

BORR Northern and Central Sections Offset Strategy (Main Roads, 2020)



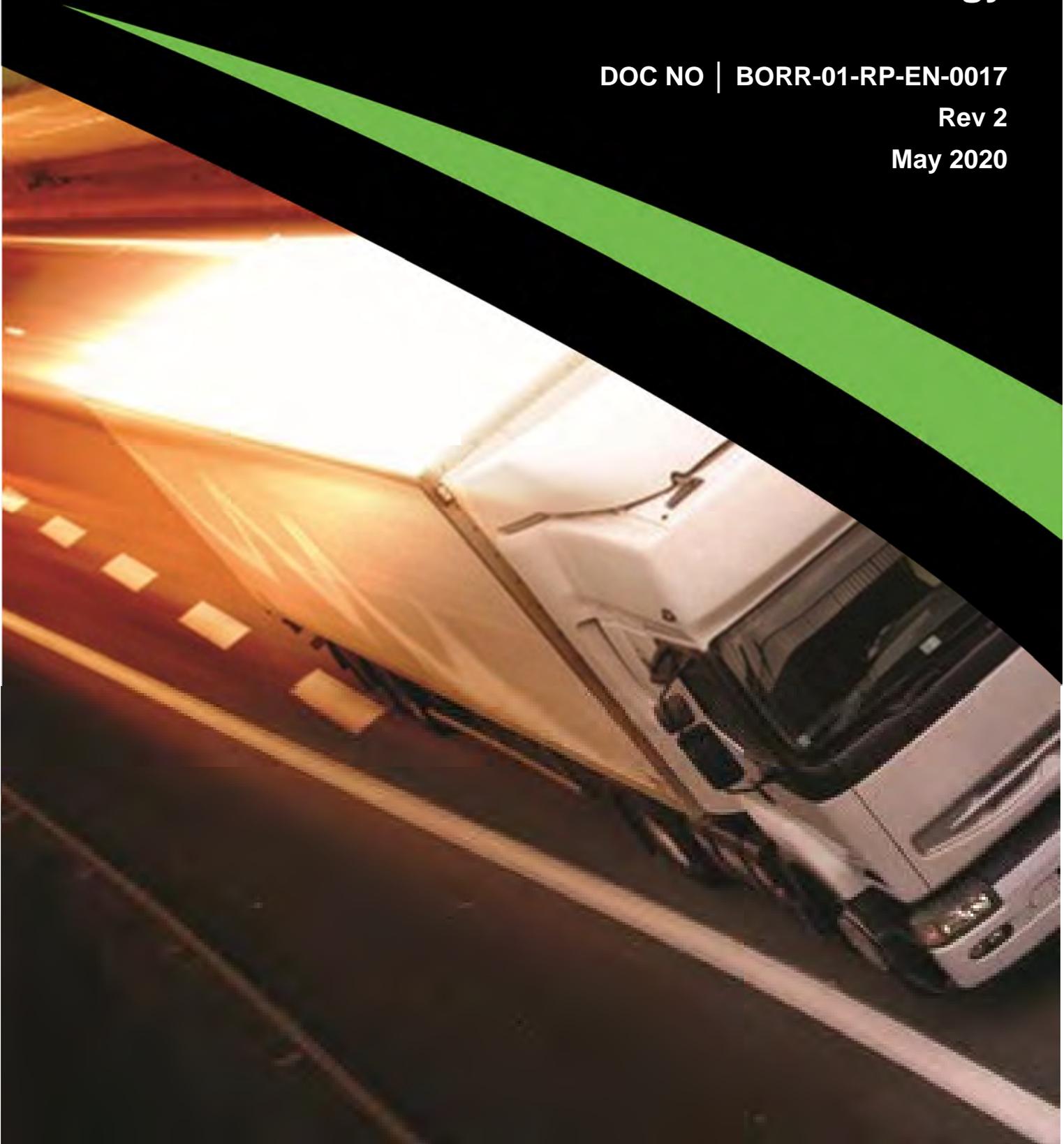
Bunbury Outer Ring Road Northern and Central Sections

Offset Strategy

DOC NO | BORR-01-RP-EN-0017

Rev 2

May 2020



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<i>Document Control</i>					
Revision	Date	Description	Prepared	Reviewed	Approved
A	20/12/19	Draft for Main Roads Review	BORR Team	FH	FH
0	31/01/20	Final issued to Main Roads for submission to EPA	BORR Team	FH	FH
1	30/04/20	Final issued to Main Roads for EPA Response to Submissions	BORR Team	FH	FH
2	06/05/2020	Update issued for EPA Response to Submissions	MRWA	NMc	NMC

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1 INTRODUCTION

1.1 Proposal background

The Commissioner of Main Roads Western Australia (Main Roads) is proposing to construct and operate the Northern and Central sections of the Bunbury Outer Ring Road (BORR) project. BORR is a planned Controlled Access Highway linking the Forrest Highway and Bussell Highway. The completed project will provide a high standard route for access to the Bunbury Port, improved road safety and facilitate proposed development to the east of the City of Bunbury.

The proposed BORR comprises three sections:

- 'BORR Northern Section' – Forrest Highway to Boyanup-Picton Road
- 'BORR Central Section' – Boyanup-Picton Road to South Western Highway
- 'BORR Southern Section' – South Western Highway (near Bunbury Airport) to Bussell Highway.

This Offset Strategy relates to the residual environmental impacts of the BORR Northern and Central Sections (the Proposal).

1.2 Purpose of this document

The Proposal is located approximately 200 km south of Perth and at its closest point, approximately six kilometres south-east of Bunbury. It occurs within the City of Bunbury and Shires of Capel, Dardanup and Harvey.

The Proposal includes construction and operation of BORR Northern and Central sections. These sections comprise 19 km of new freeway standard dual carriageway and associated bridges, interchanges and other road infrastructure including, but not limited to, culverts, lighting, noise barriers, fencing, landscaping, road safety barriers and signs.

The area being referred by Main Roads is up to 625 hectares (ha) and referred to as the Proposal Area. The majority of the land within the Proposal Area is cleared agricultural land. Pockets of native vegetation are present within the Proposal Area in road reserves, along sections of the Collie, Ferguson and Preston Rivers, or as isolated patches on properties. The Proposal Area excludes areas within BORR Central Section which was constructed in 2013. The implementation of the Proposal will result in clearing of up to 73 hectares (ha) of vegetation and 19 ha of revegetation (~15 % combined) within the 625 ha Proposal Area. The Proposal Area is shown at Figure 1 (Appendix A).

1.3 Purpose of this strategy

In June 2019, Main Roads referred the Proposal to the Environmental Protection Authority (EPA) for assessment under Section 38 of the *Environmental Protection Act 1986* (EP Act). In July 2019, the EPA advised that under Section 40(2)(a) further information was to be provided to allow it to properly assess the impacts of the Proposal, including the provision of an Offsets Strategy.

This Offset Strategy has been prepared to address the EPA's Section 40(2)(a) request and will:

- Identify, describe and quantify the potential residual impacts (direct, indirect and cumulative) on the identified key environmental factors (Flora and Vegetation and Terrestrial Fauna), that will occur

following implementation of the Proposal after consideration and applying avoidance and minimisation measures.

- Determine the significance of any residual impacts on the identified key environmental factors using the WA Environmental Offsets Guidelines and application of the Residual Impact Assessment Model.
- Where significant residual impacts remain, propose an offset strategy to counterbalance the residual impacts of the Proposal that is consistent with the WA Environmental Offsets Policy (GoWA, 2011) and WA Offset Guidelines (GoWA, 2014) and where residual impacts relate to threatened species or communities the Environmental Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy (DSEWPaC, 2012).

1.4 Impact avoidance

The WA Environmental Offsets Policy notes that environmental offsets will only be considered after avoidance and mitigation options have been pursued. Since the referral of the Proposal in June 2019, Main Roads has undertaken a comprehensive review of the design and amended the Proposal Area to reduce the potential impacts on key environmental features including:

- Western Ringtail Possum
- South-western Brush-tailed Phascogale
- Black Cockatoos
- Banksia Woodland TEC and PEC
- Claypan TEC
- Corymbia Woodland TEC.

The changes to the Proposal include:

- Reducing median widths where the alignment is on high fill embankments
- Amending the form of interchanges to reduce impacts, including fragmentation
- Increasing batter slope (gradients) and using retaining walls to reduce the area of clearing required
- Avoiding the need for bridge piers or abutments within watercourses
- Amending the alignment to reduce the area of native vegetation cleared
- Staging construction to allow for the reduced clearing footprint
- Shifting the principal shared path closer to the highway to reduce the project footprint
- Including fauna crossings.

Table 1-1 Summary of design changes and benefits

DESIGN CHANGE	SPECIES AND COMMUNITIES BENEFITTING					
	BC	WR P	BT P	CF M	BS M	TE C
Whole of alignment						
1800 m chainlink fence along the BORR road reservation with a fine gauge skirt in areas where smaller fauna may be present (i.e. not in farmland areas)	X	X	X			X

DESIGN CHANGE	SPECIES AND COMMUNITIES BENEFITTING					
	BC	WR P	BT P	CF M	BS M	TE C
The median widths have been reduced where the BORR alignment is on high fill embankments to mitigate the environmental impacts	X	X	X			X
All bridge designs have been prepared to avoid the need to have piers or abutments within the watercourse, mitigating environmental and heritage impacts				X	X	
BORR / South West Highway (North)						
Design of works along South West Highway has been modified to mitigate the impact to the TEC west of Waterloo Road						X
BORR/Forrest interchange						
BORR main alignment has been designed to mitigate impacts on vegetation	X	X	X			X
Form for the interchange deliberately planned to reduce impacts to habitat and vegetation. Environmental benefits are substantial however the solution is largely unpopular with the community	X	X	X			X
Reduced median width on BORR to minimise the impacts on vegetation	X	X	X			X
Noise wall alignment designed to mitigate environmental impacts by building wall along an existing cleared track	X	X	X			X
Noise walls will be utilised instead of bunds to minimise the clearing footprint	X	X	X			X
Road profile has been adapted to ensure the existing hydrological flows are maintained and sufficient culverts can be provided				X	X	
Batter slopes have been steepened to minimise width of clearing	X	X	X			X
Existing vegetation on the south west quadrant of the interchange has been removed from the referral area. This will restrict the construction staging options and require additional traffic staging at a cost to Main Roads	X	X	X			X
Existing vegetation on the north west quadrant of the interchange will be protected through engineering solutions to maintain the connectivity to the Brunswick River	X	X	X			X
Works along Forrest Highway have been minimised to retain as much vegetation as possible	X	X	X			X
43 fauna crossings included in the design to maintain and enhance existing movement pathways		X	X			
Potential inclusion of a water source for WRP and BTP within drainage infrastructure at the interchange – this is being negotiated with the Department of Water and Environmental Regulation (DWER)		X	X			
Fauna fence established as close to the highway as possible so that batters can be used for revegetation and recreation of habitat	X	X	X			X
BORR / Boyanup Picton Road interchange						
PSP moved closer to the BORR alignment to reduce footprint width and potential vegetation and habitat fragmentation impacts	X	X	X			X
Vegetation within the loop ramp has been removed from the referral boundary	X	X	X			X
Fauna movements will be supplemented with fauna crossings to provide connectivity to the Ferguson River		X	X			

DESIGN CHANGE	SPECIES AND COMMUNITIES BENEFITTING					
	BC	WR P	BT P	CF M	BS M	TE C
BORR / Moore Road interchange						
Drainage design to move infrastructure to cleared areas not within vegetation or habitat	X	X	X			X
BORR / South West Highway (South) interchange						
Alignment modified to save existing vegetation on the northern boundary of the existing alignment. This will require additional construction staging efforts to accommodate existing traffic patterns while the new highway is constructed.	X	X	X			X

This has resulted in a reduction in the Proposal Area (651 to 625 ha), a reduction in the clearing area of remnant native vegetation from 91 to 73 ha and a reduction in clearing area of revegetation areas from 28 to 19 ha.

1.5 Residual Significance and summary of offset requirements

The Northern and Central Sections of BORR largely occur within areas that have been largely cleared for agricultural purposes. Main Roads anticipates that the social and environmental impacts of the Proposal can be appropriately managed through the measures discussed within this document and considers the EPA's objectives for each key factor will be met. The environmental and social impact studies undertaken for this Proposal have considered and assessed potential impacts at both at a local and regional scale. The results of these studies have informed the Proposal impact assessment and development of mitigation measures.

Significant effort has occurred throughout the alignment selection and design process to locate the corridor for BORR where it will have the least environmental and social impacts, minimising the potential for residually significant impacts.

- As a consequence of the location of the Proposal in a predominantly cleared area, the impacts to flora and vegetation are not considered to be significant.
- Due to the occurrence of fauna of conservation significance, in particular the Western Ringtail Possum and three species of threatened black-cockatoo, some minor residual impacts to fauna are expected.
- Impacts to soil quality, hydrological process and water quality are not considered to be significant as proposed management measures will avoid and minimise any potential impacts.
- There will be air emissions during construction of the road however these are not considered to be significant as these will be effectively managed during construction. Air quality modelling predicted that there will be not be a significant impact on air quality as a result of the construction and operation of the Proposal.
- Although noise emissions will increase along the length of the alignment, the mitigation of these emissions will be managed in accordance with the requirements of State Planning Policy 5.4.
- The visual amenity will be altered as a result of the construction and operation of the Proposal, however, this is not expected to be significant as the Proposal Area is predominately low lying, cleared agricultural land.

The residual significance of the impacts associated with the Proposal have been fully assessed both in the original referral information and the additional information document. A summary of the residual significance of the Proposal is included in Table 1-2.

Table 1-2 Preliminary offset triggers – Residual Impact Significance Model

This table is based on the Residual Impact Significance Model page 11 of the WA Environmental Offsets Guidelines (Government of WA, 2014)

Part IV Environmental Factors	Vegetation and Flora							All factors
						Subterranean Fauna		
				Marine Fauna				
	Benthic Habitat and Communities			Benthic Habitat and Communities				
	Terrestrial Fauna							
	Rare flora	Threatened ecological communities	Remnant vegetation	Wetlands & waterways	Conservation areas	High biological diversity	Habitat for fauna	Other
<i>Residual impact that is environmentally unacceptable or cannot be offset</i>								
<i>Significant residual impacts that will require an offset – All significant residual impacts to species and ecosystems protected by statute or where the cumulative impact is already at a critical level</i>								
<i>Significant residual impacts that may require an offset – Any significant residual impact to potentially threatened species and ecosystems,</i>		The implementation of the Proposal will result in clearing 5.7 ha of native vegetation communities representative of TECs and / or PECs, Main Roads proposes to					A high level of mitigation and management has been applied to the Proposal, with Main Roads making substantial changes to the Proposal design in order to mitigate	

<p>areas of high environmental value or where the cumulative impact may reach critical levels if not managed</p>		<p>further address the residual impacts of the Proposal on Banksia Woodlands TEC/PEC and the Herb Rich Shrublands in Clay Pans (FCT08) TEC through the provision of environmental offsets.</p>					<p>potential impacts on terrestrial fauna. The changes made have resulted in the reduction in the area fauna habitat impacted. Connectivity of habitat will be maintained and enhanced through revegetation of additional areas within the Proposal Area. Main Roads intends to further counterbalance the residual impacts of the Proposal on terrestrial fauna through the provision of environmental offsets.</p>	
<p>Residual impacts that are not significant</p>	<p>No impacts to conservation significant flora are associated with the Proposal.</p>	<p>Considering that more than 95% of the 1.3 ha of the <i>Corymbia calophylla</i> – <i>Xanthorrhoea preissii</i> woodlands and shrublands of the SCP (FCT3c) TEC that will be cleared under the Proposal is Degraded or Completely Degraded, Main Roads does not consider that an additional offset to counterbalance impacts to this TEC is necessary</p>	<p>The implementation of the Proposal will result in clearing of up to 73 hectares (ha) of vegetation and 19 ha of revegetation within the 625 ha Proposal area. . No residually significant impacts are anticipated as a consequence of the proposal.</p>	<p>Changes to the Proposal design have removed the requirement for bridge piers or abutments within any water courses. Direct loss of Wetland habitat will be limited to 0.55 ha. No residual impact is anticipated.</p>	<p>No impacts to conservation areas are associated with the Proposal.</p>	<p>The Proposal avoids native vegetation and contiguous areas of high diversity by locating the corridor within areas that are predominately cleared for agriculture. Further refinements to the Proposal have significantly reduced the potential impacts of the Proposal to TECs and habitats for threatened fauna, avoiding residually significant impacts.</p>		<p>No other residually significant impacts are associated with the Proposal.</p>

Offset requirements for threatened ecological communities and terrestrial fauna have been determined through assessment of the direct residual impacts of the Proposal based on the revised design, field survey and site assessment. Details of the residual impacts are included in the Bunbury Outer Ring Road Northern and Central Sections – Response to EPA Notice of Decision (BORR IPT, 2020) and are summarised in Section 2 and 3 below. Table 1-3 presents a summary of the residual impacts to threatened ecological communities and terrestrial fauna this Offset Strategy proposes to offset.

Table 1-3 Offset requirements

ITEM	DETAILS
Title of proposal	Bunbury Outer Ring Road Northern and Central Section
Proponent name	Commissioner for Main Roads Western Australia
EPA Assessment No.	2215 / CMS 17624
Purpose of this plan	This plan is submitted to address the EPA request for additional information in respect to environmental offsets.
Environmental Offset	<p>To counterbalance the significant residual impacts to:</p> <ul style="list-style-type: none"> • 3.7 ha of vegetation representative of Banksia Woodland TEC and PEC. • 0.6 ha of vegetation representative of ‘Herb rich shrublands in clay pans (FCT08). • 43.9 ha of Western Ringtail Possum habitat comprising impacts to the home range of 20-25 individuals • 17.7 ha of Southern Brush-tailed Phascogale habitat • 37.8 ha of potential habitat for Black Cockatoo species (Baudin’s Black-Cockatoo (<i>Calyptorhynchus baudinii</i>), Carnaby’s Black-Cockatoo (<i>Calyptorhynchus latirostris</i>) and Forest Red-tailed Black Cockatoo (<i>Calyptorhynchus banksia naso</i>).

1.6 Consultation

The proposed offset measures and approach detailed in this strategy were discussed with officers from the Department of Water and Environmental Regulation (DWER), Department of Biodiversity Conservation and Attractions (DBCA) and Commonwealth Department of the Environment and Energy (DoEE) during a workshop with Main Roads on 13 November, 2019.

2 FLORA AND VEGETATION ASSESSMENT AND IMPACTS

2.1 Environmental surveys

The flora and vegetation studies and surveys have been undertaken within, or are relevant to, the Proposal are shown in Table 2-1. These investigations and the refinement of the Proposal design have been used to define the residual environmental impacts, and consequently used as the basis for determining the environmental offset requirements.

Table 2-1 Studies and surveys relevant to the Proposal

SURVEY / REPORT NAME	LOCATION / EXTENT IN SURVEY AREA	METHODOLOGY
Bunbury Port Access Road Project Stage 2 – Flora and Vegetation Survey (GHD, 2010)	Near Boyanup Picton Road to South Western Highway. Two survey areas overlap the current Proposal Area.	Survey completed on the 13, 14 and 17 October and the 4 – 5 November 2009. The survey included vegetation type and condition mapping.
Lot 1 Ducane Road, Environmental Values Assessment (GHD, 2014)	Survey of Lot 1 Ducane Road (40.5 ha) – which is located approximately 2.5 km south-west of the current Survey Area.	Survey on the 13 June 2013. This survey included vegetation mapping and quadrat based sampling.
Dardanup Structure Plan (GHD, 2015a)	Approximately 2,700 ha between Collie River and approximately Boyanup Picton Road. The study boundaries overlap the current Survey Area.	Two season flora survey in accordance with EPA guidelines at the time of survey (EPA, 2004a). Late winter (13 – 14 August 2014) and mid-spring (30 – 31 October 2014). Vegetation type and condition mapping based on quadrats and opportunistic records. Searches for conservation significant flora.
BORR South Flora Survey (GHD, 2015b)	Survey for BORR South Project Area. This occurs immediately south of the current Survey Area and is used to provide context. Two quadrats are within the current Survey Area.	Survey completed on 21 – 23 September 2011 and 16 – 18 June 2014. Level 2 flora and vegetation survey including quadrat sampling, targeted searches and vegetation type / condition mapping.
Reassessment of Floristic Communities (Biota, 2016)	Target areas within BORR South alignment. Two quadrats are within the current Survey Area.	Additional quadrats and re-analysis of the FCTs presented in GHD (2015b). Surveys carried out in September 2016.
Biota 2018 – Banksia TEC Assessment for BORR South (Biota, 2018)	24 target areas within BORR South area and surrounds. This report also provides context for the Banksia TEC assessment. Three target sites are located south-west of the current Survey Area. The closest target site is approximately 3 km south-west of the current Survey Area.	Walking transects and quadrats within the target sites. Surveys carried out in November 2017.
A Flora and Vegetation survey on Lot 104 Willinge Drive Davenport	Survey of the 83.3 ha within Lot 104 (North east of the Preston River). The study boundary intersects the Proposal Area.	Survey carried out on 30 October and 2 and 3 November 2017. Vegetation type and condition mapping and species lists presented.

SURVEY / REPORT NAME	LOCATION / EXTENT IN SURVEY AREA	METHODOLOGY
(Ecoedge, 2018)		
Bunbury Outer Ring Road North – Phytophthora Dieback Occurrence Survey (GSB, 2018)	BORR Northern and Central sections alignment.	Visual diagnosis of disease supported by laboratory assessment of soil and tissue samples within areas of assessable remnant vegetation.
BORR Northern and Central Sections Drainage Strategy (BORR IPT, 2018)	BORR Northern and Central sections alignment.	Outlines broad strategies for management of surface water throughout the Proposal Area, including flood mitigation and maintaining surface water flows to wetlands and agricultural land.
BORR Northern and Central Sections Vegetation and Flora Assessment (BORR IPT, 2019b)	Detailed flora and vegetation assessment of 1,128 ha, including the Proposal Area.	Detailed vegetation and flora survey was undertaken from 20 August 2018 to 19 December 2018. The survey included early spring, mid-spring, late spring and summer survey periods.
Bunbury Outer Ring Road Central and Northern Sections Claypan TEC Assessment Survey Report 2019 (Ecoedge, 2019a)	Within the locality of Waterloo, in the BORR Northern and Central sections alignment.	Survey carried out on 26 July to 1 August 2019. Condition, hydrology and species diversity were assessed to confirm whether the vegetation met the floristic and condition thresholds of the Claypan TEC. Results informed the avoidance, management, mitigation and monitoring actions.
A Review of the Regional Conservation Status of a Clay-based Wetland Community (Clay pans) (Ecoedge 2019b)*	Region defined as on the Swan Coastal Plain within Harvey, Bunbury, Capel, Dardanup and Busselton local government areas	Desktop and field assessments conducted in August 2019

The assessment of the broader flora and vegetation values of the area are provided in BORR IPT (2019a) and BORR IPT (2020), with the outcomes of these assessments, as they relate to offsets, summarised below.

2.2 Conservation significant flora

The Proposal will not impact any *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) nor *WA Biodiversity Conservation Act 2016* (BC Act) listed flora and will have a minor impact on three Department of Biodiversity, Conservation and Attractions (DBCA) Priority Flora.

Main Roads does not propose to provide an environmental offset for expected residual impacts on priority flora.

2.3 Threatened and priority ecological communities

The implementation of the Proposal will result in clearing of up to 73 hectares (ha) of vegetation and 19 ha of revegetation (~15 % combined) within the 625 ha Proposal area. An estimated 5.7 ha of this vegetation comprises vegetation representative of TECs and / or PECs, of which 0.9 ha is situated on private land, 0.7 ha is vested in the State and approximately 4.1 ha is within existing road or railway reserves.

Occurrences of three Threatened Ecological Communities (TECs) and one Priority Ecological Community (PEC) will potentially be impacted by the Proposal, these being:

- Banksia Woodlands of the Swan Coastal Plain (SCP) TEC – EPBC Act listed ('Banksia Woodlands TEC')

- ‘Herb rich shrublands in clay pans (FCT08)’ TEC – BC Act listed, and also a component of the EPBC Act listed Clay Pans of the Swan Coastal Plan TEC (‘FCT08’)
- ‘*Corymbia calophylla* - *Xanthorrhoea preissii* woodlands and shrublands of the SCP (FCT03c)’ TEC – BC Act and EPBC Act listed (‘FCT3c’)
- Banksia dominated woodlands of the SCP IBRA region Priority Ecological Community (PEC) (‘Banksia Woodlands PEC’).

Figure 2 (Appendix A) shows the extent of the TECs and PECs within the Proposal Area and broader Survey Area. Details of the TECs and PECs within the Proposal Area and addressed by this Offset Strategy is provided in Table 2-2.

Table 2-2 Area and condition of TEC/PEC within the Proposal Area

TEC / PEC	CONSERVATION STATUS	EXTENT IN PROPOSAL AREA	VEGETATION CONDITION
Banksia Woodland TEC and PEC	Endangered TEC – EPBC Act	3.7 ha	Excellent – Very Good: 0.15 ha Good: 1.95 ha Good – Degraded: 0.13 ha Degraded: 1.51 ha
<i>Banksia</i> dominated woodlands of the Swan Coastal Plain IBRA region – PEC	Priority 3 PEC* - DBCA listed		
Herb rich shrublands in clay pans (FCT08) - TEC	Critically Endangered TEC – EPBC Act and Vulnerable – BC Act	0.6 ha	Very Good: 0.332 ha Good: 0.171 ha Degraded: 0.123 ha
<i>Corymbia calophylla</i> - <i>Xanthorrhoea preissii</i> woodlands and shrublands of the Swan Coastal Plain Floristic Community Type (FCT3c)	Critically Endangered TEC – EPBC Act and Critically Endangered – BC Act	1.3 ha	Very Good: 0.022 ha Good: 0.03 ha Degraded: 0.034 ha Completely degraded 1.146 ha

The residual impacts, impact significance and avoidance on each of the TECs is discussed in the following sections.

2.3.1 Banksia Woodland TEC/PEC

Banksia Woodlands of the Swan Coastal Plain was listed in September 2016 as an Endangered TEC under the EPBC Act. The ‘Banksia dominated woodlands of the Swan Coastal Plain IBRA region’ PEC is listed as Priority 3 by the WA Department of Biodiversity and Conservation (DBCA). The PEC differs from the TEC in that it has no minimum condition and patch size thresholds.

2.3.1.1 Impacts

3.7 ha of Banksia Woodland TEC/ PEC vegetation within the Proposal Area will be cleared as a result of Proposal implementation, all of which occur at three locations near the Paris Road / Clifton Road interchange (Figure 2 Appendix A) and those directly adjacent to the Proposal Area are shown in Figure 3 (Appendix A). The composition and condition of these occurrences are detailed in Table 2-3.

Table 2-3 Banksia Woodlands TEC/PEC direct impact sites

SITE NO.	LOCATION	TEC / PEC TYPE	VEGETATION COMPOSITION AND CONDITION
BW-N-D-1	Forrest Highway road reserve northbound, north of Paris Road adjacent to Kingston Estate	Banksia Woodland TEC and PEC	Vegetation type: Woodland of <i>Eucalyptus marginata</i> , <i>Banksia</i> spp., <i>Kunzea glabrescens</i> Condition: 4-6 (Good to Degraded)
BW-N-D-2	Forrest Highway road reserve northbound, south of Paris Road adjacent to the Spud Shed	Banksia Woodland TEC and PEC	Woodland of <i>Eucalyptus marginata</i> over <i>Agonis flexuosa</i> , <i>Banksia attenuata</i> and <i>B. ilicifolia</i> Condition: 2-3 (Excellent to Very good)
BW-N-D-3	Forrest Highway road reserve southbound, south of Clifton Road and opposite Paris Road and Private property east of Forrest Highway, south of Site 3	Banksia Woodland TEC and PEC	Woodland of <i>Eucalyptus marginata</i> over <i>Agonis flexuosa</i> , <i>Banksia attenuata</i> and <i>B. ilicifolia</i> Condition: 4 and 6 (Good and Degraded)

No occurrences of Banksia Woodland TEC will be fragmented or indirectly impacted by the Proposal to the extent that they no longer represent occurrences of the TEC.

2.3.1.2 Impact avoidance

As discussed in Section 1.4, the changes to the design have included a range of refinements to minimise the impacts to the environment such as reducing median widths and changing the design and location of interchanges to reduce clearing requirements.

A summary of the original impact and current impact after the implementation of avoidance measures is presented in Table 2-4. Through the design changes, the area of Banksia Woodlands TEC and PEC that will be cleared as a result of Proposal implementation has been almost halved.

Table 2-4 Detailed design changes to avoid impacts to Banksia Woodland TEC/PEC vegetation

TEC / PEC TYPE	MAY 2019 S.38 REFERRAL	JANUARY 2020 S43A APPLICATION	REDUCTION IN TEC / PEC CLEARING AREA
Banksia Woodlands of the SCP TEC and Banksia dominated woodlands of the SCP IBRA region PEC	Up to 7.6 ha combined	Up to 3.7 ha of TEC and PEC	3.9 ha

2.3.1.3 Predicted outcome

A high level of mitigation and management has been applied to the Proposal, with Main Roads making substantial and costly changes to the Proposal design in order to reduce potential impacts on flora and vegetation, including Banksia Woodland TEC and PEC vegetation. The changes made have resulted in more than halving the area of Banksia Woodland TEC and PEC impacted to 3.7 ha, as shown in Table 2-4.

The EPA objective for Flora and Vegetation will be met for the Proposal through the implementation of the management and mitigation actions detailed in BORR IPT (2019a).

Based on these assessments, it is unlikely that the Proposal will have a significant impact on the Banksia TEC and PEC.

Main Roads proposes to further address the residual impacts of the Proposal on Banksia Woodlands TEC/PEC through the provision of environmental offsets.

2.3.2 Herb Rich Shrublands in Clay Pans (FCT08) TEC

The clay pans of the SCP Plain ecological community occurs where clay soils form an impermeable layer close to the ground surface, and wetlands form that rely solely on rainfall to fill and then dry to impervious pans in summers (TSSC 2012). FCT08 is listed as a Critically Endangered TEC under the EPBC Act and Vulnerable under the WA BC Act.

2.3.2.1 Impacts

Up to 0.6 ha of vegetation representing FCT08 was identified within the Proposal area, with a further 9.6 ha located directly adjacent. Occurrences within the Proposal Area are shown at (Figure 2 Appendix A) and those directly adjacent to the Proposal Area are shown in Figure 3 (Appendix A).

The composition and condition of these occurrences is also shown in Table 2-5.

Table 2-5 FCT08 Claypan TEC direct impact sites

SITE NO.	LOCATION	AREA (HA)	VEGETATION COMPOSITION AND CONDITION
CP-N-D-1	Railway Road	0.41	<p>Woodland to open forest of <i>Corymbia calophylla</i> and <i>Eucalyptus rudis</i> and sometimes <i>Melaleuca raphiophylla</i> over tall shrubland of <i>Acacia saligna</i>, <i>Viminaria juncea</i> and <i>Xanthorrhoea preissii</i> over shrubland of <i>Astroloma ciliatum</i>, <i>Daviesia physodes</i>, <i>Grevillea bipinnatifida</i>, <i>Hakea varia</i>, <i>Hemigenia incana</i>, <i>Hypocalymma angustifolium</i> and <i>Viminaria juncea</i> over sedgeland of <i>Cyathochaeta avenacea</i>, <i>Mesomelaena tetragona</i> and <i>Tetraria octandra</i> and open herbland of <i>*Babiana angustifolia</i>, <i>Haemodorum simplex</i>, <i>*Oxalis pes-caprae</i> and <i>*Watsonia meriana</i> (in more disturbed areas) and very open grassland of <i>*Briza maxima</i> on red-brown or yellow-brown clay loam.</p> <p>Condition:</p> <p>3 (Very good) - 0.206 ha</p> <p>4 (Good) - 0.133 ha</p> <p>6 (Degraded) - 0.075 ha</p>
CP-N-D-2	Wireless Road	0.12 ha	<p>Shrubland of <i>Acacia incurva</i>, <i>A. saligna</i>, <i>Hakea varia</i>, <i>Hypocalymma angustifolium</i>, <i>Melaleuca lateritia</i>, <i>M. pauciflora</i>, <i>Olearia elaeophila</i> and <i>Xanthorrhoea preissii</i> with emergent tall shrubs of <i>Viminaria juncea</i> over sedgeland of <i>Leptocarpus roycei</i> and <i>Schoenus</i> sp. and open herbland of <i>Agrostocrinum scabrum</i> subsp. <i>scabrum</i>, <i>Borya sphaerocephala</i>, <i>Cycnogeton lineare</i>, <i>Drosera erythrorhiza</i>, <i>Haemodorum simplex</i> and <i>Opercularia vaginata</i> on yellow-brown clay</p> <p>and</p> <p>Scattered tall shrubs of <i>Acacia saligna</i>, <i>Viminaria juncea</i> and <i>Xanthorrhoea preissii</i>, with occasional <i>Melaleuca raphiophylla</i> trees over grassland of <i>*Briza maxima</i>, <i>*Cenchrus clandestina</i> and <i>*Ehrharta calycina</i> on yellow-brown clay loam</p> <p>Condition:</p> <p>3 (Very good) - 0.054 ha</p>

SITE NO.	LOCATION	AREA (HA)	VEGETATION COMPOSITION AND CONDITION
			4 (Good) - 0.038 ha 6 (Degraded) - 0.033 ha
CP-N-D-3	Bell Road	0.09	Shrubland of <i>Acacia incurva</i> , <i>A. saligna</i> , <i>Hakea varia</i> , <i>Hypocalymma angustifolium</i> , <i>Melaleuca lateritia</i> , <i>M. pauciflora</i> , <i>Olearia elaeophila</i> and <i>Xanthorrhoea preissii</i> with emergent tall shrubs of <i>Viminaria juncea</i> over sedgeland of <i>Leptocarpus roycei</i> and <i>Schoenus</i> sp. and open herbland of <i>Agrostocrinum scabrum</i> subsp. <i>scabrum</i> , <i>Borya sphaerocephala</i> , <i>Cycnogeton lineare</i> , <i>Drosera erythrorhiza</i> , <i>Haemodorum simplex</i> and <i>Opercularia vaginata</i> on yellow-brown clay Condition: 3 (Very good) - 0.072 ha 6 (Degraded) - 0.015 ha

* - non native species

One FCT08 Claypan TEC occurrence, at Railway Road, will be fragmented as a result of the Proposal. All remaining occurrences that require clearing will be cleared in their entirety. No occurrences of FCT08 Claypan TEC are expected to be indirectly impacted by the Proposal.

The extent of FCT08 directly adjacent to the Proposal Area, as confirmed by Ecoedge (2019a), as specified in Table 2-5 and shown in Figure 3 (Appendix A). The composition and condition of these occurrences is also detailed.

An assessment of the loss of FCT08 Claypan TEC within local and regional context has been made through comparing the extent within the Proposal area to that published for the community (regional) and extent within the broader BORR IPT (2019b) Survey Area. Based on this assessment, the clearing of up to 0.60 ha associated with the Proposal would result in a reduction of up to 0.23 % in the reported extent of the TEC. At the greater Bunbury region scale, this represents a reduction of up to 0.5%. Of this, 0.5 ha was rated as in Good or better condition. This represents the maximum possible direct impact associated with the proposal.

2.3.2.2 Impact avoidance

The WA Environmental Offsets Policy (GoWA, 2011) notes that environmental offsets will only be considered after avoidance and mitigation options have been pursued. In accordance with this, substantial changes to the Proposal design were made in order to avoid impacts to FCT08 TEC vegetation. A summary of the original impact, design changes and resulting impact is presented in Table 2-6.

Table 2-6 Detailed design changes to avoid impacts to FCT08 TEC vegetation

TEC	JUNE 2019 S38 REFERRAL	JANUARY 2020 S43A APPLICATION	REDUCTION IN TEC / PEC CLEARING AREA
Herb rich shrublands in clay pans (FCT08) TEC	Up to 1.6 ha (including 1 ha unconfirmed)	Up to 0.6	0.2 ha (surveys subsequently showed that 0.8 ha was not Claypan TEC).

2.3.2.3 Predicted outcome

One FCT08 Claypan TEC occurrence, at Railway Road, will be fragmented as a result of the Proposal. All remaining occurrences that require clearing will be cleared in their entirety. A high level of mitigation and

management has been applied to the Proposal, with Main Roads making substantial and costly changes to the Proposal design in order to mitigate potential impacts on flora and vegetation, including FCT08 Claypan TEC vegetation. The changes made have resulted in a 25% reduction in the area of this TEC to be impacted, to 0.6 ha.

Main Roads intends to further counterbalance the residual impacts of the Proposal through implementation of an environmental offset strategy.

2.3.3 *Corymbia calophylla* – *Xanthorrhoea preissii* woodlands and shrublands of the SCP (FCT3c) TEC

Corymbia calophylla - *Xanthorrhoea preissii* woodlands and shrublands of the SCP Floristic Community Type (FCT3c) was listed as a TEC in 2000 under the EPBC Act. It is also listed as Critically Endangered under the BC Act. The DoEE (2017a) describes the TEC as a Marri (*Corymbia calophylla*) dominated plant community located on heavy soils of the eastern side of the Swan Coastal Plain between Bullsbrook, and Capel. It is noted that weed levels in most occurrences are generally quite low.

The conservation advice identifies critical habitat for the TEC as the heavy soils on which it occurs, the fresh superficial groundwater, and/ or surface water that may help sustain flora species in this community, and the catchment for this groundwater and surface water.

FCT3c was identified in a supplementary flora and vegetation survey conducted after the submission of the Section 38 referral.

2.3.3.1 Impacts

Up to 1.3 ha of FCT3c TEC was identified within the Proposal Area, and approximately 0.9 ha directly adjacent. Occurrences within and abutting the Proposal Area are shown in Figure 2 and Figure 3 (Appendix A).

The composition and condition of this TEC within the Proposal Area is detailed in Table 2-7.

Table 2-7 FCT3c direct impact sites

SITE NO.	LOCATION	AREA (HA)	VEGETATION COMPOSITION AND CONDITION
CW-N-D-1	Raymond Road	0.29	Open woodland to scattered trees of <i>Corymbia calophylla</i> over an open shrubland of <i>Xanthorrhoea preissii</i> , <i>Hypocalymma angustifolium</i> and <i>Hakea varia</i> Condition: 6-7 (Degraded to Completely degraded)
CW-N-D-2	Treendale Road	0.33	Open woodland to scattered trees of <i>Corymbia calophylla</i> over an open shrubland of <i>Xanthorrhoea preissii</i> , <i>Hypocalymma angustifolium</i> and <i>Hakea varia</i> Condition: 6-7 (Degraded to Completely degraded)
CW-N-D-3	Railway Road	0.15	<i>Corymbia calophylla</i> - <i>Eucalyptus rudis</i> - <i>Melaleuca raphiophylla</i> woodland/open forest. Woodland to open forest of <i>Corymbia calophylla</i> and <i>Eucalyptus rudis</i> and sometimes <i>Melaleuca raphiophylla</i> over tall shrubland of <i>Acacia saligna</i> , <i>Viminaria juncea</i> and <i>Xanthorrhoea preissii</i> over shrubland of <i>Astroloma ciliatum</i> , <i>Daviesia physodes</i> , <i>Grevillea bipinnatifida</i> , <i>Hakea varia</i> , <i>Hemigenia incana</i> , <i>Hypocalymma angustifolium</i> and <i>Viminaria juncea</i> over sedgeland of <i>Cyathochaeta avenacea</i> , <i>Mesomelaena tetragona</i> and <i>Tetraria octandra</i> and open herbland of * <i>Babiana angustifolia</i> , <i>Haemodorum simplex</i> , * <i>Oxalis pes-caprae</i> and * <i>Watsonia meriana</i> (in more disturbed areas) and very open grassland of * <i>Briza maxima</i> on red-brown or yellow-brown clay loam. Condition:

SITE NO.	LOCATION	AREA (HA)	VEGETATION COMPOSITION AND CONDITION
			3 (Very good) - 0.022 ha 4 (Good) - 0.028 ha 6 (Degraded) - 0.034 ha 7 (Completely degraded) 0.006 ha
CW-N-D-4	Harris Road	0.52	Open woodland to scattered trees of <i>Corymbia calophylla</i> over an open shrubland of <i>Xanthorrhoea preissii</i> , <i>Hypocalymma angustifolium</i> and <i>Hakea varia</i> Condition: 7 (Completely degraded)

Two FCT3c TEC occurrences will be fragmented as a result of the Proposal, at Raymond Road and Railway Road. The long-term viability of these occurrences will not change as a result of Proposal implementation. Both occurrences are already small, isolated and have high edge-to-area ratios. As such their long term viability is already at risk. 0.05 ha of the 0.15 ha Railway Road site is in Good or Very good condition with the remainder Degraded or Completely degraded. The Raymond Road site is Degraded to Completely degraded.

2.3.3.2 Impact avoidance

Main Roads has made changes to the Proposal design to reduce impacts to areas of FCT3c TEC to 0.6 ha.

FCT 3c was identified in a supplementary flora and vegetation survey conducted after the submission of the s.38. The Proposal Area boundary was then modified to reduce impacts to FCT3c. A summary of the design changes and resulting impact is presented in Table 2-8.

Table 2-8 Detailed design changes to avoid impacts to TEC/PEC vegetation

TEC / PEC TYPE	MAY 2019 S. 38 REFERRAL	JANUARY 2020 S43A APPLICATION	REDUCTION IN TEC / PEC CLEARING AREA
<i>Corymbia calophylla</i> - <i>Xanthorrhoea preissii</i> woodlands and shrublands of the SCP (FCT3c) TEC	Nil	Up to 1.3 ha	0.6 ha (Vegetation condition Very Good: 0.022 ha Good: 0.03 ha Degraded: 0.557 ha Degraded to completely degraded: 0.62 Completely degraded 0.032 ha

As detailed at Table 2-8, the majority of the residual impact of the Proposal on this TEC is Degraded to Completely Degraded (approximately 1.23 ha), with only 0.052 ha in Good or Better condition.

2.3.3.3 Predicted outcome

A high level of mitigation and management has been applied to the Proposal, with Main Roads making substantial and costly changes to the Proposal design in order to mitigate potential impacts on flora and vegetation, including FCT3c TEC vegetation. The changes made have resulted in a 35% reduction in the area of this TEC to be impacted, to 1.3 ha.

Considering that more than 95% of the 1.3 ha of the *Corymbia calophylla* – *Xanthorrhoea preissii* woodlands and shrublands of the SCP (FCT3c) TEC that will be cleared under the Proposal is Degraded or Completely Degraded, Main Roads does not consider that an additional offset to counterbalance impacts to this TEC is necessary.

The area, location and condition of the four TEC sites that occur within the Proposal Area are described in Table 2-9 (street view images sourced from Google Maps).

Table 2-9 Descriptions of the four *Corymbia calophylla* – *Xanthorrhoea preissii* woodlands and shrublands of the SCP (FCT3c) TEC sites that occur within the Proposal Area

Site No.	Location	Area (Ha)	Vegetation Condition
CW-N-D-1	Raymond Road	0.29	 <p>Mapped TEC extent within Proposal Area at Raymond Road highlighted in yellow (black star and arrow represent photo point and field of view direction).</p>  <p>Photo Point 1: Raymond Road looking east</p>

			
<p>CW-N-D-2</p>	<p>Treendale Road</p>	<p>0.33</p>	 <p>Mapped TEC extent within Proposal Area at Treendale Road highlighted in yellow (black star and arrow represent photo point and field of view direction).</p> 

Photo Point 2: Raymond Road looking west (note trunk sizes of *Corymbia calophylla*)

Condition: 6-7 (Degraded to Completely degraded)

Very narrow verge with cleared paddock on either side of the road. No large trees located within road reserve with only one tree greater than 500 mm DBH recorded within TEC.

Clearing of this patch of TEC is not considered significant as it is highly degraded, narrow (less than 3m wide), surrounded by cleared paddocks, is less than 0.3 ha in size and does not contain any large mature *Corymbia calophylla*.

Photo Point 1: Treendale Road western patch looking east (note only one *Xanthorrhoea preissii* was observed within either Treendale Road patch)

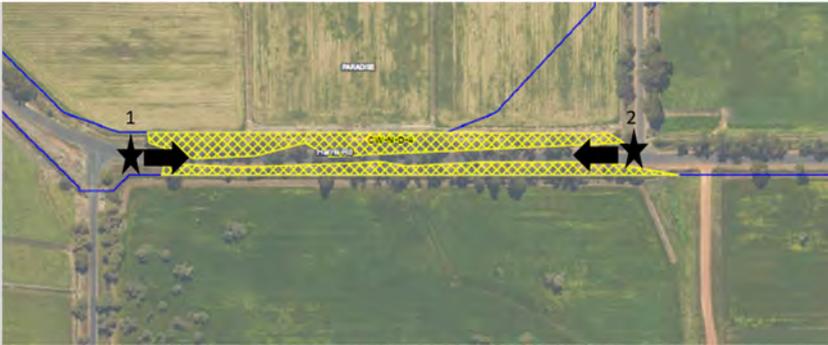


Photo Point 2: Treendale Road western patch looking west (note only one individual *Xanthorrhoea preissii* observed within either patch)



Photo Point 3: Treendale Road eastern patch looking east

			 <p>Photo Point 4: Treendale Road eastern patch looking west (note no <i>Xanthorrhoea preissii</i> in understorey)</p> <p>The Treendale Road TEC consists of two patches (eastern and western patches). No <i>Xanthorrhoea preissii</i> were observed within the eastern patch.</p> <p>Condition: 6-7 (Degraded to Completely degraded)</p> <p>Clearing of these two patches of TEC is not considered significant as they are highly degraded, weed infested, parkland cleared, narrow (less than 5m wide), surrounded by cleared paddocks, with neither patch being larger than 0.3 ha in size, with only one <i>Xanthorrhoea preissii</i> observed.</p>
<p>CW-N-D-3</p>	<p>Railway Road</p>	<p>0.14</p>	 <p>Mapped TEC extent within Proposal Area at Railway Road highlighted in yellow (note area west of yellow hatched area that has been excised from Proposal Area to minimise impacts on TEC) (black star and arrow represent photo point and field of view direction).</p> <p>Condition: 3-4 (Very Good to Good) - 0.05 ha 6-7 (Degraded to Completely degraded) - 0.09 ha</p> <p>The Railway Road TEC is split by the railway line. Main Roads has minimised its impact on this TEC patch to less than 0.15 ha at this crossing point by avoiding the TEC to the west, rather than clearing through to Waterloo Road. The clearing of this TEC at Railway Road is</p>

			not considered significant given the small area to be impacted and its degraded nature.
CW-N-D-4	Harris Road	0.52	 <p>Mapped TEC extent within Proposal Area at Harris Road highlighted in yellow (black star and arrow represent photo point and field of view direction).</p>  <p>Photo Point 1: Western end of Harris Road TEC looking east</p>  <p>Photo Point 2: Eastern end of Harris Road TEC looking west (note bare area on right hand side that has been mapped as the TEC)</p> <p>Condition: 6 (Degraded) - 0.52 ha</p>

			<p>Although this was assessed as being the be largest of the four patches of TEC within the Proposal Area, many areas mapped as TEC at the Harris Road site do not contain native vegetation (see Photo Point 2 above)</p> <p>Clearing of this patch of TEC is not considered significant as it is highly degraded, narrow (less than 5m wide), surrounded by cleared paddocks and is approximately 0.5 ha in size.</p>
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It is considered that the majority of vegetation that occurs within the four areas mapped as this TEC no longer structurally or floristically represent the TEC and are degraded to such a degree that the regeneration of the community is highly unlikely to occur.

The conservation listing advice (DoEE, 2017a) states that 29 occurrences totalling 115 ha of FCT3c have been located between Bullsbrook and Capel. DBCA have advised EPA Services that only 12 ha of this TEC remains in the south west, however it appears that these estimated extents exclude occurrences on road reserves and private property and therefore understate the actual extent remaining.

With regards to the 12 ha of this community that occurs within the south west, Main Roads is uncertain where DBCA has recorded these areas or whether they are on lands managed for conservation purposes. Limited information has been published on this community type since the 2000-2003 Interim Recover Plan was released in 2000 (English & Blyth, 2000).

Based on visual assessments of roadside vegetation, FCT3c occurs regularly in areas the vicinity of the Proposal Area (between Waterloo, Paradise and Burekup), with the vegetation communities in these reserves typically being larger and in better condition than the degraded communities that occur with the Proposal Area.

The proposed management of indirect impacts resulting from the Proposal is considered appropriate and adequate to ensure that such impacts are avoided.

3 FAUNA ASSESSMENT AND IMPACTS

Seven conservation significant fauna species were identified in the 2019 referral document as occurring or likely to occur within the Proposal Area. These species include:

- Western Ringtail Possum (*Pseudocheirus occidentalis*) (Critically Endangered, Schedule 1)
- Baudin’s Cockatoo (*Calyptorhynchus baudinii*) (Endangered, Schedule 2)
- Carnaby’s Cockatoo (*Calyptorhynchus latirostris*) (Endangered, Schedule 2)
- Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksia naso*) (Vulnerable, Schedule 3)
- Brush-tailed Phascogale (*Phascogale tapoatafa wambenger*) (Schedule 6)
- Black-stripe Minnow (*Galaxiella nigrostriata*) (Endangered, Schedule 2)
- Carter’s Freshwater Mussel (*Westralunio carteri*) (Vulnerable, Schedule 3)

3.1 Environmental surveys

Following referral of the Proposal in June 2019, additional surveys targeting threatened fauna species identified as occurring within the Proposal Area (and of key concern to stakeholders) were undertaken.

The following sections consider the results of these studies where they are relevant to those threatened fauna species.

In addition to studies undertaken to determine the sizes and densities of local WRP populations and assess habitat quality, studies were also undertaken to inform habitat clearing regimes and the design of engineered fauna movement (connectivity) structures.

Fauna field surveys and investigations undertaken relevant to the Proposal are listed in Table 3-1.

Table 3-1 Fauna investigations undertaken for the purposes of this Proposal

YEAR SURVEY COMPLETED	CONSULTANT	SURVEY NAME
2018	Biota Environmental Sciences (Biota)	Bunbury Outer Ring Road Northern and Central Section Targeted Fauna Assessment (Biota, 2019a)
2019	Biota Environmental Sciences (Biota)	Western Ringtail Possum: <i>Pseudocheirus occidentalis</i> Regional Surveys DRAFT (Biota, 2019b) (in prep)
2018	Wetland Research & Management (WRM)	Bunbury Outer Ring Road Northern and Central Investigation Area: Targeted Conservation Significant Aquatic Fauna Survey (WRM, 2019)
2019	Biota Environmental Sciences (Biota)	Bunbury Outer Ring Road Northern and Central Section – Targeted Fauna Assessment (Biota, 2019a)
2019	Wetland Research & Management (WRM)	Bunbury Outer Ring Road Northern and Central Investigation Area: Targeted Conservation Significant Aquatic Fauna Survey (WRM, 2019)

The implementation of the Proposal will result in clearing of up to 73 hectares (ha) of vegetation and 19 ha of revegetation (~15 % combined) within the 625 ha Proposal Area.

The assessment of the broader fauna values of the area are provided in BORR IPT (2019a) and BORR IPT (2020), with the outcomes of these assessments, as they relate to offsets, summarised below.

3.2 Western Ringtail Possum

The WRP was once widely distributed across the south and south-west of the state (from north of Perth to east of Albany) but are now restricted to the southern Swan Coastal Plain, the Jarrah forests near Manjimup and the south coast between Walpole and Albany. WRP was first listed as threatened under the Western Australian *Wildlife Conservation Act 1950* in 1983, and under the Commonwealth EPBC Act in 2000. Its status was reassessed to critically endangered under the BC Act in 2016 and EPBC Act in 2018.

WRP occur in three main habitat areas within the Proposal area Figure 4 (Appendix A). From north to south these are:

- At and around the Clifton Road / Paris Road interchange and north to the Brunswick River
- Around the Boyanup Picton Road interchange
- In the south near Manea Park.

These areas support patches of suitable WRP habitat and none of which are isolated from adjoining habitat.

3.2.1 Impacts

To reflect the seasonal and transient fluctuations in population size, the potential impact of the Proposal on individual WRP home ranges is presented as a range rather than a discrete figure. Based on these data, it is estimated that between 20 and 25 WRPs within the Proposal area will potentially have their home ranges disturbed by the Proposal. This indicates that approximately or up to 0.28 % and 0.34 % of the 2019 estimated regional population (of approximately 6,500 individuals) could potentially be impacted. A summary of the potential impact is presented in Table 3-2.

Table 3-2 Summary of potential direct impacts to WRP

FACTOR IMPACTED	LOSS (HA OR NUMBER)	LOSS (%)
WRP Habitat	43.9 ha	Up to 0.70 % of habitat in the Bunbury management zone of Shedley and Williams (2014)
WRP home ranges disturbed	20 to 25	0.28 % to 0.34 % of the estimated 2019 regional population

No WRP mortalities are expected as a direct result of the Proposal.

The Proposal Area is a relatively long and narrow road corridor, 200 m wide at its maximum width and 19 kilometres long. As such, it is highly unlikely that any entire WRP home ranges are contained within the Proposal Area. Between 20 and 25 home ranges may be disturbed to some degree but WRP utilising habitat within the alignment are very likely to be familiar with adjacent habitat areas, which is likely to also be part of their home range, and with navigating between these areas. As such, the impact of the Proposal on WRP home ranges is expected to be minor.

Connectivity between habitat patches in the Proposal Area is already compromised by the existing Forrest Highway and arterial roads, easements and large expanses of cleared agricultural land. Connectivity between some habitat areas will be temporarily disrupted during Proposal construction. However the majority of habitat within the Proposal Area is already disconnected from the wider landscape and will not

be further impacted in this way by the Proposal. Conversely, connectivity across the alignment between existing habitat areas will be improved as a result of Proposal implementation through the installation of approximately 43 possum over/underpasses and or rope bridges.

The maintenance of existing movement pathways and connectivity along either side of the alignment has been a priority during Proposal planning. Connectivity and suitability of cleared areas remaining within the Proposal area will be further enhanced with targeted revegetation post construction. As shown on Figure 5, Appendix A), the detailed design ensures this connectivity will remain after Proposal implementation.

The 43.9 ha of WRP habitat to be cleared through the Proposal constitutes 7.0% of the 625 ha Proposal area.

The targeted fauna assessment to support the assessment of the Proposal, mapped and surveyed fauna habitats within a study area of 1,128.01 ha including the current Proposal area and adjoining remnant vegetation (Biota 2019a). Approximately 147 ha of WRP habitat was mapped in this study area.

Key information that has resulted from the additional investigations and surveys for WRP are summarised below:

- That the regional WRP population is substantially greater than previously understood
- WRP presence, population trends and movement pathways within and around the Proposal Area
- Habitat areas adjacent to the Proposal Area have been confirmed to consistently support populations of WRP
- The importance of maintaining connectivity between habitat areas
- That there are low WRP densities in habitat areas within and adjacent to the Proposal Area compared to those along the ‘Holy Mile’ in Busselton where possum rope bridges have been the most successful.

None of the habitat areas that are currently known to support WRP (from the surveys undertaken by Biota) are anticipated to become unviable as WRP habitat as a result of Proposal implementation.

3.2.2 Impact Avoidance

The impact to WRP resulting from the BORR North and Central Proposal Area as referred to the EPA (June 2019) was expected to result in a loss of up to 70.3 ha of habitat, and disturbance of up to 49 individual home ranges. This equated to approximately 0.7 % of the regional population (Swan Coastal Plain and Crooked Brook Forest populations), which in early 2019 was estimated to be approximately 7,166 individuals.

In consideration of the predicted impact of the original Proposal as submitted in June 2019, Main Roads has gone to significant lengths to avoid and mitigate impacts to WRP habitat and home ranges, see Table 3-3.

Table 3-3 Detailed design changes to avoid impacts to WRP

WESTERN RINGTAIL POSSUM	JUNE 2019 S.38 REFERRAL	JANUARY 2020 S43A APPLICATION
Habitat extent (ha)	Approximately 70.3 ha WRP habitat	Approximately 43.9 ha WRP habitat in revised Proposal Area – with up to 26.4 ha of WRP habitat or approximately 37.5 % of expected habitat loss saved through detailed design phase

WESTERN RINGTAIL POSSUM	JUNE 2019 S.38 REFERRAL	JANUARY 2020 S43A APPLICATION
Observations (number of individuals)	Disturbance of home ranges of up to 49 individual WRPs (44 individuals observed by Biota within the Proposal Area in early 2019)	Field data indicates disturbance of home ranges of 20 to 25 individual WRPs (0.28 to 0.34% of the 2019 estimated regional population)
Bridges and underpasses	No quantity specified	Installation of forty three (43) underpasses/rope bridges now included within the design to reduce fragmentation and to maintain movement corridors

The changes outlined in Table 3.5 have resulted in a reduction of up to 26.4 ha of WRP habitat requiring removal for the Proposal. The areas that have been retained through these changes comprise intact habitat and known WRP movement pathways, not isolated trees or insignificant patches. Based on field survey data, in regards to the number of displaced WRP, this equates to between 24 to 29 individuals no longer likely to have their home ranges disturbed.

3.2.3 Predicted Outcome

A high level of mitigation and management will be applied to the Proposal, with Main Roads making substantial and costly changes to the Proposal design in order to mitigate potential impacts on WRP. As a result of the changes, a maximum of 43.9 ha of WRP habitat will be cleared, and between 20 and 25 home ranges potentially disturbed.

No areas of habitat will be cleared in their entirety and it is also unlikely that any entire home ranges will be impacted. Connectivity along and across the Proposal Area will be retained through a combination of a retention of key habitat areas where possible, and potentially improved over baseline conditions through installation of a series of fauna underpasses and / or rope bridges. Impacts of the Proposal on WRP will be manageable.

Proposed construction management and mitigation measures during operation of the Proposal are detailed in BORR IPT (2019a) and include:

- Timing of clearing
- Staging of clearing
- Sheparding of WRP from the clearing footprint
- WRP exclusion fencing and monitoring

Main Roads proposes to further address the residual impacts of the Proposal on WRP through the provision of environmental offsets.

3.3 Black Cockatoos

Three species of threatened black cockatoo were identified as occurring (foraging evidence) within the Proposal area during detailed fauna assessments:

- Baudin's Black-Cockatoo (*Calyptorhynchus baudinii*)
- Carnaby's Black-Cockatoo (*Calyptorhynchus latirostris*)
- Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksia naso*).

The Proposal Area is located in what is generally considered to be the typical breeding distribution of the Forest Red-tailed Black Cockatoo, however, all three cockatoo species have breeding areas overlapping the Proposal Area (Biota, 2019a).

All trees and areas of potential Black Cockatoo habitat within the Proposal Area were included in field surveys. Evidence of foraging by all three species was recorded within and adjacent to the Proposal Area, and either Baudin’s or Carnaby’s cockatoo were observed flying overhead during field surveys (Biota, 2019a). All three species were identified as occurring within the Proposal Area with suitable habitat for foraging and potentially breeding also identified in targeted surveys (Biota, 2019a).

Within the Proposal Area, Black Cockatoo foraging habitat was comprised of three mapped habitat types: ‘Marri/Eucalyptus woodland’, ‘Riparian woodland’ and ‘Marri/Eucalyptus in paddocks and road reserves’.

3.3.1 Impacts

The Proposal Area provides 37.8 ha of suitable foraging and potential breeding habitat for Black Cockatoos (Carnaby’s Cockatoo, Forest Red-tailed Black Cockatoo and Baudin’s Cockatoo). Of the 710 Suitable DBH Trees assessed within the Proposal Area, no Known Nesting Trees were recorded.

No known Black Cockatoo nesting hollows were recorded within the Proposal Area, however three trees with potentially suitable hollows were recorded. The remaining Suitable DBH Trees did not contain hollows or suitably sized hollows.

Assessment of the potential impacts on Black cockatoo habitat using the vegetation complexes within a 12 km radius indicated that the vegetation complexes which provided the highest quality foraging habitat (e.g. Bassendean Central and South and the Southern River vegetation complexes) were, in general, well represented outside of the Proposal Area (Biota, 2019a). Within 12 km of the Biota (2019a) Study Area, the Guildford Complex has 1,022 ha of remnant vegetation remaining, the Southern River Complex has 2,046 ha and Bassendean Complex – Central and South has 3,834 ha. The clearing of 37.8 ha of potential habitat represents a 0.5 % reduction in potential foraging and breeding habitat for the Black Cockatoo species within the local area.

No trees with known nest hollows will be impacted by the Proposal, however three trees with potentially suitable hollows will be cleared. No known breeding trees will be cleared in the Proposal Area and availability of suitable breeding hollows is not considered to be a limitation for the survival of black cockatoos within the Proposal Area (DBCA pers. Comm). In surveyed areas adjacent to the Proposal Area, Biota (2019a) located 19 trees with 20 suitable hollows for Black Cockatoo nesting, including one tree with evidence (egg fragments) of previous use for nesting.

3.3.2 Impact Avoidance

Substantial changes to the Proposal design have been made in order to avoid impacts to Black Cockatoos. Changes relating to the extent of Black Cockatoo habitat to be impacted are detailed in Table 3-4.

Table 3-4 Detailed design changes to avoid impacts to Black Cockatoo Habitat

HABITAT TYPE	JUNE 2019 S.38 REFERRAL	JANUARY 2020 S43A APPLICATION
Habitat area (Ha)	59.7	37.8
Suitable DBH trees	1116	710
Trees with a Suitable Nest Hollow	5	0
Known nesting trees	0	0

Changes to the Proposal Area have resulted in the retention of 21.9 ha of habitat and 406 Suitable DBH Trees that would have been cleared if the Proposal had been implemented as referred. The detailed design changes

have also resulted in the retention of all Trees with a Suitable Nest Hollow, ensuring no direct impact to the species' breeding habitat.

3.3.3 Predicted Outcome

A high level of mitigation and management has been applied to the Proposal, with Main Roads making substantial and costly changes to the Proposal design in order to mitigate potential impacts on terrestrial fauna including black cockatoos. The changes made have resulted in the reduction in the area of black cockatoo habitat impacted to just under 22 ha, and ensures that only three trees with potentially suitable hollows will be cleared. Connectivity of habitat will be maintained and enhanced through revegetation of additional areas within the Proposal Area.

Main Roads intends to further counterbalance the residual impacts of the Proposal through implementation of an environmental offset strategy.

3.4 Southern-western Brush Tailed Phascogale

The BTP is a small (100 – 300g), strongly arboreal marsupial. They are carnivorous, short-lived and nocturnal and are listed as Conservation Dependent (Schedule 6) under the BC Act.

3.4.1 Environmental Impacts

The Proposal Area provides a total of 17.7 ha of suitable habitat for the BTP comprising the 'Riparian Woodland' and 'Marri/ Eucalyptus Woodland' habitat types. The 'Riparian Woodland' habitat, of which there is 4.9 ha within the Proposal Area, was described as woodlands of the upper banks and floodplains of the significant drainages (Preston River, Collie River and Brunswick River). The 'Marri/ Eucalyptus Woodland' habitat refers to larger more intact remnants of this type of woodland as opposed to small, isolated, weedy remnants. There is 12.8 ha of 'Marri/ Eucalyptus Woodland' within the Proposal Area.

Phascogale habitat is closely correlated with both WRP habitat and Black Cockatoo habitat. Biota (2019a) estimated approximately 7,618 ha of suitable potential Black Cockatoo habitat with a 12 km radius of the Proposal Area. A large proportion of this habitat is also likely to comprise habitat for BTP.

No BTP mortalities are expected as a direct result of Proposal implementation.

Within Biota's recorded 47.92 ha of 'Marri/ Eucalypt Woodland' and 30.14 ha of 'Riparian Woodland' within their 1,128 ha fauna survey study area within and around the Proposal Area (Biota, 2019a). Of this 78.06 ha total, 17.7 ha or 23 % will be cleared.

BTP have large home ranges of up to 20 ha (Biota, 2019a). The Proposal Area is a long and narrow road corridor, 200 m wide at its maximum width and 19 kilometres long. As such, it is highly unlikely that any entire BTP home ranges – which are generally more than 20 ha in area - are contained within the Proposal Area.

Connectivity between habitat patches in the Proposal Area is already compromised by the existing Forrest Highway and arterial roads, easements and large expanses of cleared agricultural land. Connectivity between some habitat areas will be temporarily disrupted during Proposal construction. However the majority of habitat within the Proposal Area is already disconnected and will not be further impacted in this way by the Proposal. None of the areas of potentially suitable BTP habitat are anticipated to become unviable as habitat as a result of Proposal implementation.

No BTP mortalities are expected as a direct result of the Proposal.

3.4.2 Impact Avoidance

As noted in Section 1-4, in consideration of the predicted impact of the original Proposal as submitted in June 2019, Main Roads has gone to extensive lengths to avoid and mitigate impacts to conservation significant fauna, including BTP. The majority of the detailed design changes implemented to avoid impacts

to WRP will also result in the avoidance of impacts to BTP. The result of this effort is a revised Proposal Area that has substantially lower impact on BTP than originally proposed.

To minimise the impacts outlined above, the BORR North and Central Proposal Area was further refined during the design process. These changes are summarised in Table 3-5.

Table 3-5 Detailed design changes to avoid impacts to BTP habitat

WESTERN RINGTAIL POSSUM	JUNE 2019 S.38 REFERRAL	JANUARY 2020 S43A APPLICATION
Habitat extent (ha)	Approximately 28.2 ha BTP habitat	Approximately 17.7 ha BTP habitat in revised Proposal Area – with up to 10.5 ha or approximately 37 % of expected habitat loss saved through detailed design phase
Bridges and underpasses	No quantity specified	Installation of approximately 43 underpasses/rope bridges now included within the design to reduce fragmentation and to maintain movement corridors

3.4.3 Predicted Outcome

A high level of mitigation and management has been applied to the Proposal, with Main Roads making substantial and costly changes to the Proposal design in order to mitigate potential impacts on conservation significant fauna including the BTP. As a result of the changes made to the Proposal, a maximum of 17.7 ha of BTP habitat will be cleared. No areas of habitat will be cleared in their entirety and it is also highly unlikely that any entire home ranges will be impacted. Connectivity along and across the Proposal Area will be retained through a combination of a retention of key habitat areas where possible, and possibly even improved over baseline conditions through installation of a series of fauna underpasses and / or rope bridges. Impacts of the Proposal on BTP will be minor and manageable.

Main Roads intends to further counterbalance the residual impacts of the Proposal on BTP through implementation of an environmental offset strategy.

3.5 Black-stripe Minnow

The Black-stripe Minnow (*Galaxiella nigrostriata*) is listed as Endangered under the EPBC Act.

During additional surveys conducted in August 2019, BSM were recorded from one sampling site within the Proposal area and four sites outside of the Proposal Area.

Due to the high mobility of the species and connectivity between wetlands in wetter years, it is possible that Black-stripe Minnows migrate between wetlands and are still located within the local area.

3.5.1 Impacts

BSM were restricted within the Proposal Area to a small area of relatively undisturbed wetland in the southern end of the alignment. It was not recorded from additional areas (7 sites surveyed) of wetland habitat in the Proposal Area. The BSM was recorded from four additional sites adjacent to the Proposal area. All sites outside of the Proposal Area were relatively undisturbed or intact wetlands within or adjacent to Manea Park bushland reserve.

Given the distribution of the species in wetlands adjacent to the Proposal Area and to the south, loss of 0.55 ha as a result of construction of the Proposal is unlikely to have a significant impact on the species.

Given the distribution of the species in wetlands adjacent to the Proposal Area and to the south, loss of 0.55 ha as a result of construction of the Proposal is unlikely to have a significant impact on the species.

There is potential for Black-stripe Minnow to opportunistically utilise habitat within the Proposal Area. The majority (>99 %) of the 578 ha of Geomorphic Wetlands within the proposal area are classified as 'Multiple Use'.

Known impacts to BSM from the Proposal are considered relatively minor. Direct loss of habitat will be limited to 0.55 ha. No residual impact is anticipated.

3.5.2 Impact Avoidance

The impacts of the Proposal have been reduced through the design process. Clearing and disturbance of habitat will be carefully managed throughout construction through mechanisms outlined in (BORR IPT, 2019a) and through the implementation of a CEMP.

Impacts to hydrology will be mitigated through the implementation of the drainage strategy which aims to maintain hydrological conditions as far as possible. Fragmentation of habitat and connectivity between habitats will be mitigated through installation of culverts to maintain hydrologic linkage between the northern and southern sections. Current design for culverts is two concrete box culverts (1200 mm wide x 900 mm tall) built on a concrete base. Culverts will be set at or slightly below the existing channel invert to ensure the existing drainage is maintained either side of the culvert.

3.5.3 Predicted Outcome

Impacts to BSM from the Proposal are considered relatively minor. Direct loss of habitat will be limited to 0.55 ha and other potential impacts will be mitigated through implementation of appropriate drainage and management. No residual impact is anticipated.

Main Roads does not propose an environmental offset for BSM.

3.6 Carter's Freshwater Mussel

Carter's Freshwater Mussel (*Westralunia carteri*) (CFM) is the only freshwater mussel occurring in the south west of Western Australia. Carter's Freshwater Mussel was listed as vulnerable under the EPBC Act and the BC Act in 2018.

This species was recorded at a tributary of the Collie River (North Creek 5), Ferguson River (North Creek 5) and Preston River (North Creek 2) by WRM (2019) and in the Preston River by Biota (2019a), during the 2018 surveys.

3.6.1 Impact

Surveying for CFM was undertaken in drainage areas during targeted fauna surveys in 2018 and 2019. Within the Proposal Area, CFM is restricted to major creeklines with shallow sandy banks (Biota, 2019a).

During surveys undertaken in 2018 and 2019 by WRM (2019), CFM were recorded from:

- A tributary of the Collie River (North Creek 3) downstream of the Proposal Area;
- Ferguson River (North Creek 5 and Mussels 2) within and just upstream of the Proposal Area
- Preston River (North Creek 2) (Mussels 1 shells only and North Creek 2) within and upstream of the Proposal Area.

Potential habitat for CFM includes the Collie (tributary), Ferguson and Preston Rivers and has been mapped as maximum of 1.4 ha within the Proposal Area.

No direct impact to CFM or habitat is likely to occur as a result of the construction of this from the Proposal, indeed bridge construction may potentially provide positive outcomes for the species. Previous studies and assessments of habitat requirements for CFM have suggested bridges may be a preferred

habitat for the species (Klunzinger *et al.*, 2015; Hastie *et al.*, 2000). Shading created by bridges may provide cooler conditions that are beneficial to the species.

3.6.2 Impact Avoidance

Changes to the Proposal design have removed the requirement for bridge piers or abutments within any water courses to minimise the potential impacts on watercourses and CFM habitat at the Collie, Ferguson and Preston. This has resulted in the removal of any direct impacts to habitat for the CFM.

These changes to the design will also avoid any impacts to hydrology i.e. effects on flow velocities and erosion or deposition of sediment caused by instream structures.

3.6.3 Predicted Outcome

Impacts to CFM from the Proposal are considered to be minor. There will be no direct loss of habitat and other potential impacts will be mitigated through implementation of appropriate drainage and management during construction. No residual impact is anticipated.

Main Roads does not propose an environmental offset for CFM.

3.7 Residual fauna impacts

The alignment selected for the Proposal minimises impacts to fauna and with implementation of the mitigation measures proposed to address the potential impacts of the Proposal, the EPA objective for fauna, will be met. Table 3-6 provides a summary of the key residual impacts to fauna. Impacts set out in the table represent the maximum possible impacts associated with the Proposal.

Main Roads intends to further counterbalance the residual impacts of the Proposal through implementation of an environmental offset strategy addressing WRP and Black Cockatoos and BTP.

Table 3-6 Predicted residual impacts to fauna

ISSUE	SUMMARY DISCUSSION OF RESIDUAL / CUMULATIVE IMPACTS	OUTCOME
Western Ringtail Possums	Up to 43.9 ha of suitable Western Ringtail Possum habitat will potentially be cleared, and between 20 and 25 individual home ranges may be disturbed. Based on the results of regional surveys, this is estimated to represent 0.28 % to 0.34 % of the 2019 regional population.	The clearing of Western Ringtail Possum habitat and disturbance of 0.28 % to 0.34 % of the estimated 2019 regional population will result in a minor residual impact associated with the Proposal.
Black Cockatoos	The Proposal may potentially result in loss of up to 37.8 ha of suitable Black Cockatoo habitat. The clearing of 37.8 ha of potential habitat represents a <1 % reduction in potential foraging and breeding habitat for the Black Cockatoo species within the local area (suitable remnant vegetation within a 12 km radius).	The reduction in foraging and potential breeding habitat for Black Cockatoo species will result in a minor residual impact associated with the Proposal.
South-western Brush-tailed Phascogale	Up to 17.7 ha of suitable South-western Brush-tailed Phascogale habitat will potentially be cleared as a result for the Proposal. Brush-tailed Phascogales maintain relatively large ranges	The impact to the South-western Brush-tailed Phascogale are unlikely to be significant.

ISSUE	SUMMARY DISCUSSION OF RESIDUAL / CUMULATIVE IMPACTS	OUTCOME
	(>20 ha) and densities therefore tend to be low (Biota, 2019a).	
Carter's Freshwater Mussel	Potential disturbance of up to 1.4 ha of Carter's Freshwater Mussel (Vulnerable) habitat during construction of bridges. It is anticipated that disturbance to waterways will be temporary and minor.	The impact to Carter's Freshwater Mussel is unlikely to be significant.
Black-stripe Minnow	Loss of up to 0.55 ha of Black-stripe minnow habitat.	The impact to the Black-stripe Minnow is unlikely to be significant.

4 ENVIRONMENTAL OFFSETS

4.1 Background

Environmental offsets are conservation actions that provide environmental benefits intended to counterbalance the significant residual environmental impacts associated with a proposal (GoWA, 2014). Main Roads intend to counterbalance the residual impact of the Proposal through implementation of an environmental offset strategy. The strategy will be prepared in accordance with the WA Government's Environmental Offset Policy (GoWA, 2011), WA Offset Guideline (GoWA, 2014) and the Australian Government's EPBC Act Environmental Offset Policy (DSEWPaC, 2012). The offset will be proportionate to the level of impact and significance of the environmental impact.

Main Roads operates on a hierarchy of avoid, minimise, reduce, rehabilitate and offset environmental impacts. This hierarchy is achieved primarily through changes in scope and design, development and implementation of the EMP and finally, an offset proposal. Application of the management hierarchy has been summarised in this Offset Strategy and is detailed in BORR IPT (2019a).

The proposed environmental offsets detailed in this Offset Strategy will form the basis of an Environmental Offset Plan to be submitted for approval by the EPA.

4.2 EPBC Act Environmental Offsets Policy (DSEWPaC, 2012)

The EPBC Environmental Offsets Policy (DSEWPaC, 2012) requires the following Principles are met by an offset:

- Suitable offsets must deliver an overall conservation outcome that improves or maintains the viability of the protected matter
- Suitable offsets must be built around direct offsets but may include other compensatory measures
- Suitable offsets must be in proportion to the level of statutory protection that applies to the protected matter
- Suitable offsets must be of a size and scale proportionate to the residual impacts on the protected matter
- Suitable offsets must effectively account for and manage the risks of the offset not succeeding
- Suitable offsets must be additional to what is already required, determined by law or planning regulations, or agreed to under other schemes or programs
- Suitable offsets must be efficient, effective, timely, transparent, scientifically robust and reasonable
- Suitable offsets must have transparent governance arrangements including being able to be readily measured, monitored, audited and enforced.

4.3 WA Environmental Offset Policy (GoWA, 2011)

The WA Environmental Offsets Policy (GoWA, 2011) requires the following Principles are considered when developing an offset proposal:

- Environmental offsets will only be considered after avoidance and mitigation options have been pursued

- Environmental offsets are not appropriate for all projects
- Environmental offsets will be cost-effective, as well as relevant and proportionate to the significance of the environmental value being impacted
- Environmental offsets will be based on sound environmental information and knowledge
- Environmental offsets will be applied within a framework of adaptive management
- Environmental offsets will be focussed on longer term strategic outcomes.

4.4 Other Applicable Plans and Policies

The following Plans and Policies were taken into account when developing the offsets strategy:

- Western Ringtail Possum
 - Department of Parks and Wildlife (2017). Western Ringtail Possum *Pseudocheirus occidentalis* Recovery Plan. Wildlife Management Program No. 58. Department of Parks and Wildlife, Perth, WA.
 - Threatened Species Scientific Committee (2018). Conservation Advice *Pseudocheirus occidentalis* Western Ringtail Possum. Canberra: Department of the Environment and Energy.
- Black Cockatoos
 - Western Australian Department of Parks and Wildlife (2013), Carnaby's Cockatoo (*Calyptorhynchus latirostris*) Recovery Plan.
 - Department of the Environment, Water, Heritage and the Arts (2009). *Approved Conservation Advice for Calyptorhynchus banksii naso (Forest Red-tailed Black Cockatoo)*. Canberra: Department of the Environment, Water, Heritage and the Arts.
 - Forest Black Cockatoo (Baudin's Cockatoo *Calyptorhynchus Baudinii* and Forest Red-Tailed Black Cockatoo *Calyptorhynchus Banksii Naso*) Recovery Plan (Department of Environment and Conservation, 2008)
 - Threatened Species Scientific Committee (2018). Conservation Advice *Calyptorhynchus baudinii* Baudin's cockatoo. Canberra: Department of the Environment and Energy.
- Banksia Woodland TEC and PEC
 - Approved Conservation Advice (incorporating listing advice) for the Banksia Woodlands of the Swan Coastal Plain ecological community (DoEE, 2016a)
- Claypan TEC
 - National Recovery Plan for the Clay Pans of the Swan Coastal Plain Ecological Community (DBCA, 2019)

Conservation Advice and Recovery Plans were used to identify limiting processes and threats that could limit the effectiveness and use of offset properties by targeted conservation significant fauna species. Knowledge on threats and limiting processes were also used to, as applicable, identify potential opportunities for rehabilitation success criteria and in the case of WRP identified a key limiting research need that resulted in regional survey efforts.

Consultation was also undertaken with technical experts Barbara Jones and Mr Roy Teale (Biota zoologist) to determine what additional information was required to inform Main Roads' mitigation and management options WRP.

4.5 Residual impact

Residual impacts associated with the Proposal have been determined through application of the residual impact significance model detailed in the WA Environmental Offsets Guidelines (GoWA, 2014). Residual impacts for which Main Roads proposes environmental offsets are detailed in Table 4-1.

Table 4-1 Residual environmental impacts requiring offset

ENVIRONMENTAL ATTRIBUTE	RESIDUAL IMPACT
Western Ringtail Possum habitat	43.9 ha
Brush-tailed Phascogale habitat	17.7 ha
Black Cockatoo (Carnaby's and Baudin's Cockatoo and the Forest Red-tailed Black Cockatoo) habitat	37.8 ha
Banksia Woodlands of the SCP TEC	3.7 ha
'Herb rich shrublands in clay pans (FCT08)' TEC	0.6 ha

Main Roads has pursued a number of options in developing a package of offsets to counterbalance these residual impacts. The options investigated have comprised acquisition of land providing fauna habitat, creation of fauna habitat by on ground rehabilitation and provision of research funding. Several of the proposed offset sites will address the requirement for more than one offset attribute ie provision / creation of habitat for WRP, Black Cockatoos and BTP at a single site (Offsets 1, 2 and 3).

Table 4-2 provides an overview of the offset package under consideration, with offset property locations presented in Figures 6 and 7.

Table 4-2 Overview of proposed offset package

NO.	OFFSET TYPE	OFFSET SUMMARY	PROPERTY LOCATION	EXISTING TENURE
1	Land Acquisition	55 ha of existing native vegetation providing : <ul style="list-style-type: none"> • Banksia Woodlands of the SCP (BWSCP) TEC (to be confirmed) • WRP habitat • SW Brush-tailed Phascogale habitat • Black Cockatoo habitat 	Lot 2 Boyanup Picton Road	Freehold owned by the Commissioner of Main Roads. Lot 2 is currently zoned as Regional Open Space under the Greater Bunbury Region Scheme
2	On-ground Management	Revegetation of 45 ha to provide habitat for WRP, BTP and Black Cockatoo species	Lot 104 Willinge Drive, Davenport	Freehold owned by the Commissioner of Main Roads
3	On-ground Management	Revegetation of 90 ha to provide habitat for WRP and Black Cockatoo species	Ludlow State Forest (SF No. 2)	Vested in the Conservation and Parks Commission
4	Land Acquisition	Purchase of land supporting 1.07 ha of herb rich clay pans of the SCP (FCT08)	Confidential	Privately owned freehold land
5	Research Projects	Research projects are appropriate as an offset for the Proposal as there was a high degree of uncertainty regarding impacts of a Proposal and new science was required to develop better mitigation measures or predictive tools to avoid and minimise the particular type of impact Funding contribution to undertake a WRP Regional Survey. Objective of research was to better understand the Western Ringtail Possum population in the WA southwest through rigorous and robust field assessments.		

4.6 Description of offsets

The components of the offset package are described below. Offset 1 has been subject to some detailed survey which has confirmed the presence of WRP, Black Cockatoo and BTP. Additional surveys are proposed for 2020 to confirm the extent of Banksia woodlands TEC/PEC.

4.6.1 Offset 1 – Lot 2 Boyanup Picton Road

Offset 1 comprises a 55 ha portion of Lot 2 Boyanup Picton Road (previously Lot 102 then Lot 5) which is shown at Figure 6 (Appendix A). Lot 2 is owned freehold by the Commissioner of Main Roads and was acquired with the intention of utilising the site vegetation as an offset for the BORR project. A 22.3 ha portion was set aside as an offset for the existing BORR Stage 1 (BORR Central) constructed in 2013. Lot 2 directly abuts the existing BORR Central section of the current Proposal.

After purchase, Main Roads initiated the re-zoning of the property from rural to Regional Open Space under the Greater Bunbury Region Scheme (GBRS).

The property has been assessed by ground survey and has been shown to support habitat for, and a population of both WRP and BTP (Biota, 2019). Lot 2 was used as a survey site for the WRP Regional Survey and is also used as a research site by the University of Western Australia for zoology students. The property has been shown to provide foraging habitat and potential breeding and roosting sites for Black Cockatoo species (GHD, 2014).

A site survey conducted in October 2013 (GHD, 2014) identified six main vegetation types within the property including:

- Dense Banksia woodland
- Jarrah, Marri, *Banksia ilicifolia* and Melaleuca woodland
- Agonis, Jarrah, Marri and *Banksia ilicifolia* woodland.

Additional site assessment is proposed in spring 2020 to confirm the proposed offset area vegetation conforms to Banksia woodland TEC / PEC.

Lot 2 was identified by the EPA (2008), being part of Investigation Area 11 as comprising regionally significant vegetation. The lot forms part of Recommendation Area B which the EPA (2008) recommended be reserved as Regional Open Space. Lot 2 is currently zoned as Regional Open Space under the GBRS which provides it with long term security.

Main Roads propose that Offset 1 comprise a 55 ha portion of Lot 2 to address offset requirements for WRP, BTP, Black Cockatoo habitat and Banksia Woodland TEC. Site management for long term conservation (maximum 20 years) will include fencing and access management, weed control, firebreaks and feral animal control to maintain/improve habitat quality.

4.6.2 Offset 2 – Lot 104 Willinge Drive Davenport

Lot 104 is also owned freehold by the Commissioner of Main Roads and was purchased as a potential sand source and environmental offset site. Lot 104 occurs as two land parcels bisected by the existing BORR central section. Offset 2 comprises a portion of the 79.6 ha southern portion of the property.

Lot 104 is zoned as rural under the GBRS.

The majority of the property was previously the used as a commercial Blue Gum plantation with the timber harvested in 2017 and the land now essentially cleared with some small patches of remnant vegetation. Vegetation and flora assessment of the remnant vegetation over a portion of the proposed offset site (Ecoedge, 2017) noted that the Lot supports approximately 15 ha of good to degraded remnant native vegetation comprising:

- Jarrah, Marri, Peppermint and *Banksia attenuata* woodland.
- Jarrah, Peppermint and *Banksia* woodland
- *Eucalyptus rudis* and *Corymbia calophylla* over *Melaleuca raphiophylla* Woodland

The remnant vegetation within the proposed offset area has been shown to support a population of WRP (Biota, 2020).

The proposed offset site abuts the Preston River (to the west) and is traversed east to west by Gavins Gully (Reserve 31 866), which provides a vegetated linkage across the property from the east to the Preston River. The riparian woodland of the Preston River represents a habitat linkage for WRP and BTP. The riverine woodland provides a corridor to a number of widely separated reserve areas occurring outside the Referral Area (e.g. Manea Park and Franklandia Nature Reserve) (Biota, 2019a).

As noted above, much of Lot 104 was previously used for a commercial Blue Gum operation with the timber being harvested in 2017 and the area now cleared. Main Roads proposes to rehabilitate and revegetate a 55 ha portion of the property to provide habitat for WRP, BTP and Black Cockatoo species. Revegetation flora species will be selected to provide habitat and foraging vegetation suitable for these fauna species and will be based on site parameters and selected in consultation with DBCA. This reflects the approach for similar offset revegetation works by Main Roads in the region. Ongoing site management for long term conservation (maximum 20 years) will include fencing and access management, weed control, firebreaks and feral animal control to maintain/improve habitat quality.

Revegetation completion criteria will be determined with EPA based on advice from DBCA.

Main Roads may excavate sand from the cleared areas of the Lot prior to implementing revegetation and rehabilitation works.

Lot 104 is currently zoned as rural under the GBR. Main Roads will facilitate to have the site rezoned as Regional Open Space under the GBR to provide long term security of the offset.

4.6.3 Offset 3 – State Forest No. 2

Offset 3 comprises the proposed revegetation of a 90 ha area of a degraded portion of State Forest No. 2 (SF No. 2) which is located approximately 10-15 km east of the Busselton town centre, and is the focus of an on-going revegetation program. The site is 35-40 km from the Proposal Area and also within the Swan Coastal Plain IBRA sub-region.

The proposed rehabilitation works are congruent with the objectives of the Tuart Forest National Park Management Plan (TFNPMP) (Department of Parks and Wildlife, 2014) which are to:

- Protect and enhance the eastern wetland/tall tuart community transition zone.
- Protect and increase habitat for fauna that are highly represented in zones 5 and 6 (for example, western ringtail possum and brushtail possum).
- Enhance the resilience of this zone to disturbance and threatening processes.

Proposed management actions to achieve these objectives include “Re-establishing native vegetation in cleared areas, adapting management according to results of experimental trials.” Ongoing site management for long term conservation (maximum 20 years) will include fencing and access management, weed control, firebreaks and feral animal control to maintain/improve habitat quality.

The exact location of the 90 ha revegetation site/s is yet to be agreed with DBCA, although Main Roads has ‘in principle’ agreement with DBCA to conduct additional offset revegetation works in SF No. 2. Potential offset areas are shown at Figure 7 (Appendix A).

The proposed offset is congruent with similar environmental offsets within SF No. 2 negotiated by Main Roads with DBCA, DWER and DoEE for other road projects. Similar to Offset 2 plant species will be selected

to provide habitat for offset target species based on site parameters. Seed and seedling species will be selected in consultation with DBCA as per similar Main Roads offsets in SF 2.

Completion criteria will be determined with EPA based on advice from DBCA in line with existing Main Roads revegetation environmental offset sites in SF 2.

Main Roads proposes to rehabilitate and revegetate a 90 ha portion of State Forest No. 2 to provide habitat for WRP and Black Cockatoo species.

The proposed offset areas occur on crown land which is managed by DBCA under the Conservation and Land Management Act (GovWA, 1984), consequently the offset areas will be protected in the long term.

4.6.4 Offset 4 – Land Acquisition

Main Roads is currently investigating the purchase of a 1.3 ha privately owned property that has been determined through ground survey (Ecoedge, 2019b) to support vegetation that represent Claypan ecological communities. Site surveys conducted in 2019 did not clearly define the exact FCT that is present on the site, although indications are that it supports 1.07 ha of FCT08. Additional survey will be conducted in 2020 in consultation with DBCA to confirm the ecological community that is present.

Should the above offset site not be realised, Main Roads will further consult with DBCA to identify suitable offset FCT08. Ongoing site management for long term conservation (maximum 20 years) will include fencing and access management and weed control to improve the site vegetation quality in the long term. Main Roads will seek to have the offset site rezoned as Regional Open Space under the GBRs to provide long term security of the offset.

4.6.5 Offset 5 – Western Ringtail Possum Regional Survey

Main Roads has funded research on WRP through the WRP Regional Survey. The survey included sites over the range of the species from the Swan Coastal Plain, Cape to Cape Region, Southern Forests and Great Southern (Albany area).

The survey methodology included line survey distance sampling as agreed with the West Australian Western Ringtail Possum Recovery Team. The purpose of the survey was to develop a robust abundance estimate of the survey sites, and a consistent approach to estimating WRP abundance.

The survey was aimed to significantly improve understanding of the conservation status of this species and redress the knowledge gap identified as a key threatening process in line with recommendations of the WRP Recovery Plan (Department of Parks and Wildlife, 2017).

Main Roads have funded the survey to a total of approximately \$834, 000 for the WRP survey population research. It is proposed that funding for the survey provides a 10% indirect offset for the Proposal's significant residual impacts to WRP.

5 OFFSET GUIDE INPUTS AND JUSTIFICATION

Preliminary offset calculations have been based on the Commonwealth DoEE Environmental Offset Calculator and EPBC Offset assessment guide.

The offset values for Offsets 1-4 have been based on the available information for each of the proposed offset properties. These sites have been subject to some field survey, with further investigations proposed in spring 2020 to confirm earlier site assessments in respect to Banksia Woodland of the Swan Coastal TEC/PEC and Herb rich Claypans FCT08 TEC.

Given the habitat within the Proposal Area is likely to be used by all three Black Cockatoo species, rather than attempting to specify how much each species uses each offset site, for the purposes of calculating the offsets for impacts on the three Black Cockatoo species, the offset calculation was undertaken using the highest value for any of the attributes for any one of the three species i.e. 'endangered'.

Offset calculations are included at Appendix B for reference.

5.1 Western Ringtail Possum

Table 5-1 to Table 5-4 provide the inputs used in the EPBC Offset Assessment Guide in relation to WRP.

Table 5-1 Impact calculator – Western Ringtail Possum

ATTRIBUTE	VALUE	JUSTIFICATION
Area of impact	44 ha	Site assessments and the Proposal design have been used to identify the quanta of WRP impacted by the project.
Quality	8	
Site Condition		Site supports habitat for, and known population of WRP as identified through field surveys.
Site Context		Habitat values vary over the length of the Proposal from habitat patches up to some 10 ha to individual paddock trees.
Species stocking rate		Site contains evidence of use by WRP as assessed by field survey.

Table 5-2 Offset calculator – Western Ringtail Possum – Site 1 (Lot 2 Boyanup Picton Rd, Davenport)

ATTRIBUTE	VALUE	JUSTIFICATION
Offset area (ha)	55	
Start Quality	8	Site supports known habitat for and a population of WRP as identified through field surveys (Biota, 2019a).
Future quality without offset	6	Loss of habitat quality due to lack of site management ie impacts through illegal firewood cutting, bushfire, weeds and feral animals.
Future quality with offset	8	Site management (fencing and access management, weed control, firebreaks and feral animal control) to maintain/improve habitat quality.
Time over which loss is averted (years)	20	Site will be managed (risk mitigation) for conservation purposes for the long term (maximum 20 years)
Time until ecological benefit (years)	1	Land has been purchased and is being managed for conservation purposes
Risk of loss without offset (%)	15	Previous zoning and land use was rural with the property used for grazing cattle.

ATTRIBUTE	VALUE	JUSTIFICATION
Risk of loss with offset (%)	5	Main Roads purchased the property and initiated rezoning from rural to Regional Open space under the GBRS. The lot has been actively managed for conservation purposes to maintain / improve WRP habitat quality including weed and feral animal control, fencing and the installation of firebreaks.
Confidence in result (%)	80	High level of certainty of habitat attributes being retained and property being managed for conservation purposes in the long term.
% of impact offset	22.6	

Table 5-3 Offset calculator – Western Ringtail Possum – Site 2 (Lot 104 Willinge Drive Revegetation)

ATTRIBUTE	VALUE	JUSTIFICATION
Offset area (ha)	45	Revegetation of cleared portion of Lot 104
Start Quality	0	Site is currently mainly cleared with small isolated patches of remnant vegetation
Future quality without offset	0	The property is zoned as rural under the GBRS and could be on sold for rural activity. Site is unlikely to be revegetated to provide WRP habitat by a third party.
Future quality with offset	6	Revegetation with species suitable to create habitat for WRP and provide linkages to existing remnant vegetation. Site management (fencing and access management, weed control, firebreaks and feral animal control) to improve habitat quality.
Time over which loss is averted (years)	20	Site will be managed (risk mitigation) for conservation purposes for the long term (maximum 20 years)
Time until ecological benefit (years)	10	10 years to allow for revegetation works to provide WRP habitat after implementation.
Risk of loss without offset (%)	40	The property is zoned as rural under the GBRS and could be on sold for rural activity. Site is unlikely to be revegetated to provide WRP habitat by a third party.
Risk of loss with offset (%)	5	After revegetation the property will be actively managed for conservation to improve WRP habitat quality including weed and feral animal control, fencing and the installation of firebreaks. Main Roads will seek rezoning to Regional Open Space under GBRS. Revegetation completion criteria will ensure habitat creation.
Confidence in result (%)	80	High level of certainty of habitat WRP attributes being created through compliance with completion criteria.
% of impact offset	23.3	

Table 5-4 Offset calculator – WRP – Site 3 (State Forest No. 2 Revegetation)

ATTRIBUTE	VALUE	JUSTIFICATION
Offset area (ha)	90	Revegetation of heavily degraded portion of State Forest No. 2
Start Quality	1	Site is likely to have low value WRP habitat values.
Future quality without offset	1	Site is unlikely to be revegetated by a third party in the short term.
Future quality with offset	6	Revegetation with species suitable to create habitat for WRP and provide linkages to existing remnant vegetation. Site management (fencing and access management, weed control, firebreaks and feral animal control) to improve habitat quality.
Time over which loss is averted (years)	20	Site will be managed (risk mitigation) for conservation purposes for the long term (maximum 20 years)
Time until ecological benefit (years)	10	10 years to allow for revegetation works to provide WRP habitat after implementation.
Risk of loss without offset (%)	30	The site is unlikely to be revegetated by a third party in the short term
Risk of loss with offset (%)	5	After revegetation the property will be actively managed to improve habitat quality including weed and feral animal control, fencing and the installation of firebreaks. Revegetation completion criteria will ensure habitat creation to a suitable standard.
Confidence in result (%)	80	High level of certainty of habitat WRP attributes being created through compliance with completion criteria.
% of impact offset	45.3	

In addition to the above proposed offsets, Main Roads is seeking a 10% offset for the WRP Regional Survey. A combination of the proposed offsets (Lot 2 vegetation, Lot 104 revegetation, State Forest No. 2 revegetation and the WRP Regional survey) exceeds the 100% offset requirement.

5.2 Black Cockatoo

Table 5-5 to Table 5-8 provide the inputs used in the EPBC Offset Assessment Guide in relation to Black Cockatoo.

Table 5-5 Impact calculator – Black Cockatoo

ATTRIBUTE	VALUE	JUSTIFICATION
Impact area (ha)	38	Site assessments and the Proposal design have been used to identify the quanta of Black Cockatoo habitat impacted by the project. Offset requirement calculated based on Carnaby's Cockatoo (endangered)
Quality	8	
Site Condition		Site supports known foraging species for Black Cockatoos and potential nest hollows as identified through field surveys (Biota, 2019a).
Site Context		Site occurs within the known range of these species. Habitat values vary over the length of the Proposal from vegetation patches to individual paddock trees.

ATTRIBUTE	VALUE	JUSTIFICATION
Species stocking rate		Site contains evidence of use by Black Cockatoos species as determined by field survey

Table 5-6 Offset calculator – Black Cockatoos – Site 1 (Lot 2 Boyanup Picton Rd)

ATTRIBUTE	VALUE	JUSTIFICATION
Offset area (ha)	55	
Start Quality	8	Site supports known foraging species for Black Cockatoo and potential nest hollows as identified through field surveys
Future quality without offset	6	Loss of habitat quality due to lack of site management ie impacts through illegal firewood cutting, bushfire, weeds and feral animals
Future quality with offset	8	Site management (fencing and access management, weed control, firebreaks and feral animal control) to maintain/improve habitat quality.
Time over which loss is averted (years)	20	Site will be managed (risk mitigation) for conservation purposes for the long term (maximum 20 years)
Time until ecological benefit (years)	1	Land has been purchased and managed for conservation purposes
Risk of loss without offset (%)	15	Previous zoning and land use was rural with the property used for grazing cattle.
Risk of loss with offset (%)	5	Main Roads purchased the property and initiated rezoning from rural to Regional Open space under the GBRs. The lot has been actively managed for conservation purposes to maintain / improve WRP habitat quality including weed and feral animal control, fencing and the installation of firebreaks.
Confidence in result (%)	80	High level of certainty of habitat attributes being retained and property being managed for conservation purposes in the long term.
% of impact offset	33.4	

Table 5-7 Offset calculator – Black Cockatoos – Site 2 (Lot 104 Revegetation)

ATTRIBUTE	VALUE	JUSTIFICATION
Offset area (ha)	38	Revegetation of cleared portion of Lot 104
Start Quality	0	Site is cleared of habitat
Future quality without offset	0	Site is unlikely to be revegetated by a third party
Future quality with offset	6	Revegetation with species suitable to create habitat for the Black cockatoos Site management (fencing and access management, weed control, firebreaks and feral animal control) to improve quality
Time over which loss is averted (years)	20	Site will be managed (risk mitigation) for conservation purposes for the long term (maximum 20 years)
Time until ecological benefit (years)	10	Development of revegetation species to provide foraging habitat 5 years after implementation.
Risk of loss without offset (%)	40	The site is unlikely to be revegetated by a third party. Potential to return to pasture and sell to private buyer for agriculture.
Risk of loss with offset (%)	5	After revegetation the property will be actively managed to improve habitat quality including weed and feral animal control, fencing and the installation of firebreaks.

ATTRIBUTE	VALUE	JUSTIFICATION
		Revegetation completion criteria will ensure habitat creation.
Confidence in result (%)	80	High level of certainty of habitat attributes being created through compliance with completion criteria.
% of impact offset	48.5	

Table 5-8 Offset calculator – Black Cockatoos – Site 3 (State Forest No. 2 Revegetation)

ATTRIBUTE	VALUE	JUSTIFICATION
Offset area (ha)	16	Revegetation of heavily degraded portion of Lot 104
Start Quality	1	Site is likely to be mainly cleared of habitat
Future quality without offset	1	Site is unlikely to be revegetated by a third party in the short term
Future quality with offset	6	Revegetation with species suitable to create habitat for the Black cockatoos Site management (fencing and access management, weed control, firebreaks and feral animal control) to improve quality
Time over which loss is averted (years)	20	Site will be managed (risk mitigation) for conservation purposes for the long term (maximum 20 years)
Time until ecological benefit (years)	10	Development of revegetation species to provide foraging habitat 5 years after implementation.
Risk of loss without offset (%)	30	The site is unlikely to be revegetated by a third party in the short term. Site management will include fencing and access management, weed control, firebreaks and feral animal control to improve quality
Risk of loss with offset (%)	5	After revegetation the property will be actively managed to improve habitat quality including weed and feral animal control, fencing and the installation of firebreaks. Revegetation completion criteria will ensure habitat creation.
Confidence in result (%)	80	High level of certainty of habitat attributes being created through compliance with completion criteria.
% of impact offset	18.1	

A combination of the proposed offsets (Lot 5 vegetation, Lot 104 revegetation and State Forest No. 2 revegetation) exceeds the 100% offset requirement for Black Cockatoos.

5.3 Banksia Woodland of the Swain Coastal Plain TEC

Table 5-9 and Table 5-10 provide the inputs used in the EPBC Offset Assessment Guide in relation to Banksia Woodland of the Swan Coastal Plain (BWSCP) TEC.

Table 5-9 Impact calculator – Banksia Woodland of the Swan Coastal Plain TEC

ATTRIBUTE	VALUE	JUSTIFICATION
Area of impact (ha)	3.7	Site assessments and the Proposal design have been used to identify the quanta of Banksia Woodlands TEC impacted by the project.
Quality	7	
Site Condition		Site condition varies from degraded to excellent as detailed below: Excellent – Very Good: 0.15 ha

ATTRIBUTE	VALUE	JUSTIFICATION
		Good: 1.95 ha Good – Degraded: 0.13 ha Degraded: 1.51 ha 2.1 ha (57%) of the 3.7 ha TEC clearing area rated as in good or better condition
Site Context		The Banksia Woodlands TEC occur as small isolated stands within a highly disturbed landscape. The remnant patches have high edge to area ratios as shown at Figure 2
Species stocking rate		Clearing impact will result in the loss of 0.001% of the reported TEC extent, and 0.0045% in the Perth sub-region.

Table 5-10 Offset calculator – Banksia Woodland of the SCP TEC – Offset 1 (Lot 2 Boyanup Picton Rd)

ATTRIBUTE	VALUE	JUSTIFICATION
Offset Area (ha)	14.5	Site supports Banksia woodland (GHD, 2014). Additional survey proposed in 2020 to confirm are of Banksia Woodland TEC.
Start Quality	8	Majority of mapped Banksia woodland vegetation is in very good-excellent condition (GHD, 2014). Area proposed as offset to be confirmed through planned survey in 2020.
Future quality without offset	6	Loss of habitat quality due to lack of site management ie impacts through illegal firewood cutting, bushfire, weed invasion and feral animals.
Future quality with offset	8	Site management (fencing and access management, weed control, firebreaks and feral animal control) to maintain/improve habitat quality.
Time over which loss is averted (years)	20	Site will be managed (risk mitigation) for conservation purposes for the long term (maximum 20 years)
Time until ecological benefit (year)	1	Land has been purchased and is being managed for conservation purposes
Risk of loss without offset (%)	15	Previous zoning and land use was rural with the property used for grazing cattle.
Risk of loss with offset (%)	5	Main Roads purchased the property and initiated rezoning from rural to Regional Open space under the GBRS. The property has been actively managed for conservation purposes to maintain / improve WRP habitat quality including weed and feral animal control, fencing and the installation of firebreaks.
Confidence in result (%)	80	High level of certainty of habitat attributes being retained and property being managed for conservation purposes in the long term.
% of impact offset	103.5	

The proposed offset of 14.5 ha of Banksia Woodland occurring with Lot 2 Boyanup Picton Road exceeds the 100% offset requirement for Banksia Woodland TEC/PEC.

5.4 Herb Rich Shrublands on Clay Pans (FCT08) TEC

Table 5-11 and Table 5-12 provide the inputs used in the EPBC Offset Assessment Guide in relation to Herb Rich Shrublands on Clay Pans (FCT08) TEC.

Table 5-11 Impact calculator – Herb Rich Shrublands on Clay Pans TEC (FCT08)

ATTRIBUTE	VALUE	JUSTIFICATION
Area of impact (ha)	0.6	Site assessments and the Proposal design have been used to identify the quanta of Banksia Woodlands TEC impacted by the project.
Quality	5	
Site Condition		Site condition based on site assessment varies from degraded to very good as detailed below: Very Good: 0.332 ha Good: 0.171 ha Degraded: 0.123 ha 0.6 ha is in good or better condition.
Site Context		FCT 08 occurs as isolated remnants within road and rail reserves within a highly disturbed landscape. The remnant patches have very high edge to area ratios as shown at Figure 2.
Species stocking rate		Clearing will result in a reduction of up to approximately 2 % in the reported regional context of this TEC, and up to approximately 0.5 % of the recorded TEC within the greater Bunbury region.

Table 5-12 Herb Rich Shrublands on Clay Pans (FCT08) TEC – Offset 4 (Confidential private property acquisition)

ATTRIBUTE	VALUE	JUSTIFICATION
Area of impact (ha)	1.07	Site is suspected to support FCT08 (Ecoedge, 2019b).
Start Quality	7	Site condition varies from degraded to very good as detailed below: Very Good: 0.022 ha Good: 0.03 ha Degraded: 0.034 ha Completely degraded 1.146 ha 1.025 ha (96%) of the 1.07 ha of the site vegetation is in good or better condition.
Future quality without offset	4	The site is currently privately owned and zoned as rural under the GBR. Abutting land uses comprise farming activities with an unsealed gravel road abutting the western boundary of the site. The property is currently not fenced. The vegetation has a high edge to area ration and is under threat from weed invasion via the adjacent land use. In the long term the vegetation will be further significantly degraded.
Future quality with offset	8	Site management will include (fencing and access management and weed control) to improve the site vegetation quality in the long term.

		Management will potentially include revegetation of the degraded 0.04 ha portion.
Time over which loss is averted (years)	20	Site will be managed (risk mitigation) for conservation purposes for the long term (maximum 20 years).
Time until ecological benefit (year)	1	Land will be purchased to managed for conservation purposes.
Risk of loss without offset (%)	15	The site is surrounded by agricultural land and is not actively managed for conservation.
Risk of loss with offset (%)	10%	Land will be purchased to managed for conservation purposes.
Confidence in result (%)	80	High level of confidence. The property will be purchased and actively managed for conservation purposes to improve habitat quality including fencing and weed control, with potential for revegetation.
% of impact offset	83.1%	

As noted above, with the application of this private property as an offset for the Proposal's residual impacts on FCT08 is does not fulfil the 100% offset requirement. Main Roads is further investigating additional offset options in consultation with DBCA.

6 COUNTERBALANCE OF SIGNIFICANT RESIDUAL IMPACTS

Table 6-1 provides a summary of the offset package to counterbalance the significant residual impacts to Banksia Woodlands of the SCP, Herb rich shrublands on Clay Pans (FCT08), Western Ringtail Possum (and BTP) and Black Cockatoo species.

Table 6-1 is based on preliminary offset calculations using the EPBC Act Offset Assessment Guide, as presented in Section 4 and Appendix B.

The offset package is expected to provide adequate compensation for significant residual impacts to those environmental attributes noted above apart from Herb rich shrublands of Claypans. Main Roads is currently investigating additional offset options in consultation with DBCA.

Table 6-1 Summary of preliminary offset calculations

PROPOSED OFFSET	OFFSET AREA	% OF OFFSET REQUIRED
Western Ringtail Possum (and Brush-tailed Phascogale)		
Impact: 44 ha of WRP habitat and 18 ha of BTP habitat		
Habitat on Lot 2 Boyanup Picton Road	55 ha	22.6
Revegetation of Lot 104 Willinge Drive	45 ha	23.3
Revegetation of State Forest No. 2	90 ha	45.3
WRP Regional Survey		10
Total Offset		101.2
Black Cockatoo Species		
Impact: 38 ha of Black Cockatoo habitat		
Habitat on Lot 2 Boyanup Picton Road	55 ha	33.4
Revegetation of Lot 104 Willinge Drive	38 ha	48.5
Revegetation of State Forest No. 2	16 ha	18.1
Total Offset		100.0
Banksia Woodlands TEC/PEC		
Impact: 3.7 ha		
Habitat on Lot 2 Boyanup Picton Road	14.5	103.5
Total		103.5

PROPOSED OFFSET	OFFSET AREA	% OF OFFSET REQUIRED
Herb rich Shrublands on Claypans		
Impact: 0.6 ha		
Purchase of private property supporting FCT08	1.07	83.1

In developing the proposed offset package, Main Road has taken into account to Principles of the WA Environmental Offsets Policy (GoWA, 2011) as summarized in Table 6-2.

Table 6-2 Assessment of Offsets against the Principles of the WA Environmental Offsets Policy (2011)

PRINCIPLE	ASSESSMENT
<i>Environmental offsets will only be considered after avoidance and mitigation options have been pursued</i>	The potential impacts from the Northern and Central Sections of the BORR have been significantly reduced as a result of the efforts applied during the detailed design phase and during Environmental Assessment. This reduction has been largely achieved through the additional avoidance and mitigation measures that have been developed for the Proposal. Where appropriate, local technical expertise for key species and habitats has been sought to ensure the effectiveness of proposed management measures. Main Roads anticipates that the social and environmental impacts of the Proposal can be appropriately managed through the measures to be implemented in conjunction with the Proposal.
<i>Environmental offsets are not appropriate for all projects</i>	<p>Main Roads operates on a hierarchy of avoid, minimise, reduce, rehabilitate and offset environmental impacts. This hierarchy is achieved primarily through changes in scope and design, development and implementation of the EMP and finally, an offset proposal. Application of the management hierarchy has been summarised in this Offset Strategy and is detailed in BORR IPT (2019a).</p> <p>Main Roads has proposed offsets to counterbalance the significant residual impacts to Banksia Woodlands of the SCP, Herb rich shrublands on Clay Pans (FCT08), Western Ringtail Possum (and BTP) and Black Cockatoo species. This decision is based on the quanta of impacts, conservation status, and local context of the ecological communities and faunal habitats impacted by the Proposal.</p>
<i>Environmental offsets will be cost-effective, as well as relevant and proportionate to the significance of the environmental value being impacted</i>	Main Roads has pursued a number of options in developing a package of offsets to counterbalance residual impacts that are relevant and appropriate for the locality and quantum of impact for each environmental value impacted. The options investigated have comprised acquisition of land providing fauna habitat, creation of fauna habitat by on ground rehabilitation and provision of research funding. Several of the proposed offset sites will address the requirement for more than one offset attribute i.e. provision / creation of habitat for WRP, Black Cockatoos and BTP at a single site.
<i>Environmental offsets will be based on sound environmental information and knowledge</i>	The offset values for Offsets 1-4 have been based on the available information for each of the proposed offset properties. These sites have been subject to some field survey, with further investigations proposed in spring 2020 to confirm earlier site assessments in respect to Banksia Woodland of the Swan Coastal TEC/PEC and Herb rich Claypans FCT08 TEC. Offset 1 has been subject to detailed survey which has confirmed the

	<p>presence of WRP, Black Cockatoo and BTP. Additional surveys are proposed for 2020 to confirm the extent of Banksia woodlands TEC/PEC.</p>
<p><i>Environmental offsets will be applied within a framework of adaptive management</i></p>	<p>The proposed offsets will be subject to long term monitoring and ongoing adaptive management, as required, to ensure the anticipated values and effectiveness criteria for each offset is achieved. Where at variance to the objectives of the offset strategy, advice and management consultation with DBCA and other relevant key stakeholders will be undertaken.</p>
<p><i>Environmental offsets will be focussed on longer term strategic outcomes.</i></p>	<p>In addition to direct conservation offsets, Main Roads has pursued rehabilitation of lands as offsets that will over the longer term increase the areas of habitat provided by the proposed offsets and been judicious in identifying research offsets only where key gaps in knowledge and long terms recovery benefits from the research proposed.</p> <p>Main Roads commissioned a regional WRP population study on its own initiative in order to provide information to both industry and the community regarding the extent and distribution of the species. This information was identified as a high priority in the WRP Recovery Plan (DPAW, 2017). Prior to Main Roads' commissioning this work, the species' extent was a recognised knowledge gap, the addressing of which was identified as required in the species' recovery plan (DPaW, 2017). Through addressing this knowledge gap, Main Roads has provided vital information that will assist the long term species' management and recovery.</p>

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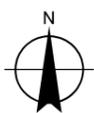
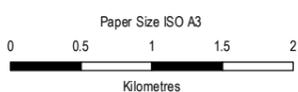
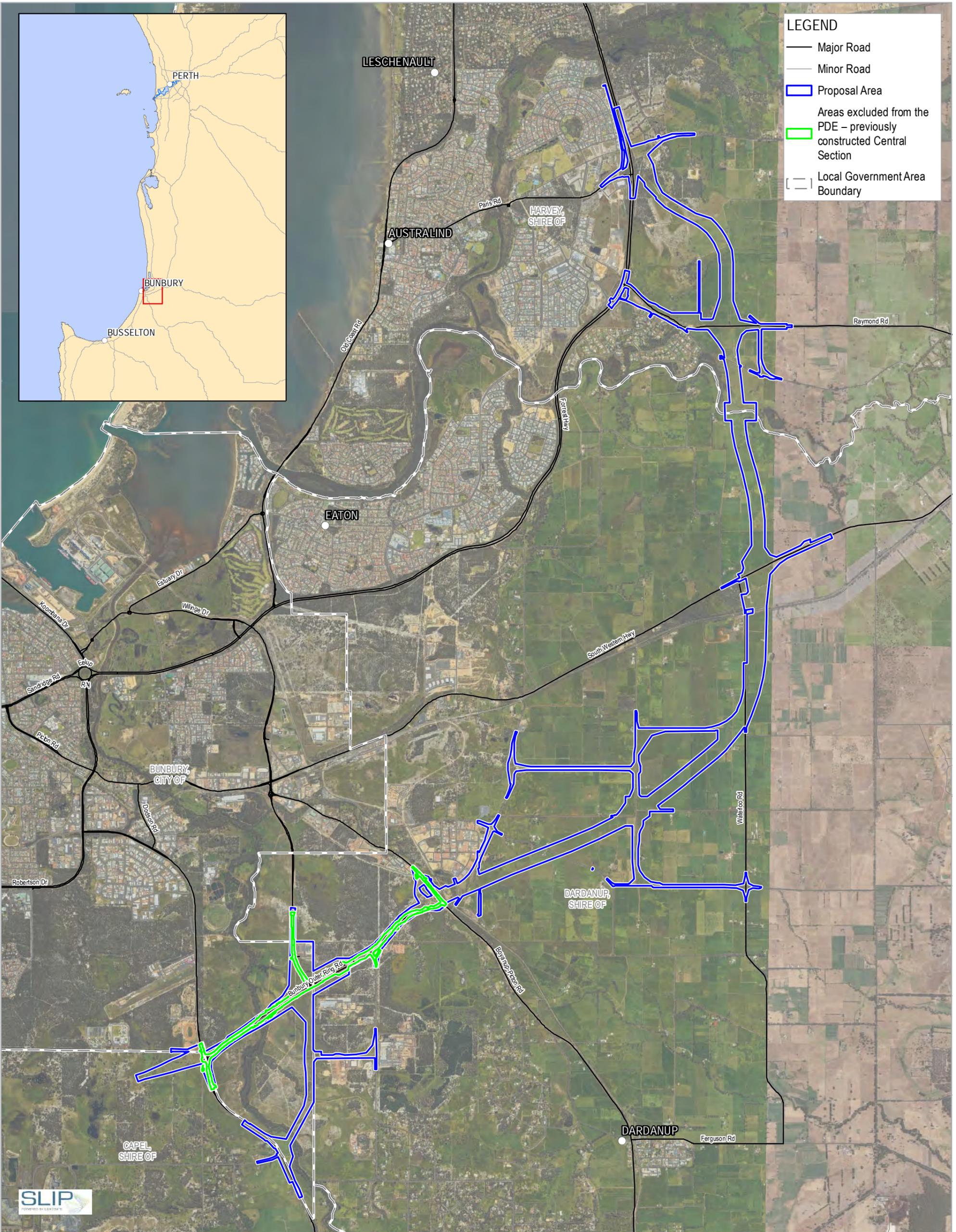
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Appendix A

Figures

- Figure 1 Proposal Area
- Figure 2 Threatened and priority ecological community extents within the Proposal Area
- Figure 3 Threatened and priority ecological community extents abutting the Proposal Area
- Figure 4 WRP habitat and observations within the Proposal Area
- Figure 5 Proposed WRP connections
- Figure 6 Proposed offset areas
- Figure 7 State Forest No. 2 Offset Areas



Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 Perth Coastal Grid 1994



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Proposal Area

FIGURE 1



LEGEND

- Major road
- ▨ Banksia Woodland TEC
- Banksia Woodland PEC
- ▭ BORR Northern and Central Section Referral Boundary

SLIP
POWERED BY LANDIMATE

Paper Size ISO A3
0 40 80 120 160
Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 Perth Coastal Grid 1994

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TEC and PEC extent within the Proposal Area

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FIGURE 2

Data source: BORR team: North environmental survey area - 20191025, North referral boundary - 20191016, TEC/PEC - 201912; Landgate: Roads - 201805, Localities - 20180319, Imagery - WA Now accessed 20191217. Created by: mmikkonen



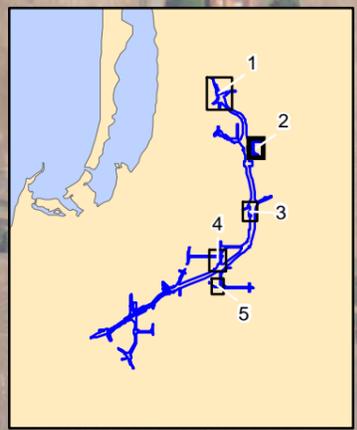
LEGEND

- Major road
- Corymbia calophylla - Xanthorrhoea preissii* woodlands and shrublands of the Swan Coastal Plain (FCT 3c)
- BORR Northern and Central Section Referral Boundary

Raymond Rd

ROELANDS

Teendale Rd



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TEC and PEC extent within
 the Proposal Area

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Page 2 of 5
FIGURE 2

Data source: BORR team: North environmental survey area - 20191025, North referral boundary - 20191016, TEC/PEC - 201912; Landgate: Roads - 201805, Localities - 20180319, Imagery - WA Now accessed 20191217. Created by: mmikonen



LEGEND

- Major road
- Corymbia calophylla - Xanthorrhoea preissii* woodlands and shrublands of the Swan Coastal Plain (FCT 3c)
- Herb rich shrublands on clay pans (TEC - Critically Endangered EPBC Act)
- BORR Northern and Central Section Referral Boundary

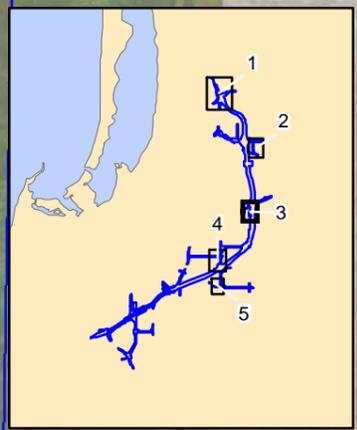
Clifton Rd

WATERLOO

Matadon Rd

Railway Rd

South Western Hwy



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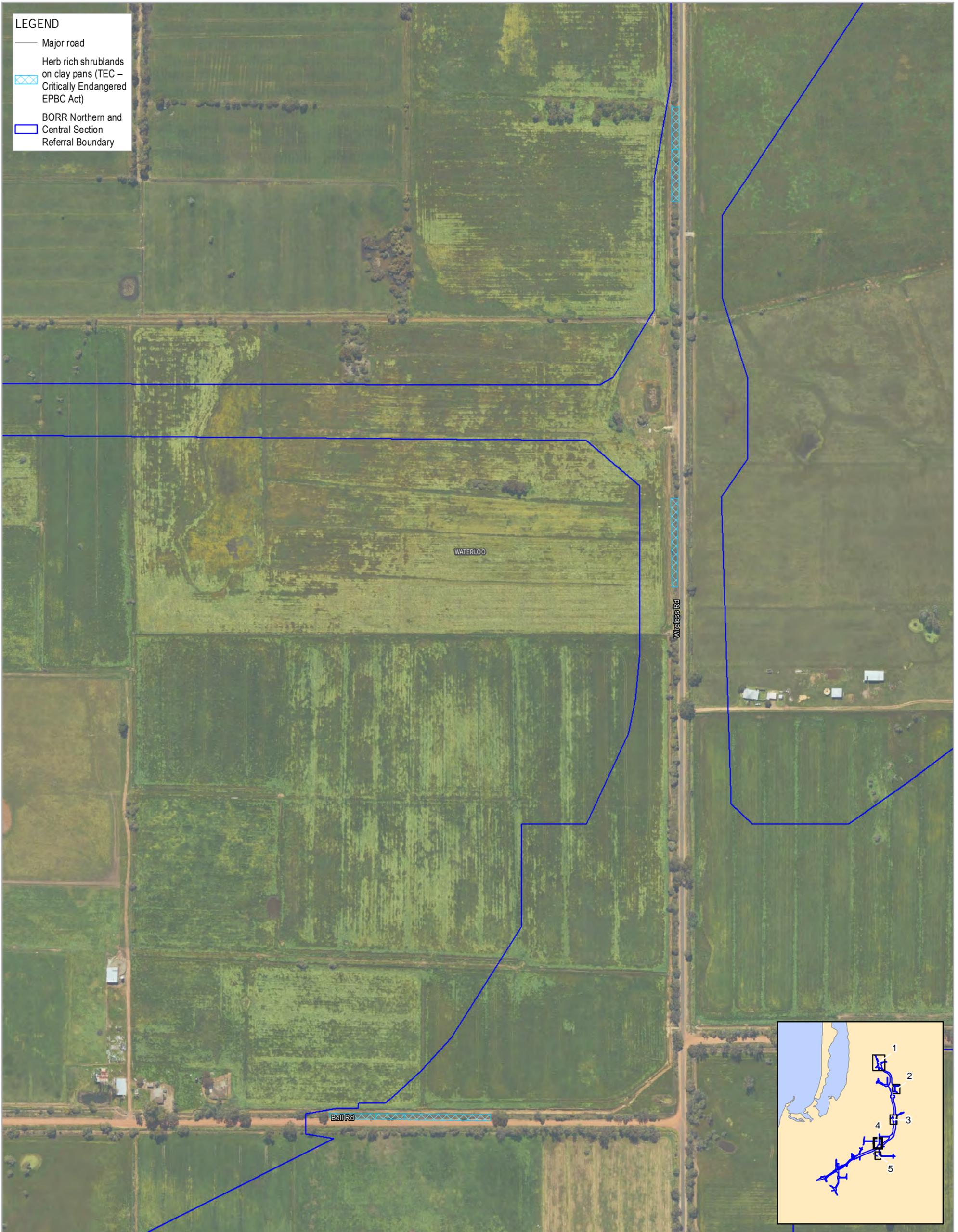
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TEC and PEC extent within
 the Proposal Area

Project No. 61-37041
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Page 3 of 5
FIGURE 2

Data source: BORR team: North environmental survey area - 20191025, North referral boundary - 20191016, TEC/PEC - 201912; Landgate: Roads - 201805, Localities - 20180319, Imagery - WA Now accessed 20191217. Created by: mmikonen



LEGEND

- Major road
- Herb rich shrublands on clay pans (TEC - Critically Endangered EPBC Act)
- BORR Northern and Central Section Referral Boundary



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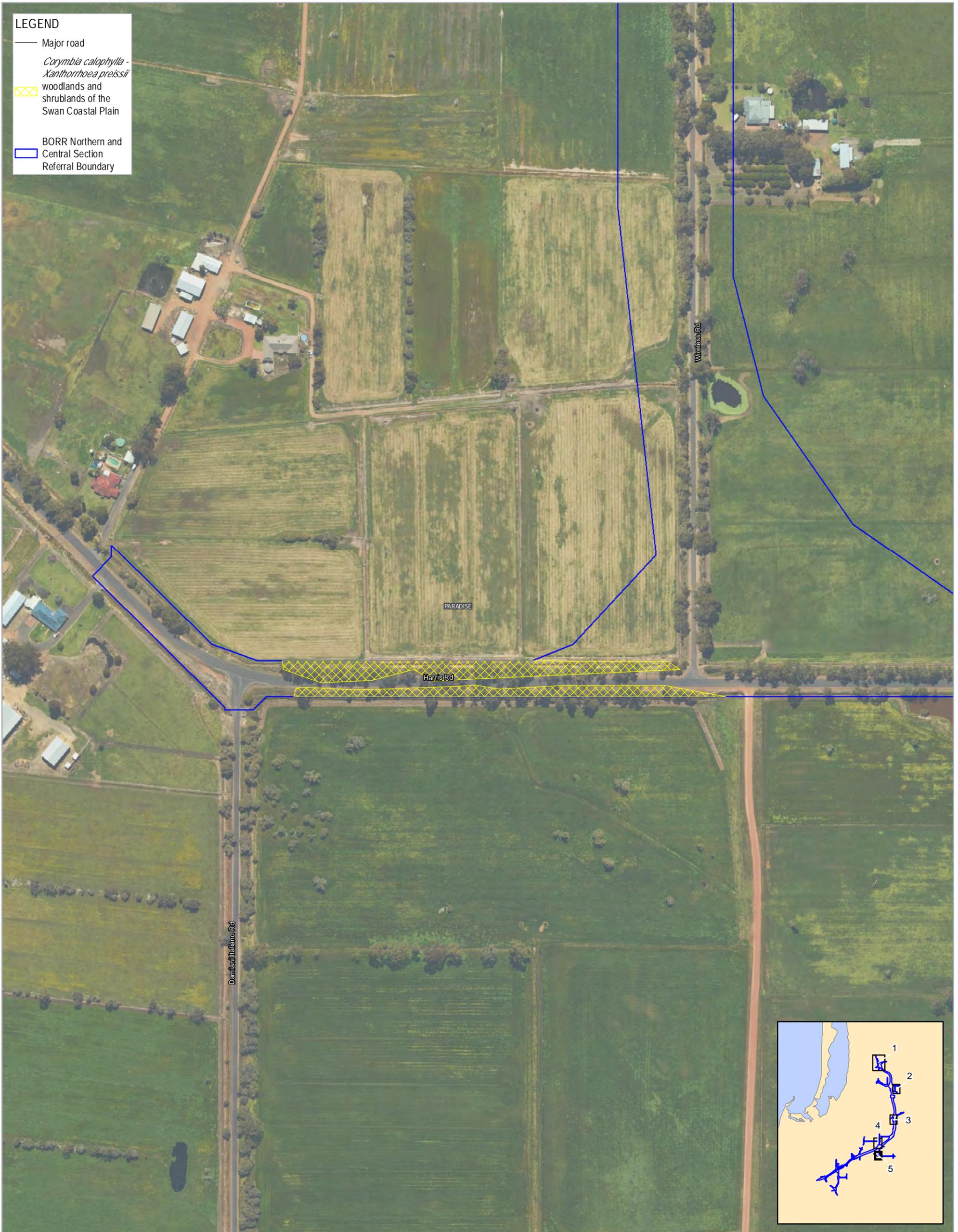


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 Additional Information Request
TEC and PEC extent within the Proposal Area

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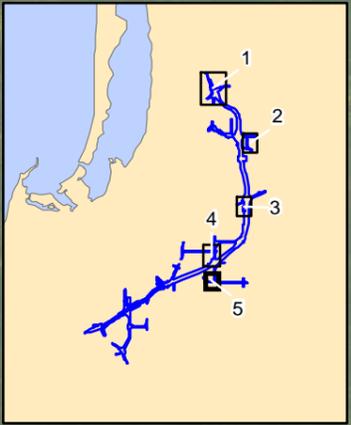
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FIGURE 2

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LEGEND

- Major road
- Corymbia calophylla - Xanthorrhoea preissii* woodlands and shrublands of the Swan Coastal Plain
- BORR Northern and Central Section Referral Boundary



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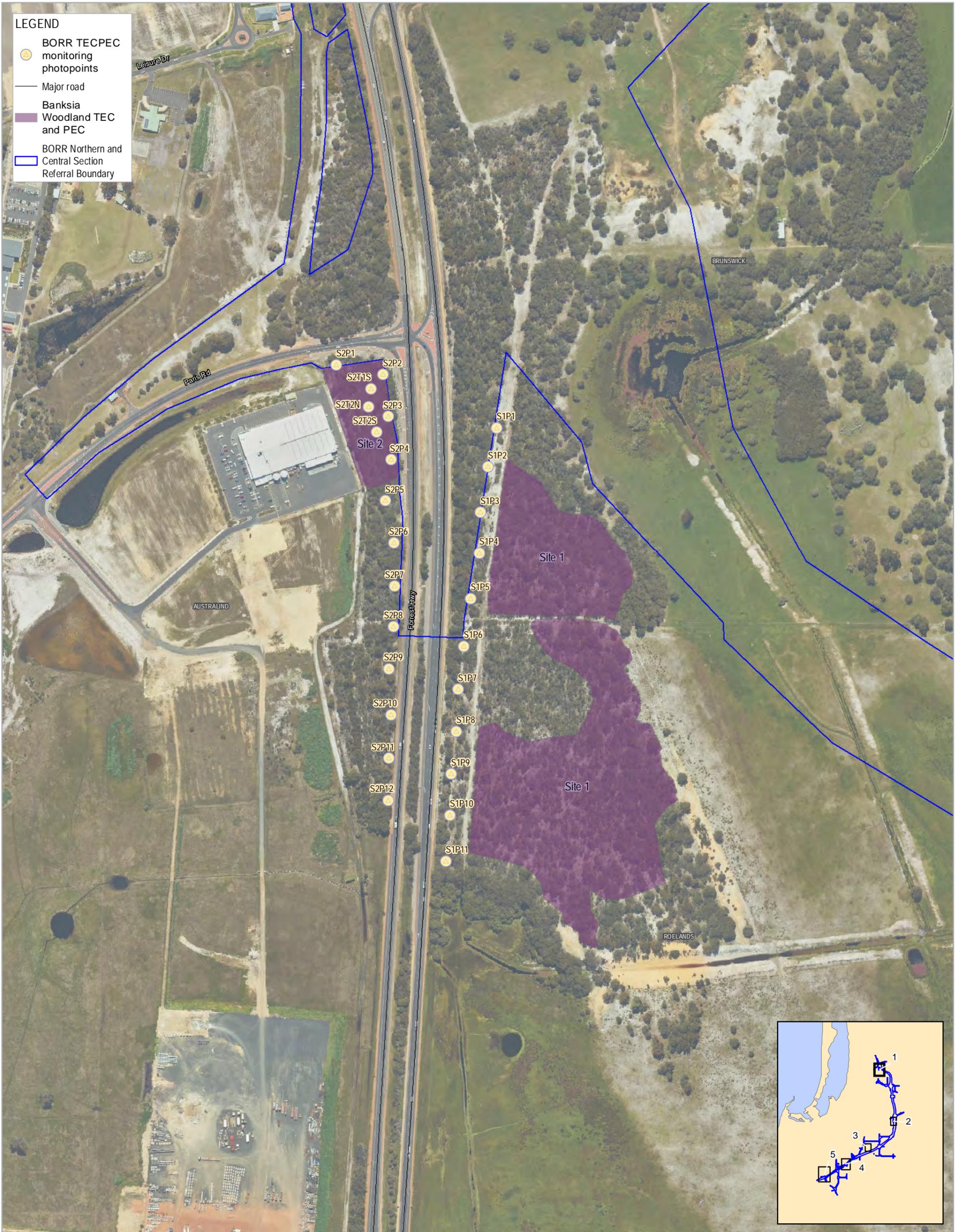
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Additional Information Request
TEC and PEC extent within
the Proposal Area

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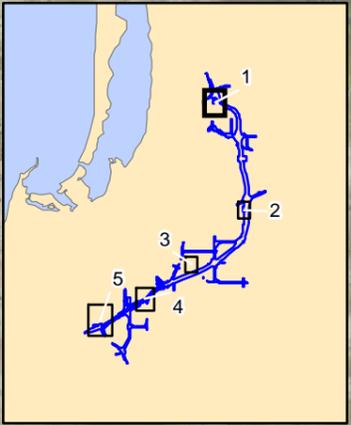
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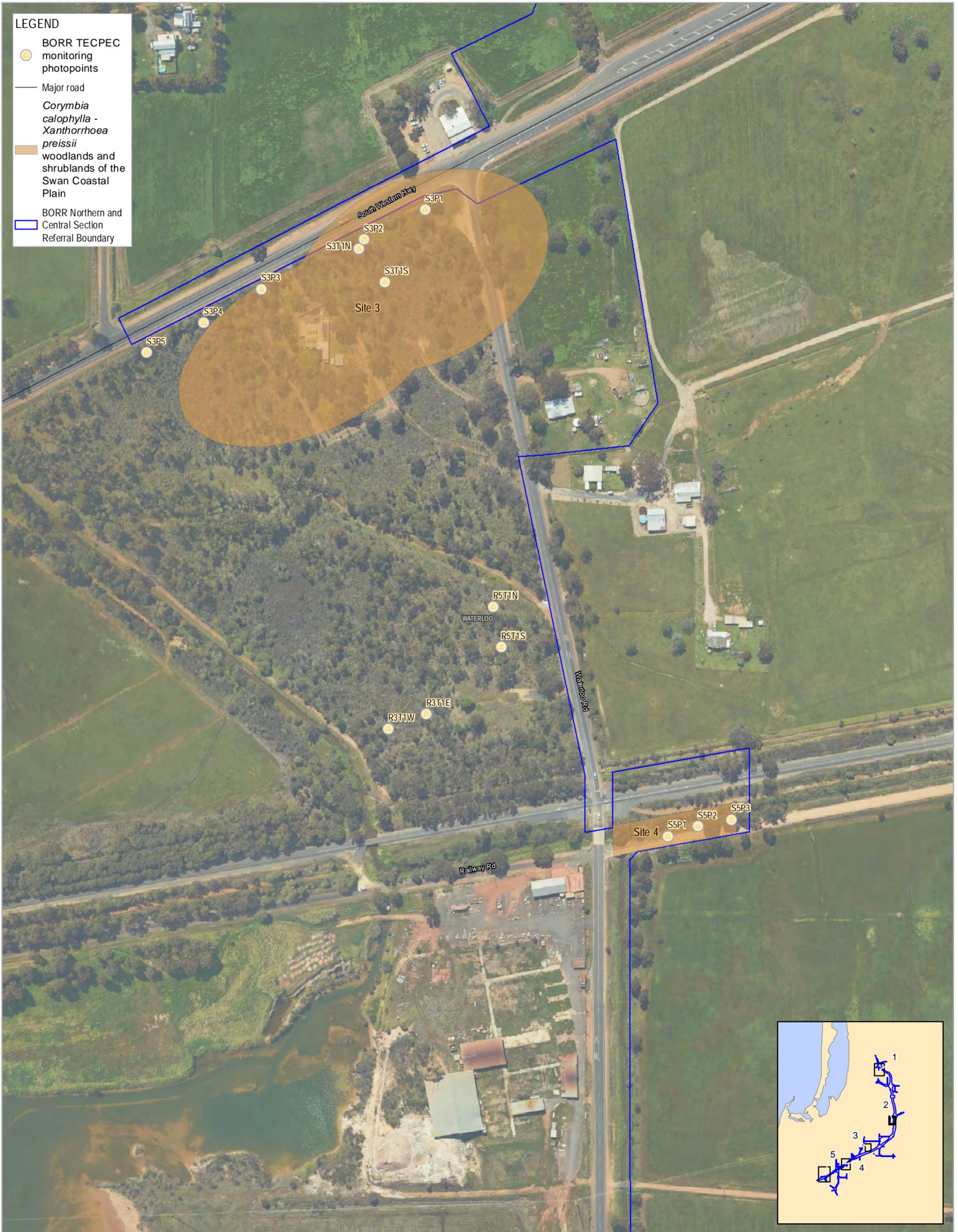


LEGEND

- BORR TECPEC monitoring photopoints
- Major road
- Banksia Woodland TEC and PEC
- BORR Northern and Central Section Referral Boundary



Data source: BORR team: North referral boundary - 20191016, TECPEC Monitoring localities - 201912; Landgate: Roads - 201805, Localities - 20180319, Imagery - WA Now accessed 20191217. Created by: mmikkonen



- LEGEND**
- BORR TECPEC monitoring photopoints
 - Major road
 - Corymbia calophylla - Xanthorrhoea preissii* woodlands and shrublands of the Swan Coastal Plain
 - BORR Northern and Central Section Referral Boundary



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 TEC and PEC extent adjacent
 to the Proposal Area

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 Date 19 Dec 2019

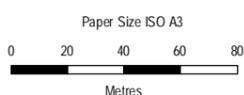
Page 2 of 5
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LEGEND

- BORR TECPEC monitoring photopoints
- Major road
- Claypan TEC
- BORR Northern and Central Section Referral Boundary



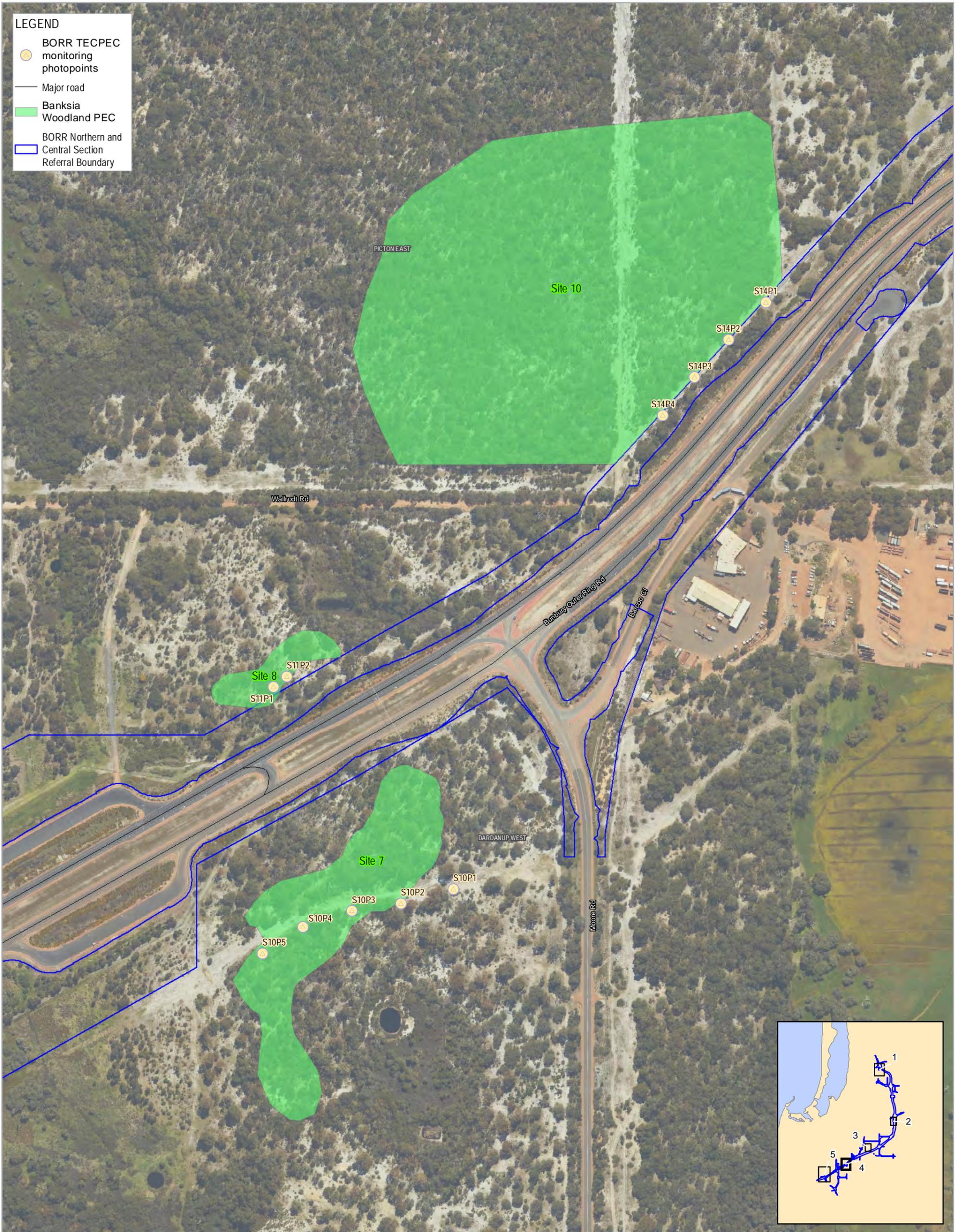
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TEC and PEC extent adjacent
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 TEC and PEC extent adjacent
 to the Proposal Area

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LEGEND

- BORR TECPEC monitoring photopoints
- Major road
- Banksia Woodland PEC
- Claypan TEC
- BORR Northern and Central Section Referral Boundary



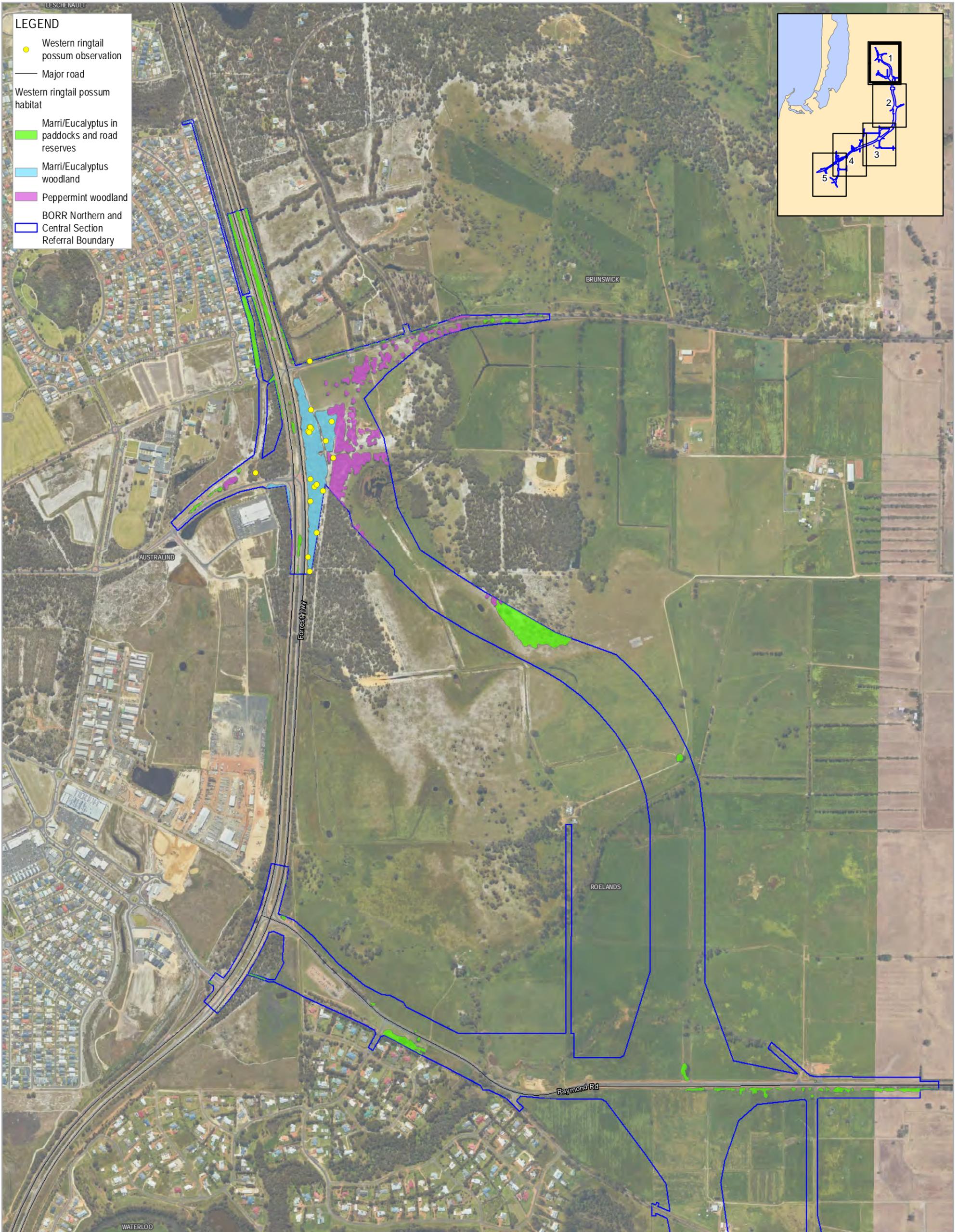
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 Bunbury Outer Ring Road Northern and Central Section
 Response to EPA Notice of Decision to Assess:
 Additional Information Request
TEC and PEC extent adjacent to the Proposal Area

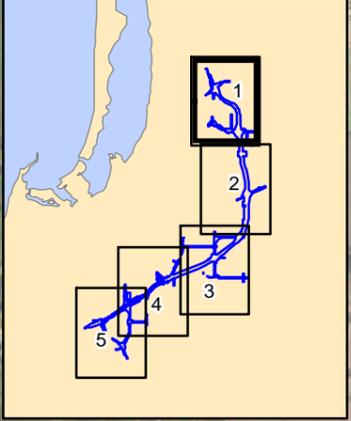
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 Date 17 Dec 2019

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LEGEND

- Western ringtail possum observation
- Major road
- Western ringtail possum habitat
- Marri/Eucalyptus in paddocks and road reserves
- Marri/Eucalyptus woodland
- Peppermint woodland
- BORR Northern and Central Section Referral Boundary



SLIP
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Paper Size ISO A3
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Map Projection: Transverse Mercator
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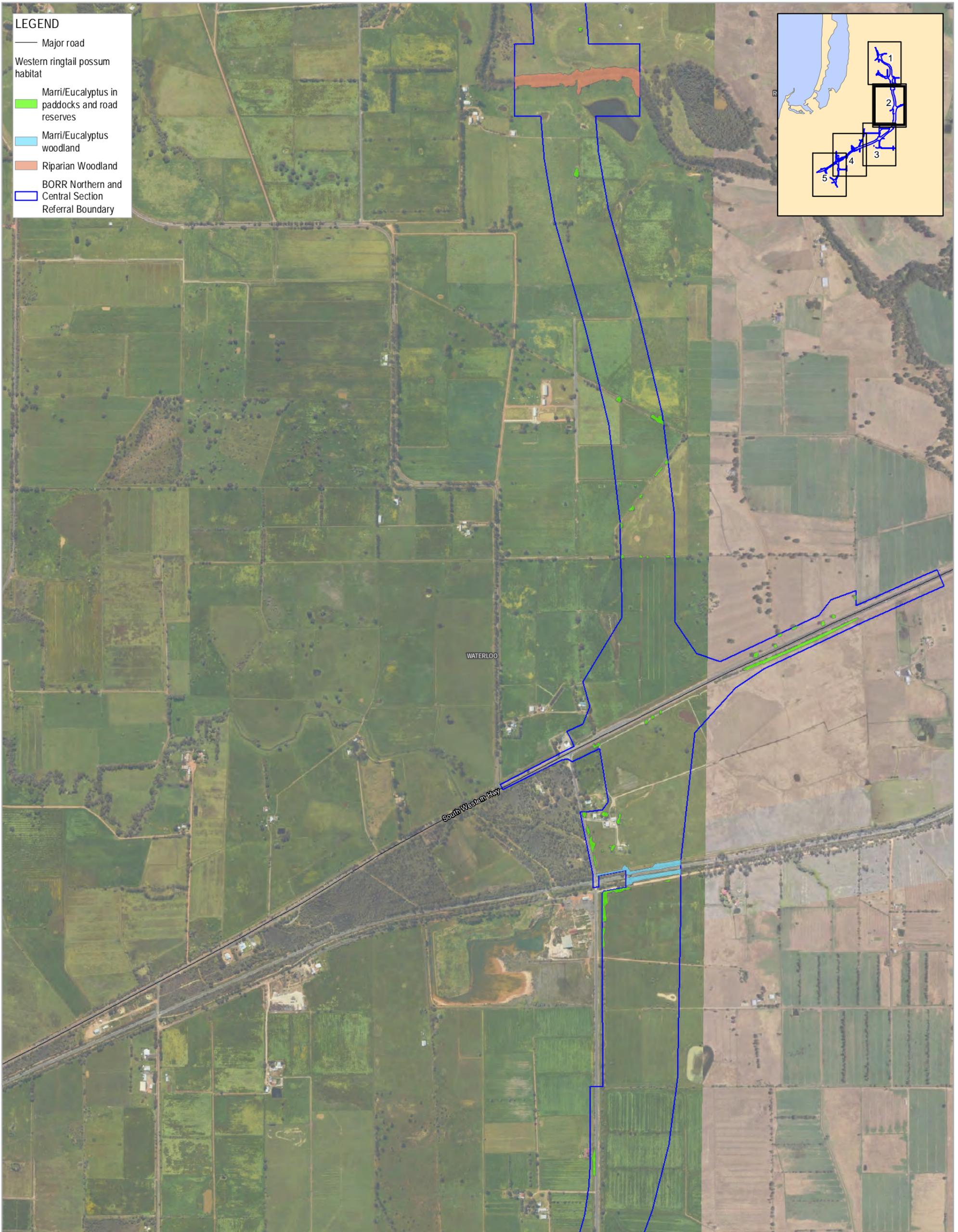
Main Roads Western Australia
Bunbury Outer Ring Road Northern and Central Section
Response to EPA Notice of Decision to Assess:
Additional Information Request

**WRP observations and habitat types
and extent within the Proposal Area**

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Revision No. 0
Date 18 Dec 2019

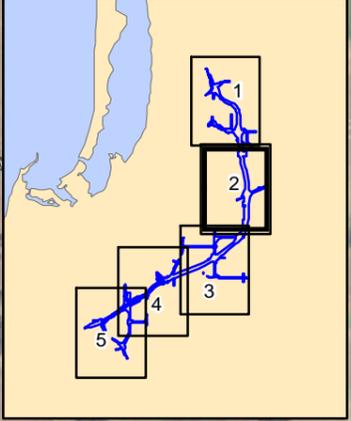
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Created by: mmikkonen



LEGEND

- Major road
- Western ringtail possum habitat
- Marri/Eucalyptus in paddocks and road reserves
- Marri/Eucalyptus woodland
- Riparian Woodland
- BORR Northern and Central Section Referral Boundary



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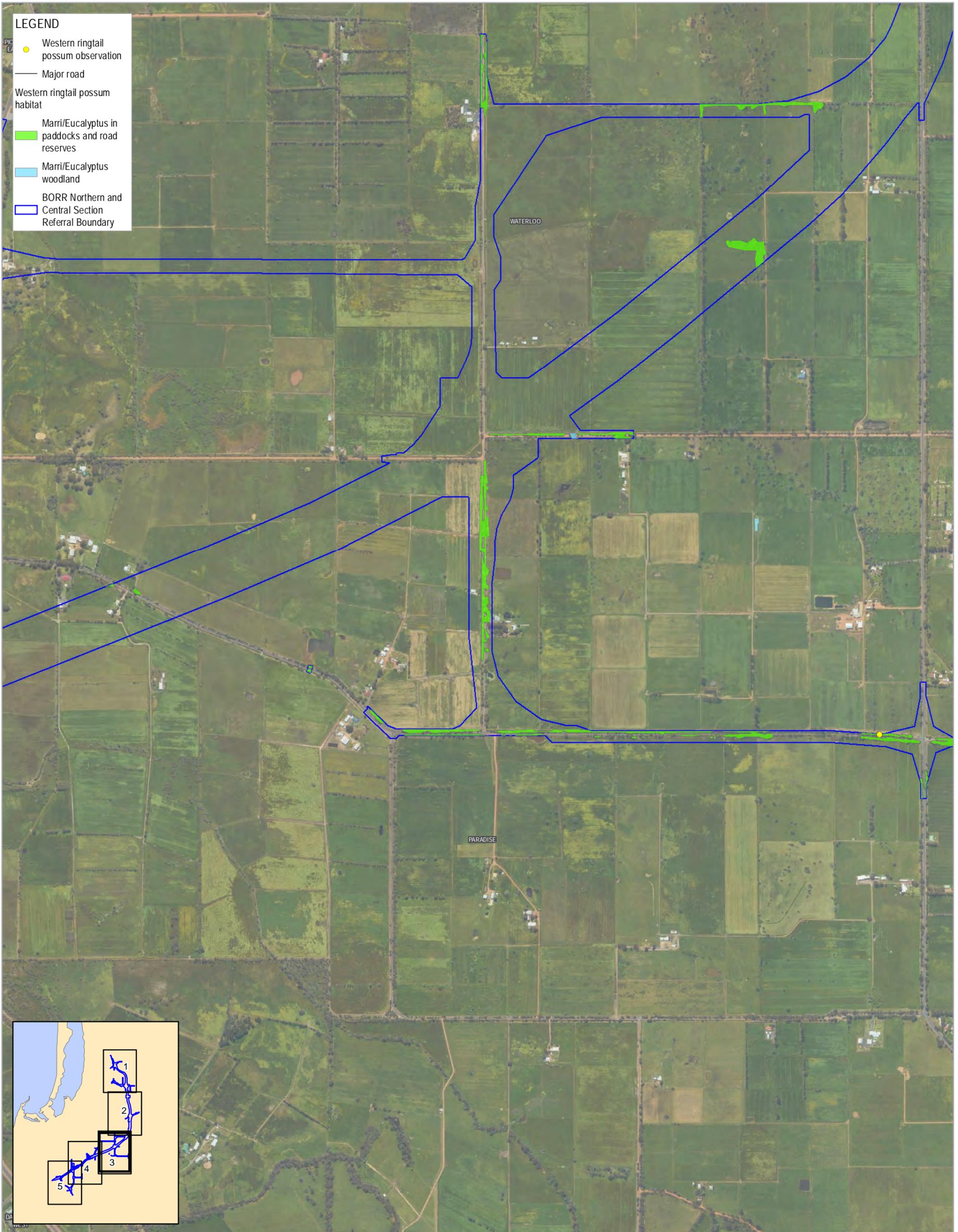
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Additional Information Request

WRP observations and habitat types
and extent within the Proposal Area

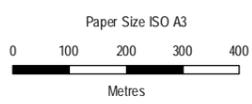
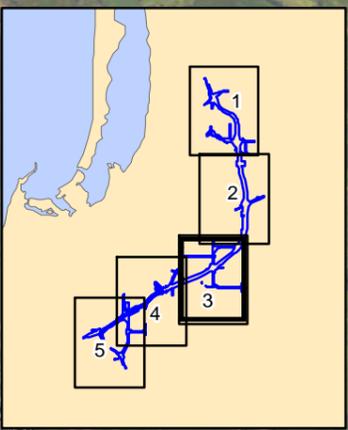
Project No. 61-37041
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FIGURE 4



LEGEND

- Western ringtail possum observation
- Major road
- Western ringtail possum habitat
- Marri/Eucalyptus in paddocks and road reserves
- Marri/Eucalyptus woodland
- BORR Northern and Central Section Referral Boundary



Map Projection: Transverse Mercator
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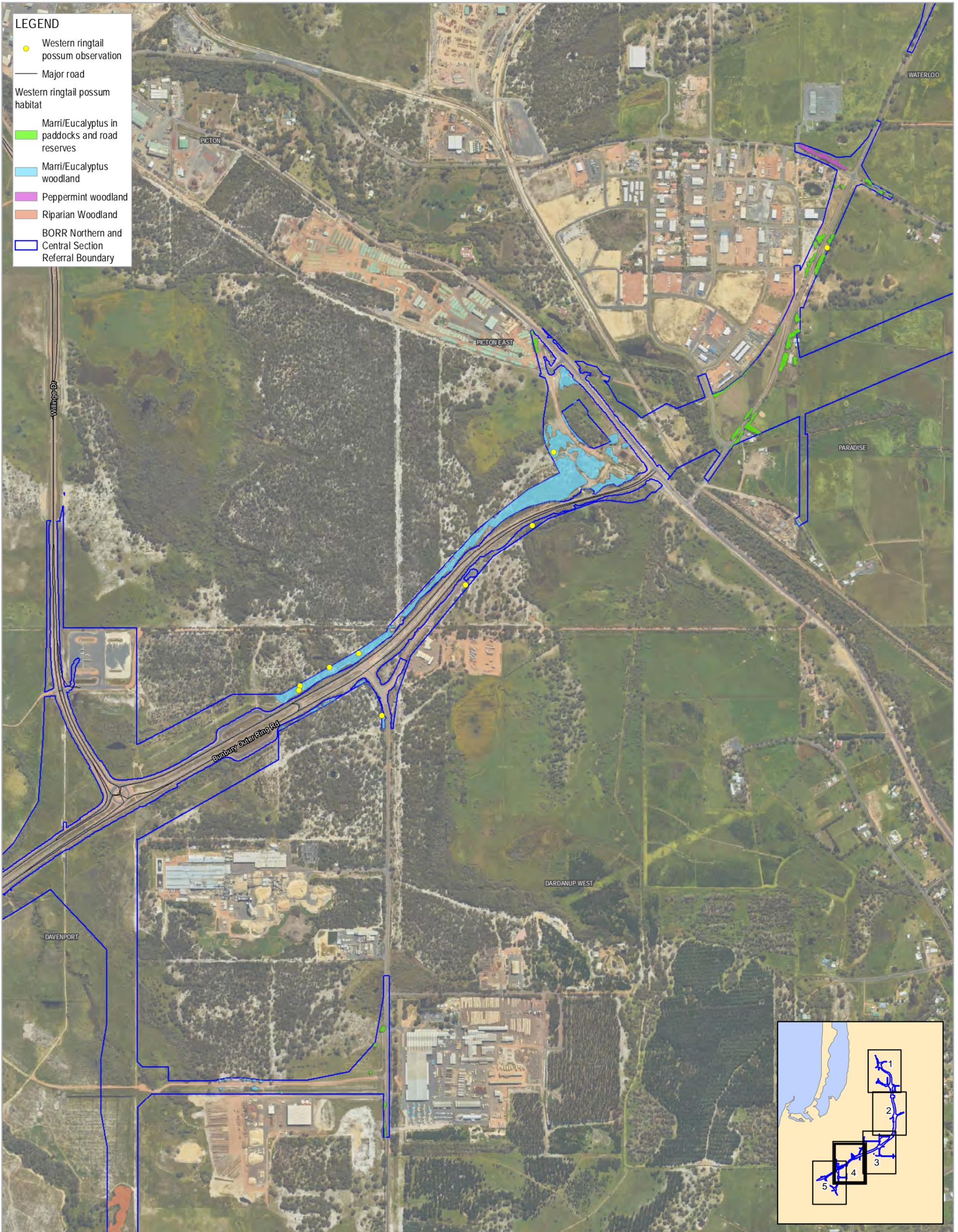


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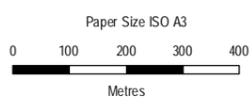
WRP observations and habitat types
and extent within the Proposal Area

Project No. 61-37041
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FIGURE 4



- LEGEND**
- Western ringtail possum observation
 - Major road
 - Western ringtail possum habitat
 - Marri/Eucalyptus in paddocks and road reserves
 - Marri/Eucalyptus woodland
 - Peppermint woodland
 - Riparian Woodland
 - BORR Northern and Central Section Referral Boundary



Map Projection: Transverse Mercator
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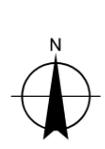
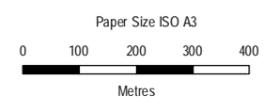
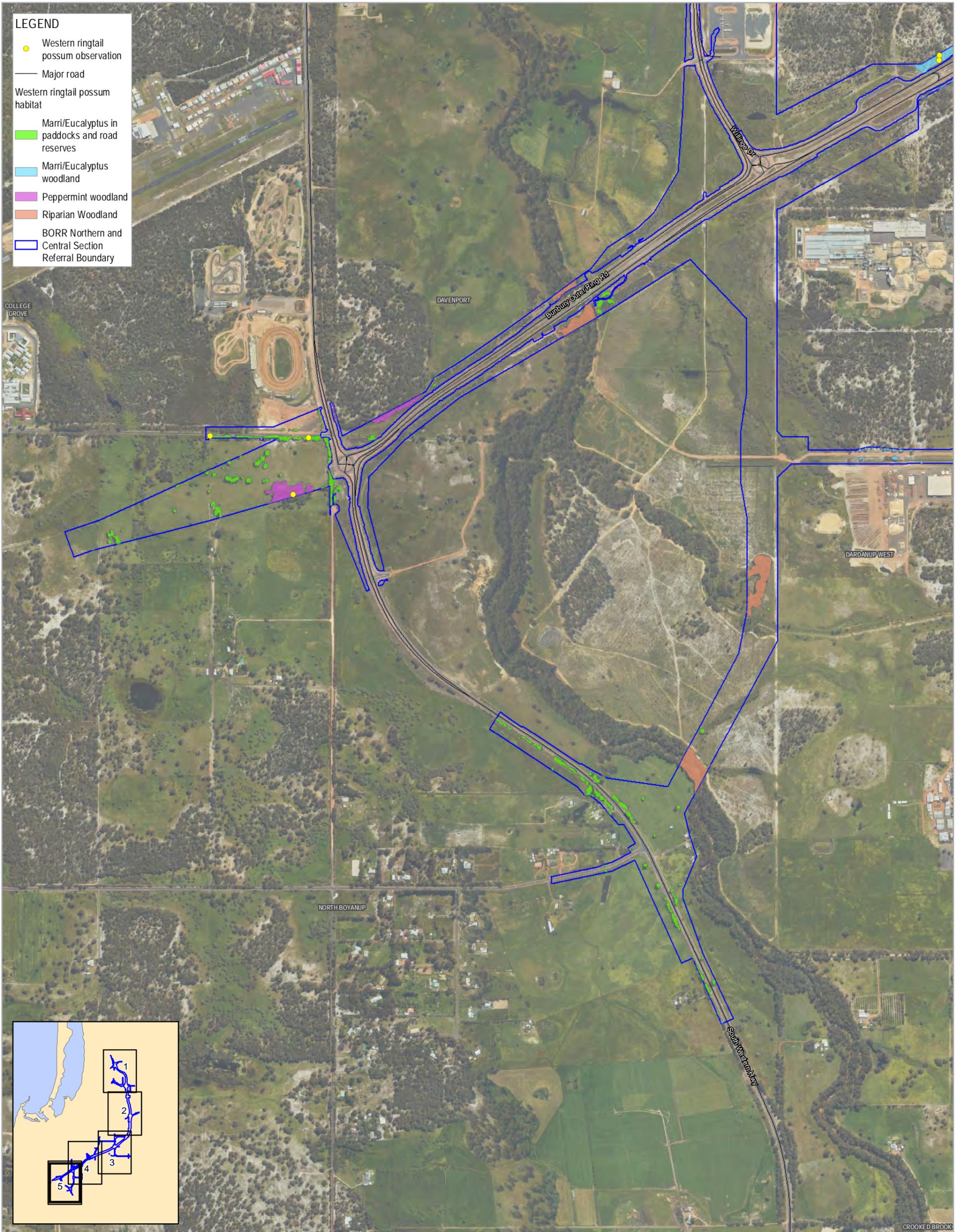
WRP observations and habitat types
 and extent within the Proposal Area

Project No. 61-37041
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Page 4 of 5
FIGURE 4

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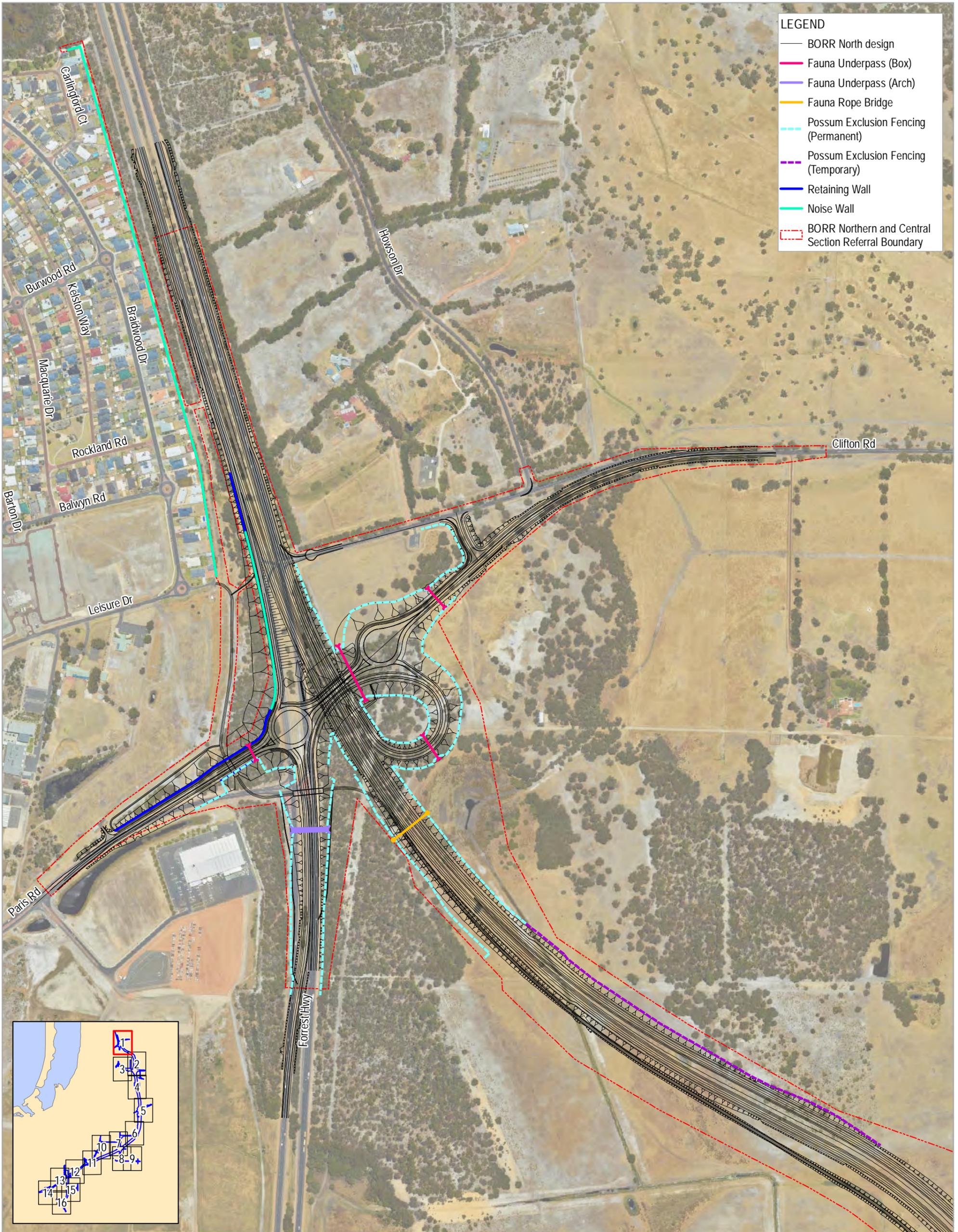


Main Roads Western Australia
Bunbury Outer Ring Road Northern and Central Section
Response to EPA Notice of Decision to Assess:
Additional Information Request

WRP observations and habitat types
and extent within the Proposal Area

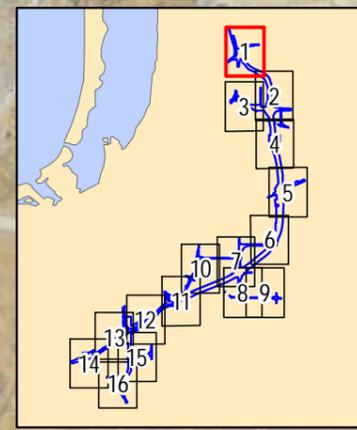
Project No. 61-37041
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FIGURE 4



LEGEND

- BORR North design
- Fauna Underpass (Box)
- Fauna Underpass (Arch)
- Fauna Rope Bridge
- Possum Exclusion Fencing (Permanent)
- Possum Exclusion Fencing (Temporary)
- Retaining Wall
- Noise Wall
- - - BORR Northern and Central Section Referral Boundary



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Paper Size ISO A3

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Map Projection: Transverse Mercator
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WESTERN AUSTRALIA
SUNBURY OUTER RING ROAD (FLANGERS) ADD DEVELOPMENT

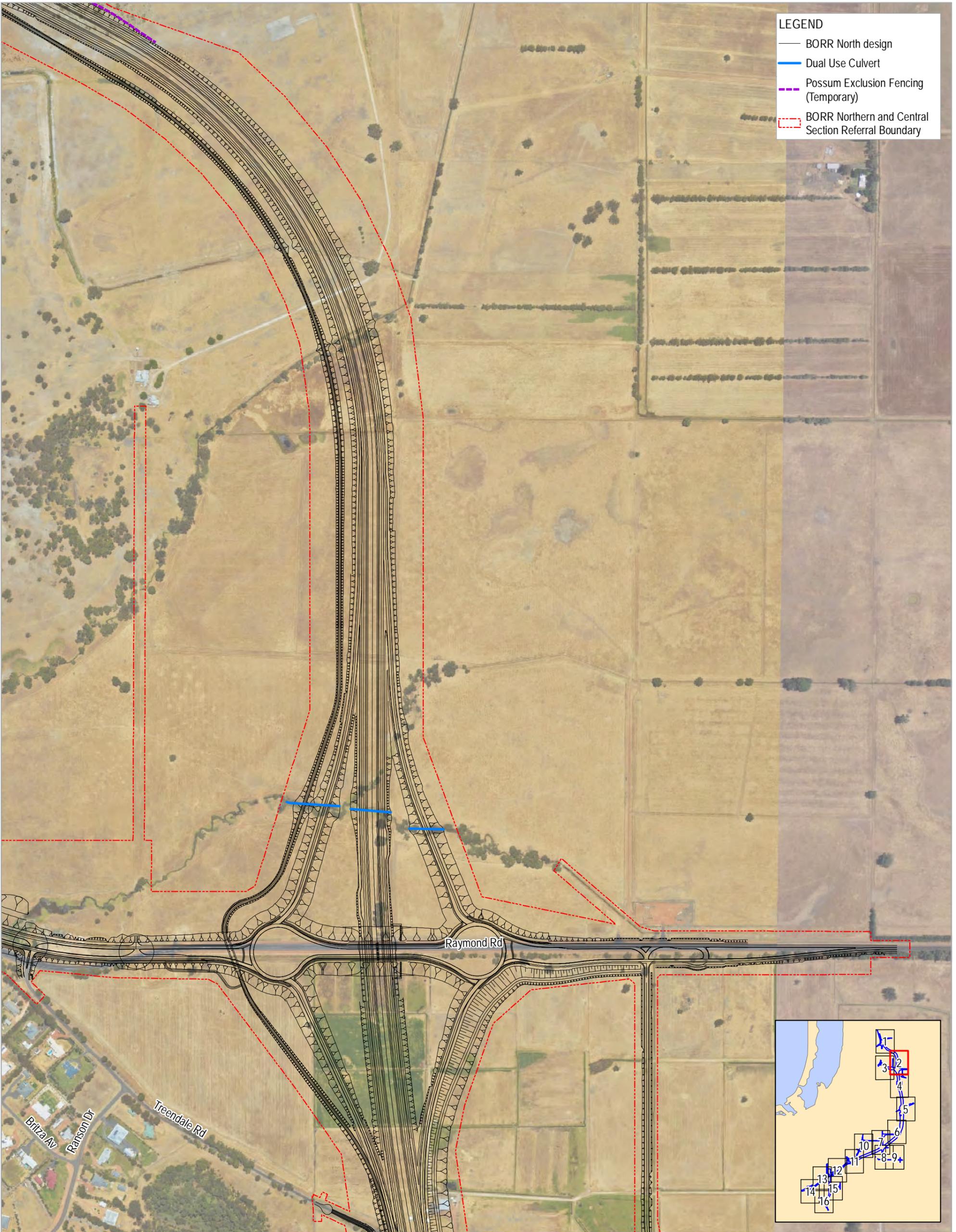
Main Roads Western Australia
Bunbury Outer Ring Road Northern and Central Section

Fauna Crossing Provisions and Exclusion Fencing Concept Plan

Project No. 61-37041
Revision No. 1
Date 07 May 2020

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LEGEND

- BORR North design
- Dual Use Culvert
- Possum Exclusion Fencing (Temporary)
- - - BORR Northern and Central Section Referral Boundary



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 Bunbury Outer Ring Road Northern and Central Section

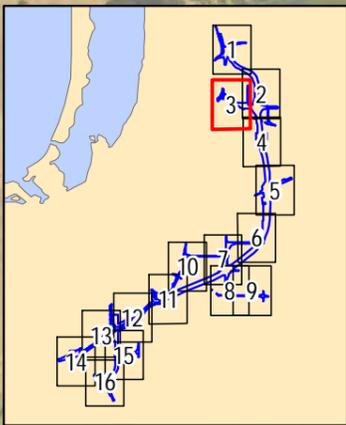
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 Revision No. 1
 Date 07 May 2020

Fauna Crossing Provisions and Exclusion Fencing Concept Plan



LEGEND

- BORR North design
- Fauna Underpass (Box)
- - - BORR Northern and Central Section Referral Boundary



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Main Roads Western Australia
 Bunbury Outer Ring Road Northern and Central Section
**Fauna Crossing Provisions and
 Exclusion Fencing Concept Plan**

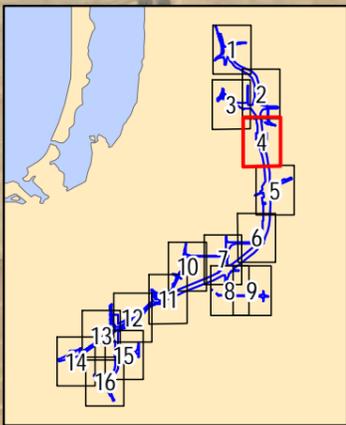
Project No. 61-37041
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FIGURE 5



LEGEND

- BORR North design
- Dual Use Culvert
- Fauna Rope Bridge
- - - BORR Northern and Central Section Referral Boundary



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 Metres
 Map Projection: Transverse Mercator
 Horizontal Datum: GDA 1994
 Grid: GDA 1994 Perth Coastal Grid 1994



Main Roads Western Australia
 Bunbury Outer Ring Road Northern and Central Section

Project No. 61-37041
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Fauna Crossing Provisions and
 Exclusion Fencing Concept Plan



LEGEND

- BORR North design
- - - BORR Northern and Central Section Referral Boundary



Paper Size ISO A3
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 Map Projection: Transverse Mercator
 Horizontal Datum: GDA 1994
 Grid: GDA 1994 Perth Coastal Grid 1994



Main Roads Western Australia
 Bunbury Outer Ring Road Northern and Central Section

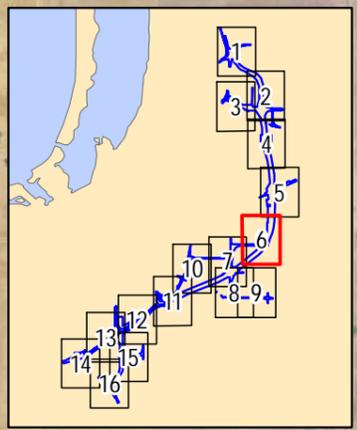
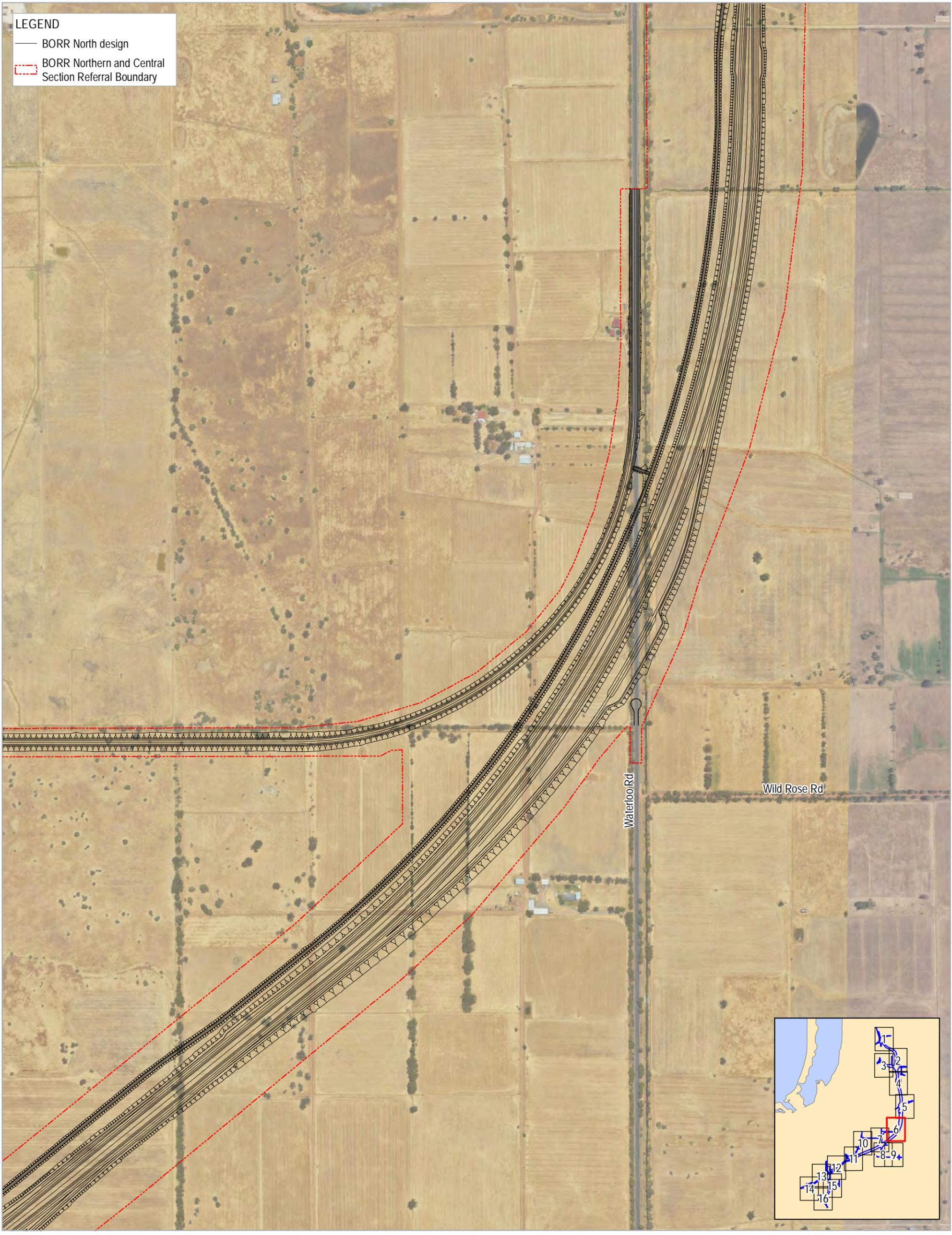
Project No. 61-37041
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 Date 07 May 2020

Fauna Crossing Provisions and
 Exclusion Fencing Concept Plan

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LEGEND
 — BORR North design
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Map Projection: Transverse Mercator
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 SUNBURY OUTER RING ROAD (FLAMBERG AND DEVELOPMENT)

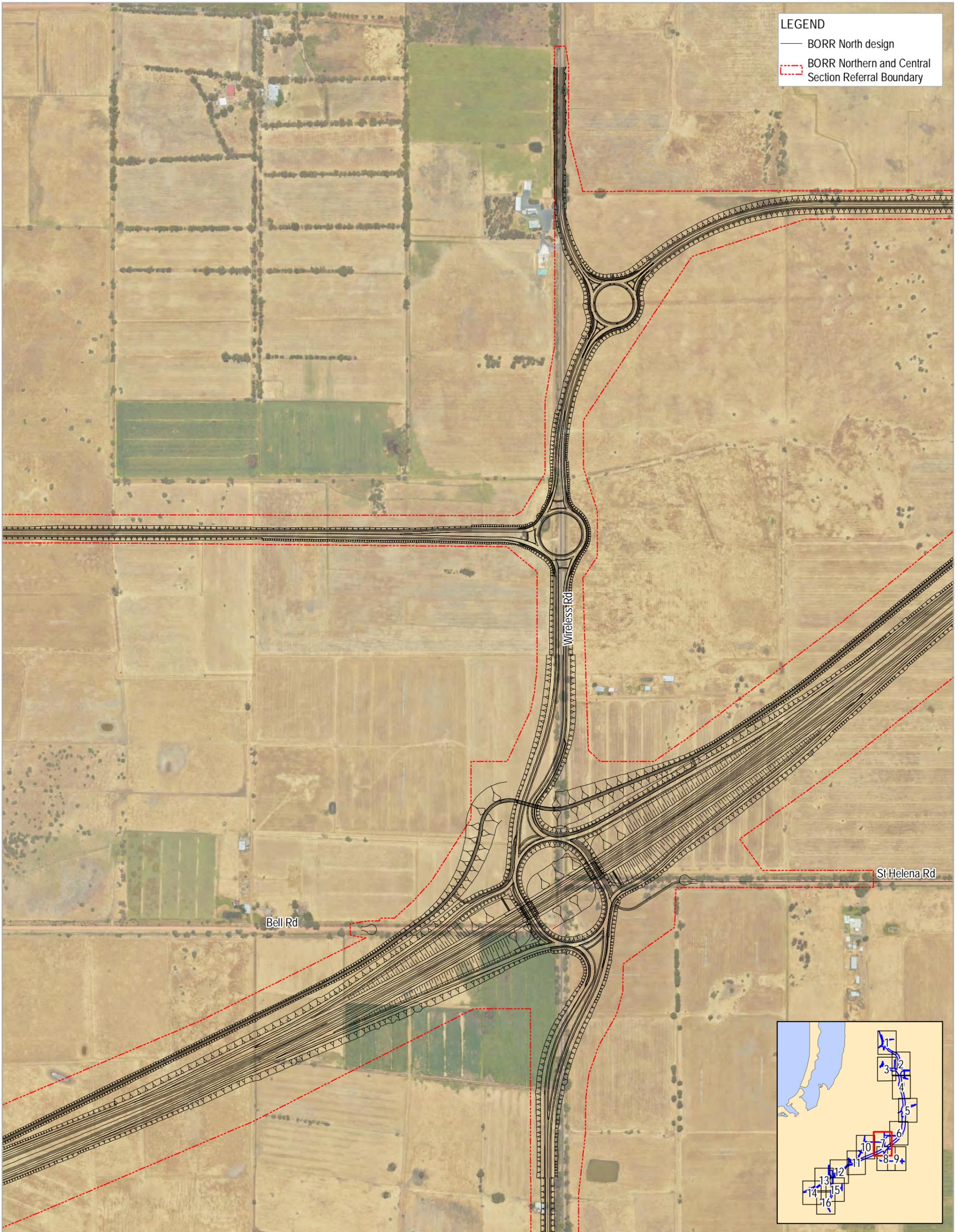
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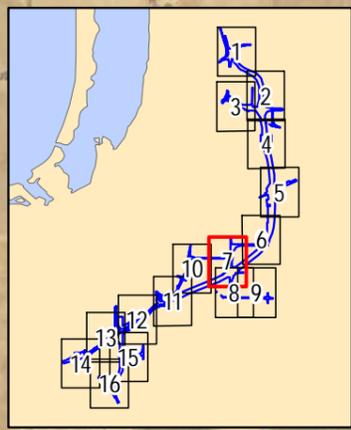
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Data source: BORR team: North design - 201908, North referral boundary - 20191016, Possum Exclusion Fencing Structure - 20200420; Biota: Western Ringtail Possum Records - 20200327, Possum habitat - 201910; Landgate: Imagery - WA Now accessed 20200507. Created by: sli



LEGEND

- BORR North design
- - - BORR Northern and Central Section Referral Boundary



Paper Size ISO A3
 0 50 100 150 200
 Metres
 Map Projection: Transverse Mercator
 Horizontal Datum: GDA 1994
 Grid: GDA 1994 Perth Coastal Grid 1994



Main Roads Western Australia
 Bunbury Outer Ring Road Northern and Central Section

Fauna Crossing Provisions and Exclusion Fencing Concept Plan

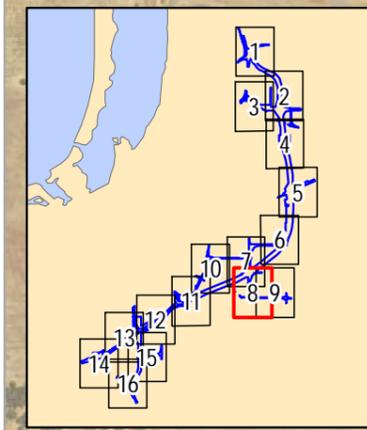
Project No. 61-37041
 Revision No. 1
 Date 07 May 2020

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Data source: BORR team: North design - 201908, North referral boundary - 20191016, Possum Exclusion Fencing Structure - 20200420; Biota: Western Ringtail Possum Records - 20200327, Possum habitat - 201910; Landgate: Imagery - WA Now accessed 20200507. Created by: slt



LEGEND
 — BORR North design
 - - - BORR Northern and Central Section Referral Boundary



Paper Size ISO A3
 0 50 100 150 200
 Metres
 Map Projection: Transverse Mercator
 Horizontal Datum: GDA 1994
 Grid: GDA 1994 Perth Coastal Grid 1994



Main Roads Western Australia
 Bunbury Outer Ring Road Northern and Central Section

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 Date 07 May 2020

Fauna Crossing Provisions and Exclusion Fencing Concept Plan

Page 8 of 16
FIGURE 5

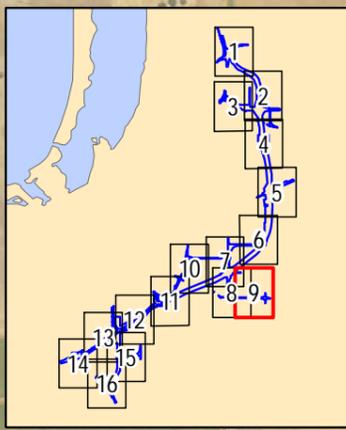
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LEGEND

- BORR North design
- - - BORR Northern and Central Section Referral Boundary



Paper Size ISO A3
 0 50 100 150 200
 Metres
 Map Projection: Transverse Mercator
 Horizontal Datum: GDA 1994
 Grid: GDA 1994 Perth Coastal Grid 1994



Main Roads Western Australia
 Bunbury Outer Ring Road Northern and Central Section

**Fauna Crossing Provisions and
 Exclusion Fencing Concept Plan**

Project No. 61-37041
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 Date 07 May 2020

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Data source: BORR team: North design - 201908, North referral boundary - 20191016, Possum Exclusion Fencing Structure - 20200420, Biota: Western Ringtail Possum Records - 20200327, Possum habitat - 201910, Landgate: Imagery - WA Now accessed 20200507. Created by: sli



LEGEND

- BORR North design
- Possum Exclusion Fencing (Permanent)
- - - BORR Northern and Central Section Referral Boundary



Paper Size ISO A3

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 Perth Coastal Grid 1994

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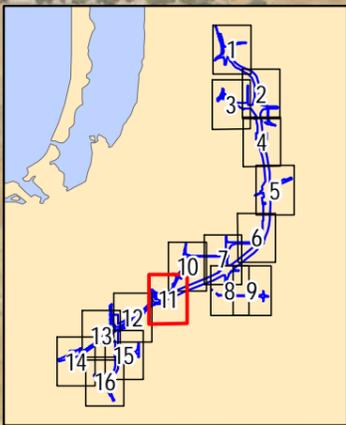
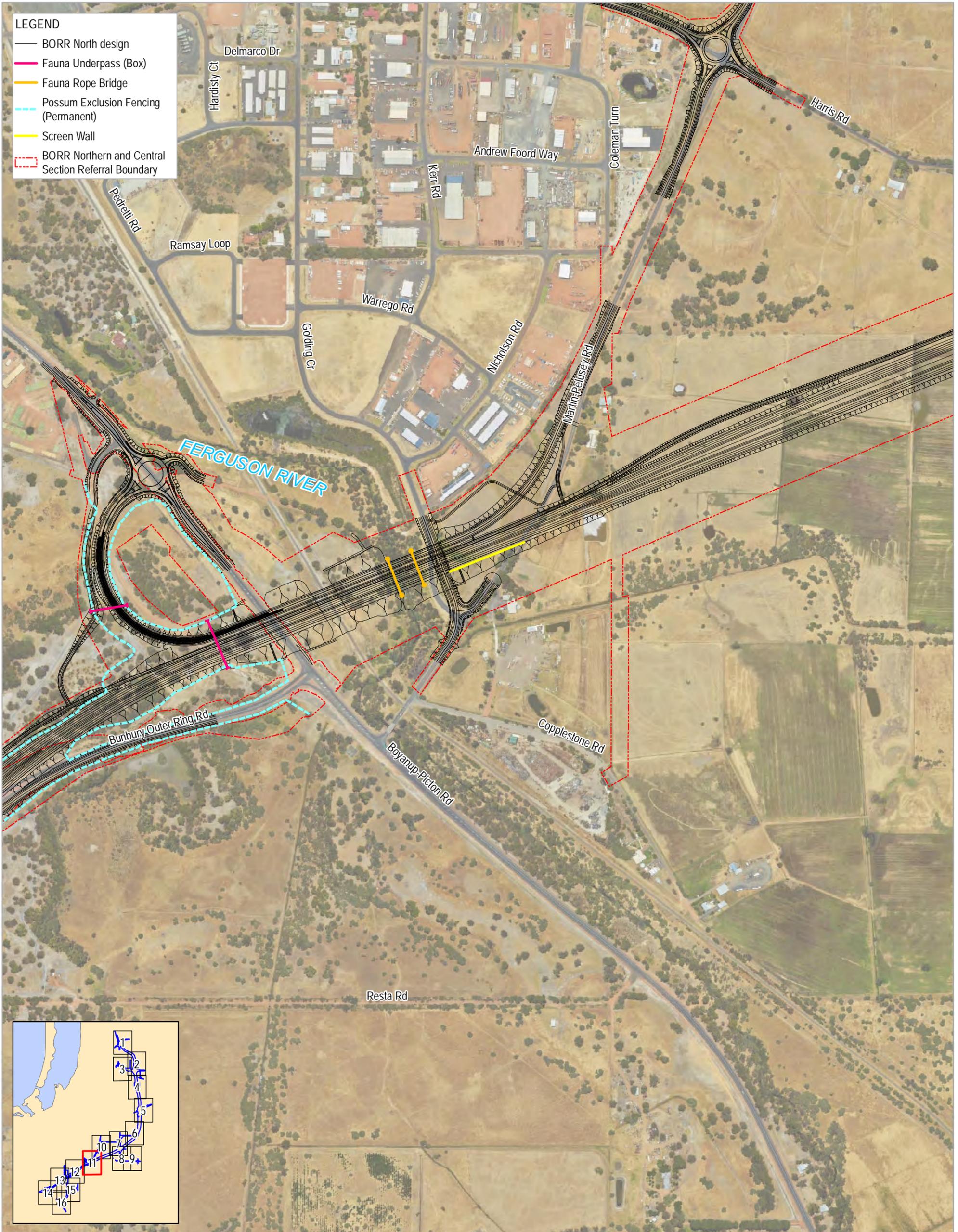
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Bunbury Outer Ring Road Northern and Central Section

Fauna Crossing Provisions and Exclusion Fencing Concept Plan

Project No. 61-37041
Revision No. 1
Date 07 May 2020

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LEGEND

- BORR North design
- Fauna Underpass (Box)
- Dual Use Culvert
- Fauna Rope Bridge
- Possum Exclusion Fencing (Permanent)
- BORR Northern and Central Section Referral Boundary



Paper Size ISO A3

0 50 100 150 200
Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 Perth Coastal Grid 1994

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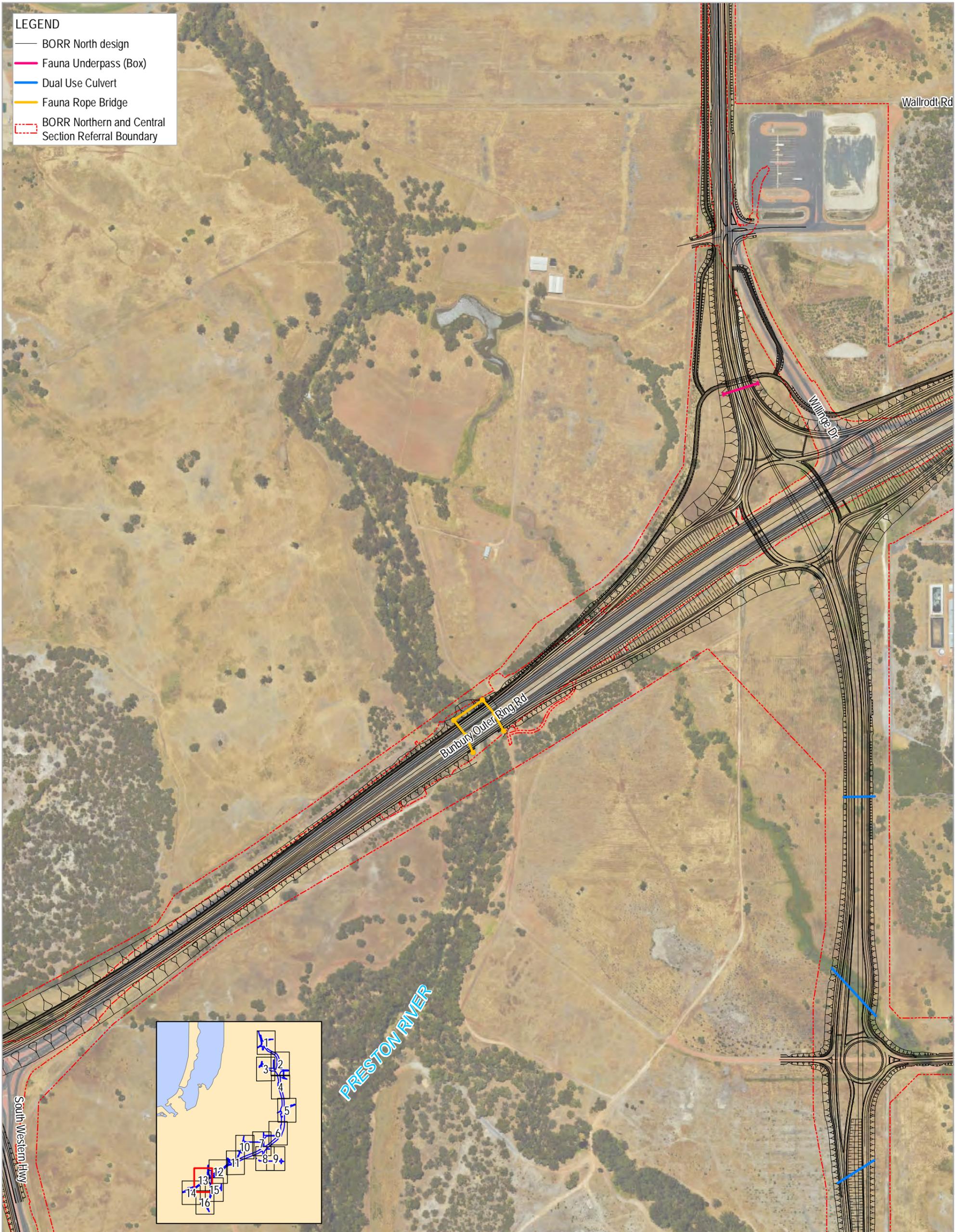
Main Roads Western Australia
Bunbury Outer Ring Road Northern and Central Section

Project No. 61-37041
Revision No. 1
Date 07 May 2020

Fauna Crossing Provisions and Exclusion Fencing Concept Plan

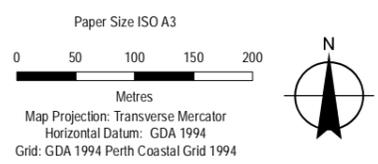
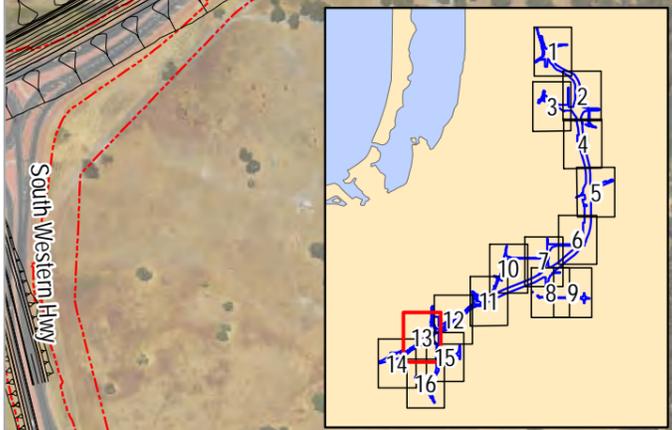
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Data source: BORR team: North design - 201908, North referral boundary - 20191016, Possum Exclusion Fencing Structure - 20200420; Biota: Western Ringtail Possum Records - 20200327, Possum habitat - 201910; Landgate: Imagery - WA Now accessed 20200507. Created by: sli



LEGEND

- BORR North design
- Fauna Underpass (Box)
- Dual Use Culvert
- Fauna Rope Bridge
- - - BORR Northern and Central Section Referral Boundary



Map Projection: Transverse Mercator
 Horizontal Datum: GDA 1994
 Grid: GDA 1994 Perth Coastal Grid 1994
 Print date: 07 May 2020 - 09:38



Main Roads Western Australia
 Bunbury Outer Ring Road Northern and Central Section

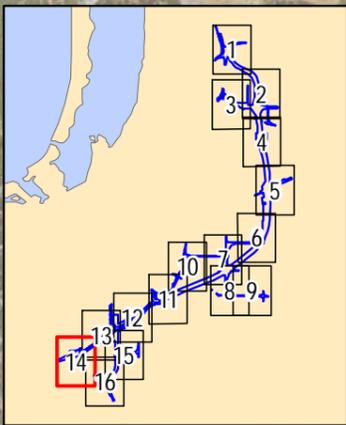
Fauna Crossing Provisions and Exclusion Fencing Concept Plan

Project No. 61-37041
 Revision No. 1
 Date 07 May 2020

Data source: BORR team: North design - 201908, North referral boundary - 20191016, Possum Exclusion Fencing Structure - 20200420; Biota: Western Ringtail Possum Records - 20200327, Possum habitat - 201910; Landgate: Imagery - WA Now accessed 20200507. Created by: sli



LEGEND
 — BORR North design
 - - - BORR Northern and Central Section Referral Boundary



Paper Size ISO A3
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 Metres
 Map Projection: Transverse Mercator
 Horizontal Datum: GDA 1994
 Grid: GDA 1994 Perth Coastal Grid 1994



Main Roads Western Australia
 Bunbury Outer Ring Road Northern and Central Section
 Fauna Crossing Provisions and
 Exclusion Fencing Concept Plan

Project No. 61-37041
 Revision No. 1
 Date 07 May 2020



LEGEND

- BORR North design
- Dual Use Culvert
- Fauna Rope Bridge
- - - BORR Northern and Central Section Referral Boundary



Paper Size ISO A3

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 Perth Coastal Grid 1994

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Main Roads Western Australia
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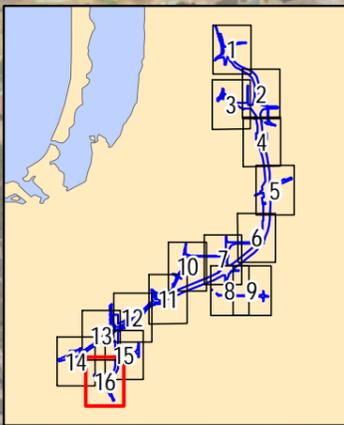
Fauna Crossing Provisions and Exclusion Fencing Concept Plan

Project No. 61-37041
Revision No. 1
Date 07 May 2020

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Data source: BORR team: North design - 201908, North referral boundary - 20191016, Possum Exclusion Fencing Structure - 20200420, Biota: Western Ringtail Possum Records - 20200327, Possum habitat - 201910, Landgate: Imagery - WA Now accessed 20200507. Created by: sli

- LEGEND**
- BORR North design
 - Dual Use Culvert
 - Fauna Rope Bridge
 - - - BORR Northern and Central Section Referral Boundary



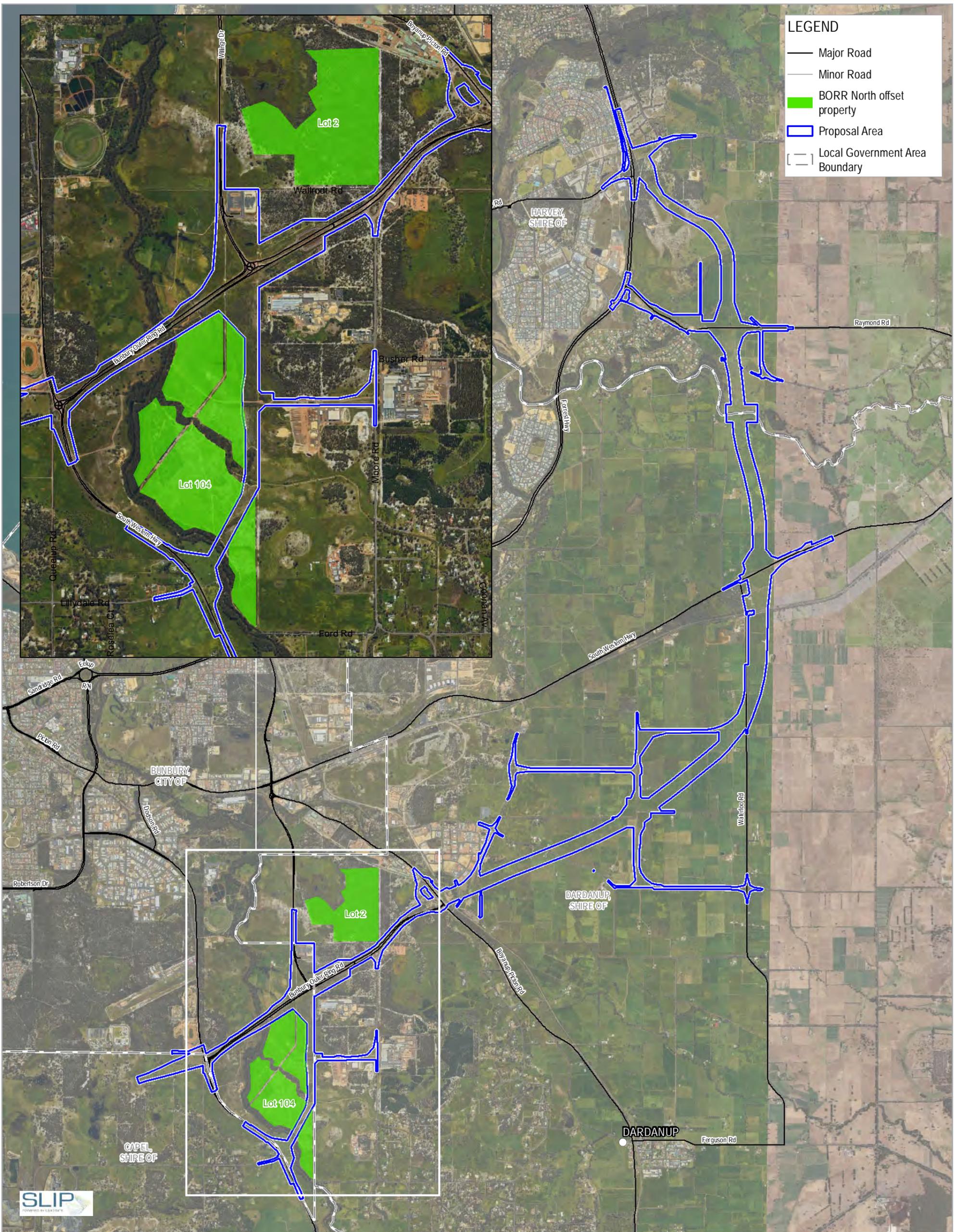
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 Grid: GDA 1994 Perth Coastal Grid 1994



Main Roads Western Australia
 Bunbury Outer Ring Road Northern and Central Section

Project No. 61-37041
 Revision No. 1
 Date 07 May 2020

**Fauna Crossing Provisions and
 Exclusion Fencing Concept Plan**



LEGEND

- Major Road
- Minor Road
- BORR North offset property
- Proposal Area
- [- -] Local Government Area Boundary

Paper Size ISO A3

Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 Perth Coastal Grid 1994



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Bunbury Outer Ring Road Northern and Central Section
Offset Strategy

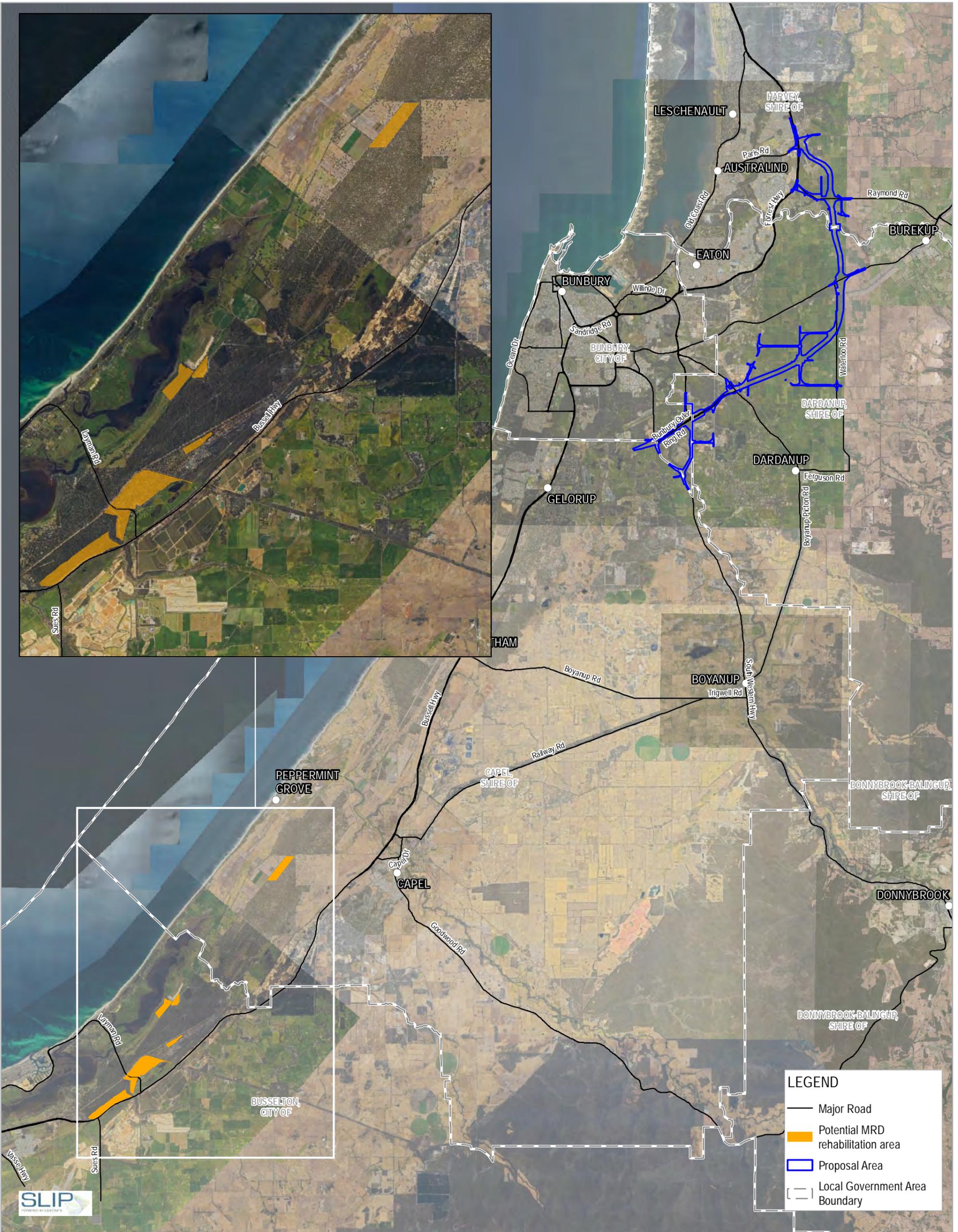
Project No. 61-37041
Revision No. 0
Date 31/01/2020

Offset property locations

FIGURE 6

G:\613704119_0_GIS\Maps\Working\BORR\North_ARIF\figures\Offset\Strategy\6137041_008_OffsetProperties_Rev0.mxd
Print date: 31 Jan 2020 - 13:04

Data source: Geoscience Australia: GeoData Topo 250k Series III - 2006; Landgate: Roads, LGA Boundaries - 20180501; Imagery - WA Now accessed 20200129; BORR: Proposal Area - 201910; Offset properties - 20200130; Excluded area - 20190227. Created by: mmkknoren



Paper Size ISO A3
 0 2 4
 Kilometres

Map Projection: Transverse Mercator
 Horizontal Datum: GDA 1994
 Grid: GDA 1994 Perth Coastal Grid 1994



Main Roads Western Australia
 Bunbury Outer Ring Road Northern and Central Section
 Offset Strategy

Project No. 61-37041
 Revision No. 0
 Date 31/01/2020

State Forest 2 potential offset areas

FIGURE 7

Offset calculations

Offsets Assessment Guide

For use in determining offsets under the *Environment Protection and Biodiversity Conservation Act 1999*
2 October 2012

This guide relies on Macros being enabled in your browser.

Matter of National Environmental Significance	
Name	Western Ringtail Possum
EPBC Act status	Critically Endangered
Annual probability of extinction Based on IUCN category definitions	6.8%

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Impact calculator						
Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
<i>Ecological communities</i>						
Area of community	No		Area			
			Quality			
			Total quantum of impact	0.00		
<i>Threatened species habitat</i>						
Area of habitat	Yes	Clearing of up to 44 ha of WRP habitat	Area	44	Hectares	Site assessment and Proposal design have been used to identify impacts
			Quality	8	Scale 0-10	
			Total quantum of impact	35.20	Adjusted hectares	
<i>Threatened species</i>						
Birth rate e.g. Change in nest success	No					
Mortality rate e.g. Change in number of road kills per year	No					
Number of individuals e.g. Individual plants/animals	No					

Offset calculator																								
Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)	Start area and quality	Future area and quality without offset	Future area and quality with offset	Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)	% of impact offset	Minimum (90%) direct offset requirement met?	Cost (\$ total)	Information source								
<i>Ecological Communities</i>																								
Area of community	No				Risk-related time horizon (max. 20 years)	Start area (hectares)	Risk of loss (% without offset)	Risk of loss (% with offset)																
					Time until ecological benefit	Start quality (scale of 0-10)	Future area without offset (adjusted hectares)	0.0	Future area with offset (adjusted hectares)	0.0														
							Future quality without offset (scale of 0-10)		Future quality with offset (scale of 0-10)															
<i>Threatened species habitat</i>																								
Area of habitat	Yes	35.20	Adjusted hectares	WRP habitat within Lot 2 North Boyanup Road	Time over which loss is averted (max. 20 years)	20	Start area (hectares)	55	Risk of loss (% without offset)	15%	Risk of loss (% with offset)	5%	Raw gain	5.50	Confidence in result (%)	80%	Adjusted gain	4.40	Net present value	1.18				
					Time until ecological benefit	1	Start quality (scale of 0-10)	8	Future area without offset (adjusted hectares)	46.8	Future area with offset (adjusted hectares)	52.3												
							Future quality without offset (scale of 0-10)	6	Future quality with offset (scale of 0-10)	8	2.00	80%	1.60	1.50										
<i>Threatened species</i>																								
Number of features e.g. Nest hollows, habitat trees	No																							
Condition of habitat Change in habitat condition, but no change in extent	No																							
Birth rate e.g. Change in nest success	No																							
Mortality rate e.g. Change in number of road kills per year	No																							
Number of individuals e.g. Individual plants/animals	No																							

Summary							
Protected matter attributes	Quantum of impact	Net present value of offset	% of impact offset	Direct offset adequate?	Cost (\$)		
					Direct offset (\$)	Other compensatory measures (\$)	Total (\$)
					Birth rate	0	
Mortality rate	0				\$0.00	\$0.00	
Number of individuals	0				\$0.00	\$0.00	
Number of features	0				\$0.00	\$0.00	
Condition of habitat	0				\$0.00	\$0.00	
Area of habitat	35.2	7.95	22.58%	No	\$0.00	#DIV/0!	#DIV/0!
Area of community	0				\$0.00		\$0.00
					\$0.00	#DIV/0!	#DIV/0!

Offsets Assessment Guide

For use in determining offsets under the *Environment Protection and Biodiversity Conservation Act 1999*
2 October 2012

This guide relies on Macros being enabled in your browser.

Matter of National Environmental Significance	
Name	Western Ringtail Possum
EPBC Act status	Critically Endangered
Annual probability of extinction Based on IUCN category definitions	6.8%

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Impact calculator						
Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
<i>Ecological communities</i>						
Area of community	No		Area			
			Quality			
			Total quantum of impact	0.00		
<i>Threatened species habitat</i>						
Area of habitat	Yes	Clearing of up to 44 ha of WRP habitat	Area	44	Hectares	Site assessment and the Proposal design have been used to identify impacts
			Quality	8	Scale 0-10	
			Total quantum of impact	35.20	Adjusted hectares	
<i>Threatened species</i>						
Birth rate e.g. Change in nest success	No					
Mortality rate e.g. Change in number of road kills per year	No					
Number of individuals e.g. Individual plants/animals	No					

Offset calculator																				
Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)	Start area and quality	Future area and quality without offset	Future area and quality with offset	Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)	% of impact offset	Minimum (90%) direct offset requirement met?	Cost (\$ total)	Information source				
<i>Ecological Communities</i>																				
Area of community	No				Risk-related time horizon (max. 20 years)	Start area (hectares)	Risk of loss (%) without offset	Risk of loss (%) with offset												
					Time until ecological benefit	Start quality (scale of 0-10)	Future area without offset (adjusted hectares)	0.0	Future area with offset (adjusted hectares)	0.0										
					Future quality without offset (scale of 0-10)	Future quality with offset (scale of 0-10)														
<i>Threatened species habitat</i>																				
Area of habitat	Yes	35.20	Adjusted hectares	Lot 104 - 45 ha of revegetation to create WRP habitat	Time over which loss is averted (max. 20 years)	20	Start area (hectares)	45	Risk of loss (%) without offset	50%	Risk of loss (%) with offset	5%	20.25	80%	16.20	4.35				
					Time until ecological benefit	10	Start quality (scale of 0-10)	0	Future area without offset (adjusted hectares)	22.5	Future area with offset (adjusted hectares)	42.8	6.00	80%	4.80	2.49	8.20	23.30%	No	
					Future value without offset	0	Future quality with offset (scale of 0-10)	6												
<i>Threatened species</i>																				
Birth rate e.g. Change in nest success	No																			
Mortality rate e.g. Change in number of road kills per year	No																			
Number of individuals e.g. Individual plants/animals	No																			

Summary							
Protected matter attributes	Quantum of impact	Net present value of offset	% of impact offset	Direct offset adequate?	Cost (\$)		
					Direct offset (\$)	Other compensatory measures (\$)	Total (\$)
					Birth rate	0	
Mortality rate	0				\$0.00	\$0.00	
Number of individuals	0				\$0.00	\$0.00	
Number of features	0				\$0.00	\$0.00	
Condition of habitat	0				\$0.00	\$0.00	
Area of habitat	35.2	8.20	23.30%	No	\$0.00	#DIV/0!	#DIV/0!
Area of community	0				\$0.00		\$0.00
					\$0.00	#DIV/0!	#DIV/0!

Offsets Assessment Guide

For use in determining offsets under the Environment Protection and Biodiversity Conservation Act 1999
2 October 2012

This guide relies on Macros being enabled in your browser.

Matter of National Environmental Significance	
Name	WRP
EPBC Act status	Critically Endangered
Annual probability of extinction Based on IUCN category definitions	6.8%

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Impact calculator						
Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
<i>Ecological communities</i>						
Area of community	No		Area			
			Quality			
			Total quantum of impact	0.00		
<i>Threatened species habitat</i>						
Area of habitat	Yes	Clearing of up to 44 ha of WRP habitat	Area	44	Hectares	WRP impact assessed through site surveys and Proposal design
			Quality	8	Scale 0-10	
			Total quantum of impact	35.20	Adjusted hectares	
Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
Number of features e.g. Nest hollows, habitat trees	No					
Condition of habitat Change in habitat condition, but no change in extent	No					
<i>Threatened species</i>						
Birth rate e.g. Change in nest success	No					
Mortality rate e.g. Change in number of road kills per year	No					
Number of individuals e.g. Individual plants/animals	No					

Offset calculator																															
Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)	Start area and quality	Future area and quality without offset	Future area and quality with offset	Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)	% of impact offset	Minimum (90%) direct offset requirement met?	Cost (\$ total)	Information source															
<i>Ecological Communities</i>																															
Area of community	No				Risk-related time horizon (max. 20 years)	Start area (hectares)	Risk of loss (%) without offset	Risk of loss (%) with offset																							
					Time until ecological benefit	Start quality (scale of 0-10)	Future area without offset (adjusted hectares)	0.0	Future area with offset (adjusted hectares)	0.0																					
							Future quality without offset (scale of 0-10)		Future quality with offset (scale of 0-10)																						
<i>Threatened species habitat</i>																															
Area of habitat	Yes	35.20	Adjusted hectares	Revegetation of SF No.2 to create WRP habitat	Time over which loss is averted (max. 20 years)	20	Start area (hectares)	90	Risk of loss (%) without offset	30%	Risk of loss (%) with offset	5%	Raw gain	22.50	Confidence in result (%)	80%	Adjusted gain	18.00	Net present value	4.83	% of impact offset	15.95	45.31%	Minimum (90%) direct offset requirement met?	No	Cost (\$ total)		Information source			
					Time until ecological benefit	10	Start quality (scale of 0-10)	1	Future area without offset (adjusted hectares)	63.0	Future area with offset (adjusted hectares)	85.5	Raw gain	5.00	Confidence in result (%)	80%	Adjusted gain	4.00	Net present value	2.07											
							Future quality without offset (scale of 0-10)	1	Future quality with offset (scale of 0-10)	6																					
Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)	Start value	Future value without offset	Future value with offset	Raw gain	Confidence in result (%)	Adjusted gain	Net present value	% of impact offset	Minimum (90%) direct offset requirement met?	Cost (\$ total)	Information source															
Number of features e.g. Nest hollows, habitat trees	No																														
Condition of habitat Change in habitat condition, but no change in extent	No																														
<i>Threatened species</i>																															
Birth rate e.g. Change in nest success	No																														
Mortality rate e.g. Change in number of road kills per year	No																														
Number of individuals e.g. Individual plants/animals	No																														

Summary							
Protected matter attributes	Quantum of impact	Net present value of offset	% of impact offset	Direct offset adequate?	Cost (\$)		
					Direct offset (\$)	Other compensatory measures (\$)	Total (\$)
					Birth rate	0	
Mortality rate	0				\$0.00		\$0.00
Number of individuals	0				\$0.00		\$0.00
Number of features	0				\$0.00		\$0.00
Condition of habitat	0				\$0.00		\$0.00
Area of habitat	35.2	15.95	45.31%	No	\$0.00	#DIV/0!	#DIV/0!
Area of community	0				\$0.00		\$0.00
					\$0.00	#DIV/0!	#DIV/0!

Offsets Assessment Guide

For use in determining offsets under the *Environment Protection and Biodiversity Conservation Act 1999*
2 October 2012

This guide relies on Macros being enabled in your browser.

Matter of National Environmental Significance	
Name	BC
EPBC Act status	Endangered
Annual probability of extinction <small>Based on IUCN category definitions</small>	1.2%

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Impact calculator					
Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact	Units	Information source
<i>Ecological communities</i>					
Area of community	No		Area		
			Quality		
			Total quantum of impact	0.00	
<i>Threatened species habitat</i>					
Area of habitat	Yes	38 ha of Black Cockatoo foraging and potential nesting and roosting habitat	Area	38	Hectares
			Quality	8	Scale 0-10
			Total quantum of impact	30.40	Adjusted hectares
Impact determined through field survey and assessment of Proposal design					
<i>Threatened species</i>					
Number of features e.g. Nest hollows, habitat trees	No				
Condition of habitat Change in habitat condition, but no change in extent	No				
Birth rate e.g. Change in nest success	No				
Mortality rate e.g. Change in number of road kills per year	No				
Number of individuals e.g. Individual plants/animals	No				

Offset calculator																															
Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)	Start area and quality	Future area and quality without offset	Future area and quality with offset	Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)	% of impact offset	Minimum (90%) direct offset requirement met?	Cost (\$ total)	Information source															
<i>Ecological Communities</i>																															
Area of community	No				Risk-related time horizon (max. 20 years)	Start area (hectares)	Risk of loss (%) without offset	Risk of loss (%) with offset																							
					Time until ecological benefit	Start quality (scale of 0-10)	Future area without offset (adjusted hectares)	0.0	Future area with offset (adjusted hectares)	0.0																					
							Future quality without offset (scale of 0-10)		Future quality with offset (scale of 0-10)																						
<i>Threatened species habitat</i>																															
Area of habitat	Yes	30.40	Adjusted hectares	55ha of Lot 2 Boyanup Picton Road	Time over which loss is averted (max. 20 years)	20	Start area (hectares)	55	Risk of loss (%) without offset	15%	Risk of loss (%) with offset	5%	Raw gain	5.50	Confidence in result (%)	80%	Adjusted gain	4.40	Net present value	3.47	% of impact offset	10.16	33.43%	Minimum (90%) direct offset requirement met?	No	Cost (\$ total)		Information source			
					Time until ecological benefit	1	Start quality (scale of 0-10)	8	Future area without offset (adjusted hectares)	46.8	Future area with offset (adjusted hectares)	52.3	Raw gain	2.00	Confidence in result (%)	80%	Adjusted gain	1.60	Net present value	1.58											
							Future quality without offset (scale of 0-10)	6	Future quality with offset (scale of 0-10)	8																					
<i>Threatened species</i>																															
Number of features e.g. Nest hollows, habitat trees	No																														
Condition of habitat Change in habitat condition, but no change in extent	No																														
Birth rate e.g. Change in nest success	No																														
Mortality rate e.g. Change in number of road kills per year	No																														
Number of individuals e.g. Individual plants/animals	No																														

Summary							
Protected matter attributes	Quantum of impact	Net present value of offset	% of impact offset	Direct offset adequate?	Cost (\$)		
					Direct offset (\$)	Other compensatory measures (\$)	Total (\$)
Birth rate	0				\$0.00		\$0.00
Mortality rate	0				\$0.00		\$0.00
Number of individuals	0				\$0.00		\$0.00
Number of features	0				\$0.00		\$0.00
Condition of habitat	0				\$0.00		\$0.00
Area of habitat	30.4	10.16	33.43%	No	\$0.00	#DIV/0!	#DIV/0!
Area of community	0				\$0.00		\$0.00
					\$0.00	#DIV/0!	#DIV/0!

Offsets Assessment Guide

For use in determining offsets under the *Environment Protection and Biodiversity Conservation Act 1999*
2 October 2012

This guide relies on Macros being enabled in your browser.

Matter of National Environmental Significance	
Name	Carnaby's Cockatoo
EPBC Act status	Endangered
Annual probability of extinction Based on IUCN category definitions	1.2%

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Impact calculator						
Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
<i>Ecological communities</i>						
Area of community	No		Area			
			Quality			
			Total quantum of impact	0.00		
<i>Threatened species habitat</i>						
Area of habitat	Yes	Clearing of up to 38ha of Black cockatoo habitat	Area	38	Hectares	Impact assessed through field survey and assessment of the Proposal design
			Quality	8	Scale 0-10	
			Total quantum of impact	30.40	Adjusted hectares	
<i>Threatened species</i>						
Number of features e.g. Nest hollows, habitat trees	No					
Condition of habitat Change in habitat condition, but no change in extent	No					
Birth rate e.g. Change in nest success	No					
Mortality rate e.g. Change in number of road kills per year	No					
Number of individuals e.g. Individual plants/animals	No					

Offset calculator																															
Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)	Start area and quality	Future area and quality without offset	Future area and quality with offset	Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)	% of impact offset	Minimum (90%) direct offset requirement met?	Cost (\$ total)	Information source															
<i>Ecological Communities</i>																															
Area of community	No				Risk-related time horizon (max. 20 years)	Start area (hectares)	Risk of loss (% without offset)	Risk of loss (% with offset)																							
					Time until ecological benefit	Start quality (scale of 0-10)	Future area without offset (adjusted hectares)	0.0	Future area with offset (adjusted hectares)	0.0																					
							Future quality without offset (scale of 0-10)		Future quality with offset (scale of 0-10)																						
<i>Threatened species habitat</i>																															
Area of habitat	Yes	30.40	Adjusted hectares	38 ha of revegetation in Lot 104 Willinge Drive	Time over which loss is averted (max. 20 years)	20	Start area (hectares)	38	Risk of loss (% without offset)	40%	Risk of loss (% with offset)	5%	Raw gain	13.30	Confidence in result (%)	80%	Adjusted gain	10.64	Net present value	8.38	% of impact offset	14.74	48.49%	Minimum (90%) direct offset requirement met?	No	Cost (\$ total)		Information source			
					Time until ecological benefit	10	Start quality (scale of 0-10)	0	Future area without offset (adjusted hectares)	22.8	Future area with offset (adjusted hectares)	36.1	Raw gain	6.00	Confidence in result (%)	80%	Adjusted gain	4.80	Net present value	4.26											
							Future quality without offset (scale of 0-10)	0	Future quality with offset (scale of 0-10)	6																					
<i>Threatened species</i>																															
Number of features e.g. Nest hollows, habitat trees	No																														
Condition of habitat Change in habitat condition, but no change in extent	No																														
Birth rate e.g. Change in nest success	No																														
Mortality rate e.g. Change in number of road kills per year	No																														
Number of individuals e.g. Individual plants/animals	No																														

Summary							
Protected matter attributes	Quantum of impact	Net present value of offset	% of impact offset	Direct offset adequate?	Cost (\$)		
					Direct offset (\$)	Other compensatory measures (\$)	Total (\$)
Birth rate	0				\$0.00		\$0.00
Mortality rate	0				\$0.00		\$0.00
Number of individuals	0				\$0.00		\$0.00
Number of features	0				\$0.00		\$0.00
Condition of habitat	0				\$0.00		\$0.00
Area of habitat	30.4	14.74	48.49%	No	\$0.00	#DIV/0!	#DIV/0!
Area of community	0				\$0.00		\$0.00
					\$0.00	#DIV/0!	#DIV/0!

Offsets Assessment Guide

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2 October 2012

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Matter of National Environmental Significance	
Name	Carnaby's Cockatoo
EPBC Act status	Endangered
Annual probability of extinction Based on IUCN category definitions	1.2%

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Impact calculator						
Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
<i>Ecological communities</i>						
Area of community	No		Area			
			Quality			
			Total quantum of impact	0.00		
<i>Threatened species habitat</i>						
Area of habitat	Yes	Clearing of up to 38ha of Black cockatoo habitat	Area	38	Hectares	Impact assessed through field survey and assessment of the Proposal design
			Quality	8	Scale 0-10	
			Total quantum of impact	30.40	Adjusted hectares	
<i>Threatened species</i>						
Birth rate e.g. Change in nest success	No					
Mortality rate e.g. Change in number of road kills per year	No					
Number of individuals e.g. Individual plants/animals	No					

Offset calculator																								
Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)	Start area and quality	Future area and quality without offset	Future area and quality with offset	Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)	% of impact offset	Minimum (90%) direct offset requirement met?	Cost (\$ total)	Information source								
<i>Ecological Communities</i>																								
Area of community	No				Risk-related time horizon (max. 20 years)	Start area (hectares)	Risk of loss (% without offset)	Risk of loss (% with offset)																
					Time until ecological benefit	Start quality (scale of 0-10)	Future area without offset (adjusted hectares)	0.0	Future area with offset (adjusted hectares)	0.0														
							Future quality without offset (scale of 0-10)		Future quality with offset (scale of 0-10)															
<i>Threatened species habitat</i>																								
Area of habitat	Yes	30.40	Adjusted hectares	Revegetation of 16 ha of SF No.2 to create Black Cockatoo habitat	Time over which loss is averted (max. 20 years)	20	Start area (hectares)	16	Risk of loss (% without offset)	30%	Risk of loss (% with offset)	5%	Raw gain	4.00	Confidence in result (%)	80%	Adjusted gain	3.20	Net present value	2.52				
					Time until ecological benefit	10	Start quality (scale of 0-10)	1	Future area without offset (adjusted hectares)	11.2	Future area with offset (adjusted hectares)	15.2	Future quality without offset (scale of 0-10)	1	Future quality with offset (scale of 0-10)	6	5.00	80%	4.00	3.55	5.49	18.06%	No	
<i>Threatened species</i>																								
Birth rate e.g. Change in nest success	No																							
Mortality rate e.g. Change in number of road kills per year	No																							
Number of individuals e.g. Individual plants/animals	No																							

Summary							
Protected matter attributes	Quantum of impact	Net present value of offset	% of impact offset	Direct offset adequate?	Cost (\$)		
					Direct offset (\$)	Other compensatory measures (\$)	Total (\$)
Birth rate	0				\$0.00		\$0.00
Mortality rate	0				\$0.00		\$0.00
Number of individuals	0				\$0.00		\$0.00
Number of features	0				\$0.00		\$0.00
Condition of habitat	0				\$0.00		\$0.00
Area of habitat	30.4	5.49	18.06%	No	\$0.00	#DIV/0!	#DIV/0!
Area of community	0				\$0.00		\$0.00
					\$0.00	#DIV/0!	#DIV/0!

Offsets Assessment Guide

For use in determining offsets under the Environment Protection and Biodiversity Conservation Act 1999
2 October 2012

This guide relies on Macros being enabled in your browser.

Matter of National Environmental Significance	
Name	Claypan TEC (FCT08)
EPBC Act status	Critically Endangered
Annual probability of extinction Based on IUCN category definitions	6.8%

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Impact calculator						
Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
<i>Ecological communities</i>						
Area of community	Yes	0.6 ha of Herb rich scrublands in claypans (FCT 08)	Area	0.6	Hectares	Site assessment and Proposal design have been used to identify impacts
			Quality	5	Scale 0-10	
			Total quantum of impact	0.30	Adjusted hectares	
<i>Threatened species habitat</i>						
Area of habitat	No		Area			
			Quality	0		
			Total quantum of impact	0.00		
Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
Number of features e.g. Nest hollows, habitat trees	No					
Condition of habitat Change in habitat condition, but no change in extent	No					
<i>Threatened species</i>						
Birth rate e.g. Change in nest success	No					
Mortality rate e.g. Change in number of road kills per year	No					
Number of individuals e.g. Individual plants/animals	No					

Offset calculator																			
Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)	Start area and quality	Future area and quality without offset	Future area and quality with offset	Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)	% of impact offset	Minimum (90%) direct offset requirement met?	Cost (\$ total)	Information source			
<i>Ecological Communities</i>																			
Area of community	Yes	0.30	Adjusted hectares	Purchase of private property supporting 1.07ha of FCT08	Risk-related time horizon (max. 20 years)	20	Start area (hectares)	1.07	Risk of loss (% without offset)	20%	Risk of loss (% with offset)	5%							
					Future area without offset (adjusted hectares)	0.9	Future area with offset (adjusted hectares)	1.0											
					Time until ecological benefit	1	Start quality (scale of 0-10)	7	Future quality without offset (scale of 0-10)	4	Future quality with offset (scale of 0-10)	8	4.00	80%	3.20	3.00	0.28	94.68%	Yes
<i>Threatened species habitat</i>																			
Area of habitat	No				Time over which loss is averted (max. 20 years)		Start area (hectares)		Risk of loss (% without offset)		Risk of loss (% with offset)								
					Future area without offset (adjusted hectares)	0.0	Future area with offset (adjusted hectares)	0.0											
					Time until ecological benefit		Start quality (scale of 0-10)		Future quality without offset (scale of 0-10)		Future quality with offset (scale of 0-10)								
Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)	Start value	Future value without offset	Future value with offset	Raw gain	Confidence in result (%)	Adjusted gain	Net present value	% of impact offset	Minimum (90%) direct offset requirement met?	Cost (\$ total)	Information source			
Number of features e.g. Nest hollows, habitat trees	No																		
Condition of habitat Change in habitat condition, but no change in extent	No																		
<i>Threatened species</i>																			
Birth rate e.g. Change in nest success	No																		
Mortality rate e.g. Change in number of road kills per year	No																		
Number of individuals e.g. Individual plants/animals	No																		

Summary							
Protected matter attributes	Quantum of impact	Net present value of offset	% of impact offset	Direct offset adequate?	Cost (\$)		
					Direct offset (\$)	Other compensatory measures (\$)	Total (\$)
Birth rate	0				\$0.00		\$0.00
Mortality rate	0				\$0.00		\$0.00
Number of individuals	0				\$0.00		\$0.00
Number of features	0				\$0.00		\$0.00
Condition of habitat	0				\$0.00		\$0.00
Area of habitat	0				\$0.00		\$0.00
Area of community	0.3	0.28	94.68%	Yes	\$0.00	#DIV/0!	#DIV/0!
					\$0.00	#DIV/0!	#DIV/0!

WA environmental offsets template

Bunbury Outer Ring Road - Northern and Central Sections

Existing environment/ Impact	Mitigation			Significant Residual Impact	Offset Calculation Methodology				
	Avoid and minimise	Rehabilitation Type	Likely Rehab Success		Type	Risk	Likely offset success	Time Lag	Offset Quantification
Up to 43.9 ha of suitable Western Ringtail Possum habitat will potentially be cleared, and between 20 and 25 individual home ranges may be disturbed. Based on the results of regional surveys, this is estimated to represent 0.28 % to 0.34 % of the 2019 regional population.	Changes to the proposal have resulted in a reduction of up to 26.4 ha of WRP habitat requiring removal for the Proposal. The areas that have been retained through these changes comprise intact habitat and known WRP movement pathways, not isolated trees or insignificant patches. Based on field survey data, in regards to the number of displaced WRP, this equates to between 24 to 29 individuals no longer likely to have their home ranges disturbed.	Onsite rehabilitation will occur within temporary construction areas.	<p><u>Can the environmental values be rehabilitated/Evidence?</u> Yes, consistent with prior Main Roads projects</p> <p><u>Operator experience in undertaking rehabilitation?</u> Main Roads has extensive experience and success in rehabilitating temporary construction areas</p> <p><u>What is the type of vegetation being rehabilitated?</u> Revegetation would utilise locally native species</p> <p><u>Time lag?</u> 3 years</p> <p><u>Credibility of the rehabilitation proposed (evidence of demonstrated success)</u></p>	<p><u>Extent</u> Up to 43.9 ha</p> <p><u>Quality</u> Degraded to completely degraded with some areas of good to very good</p> <p><u>Conservation Significance</u> Critically endangered</p> <p><u>Land Tenure</u> n/a</p> <p><u>Time Scale</u> Permanent at time of construction</p> <p>The clearing of Western Ringtail Possum habitat and disturbance of 0.28 % to 0.34 % of the estimated 2019 regional population will result in a minor residual impact associated with the Proposal.</p>	Land Acquisition, on-ground management, and research.	Low - Land to be ceded and managed by DBCA.	<p><u>Can the values be defined and measured?</u> Yes, sites have been surveyed.</p> <p><u>Operator experience/Evidence?</u> DBCA will manage land</p> <p><u>What is the type of vegetation being revegetated?</u> Fauna Habitat for WRP and Black Cockatoo</p> <p><u>Is there evidence the environmental values can be re-created (evidence of demonstrated success)?</u> This reflects the approach for similar offset revegetation works by Main Roads in the region.</p>	Habitat is secured for first 55 ha. 10 years to allow for revegetation works to provide suitable WRP habitat for other 135 ha.	In addition to the above proposed offsets, Main Roads is seeking a 10% offset for the WRP Regional Survey. A combination of the proposed offsets (Lot 2 vegetation, Lot 104 revegetation, State Forest No. 2 revegetation and the WRP Regional survey) exceeds the 100% offset requirement. The ratio of habitat protected compared to cleared was determined using the Commonwealth
The Proposal may potentially result in loss of up to 37.8 ha of suitable Black Cockatoo habitat. The clearing of 37.8 ha of potential habitat represents a <1 % reduction in potential foraging and breeding habitat for the Black Cockatoo species within the local area (suitable remnant vegetation within a 12 km radius).	A high level of mitigation and management has been applied to the Proposal, with Main Roads making substantial and costly changes to the Proposal design in order to mitigate potential impacts on terrestrial fauna including black cockatoos. The changes made have resulted in the reduction in the area of black cockatoo habitat impacted by 22 ha, and ensure that no Trees with Suitable Nest Hollows will be cleared. Connectivity of habitat will be maintained and enhanced through revegetation of additional	Onsite rehabilitation will occur within temporary construction areas. Revegetation would not include species of foraging habitat for black cockatoos, including but not limited to, Banksia spp., Hakea spp., Grevillea spp. and Eucalyptus spp. within 10 m of the constructed road carriageway.	<p><u>Can the environmental values be rehabilitated/Evidence?</u> Yes, consistent with prior Main Roads projects</p> <p><u>Operator experience in undertaking rehabilitation?</u> Main Roads has extensive experience and success in rehabilitating temporary construction areas</p> <p><u>What is the type of vegetation being rehabilitated?</u> Revegetation would utilise locally native species</p> <p><u>Time lag?</u> 3 years</p> <p><u>Credibility of the rehabilitation proposed (evidence of demonstrated success)</u></p>	<p><u>Extent</u> Up to 37.8 ha</p> <p><u>Quality</u> Degraded to completely degraded with some areas of good to very good</p> <p><u>Conservation Significance</u> Endangered and Vulnerable</p> <p><u>Land Tenure</u> n/a</p> <p><u>Time Scale</u> Permanent at time of construction</p> <p>The reduction in foraging and potential breeding habitat for Black Cockatoo species will result in a minor residual impact associated with the Proposal.</p>	Land Acquisition and on-ground management.	Low - Land to be ceded and managed by DBCA.	<p><u>Can the values be defined and measured?</u> Yes, sites have been surveyed.</p> <p><u>Operator experience/Evidence?</u> DBCA will manage land</p> <p><u>What is the type of vegetation being revegetated?</u> Fauna Habitat for WRP and Black Cockatoo</p> <p><u>Is there evidence the environmental values can be re-created (evidence of demonstrated success)?</u> This reflects the approach for similar offset revegetation works by Main Roads in the region.</p>	Habitat is secured for first 55 ha. 10 years to allow for revegetation works to provide Cockatoo habitat for other 61 ha.	A combination of the proposed offsets (Lot 5 vegetation, Lot 104 revegetation and State Forest No. 2 revegetation) exceeds the 100% offset requirement for Black Cockatoos. The ratio of habitat protected compared to cleared was determined using the Commonwealth
3.7 ha of Banksia Woodland TEC/ PEC vegetation within the Proposal Area will be cleared as a result of Proposal implementation, all of which occur at three locations near the Paris Road / Clifton Road interchange.	A high level of mitigation and management has been applied to the Proposal, with Main Roads making substantial and costly changes to the Proposal design in order to reduce potential impacts on flora and vegetation, including Banksia Woodland TEC and PEC vegetation. The changes made have resulted in more than halving the area of Banksia Woodland TEC and PEC impacted from 7.6 to 3.7 ha.	Main Roads does not anticipate to rehabilitate threatened ecological communities within temporary construction areas adjacent to the Proposal.	<p><u>Can the environmental values be rehabilitated/Evidence?</u> N/A</p> <p><u>Operator experience in undertaking rehabilitation?</u></p> <p><u>What is the type of vegetation being rehabilitated?</u></p> <p><u>Time lag?</u></p> <p><u>Credibility of the rehabilitation proposed (evidence of demonstrated success)</u></p>	<p><u>Extent</u> Up to 3.7 ha</p> <p><u>Quality</u> Good to Degraded</p> <p><u>Conservation Significance</u> State Priority 3 PEC / Endangered TEC</p> <p><u>Land Tenure</u> n/a</p> <p><u>Time Scale</u> Permanent at time of construction</p> <p>Based on these assessments, it is unlikely that the Proposal will have a significant residual impact on the Banksia TEC and PEC. Main Roads proposes to further address the residual impacts of the Proposal on Banksia Woodlands TEC/PEC</p>	Land Acquisition and on-ground management.	Low - Appropriate values likely to be present based on 2014 surveys of Offset site, but requires reconfirmation in 2020	<p><u>Can the values be defined and measured?</u> Majority of mapped Banksia woodland vegetation is in very good-excellent condition (GHD, 2014).</p> <p><u>Operator experience/Evidence?</u> DBCA will manage land</p> <p><u>What is the type of vegetation being revegetated?</u> n/a</p> <p><u>Is there evidence the environmental values can be re-created (evidence of demonstrated success)?</u> High level of certainty of habitat attributes being retained and property being managed for conservation purposes in the long term.</p>	Main Roads has secured the property and initiated rezoning from rural to Regional Open space under the GBRS.	14.5 ha of TEC protected offsetting 103.5% of impact The ratio of habitat protected compared to cleared was determined using the Commonwealth Calculator as a guide.
Clearing of up to 0.6 ha of vegetation representing FCT08 within the Proposal area, with a further 9.1 ha located directly adjacent to the proposal. No FCT08 Claypan TEC occurrences will be fragmented as a result of the Proposal as all occurrences that require clearing will be cleared in their entirety. Similarly no occurrences of FCT08 Claypan TEC are expected to be indirectly impacted.	A high level of mitigation and management has been applied to the Proposal, with Main Roads making substantial and costly changes to the Proposal design in order to mitigate potential impacts on flora and vegetation, including FCT08 Claypan TEC vegetation. The changes made have resulted in a 25% reduction in the area of this TEC to be impacted, to 0.6 ha.	Main Roads does not anticipate to rehabilitate threatened ecological communities within temporary construction areas adjacent to the Proposal.	<p><u>Can the environmental values be rehabilitated/Evidence?</u> N/A</p> <p><u>Operator experience in undertaking rehabilitation?</u></p> <p><u>What is the type of vegetation being rehabilitated?</u></p> <p><u>Time lag?</u></p> <p><u>Credibility of the rehabilitation proposed (evidence of demonstrated success)</u></p>	<p><u>Extent</u> Up to 0.6 ha</p> <p><u>Quality</u> Good to Very good with minor contiguous degraded patches.</p> <p><u>Conservation Significance</u> Critically Endangered TEC</p> <p><u>Land Tenure</u> n/a</p> <p><u>Time Scale</u> Permanent at time of construction</p> <p>One FCT08 Claypan TEC occurrence, at Railway Road, will be fragmented as a result of the Proposal. All remaining occurrences that require clearing will be cleared in their entirety. A high level of mitigation and management has been applied to the Proposal, with Main Roads making substantial and costly changes to the Proposal design in order to mitigate potential impacts on flora and vegetation, including FCT08 Claypan TEC vegetation. The changes made have resulted in a 25% reduction in the area of this TEC to be impacted, to 0.6 ha. Main Roads intends to further counterbalance the residual impacts of the Proposal through implementation of an environmental offset strategy.</p>	Land Acquisition and on-ground management.	Moderate - Site not yet acquired and work still necessary to define appropriate values are present	<p><u>Can the values be defined and measured?</u> 1.025 ha (96%) of the 1.07 ha of the site vegetation is in good or better condition.</p> <p><u>Operator experience/Evidence?</u> DBCA will manage land</p> <p><u>What is the type of vegetation being revegetated?</u> n/a</p> <p><u>Is there evidence the environmental values can be re-created (evidence of demonstrated success)?</u> High level of confidence. The property will be purchased and actively managed for conservation purposes to improve habitat quality including fencing and weed control, with potential for revegetation.</p>	Land will be purchased to managed for conservation purposes.	1.07 ha of TEC protected offsetting 83.1% of impact. Main Roads is further investigating additional offset options in consultation with DBCA. The ratio of habitat protected compared to cleared was determined using the Commonwealth Calculator as a guide.



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