local economic base, reducing reliance on a narrower range of industries and enhancing economic resilience.
- Population-driven economic activity. The increase in local population will generate ongoing demand for goods and services, supporting sustained economic growth within the surrounding area.

8.2.3.6.2 Community Benefit

The development will also deliver a range of important community outcomes, improving accessibility, convenience, and overall quality of life for residents. Key community benefits include:

- Improved access to services and amenities. The provision of conveniently located retail, health, and community services will enhance accessibility for both new and existing residents.
- Increased housing supply. The delivery of additional dwellings will support population growth and contribute to meeting housing demand within the Victoria Point catchment.
- Reduced travel demand. By providing local access to essential goods and services, the development will reduce the need for residents to travel outside the area, contributing to improved convenience and reduced transport pressures.
- Enhanced access to childcare, health, and recreation services. The inclusion of these facilities supports community wellbeing and caters to the needs of a growing residential population.

- Strengthening of Victoria Point as an activity centre. The development will reinforce the role of Victoria Point as an emerging mixed-use centre within the Redland City urban structure, supporting its function as a local service and employment node.

8.2.3.6.3 Summary

The Double Jump Road Residential Estate Development will deliver a broad range of wider economic and community benefits that extend beyond its direct measurable impacts. These benefits include:

- Strengthening of the local economic base
- Improved local employment opportunities
- Enhanced service accessibility
- Increased housing supply and population support
- Reinforcement of the local activity centre network.

Collectively, these outcomes contribute to improved economic resilience, community wellbeing, and long-term sustainability, supporting the continued growth and development of the Redland City region.

8.2.3.7 Conclusion

The Economic Impact Assessment demonstrates that the Double Jump Road Residential Estate Development will deliver substantial economic value across both the short and long term.

During construction, the project provides a significant economic stimulus, supporting employment, income, and supply chain activity. Upon completion, the development establishes a sustainable local activity centre, generating ongoing employment and business productivity while supporting increased household expenditure associated with population growth.

With an estimated $240 million in present value economic benefits over 20 years (at a 7% discount rate), the development represents a high-value regional investment. It is expected to play a key role in supporting economic growth, improving service accessibility, and enhancing the overall liveability and economic resilience of the Redland City region.

8.3 The Proponent's Environmental Record, and Capacity to Deliver on the Mitigation and Offset Commitments

With over 26 years residential development experience in South East Queensland, Sutgold Pty Ltd (the Proponent) and its related entities (Fiteni Homes, Fiteni Developments and Edgarange Pty Ltd) have an established reputation for the delivery of residential development in the Redlands / Moreton Bay region area of South East Queensland. There have been no proceedings against Sutgold Pty. Ltd. or any of the executive officers of the company under Commonwealth or State law in relation to environmental matters, or the conservation and sustainable use of natural resources. The executive officers are committed to environmental stewardship and achieving balanced environmental outcomes in an environmentally responsible manner.

Fiteni Homes (ABN 59010272849), Fiteni Developments (ABN 59010272849) are brand names, registered as business names that do not trade in their own right. Fiteni Homes and Fiteni Developments are registered as trading names for Edgarange PTY LTD (ABN 59010272849). The trading businesses that sit behind the Fiteni brands are:

- Edgarange Pty Ltd - which owns undeveloped and developed land and sells developed land parcels and completed spec homes to customers.
- Sutgold Pty Ltd has three main purposes:

- runs the day-to-day Fiteni business - employs staff, runs administration, etc.
    - builds and sells custom homes for clients
    - has a development agreement with Edgarange Pty Ltd to manage the development of land.

There are no past or present proceedings under Commonwealth or State law for the protection of the environment or the conservation and sustainable use of natural resources against the person proposing to take the action, an executive officer of the person proposing to take the action or a related body corporate of the person proposing to take the action.

9. How the Proposed Action Achieves Ecologically Sustainable Development

Section 3A of the EPBC Act sets out the principles of ESD. The Proposed Action achieves these principles as follows:

(a) decision-making processes should effectively integrate both long and short-term economic, environmental, social and equitable considerations

Environmental considerations have been set out within the main body of this PD Report. The Proposed Action will achieve positive social and economic outcomes. Environmental impacts will occur, but these will be mitigated by the provision of compensatory habitat and habitat corridors, and other contemporary environmental management measures. In this light, the Proposed Action achieves an appropriate balance of environmental, social and economic needs.

(b) if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation

The ecological assessment supporting this application provides adequate information for decision making. Where knowledge gaps exist, the precautionary principle has been adopted. The final layout has been developed through a Planning and Environment Appeal with joint experts representing the Appellant and the Respondent conclaving together to optimise avoidance and mitigation measures. This rigorous process is iterative and produces practical outcomes that ensure projects avoid, minimise and mitigate potential impacts in an appropriate manner.

(c) the principles of inter-generational equity – that the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations

The Proposed Action will contribute to the provision of sustainable population growth and affordable housing in South East Queensland, while maintaining environmental values through the avoidance, mitigation and offset measures described in this PD Report.

(d) the conservation of biological diversity and ecological integrity should be a fundamental consideration in decision making

Biological diversity and ecological integrity will be maintained via the avoidance, mitigation and offset measures proposed in this PD Report. The conservation of biological diversity and ecological integrity was a major consideration in the design evolution for the Proposed Action.

(e) improved valuation, pricing and incentive mechanisms should be promoted.

Not relevant to the Proposed Action.

10. Conclusion

This PD Report has presented an assessment of the Proposed Action in response to the DEECCW's Information Request under the EPBC Act (**Appendix 1**). Specifically, this PD Report has examined the potential impacts of the Proposed Action on three (3) MNES species.

The Proposed Action represents a contemporary residential development located within a strategic growth corridor of South East Queensland. The Project Area has been subjected agricultural pursuits 1940s and has been used primarily for rural purposes and subject to disturbance and degradation since this period; in the 1940s it was partially cleared, however by 1978 it was almost devoid of former preclear canopy cover. Consequently, the ecological value of the Site has been considerably compromised.

Nevertheless, the Site does play some role in the provision of habitat for a variety of species, including the Koala *(Phascolarctos cinereus)* and Grey-headed Flying-fox *(Pteropus poliocephalus)*; as some areas of mature vegetation do provide habitat and foraging resources for both species. However, the primary function of the Site within the landscape is the facilitation of movement for Koala *(Phascolarctos cinereus)* and other species along the Moogurrapum Creek corridor.

The current plan of development has been designed to achieve significant dedication of land for open space and conservation purposes – this represents a significant commitment to the retention and restoration of the local environment and its values for MNES. Importantly, the design and location of the Eastern Enhancement Corridor is such that the highest-quality mature vegetation is preserved and key movement corridors within the Site have been retained and proposed for enhancement works as part of the Proposed Action.

This PD Report has demonstrated that the Site provides a minor role in habitat provision for two (2) MNES of interest. Of the MNES species (Koala *(Phascolarctos cinereus)* and Grey-headed Flying-fox (*Pteropus poliocephalus*)):

- The Koala *(Phascolarctos cinereus)* is known to exist within the Project Area at low densities. Through a careful and considered approach to the Proposed Action design (retention, consolidation and restoration of the Eastern Enhancement Corridor and its buffering by 'soft' complimentary open space and recreation uses), and directional and supervised clearing and construction works (the removal of vegetation to occur under the supervision of a Fauna Spotter Catcher), the Proposed Action will mitigate some of the impacts on Koala *(Phascolarctos cinereus)*.

- While there are no mapped or identified flying fox roosts over the Project Area, or within 4 km of the site, the Project Area may be utilised in an ad-hoc or transient fashion by local Grey-headed Flying-fox *(Pteropus poliocephalus)*. The retention, protection and enhancement of the existing mature winter and spring blossoming resources within the enhancement corridors by virtue will continue to offer ad-hoc utilisation of the site by any transient individuals.

- The historic disturbance of the Project Area is of importance for determining the likely occurrence of species dependent on mature forest, in particular a third MNES, the South-eastern Glossy Black Cockatoo (*Calyptorhynchus lathami lathami*). The Project Area and connected habitat retain only a very small extent of remnant vegetation (<3.7% of the Project Area, the remainer being non-remnant). South-eastern Glossy Black Cockatoo (*Calyptorhynchus lathami lathami*) has not been recorded from the Project Area, nor from adjoining development sites. The South-eastern Glossy Black Cockatoo (*Calyptorhynchus lathami lathami*) is listed as a 'vulnerable' species under the EPBC Act.

- The Project Area is heavily disturbed with hollow bearing paddock trees and young regrowth Black She-oak (*Allocasuarina littoralis*) present. There is no dispute that both these elements could be potential habitat. Inspection of sighting records for the species are associated with better intact habitat to the south and south-west. Site based assessments over a number of years and seasons failed to identify activity of the species within or adjoining the Project Area by direct observation or indirectly by calls or observation of 'orts' (chewed seed cones of She-oaks). Hollows at the location are subject to interspecific competition from Brushtail Possum (*Trichosurus vulpecula*), Ringtail Possum (*Pseudocheirus peregrinus*), Sulphu-crested Cockatoos (*Cacatua galerita*), *Corellas* and other species. These gregarious edge and disturbance adapted species are known to competitively exclude Glossy Black Cockatoo from breeding sites. On this basis, it is our opinion that the South-eastern Glossy Black Cockatoo (*Calyptorhynchus lathami lathami*) does not now, nor will in the future, utilize the Project Area if the sites status quo is maintained.

Despite this, the South-eastern Glossy Black Cockatoo (*Calyptorhynchus lathami lathami*) cannot be completely dismissed as a potential occurrence at the Project Area, but our surveys show that the development footprint lacks important habitat relied upon by this species. Nonetheless, it has been relevant to pursue some mitigation for any relevant habitat that may be lost; and such habitat is protected within the Moogurrapum Creek (Eastern Enhancement) Corridor.

Notwithstanding, the establishment of residential development directly and indirectly impacting 32.57 ha of land within the Project Area will lead to a residual impact on these identified species, despite the avoidance, minimisation and mitigation measures proposed by the Proponent. This residual impact will be offset through a combination of off-site offset delivery (the OMPs in **Appendix 12**) and other measures, including utilisation of Safe Movement Solutions and Wildlife Management Infrastructure throughout the site.

The Proponent is highly motivated to achieve ESD through the delivery of the Proposed Action. This PD Report concludes that such an outcome is likely to occur through the approval of the Proposed Action with appropriate conditions that capture the commitments made within this assessment.

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