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Great Eastern Highway Upgrade Project SLK 56.4-67.8 EPBC 2022/9151

Offset Strategy

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EXECUTIVE SUMMARY

Main Roads Western Australia (Main Roads) proposes to upgrade a section of Great Eastern Highway (GEH) between Straight Line Kilometre (SLK) 56.4 and 67.8 (the Great Eastern Highway Upgrade Project, the Proposed Action). The Proposed Action is located approximately 56 kilometres (km) east of Perth and 25 km west of Northam in Western Australia (WA). The Development Envelope (DE) comprises an area of approximately 35.15 hectare (ha) and represents the impact footprint within which all development will be contained.

Currently, GEH is a sealed two-lane rural road and is the main east/west link between Perth, Kalgoorlie and Adelaide. The highway provides a major transport link and forms part of the Perth - Adelaide Corridor and supports social and economic integration between the west and east of Australia. In some cases, GEH is the sole connection between a large number of remote communities and the Perth metropolitan area. GEH is a heavy haulage route and is an essential route for the international transport logistics chain for mining, agriculture and other export industries.

The Proposed Action aims to improve the efficiency and safety of this section of the GEH by widening of the alignment, intersection improvements and additional overtaking lanes.

As the Proposed Action may have a significant impact on Matters of National Environmental Significance (MNES) (Commonwealth of Australia, 2013), Main Roads has prepared Preliminary Documentation to inform the assessment of the relevant impacts of the Proposed Action (Main Roads 2024a). This Preliminary Documentation was prepared in response to a request by the Department of Climate Change, Energy, the Environment and Water (DCCEEW) for the Proposed Action (EPBC 2022/9151) under the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The Proposed Action is expected to have the following significant residual impacts:

- Loss of 15.7 ha of Carnaby's Cockatoo foraging habitat
- Loss of 15.6 ha of Baudin's Cockatoo and Forest Red-tailed Black Cockatoo (FRTBC) foraging habitat
- Loss of 400 potentially suitable Black Cockatoo breeding trees (but no suitable breeding hollows).

The DE for the Proposed Action has been refined to avoid impacts to suitable diameter at breast height (DBH) trees with hollows suitable for Black Cockatoo breeding. The Proposed Action will not impact known roosting habitat and is not expected to have any significant residual indirect impacts to Black Cockatoo breeding and roosting.

This Offset Strategy is intended to support the Preliminary Documentation for EPBC 2022/9151 Great Eastern Highway Upgrade Project to demonstrate Main Roads' commitment to offset significant residual impacts to Carnaby's Cockatoo, FRTBC and Baudin's Cockatoo.

A summary of the potential offset package to counterbalance the significant residual impacts resulting from the Proposed Action is provided in Table ES-1 and Table ES-2.

Preliminary offset calculations were completed using the EPBC Act Offset Assessment Guide calculator to determine the offset packages being considered. These calculations indicate the offset package is expected to provide adequate compensation for the significant residual impacts arising from the Proposed Action (Table ES-1 and Table ES-2). The Offset Strategy will be refined subject to consultation with DCCEEW.

Table ES-1: Overall summary of the offset package

Offset type	Offset summary	Property Location	Existing tenure
Land acquisition and on ground management	Acquisition and revegetation of 29.1 ha of Moderate to High quality foraging habitat suitable for the three listed species of Black Cockatoo	Lot 704 Great Eastern Highway, Copley	Purchased and owned by the Commissioner of Main Roads
Installation of watering station	Installation of permanent elevated watering station to encourage breeding and roosting within local area, if water availability is a limitation for these activities	Lot 704 Great Eastern Highway, Copley	Purchased and owned by the Commissioner of Main Roads

Table ES-2: Summary of the offset package for each Black Cockatoo species

MNES	Habitat	Impact Value	Offset Package (EPBC Act Calculator)
Carnaby's Cockatoo	Foraging, breeding and roosting	15.7 ha x quality 6 = 9.542 ha	29.1 ha = 100.12 % of impact offset Installation of a permanent elevated drinking water station
Baudin's Cockatoo	Foraging and roosting	15.6 ha x quality 6 = 9.36 ha	29.1 ha = 100.76 % of impact offset Installation of a permanent elevated drinking water station
FRTBC	Foraging, breeding and roosting	15.6 ha x quality 6= 9.36 ha	29.1 ha = 122.90 % of impact offset Installation of a permanent elevated drinking water station

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1 INTRODUCTION

1.1 Proposed Action background

Main Roads Western Australia (Main Roads) proposes to upgrade a section of Great Eastern Highway (GEH) between Straight Line Kilometre (SLK) 56.4 and 67.8 (the Proposed Action). The Proposed Action is located approximately 56 kilometres (km) east of Perth and 25 km west of Northam in Western Australia (WA).

Figure 1 presents the Proposed Action location and Development Envelope (DE). The DE comprises an area of approximately 35.15 hectares (ha) and represents the impact footprint within which all development will be contained.

Currently, GEH is a sealed two-lane rural road and is the main east/west link between Perth, Kalgoorlie and Adelaide. The highway provides a major transport link and forms part of the Perth - Adelaide Corridor and supports social and economic integration between the west and east of Australia. In some cases, GEH is the sole connection between a large number of remote communities and the Perth metropolitan area. GEH is a heavy haulage route and is an essential route for the international transport logistics chain for mining, agriculture, and other export industries.

The 10.49 km Coates Gully section of GEH has very poor alignment, which is severely affecting the safety and efficiency of the highway. This route has been identified as the third riskiest road in regional WA for three RAC surveys (RAC 2017, 2019 and 2022[1]), owing to the poor road condition and lack of overtaking opportunity. Of particular concern is the inadequate road formation and seal widths, and the narrow or absent shoulders.

The Proposed Action aims to improve the efficiency and safety of this section of the GEH by widening of the alignment, intersection improvements and additional overtaking lanes. The Proposed Action will also include drainage, kerbing and culvert upgrades and the installation of a safety barrier.

As the Proposed Action may have a significant impact on Matters of National Environmental Significance (MNES) (Commonwealth of Australia, 2013), Main Roads has prepared Preliminary Documentation to inform the assessment of the relevant impacts of the Proposed Action (Main Roads, 2024a). This Preliminary Documentation was prepared in response to a request by the Department of Climate Change, Energy, the Environment and Water (DCCEEW, formerly the Department of Agriculture, Water and Environment [DAWE]) on 13 April 2022 and subsequent request in December 2022 and August 2024, for additional information to support assessment of impacts for the Proposed Action (EPBC 2022/9151) under the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act).

1.2 Proposed Action description

The key components of the Proposed Action include:

- Reconstruction and realignment of GEH to widen the existing 9 metre (m) road formation to a 12 m formation
- Additional westbound and eastbound overtaking lanes
- Intersection improvements at Bodeguero Way, Wariin Road, Chedaring Road, Hawke Avenue, Inkpen Road, Coates Road and Oyston Road
- Removal and relocation of all rest areas / parking bays within the DE
- Upgrade to drainage, kerbing, culverts and installation of safety barrier.

[1] https://rac.com.au/about-rac/community-programs/risky-roads

The Proposed Action's DE comprises an area of approximately 35.15 ha and represents the maximum impact footprint within which all development will be contained (Figure 1). Up to 15.7 ha of vegetation will be cleared, noting that the clearing of this vegetation will be minimised as much as practicable throughout the design and construction of the Proposed Action.

1.3 Purpose of this strategy

The Preliminary Documentation concluded the Proposed Action would result in the following significant residual impacts:

- Loss of 15.7 ha of Carnaby's Cockatoo foraging habitat
- Loss of 15.6 ha of Baudin's Cockatoo and Forest Red-tailed Black Cockatoo (FRTBC) foraging habitat
- Loss of 400 potentially suitable Black Cockatoo breeding trees (but no suitable breeding hollows).

The DE for the Proposed Action has been refined to avoid impacts to suitable diameter at breast height (DBH) trees with hollows suitable for Black Cockatoo breeding. The Proposed Action will not impact known roosting habitat and is not expected to have any significant residual indirect impacts to MNES, including Black Cockatoo breeding and roosting habitat.

At a state level, clearing permit CPS 9838/1 was granted on 9 July 2024 under section 51E(1) of the *Environmental Protection Act 1986* (the EP Act).

This Offset Strategy is submitted for approval under the EPBC Act and is intended to support the Preliminary Documentation for EPBC 2022/9151 Great Eastern Highway Upgrade Project and details how the significant residual impacts to Carnaby's Cockatoo, FRTBC and Baudin's Cockatoo will be offset. The strategy aligns with the Offset Strategy conditioned with clearing permit CPS 9838/1 under section 51E(1) of the EP Act.

Table 1 details the request for additional information and the relevant sections within this strategy that this information can be found.

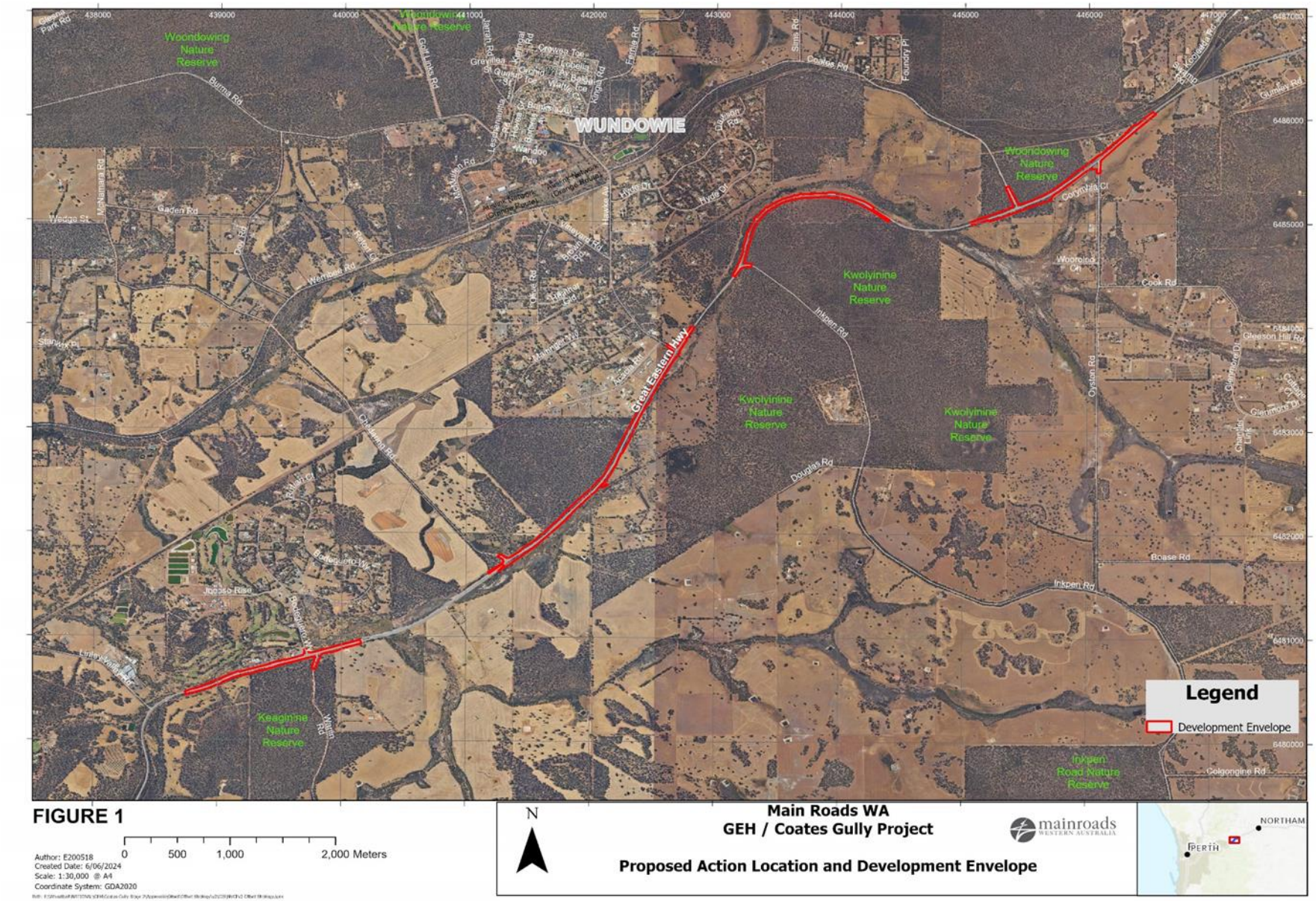

Figure 1 Proposed Action Location and Development Envelope

Table 1 Request for Additional Information

Information Requested	Section
An offset is required to compensate for all predicted or potential residual significant impacts (direct and indirect) to EBPC Act listed threatened species, including Baudin's Cockatoo, Carnaby's Cockatoo and FRTBC. Please provide an offset proposal that meets the principles of the EPBC Act Environmental Offsets Policy (2012). The offset proposal must include, but not be limited to, the following:	
A description of the proposed offset site(s) including location, size, current condition and relevant ecological / species habitat features, landscape context and cadastre boundaries of the offset site(s), supported by mapping which meets the guide for providing maps and boundary data for EPBC Act projects.	Section 3.1
Baseline survey information to determine the presence of Carnaby's Cockatoo, Baudin's Cockatoo and Forest Red-tailed Black Cockatoos and the extent and quality of the habitat at the offset site(s) in accordance with the various Departmental guidelines and conservation advice or using a scientifically robust and repeatable methodology.	Section 3.1
Evidence of the presence of, or usage by, relevant protected matter(s) on, or adjacent to the offset site(s), and the presence and quality of habitat for protected matter(s) on the offset site. These details should be based on recent site surveys or analysis of available contemporary site data, reference to research, studies or other publications relevant to the protected matter(s) and include reference to the site survey and habitat assessment methodology used for the impact site.	Section 2.2.2 Section 3.1
An outline of the management and monitoring strategies and actions proposed to ensure the offset site attains and / or maintains the same or better habitat quality as the quality of the impact site.	Section 3.1.5
Current and likely future tenure of the proposed offset site and details of how the offset site will be legally secured for the full duration of the impact.	Section 3.1.2 Section 5.1
Justification of how the offset proposal meets the requirements of the EPBC Act Offsets Assessment Policy.	Sections 5.1
If possible, details and justification demonstrating how the proposed direct offset will maintain or improve the viability of the protected matter(s) consistent with the EPBC Environmental Offsets Policy. This includes:	
A conservative estimate of the offset completion criteria (i.e. environmental outcomes) to be achieved, and reasoning for these in reference to Baudin's Cockatoo, Carnaby's Cockatoo and FRTBC.	Section 3.1.3
Milestones to demonstrate adequate progress towards achieving the offset completion criteria.	Section 3.1.5
Specific environmental management activities and mitigation measures that will attain and maintain the completion criteria, including the management of threats to relevant species and the timing of actions. Examples of specific activities are as follows: • Complete the planting, and ensure a survival rate of 90 %, of at least 15,000 seed, sapling or tube stock (or equivalent) food tree species within 5 years following commencement of the action reduce the invasive weed coverage on the offset site to 5 % within 5 years following commencement of the action • Implement an annual non-native feral pest control program over a 10-year period	Section 3.1.5
Identification of satisfactory environmental offsets	
A satisfactory environmental offset is required to counterbalance the residual significant environmental impacts as detailed in Principle 1 of the WA Environmental Offsets Policy (2011).	Section 3.1.1 Section 3.1.3 Section 4

2 PREDICTED IMPACTS OF THE PROPOSED ACTION

2.1 Controlling provisions

The Proposed Action has been determined a Controlled Action under the EPBC Act due to the likelihood of significant impacts on listed threatened species and communities (Sections [s] 18 and 18A of the EPBC Act (Commonwealth Government of Australia, 1999). The Preliminary Documentation (Main Roads, 2024a) concludes the Proposed Action will result in significant residual impacts to the following listed threatened species:

- Carnaby's Cockatoo (*Zanda latirostris* formerly *Calyptorhynchus latirostris*) – Endangered
- Baudin's Cockatoo (*Zanda baudinii* formerly *Calyptorhynchus baudinii*) – Endangered
- FRTBC (*Calyptorhynchus banksii naso*) – Vulnerable.

The Preliminary Documentation (Main Roads 2024a) provides details of the predicted impacts of the Proposed Action to the above MNES. This information is summarised below.

2.2 Existing environment

2.2.1 Survey effort

A number of field assessments were undertaken for the Proposed Action. A summary of survey effort and methodology relevant to the significant residual impacts discussed within this Offset Strategy is detailed in Table 2 below.

Adequacy of surveys

The biological surveys undertaken for the DE and its vicinity included a targeted Black Cockatoo habitat assessment in accordance with the EPBC Act referral guidelines (DSEWPaC 2012b) and consistent with the intent of the referral guideline for the three WA threatened Black Cockatoo species (DAWE, 2022).

The Bamford (2015, revised 2021) survey was undertaken in October 2015 and the Biologic (2021) survey was undertaken in October and November 2020. Both surveys occurred during the breeding season and included observations of occupancy (visual and aural), foraging residues, foraging species, potential roosting trees, suitable DBH trees (i.e. ≥300 mm or ≥500 mm) and identification of hollows.

The Bamford survey report was further revised in 2021, following the initial 2015 study. This revision included further assessment of potential impacts and recommendations to minimise these impacts.

Table 2 Survey Effort and Methodology

Report name	Survey methodology
Great Eastern Highway Coates Gully (Stage 1 and 2) Project: Detailed Flora and Vegetation Report (360 Environmental, 2020)	A detailed single season flora and vegetation survey was undertaken over a 59 ha survey area, with field visits from the 9th to the 11th October 2019. The field survey included an assessment of seven quadrats, five relevés, mapping notes, vegetation condition notes, opportunistic flora collections, observations and a targeted Priority flora search. The survey area was traversed on foot and opportunistic collections were made to identify significant flora.
Coates Gully Recheck *Phytophthora* dieback occurrence assessment – Version 1.0 (Glevan Consulting, 2020)	The presence of *Phytophthora* dieback was assessed over an 86.5 ha survey area, on Chidlow-York Road. No new *Phytophthora* dieback infestations were identified during the recheck and no changes were made to the boundaries of the two existing infestations and the total infested area remained at 0.93 ha. The only change was the addition of a temporarily uninterpretable (protectable) section where part (2.19 ha) of a previously protectable uninfested area had been burnt.
Great Eastern Highway SLK 55.8-68.5 Fauna and Black Cockatoo Habitat Assessment (Bamford 2015, revised 2021)	A targeted fauna assessment (including a Black Cockatoo habitat assessment) was undertaken over a 229 ha survey area, with field surveys conducted on the 5th, 6th and 8th of October 2015. The objective of the assessment was to identify key fauna values including critical breeding, foraging and roosting habitat for Black-Cockatoos and the potential for other conservation significant fauna species to occur in the area was also assessed during field investigations. From the initial 2015 study further assessment of potential impacts and recommendations to minimise these impacts was presented as part of the January 2021 review of the report.
H005 Great Eastern Highway Coates Gully (SLK 56.4-67.8) Biological Survey (Biologic, 2021)	Biologic undertook a desktop assessment, single season Detailed flora and vegetation survey, targeted flora, basic terrestrial vertebrate fauna survey and targeted Black Cockatoo habitat assessment over a 16.1 ha survey area. The detailed and targeted flora and vegetation survey was undertaken on the 21st and 23rd of October, and the 20th November 2020. The basic terrestrial vertebrate fauna survey and Black Cockatoo habitat assessment was undertaken on 24th and 30th November 2020.
Black Cockatoo Breeding Hollow Inspection, Coates Gully, Wundowie (T. Kirkby, 2021)	A detailed inspection of possible Black Cockatoo breeding hollows, based on hollows located during the Biologic (2021) survey, was undertaken on 8 and 9 June 2021. A total of 70 hollows located in 40 trees were assessed.
Black Cockatoo Breeding Hollow Inspection, Coates Gully, Wundowie (T. Kirkby, 2022)	A detailed inspection of possible Black Cockatoo breeding hollows, based on hollows located during the Bamford (2015, revised 2021) survey, was undertaken on 16 August 2022. A total of 22 trees containing hollows were assessed.
Survey Of Potential Black Cockatoo breeding habitat, Lot 4154, Coates Gully (T. Kirkby, 2023)	A detailed inspection of trees at Lot 4154, Great Eastern Highway, Coates Gully, for the presence of Black Cockatoo breeding hollows and breeding habitat trees was undertaken on 8 November 2023. A total of 100 trees above the required DBH were located, with five hollows deemed possible Black Cockatoo breeding hollows when viewed from ground level.

2.2.2 Black Cockatoos

Observation of presence

Carnaby's Cockatoo, Baudin's Cockatoo and FRTBC were identified during the field surveys undertaken within the DE by Bamford in 2015 (revised 2021) and Biologic in 2021. These species were observed by direct observation and foraging evidence.

Carnaby's Cockatoo was recorded during the Biologic (2021) field survey via direct observation of individuals, as well as nine instances of foraging evidence (chewed marri nuts and *Allocasuarina* nuts). The species was also recorded on multiple occasions during the Bamford (2015, revised 2021) survey, with two separate mixed flocks of seven and four individuals of Carnaby's and Baudin's Cockatoo observed, as well as two instances of foraging evidence.

Baudin's Cockatoo was recorded during the Biologic (2021) field survey via three instances of chewed marri nuts characteristic of Baudin's Cockatoo. The species was also recorded on multiple occasions during the Bamford (2015, revised 2021) survey as described above.

FRTBC was recorded during the Biologic (2021) field survey on multiple occasions, with two groups of two birds recorded, as well as a single bird. In addition, 21 instances of foraging evidence (both marri and jarrah nuts) were recorded. The Bamford (2015, revised 2021) survey recorded two groups of FRTBC, with a pair flying in a westerly direction, and a group of four individuals perched in a wandoo tree. In addition, Bamford (2015, revised 2021) also observed FRTBC via foraging evidence.

Foraging habitat

The surveys (Bamford 2015, revised 2021 & Biologic, 2021) recorded foraging residuals from all three species of Black Cockatoo within the DE (via observations of chewed nuts). Core primary foraging resources were present including marri and jarrah, as well as secondary foraging species such as *Allocasuarina*, *Hakea*, and blackbutt. The Biologic (2021) survey with reference to Bamford (2015, revised 2021) assigned foraging habitat as either 'High' quality, 'Medium' quality and 'Low' quality, as presented in Table 3 for all three species. The Bamford Foraging Scoring Model (Bamford 2020) was followed by Bamford (2015, revised 2021) and Biologic (2021).

Table 3 Black Cockatoo foraging habitat within the Development Envelope

Habitat value	Carnaby's Cockatoo		Baudin's Cockatoo		Forest Red-tailed Black Cockatoo	
	Area (ha)	Proportion (%)	Area (ha)	Proportion (%)	Area (ha)	Proportion (%)
High Quality	1.4	3.9	1.4	3.9	1.4	3.9
Medium Quality	12.5	35.5	12.5	35.5	12.5	35.5
Low Quality	1.8	5.1	1.7	4.8	1.7	4.8
Nil Quality	19.45	55.3	19.55	55.6	19.55	55.6
Total	35.15	100	35.15	100	35.15	100

The survey (Biologic, 2021) indicated that the DE comprises 1.4 ha of High quality, 12.5 ha of Medium quality and 1.8 ha of Low quality foraging habitat for Carnaby's Cockatoo and 1.4 ha of High quality, 12.5 ha of Medium quality and 1.7 ha of Low quality foraging habitat for Baudin's Cockatoo and FRTBC. The remainder of the DE ('Nil' quality) is not assessed as foraging habitat for Black Cockatoos (Figure 2, Figure 3, Figure 4 - see Appendix 1).

Regional mapping of remnant native vegetation associations known to be utilised by Black Cockatoo species was used in combination with the Native Vegetation Extent (GoWA, 2022), to indicate the potential amount of Black Cockatoo foraging habitat within a 12 km radius of the DE. The 12 km radius represents the typical maximum distance that Black Cockatoos will fly from roosting or breeding locations to forage (DSEWPC, 2012b). Foraging habitat within the DE represents 0.05 % of the recorded 32,543 ha of locally available foraging habitat within a 12 km radius.

Roosting habitat

Black Cockatoo roosting habitat is defined by DSEWPaC (2012b) as a communal site used by Black Cockatoo species during the evening, generally located in the tallest trees in an area. The species of tree is often not critical for night roosting and a suite of species are commonly used by Black Cockatoos, including species recorded within the DE (Le Roux, 2017), although Carnaby's Cockatoo and Baudin's Cockatoo will generally roost in or near riparian environments (DAWE, 2022). For the purpose of this assessment, roost trees are considered to be any live tree that is above 8 m in height (Le Roux, 2017).

No evidence of roosting (e.g. clipped leaves and branches or droppings under suitable trees) was recorded within the DE during the Biologic (2021) survey.

Bamford (2015, revised 2021) identified a white-tailed Black Cockatoo roost approximately 600 m west of the DE on Mairinger Way in Wundowie. This roost was utilised by approximately 30 birds (a mixed flock of Carnaby's and Baudin's Cockatoo) across several trees. Known roost site NORWUNR001 is located 500 m from the DE and approximately 1.1 km from the Mairinger Way roost site. NORWUNR001 has been monitored since 2010, where 125 birds were recorded. The most recent data available, the 2019 count, recorded 15 birds (Peck *et al*., 2019). Night roosts can include tall trees within approximately 1.0 km of a central roost area of larger roost sites (>150 birds at any given time), with patches of trees usually 2-3 ha in area with smaller clumps used on any individual night for roosting (Glossop *et. al.,* 2011). Carnaby's Cockatoo are known to shift the roost location of a large Bentley roost within a 2 km x 2 km area where a clump of trees used on any individual (Glossop *et al*., 2011). As such, there is a possibility that the Mairinger Way roost identified by Bamford (2015, revised 2021) forms a wider part of the monitored Birdlife roost (Biologic, 2021).

Roost site NORBAKR001 is located approximately 1.2 km north-east of the DE in the Bakers Hill Golf Club. This roost site is also highly active as a white-tailed Black Cockatoo roost, with 160 birds observed roosting during the Great Cocky Count in 2019, 52 birds roosting in 2017, and 94 birds roosting in 2016 (BirdLife Australia, 2021; Peck *et al*., 2019).

Although no FRTBC were observed utilising roost sites within the vicinity during the Bamford (2015, revised 2021) and Biologic (2021) surveys, site NORWUNR001 has previously recorded roosting individuals of the species in low numbers (n = 6 in 2015 and n = 8 in 2017) (BirdLife Australia, 2021).

The *Eucalyptus wandoo* woodland over *Banksia* (12.5 ha), *Corymbia* and *Eucalyptus marginata* woodland (1.4 ha), and Isolated Trees (1.7 ha) mapped habitat types within the DE are considered potential roosting habitat for Black Cockatoo species (Biologic, 2021).

Overall, based on the mapping provided by Biologic (2021), there is 15.6 ha of potential roosting habitat that will be impacted within the DE. The potential roosting habitat mapped by Biologic, as well as known roost sites within the vicinity of the DE, is presented in Figure 4-5 within the Preliminary Documentation (Main Roads, 2024a).

Although more than 15 ha of potential roosting habitat, based on vegetation associations present, has been mapped broadly by Biologic, it should be noted that according to Glossop *et al*. (2011), a tree has the potential to be a roost tree as long as it has foliage cover and is ≥ 8 m tall. A 2017 study by Le Roux on the characteristics of Carnaby's Cockatoo roost trees, roost sites and landscape

characteristics, identified that the average roost tree was more than 26 m (26.6 m) high and had a DBH of almost 1 m (0.98m).

The heights and diameters of all large trees (98 trees) were recorded within the Biologic survey area (2021), while only the DBH of large trees (57 trees) were measured within the survey area assessed by Bamford (2015, revised 2021). A total of 155 large (>8m) live trees were recorded within the DE. All trees measured for height were well below Le Roux's (2017) average roost tree height, with no canopy tree being taller than 14 m. Although the heights of 57 trees were not recorded, it was noted that the maximum DBH of these trees was 88 cm, well below the average roost tree DBH observed by Le Roux's (2017).

Accordingly, given the lack of tall trees (>14 m in height) within the DE, the lack of roosting records recorded within the DE and that local black cockatoo populations are low in the area around Coates Gully area (Dr Peter Mawson pers. Comm, 2024), the roosting habitat quality within the DE is considered low.

Breeding habitat

The DE does not contain any known breeding habitat trees and no hollows were confirmed in use during the surveys (Bamford 2015, (revised 2021); Biologic, 2021 and T. Kirkby 2021 & 2022).

Proposed Action will require the clearing of up to 400 suitable DBH trees for Black Cockatoos, which is associated with clearing of up to 15.7 ha of potential Black Cockatoo breeding habitat. However, the DE was modified to avoid trees with suitable hollows for Black Cockatoo breeding.

2.2.3 Threatening processes

Significant weeds

Bamford (2015, revised 2021) and Biologic (2021) together recorded 60 non-native plant taxa during the survey, of which 33 were found with the DE. Of the 60 taxa recorded, four are listed as Declared Pests, one is recognised as a Weed of National Significance (WoNS) and one is listed as both a Declared Pest and a WoNS:

- *Gomphocarpus fruticosus* (Evergreen Shrub) – Declared Pest
- *Moraea flaccida* (One-leaf Cape Tulip) – Declared Pest
- *Zantedeschia aethiopica* (Calla Lily) – Declared Pest
- *Echium plantagineum* (Paterson's Curse) – Declared Pest
- *Genista linifolia* (Flax-leaf Broom) – WoNS
- *Asparagus asparagoides* (Bridal Creeper) – Declared Pest and WoNS.

Bridal Creeper, Flax-leaf Broom, Paterson's Curse and One-leaf Cape Tulip occur within the DE. These species were found mostly in previously disturbed areas and the existing GEH, within the western portion of the DE.

***Phytophthora* dieback**

Glevan Consulting originally conducted a *Phytophthora* Dieback Occurrence Assessment of 31.88 ha of the 35.15 ha DE, with a recheck completed in August 2021 (Glevan, 2021). The original assessment identified two small areas of Dieback infestation (totalling 0.93 ha) approximately 180 m to the west of DE, in the vicinity of Linley Valley Road. A non perennial waterway Wooroloo Brook occurs within the Dieback infested area and flows to the west away from the DE. No new Dieback infestations were identified during the recheck. The Dieback infested areas are located within the vicinity of Keaginine Reserve (located approximately 600 m to the east of the infested area).

There are a number of non perennial waterways within the vicinity of the DE, construction works will not occur immediately adjacent to any watercourse and works will be managed to ensure any surface

water flows within the DE are directed to the existing constructed road drainage network. Keaginine Reserve contains Black Cockatoo habitat that has the potential to be impacted by Dieback spread, no works are planned to occur within known Dieback infested areas adjacent to Keaginine Nature Reserve.

Areas of uninfested protectable land (totalling 6.00 ha) were identified along the GEH alignment within the DE. The uninfested protectable land was located within the vicinity of the Keaginine, Kwolyinine and Woondowing Nature Reserves, which comprise Black Cockatoo foraging habitat. A recent fire within the northern portion of the Kwolyinine Nature Reserve caused significant damage to a portion of one of the previously protectable uninfested areas within the DE, resulting in this portion of land being classified as temporarily uninterpretable. A Dieback survey will be completed in the Spring of 2024 to recheck the 2021 Dieback mapping, prior to the commencement of construction activities.

Salinity

The offset site is located upslope, approximately 2.5-3 m above and approximately 25 m south, of a low-lying saline creek bed. Vegetation mapping completed within the creek bed (Biologic, 2021) notes that established vegetation exists throughout the creek bed including; Scattered *Melaleuca viminea* shrubs over *Juncus acutus* and *Bolboschoenus caldwellii* mixed open sedgeland and rushland over open *Tecticornia lepidosperma* samphire shrubland over low open *Cynodon dactylon* grassland.

The embankment of the saline creek bed is surrounded by mature well established vegetation including; *Melaleuca, Allocasuarina* and *Eucalyptus* trees which demonstrates native vegetation species are not affected by existing salinity levels adjacent to the creek bed. This is supported by the Western Australian Department of Primary Industry and Regional Development (DPIRD, 2024) salinity hazard mapping completed within the creek bed and adjacent offset site, which identifies the creek embankment and areas upslope within the Offset site as having less than 3 % of land with a moderate salinity risk.

Due to the presence of native vegetation, including mature Eucalyptus trees, located between the creek embankment and the Offset boundary 25 m upslope, the saline risk to vegetation to be established within the Offset Site is negligible.

2.2.4 Predicted impacts

The below predicted residual impact estimates are conservative, and representing the full extent of MNES values within the 35.15 ha DE. The actual clearing footprint will be refined through the detailed design and construction planning process and ultimately may not include all vegetation within the DE.

Direct impacts

No known roosting sites for Black Cockatoos will be impacted by the Proposed Action. The Proposed Action will involve the clearing of up to 400 suitable DBH trees for Black Cockatoos, none with suitable hollows for Black Cockatoo breeding.

Up to 15.7 ha of Carnaby's Cockatoo foraging habitat and up to 15.6 ha of Baudin's Cockatoo and FRTBC foraging habitat will be cleared by the Proposed Action. The Black Cockatoo foraging habitat within the DE also represents potential breeding and roosting habitat. Therefore, the Proposed Action will also require the clearing of 15.6 ha of potential breeding and roosting habitat.

Although foraging habitat in the DE represents a small proportion of the surrounding extent, Main Roads propose to offset impacts to foraging habitat as a result of the Proposed Action. It is expected this offset will also counterbalance impacts to Black Cockatoo potential breeding and roosting habitat, with the proposed offset site representing potential breeding and roosting habitat.

Indirect impacts

The Proposed Action has potential to cause indirect impacts to Black Cockatoos including:

- Indirect impacts to potentially suitable hollows within the vicinity of the DE
- Fragmentation of Black Cockatoo habitat
- Spread and / or introduction of weeds
- Spread and / or introduction of pathogens such as Dieback
- Surface water runoff
- Fire.

However, with the implementation of the management measures committed in the Great Eastern Highway Upgrade Project (EPBC 2022/9151) Construction Environmental Management Plan (CEMP), the residual risk rating for indirect impacts is Low (Main Roads, 2024b), and as such no offset is proposed for indirect impacts.

3 PROPOSED ENVIRONMENTAL OFFSETS

To offset the significant residual impacts of the Proposed Action to the listed Black Cockatoo species, this Offset Strategy identifies proposed offset actions comprising land acquisition and the creation of fauna habitat via restoration, revegetation, rehabilitation and land management. The proposed environmental offset will be fully funded and implemented by Main Roads (with the assistance of external technical experts where appropriate), with the implementation of the environmental offsets to be reported within Annual Compliance Reports.

An overview of the offsets offered are detailed in Table 4.

Table 4 Overview of offset package under consideration

Offset type	Offset summary	Offset location	Existing tenure
Land acquisition and on ground management	29.1 ha portion of Lot 704 that comprises completely degraded paddock and isolated individual trees, including potential breeding trees will be committed as an offset. This offset area will require on ground management and revegetation to provide and maintain foraging habitat for Black Cockatoos	Lot 704 Great Eastern Highway, Copley	Purchased and owned by the Commissioner of Main Roads
Installation of watering station	Installation of Installation of a permanent elevated drinking water station to encourage breeding and roosting within local area.	Lot 704 Great Eastern Highway, Copley	Purchased and owned by the Commissioner of Main Roads

3.1 Description of offsets

Main Roads has identified and purchased Lot 704 Great Eastern Highway, Copely ('Offset Area') which has a total area of 39.9 ha (Appendix 1 - Figure 5). The offset area is located immediately south of the Proposed Action area and abuts the Kwolyinine Nature Reserve to the west.

3.1.1 Offset Area Environmental Attributes

A Black Cockatoo breeding habitat survey was undertaken across the Offset Area in October 2023 by Tony Kirkby. All trees within the Offset Area were assessed for size in relation to their suitability to provide a Black Cockatoo breeding hollow. Hollows with entrances suitable for Black Cockatoos were further inspected.

A total of 100 trees above the required DBH were surveyed within the acquired property (Lot 704 Great Eastern Highway), comprising:

- Wandoo (44)
- Marri (28)
- Flooded Gum (19)
- Jarrah (8)
- Unidentified dead tree (1).

Of the 100 trees with a suitable DBH needed to form a nest hollow, five hollows were deemed possible Black Cockatoo breeding hollows when viewed from ground level. Based on additional investigations with a pole camera, and evidence of chewing at the entrance, two were considered to be likely / possible Black Cockatoo breeding hollows (Kirkby, 2023).

Foraging habitat quality for each Black Cockatoo species, based on Biologic (2021) habitat assessment scores, is presented below:

- Carnaby's Cockatoo: Medium / Moderate quality, consisting of Primary values of marri (*Corymbia calophylla*) and jarrah (*Eucalyptus marginata*) canopy (30 – 50 %) with *B. sessilis*

present in mid-storey, and Secondary values of *E. wandoo, Allocasuarina, Xanthorrhoea preissii, E. patens* and *Hakea lissocarpha*

- Baudin's Cockatoo and FRTBC: Medium / Moderate quality consisting of Primary values of marri and jarrah canopy (<10 %), and Secondary values of *Allocasuarina, X. Xanthorrhoea preissii, Banksia sessilis, E. patens* and *Hakea lissocarpha*.

The Proposed Action is expected to impact up to 155 low quality roosting trees (trees greater than 8 m but under 14 m in height). Although roosting is also not known to occur with the 100 large paddock trees within the offset site, it is considered that the large paddock trees are more suitable as roosting trees given their large size, and not immediately adjacent to a high speed high volume national highway. It is also noted that as the revegetation around the large paddock trees get older, more potential roosting trees will become established. It is expected that the planted trees will start reaching 8 m (minimum roost tree height) within 12 years.

To encourage roosting within and adjacent to the offset property, it is proposed to establish a permanent elevated drinking water station for Black Cockatoos, given the availability of drinking water is a key requirement for roosting sites.

This availability of year-round drinking water may also encourage roosting and breeding with the adjacent Kwolyinine Nature Reserve, noting that neither breeding nor roosting is known to occur within this reserve.

3.1.2 Offset Area protection mechanism

The Offset Area is owned freehold by the Commissioner of Main Roads. The property was purchased in December 2023 as an environmental offset site for the Proposed Action. The property is currently managed by Main Roads for conservation purposes and will continue to be so, ensuring the protection and maintenance of ecological benefits in perpetuity, beyond the life of the approval. Main Roads intends for the offset property to remain as freehold land in the name of the Commissioner of Main Roads, an approach that has been accepted by both the State and Commonwealth, such as for the Bunbury Outer Ring Road project.

Main Roads' long-term intention is for the Coates Gully offset to be transferred to DBCA and incorporated in the conservation estate once the environmental values have reached DBCA's requirements, reserving the values for conservation purposes. Main Roads has met with DBCA representatives on site to discuss a potential transfer of the property to the conservation estate. Main Roads will continue to consult with DBCA on the offset property until it is transferred. Main Roads understands that the transfer of the property into the conservation estate would be conditional on a number of factors including:

- The property contains vegetation that is self-sustaining
- Establishing an agreement for Main Roads to provide funding for ongoing costs associated with the management
- The property achieving certain vegetation quality standards, eg diversity, density, condition, etc.

3.1.3 Offset Area achievable ecological benefits

For the Offset Area, Main Roads commits to achieving the following ecological benefits:

- Creation, quality improvement and management of 29.1 ha of diverse Black Cockatoo foraging habitat within 20 years from commencement of the offset, within which the habitat:
  - Consists of Eucalypt woodlands containing suitable foraging tree species for each of the three species of Black Cockatoos with >40 % projected foliage cover with food sources present at two strata (Medium / Moderate quality)
  - Establishes native vegetation species and associations that reflect the naturally occurring native vegetation in the local area
  - Establishes native vegetation assemblages appropriate to the local soil types and landscape position
  - Establishes food and habitat resources for other native fauna species, and to establish ecological linkage with neighbouring remnant vegetation.

This will be achieved through the active management of weeds, animal pests, pathogens, bushfires, surface water erosion and human activities as necessary to achieve the revegetation objectives and completion criteria.

The stated achievable ecological benefits are aligned with the objectives of the Black Cockatoo conservation advices and / or recovery plans (DPAW, 2013 & TSSC, 2018).

Demonstrated capability to achieve stated ecological benefits

In December 2022, Stream Environment and Water (SEW) (2022) assessed the Black Cockatoo foraging value of a five-year-old revegetation site in the Ludlow State Forest. This site was revegetated by Main Roads between winter 2016 and winter 2017 as part of Main Roads' State Forest No. 2 Strategic Offset Site.

As at 2022 (i.e. five years of age), revegetation within the site was assessed as being Moderate quality for Carnaby's Cockatoo and FRTBC and Low quality for Baudin's Cockatoo. Overall foliage cover of the site was estimated to be 20-30 % for Eucalyptus species. Evidence of Black Cockatoo foraging (chew marks suggest Baudin's Cockatoo and potentially Carnaby's Cockatoo) was found on the site. A small flock of up to 10 white tailed Black Cockatoos was observed flying over the site during the field survey. These results provide a clear indication of Main Roads proficiency with regard to establishing Black Cockatoo foraging habitat that is utilised by the species.

Main Roads has completed numerous successful revegetation projects in the agricultural regions of WA in which the implementation of this Offset Strategy will draw upon experience gained, including Main Roads' advanced environmental offsets 'bank' in the Wheatbelt region of WA. Under this program, six sites of former cleared farmland have been successfully revegetated.

The re-establishment of Black Cockatoo foraging habitat will be an important consideration in the selection of the species mix. However, it can be expected that the goals of re-establishing both Black Cockatoo foraging habitat and returning ecosystem function using locally-occurring native species will be complimentary.

3.1.4 Offset Area achievement of ecological benefits

To achieve the ecological benefit stated in Section 3.1.3, Main Roads proposes to undertake the following activities:

- Removal of existing buildings and associated infrastructure from site

- Installation and maintenance of fencing on the property boundary to prevent unauthorised property access
- Selective weed control to improve vegetation condition and habitat quality
- Fire management
- *Phytophthora* dieback management
- Revegetation activities:
    - Earthworks (site preparation), including formation of access tracks and drainage structures
    - Weed control for a period of approximately 18 months, commencing Spring 2024
    - Planting via mechanised direct seeder (Winter 2026), requirement for supplementary infill or targeted plantings of certain species will be assessed following first summer
- Installation of an elevated bird watering station within the property
- Ongoing maintenance.

Fencing and access management

Vehicle access to the site will be restricted through the upkeep and maintenance of existing ring lock agricultural fencing. A single locked gate to allow for maintenance access via DBCA reserve will be installed.

Pest animal management

Based on monitoring results following two complete seasons, management options including seasonal shooting (kangaroo) / baiting (rabbits) will be considered where >30 % decline in overall plant survival is identified.

Selective weed control

Weed control comprising one initial blanket herbicide spraying of bare paddock area/s in 2024, supplemented by spot spraying of WONS and Declared weed species will be undertaken to ensure foraging habitat is established. After the initial treatment, control of environmental weeds such as annual grasses will be undertaken where they are increasing in prevalence or are impacting revegetation / rehabilitation works or natural regeneration. Weed control will continue to be undertaken twice per year for years 1-3 post planting / seeding and annually thereafter as required to maintain percentage canopy of foraging value habitat. Weed cover is to be monitored until Black Cockatoo foraging species (see Appendix 2 for indicative list) become established (min. 4 years following planting), as included in Table 5

Phytophthora dieback

Main Roads standard *Phytophthora* dieback management measures will be applied during the construction and maintenance of firebreaks and fences and weed control activities. No Dieback infestations are known to exist in the immediate area.

Fire

Firebreaks have been installed and will be maintained to the required standard (of width between 2 – 5 metres) to assist in the mitigation of unplanned fire.

Revegetation

Vegetation surveys within adjacent nature reserves will be used to develop a site-specific revegetation design that reflects the vegetation-soil associations found within surrounding intact vegetation communities. The species list will include species that constitute foraging habitat as defined in DSEWPaC (2012b) for all three species of Black Cockatoo. The species list will be developed based on site specific soil mapping and vegetation-soil associations found within surrounding intact

vegetation communities. This approach has been adapted from comparable revegetation sites managed by Main Roads in developing a site specific restoration plan which demonstrates how information from soil mapping and vegetation surveys are combined to inform the species mixes to be used in the revegetation of the site.

To revegetate the Offset Area, seed from Black Cockatoo foraging species contained within adjacent nature reserve/s and as reported within the biological surveys (Table 2), will be collected or sourced and provided to registered nurseries for propagation (refer species list provided in Appendix 2).

The proposed revegetation method will utilise direct seeding methods that have been used successfully in WA in the re-establishment of biodiverse native vegetation on cleared agricultural land. Initially the site will be prepared by removing remaining buildings and associated infrastructure, followed by weed control for a period of around 18 months prior to seeding. Direct seeding will be undertaken in the winter of 2026 using a mechanised direct seeder. The seeder will scalp the surface soil and deposit the seed mix in a furrow behind the scalping blades. The method is well proven and has been shown to be reliable for the revegetation of former agricultural land which typically has significant weed seed remaining within in the topsoil. Deep ripping or fertilising is generally not required on soils that have been formerly used for cropping.

The results of the direct seeding will be assessed at the end of the first summer (2027) following seeding. Dependent on the results, supplementary infill or targeted plantings of certain key species may be scheduled for the following year. This process will continue, with the monitoring results informing the need for additional plantings.

The vegetation coverage will include a variety of species within vegetation structural groups to contain at least three overstorey and two mid-storey foraging species that provide Black Cockatoo foraging habitat with a focus on the overstorey (>15 %) and mid-storey cover (>10 %). Plant density will vary across the site in response to local soil types, existing (remnant) vegetation density, and will aim to minimise bare ground and maximise the structural integrity and long-term viability of the established vegetation.

The completion criteria for revegetation reflect the revegetation objectives and provide for quantitative assessment.

Re-established native vegetation will, within 20 years:

- Contain >40 % projected foliage cover of suitable Black Cockatoo foraging species to establish High quality foraging habitat
- Contain >15 % overstorey canopy cover and >10 % mid-storey cover
- Contain at least three overstorey and two mid-storey foraging species.

The completion criteria are outcome-focused, with the key outcome being the restoration of Black Cockatoo foraging habitat appropriate to offsetting the loss of Moderate quality Black Cockatoo foraging habitat. Given that the desired outcome is the re-establishment of foraging habitat, criteria for weed cover or revegetation plant survival rate have not been included as completion criteria. Nevertheless, these aspects have been included as triggers for potential management actions (Table 5).

Based on the above, after 20 years, the 29.1 ha offset site will contain more than 5000 trees (at 300 trees per hectare), of species including:

- *Corymbia calophylla*
- *Eucalyptus marginata*
- *Eucalyptus patens*

- *Eucalyptus rudis*
- *Eucalyptus wandoo.*

Successful creation of Black Cockatoo habitat

Main Roads is proposing to restore 29.1 ha of additional Black Cockatoo foraging habitat within the Offset Area. Black Cockatoo foraging habitat within the Offset Area will also represents potential future breeding habitat in addition to existing potential breeding and roosting habitat (100 suitable DBH trees) within the Offset Area.

Given that all three species of Black Cockatoos are known to be present within the vicinity of the Offset Area, and the Offset Area is located adjacent to the Proposed Action area, it is highly likely the species will utilise the habitat once it is improved. Based on advice provided from Black Cockatoo subject matter experts, the Proposed Action is not located within known breeding area for Black Cockatoo species, however Black Cockatoos are known to be transitory within the area. To further increase the value of Black Cockatoo habitat and potential for breeding activity within and adjacent to the Offset Area, an elevated drinking water station will be positioned within the Offset Area.

Planting densities will be managed to achieve revegetation objectives within 20 years, based on fine-scale (10 m x 10 m quadrats) and site-wide (transects and drone-based) methods (see Table 5). The criteria to be achieved include:

- contains >40 % projected foliage cover of foraging species for Black Cockatoo to establish High quality foraging habitat (in the range of that seen within intact remnant vegetation occurring nearby)
- contains >15 % overstorey canopy cover and >10 % mid-storey cover
- contains three overstorey plants and two mid-storey plants
- contains more than five native species (at least one species for overstorey and two species for mid-storey).

The quadrats (10 m x 10 m quadrats) will provide data on species composition and structure. 10 m- wide transects extending across the full width of the site will be used to ground-truth and calibrate drone data. The transects and drone information will be used to assess site-wide plant stem densities, canopy cover and vertical structure.

In order to accommodate a degree of spatial heterogeneity (and avoid an unnaturally uniform distribution) of stems in the re-established vegetation, the completion criteria will be applied to the site overall rather than at the individual quadrat level. Spatial heterogeneity will be achieved by a combination of using differing species mixes matched to soil and, depending on the results of direct seeding, targeted supplementary plantings of nursery-raised seedlings.

It is noted that the canopy cover target is higher than the sum of overstorey and mid-storey cover percentages. This allows for flexibility in the total amount of projected foliage cover for each strata. For example, if a quadrat has 80 % overstorey and 10 % mid-storey, it will meet the overall projected foliage cover target, as would a quadrat that has 15 % overstorey and 60 % mid-storey projected foliage cover.

Noting the objective is to achieve >40 % canopy cover within 20 years to offset the loss of Moderate quality Black Cockatoo habitat, no completion criteria has been set for weed cover nor revegetation plant survival rate, noting interim survival rates have been included as a trigger for additional management actions see (Table 5).

Table 5 Summary of Offset Area monitoring program

Aspect	Methodology	Methodology description	Timing and frequency	Trigger Value	Corrective Action
Fence condition and firebreaks	Field survey / visual inspection	• Vehicle and / or on foot inspection of fencing to determine effectiveness and identify any maintenance requirements	• Annually commencing spring 2025	• Fence strainers damaged, fence supports not effective, access gate damaged • Firebreaks not to specified standard / restrict access for emergency use	• Investigate cause and raise incident report • Implement corrective actions which may include: - Review practicality of fencing design and structure - Undertake repair / modification of fence as required - Review monitoring frequency and method - Review practicality of firebreak network - Undertake firebreak modification and maintenance as required • Monitor outcomes
Weed control	Field survey / visual inspection	• Vehicle/ on-foot inspection of weed coverage within bare paddock areas to determine effectiveness of initial herbicide application treatment methodologies (blanket spray) • Assessment of twelve 10 m x 10 m quadrats randomly placed across the planting area to record canopy % cover • Aerial drone survey – capture of aerial photography via drone	• Vehicle / on-foot inspection: Annually commencing spring 2025 • Initial blanket weed control (year 1), spring 2024 • Herbicide spot spray treatment, 2 per year min. 4 years following revegetation planting	• Weed cover negatively impacting revegetation of black cockatoo foraging plant species, with <10 % projected foliage cover for foraging species at four years after commencement of revegetation • Weed cover negatively impacting revegetation of black cockatoo foraging plant species, with <12 % projected foliage cover for foraging species at six years after commencement of revegetation • At ten years after commencement of revegetation, review whether weed cover is likely to impact ability to achieve and maintain a >40 % projected foliage cover of foraging species for Black Cockatoo • WONS and Declared weed species observed	• Implement corrective actions which may include: - Spot spray of WONS, Declared weeds or weeds determined to be detrimentally affecting success of plantings. - Review and modify weed control program as required - Undertake targeted revegetation / infill planting - Improve personnel training and education - Review monitoring frequency and method • Monitor outcomes
Pest management	Field survey / visual inspection of fauna activity	• Vehicle / on-foot inspection to observe evidence of herbivory on seedlings across the planting area.	• Twice yearly, for a minimum of three years, commencing spring 2025	Within any monitoring period, within the planting area there is evidence of loss of individual plants or decline of plant health as a result of pest animal activity and there is >20 % impact to total planting area	• Kangaroo culling will be conducted if vegetation monitoring results are showing a decline or the trajectory indicates possible failure to attain the desired vegetation condition • Rabbit control will be considered where rabbit impacts are noted as having a detrimental impact to revegetation
Plant success	Field survey / visual inspection of survival of Black Cockatoo foraging flora species	• Vehicle / on-foot inspection of flora coverage across the site • Assessment of twelve 10 m x 10 m quadrats randomly placed across the planting area and site-wide (transects and drone-based) methods to record vegetation density and diversity	• Every three years, commencing summer 2027	At ten years after commencement of revegetation, averaged across 10 m x 10 m monitoring quadrats: • Plant survival is not occurring at a rate sufficient to achieve the stated ecological benefits within 20 years • Projected foliage cover of suitable foraging species for Black Cockatoos is <20 %, consisting of <10 % of overstorey and <5 % mid-storey • Fewer than five (5) native plant species are present • Less than 33% of total planted tubestock remain	• Implement corrective actions which may include: - Review and modify as required pest animal control program - Review and modify as required weed control program - Undertake targeted infill planting as required - Review and modify as required fire management measures - Improve personnel training and education - Review monitoring frequency and method • Monitor outcomes
Evidence of foraging	Field survey / visual inspection for foraging evidence	• Visual inspection via walking meander survey conducted by suitably experienced personnel	• Every three years, commencing 2032	Foraging not observed after year 12	
Canopy presence and vegetation cover and structure	Field survey / visual inspection Aerial drone survey	• Visual inspection – via walking meander survey by suitably experienced personnel (including weed presence) • Assessment of twelve 10 m x 10 m quadrats randomly placed across the planting area to record vegetation structure • Aerial drone survey – capture of aerial photography via drone	• Field survey / Visual inspection: Every three years, commencing 2025 • Drone survey: Every five years, commencing 2025 (baseline)	At year six after commencement of revegetation, averaged across 10 m x 10 m monitoring quadrats, the projected foliage cover of Black Cockatoo foraging species across overstorey and mid-storey is <12 % At ten years after commencement of revegetation, averaged across 10 m x 10 m monitoring quadrats: • Plant survival is not occurring at a rate sufficient to achieve the stated ecological benefits within 20 years • Projected foliage cover of suitable foraging species for Black Cockatoos is <20 %, consisting of <10 % of overstorey and <5 % mid-storey • Fewer than five (5) native plant species are present • Less than 33 % of total planted tubestock remain	

3.1.5 Offset Area monitoring

Twice-yearly monitoring will be conducted at the Offset Area for an initial three-year period to enable early detection of changes that may impede realisation of the ecological benefits, and to enable measurement of progress towards and maintenance of the ecological benefits. Following the completion of initial weed control (two years), monitoring will be reduced to annual frequency unless site observations suggest increased monitoring is required.

The results of the direct seeding will be assessed at the end of the first summer (February 2027) following seeding. Dependent on the results, supplementary infill or targeted plantings of certain key species may be scheduled for the following year. This process will continue, with the monitoring results informing the need for additional plantings.

The monitoring program will be conducted as outlined in Table 5 with all correction actions being the responsibility of Main Roads, Director of Environment and Heritage.

4 COUNTERBALANCE OF SIGNIFICANT RESIDUAL IMPACTS

The Preliminary Documentation concluded the Proposed Action would result in the following significant residual impacts:

- Loss of 15.7 ha of Carnaby's Cockatoo foraging habitat
- Loss of 15.6 ha of Baudin's Cockatoo and FRTBC foraging habitat
- Loss of 400 potentially suitable Black Cockatoo breeding trees (but no suitable breeding hollows).

The Proposed Action will also result in the loss of 155 roosting trees that are considered to provide low quality roosting habitat. The loss of 155 potential low quality roosting trees will not result in a significant residual impact on Black Cockatoo roosting.

To offset the impacts of the Proposed Action, Main Roads proposes to:

- Protect approximately 100 large paddock trees
- Restore approximately 29 ha of foraging habitat, as well as breeding and roosting habitat
- Install a Black Cockatoo elevated drinking water station.

4.1 Foraging Habitat

The Proposed Action will result in the loss of up to 15.7 ha of Carnaby's Cockatoo foraging habitat, as well as 15.6 ha of Baudin's Cockatoo and FRTBC foraging habitat.

Tree size plays a key role in fruit and seed production. Mawson (1995) found that the largest 2 % of marri trees in jarrah-marri forest sites studied accounted for an estimated 85 % of fruit and seed production. Smaller marri trees flower sparingly and set few seeds.

Of the 400 suitable DBH trees that occur within the DE, only four were considered to be large live jarrah/marri trees with DBHs greater than 100 cm, noting marri trees are a primary food source for all three species.

As Black Cockatoos are known to forage within the DE, the loss of foraging habitat may have a short and long term impact on Black Cockatoo foraging. To offset the short and long term loss of foraging habitat, Main Roads has acquired a large farm paddock (Lot 704) immediately adjacent to the DE and will commence restoring foraging habitat across 29.1 ha of the property. Currently the paddock comprises completely degraded areas that were previously used for cropping, as well as approximately 100 large isolated paddock trees. The foraging habitat to be restored will include mid-storey species, as well as trees species that also provide breeding and roosting habitat.

The offset site contains approximately 100 large trees that currently provide foraging, breeding and roosting habitat.

It is expected that the additional 29 ha of revegetation will start to provide foraging habitat after five years.

Revegetating a paddock, which also contains a large number of mature trees, with mid-storey and upper storey foraging species will provide short term and long term benefits.

Given the number of large foraging trees present on the recently purchased offset site and extent of foraging habitat projected to be present across the 29 ha offset site within 20 years, the offset will provide significant environmental benefit for Black Cockatoos.

In addition to providing and protecting foraging habitat, Main Roads also proposes to install a permanent elevated drinking water station to provide birds with a consistent water supply throughout the year and further encourage foraging, breeding and roosting within local area. The

permanent elevated drinking water station is also expected to provide a safer location to drink in a drying climate, avoiding on ground predators and the need to drink on the edge of roads.

4.1.1 Immediate Benefit

The largest marri trees are recognised as being valuable for seed and fruit generation for birds. The Proposed Action will result in the clearing of 15.7 ha of Medium quality Black Cockatoo foraging habitat, including four live jarrah/marri trees that have a DBH greater than 100cm. Of the large trees present within Lot 704, more than a third are jarrah and marris, with twenty of these having diameters of 100cm or more.

As many of the large jarrah/marri trees within Lot 704 are effectively isolated paddock trees, the clearing of these trees over time is unlikely to trigger the need for EPBC Act referral/approval. Given the property was managed for agriculture, there was an ongoing risk of loss that one or more of these trees could be removed at any time.

Accordingly, protecting these large foraging trees from potential clearing provides an immediate short-term benefit and ensures that they won't be cleared in the near future.

4.1.2 Long term Benefit

To offset the loss of 15.7 ha of Medium quality foraging habitat, Main Roads plans to revegetate a degraded paddock and bring it up to provide High quality foraging habitat.

Main Roads is aiming to achieve High quality foraging habitat by establishing a canopy cover of at least 40 % eucalypt woodlands, which is consistent with DCCEEW's habitat quality scoring guidance for Black Cockatoo foraging quality.

More than 5000 trees (at 300 trees per hectare) will be established within the 29.1 ha offset site, with jarrah and marri trees being the dominant tree species. The canopies of individual marri trees often span 20 m (noting many marri canopies can span 30 m), creating a 400m^2 canopy area. If half of the 300 trees (150 trees) per hectare obtain a canopy area of 400m^2, a canopy cover of 60 % will be achieved, noting that an overlapping mid-storey foraging layer will also be created.

Given the very high density of planting proposed at the site, there is a very high confidence that a eucalypt woodland canopy cover of at least 40 % will be obtained within 20 years of commencing the revegetation works at the offset property.

4.2 Breeding Habitat

Black Cockatoos are not known to breed within or adjacent to the DE, with the Proposed Action also not impacting on any trees that have suitably sized hollows for breeding. Accordingly, the Proposed Action is not expected to have significant short term residual impact on Black Cockatoo breeding in the area.

Of the 400 suitable DBH trees that occur within the DE, only 28 had a DBH equal or greater than 1000mm (700mm for wandoo), noting that typically larger trees are more likely to form hollows. For example, of the 500 suitably sized trees within the impact and offset sites, suitably sized hollows were only found trees that had a DBH above 1000mm (or 700mm for wandoo). Within the Lot 704 offset site, 44 of the trees were considered very large (i.e. >700mm/1000mm).

As many of these large trees are effectively isolated paddock trees, the clearing of these trees over time would have been unlikely to have triggered the need for EPBC Act referral/approval.

The protection of these 44 very large trees, some of which contain suitably sized hollows through the acquisition of Lot 704, is considered to adequately offset the short term loss of 28 very large trees from within the DE . The long-term loss of 400 DBH trees will be offset through the creation

of foraging and breeding habitat within Lot 704, noting that it is expected that more than 5000 trees will be established within the 29.1 ha offset area. Established trees will be a mixture of *Corymbia calophylla, Eucalyptus marginata* and *Eucalyptus wandoo* species.

Breeding is not known to occur within or immediately adjacent to the DE, even though suitable hollows are present in the area, including within Lot 704. To assist with encouraging breeding in the area, Main Roads is proposing to install a permanent elevated drinking water station to provide birds with a consistent water supply throughout the year. The availability of permanent drinking water may result in the hollows in the local area, including those within the adjacent Kwolyinine Nature Reserve and Lot 704, potentially being more attractive to nest in.

4.3 Roosting Habitat

Although the Proposed Action will not have a significant residual impact on roosting habitat, the offsets provided to address foraging and breeding impacts will also provide a benefit regarding roosting habitat.

It is noted that Black Cockatoos are not known to roost within the DE, as the DE has 155 potential roosting trees, none of which were recorded to be higher than 14 m, well below the average roosting tree height. Large trees are known to occur within the adjacent Kwolyinine Nature Reserve and Lot 706, although neither site contains known roosting trees.

One of the key characteristics of roosting sites is that they contain very tall trees that are close to a supply of drinking water. Although it is considered that there will not be a short term loss of roosting habitat, as the trees within the DE are not currently used for roosting, the proposed installation of a permanent elevated drinking water station to provide birds with a consistent water supply throughout the year may provide an immediate roosting habitat benefit by making adjacent areas potentially more suitable for roosting.

The short term loss of breeding and foraging habitat will be offset through protecting approximately 100 large trees that occur on Lot 704, while long term benefit will be achieved through the creation of 29.1 ha of foraging, breeding and roosting habitat within Lot 704, noting that it is expected that more than 5000 trees will be established within the offset area. It is expected that the planted trees will start reaching the minimum tree roost height (i.e. 8 m) within 12 years of planting, with established trees to include *Corymbia calophylla, Eucalyptus marginata* and *Eucalyptus wandoo* species.

4.4 Black Cockatoo Habitat Quality Assessment

4.4.1 Proposed Action Habitat Quality

Fauna habitat assessments were undertaken by Biologic environmental (2021) to determine the potential impact of the Proposed Action to Black Cockatoo habitat. In assessing Black Cockatoo habitat quality for the Proposed Action, the Biologic (2021) survey report classified habitat Site Condition into Low (value of 2), Medium (value of 3) and High (Value of 5) quality based on vegetation structure, condition and habitat features. Site Condition averaged across the Proposed Action area was determined to be Moderate quality (3 out of 6) for Black Cockatoos.

A Site Context value was determined based on connectivity of existing habitat, species distribution and threats. Contributing factors considered for the Proposed Action area included its location within the existing GEH road alignment, surrounding farmland and remaining vegetated areas including the Keaginine, Kwolyinine and Woondowing Nature Reserves. An average Site Context value of 2 (out of 3) was determined for the Proposed Action area.

The final factor assessed to determine a habitat quality was species Stocking Rate based on evidence of occupation and foraging, roosting and or breeding within the Proposed Action area. A value of 1 (out of 1) was applied to Stocking Rate.

Given the above, the Black Cockatoo habitat quality within the Proposed Action area was determined at be 6 out of a possible 10.

4.4.2 Offset Area Habitat Quality

The habitat quality of the Offset Area was scored based on Biologic's (2021) fauna survey and Kirkby's (2023) Black Cockatoo Breeding Assessment for the Offset Area.

The Offset Area comprises cleared paddocks with isolated trees, and is considered to be of Low habitat quality (value of 1) when assessed against criteria within the Biologic (2021) survey of the Proposed Action area. A Site Condition score of 1 has been determined for the Offset Site.

Given the site is currently a cleared paddock with isolated trees, a Site Context value of 1 was also applied for the Offset Site.

As almost all of the Offset Site is cleared, no Stocking Rate value was assigned to the Offset Area.

A Black Cockatoo habitat quality start score of 2 has been assigned to the Offset Site. Without an offset, this score is unlikely to change.

After twenty years of proactive management, the site will have a Site Condition score of 5, a Site Context value of 2 and a Stocking Rate of 1 (total habitat quality score of 8).

4.4.3 DCCEEW HQS

DCCEEW has developed a Black Cockatoo Habitat Quality Scoring (HQS) model to assist in scoring Black Cockatoo habitat. The model is not currently published and can be useful where subject matter expert advice is not available.

As expert advice was available, DCCEEW's HQS model was not used to score the habitat to be impacted by the Proposed Action, nor the Offsite Site habitat value.

Table 6 below provides a comparison of the habitat quality score used for this assessment and the habitat quality score using DCCEEW's HQS, for both the Proposed Action habitat and Offset Site's start, future without out and future with the offset proposed.

Table 6 Habitat Quality Score comparison

Site and Area	Calculated Habitat Quality				DCCEEW's HQS		
	Site Cond.	Site Cont.	Stock. Rate	Total	Site Cond.	Site Cont.	Total
Proposed Action 15.7 ha (Carnaby's Cockatoo) 15.6ha (Baudin's Cockatoo/ FRTBC)	**3**	**2**	**1**	**6**	**4**	**2**	**6**
Offset Area Start Quality – 29.1 ha	**1**	**1**	**0**	**2**	**1**	**2**	**3**
Offset Area Future quality without offset – 29.1 ha	**1**	**1**	**0**	**2**	**1**	**2**	**3**
Offset Area Future quality with offset – 29.1 ha	**5**	**2**	**1**	**8**	**6**	**2**	**8**

4.5 Offset Summary

The offsets proposed counterbalance the significant residual impacts of the Great Eastern Highway Upgrade Project SLK 56.4 - 67.8 to Black Cockatoos (Table 7) The extents presented in Table 6 are based on offset calculations using the EPBC Act Offset Assessment Guide. The offset package is expected to provide adequate compensation for significant residual impacts associated with the Proposed Action. Table 8 highlights the overall benefits of the proposed offset.

Table 7 Summary of Offset Calculations

MNES	Habitat	Impact Value	Offset Package (EPBC Act Calculator)
Carnaby's Cockatoo	Foraging, breeding and roosting	15.7 ha x quality 6 = 9.542 ha	29.1 ha x quality 8 = 100.12 % of impact offset Installation of a permanent elevated drinking water station
Baudin's Cockatoo	Foraging and roosting	15.6 ha x quality 6 = 9.36 ha	29.1 ha x quality 8 = 100.76 % of impact offset Installation of a permanent elevated drinking water station
FRTBC	Foraging, breeding and roosting	15.6 ha x quality 6 = 9.36 ha	29.1 ha x quality 8 = 122.90 % of impact offset Installation of a permanent elevated drinking water station

Table 8 Overall Benefit of Offset Proposal

Habitat	Impact	Proposed Offset/Mitigation	Benefit
Foraging	Clearing of 15.7 ha of Medium quality roadside foraging habitat	29.1 ha x quality 8 Protection of 100 large paddock trees that provide foraging habitat. Installation of installation of a permanent elevated drinking water station.	Immediate benefit will be gained through the protection of 100 large paddock trees. Immediate benefit will be gained following installation of a permanent elevated drinking water station. Substantial medium and long term (>5 years) benefit will be achieved when 29.1 ha of revegetation provides High quality foraging habitat.
Breeding	Clearing of 400 hollow-less trees. No breeding known to occur within or adjacent to DE.	Protection of 100 large paddock trees that provide breeding habitat immediately adjacent to the DE. Installation of installation of a permanent elevated drinking water station.	Immediate benefit will be gained through the protection of 100 large paddock trees, with many containing hollows. Immediate benefit will be gained following installation of a permanent elevated drinking water station, which may encourage breeding within the local area. Substantial long term (>50 years) benefit will be achieved when 29.1 ha of revegetation provides breeding habitat, with more than 5000 canopy trees expected to be established on the property.
Roosting	Clearing of 155 trees > 8m high. No roosting sites known to occur within or adjacent to DE.	Protection of 100 large paddock trees that provide roosting habitat immediately adjacent to the DE. Installation of installation of a permanent elevated drinking water station.	Immediate benefit will be gained through the protection of 100 large paddock trees. Immediate benefit will be gained following installation of a permanent elevated drinking water station, which may encourage roosting within the local area. Substantial medium to long term (10->50 years) benefit will be gained when 29.1 ha of revegetation provides roosting habitat, with more than 5000 canopy trees expected to be established on the property.

5 APPLICATION OF ENVIRONMENTAL OFFSETS POLICIES

The specific outcomes of the offset to be achieved is for a 100 % offset to be offered in the form of land acquisition, and on ground management, to offset residual impacts to Black Cockatoos.

5.1 EPBC Act Environmental Offsets Policy

This Offset Strategy is consistent with the principles of the EPBC Act Environmental Offsets Policy (DSEWPaC, 2012a) as presented in Table 9.

Table 9 Application of the EPBC Act Environmental Offsets Policy

Policy overarching principles	Comment
Suitable offsets must deliver an overall conservation outcome that improves or maintains the viability of the protected matter	The offsets will provide a conservation outcome that maintains or improves the viability of Black Cockatoos. The Offset Strategy provides more than 100 % direct offset for all protected matters. The conservation outcome will be achieved through protecting the protected matters through Main Roads ownership for purpose of conservation with the potential future transfer of land containing Black Cockatoo habitat to DBCA.
Suitable offsets must be built around direct offsets but may include other compensatory measures	The Offset Strategy provides more than 100 % direct offsets for Carnaby's Cockatoo, Baudin's Cockatoo and FRTBC, using the EPBC Act Offset Assessment Guide.
Suitable offsets must be in proportion to the level of statutory protection that applies to the protected matter	The quantum of offsets proposed are in proportion to the level of statutory protection applied to Carnaby's Cockatoo (Endangered), Baudin's Cockatoo (Endangered) and FRTBC (Vulnerable) as calculated EPBC Act Offset Assessment Guide (DSEWPaC ,2012a)
Suitable offsets must be of a size and scale proportionate to the residual impacts on the protected matter	The offsets will be of a size and scale proportional to the residual impacts Carnaby's Cockatoo, Baudin's Cockatoo and FRTBC. The Offset Strategy provides more than 100 % direct offset for all impacted MNES. The provision of direct offsets is based on completed offset assessment guide calculations, incorporating evidence-based justification for all inputs.
Suitable offsets must effectively account for and manage the risks of the offset not succeeding	The estimation of direct offsets is based on completed offset assessment guide calculations, incorporating a conservative assessment of risk of the offset not succeeding. Main Roads has a history of successful offset management, including the provision of land to DBCA for ongoing management and conservation. The ownership of land under the Commissioner of Main Roads for the purpose of Conservation with potential future transfer of land to DBCA is expected to have a high chance (90 %) of successfully delivering the required conservation outcomes. Main Roads has a strong track-record of demonstrated ability to undertake revegetation of Black Cockatoo foraging and potential breeding habitat.
Suitable offsets must be additional to what is already required, determined by law or planning regulations, or agreed to under other schemes or programs	The proposed offsets are additional to any other requirements.
Suitable offsets must be efficient, effective, timely, transparent, scientifically robust and reasonable	The 29.1 ha Offset Area identified in this Offset Strategy will be recognised as an offset site, with on ground management works implemented in consultation with DBCA as the State agency with lead responsibility for conservation. Main Roads proposes to transfer this offset site to DBCA, for conservation purposes. Main Roads, working with DBCA, is experienced in and has the resources to identify appropriate land parcels, acquisition, revegetation and on ground management works.

Policy overarching principles	Comment
Suitable offsets must have transparent governance arrangements including being able to be readily measured, monitored, audited and enforced.	The Offset Area will be managed, with financial input from Main Roads. Any transfer of ownership and / or contribution by DBCA, will be via a Memorandum of Understanding between Main Roads and DBCA, including requirements for land management and monitoring where appropriate.

5.2 WA Environmental Offsets Policy

This Offset Strategy is consistent with the principles of the WA Environmental Offsets Policy (Government of Western Australia, 2011) as presented in Table 10.

Table 10 Application of the WA Environmental Offsets Policy

Principle	Comment
Environmental offsets will only be considered after avoidance and mitigation options have been pursued	All avoidance and mitigation options have been pursued throughout the development of this Proposed Action including revised road alignment and avoidance of potential Black Cockatoo breeding trees.
Environmental offsets are not appropriate for all projects	Offsets are appropriate for this Proposed Action, due to the likely significant residual impacts to Carnaby's Cockatoo, Baudin's Cockatoo and FRTBC habitat.
Environmental offsets will be cost-effective, as well as relevant and proportionate to the significance of the environmental value being impacted	The offsets will be of a size and scale proportional to the residual impacts Carnaby's Cockatoo, Baudin's Cockatoo and FRTBC. The Offset Strategy provides more than 100 % direct offset for all impacted fauna values. The provision of direct offsets is based on completed offset DWER offset calculations, incorporating evidence-based justification for all inputs.
Environmental offsets will be based on sound environmental information and knowledge	The 29.1 ha Offset Area identified in this Offset Strategy will be recognised as an offset site, with on ground management works implemented in consultation with DBCA as the State agency with lead responsibility for conservation. Main Roads proposes to transfer this offset site to DBCA, for conservation purposes. Main Roads, working with DBCA, is experienced in, and has the resources to, identify appropriate land parcels, acquisition, revegetation and on ground management works.
Environmental offsets will be applied within a framework of adaptive management	The measures implemented, as described in section 3.1.4, provide the opportunity to review and revise the offset approach throughout the life of the offset management. These mechanisms are in place to take account of these risks and other potential unintended consequences which may arise.
Environmental offsets will be focussed on longer term strategic outcomes	The offsets will provide a conservation outcome that maintains or improves the viability of Black Cockatoos. The Offset Strategy provides more than 100 % direct offset for all protected matters. The conservation outcome will be achieved through protecting the protected matters through Main Roads ownership for purpose of conservation with the potential future transfer of land containing Black Cockatoo habitat to DBCA.

6 REFERENCES

360 Environmental (2020). Great Eastern Highway Coates Gully (Stage 1 and 2) Project Detailed Flora and Vegetation Report. Unpublished report prepared for Main Roads Western Australia. Perth, WA.

Bamford (2015, revised 2021). Main Roads Great Eastern Highway SLK 55.8-68.5 Fauna and Black-Cockatoo Habitat Assessment. Unpublished report prepared for Main Roads Western Australia. Perth, WA.

Bamford (2020). Scoring system for the assessment of foraging value of vegetation for Black-Cockatoos. Revised 5th June 2020.

Biologic (2021). H005 Great Eastern Highway Coates Gully (SLK 56.4-67.8) Biological Survey. Unpublished report prepared for Main Roads Western Australia. Perth, WA.

BirdLife Australia (2021). The Great Cocky Count Data Extraction. Perth, WA.

Commonwealth Government of Australia. (1999). Environmental Protection and Biodiversity Conservation Act 1999 (Cth). Canberra, ACT.

Commonwealth of Australia. (2013). Matters of National Environmental Significance. Significant Impact Guidelines 1.1. Perth: Department of the Environment.

Department of Agriculture, Water and Environment (DAWE) (2022). Referral guideline for 3 WA threatened black cockatoo species: Carnaby's Cockatoo, Baudin's Cockatoo and the Forest Red-tailed Black- cockatoo, Department of Agriculture, Water and the Environment, Canberra, February.

Department of Parks and Wildlife (DPaW) (2013). Carnaby's Cockatoo (Calyptorhynchus latirostris) Recovery Plan. Perth: Department of parks and Wildlife.

Department of Primary Industries and Regional Development, DPIRD (2024), Natural Resource Information (WA), Soil- Land Qualities-Salinity Hazard. Available online: https://dpird.maps.arcgis.com/apps/webappviewer/index.html?id=662e8cbf2def492381fc915aaf3c6a0f

Department of Sustainability, Environment, Water, Population and Communities (DSEWPAC) (2012a). EPBC Act Environmental Offsets policy. October 2012. Commonwealth of Australia, Australia.

Department of Sustainability, Environment, Water, Population and Communities (DSEWPAC) (2012b). EPBC Act referral guidelines for three threatened Black Cockatoo species. April 2012. Commonwealth of Australia, Australia.

Glevan Consulting (2020). Coates Gully Recheck Phytophthora dieback occurrence assessment – Version 1.0. Unpublished report prepared for Main Roads Western Australia. Perth, WA.

Glevan Consulting (2021). Coates Gully Recheck. Unpublished report prepared for Main Roads Western Australia. Perth, WA

Glossop B., K. Clarke, D. Mitchell, and G. Barrett. (2011). Methods for mapping of Carnaby's cockatoo habitat. Department of Environment and Conservation. Perth, WA.

Government of Western Australia (2011). WA Environmental Offsets Policy. Available online: https://www.epa.wa.gov.au/sites/default/files/Policies_and_Guidance/WAEnvOffsetsPolicy-270911.pdf

Government of Western Australia (GoWA) (2022), Native Vegetation Extent, Department of Primary Industries and Regional Development, Available online: https://catalogue.data.wa.gov.au/dataset/native-vegetation-extent

Kirkby, T. (2021). Black Cockatoo Breeding Hollow Inspection, Coates Gully, Wundowie. Unpublished report prepared for Main Roads Western Australia. Perth, WA.

Kirkby, T. (2022). Black Cockatoo Breeding Hollow Inspection, Coates Gully, Wundowie. Unpublished report prepared for Main Roads Western Australia. Perth, WA

Kirkby, T. (2023a). Survey Of Potential Black Cockatoo Breeding Habitat, Lot 4154, Coates Gully. Unpublished report prepared for Main Roads Western Australia. Perth, WA

Le Roux, C. (2017). Nocturnal roost tree, roost site and landscape characteristics of Carnaby's Black-Cockatoo (Calyptorhynchus latirostris) on the Swan Coastal Plain. https://ro.ecu.edu.au/theses/2017

Main Roads Western Australia (Main Roads) (2024a). EPBC 2022/9151 Preliminary Documentation. Unpublished report prepared for Main Roads Western Australia. Perth, WA.

Main Roads Western Australia (Main Roads) (2024b). EPBC 2022/9151 Construction Environmental Management Plan. Unpublished report prepared for Main Roads Western Australia. Perth, WA.

Peck, A., Barrett, G., Williams, M. (2019). The 2019 Great Cocky Count: a community-based survey for Carnaby's Black-Cockatoo (Calyptorhynchus latirostris), Baudin's Cockatoo (Calyptorhynchus baudinii) and Forest Red-tailed Black-Cockatoo (Calyptorhynchus banksii naso). BirdLife Australia, Floreat, WA.

Royal Automobile Club of WA (RAC 2017, 2019 and 2022), Risky Roads survey 2016/17, 2019 and 2022, Available online https://rac.com.au/about-rac/community-programs/risky-roads

Stream Environment and Water (2022). Assessment of Main Roads revegetation area, State Forest No.2. Unpublished memorandum report prepared for Main Roads Western Australia.

Threatened Species Scientific Committee (TSSC). 2018. 'Conservation Advice Calyptorhynchus baudinii Baudin's Cockatoo'. Department of the Environment and Energy, Canberra.

7 APPENDICES

Appendix	Title
Appendix 1	Figures – Suitable Black Cockatoo habitat within the Development Envelope and Offset Site
Appendix 2	Revegetation species list (Biologic 2021)

Appendix 1: Figures – Suitable Black Cockatoo habitat within the Development Envelope and Offset Site

FIGURE 2-1

Figure 2-1 Carnaby's Cockatoo foraging habitat within the Development Envelope

Figure 2-2 Carnaby's Cockatoo foraging habitat within the Development Envelope

Figure 2-3 Carnaby's Cockatoo foraging habitat within the Development Envelope

445100 445200 445300 445400 445500 445600 445700 445800 445900 446000 446100 446200 446300 446400 446500

6486000 6485900 6485800 6485700 6485600 6485500 6485400 6485300 6485200 6485100 6485000

Coates Rd

Great Eastern Hwy

Great Eastern Hwy

Great Eastern Hwy

Corymbia Cl

Oyston Rd

Legend

- Development Envelope
- Low
- Medium

FIGURE 2-4

0 130 260 520

Meters

Author: E200518
Created Date: 8/07/2024
Scale: 1:4,500 @ A3
Coordinate System: GDA2020

Path: E:\Wheatbelt\NATIONAL\GEH\Coates Gully Stage 2\Approvals\Offset\Offset Strategy\v3\GIS\MrCPv3 Offset Strategy.aprx

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GEH / Coates Gully Project

mainroads WESTERN AUSTRALIA

Carnaby's Cockatoo foraging habitat within the Development Envelope

NORTHAM
PERTH

Figure 2-4 Carnaby's Cockatoo foraging habitat within the Development Envelope

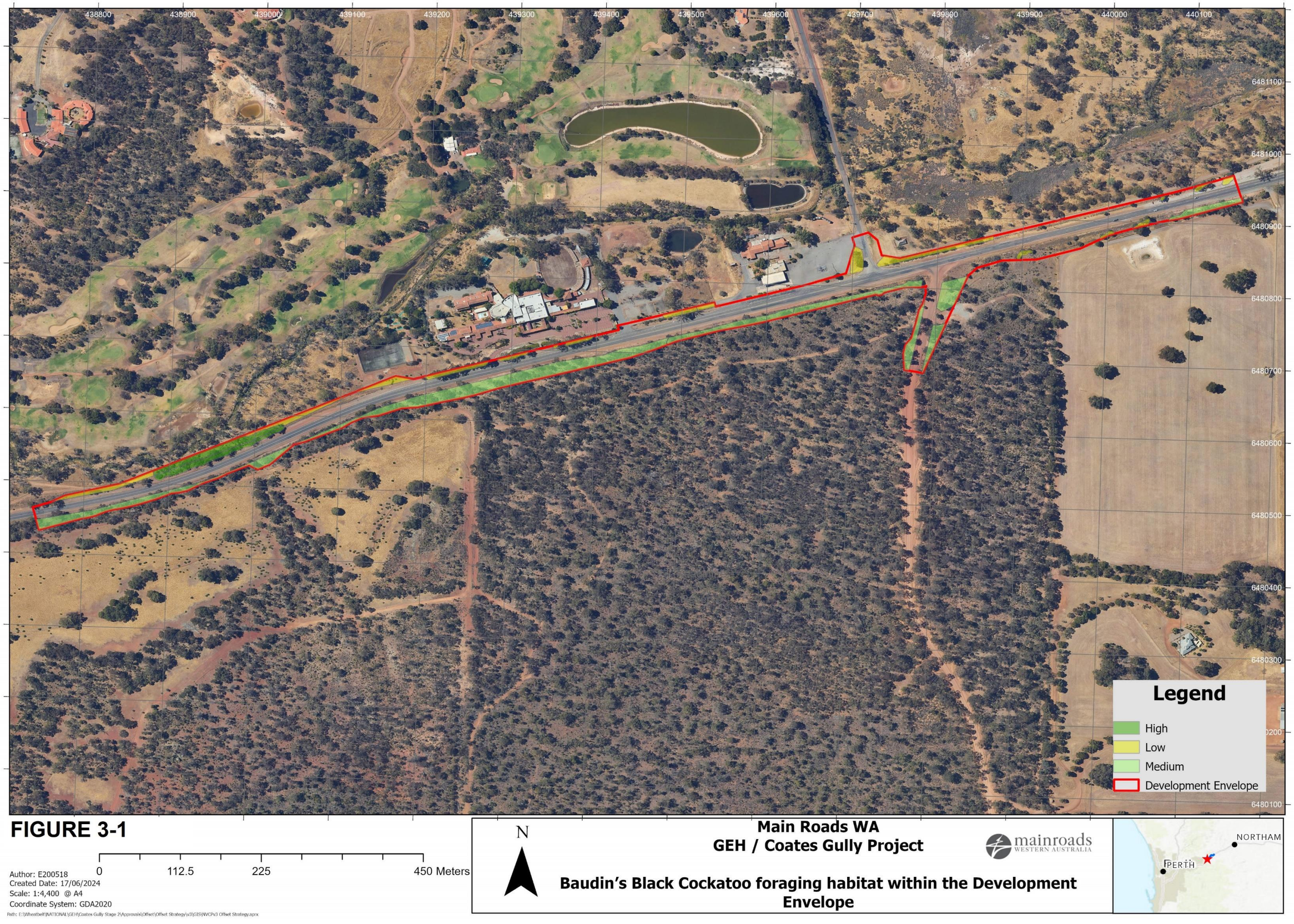

Figure 3-1 Baudin's Cockatoo foraging habitat within the Development Envelope

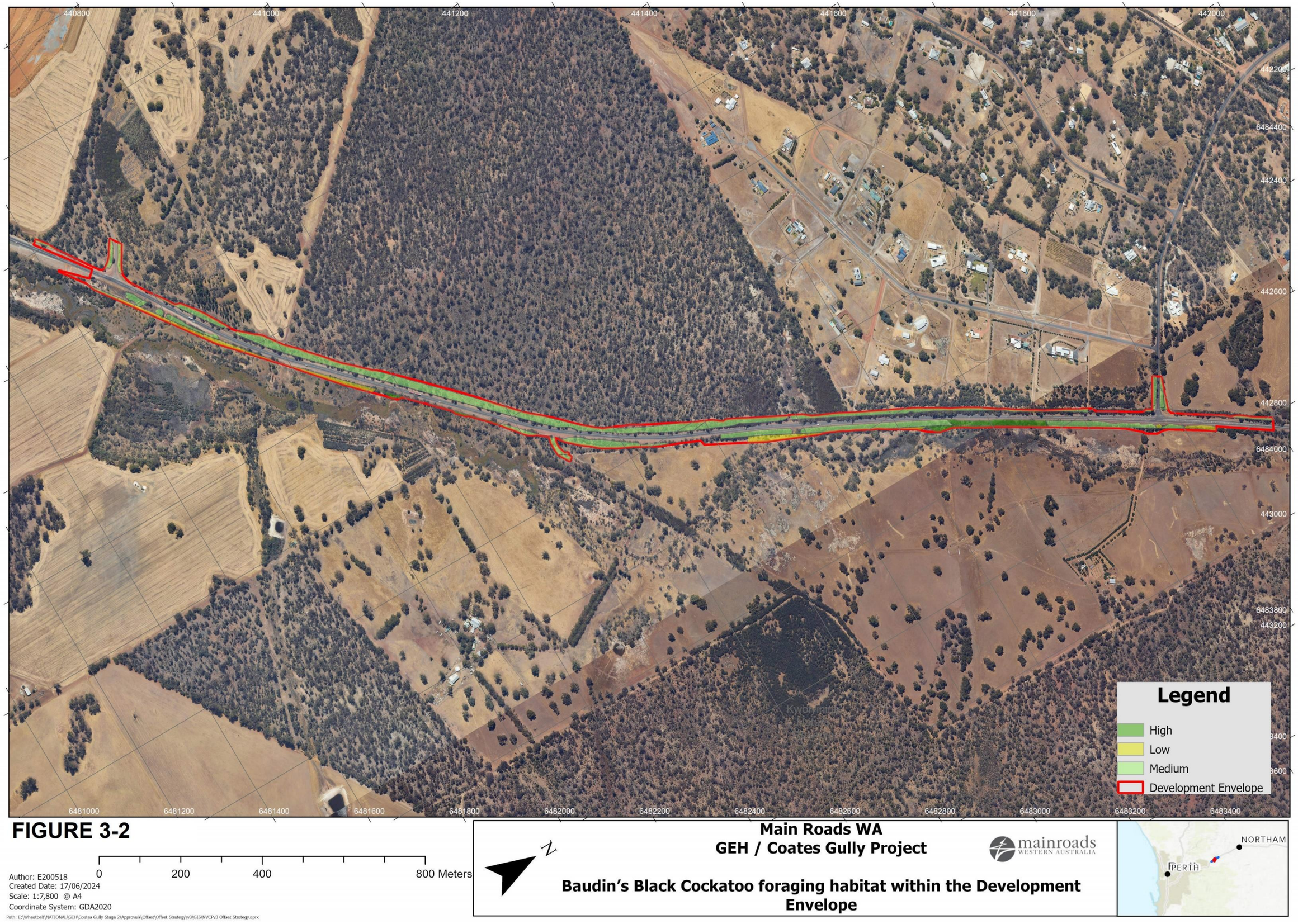

Figure 3-2 Baudin's Cockatoo foraging habitat within the Development Envelope

Figure 3-3 Baudin's Cockatoo foraging habitat within the Development Envelope

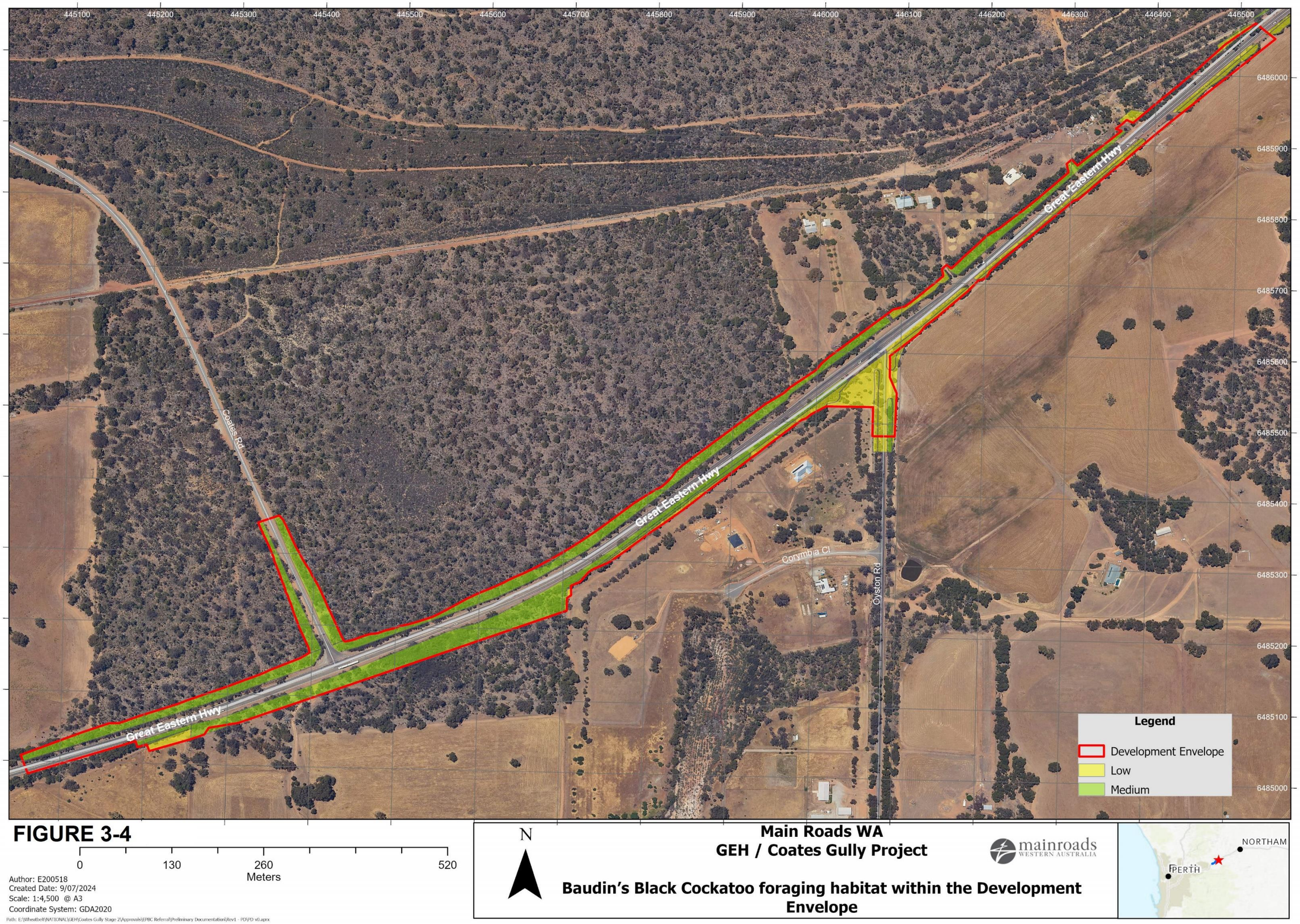

Figure 3-4 Baudin's Cockatoo foraging habitat within the Development Envelope

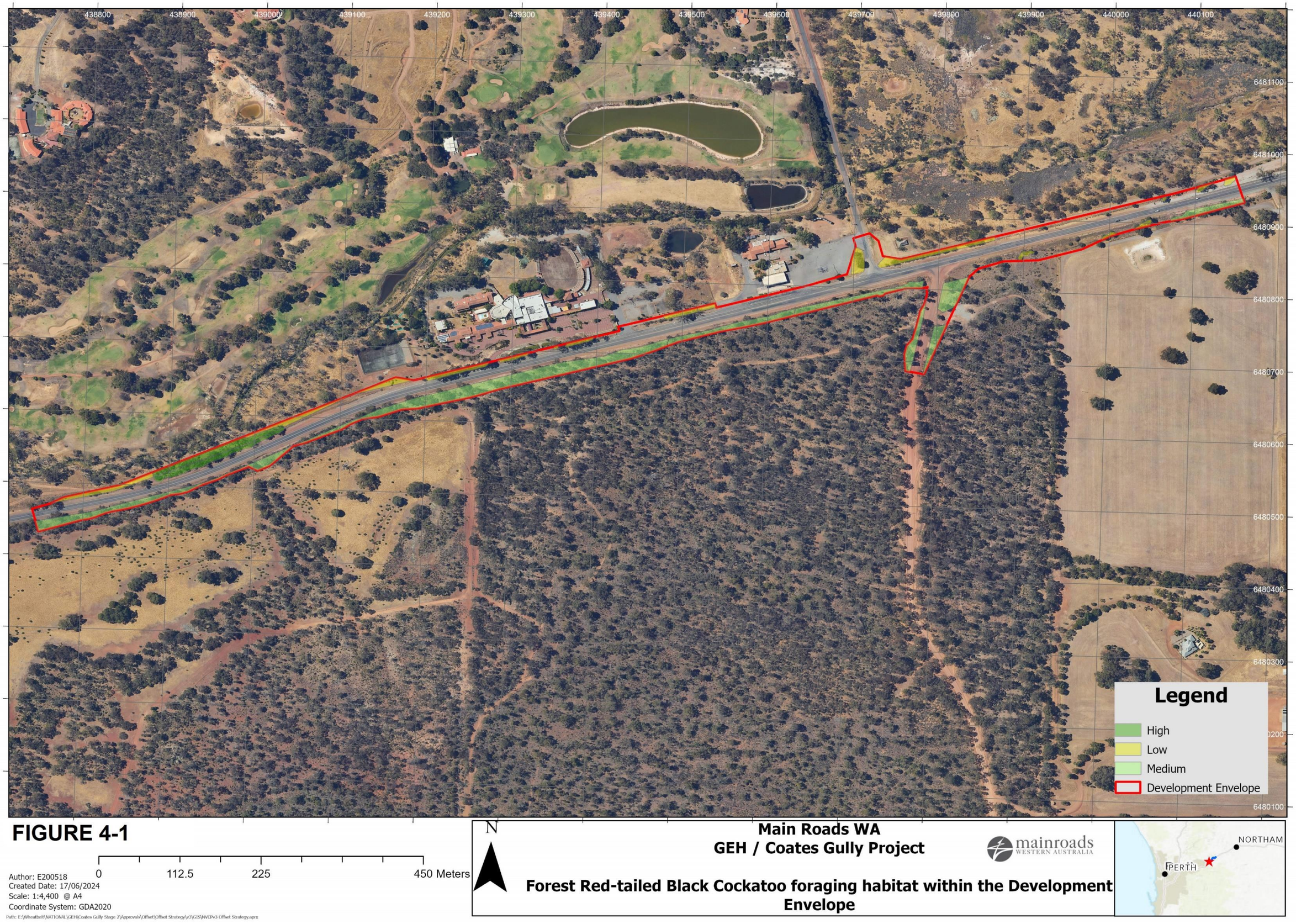

Figure 4-1 Forest Red-tailed Black Cockatoo foraging habitat within the Development Envelope

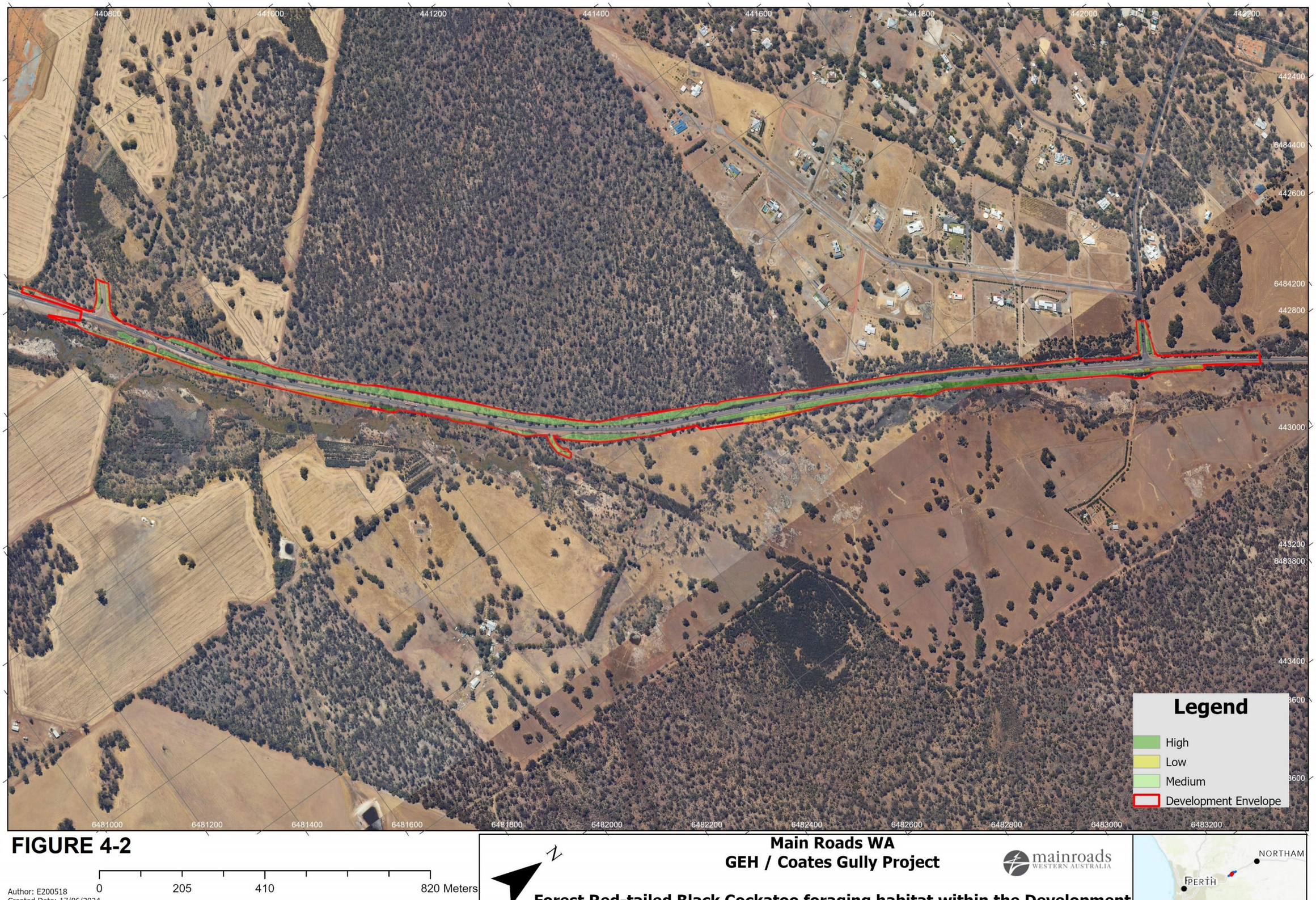

Figure 4-2 Forest Red-tailed Black Cockatoo foraging habitat within the Development Envelope

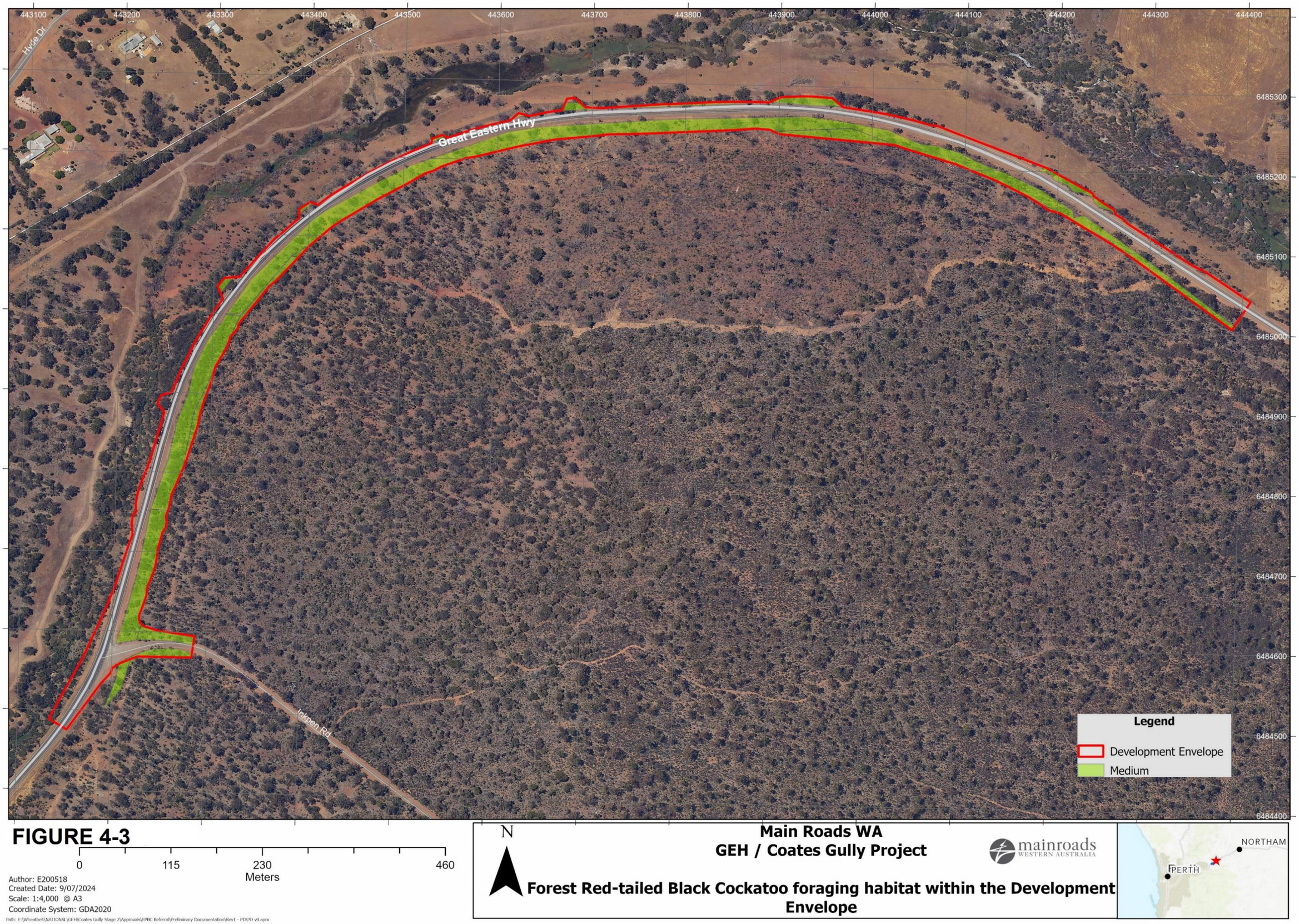

Figure 4-3 Forest Red-tailed Black Cockatoo foraging habitat within the Development Envelope

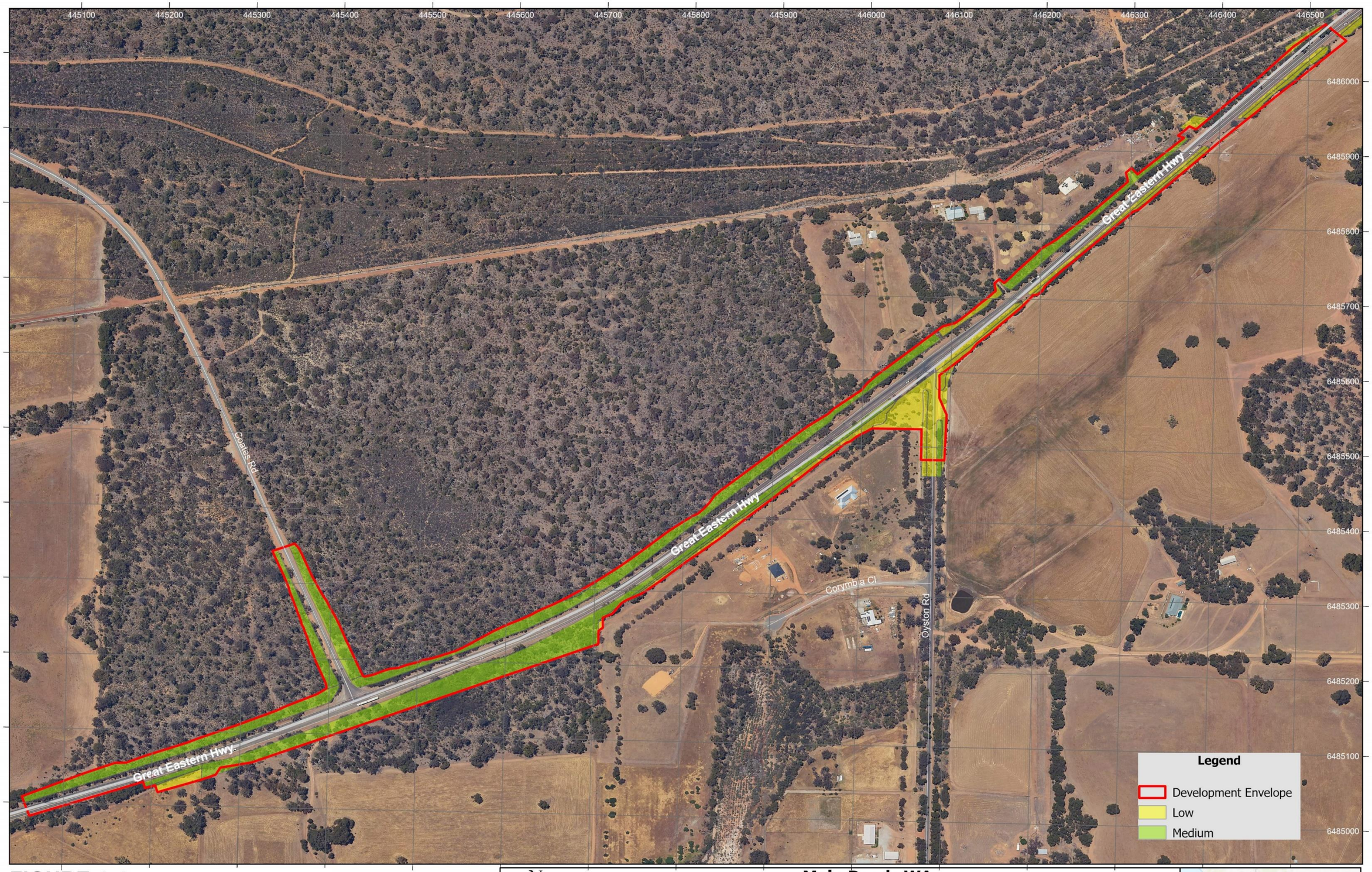

FIGURE 4-4

0 130 260 520
Meters

Author: E200518
Created Date: 9/07/2024
Scale: 1:4,500 @ A3
Coordinate System: GDA2020

Path: E:\Wheatbelt\NATIONAL\GEH\Coates Gully Stage 2\Approvals\EPBC Referral\Preliminary Documentation\Rev1 - PD\PD v0.aprx

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Forest Red-tailed Black Cockatoo foraging habitat within the Development Envelope

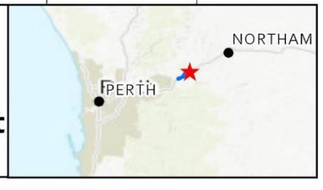

Figure 4-4 Forest Red-tailed Black Cockatoo foraging habitat within the Development Envelope

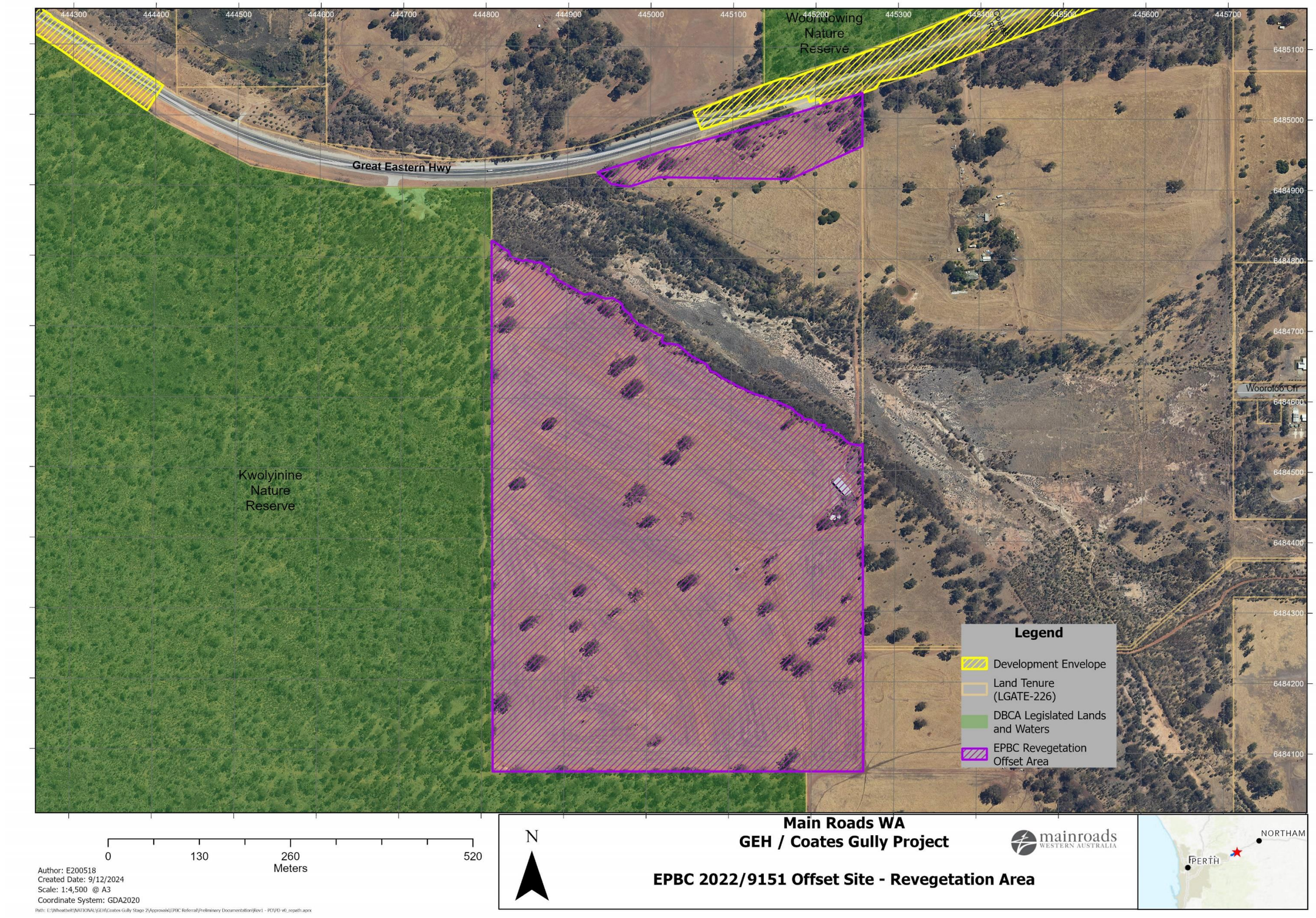

Figure 5-1 Offset Site location Map

Appendix 2: Revegetation species list – Black Cockatoo Foraging Habitat (Biologic 2021)

Species	BC Foraging Species	Canopy (Lower / Mid / Upper)
Allocasuarina fraseriana	x	Mid
Allocasuarina huegeliana	x	Mid
Allocasuarina humilis	x	Mid
Banksia dallanneyi	x	Mid
Banksia sessilis	x	Mid
Banksia squarrosa	x	Mid
Corymbia calophylla	x	Upper
Eucalyptus marginata	x	Upper
Eucalyptus patens	x	Upper
Eucalyptus rudis	x	Upper
Eucalyptus wandoo	x	Upper
Grevillea synapheae subsp. *synapheae*	x	Mid
Hakea ilicifolia	x	Mid
Hakea lissocarpha	x	Mid
Hakea prostrata	x	Mid
Hakea undulata	x	Mid
Xanthorrhoea preissii	x	Mid