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Bussell Highway Duplication Stage 2 Hutton to Sabina Section Preliminary Documentation

EPBC 2020/8800

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Amendments

Report Compilation & Review	Name and Position	Document Revision	Date
Author:	Senior Environment Officer	Draft A	13/01/2021
Reviewer:	Senior Environment Officer	Draft B	15/01/2021
Author:	Senior Environment Officer	Rev 0	19/01/2021

1 SUMMARY

Bussell Highway is the main link between Perth, Bunbury and the Busselton – Margaret River area, supporting the tourism, forestry and agricultural industries in the region. It is also an important commuter link for residents who live in the Busselton or Margaret River area and work in the Bunbury or Perth Metropolitan areas.

Of the 46 kilometre (km) portion of the highway between Bunbury and Busselton, 28.15 km is dual carriageway in both directions with the remaining section, located between Capel and the Sabina River east of Busselton, comprising a two-lane single carriageway with passing lanes.

This section of the highway is notorious for being congested, especially during school holidays and weekends.

In 2019, the RAC labelled the Bussell Highway the most dangerous road in regional Western Australia due to its narrow lanes, lack of overtaking opportunities, and lack of a median strip/traffic separation (RAC, 2019).

In the five years from 2015-2019, within the single carriageway section that is the subject of this application, 42 crashes occurred of which 25 resulted in serious injuries and three were fatal. More recently, unfortunately two separate double fatalities have occurred along the highway in November 2020, both also within this area.

To provide dual carriageway access along the entire highway between Bunbury and Busselton, Main Roads Western Australia (Main Roads) is planning to construct a second carriageway along the existing two-lane single carriageway section.

Main Roads recognises the significant environmental values that are present within its road reserves. The ongoing challenge for Main Roads is balancing road user safety, while trying to protect and conserve important environmental values.

To accommodate construction of the second carriageway, 27.3 ha of vegetation is required to be cleared. The majority of vegetation within the proposed Clearing Area is revegetation works undertaken by Main Roads and others, with 75 per cent being in Degraded or worse condition. However, for the purposes of comprehensiveness, and to expedite assessment of the Proposal, Main Roads is considering all vegetation within the proposed Clearing Area as native vegetation.

Clearing for the Proposal will impact upon:

- Habitat for all three EPBC Act-listed Black Cockatoo species ((Carnaby's Cockatoo (*Calyptorhynchus latirostris*), Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*), and Baudin's Cockatoo (*Calyptorhynchus baudinii*)).
- Habitat for Western Ringtail Possum.
- Tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain Threatened Ecological Community (Tuart Woodlands TEC).

The Proposal will result in the following residual impacts:

- Clearing up to 20.8 ha of Black Cockatoo foraging habitat.
- Removal of up to 124 suitable diameter at breast height trees.
- Removal of one tree with a hollow potentially suitable for breeding by Black Cockatoos.
- Clearing up to 24.0 ha of Western Ringtail Possum habitat.
- Clearing up to 2.0 ha of Tuart Woodlands TEC.

2 INTRODUCTION

Bussell Highway is the main link between Perth, Bunbury and the Busselton – Margaret River area, supporting the tourism, forestry and agricultural industries in the region. It is also an important commuter link for residents who live in the Busselton or Margaret River area and work in the Bunbury or Perth Metropolitan areas.

Bussell Highway between Bunbury and Busselton is 46 kilometres (km) in length, 28.15 km of which is dual carriageway in both directions. The remaining section, located between Capel and the Sabina River east of Busselton, is a two-lane single carriageway with passing lanes.

Traffic flow currently exceeds the capacity of the single carriageway section resulting in congestion, delays and safety concerns. With a current traffic growth rate in the order of 5 per cent per annum, periods of congestion on this major rural highway are predicted to become more frequent and longer in duration.

This section of the highway is notorious for being congested, especially during school holidays and weekends.

A 2019 survey compiled by the RAC labelled the Bussell Highway the most dangerous road in regional Western Australia due to its narrow lanes, lack of overtaking opportunities, and lack of a median strip/traffic separation (RAC, 2019).

In the five years from 2015-2019, within the single carriageway section that is the subject of this application, there were 42 accidents of which 25 resulted in serious injuries and 3 were fatal. More recently, unfortunately two separate double fatalities occurred along the highway in November 2020, both also within this area.

To provide dual carriageway access along the entire 46 km portion of the highway between Bunbury and Busselton, Main Roads Western Australia (Main Roads) is planning to construct a second carriageway along the existing single carriageway section (the Bussell Highway Duplication). The purpose of the duplication is to improve the safety for passenger and heavy-haulage vehicles.

The Bussell Highway Duplication will be undertaken in two stages with Stage 1, comprising a 5.55 km distance between Capel and Hutton Road, already under construction.

The Proposal comprises Stage 2, which involves the construction of the remaining 12.8 kilometre (km) two-lane carriageway (southbound) to duplicate the existing carriageway effectively between Hutton Road and the Sabina River bridge (Figure 1), and other road infrastructure, including but not limited to bridges, culverts, lighting, noise barriers, fencing, landscaping, road safety barriers and signs.

The Proposal design has sought to minimise the required clearing through the use of existing cleared areas wherever possible. Approximately 78 per cent of the Proposal Area comprises cleared land.

It is noted that the majority of vegetation within the proposed Clearing Area is revegetation works undertaken by Main Roads and others, and may not be considered to be native vegetation, see Plate 1. However, for the purposes of comprehensiveness, and to expedite assessment of the Proposal, Main Roads is considering all vegetation within the proposed Clearing Area as native vegetation.

The Proposal has been funded by the State (20 per cent) and Commonwealth governments (80 per cent).



Plate 1 Historical aerial photo (circa 1970s) of northern end of Proposal Area – note majority of road reserve having been previously cleared (inset aerial photograph from 2020)

2.1 Purpose and Scope

The Proposal was formally referred to Department of Agriculture, Water and Environment (DAWE) in October 2020 (EPBC Act referral 2020/8800) as a potential Controlled Action under the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) due to impacts on Matters of National Environmental Significance (MNES). On 12 November 2020, DAWE provided advice that the Proposal is considered a Controlled Action and that it would be assessed by preliminary documentation.

The Department considered the proposed action likely to have a significant impact on MNES, specifically:

- Black Cockatoos (Carnaby's cockatoo (*Calyptorhynchus latirostris*) (endangered), Baudin's Cockatoo (*Calyptorhynchus baudinii*) (endangered), (FRTBC (*Calyptorhynchus banksii naso*) (vulnerable)) ('Black Cockatoos').
- Western Ringtail Possum (*Pseudocheirus occidentalis*) (critically endangered) ('WRP').
- Tuart (*Eucalyptus gomphocephala*) forests and woodlands of the Swan Coastal Plain Threatened ecological community (critically endangered) ('Tuart Woodlands TEC').

DAWE requested additional information on the above and other matters to inform assessment of potential impacts of the proposed action (Appendix B).

This document has been prepared to address DAWE's request for further information to support assessment of a controlled action by preliminary documentation. The location of the further information requested is outlined in Section 4.

3 PROPOSAL DESCRIPTION

3.1 Proposal Location

The Proposal Area comprises Bussell Highway between 31.15 and 44.0 straight line kilometres (SLK). It is located approximately 185 km from Perth and at its closest point, approximately 30 km south southwest of Bunbury (Plate 2).

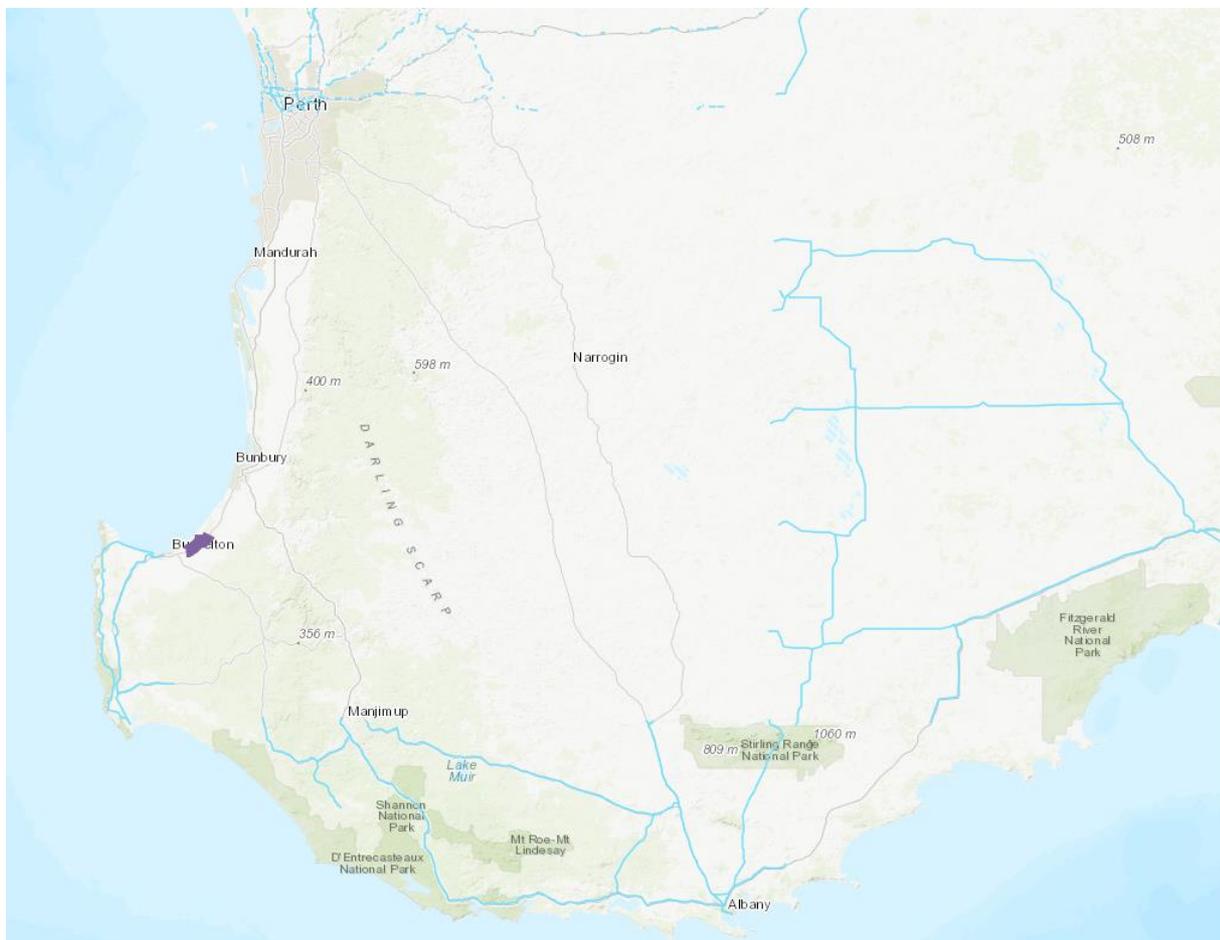


Plate 2 The Proposal Area, shown in purple, is located east of Busselton, 185 km from Perth

3.2 Proposal Summary

The Proposal will upgrade the remaining 12.8 km two-lane carriageway (southbound) section of Bussell Highway to a four-lane highway consisting of two carriageways. Once the new southbound carriageway is constructed, the existing single carriageway will become the northbound carriageway. The new carriageway is expected to be typically 31 m wide and will accommodate:

- A fully sealed 2.5 m wide left shoulder.
- A fully sealed 1.5 m wide right shoulder.
- Two 3.5 m wide lanes.
- Drainage and other infrastructure.

It is anticipated that construction of Stage 2 will commence in June 2021 and be completed in early 2024.

Once completed, the Bussell Highway Duplication Stage 2 will operate as a component of the Bussell Highway providing a dual carriageway link between Bunbury (north) and Busselton (south).

The maximum extent of potential disturbance is 124.9 hectares (ha) (the Proposal Area) (Figure 1, Appendix A). The majority of the Proposal Area is largely Degraded or completely cleared.

Since referral of the Proposal in October 2020, minor adjustments were required to be made to the construction footprint for constructability purposes. Further, in accordance with the conservative approach taken for this Proposal, direct impacts were calculated based on Ecoedge's updated fine scale mapping of vegetation, which resulted in a greater potential impact than was indicated at referral. The proposed Clearing Area within the Proposal Area was determined by overlaying the current road design with all areas that could be considered as containing native vegetation, as mapped by Ecoedge (2020a). This increased the extent of vegetation clearing required for the Proposal from 22.2 ha at referral to 27.3 ha (Figure 2, Appendix A). Of this, the majority (75.1 per cent) was considered to be in Degraded or worse condition. Much of the vegetation to be cleared is comprised of planted mixed native and non-native and/or regrowth vegetation (Main Roads, 1993).

All calculations undertaken in preparation of this document relating to potential impacts resulting from Proposal implementation were assessed against the revised proposed Clearing Area.

As a result of this conservative approach and resulting increase in the proposed Clearing Area, the extent of Black Cockatoo habitat that will be directly impacted by the Proposal has been revised from 18.0 ha at referral to 20.8 ha, and the direct impact to Western Ringtail Possum habitat has also increased, from 20.3 ha to 24 ha.

The Proposal design has sought to minimise the required clearing through the use of existing cleared areas wherever possible. Almost 80 percent of the Proposal Area comprises cleared land.

4 SUMMARY OF PRELIMINARY DOCUMENTATION

A summary of the information requested as part of the Preliminary Document and the corresponding section in this report is provided in Table 4-1.

Table 4-1 Information requested for preliminary documentation

Information requested		
Listed threatened species and ecological communities (s18 & 18A)		
Item	Comment	Section
1.	<p>The Department notes that the proposed action will likely have significant impacts on the endangered Baudin’s Black Cockatoo (<i>Calyptorhynchus baudinii</i>), endangered Carnaby’s Black-Cockatoo (<i>Calyptorhynchus latirostris</i>) and vulnerable Forest Red-tailed Black-Cockatoo (<i>Calyptorhynchus banksii naso</i>) (‘Black Cockatoos’) by removing 18.0 ha of foraging, potential roosting and potential breeding habitat for these species.</p> <p>Please provide the following information so that the Department can further assess the significance of these impacts:</p>	
	<ul style="list-style-type: none"> Additional details, for example as a table, describing the area (in hectares) of each type of foraging habitat in the project area. The most recent relevant vegetation survey by Ecoedge in 2019 provides this type of information but for a larger area than the actual project area. Specifically, the Department wants to know the vegetation composition of the 18.0 ha of foraging habitat proposed to be cleared. For example, Figures 23 to 27 in Ecoedge’s 2019 vegetation survey could be modified to show the areas of each vegetation type. This information should be presented with general information about the vegetation composition of the neighbouring Tuart Forest National Park, noting similarities and differences to the foraging habitat in the project area. 	6.1.1 (Table 6-1)
	<ul style="list-style-type: none"> A discussion of the potential direct and indirect impacts to Black Cockatoos that could arise from loss of foraging habitat. This should refer to the specific vegetation composition as requested above. 	6.1.2 6.1.3
	<ul style="list-style-type: none"> Discussion of any proposed avoidance, mitigation or management measures to be implemented prior to, during and post-clearing to manage potential direct and indirect impacts of the proposed action on Black Cockatoos and their foraging habitat. Demonstrate that the proposed measures are specific, measurable, achievable, realistic and time-bound (SMART). Please include a discussion on the efficacy of the proposed avoidance, mitigation and management measures. 	6.1.4
	<ul style="list-style-type: none"> The proponent may provide this information in an Environmental Management Plan (EMP), however if this is the case, the EMP must be provided to the Department for review. Management plans should be prepared in accordance with the Department’s Environmental Management Plan Guidelines (2014). 	N/A
2.	<p>The Department notes that the proposed action will clear up to 120 potential breeding trees within the project area, of which two trees contain suitable breeding hollows for use by Black Cockatoos. The Department is of the view that all ages and sizes of potential breeding trees are important for maintaining breeding habitat for Black Cockatoos as these trees can provide nest hollows for use in the future.</p> <p>The most recent survey supplied in the referral, undertaken by Greg Harewood in 2018, inspected the two suitable hollows with binoculars from the ground and concluded that neither were recently used by Black Cockatoos.</p>	

	<ul style="list-style-type: none"> Please inspect the two suitable Black Cockatoo hollows with an aerial drone (only if outside of the breeding season) or a camera mounted onto a pole, and report the results in the PD. Specifically, the Department wishes to confirm whether these two hollows are suitable for Black Cockatoo breeding based on their geometries, and whether either shows evidence of use. This survey should re-examine any other potential breeding trees in the same manner if it is suspected that other potential breeding hollows were overlooked in previous surveys. These results should also be included in the PD. If re-inspecting these two hollows is not feasible or possible, the Department may assume that they are suitable for breeding and offsets will likely be required. 	6.1.1, Appendix E
	<p>If the drone/camera-pole hollow examinations confirm that any suitable breeding hollows occur, with or without evidence of use, please provide:</p> <ul style="list-style-type: none"> Further details on any avoidance, mitigation and management measures proposed to reduce this impact prior to, during and/or post construction activities. These details must describe and assess the likely effectiveness of the proposed measures on reducing potential impacts to Black Cockatoo breeding. 	6.1.4
3.	<p>The Department notes that the proposed action is likely to have significant impacts on 20.3 ha of habitat for the critically endangered Western Ringtail Possum (<i>Pseudocheirus occidentalis</i>). Please provide the following information in detail so that the Department can assess the impacts of the proposed action:</p>	
	<ul style="list-style-type: none"> A discussion of the potential direct and indirect impacts to Western Ringtail Possums that could arise during vegetation clearing and from habitat loss. 	6.2.2 6.2.3
	<ul style="list-style-type: none"> Descriptions of any avoidance and mitigation measures to be implemented prior to, during and post-clearing to manage potential direct and indirect impacts of the proposed action on Western Ringtail Possum and their habitat. 	6.2.4
	<ul style="list-style-type: none"> These proposed measures, and how they will be implemented, should be illustrated with clear maps that include any new information regarding Western Ringtail Possum inhabitation and/or use of the project area, including the quality and condition of habitat proposed to be cleared, the location of primary corridors within core and supporting habitat in the project area, and any new Western Ringtail Possum fatalities. 	Appendix A: Figure 6, Figure 7, Figure 8
	<p>If the proposed mitigation measures include developing infrastructure that facilitates fauna movement, please provide:</p> <ul style="list-style-type: none"> Further details regarding the development of this proposed infrastructure, including the intended implementation, the persons responsible and potential effectiveness as a measure to mitigate the impacts on the Western Ringtail Possum. 	6.2.4
4.	<p>The Department notes that the proposed action may have significant impacts on the critically endangered Tuart (<i>Eucalyptus gomphocephala</i>) woodlands and forests of the Swan Coastal Plain ecological community ('Tuart TEC'). However, it is unclear at present whether Tuart TEC occurs in the project area according to the definitions set out in the Approved Conservation Advice (incorporating listing advice) for the Tuart (<i>Eucalyptus gomphocephala</i>) woodlands and forests of the Swan Coastal Plain ecological community ('Tuart TEC CA').</p>	

	<ul style="list-style-type: none"> Please provide the results of a targeted vegetation survey to check whether or not potential occurrences of Tuart TEC in the project area meet the definition of this ecological community as set out in the Tuart TEC CA. The analysis of survey results should count contiguous areas that extend from within the project area into neighbouring vegetation, in accordance with the patch definitions in the Tuart TEC CA. 	6.3.1 Appendix D
	<p>If new survey results show that Tuart TEC occurs in the project area:</p> <ul style="list-style-type: none"> Please discuss any direct and indirect impacts that may occur to Tuart TEC as a result of the proposed action. 	6.3.2 6.3.3
	<ul style="list-style-type: none"> Please describe any avoidance and mitigation measures to be implemented prior to, during and post-clearing/construction to manage potential direct and indirect impacts of the proposed action on Tuart TEC. These proposed measures, and how they will be implemented, should be illustrated with clear maps that include any new information regarding the distribution of Tuart TEC in the project area, including the quality and condition of the Tuart TEC. 	6.3.4
5.	<p>If avoidance, mitigation and management measures are contained within an Environmental Management Plan (EMP), please provide a copy of the proposed EMP. Please also provide any other relevant management plans that include avoidance and mitigation measures proposed in the referral documentation in relation to vegetation clearing, native fauna, dieback and weed control, for the Department's review. Management plans should be prepared in accordance with the Department's <i>Environmental Management Plan Guidelines</i> (2014).</p>	N/A
6.	<p>The Department is of the view that the proposed action will likely have the following significant impacts:</p> <ul style="list-style-type: none"> clearing 20.3 ha of Western Ringtail Possum habitat; and clearing 18.0 ha of foraging, potential roosting, and potential breeding habitat for Black Cockatoos. <p>The Department is also of the view that the proposed action may:</p> <ul style="list-style-type: none"> clear potential occurrences of Tuart TEC. <p>Avoidance and mitigation measures to these protected matters should demonstrate that the action is not inconsistent with relevant recovery plans and threat abatement plans and has regard to relevant conservation advice, including but not limited to the following documents.</p> <ul style="list-style-type: none"> Threatened Species Scientific Committee (2018). Conservation Advice <i>Calyptorhynchus baudinii</i> Baudin's cockatoo. Canberra: Department of the Environment and Energy. Department of Parks and Wildlife (2013). Carnaby's Cockatoo (<i>Calyptorhynchus latirostris</i>) Recovery Plan. Perth: Western Australia Department of Parks and Wildlife. Department of the Environment, Water, Heritage and the Arts (2009). Approved Conservation Advice for <i>Calyptorhynchus banksii naso</i> (Forest Red-tailed Black Cockatoo). Canberra: Department of the Environment, Water, Heritage and the Arts. Chapman, T. (2008). Forest Black Cockatoo (Baudin's Cockatoo <i>Calyptorhynchus baudinii</i> and Forest Redtailed Black Cockatoo <i>Calyptorhynchus banksii naso</i>) Recovery Plan. Department of Environment and Conservation, Western Australia. 	6.1.4 6.2.4 6.3.4

	<ul style="list-style-type: none"> • Department of the Environment and Energy (2018). Threat abatement plan for disease in natural ecosystems caused by <i>Phytophthora cinnamomi</i>. Canberra: Commonwealth of Australia. • Department of the Environment and Energy (2019). Approved Conservation Advice (incorporating listing advice) for the Tuart (<i>Eucalyptus gomphocephala</i>) woodlands and forests of the Swan Coastal Plain ecological community. Canberra: Department of the Environment and Energy. • Threatened Species Scientific Committee (2018). Conservation Advice <i>Pseudocheirus occidentalis</i> Western ringtail possum. Canberra: Department of the Environment and Energy. • Department of Parks and Wildlife (2017). Western Ringtail Possum (<i>Pseudocheirus occidentalis</i>) Recovery Plan. Wildlife Management Program No. 58. Perth: Western Australia Department of Parks and Wildlife. • Department of the Environment (2015). Threat abatement plan for predation by feral cats. Canberra: Department of the Environment. • Department of the Environment, Water, Heritage and the Arts (2008). Threat abatement plan for predation by the European red fox. Canberra: Department of the Environment, Water, Heritage and the Arts. <p>Any surveys required to obtain information requested in this document should be undertaken in accordance with relevant survey guidelines, including:</p> <ul style="list-style-type: none"> • Department of Sustainability, Environment, Water, Population and Communities (2011). Survey guidelines for Australia's threatened mammals: Guidelines for detecting mammals listed as threatened under the EPBC Act. Canberra: Department of Sustainability, Environment, Water, Population and Communities. • Department of the Environment, Water, Heritage and the Arts (2010). Survey guidelines for Australia's threatened birds: Guidelines for detecting birds listed as threatened under the EPBC Act. Canberra: Department of the Environment, Water, Heritage and the Arts. 	
7.	<p>The proponent should provide whatever details are necessary to demonstrate whether or not residual significant impacts are likely to occur to the Western Ringtail Possum, Black Cockatoos and Tuart TEC (if present) after all proposed avoidance, mitigation and management measures are implemented.</p> <p>If residual significant impacts are likely, then compensatory offset measures will be required. Information required regarding offsets is stated below, after all controlling provisions are listed.</p>	6.1.3, 6.1.4 6.2.3, 6.2.4 6.3.3, 6.3.4
Ramsar wetlands		
8.	<p>The Department is of the view that the proposed action may have a significant impact on the Vasse-Wonnerup Ramsar wetland, located 500 m northwest of the project area. Potential impacts are considered most likely to arise through altered hydrological regimes and run-off water contamination (sediment, hydrocarbon spills, etc.) that enter the Ludlow, Abba and Sabina rivers that flow into the Vasse-Wonnerup Ramsar wetland. Please discuss the potential direct and indirect impacts to the Vasse-Wonnerup Ramsar wetland that could result from the proposed action.</p> <p>Please discuss all proposed avoidance and mitigation measures to be implemented prior to, during and post-clearing/construction to manage potential direct and indirect impacts, including those listed in the referral documentation, against the listing criteria for the Vasse-Wonnerup Ramsar wetland, which are:</p> <ul style="list-style-type: none"> • Criterion 5: More than 33,000 waterbirds have been counted at the Vasse-Wonnerup System. Waterbird data indicate that more than 20,000 waterbirds 	Appendix F

	<p>use the Ramsar site each year, suggesting that the wetland regularly supports 20,000 waterfowl. This includes species such as the Red-necked Avocet (<i>Recurvirostra novaehollandiae</i>), Black-winged Stilt (<i>Himantopus himantopus</i>), Wood Sandpiper (<i>Tringa glareola</i>), Sharp-tailed Sandpiper (<i>Calidris acuminata</i>), Long-toed Stint (<i>Calidris subminuta</i>), Curlew Sandpiper (<i>Calidris ferruginea</i>) and Common Greenshank (<i>Tringa nebularia</i>).</p> <ul style="list-style-type: none"> • Criterion 6: At least 1 per cent of the Australian population of Black-winged Stilt and at least 1 per cent of the world population of Red-necked Avocet use Vasse-Wonnerup System in most years. <p>The proponent’s response may benefit from declaring certain carriageway design characteristics implied in the referral, but not stated explicitly. For example, the bridge reports by AECOM Australia Pty Ltd which show that the proposed second carriageway will be constructed on south-eastern side of the Bussell Highway, furthest from the Ramsar wetland.</p> <p>Please provide the above information in the form of a management plan, prepared in accordance with the Environmental Management Plan Guidelines (2014), that conforms to the SMART principles (Specific, Measurable, Achievable, Relevant and Time-bound). This management plan must have regard to the information contained on the Department’s Australian Wetlands Database profile for the Vasse-Wonnerup Ramsar wetland. Specific documents are found under the “More Information” tab, including the Ramsar Information Sheet (RIS).</p>	
Listed migratory species (s20 & 20A)		
9.	<p>The Department is of the view that if impacts occur to the Vasse-Wonnerup Ramsar wetland, the proposed action may indirectly impact on listed migratory species, including the Red-necked Stint (<i>Calidris ruficollis</i>).</p> <p>Please provide evidence that the proposed action will not cause significant residual impacts to listed migratory species, including the Red-necked Stint. It would be sufficient to demonstrate that impacts will not occur to the Vasse-Wonnerup Ramsar wetland when appropriate avoidance and mitigation measures are implemented, and therefore indirect impacts to migratory species would be unlikely. Alternatively, surveys may be conducted to confirm/deny presence.</p>	6.4.1, 6.4.2, 6.4.3, 6.4.4
10.	<p>The proponent’s response regarding whether significant residual impacts are likely to occur to listed migratory species should have regard to the following statutory documents and information:</p> <ul style="list-style-type: none"> • Commonwealth of Australia (2015). Wildlife Conservation Plan for Migratory Shorebirds. Canberra: Department of the Environment. • Other relevant species-specific information, such as on the Red-necked Stint, available on the Department’s Species Profile and Threats Database (SPRAT). 	6.4.3, 6.4.4
Offsets		
11.	<p>Please provide details of all compensatory measures (i.e. environmental offsets) proposed to compensate for the residual significant impacts on EPBC Act listed threatened species and communities, including:</p> <ul style="list-style-type: none"> • The type of offsets proposed; • Extent to which the proposed offset actions correlate to, and adequately compensate for, EPBC Act listed species and communities; • Suitability of the location of any proposed offset site for EPBC Act listed species and communities, including evidence of the presence of, or usage by, relevant protected matters; 	7

	<ul style="list-style-type: none"> • Conservation gain to be achieved by the offset i.e. positive management strategies that improve the site or averting the future loss, degradation or damage of the protected matters; • Time it will take to achieve the proposed conservation gain; • Level of certainty that the proposed offset will be successful; and • Current land tenure of any proposed land-based offset and the method of securing and managing that offset. 	
12.	Demonstrate how any proposed offset is consistent with the Department's <i>EPBC Act Environmental Offsets Policy</i> (October 2012), and provide a completed offsets assessment guide (Excel spreadsheet available on the Department's website), and justifications for figures used to complete the offsets assessment guide.	7
Economic and social matters		
13.	Please provide further details on the social and economic costs and/or benefits of undertaking the proposed action, including: <ul style="list-style-type: none"> • Estimates of any anticipated economic costs and/or benefits (in AUD); 	9.1
	<ul style="list-style-type: none"> • Explanations for any estimations of costs and/or benefits; 	
	<ul style="list-style-type: none"> • Potential employment opportunities expected to be generated at each phase of the proposed action; 	
	<ul style="list-style-type: none"> • Key benefits and disadvantages of constructing a second carriageway on the Bussell Highway between Hutton and Sabina; and 	9.2
	<ul style="list-style-type: none"> • Details of any public and stakeholder consultation activities, including the outcomes. 	9.3
Project timeline		
14.	Please provide further details on the timeline of the proposed action, including but not limited to the following stages: <ul style="list-style-type: none"> • The proponent's ambitions for the timeline of the overall EPBC assessment process, noting the 40 days provided for a final decision after the final PD is received by the Department (or 30 days if Major Project status applies); • The proponent's ambitions for the timeline of state assessment with the WA Department of Water and Environmental Regulation/Environment Protection Authority; and • The timeline of the proposed action, including when it will ideally commence, and the timings and duration of vegetation clearing, substrate construction, road construction and any post-construction environmental remediation activities. 	10

5 BIOLOGICAL SURVEYS

Flora and Vegetation

Detailed and Targeted flora and vegetation surveys were undertaken by Ecoedge in 2013, 2014, 2016, 2018 and covered an approximate area of 72.4 ha. A supplementary survey was subsequently conducted in 2020 over approximately 1.5 ha of previously unsurveyed areas. A report compiling the results of this and previous flora and vegetation surveys was then prepared (Ecoedge, 2020a) (Appendix C). Further surveys to map occurrences of Tuart Woodlands TEC were also undertaken by Ecoedge in 2020 (Ecoedge, 2020b) (Appendix D).

Phytophthora Dieback

Gleван conducted a *Phytophthora* Dieback (Dieback) survey in 2016 (Gleван Consulting, 2016). Their survey area covered portions of the existing Bussell Highway road reserve and additional land at side road intersections, and totalled 72.6 ha.

Great Southern Biologic (2020) conducted a further survey in 2020 over a 135.4 ha survey area that covered the existing Bussell Highway road reserve and additional land at side road intersections, and included the Proposal Area.

Fauna

360 Environmental conducted fauna field surveys that identified the presence of habitat for WRP and Black Cockatoos (2016a; 2016b). A follow up Level 1 fauna survey and targeted WRP and Black Cockatoo habitat survey was then undertaken in 2017 (360 Environmental, 2017), covering an approximately 80 ha survey area.

In 2018, targeted WRP and Black Cockatoos fauna surveys were undertaken, covering an area of 72.4 ha (Harewood, 2018). A further assessment for WRP was conducted by Biota Environmental Sciences (Biota) in 2020 that covered a survey area of 175 ha that generally extended 50 m each side of the centerline of the existing Bussell Highway and side roads within the Proposal Area (Biota, 2020a).

An additional fauna survey was undertaken in November 2020 (Main Roads, 2020) to ensure all key vegetated areas within the proposed Clearing Area had been assessed.

A survey to inspect two hollows potentially suitable for use by Black Cockatoos was conducted in 2020 by SW Environmental (SW Environmental, 2020) (Appendix E).

6 LISTED THREATENED SPECIES AND ECOLOGICAL COMMUNITIES

6.1 Black Cockatoos

6.1.1 Description and Habitat

Three species of Black Cockatoo were either recorded within or may utilise the Proposal Area habitat, being Carnaby's Cockatoo (*Calyptorhynchus latirostris*, endangered), Baudin's Cockatoo (*Calyptorhynchus baudinii*, endangered) and the Forest red-tailed Black Cockatoo (FRTBC) (*Calyptorhynchus banksii naso*, vulnerable).

Foraging Habitat Requirements

The referral guidelines for Black Cockatoos (DSEWPaC, 2012a) describes the foraging habitat of the three species of Black Cockatoo as follows:

- Baudin's Cockatoo forages in Eucalypt woodlands and forest, and proteaceous woodland and heath. During the breeding season feed primarily on native vegetation, particularly marri. Outside the breeding season, may feed in fruit orchards (mostly apple and pear, but also persimmon) and tips of *Pinus* spp.
- Carnaby's Cockatoo forages in native shrubland, kwongan heathland and woodland dominated by proteaceous plant species, as well as in pine plantations (*Pinus* spp.), and eucalypt woodland and forest that contains foraging species. It will also feed in individual trees and small stands of these species.
- The FRTBC forages in Jarrah and marri woodlands and forest, and the edges of karri forests including wandoo and blackbutt, within the range of the subspecies.

Habitat within the proposed Clearing Area

360 Environmental (2017) recorded two broad fauna habitat types within the proposed Clearing Area, both of which represent Black Cockatoo habitat (Figure 3, Appendix A):

- Remnant Vegetation: comprising Marri, Tuart and Flooded Gum over a midstorey that varied along the length of the Proposal Area and included *Acacia* sp., *Banksia* sp., Christmas Tree, Peppermint, Spearwood, *Jacksonia* sp., *Melaleuca* sp., and *Xanthorrhoea* sp., over a relatively sparse understorey of mixed herbs and grasses. There were also some small sections that consisted almost entirely of large old Peppermints with no midstorey species and a weedy grass understorey.
- Regrowth Vegetation: comprising a mix of many species and with a similar broad composition to the Remnant Vegetation habitat in some sections.

Ecoedge recorded thirteen vegetation units within the proposed Clearing Area (Figure 4, Appendix A). Unfortunately, Ecoedge's fine scale vegetation unit mapping does not correspond neatly with the fauna habitat mapping of 360 Environmental. 360 Environmental mapped 20.8 ha of Black Cockatoo habitat in the two broad types described above. Only 18.4 ha of this was mapped as vegetation by Ecoedge, due to variances in base aerial photography and digitisation of polygons, as well as these surveys being undertaken several years apart. In order to utilise the finer scale, more detailed mapping of Ecoedge, vegetation unit information has been extrapolated across the 20.8 ha of habitat mapped by 360 Environmental on a percentage basis. The resulting detailed description of foraging habitat and extent within the proposed Clearing Area is listed in Table 6-1.

As noted in Section 3.2, due to the requirement for minor adjustments to the Proposal Area for constructability purposes, the extent of Black Cockatoo habitat that will be impacted by the Proposal has been revised from 18.0 ha at referral to 20.8 ha.

Table 6-1 Description and extent of Black Cockatoo habitat within the Proposal Area

Vegetation unit (Ecoedge, 2020a)	Description	Extent in proposed Clearing Area
A1	<u>Peppermint-Tuart Woodland</u> . <i>Agonis flexuosa</i> low woodland/low open woodland with scattered <i>Eucalyptus gomphocephala</i> or <i>E. cornuta</i> or * <i>Pinus pinaster</i> over <i>Kunzea glabrescens</i> , (* <i>Acacia longifolia</i>) shrubland/open shrubland over introduced herbs and grasses including * <i>Lupinus angustifolius</i> , * <i>Ehrharta calycina</i> and * <i>E. longifolia</i> on grey-brown sand/sandy loam or yellow-grey sand. [Quindalup <i>Eucalyptus gomphocephala</i> and/or <i>Agonis flexuosa</i> woodlands ('community type 30b')] (Completely degraded)	Mapped extent: 1.1 ha Mapped percentage: 6% Extrapolated extent: 1.2 ha
A2	<u>Yate-Tuart-Peppermint Woodland</u> . <i>Eucalyptus cornuta</i> , <i>Agonis flexuosa</i> mid-height woodland with isolated tall trees of <i>E. gomphocephala</i> over forbland including * <i>Lupinus angustifolius</i> and grassland of * <i>Ehrharta calycina</i> and * <i>E. longifolia</i> on grey-brown sand/sandy loam or yellow-grey sand. (Completely degraded)	Mapped extent: 0.5 ha Mapped percentage: 2.7% Extrapolated extent: 0.6 ha
B	<u>Flooded Gum-Marri Woodland to Very Open Woodland</u> : <i>Eucalyptus rudis</i> subsp. <i>cratyantha</i> or <i>Corymbia calophylla</i> mid-height woodland/open forest over <i>Agonis flexuosa</i> , <i>Melaleuca preissii</i> low open woodland with occasional <i>M. raphiophylla</i> over <i>Acacia saligna</i> , <i>Astartea</i> sp., <i>Melaleuca viminea</i> open shrubland over introduced forbs and grasses including * <i>Ehrharta calycina</i> on grey-brown sandyloam or loam. (Degraded - Good)	Mapped extent: 3.3 ha Mapped percentage: 17.9% Extrapolated extent: 3.7 ha
C	<u>Marri Woodland</u> : <i>Corymbia calophylla</i> mid-height woodland (sometimes with <i>Melaleuca raphiophylla</i>) over * <i>Acacia</i> spp., <i>Hibbertia cuneiformis</i> , <i>Kunzea glabrescens</i> , (<i>Spyridium globulosum</i>) mid-height shrubland over * <i>Ehrharta calycina</i> , * <i>Eragrostis curvula</i> grassland and * <i>Zantedeschia aethiopica</i> open forbland on grey-brown or yellow-brown sand or sandy loam. (Completely degraded - Degraded)	Mapped extent: 0.6 ha Mapped percentage: 3.3% Extrapolated extent: 0.7 ha
D	* <i>Acacia</i> spp., <i>Kunzea glabrescens</i> tall shrubland/tall open shrubland/tall sparse shrubland (sometimes with emergent <i>Agonis flexuosa</i> or <i>Melaleuca preissiana</i>) over <i>Adenanthos meisneri</i> , <i>Gastrolobium praemorsum</i> , <i>Jacksonia furcellata</i> , <i>Kunzea recurva</i> , (<i>Leucopogon conostephioides</i>), <i>Melaleuca viminea</i> , (<i>Verticordia</i> sp., <i>Viminaria juncea</i>) low shrubland over <i>Loxocarya cinerea</i> and introduced herbs and grasses on grey or yellow-brown sand. (Revegetated mined areas and road embankments; is sometimes a tall shrubland/open shrubland dominated solely by <i>K. glabrescens</i>). (Completely degraded - Good)	Mapped extent: 6.8 ha Mapped percentage: 37.0% Extrapolated extent: 7.7 ha
E1	<u>Marri-Jarrah-Nuytsia Open Forest</u> : <i>Corymbia calophylla</i> , (<i>Eucalyptus marginata</i> , <i>Nuytsia floribunda</i>) mid-height open forest over <i>Kunzea glabrescens</i> tall open shrubland over (<i>Gastrolobium praemorsum</i>), <i>Hibbertia hypericoides</i> , <i>Leucopogon parviflorus</i> , <i>Stirlingia latifolia</i> and <i>Xanthorrhoea brunonis</i> low shrubland and <i>Tetraria capillaris</i> and <i>T. octandra</i> isolated sedges on grey-brown or yellow brown sand. (Degraded - Good)	Mapped extent: 0.9 ha Mapped percentage: 4.9% Extrapolated extent: 1.0 ha

Vegetation unit (Ecoedge, 2020a)	Description	Extent in proposed Clearing Area
E2	<u>Marri-Jarra Open Forest:</u> <i>Corymbia calophylla</i> and <i>Eucalyptus marginata</i> mid-height open forest/woodland over <i>Hibbertia cuneifolia</i> and <i>Kunzea glabrescens</i> tall open shrubland over * <i>Asparagus asparagoides</i> , <i>Brachyloma preissii</i> , <i>Brachysema praemorsum</i> and <i>Xanthorrhoea brunonis</i> mid-height shrubland over <i>Dampiera linearis</i> , <i>Dichopogon capillipes</i> , * <i>Hypochaeris glabra</i> open forbland and isolated <i>Lepidosperma squamatum</i> and <i>Tetraria octandra</i> sedges on yellow-brown or grey-brown sand. (Degraded - Good)	Mapped extent: 3.2 ha Mapped percentage: 17.4% Extrapolated extent: 3.6 ha
E2a	<u>Tuart - Marri-Jarra Open Forest:</u> <i>Eucalyptus gomphocephala</i> , <i>Corymbia calophylla</i> and <i>Eucalyptus marginata</i> mid-height open forest/woodland over <i>Agonis flexuosa</i> low open woodland over <i>Kunzea glabrescens</i> tall open shrubland over <i>Brachyloma preissii</i> , <i>Hibbertia hypericoides</i> , <i>Leucopogon racemosus</i> low shrubland over <i>Conostylis aculeata</i> and * <i>Hypochaeris glabra</i> open forbland and isolated <i>Lepidosperma squamatum</i> and <i>Tetraria octandra</i> sedges on yellowbrown or grey-brown sand. (Completely degraded - Degraded)	Mapped extent: 0.01 ha Mapped percentage: 0.05% Extrapolated extent: 0.01 ha
E3	<u>Peppermint Woodland:</u> <i>Agonis flexuosa</i> low woodland with emergent * <i>Pinus pinaster</i> and scattered <i>Eucalyptus marginata</i> or <i>Corymbia calophylla</i> , <i>Nuytsia floribunda</i> mid-height trees over * <i>Acacia longifolia</i> , <i>Kunzea glabrescens</i> tall shrubland over * <i>Asparagus asparagoides</i> <i>Pteridium esculentum</i> and <i>Conostylis aculeata</i> open forbland on grey-brown sand. (Good)	Mapped extent: 0.7 ha Mapped percentage: 3.8% Extrapolated extent: 0.8 ha
E4	<u>Marri-Bull Banksia Open Forest:</u> <i>Corymbia calophylla</i> , (<i>Eucalyptus marginata</i>) mid-height open forest over <i>Agonis flexuosa</i> , <i>Banksia grandis</i> low woodland over <i>Kunzea glabrescens</i> tall open shrubland over <i>Acacia alata</i> , <i>Grevillea vestita</i> , <i>Hakea varia</i> , <i>Hibbertia cuneiformis</i> , <i>Leucopogon propinquus</i> , <i>Melaleuca incana</i> mid-height shrubland over * <i>Asparagus asparagoides</i> , <i>Brachysema praemorsum</i> , <i>Hardenbergia comptoniana</i> creepers over a variable open forbland including <i>Anigozanthos flavidus</i> , <i>Dichopogon capillipes</i> , <i>Lomandra micrantha</i> , <i>Opercularia hispidula</i> , * <i>Oxalis glabra</i> , * <i>O. pes-caprae</i> , * <i>Romulea rosea</i> on grey-brown loamy sand. (Very Good)	Mapped extent: 0.6 ha Mapped percentage: 3.3% Extrapolated extent: 0.7 ha
F	<u>Melaleuca Low Open Forest:</u> <i>Melaleuca preissiana</i> low open forest/low woodland over <i>Acacia flagelliformis</i> , <i>Astartea scoparia</i> , <i>Melaleuca viminea</i> , <i>M. osullivanii</i> open mid-height shrubland over <i>Baumea juncea</i> open sedgeland on grey sand over clay. (Good-Very Good)	Mapped extent: 0.4 ha Mapped percentage: 2.2% Extrapolated extent: 0.4 ha
G	<u>Revegetated <i>Eucalyptus gomphocephala</i> Open Forest:</u> <i>Eucalyptus gomphocephala</i> and occasional <i>E. rudis</i> mid-height open forest/woodland over <i>Agonis flexuosa</i> Low woodland with <i>Melaleuca raphiophylla</i> and <i>Casuarina obesa</i> in damp areas over <i>Melaleuca viminea</i> , <i>Melaleuca teretifolia</i> and <i>Calothamnus quadrifidus</i> subsp. <i>teretifolia</i> mid/tall height shrubland over an introduced grassland of * <i>Avena</i>	Mapped extent: 0.03 ha Mapped percentage: 0.2% Extrapolated extent: 0.03 ha

Vegetation unit (Ecoedge, 2020a)	Description	Extent in proposed Clearing Area
	<i>barbata</i> , * <i>Ehrharta calycina</i> and * <i>E. longiflora</i> and a herbland dominated by * <i>Trifolium</i> spp., <i>Ursinia anthemoides</i> , and <i>Oxalis glabra</i> . (Degraded)	
H	<u>Exotic plants</u> (trees / shrubs) that have been planted or self-sown. (Completely degraded)	Mapped extent: 0.01 ha Mapped percentage: 0.05% Extrapolated extent: 0.01 ha

Field surveys conducted for the Proposal (360 Environmental, 2017; Harewood, 2018; Main Roads, 2020; SW Environmental, 2020) identified the following within the proposed Clearing Area:

- No Black Cockatoo roosting activity present.
- No known Black Cockatoo nesting hollows.
- 20.8 ha of foraging habitat (as detailed in Table 6-1).
- 124 trees with a Suitable DBH.
 - Of which ten contain one or more unsuitable hollows.
 - One contains a potentially suitable hollow with possible past signs of use that is not actively being used.

SW Environmental inspected two trees containing potentially suitable nesting hollows (SW Environmental, 2020). Of these, one had a single large vertical hollow considered suitable for Black Cockatoo breeding (with possible old chew marks) but was not being used by Black Cockatoos. The other had a single hollow network with multiple large entrances but was considered unsuitable for Black Cockatoo breeding given that there did not appear to be a hollow floor (i.e. this hollow was a hole).

It should be noted that other birds besides Black Cockatoos make chew marks (pers comm. Ron Johnstone, 2020). Furthermore, Black Cockatoos make chew marks on prospective hollows when searching for a suitable nesting hollow, with some prospective hollows with chew marks never being used (pers comm. Rick Dawson, 2021).

According to regional mapping datasets, Black Cockatoo habitat within the Proposal Area is mapped as the Abba, Cokelup, Karrakatta Central and South, Southern River and Yoongarillup vegetation complexes of Hedde *et al.* (1980) as updated by Webb *et al.* (2016). Of these, the great majority (74.9 per cent) of habitat within the proposed Clearing Area is mapped as the Southern River complex.

Habitat within the surrounding area

The nearby Tuart Forest National Park (the Park) provides substantial areas of Black Cockatoo foraging and breeding habitat. There are also large expanses of habitat within the adjacent Ludlow State Forest, and for Carnaby's and Baudin's Cockatoo, pine plantations in the adjacent Coolilup State Forest.

The majority of plant communities in the Park consist of tall Tuart woodland with an overstorey dominated by Tuart, with some marri (*Corymbia calophylla*) and jarrah (*Eucalyptus marginata*) found in the northern parts. Peppermint (*Agonis flexuosa*) is dominant as a secondary overstorey species in some sections. Five principal plant communities were identified and described (2014):

- Tuart tall woodland over pasture grasses.

- Tuart tall woodland over slender banksia (*Banksia attenuata*) woodland.
- Tuart tall woodland over peppermint open forest.
- Flat and basin wetlands.
- Pine plantations with relict Tuart.

All of these except 'flat and basin wetland' communities comprise habitat for Black Cockatoos. Similar to the Proposal Area vegetation, many of the plant communities in the Park lack structural diversity because of a lack of natural regeneration of Tuart and understorey species.

The majority of vegetation within the Park is mapped as the Karrakatta Central and South complex (Webb *et al.*, (2016)), while the majority of the Proposal Area is mapped as the Southern River complex.

The Karrakatta Central and South complex is described as 'Predominantly open forest of *Eucalyptus gomphocephala* (Tuart) - *Eucalyptus marginata* (Jarrah) - *Corymbia calophylla* (Marri) and woodland of *Eucalyptus marginata* (Jarrah) - *Banksia* species. *Agonis flexuosa* (Peppermint) is co-dominant south of the Capel River' (GoWA, 2019).

The Southern River complex is described as 'Open woodland of *Corymbia calophylla* (Marri) - *Eucalyptus marginata* (Jarrah) - *Banksia* species with fringing woodland of *Eucalyptus rudis* (Flooded Gum) - *Melaleuca raphiophylla* (Swamp Paperbark) along creek beds.'

Both complexes have canopy layers dominated by Eucalyptus and Marri with *Banksia* as dominants in the mid-layer. Both are considered high value foraging and potential breeding habitat for Black Cockatoos (Glossop B., 2011).

6.1.2 Potential Impacts

6.1.2.1 Direct Impacts

Mortality

Impact to active nest sites (potential construction impact)

Direct loss of Black Cockatoo individuals could result from Proposal clearing activities if nestlings are present within any potential nesting hollows.

Vehicle strike (potential operational impact)

Mortality or injury by vehicle strike has been recognised as a general threat from interaction with humans, and vehicle strike is a specific threat to Carnaby's Cockatoo (DSEWPC, 2012b). The risk of vehicle strike is increased if habitat is present along the road edge immediately adjacent to the formation, and if water pools on the road surface due to poor drainage. Both of these conditions attract Black Cockatoos to the road corridor for feeding and access to water.

Clearing of Habitat

The Proposal will result in the clearing of:

- No known Black Cockatoo roosting habitat.
- No known Black Cockatoo nesting hollows.
- 20.8 ha of Black Cockatoo foraging habitat (as detailed in Table 6-1).
- 124 trees with a Suitable DBH.

- Of which ten contain one or more unsuitable hollows.
- One contains a potentially suitable hollow with possible past signs of use that is not actively being used.

6.1.2.2 Indirect Impacts

Potential indirect impacts to Black Cockatoos that may result from the clearing of 20.8 ha of foraging habitat for the Proposal are considered to be limited to compromised breeding success of pairs in adjacent areas, displacement of Black Cockatoos and the introduction of *Phytophthora* dieback, Marri Canker (*Quambalaria coyrecup*) or weeds to adjacent retained habitat.

Compromised Breeding Success

In highly cleared landscapes with wide distances between habitat areas, the loss of foraging habitat has the potential to increase distances Black Cockatoos must fly in order to access food sources of sufficient quality and extent. This has the potential to impact breeding success as birds are away from the nest for longer periods while they forage.

Displacement

The Proposal may result in the displacement of Black Cockatoos from the Proposal Area habitat to other nearby habitat.

Phytophthora dieback, Marri Canker and Weeds

Without controls, Proposal construction activities could spread or introduce Dieback or weeds to retained adjacent Black Cockatoo habitat.

Marri Canker, caused by the plant pathogen *Quambalaria coyrecup*, is present along the Proposal Area and within adjacent habitat. Marri canker is naturally occurring and the reasons for the recent disease epidemic are undetermined (Paap, 2012). Research conducted to date on the disease does not indicate that construction projects are a source of the disease.

6.1.3 Assessment of Impacts

6.1.3.1 Direct Impacts

Mortality

Impact to active nest sites

No direct loss of Black Cockatoo individuals is expected as an impact of the Proposal.

Due to the high mobility of Black Cockatoos, clearing operations conducted for the Proposal are not expected to directly affect any live individuals.

The potential for mortality of Black Cockatoo nestlings in nest hollows during the clearing of native vegetation will be avoided. As outlined in Section 6.2.4, prior to the breeding season, the single potential nesting hollow within the Proposed Clearing Area will be blocked or removed to prevent breeding within this hollow to avoid the risk of individuals being present during construction. Where blocking or removal of the nest hollow prior to the breeding season is not possible e.g. due to timing, a pre-clearing fauna survey of potential nesting hollow will be undertaken to determine if it is being used by Black Cockatoos. If the hollow is occupied by nesting Black Cockatoos, clearing within a 10 m

radius of the occupied hollow will not occur until a subsequent fauna survey has confirmed the nestlings have fledged and left the nest.

Vehicle Strike

In relation to vehicle use of the Proposal Area following construction, the risk of mortality of Black Cockatoos from vehicle strike is not expected to change over current conditions. This is because the Proposal will not lead an increase in traffic volume but will double the area over which the existing traffic travels.

The number of potential impact events will remain unchanged. There have been no reports (anecdotal or formal) indicating there have been any incidents of Black Cockatoo vehicle strike in the vicinity of the Proposal.

Any revegetation works within the Proposal Area will ensure that vegetation suitable for Black Cockatoo foraging is not established within 10 m of the road formation, such that Black Cockatoos are less likely to be present near the road formation, when compared to other existing roads.

Further, the risk of pooled water on the road surface which may attract Black Cockatoos for drinking has been minimised through the Proposal design which incorporates road drainage to direct water run-off away from the road formation. Commonwealth guidance recommends road designs which limit the concentration of Black Cockatoos on roadsides (DSEWPaC, 2012a).

Clearing of Habitat

Black Cockatoo foraging debris observed within the survey area was relatively sparse. The most common evidence observed was chewed pine cones presumably left by foraging Carnaby's Cockatoo. 360 Environmental (2017) found foraging evidence in the form of "chewed Marri nuts and to a much lesser extent on banksia and pine cones". One tree containing a potentially suitable hollow with possible past signs of use will be cleared for the Proposal. With regard to this tree, as it is a large dead stag immediately adjacent to the existing carriageway (Plate 3) and this species not being cryptic, it is considered that if Black Cockatoos have been recently using this tree for breeding, breeding activity would have been observed and reported.

No known breeding trees will be cleared in the Proposal Area.

Habitat within the proposed Clearing Area forms part of a broader area of native vegetation that includes the Tuart Forest National Park and Ludlow State Forest. Using the work of Glossop *et al.*, (2011), based on an assessment of the vegetation complexes of Webb *et al.* (2016), there is approximately 5,895 ha of Black Cockatoo foraging and potential breeding habitat present within a 10 km radius of the proposed Clearing Area (Figure 5, Appendix A) (GoWA, 2020a).

The clearing of 20.8 ha of foraging habitat equates to 0.3 per cent of the 10 km radius extent. However, it should be noted that the majority (61 per cent) of the proposed Clearing Area vegetation was not included in the Western Australian Department of Primary Industries and Regional Development (DPIRD) remnant vegetation dataset that was used to derive the extent of potential habitat remaining within the 10 km radius (GoWA, 2020a). Therefore the actual impact of Proposal clearing to the estimated extent of suitable intact habitat surrounding the Proposal Area is less substantial.



Plate 3 Showing the location of the potential Black Cockatoo nesting tree immediately adjacent to the existing highway.

An assessment of GoWA (2020b) indicates that no known roost sites are located within 10 km of the Proposal Area (Figure 5, Appendix A).

An assessment of GoWA (2020c) indicates that three Black Cockatoo breeding sites are located within 10 km of the Proposal Area, two in the Tuart Forest National Park and one in State Forest near Ludlow-Hithergreen Road. None are located within the Proposal Area or proposed Clearing Area (Figure 5, Appendix A).

Black Cockatoo habitat within the proposed Clearing Area comprises a long narrow strip of largely disturbed vegetation up to 31 m wide adjacent to an existing dual-lane highway. The clearing impact will be diffuse, and restricted to the edge of the existing road.

Large expanses of better quality food sources for Black Cockatoos are present within these nearby areas, comprising both native vegetation and pine plantation (in the Coolilup State Forest), and it is highly unlikely that Black Cockatoos are reliant on foraging habitat within the Proposal Area.

Given the long, narrow configuration of the proposed Clearing Area and the proximity of this habitat to the existing highway, it is also unlikely that Black Cockatoos are reliant on potential breeding habitat within the Proposal Area.

6.1.3.2 Indirect Impacts

Compromised Breeding Success and Displacement

The proposed Clearing Area comprises a long narrow strip of vegetation up to 31 m wide adjacent to an existing dual-lane highway. The clearing impact will be diffuse, and restricted to the edge of the existing road.

The quality of habitat within the Proposal Area is commensurate with that in the surrounding area, particularly in the Tuart Forest National Park and Ludlow State Forest, with these areas containing more than 2,000 ha of potential habitat.

Black Cockatoos are known to fly up to 12 km in order to access quality foraging habitat (DSEWPac, 2012a). Within 10 km of the Proposal, approximately 5,895 ha of Black Cockatoo foraging habitat is predicted to remain (GoWA, 2020d) (Figure 5, Appendix A). Two thirds (66 per cent) of the habitat within the 10 km buffer is present within 5 km, indicating that substantial habitat remains in close proximity to the Proposal Area.

Considering the extent of available adjacent habitat, the low number of breeding records (three) in the area, the lack of roosting sites records (zero) in the area, and the presence of the existing highway, it is highly unlikely that Black Cockatoos are reliant on foraging habitat within the Proposal Area.

The existing Bussell Highway already dissects areas of suitable habitat in the vicinity of the Proposal Area. No new gaps in this habitat will be created as a result of the Proposal, however there will be a slightly wider distance (up to 31 m) between habitat areas on either side of the road. As Black Cockatoos are known to fly long distances to access habitat, this minor increase in width between habitat areas is not expected to impact the species' foraging activity.

Significant indirect impacts to the breeding success of Black Cockatoos in areas adjacent to the Proposal are considered highly unlikely to occur as result of Proposal implementation. Similarly, the potential displacement of Black Cockatoos as a result of clearing up to 20.8 ha of habitat adjacent to the existing highway, while it may occur, is also unlikely to significantly impact the local Black Cockatoo population.

Dieback, Marri Canker and Weeds

In regard to *Phytophthora* dieback and the long-term viability of the Proposal Area vegetation, the majority of Black Cockatoo habitat within the Proposal Area was mapped as 'Uninterpretable', with the remainder (except for 0.03 ha) mapped as 'Infested'.

Dieback infested vegetation was identified at the junction of Ruabon Road and the Bussell Highway (Great Southern Bio Logic, 2020). Disease expression was limited to the northern side of the highway however, the identified deaths were associated with a roadside drain that linked both sides via an underground culvert. Therefore, the extent of the mapped infested area was extended to cover vegetation along the drain on either side of the Bussell Highway. A second infested area was identified at the eastern end of the Proposal Area, with a positive sample being collected from the southern side of the highway in vegetation that was draining across the road. None of the habitat within the Proposal Area was considered 'Protectable' from the disease, indicating that this habitat is potentially at risk of loss with or without the Proposal, especially given the uncontrolled nature of a public road reserve.

Control or management options for Marri Canker disease have not yet been developed (Paap, 2012). Standard hygiene protocols will be applied during Proposal construction.

Weeds are present in the proposed Clearing Area vegetation. Most are low impact environmental weeds, however two species Declared as pest plants under the Biosecurity and Agriculture Management Act 2007 were recorded, being Arum lily (*Zantedeschia aethiopica*) and Bridal creeper (*Asparagus asparagoides*) (Ecoedge, 2020a).

In addition to applying appropriate hygiene measures to minimise the introduction and spread of dieback and weeds, monitoring for and active management of Declared pest plants within the Proposal Area will also be undertaken.

Given the configuration of the proposed Clearing Area, the large extent of similar quality adjacent habitat, and the mitigating effect of proposed controls, indirect impacts to Black Cockatoos resulting from the clearing of 20.8 ha of foraging habitat for the Proposal are considered negligible.

6.1.4 Avoidance, Mitigation and Management

Avoid

During Proposal planning, five design concepts were considered. Key selection criteria used in the assessment included the amount of vegetation clearing/habitat loss, amount of fill material required, closeness to the existing carriageway, and compliance with design standards. The chosen option minimises impacts to native vegetation and habitat whilst still maintaining necessary safety standards and efficient resource use.

The design for the Proposal was refined in order to avoid important environmental values, including Black Cockatoo habitat where possible. This has involved reducing the median width, and steepening batters and drainage slopes where possible.

Mitigation/Management

The following management targets have been identified for Black Cockatoos:

- Construct and operate the Proposal to avoid and minimise impacts to Black Cockatoos.
- No disturbance to nesting Black Cockatoos (adults and young).

Main Roads has devised SMART performance standards for Black Cockatoos (Table 6-2), and identified a range of management actions to be implemented to control and minimise direct and potential indirect impacts of the Proposal to Black Cockatoos and their habitat. These, along with the related performance targets, are detailed in Table 6-3.

The proposed performance targets and management actions have been informed by the results of field studies (Section 5), best practice and recent experience on similar road projects in Western Australia. These will minimise potential residual impacts and achieve the identified management targets.

The following species Recovery Plans and referral guidelines have informed the development of this additional information document:

- Department of Environment and Conservation (DEC) (2008). Forest Black Cockatoo (*Baudin's Cockatoo Calyptorhynchus baudinii* and Forest Red-tailed Black Cockatoo *Calyptorhynchus banksii naso*) Recovery Plan.
- Department of Parks and Wildlife (DPaW) (2013). Carnaby's Cockatoo (*Calyptorhynchus latirostris*) Recovery Plan.
- Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) (2012a). Referral guidelines for three species of Western Australian Black Cockatoos.

Mortality

In regard to the risk of mortality, the combination of the installing a nesting hollow barrier prior to clearing, pre-clearance survey and ensuring a fauna spotter is present during the clearing of Black Cockatoo habitat will ensure no Black Cockatoos are harmed during clearing activities.

Indirect Impacts

Potential indirect impacts identified above can be appropriately managed in accordance with Main Roads standard operational controls. These standard controls include hygiene management, which can be expected to appropriately control the risk of Dieback, Marri Canker and weeds.

Where possible, fauna habitat values to be impacted will be reinstated through revegetation following construction of the proposal. The clearing impact will be medium term until the revegetation is established. To reduce the likelihood of vehicle strike, flora species recognised as Black Cockatoo foraging habitat will not be used within 10 m of the road edge.

Table 6-2 SMART Performance Standards for Black Cockatoos

Threshold Criteria	Performance Indicators	Completion Criteria
Clearing of 20.8 ha of Black Cockatoo foraging habitat	Amount of Black Cockatoo foraging habitat cleared	Not more than 20.8 ha of Black Cockatoo foraging habitat cleared
Clearing of 124 trees with a DBH \geq 500 mm	Number of trees with a DBH \geq 500 mm	Not more than 124 large trees (DBH \geq 500 mm) cleared
Clearing of one tree with a DBH \geq 500 mm which contains a potentially suitable nesting hollow	Number of trees with a DBH \geq 500 mm which contain a potentially suitable nesting hollow(s) cleared	Not more than one large tree (DBH \geq 500 mm) which contains a potentially suitable nesting hollow(s) cleared

Table 6-3 Black Cockatoo Management Actions

Timeframe	Management Action	Performance Target
Prior to construction	<ul style="list-style-type: none"> • Apply Main Roads standard operational controls, which include hygiene management and fire management and provide for monitoring during construction • Contractor induction will include familiarisation with and discussion of Black Cockatoos, <i>Phytophthora</i> dieback management and hygiene management • Prior to clearing, the final road design will be assessed against the proposed clearing area to ensure the required clearing area is no more than the approved area • Habitat to be cleared within the area of the Proposal Area will be clearly demarcated in the field • Where the tree with suitable nest hollow for Black Cockatoos will require clearing for the Proposal, the hollow will be visually 	<ul style="list-style-type: none"> • No direct impacts to Black Cockatoos • No clearing outside the approved footprint • Preclude potential breeding within the proposed Clearing Area

Timeframe	Management Action	Performance Target
	<p>inspected where safe and practicable. Where not in use the hollow will be 'blocked' to prevent breeding</p> <ul style="list-style-type: none"> Where blocking of the nest hollow cannot be undertaken (e.g. timing, access), a pre-clearing fauna assessment will be undertaken by a suitably experienced person to determine if the hollow is being used by Black Cockatoos 	<p>prior to construction</p>
<p>During construction</p>	<ul style="list-style-type: none"> A suitably experienced zoologist/environmental scientist will be on-site at all times during clearing of breeding habitat for Black Cockatoos and must maintain radio communication with machinery operators Where a suitable nest hollow has been blocked prior to the Black Cockatoo breeding season, the tree may be felled as part of the standard vegetation clearing process Where a suitable nest hollow has not been blocked and the pre-clearing fauna assessment has not identified any Black Cockatoo occupation of the nest hollow, prior to clearing the tree will be 'bumped gently' with a machine with the machine operator and zoologist to wait and observe the tree for a short time after. If no Black Cockatoo appears to be present following being bumped gently then the tree shall be pushed over slowly to minimise risk of injury to any undetected animal (if present) Where a suitable nest hollow has not been blocked and the pre-clearing fauna assessment identifies any Black Cockatoo occupation of the nest hollow (which may include nestlings), the tree with the nest hollow will not be cleared until after the completion of the breeding season. No vegetation within 10 m of the tree would be cleared until after the completion of the breeding season Any Black Cockatoos showing signs of injury or illness will be promptly referred to an experienced wildlife veterinarian or approved wildlife rehabilitation facility A post-clearing survey shall be undertaken to ensure no injured Black Cockatoo individuals are present All Department of Fire and Emergency Services (DFES) and Local Government Authority (LGA) restrictions on fire and machinery movement will be strictly adhered to 	<ul style="list-style-type: none"> No direct impacts to Black Cockatoos No clearing outside the approved footprint No abandonment of breeding hollows within the proposed Clearing Area
<p>Post-construction</p>	<ul style="list-style-type: none"> Where space and access allows, revegetation and landscaping of cleared areas within the Proposal Area with suitable endemic native species will be undertaken to provide foraging habitat for Black Cockatoos (excluding 10 m buffer from nearest traffic lane) 	<ul style="list-style-type: none"> Rehabilitation provides suitable foraging habitat

6.2 Western Ringtail Possum

6.2.1 Description and Habitat

The WRP is a medium-sized arboreal marsupial, endemic to south-western Western Australia. The species is exclusively folivorous, feeding on leaves of myrtaceous species, predominantly Peppermint (*Agonis flexuosa*) but also Marri and Jarrah. Home range size varies with the productivity of the habitat but is generally less than five ha, although densities of up to 20 individuals per hectare have been recorded in Peppermint woodland near Busselton (DPaW, 2017).

WRP numbers are known to fluctuate seasonally based on habitat quality and in response to climatic conditions (Biota, 2020b), with the local population peaking in spring and early summer.

Habitat and presence within the proposed Clearing Area

Most (24 ha, 87.9 per cent) of the vegetation present within the proposed Clearing Area represents potential WRP habitat (Figure 6, Appendix A) (360 Environmental, 2017) and the species was found at a number of locations within the survey areas of all three surveys conducted for the Proposal. WRP individuals recorded within the proposed Clearing Area are detailed in Table 6-4.

The maximum number of individuals recorded within the proposed Clearing Area was 35, recorded during Phase 2 of Biota's two-phase targeted survey (Biota, 2020a).

Table 6-4 WRP recorded from proposed Clearing Area

Survey	Date	No. Individuals
Harewood (2018)	18 January 2018	13
Harewood (2018)	23 January 2018	14
Biota (2020a) Phase 1	11 September/19 October 2019	15
Biota (2020a) Phase 2	10 February 2020	35

The great majority of WRP habitat within the proposed Clearing Area is mapped as 'Supporting' habitat (DEWHA, 2009a) (Figure 7, Appendix A). There are three small portions of 'Core' habitat, one at the Sabina River, one between Sues Road and Wonnerup South Road and another near the intersection with Ludlow Hithergreen Road.

Habitat and presence within the surrounding area

Over 7,500 ha of remnant vegetation (likely suitable intact habitat) is located within 10 km of the Proposal Area, including approximately 1,079 ha of suitable habitat that is protected within 'Tuart Forest Central' located immediately north-west of the Proposal Area, and a further 630 ha within 'Tuart Forest South' (Biota, 2020b).

Habitat directly adjacent to the Proposal Area in the Ludlow State Forest and Tuart Forest National Park is mapped as 'Core' habitat by DEWHA (2009a) (Figure 7, Appendix A).

In 2019/2020, Biota (2020a) conducted a two-phase targeted survey for WRP within approximately 52 ha of remnant vegetation within a 175 ha study area that contained the proposed Clearing Area. Phase 1 occurred during spring 2019 and Phase 2 in summer 2019/2020. Within their study area, during Phase 1, 55 individual WRPs were recorded from 41 observations, and in Phase 2, 77 individuals were recorded from 74 observations (Figure 6, Appendix A).

The sections of the Biota (2020a) survey area that contained uninterrupted vegetation supported the highest abundances of WRPs. Within the Proposal Area, most WRPs were observed in Jarrah, Marri, Tuart and Peppermint trees, however, the species was also observed in less typical habitat types including in Acacia and Melaleuca shrubs.

The density of WRPs in the Biota survey area (1.06-1.49 individuals/ha) was comparable to other sites sampled on the Swan Coastal Plain (SCP) (Biota, 2020b). Highest abundances of WRPs were located at the southern (Sabina River) end of the survey area, where the road reserve is continuous with large remnant areas of habitat outside the survey area, including both the Tuart Forest National Park and the riparian vegetation of the Sabina River (Biota, 2020a).

The Tuart Forests between Busselton and Bunbury are a well-documented stronghold for the WRP and recent work in this area again demonstrated high densities in the area. Biota (2020b) estimated a local population of 1,420 individuals in 'Tuart Forest Central' located immediately north-west of the Proposal Area, with an estimated density of 1.32 individuals per hectare, and a local population of 2,145 in 'Tuart Forest South' located immediately to the south-west, with an estimated density of 3.4 individuals per hectare.

6.2.2 Potential Impacts

6.2.2.1 Direct Impacts

Mortality

Impact to active refuge sites (potential construction impact)

Direct loss of WRP individuals could result from Proposal clearing activities if WRP are present in dreys, hollows or other refuge sites within the clearing zone. The seasonal fluctuation in WRP numbers is of consideration in relation to the timing of clearing operations.

Vehicle strike (potential operational impact)

WRP are known to go to the ground to move between habitat areas. While no WRP deaths from vehicle strike have been recorded by Main Roads along the existing Bussell Highway within the Proposal Area, it is acknowledged that where habitat adjoins roadways, vehicle strike is a cause of WRP mortality.

Clearing of Habitat

The Proposal will result in the clearing of up to 24 ha of potential WRP habitat that supports up to an estimated 35 individual WRP home ranges.

At a subregional scale, Shedley and Williams (2014) assessed the habitat for WRP in the southern SCP between Binningup and Dunsborough and provided a classification and GIS mapping dataset to enable the prioritisation of habitat. The majority of this habitat coinciding with the Proposal (30.8 per cent) is classified by Shedley and Williams (2014) as 'Medium' quality, with the remaining areas mapped as a combination of 'High' (6.2 per cent) and Low (2.2 per cent) quality (with no areas mapped as 'Very High' or 'Very Low' quality). Approximately 60 per cent of the Proposal Area habitat was not assessed by Shedley and Williams, as their assessment was undertaken at a much larger scale than the finer habitat mapping conducted for the Proposal (Table 6-5).

Table 6-5 Summary of Direct Impacts to WRP

Proposal Impacts	Direct Impact
Clearing of native vegetation	<p>Clearing of up to 24.0 ha of WRP habitat</p> <ul style="list-style-type: none"> • Comprising Shedley and Williams (2014) habitat classes as follows: <ul style="list-style-type: none"> – 6.2% High – 30.8% Medium – 2.2% Low – 60% Unmapped • Representing up to 0.4% of the recorded habitat within the Bunbury management zone of Shedley and Williams (2014) • Disturbance of up to 35 WRP individuals’ home ranges

Home Ranges

Based on data obtained during field surveys and populations estimates, the Proposal will disturb the home ranges of up to 35 WRP individuals. Biota (2020b) conducted a regional survey across known strongholds for the species, including the SCP. Biota’s SCP management zone (in which the Proposal Area is located) yielded an estimated abundance of 9,270 WRP individuals.

Connectivity

The existing single lane carriageway within the Proposal Area separates areas of WRP habitat on either side of the highway. The Proposal involves the duplication of the existing carriageway. The Proposal will not create new breaks between habitat areas or disrupt existing connectivity, however will widen the distance between retained habitat areas situated on either side of the highway.

One main corridor utilised by WRPs appears to be present within the Proposal Area, comprising riparian vegetation along the Sabina River on either side of the existing carriageway and crossing the Proposal Area. The highest abundances of WRP were found at and surrounding this location (Biota, 2020a).

In their targeted two-phase study conducted in 2020, Biota recorded WRP (one in Phase 1 and two in Phase 2) from the median strip where the highway is dual carriage at the southernmost extent of their study area, proximate to the Sabina River. This finding may indicate individuals have been crossing the Bussell Highway (Biota, 2020a). Biota (2020a) also note that tracking work in progress near Bunbury (Biota in prep.) includes one individual who appears to regularly cross a road to access one of its preferred day shelters.

6.2.2.2 Indirect Impacts

The Proposal may also result in indirect impacts to WRP including:

- Incremental loss of fauna habitat (fragmentation, barrier effects, introduction or spread of disease, and edge effects).
- Decline in habitat quality.

In some parts of the proposed Clearing Area, WRP habitat is present in large intact patches, portions of which will be cleared for Proposal implementation. In other areas, habitat is present in very small patches that are distant from one another, separated by large expanses of cleared land (e.g. as is shown on map 3 and 4 of Figure 6, Appendix A). In these areas, some fragmentation of WRP habitat will result.

The Proposal will increase the distance between habitat areas on either side of the highway, thus potentially exacerbating the existing barrier to movement for WRP created by the single lane carriageway.

The potential decline in habitat quality relevant to the Proposal relates to edge effects along the newly created clearing boundary in retained habitat and the introduction or spread of diseases such as *Phytophthora* dieback or Canker pathogen (*Neofusicoccum australe*¹). Edge effects include such things as decreased native vegetation cover and diversity at the mid and ground layer strata, increased weed cover, potential opening up of the canopy, and a potential increase in predator presence. These result from changes in local environmental conditions, including increased wind and light exposure, and access (in the case of predator presence). Without controls, Proposal construction activities could spread or introduce Dieback to retained adjacent WRP habitat.

Displacement of WRP individuals due to noise is not expected to result from the Proposal. Although the Proposal will spread the traffic out across two carriageways, the traffic volume will remain unchanged. The presence of WRP within the road reserve of the existing single lane carriageway indicates that WRPs are able to successfully adapt to noise impacts created by this scale of road infrastructure. The noise levels on either verge are expected to be less after Proposal implementation with traffic now spread out across two separate carriageways.

6.2.3 Assessment of Impacts

6.2.3.1 Direct Impacts

Mortality

No WRP mortalities are considered likely to result during construction of the Proposal.

A pre-clearing targeted fauna survey will be undertaken to identify the presence and locations of WRP individuals to assist with the planning of the clearing activities. WRP are mobile fauna taxa and will be encouraged and enabled to move of their own accord into adjacent areas of retained habitat during the clearing activities.

The approach of allowing WRPs to self-relocate to adjacent habitat has been chosen as it is considered to provide the best outcome in terms of animal welfare. Surveys conducted by Biota indicate that habitat areas adjacent to the Proposal Area support populations of WRP, indicating that these areas provide the necessary habitat requirements (Biota, 2020a; 2020b). Allowing WRPs to relocate to adjacent habitat of their own accord eliminates the requirement for handling, substantially reducing the likelihood of WRPs being placed under undue stress.

The linear clearing corridor for the Proposal provides for good dispersal options for WRPs into adjacent habitat, and it is likely that dispersing individuals are already familiar with these adjacent habitat areas as part of their existing home range. It is anticipated that WRP individuals will readily relocate into other parts of their home ranges.

The risk of a vehicle strike during clearing operations will be managed through the implementation of temporary traffic management protocols, including variable message boards alerting road users to the potential presence of fauna on the road. In addition to this, clearing operations adjacent to WRP habitat will only be undertaken during daylight hours and with a dedicated fauna spotter.

¹ Dieback of *Agonis flexuosa* is caused by this common native fungal endophyte, which is capable of causing disease in a stressed host.

Clearing of Habitat

The proposed clearing represents approximately 1 per cent of suitable habitat in the immediate area as mapped by Biota (2020b) and 0.25 per cent at the local level (10 km radius). It should be noted that the majority (61 per cent) of the proposed Clearing Area vegetation was not included in the DPIRD remnant vegetation dataset that was used to derive the extent of potential habitat remaining within the 10 km radius (GoWA, 2020a). Therefore the actual impact of Proposal clearing to the documented extent of suitable intact habitat surrounding the Proposal Area is less substantial.

WRP habitat within the proposed Clearing Area comprises a long narrow strip of largely disturbed vegetation up to 31 m wide adjacent to an existing dual-lane highway. The clearing impact will be diffuse, and restricted to the edge of the existing highway. The habitat to be cleared is a mixture of remnant, non-native and regrowth vegetation interspersed with larger portions of cleared land. It is structurally simple and does not provide a diverse range of habitat values. The vegetation to be cleared is not considered to be a significant habitat for WRP.

WRP habitat present within the proposed Clearing Area is well represented in the surrounding area, for example, the nearby Tuart Forest National Park and Ludlow State Forest (refer to Figure 1, Appendix A). Large tracts of intact, high quality habitat that is known to support WRPs in high densities remains within these areas (Shedley, E. and Williams, K., 2014). The estimated density of WRPs in 'Tuart Forest South' within this area is 3.4 individuals/ha (Figure 6, Appendix A) (Biota, 2020b), with this area categorised as part of the 'Core' habitat zone of DEWHA (2009a) (Figure 7, Appendix A).

By contrast, the 24.0 ha of habitat within the Proposal's Clearing Area, the great majority of which is mapped as 'Supporting' habitat by DEWHA, contained between 0.54 and 1.46 WRP individuals/ha. The lower end of this range was recorded during Harewood's nocturnal survey conducted in January 2018 (Harewood, 2018), while the upper range was recorded in Phase 2 of Biota's study, which occurred in summer (February) during the species' seasonal peak in numbers (Biota, 2020a). This density range is comparable to other sites sampled on the SCP within the 'Supporting' habitat zone (Biota, 2020b).

The impact to the three small areas of 'Core' habitat within the Proposal Area will be minimal and restricted to the road reserve. The connectivity of habitat in two of these areas, at the Abba and Sabina Rivers, will be enhanced over existing conditions by the Proposal through the installation of fauna bridges to link riparian vegetation on either side of the highway.

It is considered that WRPs are not reliant on the 'Supporting' habitat, of mostly Degraded condition vegetation, within the proposed Clearing Area, particularly considering the large expanse of 'Core' habitat located immediately adjacent.

In the context of the large tracts of remnant vegetation in the vicinity of the Proposal Area, the impact of the Proposal to WRP habitat within the proposed Clearing Area is unlikely to result in a significant detrimental impact to WRP at a species or ecosystem level.

Home Ranges

It is estimated that up to 35 (at peak population) WRP individuals within the Proposal Area will potentially have their home ranges disturbed by the Proposal. This indicates that up to 0.38 per cent

of the 2019 estimated WRP population within the SCP management zone as identified by Biota (2020b) (of up to 9,270 individuals) could potentially be impacted.

Connectivity

The existing Bussell Highway is an obstacle to habitat connectivity across the landscape. No fauna crossing structures currently exist. As part of the Proposal, Main Roads is proposing to install fauna bridges under the existing and proposed bridges at both the Abba and Sabina Rivers.

These fauna bridges will improve connectivity between known habitat areas across an obstacle that already exists.

6.2.3.2 Indirect Impacts

Approximately 75 per cent of the proposed Clearing Area vegetation is in Degraded or worse condition, and largely comprises revegetated mining areas or areas previously cleared for agricultural or road construction purposes. Much of the vegetation exists in narrow linear patches adjacent to cleared farmland. Due to these past disturbances, habitat within the proposed Clearing Area is already fragmented and impacted by edge effects. Habitat surrounding the Proposal Area is also dissected by the existing single lane carriageway.

Despite this, where habitat exists, WRPs are present within the Proposal Area at densities similar to those of the surrounding areas (Biota, 2020a), indicating that these factors, unlike for many other native fauna species, are not determinate of the utilisation of habitat areas by WRPs. While implementation of the Proposal will create new clearing edges, and further edge effects may occur in these areas, the impact on WRP utilisation of habitat in these areas is not expected to be significant.

With regard to the potential introduction or spread of plant diseases, standard hygiene protocols will be applied during Proposal construction.

6.2.4 Avoidance, Mitigation and Management

Avoid

During Proposal planning, five design concepts were considered. Key selection criteria used in the assessment included the amount of vegetation clearing/habitat loss, amount of fill material required, closeness to the existing carriageway, and compliance with design standards. The chosen option minimises impacts to native vegetation and habitat whilst still maintaining necessary safety standards and efficient resource use.

The design for the Proposal was refined in order to avoid important environmental values, including habitat for WRP where possible. This has involved reducing the median width, and steepening batters and drainage slopes where possible.

Mitigation/Management

The management target of constructing and operation the Proposal to avoid and minimise impacts to WRP has been set for the Proposal.

Main Roads has devised SMART performance standards for WRP (Table 6-6), and identified a range of management actions to be implemented to control and minimise direct and potential indirect impacts of the Proposal to WRP and their and habitat. These, along with the related performance target, are detailed in Table 6-7.

The proposed performance target and management actions have been informed by the results of field studies (Section 5), best practice and recent experience on similar road projects in Western Australia. These will minimise potential residual impacts and achieve the identified management target.

The following species Recovery Plans and referral guidelines have informed the development of this additional information document:

- DPaW (2017). Western Ringtail Possum (*Pseudocheirus occidentalis*) Recovery Plan. Wildlife Management Program No. 58.
- DEWHA (2009a). Significant impact guidelines for the vulnerable western ringtail possum (*Pseudocheirus occidentalis*) in the southern Swan Coastal Plain, Western Australia.
- TSSC (2018b). Conservation Advice *Pseudocheirus occidentalis* Western Ringtail Possum.

Mortality

In regard to the risk of mortality, the combination of the installing potential refuge site (dreys and hollows) barriers prior to clearing, pre-clearance survey and ensuring a fauna spotter is present during the clearing of WRP habitat will ensure no WRPs are harmed during clearing activities. The approach of allowing WRP to self-relocate is considered to provide the best outcome in terms of animal welfare.

The implementation of traffic management protocols, including variable message boards informing road users of the potential presence of WRP on the roadway, will minimise the risk of vehicle strike during clearing operations.

Clearing of Habitat

Timing clearing operations to occur outside of the population peak (spring and early summer) wherever possible in concert with directional clearing towards habitat areas adjacent to the Proposal Area allows WRPs to relocate passively. Clearing during non-population peak times will also maximise the opportunity for successful re-establishment of dispersing WRPs through minimising competition in adjacent habitat areas.

Connectivity

To maintain and improve connectivity along riparian areas, Main Roads is proposing to install 'fauna bridges' under bridges on the Abba and Sabina Rivers where linkage vegetation exists to allow WRPs to move between suitable habitat either side of the highway. The general locations of these structures, along with notional indication of the main corridor across the Sabina River, are shown in Figure 8 (Appendix A). The specific locations and design(s) of these structures will be developed in consultation with Department of Biodiversity, Conservation and Attractions (DBCA). Successful rope bridges have been installed at Treendale (where underpasses connects the riparian zone along the Collie River in Australind) (Barbara Jones, pers. comm., 2020) and Vasse (where substantial areas of Peppermint woodland habitat on either side of Bussell Highway are connected via rope bridges) (Yokochi, K., & Bencini, R. , 2015). The design utilised in the Proposal fauna bridges will apply learnings from these past successes. Main Roads will be responsible for the fauna bridge design and the construction contractor will be responsible for construction and installation.

Riparian vegetation adjacent to rivers will be retained (where possible) to enable installation of fauna bridges and refuge areas.

It is noted that fauna bridges have not been installed for any of the bridges on the existing carriageway. Thus the installation of fauna bridges under the proposed and existing bridges is expected to improve WRP movement from one side of the road reserve to the other.

Where possible, WRP habitat values to be impacted will be reinstated through revegetation following construction of the proposal. The clearing impact will be medium term until the revegetation is established.

Indirect Impacts

Potential indirect impacts can be appropriately managed through the implementation of Main Roads standard operational controls. These standard controls include hygiene management, which can be expected to appropriately control the risk of edge effects and the introduction or spread of plant diseases.

Table 6-6 SMART Performance Standards for WRP

Threshold Criteria	Performance Indicators	Completion Criteria
Clearing of 24 ha of WRP habitat	Amount of WRP habitat cleared	Not more than 24 ha of WRP habitat cleared

Table 6-7 WRP Management Actions

Timeframe	Management Action	Performance Target
Prior to construction	<ul style="list-style-type: none"> Apply Main Roads standard operational controls, which that include hygiene management and fire management and provide for monitoring during construction Contractor induction will include familiarisation with and discussion of WRP, <i>Phytophthora</i> dieback management and hygiene management Prior to clearing, the final road design will be assessed against the proposed clearing area to ensure the required clearing area is no more than the approved area Habitat to be cleared within the Proposal Area will be clearly demarcated in the field Pre-clearing fauna assessment and spotlighting will be undertaken by a suitably qualified person over two nights within the five nights prior to clearing. Assessment is to include hollows, dreys, ground debris, dense ground-level vegetation, timber and logs 	<ul style="list-style-type: none"> Reduce clearing of WRP habitat to the extent practicable in final design Preclude use of refuge sites (dreys, hollows) within the proposed Clearing Area prior to construction No direct impacts to WRP No clearing outside the approved footprint
During construction	<ul style="list-style-type: none"> A suitably experienced zoologist/environmental scientist will be on-site at all times during clearing of WRP habitat and must maintain radio communication with machinery operators Vacant dreys will be removed prior to clearing where they are accessible Vacant tree hollows suitable for possums will be removed or blocked prior to clearing where they are accessible No night time clearing of vegetation will occur 	<ul style="list-style-type: none"> No direct impacts to WRP No clearing outside the approved footprint

Timeframe	Management Action	Performance Target
	<ul style="list-style-type: none"> • Temporary traffic management measures including variable message boards will be implemented to alert road users to the possible presence of WRP on the roadway • Cleared vegetation will be chipped immediately or transported at least 100 m from WRP habitat before further processing • Movement/disturbance of clearing stockpiles will be confined to the period between one hour after sunrise and one hour prior to sunset • Habitat clearing is to commence from existing edge lines/roads and progress towards habitat that will be retained, where possible • If WRPs are observed during clearing operations, the tree containing the animal shall be left for up to 48 hours to allow for the animal to vacate, while clearing continues in adjacent vegetation. If the tree continues to be occupied after 48 hours, the animal will be coerced/moved to a safe area outside of the clearing footprint by the appointed zoologist/environmental scientist/fauna spotter • Trees, as noted above, that are observed to support WRP after 48 hours will be 'bumped gently' with a machine prior to felling. The operator and spotter will wait and observe the tree for a short time. If the animal remains in the tree, the tree shall be pushed over slowly onto vegetation within the clearing area that is yet to be cleared. The 'soft felling' of habitat trees will provide a 'cushion' for the vegetation being felled, minimising the risk of injury to the animal and allowing any WRP present with the opportunity to safely vacate • Felled trees with hollows will be checked immediately for WRPs after felling and prior to further processing. If it is not possible to fully inspect the hollow the tree will be left on the ground overnight to allow time for any undetected fauna to vacate • A post-clearing survey shall be undertaken immediately following each day's clearing operations and the following morning to identify the presence of any injured animals • Any WRP showing signs of injury or illness will be promptly referred to an experienced wildlife veterinarian or approved wildlife rehabilitation facility • All DFES and LGA restrictions on fire and machinery movement will be strictly adhered to 	
<p>Post-construction</p>	<ul style="list-style-type: none"> • Install fauna bridges under bridges crossing the Abba and Sabina Rivers • Where space and access allows, revegetation and landscaping of cleared areas within the Proposal Area with suitable endemic native species will be undertaken to provide habitat for WRPs. Revegetation of fauna bridge access and egress points will be undertaken where possible. 	<ul style="list-style-type: none"> • Rehabilitation provides suitable habitat

6.3 Tuart Woodlands TEC

6.3.1 Description

The Tuart Woodlands TEC occurs on the SCP from Jurien, approximately 200 km north of Perth, to the Sabina River, near Busselton. The distribution was historically almost continuous from the Sabina River to Lancelin, with the woodlands and forests being most prominent in the southern part of the range. The TEC is strongly associated with calcareous soils of the western part of the SCP, including those very close to the coast (TSSC, 2019).

Extent within the Proposed Clearing Area

The Tuart Woodlands TEC was recorded by within and surrounding the Proposal Area (Ecoedge, 2020b). A total of 29.0 ha was recorded in three occurrences that all extend beyond the Proposal Area (Figure 9, Appendix A).

Extent within the Surrounding Area

The TSSC (2019) identifies the remaining extent (as at 2015, which is the most current data available) of the Tuart Woodlands TEC as >17,000 ha, with the majority (approximately 75 per cent) occurring within the southern part of its distribution (south of the town of Rockingham), within which the Proposal Area is located. The three largest remaining patches of the TEC are also found in the southern part of the range, and are all substantially contained within conservation tenure. One of these is the Tuart Forest National Park, which is directly adjacent to the Proposal Area and itself supports the majority of the local extent of the TEC in the vicinity of the Proposal.

Figure 10 (Appendix A) shows the regional predicted extent of Tuart Woodlands TEC within a 5 km radius of the Proposal (GoWA, 2020e) (as supplied by DBCA).

6.3.2 Potential Impacts

6.3.2.1 Direct Impacts

The Proposal will require the clearing of three occurrences of Tuart Woodlands TEC that total approximately 2.0 ha. A description of these occurrences from Ecoedge (2020b) is provided in Table 6-8.

Table 6-8 Tuart Woodlands TEC occurrences intersecting the proposed Clearing Area

Patch ID (Ecoedge, 2020b) and location	Total Patch Size (ha) (including extents outside the Proposal Area)	Extent in Proposed Clearing Area (ha)	Patch Condition (TSSC, 2019)	Meets TSSC (2019) Criteria after Clearing (Yes/No)
Patch 22 (between Hutton and Ludlow-Hithergreen Roads)	7.7	1.4	Moderate	Yes
Patch 23 (between Hutton and Ludlow-Hithergreen Roads)	9.8	0.05	Poor, Moderate	Yes
Patch 24 (near Hutton Road)	11.3	0.5	Poor	Yes

6.3.2.2 Indirect Impacts

Potential indirect impacts to retained Tuart Woodlands TEC vegetation adjacent to the Proposal include:

- Increased risk of spread or introduction of weeds during construction works.
- Introduction and / or spread of *Phytophthora* dieback during construction works.

- Potential for fire caused by construction works (in particular, for 'hot works' such as grinding/welding of steel in bridge construction).

It is also possible that edge effects may result along the newly created clearing boundary in retained TEC vegetation. Edge effects include such things as decreased native vegetation cover and diversity at the mid and ground layer strata, increased weed cover, and the potential opening up of the canopy. These result from changes in local environmental conditions, including increased wind and light exposure.

In regards to fragmentation, the Proposal is not expected to remove areas of Tuart Woodlands TEC to an extent that the remaining occurrence is no longer representative of the TEC under the TSSC (2019) criteria (refer to Section 6.3.3 for more information).

Indirect impact to Tuart Woodlands TEC from changes in hydrology is not expected, and accordingly, has not been listed above. Altering existing flow paths has the potential to negatively impact the hydrological regime (most notably drying) of TEC occurrences. The Proposal requires the duplication of the existing carriageway following the alignment of and immediately adjacent to the existing carriageway. The Proposal will maintain the existing drainage regime through standard engineering design with no change to water flows. Proposal design incorporates table drains and flat-bottomed swale drains to facilitate infiltration of surface water runoff at source. Where culverts exist on the existing alignment, these will be duplicated on the new carriageway to maintain existing flow paths. No dewatering in the vicinity of the TEC occurrences is required for the Proposal. Impacts to TEC vegetation from changes to flow paths are therefore not expected to result from the Proposal.

6.3.3 Assessment of Impacts

6.3.3.1 Direct Impacts

The Proposal requires the clearing of approximately 2.0 ha of Tuart Woodlands TEC (Figure 9, Appendix A), much of which has been planted as part of minesite rehabilitation activities or landscaping associated with the construction of the existing highway in the 1990s. Aerial photography from 1996 shows the extent of disturbance to each occurrence, as shown in Plates 4-6 below.

The Tuart Woodlands TEC occurrences within the proposed Clearing Area occur on the Southern River complex (Plate 7). This complex is not defined as featuring or being dominated by Tuart in the canopy (GoWA, 2019), and further, Tuart Woodland TEC is not predicted to occur in this location (Figure 10, Appendix A) (GoWA, 2020e) (as supplied by DBCA). The Tuarts present are more likely to be a result of historic rehabilitation programs rather than being a natural occurrence. While scattered remnant Tuarts are present within remnant vegetation on the Southern River complex in this area, the concentration of Tuarts that occur within the Proposal Area on the Southern River complex is not considered to be consistent with the concentration of Tuarts on that complex in remnant areas. The density of Tuarts present within the Proposal Area is more representative of the concentrations that occur immediately to the west on the Cokelup and Karrakatta Central and South complexes within the TEC's predicted occurrence, the definitions of which both include Tuart as a dominant or featured species. The Tuart Forest National Park is situated across both these complexes, and largely coincides with the Karrakatta Central and South complex.

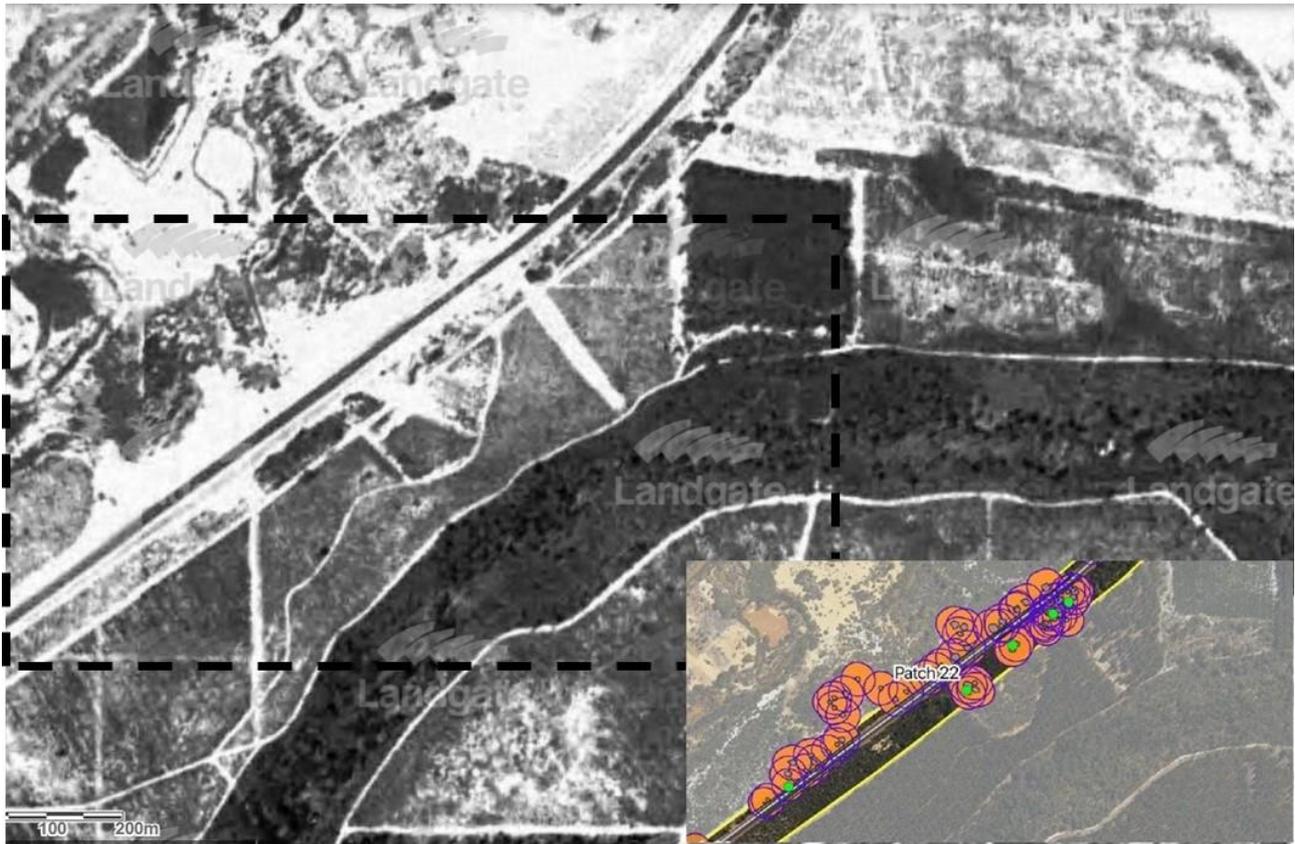


Plate 4 Tuart Patch 22 historical aerial photo (circa 1996) of northern end of Proposal Area – note majority of road reserve having been previously cleared (inset aerial photograph from 2020 (Ecoedge, 2020b))

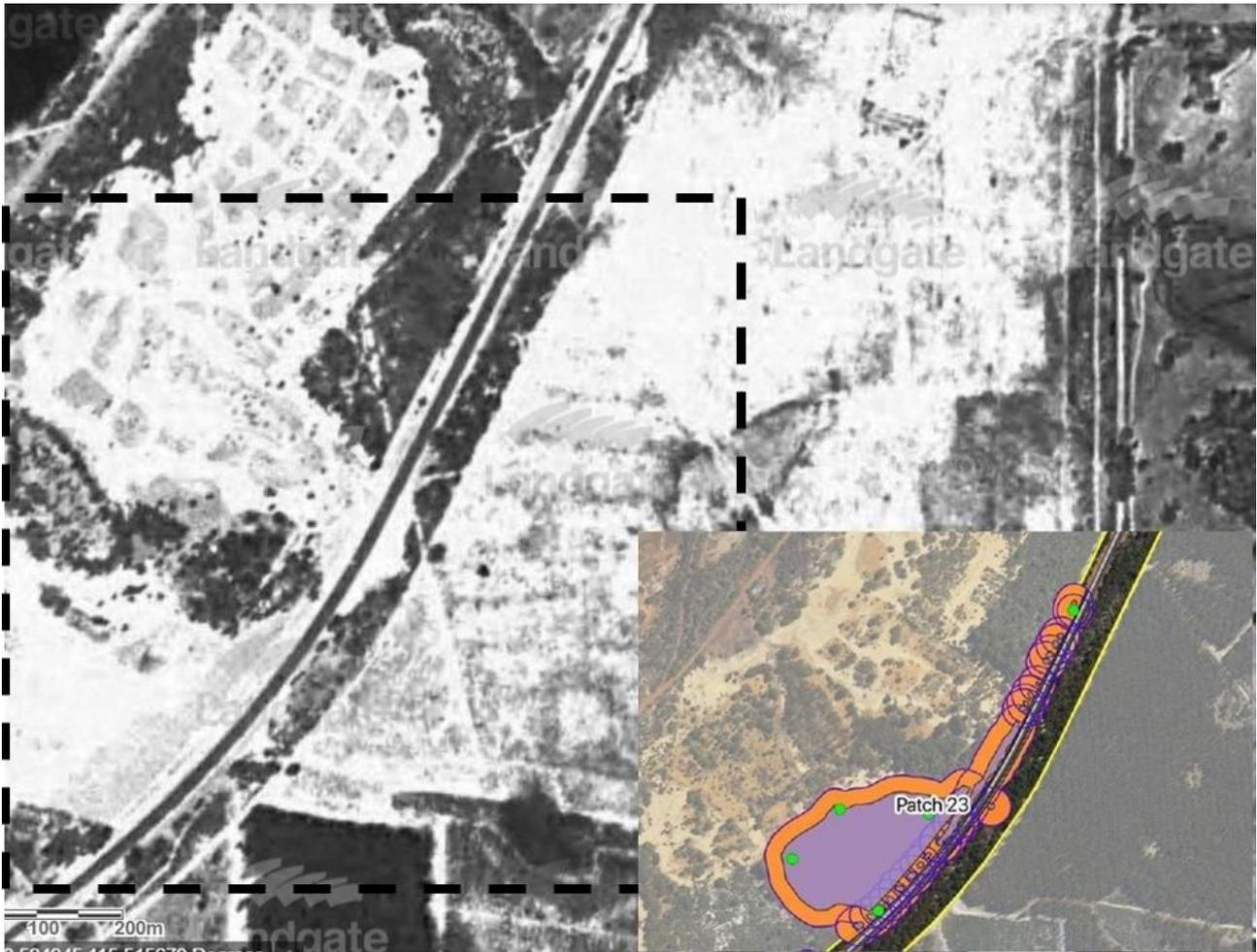


Plate 5 Tuart Patch 23 historical aerial photo (circa 1996) of northern end of Proposal Area – note majority of road reserve having been previously cleared (inset aerial photograph from 2020 (Ecoedge, 2020b))

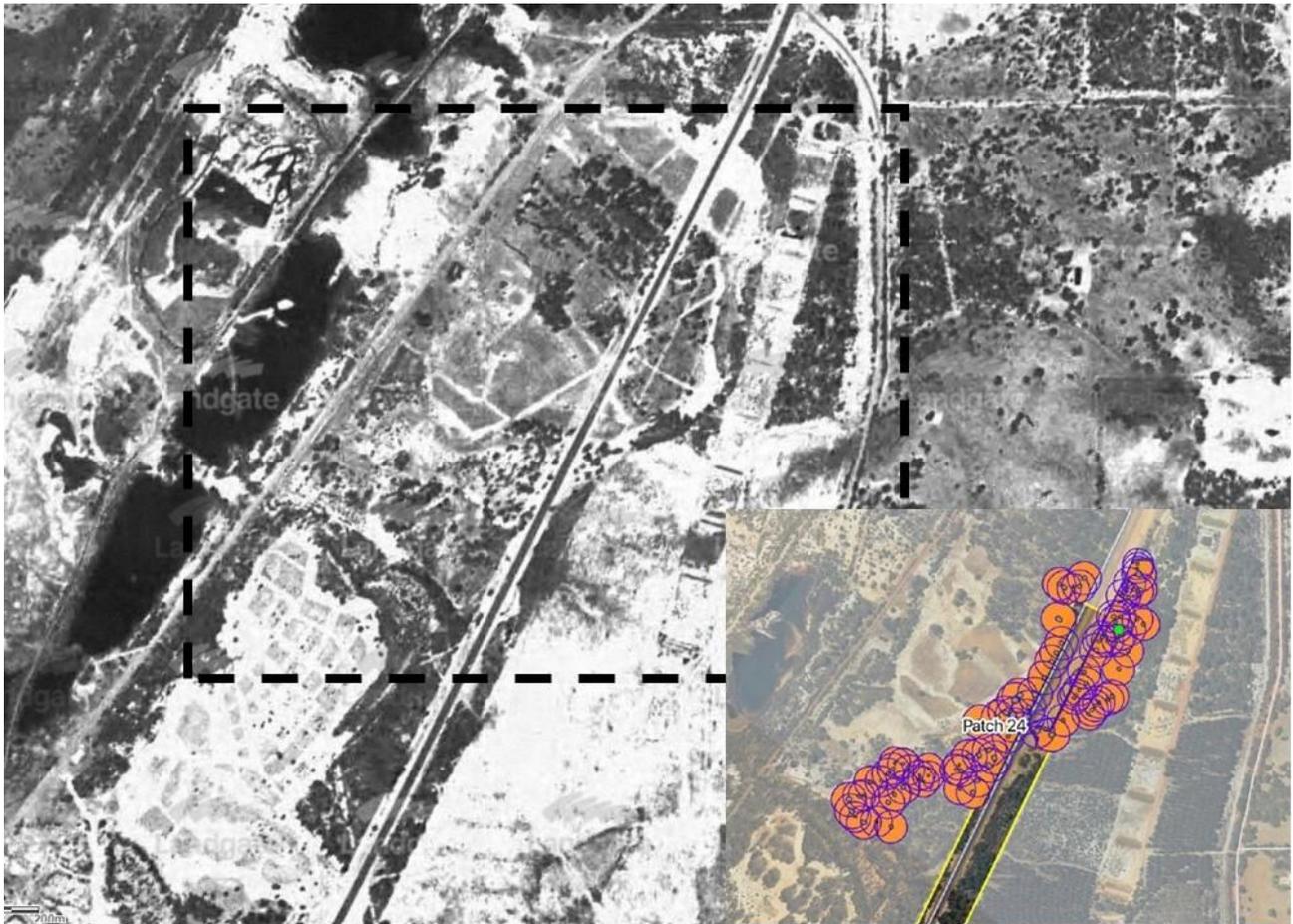


Plate 6 Tuart Patch 24 historical aerial photo (circa 1996) of northern end of Proposal Area – note majority of road reserve having been previously cleared (inset aerial photograph from 2020 (Ecoedge, 2020b))

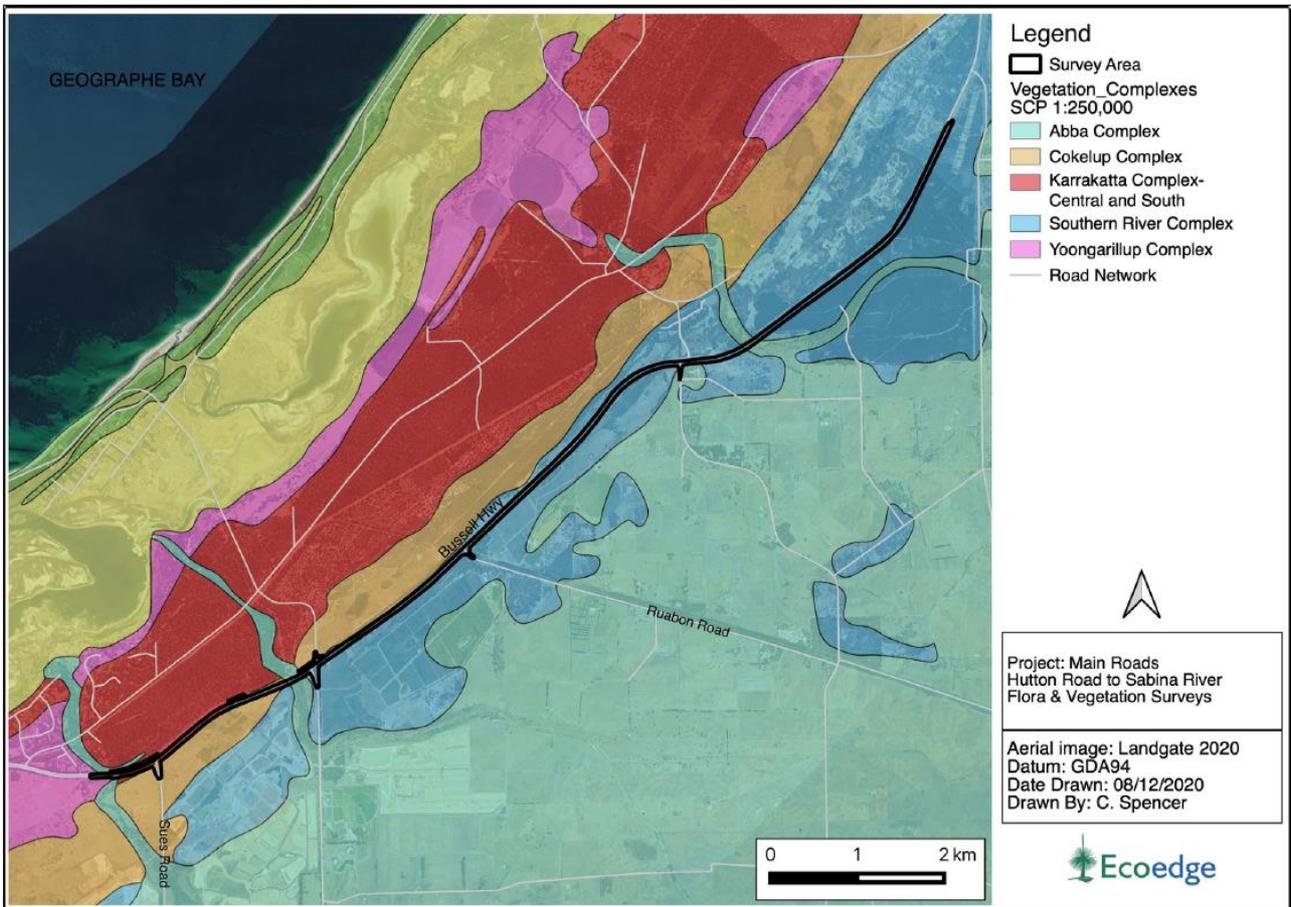


Plate 7 Vegetation complexes mapped for the Proposal Area (Webb *et al.*, 2016)

An assessment of the clearing of Tuart Woodlands TEC at total extent and local scales was made by comparing the extent within the Proposal Area to that published for the community (TSSC, 2019) and within a 5 km radius (based on data provided by DBCA).

The clearing of approximately 2.0 ha would result in a reduction of 0.01 per cent of the recorded remaining extent of >17,000 ha (TSSC, 2019).

According to the DBCA, 2,325 ha of the TEC is estimated to remain within a 5 km radius of the Proposal Area, most of which occurs within the Tuart Forest National Park. The clearing of approximately 2.0 ha for the Proposal equates to a reduction of 0.09 per cent of the local extent.

As is detailed in Table 6-9, all three occurrences of Tuart Woodlands TEC remaining after Proposal implementation will still meet the criteria for the TEC as defined by the TSSC (2019).

Table 6-9 Status of Tuart Woodlands TEC Occurrences after Clearing

Patch ID (Ecoedge, 2020b)	Total Patch Size (ha)	Extent in Proposed Clearing Area (ha)	Patch Size after Clearing (ha)	Meets TSSC (2019) Criteria After Clearing (Yes/No)
Patch 22	7.7	1.4	6.3	Yes
Patch 23	9.8	0.05	9.75	Yes
Patch 24	11.3	0.5	10.8	Yes

Considering the minor scale of clearing, its location along the existing road edge, the predominantly Poor condition of TEC vegetation to be cleared, and the fact that all occurrences will still meet the

TSSC criteria after clearing has been undertaken, the direct impact of the Proposal to Tuart Woodlands TEC vegetation is not considered to be significant.

6.3.3.2 Indirect Impacts

The majority of Tuart Woodlands TEC within the proposed Clearing Area occurs in relatively narrow linear strips and is in Poor condition according to the scale of the TSSC (2019). It comprises substantial areas of land that was revegetated after mining activity or areas previously cleared for road construction purposes. Very little of the TEC within the proposed Clearing Area is remnant, with most being planted or a mixture of planted and regrowth. Due to these past disturbances, TEC vegetation within the proposed Clearing Area is already fragmented and impacted by edge effects. The scale of clearing of TEC vegetation required for the Proposal is minor, and restricted to a narrow band along the edge of the existing highway. For these reasons, the viability of these occurrences is considered unlikely to change as a result of Proposal implementation.

6.3.4 Avoidance, Mitigation and Management

Avoid

During Proposal planning, five design concepts were considered. Key selection criteria used in the assessment included the amount of vegetation clearing/habitat loss, amount of fill material required, closeness to the existing carriageway, and compliance with design standards. The chosen option minimises impacts to native vegetation and habitat whilst still maintaining necessary safety standards and efficient resource use.

The design for the Proposal was refined in order to avoid important environmental values, including Tuart Woodlands TEC vegetation where possible. This has involved reducing the median width, and steepening batters and drainage slopes where possible.

Mitigation/Management

The management target of construct and operate the Proposal to avoid and minimise impacts to Tuart Woodlands TEC has been set for the Proposal.

Main Roads has devised SMART performance standards for Tuart Woodlands TEC (

Table 6-10), and identified a range of management actions to be implemented to control and minimise direct and potential indirect impacts of the Proposal to Tuart Woodlands TEC. These, along with the related performance target, are detailed in Table 6-11.

The proposed performance target and management actions have been informed by the results of field studies (Section 5), best practice and recent experience on similar road projects in Western Australia. These will minimise potential residual impacts and achieve the identified management target.

The Conservation Advice (TSSC, 2019) has informed the development of this additional information document, including the proposed mitigation and management measures.

Potential indirect impacts to retained Tuart Woodlands TEC vegetation can be appropriately managed in accordance with Main Roads standard operational controls. Implementation of these controls can be expected to appropriately control the risk of the introduction or spread of weeds and *Phytophthora* dieback, and of fire during construction works.

Table 6-10 SMART Performance Standards for Tuart Woodlands TEC

Threshold Criteria	Performance Indicators	Completion Criteria
Clearing of 2.0 ha of Tuart Woodlands TEC	Amount of Tuart Woodlands TEC habitat cleared	Not more than 2.0 ha of Tuart Woodlands TEC cleared

Table 6-11 Tuart Woodlands TEC Management Actions

Timeframe	Management Action	Performance Target
Prior to construction	<ul style="list-style-type: none"> Apply Main Roads standard operational controls, including hygiene and fire management procedures, such as machinery/vehicle clean down, weed treatments and restrictions on vehicle/machinery movements, and provide for monitoring during construction Contractor induction will include familiarisation with and discussion of TEC vegetation, <i>Phytophthora</i> dieback management and hygiene management Design refinement to minimise the area of TEC vegetation needed to be cleared for the Proposal (hold point) Prior to clearing, the final road design will be assessed against the proposed clearing area to ensure the required clearing area is no more than the approved area Tuart Woodlands TEC vegetation to be cleared within the Proposal Area will be clearly demarcated in the field Declared Plants and WoNS within the Proposal Area will be removed or treated with herbicide 	<ul style="list-style-type: none"> Reduce clearing of TEC vegetation to the extent practicable in final design No clearing outside the approved footprint
During construction	<ul style="list-style-type: none"> Demarcation of the active construction front of TEC vegetation areas will be maintained during the construction phase Movement of machines and other vehicles will be restricted to the limits of the areas cleared within the Proposal Area or on designated tracks outside the area Infestations of Declared Plants and WoNS within the Proposal Area will be removed or treated with herbicide No re-fuelling of equipment will be conducted within 100 m of TEC vegetation As far as practical, clearing activities will occur during the dry months to reduce the risk of spreading <i>Phytophthora</i> dieback All DFES and LGA restrictions on fire and machinery movement will be strictly adhered to 	<ul style="list-style-type: none"> No clearing outside the approved footprint No disturbance of TEC vegetation during construction as a result of unrestricted access No new WoNS or Declared Plants establishing in TEC vegetation or the spread of existing infestations as a result of Proposal implementation No new Dieback infestations in TEC vegetation as a result of Proposal implementation
Post-construction	<ul style="list-style-type: none"> Not applicable. 	<ul style="list-style-type: none"> Not applicable

6.4 Listed Migratory Species (S20 and 20A)

6.4.1 Description and Habitat Requirements

MNES migratory species relevant to the Proposal are migratory bird species that utilise habitat in the Vasse-Wonnerup Ramsar-listed wetland system (Vasse-Wonnerup System) (DotE, 2015). One species meets this criteria, being the Red-necked Stint (*Calidris ruficollis*).

Red-necked Stint

The Red-necked Stint is a small Calidridinae approximately 13–16 cm in length and is the smallest shorebird in Australia (DAWE, 2020). It is one of 35 migratory shorebird species listed in the *Wildlife Conservation Plan for Migratory Shorebirds* that regularly visit Australia (DotE, 2015). The species is distributed along most of the Australian coastline with large densities on the Victorian and Tasmanian coasts. It breeds in Siberia and sporadically in north and west Alaska, and spends winter in Australasia, mostly in Australia, arriving from August (and possibly July), with most from early September.

In Australasia, the Red-necked Stint is mostly found in coastal areas, including in sheltered inlets, bays, lagoons and estuaries with intertidal mudflats, often near spits, islets and banks and, sometimes, on protected sandy or coralline shores. The species roosts on sheltered beaches, spits, banks or islets, of sand, mud, coral or shingle, sometimes in saltmarsh or other vegetation (DAWE, 2020).

Four key threats to the species are noted by DAWE (2020), being habitat loss, habitat degradation, disturbance and direct mortality. The greatest of these is habitat loss. In Australia, this includes direct losses through land clearing, inundation, infilling or draining. Indirect loss may occur due to changes in water quality, hydrology or structural changes near roosting sites.

DAWE (2020) cites activities that cause habitat degradation to the species' habitat as including but not being restricted to:

- Loss of marine or estuarine vegetation, which is likely to alter the dynamic equilibrium of sediment banks and mudflats.
- Invasion of intertidal mudflats by weeds such as cord grass.
- Water pollution and changes to the water regime.
- Changes to the hydrological regime.
- Exposure of Acid Sulphate Soils (ASS), hence changing the chemical balance at the site.

Disturbance can result from residential and recreational activities including; fishing, power boating, four wheel driving, walking dogs, noise and night lighting. Sustained disturbances can prevent shorebirds from using parts of the habitat.

Direct mortality is a result of human activities around the migration pathways of shorebirds and at roosting and foraging sites.

Vasse-Wonnerup System

The proposed Clearing Area intersects three waterways, the Sabina, Abba and Ludlow Rivers, which flow into the Vasse-Wonnerup System when flowing (generally in the wetter (winter) months). Wetland components of the Vasse-Wonnerup System are located approximately 1.5 km from the Proposal at the nearest point (Ecoedge, 2020a) (Figure 11, Appendix A). An Environmental

Management Plan for the Vasse-Wonnerup System has been prepared for the Proposal and is included in Appendix F (the Vasse-Wonnerup EMP).

6.4.2 Potential impacts

Potential impacts to the Red-necked Stint and other migratory species possibly resulting from the Proposal would originate from impacts to the Vasse-Wonnerup System.

No direct impacts to the System (or consequently to the Red-necked Stint or other migratory birds) are expected to result from Proposal implementation.

As detailed in the Vasse-Wonnerup EMP, potential indirect impacts of the Proposal to the System are expected to be limited to run-off water contamination (sediment and hydrocarbon spills) and exposure of ASS, both primarily associated with bridge construction. Bushfire as a result of Proposal construction is also a potential indirect impact. These potential indirect impacts are associated with the 'habitat degradation' threat identified by DAWE (2020). Impacts to the Vasse-Wonnerup System from changes to hydrological regimes are not expected.

6.4.3 Assessment of Impacts

The Proposal is not considered to be inconsistent with the vision or any of the objectives detailed in DotE (2015). Proposal implementation will not lead to a loss of Red-necked Stint habitat. No disturbance of Red-necked Stint individuals as a result of increased or modified human activity will result from the Proposal. Proposal implementation is not expected to result in any direct mortality of Red-necked Stint individuals.

No direct impacts to the Vasse-Wonnerup System (or consequently to the Red-necked Stint or other migratory birds) are expected to result from Proposal implementation.

Main Roads proposed mitigation and management measures for potential indirect impacts to the the Vasse-Wonnerup System are detailed in the EMP, along with the associated risk assessment conducted as prescribed in DotE (2014). The likelihood and consequence assessments, and the resulting 'risk outcomes', are based upon expected residual risk levels after management and monitoring activities are implemented.

After the proposed measures are implemented, all risks are rated having a 'low' risk outcome.

Based on the assessment above, significant residual impacts to the Red-necked Stint and other migratory bird species are not expected to result from the Proposal.

6.4.4 Avoidance, Mitigation and management

Potential indirect impacts on migratory species habitat can be appropriately managed in accordance with Main Roads standard operational controls. Implementation of these controls, which include drainage and ASS management, can be expected to appropriately control the risk of habitat degradation.

7 ENVIRONMENTAL OFFSETS

The Proposal will result in the following residual impacts:

- Clearing up to 20.8 ha of Black Cockatoo foraging habitat.
- Removal of up to 124 suitable DBH trees.
- Removal of one tree with a hollow potentially suitable for breeding by Black Cockatoos.
- Clearing up to 24.0 ha of WRP habitat supporting up to 35 individual home ranges.
- Clearing up to 2.0 ha of Tuart Woodlands TEC.

Main Roads intends to counterbalance all residual impacts of the Proposal listed above through implementation of an environmental offset strategy. The strategy will be prepared in accordance with the Australian Government's *EPBC Act Environmental Offset Policy* (DSEWPaC, 2012b) and *Environmental Offset Assessment Guide* (DSEWPaC, 2012c). The offset(s) will be proportionate to the level of impact and significance of the environmental impact.

Main Roads is pursuing a number of options in developing a package of offsets to counterbalance these residual impacts. The options being investigated comprise acquisition and management of land providing fauna habitat and TEC vegetation, and the creation of fauna habitat and TEC vegetation by on-ground rehabilitation.

The offset package will comprise direct and indirect offsets.

Main Roads has purchased Lot 201 West Boundary Road in Manjimup. Lot 201 is located immediately adjacent to the Faunadale Nature Reserve, which is a recognised WRP stronghold (Biota, 2020b). Lot 201 contains approximately 17.3 ha of both WRP habitat and Black Cockatoo foraging and potential breeding habitat. DBCA has provided a letter of support for the inclusion of Lot 201 into the Faunadale Nature Reserve.

The value of the final suite of proposed offsets will directly relate to the Proposal impact, with fauna habitat being either secured in perpetuity or re-established to replace habitat cleared for the Proposal, and TEC vegetation being secured in perpetuity to offset TEC vegetation that will be cleared for the Proposal.

Main Roads is looking into a number of offset options and will provide DAWE with an Offset Strategy within the next 12 months. The proposed offsets will be proportionate to the size and scale of the residual impacts resulting from the Proposal and will deliver conservation gains that are considered to adequately compensate for these impacts.

Further to the Offset Strategy, as part of the offsets package, Main Roads will develop an Offset Management Plan detailing SMART targets, management measures (including methodologies for ensuring security of tenure) and monitoring required to ensure that each proposed offset site provides the required value(s) commensurate with the relevant residual impact. The Offset Management Plan will address each of the requirements specified in the *EPBC Act Environmental Offsets Policy* (DSEWPaC, 2012b).

8 RELEVANT RECOVERY PLANS AND THREAT ABATEMENT PLANS

Recovery Plans, Conservation Advices and Threat Abatement Plans relevant to MNES which the Proposal may impact upon have been listed in Table 8-1 and Table 8-2. A discussion of how the Proposal conforms to the Advice or Plan requirements is included in these Tables.

Table 8-1 Relevant Recovery Plans and Conservation Advice for MNES

EPBC ACT LISTED MNES	PLAN/ CONSERVATION ADVICE AND THREATS	RESPONSE	
Tuart Woodlands TEC	TSSC (2019), 'Approved Conservation Advice (incorporating listing advice) for the Tuart (<i>Eucalyptus gomphocephala</i>) Woodlands and forests of the Swan Coastal Plain ecological community'		
	1	Clearing and fragmentation of vegetation	The Proposal will result in the direct loss of 2.0 ha of Tuart Woodlands TEC vegetation (equivalent to a 0.01% reduction in extent) but is not expected to exacerbate this threat
	2	Invasive flora and fauna	The Proposal is not expected exacerbate this threat A Hygiene Management Plan will be implemented for construction of the Proposal as per standard operational controls, to minimise risk of the impact of spread of invasive flora
	3	Tree dieback and pathogens	The Proposal is not expected to exacerbate this threat Dieback mapping has been completed for Proposal. The two infestations present are known and will be managed appropriately. No areas of Proposal Area vegetation are 'protectable' from the disease A Hygiene Management Plan will be implemented for construction of the Proposal as per as per standard operational controls to minimise risk of the impact of disease
	4	Altered fire regimes	The Proposal is not expected to exacerbate this threat There is considered to be a low risk of accidental fire as a result of construction activities Clearing activities are a potential risk of fire generation. To minimise the risk of fire, clearing activities will not be undertaken when the Fire Danger Rating is severe or higher. Standard operational controls include an emergency management plan
	5	Climate change	The Proposal is not expected exacerbate this threat
	6	Water extraction and other hydrological change	The Proposal is not expected exacerbate this threat Dewatering is not required in the vicinity of TEC occurrences
7	Loss of fauna supporting key ecological processes	The Proposal will result in the direct loss of suitable fauna habitat but is not expected to exacerbate this threat	
Black Cockatoos	WA Department of Parks and Wildlife (DPAW) (2013), 'Carnaby's Cockatoo (<i>Calyptorhynchus latirostris</i>) Recovery Plan'		
	1	Loss of breeding habitat	The Proposal may exacerbate this threat, however the Proposal is designed to minimise the loss of breeding habitat Up to 20.8 ha of Black Cockatoo potential breeding habitat will be removed for the Proposal

EPBC ACT LISTED MNES	PLAN/ CONSERVATION ADVICE AND THREATS	RESPONSE
		Up to 124 Black Cockatoo suitable DBH trees will be removed for the Proposal including one tree with a potentially suitable nest hollow. No known nesting trees are present within the Proposal Area.
	2 Loss of non-breeding, foraging and night roosting habitat	The Proposal may exacerbate this threat, however the Proposal is designed to minimise the loss of habitat
	3 Tree health	The Proposal is not expected to exacerbate this threat Dieback mapping has been completed for Proposal. The two infestations present are known and will be managed appropriately. No areas of Proposal Area vegetation are 'protectable' from the disease. A Hygiene Management Plan will be implemented for construction of the Proposal as per standard operational controls to minimise risk of the impact of disease
	4 Illegal shooting	The Proposal will not exacerbate this threat No firearms will be permitted on site as per standard operational controls
	5 Illegal taking	The Proposal will not exacerbate this threat Only qualified fauna handlers will relocate fauna as per the specified management actions (Section 6.1.4)
	6 Collisions with motor vehicles	The Proposal is not expected to exacerbate this threat The Proposal involves the duplication of the existing carriageway, doubling the area over which the existing traffic travels. No increase in traffic volume is expected to result from the Proposal.
Department of the Environment, Water, Heritage and the Arts (DEWHA) (2009b), 'Approved Conservation Advice for <i>Calyptorhynchus banksii naso</i> (Forest Red-tailed Black Cockatoo)'		
	1 Illegal shooting	The Proposal will not exacerbate this threat No firearms will be permitted on site as per standard operational controls
	2 Habitat loss	The Proposal may exacerbate this threat, however the Proposal is designed to minimise the loss of habitat Up to 20.8 ha of potential Black Cockatoo (breeding and foraging) habitat will be removed for the Proposal
	3 Nest hollow shortage	The Proposal may exacerbate this threat however, the Proposal is designed to minimise the loss of breeding habitat Up to 20.8 ha of Black Cockatoo potential breeding habitat will be removed for the Proposal Up to 124 Black Cockatoo suitable DBH trees will be removed for the Proposal including one tree with a

EPBC ACT LISTED MNES	PLAN/ CONSERVATION ADVICE AND THREATS	RESPONSE
		potentially suitable nest hollow. No known nesting trees are present within the Proposal Area.
	4 Competition from other species	The Proposal is not expected to exacerbate this threat Various other bird species (e.g. other Black Cockatoo species, Galahs and Wood Ducks) and other fauna (WRP and South-western Brush-tailed Phascogales) that may compete for hollows with the Black Cockatoos are known to occur within the Proposal Area
	5 Injury or death from <i>Apis mellifera</i> (European Honeybees)	The Proposal is unlikely to exacerbate this threat The Proposal will result in the clearing of one tree containing a potentially suitable nest hollow for Black Cockatoos. A general reduction in the amount of tree hollows may increase competition between fauna using the hollows and the European Honeybee. There are no plans to control European Honeybee populations.
Department of Environment and Conservation (DEC) (2008), 'Forest Black Cockatoo (Baudin's Cockatoo <i>Calyptorhynchus Baudinii</i> and Forest Red-Tailed Black Cockatoo <i>Calyptorhynchus Banksii Naso</i>) Recovery Plan'		
	1 Killing by illegal shooting	The Proposal will not exacerbate this threat No firearms will be permitted on site as per standard operational controls
	2 Feral honeybees	The Proposal is unlikely to exacerbate this threat The Proposal will result in the clearing of one tree with a potentially Suitable Nest Hollow for Black Cockatoos. A general reduction in the amount of tree hollows may increase competition between fauna using the hollows and the European Honeybee. There are no plans to control European Honeybee populations.
	3 Habitat loss	The Proposal may exacerbate this threat, however the Proposal is designed to minimise the loss of habitat Up to 20.8 ha of Black Cockatoo (foraging and) potential breeding habitat will be removed for the Proposal
	4 Nest hollow shortage	The Proposal may exacerbate this threat however, the Proposal is designed to minimise the loss of breeding habitat Up to 20.8 ha of Black Cockatoo (foraging and) potential breeding habitat will be removed for the Proposal Up to 124 Black Cockatoo suitable DBH trees will be removed for the Proposal including one tree with a potentially suitable nest hollow(s). No known nesting trees are present within the Proposal Area.
	5 Nest hollow competition	The Proposal is unlikely to exacerbate this threat The Proposal will result in clearing of one tree containing a potentially suitable nest hollow for Black Cockatoo. A general reduction in the amount of tree hollows may increase competition between fauna and other species using hollows.

EPBC ACT LISTED MNES	PLAN/ CONSERVATION ADVICE AND THREATS	RESPONSE
	<p>TSSC (2018a), 'Conservation Advice <i>Calyptorhynchus baudinii</i> Baudin's Cockatoo'</p>	
1	Destruction of nesting and foraging trees from fire events	<p>The Proposal is not expected to exacerbate this threat</p> <p>The threat of bushfires will be managed as per standard operational controls</p>
2	Loss of hollows from European honey bees (<i>Apis mellifera</i>)	<p>The Proposal is unlikely to exacerbate this threat</p> <p>The Proposal will result in clearing of one tree containing a potentially suitable nest hollow for Black Cockatoo. A general reduction in the amount of tree hollows may increase competition between fauna using the hollows and the European Honeybee. There are no plans to control European Honeybee populations.</p>
3	Nest hollow shortage due to competition with native bird species	<p>The Proposal may exacerbate this threat, however the Proposal is designed to minimise the loss of breeding habitat</p> <p>Various other bird species (e.g. other Black Cockatoo species, Galahs and Wood Ducks) and other fauna (WRP and South-western Brush-tailed Phascogales) that may compete for hollows with Baudin's Cockatoo are known to occur within the Proposal Area; the general reduction in available hollows may increase competition between bird species.</p>
4	Illegal shooting	<p>The Proposal will not exacerbate this threat</p> <p>No firearms will be permitted on site as per standard operational controls</p>
5	Phytopathogens (Dieback)	<p>The Proposal is not expected to exacerbate this threat</p> <p>Dieback mapping has been completed for Proposal. The two infestations present are known and will be managed appropriately. No areas of Proposal Area vegetation are 'protectable' from the disease.</p> <p>A Hygiene Management Plan will be implemented for construction of the Proposal as per standard operational controls to minimise risk of the impact of disease</p>
Western Ringtail Possum	<p>DPaW (2017), 'Western Ringtail Possum (<i>Pseudocheirus occidentalis</i>) Recovery Plan. Wildlife Management Program No. 58'</p>	
1	Habitat loss and fragmentation	<p>The Proposal may exacerbate this threat</p> <p>Clearing of up to an estimated 24.0 ha of potential habitat and impact to the home ranges (to varying degrees) of up to 35 individuals estimated to utilise this habitat (up to 0.38 % of the estimated regional population) could result in a minor residual impact associated with the Proposal.</p>
2	Timber harvesting	<p>The Proposal is not expected to exacerbate this threat</p> <p>Timber harvesting will not be undertaken other than to recover the timber within the clearing area</p>
3	Fire	<p>The Proposal is not expected to exacerbate this threat</p>

EPBC ACT LISTED MNES	PLAN/ CONSERVATION ADVICE AND THREATS	RESPONSE
		<p>There is considered to be a low risk of accidental fire as a result of construction activities</p> <p>Clearing activities are a potential risk of fire generation. To minimise the risk of fire, clearing activities will not be undertaken when the Fire Danger Rating is severe or higher.</p> <p>Standard operational controls include an emergency management plan</p>
4	Competition for tree hollows	<p>The Proposal may exacerbate this threat</p> <p>Clearing of suitable WRP habitat may potentially increase competition for tree hollows within habitat immediately surrounding the Proposal Area</p>
5	Habitat tree decline	<p>The Proposal is not expected to exacerbate this threat</p> <p>Dieback mapping has been completed for Proposal. The two infestations present are known and will be managed appropriately. No areas of Proposal Area vegetation are 'protectable' from the disease.</p> <p>A Hygiene Management Plan will be implemented for construction of the Proposal as per standard operational controls to minimise risk of the impact of disease</p>
6	Unregulated relocation of orphaned, injured and rehabilitated Western Ringtail Possums	<p>The Proposal will not exacerbate this threat</p> <p>An appropriately qualified fauna handler will be on site during clearing of WRP habitat, and will be responsible for any relocation of WRP individuals.</p>
7	Disease	<p>The Proposal is not expected to exacerbate this threat</p> <p>No disease impacting WRP is expected to result from Proposal implementation</p> <p>A Hygiene Management Plan will be implemented for construction of the Proposal as per standard operational controls to minimise risk of the impact of Dieback disease</p>
8	Gaps in knowledge	The Proposal will not exacerbate this threat
TSSC (TSSC, 2018b) 'Conservation Advice <i>Pseudocheirus occidentalis</i> Western Ringtail Possum'		
1	Groundwater depletion and altered hydrology	<p>The Proposal is not expected to exacerbate this threat</p> <p>The Proposal will maintain the existing drainage regime through standard engineering design with no change to water flows. Temporary dewatering will be required during bridge construction, intended to be undertaken during summer/autumn months when water levels and flows are low. Impacts from dewatering to remnant native vegetation at these locations are not expected however monitoring will be conducted as required</p>

EPBC ACT LISTED MNES	PLAN/ CONSERVATION ADVICE AND THREATS		RESPONSE
	2	Land clearing and habitat fragmentation caused by urbanisation	The Proposal is not expected to exacerbate this threat
	3	Fire	<p>The Proposal is not expected to exacerbate this threat</p> <p>There is considered to be a low risk of accidental fire as a result of construction activities</p> <p>Clearing activities are a potential risk for fire generation. To minimise the risk of fire, clearing activities will not be undertaken when the Fire Danger Rating is severe or higher.</p> <p>Standard operational controls include an emergency management plan</p>
	4	Tree decline and insect outbreaks	<p>The Proposal is not expected to exacerbate this threat</p> <p>Dieback mapping has been completed for Proposal. The two infestations present are known and will be managed appropriately. No areas of Proposal Area vegetation are 'protectable' from the disease.</p> <p>A Hygiene Management Plan will be implemented for construction of the Proposal as per standard operational controls to minimise risk of the impact of disease</p>
	5	Competition for tree hollows	<p>The Proposal may exacerbate this threat.</p> <p>Clearing of suitable WRP habitat may potentially increase competition for tree hollows within habitat immediately surrounding the Proposal Area</p>
	6	Logging	<p>The Proposal will not exacerbate this threat</p> <p>Timber harvesting will not be undertaken other than to recover timber within clearing area</p>
	7	Myrtle rust	<p>The Proposal is not expected to exacerbate this threat</p> <p>A Hygiene Management Plan will be implemented for construction of the Proposal as per standard operational controls to minimise risk of the impact of disease</p>
	8	Injury and mortality due to vehicle strike	<p>The Proposal may exacerbate this threat</p> <p>Appropriate temporary traffic management measures will be implemented during clearing activities to mitigate this threat.</p> <p>The Proposal involves the duplication of the existing carriageway, doubling the area over which the existing traffic travels. No increase in traffic volume is expected to result from the Proposal thus no change to the impact to WRP from vehicle strike is expected during operation of the Proposal, rather the installation of fauna bridges</p>

EPBC ACT LISTED MNES	PLAN/ CONSERVATION ADVICE AND THREATS	RESPONSE
		may assist in reducing this threat.
	9 Unregulated relocation of orphaned, injured and rehabilitated Western Ringtail Possums	The Proposal will not exacerbate this threat An appropriately qualified fauna handler will be on site during clearing of WRP habitat and will be responsible for any relocation of WRP individuals

Table 8-2 Relevant Commonwealth threat abatement plan/objectives for potential impacts on MNES within the Proposal Area

IMPACT	PLAN AND THREATS	RESPONSE	
Foxes	DEWHA (2008), 'Threat abatement plan for predation by the European red fox'		
	1	Prevent foxes occupying new areas in Australia and eradicate foxes from high-conservation-value 'islands'	The Proposal is not considered to be inconsistent with this objective The Proposal will not result in the establishment of foxes in new areas in Australia. Fox control does not form part of the Proposal
	2	Promote the maintenance and recovery of native species and ecological communities that are affected by fox predation	The Proposal is considered to be consistent with this objective. Fauna bridges will be installed across the Proposal and existing Bussell Highway at the Abba and Sabina Rivers to create new connections between habitat areas that are disrupted by the existing roadway Where possible, WRP habitat values to be impacted will be reinstated through revegetation following construction of the proposal. The clearing impact will be medium term until the revegetation is established
	3	Improve knowledge and understanding of fox impacts and interactions with other species and other ecological processes	The Proposal is not considered to be inconsistent with this objective Research of fox impacts and interactions with other species and other ecological processes does not form part of the Proposal
	4	Improve the effectiveness, target specificity, integration and humaneness of control options for foxes	The Proposal is not considered to be inconsistent with this objective Fox control does not form part of the Proposal
	5	Increase awareness of all stakeholders of the objectives and actions of the threat abatement plan, and of the need to control and manage foxes	The Proposal is not considered to be inconsistent with this objective

IMPACT	PLAN AND THREATS		RESPONSE
Feral cats	DotE (DotE, 2015), 'Threat abatement plan for feral cats'		
	1	Effectively control feral cats in different landscapes	The Proposal is not considered to be inconsistent with this objective Feral cat control does not form part of the Proposal
	2	Improve effectiveness of existing control options for feral cats	The Proposal is not considered to be inconsistent with this objective Research of effective feral cat control methodologies does not form part of the Proposal
	3	Develop or maintain alternative strategies for threatened species recovery	The Proposal is not considered to be inconsistent with this objective In regard to clearing protocols, the re-establishment of suitable habitat for threatened fauna species, and consideration of options to improve habitat connectivity, the Proposal utilises current best practice methodologies based on successful past projects undertaken by Main Roads and others
	4	Increase public support for feral cat management and promote responsible cat ownership	The Proposal is not considered to be inconsistent with this objective
Dieback	DEE (2018) 'Threat abatement plan for disease in natural ecosystems caused by <i>Phytophthora cinnamomi</i>'		
	1	Identify and prioritise for protection of biodiversity assets that are, or may be, impacted by <i>Phytophthora cinnamomi</i>	The Proposal is considered to be consistent with this objective Dieback mapping has been completed for Proposal. The two infestations present are known and will be managed appropriately. No areas of Proposal Area vegetation are 'protectable' from the disease.
	2	Reduce the spread and mitigate the impacts of <i>Phytophthora</i> to protect priority biodiversity assets and susceptible landscapes	A Hygiene Management Plan will be implemented for construction of the Proposal as per standard operational controls to minimise risk of the impact of disease
	3	Inform and engage the community by promoting information about <i>Phytophthora</i> , its impacts on biodiversity and actions to mitigate these impacts	The Proposal is not considered to be inconsistent with this objective

9 ECONOMIC AND SOCIAL MATTERS

9.1 Economic Costs and Benefit Estimates

The total Bussell Highway Duplication Stage 2 Proposal cost estimate is \$64 million. The combined cost of Stages 1 and 2 is \$85 million. The Proposal cost was determined through Main Roads standard cost estimating process.

In December 2020, the Australian Government committed funding of \$65.26 million towards the total P50 cost of \$81.57 million for the delivery of the Proposal, with the WA Government to fund the remaining \$16.31 million.

During construction, the Proposal will employ approximately 83 people (full-time equivalents), many from the local area. During the operational phase, the Proposal will employ two people (full-time equivalents).

Most importantly, the duplication is expected to reduce the impacts on the community associated with road fatalities. In Q4 2020 alone, four people lost their lives on this stretch of road. Reducing the likelihood and severity of crashes in this area will significantly benefit the local and wider community.

Other intangible economic benefits from the Proposal include reducing the longer-term maintenance costs for the road and improving travelling time through reduced congestion.

9.2 Benefits and Disadvantages of Construction of Second Carriageway

Benefits

The Bussell Highway Duplication Stage 2 Proposal aims to create free flowing traffic movement for all road users while simultaneously reducing local congestion and improving public safety. This relatively short section of single carriageway is the last remaining single carriageway on this significant route between Perth and Busselton.

Flow on benefits of providing dual carriageway road network between Perth and Busselton, in line with the South West Regional Blueprint, highlights the importance of reducing the tyranny/barrier of distance to the South West economy, and the need for improvements to business productivity and access to markets that would flow from improved transport infrastructure.

The safety benefits of the Proposal include:

- Reduced crash frequency and severity.
- Improved incident/emergency response access.
- Improved visibility and access at intersections.
- Improved road surface, including shoulders.
- Improved overtaking conditions.
- Reduced congestion and traffic density.
- General traffic time savings.
- Improved access for road maintenance works (currently restricted due to a lack of detours).
- Adequate capacity for projected future demand.

The social benefits of the Proposal include:

- Safer roads, due to the reduced risks of fatal accidents and hospitalisation from crash impact.
- Reduced travel times.
- Improved driver comfort and consequently reducing driver fatigue and frustration.
- Improved driving experience for all road users and local communities.

Disadvantages

There will be temporary disruption for local road users during construction.

9.3 Consultation

A Community and Stakeholder Engagement Plan (CSES) has been developed for the Proposal which outlines the objectives, potential issues and mitigation and the engagement and communication requirements for the Proposal. Consultation with key stakeholders has been undertaken for this Proposal in accordance with Main Roads internal processes.

The Proposal is high profile and has significant community support which can be mainly attributed to the need for safety improvements and current delays experience during holiday times and long weekends.

Landowners adjacent to the Proposal Area, including Tronox, the locally situated mineral sands mining company, are being engaged directly as per the CSES to ensure potential disruptions are managed, including dust and access.

Both the Shire of Capel and the City of Busselton are strongly supportive of the Proposal, and have offered assistance where required. A workshop to discuss the Proposal with the local government authorities was held on 4 August 2016 to get feedback regarding material sourcing, as well as local knowledge, stakeholders and environment. This was critical to ensure that Main Roads understands concerns and issues. Both LGAs will continue to be engaged prior to and during construction.

Consultation with DAWE occurred during DAWE's annual Main Roads site visit on 25 May 2018, which was also attended by a representative from DWER.

Consultation with DBCA has been ongoing throughout Proposal planning and will continue prior to and during construction.

The local Aboriginal community has been engaged through the Section 18 process under the *Aboriginal Heritage Act 1972*.

Approvals have been sought from DWER's Native Vegetation branch in regard to clearing of vegetation for the Proposal, including consultation. Clearing Permit documentation was submitted to DWER on 23 December 2020.

10 PROPOSAL TIMELINE

Major Project status applies to this Proposal. It is anticipated that the EPBC assessment process will be completed and decision subsequently handed down no later than 30 June 2021.

Confirmation of the outcome of the state assessment is also expected to be received no later than 30 June 2021, appeals notwithstanding.

Construction of the Proposal will commence in June 2021 or, if approval to proceed from both state and Commonwealth governments has not been received at this time, then immediately on confirmation of these approvals.

Vegetation clearing for the Proposal will commence at this time. Where possible, Main Roads intends to complete clearing of WRP and Black Cockatoo habitat before the end of August 2021, being prior to the seasonal increase in WRP numbers and prior to the main Black Cockatoo breeding season.

Due to the 12.8 km length of the roadwork footprint, for constructability purposes the construction footprint is likely be divided into sections. Road construction phases of topsoil strip, subgrade preparation, embankment construction, pavement layer works and wearing course (seal) will be undertaken sequentially to optimise plant and equipment availability and efficiency. Bridge construction is anticipated commence at the same time as road construction activities, or prior, depending on the timing of receipt of state and Commonwealth environmental approvals.

Partial revegetation work on sections where topsoil has been respread is anticipated to commence by the onset of winter of 2022.

Post-construction, final seal of the wearing course by Main Roads will take place a year after the initial seal is completed.

It is anticipated that construction of Stage 2 will be completed in early 2024.

11 REFERENCES

- 360 Environmental. (2016a). *Fauna Assessment Bussell Highway*. Unpublished report prepared for Main Roads Western Australia.
- 360 Environmental. (2016b). *Bussell Highway - Hutton to Sabina (31.25 to 43.67 SLK) Environmental Impact Assessment (EIA)*. Unpublished report prepared for Main Roads Western Australia.
- 360 Environmental. (2017). *Bussell Highway – Hutton Road to Sabina section. Level 1 Fauna and Targeted Western Ringtail Possum Survey*. Unpublished report prepared for Main Roads Western Australia.
- Biota. (2020a). *Bussell Highway (Hutton to Sabina) Western Ringtail Possum Assessment*. Unpublished report prepared by Biota Environmental Sciences for Main Roads Western Australia.
- Biota. (2020b). *Western Ringtail Possum Pseudocheirus occidentalis Regional Surveys*. Prepared by Biota Environmental Sciences for Main Roads Western Australia.
- DAWE. (2020). *Species Profile and Threats Database*. Retrieved from *Calidris ruficollis* — Red-necked Stint: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=860
- DEC. (2008). *Forest Black Cockatoo (Baudin's Cockatoo Calyptorhynchus Baudinii and Forest Red-Tailed Black Cockatoo Calyptorhynchus Banksii Naso) Recovery Plan*. Perth, Western Australia: Department of Environment and Conservation.
- DEWHA. (2008). *Threat abatement plan for predation by the European red fox*. Canberra, Australian Capital Territory: Department of the Environment, Water, Heritage and the Arts.
- DEWHA. (2009a). *Significant Impact Guidelines for the Vulnerable Western Ringtail Possum (Pseudocheirus occidentalis) in the southern Swan Coastal Plain, Western Australia. EPBC Act policy statement 3.10*. Canberra, Australian Capital Territory: Department of Water, Heritage and the Arts.
- DEWHA. (2009b). *Approved Conservation Advice for Calyptorhynchus banksii naso (Forest Red-tailed Black Cockatoo)*. Canberra, Australian Capital Territory: Department of the Environment, Water, Heritage and the Arts.
- DotE. (2014). *Environmental Management Plan Guidelines*. . Department of the Environment. Canberra, Australia.
- DotE. (2015). *Threat abatement plan for predation by feral cats*. Canberra, Australian Capital Territory: Department of the Environment.
- DotE. (2015). *Wildlife Conservation Plan for Migratory Shorebirds*. Canberra, Australian Capital Territory: Commonwealth of Australia Department of the Environment.
- DPaW. (2013). *Carnaby's Cockatoo (Calyptorhynchus latirostris) Recovery Plan*. Perth, Western Australia: Department of Parks and Wildlife.
- DPaW. (2014). *Tuart Forest National Park Management Plan 2014*. Perth, Western Australia: Department of Parks and Wildlife.
- DPaW. (2017). *Western Ringtail Possum (Pseudocheirus occidentalis) Recovery Plan. Wildlife Management Program No. 58*. Perth, Western Australia: Department of Parks and Wildlife,.
- DSEWPaC. (2012a). *EPBC Act referral guidelines for three threatened black cockatoo species*. Canberra, Australian Capital Territory: Australian Government, Department of Sustainability, Environment, Water, Population and Communities.
- DSEWPaC. (2012b). *Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy*. . Retrieved from http://www.environment.gov.au/system/files/resources/12630bb4-2c10-4c8e-815f-2d7862bf87e7/files/offsets-policy_2.pdf: Department of Sustainability, Environment, Water, Population and Communities.
- DSEWPaC. (2012c). *Offsets Assessment Guide Excel Spreadsheet*. Canberra, Australian Capital Territory: Department of Sustainability, Environment, Water, Population and Communities.
- Ecoedge. (2020a). *Detailed and Targeted Flora and Vegetation Survey along Bussell Highway, Hutton Road to Sabina River (32.10 – 43.92 SLK) updated 2020*. Unpublished report prepared for Main Roads Western Australia.

- Ecoedge. (2020b). *Targeted Vegetation Survey of Threatened and Priority Ecological Communities Hutton Road to Sabina River, Capel*. Unpublished report prepared for Main Roads Western Australia.
- Glevan Consulting. (2016). *Phytophthora Dieback Occurrence Assessment*. Unpublished report prepared for Main Roads Western Australia.
- Glossop B., C. K. (2011). *Methods for Mapping Carnaby's Cockatoo Habitat*. Perth, Western Australia: Department of Environment and Conservation.
- GoWA. (2019). *2018 Statewide Vegetation Statistics incorporating the CAR Reserve Analysis (Full Report)*. Current as of March 2019. Perth, Western Australia: Department of Biodiversity, Conservation and Attractions.
- GoWA. (2020a). *Native Vegetation Extent (DPIRD-005)*. Retrieved from data.wa.gov.au: <https://catalogue.data.wa.gov.au/dataset/native-vegetation-extent>
- GoWA. (2020b). *Black Cockatoo Roosting Sites - Buffered (DBCA-064)*. Retrieved from data.wa.gov.au: <https://catalogue.data.wa.gov.au/dataset/black-cockatoo-roosting-sites-buffered>
- GoWA. (2020c). *Black Cockatoo Breeding Sites - Buffered (DBCA-063)*. Retrieved from data.wa.gov.au: <https://catalogue.data.wa.gov.au/dataset/black-cockatoo-breeding-sites-buffered>
- GoWA. (2020d). *Carnabys Cockatoo Areas requiring investigation as feeding habitat in the Swan Coastal Plain (SCP) IBRA Region (DBCA-057)*. Retrieved from data.wa.gov.au: <https://catalogue.data.wa.gov.au/dataset/carnabys-cockatoo-unconfirm-feeding-areas-scp>
- GoWA. (2020e). *Tuart Woodlands (DBCA-048)*. Retrieved from data.wa.gov.au: <https://catalogue.data.wa.gov.au/dataset/tuart-woodlands>
- Great Southern Bio Logic. (2020). *Phytophthora Dieback Occurrence Survey Bussell Highway (H043) Duplication Hutton to Sabina, SLK 31.15 – 43.95*. Unpublished report prepared for Main Roads Western Australia.
- Harewood. (2018). *Targeted Fauna Survey. Bussell Highway – Hutton to Sabina Section*. Unpublished report prepared for Main Roads Western Australia.
- Hedde, E. M., Loneragan, O. W., & Havel, J. J. (1980). *Vegetation Complexes of the Darling System, Western Australia, in Atlas of Natural Resources, Darling System Western Australia*. Perth, Western Australia: Department of Conservation and Environment.
- Main Roads. (1993). *Ludlow Deviation Landscape Design*. Main Roads Western Australia.
- Main Roads. (2020). *Bussell Highway (H043) Duplication Hutton Road to Sabina River Project: Supplementary fauna habitat assessment*. Memo report prepared by Main Roads Western Australia.
- Paap, T. M. (2012). *Research Findings 2012 Bulletin No. 3 Identifying Marri Canker Disease*. Perth, Western Australia: Centre of Excellence for Climate Change, Woodland and Forest Health.
- RAC. (2019). *RAC Risky Roads Survey results 2018/19*. Perth, Western Australia: Royal Automobile Club.
- Shedley, E. and Williams, K. (2014). *An assessment of habitat for Western Ringtail Possum (Pseudocheirus occidentalis) on the southern Swan Coastal Plain (Binningup to Dunsborough)*. Perth, Western Australia: Department of Parks and Wildlife.
- SW Environmental. (2020). *Bussell Highway (H043) Duplication Project: Tree hollow inspection*. Unpublished memo report prepared for Main Roads Western Australia.
- TSSC. (2018a). *Conservation Advice Calyptorhynchus baudinii Baudin's Cockatoo*. Canberra, Australian Capital Territory: Threatened Species Scientific Committee.
- TSSC. (2018b). *Conservation Advice Pseudocheirus occidentalis Western Ringtail Possum*. Canberra, Australian Capital Territory: Department of the Environment and Energy.
- TSSC. (2019). *Approved Conservation Advice (incorporating listing advice) for the Tuart (Eucalyptus gomphocephala) woodlands and forests of the Swan Coastal Plain ecological community*. Canberra, Australian Capital Territory: Threatened Species Scientific Committee.
- Webb, A., Kinloch, J., Keighery, G. and Pitt, G. (2016). *The extension of vegetation complex mapping to landform boundaries within the Swan Coastal Plain landform and forested*

region of south west Western Australia. Perth, Western Australia: Department of Parks and Wildlife.

Yokochi, K., & Bencini, R. . (2015). *(A remarkably quick habituation and high use of a rope bridge by an endangered marsupial, the western ringtail possum.* Nature Conservation, 16.

12 APPENDICES

Appendix	Title
Appendix A	Figures
Appendix B	DAWE Request for Additional Information
Appendix C	Flora and Vegetation Survey Report (Ecoedge, 2020a)
Appendix D	TEC/PEC Vegetation Survey Report (Ecoedge, 2020b)
Appendix E	Tree Hollow Inspection Memorandum (SW Environmental, 2020)
Appendix F	Vasse-Wonnerup Ramsar Wetland Site Environmental Management Plan