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

Preliminary Documentation

D22#1068733
December 2024

Version Control

Revision	Date	Name	
0	October 2022	GHD	Author
0	October 2022	GHD	Reviewer
0	October 2022	Main Roads	Reviewer / Approver
1	July 2024	Main Roads	Reviewer / Approver
2	September 2024	Main Roads	Reviewer / Approver
3	December 2024	Main Roads	Author

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, forming 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.

The key components of the Proposed Action include:

- Clearing of up to 15.7 ha of suitable habitat for Black Cockatoo species, including 15.6 ha of potential breeding and low quality roosting habitat, and up to 400 suitable Diameter at Breast Height (DBH) trees for Black Cockatoos
- 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.

As the Proposed Action may have a significant impact on Matters of National Environmental Significance (MNES), Main Roads was required to prepare Preliminary Documentation to inform the assessment of the relevant impacts of the Proposed Action. This Preliminary Documentation was prepared in response to a request by the Department of Climate Change, Energy, the Environment and Water (DCCEEW) on 13 April 2022 and subsequent request on 05 December 2022 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).

The Proposed Action will result in significant residual impacts to Carnaby's Cockatoo (*Zanda latirostris* formerly *Calyptorhynchus latirostris)*, Forest Red-tailed Black Cockatoo (FRTBC, *Calyptorhynchus banksia naso)* and Baudin's Cockatoo (*Zanda baudinii* listed as *Calyptorhynchus baudinii)*, due to the following impacts:

- 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 (totalling 15.7 ha)
- 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 (totalling 15.6 ha)
- Clearing of up to 400 suitable DBH trees for Black Cockatoos. No suitable or potentially suitable hollows will be impacted by the Proposed Action.

The above estimates are conservative, representing the full extent of MNES values within a reduced 35.15 ha DE following further modification to the Project Design, which represents the preliminary

impact footprint. The actual clearing footprint may be less and will be refined through the detailed design and construction planning process.

The Proposed Action will also impact on potential breeding and roosting habitat. The Proposed Action will not impact on any known or potentially suitable Black Cockatoo breeding hollows. No known Black Cockatoo roosting sites will be impacted by the Proposed Action.

Given the scale, nature and location of the works, the Proposed Action is not expected to result in significant indirect impacts to Carnaby's Cockatoo, FRTBC or Baudin's Cockatoo. All potential indirect impacts are considered to be minor that can be managed using standard management measures. Potential indirect impacts include:

- Accidental clearing of nearby potentially suitable hollows
- Fragmentation
- Spread or introduction of weeds and dieback
- Vehicle strike
- Changes to surface water run-off
- Alteration to fire regimes.

The Proposed Action construction works will be managed in accordance with a Construction Environment Management Plan (CEMP). The CEMP details how potential environmental impacts will be managed. This includes a pre-clearance inspection of hollows within 10 m of the DE and the requirement for the presence of a fauna spotter / catcher on site during all clearing activities. The CEMP also includes strict access and fire controls, as well as dieback and weed hygiene requirements to protect adjacent areas of Black Cockatoo habitat.

Main Roads has developed an Offset Strategy to identify how it will counterbalance the Proposed Action's significant residual impacts to Carnaby's Cockatoo, FRTBC and Baudin's Cockatoo habitat. To offset the Proposed Action's impact on foraging habitat, Main Roads has acquired an adjacent property and will be restoring Black Cockatoo foraging habitat.

Implementation of the Proposed Action:

- Is consistent with the Regional Road reserve under the Metropolitan Region Scheme
- Provides substantial social, economic and safety benefits
- Has been developed with consideration to appropriate stakeholder consultation
- Incorporates substantial impact avoidance and mitigation, and established, effective construction management measures
- Will be undertaken in accordance with a CEMP
- Includes an offset to counterbalance 100 % of the residual impact.

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1 INTRODUCTION

1.1 Overview

Main Roads Western Australia (Main Roads) proposes to upgrade almost 10.5 kilometres (km) 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 passes through Coates Gully and is located approximately 56 km east of Perth and 25 km west of Northam in Western Australia (WA). Figure 1-1 presents the Proposed Action location and Development Envelope (DE). The DE comprises an area of approximately 35.15 hectare (ha) and represents the Proposed Action's impact footprint.

Currently, the 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, forming part of the Perth - Adelaide Corridor and supports social and economic integration between the west and east of Australia. In some cases, the GEH is the sole connection between a large number of remote communities and the Perth metropolitan area. The 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 Coates Gully section of the GEH has very poor alignment, which critically affects road-user safety. This has resulted in significant crashes, as well as restricts the efficiency of the highway as a major freight route. This route has been identified as the third riskiest road in regional WA for three consecutive RAC surveys (2017, 2019 and 2022[1]), owing to the poor road condition. Of particular concern, is the inadequate road formation and seal widths, absence of vehicle passing overtaking lanes and the narrow or absent shoulders.

The key components of the Proposed Action include:

- Clearing of up to 15.7 ha of suitable habitat for Black Cockatoo species, including 15.6 ha of potential breeding and low quality roosting habitat, and up to 400 suitable Diameter at Breast Height (DBH) trees for Black Cockatoos for the reconstruction and realignment of the existing 9 metre (m) road formation and widening 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.

1.2 Purpose and Scope

On 28 March 2022, a delegate of the Minister for the Environment determined the Proposed Action was a 'Controlled Action' under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) to be assessed by Preliminary Documentation. The relevant controlling provisions are listed threatened species and communities (sections [s] 18 & 18A).

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

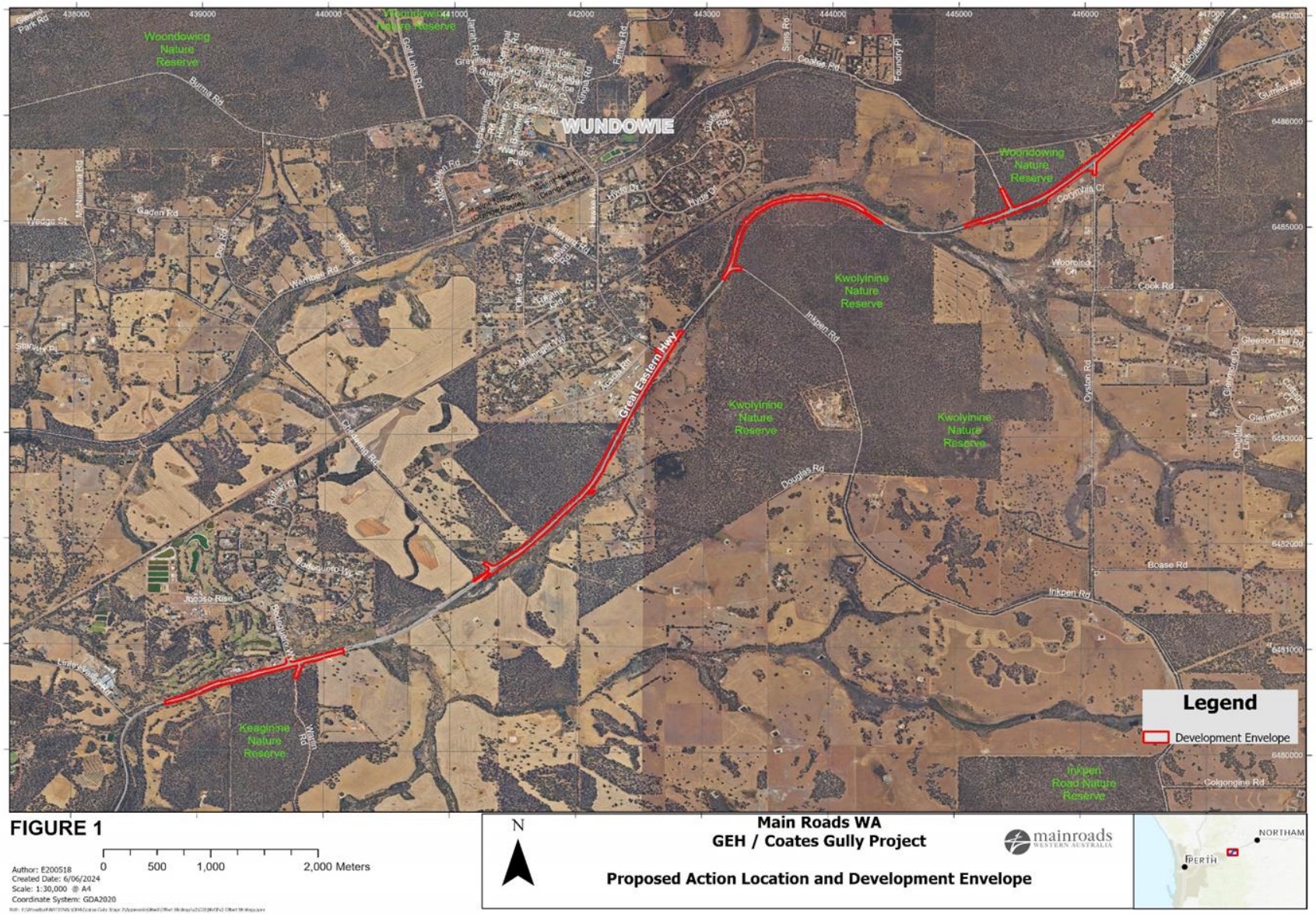

Figure 1-1 Proposed Action location and Development Envelope

On the 13 April 2022, the Department of Climate Change, Energy, the Environment and Water (DCCEEW, formerly the Department of Agriculture, Water and Environmental Regulation [DAWE]) requested additional information to inform the assessment of the relevant impacts of the Proposed Action. In making the request, DCCEEW considered the Proposed Action may impact Matters of National Environmental Significance (MNES) including:

- Carnaby's Cockatoo (*Zanda latirostris* formerly *Calyptorhynchus latirostris*) – Endangered
- Baudin's Cockatoo (*Zanda baudinii* listed as *Calyptorhynchus baudinii*) – Endangered
- Forest Red-tailed Black Cockatoo (FRTBC, *Calyptorhynchus banksia naso*) – Vulnerable.

This document has been prepared to address DCCEEW's request for further information to support assessment of a Controlled Action by Preliminary Documentation. The further information requested is outlined in Section 2.

1.3 Variations to the Proposed Action

1.3.1 S156(a) 2022 Variation

In 2022, six months after its initial referral of the Proposed Action, Main Roads requested an increase to the DE and the areas of Black Cockatoo habitat to be impacted. This increase was due to the initial referral not having regard for the disturbances required to construct the road and provide for the safe movement of machinery and other construction activities. The proposed amendments resulted in the following changes:

- DE increasing by 0.34 ha to 37.62 ha
- Carnaby's Cockatoo foraging habitat impact increasing by 0.34 ha to 16.34 ha
- Baudin's Cockatoo and FRTBC foraging habitat impact increasing by 0.22 ha to 16.22 ha
- Suitable DBH trees to be cleared increasing by 207 to 451.

The variation request was approved by the Delegate on 24 October 2022.

1.3.2 S156(a) 2024 Variation

Subsequent to the submission of the draft 2022 Preliminary Document to DCCEEW, the Proposed Action was redesigned to avoid and reduce impacts on Black Cockatoo habitat. This redesign resulted in the following outcomes:

- The DE being reduced from 37.62 ha to 35.15 ha
- Avoidance of all potentially suitable hollows
- Reduction in the number of suitable DBH trees for Black Cockatoos, from 451 down to 400
- Reduction in amount of foraging habitat for Carnaby's Cockatoo to be cleared, from 16.34 ha down to 15.7 ha
- Reduction in amount of foraging habitat for Baudin's Cockatoo and FRTBC to be cleared from 16.22 to 15.6 ha.

On 08 July 2024, Main Roads submitted a variation request under section 156A of the EPBC Act to reduce the size of the DE and amount of Black Cockatoo habitat to be impacted.

The variation request was approved by the Delegate on 26 July 2024.

1.3.3 Summary of S156(a) Variations

A summary of the impacts of the referral and subsequent variations is shown in Table 1-1.

Table 1-1 Proposed Action Impacts – Referral and Variations

Environmental Aspect	Original Proposed Action	2022 Variation	2024 Variation	2024 Variation Change
Development Envelope	27.53 ha	37.62 ha	35.15 ha	-2.47 ha
Carnaby's Cockatoo Foraging Habitat	16 ha	16.34 ha	15.7 ha	-0.64 ha
Baudin's Cockatoo Foraging Habitat	15.8 ha	16.22 ha	15.6 ha	-0.62 ha
Forest Red-tailed Black Cockatoo Foraging Habitat	15.8 ha	16.22 ha	15.6 ha	-0.62 ha
Black Cockatoo Suitable DBH Trees (no hollows)	244 trees	451 trees	400 trees	-51 trees

1.4 Proponent

The proponent for the Proposed Action is the Commissioner of Main Roads and formal contact details are listed in Table 1-2.

Table 1-2 Proponent and Proposed Action Key Contact

Proponent / Contact	Contact details
Proponent	Commissioner of Main Roads Main Roads Western Australia PO Box 6202 East Perth WA 6002 ABN/ACN 50 860 676 021
Proposed Action Key Contact	Martine Scheltema Director Environment and Heritage Main Roads Western Australia

2 PRELIMINARY DOCUMENTATION

This Preliminary Documentation presents the additional information requested by DCCEEW, to support the assessment of the Great Eastern Highway Upgrade Project (EPBC 2022/9151, the Proposed Action) under the EPBC Act. The structure and content of this Preliminary Documentation has been prepared in accordance with DCCEEW's request for additional information (see Table 2-1).

Table 2-1 Structure and Content of Preliminary Documentation

Information Requested	Section
Description of the action	
Provide details of the action, including: • A summary of all components/phases of the Proposed Action, including construction, pre-construction, operational and any decommissioning and rehabilitation, and their respective timing • The activities associated with each phase of the Proposed Action • The location, boundaries and size (in hectares (ha)) of the Proposed Action area, any discrete disturbance areas, and any adjoining areas which may be directly or indirectly impacted by the Proposed Action, including nearby habitat and areas for stockpiles, vehicle access and associated activities • A layout plan for the Proposed Action area, including but not limited to key infrastructure, laydown areas and construction camps, new access tracks, conservation areas and heritage agreements the project corridor passes through • The anticipated timing and duration (including start and completion dates) of each component of the Proposed Action, and associated impacts. • A description of operational requirements of the Proposed Action including any anticipated maintenance works • A description and likely timing of rehabilitation activities associated with the Proposed Action.	Section 3 to Section 3.6
Any feasible alternatives to the Proposed Action to the extent reasonably practicable, including, the alternative of taking no action, a comparative description of the impacts of each alternative on EBPC Act listed threatened species and communities and sufficient detail to make clear why any alternative is preferred to another. Short, medium and long-term advantages and disadvantages of the options should be discussed.	Section 3.8
Listed threatened species and communities	
Include details of Black Cockatoo roosting and breeding habitat for the site. The details must include: • The total area (in ha) of breeding habitat present on the impact site, consistent with the definition of breeding habitat in the Referral Guidelines for three species of Western Australian Black Cockatoos (2012a) • The total area (in ha) of habitat suitable for roosting on the impact site, consistent with the definition of roosting habitat in the Referral Guidelines for three species of Western Australian Black Cockatoos (2012a).	Section 4.3.2
Provide description of potential impacts (direct and indirect) on the Carnaby's Cockatoo, Baudin's Cockatoo and FRTBC as a result of Proposed Action activities, particularly construction. This should include consideration of potential indirect impacts to adjacent	Section 4.3, Section

Information Requested	Section
areas of Black Cockatoo habitat. Potential impacts include but are not limited to the following: • Fragmentation of habitat and impacts on habitat use due to this fragmentation. The description must include details of the distances between the Proposed Action site and watering sites, roosting sites, breeding habitat and High to Medium Quality foraging habitat within 12 km of the Proposed Action site, and make note of where any changes to the distances between these sites could impact Black Cockatoo access to, and use of, those habitat areas • The total area (in ha) of breeding habitat that will be impacted, including the number of known nesting trees (any existing tree in which breeding has been recorded or suspected), suitable nesting hollows, and potential nesting trees (trees of the right species and with a suitable Diameter at Breast Height) that will be removed. The assessment must provide an estimation of years until potential nesting trees would reach an age or size to potentially develop a suitable nesting hollow for Black Cockatoos. • The total area (in ha) of habitat suitable for roosting that will be impacted, including the number of trees considered suitable for roosting by Black Cockatoos.	5.1 and Section 5.2
Characterise the nature of impacts, including timing and whether the impact is temporary or permanent.	Section 5.2 and Appendix 1
Include a risk assessment of the potential impacts of the Proposed Action, including whether the nature and/or scale of the potential impacts are unknown, unpredictable or irreversible, and what confidence is placed on the predictions or relevant impacts.	Section 5.3 and Appendix 1
Include details of any relevant policy guidelines, studies, surveys, management plans or consultations with subject-matter experts which were not included in the original referral.	Section 5.4
Provide a Construction Environmental Management Plan (CEMP) that details how potential environmental impacts associated with construction activities will be managed. The CEMP provided should be developed consistent with the Department's Environmental Management Plan (EMP) Guidelines. The CEMP should include, but not be limited to: • Procedures to protect fauna during construction, through ensuring that a fauna spotter catcher is present during all clearing and is given sufficient authority to guide all clearance, including stopping clearing while any checks or relocation requested by the fauna spotter catcher is undertaken. This should ensure that any Black Cockatoos that may be present have safely moved out of the DE identified for clearing, of their own volition, before the habitat is cleared. The Department notes that the survey done on 24 November 2020 and 30 November 2020 found all three Black Cockatoos on site at the time via direct and indirect evidence • Procedures to minimise impacts on surrounding areas. This may include measures for work vehicles, noise contamination, the amount of human and non-human traffic allowed in the area, and specific speed limits for heavy vehicles.	Section 6.3 and Appendix 2
Provide information (including engineering, technical and operational considerations) that demonstrates why the development must be constructed in the proposed location, and not in an alternative location which does not impact MNES. This information should include	Section 3.8 and 6.2

Information Requested	Section
discussion of any alternative designs that were considered but ruled out prior to acceptance of the current proposed design.	
If any nesting hollows will be lost as a result of the Proposed Action, provide a Black Cockatoo Artificial Nest Hollow Management Plan (ANHMP) that includes commitments to install Artificial Nest Hollows (ANH). The ANHMP must be consistent with the Environmental Management Plan Guidelines (2014) and must include the following: • A clear statement of the environmental outcomes that will be achieved by the ANHMP • A summary table of the commitments made in the ANHMP including the timing of each commitment, and a reference to exactly where these commitments are described in detail in the ANHMP • The number of artificial hollows to be installed, including a justification for how many will be installed for every nest hollow that will be lost • A description of how the ANH will be constructed and installed, including: o Commitments to current best practice methods for the construction and installation of ANH, including references to Fauna Notes Artificial Hollows for Carnaby's Cockatoo (2015) and Fauna Notes How to Monitor and Maintain Artificial Hollows for Carnaby's Cockatoo (2015), if applicable o The proposed timing of installation of the artificial nesting hollows, in relation to the timing of the loss of suitable nest hollows as a result of the Proposed Action. • A description and justification of the proposed location of each ANH • Proposed timing of installation, maintenance checks and other relevant management actions for each ANH • Funding commitments to ensure the ANH are managed and maintained for at least as long as it takes for replacement habitat (provided as an offset) to produce additional natural suitable nesting hollows to replace the hollows that will be lost • Reporting and review mechanisms, to demonstrate compliance with the commitments in the AHNMP, including: o Measurable performance indicators o Trigger values for corrective actions o The timing and frequency of monitoring to detect trigger values and changes in the performance indicators o Proposed corrective actions if trigger values are reached o Completion or success criteria.	Section 6.4
Offsets	
An offset is required to compensate for all predicted or potential residual significant impacts (direct and indirect) to EBPC Act listed threatened species, including the Baudin's Cockatoo, Carnaby's Cockatoo and FRTBC. Please provide an offset proposal that meets the principles of the EPBC Act Environmental Offsets Policy (DSEWPaC, 2012b). 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 • 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	Section 7 and Appendix 3

Information Requested	Section
habitat at the offset site(s) in accordance with the various Departmental guidelines and conservation advice, or using a scientifically robust and repeatable methodology • 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 • 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 • 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 • Justification of how the offset proposal meets the requirements of the EPBC Act Offsets Assessment Policy.	
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 Carnaby's Cockatoo, Baudin's Cockatoo and FRTBC • Milestones to demonstrate adequate progress towards achieving the offset completion criteria • 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: o 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 o Reduce the invasive weed coverage on the offset site to 5 % within 5 years following commencement of the action o Implement an annual non-native feral pest control program over a 10-year period. • Level of certainty that the proposed offset will be successful.	Section 7 and Appendix 3
Other approvals and conditions	
The preliminary documentation must include information on any other requirements for approval or conditions that apply, or that you reasonably believe are likely to apply, to the Proposed Action This must include: • A description of any approval obtained or required to be obtained from a State or Commonwealth agency or authority (other than an approval under the EPBC Act), including any conditions that apply (or are reasonably expected to apply) to the action • A description of the monitoring, enforcement and review procedures that apply, or are proposed to apply, to the action.	Section 8
Economic and social matters	

Information Requested	Section
Please provide further detail on the social and economic costs and/or benefits of undertaking the Proposed Action, including: • Estimate of any anticipated economic costs and/or benefits (in AUD) • Basis for any estimations of costs and/or benefits • Potential employment opportunities expected to be generated at each phase of the Proposed Action • Details of any public and stakeholder consultation activities, including the outcomes • Details of any public and/or Indigenous stakeholder consultation activities, and their outcomes, noting that National Indigenous Australians Agency (NIAA) has advised that the Proposed Action will be subject to the Department of Infrastructure, Transport, Regional Development and Communication's Indigenous employment and Supplier Use Infrastructure Framework and will require the development of Indigenous Participation Plan.	Section 9

3 DESCRIPTION OF THE ACTION

3.1 Components and Phases

Main Roads proposes to upgrade a section of the GEH between SLK 56.4 and 67.8 (Figure 1-1). The Proposed Action passes through Coates Gully and is located approximately 56 km east of Perth and 25 km west of Northam in WA. The DE comprises an area of approximately 35.15 ha and represents the impact footprint within which all development will be contained. The key components of the Proposed Action include:

- Clearing of up to 15.7 ha of suitable habitat for Black Cockatoo species, including 15.6 ha of potential breeding and low quality roosting habitat, and up to 400 suitable DBH trees for Black Cockatoos for the reconstruction and realignment of the existing 9 m road formation and widening 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.

The Proposed Action will require pre-construction, construction, and operational phases. Decommissioning is not relevant to the Proposed Action. There are limited opportunities for rehabilitation within the DE as the Proposed Action constitutes minimal realignment and all contractor ancillary activities will be confined to existing cleared areas (i.e. farmers' paddocks). No clearing of native vegetation will be undertaken for temporary construction activities.

Pre-construction for the Proposed Action is anticipated to start in Quarter (Q) 3 2024 and will continue until commencement of construction of the Proposed Action, anticipated to be Q1 2025 (subject to approvals).

Construction of the Proposed Action is planned to commence in Q1 2025 and take approximately 6 months. The commencement of the Proposed Action is subject to approvals and refinement of the preferred design option.

Operation of the Proposed Action will commence upon completion of construction and will continue for the life of the road, although it is considered that the operation phase will not have an impact on MNES.

3.2 Phase Activities

3.2.1 Pre-construction

On-ground pre-construction activities will include the ongoing maintenance of the existing GEH (as required) and site preparation activities (e.g. establishment of a site office, laydown areas and traffic management). Pre-construction activities required for the Proposed Action also include the relocation of Telstra and Western Power services and construction of new fences along new cadastral boundaries. Minor vegetation clearing may be required for these activities.

3.2.2 Construction

Construction will be undertaken using traditional earth-moving equipment and construction techniques. Construction activities required for the Proposed Action include:

- Clearing and earthworks
- Reconstruction and realignment of the existing 9 m formation and widening to a 12 m formation, including 1.0 m median
- Intersection improvements at Bodeguero Way, Wariin Road, Chedaring Road, Hawke Avenue, Inkpen Road, Coates Road and Oyston Road
- Construction of additional eastbound and westbound passing lanes including an extension of the passing lane at the GEH/Coates Road intersection
- Culvert and drainage upgrades.

3.2.3 Operation

The GEH will continue to operate as a two-lane road; however, the road will be widened to achieve a 12 m seal on a 12 m formation cross section (inclusive of a 1.0 m painted median). Operation of the Proposed Action will be improved through minor realignment, widening and overlay. Additional westbound and eastbound overtaking lanes will be constructed to improve the safety of this section of the GEH and all rest areas / parking bays within the DE will be removed in accordance with the Wheatbelt region's Rest Area Strategy.

3.2.4 Decommissioning and Rehabilitation

Decommissioning is not relevant to the Proposed Action. There are limited opportunities for rehabilitation within the DE as the Proposed Action constitutes minimal realignment and all contractor ancillary activities will be restricted to existing cleared areas (i.e. farmers paddock). No clearing of native vegetation will be required for temporary construction activities.

Rehabilitation will be conducted where required and where possible. Any revegetation undertaken will be undertaken in accordance with *MRWA Vegetation Placement within the Road Reserve Doc. No. 6707/022* (Main Roads, 2013). This guide defines the recommended setbacks and clearance requirements that apply to all revegetation or landscaping associated with new road construction.

3.3 Location

The Proposed Action is located along the GEH, from Linley Valley Road to Swamp Road, approximately 56 km east of Perth and 25 km west of Northam in WA. The location of the Proposed Action is provided in Figure 1-1.

The DE covers 35.15 ha and includes the disturbance footprint for the Proposed Action. Any associated infrastructure, stockpiles, laydown areas and access tracks will be located either within the DE or adjacent existing cleared areas (i.e. farmers' paddocks).

The DE follows the existing road corridor of the GEH and, accordingly, the majority of the DE is already cleared due to the presence of the existing road. The remainder of the DE consists of vegetation and areas that have been cleared for agricultural and rural land uses.

The majority of the DE is located in the Shire of Northam, with a small western portion of the DE located within the Shire of Mundaring. The Proposed Action traverses the suburbs of Wooroloo, Copley, Wundowie and Bakers Hill. The following land uses are adjacent to the DE:

- The Keaginine Nature Reserve (R 14278) for the purpose of the Conservation of Flora and Fauna, vested with the Conservation Commission Of WA
- The Kwolyinine Nature Reserve (R 14276) for the purpose of the Conservation of Flora and Fauna, vested with the Conservation Commission Of WA
- The Woondowing Nature Reserve (R 14275) for the purpose of the Conservation of Flora and Fauna, vested with the Conservation Commission Of WA
- Rural areas, including rural residential and rural land
- Land zoned for 'public purposes'.

Nature reserve adjacent to the DE are shown in Figure 1-1.

3.4 Layout Plan

The DE includes the disturbance footprint for the Proposed Action. No native vegetation or impacts to MNES will occur outside of the DE. Non-road related infrastructure including, contractor site office, laydown areas and other miscellaneous activities will be restricted to existing cleared areas (either within the DE or adjacent farmers paddocks). Materials required for the Proposed Action will be sourced from local commercial sources. Water will be contractor supplied (from licenced sources).

The DE traverses two conservation areas including the Kwolyinine and Woondowing Nature Reserves. Main Roads has acquired 0.42 ha of Kwolyinine Nature Reserve and 0.55 ha of the Woondowing Nature Reserve as Road Reserve for the Proposed Action. The DE also lies adjacent to, but outside of, the Keaginine Nature Reserve. The Proposed Action does not intersect any Heritage Agreements; however, it is located within the Whadjuk People Indigenous Land Use Agreement.

The proposed layout and design for the Proposed Action is detailed in Figure 3-1.

3.5 Operational and Maintenance

The GEH will continue to operate as a two-lane road; however, the road will be widened to achieve a 12 m seal on a 12 m formation cross section (including a 1.0 m painted median). The GEH will be subject to normal routine, recurrent and periodic maintenance during operation of the highway. The maintenance operations will be confined to the road corridor and the road itself, typically including maintenance of vegetation, drainage, lighting, road markings, signs, and the road pavement. Ongoing operation of the Proposed Action will not require the clearing of native vegetation or impact upon MNES.

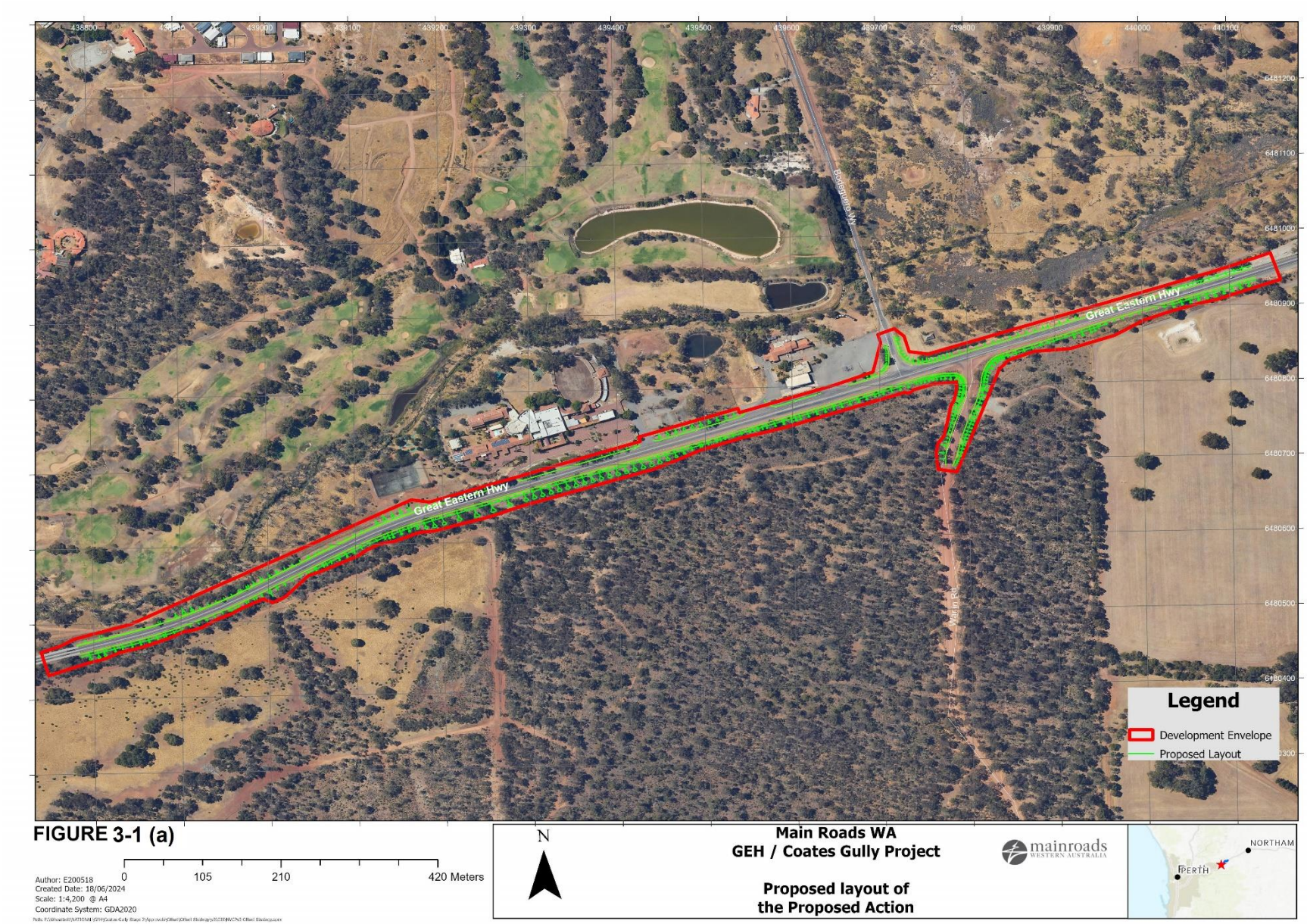

Figure 3-1 (a)Proposed layout of the Proposed Action

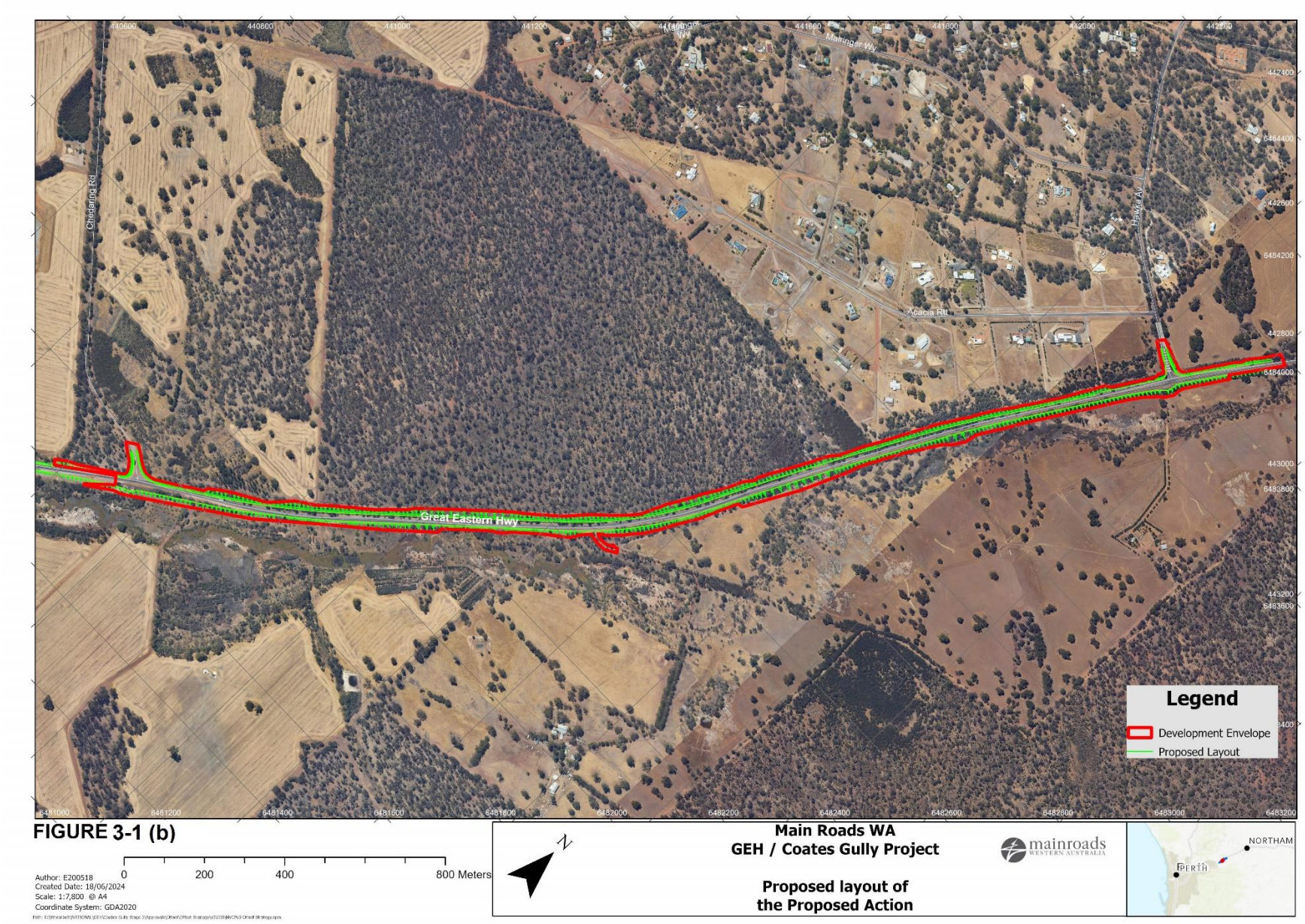

Figure 3-1 (b) Proposed layout of the Proposed Action

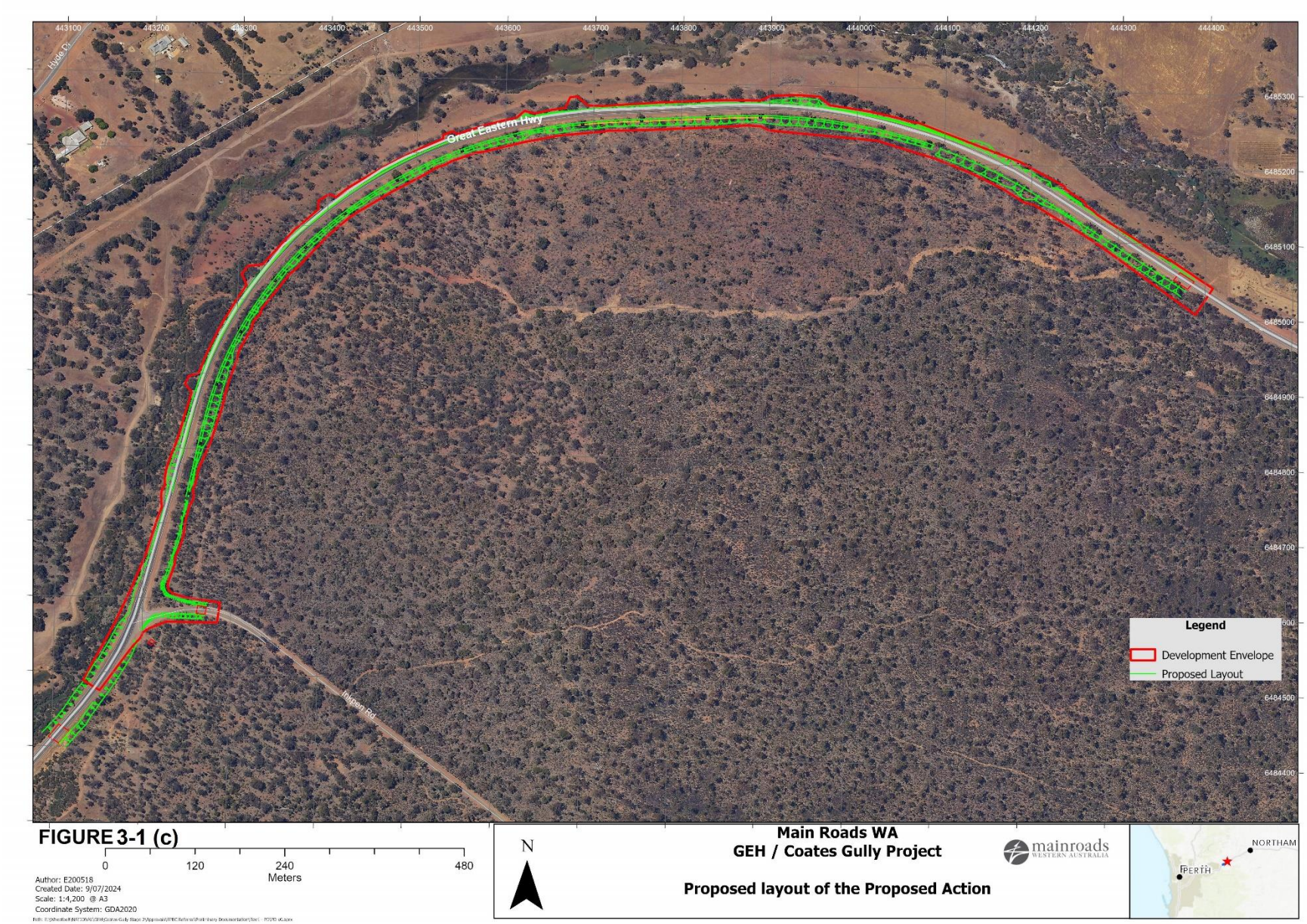

Figure 3-1 (c) Proposed layout of the Proposed Action

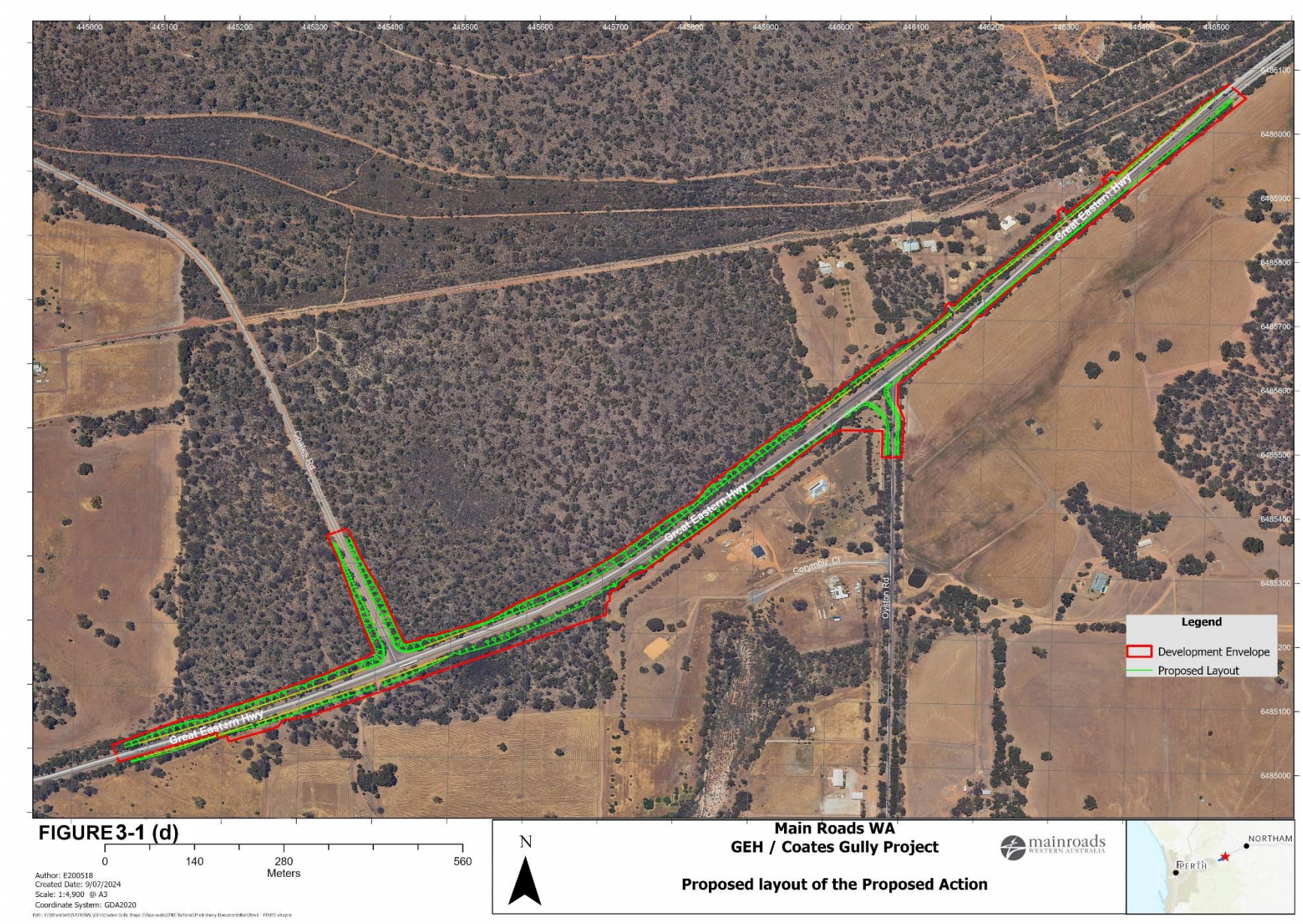

Figure 3-1 (d) Proposed layout of the Proposed Action

3.6 Timing and Duration

3.6.1 Pre-construction

Pre-construction for the Proposed Action is anticipated to start Q1 2025 and will continue until commencement of construction of the Proposed Action (anticipated to be Q1 2025, subject to approvals).

Pre-construction activities required for the Proposed Action may include the relocation of Telstra and Western Power services and construction of new fences along new cadastral boundaries. These activities will be confined to existing cleared areas (i.e. farmers' paddocks) where practicable.

The design of the Proposed Action will continue to be refined during the pre-construction phase, in order to reduce the environmental impacts and improve safety and usability. Consequently, the final disturbance from the Proposed Action is expected to be less than is proposed in this Preliminary Documentation.

3.6.2 Construction

Construction of the Proposed Action is planned to commence in Q1 2025 and take approximately 6 months. The commencement of the Proposed Action is subject to approvals and refinement of the preferred design option.

Construction activities associated with the Proposed Action will be managed in accordance with a Construction Environmental Management Plan (CEMP, Appendices 2) to mitigate potential impacts associated with the Proposed Action.

Construction of the road will be undertaken using conventional earth-moving and paving equipment and construction techniques. The road formation will be built using both imported fill and cut-to-fill materials from the DE. Laydown areas for road-building material will be established by the construction contractor in consultation with Main Roads and the Local Government Authorities. All laydown areas and areas required for associated infrastructure will be restricted to existing cleared areas (most likely farmers paddocks). No additional clearing of native vegetation or impact upon MNES will occur as a result of laydown areas and associated infrastructure. Materials required for the construction will be sourced from local commercial sources. Water will be contractor supplied (from licenced sources).

As discussed in detail in Section 5.1, during construction, the Proposed Action will reduce vehicle speed of road users and machinery speeds within the DE, further reducing the likelihood of vehicle strike to fauna, including Black Cockatoos.

3.6.3 Operation

Operation of the Proposed Action will commence upon completion of construction and will continue for the life of the road. Ongoing operation of the Proposed Action will not require additional clearing of native vegetation or increased impact upon MNES.

As discussed in detail in Section 5.1, post construction (during operation) pre-existing speed limits will be established, noting the existing alignment was designed to be utilised as a strategic major freight route. Given the improved sight lines the Proposed Action will provide for drivers and the improved road geometry, it is expected that drivers will have more time to react to fauna entering the road area.

3.7 Description and Timing of Rehabilitation Activities

Any revegetation undertaken within the DE will be undertaken in accordance with *MRWA Vegetation Placement within the Road Reserve Doc. No. 6707/022* (Main Roads, 2013). This guide defines the recommended setbacks and clearance requirements that apply to all revegetation or landscaping associated with new road construction.

Revegetation, if required, will be undertaken in the first winter following the completion of construction and will be monitored and maintained over a three-year period.

Placement of vegetation near road infrastructure is restricted to maintain road safety. These requirements minimise ongoing maintenance and maintain a standard amenity and safety level for road users. Revegetation will incorporate these restrictions when undertaking planting, in particular, the need for roadside maintenance and clear zones. Revegetation will not be undertaken over areas required for ongoing operations such as roadside drains, road embankments and median strips. Main Roads also expects it will be required to not plant Black Cockatoo foraging species within 10 m of the edge of the road.

3.8 Feasible Alternatives to the Proposed Action

Currently, the 10.49 km Coates Gully section of the GEH has poor alignment, which severely affects the safety and efficiency of the highway. This route has been identified as the third riskiest road in regional WA for three consecutive RAC surveys ((2017, 2019 and 2022[2])), owing to the poor road condition. Of particular concern is the inadequate road formation and seal widths, and the narrow or absent shoulders. The existing highway geometry through Coates Gully contains elements that are below design standard for the nominated 110 km/h highway design speed. Intersections also have poor sight distance for vehicles entering onto GEH. The seal and pavement widths are both below the recommended standard of 12 m and signs, lines and delineation are substandard and / or inconsistent. Furthermore, there are limited safe passing opportunities for the exiting traffic volumes and composition.

The purpose of the Proposed Action is to address these safety and efficiency concerns along the 10.49 km Coates Gully section of the GEH through improved road design. The improved road design is intended to:

- Improve driver safety by reducing overall vehicle crashes by 80 %
- Reduce driver fatigue and frustration
- Reduce the number of hazards along this section of the GEH
- Upgrade the current cross section in line with the Road Safety Management (ROSMA) safe systems approach
- Improve intersection safety and operation.

When identifying the Proposed Action location, Main Roads considered five options with alternative preliminary designs to address these issues. An internal multi-criteria analysis (MCA) was undertaken to qualitatively assess each option as part of a larger business case for the Coates Gully Project and a summary of the options considered are provided below.

3.8.1 Option 1: Base Case

The Base Case option includes no changes to the existing alignment. No increased clearing is required and no increased impact upon MNES. This Base Case option is not considered suitable as current national road safety standards are not satisfied, prolonging the significant risk of avoidable accidents involving freight and local commuter and tourist vehicles. Additionally, this option does

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

not remove the current load restrictions on GEH specifically on the efficiency of heavy freight movements and may require the Network Rating to be downgraded considering no alternative major freight routes exist.

3.8.2 Option 2: Proposed Action

Option 2 includes road realignment of the GEH between El Caballo and Bakers Hill with eastbound and westbound passing lanes and minor intersection improvements. This option aligns safety requirements with national standards and will improve freight efficiency outcomes.

This option is considered a significant step in the improvement of the network rating of the GEH transport route, increasing the load limit and subsequently increasing the flexibility in the road network which will result in better efficiency of freight movements. This aligns with Main Roads 2016 Network Access Strategy that explicitly encourages the movement of freight by larger, more efficient freight vehicles. This will result in less traffic as freight can be moved with fewer vehicle movements. Larger vehicles are also safer as they have more stringent safety requirements.

The Proposed Action is expected to deliver significant safety benefits. Over the period 2012 to 2016, 56 crashes were recorded in this section of Great Eastern Hwy, with a range of severities, including three fatalities and 12 hospitalisations. Based on the 2016 ROSMA Road Trauma Treatment Guide (Main Roads, 2016) proposed road treatment types are assigned a predicted crash reduction factor then applied to the 2012-2016 crash data. An overall 80 % reduction in overall vehicle crashes is predicted for this section of road.

It needs to be noted that the crash reduction estimates are expected to be conservative. 2016 ROSMA Road Trauma Treatment Guide (Main Roads, 2016) notes the crash reduction outcomes are based on statistical outcomes for all crash types, and that the actual effect on serious injuries and fatalities is often higher than the effect on minor non injury crashes. Therefore, using the casualty reduction listed in 2016 ROSMA Road Trauma Treatment Guide (Main Roads, 2016) often leads to a conservative value for the expected reduction in fatal and serious injury. It has been assumed that there will be an equal reduction in all crash types following the treatments, noting that this is conservative as serious crashes are likely to be reduced more than minor crashes.

3.8.3 Option 3: Minor Alignment Corrections

Option 3 primarily involved minor alignment corrections to achieve Stopping Sight Distance only, with intersection improvements based only on Stopping Sight Distance criteria.

Based on the 2016 ROSMA Road Trauma Treatment Guide (Main Roads, 2016), Option 3 improvements is predicted to provide an overall 70 % reduction in vehicle crashes for this section of road.

This option did not adequately address critical safety risks and freight inefficiencies associated with the existing highway geometry, additional passing lane opportunities or poor sightlines associated with blind crests.

Option 3's impacts on MNES were calculated based on removing design elements including eastern and western passing lanes included in the Option 2 detailed design. Impact to MNES included in the Proposed Action (Option 2) remain significant for Option 3 with up to; 8.6 ha of Carnaby's Cockatoo Foraging Habitat, 8.5 ha of Baudin's Cockatoo and FRTBC Foraging Habitat and 129 DBH trees (no hollows) impacted. Impacts to MNES are reduced to those associated with Option 2; however, these impacts remain significant due to the existence of Black Cockatoo habitat, including DBH trees immediately surrounding all intersection locations and the realignment tie ins with the existing road.

Although Option 3 had a 45 % reduction in MNES impacts compared to Option 2; unfortunately, this option did not adequately address critical safety risks and freight inefficiencies associated with the

existing highway geometry, additional passing lane opportunities or poor sightlines associated with blind crests. Accordingly, this option was not developed beyond concept stage.

3.8.4 Option 4: Widening of Pavement Without Clearing

Option 4 involves the widening of the GEH along the existing road alignment only, with no clearing required. No additional impact on MNES is anticipated.

Based on the 2016 ROSMA Road Trauma Treatment Guide (Main Roads, 2016), Option 4 improvements are predicted to provide an overall 55 % reduction in vehicle crashes for this section of road.

This option was not developed further than concept design given the critical safety concerns for this section of the GEH. Widening the pavement within the existing road alignment does not allow sufficient clearances to improve sight distances, crest improvements, supply additional passing opportunities nor allow for improvement in road geometry to meet current road safety national standards. Given the limited footprint area available within the existing road alignment with the widening being minimal, this option was not progressed further than the concept stage.

3.8.5 Option 5: Speed Reduction Zoning

The need to upgrade GEH is led by critical road safety improvements to address the physical geometry, condition of the road surface, vehicle sight distance and blind spots and absence of vehicle overtaking opportunities for current traffic volumes and composition. These safety improvements are not driven by vehicle speed and are not able to be corrected through speed reduction zoning.

The proposed road safety improvements will; allow national freight and other road users the ability to maintain current designated speeds, improve efficiency of the road network, improve road user experience and reduce road users' fatigue and frustration through access to vehicle passing lanes.

It is well understood that driver fatigue and frustration are one of the main causes of accidents, particularly in regional areas. There are significant efforts to combat driver fatigue amongst motorists travelling in regional WA. A better road, designed to create a consistent driver experience, is expected to reduce driver fatigue and frustration and lead to improved safety outcomes.

The implementation of speed reduction zoning within this section of GEH was not progressed beyond the concept stage as the existing section of GEH has speed zoning appropriate for a major freight route and is consistent with the entire length of GEH between Sawyers Valley and Northam.

Speed reductions exist to the west (The Lakes) and to the east (Bakers Hill) of this section of GEH at the approach (80 km) and within the townsite (60 km) or where specific land use requirements demand. A breakdown of existing speed zones within 20 km of this section of GEH is provided in Table 3-1 and specifically for this section of GEH in Figure 3-2.

Table 3-1 Legal Speed Limits along GEH within and adjacent to Proposed Action

Nearest intersection	SLK start	SLK end	Speed Limit
The Lakes	46.81	48.67	80
Cable St	48.67	56.33	110
Linely Valley Rd*	55.85	58.95	100
Chinganning Gully*	58.59	68.68	110
Martin St	68.68	69.26	90
Jordi Rd, Bakers Hill townsite	69.26	70.41	60
Bedford St	70.41	70.91	90
Ashman Rd	70.91	88.65	110

Within extent of Proposed Action

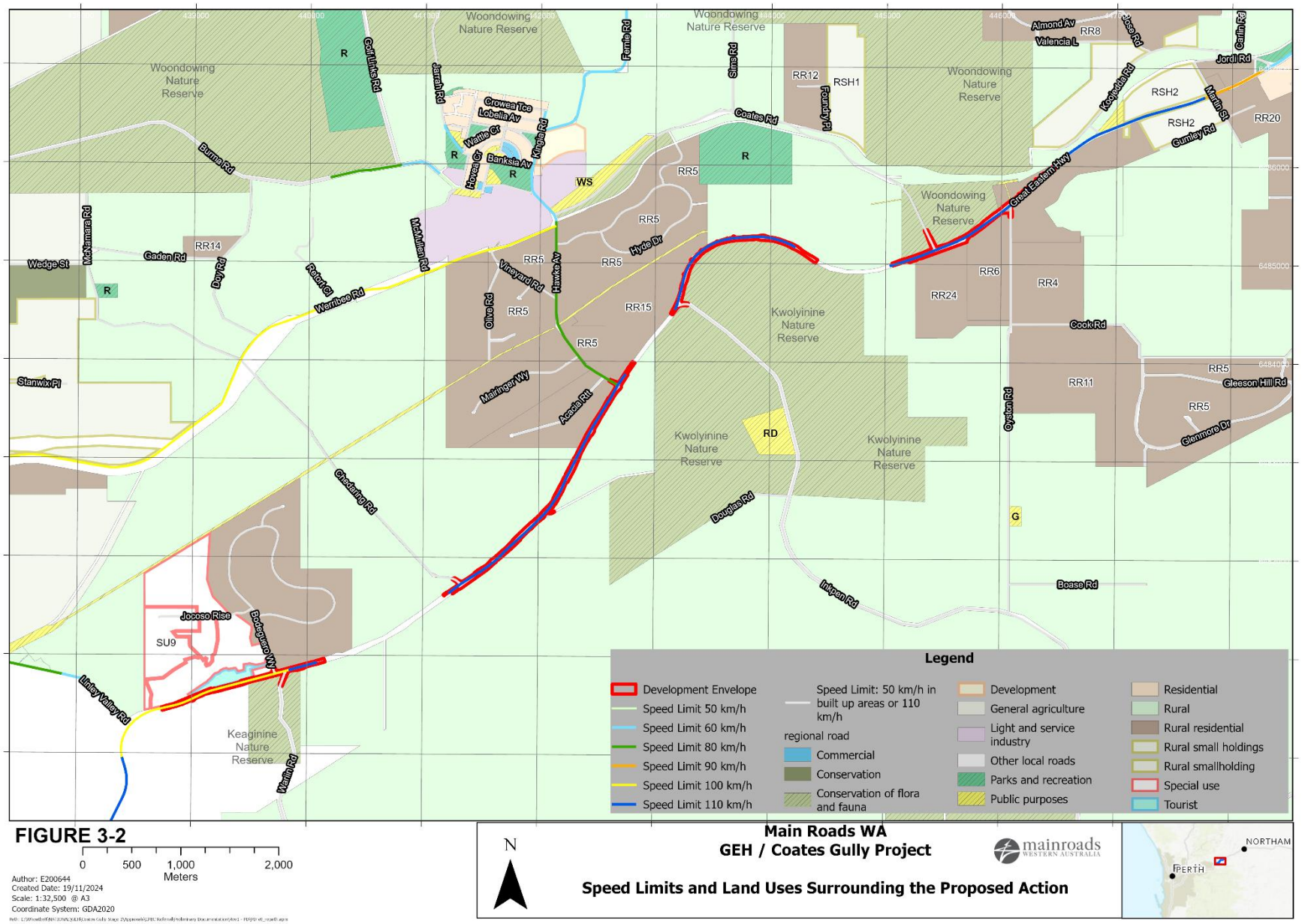

Figure 3-2 Speed Limits and Land Uses Surrounding the Proposed Action

3.8.6 Option Assessment

A Multi Criteria Analysis (MCA) of the above options was undertaken as part of the Business Case for the Coates Gully Project. A summary of the MCA is provided in Table 3-2.

Option 2 (the Proposed Action) and Option 3 are comparable in terms of impacts to MNES given each option involves widening GEH along the existing alignment. An economic analysis was undertaken on Option 2 and Option 3 to review the cost and safety improvements of each option using 2016 ROSMA Road Trauma Treatment Guide (Main Roads, 2016) and Australian Transport Assessment and Planning Guidelines (ATAP, 2016) The cost benefit analysis determined Option 2 had the higher benefit cost ratio when compared to Option 3.

Given the safety benefits that will be achieved, Option 2 has progressed as the preferred option. This option involves intersection improvements to achieve full visibility requirements, modifications of road geometry and a minor road re-alignment between El Caballo and Bakers Hill to allow for eastbound and westbound passing lanes. This option will provide critical road safety upgrades to meet national standards, while providing additional benefit to the state and national major freight network.

Based on preliminary design and road crash data within the extent of the Proposed Action, between El Caballo and Bakers Hill, it is predicted that there will be a crash reduction of more than 80 %.

In developing the detailed design of Option 2, design elements have been implemented to reduce impacts to MNES as far as practicable while ensuring national road safety requirements are achieved. These design elements have included:

- Steepening of batter slopes
- Installation of safety barriers to allow batters to be steepened and to protect fauna habitat trees, minimising deviation of the existing road alignment
- Installation of kerbing to direct surface water flows
- Maximising the use of pre-existing road drainage network.

Figure 3-3(a) to Figure 3-3 (c) below provide examples of design strategies implemented to minimise impact to Black Cockatoo foraging habitat and potential breeding habitat.

Table 3-2 Business Case Multi Criteria Analysis Results

Decision Criteria	Option 1 Base Case	Option 2 Proposed Action	Option 3	Option 4	Option 5
Does the option sufficiently reduce the risk emergency road closures?	No	Yes	Yes	Yes	No
Does the option represent value for money from a whole of life perspective?	No	Yes	Yes	Yes	Yes
Does the option remove the 85 % T44 load restriction which is limiting the route?	No	Yes	Yes	Yes	No
Does the option meet safe systems/ROSMA requirements?	No	Yes	Yes	No	No
Does the option address crash types?	No	Yes	Yes	No	No
Does the option address intersection safety and operation?	No	Yes	No	No	No
Does the option increase amenity for road users?	No	Yes	Yes	No	No
Is the option practical to construct?	Yes	Yes	Yes	Yes	Yes
Is the option's impact on the environment and heritage minimised?	Yes	Yes	Yes	Yes	Yes
Is the option's impact on other infrastructure and adjacent land use minimised?	Yes	Yes	Yes	Yes	Yes
Capital Cost	$0	$27M	$26M	Not calculated	Not calculated
Accepted/ Not preferred / Not acceptable	**Not acceptable**	**Accepted**	**Not preferred**	**Not acceptable**	**Not acceptable**

Figure 3-3(a) Installation of crash safety barriers (solid double green line on southern side of road) to avoid tree with a hollow of suitable size for Black Cockatoo breeding (TCOG – 229) and other suitable DBH trees.

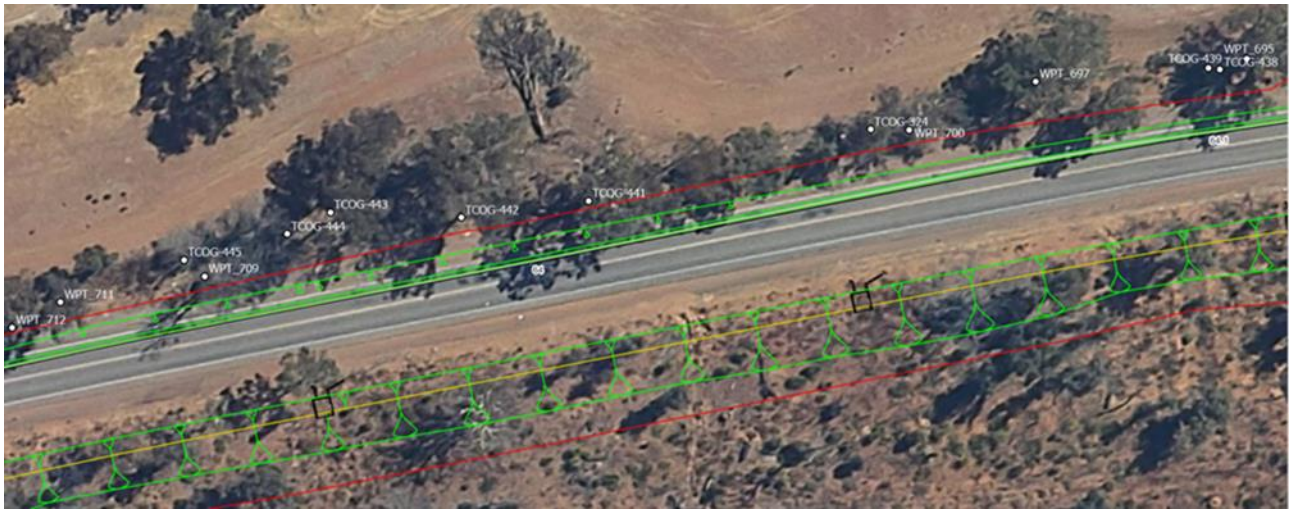

Figure 3-3(b) Example of alignment positioned to one side to avoid better quality habitat on the other side of the road.

Figure 3-3(c) Shifting alignment to one side and utilising existing road drainage network to minimise impact on suitable DBH trees.

4 MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE

4.1 Description of Protected Matters Within the Proposed Action Area

4.1.1 Listed Threatened Species and Communities

This Preliminary Documentation describes the following MNES (listed threatened species and ecological communities [s18 & 18A]) listed under the EPBC Act that may be present within the DE and the surrounding area:

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

4.2 Biological Surveys

A number of field assessments were undertaken to support and inform the development of the Proposed Action. A summary of surveys relevant to MNES are detailed in Table 4-1 below.

Table 4-1 Studies and Surveys relevant to the Proposed Action

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 9 - 11 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, 2021)	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 5, 6 and 8 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 survey, 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 21 and 23 October, and 20 November 2020. The Basic terrestrial vertebrate fauna survey and targeted Black Cockatoo habitat assessment was undertaken on 24 and 30 November 2020.

Report name	Survey methodology
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 - 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.

4.3 Black Cockatoos

4.3.1 Description Of Species

Carnaby's Cockatoo

Carnaby's Cockatoo (*Zanda latirostris* formerly *Calyptorhynchus latirostris*) is listed as Endangered under the EPBC Act and is endemic to the south-west of WA. The species range and abundance has significantly reduced due to land clearing for agriculture, forestry and urban development. Carnaby's Cockatoo faces continuing threats on the Swan Coastal Plain (SCP) as important feeding habitat is cleared. The total population of Carnaby's Cockatoo has been estimated to be a maximum of 60,000 (Saunders *et. al*., 1985) and more recently at around 40,000 (Department of Parks and Wildlife, 2013). The population of the Perth-Peel region is estimated to be about 13,000 birds (Peck *et. al.,* 2019).

Carnaby's Cockatoo breed in eucalypt woodlands between the Stirling Range and Three Springs. The Proposed Action is within the known breeding range of the species (DSEWPaC, 2012a). The species nests in hollows in live or dead trees of *Eucalyptus salmonophloia (*salmon gum), E. *wandoo* (wandoo), *E. gomphocephala* (tuart), *E. marginata* (jarrah), *E. rudis* (flooded gum), *E. loxophleba* subsp. *loxophleba* (york gum), *E. accedens* (powderbark), *E. diversicolor* (karri) and *Corymbia calophylla* (marri). Breeding occurs mainly from July to mid-December.

The breeding range of this species has undergone a shift since the middle of the last century to the west and south, with a more rapid shift in the past 10 to 30 years, moving into the tuart forests of the SCP and the jarrah-marri forests of the Darling Scarp (Johnstone and Kirkby, 2009). The closest confirmed breeding site for Black Cockatoos is approximately 9 km north of the DE.

During the desktop assessment, Biologic (2021) identified two unverified Black Cockatoo nesting records within the Wundowie Reserve, located approximately 5 km north of the DE. These unconfirmed records were taken from Wheatbelt Natural Resource Management (2021).

Breeding success for Carnaby's Cockatoo is largely dependent on suitable feeding habitat adjacent to the nest site, to provide the necessary food for the survival of the chick. As breeding individuals forage no more than approximately 20 km from their nesting hollows, the presence of sufficient foraging resources close to breeding areas (particularly within a 12 km radius) is critical to the species' breeding success.

The species is a post-nuptial nomad with many individuals spending the non-breeding season on the SCP (including the Perth metropolitan region) from December to July. Some non-breeding individuals (usually juveniles) will remain on the SCP during the breeding season. The species feeds in the canopy and understorey. Within the northern jarrah forest, the species forages on eucalypts, predominantly jarrah and marri, and proteaceous woodland and heath.

Baudin's Cockatoo

Baudin's Cockatoo (*Zanda baudinii* formerly *Calyptorhynchus baudinii*) is listed as Endangered under the EPBC Act and is endemic to the southwest of WA. This species is generally found in woodland or forest habitat but can be found in fragmented forests. The total population of Baudin's Cockatoo is estimated to be 12,500 individuals, and the species occurs mainly in flocks (up to 300 individuals) and occasionally larger aggregations (up to 1,200 individuals) at roosts (DPC, 2015). They primarily nest in hollows of live or dead karri (*Eucalyptus diversicolor*) marri, wandoo, and Tuart trees. This species breeds from August to March in the eucalypt forests of the south-west (DSEWPaC 2012a). From March, the species flies north to the central and northern parts of the Darling Scarp for the non-breeding season. The species roosts in or near riparian environments or other permanent water sources. Baudin's Cockatoo are not known to breed within or near the DE, with the closest known Baudin's Cockatoo breeding area located over 140 km south of the DE (T. Kirkby, 2021).

The species forages in eucalypt species, predominantly jarrah, marri and karri, and proteaceous woodland and heath. They also feed on nectar, buds and flowers, and strip bark from dead trees to search for beetle larvae.

Forest Red-tailed Black Cockatoo

The FRTBC (*Calyptorhynchus banksii naso*) is listed as Vulnerable under the EPBC Act and is endemic to the southwest of WA. The FRTBC occurs in one population of approximately 15,000 birds (DEWHA, 2009).

FRTBC display erratic breeding activity in the summer and winter seasons, peaking from April to June and August to October (Johnston *et. al.,* 2013). The species primarily nests in hollows of large, mature marri trees and to a lesser extent jarrah, blackbutt, bullich and wandoo (Johnstone *et. al.*, 2013). Key breeding areas are within the jarrah-marri forest of the Darling Scarp/Plateau or adjacent areas of the SCP, with limited records on the western extent of the SCP (e.g. at Murdoch University and possibly Perry Lakes) (Johnstone *et. al.,* 2017). The closest confirmed breeding site is approximately 9 km north of the DE.

The FRTBC is a canopy feeder, with a diet primarily consisting of seeds of marri and jarrah and, in recent times, the seeds of *Melia azedarach* (cape lilac) (Johnstone *et. al.,* 2017). Other, less important foods include *E. patens* (blackbutt), karri, *Allocasuarina fraseriana* (sheoak), *Persoonia longifolia* (snotty gobble), *Hakea* spp., tuart and *E. decipiens* (Johnstone, *et. al.,* 2017).

4.3.2 Habitat Assessment

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 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.

As discussed in Section 5.8, Dr Peter Mawson (pers. comm 2024) examined the published Birds Australia Great Cocky Count reports (Peck *et. al*. 2019) and identified that white-tailed Black Cockatoos (most likely Carnaby's Cockatoos at these locations) were recorded roosting at Wooroloo (n=42 in 2018), Bakers Hill (17 in 2010, 84 in 2016, 52 in 2017 and 160 in 2019) and Wundowie (125 in 2010, 8 in 2012 and 15 in 2019) and concluded that the number of Black Cockatoos observed is very low relative to the total estimated population for Carnaby's Cockatoo (n=34,000 CI 20,000-52,000; (Garnett and Baker, 2021) and FRTBC (n=16,800 CI 12,800-20,800; Garnett and Baker, 2021).

Dr Peter Mawson (pers. comm 2024) concluded that the results from the Great Cocky Count series suggests that the local Black Cockatoo populations (Carnaby's Cockatoo and FRTBC) are low in the area around Coates Gully, Wundowie (at least in mid-autumn when the counts are undertaken).

Breeding habitat

Black Cockatoo breeding habitat is considered to consist of tree species known to support breeding within the range of the species, which either have a suitable nest hollow or are of a suitable DBH to develop a nest hollow (being greater than 500 mm DBH for most Eucalypts or 300 mm in the case of wandoo and Salmon Gum) (DSEWPaC, 2012a). The trees are referred to within this Preliminary Documentation as 'suitable DBH trees' and does not mean that such trees contain hollows or suitable hollows for nesting. Hollows with potential to support Black Cockatoo breeding in the future (following consideration of attributes such as angle, tree species, presence of competitors, and potential depth) are referred to within this Preliminary Documentation as 'potentially suitable hollows'; however, this does not mean that the hollows were occupied or in-use by Black Cockatoos.

360 environmental (2020) and Biologic (2021) identified the eucalypt-based habitat types within the DE as containing a concentrated number of hollow-bearing trees. These habitat types are considered to provide potential breeding habitat for Carnaby's and Baudin's Cockatoo species. The Proposed Action involves the clearing of up to 15.6 ha of potential Carnaby's and Baudin's Cockatoo breeding habitat as detailed in Table 4-2 and presented on Figure 4-1.

Table 4-2 Potential Black Cockatoo breeding habitat within the Development Envelope

Habitat type	Area (ha)
Eucalyptus wandoo woodland over Banksia	12.49
Corymbia and *Eucalyptus marginata* woodland	1.38
Isolated Trees (Native)	1.83
Total	15.7

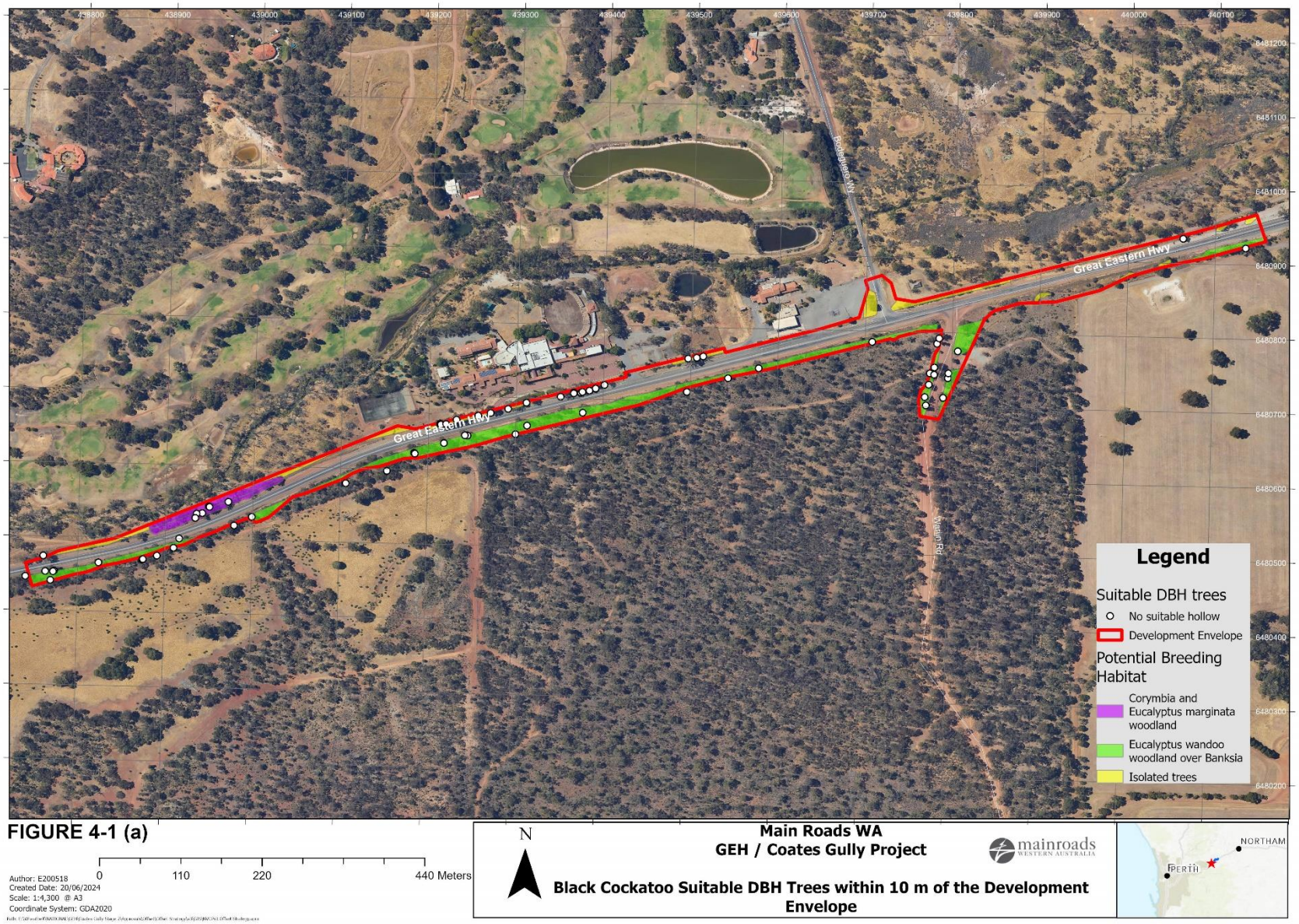

Figure 4-1 (a) Potential Black Cockatoo breeding habitat within the DE

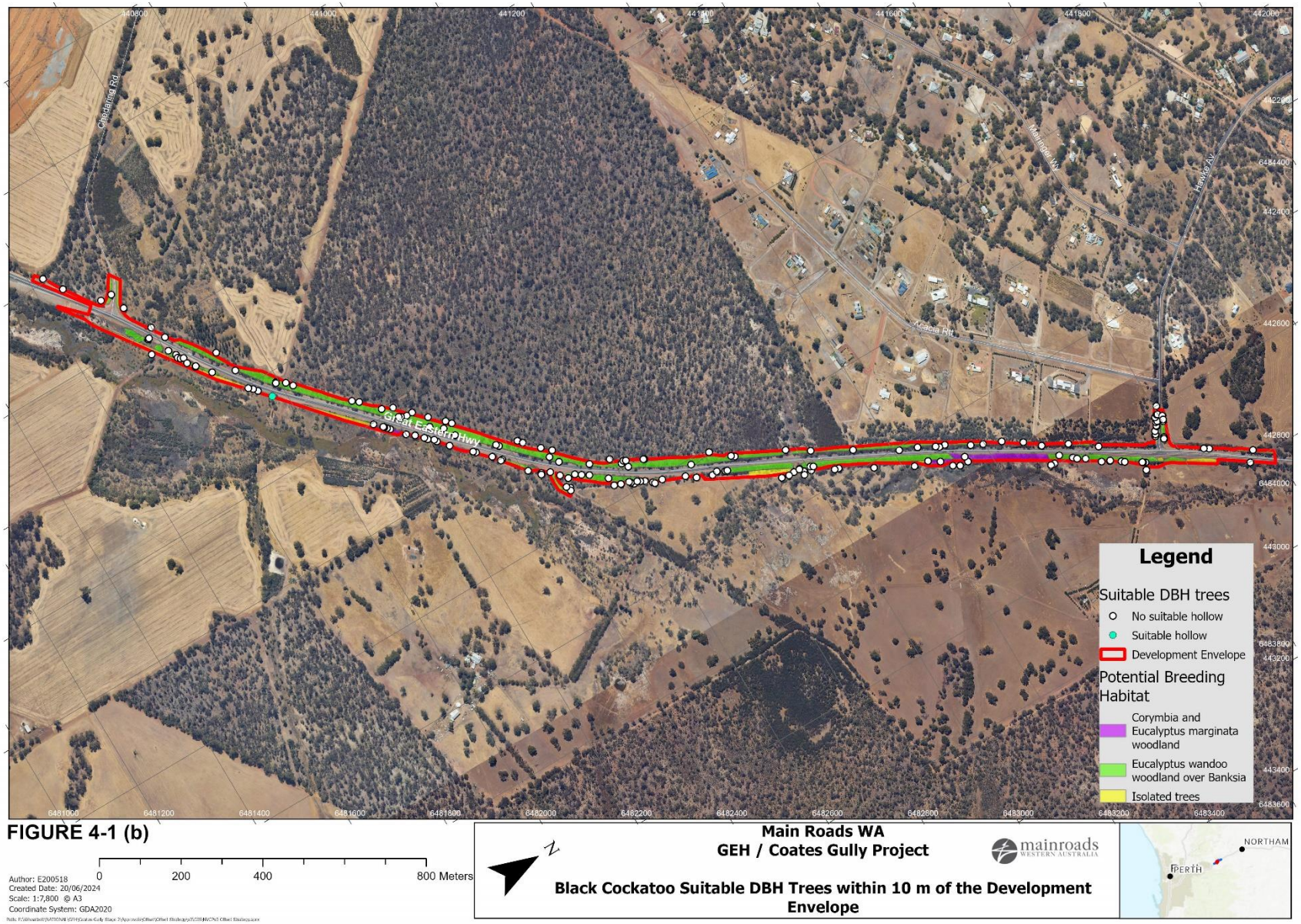

Figure 4-1 (b) Potential Black Cockatoo breeding habitat within the DE

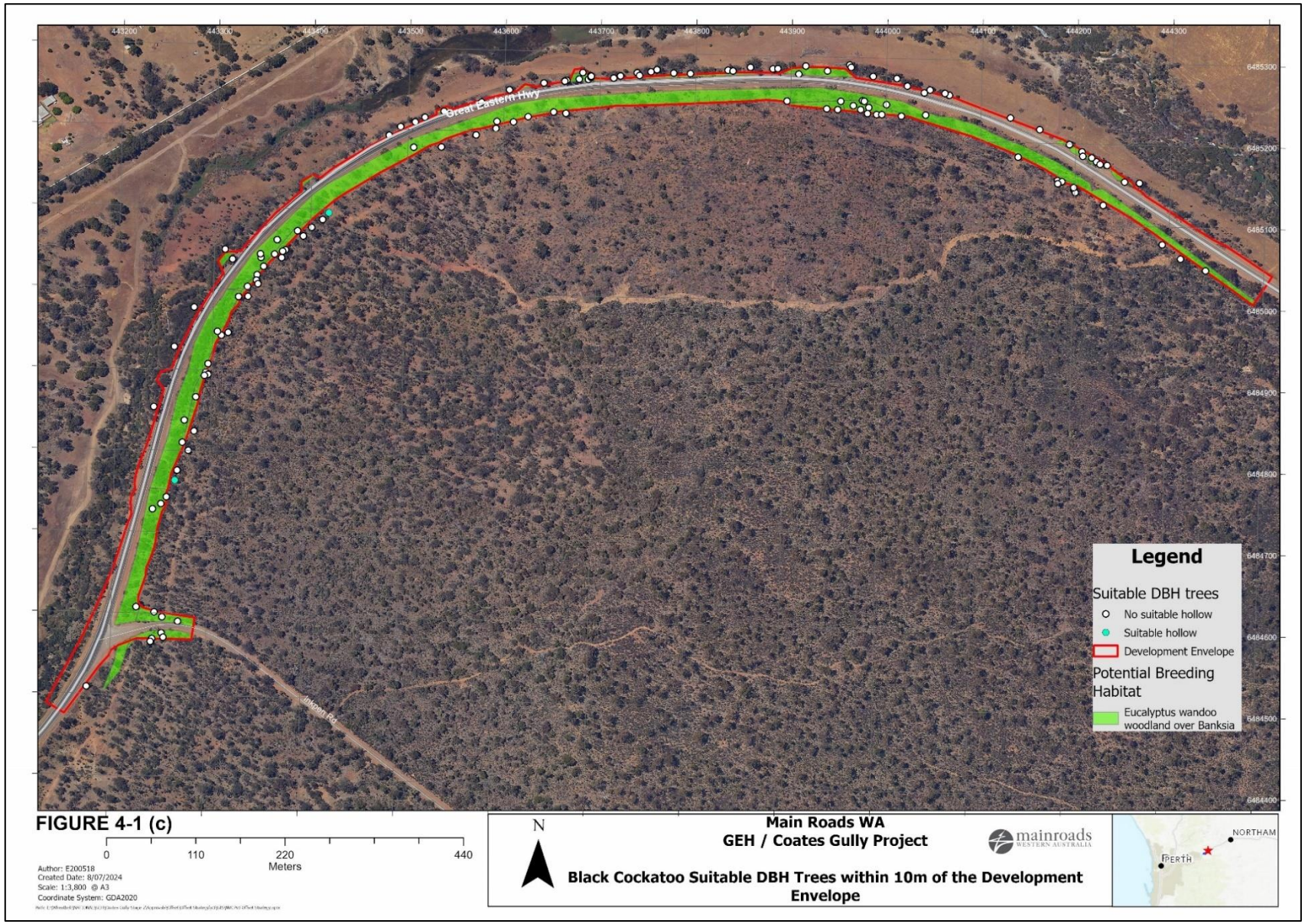

Figure 4-1 (c) Potential Black Cockatoo breeding habitat within the DE

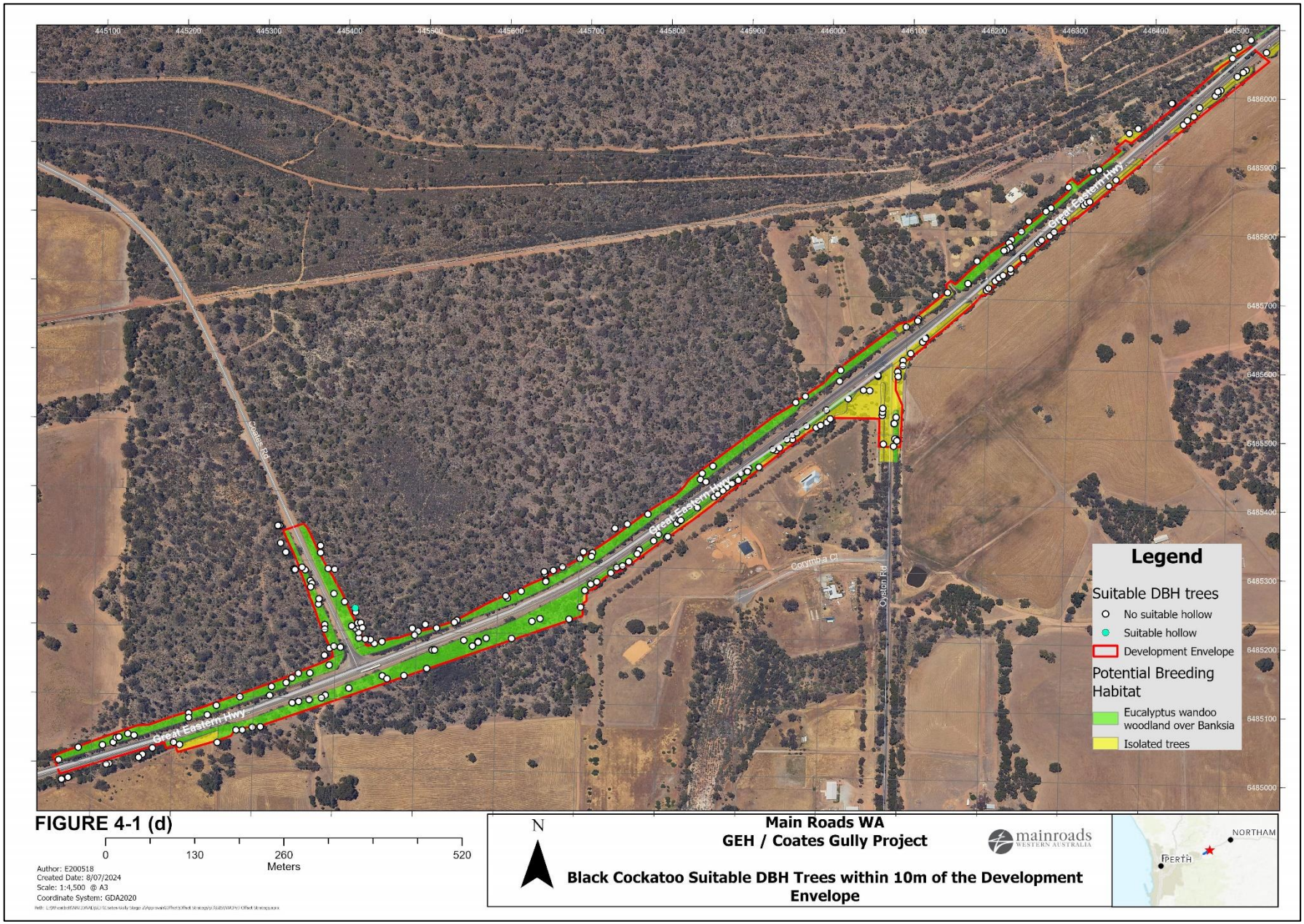

Figure 4-1 (d) Potential Black Cockatoo breeding habitat within the DE

Bamford (2015, revised 2021) and Biologic (2021) identified 400 suitable DBH trees within the DE, based on a suitable DBH (>300 mm or >500 mm) and species known to support breeding (Figure 4-1). Of the 400 suitable DBH trees within the DE, no potentially suitable hollows to support Black Cockatoo breeding have been located.

A subsequent detailed inspection (using a pole camera) of potentially suitable hollows within the DE was completed by Tony Kirkby in June 2021 and August 2022 (T. Kirkby, 2021 & 2022), coinciding with the breeding period for Carnaby's Cockatoo and FRTBC, noting Baudin's Cockatoos are not considered to breed within the local area (Kirkby, 2021).

Hollows were inspected from ground level using binoculars for sign of use such as chewing or wear at the hollow entrance. All trees were then raked with a pole. This method will flush to the top of a hollow a female Black Cockatoo which may be incubating an egg or brooding a chick. Hollows which were considered suitable to be used by Black Cockatoos were then inspected internally using a pole camera. The survey was undertaken by Tony Kirkby who has over twenty years of experience undertaking Black Cockatoo surveys in the south-west of Western Australia.

The hollow inspection indicated that the majority of the potentially suitable hollows were either blocked or too small to support Black Cockatoo breeding (T. Kirkby, 2021 & 2022). One hollow occurring within the previous DE was identified as having a worn entrance of sufficient size to support Black Cockatoo breeding; however, the hollow was located too close to powerlines to be inspected with a pole camera (T. Kirkby 2021). This hollow is located within a wandoo (*E. wandoo*) tree (Tree ID 229). Further modification of the Project Design (installation of safety barriers and steepened batter slope) has avoided impact to this Black Cockatoo hollow tree. This hollow was confirmed to not be in use at the time of the Bamford (2015, revised 2021), Biologic (2021) and T. Kirkby (2021) surveys, with inspections completed within Black Cockatoo suitable breeding times.

The 400 suitable DBH trees, number of hollows and number of suitable breeding hollows within the DE are summarised in Table 4-3 and presented in Figure 4-1.

Table 4-3 Potential Black Cockatoo breeding trees within the Development Envelope

Tree species	Number of suitable DBH trees within the DE (DBH > 300 mm or > 500 mm)	Number of Potential Breeding Hollows	Suitable Breeding Hollows
Corymbia calophylla	100	9	-
Eucalyptus gomphocephala	2	-	-
Eucalyptus marginata	15	1	-
Eucalyptus rudis	2	-	-
Eucalyptus wandoo	272	31	-
Eucalyptus patens	1	1	-
Unknown (Alive)	3	-	-
Unknown (Dead)	5	0	-
Total	**400**	**43**	**0**

Within 10 m of the DE, there are four potentially suitable hollows to support Black Cockatoo breeding occurring within four trees, including the aforementioned wandoo (Tree ID 229). Following a detailed hollow inspection by T. Kirkby (2021), one hollow is considered to be potentially suitable (wandoo,

Tree ID 229) and three are considered to be suitable hollows (jarrah, Tree ID 289, wandoo, Tree ID 171 and wandoo, Tree ID 138). The hollow in Tree 229 is considered to be a potentially suitable hollow as it was observed to have a worn entrance of sufficient size to support Black Cockatoo breeding; however, the hollow could not be inspected with a pole camera (T. Kirkby, 2021). The hollow in Tree 289 was observed to have a suitable hollow with slight chewing at the entrance and is possibly a Black Cockatoo breeding hollow (T. Kirkby, 2021); however, due to high winds and dead branches this hollow could not be inspected for further signs of use with a pole camera (T. Kirkby, 2021). The hollows in Tree 171 and Tree 138 are considered to be suitable hollows as they were observed to have a suitable entrance and contained chew marks at the entrances and internally and are highly likely to be Black Cockatoo breeding hollows (T. Kirkby, 2021).

No hollows were identified as being actively used during any of the surveys that were undertaken during the Black Cockatoo breeding seasons (Bamford, 2015 revised 2021, Biologic 2021 and T. Kirkby, 2021 & 2022). The DE represents potential breeding habitat for Black Cockatoos, given the presence of suitable DBH trees (mostly wandoo and marri) and foraging habitat.

During the desktop assessment, Biologic (2021) identified two unverified Black Cockatoo nesting records within the Wundowie Reserve, located approximately 5 km north of the DE. These unconfirmed records were taken from Wheatbelt Natural Resource Management (2021).

Records of FRTBC breeding are located within approximately 9 km of the DE.

Given no known breeding hollows are located within several kilometres of the DE, neither the existing or Proposed Action is expected to have any impact on breeding Black Cockatoos within the area.

The DE is unlikely to provide breeding habitat for Baudin's Cockatoo. Although the species uses the northern jarrah Forest and eastern fringes of the Perth Metropolitan Region for foraging during the winter, the species' known breeding areas and predicted breeding range predominantly lie within the southern jarrah, marri and karri forests in the South-West region of WA (Johnstone *et. al*., 2008). Baudin's Cockatoos are not considered to breed within the local region with the closest known breeding site over 140 km south (Kirkby, 2021).

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 assigned foraging habitat as either 'High Quality', 'Medium Quality' and 'Low Quality', as presented in Table 4-4 for all three species, and each species separately in Figure 4-2, Figure 4-3 and Figure 4-4. The survey (Biologic, 2021) indicated that 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 will be impacted from Proposed Action 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 will be impacted within the DE. The remainder of the DE ('Nil Quality') is not assessed as foraging habitat for Black Cockatoos.

The Biologic (2021) basic terrestrial vertebrate fauna survey and Black Cockatoo habitat assessment was competed based on EPBC Act referral guidelines (DSEWPaC, 2012a) by suitably qualified persons who have completed numerous Black Cockatoo habitat assessments.

Fauna habitat assessments were undertaken in the field to characterise and define habitats and their significance to vertebrate fauna. Suitable foraging resources were identified during the targeted Black Cockatoo assessment and from sampling undertaken during the concurrent flora and vegetation field surveys (Biologic, 2021). In addition to the classification of habitats, searches were

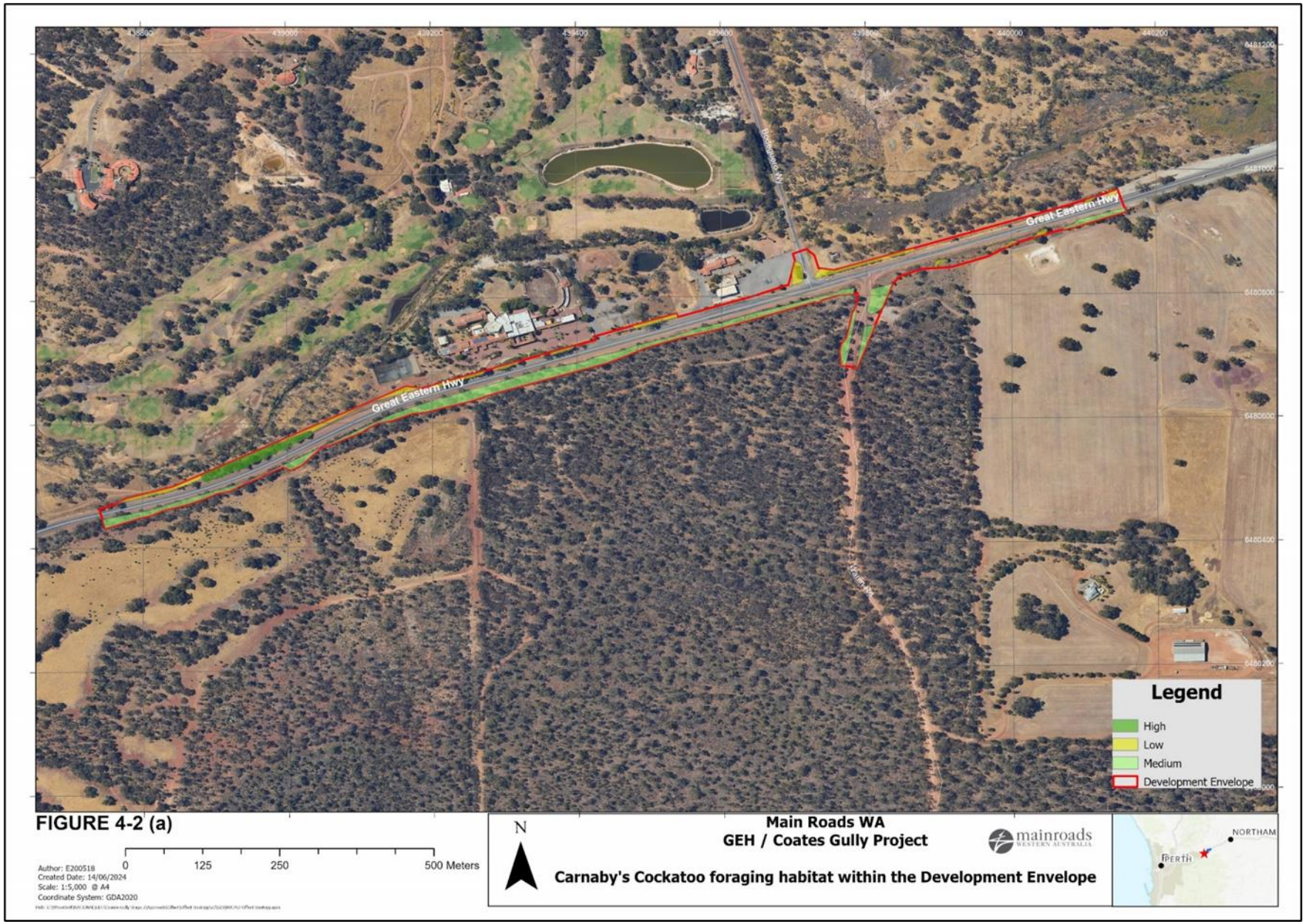

Figure 4-2 (a) Carnaby's Cockatoo foraging habitat within the DE

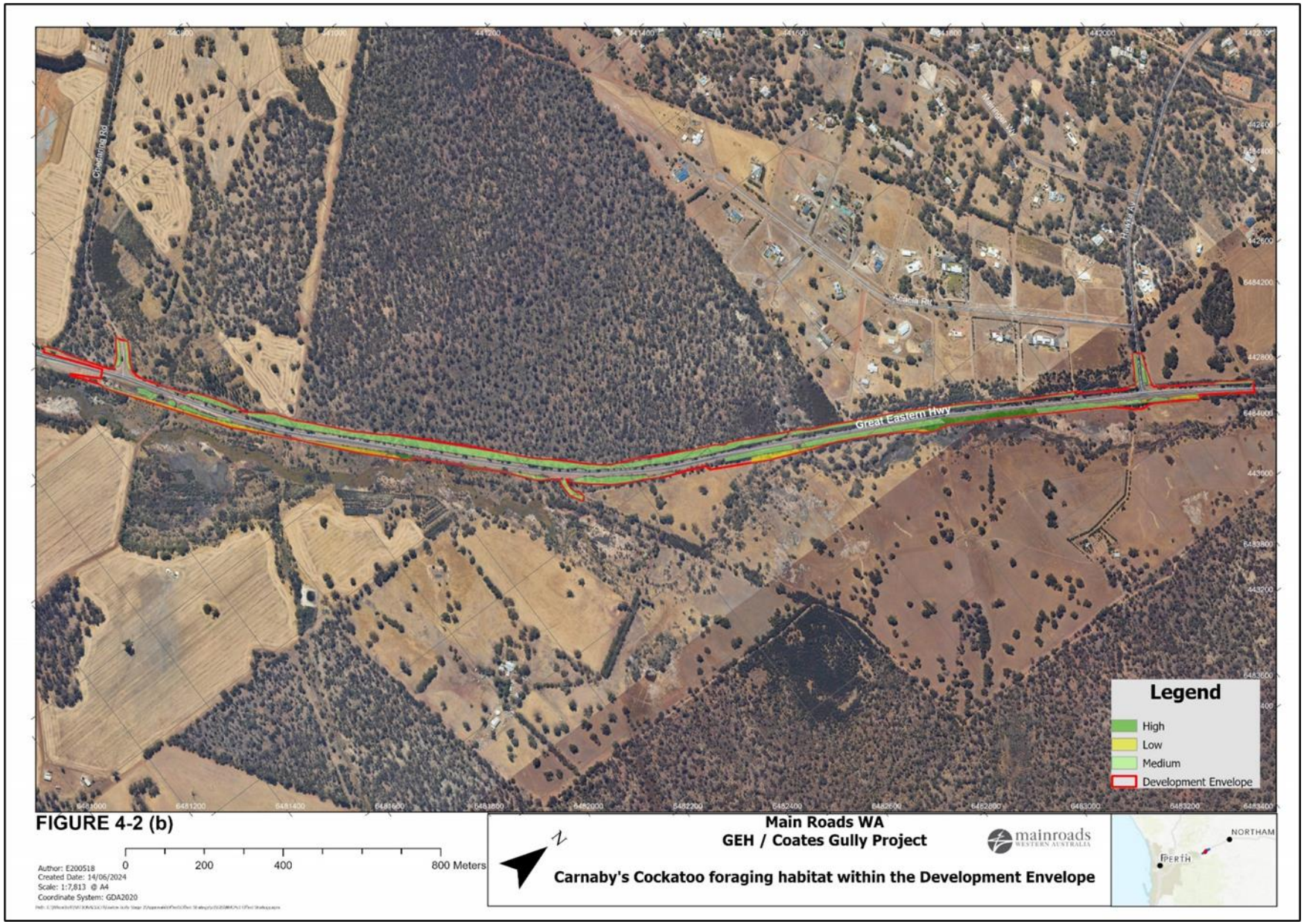

Figure 4-2 (b) Carnaby's Cockatoo foraging habitat within the DE

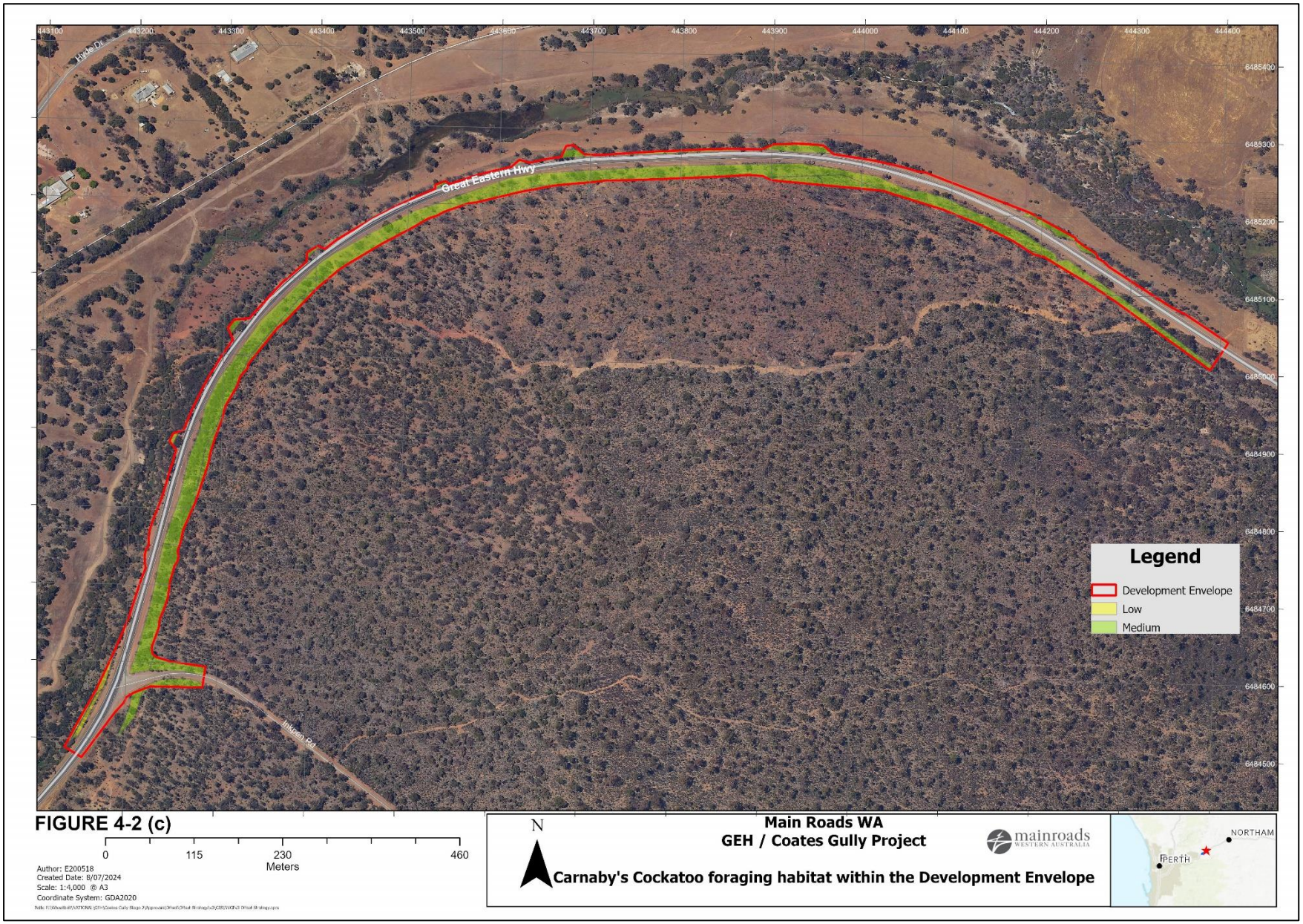

Figure 4-2 (c) Carnaby's Cockatoo foraging habitat within the DE

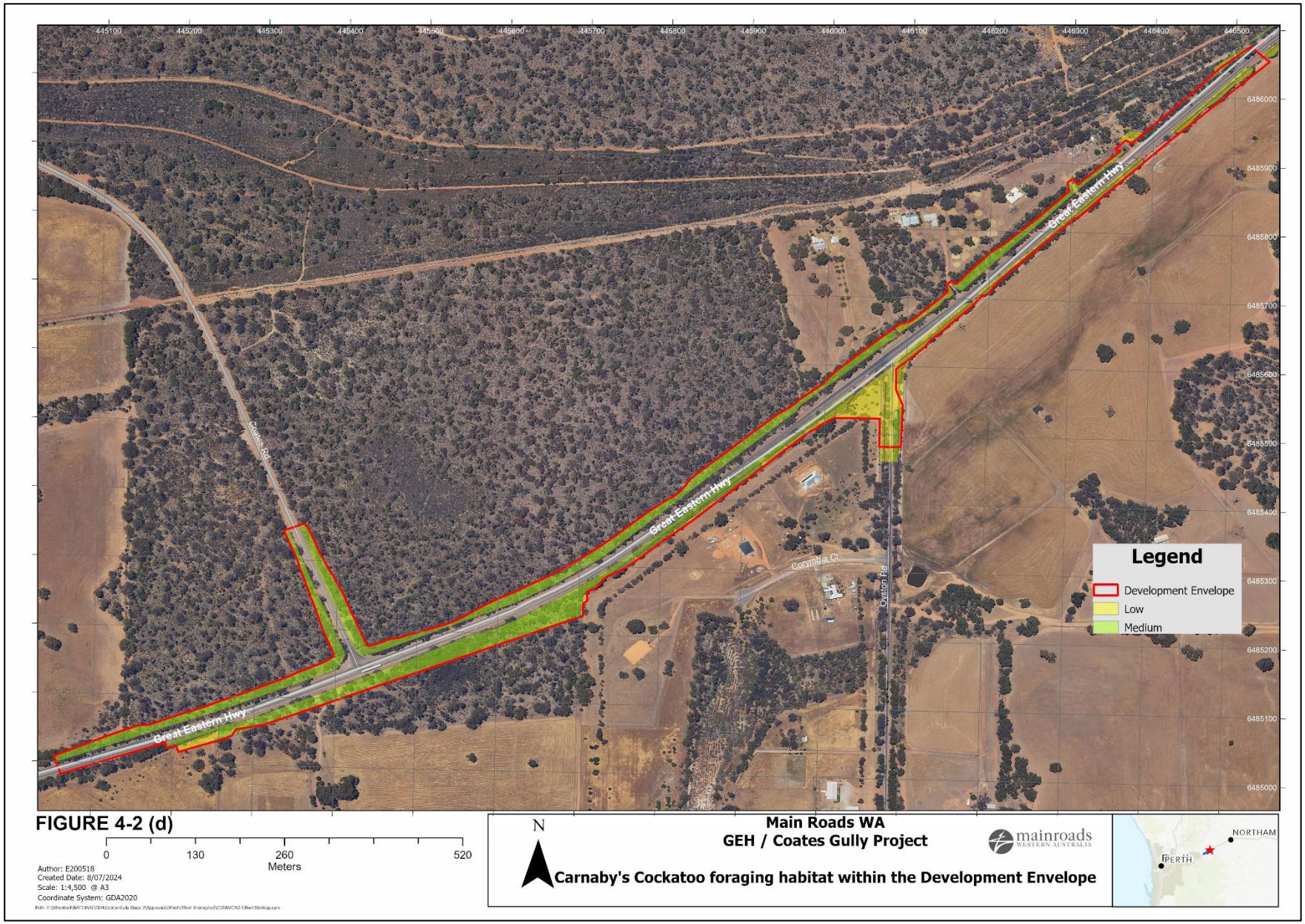

Figure 4-2 (d) Carnaby's Cockatoo foraging habitat within the DE

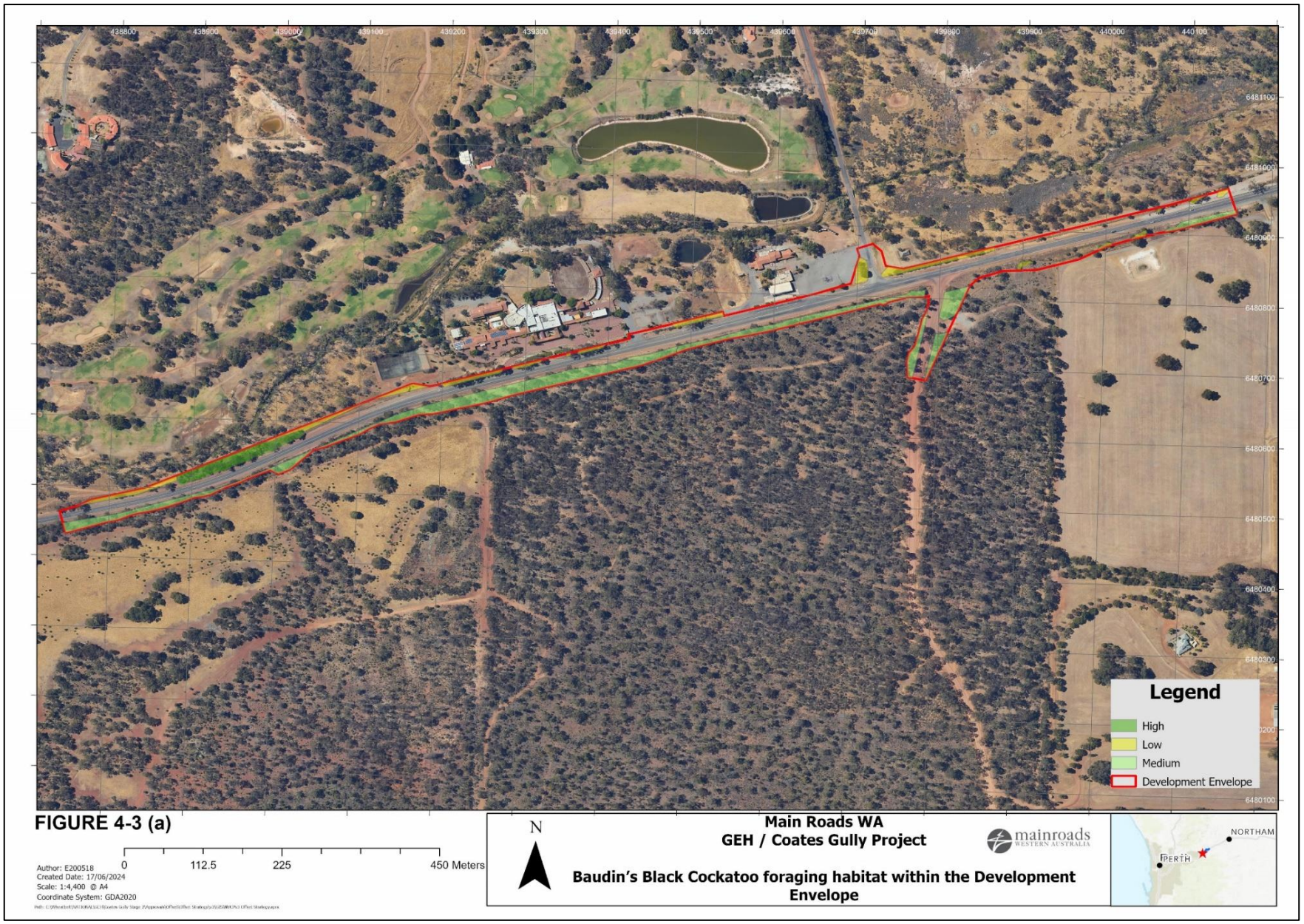

Figure 4-3 (a) Baudin's Cockatoo foraging habitat within the DE

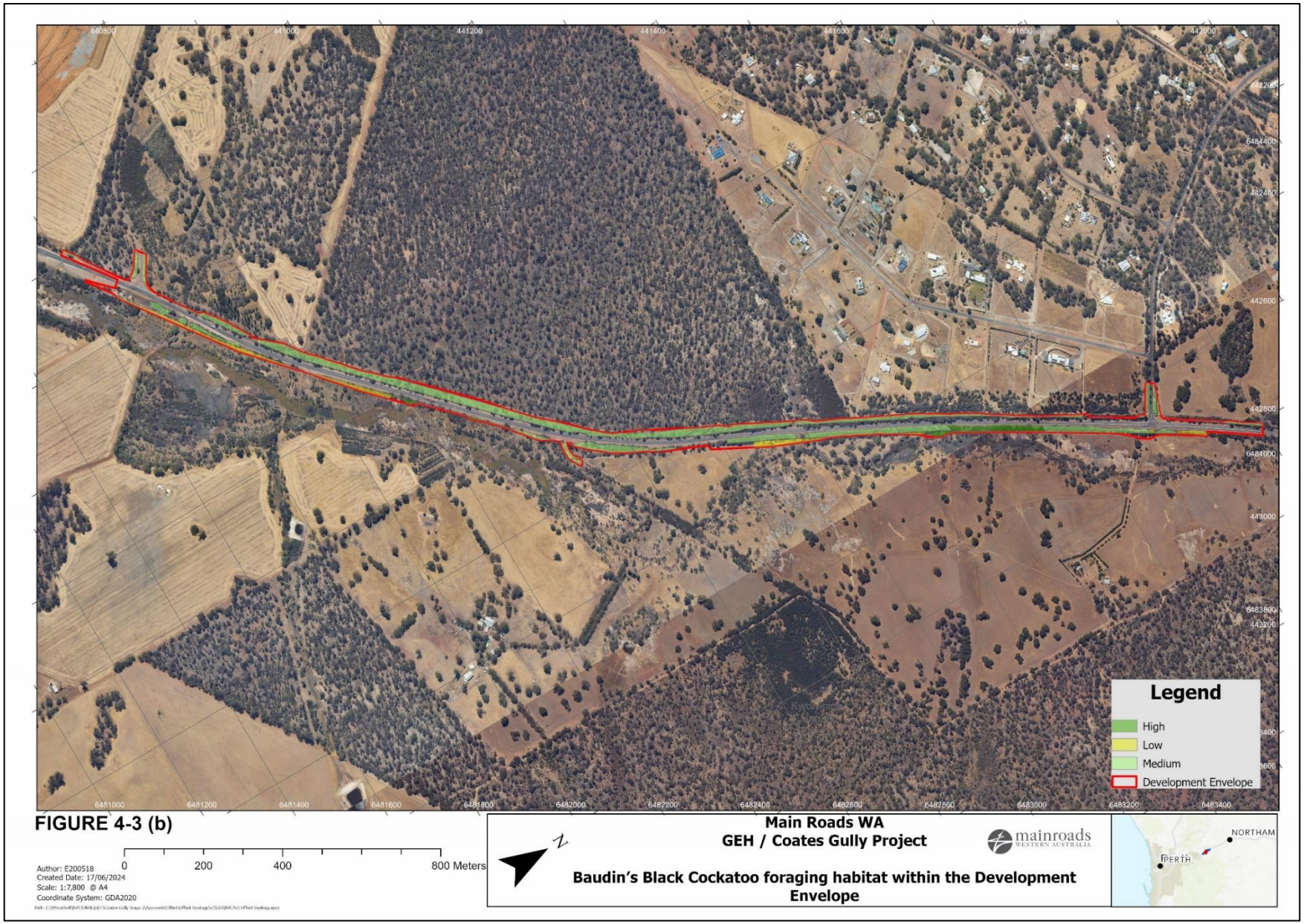

Figure 4-3 (b) Baudin's Cockatoo foraging habitat within the DE

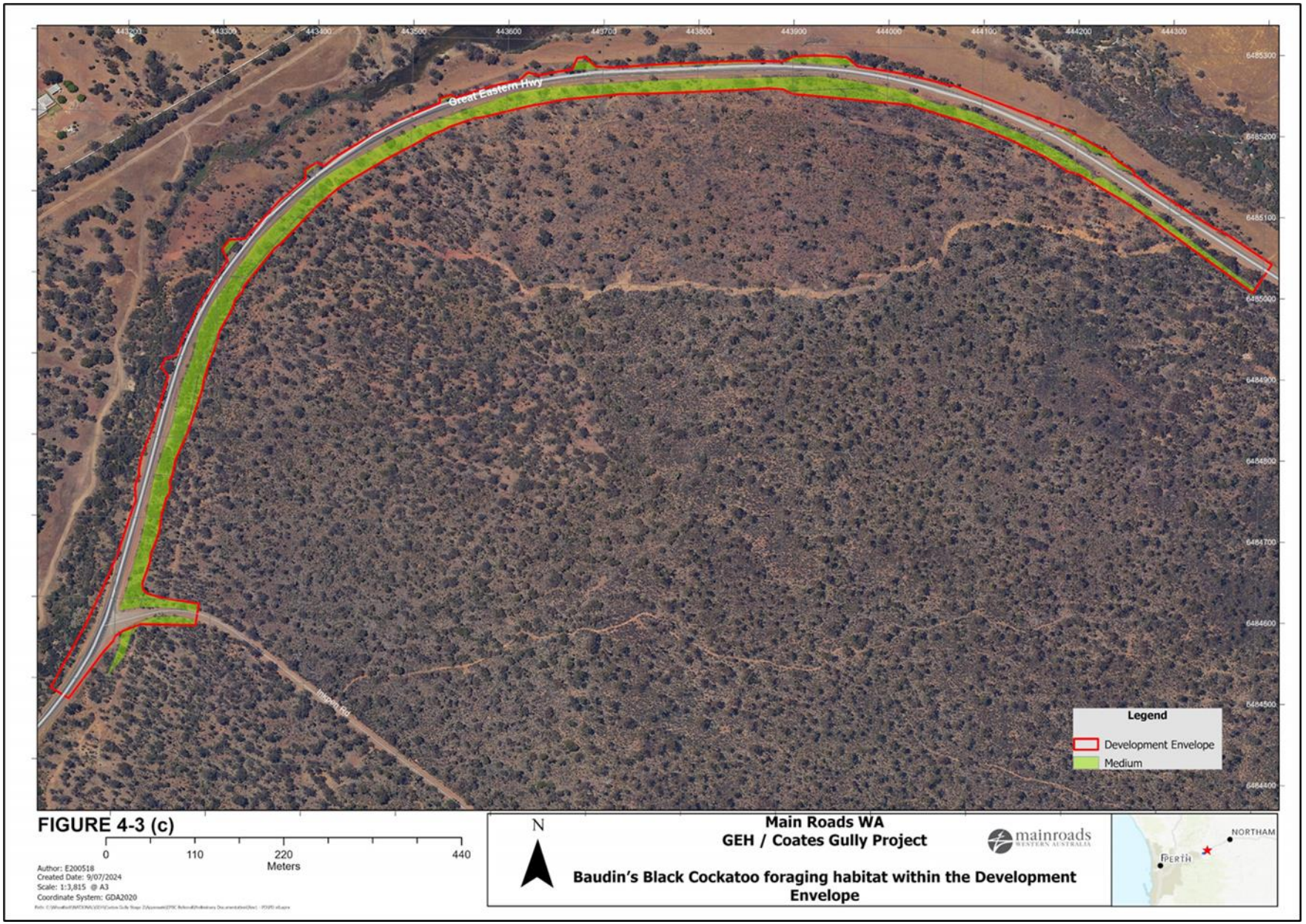

Figure 4-3 (c) Baudin's Cockatoo foraging habitat within the DE

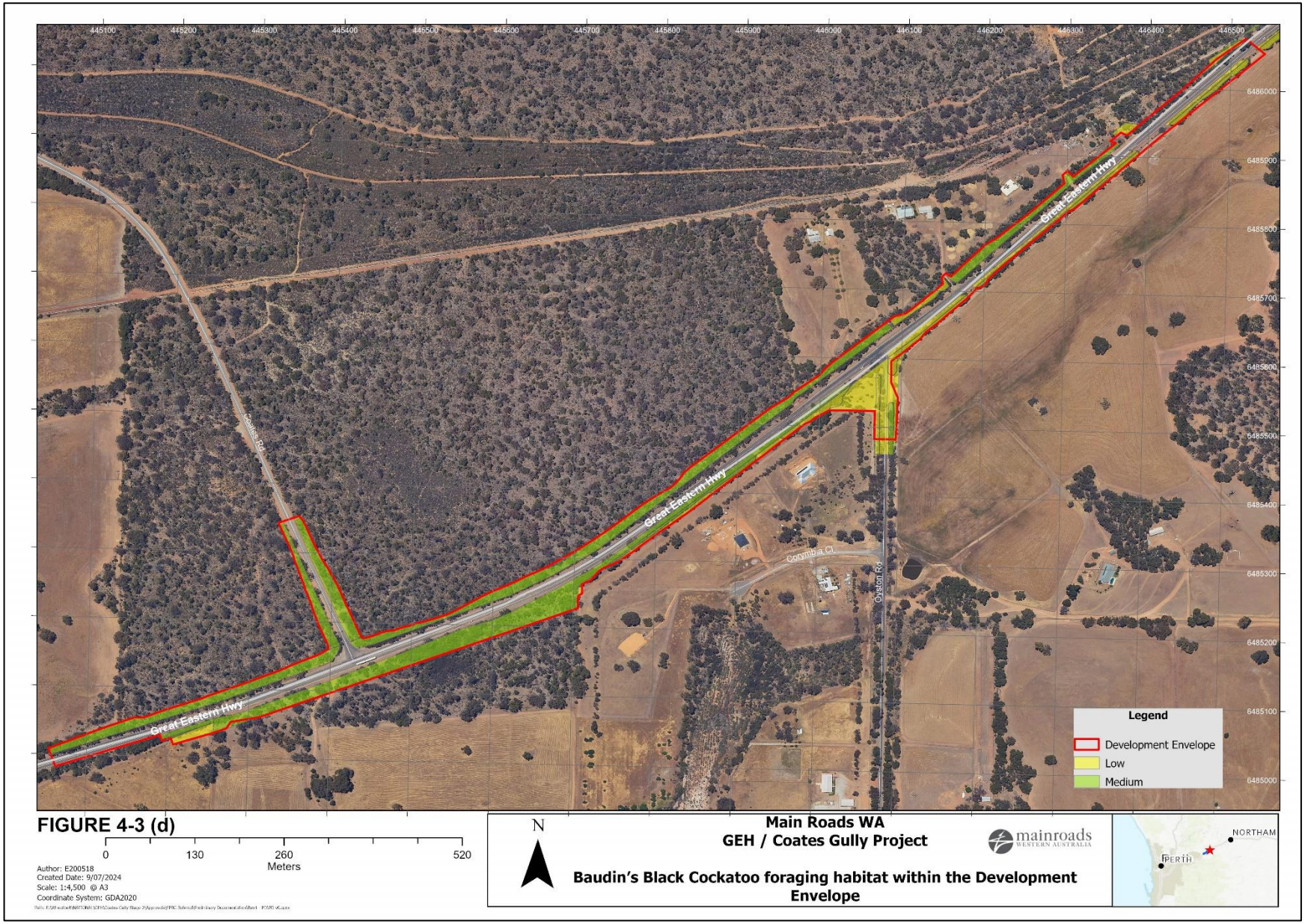

Figure 4-3 (d) Baudin's Cockatoo foraging habitat within the DE

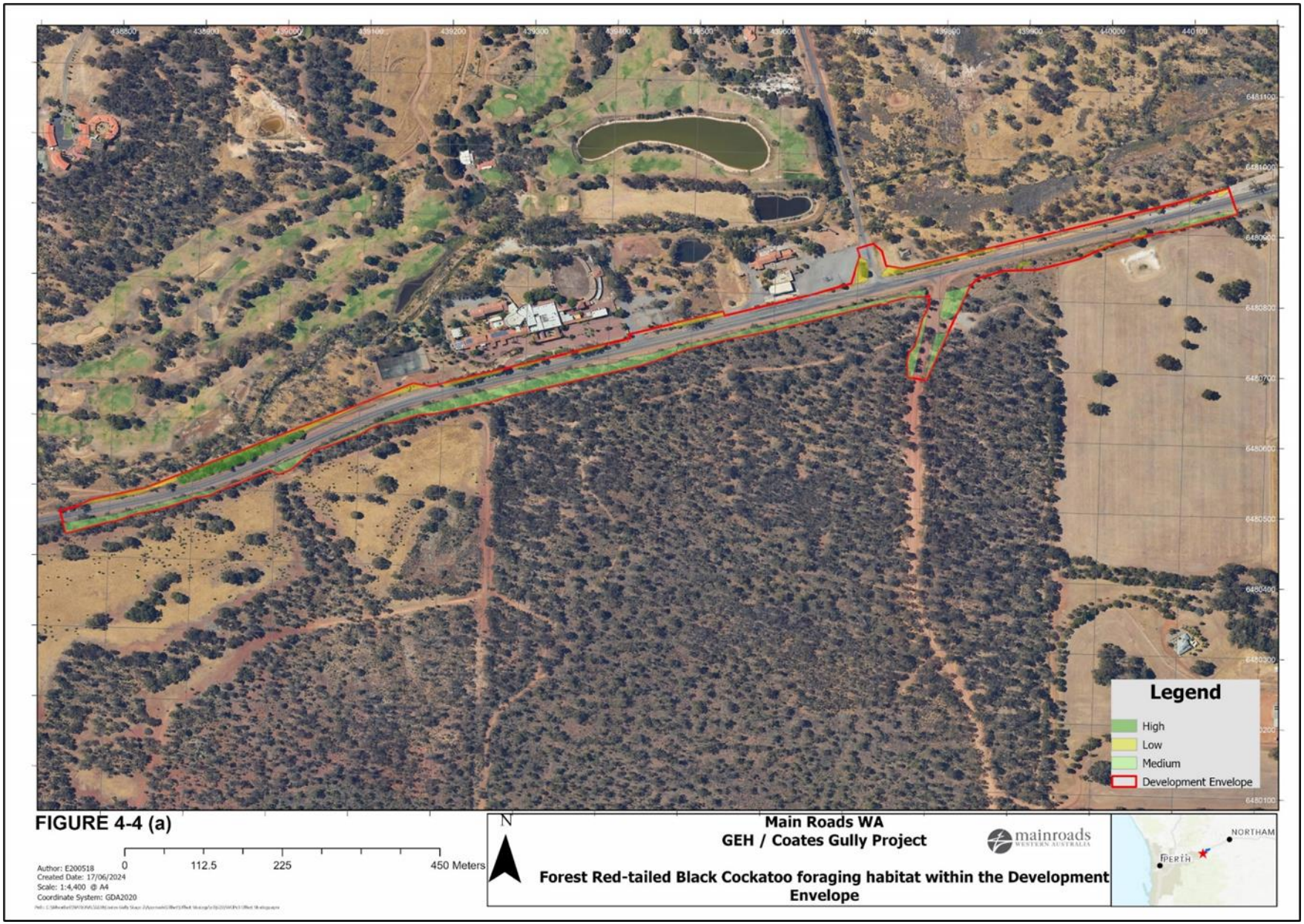

Figure 4-4 (a) Forest Red-tailed Black Cockatoo foraging habitat within the DE

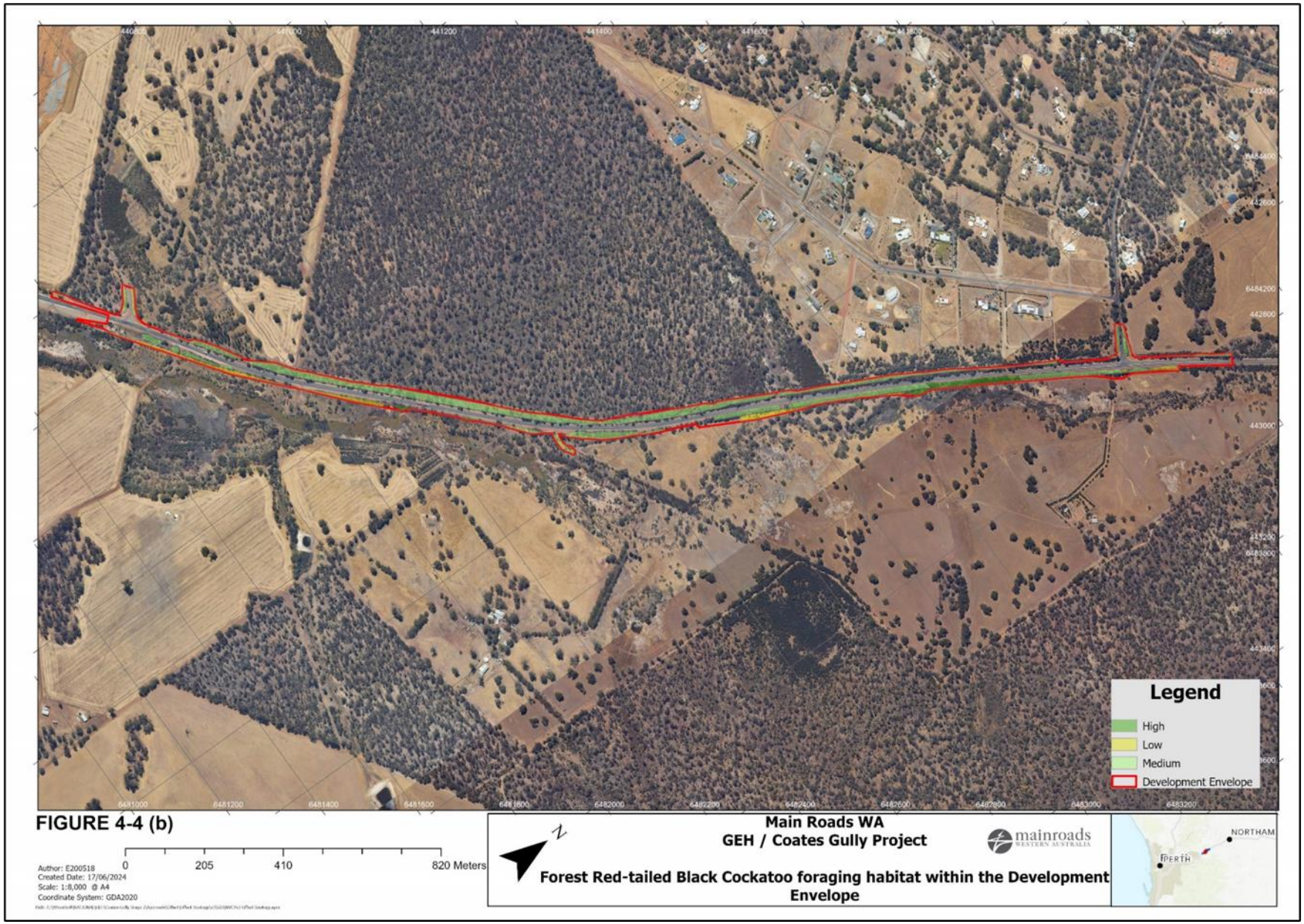

Figure 4-4 (b) Forest Red-tailed Black Cockatoo foraging habitat within the DE

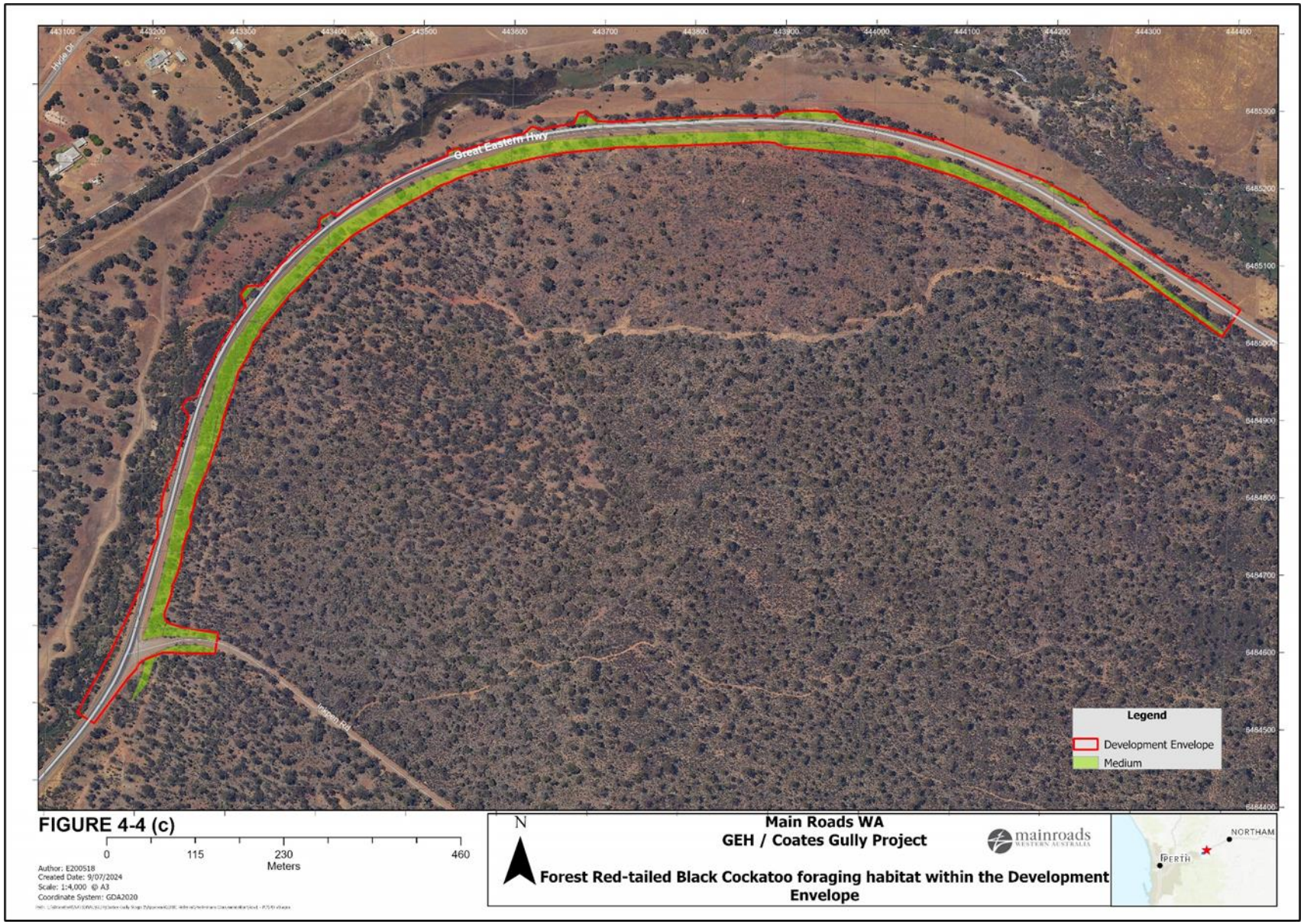

Figure 4-4 (c) Forest Red-tailed Black Cockatoo foraging habitat within the DE

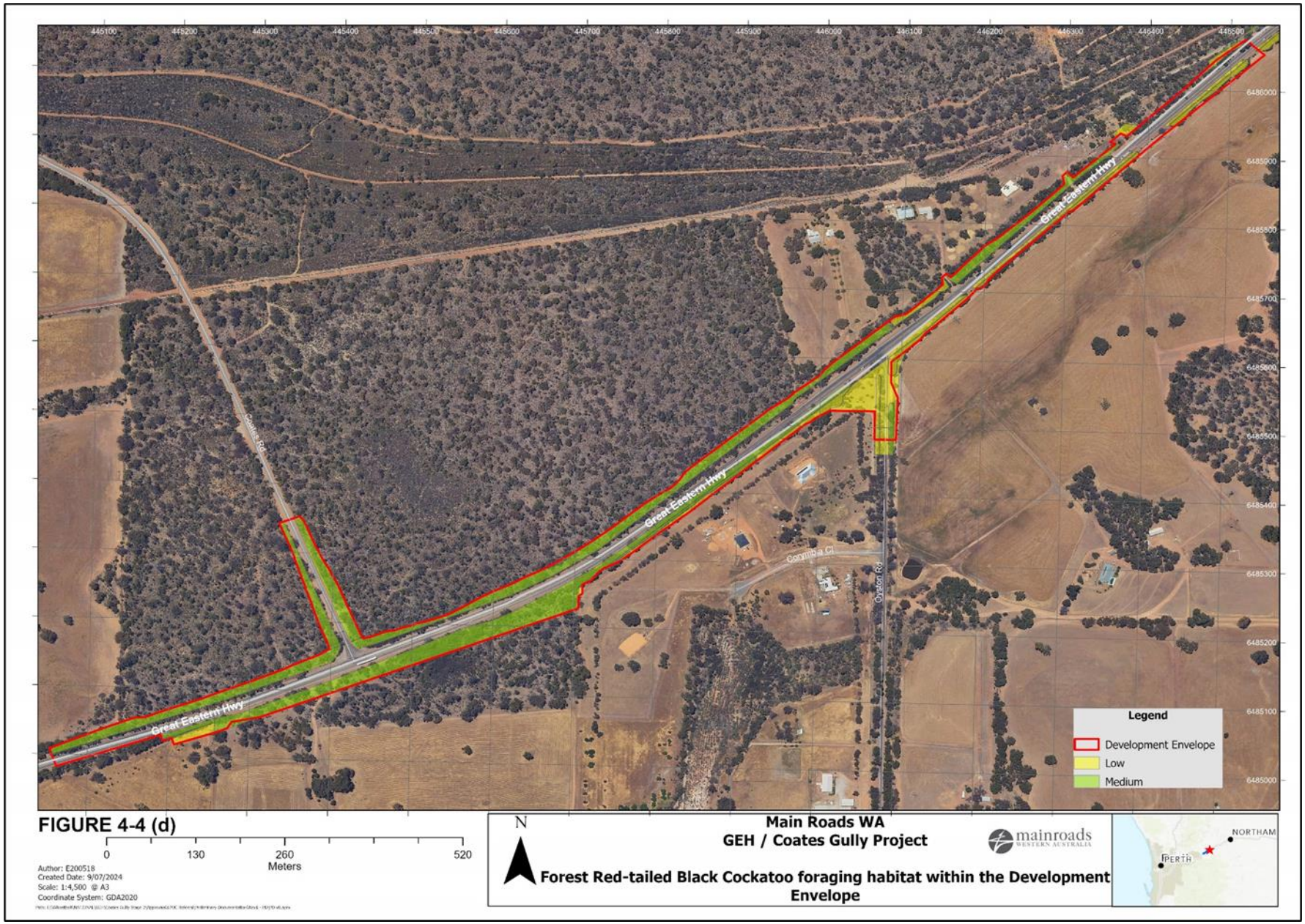

Figure 4-4 (d) Forest Red-tailed Black Cockatoo foraging habitat within the DE

undertaken for evidence of occurrence from feeding debris, such as 'chewed' Banksia, pinecones, or marri nuts, as well as broken or scattered flowers.

Table 4-4 Impacted 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	4.1	1.4	4.1	1.4	4.1
Medium Quality	12.5	36.9	12.5	36.9	12.5	36.9
Low Quality	1.8	5.3	1.7	5	1.7	5
Nil Quality	18.2	53.7	18.3	54	18.3	54
Total	33.9	100	33.9	100	33.9	100

Foraging habitat quality was assessed post-survey throughout the survey area using the habitat scoring tool. The tool inputs are based on known foraging attributes and preferences for each of the three species in a local and regional context, to give value habitat as High, Medium, Low, or Nil. The primary attribute of consideration is the presence and overall canopy cover of primary food resources. Black Cockatoos are recorded to preferentially forage in a canopy compared to the ground within Banksia-habitats and pine habitats, where canopy shade may be a significant factor in reducing sun exposure. The presence of secondary food resources and vegetation health are also considerations (Biologic, 2021).

Roosting habitat

Black Cockatoo roosting habitat is defined by DSEWPaC (2012a) 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 will generally roost in or near riparian environments (DSEWPaC 2012a). 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 (Figure 4-5). 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 (Figure 4-5) 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 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).

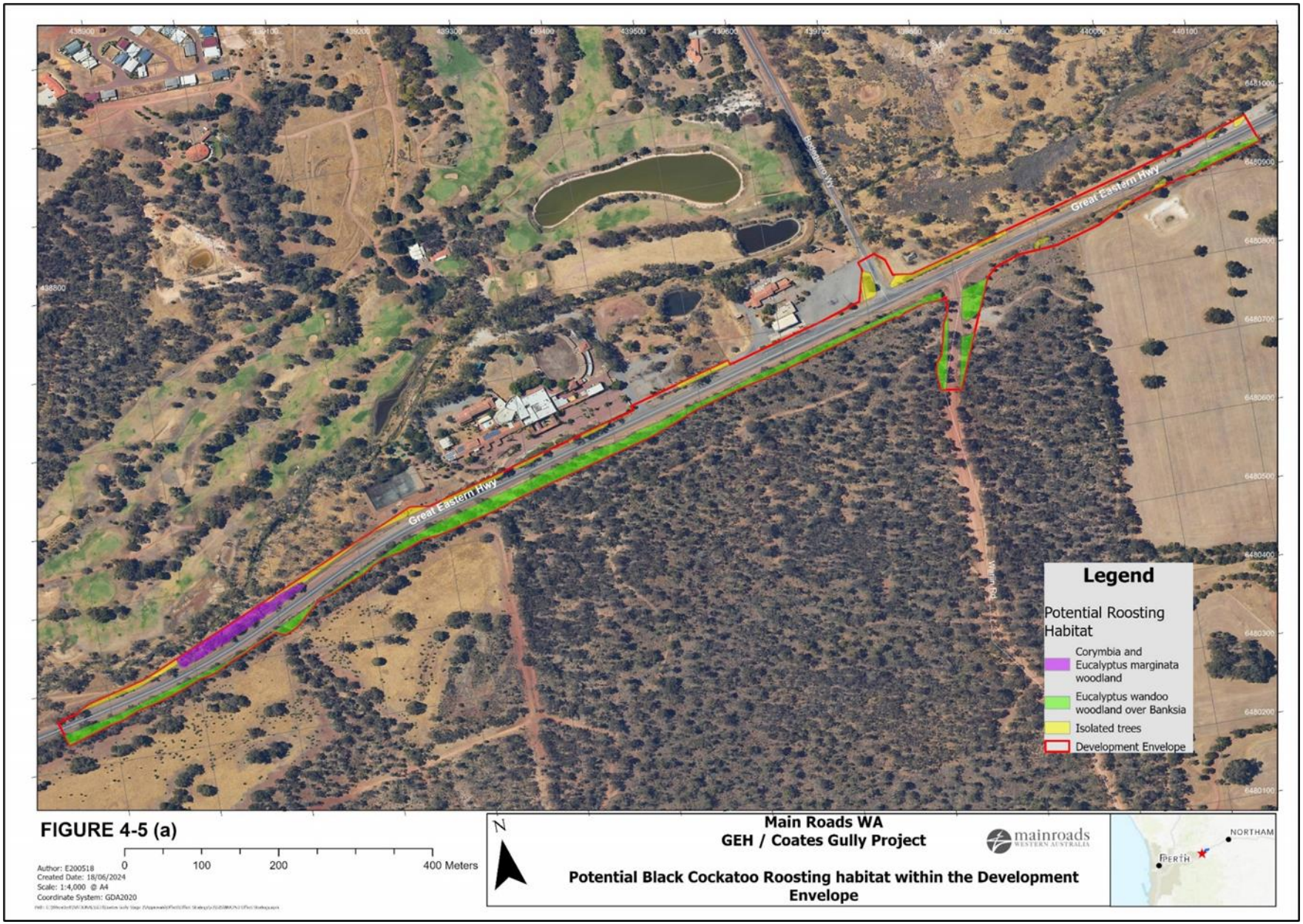

Figure 4-5 (a) Potential Black Cockatoo roosting habitat within the DE

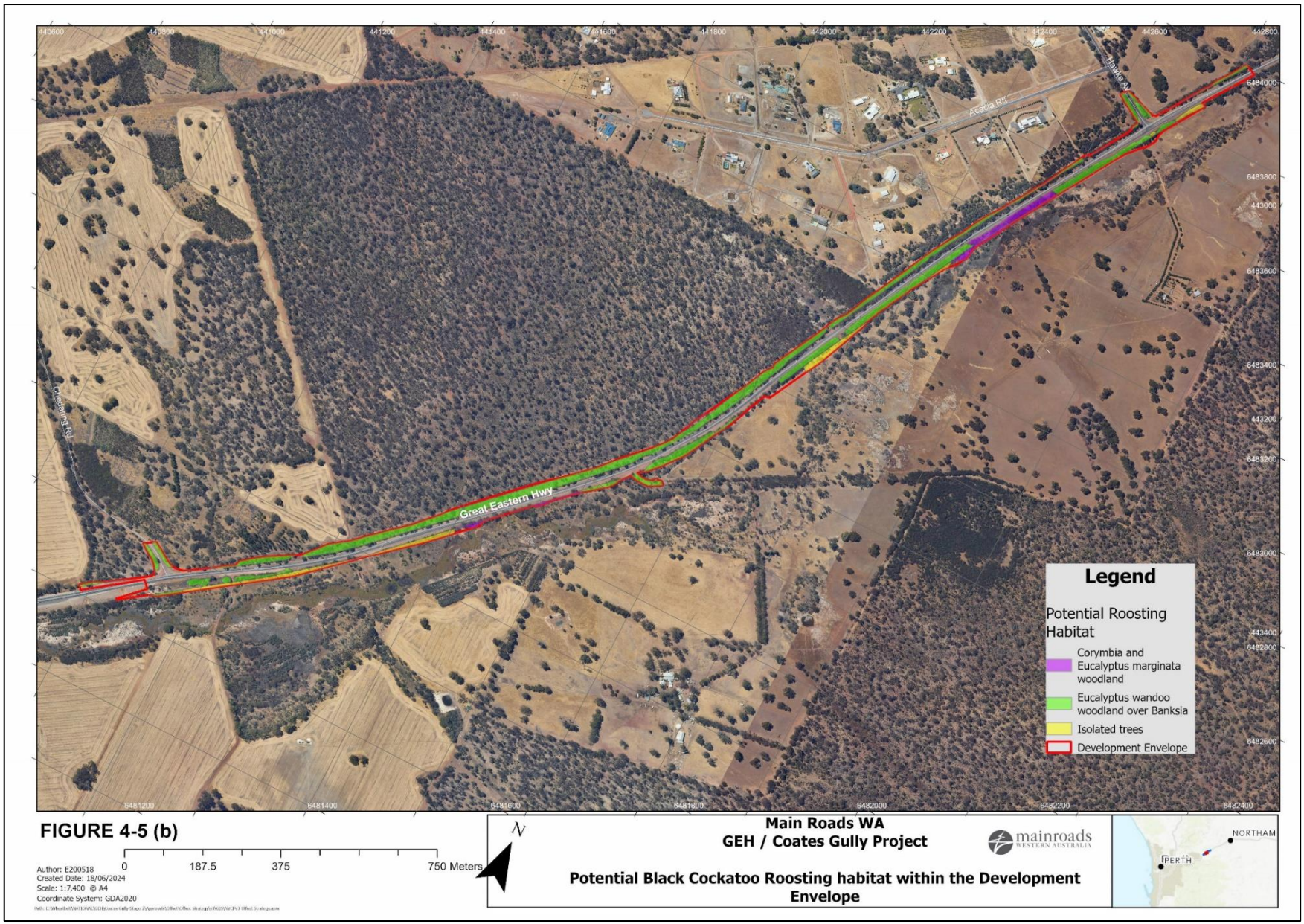

Figure 4-5 (b) Potential Black Cockatoo roosting habitat within the DE

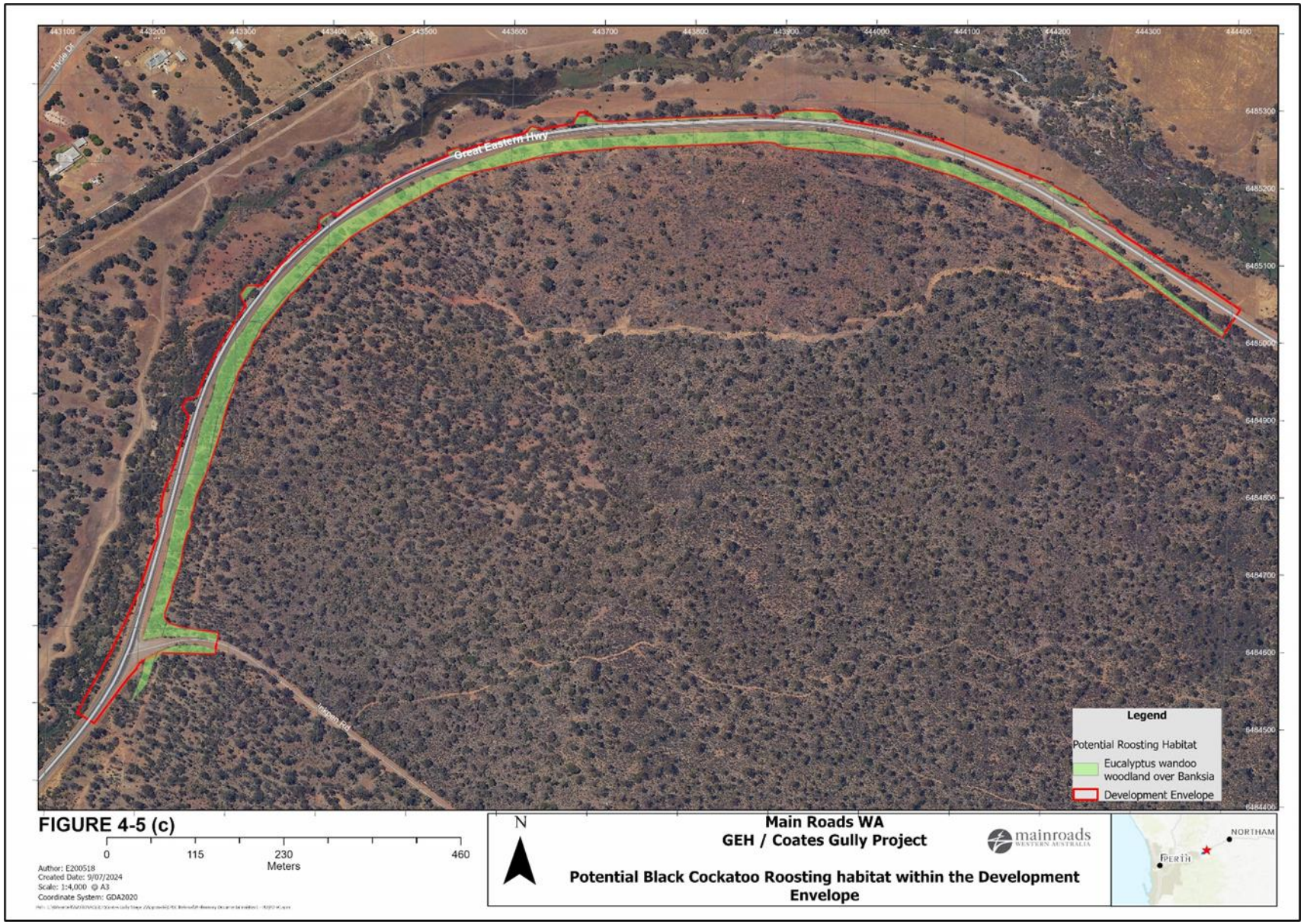

Figure 4-5 (c) Potential Black Cockatoo roosting habitat within the DE

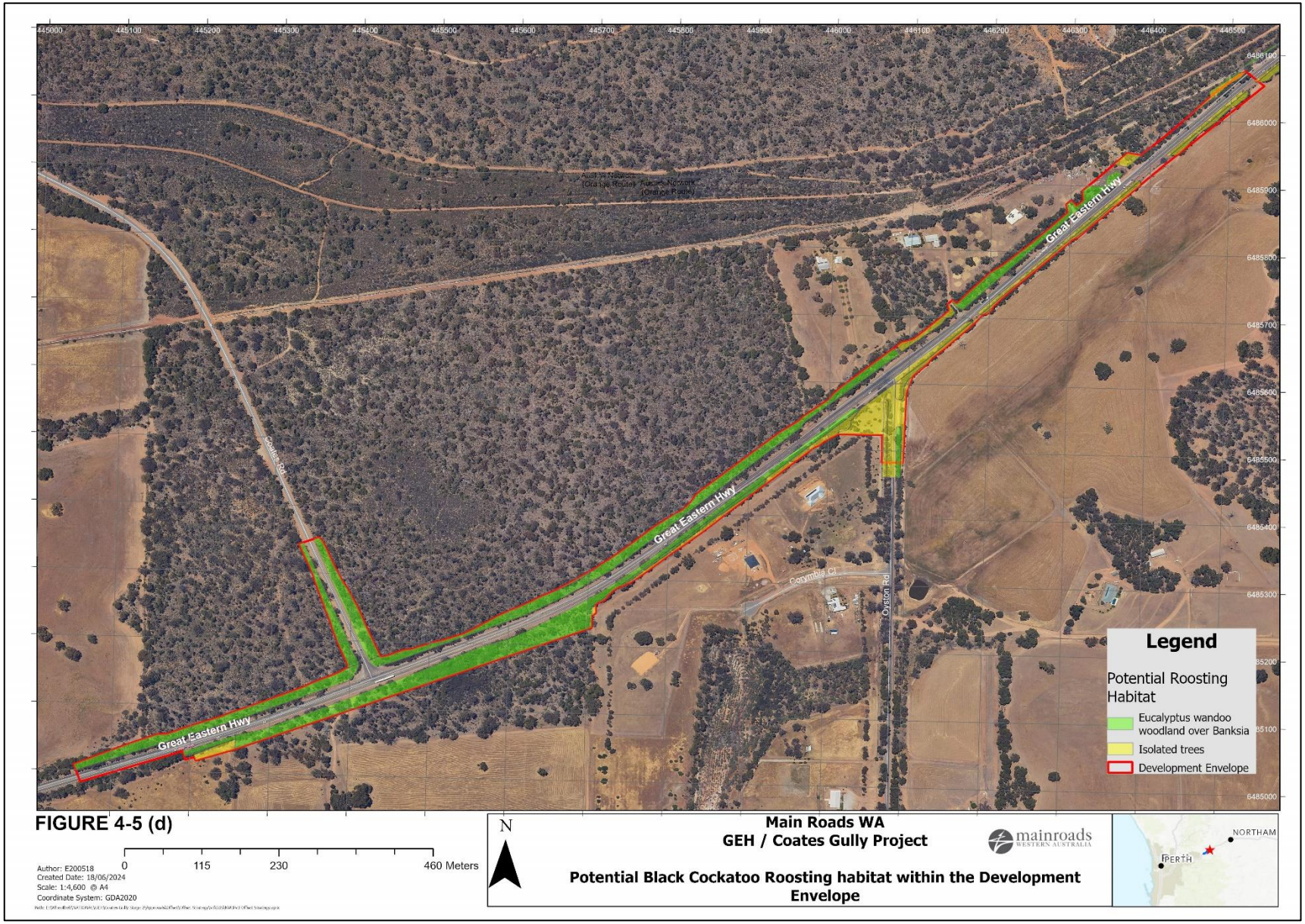

Figure 4-5 (d) Potential Black Cockatoo roosting habitat within the DE

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 and 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).

There are nine known night roosts within 20 km of the DE. Given the low numbers of roosts within the vicinity of the DE, the presence of two within 600 m of the survey area is significant (Biologic, 2021). Overall, although no roosting sites were recorded within the DE, the presence of active Black Cockatoo roosts in the immediate vicinity adds significance to suitable foraging habitat within the DE (Biologic, 2021).

The *Eucalyptus wandoo* woodland over *Banksia* (12.5 ha), *Corymbia* and *Eucalyptus marginata* woodland (1.4 ha), and Isolated Trees (1.7 ha) are considered potential roosting habitat for Black Cockatoo species that will be impacted within the DE (Biologic, 2021). These habitats display characteristics of suitable night roosting habitat, including medium foliage density and habitats that are not too densely forested amongst other trees (Le Roux, 2017). Well-spaced and tall trees may offer greater protection from predators and may allow cockatoos to enter and exit more easily (Le Roux, 2017). The presence of smooth-barked tree species such as wandoo enhances the potential suitability of these habitats.

Overall, based on the mapping provided by Biologic (2021), there is 15.6 ha of potential roosting habitat 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.

Although more than 15 ha of potential roosting habitat, based on vegetation associations present, has been mapped broadly by Biologic (2021), 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 study by Le Roux in 2017 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 1.0 m (0.98 m).

The heights and diameters of all large trees (98 trees) were recorded within the Biologic survey area (2021), while the DBH of large trees (57 trees) was measured within the survey area assessed by Bamford (2015, revised 2021). A total of 155 large (>8 m) 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 within the DE 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 (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.

4.3.3 Local and Regional Context

Regional mapping of remnant native vegetation associations known to be utilised by Black Cockatoo species was used to indicate potential amount of Black Cockatoo foraging habitat within a 6 km and

12 km radius of the DE and regionally within the Jarrah Forest IBRA region (Figure 4-6). The 6 – 12 km radius represents the distance Black Cockatoos will generally forage while breeding.

Within 6 km of the DE there is an estimated 6,905 ha of potential foraging habitat for Carnaby's Cockatoo, with 2,385 ha (34.0 %) located within DBCA managed lands. The Proposed Action constitutes minimal realignment, incorporating the predominately cleared corridor along the GEH with minor deviations into the Kwolyinine and Woondowing Nature Reserves. Main Roads has acquired 0.42 ha of Kwolyinine Nature Reserve and 0.55 ha of the Woondowing Nature Reserve as Road Reserve for the Proposed Action. The land acquired is considered Medium quality Black Cockatoo foraging habitat and contains 37 DBH trees, none with suitable breeding hollows.

Within 12 km of the DE there is 32,453 ha of potential foraging habitat for Carnaby's Cockatoo, with over 12,000 ha located in DBCA managed lands. For Baudin's Cockatoo and FRTBC, there is an estimated 6,014 ha and 23,190 ha of potential foraging habitat within 6 km and 12 km of the DE, respectively. Approximately 19,167 ha of potential foraging habitat for Baudin's Cockatoo and FRTBC within 12 km is located within DBCA managed lands.

Within the Jarrah Forest IBRA region, there is an estimated 2,430,147 ha of potential Black Cockatoo foraging habitat. There are three confirmed white-tailed Black Cockatoo (Carnaby's and/ or Baudin's Cockatoo) roosts, three FRTBC roosts, and three joint roost sites within 20 km of the survey area (nine total; BirdLife Australia, 2021). All three Black Cockatoo species are known to breed in the Jarrah Forest bioregion, with only Carnaby's and FRTBC having confirmed breeding sites within 20 km of the DE (DoEE, 2017). The closest confirmed breeding site is approximately 9 km north of the DE.

During the desktop assessment, Biologic (2021) identified two unverified Black Cockatoo nesting records within the Wundowie Reserve, located approximately 5 km north of the DE. These unconfirmed records were taken from Wheatbelt Natural Resource Management (2021).

Records from BirdLife surveys between 2009 and 2013 identified eight confirmed breeding records for Carnaby's Cockatoo, approximately between 12 - 20 km of the DE, all within natural hollows. There are no confirmed breeding records in artificial hollows within that radius (BirdLife Australia, 2021).

Table 4-5 presents the impact of the Proposed Action on habitat loss within 6 km and 12 km of the DE.

Figure 4-6 Potential Black Cockatoo habitat – Local Context

Table 4-5 Contextual Habitat Loss

Species	Habitat loss due to the Proposed Action	Portion of local habitat loss	Portion of regional habitat loss
Carnaby's Cockatoo	Clearing of 15.7 ha, including: • 1.4 ha of High Quality foraging habitat • 12.5 ha of Medium Quality foraging habitat • 1.8 ha of Low Quality foraging habitat	0.22 % of 6,905 ha within 6 km 0.04 % of 32,543 ha within 12 km	<0.001 % of 2,430,147 ha
Baudin's Cockatoo	Clearing of 15.6 ha, including: • 1.4 ha of High Quality foraging habitat • 12.5 ha of Medium Quality foraging habitat • 1.7 ha of Low Quality foraging habitat	0.25 % of 6,014 ha within 6 km 0.06 % of 23,190 ha within 12 km	<0.001 % of 2,430,147 ha
Forest Red-tailed Black Cockatoo	Clearing of 15.6 ha, including: • 1.4 ha of High Quality foraging habitat • 12.5 ha of Medium Quality foraging habitat • 1.7 ha of Low Quality foraging habitat	0.25 % of 6,014 ha within 6 km 0.06 % of 23,190 ha within 12 km	<0.001 % of 2,430,147 ha

4.3.4 Adequacy of Surveys Undertaken

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 2012a). 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 and investigation of hollows. The hollow inspections of the hollows identified by Bamford (2015, revised 2021) and Biologic (2021), were undertaken by T. Kirkby in June 2021 and August 2022, were also during the breeding season, and included a detailed inspection of possible Black Cockatoo breeding hollows identified during the previous surveys. The entire DE was surveyed and mapped for habitat quality and breeding habitat.

5 ASSESSMENT OF IMPACTS

5.1 Potential Impacts (Direct and Indirect)

5.1.1 Direct Impacts

The Proposed Action will result in the following direct impacts to Black Cockatoos:

- Clearing of up to 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 (Figure 4-2) (totalling 15.7 ha)
- Clearing of up to 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 (Figure 4-3 and Figure 4-4) (totalling 15.6 ha)
- Clearing of up to 15.6 ha of potential breeding and low quality roosting habitat for Black Cockatoos (Figure 4-1and Figure 4-5) (totalling 15.6 ha)
- Clearing of up to 400 suitable DBH trees for Black Cockatoos (Figure 4-1)

The above amounts are conservative, representing the full extent of MNES values within the 35.15 ha DE that will be cleared by the Proposed Action, representing the preliminary impact footprint. The actual clearing footprint may decrease as the construction planning process continues and following further refinement of the design.

The Proposed Action is not expected to result in impacts to known nesting hollows of Carnaby's Cockatoo and FRTBC. The Proposed Action is not expected to result in impacts to Baudin's Cockatoo breeding habitat.

No known roosting sites for Black Cockatoos will be impacted by the Proposed Action.

The DE includes 400 suitable DBH trees for Black Cockatoos, with 959 suitable DBH trees within the entire Biologic (2021) and Bamford (2015, revised 2021) survey areas. The DE contains potential breeding habitat for Carnaby's Cockatoo and FRTBC. The DE has the potential to support breeding given known breeding sites occur within 5 km of the DE, and there is evidence of occupation and foraging of Black Cockatoos within the area. The DE does not support breeding for Baudin's Cockatoo, as it lies outside of the species breeding range.

An assessment was undertaken for the 400 suitable DBH trees within the DE that do not currently contain potentially suitable hollows, to identify their potential to develop suitable hollows. Hollows are most likely to develop in large trees with moderately senescent crowns (Whitford, 2002). The age at which a tree will begin to develop potentially suitable hollows will vary; however, based on the estimated age for jarrah and marri to reach a diameter of 50 cm, the average age for trees to potentially develop suitable hollows is approximately 125 years (Whitford, 2002 and Rose, 1993).

Although all trees with suitable sized hollows for Black Cockatoo breeding have been avoided, all 400 DBH trees within the DE are considered to be of a suitable size and age to be able to develop hollows in the future. It is noted that the nearest breeding record is approximately 5 km and that the local Black Cockatoo populations are low in the area around Coates Gully area (Dr Peter Mawson pers. comm 2024). Although 400 suitable DBH trees without hollows may be impacted by the Proposed Action, trees with suitable sized hollows will be retained adjacent to the DE, providing nesting opportunities for Black Cockatoos if they were to breed in the immediate area.

The DE does not contain evidence of roosting, nor any known roosting sites. Known roosts sites for all three species of Black Cockatoos are located within the vicinity of the DE (approximately 600 m west). Based on vegetation mapping, up to 15.6 ha of potentially suitable roosting habitat occurs within the DE, of which 155 trees are above 8 m tall.

Of the trees that had their heights measured (98 trees), all were well below the average roost tree height (26 m) (Le Roux, 2017), with no live tree recording a height of more than 14 m. Of the 57 trees that only had DBH recorded, no tree had a DBH greater than the average roost tree DBH (98 cm), with the maximum DBH recorded being 88 cm.

Given no very tall trees are present within the DE, nor records or evidence of roosting occurring 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 to be low. Accordingly, the Proposed Action is not likely to have a significant impact on roosting habitat.

Clearing of up to 15.7 ha of foraging habitat for Carnaby's Cockatoo represents 0.2 % and 0.04 % of the estimated potential foraging habitat for the species within 6 km and 12 km, respectively. Clearing of up to 15.6 ha of foraging habitat for Baudin's Cockatoo and FRTBC represents 0.2 % and 0.06 % of the estimated potential foraging habitat for these species within 6 km and 12 km, respectively. The clearing will result in a <0.001 % reduction in the estimated available foraging habitat for all three Black Cockatoo species in the northern jarrah forest.

5.1.2 Indirect Impacts

The Proposed Action has the potential to cause indirect impacts to Black Cockatoo habitat that lies adjacent to the DE. Potential indirect impacts may be caused from:

- Indirect impacts to potentially suitable hollows within the vicinity of the DE
- Fragmentation of Black Cockatoo habitat
- Spread and/or introduction of weeds
- Introduction and/or spread of pathogens, such as Dieback (*Phytophthora cinnamomi*)
- Vehicle strike
- Erosion, Sedimentation
- Fire.

The Proposed Action is not expected to cause significant indirect impacts to Black Cockatoo habitat, with discussion provided for each indirect impact below.

Indirect Impacts to Suitable Hollows

As discussed in Section 4.3.2, one potentially suitable and three suitable hollows were confirmed by T. Kirkby (2021) within 10 m of the DE (located adjacent to the centre and to the east of the DE). Of these, a single potentially suitable hollow was recorded within the former DE, which has now been modified to avoid this hollow. The Proposed Action construction works now avoid all trees with potentially suitable or suitable hollows. If breeding occurs within any of these four hollows during construction, all construction activities within 10 m of the tree will cease until the breeding activity ceases and it is no longer being visited by the breeding pairs.

Pre-clearance hollow inspection surveys will be undertaken at least seven days prior to works commencing for hollows located within 10 m of proposed clearing areas, for any clearing completed within the breeding period for Black Cockatoos (i.e. July to February). The ability to avoid these trees in the Proposed Action design has a positive outcome for the local retention of hollow-bearing trees. In addition, Main Roads will implement the Proposed Action to avoid any impacts to the four hollow tree, root zones and canopies.

As a result, the Proposed Action is not expected to have an indirect impact to the one potentially or three suitable hollows that are located within 10 m of construction activities.

Fragmentation Of Black Cockatoo Habitat

The Proposed Action is not expected to significantly fragment Black Cockatoo habitat within the vicinity of the DE. The Proposed Action follows the existing GEH, comprising of upgrades and widening of the existing road. The existing GEH is approximately 9 m wide, with upgrades proposing to widen the road to a 12 am formation.

No waterways or major drainage lines run through the DE; however, the Wooroloo Brook and Coates Gully are located within the immediate vicinity (Figure 5-1). Coates Gully is a minor water course which follows the GEH within the vicinity of the eastern portion of the DE. The Wooroloo Brook runs directly to the North of the western portion of the DE. Coates Gully is fed by numerous other water courses surrounding the DE, before flowing into an unnamed major perennial water course, then into Wooroloo Brook, and eventually discharging into the Swan River.

There are nine known Black Cockatoo night roosts within 20 km of the DE, with the one located approximately 600 m west of the DE on Mairinger Way in Wundowie (Bamford 2015, revised 2021). Known roost site, NORWUNR001, is located 500 m from the DE and approximately 1.1 km from the Mairinger Way site. Roost site NORBAKR001 is located approximately 1.2 km north-east of the DE in the Bakers Hill Golf Club.

During the desktop assessment, Biologic (2021) identified two unverified Black Cockatoo nesting records within the Wundowie Reserve, located approximately 5 km north of the DE. These unconfirmed records were taken from Wheatbelt Natural Resource Management (2021).

The closest record of known breeding of FRTBC is approximately 9 km from the DE.

Within 12 km of the DE there is approximately 32,543 ha of potential Carnaby's Cockatoo foraging habitat, and 23,190 ha of potential Baudin's Cockatoo and FRTBC foraging habitat (Figure 4-6). Habitat within the vicinity of the DE has already been fragmented in the past due to the original construction of GEH and previous land uses (e.g. clearing for agriculture).

Black Cockatoos are highly mobile and a widely distributed species. They are known to cross large areas of open land to access feeding areas and water. Clearing for the Proposed Action involves the removal of a relatively small area of Black Cockatoo habitat already bisected by GEH, with connections to adjacent foraging habitat to the north, south and east remaining. The distances to nearby watering, roosting and breeding sites will not increase to the point that Black Cockatoos will be unable to access these areas.

Spread and/or Introduction of Weeds

The construction and operation phases of the Proposed Action have the potential to result in the spread of introduced weeds into adjacent Black Cockatoo habitat through activities such as clearing, and the increased movement of vehicles, or earth-moving machinery.

360 environmental (2020) and Biologic (2021) together recorded 60 non-native 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.

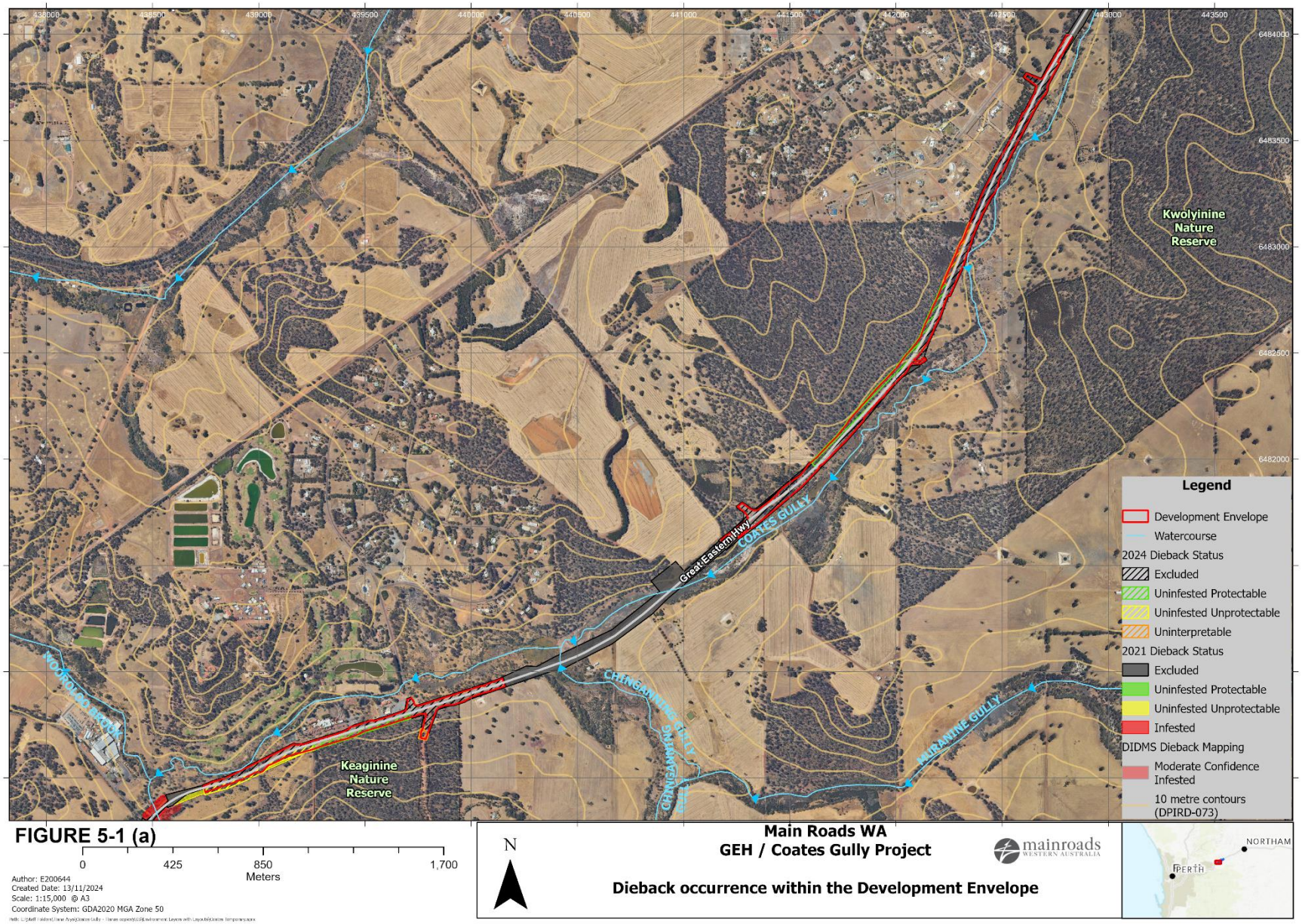

Figure 5-1 (a) Hydrology and Dieback within the DE

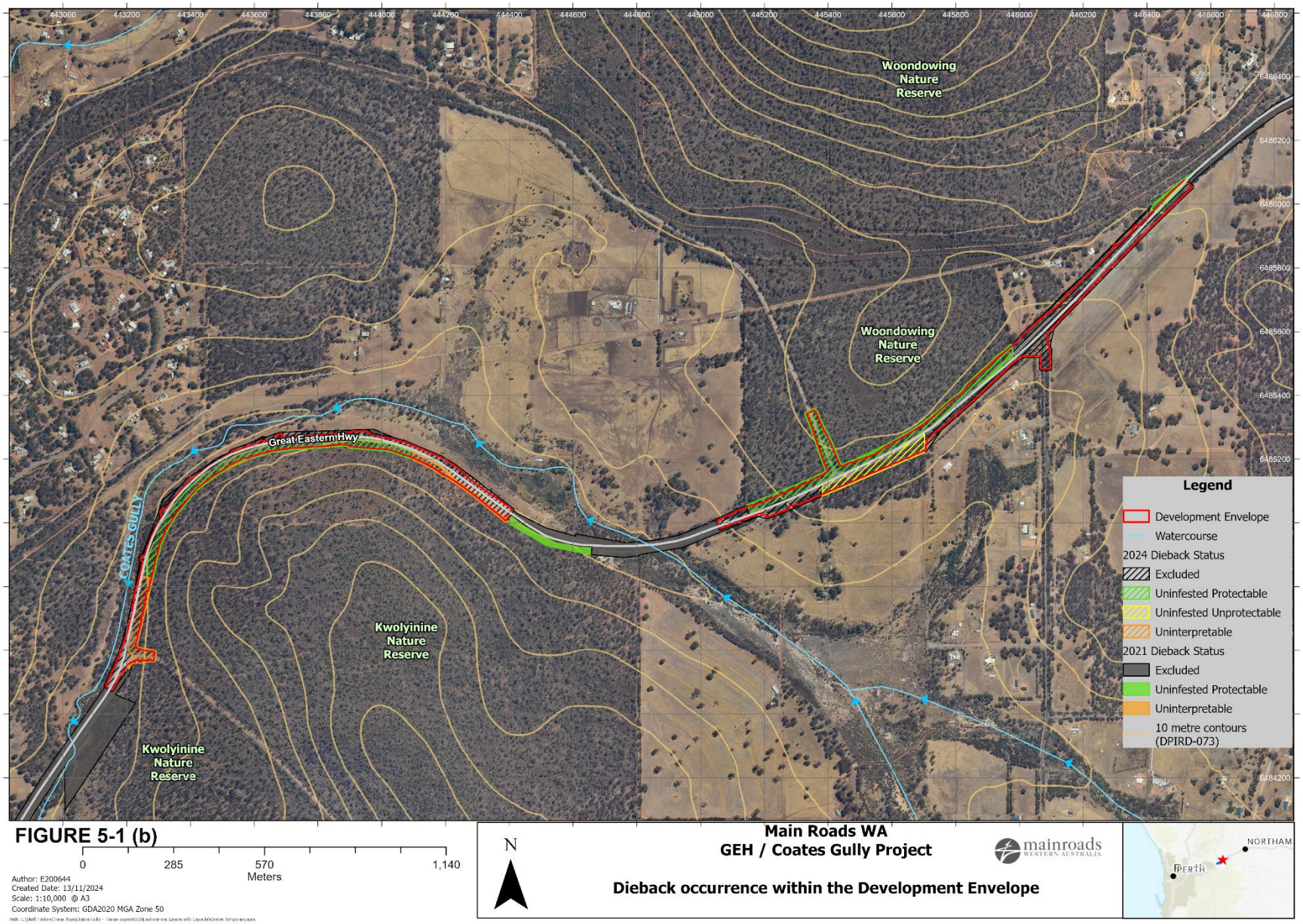

Figure 5-1 (b) Hydrology and Dieback within the DE

The 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. Figure 5-2 presents the locations of all non-native taxa including Declared Pests and WoNS recorded within the DE.

The Proposed Action may result in the spread of Declared Pests and WoNS from the DE to adjacent, un-infested native vegetation through clearing and earthworks activities that spread weeds and seeds, and wind-blown spread of seeds from weeds establishing in the DE.

Access controls, weed treatment, hygiene and monitoring will be implemented during and after construction to prevent the introduction and spread of weeds within the DE and to adjacent vegetation. Established control methods for all Declared Pests recorded within the DE are outlined in the CEMP (Appendix 2) and will be implemented from the pre-construction through to post-construction phases of the Proposed Action.

The Proposed Action is not expected to spread weeds and seeds in stormwater runoff, as stormwater will be captured and infiltrated or detained within roadside drains in the road reserve. Weeds may become established in the roadside drains, which may then facilitate the spread via wind-blown seeds to adjacent un-infested native vegetation. Accordingly, ongoing weed management will occur in drainage areas adjacent to un-infested native vegetation as part of ongoing standard road maintenance.

Through construction and operational management, the Proposed Action is not expected to result in the introduction or spread of weeds that could result in significant impacts to Black Cockatoo habitat.

Introduction and/or Spread of Dieback and Other Pathogens

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) and September 2024. Main Roads is committed to undertaking up-to-date Dieback mapping of the entire DE before commencing construction of the Proposed Action.

The original assessment identified two small areas of Dieback infestation (totalling 0.93 ha) approximately 180 m to the west and downstream of DE, in the vicinity of Linley Valley Road (Figure 5-1 (a)). No new Dieback infestations were identified during the rechecks (Figure 5-3). The Dieback infested areas are located within the vicinity of Keaginine Reserve (located approximately 600 m to the east of the infested area). Keaginine Reserve contains Black Cockatoo habitat that has the potential to be impacted by Dieback spread. Areas of high disturbance where natural vegetation is unlikely to recover were excluded from the assessment. Several areas were 'Uninterpretable", being undisturbed areas where susceptible plants are absent, or too few to make a determination of the presence or absence of dieback.

A non-perennial surface waterway is located in the proximity of the Proposed Action occurring at its closest point approximately 30 m from the DE and drains in an easterly direction. No known Dieback infested areas occur within or adjacent to the DE that has the potential to intercept surface drainage lines that may have the potential to spread Dieback. The one identified Dieback infested area is located downstream, to the east of the DE, no surface drainage features exist that may result in Dieback Infested water to flow toward the DE.

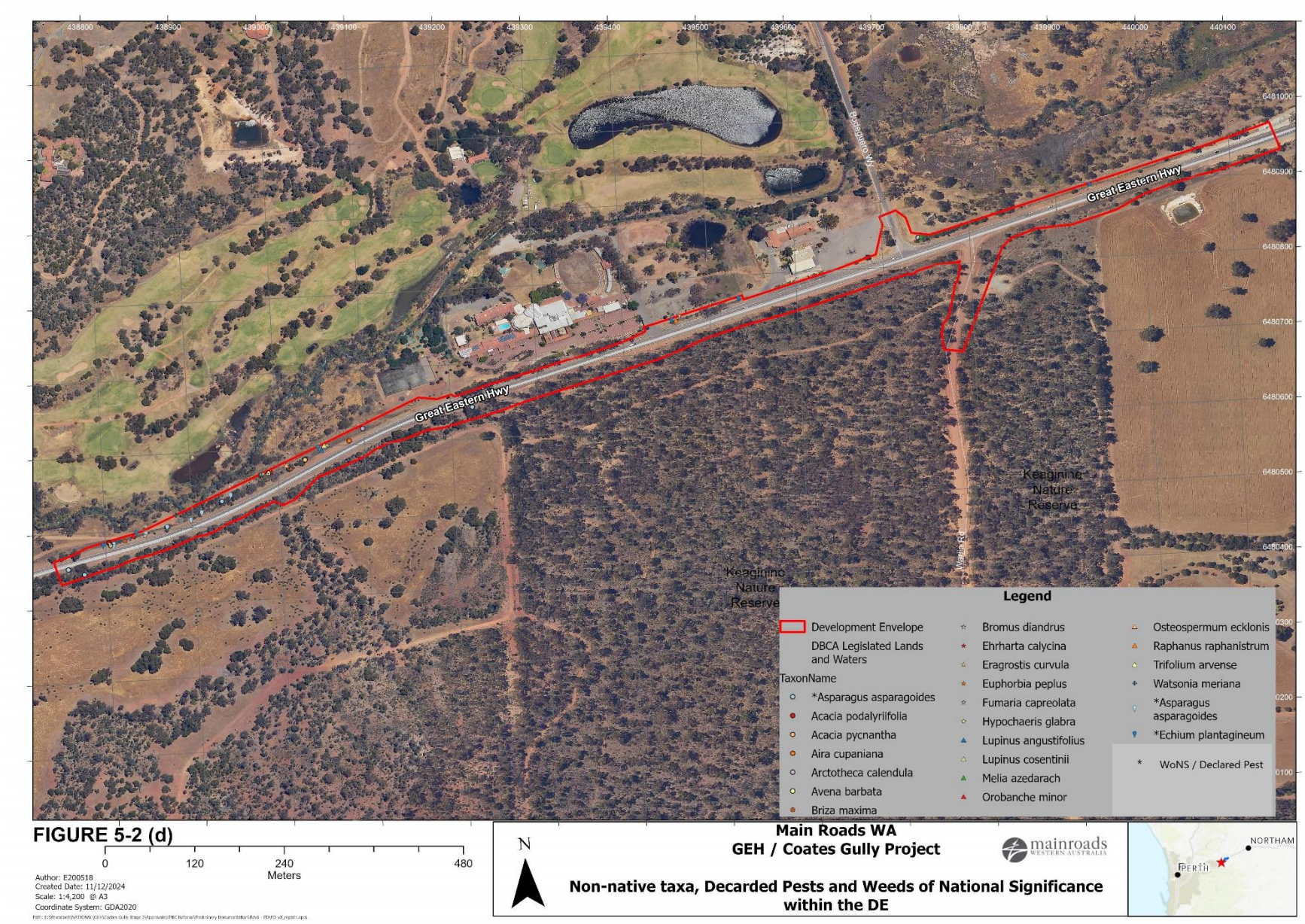

Figure 5-2 (a) Non-native taxa including Declared Pests and WoNS recorded within the DE

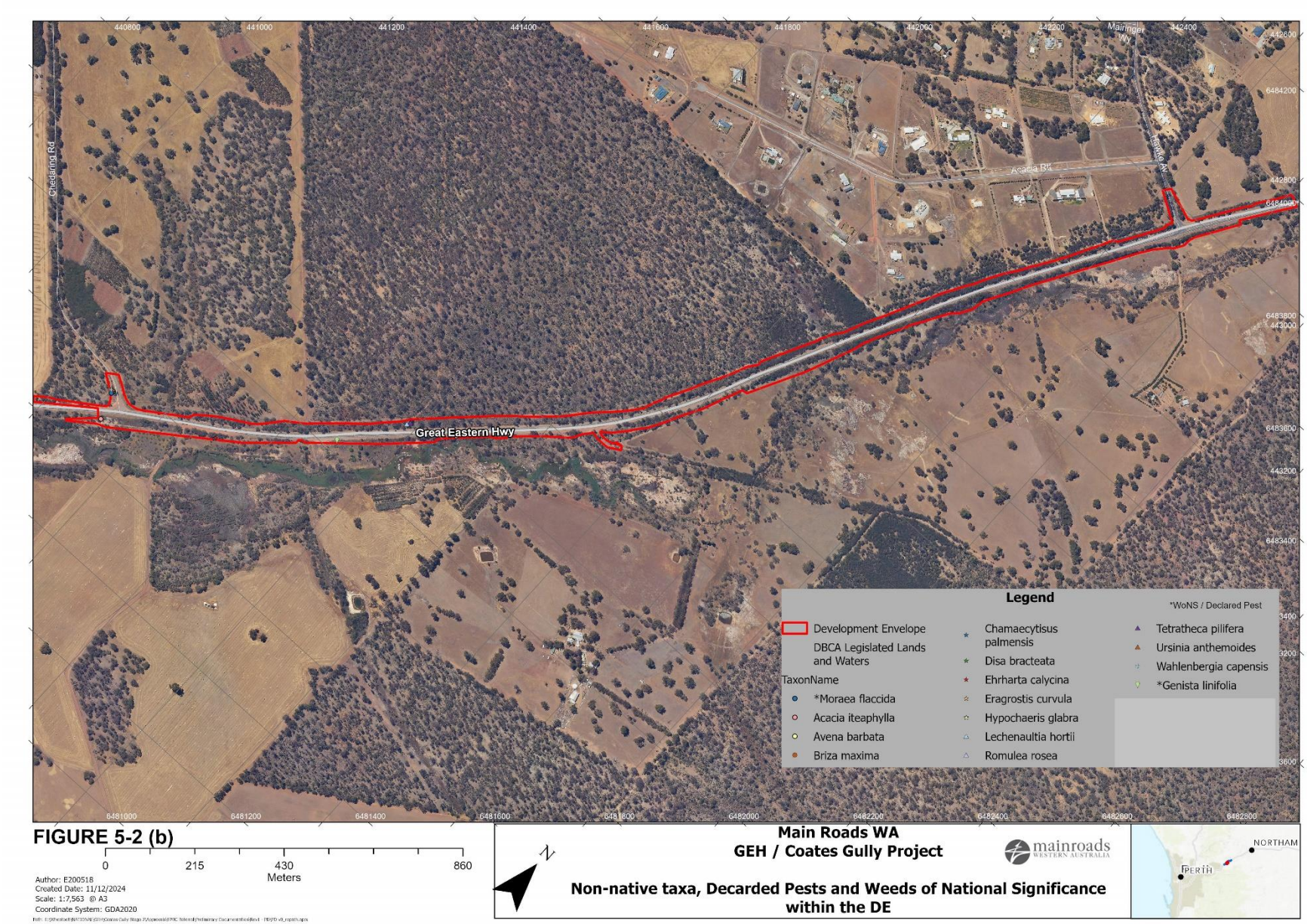

Figure 5-2 (b) Non-native taxa including Declared Pests and WoNS recorded within the DE

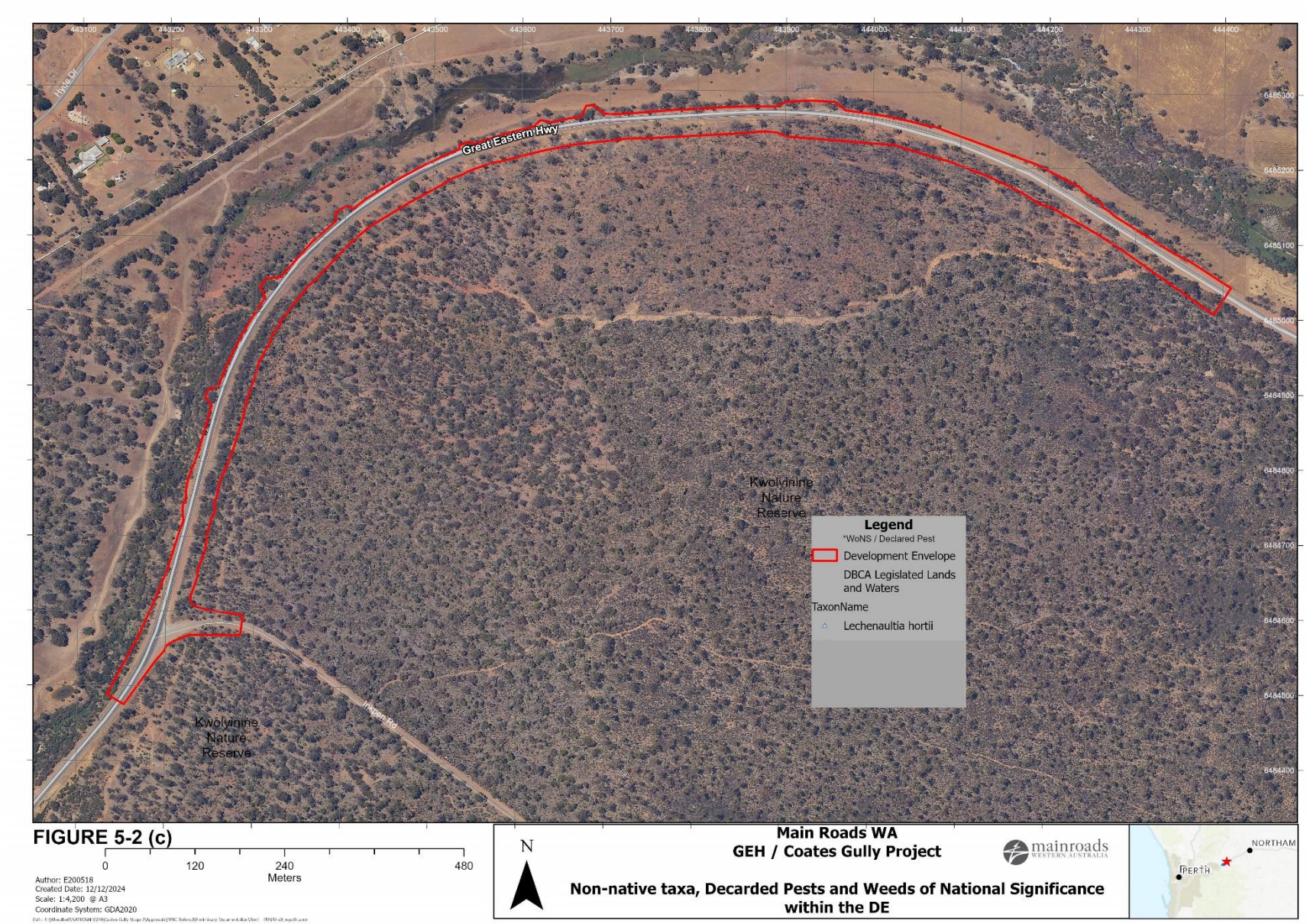

Figure 5-2 (c) Non-native taxa including Declared Pests and WoNS recorded within the DE

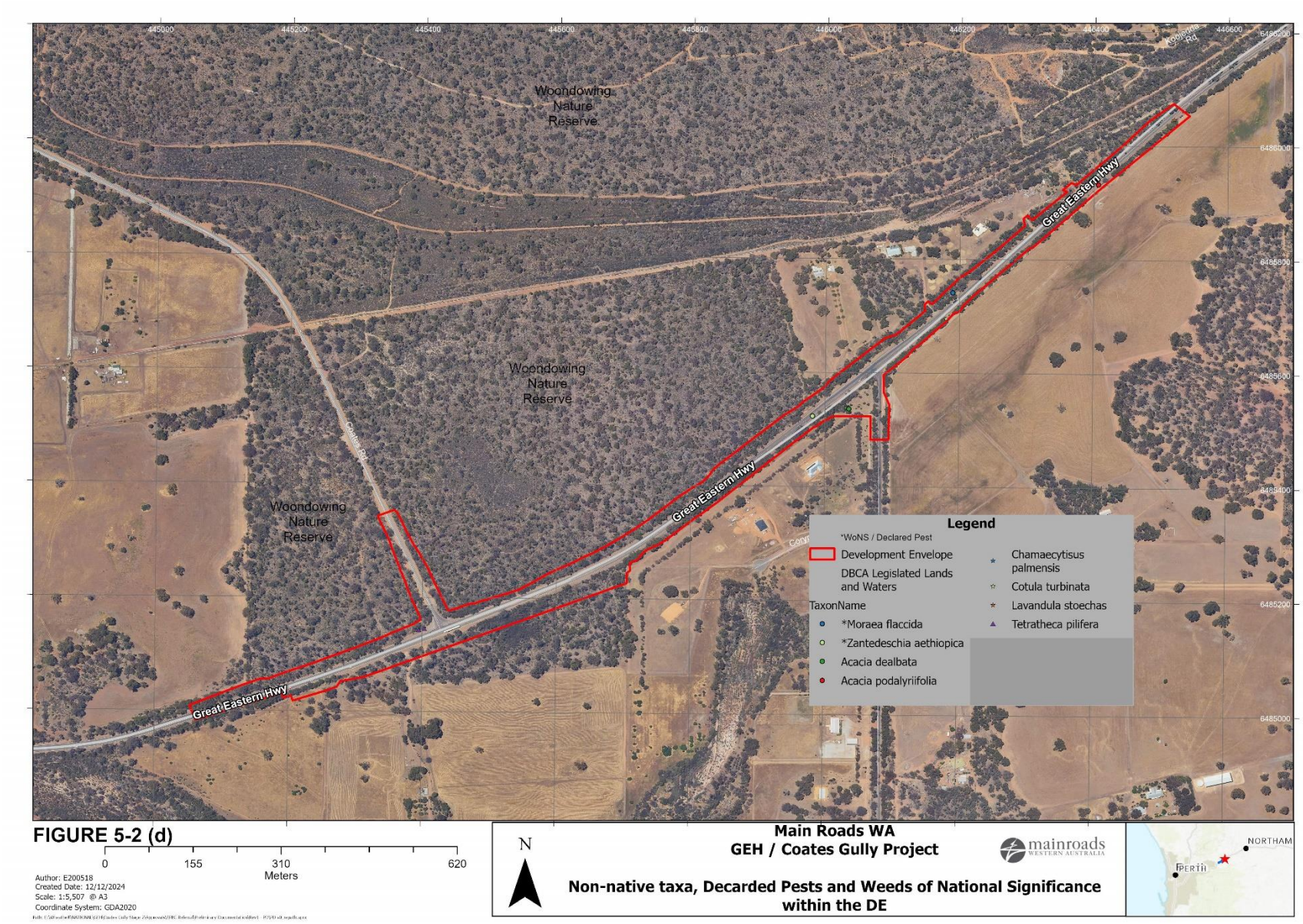

Figure 5-2 (d) Non-native taxa including Declared Pests and WoNS recorded within the DE

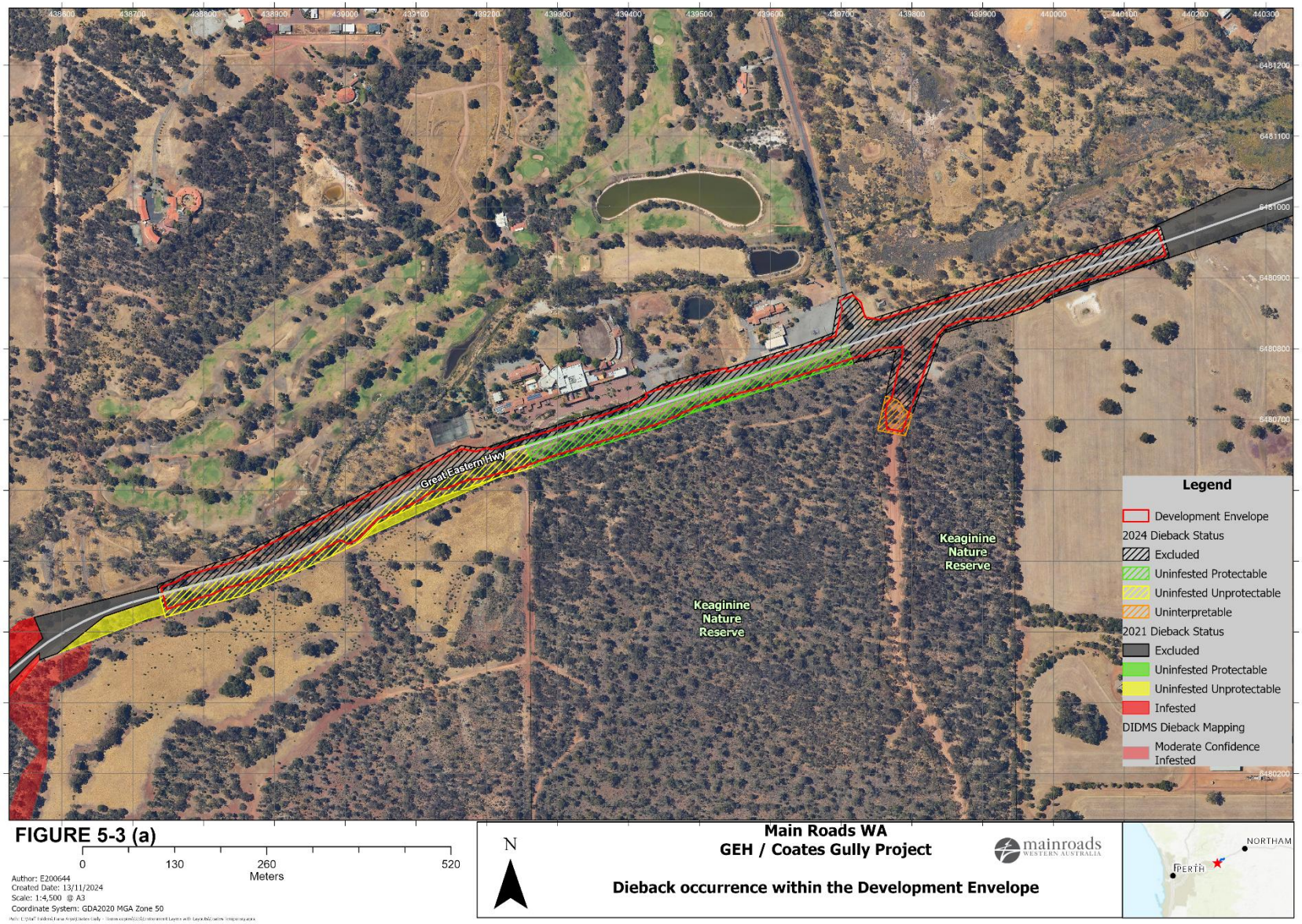

Figure 5-3 (a) Dieback occurrence within the DE

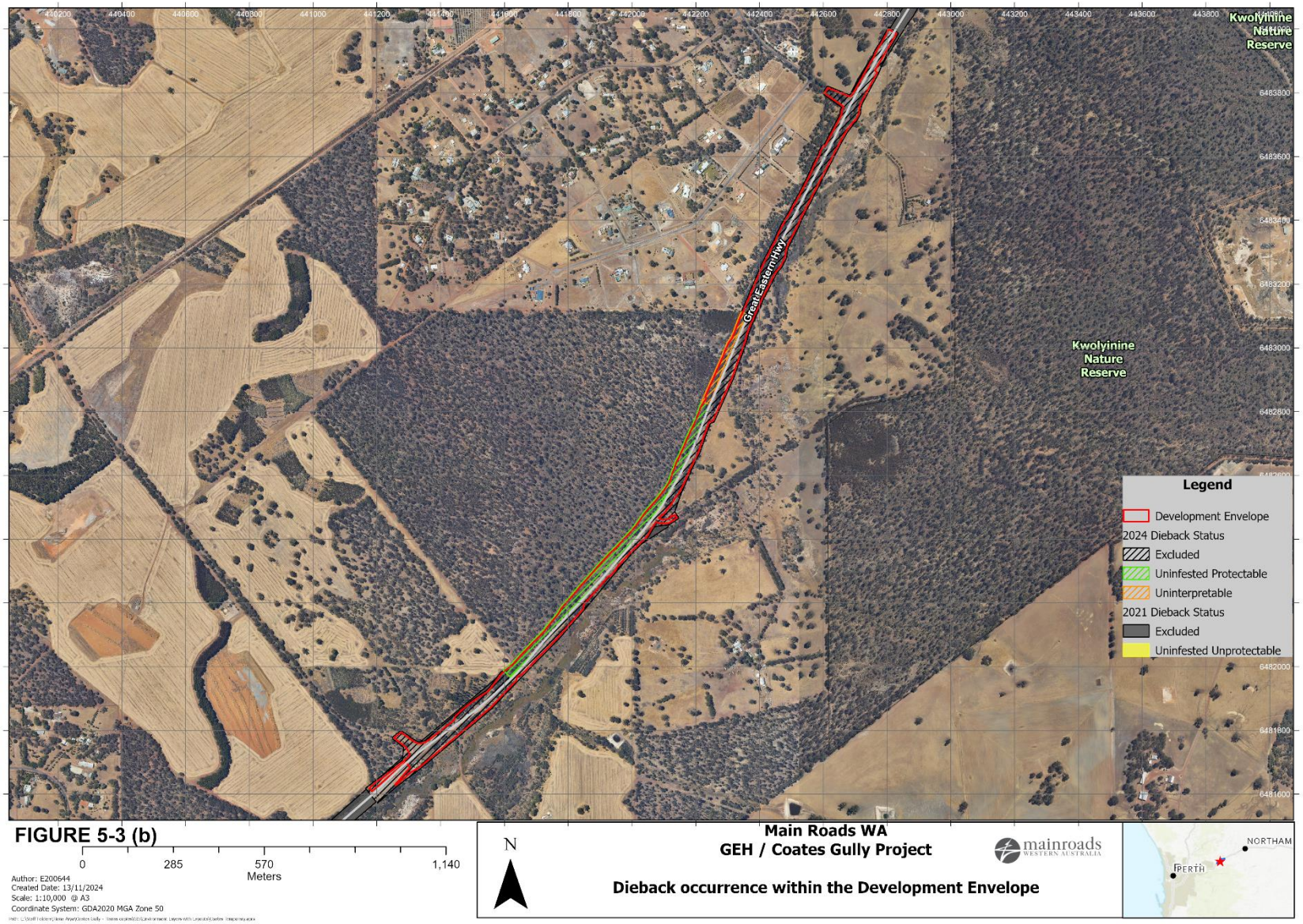

Figure 5-3 (b) Dieback occurrence within the DE

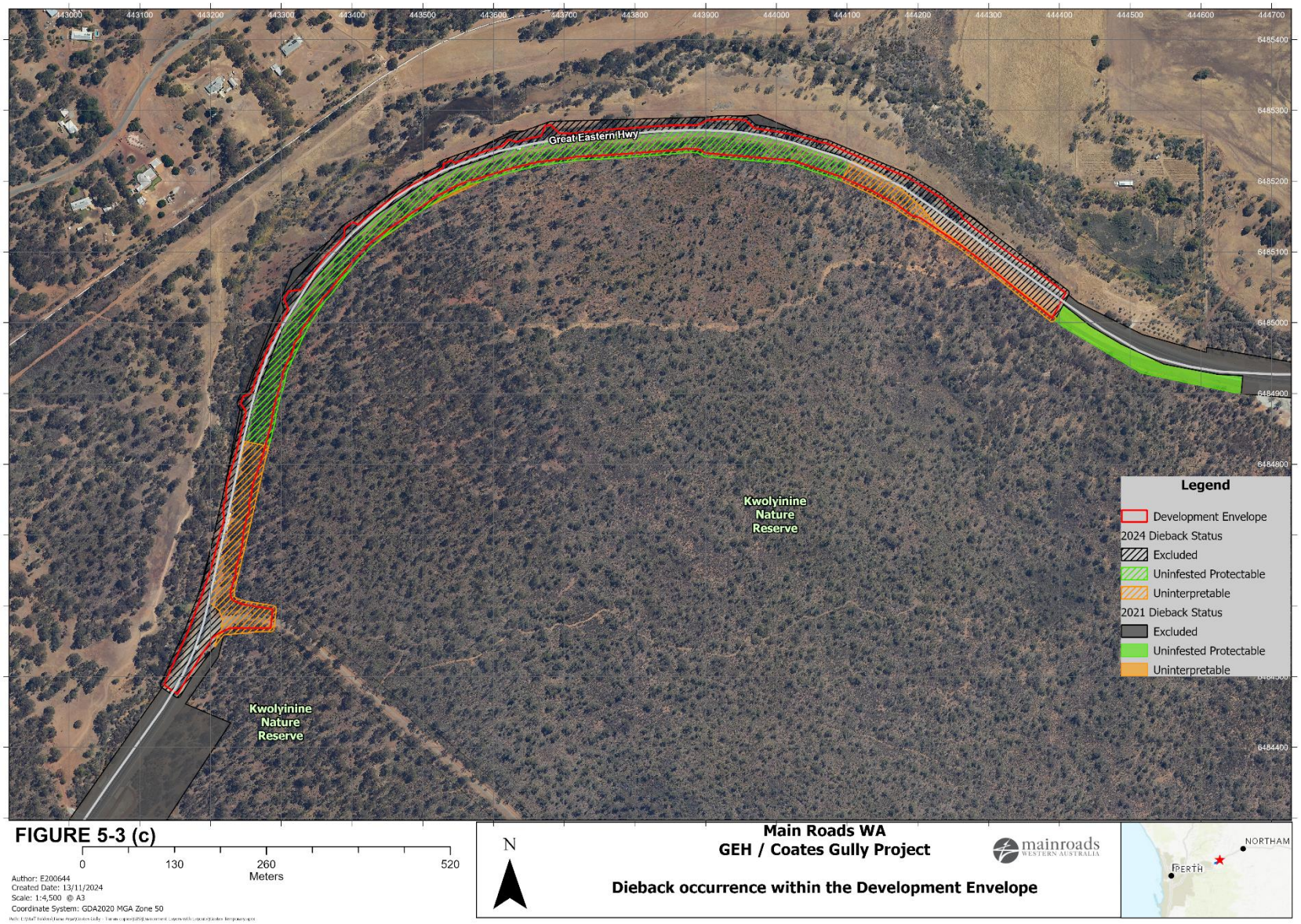

Figure 5-3 (c) Dieback occurrence within the DE

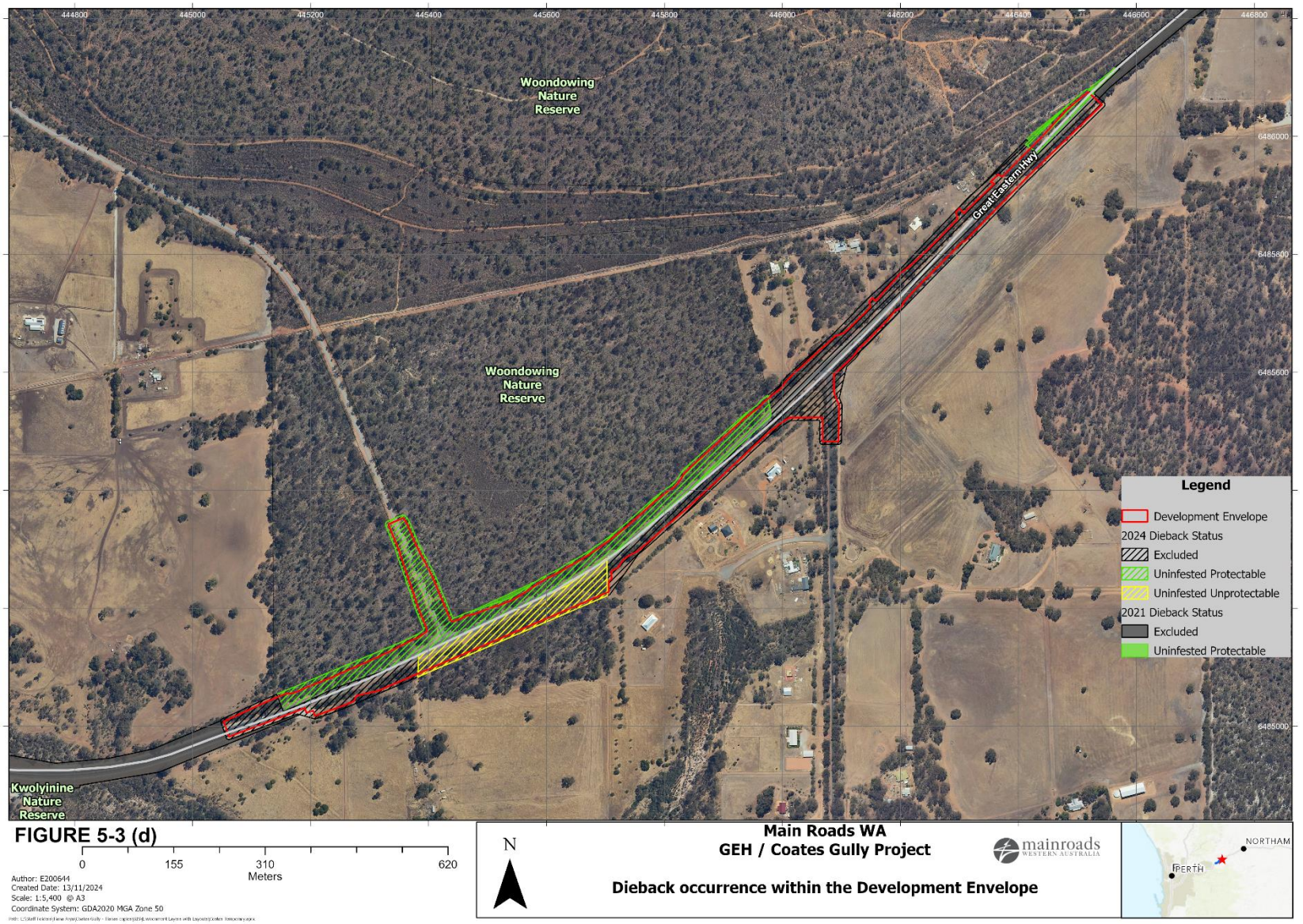

Figure 5-3 (d) Dieback occurrence within the DE

No surface water or groundwater is proposed to be abstracted or intercepted from within or adjacent to the DE. All water required for the Proposed Action will be sourced from external sources. The Proposed Action is located within pre-existing raised road formation; minor sections will require material to be imported from Dieback free sources to ensure new sections are uniform with exiting raised road formation. Given the nature of the existing alignment and construction requirements, groundwater will not be intercepted. The potential for Dieback infested water to be intercepted or introduced into the DE is not expected.

Areas of Dieback uninfested protectable land (totalling 6.0 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. The entire DE, including previously uninterpretable areas will be rechecked for Dieback prior to commencement of construction activities.

The Proposed Action will incorporate Dieback hygiene during construction to protect adjacent vegetation that may be uninfested and vulnerable, particularly in the vicinity of the Keaginine Nature Reserve. The Proposed Action will establish protectable areas along sections of the DE boundary and incorporate access controls, equipment and vehicle washing/segregation, soil movement controls, and monitoring during construction (see CEMP in Appendix 2). In particular, soil harvested from infested or uninterpretable areas will not be reused in protectable areas, and equipment and vehicles working in or adjacent to infested or uninterpretable areas will not be able to access protectable areas unless cleaned and inspected prior to entry. Soil harvested from infested areas will only be reused in infested areas in accordance with DBCA guidance, or disposed of at a licensed landfill.

The Proposed Action is not expected to spread Dieback through sediment in stormwater runoff, as stormwater will be captured and infiltrated within roadside drains in the road reserve and will not discharge into the Keaginine, Kwolyinine and Woondowing Nature Reserves outside the DE.

Through construction management, the Proposed Action is not expected to result in the introduction or spread of Dieback that could result in significant impacts to Black Cockatoo habitat. Dieback assessments will be undertaken bi-annually adjacent to areas identified as uninfested or protectable for up to 3 years.

Risk of Vehicle Strike

Although, the current GEH alignment poses an existing risk of vehicle strike to Black Cockatoos, Main Roads is not aware of any bird-vehicle strike events being recorded within the DE.

Carnaby's Cockatoo are most commonly killed by vehicle strikes whilst drinking from puddles on or besides roads, or flying between foraging trees on roadsides (Johnstone *et. al*., 2017). Johnstone *et. al*. (2017) note an increased incidence and risk of vehicle strike and mortality of FRTBC with their expansion onto the SCP, particularly within the Perth metropolitan area.

Birds drinking on the edge of roads are very susceptible to vehicle strike. If water does pool on the side of roads, it typically occurs where the bitumen ends and the gravel shoulder begins. This is also where grains from passing trucks often accumulate. As the Proposed Action involves the widening of the road formation, a benefit of the action would be that a greater separation distance will be created between the trafficked lane and the gravel shoulder.

During construction, the Proposed Action will reduce vehicle speed of road users and machinery speeds within the DE, further reducing the likelihood of vehicle strike to Black Cockatoos.

Post construction (during operation) pre-existing speed limits will be established, noting the existing alignment was designed to be utilised as a strategic major freight route. Given the improved sight lines the Proposed Action will provide for drivers and the improved road geometry, it is expected that drivers will have more time to react to fauna entering the road area.

If approved, Main Roads expects that the conditions of approval will require it to not revegetate or landscape the DE with Black Cockatoo foraging species within 10 m of the edge of the road.

Main Roads is not aware of any bird-vehicle strikes ever occurring within the DE and, given the scale and nature of the changes proposed for each option, it does not expect any of the options considered to increase the likelihood of strikes occurring within the DE.

Main Roads sought advice from Dr Peter Mawson from Australian Black Cockatoo Specialists regarding the Proposed Action's potential impact on Black Cockatoos through increased vehicle strike. Dr Mawson is widely recognised as one of the state's leading Black Cockatoo experts and was the former Director of Animal Health and Research at Perth Zoo. Dr Mawson's commentary on the likelihood of Black Cockatoo vehicle strike is provided below:

> *Collision with motor vehicles has been identified as a key threatening process for Carnaby's and FRTBC in their respective species Recovery Plans and in published research (Le Souëf et. al., 2015). Le Souef et. al. (2015) reported that the most-common reason for admission of Black Cockatoos to the Perth Zoo Veterinary Department was trauma from all causes (at least 76.7% of cases), and trauma was also the most-frequent finding on necropsy examination (80.1 % of cases). Black Cockatoos are susceptible to vehicle strike owing to their tendency to feed on remnant vegetation alongside road verges and flying out into clear air space when leaving a feeding area, which often places them in the path of oncoming vehicle traffic (Saunders et. al., 2011).*
>
> *The risk to Black Cockatoos from collisions with vehicles varies across space and time, with little difference between species (Coyle, 2021). A geospatial investigation of the location information derived from admission records of Black Cockatoos admitted to the Perth Zoo Veterinary Department for the period spanning 2011-2020 identified 547 specific admissions for Carnaby's and Forest red-tail cockatoos that were (or were likely to have been) due to collisions with vehicles. The majority (53 %) of the admissions related to FRTBC. The investigation was focused on the greater Perth metropolitan area, which lies just to the west of the area of Coates Gully, Wundowie, but the major findings are still relevant to the proposed road development at Coates Gully, Wundowie. This investigation found significant evidence of clustering of collisions across both species and time-periods, with large hotspots observed around Curtin and Murdoch Universities, as well as roadways bordering the Darling Scarp (on the eastern SCP). Increased vehicle collisions with Black Cockatoos were shown to be positively correlated with greater road density and percentage of remnant roadside vegetation, while negatively correlated with distance to known roosting sites.*
>
> *Over the 2011-2015 period, the number of Black Cockatoo vehicle collisions (BCVCs) were positively correlated with road density ($p<0.001$) and percentage of roadside vegetation ($p=0.005$), but negatively correlated with distance to roosting sites ($p<0.001$). Over the 2016-2020 period, BCVC was also positively correlated with road density ($p<0.001$) and percentage of vegetation ($p=0.003$), but negatively correlated with distance to roosting sites ($p=0.005$). Percentage of water bodies and traffic volume was <u>not</u> (emphasis added) correlated with BCVC over the 2016-2020 period.*

Examination of the published Birds Australia Great Cocky Count reports (Peck et. al. 2019) indicate that white-tailed Black Cockatoos (most likely Carnaby's Cockatoos at these locations) have been recorded roosting at Wooroolo (n=42 in 2018), Bakers Hill (17 in 2010, 84 in 2016, 52 in 2017 and 160 in 2019) and Wundowie (125 in 2010, 8 in 2012 and 15 in 2019). Remembering that these data are from counts on a single late afternoon/evening in late April each year, the number of Black Cockatoos observed is very low relative to the total estimated population for Carnaby's Cockatoo (n=34,000 CI 20,000-52,000; Garnett and Baker 2021) and FRTBC (n=16,800 CI 12,800-20,800; Garnett and Baker 2021).

The results from the Great Cocky Count series suggests that the local Black Cockatoo populations (Carnaby's Cockatoo and FRTBC) are low in the area around Coates Gully, Wundowie (at least in mid-autumn when the counts are undertaken). The only manor that risk from vehicle strike to Black Cockatoos could logically increase in the Proposed Action area is if the Black Cockatoo population increases significantly, or the road density increases. There is no obvious reason for the Black Cockatoo population to increase as the value and volume of native foods is not proposed to increase significantly. The proposed road development will also not contribute to any increase in road density in the area. While it is possible that over time the volume of traffic may increase as the human population of the Perth-Peel Region increases, such an increase will of itself not result in an increase in the rate of BCVCs unless there are changes in other factors that draw the Black Cockatoos in to proximity to the road carriage-way.

Data generously provided to Main Roads WA from records kept by the Kaarakin Black Cockatoo Conservation Centre ('Kaarakin') for birds admitted to that facility over the last five years indicate that since the start of 2019, 'Kaarakin' had admitted 1144 Black Cockatoos, of which almost 500 were categorised as being hit by a motor vehicle. It should be noted that birds that survive traumatic events and that are treated at Perth Zoo Veterinary Department before being sent to one of two dedicated Black Cockatoo rehabilitation centres currently operating account for only 40 % of the total number of birds admitted to the Perth Zoo. The remaining 60 % are either dead on arrival at the Zoo, die in care, or are euthanased due to the nature and extent of their injuries (Mawson et. al. in prep).

Admission records for Black Cockatoos were examined to determine which came from the suburbs that the Proposed Action passes through, or is adjacent to. These suburbs were Bakers Hill, Beechina, Clackline, Chidlow, Copley, The Lakes, Wooroloo and Wundowie. Of the motor vehicle collision patients admitted, the following were recorded from those suburbs:

- *two birds were admitted from Bakers Hill (one each in 2021 and 2022)*
- *one bird was admitted from Chidlow in 2022*
- *one bird was admitted from The Lakes in 2024.*

Two Black Cockatoos with injuries of an unknown cause were also recorded from Chidlow in 2021 and one individual with an unknown cause of injury was recorded from Bakers Hill in 2023. No motor vehicle collision records were recorded from Beechina, Clackline, Copley, Wooroloo or Wundowie. No records were recorded for Great Eastern Highway in and around the Coates Gully area.

While acknowledging that these admission records limit the scope of the response to Black Cockatoos injured/killed and that are reported to DBCA/Perth Zoo or either of the two dedicated Black Cockatoo rehabilitation specialists, it is reasonable to conclude that the

observed vehicle collision injury rate is very low in the area around the Proposed Action. It is also important to note that the proposed road upgrade will not initially increase the volume of traffic using this section of the GEH, nor will it increase the speed of traffic. It follows that whatever level of risk the Black Cockatoos are currently subject to, the Proposed Action should not increase that risk. Furthermore, the upgraded road will also result in a greater separation distance been the traffic lane and the gravel shoulder, where Black Cockatoos have been known to forage at ground level. Accordingly, it is expected that the number of bird-vehicle interactions will not increase; if anything, the likelihood of collision may be reduced.

The likely extent of the impact of the existing roadway can be reasonably be assumed to be very low at a population level for both Carnaby's Cockatoo and FRTBC. Examination of the vegetation communities immediately surrounding the road alignment indicates that it is low quality wandoo (Eucalyptus wandoo) with sub-dominant marri (Corymbia calophylla) growing in heavy clay-based soils along a drainage line. The understory is stunted marri and native hakea species and sedges growing in the seasonal drainage line that flow parallel to the highway and along its southern side. This type of habitat is not recorded as being used by FRTBC. While Carnaby's Cockatoo regularly nests in wandoo woodlands (Garnett and Baker, 2021), none of the major breeding sites recorded are in wandoo woodland in the lowest part of the landscape along drainage lines (Saunders and Dawson, 2017 and Dawson & Mawson unpublished data). Known roost sites for both species in undulating terrain such as that found at the Proposed Action site and involving either wandoo or marri trees, are always found in large mature trees in the mid-slope sections of woodlands located. Limiting the planting of high-quality food species close to the new road alignment, and avoiding the deployment of any artificial nest hollows within 100 m of the road reserve will make a genuine contribution to reducing any possible impact on the two cockatoo species making local use of the area.

The presence of two known breeding hollows within 5 km of the proposed road development (and other potential breeding hollows), are not at significant risk due to the low quality of the native vegetation along the highway in the Proposed Action, in terms of the food value and volume that it can provide for Black Cockatoos. marri grows poorly in heavy soils with a high clay content and does not reach a size where its canopy produces meaningful quantities of seed. 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. Small marri trees (<6 m tall) flower sparingly, and set few seed. wandoo trees are not recorded as being a food source for FRTBC and are only fed on by Carnaby's Cockatoos during the flowering period to access nectar. When the finding by Coyle (2021), that vegetation density was a predictive factor in vehicle collision risk is considered, it is highly unlikely that the Proposed Action will increase the risk to the known breeding population.

No increased risk of bird strike is expected as a result of the Proposed Action, and, given the greater separation distance between foraging habitat and improved driver sightlines, the risk may be reduced by the Proposed Action.

Encroachment into the Tree Protection Zones

The tree protection zone (TPZ) is an area surrounding a tree that is designated for protection during construction or development. Main Roads has a long history of constructing roads and has well established procedures to ensure adjacent vegetation is not indirectly impacted. Main Roads is not aware of any examples where its roads have resulted in indirect impacts to adjacent vegetation due to encroachment into the TPZ.

Given the scale and nature of its construction works, and the layout of the road formation with drainage being directed to the nearby adjacent vegetation, the Proposed Action, nor any of the other options considered, are expected to have an indirect impact on adjacent vegetation due to encroachment into the TPZ.

Erosion, Sedimentation and Pollution

The Proposed Action lies within the northern jarrah forest, which comprises laterite gravels to the west, transitioning to clayey soils in the east. The northern jarrah forest occupies the northern portion of the Darling Plateau to the east of the Darling Scarp and overlies Archaean granite and metamorphic rocks.

No waterways or major drainage lines run through the DE; however, the Wooroloo Brook and Coates Gully are located within the immediate vicinity (Figure 5-1). Coates Gully is a minor water course which follows the GEH within the vicinity of the eastern portion of the DE. The Wooroloo Brook runs directly to the North of the western portion of the DE. Coates Gully is fed by numerous other water courses surrounding the DE, before flowing into an unnamed major perennial water course, then into Wooroloo Brook, and eventually discharging into the Swan River.

The Proposed Action will involve construction of new and upgraded road pavements. Surface runoff generated from the new and upgraded pavements will drain into adjacent infiltration roadside drains constructed within the DE. The roadside drains will be designed to capture and infiltrate runoff from a 1 in 100-year Average Recurrence Interval (ARI) rainfall event, to prevent stormwater runoff into adjacent areas of native vegetation and prevent increase of the risk of flooding of adjacent properties. No drains will be located outside the DE.

Given that no waterways or major drainage lines intersect the DE, and the provision of roadside drains, the Proposed Action is not expected to cause increased erosion, sedimentation or pollutants entering natural surface water drainage lines that could indirectly impact Black Cockatoo habitat. During construction temporary measures will be implemented to ensure surface water flows with the potential to contain high sediment loads or pollutants diverted to roadside drains within the DE. Drains will be monitored regularly throughout construction period to ensure sufficient holding capacity is maintained. In order to reduce erosion to areas immediately surrounding the DE, contours within the DE will be graded to ensure any potential surface water flows are directed to drains. The location of temporary diversion drains will be positioned strategically to allow construction works to be completed progressively while ensuring impacts to surrounding land outside the DE is avoided.

Fire

The DE lies adjacent to areas of native vegetation, including areas of Black Cockatoo foraging habitat within the Keaginine, Kwolyinine and Woondowing Nature Reserves. Areas surrounding the DE are subject to fire risks from urban activities that are out of Main Roads control.

There is the potential for fire risk from the Proposed Action during construction, due to the use of equipment and heavy machinery. The CEMP (Appendix 2) incorporates fire control measures to minimise the likelihood of fires arising within the DE during construction. This will include identifying potential ignition sources and/or activities with the potential to lead to fire, and preventable measures. Fire is considered manageable, and the implementation of the Proposed Action is unlikely to significantly impact existing fire regimes or increase the likelihood of fires. Through the provision of construction fire controls and ongoing access controls, the Proposed Action is not expected to result in increased frequency of fire events that cause significant indirect impacts to Black Cockatoo habitat.

5.2 Nature of Impacts - Temporary and Permanent

Impacts to Black Cockatoos from the Proposed Action will arise from the clearing of vegetation within the DE required for the widening of the road along the existing alignment.

Although expected to be minor, if they did occur, potential temporary impacts associated with construction of the Proposed Action may also include:

- Erosion / Sedimentation / Pollution
- Waste
- Anthropogenic disturbance (lights/noise/activity).

Impacts associated with clearing required for the Proposed Action are anticipated to be permanent in nature, as all clearing of native vegetation is required for the installation of permanent infrastructure (road surface, embankments, draining). The requirement for temporary clearing of native vegetation has been avoided by using cleared areas for temporary construction requirements. Permanent impacts include:

- Removal of up to 15.7 ha High to Low quality foraging habitat for Carnaby's Cockatoo
- Removal of up to 15.6 ha High to Low quality foraging habitat for Baudin's Cockatoo and FRTBC
- Clearing of up to 15.6 ha of potential breeding and low quality roosting habitat for Black Cockatoos
- Clearing of up to 400 suitable DBH trees for Black Cockatoos.

Potential indirect impacts identified that are not expected to be significant (as discussed in Section 5.1.2), include:

- Indirect impacts to potentially suitable hollows within the vicinity of the DE
- Habitat fragmentation
- Increased risk of weed / dieback spread.

5.3 Risk Assessment of the Potential Impacts

Appendix 1 presents a risk assessment for the Proposed Action. The risk assessment addresses the following:

- Likelihood and consequence of impacts to MNES, based on the material presented in the Preliminary Documentation
- Whether nature and/or scale of impacts are unknown, unpredictable, or irreversible
- Confidence of predictions of impacts.

The risk assessment indicates that the Proposed Action poses a low residual risk to MNES, with the exception of the following:

- Direct impacts to MNES from clearing not authorised under the Proposed Action: Medium residual risk, to be addressed by the CEMP (Main Roads 2024b, Appendix 2).

5.4 Non-Referred Policy Guidelines, Studies, Surveys or Management Plans

An additional survey has been undertaken since referral of the Proposed Action to confirm the number of suitable Black Cockatoo hollows within the DE. In August 2022, experienced fauna ecologist Tony Kirkby undertook a detailed inspection of the additional 22 trees containing hollows that were identified by Bamford (2015, revised 2021). During the survey, hollows were inspected from ground level using binoculars for sign of use such as chewing or wear at the hollow entrance. All trees were then raked with a pole to flush female Black Cockatoos that may be incubating an egg or

brooding a chick. Hollows which were considered suitable for Black Cockatoos were then inspected internally using a pole camera.

Additional management plans have been developed to manage and mitigate the impacts associated with the Proposed Action. These plans include a CEMP (Main Roads, 2024b and Appendix 2) that details how potential environmental impacts associated with construction activities will be managed.

6 AVOIDANCE AND MITIGATION MEASURES

6.1 Impact Avoidance

The Proposed Action has been designed to avoid impacts to Black Cockatoo habitat as far as practicable. Avoidance measures undertaken by Main Roads for the Proposed Action include:

- The Proposed Action constitutes minimal realignment, incorporating the predominately cleared corridor along the GEH with only minor deviations into the Kwolyinine and Woondowing Nature Reserves
- The Proposed Action is an upgrade of the existing GEH, avoiding more extensive clearing of a greenfield road corridor
- The DE avoids intrusion into or bisection of patches of native vegetation, including the Kwolyinine and Woondowing Nature Reserves. The DE is limited to land adjacent to existing cleared areas of the GEH
- All associated infrastructure and contractor ancillary activities required for the Proposed Action will be contained within the DE or limited to existing cleared areas
- All laydowns, stockpiles and access tracks will be constructed within existing cleared areas or within the permanent footprint of the works. No native vegetation will be cleared for temporary works outside the permanent footprint
- The design of the Proposed Action has sought to reduce and minimise the proposed clearing and impacts to potential Black Cockatoo breeding habitat by steepening batter slopes and installation of safety barriers. Earthworks have been reduced (fill height/cut depth) in areas where native vegetation exists
- Surface runoff within the DE will drain into roadside drains constructed within the DE. The roadside drains will be designed to capture and infiltrate runoff from a 1 in 100-year ARI rainfall event, to prevent stormwater runoff into adjacent areas of native vegetation
- The Proposed Action will avoid impacts to one potentially suitable and three suitable hollows, root zones and canopies that are located within 10 m of the DE (Tree ID 138, Tree ID 171, Tree ID 229 and Tree ID 289, refer to Section 4.3.2)
- Main Roads will undertake a pre-clearance survey for the four hollows located within 10 m of construction works, at least 7 days prior to commencing works and within the breeding period for Black Cockatoos (i.e. July to December). If the hollows are being used for breeding by Black Cockatoos prior to, or during construction, works will not commence, or will cease, within 10 m of the hollow until the breeding event is complete.

6.2 Criticality of Proposed Location and Alternative Locations

This route has been identified as the third riskiest road in regional WA for three consecutive RAC surveys (2017, 2019 and 2022[3]).

The Proposed Action is required due to the poor safety record of this section of the existing GEH major freight route, largely due to its poor geometry, lack of passing lanes and containing elements that are below current national road standards. Intersections also have poor sight distance and poor approach alignment to GEH which present as a significant safety risk for road users.

As discussed in Section 3.8, Main Roads considered four options with alternative preliminary design elements to address these issues. Main Roads developed selection criteria linked to the problem of safety and efficiency along this section of the GEH and then conducted an MCA to qualitatively assess the options.

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

To adequately address these safety concerns, widening on the existing GEH alignment between El Caballo and Bakers Hill with eastbound and westbound passing lanes is recommended. This option will require the removal of vegetation along either side of the existing road including sections of nature reserve, however, will not require a major realignment of this section of the GEH.

The only alternative option to the Proposed Action that provides the same or better predicted reduction on crashes (+80 %) is a total realignment of the GEH, largely through state nature reserves, which would result in increased impacts to Black Cockatoo foraging and potential breeding habitat. This option was not assessed as a concept design as it was considered to have an unacceptable impact on Black Cockatoo habitat.

6.3 Construction Environmental Management Plan

The Proposed Action construction works will be managed in accordance with a CEMP, which is presented in Appendix 2 (Main Roads, 2024b). The CEMP details how potential environmental impacts will be managed. This includes the requirement for the presence of a designated fauna spotter/catcher on site during all clearing activities, preclearing checks and clearing in a controlled progressive manner to address risks to fauna species. The CEMP also includes strict access and fire controls, and dieback and weed hygiene requirements to protect adjacent areas of Black Cockatoo habitat.

The measures proposed in Appendix 2 are established management measures Main Roads applies to projects of this scale and nature. These projects are audited regularly to continually improve the effectiveness of the measures that are applied. Main Roads considers that the mitigation measures proposed will effectively manage all risks and ensure compliance with approval related conditions.

6.4 Artificial Nest Hollow Management Plan

A Draft Artificial Nest Hollow Management Plan (ANHMP) was developed for the Proposed Action (Main Roads, 2022) to offset the clearing of nesting hollows impacted by the Proposal Action. Due to modifications to the design of the Proposed Action, no suitable Black Cockatoo hollows will be cleared or removed.

The installation of Artificial Nesting Hollows are not proposed for the Proposed Action given:

- No suitable hollows are present within the DE
- The lack of breeding records within 5 km of the DE
- That the local Black Cockatoo populations are low in the area around Coates Gully area (Dr Peter Mawson pers. comm 2024)
- Although currently unused, there are trees with suitable sized hollows located adjacent to the DE and within the proposed offset site that provide nesting opportunities for Black Cockatoos, if Black Cockatoos were to breed in the area.

7 OFFSETS

To counterbalance the potential significant residual impacts to Carnaby's Cockatoo, FRTBC and Baudin's Cockatoo, an Offset Strategy has been prepared and is intended to be implemented as a condition of the Commonwealth Approval (Main Roads, 2024a and Appendix 3).

The Proposed Action will have a significant impact on up to:

- 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
- 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.

7.1 Extent of Potential Significant Residual Impacts Offset

The Offset Strategy demonstrates Main Roads' commitment to offset significant residual impacts to Carnaby's Cockatoo, FRTBC and Baudin's Cockatoo and involves the acquisition of freehold land to offset 100 % of the significant residual impact on Black Cockatoo foraging habitat.

The Offset Strategy meets the requirements of the DCCEEW's EPBC environmental offsets policy including details of the proposed offset suitability (such as locations and areas), level of certainty attached to achieving the environmental outcomes of the offset, and the quality of the offset.

7.2 Suitability of Potential Offset Site

To offset the significant residual impacts of the Proposed Action to the listed Black Cockatoos, an Offset Strategy has been prepared that describes the 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.

A summary of the Proposed Action's Offset Strategy is detailed in Table 7-1.

An overview of the offsets offered are detailed in Table 7-2.

Table 7-1 Summary of Proposed Actions Offset Strategy

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

Table 7-2 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 offset 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 presented in the offset calculations (Appendix 3).
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 the 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 undertake revegetation and on ground management works.
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.

8 OTHER APPROVALS AND CONDITIONS

A summary of the approvals or conditions that apply or are likely to apply to the Proposed Action (in addition to an approval under the EPBC Act) are outlined below.

8.1 *Environmental Protection Act 1986,* Part V Native Vegetation Clearing Permit

Main Roads has obtained a Native Vegetation Clearing Permit (CPS 9838/1) under Part V of the EP Act, for approval to clear native vegetation within the DE.

An offset strategy to offset impacts on Black Cockatoo foraging habitat was developed and approved as part of the permit application.

8.2 Other Management Plans, Approvals and Regulation

Following primary environmental approval of the Proposed Action under Part V of the EP Act, additional regulatory approvals and management plans will be required to develop and operate the Proposed Action. These are summarised in Table 8-1.

Table 8-1 Summary of Other Regulatory Approvals Required

Proposed activities	Type of approval/management plan	Regulatory agency	Legislation regulating the activity
Interference with the bed and banks of a water course or wetland (clearing of vegetation and construction works)	Application for a permit to authorise the interference or obstruction of the bed and banks of a watercourse or wetland	DWER	*Rights in Water and Irrigation Act 1914* (RIWI Act)
Clearing within a dieback susceptible area	Dieback and Weed Management Plan	DBCA	N/A

8.3 Planning Approvals

The alignment of the Proposed Action will not be fully located within land currently reserved under the Metropolitan Region Scheme (MRS) for Primary Regional Roads or Other Regional Roads. Sections of the realignment that exist outside the MRS will be incorporated into Primary Regional Roads, or zoned appropriately, through an ominibus amendment to the MRS pursuant to section 28 (1) of the *Land Administration Act 1997* prior to commencement of Proposed Action.

Main Roads has acquired 0.42 ha of Kwolyinine Nature Reserve and 0.55 ha of the Woondowing Nature Reserve as Road Reserve for the Proposed Action.

9 ECONOMIC AND SOCIAL MATTERS

9.1 Projected Economic Costs and Benefits and Basis For Estimation

9.1.1 Projected Costs and Benefits

Main Roads has completed a Business Case for the Proposed Action. The cost benefit analysis (CBA) analysed costs and benefits over a 30 year operating period, with a 7 % real discount rate. The Proposed Action cost estimate is $20.32 million. The Proposed Action cost was determined through Main Roads standard cost estimating process.

The CBA was completed for Option 2 (Proposed Action) and Option 3. The results indicated that Option 2 had a higher Benefit Cost Ratio (BCR) of 1.85 (as opposed to 1.65 for Option 3). The results for the higher BCR for Proposed Action are largely driven by the considerable safety benefits this option provides.

The Proposed Action is expected to deliver significant safety benefits to this 10.49 km Coates Gully section of the GEH. Motorist safety is a significant problem in this section of the GEH, as evidenced by the crash data (56 crashes over 4 years), outlined in Table 9-1 below. The existing highway geometry is the main contributing factor to the high crash rate, as it contains elements that are below current design standard for the nominated 110 km/h highway design speed. Intersections also have poor sight distance and their approach alignment to the GEH is frequently poor. Seal and pavement width is below the recommended link standard of 12 m seal on a 12 m formation and the signs, lines and delineation are substandard and/or inconsistent. There are also limited safe passing opportunities for the traffic volumes and composition.

These shortcomings result in poor driver experience and comfort and can contribute to driver fatigue and frustration. It is well understood that driver fatigue and frustration are one of the main causes of accidents, particularly in regional areas. The Proposed Action has been designed to create a consistent driver experience and is likely to significantly reduce driver fatigue and frustration, leading to improved safety outcomes.

Other intangible economic benefits from the Proposed Action include increasing the efficiency of heavy vehicle operation, reducing the longer-term maintenance costs for the road and improving travelling time through reduced congestion.

Table 9-1 Crash Data for Great Eastern Highway between El Caballo and Bakers Hill, 2012 to 2016

MR Nature	Count	Percentage
Hit Object	17	30.4%
Rear End	10	17.9%
Head On	10	17.9%
Right Angle	7	12.5%
Other / Unknown	6	10.7%
Non Collision	3	5.4%
Right Turn Thru	2	3.6%
Sideswipe Same Dirn	1	1.8%
Sideswipe Opposite Dirn	0	0.0%
Hit Pedestrian	0	0.0%
Hit Animal	0	0.0%
Total:	56	100.0%

Severity	Count	Percentage
PDO Major	22	39.3%
Hospital	12	21.4%
PDO Minor	12	21.4%
Medical	7	12.5%
Fatal	3	5.4%
Other / Unknown	0	0.0%
Total:	56	100.0%

9.1.2 Basis of Cost and Benefit Estimation

The key assumptions of the CBA include:

- Costs and benefits have been discounted over a 30 year assessment period using a 7% discount rate
- Capital costs for each project option are based on a P90 estimate and 15 % design
- Safety outcomes were based on 2016 ROSMA Road Trauma Treatment. Crash costs are based on the Willingness to Pay (WTP) approach sourced from Australian Transport Assessment and Planning Guidelines 2016
- Heavy vehicle travel time benefits were not included as the Project Options would not immediately improve the Network 4 rating.

Safety outcomes were based on 2016 ROSMA Road Trauma Treatment Guide (Main Roads, 2016). The ROSMA guide links each treatment type to a predicted crash reduction factor. The crash reduction factor was then multiplied by actual crash data for the period 2012-2016 to obtain an expected future crash number under each option after project completion.

Costs per crash were sourced from Australian Transport Assessment and Planning Guidelines 2016 (ATAP, 2016). As no data exists linking crash types (eg head on, run off road etc) to crash outcomes (eg fatality, medical, PDO) calculations are weighted crash cost as demonstrated in Table 9-2.

Table 9-2 Weight Average Cost of Crashes

Crash severity	Average cost (Rural)	# of crashes (2012-2016)	% of crashes (2012-2016)	Weighted average cost of crash
Fatal	$8,537,385	3	5.4	$457,359
Hospital	$294,498	12	21.4	$63,106
Medical Treatment	$35,079	7	12.5	$4,384
PDO	$9,257	34	60.7	$5,620
Total	**$8,876,219**	**56**	**100**	**$530,471**

The weighted average cost was then applied to the actual and expected number of crashes for each option to quantify safety costs.

9.2 Potential Employment Opportunities

The Proposed Action directly aligns with Main Roads strategic intent to "Keep WA Moving". The Proposed Action will result in a safer road, with improved driver comfort, fewer closures for maintenance and improved freight efficiency.

The Proposed Action will provide employment opportunities during the pre-construction and construction phases, and the requirement for ongoing maintenance. The Proposed Action is expected to provide 30 to 50 contractor employment positions during the construction phase.

9.3 Aboriginal Peoples Participation

Main Roads is committed to supporting and delivering a range of initiatives that lead to the improvement of economic, social and cultural outcomes for Aboriginal peoples through the participation and engagement of Aboriginal peoples and businesses across works and projects throughout WA.

This is achieved through maximising and promoting contracting opportunities for Aboriginal businesses, providing training for identified Aboriginal businesses engaged on Main Roads' projects to develop their capacity and capabilities, and supporting training and career pathways for Aboriginal peoples to gain sustainable employment. Main Roads also strives to provide a culturally safe working environment by requiring Main Roads' staff and contractors participate in Cultural Awareness Training.

Main Roads has successfully engaged Aboriginal businesses and peoples on projects throughout the state. During the 2023-24 financial year, Main Roads awarded 98 contracts to Aboriginal suppliers, which was 15.34 % of all Main Roads' contracts awarded for this period. Main Roads was the top state government agency in WA by the number of contracts awarded and had the second highest spend by state government agencies in WA.

For example, the new Wilman Wadandi Highway (Bunbury Outer Ring Road project),set ambitious Aboriginal employment targets which were significantly higher than the local Aboriginal working-age population. These targets were achieved by partnering with local Aboriginal organisations very early in the planning stage, resulting in Aboriginal peoples working 11 % of the hours worked, as of October 2024. Additionally, the project exceeded their initial targets of awarding $30 million of contracts to Aboriginal owned businesses, and as of August 2024, had awarded contracts worth over $50 million to 46 Aboriginal-owned businesses and suppliers.

These initiatives are underpinned by Main Roads' Aboriginal Engagement and Participation Framework and Aboriginal Engagement Participation Policy, both of which apply to all Main Roads' staff and others working on Main Roads' behalf.

The Great Eastern Highway Upgrade – Coates Gully project will include a contractual commitment for mandatory targets to be achieved for the value of contracts awarded to Aboriginal owned businesses and for hours worked by Aboriginal peoples, with this information to be verified by the project and included in monthly and quarterly reports.

9.4 Details of Public and Stakeholder Consultation Activities

Main Roads has undertaken detailed and ongoing consultation with DBCA given the Proposed Action's interaction with the CALM Act as the location is adjacent to the Keaginine, Kwolyinine and Woondowing Nature Reserves. Additional consultation will be held with DBCA to consider the environmental impacts to the Keaginine, Kwolyinine and Woondowing Nature Reserves resulting from the Proposed Action.

Consultation has been undertaken with DBCA regarding long-term management of the Proposed Action Offset site. Consultation is ongoing and will continue with revegetation monitoring of the Offset site to address criteria and actions in agreement with DBCA. It is intended that long-term management of the Offset site will be handed to DBCA.

The Proposed Action constitutes minimal realignment, incorporating the predominately cleared corridor along the GEH with only minor deviations into the Kwolyinine and Woondowing Nature Reserves.

Main Roads has acquired 0.42 ha of Kwolyinine Nature Reserve and 0.55 ha of the Woondowing Nature Reserve as Road Reserve for the Proposed Action.

A clearing permit has been obtained for the Proposed Action (CPS 9838/1). The Department of Water and Environmental Regulation (DWER) advertised the application for 21 days and no community submissions were lodged. Following the clearing permit application being approved, the permit was then subject to an appeals period of 21 day, for which no appeals were lodged.

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11 APPENDICES

Appendix	Title
Appendix 1	Risk Assessment
Appendix 2	Construction Environmental Management Plan
Appendix 3	EPBC Offset Strategy

Appendix 1: Risk assessment

Risk Assessment for Proposed Action

A risk assessment has been undertaken of the potential impacts identified for the Proposed Action construction and operational phases. The risk assessment adopts likelihood and consequence criteria and a risk matrix, presented in Table A3 1, Table A3 2 and Table A3 3.

Table A1 presents the risk assessment results, incorporating a summary of mitigation measures to generate a residual risk outcome for each identified risk. Details of mitigation measures are presented in the CEMP (Appendix 2).

Table A1 includes an assessment whether the nature and scale of impacts is unknown, unpredictable or irreversible, consistent with the DCCEEW request for additional information.

Table A3 1 Likelihood criteria

Likelihood	Criteria
Highly likely	Is expected to occur during the construction/operation period
Likely	Will probably occur during the construction/operation period
Possible	Might occur during the construction/operation period
Unlikely	Could occur during construction/operation but considered unlikely or doubtful
Rare	May occur in exceptional circumstances

Table A3 2 Consequence criteria

Likelihood	Criteria
Minor	Minor environmental impact that can be reversed
Moderate	Isolated but substantial environmental impact that could be reversed with intensive efforts
High	Substantial environmental impact that could be reversed with intensive efforts
Major	Major loss of environmental value and real danger of continuing
Critical	Severe widespread loss of environmental value and irrecoverable environmental damage

Table A3 3 Risk ranking matrix

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

Table A1 Risk assessment of the Proposed Action to MNES

Impact	Cause	Is the scale or nature of the impact unknown, unpredictable or irreversible? Confidence in predictions?	Summary of Mitigation	Residual risk		
				Likelihood	Consequence	Risk rating
Direct impact causing loss **exceeding:** • 15.7 ha of foraging habitat for Carnaby's Cockatoo • 15.6 ha of foraging habitat for FRTBC and Baudin's Cockatoo • 400 suitable DBH trees for Black Cockatoo species	**Unauthorised** Clearing of native vegetation outside of DE	• The nature of potential impact is known and predictable based on surveys in land adjacent to the DE, undertaken in accordance with EPA and Commonwealth guidance • The scale of potential impacts is unpredictable as it relates to unauthorised clearing; however, should it occur it is only likely to be isolated and of a much smaller scale than the authorised clearing • There are limited opportunities for revegetation within the DE, as the Proposed Action incorporates very little realignment and temporary clearing will be restricted to existing cleared areas. Therefore, the direct impact of unauthorised clearing may be irreversible • High confidence in prediction of nature of impacts and moderate confidence in prediction of scale of impacts	• Identification and demarcation of earthwork limits and vegetation to be retained within DE, including MNES where practicable • Pre-construction inspection of known hollow trees, clearing limits and retention areas to confirm demarcation in place • Induction of construction personnel on the presence and high value of MNES adjacent to the DE, and MNES to be retained within the DE • Daily inspection of clearing areas, retention areas during clearing stage • Temporary construction areas will be located in existing cleared areas, areas to be cleared for permanent works, or in areas devoid of MNES	Unlikely	High	Medium
Indirect impacts to condition of adjacent native vegetation including: • Foraging and potential breeding habitat for Black Cockatoos	Construction plant, equipment and soil movement introducing or spreading weeds and/or dieback to uninfested vegetation	• The nature of potential impact is known and predictable based on identified weed and dieback infested areas and vulnerable vegetation in surveys undertaken in DE and adjacent land • The scale of potential impacts is unpredictable as it relates to weeds and dieback which may progressively spread from the DE boundary into adjacent vegetation, and some vegetation may be resistant to dieback expression	• Declared Plants within the DE will be treated according to WA Government advice, with the aim of eradication where possible but as a minimum prevent off site movement • WoNS and environmental weeds within the DE will be treated according to Weeds Australia guidance with the aim of controlling off-site movement	Rare	High	Low
	Unauthorised site access introducing or spreading weeds and/or dieback to uninfested vegetation	• The impact from weeds is potentially reversible with intensive efforts using established methods (e.g. mechanical removal, targeted herbicide, replanting native species) • The impact from dieback is considered effectively irreversible. Phosphite treatment is effective at controlling the spread and impact of dieback in infested areas for periods of up to five years • High confidence in prediction of nature of impacts and moderate confidence in prediction of scale of impacts	• Topsoil containing Declared Pests or WoNS will not be reused in landscaping or revegetation • All heavy plant and machinery will be inspected prior to entry at the work site and confirmed to be clean and free of vegetation and soil material • Dieback protectable areas will be identified and established within the DE and adjacent land to guide dieback hygiene practices including restrictions on equipment and vehicle movement, soil movement, and Clean on Entry and/or Exit (CoE)	Rare	High	Low
	Sedimentation/pollution of surface water from temporary construction areas causing impact to fauna habitat	• The nature of the impact is known as construction will involve ground disturbance, generation of wastes and use of hazardous materials (e.g. diesel fuel), and will occur adjacent to Black Cockatoo habitat • The scale of the impact is unpredictable as it relates to major storm or spill events, however, it is expected to be localised to land in the vicinity of the DE • The impact is expected to be reversible as, sedimentation and contamination of surface water can be remediated with established technologies • Moderate confidence in prediction of nature and scale of impacts	• Temporary controls will be maintained within the DE during construction to prevent stormwater runoff from construction areas to be discharged to adjacent native vegetation • Waste and hazardous materials management measures in addition to controlled surface drainage lines will be implemented during construction to avoid potential contaminantion interacting with surface water and being discharged to adjacent native vegetation • No uncontrolled storage of waste or hazardous materials within 50 m of Black Cockatoo habitat	Unlikely	Moderate	Low

Impact	Cause	Is the scale or nature of the impact unknown, unpredictable or irreversible? Confidence in predictions?	Summary of Mitigation	Residual risk		
				Likelihood	Consequence	Risk rating
	Surface water runoff from road surface causing erosion, sedimentation or contamination	• The nature of the impact is known as the DE will comprise road widening and upgraded intersections that will generate stormwater runoff, and lie adjacent to Black Cockatoo habitat • The scale of the impact is unpredictable as it relates to major storm or spill events, however, it is expected to be localised to land in the vicinity of the DE • The impact is expected to be reversible as erosion, sediment deposition and contamination can be remediated with established technologies. • Moderate confidence in prediction of nature and scale of impacts.	• Surface runoff within the DE will drain into roadside drains constructed within the DE. The roadside drains will be designed to capture and infiltrate runoff from a 1 in 100 year Average Recurrence Interval (ARI) rainfall event, to prevent stormwater runoff into adjacent areas of native vegetation.	Rare	Moderate	Low
	Damage to vegetation from accidental fires caused by construction activities Damage to vegetation from fires caused by weed growth or fuel build up in road verge	• The nature of the impact is known, as Black Cockatoo foraging habitat is susceptible to impacts from changes to fire regimes • The scale of the impact is expected to be within the area of native vegetation that lies adjacent to the DE and • The impact from fires is expected to be reversible through recovery of most vegetation that is adapted to fires • Moderate confidence in prediction of nature and scale of impacts	• All hot work will be undertaken in accordance hot work procedures • All vehicles, plant and equipment to be fitted with fire extinguishers and restricted to designated cleared areas unless involved in clearing operations • Fire danger ratings and Local Government vehicle movement bans to be observed and the requirements of these implemented • Regular maintenance of road verge during operations to treat weeds and reduce fuel build up consistent with current maintenance programs	Rare	Moderate	Low
Injury or mortality to Black Cockatoo individuals	Vehicle collision with birds during construction	• The nature of the impact is known, as the DE contains and lies adjacent to Black Cockatoo habitat. • Black Cockatoos have been known to be killed through vehicle strike, although not within DE. • The scale of the impact is unpredictable as it relates to unplanned events and bird/flock behaviour. Collisions are expected to impact individuals or small numbers of birds; however, the number of collisions is unpredictable • The loss of birds to mortality/injury over a temporary period is considered unlikely and reversible. • Moderate confidence in prediction of nature and scale of impacts.	• Speed limits between 40-60 km/hr will be applied throughout the construction site for safety purposes which will consequently reduce the risk of fauna strikes during construction • A list of local wildlife rescue organisations and carers will be maintained on site to contact in the event of fauna injury • Induction of construction personnel on reducing the risk of fauna injury and the procedure in the event of fauna injury or death.	Rare	Moderate	Low
	Clearing of active breeding trees	• The nature of the impact is known. No suitable Black Cockatoo breeding hollows will be impacted by the Proposed Action. There is three suitable and one potentially suitable hollows located within 10 m of the DE. Although there is no evidence to confirm that they have been used by Black Cockatoos for breeding, there is potential that these hollows may be used by Black Cockatoos during construction. • The scale of the impact is expected to be low given no suitable hollows will be impacted and only four hollows occur within 10 m of the DE. Very few breeding records have been recorded within 12 km of the DE, and unverified records within 5 km of the DE.	• Within 7 days prior to clearing, the trees with suitable or potentially suitable hollows within 10 m of the DE will be subject to a pre-clearance survey where adjacent vegetation is proposed to be cleared.	Rare	High	Low

Impact	Cause	Is the scale or nature of the impact unknown, unpredictable or irreversible? Confidence in predictions?	Summary of Mitigation	Residual risk		
				Likelihood	Consequence	Risk rating
		• Moderate confidence in prediction of nature and scale of impacts				
	Vehicle collision with birds during operations (additional impact above and beyond existing road)	• The nature of the impact is known, as the DE lies adjacent to Black Cockatoo habitat. • Black Cockatoos have been known to be killed through vehicle strike, although not within DE. • The scale of the impact is unpredictable as it relates to unplanned events and bird/flock behaviour. Collisions are expected to impact individuals or small numbers of birds; however, the frequency of collisions is unpredictable • Risk of vehicle strike expected to be the same as the existing road • Moderate confidence in prediction of nature and scale of impacts.	• Revegetation within the DE that is within 10 m of the road seal will not be planted with Black Cockatoo foraging species.	Rare	High	Low

Appendix 2: Construction Environmental Management Plan

We're working for Western Australia.

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

Construction Environmental Management Plan

D22#1068744
December 2024

Version Control

Revision	Date	Name	
0	October 2022	GHD	Author
0	October 2022	GHD	Reviewer
0	October 2022	Main Roads	Reviewer / Approver
1	July 2024	Main Roads	Author
2	September 2024	Main Roads	Author
3	December 2024	Main Roads	Author

Executive Summary

Background

Main Roads Western Australia (Main Roads) proposes to upgrade a section of the Great Eastern Highway (GEH) between Straight Line Kilometre (SLK) 56.4 and 67.8 (the GEH Upgrade Project SLK 56.4-67.8, the Proposed Action, EPBC 2022/9151).

On 28 March 2022, a delegate of the Minister for the Environment determined the Proposed Action was a 'Controlled Action' under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) to be assessed by Preliminary Documentation. The relevant controlling provisions are listed threatened species and communities (sections [s] 18 & 18A).

On the 13 April 2022, the Department of Climate Change, Energy, the Environment and Water (DCCEEW) requested additional information to inform the assessment of the relevant impacts of the Proposed Action. In making the request, DCCEEW considered the Proposed Action may impact Matters of National Environmental Significance (MNES) including:

- Carnaby's Black Cockatoo (*Zanda latirostris* formerly *Calyptorhynchus latirostris*) – Endangered
- Baudin's Black Cockatoo (*Zanda baudinii* listed as *Calyptorhynchus baudinii*) – Endangered
- Forest Red-tailed Black Cockatoo (FRTBC, *Calyptorhynchus banksii naso*) – Vulnerable.

This Construction Environmental Management Plan (CEMP) has been prepared to address DCCEEW's request for further information to support assessment of a controlled action by Preliminary Documentation. The CEMP has been prepared in accordance with the Department's *Environmental Management Plan Guidelines* 'the EMP Guidelines' (DoE, 2014).

Purpose and structure of this Plan

This CEMP has been prepared and is structured in accordance with the EMP Guidelines to support the Commonwealth assessment of EPBC 2022/9151.

This CEMP outlines the actions required to mitigate and manage the impacts from Proposed Action construction activities on MNES, as described in the Proposed Action Preliminary Documentation (Main Roads 2024).

Objectives of this Plan

The overarching objective of this CEMP is to minimise and manage adverse impacts on Black Cockatoos resulting from construction of the Proposed Action. This CEMP aims to achieve the overarching objective through implementation of the following environmental outcomes, to address the potential impacts and risks to MNES:

1. To minimise and manage unauthorised impacts to habitat for Carnaby's Black Cockatoo, Baudin's Black Cockatoo and FRTBC
2. To minimise and manage edge impacts into adjacent areas of habitat for Carnaby's Black Cockatoo, Baudin's Black Cockatoo and FRTBC outside of the Development Envelope (DE)
3. To minimise and manage injury or mortality to Carnaby's Black Cockatoo, Baudin's Black Cockatoo and FRTBC during vegetation clearing and construction.

COVER PAGE AND DECLARATION OF ACCURACY

- **EPBC number**: 2022/9151
- **Project name**: Great Eastern Highway Upgrade Project SLK 56.4-67.8
- **Action management plan title**: Great Eastern Highway Upgrade Project SLK 56.4-67.8 Construction Environmental Management Plan
- **Proponent /approval holder and ACN or ABN**: Main Roads Western Australia, ABN 50860676021
- **Proposed / approved action**: Great Eastern Highway Upgrade Project SLK 56.4-67.8
- **Location of the action**: Great Eastern Highway from Linley Valley Road to Swamp Road, approximately 56 km east of Perth and 25 km west of Northam in WA
- **Date of preparation of the action management plan:** October 2022
- **Person accepting responsibility for the action management plan**: Martine Scheltema, Director Environment and Heritage, Main Roads Western Australia

Declaration of accuracy

I declare that to the best of my knowledge, all the information contained in, or accompanying this document is complete, current and correct. I am duly authorised to sign this declaration on behalf of the proponent/approval holder. I am aware that:

a) giving false or misleading information is a serious offence under section 137. 1 of the *Criminal Code Act 1995* (Cth)
b) section 137.2 of the *Criminal Code Act 1995* (Cth) makes it an offence for a person to produce a document to another person in compliance or purported compliance with a law of the Commonwealth where the person knows that the document is false or misleading;
c) section 490 of the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act) makes it an offence for an approval holder to provide information in response to an approval condition where the person is reckless as to whether the information is false or misleading; and
d) section 491 of the EPBC Act makes it an offence for a person to provide information or documents to specified persons who are known by the person to be performing a duty or carrying out a function under the EPBC Act or the *Environment Protection and Biodiversity Conservation Regulations 2000* (Cth) (EPBC Regulations) where the person knows the information or document is false or misleading.

Signed: Martine Scheltema
Full name: Martine Scheltema, Director Environment and Heritage
Organisation: Main Roads Western Australia (ABN 50 860 676 021)
Date 15/12/24

Contents

1 PROJECT DESCRIPTION

1.1 Proposed works

Main Roads proposes to upgrade a section of the GEH between SLK 56.4 and 67.8 (the Proposed Action). The Proposed Action is located approximately 56 km east of Perth and 25 km west of Northam in WA. Figure 1 presents the Proposed Action location and DE. The DE comprises an area of approximately 35.15ha and represents the impact footprint within which all development will be contained.

Currently, the 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, the GEH is the sole connection between a large number of remote communities and the Perth metropolitan area. The 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 the 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 consecutive RAC surveys (RAC, 2024), owing to the poor road condition. Of particular concern is the inadequate road formation and seal widths, and the narrow or absent shoulders.

The key components of the Proposed Action include:

- Clearing of up to 15.7 ha of suitable habitat for Black Cockatoo species, including 15.6 ha of potential breeding and roosting habitat, and up to 400 suitable diameter at breast height (DBH) trees for Black Cockatoos for the reconstruction and realignment of the existing 9 metre (m) road formation and widening 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.

1.2 Proposed schedule

The Proposed Action construction works are scheduled to commence in Quarter 4 2024 and will take approximately 6 months. These dates are subject to change depending on a number of factors and will be updated accordingly.

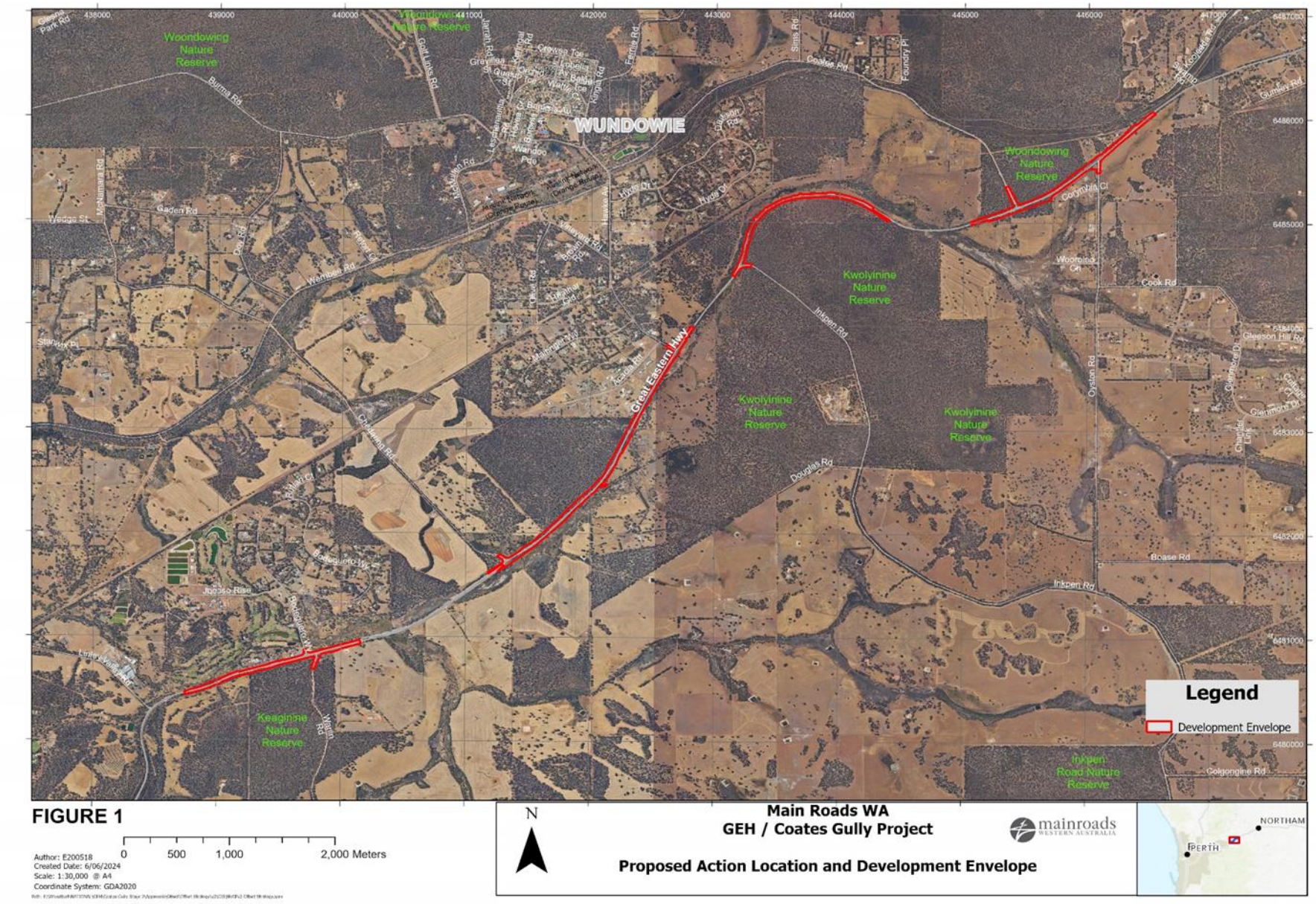

Figure 1 Proposed Action location and Development Envelope

2 POTENTIAL ENVIRONMENTAL IMPACTS AND RISKS

2.1 Threats to Matters of National Environmental Significance

2.1.1 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 (s18 and s18A of the Act), including:

- Carnaby's Black Cockatoo (*Zanda latirostris* formerly *Calyptorhynchus latirostris*) – Endangered
- Baudin's Black Cockatoo (*Zanda baudinii* listed as *Calyptorhynchus baudinii*) – Endangered
- Forest Red-tailed Black Cockatoo (FRTBC, *Calyptorhynchus banksia naso*) – Vulnerable.

The Preliminary Documentation (Main Roads, 2024) provides details of the environmental values relating to the above MNES. The information is summarised below in Section 2.1.2.

2.1.2 Environmental values

2.1.2.1 Biological surveys

A number of field assessments were undertaken to support and inform the development of the Proposed Action. The surveys relevant to MNES are summarised in Table 1.

Table 1 Studies and surveys relevant to the Proposed Action

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 9 to 11 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, 2021)	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 5, 6 and 8 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	Biologic undertook a desktop assessment, single season detailed flora and vegetation survey, targeted flora, basic terrestrial vertebrate fauna survey

Report name	Survey methodology
(SLK 56.4-67.8) Biological Survey (Biologic, 2021)	and Targeted Black Cockatoo habitat assessment over a 16.1 ha survey area. The detailed and targeted flora and vegetation survey was undertaken on 21 and 23 October, and 20 November 2020. The basic terrestrial vertebrate fauna survey and Black Cockatoo habitat assessment was undertaken on 24 and 30 November 2020.
Black Cockatoo Breeding Hollow Inspection, Coates Gully, Wundowie (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.

2.1.2.2 Locality

The DE follows the existing road corridor of the GEH and the majority of the DE is located in the Shire of Northam, with a small western portion of the DE also within the Shire of Mundaring. The DE traverses two conservation areas including the Kwolyinine and Woondowing Nature Reserves. There is 2.50 ha of native vegetation within the Kwolyinine Nature Reserve and 0.34 ha of native vegetation within the Woondowing Nature Reserve within the DE. The DE also lies adjacent to, but outside, the Keaginine Nature Reserve.

The Proposed Action occurs within the Northern Jarrah Forest, which comprises laterite gravels to the west, transitioning to clayey soils in the east. The Northern Jarrah Forest occupies the northern portion of the Darling Plateau to the east of the Darling Scarp and overlies Archaean granite and metamorphic rocks (Beard, 1990).

No waterways or major drainage lines run through the DE; however, the Wooroloo Brook and Coates Gully are located within the immediate vicinity. Coates Gully is a minor water course which follows the GEH within the vicinity of the eastern portion of the DE. The Wooroloo Brook runs directly to the North of the western portion of the DE. Coates Gully is fed by numerous other water courses surrounding the DE, before flowing into an unnamed major perennial water course then into Wooroloo Brook, eventually discharging into the Swan River.

2.1.2.3 Black Cockatoos

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

Breeding habitat

360 environmental (2020) and Biologic (2021) identified a total of 15.6 ha of potential Black Cockatoo breeding habitat within the DE. Bamford (2015, revised 2021) and Biologic (2021) identified 400 suitable DBH trees within the DE, based on a suitable DBH (>300 mm or >500 mm) and species known to support breeding (Figure 2). Of the 400 suitable DBH trees within the DE, no hollows have been confirmed to be suitable support Black Cockatoo breeding (T. Kirkby, 2021).

Within 10 m of the DE, there are four potentially suitable hollows to support Black Cockatoo breeding (T. Kirkby, 2021). Main Roads will implement the Proposed Action to avoid any impacts to the four

hollows, root zones and canopies. In addition, Main Roads will undertake a pre-clearance survey for the hollows where adjacent vegetation is proposed to be cleared within the breeding period for Black Cockatoos (i.e. July to December).

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). 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 Black 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 Black Cockatoo and FRTBC (Biologic, 2021).

Roosting habitat

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. 360 environmental (2020) and Biologic (2021) identified a total of 16.22 ha of potential Black Cockatoo roosting habitat within the DE.

Bamford (2015, revised 2021), however, identified a white-tailed Black Cockatoo roost approximately 600 metres west of the DE on Mairinger Way in Wundowie.

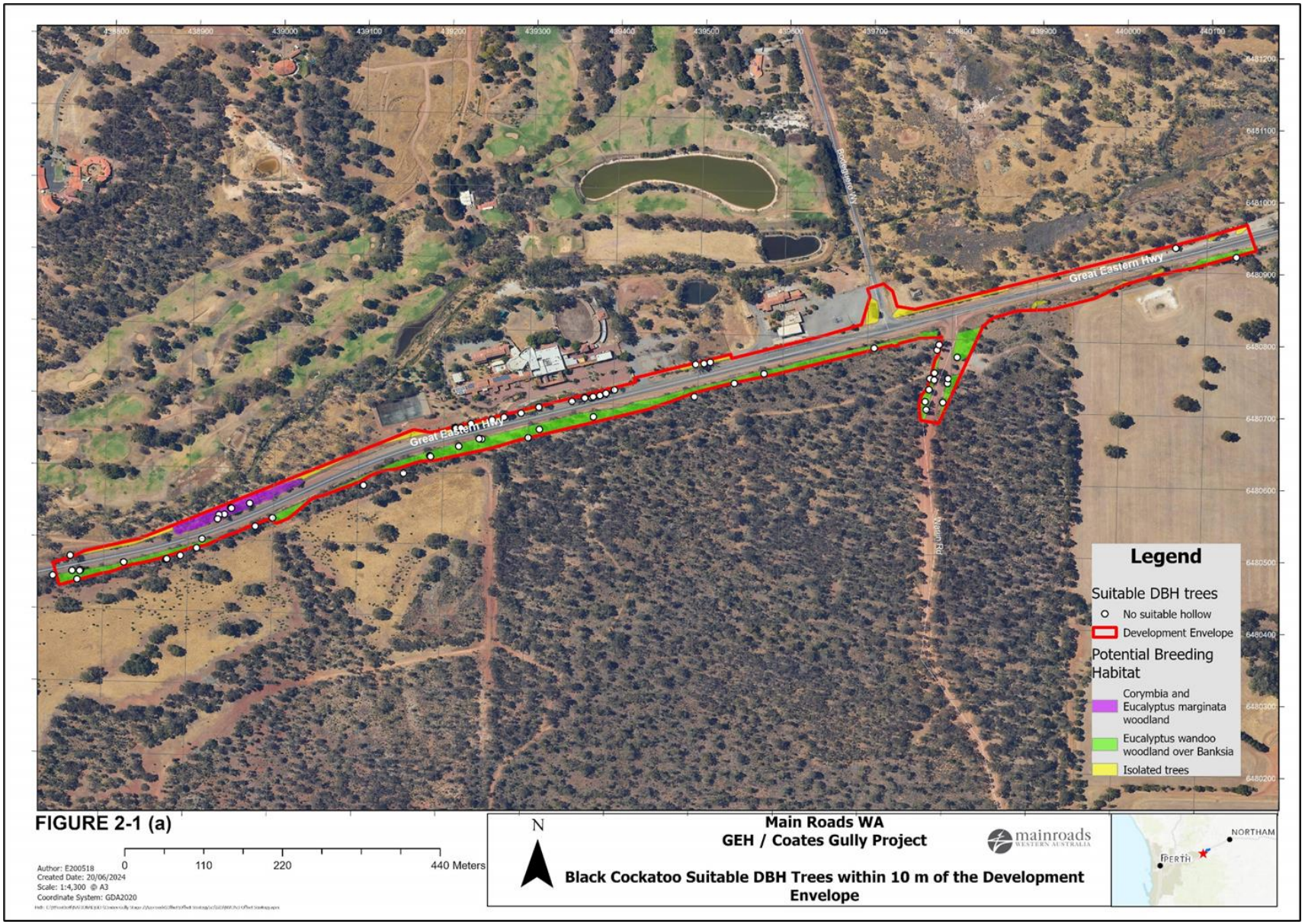

Figure 2-1 (a) Potentially suitable hollows within 10 m of the Development Envelope

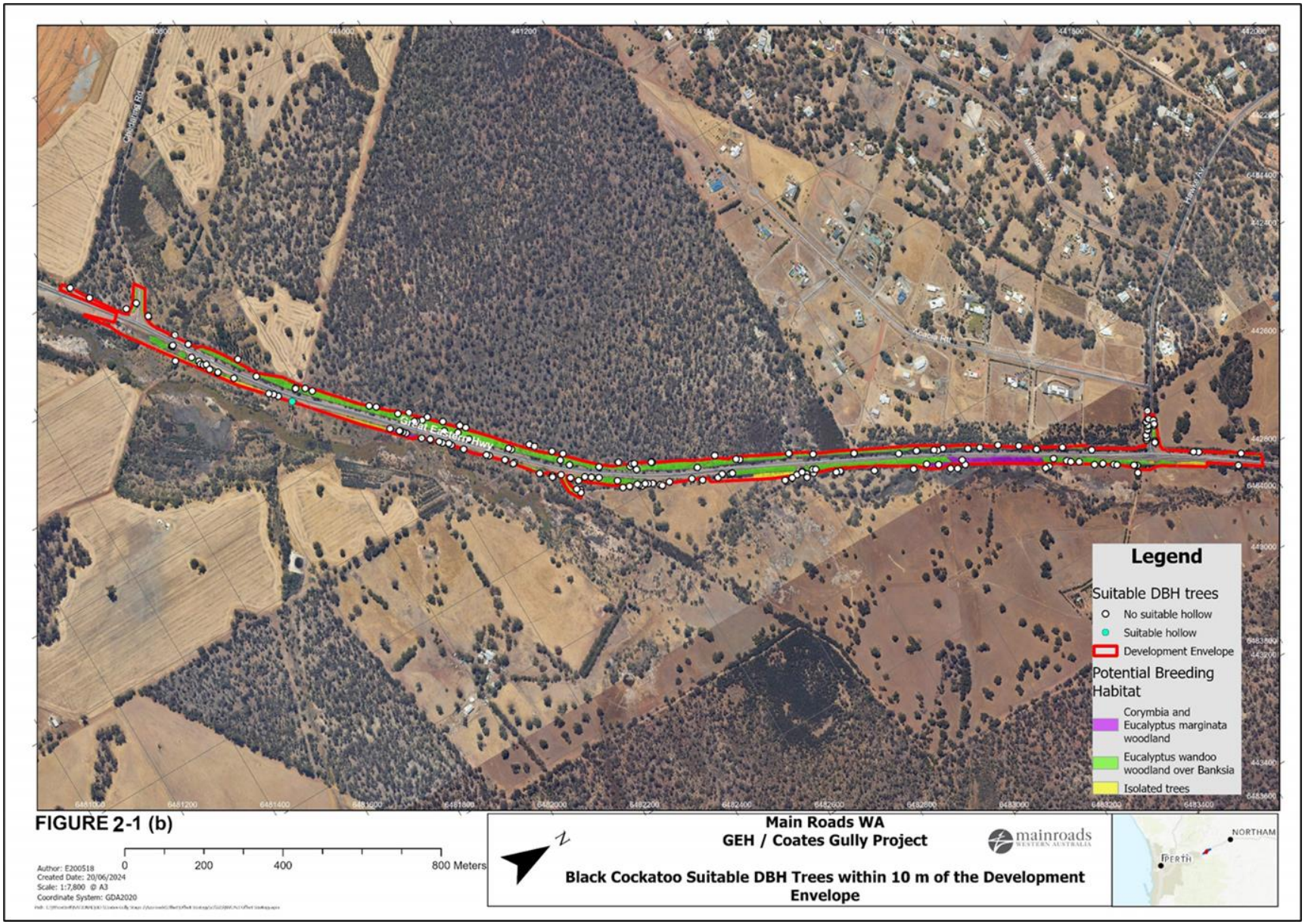

Figure 2-1 (b) Potentially suitable hollows within 10 m of the Development Envelope

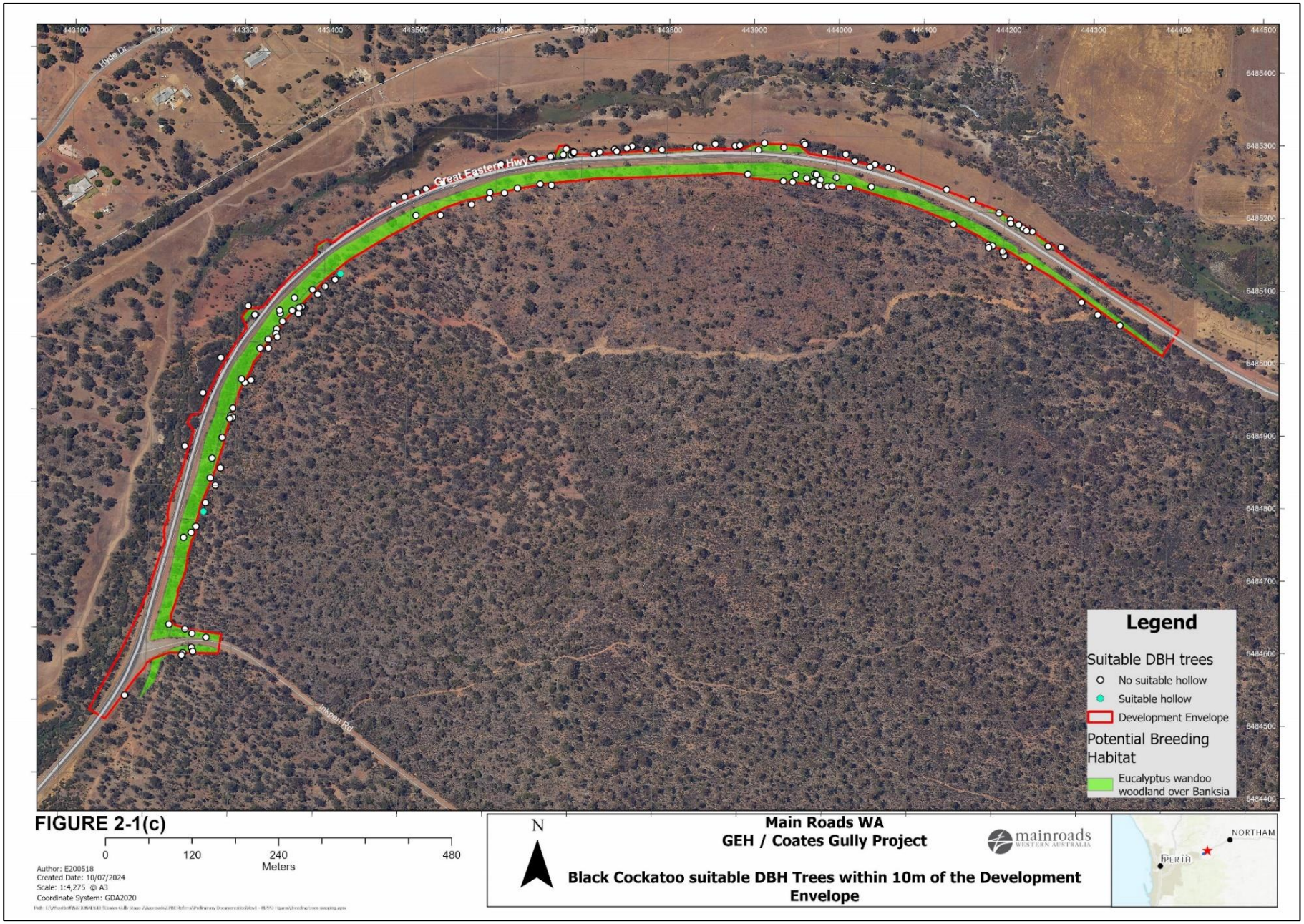

Figure 2-1 (c) Potentially suitable hollows within 10 m of the Development Envelope

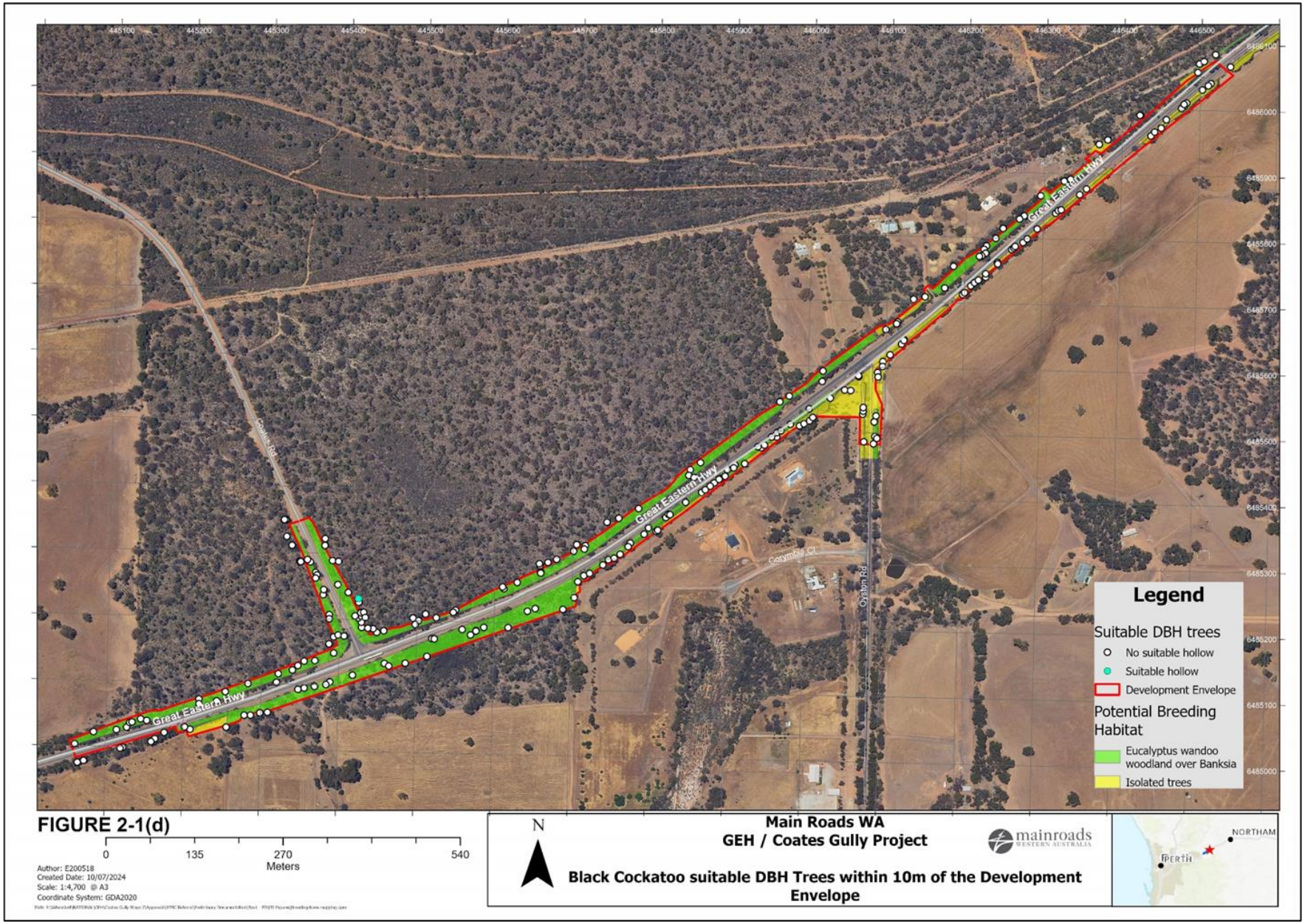

Figure 2-1 (d) Potentially suitable hollows within 10 m of the Development Envelope

2.1.2.4 Weeds

Bamford (2015, revised 2021) and Biologic (2021) together recorded 60 non-native taxa during the surveys, of which 33 were found within the DE. Of the 60 taxa recorded within the wider survey areas, 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* (Narrowleaf Cotton Bush) – Declared Pest (located outside of the DE)
- *Moraea flaccida* (One-leaf Cape Tulip) – Declared Pest
- *Zantedeschia aethiopica* (Arum Lily) – Declared Pest
- *Echium plantagineum* (Paterson's Curse) – Declared Pest
- *Genista linifolia* (Flax-leaf Broom) – WoNS
- *Asparagus asparagoides* (Bridal Creeper) – Declared Pest and WoNS.

The Bridal Creeper, Flax-leaf Broom, Paterson's Curse and One-leaf Cape Tulip occur within the DE (Figure 3). These species were found mostly in previously disturbed areas and the existing GEH, within the western portion of the DE.

2.1.2.5 Dieback

Glevan Consulting originally conducted a *Phytophthora* Dieback Occurrence Assessment of 31.88 ha of the 35.15ha 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), see Figure 4. There are a number of non perennial waterways within the vicinity of to 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. It is likely to be at least three years before this area becomes interpretable. A Dieback Survey will be completed the Spring of 2024 to recheck 2021 Dieback mapping, prior to the commencement of construction activities. The 2024 Dieback survey will inform construction works and further prevent potential introduction and spread of Dieback into protectable land during works.

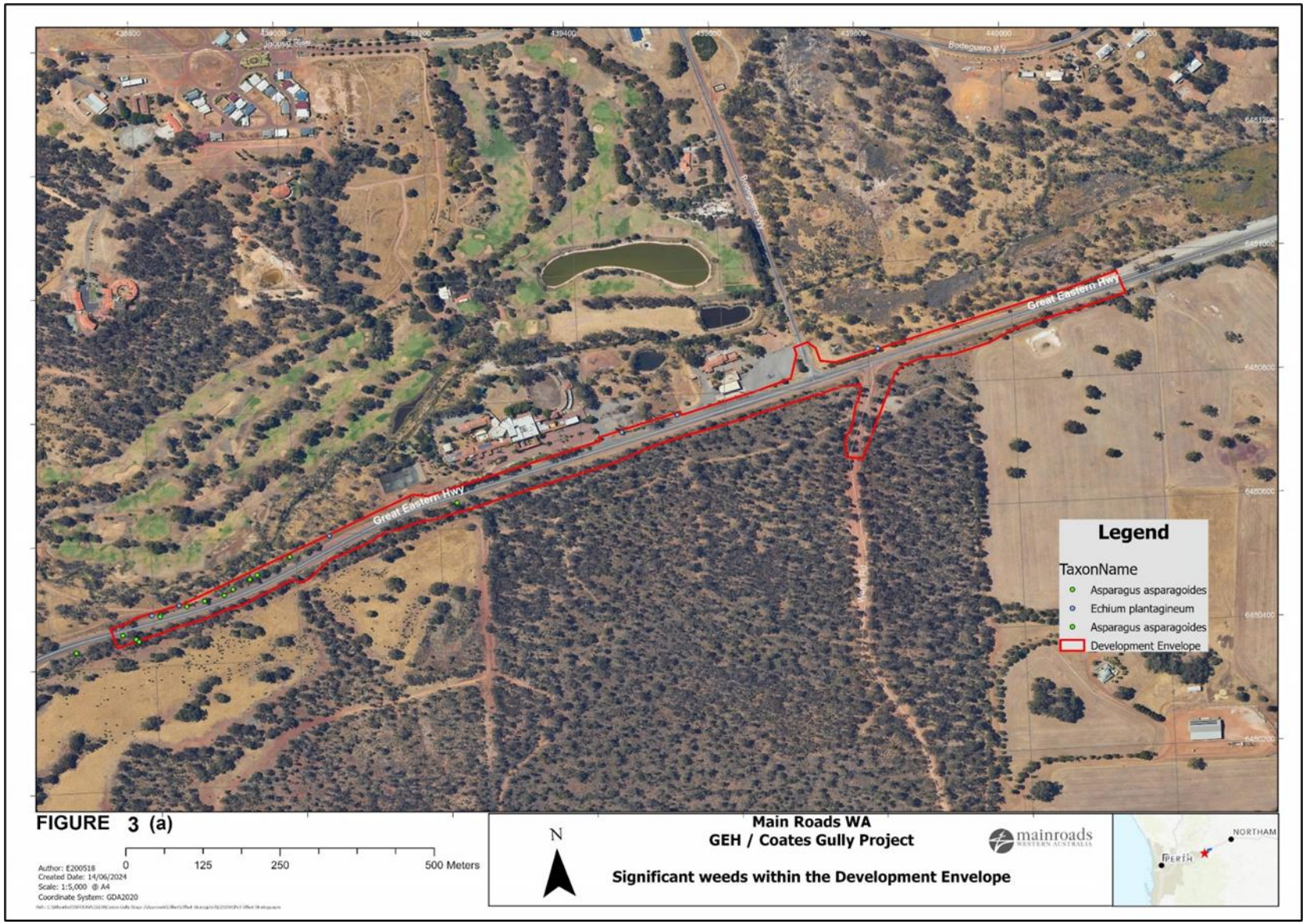

Figure 3 (a) Significant weeds

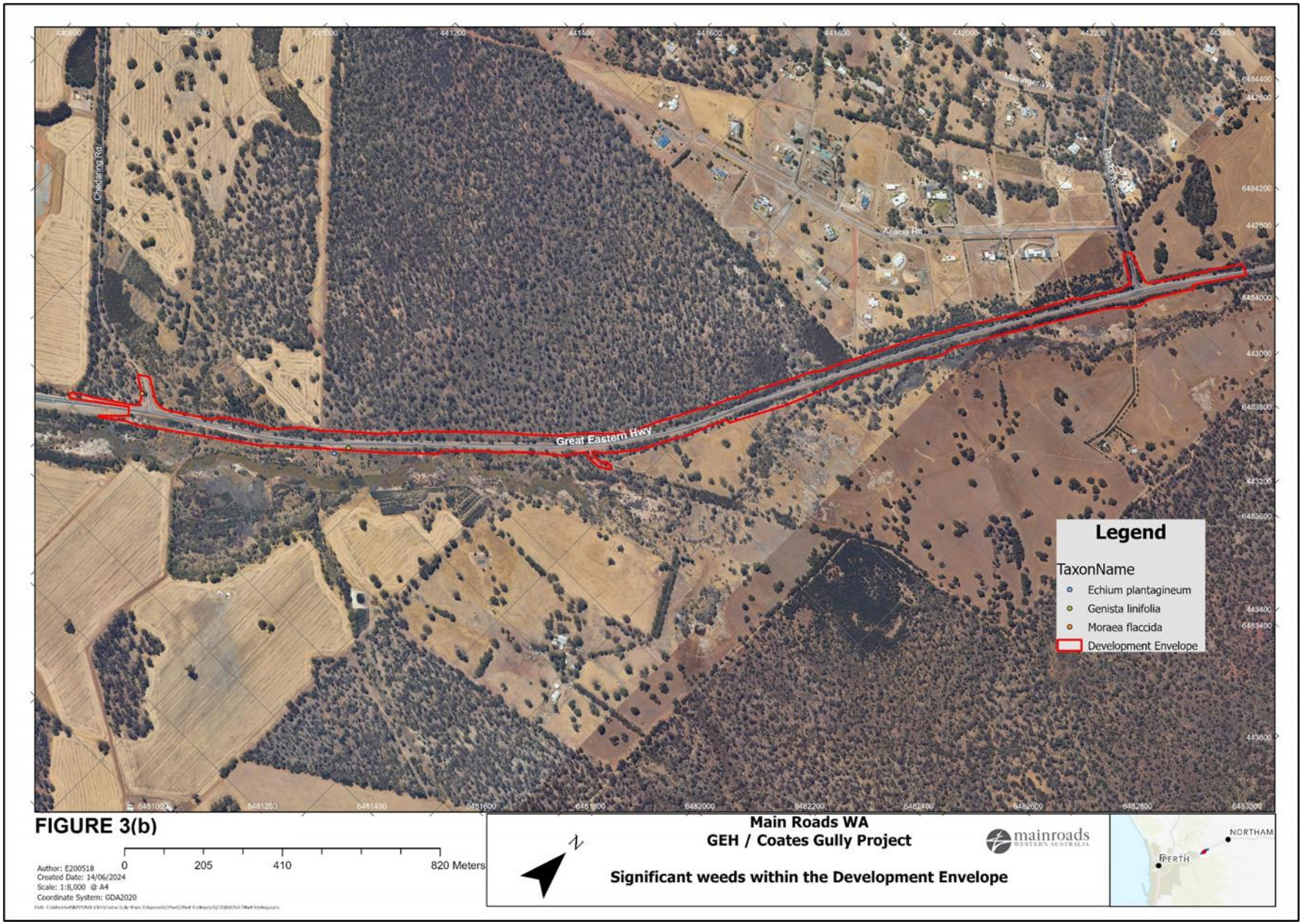

Figure 3 (b) Significant weeds

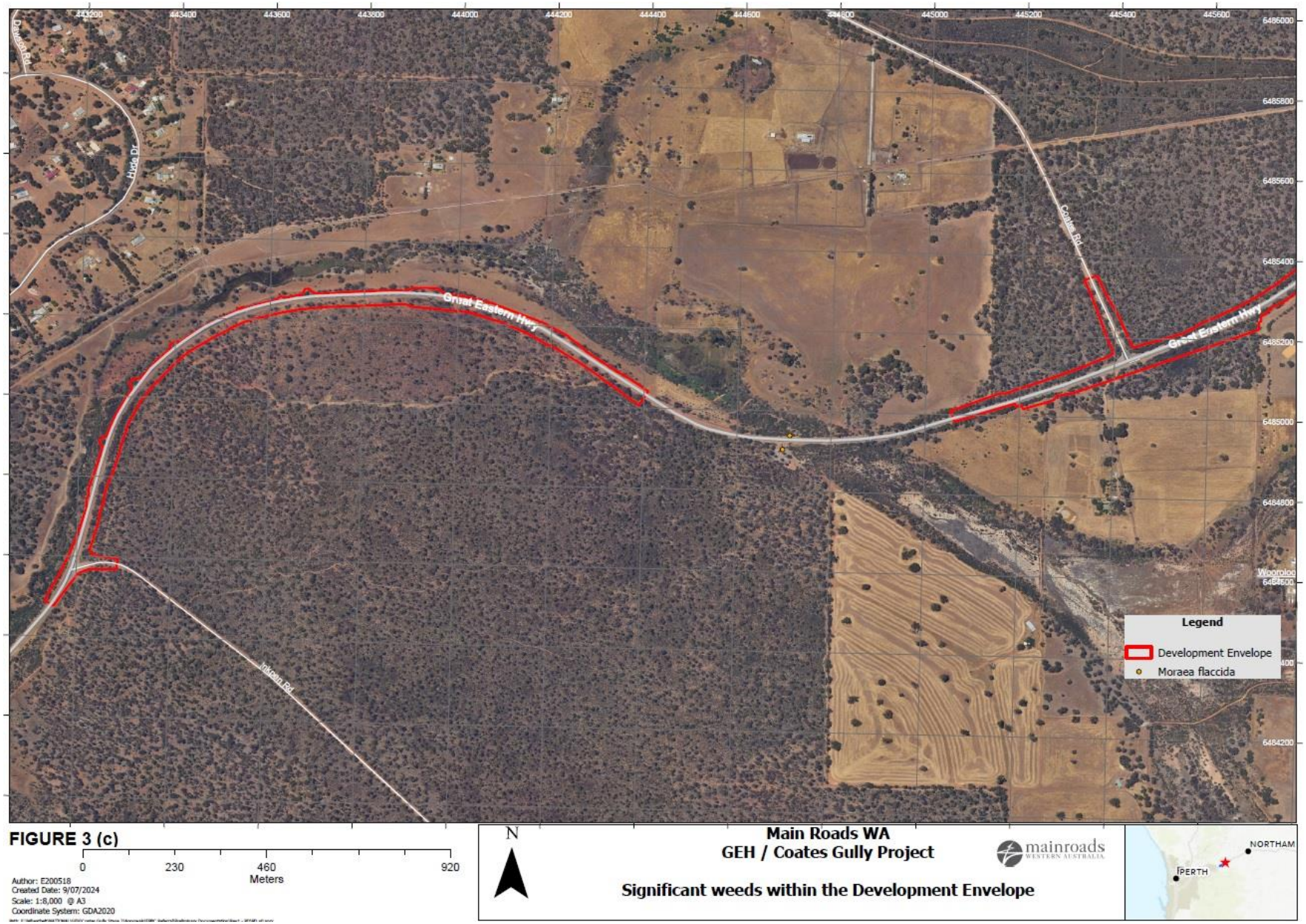

Figure 3 (c) Significant weeds

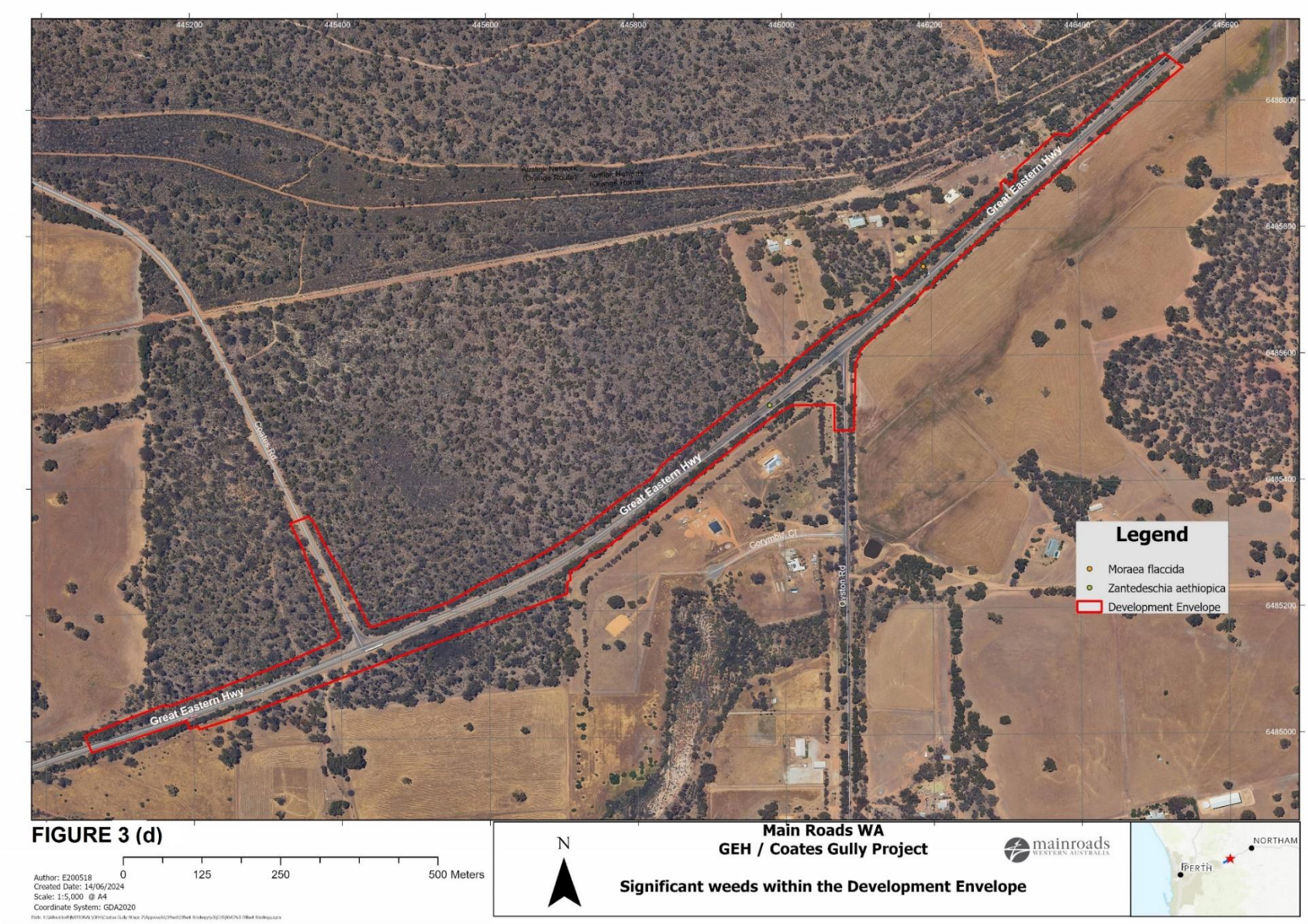

Figure 3 (d) Significant weeds

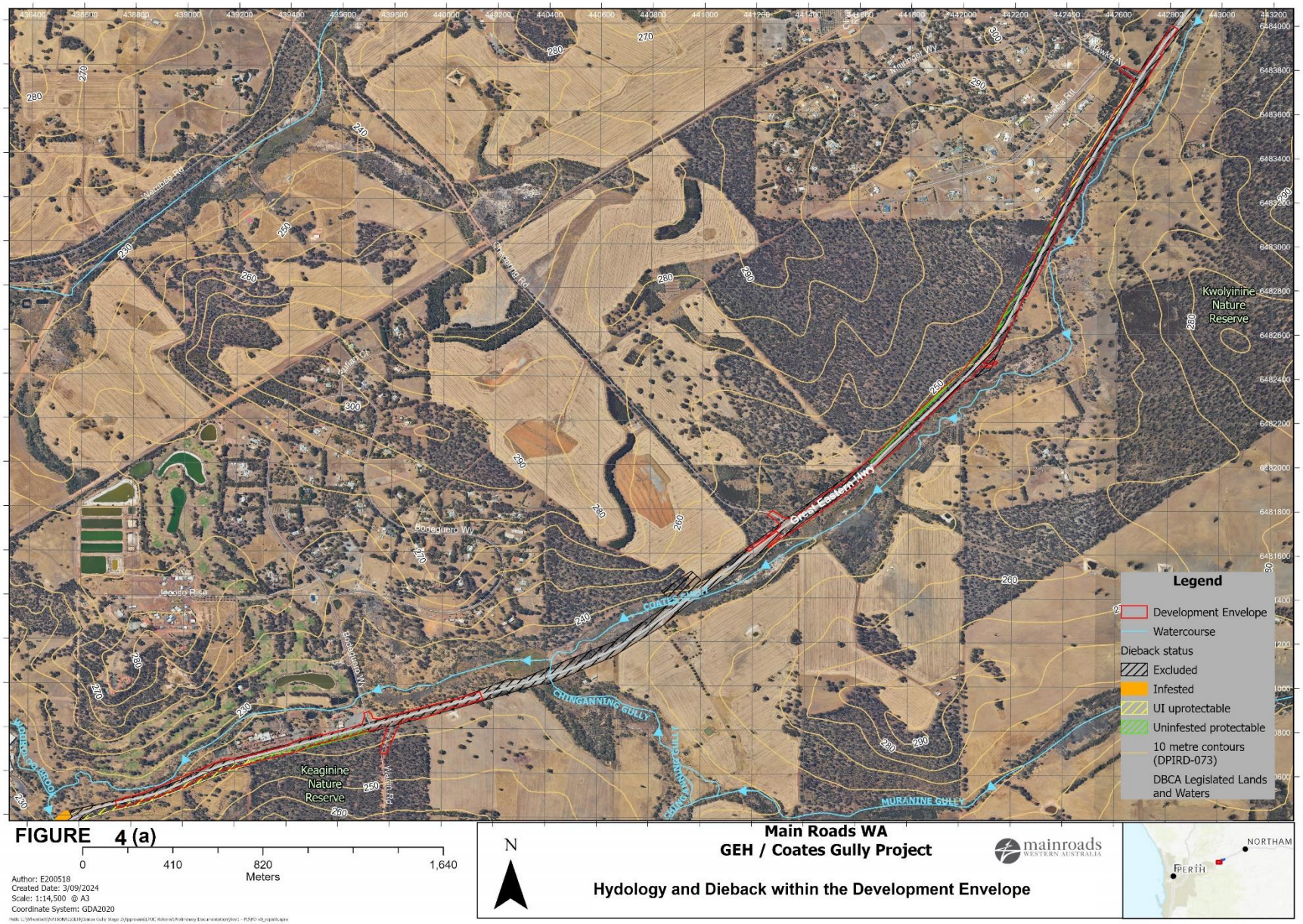

Figure 4 (a) Hydrology and Dieback

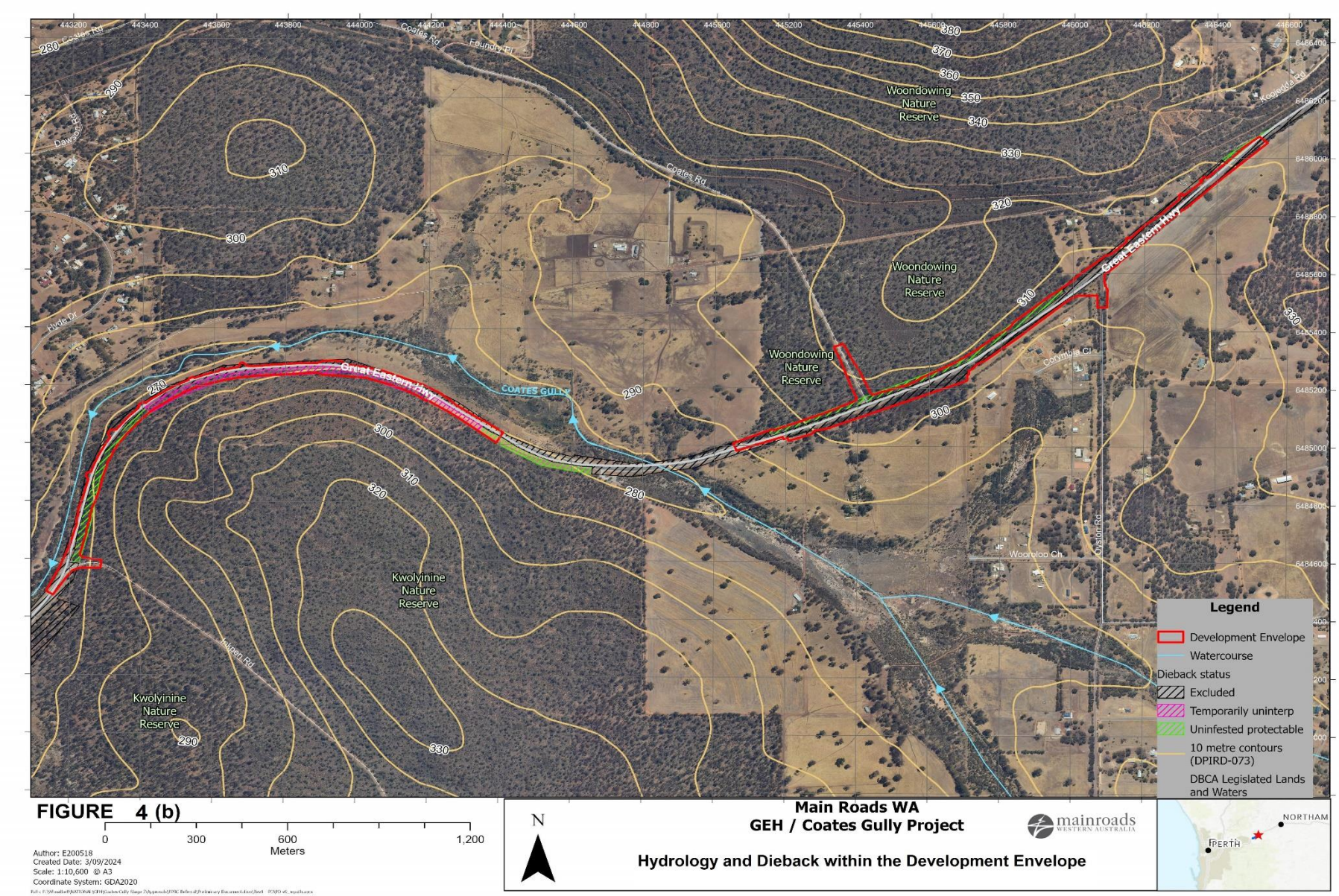

Figure 4 (b) Hydrology and Dieback

2.2 Potential impacts

This section provides a summary of potential impacts to MNES from the Proposed Action construction activities, based on the detailed assessment of impacts presented in the Preliminary Documentation (Main Roads, 2024).

2.2.1 Direct impacts

The Proposed Action is expected to result in the following direct impacts to habitat for Carnaby's Black Cockatoo, Baudin's Black Cockatoo and FRTBC within the DE:

- Clearing of up to 1.4 ha of High Quality, 12.5 ha of Medium Quality and 1.8 ha of Low Quality foraging habitat for Carnaby's Black Cockatoo
- Clearing of up to 1.4 ha of High Quality, 12.5 ha of Medium Quality and 1.7 ha of Low Quality foraging habitat for Baudin's Black Cockatoo and FRTBC
- Clearing of up to 15.6 ha of potential breeding and roosting habitat for Black Cockatoos
- Clearing of up to 400 suitable DBH trees for Black Cockatoos.

The Proposed Action construction activities have the potential to result in direct impacts (injury or mortality) to Carnaby's Black Cockatoo, Baudin's Black Cockatoo and FRTBC individuals present during clearing activities and via bird strike with construction vehicles.

The Proposed Action is not expected to result in impacts to known nesting hollows of Carnaby's Black Cockatoo and FRTBC. The Proposed Action is not expected to result in impacts to Baudin's Black Cockatoo breeding habitat. However, the DE represents potential breeding habitat for Black Cockatoos, given the presence of suitable DBH trees (mostly Wandoo and Marri) and foraging habitat.

Two unverified Black Cockatoo breeding records within the vicinity of the DE, in the Wundowie Reserve (5 km north) were identified during initial desktop assessment of the Proposed Action (Biologic, 2021). Records of FRTBC breeding located within approximately 9 km of the DE. The closest verified breeding record for Baudin's Black Cockatoo is 50 km south of the DE within the Wungong catchment area (T. Kirkby, pers. comm.).

No known roosting sites for Black Cockatoos will be impacted by the Proposed Action. Although roosting was not recorded within the DE during the survey (Bamford 2015, revised 2021 & Biologic, 2021), there is potential for Carnaby's Black Cockatoo, Baudin's Black Cockatoo and FRTBC to roost within the DE during the construction phase in one or more of the large trees present in the *Eucalyptus* woodland and Isolated trees habitat. Roosting may potentially occur throughout the year.

There are limited opportunities for rehabilitation within the DE as the Proposed Action constitutes minimal realignment and all contractor ancillary activities will be restricted to existing cleared areas (i.e. farmers paddocks).

2.2.2 Indirect impacts

The Proposed Action has the potential to cause indirect impacts to Black Cockatoo habitat that lies within and adjacent to the DE. Potential indirect impacts can be caused by:

- Indirect impacts to potentially suitable hollows within the vicinity of the DE
- Spread and/or introduction of weeds
- Introduction and/or spread of pathogens, such as Dieback (*Phytophthora cinnamomi*)
- Vehicle strike
- Erosion, Sedimentation
- Spills of hazardous materials and wastes
- Fire.

The introduction and/or spread of dieback and/or weeds would result in long term impacts, whereas indirect impacts to potentially suitable hollows within the vicinity of the DE, erosion and sedimentation, hydrocarbon/waste spills and fire would result in short term impacts. The DE lies adjacent to good condition native vegetation and Black Cockatoo habitat within the Keaginine, Kwolyinine and Woondowing Nature Reserves.

2.2.2.1 Potential long-term indirect impacts

Dieback assessment found 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 (Glevan, 2021). Although the DE is devoid of Dieback infestation, there is the potential for construction activities to spread *Phytophthora* from the existing infestations within the vicinity of the DE. In addition, Dieback could be introduced to the DE through imported soil/plant materials/surface water or on construction plant or vehicles.

The DE and adjacent contains areas of infestation with Declared Pests:

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

Construction activities have potential to spread existing weed infestations as well as introduce weeds with imported soil/plant materials/surface water or on construction plant or vehicles. Weeds spread or introduced within the DE will require management during operations and may spread into adjacent land.

2.2.2.2 Potential short-term indirect impacts

Proposed Action construction works will not require the removal of the four trees identified with potentially suitable hollows that are located within 10 m of construction works, however, construction activities may affect breeding pairs utilising the potentially suitable hollow(s), should the delivery of the Proposed Action coincide with the Black Cockatoo breeding season. Potentially suitable hollow/s identified to contain active breeding BC species are likely to be exposed to increased noise from construction works and potentially be affected by dust and lighting towers should works occur outside of daylight hours.

Construction activities have potential to cause uncontrolled surface runoff from compacted and paved areas resulting in erosion and sediment discharge, as well as accidental spills of hazardous materials or wastes. These discharges could result in localised impact to vegetation condition within and adjacent to the DE.

Construction activities have potential to result in fires through hot works, operation of vehicles with spark ignition engines, and inappropriate disposal of cigarettes. Fire spread from the DE into surrounding areas may potentially affect large areas of the Keaginine, Kwolyinine and Woondowing Nature Reserves.

Construction activities will result in increased amount of heavy machinery within the DE which has the potential to result in an increased number of fauna strikes to BC species known to foraging in adjacent bushland vegetation.

2.3 Risk assessment

A risk assessment has been undertaken of the potential impacts identified for the Proposed Action construction activities, in accordance with the EMP Guidelines. The risk assessment adopts likelihood and consequence criteria and a risk matrix, presented in Table 2, Table 3 and Table 4.

Table 5 presents the risk assessment results, incorporating management objectives and measures to generate a residual risk outcome for each identified risk. Management measures, references and documents (*procedures, processes, work practices and forms)* referred to in Table 5 are listed in Section 6, Controlling Documents.

Section 3 provides implementation details for the management objectives and measures.

Table 2 Likelihood criteria

Likelihood	Criteria
Highly likely	Is expected to occur during the construction/operation period
Likely	Will probably occur during the construction/operation period
Possible	Might occur during the construction/operation period
Unlikely	Could occur during construction/operation but considered unlikely or doubtful
Rare	May occur in exceptional circumstances

Table 3 Consequence criteria

Likelihood	Criteria
Minor	Minor environmental impact that can be reversed
Moderate	Isolated but substantial environmental impact that could be reversed with intensive efforts
High	Substantial environmental impact that could be reversed with intensive efforts
Major	Major loss of environmental value and real danger of continuing
Critical	Severe widespread loss of environmental value and irrecoverable environmental damage

Table 4 Risk ranking matrix

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

Table 5 Risk assessment of Proposed Action construction activities to Matters of National Environmental Significance

Management objective / desired outcome	Risk	Cause	Unmoderated Risk			Management measures (refer to Table 8)	Residual risk		
			Likelihood	Consequence	Risk rating		Likelihood	Consequence	Risk rating
To avoid impacts to Black Cockatoo habitat beyond that approved	Loss of habitat for Carnaby's Black Cockatoo, Baudin's Black Cockatoo and FRTBC	• Clearing more than 1.4 ha High Quality foraging habitat, 12.5 ha of Medium Quality foraging habitat and 1.8 ha of Low-Quality foraging habitat for Carnaby's Black Cockatoo • Clearing more than 1.4 ha High Quality foraging habitat, 12.5 ha of Medium Quality foraging habitat and 1.7 ha of Low-Quality foraging habitat for Baudin's Black Cockatoo and FRTBC • Clearing of more than 400 suitable DBH trees for Black Cockatoos • Clearing of Black Cockatoo habitat outside of the approved area	Likely	High	High	• All currently identified Black Cockatoo DBH trees within DE that are not required to be cleared will be marked with white flagging tape and identified as no-go areas, demarcated on relevant drawings and provided to the Construction Contractor Representative – Doc #; 201928-0001-2 and 201928-0007. • Vegetation to be retained within the DE will be clearly marked with white flagging tape- Doc #; 201928-0001-2 • All clearing areas will surveyed, demarcated and identified with pink flagging tape and approved by the Main Roads Superintendent prior to clearing commencing – Doc #; 201928-0001-2 • A pre-clearance inspection will be undertaken prior to commencement of clearing to ensure flagging of DBH trees, no-go zones, vegetation retention and vegetation clearing limits is correct and aligns with drawings showing no-go areas– Doc #; 201928-0001-2 and 201928-0007 • Induction of construction personnel on the presence and value of vegetation and Black Cockatoo habitat adjacent to the DE, and vegetation and Black Cockatoo habitat to be retained within the DE • Daily inspection of flagging, clearing areas and retention areas during clearing stage - Doc # 201928-0001-2 and D19#787510 • Ancillary services required for construction such as laydown areas, stockpile areas and vehicle turn around, will be located in areas cleared for permanent works or areas that do not contain Black Cockatoo habitat (i.e. farmers paddocks)	Unlikely	High	Medium
To avoid edge impacts into adjacent areas of habitat outside the DE	Degradation in condition of foraging and potential breeding habitat for Black Cockatoos	• Construction plant, equipment, soil, surface water movement introducing or spreading weeds and/or dieback to uninfested vegetation • Unauthorised site access introducing or spreading weeds and/or dieback to uninfested vegetation	Possible	High	Medium	• Declared Plants within the construction site boundary will be treated prior to clearing according to their Control Codes and advice from Department of Primary Industries and Regional Development (DPIRD), with the aim of eradication where possible but as a minimum prevent off site movement -refer to Appendix 1 • Prior to clearing, control of WoNS and environmental weeds within the construction site boundary will be treated according to the weed control management outlined by Weeds Australia (http://weeds.ala.org.au/) with the aim of controlling off-site movement - refer to Appendix 1 • Topsoil containing Declared Plants or WoNS (plus a 5 m buffer) will be removed and stockpiled separately to clean topsoil at designated stockpile area or disposed to waste facility – Doc # 201928-0002-1 • Areas of infested stockpiled topsoil to be clearly marked as no use areas - – Doc # 201928-0007 • Infested topsoil to be buried at a depth of at least 300 mm or disposed off-site at a landfill • All heavy plant and machinery will be inspected by the contractor and a vehicle hygiene inspection checklist completed prior to entry at the work site and be confirmed to be clean and free of vegetation and soil material – Doc # D18#847320 • Dieback infested areas to be survey and demarcated within the DE prior to commencing works, Clean on Entry points established and site induction to	Rare	High	Low

Management objective / desired outcome	Risk	Cause	Unmoderated Risk			Management measures (refer to Table 8)	Residual risk		
			Likelihood	Consequence	Risk rating		Likelihood	Consequence	Risk rating
						clearly communicate hygiene works requirements. – Doc # D18#847320, D23#179551 • Topsoil from infected or potentially infected Phytophthora dieback areas shall be segregated and not used in non-infected areas • Dieback protectable areas will be identified and established within the DE and adjacent land to guide dieback hygiene practises including Clean on Entry and/or Exit (CoE) procedures that will be implemented on site, and entry and exit records kept for the CoE points. – Doc # D18#847320, D23#179551 • Dieback survey to be undertaken within 12months of commencing work for the DE and surrounding area prior to commencing and ongoing 6 monthly in locations identified as protectable or un-infested. • No uncontrolled discharge of surface water outside of DE, surface drainage within DE directed to existing constructed road drainage network.			
		• Reduced habitat quality/condition due to construction dust emissions	Possible	Moderate	Medium	• Water carts and/or surface stabilisation measures (e.g. hydro mulch) will be used to minimise dust generated from cleared areas/ bare unsealed surfaces • Local weather conditions are to be monitored daily to identify high risk conditions (dry with high/gusty winds), water-cart on standby during high risk weather. • Dust generating activities will be suspended at the direction of the Construction Contractors Environmental Representative and will not recommence without approval of Contractors Environmental Representative • No construction to occur within 10m of an identified active BC breeding hollow within breeding BC season • Vehicle speeds will be limited to between 40-60km/hr on site for safety purposes and this will consequently reduce dust generated.	Unlikely	Moderate	Low
		• Surface water runoff and spills from temporary construction areas causing erosion, sedimentation or contamination	Possible	Moderate	Medium	• Temporary erosion and sediment controls will be maintained within the DE during construction to prevent stormwater runoff from construction areas from eroding or causing sediment deposition in adjacent native vegetation. • No uncontrolled discharge of surface water outside of DE, surface drainage within DE directed to existing constructed road drainage network. • Waste and hazardous materials management measures will be implemented during construction to prevent contaminant discharges to adjacent native vegetation. • No storage of waste or hazardous materials within 50 m of Black Cockatoo habitat or water bodies.	Unlikely	Moderate	Low
		• Surface water runoff from road surface causing sedimentation or pollution	Possible	Moderate	Medium	• Surface runoff within the DE will drain into roadside drains constructed within the DE. The roadside drains will be designed to capture and infiltrate runoff from a 1 in 100 year Average Recurrence Interval (ARI) rainfall event, to prevent stormwater runoff into adjacent areas of native vegetation. • Local weather forecasts to be monitored daily, additional temporary measures (such as diversion channels/ sand bagging) to be installed to divert surface water flows away from sensitive receivers to constructed road drainage lines if significant rainfall event is forecast.	Rare	Moderate	Low
		• Damage to vegetation from accidental fires caused by construction activities	Possible	High	Medium	• All hot work will be undertaken in accordance with Contractor's hot work procedure. This will be reviewed and approved by the Main Roads Superintendent prior to work commencing • All vehicles, plant and equipment to be fitted with fire extinguishers and restricted to designated cleared areas unless involved in clearing operations • No smoking permitted onsite unless within designated smoking areas	Rare	High	Low

Management objective / desired outcome	Risk	Cause	Unmoderated Risk			Management measures (refer to Table 8)	Residual risk		
			Likelihood	Consequence	Risk rating		Likelihood	Consequence	Risk rating
						• No burning of any material authorised onsite • Fire danger ratings and Shire vehicle movement bans to be observed and the requirements of these implemented			
		• Landscaping introducing or spreading weeds and/or dieback to uninfested vegetation	Possible	Moderate	Medium	• Topsoil within the DE will be harvested, stockpiled and reused in accordance with Main Roads Environmental Guideline Topsoil Management- Doc#201928-0002-1 • Landscaping within the road reserve will use local native species in accordance with Main Roads Specification 304 (Revegetation and Landscaping) and Main Roads Environmental Guideline Revegetation Planning and Techniques. Doc # D19#12558 and D19#12560 • Dieback hygiene measures to be implemented during construction, including clean on entry – Doc # D18#847320, D23#179551 • All fill material required during construction is to be sourced from approved and certified sources only, free from weed and dieback	Unlikely	Moderate	Low
To avoid injury or mortality to Black Cockatoos, during vegetation clearing and construction	Fauna mortality during construction	• Vehicle collision with birds during construction	Unlikely	High	Medium	• Induction of construction personnel on reducing the risk of fauna injury and the procedure in the event of fauna injury or death – Doc # D17#681312, Appendix 2 • A designated fauna spotter will be present during all clearing activities. The person will hold a permit to handle and move significant fauna under Section 40 of the Biodiversity Conservation Act 2016, have suitable equipment to administer emergency care to injured and or displaced fauna, and have access to a care facility that can used to rehabilitate injured fauna • Speed limits between 40-60km p/hr will be applied throughout the construction site for safety purposes which will consequently reduce the risk of fauna strikes during construction • Where active BC breeding trees are located within 10 m of construction works, works will be postponed until breeding event is complete • Local wildlife rescue organisations and/or carers will be contacted in the event of fauna injury' • Revegetation designs shall not include foraging or breeding plant species within 10 m of the road alignment- Doc # D19#12558 and D19#12560	Rare	High	Low
		• Clearing of active breeding trees	Unlikely	High	Medium	• Within 7 days prior to commencing clearing, the four trees identified within 10m of the DE will be inspected by a suitably qualified person to confirm that potentially suitable hollows are not currently being used by Black Cockatoos within the breeding period for Black Cockatoos (i.e. July to December). Unoccupied hollows identified during this survey will be blocked to deter Black Cockatoo use during construction. • Within 7 days prior to clearing events, any tree and vegetation within 10 m of any tree identified as being potentially used by Black Cockatoos for nesting must not be cleared until a suitably experienced person has verified that the tree is not in use • A designated fauna spotter will be present during all clearing activities. The person will hold a permit to handle and move significant fauna under Section 40 of the Biodiversity Conservation Act 2016, have suitable equipment to administer emergency care to injured and or displaced fauna, and have access to a care facility that can used to rehabilitate injured fauna	Rare	High	Low

3 ENVIRONMENTAL MANAGEMENT MEASURES

SMART performance standards have been developed for this CEMP to address the requirements of both the EPA (Environmental Management Plans EPA (2024)) and DCCEEW (DoE (2014) *Action Management Plan Criteria)*. Relevant terminology from both formats is included where relevant. SMART performance standards are intended to relate to measurable (numerical) values, which can be applied to a Proposed Action (rather than qualitatively measured management / monitoring actions), and can include measurements such as 'performance indicators', 'corrective actions' and 'completion criteria'. Terms used in the SMART performance standards in this plan are defined in Table 6.

Table 6 Smart performance standard term definitions

Term	Definition
Performance target / Outcome	Proposed Action-specific measurable target defined to assess whether the management actions are effective in achieving the environmental objective
Performance indicator	The aspect of monitoring that provides a quantifiable parameter to measure performance over time to assess whether the target/outcome will be achieved/has been maintained.
Trigger / Early warning indicator	Values specified for the performance indicator that provide for early warning of potential impacts or plan not meeting plan objective/s (reach of which is determined through monitoring)
Contingency / corrective action	Actions to be undertaken should a trigger value be reached or exceeded
Completion criteria	Proposed Action-specific indicators designed to demonstrate the environmental objective is being or has been met (criteria for success)

In relation to listed threatened fauna, Main Roads has prepared SMART performance standards directly related to the measurable impacts of the Proposed Action on each taxon. The proposed SMART performance standards for the Proposed Action are identified in Table 7.

These SMART performance standards are aligned to the management actions and performance targets, monitoring actions and corrective actions identified in Table 8.

The 'trigger criteria' and 'completion criteria' are considered to be achievable; with the risk potential of not achieving the proposed SMART performance standards captured by the risk assessment presented Section 2.3 and Table 5.

As the proposed SMART performance standards for 'trigger criteria' and 'completion criteria' relate to physical measures that can be readily controlled through standard construction management processes[1], the proposed SMART performance standards have a low level of uncertainty, with additional margins for safety not required.

[1] Measures that have been applied successfully to other large scale projects that are considered appropriate in minimising the environmental impacts. These measures ensure that clearing is implemented properly, that erosion does not occur, and that spills are minimised and managed appropriately.

Table 7 SMART performance standards for Black Cockatoo

Environmental objective: Minimise the impacts to Black Cockatoos during construction of the Proposed Action				
Performance target / outcome	**Trigger / early warning indicator**	**Performance indicator**	**Corrective actions**	**Completion criteria**
To minimise and manage impacts to Black Cockatoo habitat beyond that approved	• Clearing of Black Cockatoo habitat and / or suitable DBH trees at 90% of approved limit	Amount of Black Cockatoo foraging and potential breeding habitat cleared	• Review clearing program progress against design to confirm clearing of Black Cockatoo habitat will not exceed the approved limit	• Not more than 400 suitable DBH trees cleared • No potentially suitable hollow (suitable and worn entrance) cleared • Not more than 15.7 ha of Carnaby's Black Cockatoo foraging habitat cleared • Not more than 15.6 ha of Baudin's Black Cockatoo and FRTBC foraging habitat cleared • Not more than 15.6 ha of Black Cockatoo breeding and roosting habitat cleared
To minimise and manage edge impacts into adjacent areas of habitat outside the DE	• Occurrence of a Declared Plant or WoNS within the DE or immediately adjacent during construction • Occurrence of dieback within the DE or immediately adjacent during construction	Number of Declared Plants, WoNS or dieback occurrence within the DE or immediately adjacent	• Application of weed eradication techniques for the weed species (refer to Appendix 1) • Review CoE process Doc # D23#179551 , D17#859669 • Survey for Dieback infestation within protectable / un-infested land bi-annually • Hygiene management procedures and site induction reviewed for suitability if non-conformance is identified	• No new Declared Plants, WoNS or *Phytophthora* dieback in land within or adjoining the DE as a result of the Proposed Action
To minimise and manage injury or mortality to Black Cockatoos during vegetation clearing and construction	• Trees located within 10m of the DE with hollows used by or suitable for use by Carnaby's Black Cockatoo or FRTBC not inspected by a suitably experienced person within 7 days prior to clearing • Black Cockatoo sighting within a tree hollow -/+ 10 m from construction area • Injured Black Cockatoo individual(s) within DE with injury suspected to be a consequence of construction activity • Live individual(s) identified within a hollow of a felled tree (despite preclearing fauna survey of hollows)	Number of Black Cockatoos injured or killed	• Clearing in the direct vicinity will cease immediately if trigger is met • Immediate inspection of injured Black Cockatoo (if required) • Contractor to provide evidence that a suitably experienced person is engaged to conduct surveys prior to subsequent clearing events • Contractor to provide evidence that surveys are scheduled within 7 days prior to subsequent clearing events • Clearing will not recommence until no go areas have been reviewed and confirmed to be in place correctly, and Main Roads Superintendent provides approval to recommence • Local wildlife rescue organisations and/or carers will be contacted to advise of an appropriate destination to transfer injured cockatoo(s) • Clearing will not recommence until Black Cockatoo has been relocated and checks have been completed to ensure no additional Black Cockatoo individuals are present, and the fauna spotter / catcher provides approval to recommence	• No Black Cockatoo mortalities as a consequence of construction activities

The SMART performance standards do not require detailed statistical analysis to determine if the 'trigger criteria' and 'completion criteria' have been met, nor require statistical power to detect change (for example, seasonal or climatic variability) at control or reference sites (for comparative purposes).

3.1 Implementation

Table 8 provides detail of the management measures to be put in place to achieve the outcomes identified in the risk assessment, including performance targets/completion criteria, implementation timing, monitoring, reporting and corrective action.

Management controls, references and documents (*procedures, processes, work practices and forms)* referred to in Table 8 are listed in Section 6.

Table 8 Management measures for Black Cockatoos

Management objective / desired outcome	Timing	Management measures	Performance target / outcome	Completion criteria	Monitoring / reporting activity	Trigger / early warning indicator	Corrective action	Corrective action responsibility
To minimise and manage unauthorised impacts to Black Cockatoo habitat	Contract award and prior to commencement of clearing	Induction of construction personnel on the presence and value of vegetation and Black Cockatoo habitat adjacent to the DE, and vegetation and Black Cockatoo habitat to be retained within the DE	• All construction personnel inducted prior to clearing activities Doc # D17#681312	• Clearing limit to be surveyed and demarcated prior to commencing clearing activities • Not more than 400 suitable DBH trees cleared • No potentially suitable hollow within 10m of DE (suitable and worn entrance) cleared • Black Cockatoo foraging habitat cleared • Not more than 15.6 ha of Baudin's Black Cockatoo and FRTBC foraging habitat cleared • Not more than 15.6 ha of Black Cockatoo breeding and roosting habitat cleared	• Induction records reviewed prior to commencement of clearing Doc # D17#681312	• Any construction personnel not inducted prior to the commencement of clearing activities	• Undertake induction prior to recommencing work Doc# D17#681312	• Construction Contractor Environmental Management Representative • Main Roads Superintendent
		All currently identified Black Cockatoo suitable DBH trees within DE that are not required to be cleared will be marked with white flagging tape and identified as no-go areas, demarcated on relevant drawings and provided to the Construction Contractor Representative - Doc # 201928-0001-2	• All environmental no-go areas clearly marked with white flagging tape on site and inspected prior to clearing hold points being released. Doc # 201928-0001-2 • Drawings showing environmental no-go areas provided to the Construction Contractor Representative		• Record of provision of drawings showing environmental no-go areas • Environmental Management Representative inspection prior to clearing to confirm no-go areas are appropriately flagged / fenced, and that clearing remains within limits - Doc # 201928-0001-2 • Incident reporting (EQSafe) – see Form Appendix 2, Doc # D12#153561 • Weekly site inspections • Weekly site inspection by Construction Contractor	• No-go areas not flagged, or incorrectly flagged, on site prior to clearing • Drawings showing no-go areas not provided to the Construction Contractor Representative prior to clearing	• Clearing in the direct vicinity will cease immediately if trigger is met. Clearing will not recommence until no-go areas have been reviewed and confirmed to be in place correctly, and Main Roads Superintendent provides approval to recommence • Flagging within the DE will be corrected prior to clearing • Incorrectly cleared areas will be rehabilitated within 6 months of completion of clearing for revegetation with Black Cockatoo foraging habitat species	
		Vegetation to be retained within the DE will be clearly marked with white flagging tape Doc # 201928-0001-2	• All vegetation to be retained within the DE will be marked with white flagging tape Doc # 201928-0001-2			• Vegetation to be retained within the DE not flagged or incorrectly flagged, prior to commencement of clearing		
		All clearing areas will be marked with pink flagging tape and approved by the Main Roads Superintendent prior to clearing commencing Doc # 201928-0001-2	• All areas to be cleared within the DE will be marked with pink flagging tape Doc # 201928-0001-2			• Areas to be cleared within the DE not flagged, or incorrectly flagged prior to commencement of clearing		

Management objective / desired outcome	Timing	Management measures	Performance target / outcome	Completion criteria	Monitoring / reporting activity	Trigger / early warning indicator	Corrective action	Corrective action responsibility
		A pre-clearance inspection will be undertaken prior to commencement of clearing to ensure flagging for no-go zones, vegetation retention and vegetation clearing is correct and aligns with drawings showing no-go areas Doc # 201928-0001-2	• All vegetation to be cleared and vegetation to be retained within the DE is correctly flagged and aligns with drawings showing no-go areas Doc # 201928-0001-2		• Pre-clearance inspection report	• Areas within the DE not correctly flagged during pre-clearance survey		
	During construction	Daily inspection of clearing areas and retention areas during clearing stage	• Clearing and retention areas inspected daily, clearing area appropriately flagged Doc # 201928-0001-2		• Inspection reports	• Daily inspection not undertaken; no site flagging identified	• Cease clearing and undertake inspection.-Re-survey, demarcate and flag clearing limits. Clearing will not recommence until inspection complete.	
		Ancillary services required for construction such as laydown areas, stockpile areas and vehicle turn around, will be located in areas cleared for permanent works or areas that do not contain Black Cockatoo habitat (i.e. farmers paddocks) Clearing will be avoided for any temporary construction activities	• Areas for ancillary services / temporary construction activities located in cleared areas or areas that do not contain Black Cockatoo habitat • No clearing of Black Cockatoo habitat for ancillary services / temporary construction activities		• Construction site plan (and photos showing all ancillary areas not located on land containing Black Cockatoo habitat) reviewed by Main Roads Superintendent prior to release of clearing hold point. • Monthly site inspections Doc # D18#685148	• Areas for ancillary services / temporary construction activities planned to be located within areas that contain Black Cockatoo habitat	• Main Roads Superintendent is required to provide approval for clearing of native vegetation for construction laydown etc., approval must only be given if there are no other practicable options • Incorrectly cleared areas will be rehabilitated within 6 months of completion of clearing for revegetation with Black Cockatoo foraging habitat species	• Main Roads Superintendent
To minimise and manage edge impacts into adjacent areas of Black Cockatoo habitat outside the Development Envelope	Prior to and during construction	Declared Plants within the DE will be treated prior to clearing according to their Control Codes and advice from Department of Primary Industries and Regional Development (DPIRD), with the aim of eradication where possible but as a	• Number of new occurrence or spread of Declared Plants within the DE or in immediately adjacent areas during construction activities	No new Declared Plants, WoNS or *Phytophthora* dieback in land within or adjoining the DE as a result of the Proposed Action	• Weekly site inspections • Annual revegetation Representative monitoring	• Occurrence of a Declared Plant or WoNS within the DE or immediately adjacent during construction	• Re-Application of weed eradication techniques for the weed species (refer to Appendix 1) • Review and update CoE process – Doc # D17#859669, D23#179551	• Construction Contractor Representative • Construction Environmental Management Representative

Management objective / desired outcome	Timing	Management measures	Performance target / outcome	Completion criteria	Monitoring / reporting activity	Trigger / early warning indicator	Corrective action	Corrective action responsibility
		minimum prevent off site movement – Appendix 1						
		Prior to clearing, control of WoNS and environmental weeds within the construction site boundary will be treated according to the weed control management outlined by Weeds Australia (http://weeds.ala.org.au/) with the aim of controlling off-site movement (refer to Appendix 1)	• No new occurrence or spread of WoNS or environmental weeds through construction activities				• Application of weed eradication techniques for the weed species (refer to Appendix 1) until completion criteria of weed cover at less than 30% is met • Review CoE process – Doc # D17#859669, D23#179551	
	During construction	• Topsoil containing Declared Plants or WoNS (plus a 5 m buffer), based on baseline flora and vegetation survey mapping, removed and stockpiled separately to clean topsoil – Doc # 201928-0002-1 • Areas of infested (weeds) stockpiled topsoil to be clearly marked as no use areas - Doc # 201928-0007 • Infested topsoil to be buried at a depth of at least 300 mm or disposed off-site at a landfill	• Topsoil containing Declared Pests or WoNS shall not be reused in landscaping, revegetation or respread within DE		• Records of topsoil segregation and burial or disposal at licensed waste facilities provided within Construction Contractor's monthly report.	• Topsoil containing Declared Pests and WoNS planned to be used in landscaping or revegetation activities	• Topsoil removed from landscaping/revegetation areas and replaced with clean topsoil. Infested topsoil buried at depth or disposed at a licensed waste facility	

Management objective / desired outcome	Timing	Management measures	Performance target / outcome	Completion criteria	Monitoring / reporting activity	Trigger / early warning indicator	Corrective action	Corrective action responsibility
	Prior to and during construction	• All heavy plant and machinery will be inspected by the contractor prior to entry at the work site and be confirmed to be clean and free of vegetation and soil material. Doc # D17#859669, D23#179551	• All heavy plant and machinery will be verified clean on arrival at site- Doc # D17#859669 • No entry of heavy plant and machinery into the DE without prior inspection. - Doc # D23#179551		• Records verifying plant and machinery arriving on site is clean - Doc # D17#859669	• Heavy plant and machinery not inspected prior to entry of work site during construction activities	• Refresher training will be conducted - Doc # D17#859669, D23#179551, D17#681312	
	During construction	Topsoil from infected or potentially infected *Phytophthora* dieback areas shall be segregated and not used in non-infected areas - Doc # 201928-0002-1 Clean on Entry hygiene form completed prior to construction activities commencing - Doc # D17#859669	• No reuse of topsoil containing infected or potentially infected *Phytophthora* dieback - Doc # 201928-0002-1 • All topsoil from infested and potentially infected dieback areas disposed of at a licensed facility • Dieback Protectable land does not become infested		• Records of topsoil segregation - Doc # 201928-0002-1 • Hygiene forms complete - Doc # D17#859669, D23#179551 • Clean on Entry / dieback infested/ dieback protectable signage onsite- Doc # 201928-0007 • Dieback survey of protectable areas to be completed bi-annually for upto 3 years.	• Topsoil from infected or potentially infected Phytophthora dieback not segregated or planned to be used in non-infected areas during construction activities • No signage for dieback protected areas / clean on entry onsite • Site induction material does not cover site hygiene requirements • No hygiene inspection form completed	• Topsoil sampled for Phytophthora at sampling density according to WA guidelines • If topsoil found to contain *Phytophthora*, the topsoil will be removed and temporarily placed on an infected area and disposed of at a licensed waste facility • If infected topsoil is used in non-infected areas, phosphite will be applied to dieback susceptible species within 30 m of placed topsoil that tested positive for *Phytophthora*, in accordance with DBCA guidance • Any protectable area with unauthorised activities to be surveyed for dieback infestation	
	During Construction	Dieback infested and protectable areas will be identified and established within the DE and adjacent land to guide dieback hygiene practises including CoE procedures that will be implemented on site,	• No breach of CoE protocols • No unauthorised entry to site • Clear signage onsite to demarcate COE / dieback infested /		• Entry and/or exit hygiene records for CoE points - Doc # D17#859669, D23#179551 • Monthly site inspections	• Hygiene checklist forms not available onsite • No COE sign-posted onsite • No dieback signage onsite to identify	• Refresher training / site induction to be re-completed • Site induction to be reviewed • Hygiene management forms and site requirements reviewed for	

Management objective / desired outcome	Timing	Management measures	Performance target / outcome	Completion criteria	Monitoring / reporting activity	Trigger / early warning indicator	Corrective action	Corrective action responsibility
		and entry and exit records kept for the CoE points - Doc # 201928-0002-1, D17#859669, D23#179551	protectable areas - Doc # 201928-0002-1		• Clear signage onsite to indefinity soil/land dieback status - Doc # 201928-0002-1	boundaries or soil stockpile status	suitability Doc # D17#859669, D23#179551	
	During construction	• Water carts and/or surface stabilization measures (e.g. hydro mulch) will be used to minimise dust generated from cleared areas • Dust generating activities will be suspended at the direction of the Construction Contractors Environmental Representative if deemed too dusty and will not recommence without approval	• No hazardous dust plumes generated by construction activities • No dust complaints from community or other stakeholders	Dust does not pose a visual hazard and safety issue to workforce or traveling public	• Visual dust observations by all project personnel • Daily site inspection of site • Daily monitoring of local weather forecast • Monthly site inspections	• Visual dust observed during construction activities • Dry windy/gusty local weather conditions present / forecast	• Increased application rate/frequency for dust suppression methods (e.g. water carts, additives added to water) will be implemented effective immediately of trigger being realised • Suspend dust generating activities at the direction of the Construction Contractor	• Construction Contractor • Environmental Management Representative
		• Vehicle speeds will be limited to between 40-60km/hr on site for safety purposes and this will consequently reduce dust generated	• No incidents of speeding within the construction site boundary		• Visual monitoring by all construction personnel Incident reporting (EQSafe) Appendix 2, Doc # D12#153561		• Refresher training will be conducted within 1 week • Instances of speeding are identified, and offenders will be asked to immediately reduce speed • Repeat offenders (i.e. Caught speeding more than 2 times) will undergo further refresher training	
	During hot works such as welding	• All hot work will be undertaken in accordance with Contractor's hot work procedure. This will be reviewed and approved by the Main Roads Superintendent prior to work commencing	• No fires started as a result of hot works	No changes to baseline quality / condition (function and value) of Black Cockatoo habitat as a result of fires adjacent to the DE, as a result of the Proposed Action	• Monthly site inspections to confirm required controls are in place • Incident reports related to fires Appendix 2, Doc # D12#153561	• Hot work not undertaken in accordance with Contractor's hot work procedure	• Incident investigation shall be initiated within 1 day and a report completed within 1 week • Fire impacted areas will be recorded in a plan of DE • Refresher training will be conducted within 1 week Doc # D17#681312	• Construction Contractor • Environmental Management Representative

Management objective / desired outcome	Timing	Management measures	Performance target / outcome	Completion criteria	Monitoring / reporting activity	Trigger / early warning indicator	Corrective action	Corrective action responsibility
	During construction	• All vehicles, plant and equipment to be fitted with fire extinguishers and restricted to designated cleared areas unless involved in clearing operations	• No fires started as a result of construction vehicles or equipment			• Vehicles, plant and equipment not fitted with fire extinguishers prior to construction activities		
		• Fire danger ratings and Shire vehicle movement bans to be observed and the requirements of these implemented	• No fires started as a result of construction vehicles or equipment			• Fire danger ratings and Shire vehicle movement bans not observed during construction activities		
		• Temporary erosion and sediment controls will be maintained within the DE during construction to prevent stormwater runoff from construction areas from eroding or causing sediment deposition in adjacent native vegetation • Surface runoff within the DE will drain into roadside drains constructed within the DE. The roadside drains will be designed to capture and infiltrate runoff from a 1 in 100 year Average Recurrence Interval (ARI) rainfall event, to prevent stormwater runoff into adjacent areas of native vegetation	• No evidence of erosion and/or sedimentation from construction activities within no-go areas or retained Black Cockatoo habitat.	No evidence of erosion and/or sedimentation within or adjoining the DE as a result of the Proposed Action	• Daily site inspection • Incident reporting (EQSafe) – Appendix 2, Doc # D12#153561 • Monitor local weather forecasts for indication of future rainfall events	• Scouring or erosion observed at temporary drainage structures • Scouring or erosion of adjacent vegetated areas occurring as a result of construction activities	• Review drainage to identify whether there are any failure points, and repair/address any failure points identified within 1 week	• Construction Contractor • Environmental Management Representative
		• Waste and hazardous materials management	• No evidence of waste and hazardous	No evidence of waste and/or hazardous materials within or		• No waste or hazardous materials	• Review waste and/or hazardous materials management measures	

Management objective / desired outcome	Timing	Management measures	Performance target / outcome	Completion criteria	Monitoring / reporting activity	Trigger / early warning indicator	Corrective action	Corrective action responsibility
		measures will be implemented during construction to prevent contaminant discharges to adjacent native vegetation • No storage of waste and/or hazardous materials within 50 m of Black Cockatoo habitat	materials discharge within or adjacent to the DE	adjoining the DE as a result of the Proposed Action		management measures detailed prior to construction • Waste or hazardous materials within adjacent vegetated areas occurring as a result of construction activities • Waste / material storage areas not appropriately designed to contain stored waste/ materials	within 2 weeks of identified discharge	
	Prior to and during construction and landscaping	• Topsoil within the DE will be harvested, stockpiled and reused in accordance with Main Roads Environmental Guideline Topsoil Management - Doc # 201928-0002-1, 201928-0007	• Topsoil is managed in accordance with Main Roads Guideline - Doc # 201928-0002-1, 201928-0007	No harvesting, stockpiled and reused topsoil that is not in accordance with Main Roads Guideline - Doc # 201928-0002-1, 201928-0007	• Monthly site inspections	• Topsoil within the DE harvested, stockpiled and reused not in accordance with Main Roads Environmental Guideline Topsoil Management during construction activities	• Topsoil management amended to ensure compliance with Main Roads Guideline - Doc # 201928-0002-1, 201928-0007	• Construction Contractor • Environmental Management Representative
	Prior to and during landscaping	• Landscaping within the road reserve will use local native species in accordance with Main Roads Specification 304 (Revegetation and Landscaping) and Main Roads Environmental Guideline Revegetation Planning and Techniques Doc # D18#755580, D19#12558, D19#12560	• Landscaping is compliant with Main Roads Specification 304 and Guideline	No landscaping without compliance with Main Roads Specification 304 and Guideline Only local, native species used in landscaping	• Review of landscaping areas and species list • Inspection of landscaping areas	• Landscaping within the road reserve does not use local native species • Landscaping within the road reserve is not in accordance with Main Roads Specification 304 (Revegetation and Landscaping) and Main Roads Environmental Guideline Revegetation Planning and Techniques	• Landscaping design and species list amended to ensure compliance • Landscaping works are replanted to comply with approved designs and species list	• Construction Contractor • Environmental Management Representative • Main Roads Superintendent

Management objective / desired outcome	Timing	Management measures	Performance target / outcome	Completion criteria	Monitoring / reporting activity	Trigger / early warning indicator	Corrective action	Corrective action responsibility
		• No landscaping with BC foraging species within 10m of road alignment						
To minimise and manage injury or mortality to Black Cockatoos during vegetation clearing and construction	Prior to construction	• Induction of construction personnel on the presence and value of vegetation and Black Cockatoo habitat adjacent to the DE, and vegetation and Black Cockatoo habitat to be retained within the DE	• All construction personnel inducted prior to clearing activities Doc # D17#681312	All construction personnel inducted prior to clearing activities Doc # D17#681312	• Induction records Doc # D17#681312	• Any construction personnel not inducted prior to the commencement of clearing activities	• Undertake induction within 48hrs	• Construction Contractor • Environmental Management Representative
	During construction	• A designated fauna spotter will be present during all clearing activities. The person will hold a permit to handle and move significant fauna under Section 40 of the *Biodiversity Conservation Act 2016*, have suitable equipment to administer emergency care to injured and or displaced fauna, and have access to a care facility that can used to rehabilitate injured fauna	• No death of Black Cockatoos due to direct interaction with equipment and machinery	Presence of a designated fauna spotter during all clearing activities	• Fauna spotting program • Daily observation reports to be filed by Fauna Spotter • Incident reporting (EQSafe) – Appendix 2, Doc # D12#153561	• Injured Black Cockatoo individual within DE with injury suspected to be a consequence of construction activity • Live individual identified within hollow of a felled tree (despite preclearing fauna survey of hollows)	• Clearing in the direct vicinity will cease immediately if trigger is met • Immediate inspection of injured Black Cockatoo • A list of local wildlife rescue organisations and carers will be maintained on site. This will allow efficient identification of an appropriate destination to which to transfer injured cockatoo • Clearing will not recommence until Black Cockatoo has been relocated and checks have been completed to ensure no additional Black Cockatoo individuals are present, and the fauna spotter / catcher provides approval to recommence	• Fauna spotter / catcher
		• Where trees that are known to be Black Cockatoo habitat are retained but are located within 10 m of the edge of the	• Risk assessment undertaken if Black Cockatoo habitat is retained within 10 m of	No Black Cockatoo mortalities as a consequence of construction activities	• Risk assessment	• Wildlife hazard signage not implemented where required • Injured Black Cockatoo individual	• Install wildlife hazard signage if required	• Construction Contractor • Environmental Management Representative

Management objective / desired outcome	Timing	Management measures	Performance target / outcome	Completion criteria	Monitoring / reporting activity	Trigger / early warning indicator	Corrective action	Corrective action responsibility
		road seal the risk of fauna strike will be assessed to determine if wildlife hazard signage is required	the edge of the road seal • Installation of wildlife hazard signage, if required from the risk assessment	Wildlife hazard signage if required		within DE with injury suspected to be a consequence of construction activity		
		• Speed limits between 40-60km p/hr will be applied throughout the construction site for safety purposes which will consequently reduce the risk of fauna strikes during construction	• No incidents of speeding within the construction site boundary	No Black Cockatoo mortalities as a consequence of construction activities	• Visual monitoring by all construction personnel • Incident reporting (EQSafe) – Appendix 2, Doc # D12#153561	• Injured Black Cockatoo individual within DE with injury suspected to be a consequence of construction activity	• Refresher training will be conducted within 1 week • Instances of speeding are identified and offenders will be asked to immediately reduce speed • Repeat offenders (i.e. Caught speeding more than 2 times) will undergo further refresher training	
		• A list of local wildlife rescue organisations and carers will be maintained on site to contact in the event of fauna injury	• A list of local wildlife rescue organisations and carers is on site at all times	All injured and ill Black Cockatoos are taken to an experienced wildlife veterinarian or approved wildlife rehabilitation facility	• Monthly inspection Doc #D18#685148 • Incident reporting (EQSafe) – Appendix 2, Doc # D12#153561	• List of local wildlife rescue organisations and carers is not onsite prior to commencement of construction activities	• A list of local wildlife rescue organizations and carers is obtained by site immediately • Refresher training will be conducted within 1 week	
	Prior to commencement of revegetation	• Revegetation designs shall not include foraging or breeding plant species within 10 m of the road	• Revegetation designs exclude foraging or breeding plant species within 10 m of the road	No revegetation with Black Cockatoo foraging or breeding plant species within 10 m of the road	• Record of revegetation drawings showing species mix • Revegetation Monitoring Report – Doc # D18#847320	• Revegetation designs include Black Cockatoo foraging or breeding plant species within 10 m of the road	• Design drawings amended to exclude revegetation with foraging or breeding plant species within 10 m of the road • Foraging or breeding plant species removed from within 10 m of the road and replaced with non-habitat species	• Construction Contractor • Environmental Management Representative • Main Roads Superintendent
	Within 7 days prior to clearing events	Within 7 days prior to clearing: • The four trees with potentially suitable hollows within 10 m of the DE will be subject to a pre-clearance survey where adjacent	• Survey of trees with hollows potentially suitable for use by Black Cockatoo undertaken within 7 days	No clearing of trees with active hollows No clearing within 10 m of an identified active hollow No Black Cockatoo mortalities as a	• Surveys undertaken by suitably experienced person to confirm potentially suitable hollow within 10 of DE is no longer being used by Black Cockatoo	• Trees with hollows potentially suitable for use by Carnaby's Black Cockatoo or FRTBC not inspected by a suitably experienced person	• Clearing in the direct vicinity will cease immediately if trigger is met • Immediate inspection of felled tree (e.g. with hollow currently in use) to determine survivability of Black Cockatoo (if present)	• Construction Contractor • Environmental Management Representative

Management objective / desired outcome	Timing	Management measures	Performance target / outcome	Completion criteria	Monitoring / reporting activity	Trigger / early warning indicator	Corrective action	Corrective action responsibility
		vegetation is proposed to be cleared within the breeding period for Black Cockatoos (i.e. July to December). Unoccupied hollows identified during this survey will be blocked to deter Black Cockatoo use during construction • Within 7 days prior to clearing events, any tree and vegetation within 10 m of any tree identified as being used by Black Cockatoos for nesting must not be cleared until a suitably experienced person has verified that the tree is not in use	prior to clearing events • No clearing of trees used by Black Cockatoo • All trees currently being used by Black Cockatoos are marked with white flagging as no-go areas with flagging with a 10 m exclusion zone • All hollows being utilised by the species are detected during tree pre-works inspection survey • No Black Cockatoo mortality or injury during clearing Doc # D12#153561	consequence of construction activity	• Maintain a register of nesting trees	within 7 days prior to clearing • Injured Black Cockatoo individual within DE with injury suspected to be a consequence of construction activity • Live individual identified within hollow of a felled tree (despite preclearing fauna survey of hollows) • Incident reporting (EQSafe) Appendix 2, Doc # D12#153561	• Contractor to provide evidence that a suitably experienced person is engaged to conduct surveys prior to subsequent clearing events • Contractor to provide evidence that surveys are scheduled within 7 days prior to subsequent clearing events • Unanticipated clearing event delays will be risk assessed against survey findings • A list of local wildlife rescue organisations and carers will be maintained on site. This will allow efficient identification of an appropriate destination to which to transfer injured cockatoo	

3.2 Monitoring program

A number of activities will be undertaken to monitor and report on the implementation of management measures and achievement of completion criteria. Monitoring activities are mapped to each management measure in Table 9. Table 9 describes the monitoring in detail and includes relevant monitoring guidelines or methods and responsible people.

Table 9 Monitoring schedule

Monitoring activity	Parameter measures	Items addressed	Applicable method / guideline	Responsibility
• Pre-clearing surveys of potentially suitable hollows within 10 of DE for use by Black Cockatoos	Presence of hollow/s being used by Black Cockatoos	• Confirm DBH trees with potentially suitable breeding hollows located within 10m of work area do not have active breeding BCs • Confirm DBH trees with potentially suitable breeding hollows within 10m of works area are not being utilised before construction commences • Maintain a register of confirmed active and non-active DBH breeding hollows located within 10m of construction area • Record the location of any active breeding hollow or potentially suitable breeding hollows and marked as no-go areas	• Suitably experienced person with experience in BC breeding hollow identification to visually inspect all potential breeding trees within 10m of construction area and record spatial co-ordinates for any DBH trees identified as active breeding hollows that are being utilised, or are capable of being utilised, by Black Cockatoos • Monitoring will be conducted in line with best practice and monitoring methods used will be consistent advice contained within the Black Cockatoo Recovery Plan (DPaW, 2013) • Note: no-go areas are areas of vegetation that are not approved to be cleared, these include trees with confirmed or potentially suitable breeding hollows that are being used by Black Cockatoos, conservation significant flora and all areas outside of the approval boundary. These areas are identified on the engineering drawings issued for construction	• Suitably experienced person • Construction Contractor • Environmental Management Representative
• Weekly site inspection	Compliance with CEMP requirements	• Confirm all vegetation to be retained is clearly marked with flagging on site - Doc # 201928-0001-2 • Confirm environmental no-go areas are clearly marked on site - Doc # 201928-0001-2 • Confirm that clearing outside of approved area or in excess of approved limits has not or will not occur - Doc # 201928-0001-2 • Confirm areas required for temporary construction activities, such as laydown, are only located on previously cleared areas • Confirm all plant and machinery are verified clean on arrival at site – Doc # D23#179551, D17#859669 • Confirm no new occurrences of declared/WoNS flora are located within or adjacent to the construction site boundary • Confirm no breach of CoE procedures • Confirm soil from known or potential dieback infested areas has only been reused in infested areas or disposed off-site at a licensed waste facility • Confirm list of wildlife rescue organization contact details is on site • Confirm no visual dust plumes/hazards • Confirm hot works procedures are in place and correctly implemented • Confirm no erosion or scouring in DE or within vegetation that is to be retained in no-go areas or outside the approval boundary • Confirm topsoil is harvested, stockpiled, sign-posted and reused in accordance with Main Roads Environmental Guideline Topsoil Management – Doc # 201928-0002-1 • Confirm landscaping within the road reserve is compliant with approved landscaping designs and species mix – Doc # D19#12558, D19#12560 • Confirm weed control measures have been effective and if follow-up treatment is required to eliminate the weeds – Appendix 1 • Confirm weed control measures have been implemented as per this CEMP and in line with Weeds Australia Guidance (http://weeds.ala.org.au/WoNS/) – Appendix 1	• Visual inspection to confirm that management measures in the CEMP are being implemented correctly • Contractors Monthly Performance Report • Main Roads Surveillance Officer daily inspection journal	• Construction Contractor • Environmental Management Representative • Main Roads Environmental Representative

3.3 Managing uncertainty

This CEMP has been developed based on varying data and information sources. These sources have informed the risk assessments and management measures contained within the CEMP and therefore, any limitations or uncertainties with this data or information may impact the accuracy of this CEMP. **Error! Not a valid bookmark self-reference.** contains measures for managing uncertainty so that the CEMP continues to be based on the most up to date and relevant information and data.

Table 10 Managing uncertainty

Data	Limitations / uncertainty	Risk presented by limitations / uncertainty	Risk management measures
Road alignment design	High level of certainty of maximum impact within the DE	Low risk	N/A
Detailed Flora and Vegetation Report (360 environmental 2020)	Detailed Flora and Vegetation survey reported nil to low limitations in desktop or field components	Low risk	N/A
Recheck *Phytophthora* dieback occurrence assessment (Glevan Consulting, 2021)	Observable symptoms of *Phytophthora* must be present in vegetation during the assessment period	Unrecorded / unexpressed *Phytophthora* infestations may be present	Dieback hygiene management adopted as a precautionary measure, Dieback survey within 12months of commencing works, 3 monthly surveys to determine spread of Dieback
Fauna and Black Cockatoo Habitat Assessment (Bamford 2015, revised 2021)	Fauna and Black Cockatoo Habitat Assessment reported nil to low limitations or uncertainties within the report	Low risk	N/A
Biological Survey (Biologic, 2021)	Biological survey reported nil to low limitations in the majority of the desktop or field components. The availability of data and information was assessed as a partial limitation as limited survey work has been undertaken in the vicinity of the survey area	Low risk	N/A
Black Cockatoo Breeding Hollow Inspection (Kirkby, 2021 & Kirkby, 2022)	Black Cockatoo Breeding Hollow Inspection reported nil to low limitations or uncertainties within the report. All potentially suitable hollows within 10 m of the DE were confirmed to not be active	Medium risk	Inspection of four trees containing potential breeding hollows to determine BC activity to be conducted at least 7 days prior to

Data	Limitations / uncertainty	Risk presented by limitations / uncertainty	Risk management measures
	nesting BC breeding trees. Four potential suitable hollows exist within 10 m of construction area.		construction commencement.

4 CEMP IMPLEMENTATION AND REVIEW

4.1 Roles and responsibilities

All project personnel, including sub-contractors/sub-consultants, are responsible for complying with applicable Commonwealth and state legislation, local government requirements and the conditions of all licences, permits and approvals. Specific responsibilities in relation to the CEMP are outlined in Table 11.

Table 11 Construction Environment Management Plan roles and responsibilities

Role	CEMP responsibilities
Main Roads Project Manager	• Reviewing and approving the CEMP • Assisting with implementation of the CEMP • Providing the necessary resources to ensure the CEMP is properly implemented • Ensuring all personnel are inducted into the project's environmental requirements prior to commencement of works on-site • Ensuring suppliers are made aware of the environmental objectives pertaining to them through conditions of contract • Taking strategic actions to continuously improve the CEMP • Participating in incident investigations • Management, implementation, monitoring and compliance of the CEMP and any approval conditions, including construction supervision and performance of all staff, contractors and subcontractors • Reviewing CEMP performance and implementation of correction actions, or stop work procedures, in the event of breaches of CEMP conditions, that may lead to serious impacts on local communities, or affect the reputation of the project • Representing the project at community meetings
Main Roads Superintendent	• Confirming all environmental requirements are implemented as outlined in the CEMP as required to avoid and minimise actual or potential environmental harm on-site • Assisting the Contractor Environmental Management Representative to develop and maintain the various registers and checklists • Supporting the Environmental Management Representative to plan and implement environmental requirements • Reporting activity that has resulted, or has the potential to result, in an environmental incident immediately to the Environmental Management Representative • Participating in incident investigations

Role	CEMP responsibilities
	• Monitoring construction activities to ensure that identified and appropriate control measures are effective and in compliance with the CEMP • Managing CEMP performance and implementation of correction actions, or stop work procedures, in the event of breaches of CEMP conditions, that may lead to serious impacts on local communities, or affect the reputation of the project • Ensuring that all construction personnel and subcontractors are informed of the intent of the CEMP and are made aware of the required measures for environmental a compliance and performance • Ensuring effective communication and dissemination of the content and requirements of the CEMP to contractors and subcontractors • During construction, maintain traffic safety along access roads, with special emphasis on high trafficked areas
Main Roads Environmental Representative	• The overall management and review control of the CEMP • Review monitoring programs required under this CEMP • Managing procedures and practices for receiving and responding to complaints and inquiries in relation to the environmental performance • Assist in managing any activity that has resulted in, or has the potential to result in an environmental incident immediately to the Project Manager, Construction Manager and other relevant personnel • Considering and advising on matters specified in the conditions of licences and approvals relating to the environmental performance and impacts of the Proposed Action • Requiring reasonable steps to be taken to avoid or minimise unintended or adverse environmental impacts, and failing the effectiveness of such steps, to direct that relevant actions be ceased immediately should an adverse impact on the environment is likely to occur • Reviewing environmental competence of all staff to ensure adequate delivery of environmental training to all site personnel involved with construction. • Acting as main point of contact between the regulatory authorities and the Proposed Action on environmental issues • Providing advice and liaison with the construction teams to ensure that environmental risks are identified, and appropriate controls are developed and included within method statements • Assisting in the development and delivery of environmental training for site personnel and subcontractors • Environmental auditing of subcontractors and suppliers
Construction Contractor Representative	• Implementation of the CEMP on-site for construction related activities • Providing the necessary resources to ensure the CEMP is properly implemented • Making sure all personnel are inducted into the Proposed Action's environmental requirements prior to commencement of works on-site • Participating in reporting and incident investigations • Developing monitoring programs required under this CEMP • Management, implementation, monitoring and compliance of the CEMP and any approval conditions

Role	CEMP responsibilities
	• Daily, weekly and monthly inspection of the entire worksite against this CEMP for the duration of construction works
Construction Contractor Environmental Management Representative	• Developing and maintaining various procedures, registers and checklists required during clearing for construction • Coordinating and managing all the environmental activities during the construction phase • Being the primary contact point in relation to the environmental performance of the construction phase • Managing procedures and practices for receiving and responding to complaints and inquiries in relation to the environmental performance • Reporting any activity that has resulted in, or has the potential to result in an environmental incident immediately to the Main Roads Superintendent and other relevant personnel • Requiring reasonable steps to be taken to avoid or minimise unintended or adverse environmental impacts, and failing the effectiveness of such steps, to direct that relevant actions be ceased immediately should an adverse impact on the environment is likely to occur • Identify environmental competence requirements for all staff and ensure delivery and efficiency of environmental training to all site personnel involved with construction works, prior to personnel commencing works onsite • Assistance in the development and delivery of environmental training for site personnel and subcontractors • Participating in reporting and incident investigations • Assist in daily, weekly and monthly inspection of the worksite against this CEMP for the duration of construction works • Management of the construction contractor's environmental monitoring, inspection and audit program in so far as it relates to construction activities
Fauna spotter / catcher	• Being onsite during all pre-clearing activities to inspect and monitor clearing areas for the presence of Black Cockatoo individuals • Having sufficient authority to guide all clearing activities • Manage and handle all fauna tasks onsite • Implement fauna contingency measures (where required) • Prepare report following the completion of vegetation clearing • Participating in reporting of incidents

4.2 Inspections, audits and reporting

4.2.1 Contractor inspections and audits

The Construction Contractor will undertake monthly inspection of the entire worksite against this CEMP for the duration of construction works. Where any High or Severe risks are identified, inspections in the areas to which these apply will be undertaken on a weekly basis or daily where relevant.

An audit of this CEMP will be undertaken by the Construction Contractor within five weeks of the commencement of work and every three months thereafter.

Main Roads will conduct environment and heritage audits of the construction contract area on a three-monthly basis during the construction phase.

4.2.2 Incident reporting

Environmental incident categories and reporting timeframes are outlined in the Main Roads EQSafe Environmental Incident Reporting, Investigation and Management Procedure, Doc # D12#153561. This procedure provides a process for the reporting, investigation and management of environment or heritage incidents.

Where an environmental incident occurs, the following will be actioned:

- Immediate remedial action: where safe to do so the observer of an incident should undertake any immediate actions to stop, control or contain the incident to prevent further damage
- Determine the environmental incident category (i.e. minor, significant or major): environmental incidents are to be categorised as per the Main Roads Environmental Incident Reporting, Investigation and Management Procedure
- Notifications: Notification requirements for environmental incidents are outlined on the Main Roads Environmental Incident Reporting, Investigation and Management Procedure, Doc # D12#153561
- Assessment and investigation into the environmental incident, including cause, environmental impact and mitigation/remediation
- Incident report: EQSafe is Main Roads electronic system for the recording and management of all incidents. Where EQSafe cannot be accessed the Main Roads Corporate Environmental Incident Report Form (see Appendix 2) will be used to record environmental incidents associated with the Project
- Corrective and preventative actions – the Construction Contractor will track the progress of agreed corrective and preventative actions
- All environmental incidents are to be reported to the Main Roads Superintendent and filed by the Construction Contractor.

Corrective actions may also arise from audits, inspections, and management reviews. Correction actions are to be reviewed and endorsed by Main Roads Superintendent before the action is implemented. Audits will follow to confirm satisfactory completion.

All environmental incidents that result in an off-site impact to the Keaginine, Kwolyinine and Woondowing Nature Reserves will be reported by Main Roads Environment Representative to Department of Biodiversity, Conservation and Attractions.

4.3 Environmental training

An environment induction will be developed by the Construction Contractor and reviewed by Main Roads Environmental Representative with all visitors, all site personnel, contractors and sub consultants completing the induction prior to commencing work on the Project Site. This induction details the responsibilities of all project personnel, contractors and sub consultants under this CEMP

and outlines environment requirements that personnel need to be aware of when undertaking work activities in accordance with this CEMP.

All personnel will be required to sign an attendance form on completion of the induction, Doc # D17#681312. Attendance at these inductions is recorded in the Training Register developed and maintained by the Construction Contractor for the duration of Project.

Daily pre-start meetings will be conducted to inform Project personnel, including visitors and sub-consultants, of specific environmental issues related to the day's work. Additionally, toolbox meetings will be undertaken with all personnel to provide environmental awareness training, disseminate relevant outcomes of environmental inspections and audits, including improvements or achievements.

Specialist training will be provided to relevant personnel and will include spill prevention, control and containment/clean up, erosion and sediment control, and environmental emergency response.

Main Roads will maintain documented records as verification that personnel have received the appropriate training and are competent to fulfil their roles.

4.4 Review

4.4.1 Risk Review

The risk assessment will be reviewed annually to confirm it remains relevant and captures all risks to MNES. Review triggers are:

- Changes to Project/CEMP scope
- Following significant environmental incidents
- Where corrective actions or contingency management measures are implemented
- When new information regarding MNES becomes available.

4.4.2 CEMP review

Throughout the life of the EPBC Act approval the CEMP will be reviewed and updated as required. The review will include an evaluation of the effectiveness of the plan and incorporate new data or information pertinent to the management of Black Cockatoos.

Review triggers are as follows:

- Annually on the anniversary of the approval of the CEMP
- Following significant incidents
- Anticipated changes to scope and new risks
- Following community or stakeholder complaints
- Identification of non-compliance with environmental approval conditions
- Monitoring results, inspections or audits indicate performance targets or completion criteria may not be achieved or maintained
- Monitoring results, inspections or audits indicate completion criteria have been achieved.

The CEMP will be updated by the Main Roads Environmental Representative or suitably qualified delegate and approved by the Main Roads Project Director.

Changes to the CEMP will be communicated to all Project personnel, contractors and sub consultants via the regular pre-start and toolbox meetings. Main Roads will inform DCCEEW of any changes to the CEMP.

5 DATA MANAGEMENT

Records will be kept to demonstrate compliance with this CEMP. These records include, but are not limited to:

- Risk assessments
- Audit results and reports, including the timing, location and spatial delineation of clearing, and periodic reconciliation against approved disturbance limits
- Black Cockatoo potential breeding hollow pre-clearing inspections
- Monthly, weekly and daily inspection results
- Environmental incident reports
- Monitoring data, results and reports
- Landscaping design and species mix approved for use
- Topsoil harvesting, storage and reuse from known/potential dieback infected areas
- Records of landscaping activities including dates, location and area of landscaping, species mixes used and quantities
- Induction records
- Pre-start and Toolbox meeting minutes
- Correspondence in relation to the requirements of this CEMP between Main Roads, Construction Contractors and/or regulators.

The Main Roads Site Superintendent and the Construction Contractor Representative are responsible for establishing and maintaining electronic and hardcopy filing systems for the above information. Once construction is completed, all documents that were kept on site during construction will be transferred to Main Roads head office as part of site demobilisation.

6 CONTROLLING DOCUMENTS

Management documents relevant to actions, procedures noted in the CEMP are included in Table 12 below and indicative documents included the Appendix. Additional control documents not listed below that are referred to within the CEMP are to be developed by the Construction Contractor and provided to Main Roads Superintendent for approval prior to commencement of construction activities.

Table 12 Controlling documents

Document Number	Description
201928-0001-2	Construction Peg Colour Code Drawing
201928-0007	Construction Environmental Management Signs
201928-0002-1	Main Roads Environmental Guideline Topsoil Management Guideline Drawing
D12#153561	Main Roads Environmental Incident Reporting, Investigation and Management Procedure
D17#681312	Training Attendance Sheet
D17#859669	Hygiene Inspection Checklist / Clean on Entry Hygiene Form
D18#685148	Monthly Reporting Form
D18#755580	Specification 304 Landscaping & Revegetation
D18#847320	Revegetation Site Assessment Checklist
D19#12558	Specification 304 Revegetation
D19#12560	Specification 304 Rehabilitation of Disturbed Areas
D19#787510	Clearing Site Inspection Checklist
D23#179551	Hygiene Inspection Register

7 REFERENCES

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Weeds Australia (2024). Weed Profiles, Weed management guide, available online https://weeds.org.au/weeds-profiles/

8 APPENDICES

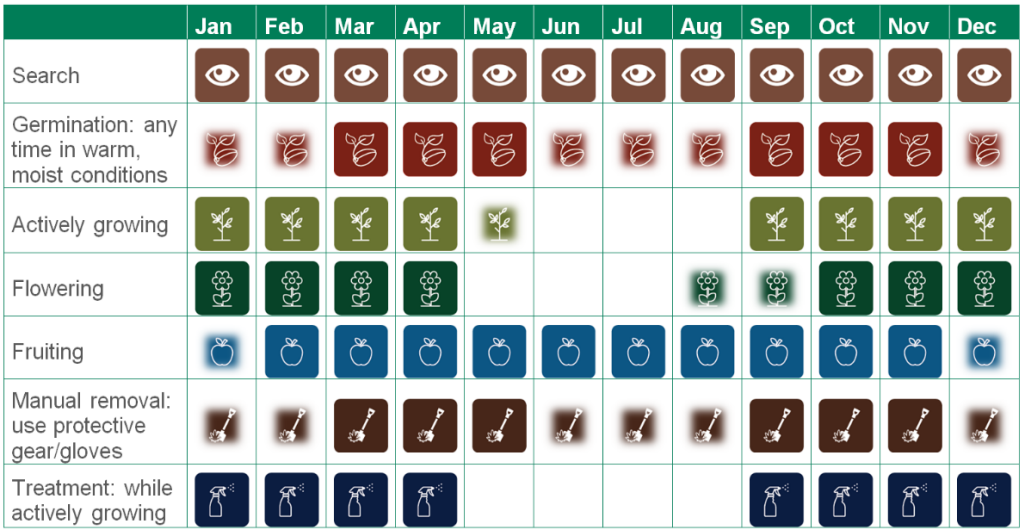
Appendix	Title
Appendix 1	Summary of weed controls for Declared Pests and WoNS
Appendix 2	Main Roads Environment Incident Reporting Form
Appendix 3	Construction Peg Colour Code
Appendix 4	Indicative Construction Environmental Management Signs
Appendix 5	Topsoil Management Guideline
Appendix 6	Indicative Training Attendance / Site Induction Register
Appendix 7	Indicative Hygiene Inspection Checklist / Clean on Entry Hygiene Form
Appendix 8	Indicative Hygiene Inspection Register

Appendix 1: Summary of weed controls for Declared Pests and WoNS

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

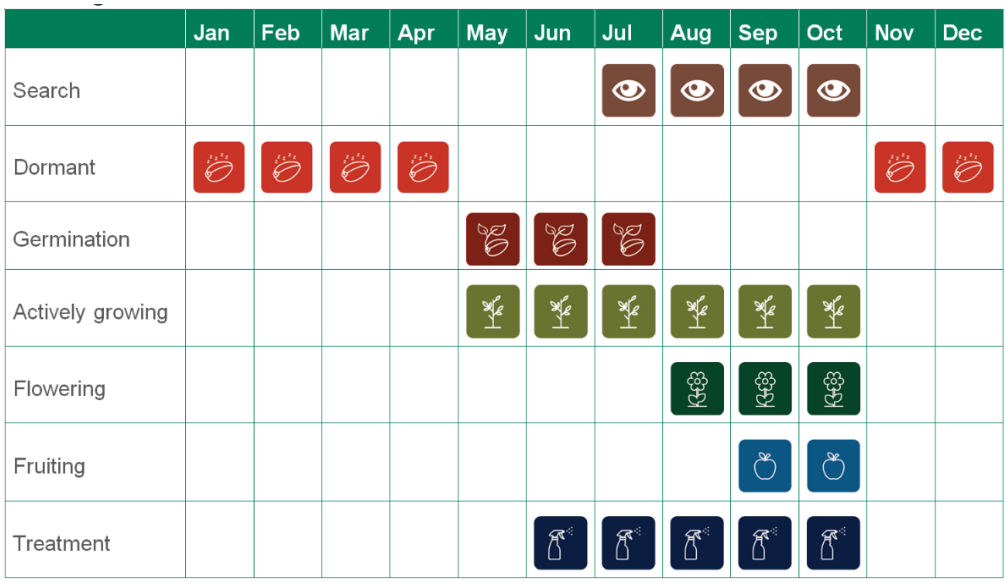
Weed Control Summary Sheet

Narrow leaf cotton bush

Species	*Gomphocarpus fruticosus*
Status	Declared Pest
Objective	Aim to eradicate where possible, as a minimum prevent off-site movement
Management Summary	Refer to https://www.agric.wa.gov.au/declared-plants/narrow-leaf-cotton-bush-declared-pest for management details 
Control Methods Recommended herbicides (Department of Primary Industries and Regional Development)	**Chemical control** Recommended herbicides Active growing, July to December • Glyphosate • Triclopyr
Further Information	For other methods of control refer to declared plant control handbook (DPIRD (2024) available at: https://www.agric.wa.gov.au/herbicides/declared-plant-control-handbook

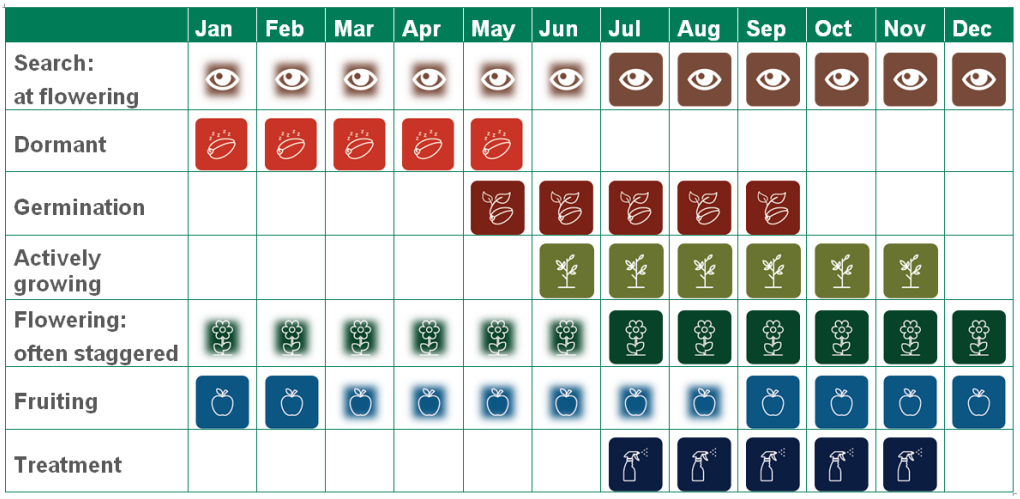
Weed Control Summary Sheet

One-leaf Cape Tulip

Species	*Moraea flaccida*
Status	Declared Pest
Objective	Aim to eradicate where possible, as a minimum prevent off-site movement
Management Summary	Refer to https://www.agric.wa.gov.au/declared-plants/one-leaf-cape-tulip-declared-pest for management details 
Control Methods Recommended herbicides (Department of Primary Industries and Regional Development)	Recommended herbicides (One-leaf) August-September, (two-leaf) July-end August • 2,4-D LV ester (cereals and pasture) • 2,4-D amine (cereals and pasture) • 2,4-DB (cereals and pasture) • Paraquat (blanket wiper) Full emergence to early August • 2,2-DPA
Further Information	For other methods of control refer to declared plant control handbook DPIRD (2024) available at: https://www.agric.wa.gov.au/herbicides/declared-plant-control-handbook

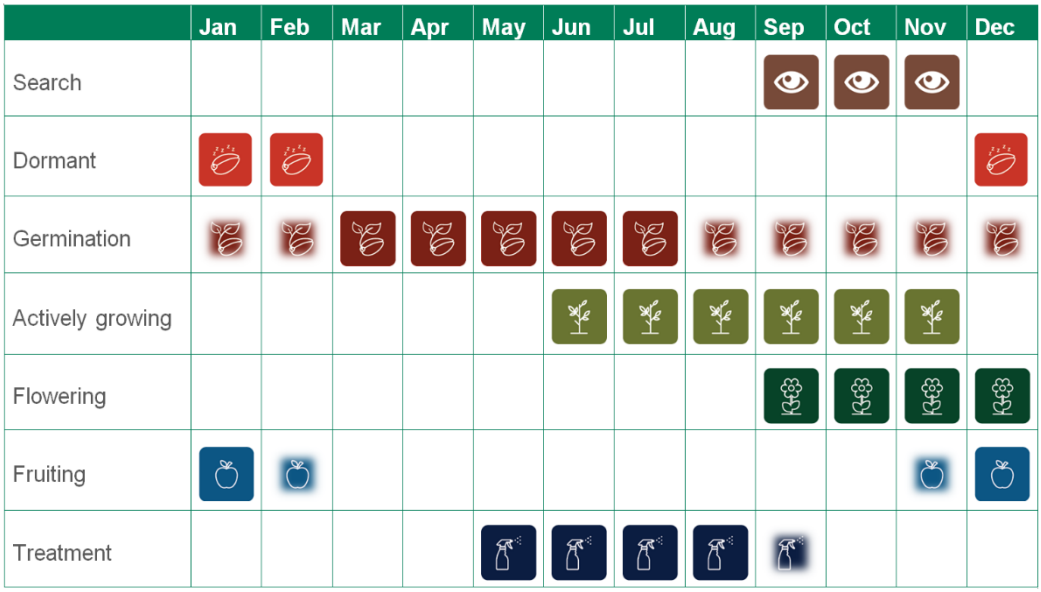
Weed Control Summary Sheet

Arum Lily

Species	*Zantedeschia aethiopica*
Status	Declared Pest
Objective	Aim to eradicate where possible, as a minimum prevent off-site movement
Management Summary	Refer to https://www.agric.wa.gov.au/declared-plants/arum-lily-declared-pest for management details 
Control Methods Recommended herbicides (Department of Primary Industries and Regional Development)	Recommended herbicides June to October • Chlorsulfuron • Metsulfuron • 2,4-D amine • Paraquat
Further Information	For other methods of control refer to declared plant control handbook DPIRD (2024) available at: https://www.agric.wa.gov.au/herbicides/declared-plant-control-handbook

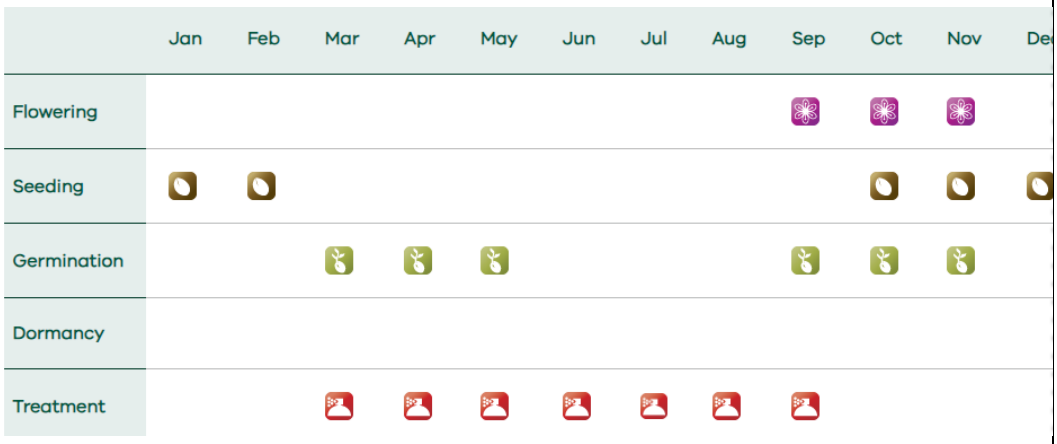
Weed Control Summary Sheet

Paterson's Curse

Species	*Echium plantagineum*
Status	Declared Pest
Objective	Aim to eradicate where possible, as a minimum prevent off-site movement
Management Summary	Refer to https://www.agric.wa.gov.au/declared-plants/paterson%E2%80%99s-curse-declared-pest for management details 
Control Methods Recommended herbicides (Department of Primary Industries and Regional Development)	Recommended herbicides In cereals • Chlorsulfuron; Metsulfuron methyl; Triasulfuron; Tigrex; Broadstrike; Jaguar; Bromoxynil + MCPA In pasture, up to four leaf stage • Jaguar®; Tigrex®; Broadstrike®; Bromoxynil + MCPA At early flowering, seed set control • Chlorsulfuron; Metsulfuron methyl; Triasulfuron; Glyphosate + 2,4-D LV ester
Further Information	For other methods of control refer to declared plant control handbook DPIRD (2024) available at: https://www.agric.wa.gov.au/herbicides/declared-plant-control-handbook

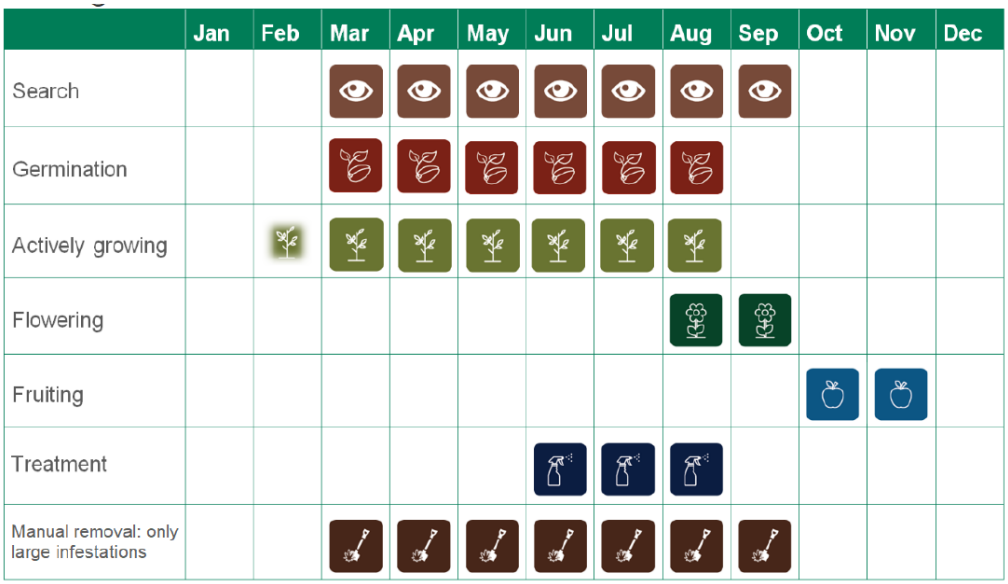
Weed Control Summary Sheet

Flax-leaf Broom

Species	*Genista linifolia*
Status	Weed of National Significance
Objective	Aim to eradicate where possible, as a minimum prevent off-site movement
Management Summary	Refer to https://weeds.org.au/weeds-profiles/?botanical=Genista%20linifolia&region=wa for management details 
Control Methods Recommended herbicides (Department of Primary Industries and Regional Development)	• Hand pull or dig out small seedlings ensuring removal of all roots • For mature plants cut and paint with 50% glyphosate or foliar spray with 1% glyphosate, repeat treatment • Alternatively 250 ml Access® in 15 L of diesel to basal 50 cm of stem (basal bark) • Monitor site for recruitment from seedbank
Further Information	For other methods of control for the Flax-leaf Broom, refer to the Weed Management Guide (Weeds Australia, 2024) available online https://weeds.org.au/.

Weed Control Summary Sheet

Bridal Creeper

Species	*Asparagus asparagoides*
Status	Declared Pest Weed of National Significance
Objective	Aim to eradicate where possible, as a minimum prevent off-site movement
Management Summary	Refer to Aim to eradicate where possible, as a minimum prevent off-site movement for management details 
Control Methods Recommended herbicides (Department of Primary Industries and Regional Development)	Recommended herbicides • Metsulfuron • Glyphosate
Further Information	For other methods of control for the Bridal Creeper, refer to the Weed Management Guide (Weeds Australia, 2024) available online https://weeds.org.au/.

Appendix 2: Main Roads Environment Incident Reporting Form

Environmental and Heritage Incident Reporting Form

This Form is to be completed for **environmental and heritage** incidents when an electronic incident reporting system is unavailable. All fields in the form must be completed. The completed Form must be emailed to: **environmentincidents@mainroads.wa.gov.au**

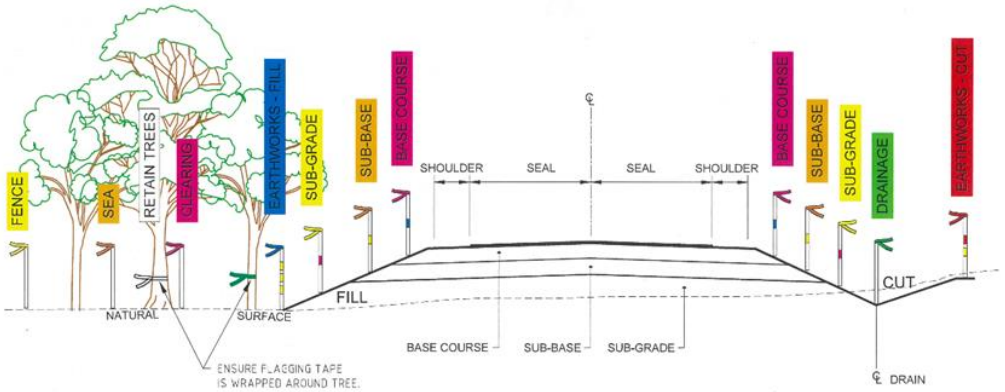
Name and contact details of person reporting the Incident	*Name*	*Phone and Email*			
Organisation Responsible for Managing the Incident	*Insert the Name of the Contractor Organisation, Main Roads or Third Party*				
Name of Main Roads person the Incident was reported to	*Name*	*Phone and Email*			
Main Roads Workgroup (*where the Incident Occurred*)	*This is Main Roads Region. If it has occurred under a Main Roads Contract, also enter the Contract Number. Enter N/A of not known.*				
Location of Incident:	☐ Don Aitken Centre ☐ Heavy Vehicle Services ☐ Materials Engineering Branch ☐ Traffic Operations Centre ☐ Network Operations Centre ☐ Construction Site ☐ Temporary Traffic Management ☐ Journey On Road ☐ Depot ☐ Regional Office ☐ Laboratory ☐ Material Pit ☐ Road Reserve ☐ Offsite or Private Property ☐ Other ☐ N/A				
Name of Main Roads Project Manager:		**Road Name:**			
Project Name:		**Road Number:**			
Contractor:		**Structure Name:**			
EOS No.:		**Structure Number:**			
Date of Incident:		**SLK From:**			
Date and Time Reported:		**SLK To:**			
Environmental Incident (Event Sub Type)	☐ Asbestos containing material intercepted (Natural or man-made) ☐ Contamination intercepted (inherited with site and not Asbestos) ☐ Erosion and sedimentation ☐ Emission of dust / degradation of air quality ☐ Emission of noise / light / vibration ☐ Fire ☐ Impact to Aboriginal heritage site ☐ Impact to Historic heritage site ☐ Impact to Ground or surface water ☐ Impact to Fauna ☐ Impact to Native Title	☐ Impact to Threatened Plants or Ecological Communities ☐ Introduction or spread of weeds, pests, disease ☐ Non-compliance with approval conditions (no environmental impact) ☐ Spill of hydraulic oil ☐ Spill of polluting substance other than hydraulic oil ☐ Spill of grain or canola ☐ Spill of primer or seal in runoff after rainfall ☐ Unauthorised vegetation clearing ☐ Unauthorised waste disposal ☐ Other			
Description of Event: (Insert Short description):	*Insert a title for the incident (i.e.: Duncan Rd SLK 78.33 - Trailer Hydraulic Line Leak.)* **Insert a short description of the incident**				
Describe the Event in detail: attach pictures/maps etc. if you have them:	*Insert step by step description of the incident (including the immediate actions that were undertaken). Please also note the existing controls located at the site.* Outline the environmental approvals and assessment process of the works (if applicable). Outline the contractual governance that the works were delivered under (if applicable). If the incident was a spill indicate approximate volume and advise if the spill was cleaned up. If the incident was clearing of native vegetation advise of the area. **Describe the Event in detail: attach associated documents/pictures/maps and/or provide document TRIM numbers if you have them**				
See Table 1 – Consequence Description					
Actual Consequence	☐ **Insignificant**	☐ **Minor**	☐ **Moderate**	☐ **Major**	☐ **Catastrophic**
See Table 2 and Table 3 for further guidance					
Potential Likelihood	☐ **Almost Certain**	☐ **Likely**	☐ **Possible**	☐ **Unlikely**	☐ **Rare**

Table 1: Qualitative Measures of Consequence					
Level	Rank	Reputation & Trust (Political, Stakeholders and Community)	Business Operations	Environmental	Legal & Compliance
1	INSIGNIFICANT	• Isolated local community or individual's issue-based concerns. • Low profile media attention.	• Some insignificant delays to business activities. • Up to 5% variation in KPI or objective.	• Minimal impact to isolated area. • Simple or no treatment required. • No lasting effect on ecological communities, animal and plant populations it contains, and environmental and heritage values of the area. *i.e.: Contained oil spill in non-sensitive environment.*	• Guidance required for legal/ compliance issues managed through routine procedures. • Legal action unlikely.
2	MINOR	• Local community impacts and concerns. • Occasional once off negative media attention. • Trust issues raised.	• Minor delays to business activities. • 5% to 10% variation in KPI or objective.	• Contained impact. • Rectified with standard treatment. • Short-term residual effect on local ecological communities, animal and plant populations it contains, and environmental and heritage values of the area. *i.e.: Contained oil spills in sensitive environment; Unauthorised clearing (< 10ha) of area with low environmental values.*	• Complex legal/ non-compliance issue to be addressed. • Legal action and /or public liability claim possible.
3	MODERATE	• Sectional community impacts and concerns publicly expressed. • Increased negative media attention. • Loss of confidence and trust by community and stakeholders in Agency processes and capability. • Ministerial concern.	• Some moderate delays to business activities. • 10% - 25% variation in KPI or objective. • One or more projects is significantly impaired.	• Uncontained impact • Rectified in short-medium term. • Medium-term residual effect on local ecological communities, animal and plant populations it contains, and environmental and heritage values of the area. *i.e.: Uncontained spills causing minor pollution; Unauthorised clearing of any sized area of native vegetation that does not contain other significant environmental values; Unauthorised and limited impact to an Aboriginal Heritage or Historic Heritage site; Non-conformance to EMS process, legislation or permit/approval/licence.*	• Non-compliance/s with regulation and/ or probity infringements, which may result in some processes repeated. • Legal action probable.
4	MAJOR	• Considerable and prolonged community impact and dissatisfaction publicly expressed. • Consistent negative media attention. • Criticism and loss of confidence/ trust by community and stakeholders in Agency processes and capability. • Ministerial intervention	• Major delays to activities. • 25% to 50% variation in KPI or objective. • One or more critical programs or projects cannot be delivered.	• Substantial hazardous impact. • Rectified in long-term. • Substantial residual effect on local ecological communities, animal and plant populations it contains, and environmental and heritage values of the area. *i.e.: Unauthorised clearing of native vegetation that has a significant impact to significant environmental values; Major pollution of waterways at local scale; Major unauthorised damage to one or more Aboriginal Heritage or Historic Heritage sites; Major non-compliance with legislation.*	• Major non-compliance with regulation which may result in termination of a process or imposed penalties. • Legal action taken against agency and/ or major public liability claim or potential class action.
5	CATASTROPHIC	• Significant adverse community impacts and condemnation. • Extreme negative media attention. • Consistent ongoing community loss of confidence and trust in Agency capabilities and intentions. • Government intervention.	• Activities ceased. • More than 50% variation in KPI or objective. • Multiple critical programs or projects cannot be delivered.	• Severe uncontained hazardous impact • Requires long-term treatment and monitoring • Severe residual effect on local ecological communities, animal and plant it contains, and environmental and heritage values of the area. *i.e.: Unauthorised clearing of any sized area containing significant environmental value/s where the impacts were understood and the impacts were deliberate; Extensive pollution of waterways at regional scale, Extensive unauthorised damage to one or more Aboriginal Heritage sites; Major non-compliance with legislation.*	• Major non-compliance with legislation and/ or regulation which may result in criminal charges and/ or loss of required accreditation. • Significant legal consequences/ class action against Agency.

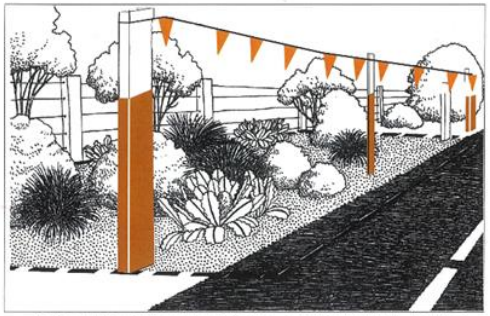
Table 2: Potential Likelihood Ratings		
Rating	Description	Frequency
Rare	The event may occur only in exceptional circumstances	Less than once every 50 years
Unlikely	The event could occur at some time	Once every 10-50 years
Possible	The event might occur at some time	Once every 1-10 years
Likely	**The event will probably occur in most circumstances**	**More than once per year**
Almost certain	The event is expected to occur in most circumstances	More than once per month

Table 3: Potential Risk Rating					
	Consequence				
Likelihood	Insignificant	Minor	Moderate	Major	Catastrophic
Almost Certain	Low 7	High 10	High 15	Very High 20	Very High 25
Likely	Low 4	Medium 8	High 12	Very High 16	Very High 20
Possible	Low 3	Low 6	Medium 9	High 12	High 15
Unlikely	Low 2	Low 4	Low 6	Medium 8	High 10
Rare	Low 1	Low 2	Low 3	Low 4	Low 5

Appendix 3: Construction Peg Colour Code Drawing



DETAIL (1) NTS — PEG COLOUR CROSS SECTION



ROPE FLAGGING FOR SPECIAL ENVIRONMENT AREAS.

DETAIL (2) NTS

TAPES ON PEGS

There are two types of tapes on survey pegs. Flappers and Wraps.

Flappers are the long tapes that blow in the breeze. They are usually at the top of the pegs. They are used to show you what type of peg it is as per below.

YELLOW (outside earthworks)	Fence
ORANGE (outside earthworks)	SEA - Special Environment Area
PINK (in bush)	Clearing peg
PINK (on trees)	Remove tree
WHITE (on tree)	Retain tree
WHITE (on tree) and PINK (on tree limb)	Retain tree Remove limb
GREEN (on tree)	Reuse Vegetation
RED	Earthworks CUT peg
BLUE	Earthworks FILL peg
GREEN	Drainage peg
YELLOW	Sub-grade peg
ORANGE	Sub-base peg
PINK (on pavement)	Basecourse peg

Wraps are the short tied tapes on the pegs and they are used to show the required level to trim to or to reference the level that is needed to be achieved. The different colours are explained below.

BLUE	Finished level of basecourse
YELLOW	Finished level of sub base
PINK	Sub-grade level (can be on earthworks and on sub-grade pegs)
RED	500mm CUT of FILL depending on whether the Flapper is Red or Blue
YELLOW	1 metre CUT or FILL depending on whether the Flapper is Red or Blue

Example 1 - The earthworks peg which has a Red Flapper with a Red & Yellow Wrap means 1.5m CUT and it refers to the next point in from the top of batter, i.e. the drain.

Example 2 - The earthworks peg which has a Blue Flapper with 3 Yellow Wraps means 3m FILL and it refers to the next point in from the toe of batter, i.e. the sub-grade hinge point.

No.	DESCRIPTION	APPROVED & DATE
1.	NOTES ADDED & PROTECTED AREA ROPE FLAGGING DIAGRAM INCLUDED	
2.	ADDED GREEN FLAGGING ON TREE AND AMENDED TABLE TO SHOW NEW FLAGGING DESCRIPTION	

AMENDMENTS

NOTES

1. SETOUT TO FOLLOW THE CONSTRUCTION SURVEYING GUIDELINE ID12P43455S1 ON MAIN ROADS' WEB SITE.
2. FOR CLEARING LINE (PINK) ENSURE SUFFICIENT STAKES/PEGS TO MAINTAIN LINE-OF-SIGHT VISIBILITY, MAXIMUM 40M INTERVAL. INCLUDE STAKES/PEGS AT SIGNIFICANT VERTICES/CHANGES OF DIRECTION.
3. FOR SPECIAL ENVIRONMENT AREAS (SEA - ORANGE) ROPE FLAGGING AS PER DETAIL 2 TO BE INSTALLED ALONG THE LENGTH OF THE SPECIAL ENVIRONMENT AREA.

mainroads WESTERN AUSTRALIA
PLANNING AND TECHNICAL SERVICES DIRECTORATE
ENVIRONMENT BRANCH
Waterloo Crescent
Telephone (08) 9323 4111 East Perth 6004

DESIGNED	B. GRINTER	FEB 2013
DRAWN	A. SZELIGA	FEB 2013
VERIFIED	N. ROWE	01.05.2021
APPROVED	M. SCHELTEMA	01.05.2021
FILE NUMBER	12/3221	MS 15/5/23

STANDARD DRAWING

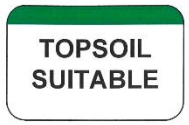
CONSTRUCTION PEG COLOUR CODE

MRWA DRAWING NUMBER 201928-0001-2

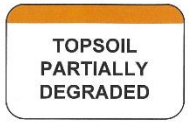
SCALE N.T.S.

SIZE A3

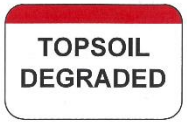
Appendix 4: Indicative Construction Environmental Management Signs



SIGN TYPE A



SIGN TYPE B



SIGN TYPE A

SIGN TYPE A

SIGN TYPE A

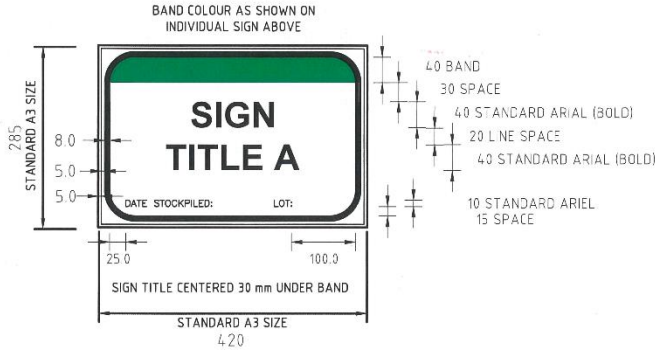
SIGN TYPE B

SIGN TYPE A

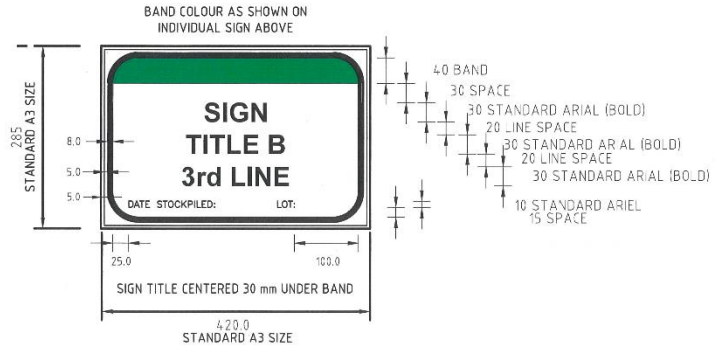
SIGN TYPE A

SIGN TYPE B

SIGN TYPE A



SIGN TYPE B



AMENDMENTS

No.	DESCRIPTION	APPROVED & DATE

NOTES

1. DIMENSIONS
   MEASUREMENTS IN MILLIMETRES
   SIZE 450(W) x 285(H) – STANDARD A3
   CORNER RADIUS = 40
   BORDER = 8
2. COLOURS:
   BLACK LEGEND AND BORDER
   ON WHITE BACKGROUND
   BAND AS PER INDIVIDUAL SIGN
3. MATERIALS:
   SIGN MATERIALS, MANUFACTURE
   AND INSTALLATION TO BE IN
   ACCORDANCE WITH MRWA
   SPECIFICATION 601
4. TEXT FONTS SHALL BE AS PER SHOWN
   ON DRAWING

mainroads WESTERN AUSTRALIA
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ENVIRONMENT BRANCH
Waterloo Crescent EAST PERTH 6004
Telephone 138 138

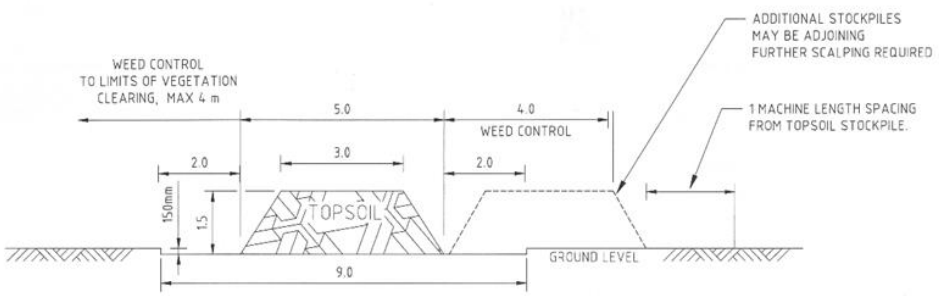
DRAWN	T. OVINGTON
DESIGNED	A. SUTHERLAND
CHECKED	
APPROVED	Martin Sleet 15/5/23
FILE NO	

A3

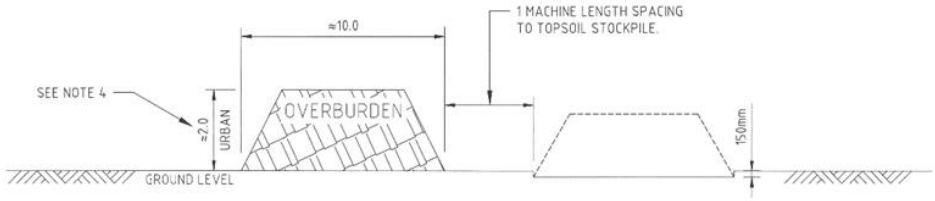
GENERAL SERIES
CONSTRUCTION – ENVIRONMENTAL MANAGEMENT SIGNS

MRWA DRAWING NUMBER: 201928-0007
AMENDMENT:

Appendix 5: Topsoil Management Guideline



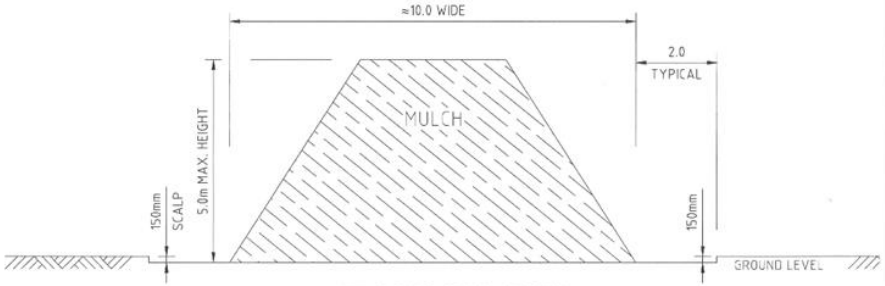
ELEVATION: STOCKPILING OF SITE TOPSOIL
SCALE 1:100



OVERBURDEN CROSS SECTION
SCALE 1:100

NOTES

1. ALL DIMENSIONS ARE IN METRES UNLESS STATED OTHERWISE.
2. MULCH PILES WITH 5 METRE HEIGHT ARE FOR TEMPORARY STORAGE (I.E. DURING MULCHING PROCESS), LOWER HEIGHT REQUIRED FOR LONG TERM STORAGE. DEPARTMENT OF FIRE & EMERGENCY SERVICES (DFES) RECOMMEND THAT MULCH PILES HAVE A MAXIMUM ALLOWABLE LENGTH OF 50 METRES AND WITH A BUFFER ZONE AROUND THEM, TO BE FREE OF VEGETATION FOR SAFETY REASONS IN THE EVENT OF FIRE.
3. DO NOT MIX FRESH 'GREEN MULCH' IN AN EXISTING OLDER, DRY MULCH PILE - CREATE A SEPARATE STOCKPILE FOR THE NEW MULCH.
4. TOPSOIL NOT USED FOR REVEGETATION PURPOSES (I.E. NO NATIVE SEED BANK IN THE SOIL, CAN BE STOCKPILED AS FOR OVERBURDEN.
5. OVERBURDEN HEIGHTS ARE APPROXIMATE, CONSIDERATION OF STOCKPILES IN URBAN AREAS IS FOR SAFETY AND AESTHETICS WHEREAS IN RURAL AREAS CONSIDERATION OF HEIGHT IS PRIMARILY AROUND SAFETY.
6. BEST PRACTICE IS TO STRIP TOPSOIL WHEN THE MATERIAL IS DRY.
7. REFER TO DRAWING 201928-0003 and 201928-0004 FOR ADDITIONAL INFORMATION ON OPENING MATERIAL PITS.
8. STOCKPILES TO BE SIGNED IN ACCORDANCE WITH 201928-0007 - CONSTRUCTION ENVIRONMENTAL MANAGEMENT SIGNS.



MULCH PILE CROSS SECTION
SCALE 1:100

No	DESCRIPTION	APPROVED & DATE
1.	ORDER OF STOCKPILES CHANGED, NEW NOTES ADDED/AMENDED	

AMENDMENTS

CROSS SECTIONS
STOCKPILING IN PITS OR AT LAYDOWNS

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Telephone (08) 9323 4300

DRAWN	A. BERRY
DESIGNED	N. ROWE
VERIFIED	
APPROVED	
FILE NO.	

Martin Schell 24.5.23

GUIDELINE DRAWING
TYPICAL REVEGETATION DETAILS
STOCKPILING IN PITS OR AT LAYDOWNS
TOPSOIL, OVERBURDEN & MULCH

MRWA DRAWING NUMBER: 201928-0002-1
AMENDMENT:

SCALE: 1:100
A3

Appendix 6: Indicative Training Attendance / Site Induction Register

Site Induction / Training Register

Name	Signature	Date
1.		
2.		
3.		
4.		
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28.		

Appendix 7: Indicative Hygiene Inspection Checklist / Clean on Entry Hygiene Form

mainroads WESTERN AUSTRALIA

JUNE 2024

Hygiene Checklist

Vehicles, machinery, trailers, equipment and plant can transport invasive species like *Phytophthora cinnamomi*, pests and weeds into remnant vegetation. This checklist ensures that all vehicles and plant do not arrive or leave Main Roads sites with contaminating material.

Table 1: Project Details

Project Name:			
Region Name:			
Project Number:		**Task Code:**	
Contractor Name:		**Contract Number:**	

Table 2: Vehicle / Machinery / Trailer / Equipment / Plant Details

Date:		**ENTRY or EXIT from site**	*Circle one*
Location of Inspection:			
Owner / Operator:			
Type / Make/ Model:			
Registration Number:			
Odometer / Hour Meter Reading:			

Table 3: Hygiene Checklist

Check the following sections of the Vehicle / Machinery / Trailer / Equipment / Plant, to ensure it is clean and free of vegetative (including weeds and seeds) and soil material.

Item	Type (front, rear, sides)	Not Applicable	Not Clean	Clean
Scrub bar		☐	☐	☐
Air filter		☐	☐	☐
Fenders		☐	☐	☐
Radiator area		☐	☐	☐
Belly plates /underside		☐	☐	☐
Bucket, blade and forks, backhoe attachment , scraper		☐	☐	☐
Rippers		☐	☐	☐
Suspension		☐	☐	☐
Spare wheels		☐	☐	☐
Wheels and tracks, skids		☐	☐	☐
Drill bits		☐	☐	☐
Mud flaps		☐	☐	☐
Flat sections	*Esp. horizontal*	☐	☐	☐
Cupped sections		☐	☐	☐
Chassis areas	*H or C sections*	☐	☐	☐
Hinged points	*Esp. articulated areas e.g. truck, crane, excavator arm*	☐	☐	☐

Item	Type (front, rear, sides)	Not Applicable	Not Clean	Clean
Leaks	*Motor, transmission, hoses, hydraulics to be stuck down, reservoirs*	☐	☐	☐
Spill kits		☐	☐	☐
Fire suppression gear		☐	☐	☐
Trailers		☐	☐	☐
Cargo space		☐	☐	☐
Inside Cabin		☐	☐	☐
Under the Bonnet / Engine Bay		☐	☐	☐
Lights, Bumpers and Accessories e.g. toolboxes, spare tyres.		☐	☐	☐
Hydraulics and any attachments e.g. arms/booms, tynes and rippers, support frames, hydraulic hoses etc.		☐	☐	☐
OTHER COMMENTS ON HYGIENE OF VEHICLE / MACHINERY / TRAILER / EQUIPMENT / PLANT				

INSPECTION SIGN OFF

I declare that the Vehicle / Machinery / Trailer / Equipment / Plant listed above has been thoroughly inspected by myself, and is free of all vegetative and soil material.

Name:			
Company Name:	*(If relevant)*	**Position:**	
Signature:		**Date**	

I concur (different from the person who "declared") that the Vehicle / Machinery / Trailer / Equipment / Plant meets the required hygiene standards and is therefore suitable for entry to/or exit from this site.

Name:			
Company Name:	*(If relevant)*	**Position:**	
Signature:		**Date:**	

OR

This Vehicle / Machinery / Trailer / Equipment / Plant does not meet the required hygiene standards, and is therefore not suitable for entry to or exit from this site until the following areas are further cleaned.

Name:			
Company Name:	*If relevant*	**Position:**	
Signature:		**Date:**	

PHOTOS OF CLEAN VEHICLE/MACHINERY/EQUIPMENT

<Insert photos if required>

Appendix 8: Indicative Hygiene Inspection Register

MAY 2024
D23#179551 (Rev 1)

HYGIENE INSPECTION REGISTER

All vehicles entering a Clean on Entry Point on a Main Roads Construction Site must complete the below vehicle registration to ensure that the vehicle is clean of any material to limit the spread of dieback.

PROJECT DETAILS

Project Name:			
Region Name:			
Contractor Name:		**Contract Number:**	

VEHICLE REGISTRATION & DETAILS

Date:	Time:	Vehicle Registration:	Name:	Organisation:	Hygiene Inspection Checklist

Appendix 3: EPBC Offset Strategy

We're working for Western Australia.

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

Offset Strategy

D24#836178

December 2024

Version Control

Revision	Date	Name	
0	October 2022	GHD	Author
0	October 2022	Main Roads	Reviewer/ Approver
1	March 2024	GHD	Author
1	July 2024	Main Roads	Reviewer/ Approver
2	September 2024	Main Roads	Reviewer/ Approver
3	December 2024	Main Roads	Reviewer/ Approver
4	December 2024	Main Roads	Reviewer/ Approver

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

Contents

List of Tables

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.

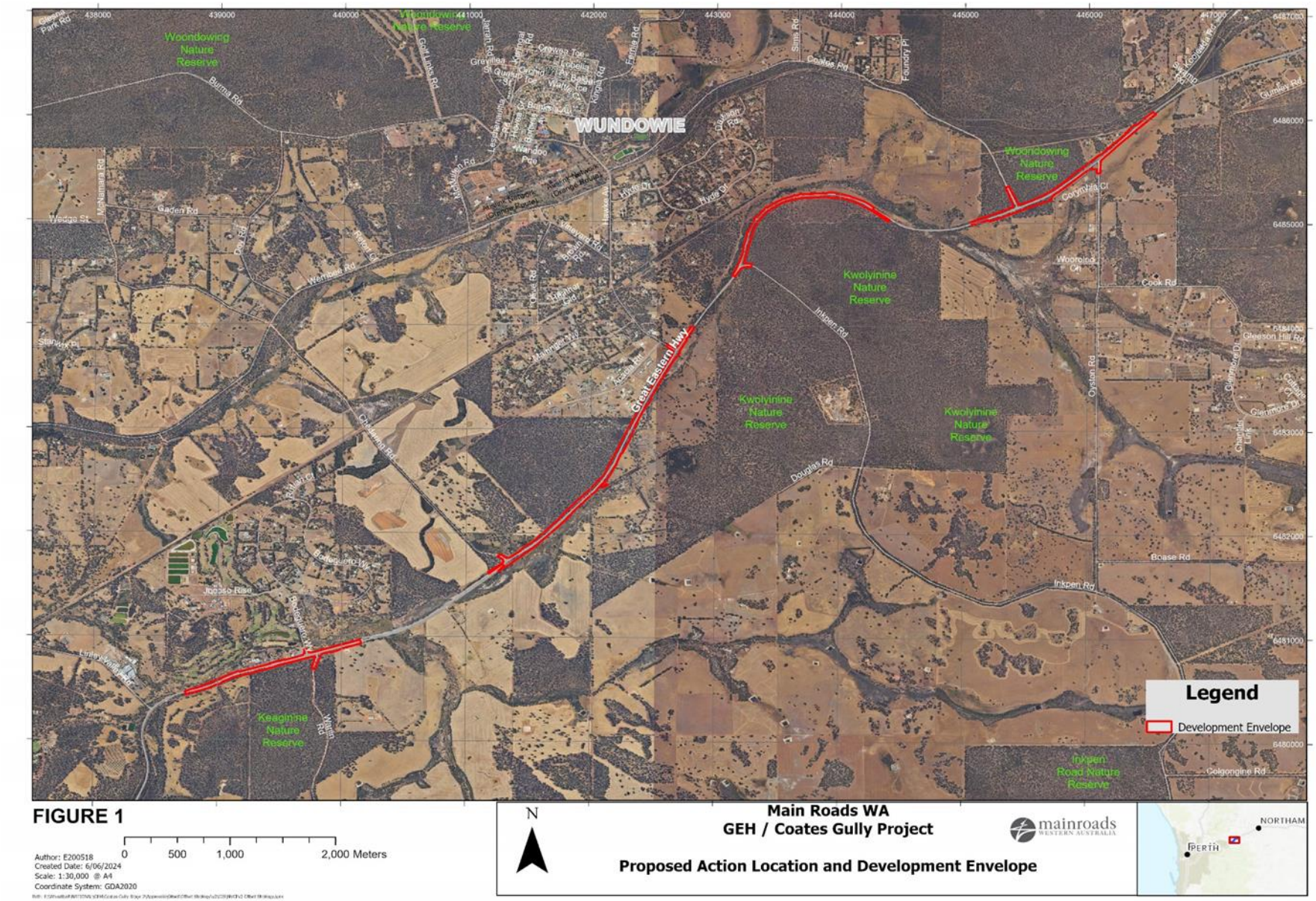

Figure 1 Proposed Action Location and Development Envelope

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**	**3**	**7**
Offset Area Start Quality – 29.1 ha	**1**	**1**	**0**	**2**	**1**	**3**	**4**
Offset Area Future quality with offset – 29.1 ha	**5**	**2**	**1**	**8**	**6**	**3**	**9**

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.

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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

N

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Carnaby's Cockatoo foraging habitat within the Development Envelope

NORTHAM
PERTH

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

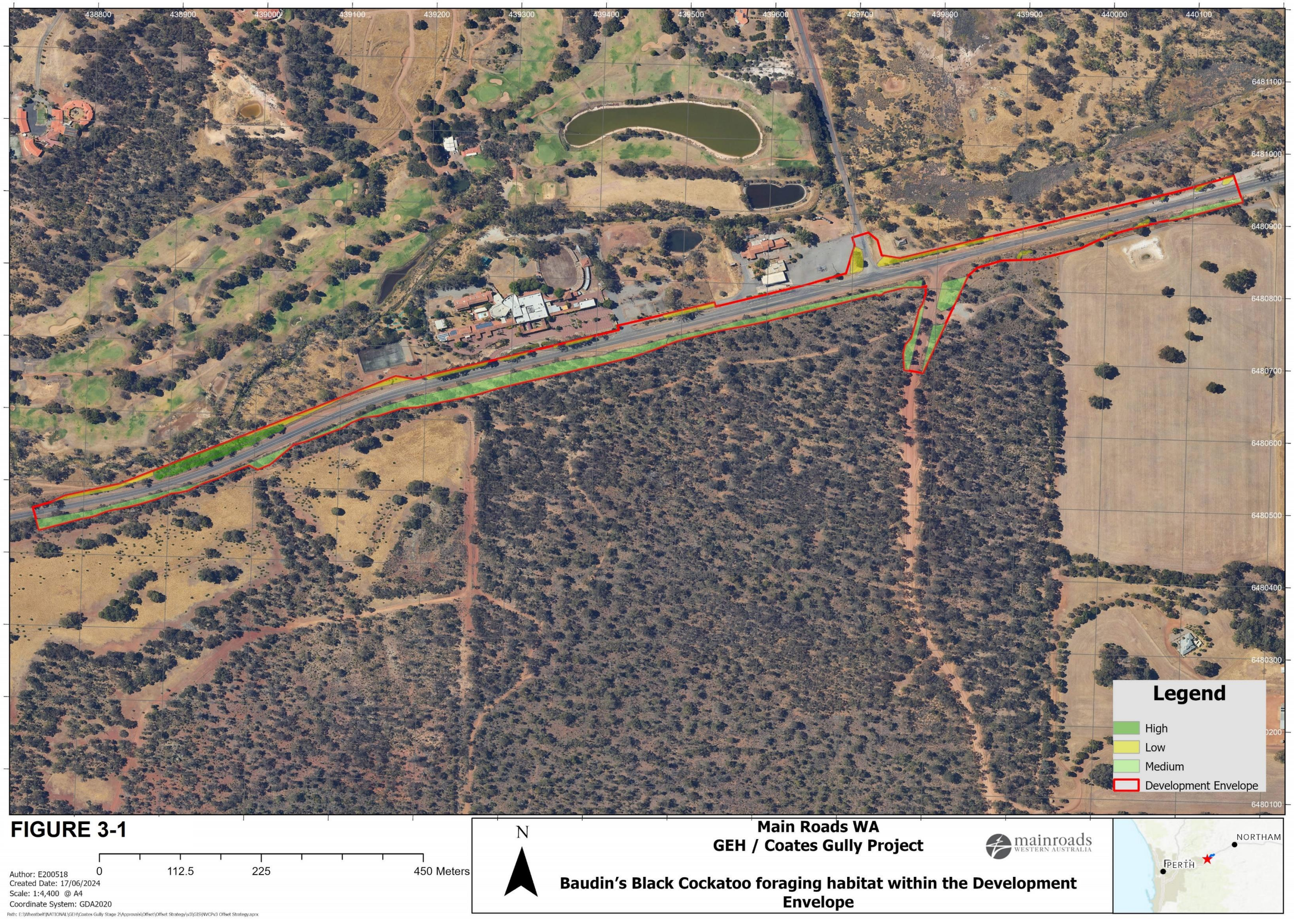

Figure 3-1 Baudin's Cockatoo foraging habitat within the Development Envelope

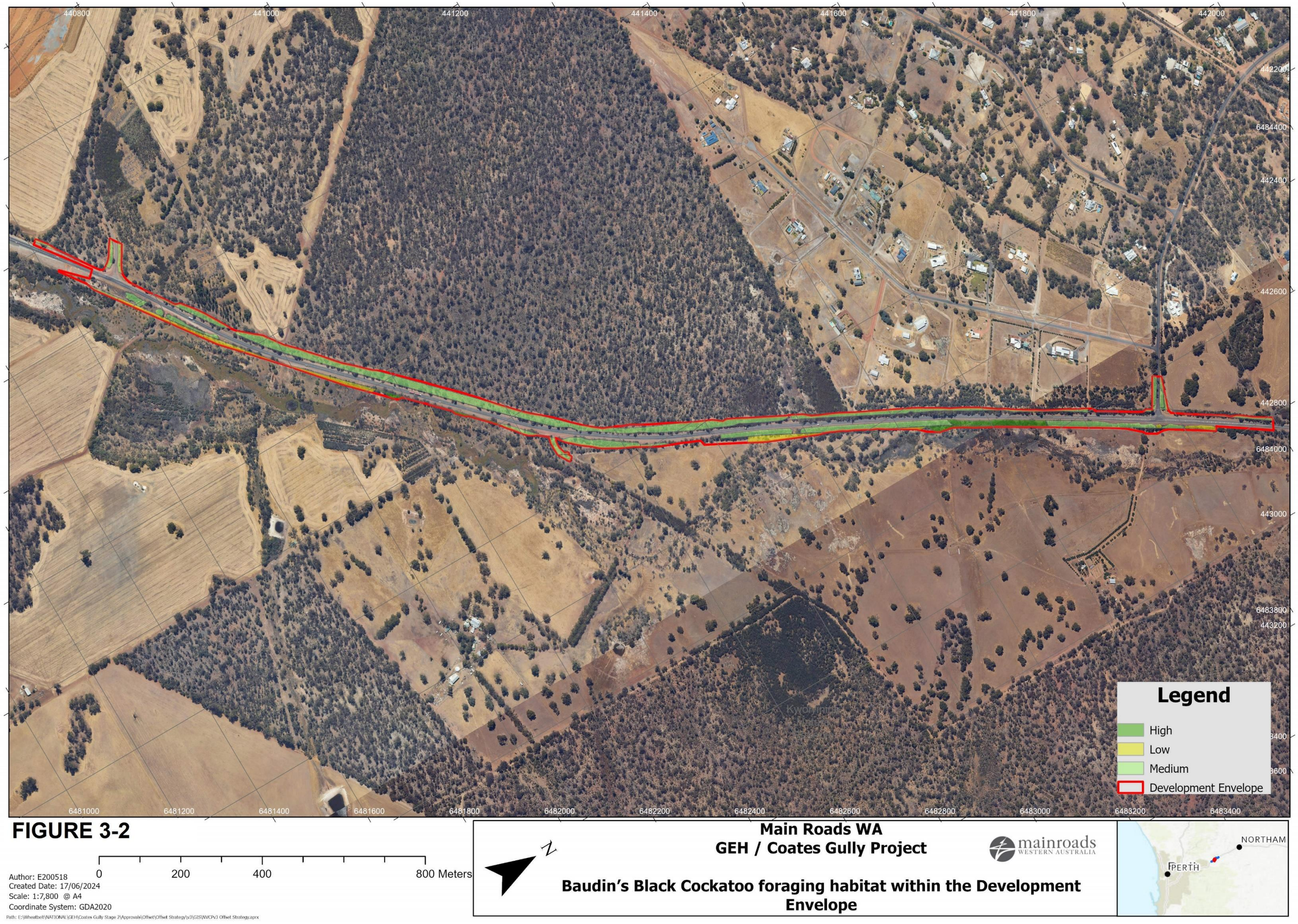

Figure 3-2 Baudin's Cockatoo foraging habitat within the Development Envelope

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

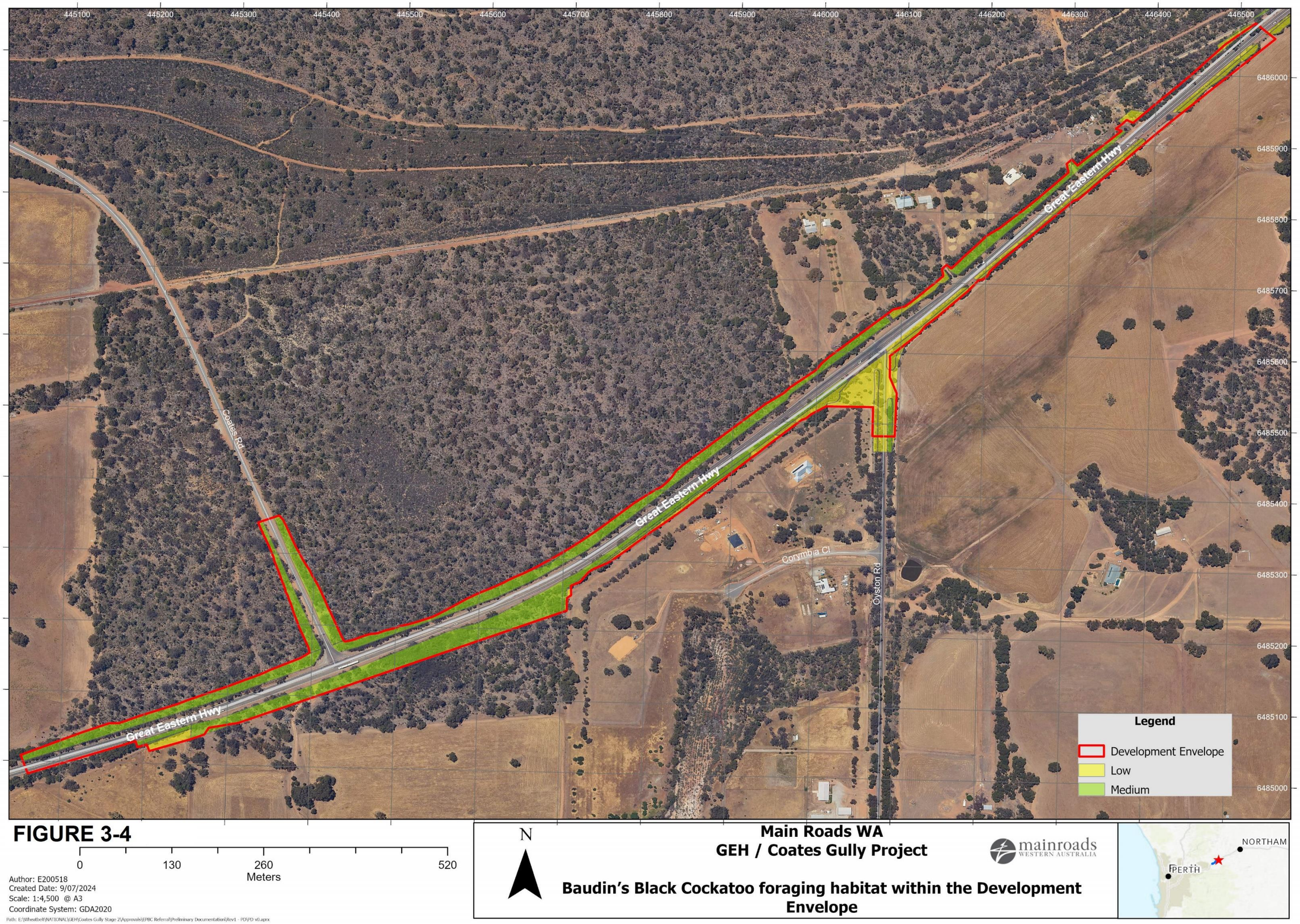

Figure 3-4 Baudin's Cockatoo foraging habitat within the Development Envelope

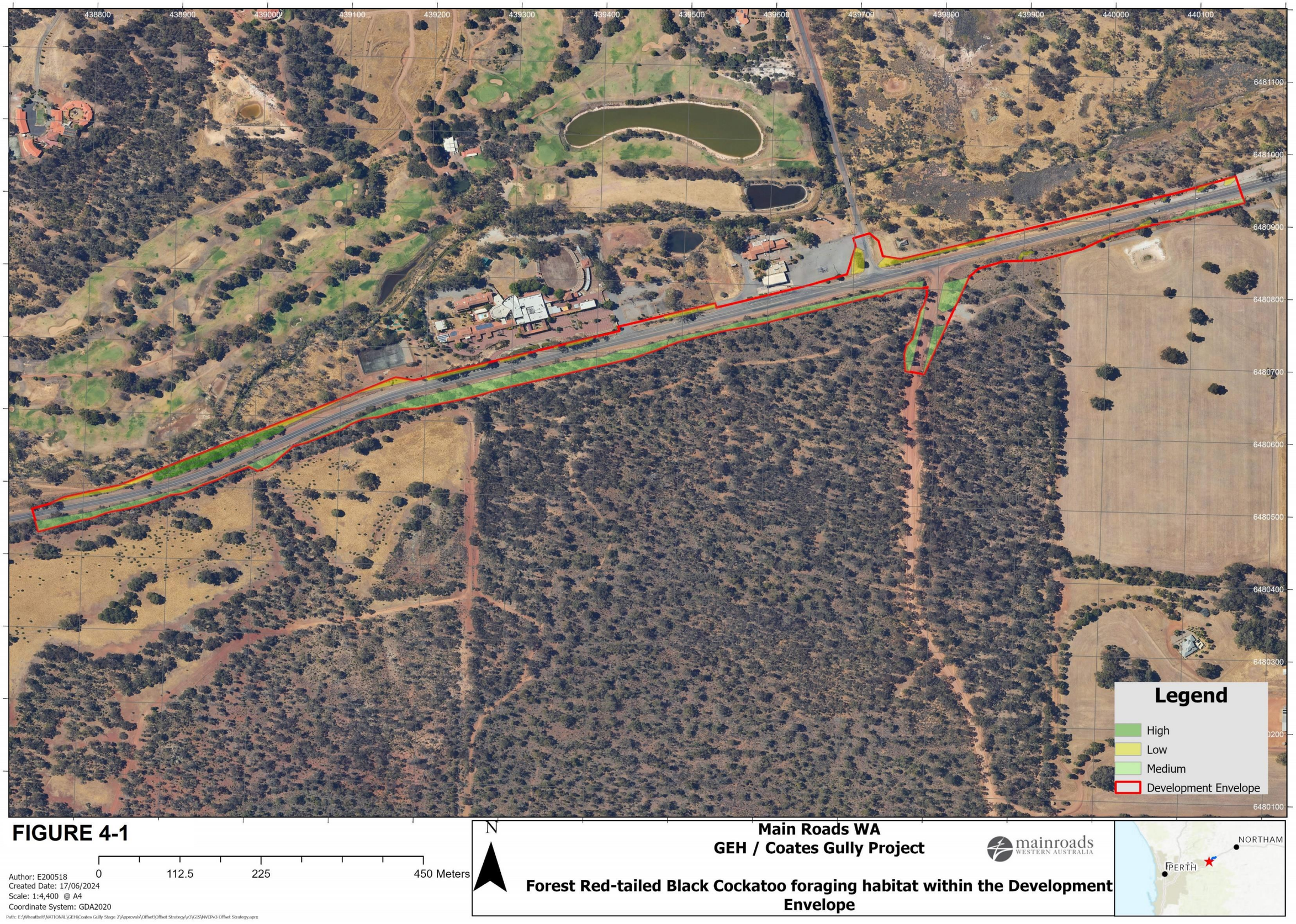

Figure 4-1 Forest Red-tailed Black Cockatoo foraging habitat within the Development Envelope

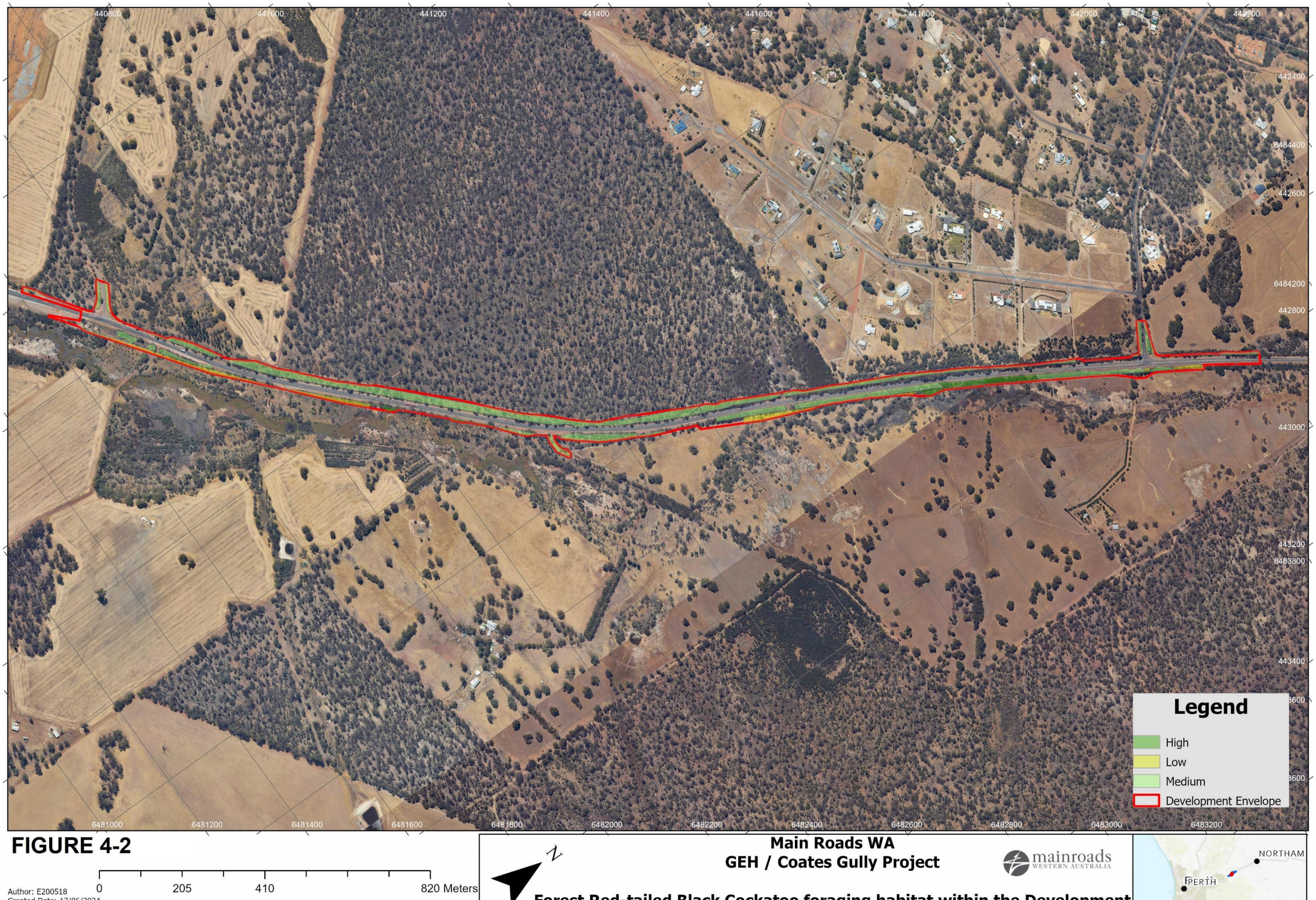

Figure 4-2 Forest Red-tailed Black Cockatoo foraging habitat within the Development Envelope

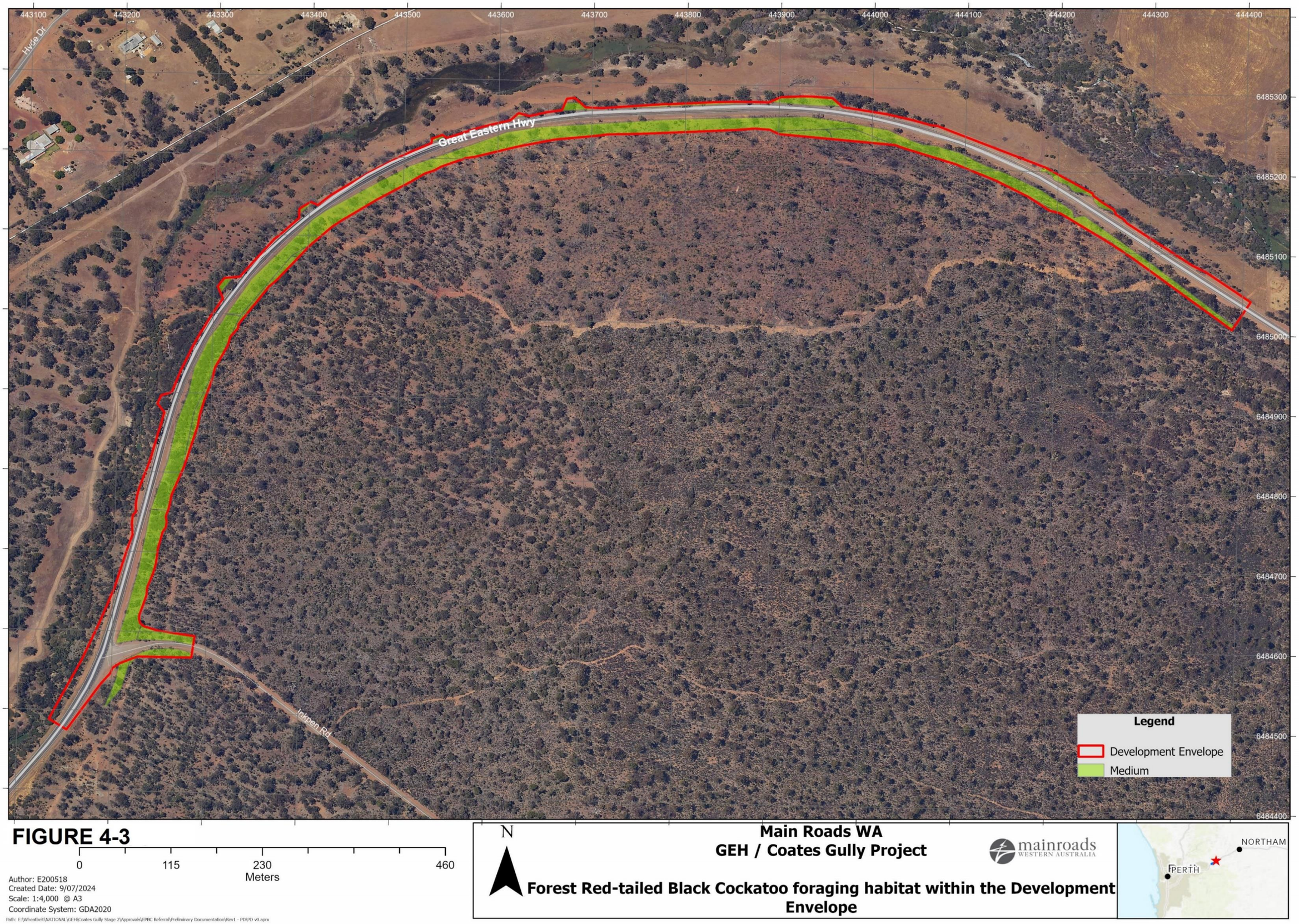

Figure 4-3 Forest Red-tailed Black Cockatoo foraging habitat within the Development Envelope

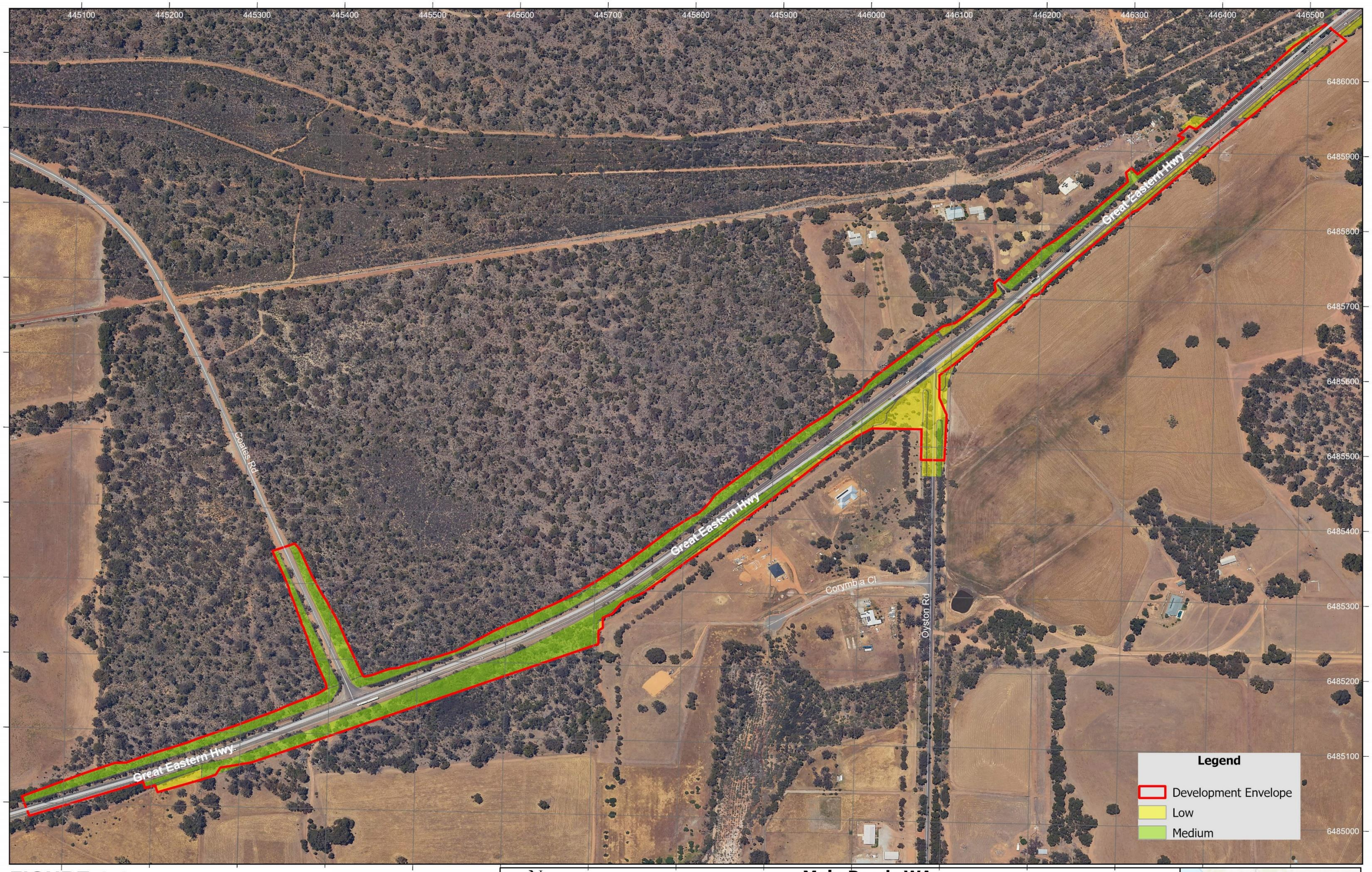

FIGURE 4-4

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

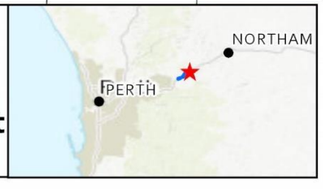

Figure 4-4 Forest Red-tailed Black Cockatoo foraging habitat within the Development Envelope

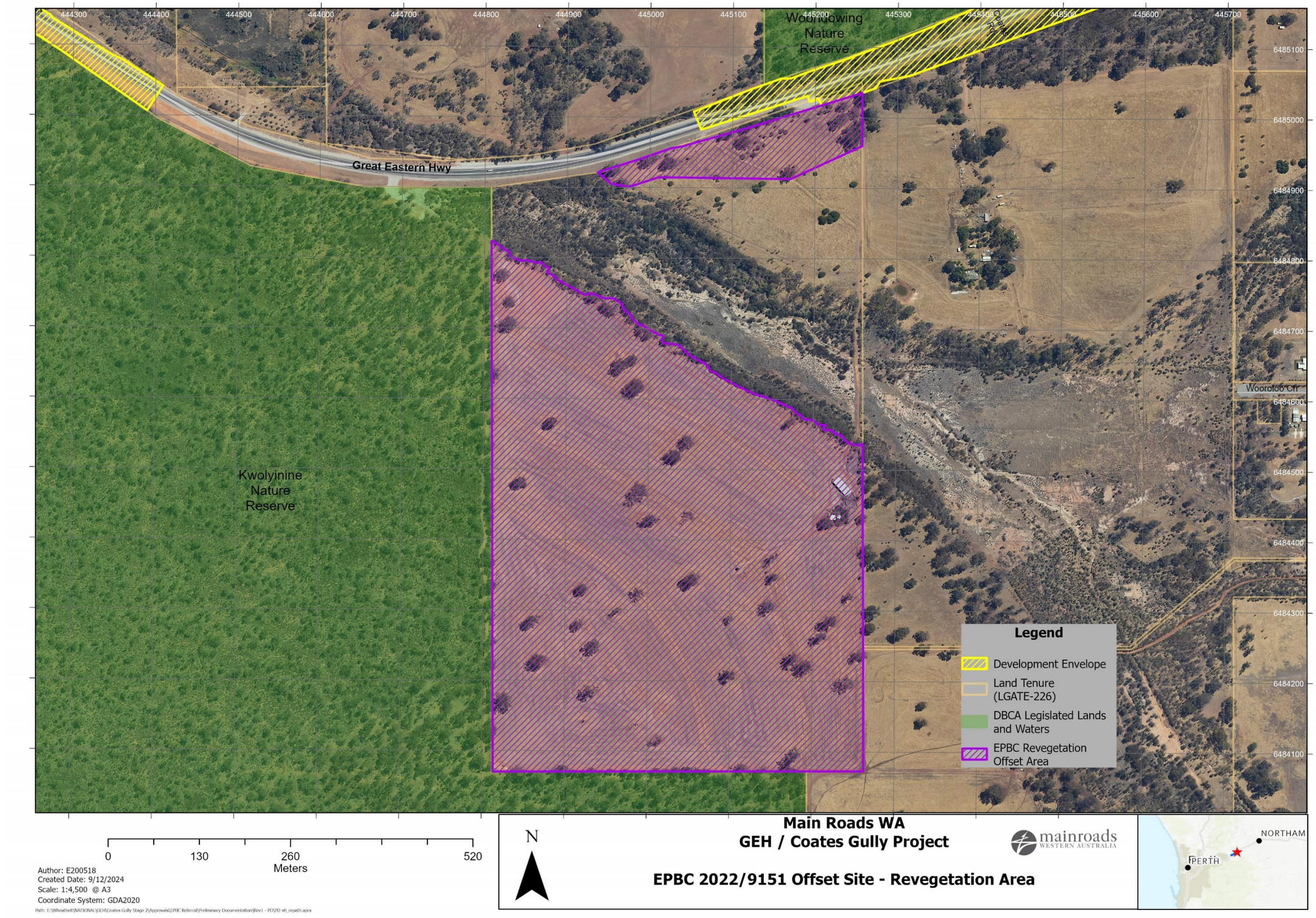

Figure 5-1 Offset Site location Map

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