Bunbury Outer Ring Road – Southern Section

Construction Fauna Management Plan

July 2022

We're working for Western Australia.

D22#505302
July 2022

Amendments

Revision Number	Revision Date	Description of Key Changes	Section / Page No.
A	June 2022	Review Draft	All
0	July 2022	Plan amended to address regulator review	All
1	July 2022	Plan amended to address regulator review	All
1A	July 2022	Plan for Issue	All

EXECUTIVE SUMMARY

Bunbury Outer Ring Road Project

The BORR Southern Section (BORR South / the Proposal) includes the construction and operation of 10.5 km of new freeway standard dual carriageway, associated bridges, interchanges and other road infrastructure including, but not limited to, culverts, lighting, noise barriers, fencing, landscaping, road safety barriers and signs. The Proposal is located approximately 200 km south of Perth and, at its closest point, approximately six km south-east of Bunbury.

The Proposal will be constructed within the 200 ha Development Envelope (Figure 1) which is located within the City of Bunbury and Shire of Capel. Approximately 62 % of land within the Development Envelope is cleared. The Development Envelope comprises 76 ha of native vegetation and 124 ha of cleared agricultural land.

Construction of the Proposal is anticipated to commence in 2022 and continue for a period of 2-3 years. Once BORR South is constructed and open for public use, operation of the Proposal will be ongoing.

Purpose of this FMP

This Construction Fauna Management Plan (CFMP) has been prepared to document measures to minimise and manage adverse impacts on conservation significant fauna that may occur during construction of the Bunbury Outer Ring Road – Southern Section (BORR South / the Proposal), as required under condition 5 of Ministerial Statement (MS) 1191, approved on 31 May 2022. The plan covers western ringtail possum (WRP) (*Pseudocheirus occidentalis*), State and Commonwealth listed as critically endangered, and south-western brush-tailed phascogale (BTP) (*Phascogale tapoatafa*), State listed as Conservation Dependent (Schedule 6) under the Western Australian *Biodiversity Conservation Act 2016* (BC Act).

This plan should be read in conjunction with the Proposal Habitat Fragmentation Management Plan as required under condition 6 of MS 1191, and Offset Plan required under condition 9 of MS 1191. These plans detail the actions to be taken after construction of the Proposal to manage, monitor and mitigate impacts to conservation significant fauna, and the package of offsets developed to counterbalance significant residual impacts to environmental values, respectively.

Additional context and background for the measures proposed herein can be found in the *Bunbury Outer Ring Road Southern Section Updated Referral Supporting Document and Additional Information* (BORR IPT, 2020a) and *BORR Southern Section Additional Information for Preliminary Documentation* (EPBC 2019/8543) (BORR IPT, 2020b).

This CFMP has been prepared consistent with the following guidance documentation:

- Environmental Protection Authority (EPA) Template for Environmental Protection Act 1986 Part IV Environmental Management Plans.

The framework for the plan is summarised in Table 0-1.

Table 0-1: CFMP Executive Summary

Proposal name	Bunbury Outer Ring Road – Southern Section
Proponent name	Main Roads Western Australia
Ministerial Statement number	1191
Purpose of the EMP	In accordance with condition 5 of Ministerial Statement (MS) 1191, a Construction Fauna Management Plan (CFMP) is required to
Key environmental factor/s, outcome/s and/or objectives	Minimise and manage project attributable adverse impacts to conservation significant terrestrial fauna including western ringtail possum and south-western brush-tailed phascogale during construction.
Condition clauses (if applicable)	Condition 5
Key components in the EMP (if applicable)	1) specify the passive relocation management actions to be implemented prior to and during clearing; 2) define the low-risk clearing timeframe for western ringtail possum applicable to Category 1 Clearing Areas and append supplementary survey evidence to justify the chosen timeframe; 3) specify monitoring that: a) includes a baseline survey to be undertaken within thirty (30) days prior to clearing (or if staged, prior to each clearing stage) to confirm presence/absence and number of western ringtail possum and south-western brush-tailed phascogale individuals within the development envelope and at receival sites. The baseline survey shall be prepared and undertaken on advice of DBCA during the preparation of the Construction Fauna Management Plan; b) records whether threatened or priority fauna is encountered during clearing, and reports to the CEO and DBCA within thirty (30) days after clearing (or each clearing stage) on the number of individuals relocated in accordance with any requirements of the lawful authority obtained under the Biodiversity Conservation Act 2016;

	c) evaluates the suitability, adequacy and effectiveness of passive relocation management actions at reducing impacts to western ringtail possum individuals displaced by clearing from Category 1 Clearing Areas defined in Figure 3; (**Figure 2 of this CFMP**); d) evaluates impacts to residential western ringtail possum individuals at receival sites; and e) uses monitoring methods including, but not limited to, radio telemetry with robust sample sizes (the minimum number of tagged animals to be determined in consultation with DBCA). 4) identify and spatially define the study area(s) and reference sites proposed for monitoring and evaluation and provide rationale for the location of the sites; 5) specify management actions; management targets; monitoring locations, methodologies, indicators and timing; actions and investigations in the event of a failure to meet a management target; and reporting to demonstrate that the objective in condition 5-1 will be met; and 6) be prepared in consultation with the DBCA and in accordance with any requirements of a lawful authority obtained under the Biodiversity Conservation Act 2016.
Proposed construction date	07/2022
EMP required pre-construction?	Yes ☒ No ☐

Contents

Tables

Figures

Definitions

Term	Definition
Biannual	Taking place twice a year
Bi-monthly	Taking place every two months
Control Area	The predator control area includes the whole of the development envelope and accessible adjacent habitat areas
Daylight hours	The period from one hour after sunrise to one hour prior to sunset, consistent with Geoscience Australia astronomical definitions for sunrise / sunset (Geoscience Australia, 2022)
Development Envelope	The Development Envelope (Figure 1) is located within the City of Bunbury and Shire of Capel, at its closest point approximately six km south-east of Bunbury and 200 km south of Perth. The Development Envelope extends 10.5 km between South Western Highway and Bussell Highway. The Development Envelope covers 200 hectares (ha) and includes existing road reserves, agricultural land and native vegetation. The BORR South will be constructed within the Development Envelope.
Fauna spotter	A person who has a relevant lawful authority under the *Biodiversity Conservation Act 2016* as defined in MS 1191
Main Roads	Main Roads Western Australia
Monitoring Period	The monitoring event occurring at a defined timeframe (e.g., monthly, bi-monthly, biannual, annual, biennial) for each respective monitoring aspect.
Proposal	Main Roads proposes to construct the Bunbury Outer Ring Road (BORR) Southern Section from South West Highway (north) to Bussell Highway (south), at its closest point approximately six km from East Bunbury, in the South West Region of Western Australia (WA) (referred to as the Proposal)
Receival sites	Habitat outside the Development Envelope that contains home-ranges of residential western ringtail possums intersecting or adjoining the **Category 1 Clearing Areas** defined in this plan where western ringtail possums from inside the **Development Envelope** are moved into, and are: • owned by State or Local Government; • owned by the Proponent (such as the **clearing exclusion areas vegetation retention areas** or nominated offset sites); and • residential private lands granting access.
Reference sites	Lot 2 Boyanup Picton Road and Reserve 23000. The two WRP reference sites comprise Western Ringtail Possum habitat in the vicinity of but separate to the Development Envelope that has been included in the bi-monthly surveys and is known to contain WRP populations.

Term	Definition
Standard construction management	Measures that have been applied successfully by Main Roads to other large scale projects that are considered appropriate in minimising the environmental impacts. These measures ensure that clearing is implemented properly, that erosion does not occur, and that spills are minimised and managed appropriately.

Acronyms / Abbreviations

Acronym	Definition
ANZECC	Australian and New Zealand Environment and Conservation Council
BC Act	*Biodiversity Conservation Act 2016*
BORR	Bunbury Outer Ring Road
BORR IPT	Bunbury Outer Ring Road Integrated Project Team
BTP	South-western Brush-tailed Phascogale
CEMP	Construction environmental management plan
CFMP	Construction fauna management plan
DAWE	Department of Agriculture, Water and the Environment
DBH	Diameter Breast Height
DoEE	Department of the Environment and Energy
DPaW	Department of Parks and Wildlife
DSEWPaC	Department of Sustainability, Environment, Water, Population and Communities
DWER	Department of Water and Environmental Regulation
EPA	Environmental Protection Authority of Western Australia
EP Act	*Environmental Protection Act 1986*
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
MNES	Matters of National Environmental Significance
MS	Ministerial Statement
WA	Western Australia
WoNS	Weeds of National Significance
WRP	Western Ringtail Possum

1 CONTEXT, SCOPE AND RATIONALE

This Construction Fauna Management Plan (CFMP) has been prepared to document measures to minimise and manage adverse impacts on conservation significant fauna that may occur during construction of the Bunbury Outer Ring Road – Southern Section (BORR South / the Proposal), as required under condition 5 of Ministerial Statement (MS) 1191, approved on 31 May 2022. The plan addresses western ringtail possum (WRP) (*Pseudocheirus occidentalis*), State and Commonwealth listed as critically endangered, and south-western brush-tailed phascogale (BTP) (*Phascogale tapoatafa*), State listed as Conservation Dependent (Schedule 6) under the *Western Australian Biodiversity Conservation Act 2016* (BC Act).

This CFMP presents management-based provisions, as defined under condition 5, to document management actions required during Proposal implementation and construction. Management measures within this CFMP are specific to the Proposal and include management actions that are 'over and above' standard environmental management practises.

1.1 Proposal

BORR South (Figure 1) includes the construction and operation of 10.5 km of new freeway standard dual carriageway, associated bridges, interchanges and other road infrastructure including, but not limited to, culverts, lighting, noise barriers, fencing, landscaping, road safety barriers and signs. The Proposal is located approximately 200 km south of Perth and, at its closest point, approximately six km south-east of Bunbury.

The Proposal will be constructed within the 200 ha Development Envelope, which is located within the City of Bunbury and Shire of Capel. Approximately 62 % of land within the Development Envelope is cleared. The Development Envelope comprises 76 ha of native vegetation and 124 ha of cleared agricultural land.

Construction of the Proposal is anticipated to commence in 2022 and continue for a period of 2-3 years. Once BORR South is constructed and open for public use, operation of the Proposal will be ongoing. Some of the measures and monitoring identified in this plan will continue into operation and are documented in a separate Habitat Fragmentation Management Plan (HFMP), as required under condition 6 of Ministerial Statement 1191 (MS) 1191.

1.1.1 State assessment

In September 2019, Main Roads referred the Proposal to the Environmental Protection Authority (EPA) of Western Australia (WA) for assessment under Section 38 of the Environmental Protection Act 1986 (EP Act). The referral included an Environmental Referral Supporting Document (BORR IPT, 2019a) which describes the receiving environments, potential impacts and mitigation strategies to address the identified impacts. The Proposal was advertised for a seven day public comment period during September 2019. In October 2019, the EPA determined that the Proposal would be subject to an environmental assessment at the level of Referral Information, with additional information required under Section 40(2)(a) of the EP Act.

On 28 April 2020, the EPA consented under Section 43A of the EP Act to a change in the Proposal that will result in an overall reduction of 100 ha from the Proposal Area from 300 ha to 200 ha. The change to the Proposal also resulted in an overall reduction of remnant native vegetation being cleared from 98 ha to 76 ha.

On 9 August 2021, Main Roads submitted a request to the EPA to, under Section 43A of the EP Act, to change the Proposal to document improvements to the Proposal to improve social and ecological connectivity, minimise the potential environmental impacts to flora and vegetation and fauna and substantially expand the scale and nature of the Offset Strategy. The changes include avoidance and management measures including:

- Establishing Clearing Exclusion Areas within the Proposal Area (Figure 1). Three Clearing Exclusion Areas have been established within Gelorup that will avoid:
    - 2.61 ha of Western Ringtail Possum (WRP), Black Cockatoo and Brushtail Phascogale habitat.
    - 10 Suitable Diameter at Breast Height (DBH) trees, of which two contained hollows that were suitably sized (no known use).
    - 1.47 ha of Banksia Woodland Threatened Ecological Community (TEC).
    - Reducing the overall amount of WRP habitat to be cleared by 1.9 ha through design modifications, with Main Roads committing to clearing no more than 71.5 ha of native vegetation and no more than 60.9 ha of WRP habitat.
- Inclusion of additional rope bridges and a dedicated fauna bridge approximately 300 m east of Yalinda Drive.

On 19 October 2021, the EPA published Report 1714, setting out the assessment findings. Following appeal, the Project was approved by the EPA under MS 1191 on 31 May 2022.

1.1.2 Commonwealth assessment

The Proposal was formally referred to the then Commonwealth Department of the Environment and Energy (DoEE) in September 2019 (EPBC Act referral 2019/8543) as a potential Controlled Action under the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) due to impacts on Matters of National Environmental Significance (MNES) (BORR IPT, 2020a).

Under Commonwealth government reforms announced in December 2019, DoEE was consolidated with the Department of Agriculture to form the new Department of Agriculture, Water and Environment (DAWE), effective 1 February 2020. DAWE is the Commonwealth Department with primary EPBC Act regulatory authority. DAWE provided advice in February 2020 that the Proposal is considered a Controlled Action and that it would be assessed based on preliminary documentation with additional information provided to support the assessment (DAWE, 2020a).

The Additional Information Request for Preliminary Documentation was submitted to DAWE for assessment in October 2020 and subsequently advertised for public comment for four weeks commencing 20 November 2020 and ending 18 December 2020. Commonwealth Approval Notice 2019/8543 under the EPBC Act was granted on 29 June 2022.

1.2 Key Environmental Factor – Terrestrial Fauna

1.2.1 Western Ringtail Possum

1.2.1.1 Species description

The Western Ringtail Possum (WRP) is a medium sized arboreal marsupial, endemic to the south-west of Western Australia. WRP were 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 three key management zones: the Swan Coastal Plain (SCP), the Southern Forests and the South Coast. Although primarily arboreal, WRPs are known to move on the ground (DPaW, 2017).

The major threats to the species include habitat loss and fragmentation. Other threats include predation by introduced carnivores, climate change, logging, fire, competition for nest hollows, habitat tree decline and disease (DPaW, 2017). In addition to these threats, the Commonwealth Conservation Advice also lists groundwater depletion and altered hydrology, increasing temperature, tree decline and insect outbreaks, domestic dogs, ravens, (potentially in future) Myrtle rust, mortality due to vehicle strike and un-regulated relocation of orphaned or injured rehabilitated WRP (TSSC, 2018a).

1.2.1.2 Habitat within and adjacent to Development Envelope

WRP have been recorded throughout and adjacent to the Development Envelope as shown in Figure 2. The Development Envelope, excluding Clearing Exclusion Areas, contains approximately 60.9 ha of WRP habitat (Biota, 2020).

Shedley and Williams (2014) devised a habitat quality classification for WRP habitat based on estimates of WRP density[1]. The area of habitat in each habitat quality class within the Development Envelope as mapped by Shedley and Williams (2014) is shown in Table 1-1. Baseline habitat quality and / or condition data for known WRP habitat areas (i.e. receival sites) adjacent to the Development Envelope will be recorded prior to clearing.

Table 1-1. Development Envelope WRP habitat extent by quality class, excluding Clearing Exclusion Areas

Habitat quality class	Extent within Development Envelope in Ha (percent of total)
A ('Very High' quality)	0
B ('High' quality)	7.0 ha (11.5 %)
C ('Medium' quality)	31.9 ha (52 %)
D ('Low' quality)	0.3 ha (< 1 %)
Not Assessed	21.6 ha (35.5 %)

1.2.2 South-western Brush-tailed Phascogale

1.2.2.1 Species description

The BTP is a small (100 – 300 g), strongly arboreal marsupial species. They are carnivorous, short-lived and nocturnal. BTPs are found in dry sclerophyll forests and open woodlands between Perth and Albany. They feed predominantly on arthropods and other invertebrates and forage in tree canopies. They are listed as Conservation Dependent (Schedule 6) under the BC Act.

CALM (2002) lists threats to the BTP as habitat clearing and fragmentation, and habitat alteration by logging and mining, with the greatest being reduced availability of trees with hollows, and predation by cats. Predation by foxes is also listed, as is the fragmentation of residual habitat which can isolate populations and impede genetic exchange.

[1] Estimated WRP densities: Class A - >10/ha, Class B – 5-10/ha, Class C – 2-5/ha, Class D – 0.5-2/ha.

1.2.2.2 Habitat within and adjacent to Development Envelope

The Development Envelope contains 39.2 ha of suitable habitat for BTP, all comprising the 'Marri / *Eucalyptus* Woodland' habitat type as mapped by Biota (2020) (Figure 3).
Main Roads has included BTP observations as part of the on-going bi-monthly WRP surveys conducted in the Development Envelope since October 2019. Nine BTP sightings have been recorded during the 17 surveys over this 34 month period.

1.2.3 Potential impacts

The potential impacts to WRP and BTP associated with the implementation of the Proposal are summarised in Table 4-2 and discussed further below.

Table 1-2. Environmental impacts of the Proposal to WRP and BTP

Taxon	Impact	Description
Direct impacts		
WRP	Clearing of native vegetation	Clearing of up to 60.9 ha of WRP habitat, comprising 49 to 72 WRP individuals home ranges
BTP		Clearing of up to 39.2 ha of BTP habitat
WRP and BTP	WRP injury or mortality	Potential WRP injury or mortality as a consequence of construction activity and / or road operation
Potential indirect impacts		
WRP and BTP	Incremental loss of WRP habitat	Loss of WRP habitat resulting from reduced connectivity, barrier effects and edge effects
	Displacement of WRP	Displacement of WRP due to traffic noise exposure and light spill from street lighting and traffic
	Predation	Increased predation impacts due to WRP displacement and that some WRP may need to establish new or extend existing home ranges

Clearing of native vegetation
As outlined by BORR IPT (2020a; 2020b) and summarised in Table 1-2, implementation of the Proposal will result in clearing of up to 60.9 ha of WRP habitat and up to 39.2 ha of BTP habitat within the 200 ha Development Envelope. The habitat to be cleared is currently fragmented, dissected by existing roads, easements and cleared agricultural land.

The habitat to be cleared for the Proposal is a typical example of low density (less than 2 WRP / ha) WRP habitat that is widespread in the area. WRP density within the Development Envelope is 0.93 WRP / ha. The region's critically important WRP habitat values are principally associated with retained habitat to the west and north of the Development Envelope (Jones, 2022), which will not be impacted by the Proposal.

WRP records accumulated between 2013-21 describe a widespread population that has been using an extensive area of retained woodland remnants south of Bunbury. Distance sampling surveys undertaken in 2018-19 confirmed that seven larger mixed woodland blocks within 6 km of the Proposal Area carried a total of 1,755 WRP on 1,076 ha at the time of the survey (Biota, 2020c). Other 2013-21 records from the wider Bunbury area confirm that the Bunbury WRP population was not restricted to the native woodland habitat but also used moderately modified domestic habitat (e.g. within the Gelorup subdivision), and even heavily modified 'urban' habitat (Bunbury suburbs).

BORR South impacts are concentrated in <61 ha of low density, modified mixed woodland habitat. According to the field data, of this <61 ha, 45 ha was regularly used by one or more WRP on most nights (Clearing Category 1[2] (Figure 2), indicating the presence of settled resident WRP. The habitat fragments that make up the remaining 16 ha of the Proposal Area habitat (Clearing Categories 2[3] and 3[4] (Figure 2) had more nights without WRP detections than nights with one or more detections. Patches of habitat that are often without WRP on repeat surveys represent marginal WRP habitat that is infrequently used by the local WRP. Habitat without a pattern of consistent and regular detections is probably unsuited to use by settled resident animals but adequate for wandering or dispersing WRP to feed and rest in for a few nights or weeks before moving to other areas. Therefore, clearing the habitat fragments in this 16 ha would present only minor population disturbance.

For the remaining 45 ha with settled residents, the bi-monthly survey (commencing October 2019 and continuing to present) results imply that for a probable upper limit of 40 settled WRP home ranges, up to 10 WRP could be likely to have retained no part of their former home range if clearing had been conducted during the period when WRP counts were low in 2020 or 2021. For these 'immediately displaced' animals, clearing means they must immediately move on to nearby trees and would join the transient portion of the population. Most of these animals would have been transients before they became residents. The 45 ha with settled residents includes 26.9 ha within the Gelorup section of the Development Envelope (from Jilley Road to the east edge of Bussell Highway) that would be cleared from patches 7 and 8a due to the Proposal (Figure 2, Map 3).

The area to be cleared represents up to 0.97 % of habitat in the Bunbury management zone of Shedley and Williams (2014)[5]. It is estimated that between 49 and 72 WRPs within the Development Envelope will potentially have their home ranges disturbed[6] by the Proposal, which is between 0.5 % and 0.74 % of the 2019 estimated WRP population within the Southern SCP Management Zone as identified by Biota (2019) (of up to 9,270 individuals).

WRP and BTP mortality

With implementation of management measures outlined in this CFMP no WRP or BTP mortalities are likely to result directly from the Proposal. Sensitive clearing protocols have been designed for the Proposal and are presented in detail in this Plan.

Indirect impacts

Historical clearing combined with incremental reduction in habitat has restricted the distribution of WRP and BTP within the Development Envelope. It is generally accepted that, as habitat is cleared, patch sizes decrease and the impact of 'edge effect' increases with likely introduction of weeds and dieback, ultimately changing the species composition of the vegetation community and reducing suitability of habitat for local fauna species, including WRP and BTP.

[2] Clearing areas in which resident and transient WRP are expected to be encountered during clearing.
[3] Habitat patches that were not often utilised. Not considered suitable for resident WRP but may be used by a transient animal for the short term. High probability no WRP encountered during clearing.
[4] Other WRP habitat - small areas of isolated remnant vegetation and paddock trees. Unsuitable for resident WRP but may be used by a transient animal for the short term. Very high probability no WRP encountered during clearing
[5] The majority of Proposal Area WRP habitat was included in the mapping of Shedley and Williams (2014).
[6] based on data available during the assessment phase.

WRP may relocate to other habitat areas in order to move away very noisy and brightly lit areas (pers comm. Barbara Jones), however WRP have adapted to urban and semi-urban area and are often found in high densities in these areas (Shedley & Williams, 2014). This indicates that they are able to adjust to developed areas and impacts from light and noise levels in the medium to long term are limited.

BTP have large home ranges of up to 20 ha (Biota, 2020). If severe enough, traffic noise and light exposure may potentially result in BTP relocating to other habitat areas in order to move away from the noise and / or light sources.

Risks from predation have the potential to increase as a result of clearing due to fragmented populations (more vulnerable to predation due to their smaller size), an increase in predator numbers (predators may increase in abundance along roads and in areas of disturbance), and from altered behaviour by WRP (individuals spending more time close to or on the ground).
Predation is not expected to increase as a result of the Proposal. This is due to the low density of the Gelorup WRP population (1 WRP/ha), the likelihood that, for the majority of WRP to be impacted by Proposal clearing, portions of their home range will be retained to which they can relocate to after clearing, and the substantial extent of habitat available for transient / displaced WRPs. The bi-monthly survey results confirmed that the Gelorup WRP population has a high proportion (almost 26 %) of transient WRPs (Jones, 2022). This indicates that these individuals have a history of persisting in the wider Gelorup habitat despite of predation threats. However, predation remains a potential threat for displaced WRPs, especially considering that up to ten WRPs could be likely to have retained none of their former home range (if clearing had been conducted during the period when WRP counts were low in 2020 or 2021) and would therefore need to join the transient population or establish new home ranges.

1.2.4 Risk assessment

A risk assessment to assess the likelihood and consequence of each potential impact has been included in this Plan in order to ensure that risks are translated into controls, mitigation and management actions.

Main Roads applies a standard risk assessment matrix to its operations, whereby the 'likelihood' and 'consequence' of events is considered, with monitoring and management actions identified to control the level of risk.

Main Roads completed a risk assessment for each of the relevant conservation significant fauna taxa in preparation of this CFMP. The likelihood and consequence assessment, with the resulting 'risk outcome', have been based upon the residual risk levels after management and monitoring activities are implemented. The assessments have applied the definitions for both likelihood and consequence as prescribed within DoEE (2019), and are presented in Table 1-3.

Related management actions and monitoring activities can be found in Section 2.1.

Table 1-3. WRP and BTP risk assessment

Objective: To ensure that impacts to WRP and BTP are avoided and minimised as far as practicable during construction and operation of the Proposal. Key environmental values: WRP / BTP individuals and habitat				
Environmental objective	**Risk**	**Post control risk assessment**	**Management approach**	**Monitoring approach**
Minimise impacts to WRP and BTP	Injury or death of WRP and BTP individuals during Proposal implementation	Likelihood: Likely Consequence: Moderate Risk outcome: Medium	Management (Section 2.1) during construction for risk of impact to WRP or BTP individuals	Pre-construction, construction and post-construction monitoring (Section2.3)
Minimise area of WRP and BTP habitat cleared during construction	Clearing of WRP and BTP habitat outside of the approved clearing area	Likelihood: Unlikely Consequence: Minor Risk outcome: Low	Standard construction management to control construction clearing (not specific to CFMP)	Standard construction monitoring to verify construction clearing (not specific to CFMP)
No significant indirect impacts to WRP or BTP habitat adjacent to the Proposal attributable to Proposal implementation	Reduction in WRP and BTP habitat quality / condition (function and value) adjacent to the Proposal	Likelihood: Unlikely Consequence: Minor Risk outcome: Low	Implement WONS, Declared Plant, surface water, and *Phytophthora* dieback management measures within Development Envelope vegetation / revegetation Standard construction management to control construction clearing	Pre-construction, construction and post-construction monitoring to assess habitat quality / condition (function and value) adjacent to the Proposal Monitoring to verify efficacy of applied control measures
	Increased predation of WRP adjacent to the Development Envelope	Likelihood: Unlikely Consequence: Minor Risk outcome: Low	Implement predator control management measures within Development Envelope and at fauna crossing structures access and egress points	On-going monitoring to verify efficacy of applied control measures

Objective: To ensure that impacts to WRP and BTP are avoided and minimised as far as practicable during construction and operation of the Proposal. Key environmental values: WRP / BTP individuals and habitat				
Environmental objective	**Risk**	**Post control risk assessment**	**Management approach**	**Monitoring approach**
	Bushfires generated as a result of Proposal construction	Likelihood: Possible Consequence: Moderate Risk outcome: Medium	Standard construction management to control potential ignition sources construction clearing (not specific to CFMP)	Standard construction monitoring to verify management of potential ignition sources and fire response during construction clearing (not specific to CFMP)
	Groundwater drawdown impacts on or changes in hydrology of WRP and BTP habitat adjacent to the Proposal	Likelihood: Unlikely Consequence: Moderate Risk outcome: Low	Standard construction management to control groundwater water abstraction consistent with WA Government water licensing (not specific to CFMP)	Standard construction monitoring to verify groundwater water abstraction consistent with WA Government water licensing (not specific to CFMP)
	Engineered movement structures not installed and / or ineffective	Likelihood: Possible Consequence: Moderate Risk outcome: Medium	Installation of engineered movement structures as per specification and responsive management (covered under separate HFMP)	On-going monitoring to verify effectiveness of structures (covered under separate HFMP)
	Landholder access approval for monitoring not granted	Likelihood: Possible Consequence[7]: Moderate Risk outcome: Medium	Ongoing liaison with landholders	The wide variety of monitoring approaches included for Proposal minimises impact of this risk

[7] Consequence is on ability to conduct monitoring, not on the species or habitat.

1.2.5 Key assumptions and uncertainties

This CFMP has been prepared on the basis of information provided from the environmental surveys conducted for the Proposal and based upon knowledge of Main Roads construction and operation of similar projects. The key assumptions and uncertainties relevant to the Proposal are:

- The relevant studies and surveys have accurately recorded the presence of conservation significant fauna species within the Development Envelope.
- Environmental survey reports have not been independently verified, however these surveys were undertaken by suitably qualified individuals experienced in fauna ecology and habitat identification, and are therefore assumed to have accurately recorded the presence and locations of habitat (including breeding habitat such as nest hollows, where relevant).
- The Proposal may have the potential for an indirect impact to conservation significant fauna individuals and habitat.
- All significant direct and indirect impacts to conservation significant fauna that may result from the Proposal have been identified.
- Direct impacts to fauna during construction are limited to habitat loss and injury or mortality during construction activities (clearing and plant movement).
- Mobile fauna will disperse in front of clearing activities.
- Fauna underpasses and fauna bridges are effective in maintaining ecological linkages.
- Possum exclusion fencing (combined with noise and screen walls) will exclude WRP from the road during operations limiting the potential for injury / mortality.
- Existing cleared areas within the Development Envelope do not contain habitat for or known records of conservation significant species.
- Conservation significant fauna are not expected to occur within areas cleared of native vegetation, therefore these areas do not require management during the construction of the Proposal to meet the environmental objectives.
- If any conservation significant species assumed not to occur in the Development Envelope are subsequently recorded, the proposed management actions would ensure there are no additional impacts.
- The proposed management actions detailed in this plan will be successful in achieving the objective stated in condition 5-1(1) of MS 1191.

More information on the key assumptions and uncertainties are provided in the appendices of the *Bunbury Outer Ring Road Southern Section Environmental Referral Supporting Document* (BORR IPT, 2019a), the *Bunbury Outer Ring Road Southern Section Updated Environmental Referral Document and Additional Information* (BORR IPT, 2020b) and the *BORR Southern Section Additional Information for Preliminary Documentation* (EPBC 2019/8543) (BORR IPT, 2020a).

1.3 Condition requirements

This CFMP has been prepared to meet the requirements of condition 5 of MS 1191 for Main Roads to prepare a Construction Fauna Management Plan (CFMP). MS 1191 prescribed a requirement for Main Roads to detail the proposed WRP and BTP management measures to minimise project attributable adverse impacts during construction.

Table 1-4. Condition 5 of MS 1191 (Construction Fauna Management Plan)

Condition no.	Condition	Applicable Section
5	Construction Fauna Management Plan	This document
5-1	The proponent shall implement the proposal to achieve the following environmental **objective**:	
	(1) during construction, minimise and manage project attributable adverse impacts to conservation significant terrestrial fauna including western ringtail possum and south-western brush-tailed phascogale.	
5-2	The proponent shall prepare a Construction Fauna Management Plan and submit to the CEO prior to **ground-disturbing activities**. This Plan shall:	
	1) specify the **passive relocation management actions** to be implemented prior to and during clearing;	2.1
	2) define the **low-risk clearing timeframe for western ringtail possum** applicable to **Category 1 Clearing Areas** and append supplementary survey evidence to justify the chosen timeframe;	1.4.1.1.1
	3) specify monitoring that:	
	a) includes a baseline survey to be undertaken within thirty (30) days prior to clearing (or if staged, prior to each clearing stage) to confirm presence/absence and number of western ringtail possum and south-western brush-tailed phascogale individuals within the **development envelope** and at **receival sites**. The baseline survey shall be prepared and undertaken on advice of **DBCA** during the preparation of the Construction Fauna Management Plan;	2.3.1
	b) records whether **threatened or priority fauna** is encountered during clearing, and reports to the CEO and **DBCA** within thirty (30) days after clearing (or each clearing stage) on the number of individuals relocated in accordance with any requirements of the lawful authority obtained under the Biodiversity Conservation Act 2016;	2.3.1
	c) evaluates the suitability, adequacy and effectiveness of **passive relocation management actions** at reducing impacts to western ringtail possum individuals displaced by clearing from **Category 1 Clearing Areas** defined in Figure 3; (**Figure 2 of this CFMP**)	2.3.4
	d) evaluates impacts to residential western ringtail possum individuals at **receival sites**; and	2.3
	e) uses monitoring methods including, but not limited to, radio telemetry with robust sample sizes (the minimum number of tagged animals to be determined in consultation with **DBCA**).	2.3.5
	4) identify and spatially define the study area(s) and reference sites proposed for monitoring and evaluation and provide rationale for the location of the sites;	2.2, 2.3.4
	5) specify **management actions**; **management targets**; monitoring locations, methodologies, indicators and timing; actions and investigations in the event of a failure to meet a **management target**; and reporting to demonstrate that the **objective** in condition 5-1 will be met; and	2.1

Condition no.	Condition	Applicable Section
	6) be prepared in consultation with the **DBCA** and in accordance with any requirements of a lawful authority obtained under the Biodiversity Conservation Act 2016.	4
5-3	The proponent shall annually submit an Environmental Performance Report as part of the Compliance Assessment Report required by condition 12-6, that shall:	2.4.2
	1) outline the monitoring that was undertaken during the implementation of the Construction Fauna Management Plan required in condition 5-2;	
	2) outline the results of the monitoring undertaken to report whether that the environmental **objective** specified in condition 5-1(1) was achieved;	
	3) report whether that the **objective** in condition 5-1(1) was achieved; and	
	4) outline any management actions undertaken during the implementation of the Construction Fauna Management Plan required in condition 5-2 to meet the **objective** in condition 5-1(1).	
5-4	The proponent shall not commence **ground-disturbing activities** until the CEO has confirmed in writing that the Construction Fauna Management Plan satisfies the requirements of condition 5-2.	n/a
5-5	The proponent shall implement the latest revision of the Construction Fauna Management Plan approved by the CEO.	n/a
5-6	The Proponent:	n/a
	1) may review and submit proposed amendments to the Construction Fauna Management Plan; or	n/a
	2) shall review and submit proposed amendments to the Construction Fauna Management Plan when directed by the CEO.	n/a
5-7	The proponent shall continue to implement the Construction Fauna Management Plan as approved by the CEO in writing, until the CEO has confirmed by written notice that the proponent has demonstrated that the requirements of the Construction Fauna Management Plan have been achieved.	n/a

This CFMP sets out the environmental management actions proposed to manage, monitor and mitigate the direct and potential indirect impacts of the Proposal. It includes the environmental management of activities to be undertaken by Main Roads, its employees and contractors. The CFMP has been prepared consistent with the following guidance documentation:

- Environmental Protection Authority (EPA) *Template for Environmental Protection Act 1986 Part IV* Environmental *Management Plans*

Relevant guidelines such as recovery plans, interim recovery plans, conservation advice and threat abatement plans have been taken into consideration during the preparation of this CFMP. The species recovery plans, conservation advice and referral guidelines which have been used to inform the development of this CFMP are listed below:

- 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
- Department of Conservation and Land Management (2002). *Brush-tailed Phascogale* Phascogale tapoatafa (Meyer, 1793) Species Profile.

Proposed management actions also reflect Main Roads experience in managing WRP and BTP on recent similar projects including the BORR Northern and Central sections and Bussell Highway (Hutton to Sabina section).

1.4 Rationale and Approach

1.4.1 Management objective

The objective of this CFMP is to minimise and manage project attributable adverse impacts to WRP and BTP during construction.

This CFMP presents management-based provisions to document management actions required during Proposal implementation and construction. Management measures within this CFMP are specific to the Proposal and include management actions that are 'over and above' Main Roads standard environmental management practises.

1.4.1.1 WRP information to guide the management approach

The approach to WRP management during clearing operations is focused on:

- Bi-monthly fauna surveys of the Development Envelope conducted since late 2019
- Pre-clearing surveys
- Timing of low-risk clearing (when WRP are at / near their expected seasonal low)
- Sensitive clearing practises
- Staged clearing operations to encourage WRP to move into adjacent habitat beyond the clearing area
- WRP monitoring during clearing works.

Allowing WRP to self-relocate to adjacent habitat of their own accord avoids the need for translocation and minimises handling of animals, and prioritises WRP welfare.

A pre-clearing behaviour study of WRP in relation to the addition of water points, artificial dreys and canopy connections will be conducted to inform WRP management. WRP behaviour will be assessed using a combination of remote cameras and GPS collars (of the type used in the recently completed movement study (Biota, in Prep.). The behaviour study will continue during clearing to see how individual animals respond to clearing and examine whether animals can be encouraged to leave the clearing footprint prior to clearing using strategically placed water points and canopy connections. Post clearing, collared animals will continue to be monitored using a combination of GPS collars and a mark-resight study.

1.4.1.1.1 Low risk clearing

Monitoring of WRP (October 2019 – February 2022) within the greater Bunbury area by Biota (Biota, 2019; Biota, 2020) highlights a period of February – August (inclusive) with lower or much lower WRP counts than peak season counts in October – December, as described in *Progress report: a monitoring record for part of the Bunbury population of the Western Ringtail Possum,* Pseudocheirus occidentalis (Jones, 2022), Appendix B.

WRP habitat clearing protocols, including the delineation of clearing categories, have been developed based on WRP site surveys and observations, and the lower risk clearing timeframes for WRP occurrence based on WRP monitoring data. Clearing of Category 1 habitat areas will be conducted during the period 1 March to 30 August. An authorised terrestrial fauna spotter, contracted under the Bunbury Outer Ring Road Southern Project, is empowered by the Authorisation Holder under the Construction Fauna Management Plan, to cease clearing based on fauna spotter observations that indicate clearing would be in contradiction to the definition of low-risk clearing timeframe for western ringtail possum (as per Ministerial Statement 1191).

Habitat clearing categories are shown in Figure 2 and clearing protocols for each category are detailed in Table 1-5. Based on the habitat clearing categories, WRP surveys and habitat extent, proposed clearing staging has been defined and are shown in Figure 4. Where it would be beneficial to do so in terms of outcomes for WRP, the proposed clearing staging and / or direction (not the habitat clearing categories) may be modified. **Any such decision is to be determined at the sole discretion of the fauna spotter(s) based on observations of WRP.**

Fauna spotter(s) will be present for clearing of all WRP habitat, regardless of category. Where animals are observed in Category 2 or 3 habitat during pre-clearing surveys, a 24-hr time separation between clearing of adjoining Category 3 and Category 2 areas, or Category 2 and Category 1 areas, may be required. **Application of this management measure is to be determined at the sole discretion of the fauna spotter(s) based on observations of WRP.**

In order to accommodate the low risk clearing timeframe, clearing may be required to be conducted in stages over two consecutive years. Management actions will be implemented for each stage of clearing should clearing be undertaken at different times. It is anticipated that a proportion of clearing will be undertaken in 2022 with the remainder being undertaken in 2023.

Table 1-5. WRP habitat clearing categories

Habitat clearing category	Clearing management
Category 1 **Resident and transient WRP expected to be encountered during clearing**	• Clearing shall be conducted during the period of 1 March to 30 August • Temporary supplementary watering points shall be installed in receival sites, clearing exclusion areas and other areas where appropriate (at a minimum of two per hectare) at least six weeks prior to clearing • Temporary dreys shall be installed in receival sites, clearing exclusion areas and other areas where appropriate (at a minimum of two per hectare) at least six weeks prior to clearing

Habitat clearing category	Clearing management
	• One clearing front with a single machine at a time in each continuous Clearing Category 1 patch • Maximum clearing area of one hectare per day per Habitat Clearing Category 1 patch with a total of five hectares per week • Habitat Clearing Category 2 and 3 areas that are within 500 m of Habitat Clearing Category 1 areas, and that will be cleared during the same clearing stage, shall be cleared prior to clearing Habitat Clearing Category 1 areas • Two fauna spotters per each machine conducting clearing operations • Clearing to be conducted as per the Proposed Clearing and Clearing Staging Plans.
Category 2 **Habitat patches that were not often utilised. Not considered suitable for resident WRP but may be used by a transient animal for the short term. High probability no WRP encountered during clearing**	• Habitat Clearing Category 2 areas to be cleared prior to clearing Habitat Clearing Category 1 areas (with a potential 24-hr temporal separation between clearing of adjoining Category 2 and Category 1 areas) • One fauna spotter per machine conducting clearing.
Category 3 **Other WRP habitat - small areas of isolated remnant vegetation and paddock trees. Unsuitable for resident WRP but may be used by a transient animal for the short term. Very high probability no WRP encountered during clearing**	• Habitat Clearing Category 3 areas to be cleared prior to clearing Habitat Clearing Category 1 and 2 areas(with a potential 24-hr temporal separation between clearing of adjoining Category 3 and Category 2 areas) One fauna spotter per machine conducting clearing.

1.4.1.1.2 Predator control

The WRP Recovery Plan (DPaW, 2017) identifies predation as a key risk to WRP. Predator control measures have been developed to for the Proposal.

The objectives of the predator control program are to minimise the impacts from predation that are exacerbated by the proposal on western ringtail possum and reduce the number and prevalence of feral animal WRP predators within the Development Envelope to below baseline levels. Associated targets and completion criteria for the program are set out in Table3-1.

Timeframes and location

To minimise risks of predation to dispersing WRP, one month prior to clearing, targeted predator control will be undertaken within the clearing area (for each stage of clearing). To maintain reduced predator numbers, predator control will be maintained within the Development Envelope and receival sites during construction. Predator control actions will continue post-construction, as detailed in the Proposal Habitat Fragmentation Plan.

Approach
To minimise impacts on non-target species, predator control will be undertaken using soft-jaw traps. Traps will be left in place for a minimum of three nights, and longer if required (until the targeted animal is caught). Traps will be checked and cleared daily following deployment.

Trap density
Trap density will be sufficient to achieve the stated completion criteria of reducing predator (fox and cat) numbers by at least 50 % within control areas. Density within the control areas will be dynamic, based on bi-monthly assessment of the following factors:

- The level of predator activity (determined via observations of foxes or evidence of fox presence e.g. scats, tracks)
- Predator movement patterns
- Landforms
- Vegetation type and density
- Adjoining landuse and activity

Trap deployment frequency
Traps will be deployed at least once prior to and during the 30-day period prior to construction commencing, with adaptive management of traps as required to manage predators in the Development Envelope and receival habitats. During construction, traps will be deployed based on the outcomes of site assessments and the ongoing efficacy of the trapping program. Post-construction, traps will be deployed bi-annually at crossing access and egress points, once in each of the autumn and spring seasons. This timeframe maximises opportunities to capture roaming animals looking for mates during the mating season and young dispersing from the den, and also optimises the benefit of the control program to dispersing WRPs.

Trap deployment will be adaptive throughout the duration of approval in response to predator abundance within the control areas.

1.4.1.1.3 Water points, artificial dreys, protective natural structures and tree-canopy connections

Temporary water points will be introduced to the remnant vegetation adjacent to clearing during construction where access is granted. Artificial water points shall be installed on wooden planks. The water points will be made using automatic refilling poultry lubing cups attached to a 2-litre bottle of water, placed on wooden planks adjacent to an artificial drey that is similar in design to a standard Sheffield cage trap. These shall be located in receival sites, exclusion areas and other areas where appropriate at a minimum density of two per hectare, and installed at least six weeks prior to clearing. The water points will remain in place during clearing and for six weeks post-clearing.

To increase the value of habitat for relocating WRPs, artificial dreys will be installed in receival sites outside the development envelope, clearing exclusion areas and other areas where appropriate at least 6 weeks prior to clearing.

Protective natural structures (such as felled trees) will also be placed in receival site habitat outside the development envelope where possible and in the clearing exclusion areas.

In Category 1 clearing areas, tree-canopy connections comprising of ropes will be installed prior to clearing to connect habitat within the Development Envelope to receival site habitat outside of the clearing areas. This will facilitate WRP relocation into adjacent receival habitat. A concept diagram of a tree-canopy connection is shown in Plate 1.

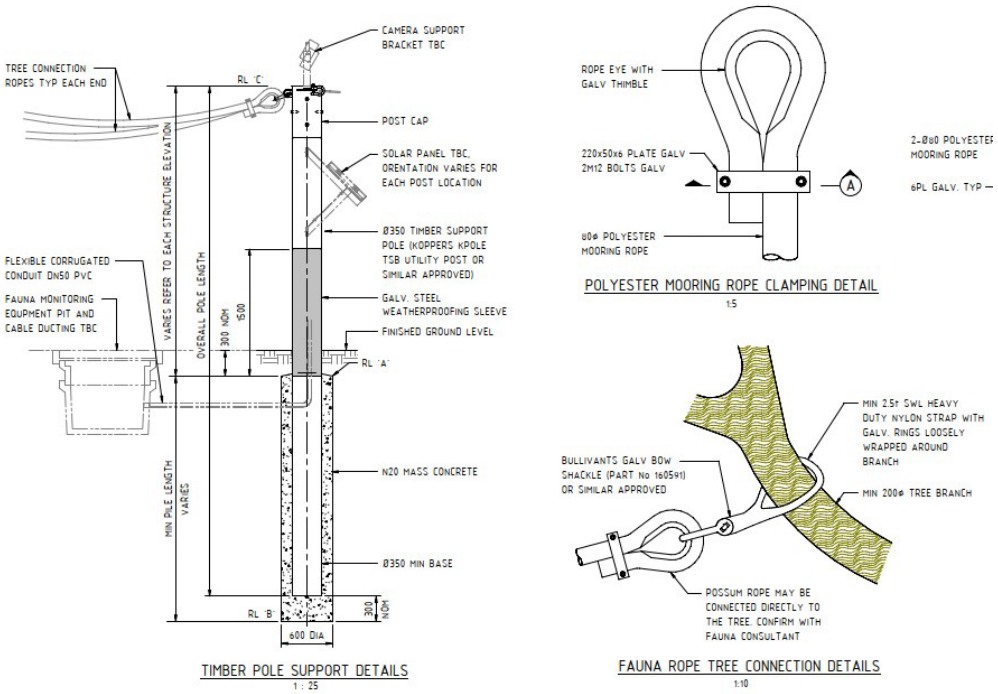


Plate 1 Tree canopy connection concept diagram

1.4.1.1.4 Fauna fencing

Temporary fencing of WRP habitat areas may be undertaken during clearing operations where beneficial to minimise impacts to WRP, noting that such fencing may preclude WRP self-relocating to receival sites. **The requirement for temporary fencing during construction will be determined at the sole discretion of the fauna spotter(s) engaged to assist with clearing operations**.

To minimise impacts during operation, after the completion of clearing, a combination of permanent and temporary fencing Possum exclusion fencing will be installed adjacent to known habitat areas to exclude WRP and BTP moving onto the road. The fencing will be 1.5 m high and constructed to prevent possums being able to climb over or dig under it, as shown in Figure 5. Locations for Possum exclusion fencing have been located based on the Habitat Clearing Categories, targeted WRP surveys and adjacent habitat patches as shown in Figure 2. The possum exclusion fencing will be constructed in addition to noise and screen walls which will also exclude possum movement from adjacent habitat onto the road carriageway. Temporary Possum fencing will be removed 5 years post-construction. Possum exclusion fencing, noise wall and screen wall locations are included in Figure 6.

1.4.1.1.5 Weeds

Weed control will be applied in WRP habitat within the Development Envelope, and will be focused on species that degrade WRP habitat values, such as Declared plant pests, WONS and selected aggressive environmental weeds.

1.4.1.2 BTP information to guide the management approach

BTP habitat is closely correlated with WRP habitat. Connectivity of habitat areas is important to enable dispersal of BTP to find habitat, mates and maintain the exchange of genetic material between populations. Good connectivity is also important to enable BTPs to access additional food resources and water as required.

Main Roads has included BTP observations as part of the on-going bi-monthly WRP surveys conducted in the Development Envelope since October 2019. Nine BTP sightings have been recorded during the 17 surveys completed, indicating infrequent occurrence and low densities of this species.

Threats, potential impacts and responsive management measures proposed for WRP will also apply for BTP as both species are primarily arboreal and share similar habitat types. Sensitive clearing protocols, as outlined in Section 2.3 for WRP, are required and will also apply for BTP.

As such, within this CFMP potential impacts, management measures and monitoring activities will be presented for BTP together with WRP.

2 CFMP COMPONENTS

In order to comply with relevant environmental legislation and manage impacts to the local environment, Main Roads has defined objectives and management-based provisions to ensure that impacts to conservation significant fauna are avoided and minimised as far as practicable during implementation of the Proposal.

2.1 Environmental management activities, controls and performance targets

Main Roads has taken a 'hierarchical approach' to the mitigation of potential impacts associated with the Proposal, and in the first instance, has sought to avoid areas of conservation significant fauna habitat through design refinement. Where impacts cannot be avoided, Main Roads has designed the Proposal to reduce the intensity and / or extent of impacts on conservation significant fauna individuals and habitat as far as practicable.

Risk-based management actions have been identified and prioritised to achieve the environmental objective detailed in Section 1.4.1. The management actions focus the greatest management effort on reducing habitat and ecological connectivity loss and impact to individual conservation significant fauna. These management actions were specifically developed to ensure that impacts are minimised as far as practicable during the final design, construction and operation of the Proposal. They have been informed by the results of field studies, best practice and recent experience on similar road projects in Western Australia.

Based on the controls identified above and these management actions, Main Roads has developed performance targets for each conservation significant fauna taxa to identify the outcomes sought

from the management actions. These, along with the proposed management actions, are identified in Table 2-1.

All proposed management actions, monitoring, performance indicators and corrective actions are aligned with the performance targets identified for each conservation significant fauna taxa. These have been refined based on Main Roads experience in clearing activities in recent and on-going projects.

Whilst the management actions have been defined as a risk-based protocol for minimising adverse impacts on WRP and BTP from the Proposal, unforeseen situations and risks may occur during construction. **Accordingly, fauna spotters with lawful authority are empowered to implement alternative management actions where strictly implementing the plan would contradict the environmental objective stated in condition 5-1 and / or result in poor outcomes for individual animals. Fauna spotters (with the lawful authority) have the authority to cease clearing if they consider that one or more listed threatened species may be injured or killed during clearing operations.** Such situations should be used, as applicable, to refine and / or amend this plan, as allowed under condition 5-6 of MS 1191.

Table 2-1. WRP and BTP management actions and performance targets

Timing	Management actions	Performance targets
Prior to clearing / construction	• Prior to clearing, the final road design shall be assessed against the proposed clearing area to ensure the required clearing area is no more than the approved area • At least six (6) weeks prior to clearing, install artificial dreys, artificial watering points and protective natural structures (such as felled trees) in receival sites outside the development envelope, exclusion areas and other areas where appropriate (refer to Section 1.4.1.1.3)At least six (6) weeks prior to clearing, install arboreal ropes where practical to provide connections from habitat inside the development envelope to receival sites outside the development envelope to minimise the need for WRP to go to ground (refer to Section 1.4.1.1.3) • Within thirty (30) days prior to clearing (or if staged, prior to each clearing stage) survey for WRP and BTP shall be undertaken to confirm presence / absence and number individuals within the development envelope and at receival sites[8] (refer to Section 2.3.2) • Deploy soft-jaw traps within the Development Envelope during the 30-day period prior to the clearing based on field observations (refer to Section 1.4.1.1.2) • Vacant dreys suitable for WRP or BTP shall be removed, and hollows blocked prior to clearing were deemed appropriate and safe • Prior to clearing, control of WONS, declared plants and aggressive environmental weeds recognised as threats to WRP habitat will be undertaken within the Development Envelope • All WRP and BTP habitat that is to be retained within the Development Envelope shall be delineated prior to site works to ensure it is conserved • Clearing of vegetation shall be confined to daylight hours[9] • Cleared vegetation shall be chipped immediately (i.e. not stockpiled) or transported at least 100 m from WRP and BTP habitat before further processing • Movement / disturbance of recently cleared vegetation (within 24 hours and prior to downsize / chipping) shall be confined to daylight hours	• Avoid direct impacts to WRP and BTP individuals • Minimise indirect impacts on adjacent receival habitat • Preclude use of refuge sites within the Development Envelope prior to construction • Reduce predator population within the Development Envelope and adjacent habitat

[8] Prepared and undertaken on advice of DBCA sought during preparation of this plan.
[9] The period from one hour after sunrise to one hour prior to sunset, using Geoscience Australia astronomical definitions for sunrise/sunset (Geoscience Australia, 2022)

Timing	Management actions	Performance targets
	• All buildings requiring demolition for the Proposal shall be inspected for WRP and BTP twice a day for two days prior to demolition works • Where WRP or BTP are observed, or suspected, to be in any building to be demolished attempts shall be made to capture the animal prior to the demolition works commencing • A licensed fauna-spotter shall be on-site at all times during the demolition of buildings suspected or observed to house WRP or BTP • Machinery operators shall maintain radio communication with their spotter • Any pest animal baits used in buildings to be demolished shall be in bait stations and disposed of prior to demolition.	
During clearing	**Sensitive clearing protocols** • Patches of WRP habitat to be cleared will be delineated prior to clearing • Clearing timeframes for Category 1, 2 and 3 Habitat Clearing Categories (Table 1-5) shall be followed • Spotlighting of potential WRP and BTP habitat shall be undertaken by a suitably experienced person for two nights within the seven (7) days prior to clearing. Trees containing WRP will be tagged and checked during pre-clearing fauna searches. • Pre-clearing fauna searches shall be conducted immediately prior to (i.e. on the day of) and during clearing operations and will include hollows, dreys, ground debris, dense ground-level vegetation, fallen timber and logs • Clearing shall be conducted congruent with the habitat clearing categories as detailed in Table 1-5 and shown in Figure 2 • Where western ringtail possums (WRP) are observed during clearing operations, the tree containing the animal shall be left for up to two consecutive nights to allow for the animal to vacate or move into an artificial drey (installed within or near trees known to contain possums prior to clearing), while clearing continues in adjacent vegetation. If the tree continues to be occupied after two consecutive nights, the animal will be safely coerced / relocated to a safe area outside of the clearing footprint by the authorised fauna spotter(s). Where possums have been identified as likely to occur (i.e observed hollow), trees shall be 'bumped gently" with a machine prior to felling. The machinery operator and fauna spotter(s) will wait and observe the tree for a period of time to allow fauna to move off on its own accord into the surrounding vegetation. If the animal remains in the tree, the tree shall be felled	• Avoid direct impacts to WRP and BTP • Minimise indirect impacts on adjacent receival habitat • Avoid indirect impacts to WRP in adjacent habitat • Restore and maintain connectivity between known WRP and BTP habitat areas • Reduce predator population within the Development

Timing	Management actions	Performance targets
	slowly and controlled onto vegetation, as directed by the fauna spotter(s). The 'soft felling' of habitat trees will provide a 'cushion' for the vegetation being felled, minimising the risk of injury to the animal and allow any WRP the opportunity to safely vacate.. • Artificial dreys may be installed within or near trees known to contain WRP prior to clearing, as WRP appear to preferentially move into artificial dreys. Entrances of inhabited dreys will be safely blocked, and both the drey and WRP will be securely relocated into nearby receival site habitat, as has been successfully implemented in other local clearing projects (Dr. Mike Bamford, pers. comm.). Alternatively, where practical, the hollow may be cut from the tree with the WRP in situ, and relocated to nearby receival habitat, as has been successfully implemented in other local clearing projects (Dr. Mike Bamford, pers. comm.) • In situations where connections to adjacent receiving habitat have been reduced by ongoing clearing or potentially cause stress or take of the animal, a licensed fauna spotter may coerce / move the animal to a safe area outside of the clearing footprint. Where practical, WRP will be encouraged to move along the branches of one tree to the next, into receival site habitat. Experience shows that WRP will also step onto a net and allow themselves to be carried on the net to trees in receival habitat (Dr. Mike Bamford, pers. comm.) • Felled trees with hollows shall be checked immediately for fauna after felling (by fauna spotter) and prior to further processing. If it is not possible to fully inspect the hollow, the tree will be left on the ground overnight to allow time for any undetected fauna to vacate • Habitat clearing is to be staged, commencing from existing cleared edges / roads and progressing towards habitat that will be retained to direct WRP and BTP towards these areas as per the proposed clearing staging (Figure 2) • Vacant dreys within felled trees will be destroyed immediately to prevent animals re-entering them • A post-clearing survey shall be undertaken (by fauna spotter) immediately following each day's clearing operations and the following morning to identify the presence of any injured animals. **Terrestrial fauna handling** • Fauna handling shall only be conducted by licensed fauna spotters	Envelope and adjacent habitat

Timing	Management actions	Performance targets
	• Any WRP and BTP showing signs of injury or illness shall be caught, bagged and taken to an experienced wildlife veterinarian • If an injured WRP or BTP has not already been captured, then the appointed fauna-spotter must attempt to capture the animal for the purposes of veterinary assessment and treatment • All treatment of injured fauna shall be undertaken by a veterinarian • Where clearing operations abut existing roads, in addition to standard traffic management measures, visual message boards shall be installed to warn drivers of the potential for fauna to cross the road during clearing operations.	
During construction	• Road construction activities (i.e. activities undertaken after clearing has been completed) adjacent to WRP habitat will only be undertaken during daylight hours where practicable • Post-clearing, possum exclusion fencing (temporary and permanent) shall be installed adjacent at known habitat areas to exclude WRP and BTP moving onto the road (Figure 6). The fencing will be 1.5 m high and be constructed to prevent possums being able to climb over or dig under it. Possum exclusion fencing shall take account of and complement noise and screen walls in excluding fauna from moving onto the road • Deploy soft-jaw traps bi-monthly within the Development Envelope during construction based on the outcomes of site assessments **Loss of ecological connectivity** • Construct two fauna bridges at Yalinda Drive and 350 meters to the east, at least 5 meters in width • Install permanent possum rope bridges / underpasses at key location(s) to enable fauna including WRP to move between retained habitat areas, see Figure 6 • Install tree-canopy connections to all crossing structures • The size and design of all movement devices will be based on MRWA Design of Fauna Underpasses (MRWA, 2010), topography at the site, expert advice (Barbara Jones, pers. comm.), information from relevant studies and reports (QDMR, 2000; Harper, M., Mccarthy, M. & van der Ree, R., 2008) and in line with the concept designs • Underpass dimensions will be based on the fauna recorded or expected to occur in the vicinity	• Avoid direct impacts to WRP and BTP • Minimise indirect impacts on adjacent receival habitat • Avoid indirect impacts to WRP in adjacent habitat • Restore and maintain connectivity between known WRP and BTP habitat areas • Reduce predator population within the Development Envelope and adjacent habitat

Timing	Management actions	Performance targets

	• The final underpass designs will incorporate the following features known to encourage use by fauna and reduce the risk of predation:
	  ○ Connection to nearby habitat via overhead rope hawsers and poles (minimum 2.5 m high) (Plate 1)
	  ○ Objects for fauna to shelter on, under or in (furniture) will be locally sourced and will include sand, mulch, logs and rocks
	  ○ Revegetation using fast growing species at underpass entrances to provide cover for animals approaching, entering and leaving the underpasses
	  ○ Natural flooring such as sand or gravel
	  ○ Possum fencing to direct fauna towards the underpass entrance
	  ○ Dual-use underpasses will have a concrete substrate and will not contain furniture (furniture would be washed away by drainage flows)
	• The Proposal Area boundary will be fenced according to the detailed design to restrict pedestrian and vehicular access to retained WRP habitat
	
	Drainage, weeds and fire
	• Implement Proposal Drainage Strategy and ground and surface water management measures to avoid negative impacts to adjacent WRP and BTP habitat
	• Implement WONS and Declared Plant control, and surface water and *Phytophthora* dieback management measures within Development Envelope vegetation / revegetation to prevent potential indirect impacts to WRP / BTP habitat
	• As part of the CEMP, the construction contractor shall prepare a Fire Management Plan to minimise risk of ignition from construction activities and effectively manage any resulting fires	

Post construction	• Deploy soft-jaw traps bi-annually at fauna crossing structure access and egress points (once in each of the spring and autumn seasons) for five years post-construction based on the outcomes of site assessments Also refer to Proposal Habitat Fragmentation Management Plan for post-construction management actions	• Minimise predation at crossing structures

2.1.1 SMART performance standards

In their Instructions on how to prepare EP Act Part IV Environmental Management Plans (EPA, 2018), the EPA specifies the inclusion of performance indicators, trigger criteria contingency actions for management-based plans. SMART (Specific, Measurable, Achievable, Relevant and Time-bound) performance standards have been developed for this CFMP to address the requirements of the EPA. Relevant terminology from both formats is included where relevant.

SMART performance standards are intended to relate to measurable (numerical) values which can be applied to a Proposal (rather than qualitatively measured management / monitoring actions), and may include measurements such as 'performance indicators', 'corrective actions' and 'completion criteria'.

In relation to conservation significant fauna, Main Roads has prepared SMART performance standards directly related to the measurable impacts of the Proposal on each taxon as identified in Table 1-2 and potential indirect impacts as identified in Section 1.2.3. The proposed SMART performance standards for the Proposal are identified in Table 2-2.

These SMART performance standards are aligned to the management actions and performance targets identified in Table 2-1, the monitoring actions identified in Section 2.3 and the corrective actions identified in Table 2-2.

The 'threshold criteria' and 'completion criteria' are considered to be achievable, with the risk potential of not achieving the proposed SMART performance standards captured by the risk assessment presented in Table 1-3.

As the proposed SMART performance standards for 'trigger criteria' and 'completion criteria' relate to physical measures which can be readily controlled through standard construction management processes[10], it is considered the proposed SMART performance standards have a low level of uncertainty, with additional margins for safety not required.

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

2.1.2 Corrective actions

Potential corrective actions to be undertaken should a trigger value be reached are listed but not limited to those outlined in Table 2-2. Monitoring (parameters, data collection method, location of sites, frequency and timing) and reporting of corrective actions will follow the methodologies described in Section 2.3 and Table 2-3.

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

Table 2-2. SMART performance standards for WRP and BTP

Performance target / Outcome	Trigger / Early warning indicator	Performance indicators	Corrective / Contingency actions (refer to Table 2-3 for detail on monitoring methodology, location, timing and frequency)	Completion criteria
During construction				
Avoid direct impacts to WRP and BTP individuals **Preclude use of refuge sites within the Development Envelope prior to construction**	WRP observed in Category 2 or 3 areas prior to clearing	Number WRP injured or killed	• If WRP occur with Category 2 or 3 Habitat areas, the adjacent Category 1 or 2 Habitat respectively won't be cleared for 24hrs.	No WRP injuries or mortalities as a consequence of construction activity
	Unexpected observation of WRP or BTP on site	Number WRP or BTP injured or killed	• Stop works (temporary) within 50 m of the individual • Tree to be retained for 2 consecutive nights • Engage a suitably licensed fauna specialist to remove individuals and if injured transport the individual to a veterinarian • Soft fell tree • Record environmental incident • Modify pre-clearing fauna survey methodology (if appropriate) • Monitor outcomes.	No WRP or BTP injuries or mortalities as a consequence of construction activity

Performance target / Outcome	Trigger / Early warning indicator	Performance indicators	Corrective / Contingency actions (refer to Table 2-3 for detail on monitoring methodology, location, timing and frequency)	Completion criteria
	Injured WRP or BTP individual within Development Envelope with injury suspected to be a consequence of construction activity		• All clearing and / or construction within the habitat area is immediately to cease • Investigate cause of injury or loss • Main Roads to consult with DBCA, and advise DWER of the incident occurring • Revise clearing and construction measures for minimising impacts to WRP / BTP in consultation with DBCA to reduce likelihood of further WRP / BTP injury / mortality before work recommences • Improve training and education for all personnel • Restart clearing within habitat area and monitor outcomes	
	Observations identify multiple WRP with pouch young or young at heel over two consecutive observations.	Presence of WRP with pouch young or young at heel	• Where fauna spotter of WRP with pouch young or young at heel are observed continuation of the clearing operations will be ceased	No WRP injuries or mortalities as a consequence of construction activity
Reduce predator population within the DE and adjacent habitat	Predator observations[11] do not decrease more than 25 % against baseline survey results	Predator survey observations throughout the Development Envelope	• Investigate cause and develop remedial actions with predator control contractor • Monitor outcomes	Predator observations decrease by at least 50 % against baseline survey results

[11] Includes direct sightings as well evidence of, such as tracks and scats

Performance target / Outcome	Trigger / Early warning indicator	Performance indicators	Corrective / Contingency actions (refer to Table 2-3 for detail on monitoring methodology, location, timing and frequency)	Completion criteria
	within 3 months of initiation or increase to within 25 % of baseline during construction			
Minimise indirect impacts on adjacent receival habitat **Reduce clearing of WRP and BTP habitat to the extent practicable in final design**	Clearing or disturbance of WRP or BTP habitat outside of the approved development envelope Unauthorised clearing of WRP or BTP habitat within the clearing exclusion areas.	Amount of WRP and BTP habitat cleared	• Stop works (temporary) • Record environmental incident • Investigate cause • Update environmental training of personnel (if appropriate) • Report incident to DWER in accordance with MS 1191 condition 12-5 • Undertake remediation works (if appropriate, following consultation with DWER).	Not more than 60.9 ha of WRP and 39.2 ha of BTP habitat cleared
Post construction				
Minimise indirect impacts on WRP in adjacent receival habitat	WRP abundance trends from bi-monthly monitoring (section 2.3.2) at	WRP density (individuals / ha) from bi-monthly monitoring at receival sites	• Investigate cause and consult with DBCA and / or DWER • Implement contingency actions which may include: - Review practicality and relevance of management measures	WRP abundance trends at monitored receival sites commensurate with (i.e. not greater than

Performance target / Outcome	Trigger / Early warning indicator	Performance indicators	Corrective / Contingency actions (refer to Table 2-3 for detail on monitoring methodology, location, timing and frequency)	Completion criteria
	receival sites more than 10 % lower than reference sites as determined via prediction interval and / or breakpoint analysis	and comparative reference sites	- Repair / alter design of fencing to block vehicular access if required • Install additional signage (e.g. Visual message boards warning road users of potential presence of WRP) • Monitor outcomes.	5% different to) those at reference sites
Maintain condition rating in adjacent WRP and BTP receival habitat	Condition decline across more than 5 % of adjacent receival habitat in a single monitoring period or 10% decline against Pre-construction habitat survey (Section 2.3.1)	Quality / condition (function and value) of known WRP and BTP habitat in monitored receival sites adjacent to the Development Envelope	• Assessment of project related runoff and indirect impact mechanisms against regional trends • Consult with DBCA and / or DWER • Implement contingency actions which may include: - Improve and implement increased protective measures / controls as necessary to eliminate impacts beyond the DE - Repair / alter design of drainage structures - Implement weed control and or other management in receival sites, where access is allowed • Monitor outcomes through bi-annual 3D aerial surveys	Quality / condition of WRP and BTP monitored receival sites adjacent to the Development Envelope is maintained at baseline or any change is commensurate with (i.e. not greater than 5% different to) that at reference site habitat
	WONS, Declared weeds and / or environmental weeds recognised	Extent of WONS, Declared weeds and / or environmental	• Investigate cause and develop remedial actions with weed control contractor • Modify review schedule if required • Monitor outcomes.	WONS, Declared weeds and / or environmental weeds recognised as threats

Performance target / Outcome	Trigger / Early warning indicator	Performance indicators	Corrective / Contingency actions (refer to Table 2-3 for detail on monitoring methodology, location, timing and frequency)	Completion criteria
	as threats to WRP remain within the Development Envelope remain at or above baseline survey levels	weeds recognised as threats to WRP within the Development Envelope		to WRP within the Development Envelope are below baseline survey levels
Restore and maintain connectivity between known WRP and BTP habitat areas	Failure to install engineered fauna movement structures as per specification	Number and design of installed structures	• Investigate cause and raise an incident report • Implement contingency actions which may include: - Review practicality and relevant of management measures - Improve training and education for all personnel - Improve and implement increased protective measures/controls as necessary - Review monitoring frequency and method • Monitor outcomes.	Installation of engineered movement structures as per specification
Minimise predation at crossing structures	Predator observations at monitored crossings increase by 25% over prior monitoring period	Predator observations at monitored crossings	• Investigate cause and develop remedial actions with predator control contractor • Implement agreed contingency actions which may include: – Increase trap density in key areas where observations remain at baseline – Review resource availability • Monitor outcomes on weekly basis until below trigger	

2.2 Environmental maps and diagrams

- Figure 1 identifies the location of the Development Envelope
- Figure 2 identifies the locations of WRP observations and habitat clearing categories
- Figure 3 identifies BTP records within the Development Envelope
- Figure 4 shows the clearing staging plan
- Figure 5 shows the possum fence design concepts
- Figure 6 shows the locations of the fauna crossing structures and possum exclusion fencing, noise walls and screen walls
- Figure 7 identifies receival sites adjacent to the Development Envelope
- Figure 8 identifies the BORR South WRP reference sites
- Figure 9 identifies the Telemetry study area
- Figure 10 example of the Lotek Lite Track 30 collar

2.3 Environmental monitoring

The objectives of the monitoring program are to:

- Determine the suitability, adequacy and effectiveness of the passive relocation management actions at reducing impacts to WRPs displaced by clearing from Category 1 Clearing Areas
- Evaluate impacts (if any) to residential WRP individuals within the Development Envelope or in receival sites.

Main Roads has identified key actions to monitor the potential direct and indirect impacts of the Proposal to conservation significant fauna individuals and habitat prior to, during and post construction. The proposed monitoring program is presented in Sections 2.3.1 to 2.3.6 and comprises:

- Pre-clearing WRP and BTP survey of the Development Envelope, receival sites and reference sites
- Recording of conservation significant fauna encounters that occur during clearing
- Post-clearing WRP and BTP surveys of the receival and reference sites as part of on-going bi-monthly surveys
- Mark-resight study using PIT tags of WRP within the Development Envelope and receival sites
- Telemetry study using GPS collars on up to fifty WRP and monitoring these animals for up to 3 months
- A genetic relatedness study of WRP with a minimum of 20 and up to 50 a samples DNA sequenced.

Except for the recording of WRP encounters during clearing operations, all the above-listed surveys contribute to Main Roads ability to assess achievement of the environmental objective stated in condition 5-1(1) to 'during construction, minimise and manage potential project attributable adverse impacts to conservation significant fauna including western ringtail possum and south-western brush-tailed phascogale'. Baseline values will be recorded or collections made (for DNA samples) for all surveys.

In order to accommodate the low risk clearing timeframe, clearing may be required to be conducted in stages over two consecutive years. Management and monitoring measures outlined in this plan will be applied during all clearing operations.

2.3.1 WRP and BTP habitat surveys

WRP and BTP habitat within the Development Envelope, at receival sites and at reference sites will be monitored prior to, during and after clearing and construction via assessment of 3D aerial imagery. The methodology and timing of this aspect of Proposal monitoring is detailed in the corresponding HFMP and is not repeated in this plan.

2.3.2 Bi-monthly surveys

WRP presence, abundance and distribution will be monitored via the bi-monthly survey method adopted for the project, commencing in October 2019. The bi-monthly surveys involve strip sampling of WRP habitat along transects spaced 20 m apart. These strips will be pre-loaded onto map imagery and displayed on tablets (UniStrong UT 10) with a GPS accuracy typically to within 1.5 m. Each strip will be surveyed by an appropriately experienced zoologist walking centrally through the strip at a slow steady pace (typically at between 1 and 2 km/hr), using a high-powered head torch to detect animals.

All observations of WRPs, BTPs, Common Brushtail Possum and any feral species within each survey will be recorded. In addition to species level identity, the following will be recorded:

- Number of individuals in each detection event
- Age class of each individual (where possible)
- Sex of individuals (where possible)
- Reproduction status of females (where possible)
- Tree species in which the animal was detected
- Presence of dreys or hollows.

As well as providing insight into WRP distribution and use of habitat areas, the bi-monthly sampling also captures seasonality and timing of peak fauna activity, which have been used to inform management measures. The longitudinal nature of the study enables detection of WRP abundance (density) trends.

Monitoring will be conducted prior clearing to establish baseline values and enable assessment of changes that may occur as a result of clearing. In accordance with condition 5-2(3)(a), a baseline survey will be undertaken within thirty (30) days prior to clearing (or if staged, prior to each clearing stage) to confirm presence / absence and number of WRP and BTP individuals within the Development Envelope and receival sites (Figure 7).

The bi-monthly surveys are and will continue to be undertaken consistent with monitoring methods that have been implemented for the BORR bi-monthly monitoring program and the BORR North and Central construction management. Category 1 WRP habitat within the Development Envelope will be included in the bi-monthly surveys until it is cleared.

Two reference sites (Figure 8) will (continue to) be surveyed as part of the on-going bi-monthly monitoring. The reference sites (Reserve 23000 and Lot 2 Boyanup Picton Road) were identified based on their proximity to the Development Envelope and the similarity of their habitat to that of the Development Envelope. Both reference sites have been included in the bi-monthly surveys since October 2019.

Triggers/early warning indicators and corrective/contingency actions for monitoring of any WRP decline are provided in Table 3-2.

Post-clearing surveys
Post-clearing monitoring will be conducted in receival sites adjacent to Category 1 habitat as part of the on-going bi-monthly survey, with the timing amended to be as close after clearing has been completed as possible. Bi-monthly monitoring of receival sites and reference sites will continue for a minimum of 12 months after clearing is completed, after which time, monitoring frequency will reduce to bi-annually unless results indicate more frequent monitoring is required.

For the purposes of monitoring, receival sites are considered to extend one home-range width from the edge of the Development Envelope, estimated to be approximately 100 m. The 100 m width has been determined based on previous WRP home range assessment studies conducted within the Gelorup section of the Development Envelope (Biota, in Prep.).

For Category 1 habitat areas in Gelorup, where the greatest number of WRP individuals and area of WRP habitat occur within the Development Envelope, additional monitoring is proposed, as described in Sections 2.3.4, 2.3.5 and 2.3.6 below. This additional monitoring cannot be applied to areas of the Development Envelope that contain WRP habitat areas that are only sparsely populated by WRP. The bi-monthly survey method is considered adequate to 'evaluate the suitability, adequacy and efficacy of passive relocation management actions at reducing impacts to western ringtail possum individuals displaced by clearing from Category 1 Clearing Areas' and 'evaluate impacts to residential western ringtail possum individuals at receival sites' outside of Gelorup, as required under condition 5-2(3)(c) and 5-2(3)(d), respectively.

A report summarising the findings of the surveys will be provided annually, as part of the annual Environmental Performance Report and compliance reporting. The report will document all records of Threatened and Priority fauna consistent with condition 5-2(3b).

2.3.3 During clearing survey

In accordance with condition 5-2(b), records will be maintained during clearing operations regarding sightings of WRP and BTP (and other Threatened or Priority fauna) encountered during clearing. A report summarising the number of individuals relocated in accordance with any requirements of the lawful authority obtained under the BC Act will be provided within thirty (30) days after clearing (or each clearing stage).

2.3.4 Mark-resight study

The targeted monitoring of WRP will incorporate a mark-resight study that will include uniquely identifying individuals via inserting passive integrated transponders (PIT tags). The mark-resight study will commence prior to clearing and continue on a bi-monthly basis into the post construction period as necessary to meet the objectives of the Habitat Fragmentation Management Plan (HFMP) required under condition 6 of MS 1191. Results of this aspect of the monitoring program will be reported annually as part of the annual Environmental Performance Report and compliance reporting.

The study will be concentrated within and adjacent to the Development Envelope between Jilley Road and Bussell Highway (Patches 7 and 8a (as shown in Figure 2)), which is the only substantial

part of the Development Envelope with extensive habitat and numerous WRP home ranges adjacent to, extending into or within the clearing footprint. The key objectives of the mark-resight program are to:

- Uniquely identify as many WRP as possible within the Development Envelope and receiving habitat
- Provide permanent identification of WRP
- Provide a mechanism to confirm that any WRP reported as deceased by members of the public or by contractors originated in the Development Envelope
- Identify the sex and age class (adults versus young) of as many WRP as possible from within the Development Envelope and receiving habitat
- Provide insight into the proportion of the population that might be considered transient.

Using PIT tags to uniquely identify most WRP likely to be within and adjacent to patches 7 and 8a at clearing will allow for monitoring of individual movement patterns before, during and after clearing via a resighting program. This requires capturing as many WRP as possible from within patches 7 and 8a and their likely receiving habitat (at least one home range wide from the Development Envelope – 100 m), prior to clearing, using either traps or by hand (as per approved ethics application AEC 19-6-26).

The mark-resight study can also help inform the genetic relatedness study (see Section 2.3.6) by calibrating the degree of genetic relatedness across different familial relationships. The nature of familial relationships and degree of integration / overlap of home ranges may provide insights into the behaviour of displaced WRP.

Re-sightings would generally be undertaken in conjunction with on-going bi-monthly surveys and / or the pre-clearing surveys.

The mark-resight study will be initiated as early as practicable in the period leading up to clearing. It is proposed that the program would initially commence concurrent with the June 2022 bi-monthly survey.

WRP will predominantly be hand-captured, using long poles to direct individuals into trees where they can be captured. Targeted cage trapping may also be used, with cages strapped securely onto tree branches and cleared within two hours of sunrise (Biota 2022, AEC 19-6-26).

Upon capture each animal will be weighed, aged, sexed and measured and a pit-tag (Virbac BackHome Bioglass Mini Transponder) inserted under the skin between the scapulae. It is estimated that between 50 and 70 animals may be PIT tagged, but the final number will be determined by the population size. A pole mounted reader connected to a receiver via an 8 m cable will be used to scan accessible WRP for PIT tags.

2.3.5 Telemetry study

GPS collars record and store the location of an animal according to a pre-programmed schedule. Collars with Radio Frequency (RF) communication permit data to be downloaded remotely (up to a distance of 200 – 300 m depending on obstacles) and allow for remote upload of different recording schedules. GPS collars therefore represent the ideal tool for monitoring WRP prior to, during and after clearing activities.

Collars will be fitted to animals prior to clearing, with data anticipated to be received from the collars for up to 199 days from deployment. Results of this aspect of the monitoring program will be reported annually as part of annual compliance reporting.

The Telemetry study will be focused on the Gelorup section (between Jilley Road and Bussell Highway) (Patches 6, 7 and 8a (Figure 9)) of the BORR South Development Envelope as indicated in Figure 9. This section (combined with Patch 6, the isolated habitat patch to the east) represents the only portion of the Development Envelope where the WRP population is large enough to collar a suitable number of animals and where there is extensive adjacent receiving habitat. A minimum of 20 and up to 50[12] animals will be fitted with radio collars for the telemetry study. The Telemetry study is designed as a longitudinal study, where the home range of WRP individuals will be modelled from a number of GPS locations for a period of at least 3 months (ideally six weeks is required to model the home range).

The key objectives of the Telemetry study are to:

- Estimate home range size for WRP before, during and after clearing of an agreed section of the Gelorup section (Jilley Road to Bussell Highway) and an isolated habitat patch (Patch 6) as indicated in Figure 7
- Determine the fate of displaced WRP
- Determine the extent to which displaced WRP are able to establish new home ranges within adjacent habitat
- Determine the extent to which these new home ranges overlap with pre-existing home ranges
- Determine whether genetic relatedness influences the likelihood of WRP successfully sharing home ranges
- Determine whether artificial den sites, canopy connections, water sources and dens continue to be utilised post-clearing.

Consistent with previous studies for the Proposal, (Biota, in Prep.), the study will use Lotek LiteTrack 30 collars (Figure 10). The collars have a measured weight of 35 g which represents less than 4 % of the body weight of the smallest target adult animals (900 g) and potentially as little as 3.4 % of the larger animals (1,050 g). Initially, the collars will record at least six fixes in a 24-hour period and are fitted with a radio frequency (RF) and a VHF transmitter to permit additional fixes, ultimate retrieval of the collar and remote upload and download of data. The current battery life is estimated at 199 days based on the six GPS fixes and four hours of VHF Beacon and RF communication per day, potentially allowing for multiple deployments. This schedule would typically yield an estimated lifespan of 199 days in an average case scenario. The lifespan of the battery could be reduced or extended by adjusting the number of night-time fixes remotely via the RF communication. GPS schedules may be adjusted if required for short-term on-ground management during the clearing stage.

[12] Plan provided to DBCA June 2022. DBCA provided comment which was subsequently discussed during a workshop held on 28 June 2022. At the workshop, it was agreed by DBCA that the Telemetry and PIT tagging sample sizes were sufficient. It was further agreed that, where collars detach from an animal or a collared animal dies, the collar will be retrieved (if possible) and attached to a new individual to maintain the study sample size.

WRP will be captured using the standard and accepted techniques utilised previously (Biota, in Prep.), AEC 19-6-26)). WRP will predominantly be hand-captured, using long poles to direct individuals into trees where they can be captured. Targeted cage trapping may also be used, with cages strapped securely onto tree branches and cleared within two hours of sunrise. Females with obvious pouch young or dependent young will not be targeted for capture. Only adults heavier than 900 g will be considered for collaring. The animal must be adult so that it cannot outgrow the collar circumference during the life of the survey and of sufficient weight to accommodate the collar. The collaring team will include a wildlife veterinarian on-call during all capture sessions, and animals will be released at point of capture if they are highly stressed and difficult to handle. It should be noted however, that during the 2020 study, no captured WRP displayed signs of acute stress and all proved easy to handle and collar.

Upon capture, each WRP will have general health measurements recorded, including weight, sex, and an appraisal of tooth wear. Prior to fitting the collars, all animals will be scanned for microchips, and if none are present, will be injected with a PIT tag to permit unique identification in the future. The animal will then be fitted with a collar (GPS and VHF enabled), a small ear-clip will be taken for genetic testing, and the WRP will be released at point of capture.

Based on the results of the 2020 collaring project at the same site, application of collars across the estimated 199-day battery-life period is not anticipated to result in negative effects on survivorship. To assist with the retrieval of collars, a VHF beacon will be utilised that permits collars to be located using standard telemetry approaches. The VHF beacon has a mortality function whereby the VHF pulse rate doubles after a user defined period of inactivity. The VHF has a lifespan of approximately one week after the GPS ceases to record locations (expected to be on average 199 days).

The same techniques listed above for initial WRP capture (hand-capture with long pole assistance, and targeted cage trapping) will be used for recapturing WRP to retrieve their collars, along with the following variation of the targeted cage trapping technique. This technique involves replacing actively-used artificial den sites with cage traps overnight the WRP is foraging, and thus capturing the animal upon its return in the early morning. These traps would be checked within two hours of sunrise. Following capture and collar retrieval, the artificial den site would be reinstalled, and the WRP released inside it, where it is expected to stay and return to sleep until nightfall (B. Jones, pers. comm. 2021).

Data can be downloaded from the collars remotely and new schedules uploaded should the data indicated a schedule change is warranted. Over the anticipated three-month period that collars are attached, there will be considerable on-ground tracking of the animals, especially throughout the clearing process where the licensed fauna spotter will be onsite to ensure that the collared animals are appropriately shepherded from the clearance corridor and into adjacent habitat. During this period, the data schedule may be changed to best align with on-ground works.

Whilst tracking, the monitoring will aim to assess how well an animal is coping with the collar and carefully consider any significant changes to their pattern of movement from the data that may indicate distress.

To ensure the sample size remains robust, any collars that become detached from an individual or that are retrieved from deceased animals, and that are still in good working order, will be fitted to another individual within the study area. Testing for predator DNA will be conducted on the carcass of and / or collars retrieved from deceased animals.

2.3.6 Genetic relatedness study

Intuitively, animals dispersing into adjacent and familiar habitat should have a higher probability of survival than those relocated to entirely new locations even if these sites are relatively close by. Survival may also be enhanced if WRP disperse into the home ranges of WRP they are genetically related to, as opposed to being relocated into the home ranges of unrelated possums. This genetics hypothesis is untested and will be incorporated into the CFMP. All animals captured from within the Development Envelope and receiving habitat will have a small ear clip taken which will be used for subsequent genetic analyses of the population and relational dynamics of WRP within the Development Envelope.

It is expected that a minimum of twenty (20) and up to fifty (50) animals will be sampled and their DNA sequenced as part of this study. Samples will be collected during application of PIT tags (refer to Section 2.3.4) and / or collars (2.3.5).

Results of this aspect of the monitoring program will be reported annually as part of the annual Environmental Performance Report and compliance reporting.

2.3.7 Installed habitat features

Monitoring of WRP use of artificial dreys, protective natural structures, tree-canopy connections and water points will be undertaken prior to clearing, during clearing and for six weeks post-clearing. WRP behaviour will be assessed using a combination of remote cameras and GPS collars through the Telemetry study described in Section 2.3.5.

Table 2-3. Proposed WRP monitoring program

Performance target / outcome	Parameter to be monitored	Location	Methodology	Frequency	Recording and reporting
Avoid direct impacts to WRP individuals	Injury or death of WRP	• Development Envelope	• Low risk clearing protocol in Category 1 Habitat • Pre-clearing and post-clearing walkover inspection of cleared areas and fallen trees for conservation significant fauna species • Pre-demolition visual assessments • Pre-removal visual checks of vegetation stockpile areas • Telemetry study • Mark-resight study	During construction: Daily prior to and after each clearing and demolition event and opportunistically during clearing. Predator DNA on deceased WRP would occur for each occurrence of a deceased WRP Post construction: Not applicable	• Injury or death of WRP recorded by Fauna spotters (with lawful authority) and reported to Manager Environment within 24 hours of incident occurring • Main Roads to consult with DBCA of the WRP injury or mortality occurring • Report annually as part of Environmental Performance Report or in response Summary of achievement of annual compliance against performance measures and contribution of measures to achievement of the environmental objective
	Usage of installed habitat features (as described in section 2.3.7)	• Development Envelope and adjacent receival site habitat	• remote motion sensor cameras, GPS collars or observations (such sightings, scats etc)	Prior to clearing, during clearing and for six weeks post-clearing	• Report annually as part of Environmental Performance Report
	WRP relocated	• Development Envelope and adjacent	• Low risk clearing protocol in Category 1 Habitat	During clearing and / construction: Daily	• Relocation of WRP recorded by Fauna spotters (with lawful authority) and reported to

Performance target / outcome	Parameter to be monitored	Location	Methodology	Frequency	Recording and reporting
		receival site habitat			DBCA / DWER within thirty (30) days after clearing (for each clearing stage).
		• Development Envelope between Jilley Road and Bussell Highway	• Telemetry study	For 6 weeks prior to clearing, during clearing and 6 weeks post clearing	• Report annually as part of Environmental Performance Report
		• Development Envelope between Jilley Road and Bussell Highway	• Mark-resight study	Pre-clearing, clearing and post clearing on a bi-monthly basis for 6 months	• Presence of collared and marked individuals • Report annually as part of Environmental Performance Report
Reduce clearing of WRP habitat to the extent practicable in final design **Minimise indirect impacts on adjacent receival habitat**	Clearing area (ha) of WRP habitat within design specification	• Development Envelope	• Pre-clearing: Assessment of design against approved clearing area • During construction: Construction area assessment to visually check / review clearing boundaries and assess vegetation clearing	During construction: Prior to clearing and daily Post construction: Not applicable	• Area of WRP habitat cleared recorded by Fauna spotters (with lawful authority) and reported to Manager Environment monthly • Report annually as part of Environmental Performance Report Summary of achievement of annual compliance against performance measures and contribution of measures to

Performance target / outcome	Parameter to be monitored	Location	Methodology	Frequency	Recording and reporting
					achievement of the environmental objective
Preclude use of refuge sites within the Development Envelope prior to construction	WRP access to potentially suitable refuge sites	• Development Envelope	• Visual inspection	During construction: Pre-clearing	• Number of potentially suitable refuge sites blocked prior to construction recorded by Fauna spotters (with lawful authority) and reported to Manager Environment monthly
Restore and maintain connectivity between known WRP habitat areas	Engineered movement structures included in design specification	• Development Envelope	• Review of design reports and drawings at 50 % design and IFC (issued for construction) to ensure WRP bridges / underpasses are designed and incorporated into Proposal	Pre-construction	• Report annually as part of Environmental Performance Report or in response Summary of achievement of annual compliance against performance measures and contribution of measures to achievement of the environmental objective
	Engineered movement structures installed within specification	• Development Envelope and adjacent receival site habitat	• Visual assessment of constructed / in construction WRP movement structures to confirm these are as per detailed design	During construction: Bi-annually	

Performance target / outcome	Parameter to be monitored	Location	Methodology	Frequency	Recording and reporting
	WRP monitored using rope bridge or underpass	• Development Envelope and adjacent receival site habitat	• Use motion sensor IR cameras to assess utilisation (visual assessment of footage) • Mark-resight Study • Telemetry Study	Post construction: Bi-annually for a minimum of 15 years or otherwise agreed by the DWER CEO	
	Rehabilitation success	• Engineered movement structure locations	• Visual inspection of rehabilitation installed around engineered movement structure locations	Post construction: minimum of 15 years or otherwise agreed by the DWER CEO	
Minimise indirect impacts on WRP in adjacent receival habitat	WRP presence/ absence, abundance and distribution	• Development Envelope, adjacent receival site habitat and reference sites	• Nocturnal visual assessment for WRP in receival sites and reference sites (Lot 2 Boyanup Picton Road and Reserve 23000 Bussell Highway)	Prior to construction: Bi-monthly baseline monitoring to determine pre-construction conditions including WRP abundance and distribution During construction: Bi-monthly strip sampling surveys (continuation of those commenced in October 2019) Post construction: Bi-annually for a minimum	• Report annually as part of Environmental Performance Report Summary of achievement of annual compliance against performance measures and contribution of measures to achievement of the environmental objective

Performance target / outcome	Parameter to be monitored	Location	Methodology	Frequency	Recording and reporting
				of 15 years or otherwise agreed by the DWER CEO	
	WRP tracking into adjacent habitat during clearing WRP use of installed habitat features	• Development Envelope between Jilley Road and Bussell Highway	• Mark-resight study and Telemetry study	During construction: Pre-clearing and bi-monthly Post construction: ○ Bi-annually for years 1 and 2 ○ Annually thereafter for a minimum of 13 years or otherwise agreed by the DWER CEO	
	Genetic diversity / mean observed heterozygosity Predator DNA on deceased WRP carcass / retrieved collar(s)	• Development Envelope between Jilley Road and Bussell Highway	• DNA scat analysis • DNA sample analysis	During construction: bi-monthly Post-construction: Bi-annually for a minimum of 15 years or otherwise agreed by the DWER CEO Predator DNA on deceased WRP would occur for each occurrence of a deceased WRP	

Performance target / outcome	Parameter to be monitored	Location	Methodology	Frequency	Recording and reporting
	Possum fence installation within specification Possum fence condition	• Development Envelope	• Visual inspection of constructed / in construction possum fences • Visual inspection of possum fence for damage	During construction: Bi-annually Post construction: Bi-annually for a minimum of 15 years or otherwise agreed by the DWER CEO	
Maintain condition rating in adjacent WRP receival site habitat	Quality / condition (function and value) of receival site habitat adjacent to the Development Envelope	• Receival site habitat adjacent to the Development Envelope	• Analysis of 3D aerial footage and visual assessment of habitat quality to the derived difference in vegetation cover (between time periods) using Normalised Difference Vegetation Index (NDVI) layers.	Prior to construction: Once (baseline monitoring) During construction: Bi-annually Post construction: Bi-annually fora minimum of 15 years or otherwise agreed by the DWER CEO	• Report annually as part of Environmental Performance Report or Summary of achievement of annual compliance against performance measures and contribution of measures to achievement of the environmental objective
	WONS, Declared weeds and / or environmental weeds recognised as threats to WRP within the Development Envelope	• Receival site habitat adjacent to the Development Envelope	• Development Envelope weed survey	Prior to construction: Once (baseline monitoring) During construction: Bi-annually	

2.4 Reporting and accountability

2.4.1 Roles and responsibility

This CFMP identifies the environmental management of activities to be undertaken by Main Roads or its delegate in implementation of the Proposal. Main Roads acknowledges that the environmental management actions contained within this CFMP are legal requirements to be met by Main Roads.

The Manager Environment at Main Roads will maintain responsibility for implementation of the management actions outlined within this CFMP, on behalf of Main Roads Managing Director. Management actions may be undertaken by employees and / or contractors of Main Roads on behalf of the Managing Director.

Where management actions are undertaken by employees and / or contractors of Main Roads, these will be communicated and documented to the relevant personnel through relevant environmental training (refer to Section 2.4.3).

2.4.2 Reporting

Main Roads will report to DWER on the implementation of this CFMP as part of the Environmental Performance Report to be filed with the Compliance Assessment Report (CAR) required under condition 12-6 of MS 1191. It is anticipated the EPR will report annually on achievement of annual compliance against performance measures detailed in the CAR and contribution of measures to achievement of the environmental objective, including metrics on the outcomes derived from monitoring proposed in Section 2.3.

Where the EPR or compliance audits undertaken by Main Roads identify that the environmental management actions and / or the environmental objectives are not being achieved (i.e. non-compliance or an environmental incident), Main Roads will notify DWER and as soon as reasonably practicable and no later than seven days of the non-compliance being known. Consistent with standard document control procedures, Main Roads will maintain copies of all reports submitted to DWER.

The reporting requirements for this CFMP are identified in Table 2-4.

Table 2-4. Reporting requirements

Aspect	Report from	Report to	Reporting frequency
Implementation of CFMP	Manager Environment	DWER	Annually (as part of annual compliance reporting)
WRP relocation	Manager Environment	DWER and DBCA	Report within thirty (30) days after clearing (or each clearing stage) on the number of WRP relocated
Non-compliance with CFMP or Environmental Incident	Manager Environment	DWER	As soon as reasonably practicable but not more than seven days

The format and content of annual reporting will be in accordance with the requirements of conditions 5-3 and 12-6 of MS 1191. The format and content of reporting of a non-compliance event or an environmental incident will be subject to the nature of the non-compliance / incident and will include all requested information from DWER. In consideration of this, specific templates for reporting these are not provided as part of this CFMP.

2.4.3 Environmental training

Main Roads will ensure that all personnel undertaking works for the Proposal, including visitors, have undertaken a site induction, or are escorted to the site. Main Roads will evaluate all personnel undertaking the site induction training program through a test to ensure that all personnel have an understanding of the environmental requirements for the Proposal.

Where it is identified that personnel have not undertaken the works in accordance with the environmental requirements for the Proposal, Main Roads will require such personnel to repeat the site induction training program.

The general content of the site induction training program for the Proposal is outlined in Table 2-5.

Table 2-5. Site induction training program content

Aspect	Site induction training program content
Site induction training program	Awareness of Main Roads Environmental Policy
	Identification of the environmental values in the Development Envelope
	Identification of key environmental risks associated with the Proposal, and the identification of management requirements to control such risks
	Roles and responsibilities of all personnel in the protection and management of the environment, including identification of key personnel that have specific roles or responsibilities
	Awareness of importance of compliance with the environmental requirements (including penalties for non-conformance with the environmental requirements)
	Pegging of the area of works, and other pegging types (for example, trees to be retained)
	Clearing of native vegetation and management of topsoil
	Hygiene procedures for *Phytophthora* Dieback management and weed management
	Appropriate disposal of wastes
	Environmental incidents, including the requirements for management and reporting
	The environmental benefits of improved personal performance

2.4.4 Emergency contacts and procedures

Emergency contact details will be signposted at appropriate locations within the Development Envelope, to enable immediate contact and response in the event of an emergency / environmental incident observed by Main Roads personnel, contractors or the public.

Emergency response procedures will be followed in the event of an emergency / environmental incident.

Main Roads general and emergency contacts for the Proposal are provided in Table 2-6.

Table 2-6. Emergency contact details

Aspect	Contact details
General contact	• Main Roads Head Office Address: Don Aitken Centre, Waterloo Crescent, EAST PERTH WA 6004 Mail: PO Box 6202, EAST PERTH WA 6002 Email: enquiries@mainroads.wa.gov.au Phone: 138 138 • Main Roads South West Region Address: Robertson Drive, BUNBURY WA 6231 Mail: PO Box 5010, EAST PERTH WA 6231 Email: enquiries@mainroads.wa.gov.au Phone: 138 138 / (08) 9724 5600
Emergency contact	• Manager Environment, Main Roads Email: Martine.Scheltema@mainroads.wa.gov.au Phone: (08) 9323 4614 • Regional Manager, Main Roads South West Region Email: robert.barnsley@mainroads.wa.gov.au Phone: (08) 9724 5600

3 ADAPTIVE MANAGEMENT AND REVIEW

This CFMP adopts an 'adaptive management' approach which aims to reduce impacts by embedding a cycle of monitoring, reporting and implementing change, where required. Main Roads will apply the principles of adaptive management through monitoring, adaptive management actions and implementing changes necessary to effectively meet the environmental objective. Accordingly, it is intended that this CFMP is dynamic and may be updated (as required) over the life of the Proposal to reflect changes in the monitoring and management practices, subject to the results of the monitoring to identify that the environmental objective is being achieved. This will allow flexibility to respond to new environmental impacts and adopt new technologies / management measures. The CFMP may also be revised to address learnings from the implementation of corrective actions, should this occur.

After completion of the construction contract, the BORR will be managed in line with Main Roads operational management procedures for the maintenance of roads.

3.1 Environmental auditing

This CFMP will be audited by Main Roads during construction for the Proposal to ensure the implementation of the management and monitoring measures, and to confirm the management measures specified are achieving the environmental objective.

The proposed auditing schedule for this CFMP is identified in Table 3-1.

Table 3-1. Environmental audit schedule

Timing	Action	Schedule
Pre-construction	Review of construction procedures to ensure CFMP management / monitoring actions are incorporated within works procedures	Prior to construction (single event)
Construction	Inspections by site environmental personnel during the clearing of Habitat Category 1 areas	Daily
	Inspections by site environmental personnel to identify compliance with CFMP	Periodic (generally weekly)
	Independent 'third-party' audit for assessment of compliance with CFMP	Once during construction
Post construction	Independent 'third-party' audit for assessment of compliance with CFMP	Once during 3 year post construction period

The results of the construction and post construction independent 'third-party' audit findings will be reported by Main Roads to DWER as part of annual compliance reporting as outlined within Section 2.4.

3.2 Environmental review

Main Roads proposes to review this CFMP annually (12 month period from MS 1191 approval) in order to consider:

- The management and monitoring actions
- Opportunities for an improvement in environmental performance (for example, changes to construction methodology or timing)
- Identify a need to update this CFMP to capture changes to the management and/or monitoring actions
- Identify any general need to update this CFMP (for example, to capture new information on WRP knowledge or management).

Main Roads acknowledge that a revision to this CFMP may trigger a need for additional approval by DWER prior to implementing any changes to the specified management or monitoring actions.

The proposed CFMP review schedule for the Proposal is identified in Table 3-2.

Table 3-2. CFMP review schedule

Timing	Action	Schedule
Construction	• CFMP will be reviewed and updated, as necessary with adaptive management measures following completion of year 1 clearing	• Prior to recommencing of Category 1 Habitat in 2023
Construction and Post construction	• Review of CFMP management and monitoring actions	• Annually • (once during construction)

Timing	Action	Schedule
	• Review of opportunities for an improvement in environmental performance • Revise CFMP (if appropriate) and seek DWER approval of revised CFMP	• Once every three years post construction for nine (9) years.

3.3 Data management

Main Roads will maintain records on the implementation of this CFMP in accordance with Main Roads corporate standard document control procedures.

The retention of records held by Main Roads will be maintained and managed in accordance with the Western Australian *State Records Act 2000* (WA).

In accordance with MS 1191 Condition 13, a copy of all validated environmental data (including sampling design, sampling methodologies, empirical data and derived information products (e.g. maps)) management plans, including this plan, and reports will be made publicly available via the Main Roads website.

4 STAKEHOLDER CONSULTATION

4.1 Stakeholder consultation

Main Roads has consulted with a range of stakeholders on the Proposal. These consultations have assisted to inform the preparation of this CFMP.

A list summary of the stakeholders consulted on the Proposal (for which the environmental impact and management of conservation significant fauna taxa were discussed) is identified in Table 4-1.

Table 4-1. Stakeholder consultation

Type	Stakeholder	Consultation Issues
Community	BORR Southern Community Reference Group	• Proposal design to minimise impact to fauna habitat and wetland habitat • Residual direct and potential indirect impacts to fauna habitat • Management and monitoring of conservation significant fauna taxa • Environmental assessment processes relevant to conservation significant fauna taxa.
Government	• Commonwealth Department of Agriculture, Water and Environment • State Department of Water and Environment Regulation (EPA Services) • State Department of Biodiversity, Conservation and Attractions	• Proposal design to minimise impact to conservation significant fauna taxa habitat • Residual direct and potential indirect impacts to conservation significant fauna taxa habitat • Preparation / implementation of an CFMP for the management and monitoring of impacts to conservation significant fauna taxa. • Review of this CFMP during approval process • Approval of this CFMP for implementation by EPA Services
Scientific community / industry	Biota Environmental Sciences	• Provided advice regarding monitoring and management of WRP and BTP that has been incorporated into the development of this CFMP
	Ms. B Jones	• Provided advice regarding monitoring and management of WRP that has been incorporated into the development of this CFMP.
	SW Environmental	• Provided advice regarding management of WRP and BTP that has been incorporated into the development of this CFMP.

June 2022	DBCA, EPA Services	• Workshop to discuss and resolve DBCA comments on draft CFMP and HFMP, including advice regarding the pre-clearing baseline survey for WRP as specified in condition 5-2(3)(a).

4.2 External communications and complaints

The Construction Contractor will develop and maintain a complaints register to record all complaints. Complaints will be recorded by the person who receives the complaint (at the time it is received). Records to be obtained about a complaint include:

- Contact details for the person making the complaint (name and phone number as a minimum)
- Approximate location that the issue was identified by complainant
- Date, time and issues that the complaint relates to.

5 REFERENCES

Biota. (2019). *Western Ringtail Possum: Pseudocheirus occidentalis Regional Surveys DRAFT*. Draft report for Main Roads Western Australia.

Biota. (2020). *Bunbury Outer Ring Road Northern and Central Section Targeted Fauna Assessment*. Unpublished report for Main Roads Western Australia.

Biota. (2020). *Bunbury Outer Ring Road Southern Section Targeted Fauna Assessment*. Unpublished report for Main Roads Western Australia.

Biota. (2020c). *Western Ringtail Possum Pseudocheirus occidentalis Regional Survey*.

Biota. (in Prep.). *Western Ringtail Possum Movement Study*. Unpublished report prepared for Main Roads Western Australia.

BORR IPT. (2019a). *Bunbury Outer Ring Road Southern Section EPA Environmental Referral Supporting Document*. Unpublished report for Main Roads Western Australia.

BORR IPT. (2019b). *Bunbury Outer Ring Road Southern Section Drainage Strategy*. Unpublished report for Main Roads Western Australia.

BORR IPT. (2020). *Bunbury Outer Ring Road Southern Section Updated Environmental Referral Document*. Unpublished report prepared for Main Roads Western Australia.

BORR IPT. (2020a). *BORR Southern Section Additional Information for Preliminary Documentation – EPBC Ref: 2019/8543*. Unpublished report prepared for Main Roads Western Australia.

BORR IPT. (2020a). *Bunbury Outer Ring Road Southern Section Updated Environmental Referral Document and Additional Information*. Unpublished report prepared for Main Roads Western Australia.

BORR IPT. (2020b). *BORR Southern Section Additional Information for Preliminary Documentation – EPBC Ref: 2019/8543*. Unpublished report prepared for Main Roads Western Australia.

BORR IPT. (2020b). *Bunbury Outer Ring Road Southern Section Black Cockatoo Action Management Plan*. Unpublished report to Main Roads Western Australia.

BORR IPT. (2020b). *Bunbury Outer Ring Road Southern Section Updated Environmental Referral Document and Additional Information*. Unpublished report prepared for Main Roads Western Australia.

BORR IPT. (2020b). *Bunbury Outer Ring Road Southern Section Updated Environmental Referral Document and Additional Information*. Unpulished report prepared for Main Roads Western Australia.

BORR IPT. (2020c). *Bunbury Outer Ring Road Southern Section Vegetation and Flora Study*. Unpublished report prepared for Main Roads Western Australia.

CALM. (2002). *Brush-tailed Phascogale Phascogale tapoatafa*. Department of Conservation and Land Management (CALM).

Clarke, J. (2011). *Translocation outcomes for the Western Ringtail Possum (Pseudocheirus occidentalis) in the presence of the common Brushtail Possum (Trichosurus vulpecula): Health, Survivorship and Habitat Use*. Murdoch University: PhD Thesis.

DAWE. (2020a). *Additional Information Request for Preliminary Documentation (2019/8543)*. Department of Agriculture, Water and Environment.

De Tores, P. (2004). *A proposal for Translocation of the western ringtail possum, Pseudocheirus occidentalis, an arboreal marsupial endemic to the south-west of Western Australia.* Perth, Western Australia: Department of Conservation and Land Management.

DoEE. (2019). *Request for Additional Information Required for Assessment by Preliminary Documentation.* Department of the Environment and Energy.

DotE. (2014). *Environmental Management Plan Guidelines.* . Department of the Environment. Canberra, Australia.

DPaW. (2017). *Western Ringtail Possum Recovery Plan.* Perth, Western Australia: Department of Parks and Wildlife.

EPA. (2018). *Instructions on How to Prepare Environmental Protection Act 1986 Part IV Environmental Management Plans* . Perth, Western Australia: Environmental Protection Authority.

EPA. (2018). *Statement of Environmental Principles, Factors and Objectives.* Prepared for the Government of Western Australia. Retrieved August 2018, from http://www.epa.wa.gov.au/statement-environmental-principles-factors-and-objectives

EPA. (2020). *Technical Guidance - Terrestrial vertebrate fauna surveys for environmental impact assessment.* Perth, WA: Environmental Protection Authority.

Geoscience Australia. (2022, May 15). *Astronomical Definitions | Geoscience Australia*. Retrieved from Australian Government | Geoscience Australia: https://www.ga.gov.au/scientific-topics/astronomical/astronomical-definitions

GSBL. (2020). *Phytophthora Dieback Survey Bunbury Outer Ring Road South.* Unpublished report prepared by Great Southern Bio Logic Pty Ltd (GSBL) for BORR IPT on behalf of Main Roads Western Australia.

Harper, M., Mccarthy, M. & van der Ree, R. (2008). Resources at the landscape scale influence possum abundance. *Austral Ecology*, 33, 243-252.

Jones, B. (2022). *Progress report: a monitoring record for part of the Bunbury population of the Western Ringtail Possum, Pseudocheirus occidentalis.* Bunbury, WA.

MRWA. (2010). *Design of Fauna Underpasses.* Main Roads Western Australia.

Office of the Appeals Convenor. (2022). *Appeals objecting to Report and Recommendations of EPA Report 1714 – Bunbury Outer Ring Road Southern Section.* Perth: Appeals Convenor's Report for the Minister for Environment.

QDMR. (2000). *A Brief Report on Pavement Deterioration Profiles (PDAT) p. 15.* Brisbane, Australia: Queensland Department of Main Roads. Asset Management Section : Road System Management Division.

Shedley, E., & Williams, K. (2014). *An assessment of habitat for Western Ringtail Possum on the southern Swan Coastal Plain (Binningup to Dunsborough).* Department of Parks and Wildlife.

TSSC. (2018a). *Conservation Advice Pseudocheirus occidentalis Western ringtail possum.* Department of the Environment and Energy.

TSSC. (2018b). *Conservation Advice Galaxiella nigrostriata black-stripe minnow.* Canberra: Department of the Environment and Energy. Retrieved from http://www.environment.gov.au/biodiversity/threatened/species/pubs/88677-conservation-advice-11052018.pdf

WRM. (2019). *Bunbury Outer Ring Road Alternate Alignment: Targeted Conservation Significant Aquatic Fauna Survey*. Unpublished report prepared for BORR IPT on behlaf of Main Roads Western Australia.

WRM. (2020a). *Bunbury Outer Ring Road Souther Investigation Area: Targeted Conservation Significant Aquatic Fauna Survey*. Unpublished report prepared for Main Roads Western Australia.

6 APPENDICES

Appendix	Title
Appendix A	Figures
Appendix B	Progress report: a monitoring record for part of the Bunbury population of the Western Ringtail Possum, *Pseudocheirus occidentalis* (Jones, 2022)

Appendix A: Figures

COLLEGE GROVE

DALYELLUP

GELORUP

STRATHAM

HENTY PLAINS

Bussell Highway

Western Highway

LEGEND

- Proposal Area
- Retention Vegetation Area
- Clearing Exclusion Areas
- Major Road

HARVEY
BUNBURY
CAPEL
BUSSELTON

SLIP POWERED BY LANDGATE

Paper Size ISO A3

0 250 500 750 1,000

Meters

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

N

BORR Team

Australian Government
BUILDING OUR FUTURE

mainroads WESTERN AUSTRALIA
BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

Main Roads Western Australia
Bunbury Outer Ring Road Southern Section

Proposal Area

Project No. **61-37041**
Revision No. **4**
Date **19/08/2021**

Overview

FIGURE 1

G:\61\37041\19_0_GIS\Maps\Working\BORR South Referral Update\Fauna EMP Update\6137041_001_BORRSouthProposalArea_Overview_Rev4.mxd
Print date: 19 Aug 2021 - 14:24

Data source: Geoscience Australia: GeoData Topo 250k Series III - 2006; Landgate: Roads - 20180501, Imagery - WA Now accessed 20210819; BORR: Proposal Area - 20191212, Vegetated Exclusion Area - 20210513. Created by: slei

Bussell Hwy

LEGEND

- Proposal Area
- Retention Vegetation Areas
- Clearing Exclusion Areas

Clearing category

- 1
- 2
- 3

***Pseudocheirus occidentalis* Observation**

Year 2019

- August 2019
- September 2019
- October 2019
- November 2019
- December 2019

Year 2020

- February 2020
- April 2020
- June 2020
- July 2020
- August 2020

SLIP POWERED BY LANDGATE

Paper Size ISO A3

0 100 200 300 400

Metres

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

N

BORR Team

Australian Government

BUILDING OUR FUTURE

BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

Main Roads Western Australia
Bunbury Outer Ring Road Southern Section

WRP habitat clearing categories

Project No. **61-37041**
Revision No. **4**
Date **20/08/2021**

FIGURE 2

G:\61\37041\19_0_GIS\Maps\Working\BORR South Referral Update\Fauna EMP Update\6137041_002_WRPClearingCategories_Rev4.mxd
Print date: 20 Aug 2021 - 10:39

Data source: Geoscience Australia: GeoData Topo 250k Series III - 2006; DBCA: *Pseudocheirus occidentalis* Habitat - 20200220; Landgate: Roads - 20180501, Imagery - WA Now accessed 20210820; BORR: Proposal Area - 20191212, Environmental Survey Area - 20200214; Biota: Western Ringtial Possum Observations - 20200130, Clearing categories - 20200317. Created by: slei

LEGEND

- Proposal Area
- Retention Vegetation Areas
- Clearing Exclusion Areas

Clearing category

- 1
- 2
- 3

***Pseudocheirus occidentalis* Observation**

Year 2019

- August 2019
- September 2019
- October 2019
- November 2019
- December 2019

Year 2020

- February 2020
- April 2020
- June 2020
- July 2020
- August 2020

1

2

Bussell Hwy

SLIP POWERED BY LANDGATE

Paper Size ISO A3

0 100 200 300 400

Metres

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

N

BORR Team

Australian Government

BUILDING OUR FUTURE

BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

mainroads WESTERN AUSTRALIA

Main Roads Western Australia
Bunbury Outer Ring Road Southern Section

WRP habitat clearing categories

Project No. **61-37041**
Revision No. **4**
Date **20/08/2021**

FIGURE 2

G:\61\37041\19_0_GIS\Maps\Working\BORR South Referral Update\Fauna EMP Update\6137041_002_WRPClearingCategories_Rev4.mxd
Print date: 20 Aug 2021 - 10:46

Data source: Geoscience Australia: GeoData Topo 250k Series III - 2006; DBCA: *Pseudocheirus occidentalis* Habitat - 20200220; Landgate: Roads - 20180501, Imagery - WA Now accessed 20210820; BORR: Proposal Area - 20191212, Environmental Survey Area - 20200214; Biota: Western Ringtial Possum Observations - 20200130, Clearing categories - 20200317. Created by: slei

Bussell Hwy

1

2

LEGEND

Proposal Area

Phascogale tapoatafa wambenger Habitat – Survey Area (91 ha)

Phascogale tapoatafa wambenger Record – Survey Area

Year 2018

- Feburary 2018
- March 2018
- August 2018
- October 2018

Year 2019

- August 2019
- November 2019
- December 2019

Year 2020

- Feburary 2020

SLIP POWERED BY LANDGATE

Paper Size ISO A3

0 100 200 300 400

Metres

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

N

BORR Team

Australian Government

BUILDING OUR FUTURE

mainroads WESTERN AUSTRALIA

BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

Main Roads Western Australia
Bunbury Outer Ring Road Southern Section

Phascogale observations and habitat extent within and adjacent to the Proposal Area

Project No. **61-37041**
Revision No. **1**
Date **12/05/2020**

FIGURE 3

G:\61\37041\19_0_GIS\Maps\Working\BORR South s40(2)(a)\Fauna EMP\6137041_007_BORRSouthPhascogale_Multipage_Rev1.mxd
Print date: 12 May 2020 - 15:33

Data source: Geoscience Australia: GeoData Topo 250k Series III - 2006; Landgate: Roads - 20180501, Imagery - WA Now accessed 20200512; BORR: Proposal Area - 20191212, Environmental Survey Area - 20200214; Biota: *Phascogale tapoatafa wambenger* Records, *Phascogale tapoatafa wambenger* Habitat - 20200313. Created by: slei

Bussell Hwy

1

2

LEGEND

Proposal Area

Phascogale tapoatafa wambenger Habitat – Survey Area (91 ha)

Phascogale tapoatafa wambenger Record – Survey Area

Year 2018

- Feburary 2018
- March 2018
- August 2018
- October 2018

Year 2019

- August 2019
- November 2019
- December 2019

Year 2020

- Feburary 2020

SLIP POWERED BY LANDGATE

Paper Size ISO A3

0 100 200 300 400

Metres

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

N

BORR Team

Australian Government

BUILDING OUR FUTURE

BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

Main Roads Western Australia
Bunbury Outer Ring Road Southern Section

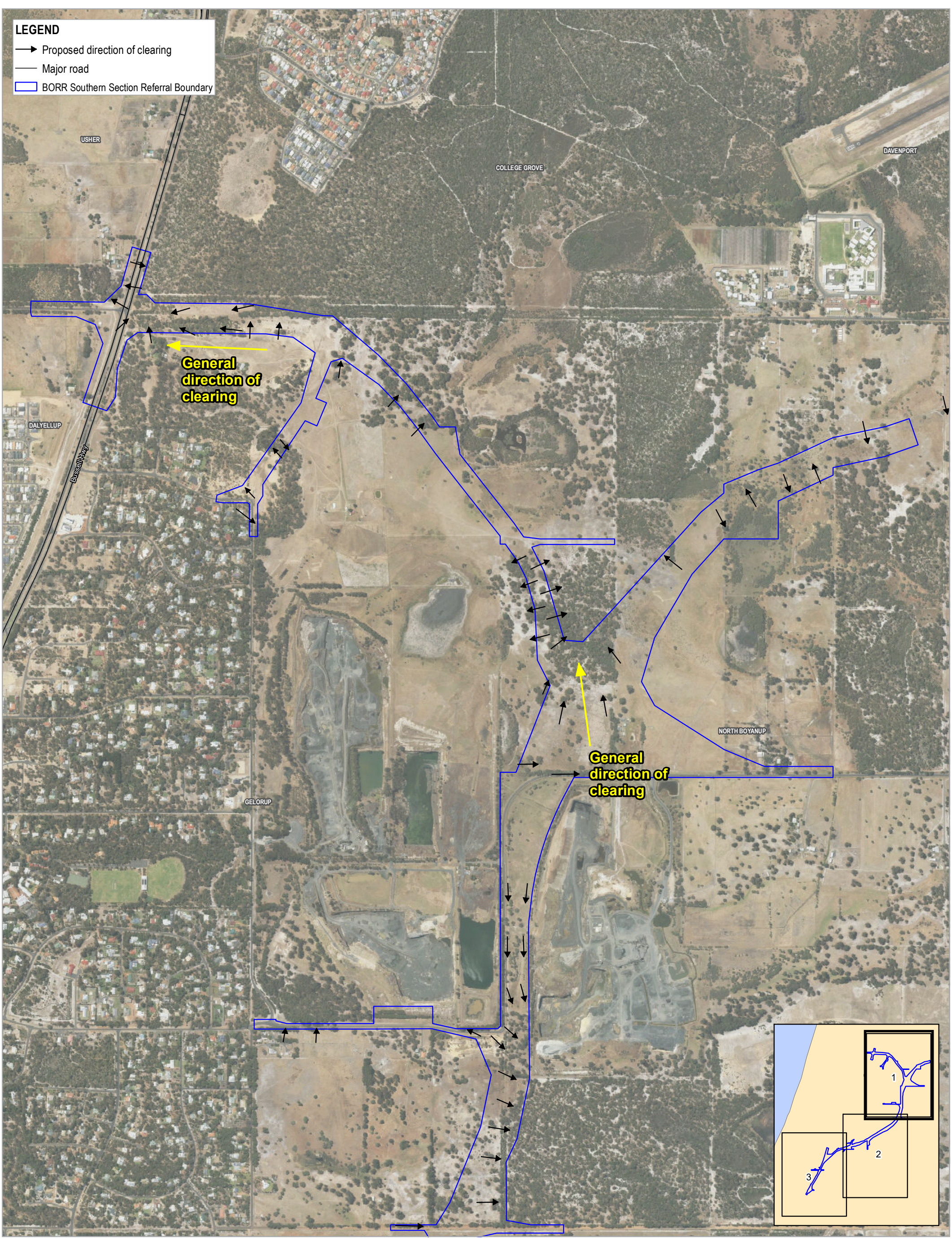
Phascogale observations and habitat extent within and adjacent to the Proposal Area

Project No. **61-37041**
Revision No. **1**
Date **12/05/2020**

FIGURE 3

G:\61\37041\19_0_GIS\Maps\Working\BORR South s40(2)(a)\Fauna EMP\61370411_007_BORRSouthPhascogale_Multipage_Rev1.mxd
Print date: 12 May 2020 - 15:33

Data source: Geoscience Australia: GeoData Topo 250k Series III - 2006; Landgate: Roads - 20180501, Imagery - WA Now accessed 20200512; BORR: Proposal Area - 20191212, Environmental Survey Area - 20200214; Biota: *Phascogale tapoatafa wambenger* Records, *Phascogale tapoatafa wambenger* Habitat - 20200313. Created by: slei



SLIP POWERED BY LANDGATE

Paper Size ISO A3

0 100 200 300 400

Metres

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

N

BORR Team

Australian Government

BUILDING OUR FUTURE

BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

mainroads WESTERN AUSTRALIA

Main Roads Western Australia
Bunbury Outer Ring Road Southern Section
Environmental Management Plan

Proposed Clearing and Clearing Staging

Project No. **61-37041**
Revision No. **2**
Date **20/08/2021**

FIGURE 4

G:\61\37041\19_0_GIS\Maps\Working\BORR South Referral Update\Fauna EMP Update\6137041_003_WRPClearingStaging_Rev2.mxd
Print date: 20 Aug 2021 - 11:53

Data source: BORR team: South referral boundary - 20191212, Clearing stages, directions - 20200317; Biota: WRP Observations - 2020; Landgate: Roads - 201805, Localities - 20180319, Imagery - WA Now accessed 20200317. Created by: slei

LEGEND

- Proposed direction of clearing
- Major road
- Retention Vegetation Area
- Clearing Exclusion Areas
- BORR Southern Section Referral Boundary

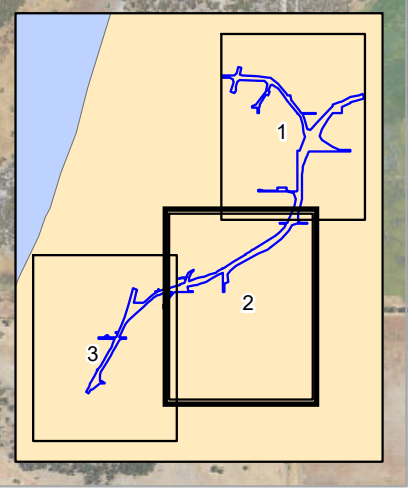
General direction of clearing

General direction of clearing

General direction of clearing

NORTH BOYANUP

GELORUP



SLIP POWERED BY LANDGATE

Paper Size ISO A3

0 100 200 300 400

Metres

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

N

BORR Team

Australian Government

BUILDING OUR FUTURE

BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

mainroads WESTERN AUSTRALIA

Main Roads Western Australia
Bunbury Outer Ring Road Southern Section
Environmental Management Plan

Proposed Clearing and Clearing Staging

Project No. **61-37041**
Revision No. **2**
Date **20/08/2021**

FIGURE 4

G:\61\37041\19_0_GIS\Maps\Working\BORR South Referral Update\Fauna EMP Update\6137041_003_WRPClearingStaging_Rev2.mxd
Print date: 20 Aug 2021 - 11:53

Data source: BORR team: South referral boundary - 20191212, Clearing stages, directions - 20200317; Biota: WRP Observations - 2020; Landgate: Roads - 201805, Localities - 20180319, Imagery - WA Now accessed 20200317. Created by: slei

LEGEND

- Proposed direction of clearing
- Major road
- Retention Vegetation Area
- Clearing Exclusion Areas
- BORR Southern Section Referral Boundary

DALYELLUP

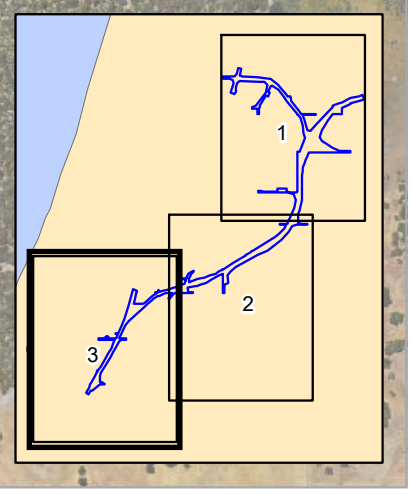
General direction of clearing

GELORUP

General direction of clearing

Bussell Hwy

STRATHAM



SLIP POWERED BY LANDGATE

Paper Size ISO A3

0 100 200 300 400

Metres

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

N

BORR Team

Australian Government

BUILDING OUR FUTURE

mainroads WESTERN AUSTRALIA

BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

Main Roads Western Australia
Bunbury Outer Ring Road Southern Section
Environmental Management Plan

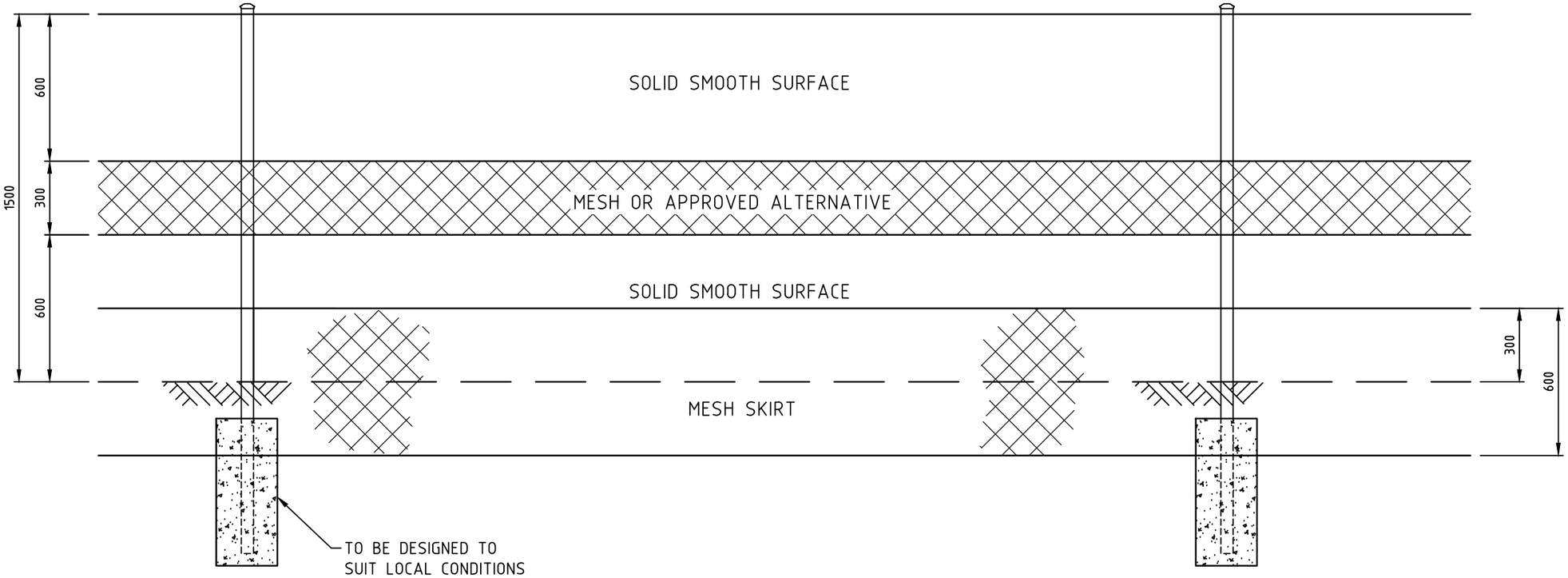
Proposed Clearing and Clearing Staging

Project No. **61-37041**
Revision No. **2**
Date **20/08/2021**

FIGURE 4

G:\61\37041\19_0_GIS\Maps\Working\BORR South Referral Update\Fauna EMP Update\6137041_003_WRPClearingStaging_Rev2.mxd
Print date: 20 Aug 2021 - 11:54

Data source: BORR team: South referral boundary - 20191212, Clearing stages, directions - 20200317; Biota: WRP Observations - 2020; Landgate: Roads - 201805, Localities - 20180319, Imagery - WA Now accessed 20200317. Created by: slei



AMENDMENTS

No.	DATE	DESCRIPTION	APPROVED

NOTES

1. SOLID MATERIAL TO BE CONTINUOUS METAL.
2. ANY POSTS TO BE ON ROADSIDE OF FENCE.
3. SUITABLE END TREATMENTS/STRAINER ASSEMBLIES TO BE DESIGNED TO SUIT LOCAL CONDITIONS.
4. REFER TO MRWA DRG No. 202002-0220 FOR MESH SKIRT DETAILS.

FIGURE 5

METADATA

GROUND SURVEY STANDARD:
DATE OF CAPTURE:
MAPPING SURVEY STANDARD:
DATE OF CAPTURE:
MAIN ROADS PROJECT ZONE:
HEIGHT DATUM:

mainroads WESTERN AUSTRALIA
METROPOLITAN & SOUTHERN REGIONS DIRECTORATE
SOUTH WEST REGION
ROBERTSON DRIVE BUNBURY 6230
Telephone(08) 9724 5600 Fax (08) 9724 5656

NOT TO SCALE

SCALE A3

FILE NUMBER 18/3958

DESIGNED / DRAWN A. SZELIGA 30/03/2020

VERIFIED

APPROVED

BUNBURY OUTER RING ROAD (H058)
FORREST HWAY (H057) TO BUSSELL HWAY (H009)
NORTHERN AND SOUTHERN SECTIONS
POSSUM FENCE CONCEPT PLAN

LOCAL AUTHORITY (211, 208, 206) SHIRE OF HARVEY, DARDANUP & CAPEL

MRWA DRAWING NUMBER 202002-0251

AMENDMENT

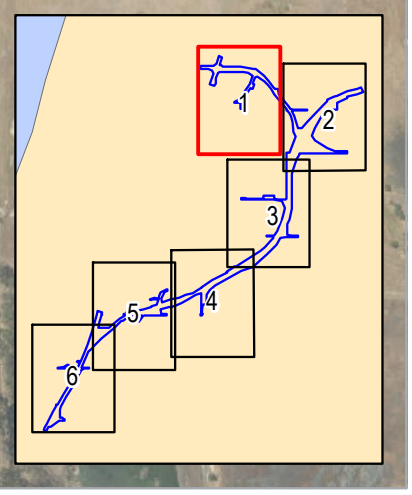
LEGEND

- BORR South Design
- BORR Southern Section Referral Boundary

Fauna Connectivity Structures

- Dual Use Culvert
- Fauna Rope Bridge
- Retaining Wall
- Combined Possum and Kangaroo Exclusion Fencing
- Kangaroo Exclusion Fencing
- Possum Exclusion Fencing

C31-



SLIP POWERED BY LANDGATE

Paper Size ISO A3

0 50 100 150 200

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

N

BORR Team

Australian Government
BUILDING OUR FUTURE

mainroads WESTERN AUSTRALIA
BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

Main Roads Western Australia
Bunbury Outer Ring Road Southern Section

Fauna Crossing Provisions and Exclusion Fencing Plan

Project No. **61-37041**
Revision No. **5**
Date **30 Jun 2022**

FIGURE 6

G:\61\37041\19_0_GIS\Maps\Working\BORR South Referral Update\Fauna EMP Update\6137041_004_PossumExclusionFencing_Rev4.mxd
Print date: 30 Jun 2022 - 14:04

Data source: BORR team: North design - 201908, North referral boundary - 20191016, Possum Exclusion Fencing Structure - 20210222; Biota: Western Ringtail Possum Records - 20200327, Possum habitat - 201910; Landgate: Imagery - WA Now accessed 20220630. Created by: bmorgan

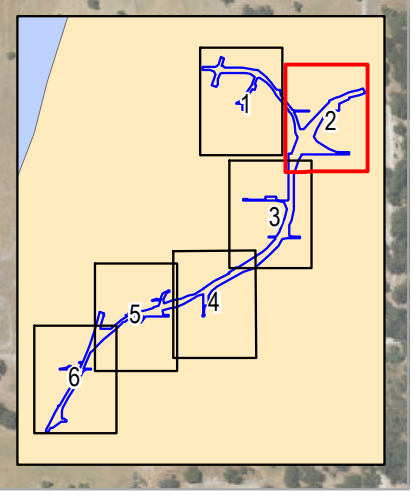
LEGEND

- BORR South Design
- BORR Southern Section Referral Boundary

Fauna Connectivity Structures

- Dual Use Culvert
- Combined Possum and Kangaroo Exclusion Fencing
- Kangaroo Exclusion Fencing

C31-024B
C31-024A
C31-023
C31-012A
C31-013A
C31-014A
C31-012B
C31-013B
C31-014B



SLIP POWERED BY LANDGATE

Paper Size ISO A3

0 50 100 150 200

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

N

BORR Team

Australian Government
BUILDING OUR FUTURE

BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

mainroads WESTERN AUSTRALIA

Main Roads Western Australia
Bunbury Outer Ring Road Southern Section

Fauna Crossing Provisions and Exclusion Fencing Plan

Project No. **61-37041**
Revision No. **5**
Date **30 Jun 2022**

FIGURE 6

G:\61\37041\19_0_GIS\Maps\Working\BORR South Referral Update\Fauna EMP Update\6137041_004_PossumExclusionFencing_Rev4.mxd
Print date: 30 Jun 2022 - 14:04

Data source: BORR team: North design - 201908, North referral boundary - 20191016, Possum Exclusion Fencing Structure - 20210222; Biota: Western Ringtail Possum Records - 20200327, Possum habitat - 201910; Landgate: Imagery - WA Now accessed 20220630. Created by: bmorgan

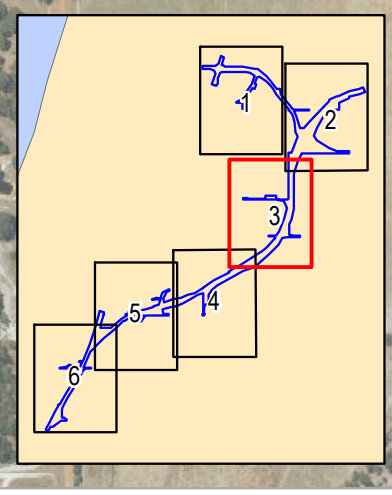
LEGEND

- BORR South Design
- BORR Southern Section Referral Boundary

Fauna Connectivity Structures

- Fauna Underpass (Box)
- Combined Possum and Kangaroo Exclusion Fencing
- Kangaroo Exclusion Fencing
- Possum Exclusion Fencing
- Possum Exclusion Fencing (Temporary)

C31-007



SLIP POWERED BY LANDGATE

Paper Size ISO A3

0 50 100 150 200

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

N

BORR Team

Australian Government
BUILDING OUR FUTURE

mainroads WESTERN AUSTRALIA
BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

Main Roads Western Australia
Bunbury Outer Ring Road Southern Section

Fauna Crossing Provisions and Exclusion Fencing Plan

Project No. **61-37041**
Revision No. **5**
Date **30 Jun 2022**

FIGURE 6

G:\61\37041\19_0_GIS\Maps\Working\BORR South Referral Update\Fauna EMP Update\6137041_004_PossumExclusionFencing_Rev4.mxd
Print date: 30 Jun 2022 - 14:04

Data source: BORR team: North design - 201908, North referral boundary - 20191016, Possum Exclusion Fencing Structure - 20210222; Biota: Western Ringtail Possum Records - 20200327, Possum habitat - 201910; Landgate: Imagery - WA Now accessed 20220630. Created by: bmorgan

LEGEND

- BORR South Design
- BORR Southern Section Referral Boundary
- Retention Vegetation Areas
- Clearing Exclusion Areas

Fauna Connectivity Structures

- Dual Use Culvert
- Fauna Land Bridge
- Fauna Rope Bridge (Under Bridge)
- Fauna Underpass (Arch)
- Fauna Underpass (Box)
- Noise Walls
- Retaining Wall
- Combined Possum and Kangaroo Exclusion Fencing
- Kangaroo Exclusion Fencing
- Possum Exclusion Fencing
- Possum Exclusion Fencing (Temporary)

UP9499

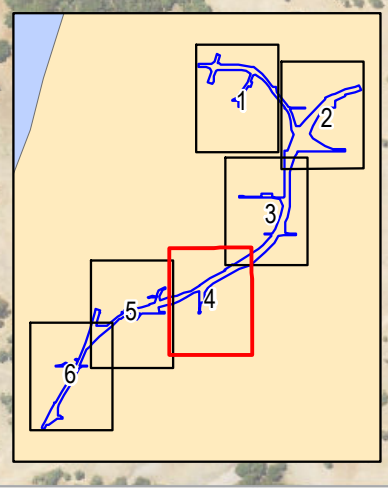
C32-003

C32-002

BR1916

C31-002

C31-00X



SLIP POWERED BY LANDGATE

Paper Size ISO A3

0 50 100 150 200

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

N

BORR Team

Australian Government
BUILDING OUR FUTURE

mainroads WESTERN AUSTRALIA
BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

Main Roads Western Australia
Bunbury Outer Ring Road Southern Section

Fauna Crossing Provisions and Exclusion Fencing Plan

Project No. **61-37041**
Revision No. **5**
Date **30 Jun 2022**

FIGURE 6

G:\61\37041\19_0_GIS\Maps\Working\BORR South Referral Update\Fauna EMP Update\6137041_004_PossumExclusionFencing_Rev4.mxd
Print date: 30 Jun 2022 - 14:05

Data source: BORR team: North design - 201908, North referral boundary - 20191016, Possum Exclusion Fencing Structure - 20210222; Biota: Western Ringtail Possum Records - 20200327, Possum habitat - 201910; Landgate: Imagery - WA Now accessed 20220630. Created by: bmorgan

LEGEND

- BORR South Design
- BORR Southern Section Referral Boundary
- Retention Vegetation Areas
- Clearing Exclusion Areas

Fauna Connectivity Structures

- Fauna Land Bridge
- Fauna Rope Bridge
- Fauna Rope Bridge (Under Bridge)
- Fauna Underpass (Box)
- Noise Walls
- Screen Walls
- Retaining Wall
- Combined Possum and Kangaroo Exclusion Fencing
- Kangaroo Exclusion Fencing
- Possum Exclusion Fencing

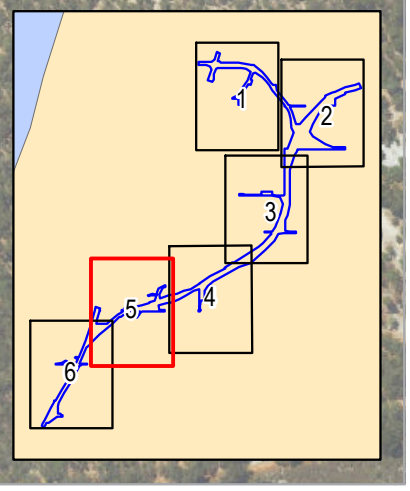
C3

C32-006

C32-005

C32-004

BR1916



SLIP POWERED BY LANDGATE

Paper Size ISO A3

0 50 100 150 200

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

N

BORR Team

Australian Government

BUILDING OUR FUTURE

BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

Main Roads Western Australia
Bunbury Outer Ring Road Southern Section

Fauna Crossing Provisions and Exclusion Fencing Plan

Project No. **61-37041**
Revision No. **5**
Date **30 Jun 2022**

FIGURE 6

G:\61\37041\19_0_GIS\Maps\Working\BORR South Referral Update\Fauna EMP Update\6137041_004_PossumExclusionFencing_Rev4.mxd
Print date: 30 Jun 2022 - 14:05

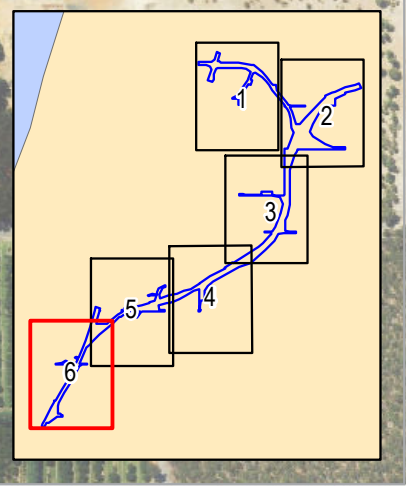
Data source: BORR team: North design - 201908, North referral boundary - 20191016, Possum Exclusion Fencing Structure - 20210222; Biota: Western Ringtail Possum Records - 20200327, Possum habitat - 201910; Landgate: Imagery - WA Now accessed 20220630. Created by: bmorgan

LEGEND

- BORR South Design
- BORR Southern Section Referral Boundary

Fauna Connectivity Structures

- Fauna Rope Bridge
- Fauna Underpass (Box)
- Noise Walls
- Retaining Wall
- Possum Exclusion Fencing



SLIP POWERED BY LANDGATE

Paper Size ISO A3

0 50 100 150 200

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

N

BORR Team

Australian Government
BUILDING OUR FUTURE

mainroads WESTERN AUSTRALIA
BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

Main Roads Western Australia
Bunbury Outer Ring Road Southern Section

Fauna Crossing Provisions and Exclusion Fencing Plan

Project No. **61-37041**
Revision No. **5**
Date **30 Jun 2022**

FIGURE 6

G:\61\37041\19_0_GIS\Maps\Working\BORR South Referral Update\Fauna EMP Update\6137041_004_PossumExclusionFencing_Rev4.mxd
Print date: 30 Jun 2022 - 14:05

Data source: BORR team: North design - 201908, North referral boundary - 20191016, Possum Exclusion Fencing Structure - 20210222; Biota: Western Ringtail Possum Records - 20200327, Possum habitat - 201910; Landgate: Imagery - WA Now accessed 20220630. Created by: bmorgan

Patch 1

Patch 2

Patch 3

Patch 4

BUSSELL HIGHWAY

Lillydale Road

Map Index

MAP 1

MAP 2

MAP 3

MAP 4

Location Map

KARRATHA

W A

KALGOORLIE

PERTH

Map Area

LEGEND

BORR South development envelope

BORR South category 1 clearing areas

WRP receiving sites

N

0 400

metres

Author: R Teale Drawn: P Sawers Job No.: 1660

Date: 23 Mar 2022 Revised: 1 July 2022

Projection: MGA Z50 (GDA94) Scale: 1:7,250 @ A3

Figure 7
BORR South - Map 1
Category 1 Clearing Areas
WRP Receiving Sites

Biota Environmental Sciences

Map Index

MAP 1

MAP 2

MAP 3

MAP 4

Patch 5

Ducane Road

Marchetti Road

Lot 301 Marchetti Road

Patch 6

Location Map

KARRATHA

W A

KALGOORLIE

PERTH

Map Area

LEGEND

BORR South development envelope

BORR South category 1 clearing areas

WRP receiving sites

N

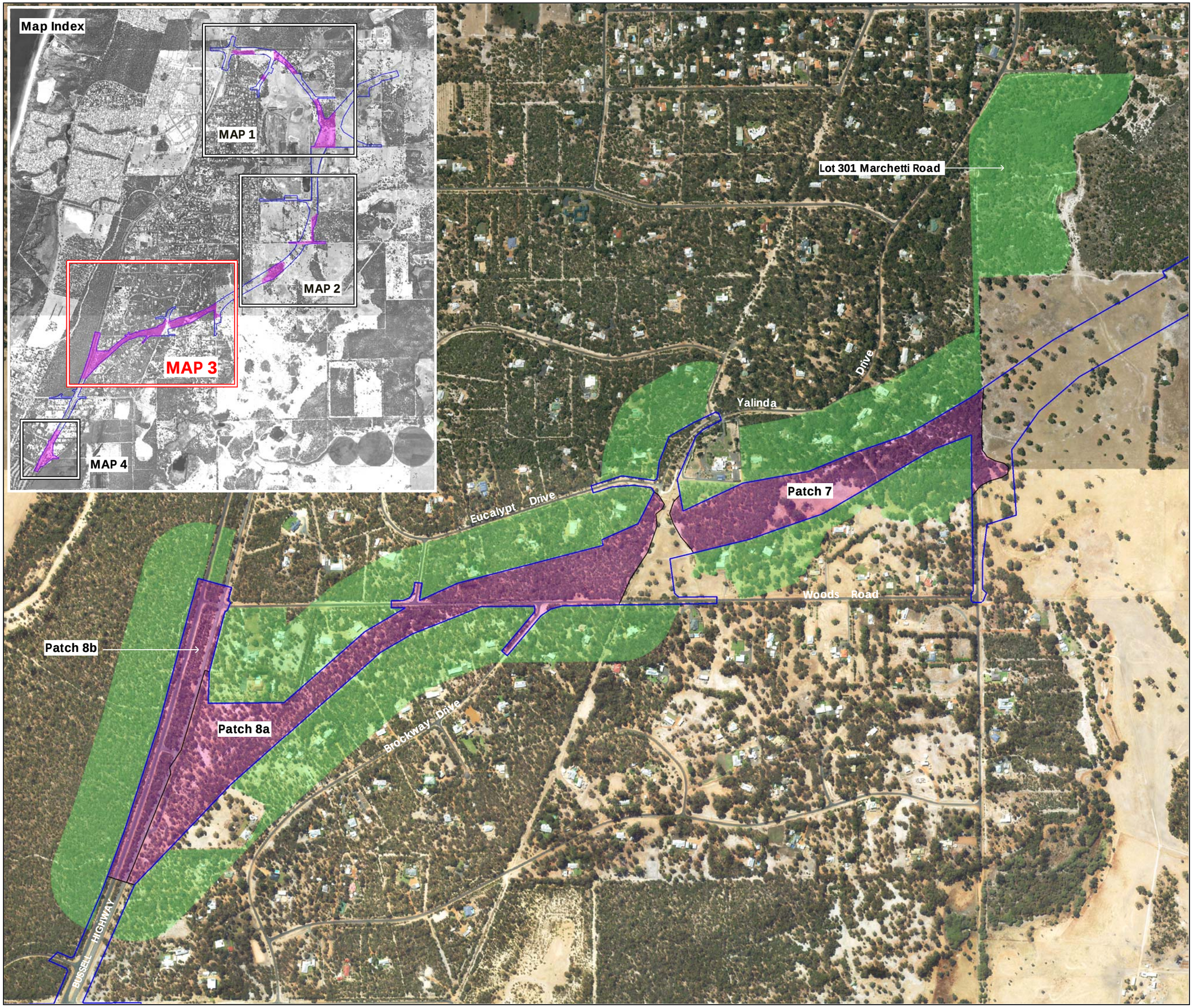
0 400

metres

Figure 7
BORR South - Map 2
Category 1 Clearing Areas
WRP Receiving Sites

Biota Environmental Sciences

Author: R Teale | Drawn: P Sawers | Job No.: 1660 | Date: 23 Mar 2022 | Revised: 1 July 2022 | Projection: MGA Z50 (GDA94) | Scale: 1:7,000 @ A3



LEGEND

- BORR South development envelope
- BORR South category 1 clearing areas
- WRP receiving sites

N

0 300

metres

Author: R Teale | Drawn: P Sawers | Job No.: 1660

Date: 23 Mar 2022 | Revised: 1 July 2022

Projection: MGA Z50 (GDA94) | Scale: 1:9,250 @ A3

Figure 7

BORR South - Map 3

Category 1 Clearing Areas

WRP Receiving Sites

Biota Environmental Sciences

Jaymon Road

Patch 9

BUSSELL HIGHWAY

Map Index

MAP 1

MAP 2

MAP 3

MAP 4

Location Map

KARRATHA

W A

KALGOORLIE

PERTH

Map Area

LEGEND

BORR South development envelope

BORR South category 1 clearing areas

WRP receiving sites

N

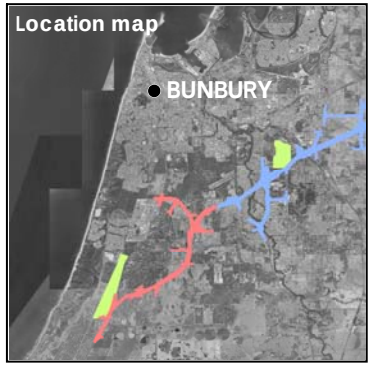
0 400

metres

Figure 7
BORR South - Map 4
Category 1 Clearing Areas
WRP Receiving Sites

Biota Environmental Sciences

Author: R Teale | Drawn: P Sawers | Job No.: 1660 | Date: 23 Mar 2022 | Revised: 1 July 2022 | Projection: MGA Z50 (GDA94) | Scale: 1:3,500 @ A3



LEGEND

- BORR South
- BORR Northern and Central Section
- Reference sites

N

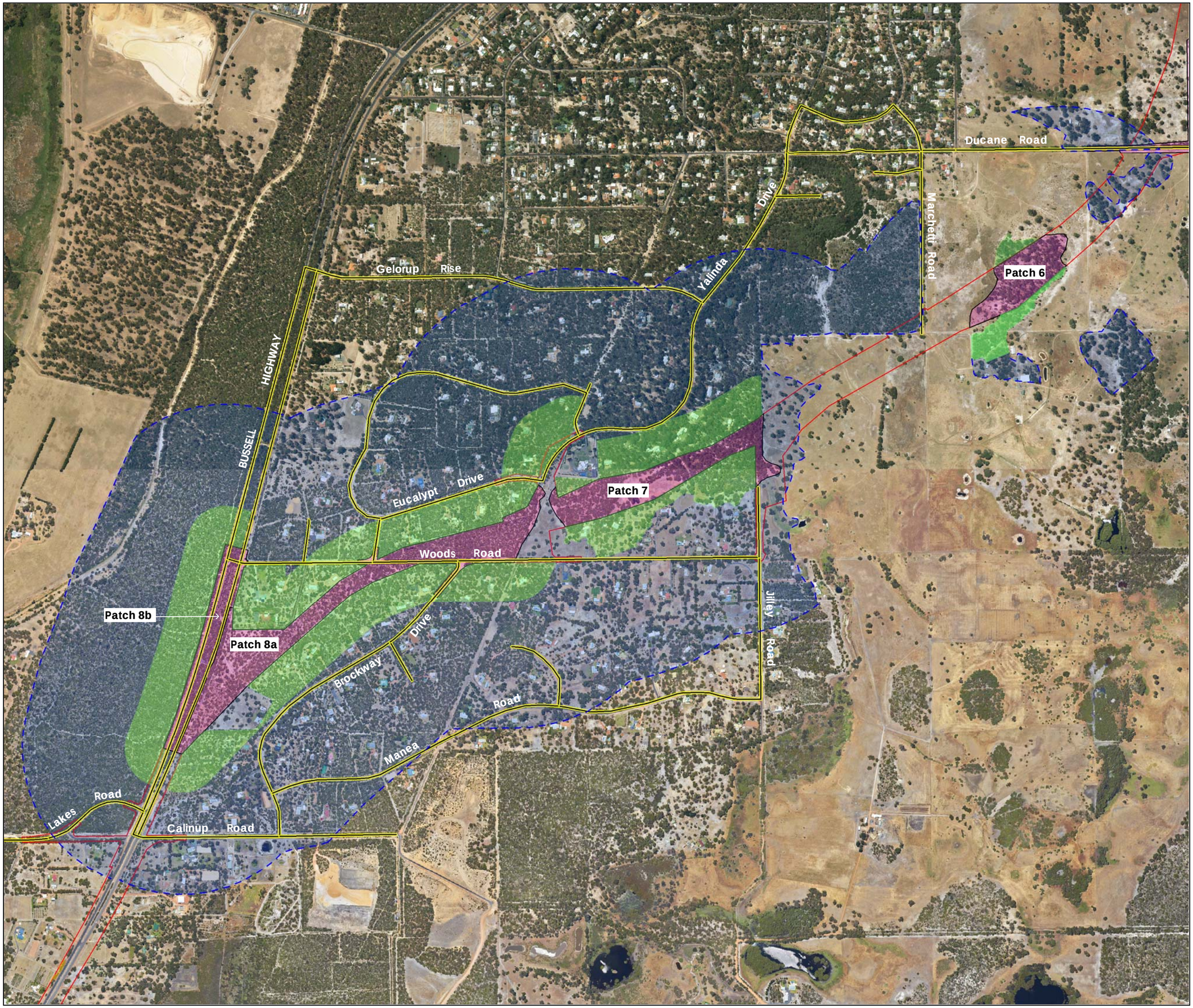
0 2

kilometres

Author: Biota **Drawn: P Sawers**
Job No.: 1660
Date: 20 May 2022 **Revised: 2 June 2022**
Projection: MGA Z50 **Scale: 1:50,000 @ A4**

Figure 8
BORR WRP Reference Sites

Biota Environmental Sciences



Location Map

LEGEND

WRP Targeted for Collars

- BORR South category 1 clearing areas
- WRP receiving & temporary receiving habitats
- Development envelope
- Search areas for collars
- Roads that can be used to locate collars (others will be used as required)

N

0 300

meters

Author: R Teale Drawn: P Sawers Job No.: 1660

Date: 16 May 2022 Revised: 20 May 2022

Projection: MGA Z50 (GDA94) Scale: 1:13,500 @ A3

Figure 9
BORR South Gelorup WRP Receiving Habitat & Telemetry Study

Biota Environmental Sciences

Figure 10. Lotek LiteTrack 30 collar

Appendix B: Progress report: a monitoring record for part of the Bunbury population of the Western Ringtail Possum, *Pseudocheirus occidentalis* (Jones, 2022)

Progress report: a monitoring record for part of the Bunbury population of the Western Ringtail Possum, *Pseudocheirus occidentalis*

Prepared for MRWA and Biota by Barbara Jones in April 2022

1. Background

The Western Ringtail Possum (WRP, *Pseudocheirus occidentalis*) is a threatened marsupial that is now relatively common in numerous parts of the west coastal strip between Dawesville and East Augusta. In the period 1970-1990 this possum was absent or very rare in most of this west-coastal strip, and common only in a limited area between Peppermint Grove Beach and Yallingup. During the period 2010-20 clear evidence was emerging and accumulating of scattered population increases from the 1970-1990 levels, particularly in the south, in the Margaret River area and township, and within the Augusta township, and further north around Australind and Bunbury, around Myalup and Binningup, and also between Dawesville and Martins Tank.

Main Roads Western Australia (MRWA) and Biota Environmental Services commenced a Bunbury WRP monitoring project in late 2019. The project aimed to track the seasonal and ongoing population trends for the southeastern part of the Bunbury WRP population in each of two substantial woodland remnants (of 146 ha and 88 ha, where the vegetation was expected to persist in a natural state) and in the occupied woodland patches within the nearby BORR Southern Section development envelope. This 290 ha monitoring footprint was recounted in alternate months. This brief summary describes population trends evident in the largest available WRP sample over the first 15 counts (spanning 29 months, October 2019 to February 2022) of this ongoing monitoring sequence. At this stage, it is envisaged that this bimonthly count schedule will continue into 2023.

All WRP counts used a 20 m wide strip sampling approach. These strips were pre-loaded onto map imagery and displayed on tablets (UniStrong UT 10) with a typical GPS accuracy of 1.5 m. An appropriately experienced zoologist walked centrally through the strip at a steady pace (typically 1-2 km/hr) using a high-powered head torch to detect animals.

The monitoring sequence shows population peaks associated with seasonal recruitment, and identifies those months of each year when counts were lower. The seasonal lows are of major interest for the management of habitat clearing, since these identify a regular part of each year when most WRP are mature and WRP numbers are lowest.

2. Population peaks and lows

In each of the two years with complete counts (2020, 2021), the lowest counts were in August (Table 1).

Table 1. WRP counts in 290 ha of Bunbury mixed woodland counted 15 times since October 2019

Count #	Year	Month	WRP counted	% down after each peak count
1	2019	October	365	
		November		
2		December	422	100%
	2020	*January*		
3		February	315	25%
		March		
4		April	294	30%
		May		
5		June	301	29%
		July		
6		August	270	36%
		September		
7		October	348	100%
		November		
8		December	296	15%
	2021	*January*		
9		February	255	27%
		March		
10		April	223	36%
		May		
11		June	211	39%
		July		
12		August	209	40%
		September		
13		October	295	100%

Count #	Year	Month	WRP counted	% down after each peak count
		November		
14		December	284	4%
	2022	*January*		
15		February	186	37%

In 2020 and 2021, the August minimum was followed by a peak count in October. In 2019, the peak count was in December. These observations suggest that WRP counts would have started rising in September, and peaked sometime within the two-month period October-November.

By the February counts (2020, 2021, 2022), WRP numbers were 25-35% lower than they had been on the recent peak count (October or December). By the August counts (2020, 2021), WRP numbers were 35-40% lower than they had been on the previous year's peak.

Figure 1 shows the WRP numbers averaged for two counts in each of three seasonal periods: a spring recruiting peak (Oct-Dec), and for autumn (Feb-Apr) and winter (Jun-Aug). The overall decline in WRP numbers evident in Figure 1 is discussed later, in Section 5.

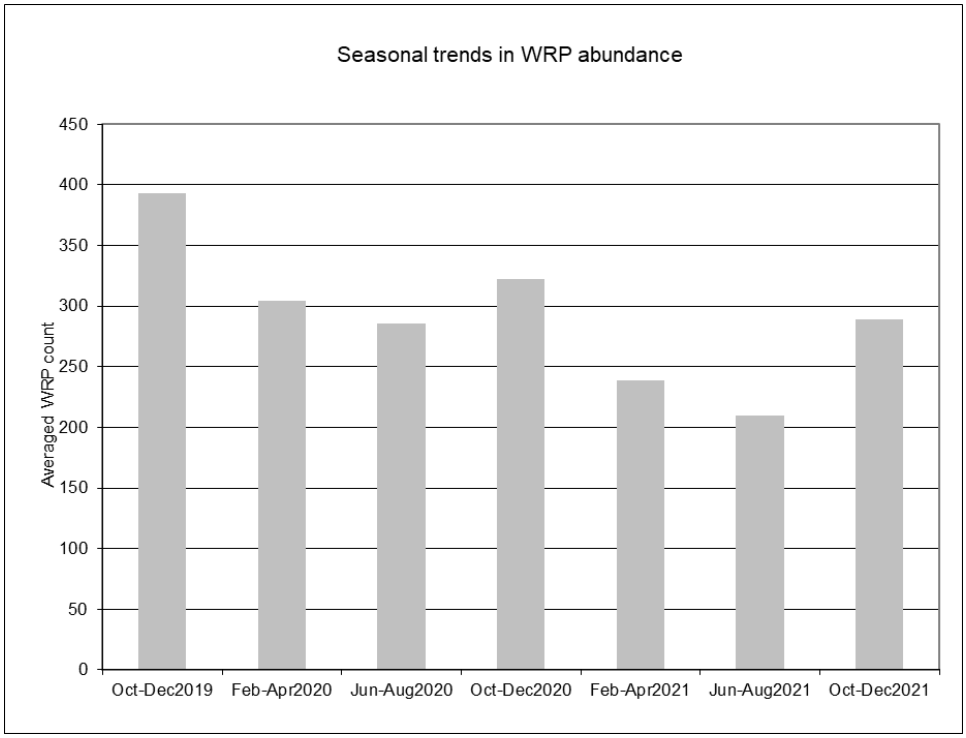


Figure 1. Seasonal trends in WRP abundance

3. Seasonal recruitment

The seasonal trends (Table 1) imply that, in the monitored habitat, most young were emerging from their mother's pouch after August, mostly during October, but also during September. However, the late 2019 counts peaked in December, confirming that, in some years, pouch young were still emerging during November. It is important to note that despite the strong October-December peak evident in this monitoring sequence (Figure 1), some females may not be strictly synchronized with the main peak.

Limited data from multiple sources (mostly Jones *et al* 1994, Ellis and Jones 1992, WRP Care Manual 2010 and Jones unpublished) relating to west-coastal WRP (mostly Ludlow & Busselton) suggests most young WRP can be expected to take about 10-12 weeks (after emergence) to reach their expected weaning weight of about 500-600 g. Hence, young that emerged around mid-September would be expected to be weaning in November, and young that emerged around mid-November would be weaning in January. By the time young WRP have reached 600 g, they are, in night counts, essentially indistinguishable from adults (body weights > 850 g).

In summary, the available monitoring record and the expected (west-coastal) post-emergent growth rates indicated that, between the months of September and January, immature WRP (< 500 g) were relatively common in the Bunbury habitat. By February, most surviving young from the previous seasonal peak would have been weaned, and be at, or approaching, adult weight (≥ 850-900 g).

Limited data suggests young WRP spend about 12-14 weeks in the pouch before they first emerge at around 100-120g. Weight records from WRP pouch young being fed on an artificial diet and regularly weighed (by wildlife carers) indicate that (uninjured) pouch young usually grow from about 60g to 110g in the last 3-4 weeks of their pouch life (WRP Care Manual 2010).

From my own field experience (Barbara Jones) the pouch remains tightly closed when a healthy female is carrying a pouch young smaller than about 65g (about 9-10 weeks old), even when these females are temporarily stressed by hand capture or diurnal shepherding. However, when females have older and heavier pouch young (> 85g) the pouch can open much more easily. Based on these considerations, and the available monitoring results, even in early August, most of the females in the monitoring sequence would have had pouch young that were less than, or much less than, 60g.

4. Clearing window for occupied BORR Southern Section WRP habitat

The monitoring sequence revealed that the period February – August (inclusive) had lower or much lower WRP counts than the peak season counts.

The monitoring sequence suggests that in autumn, most pouches would have been empty. By late May and June very small pouch young would have been present, but by late July the older pouch young would have still been smaller than 60-65g. By late August, some early females with a pouch young ready to emerge around mid-September would have had the heavier pouches that make these females more vulnerable to unusual disturbance.

These conclusions indicate that clearing of occupied (BORR S) WRP habitat should not be scheduled for the period of 24 weeks between mid August and the end of January. This prohibition protects each year's main recruiting effort. This leaves a period of 28 weeks from February 1st through to August 15 when WRP numbers are lower or lowest (mostly down by 25-35% versus the previous peak), and most animals are at or near adult body weight. During this 28-week period clearing could occur with predictably lower numbers of WRP within an approved clearing footprint.

5. Monitored decline

In the monitored habitat, the sharp declines highlighted by comparing the February counts with the December counts (Table 1) are consistent with an assumption that seasonal

conditions were contributing to a discernable level of WRP mortality during summer. The three February counts that are currently available (for 2020, 2021 and 2022) indicate an overall decline with about 20% of the Feb 2020 count gone by Feb 2021, and about 40% of the Feb 2020 count gone by February 2022.

WRP have long been known to be sensitive to dehydration, prolonged periods of higher temperatures, and SW rainfall deficits 2001-2015 (e.g. see details in Shedley and Williams 2014). These sensitivities have led to the conclusion that the SW's changing climate trends are likely to present serious impacts for distinctive populations, or for the species as a whole, either sooner or later. The monitored part of the Bunbury population is one of the driest parts of the species distribution. Weather records for the Bureau of Meteorology' Bunbury Station (9965) cover the years 1995-2022, and inform this discussion.

An examination of the seasonal heat loads for the three summer seasons within the monitoring sequence and for the 21 summer seasons prior to mid 2016 (Table 2) revealed some striking trends likely to be of substantial significance to the local WRP population. The three summers within the WRP monitoring period all started with unusual December heat, with 6-7 days ≥ 35°. During the previous 24 Decembers, 22 had fewer than 5 days ≥ 35°, and 11 had 0-1 days ≥ 35°. Prior to 2019 no Decembers had 7 days ≥ 35°, and only one December had 6 days ≥ 35°. In contrast to the unusually hot Decembers of the last three summers, the three Decembers preceding the start of the monitoring sequence (2016/17, 2017/18, 2018/19) were much milder, each with only 1 day ≥35°.

Table 2. Cumulative tally of days ≥ 35°C each summer (Bunbury BOM stn 9965).

Period	Year	Days ≥35 to Dec 31	Days ≥35 to Jan 31	Days ≥35 to Feb 28
1	1995/6	0	2	8
2	1996/7	1	6	7
3	1997/8	2	5	7
4	1998/9	1	2	6
5	1999/2000	5	10	11
6	2000/1	3	5	5
7	2001/2	0	1	2

Period	Year	Days ≥35 to Dec 31	Days ≥35 to Jan 31	Days ≥35 to Feb 28
8	2002/3	6	10	12
9	2003/4	1	2	5
10	2004/5	4	6	8
11	2005/6	0	1	4
12	2006/7	0	5	6
13	**2007/8**	2	7	14
14	2008/9	2	8	9
15	2009/10	4	10	16
16	**2010/11**	2	7	16
17	2011/12	2	10	13
18	2012/13	2	4	10
19	2013/14	2	8	9
20	2014/15	0	7	12
21	**2015/16**	2	5	11
22	2016/17	1	5	7
23	2017/18	1	2	2
24	2018/19	1	2	4
25	2019/20	**7**	9	13
26	2020/21	**7**	**13**	15
27	2021/22	6	**14**	**20**

Note: Shaded entries indicate record heatloads achieved after 2018.

The December-January periods of the summers of 2020/21 and 2021/22 also had more sustained heat loads than previous summers, with bimonthly totals of 13 and 14 days ≥35°. The previous 25 December-January periods had no more than 10 days ≥ 35°, and the 2019/2020 December-January period had 9 days ≥ 35°. Given the presence of young WRP in September-December, the December-January period would normally be important for weaning young and recently weaned young. These individuals can be expected to be especially vulnerable to unusually hot conditions.

An examination of the difference between the monthly average of the daily maximum temperature and the monthly median temperature (for 1996-2021) for the months of December, January and February (Figure 2) further highlights the unusual pattern of summer heat loads that prevailed during the monitoring period. The three summers 2016/17,

2017/18, and 2018/19 were unusually cool compared to the three summers of the monitoring period. It is reasonable to postulate that this provided the local population with three successive summers with adequate or good summer conditions for weaning and post-weaning young, contributing to the higher WRP numbers during 2019.

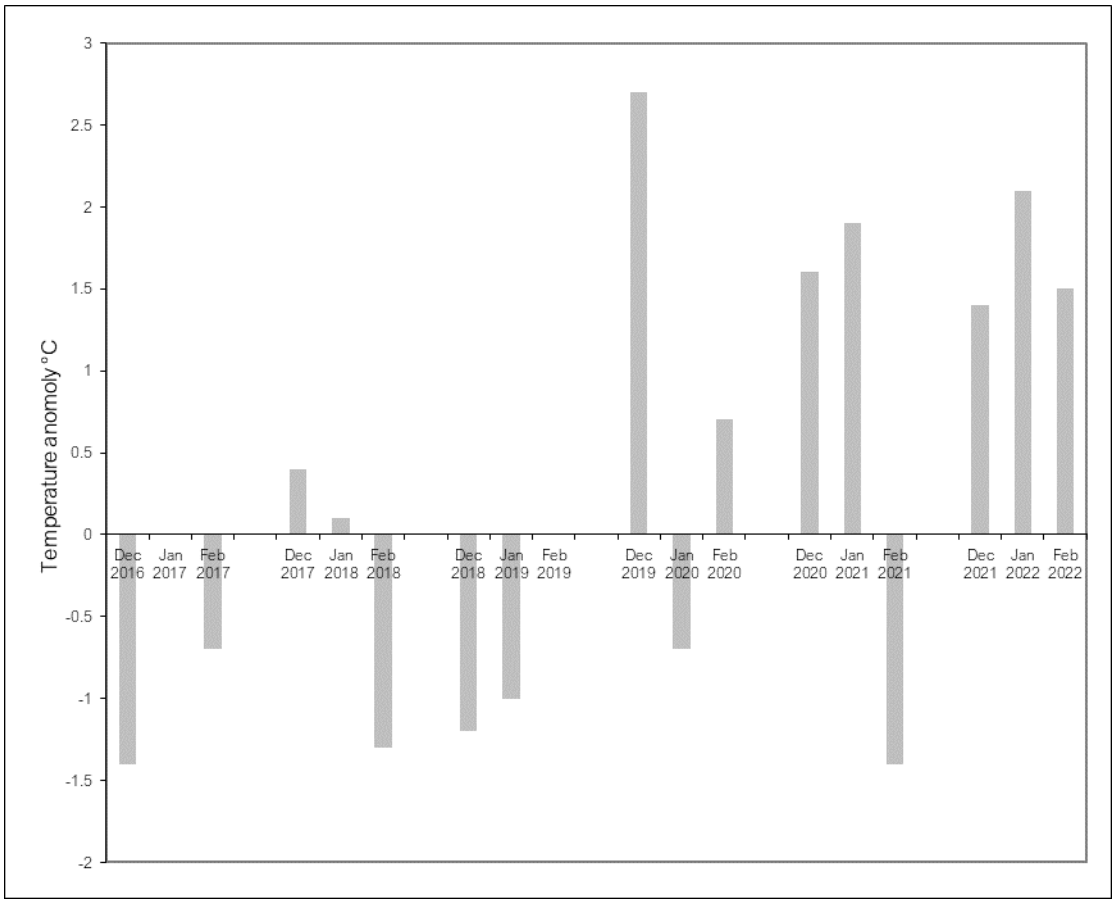


Figure 2. The monthly temperature anomaly [(monthly average maximum) - (the 1996-2021 median)] for BOM stn 9965 showing the three summers before WRP monitoring started and the three summers with WRP monitoring counts.

Disconcertingly, the three summers of the monitoring period appear to have been incrementally hotter for longer (Figure 2). If this trend continues, higher summer heat loads will challenge the seasonal recruitment patterns in Bunbury woodland remnants that had been suitable for adequately successful spring-summer recruitment up to 2020.

6. References

Care Manual Rehabilitation of Western Ringtail Possums. 2010. Possum Centre Busselton Inc 2010.

Ellis M and Jones B (1992) Observations of captive and wild western ringtail possums *Pseudocheirus occidentalis*. The Western Australian Naturalist 19:1-10

Jones BA, How RA and Kitchener DJ (1994) A field study of *Pseudocheirus occidentalis* (Marsupialia: Petauridae). II. Population studies. Wildlife Research, 21:189-201.

Shedley E and Williams K (2014) An assessment of habitat for western ringtail possum (*Pseudocheirus occidentalis*) on the southern Swan Coastal Plain. Unpublished report for the Department of Parks and Wildlife, Bunbury, Western Australia.