

# BORR Northern and Central Sections Environmental Management Plan – Conservation Significant Fauna

---



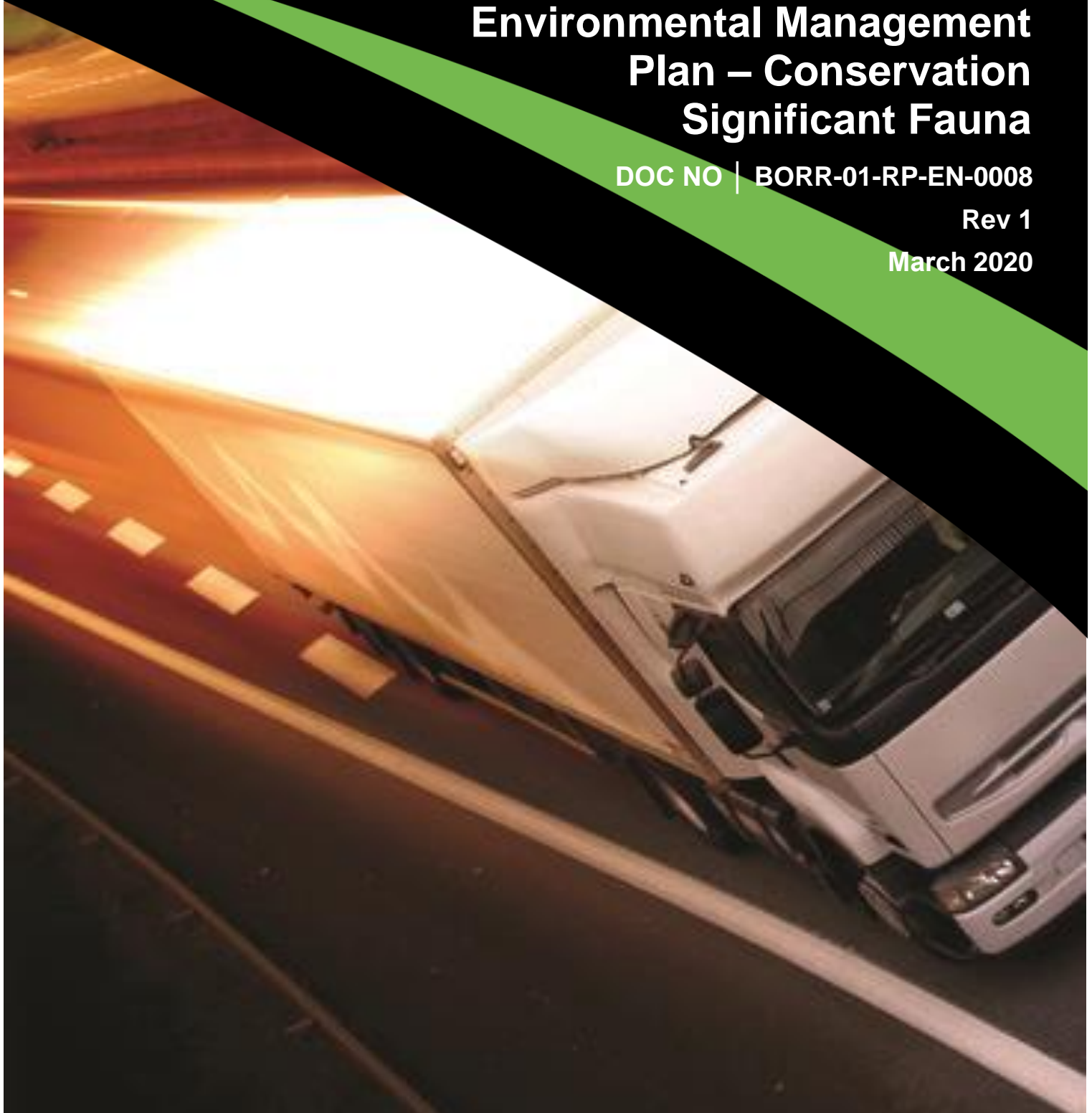
# Bunbury Outer Ring Road Northern and Central Sections

## Environmental Management Plan – Conservation Significant Fauna

DOC NO | BORR-01-RP-EN-0008

Rev 1

March 2020



---

## CONTENTS

<b>1. SUMMARY</b>	<b>1</b>
1.1 Purpose	1
<b>1. CONTEXT, SCOPE AND RATIONALE</b>	<b>2</b>
1.2 Proposal	2
1.3 Purpose and scope of this Environmental Management Plan	2
1.4 Key environmental factor and impacts	3
1.5 Rationale and approach	3
1.6 Index of Biodiversity Surveys for Assessments (IBSA)	8
<b>ENVIRONMENTAL MANAGEMENT PLAN PROVISIONS</b>	<b>9</b>
1.7 Management-based provisions	9
<b>ADAPTIVE MANAGEMENT AND REVIEW OF THE EMP</b>	<b>18</b>
1.1 Monitoring triggers, thresholds and contingency actions	18
1.1 EMP revision	24
1.2 Audits	24
<b>COMMUNICATION</b>	<b>25</b>
1.3 Stakeholder consultation	25
1.4 External communications and complaints	25
1.5 Reporting	25
<b>REFERENCES</b>	<b>26</b>

---

## TABLE INDEX

Table 1	Key environmental factors, values and impacts relevant to the Proposal EMP .....	3
Table 2	Studies and surveys relevant to the Proposal.....	3
Table 4	Management actions for Key Impacts and Risks .....	9
Table 10	Monitoring approach for Black-stripe Minnow .....	16
Table 11	Triggers, Thresholds and Contingency Actions - Western Ringtail Possum and Brush-tailed Phascogale .....	19
Table 12	Triggers, Thresholds and Contingency Actions - Carter's Freshwater Mussel.....	21
Table 13	Triggers, Thresholds and Contingency Actions - Black-stripe Minnow.....	22
Table 14	Stakeholder consultation summary .....	25

---

## FIGURES INDEX – APPENDIX A

Figure 1	The Proposal – Bunbury Outer Ring Road – Northern and Central Sections
Figure 2	WRP observations and habitat clearing categories

Figure 3	Clearing Staging Plans
Figure 4	Proposed Engineered Movement Structures and Possum Fencing
Figure 5	Carter's Freshwater Mussel Observations Within and Adjacent to the Proposal Area and Locations of Silt Curtains
Figure 6	Black Striped Minnow observations Within and Adjacent to the Proposal Area
Figure 7	Brush-tailed Phascogale Records Within and Adjacent to the Proposal Area

---

## APPENDICES

### Appendix A - Figures

Document Control					
Revision	Date	Description	Prepared	Reviewed	Approved
A	29/10/2019	Draft for Main Roads review	BORR IPT	FH	
B	29/01/2020	Rev 0	MRWA	MRWA	MRWA
C	01/03/2020	Rev 1	MRWA	NMc	GW

#### Disclaimer

This document is and shall remain the property of BORR Team. The document may only be used for the purposes for which it was commissioned and in accordance with the Terms of Engagement for BORR Team. Unauthorised use of this document in any form whatsoever is prohibited.

© BORR Team 2020



---

# 1. SUMMARY

## 1.1 Purpose

This Environmental Management Plan (EMP) is submitted in accordance with *Environmental Protection Act 1986* (EP Act) Section 40(2)(a) Notice Requiring Information for Assessment for the Northern and Central sections of the Bunbury Outer Ring Road (BORR), which will be developed by Main Roads Western Australia (Main Roads).

This document sets out the environmental management actions to manage, monitor and mitigate direct and indirect impacts of the proposal on the following conservation significant fauna:

- Western Ringtail Possum - (Critically endangered, Schedule 1)
- Carter's Freshwater Mussel - (Vulnerable, Schedule 3)
- Black striped Minnow - (Endangered, Schedule 2)
- Brush-tailed Phascogale - (Schedule 6)

Table 1 details the environmental management targets to measure achievement of the environmental objectives that must be met through implementation of the plan.

**Table 1 Purpose of the Environmental Management Plan**

Item	Description
<b>Title of proposal</b>	BORR North and Central
<b>Proponent name</b>	Main Roads Western Australia
<b>Purpose of the EMP</b>	This EMP is submitted to fulfil the requirements of the EPA's Section 40(2)(a) Notice Requiring Information for Assessment.  This EMP has been developed as a 'management-based' EMP to document management actions throughout the life of the Proposal (planning / design / implementation and operations).
<b>Key environmental factor</b>	Terrestrial Fauna
<b>EPA's environmental objective for the key environmental factor terrestrial fauna</b>	To protect terrestrial fauna so that biological diversity and ecological integrity are maintained.
<b>Environmental objective</b>	To ensure that impacts to conservation significant fauna are avoided and minimised as far as practicable during the construction and operation of the Proposal.
<b>Management Targets</b>	Management target 1: Construct and operate the Proposal to avoid and minimise impacts to conservation significant fauna.  Management target 2: Fauna underpasses and overpasses will be designed, situated and constructed using best practice guidelines, and based on data from site fauna surveys.  Management target 3: Avoid mortality of conservation significant fauna during construction.

---

## 2. CONTEXT, SCOPE AND RATIONALE

### 2.1 Proposal

The Commissioner of Main Roads is proposing to construct and operate the Northern and Central sections of the Bunbury Outer Ring Road (BORR) (the Proposal) (Figure 1, Appendix A). BORR is a planned Controlled Access Highway linking the Forrest Highway and Bussell Highway. The completed project will provide a high standard route for access to the Bunbury Port and facilitate proposed development to the east of the City of Bunbury. BORR will also provide an effective bypass of Bunbury for inter-regional traffic.

The proposed BORR comprises three sections:

- ‘BORR Northern Section’ – Forrest Highway to Boyanup-Picton Road
- ‘BORR Central Section’ – Boyanup-Picton Road to South Western Highway, an existing four km section which was completed in May 2013, along with a 3 km extension of Willinge Drive southwards to South Western Highway
- ‘BORR Southern Section’ – South Western Highway (near Bunbury Airport) to Bussell Highway.

This document refers to BORR Northern and Central Sections only. Construction of the Proposal is anticipated to commence in Quarter 1 (Q1) 2021 and continue for a period of 2-3 years.

### 2.2 Purpose and scope of this Environmental Management Plan

The Proposal was referred to the EPA under Section 38 of the EP Act in June 2019. The level of assessment set for the Proposal is ‘Additional Information Requirement’. One of the additional information items required is an Environmental Management Plan (EMP) addressing conservation significant fauna (this document). Specifically, this EMP has been prepared in response to a Notice Requiring Information for Assessment under section 40(2)(a) of the EP Act, dated 17 July 2019. The Notice specifies the following:

#### Terrestrial Fauna

- Provide supplemental information and append a fauna management plan to manage, monitor and mitigate direct and indirect impacts to the following conservation significant species:
  - Western Ringtail Possum (WRP) – (\*<sup>1</sup>critically endangered, \*\*schedule 1)
  - Carter’s Freshwater Mussel (CFM) – (\*vulnerable, \*\*schedule 3)
  - Black-stripe Minnow (BSM) – (\*endangered, \*\*schedule 2)
  - Brush-tailed Phascogale (BTP) – (\*\*schedule 6)
- Include detailed mapping within the EMP to illustrate impacts and the proposed mitigation and management measures.

This EMP has been prepared to ensure the EPA’s objective for terrestrial fauna will be met and to satisfy the EPA that Main Roads can manage the Proposal so that impacts to threatened fauna are acceptable. The EMP has been developed in accordance with the EPA Instructions on how to prepare *Environmental Protection Act 1986* Part IV Environment Management Plans (2018) and has taken into consideration relevant guidelines such as recovery plans, interim recovery plans, conservation advices and threat abatement plans.

The EMP includes the environmental management of activities to be undertaken by Main Roads, its employees and contractors.

This EMP has been developed as a ‘management-based’ EMP to document management actions throughout the life of the Proposal (implementation and operations). Management measures within this EMP are specific

---

<sup>1</sup> \* denotes Commonwealth status. \*\* denotes status in Western Australia.

to the Proposal and the species listed above and specifies management actions that are over and above 'business as usual' environmental management practises.

A Construction Environmental Management Plan (CEMP) will be prepared by the Construction Contractor and include the management actions detailed in this EMP and Main Roads 'business as usual' environmental management measures. The CEMP will be prepared prior to, and implemented to minimise and manage impacts to the above conservation significant species.

### 2.3 Key environmental aspects and impacts

Implementation of the Proposal will result in clearing of up to 44 hectares (ha) of conservation significant fauna habitat within the 625 ha Proposal Area. The Proposal also has the potential to indirectly impact on conservation significant fauna and their habitat in uncleared and adjacent areas during the construction and operation. Table 2 summarises the environmental aspects, impacts and activities for this key environmental factor.

**Table 2 Key environmental factors, impacts and activities relevant to the Fauna EMP**

Environmental Aspect of Proposal	Affected Species	Impact	Activity
Clearing of native Vegetation	<ul style="list-style-type: none"> <li>Western Ringtail Possum</li> <li>Carter's Freshwater Mussel</li> <li>Black-stripe Minnow</li> <li>Brush-tailed Phascogale</li> </ul>	Loss of habitat and ecological connectivity (habitat/population fragmentation).	<ul style="list-style-type: none"> <li>Loss of habitat</li> <li>Loss of ecological connectivity leading to increased risk of loss of genetic diversity and ecological diversity.</li> <li>Severance of ecological linkages.</li> <li>Increased risk of fire, disease and predation due to loss of shelter.</li> <li>Potential for fauna to be killed or injured by construction machinery during construction activities other than clearing.</li> </ul>

### 1.2 Rationale and approach

For each of the threatened fauna species listed above, the EMP details:

- Management measures to address potential impacts, including fauna injury/mortality and habitat loss and connectivity.
- Monitoring programs developed for each of the species, where direct and indirect impacts may occur; and
- A response framework including triggers, thresholds and contingency actions.

The development of the EMP has been informed by the results of baseline surveys and is based on the assumptions and uncertainties stated in Section 1.2.2.

#### 1.2.1 Survey and study findings

The following studies and surveys have been undertaken within, or are relevant to, the Proposal (Table 3).

**Table 3 Studies and surveys relevant to the Proposal**

Survey / report name	Location / extent in survey area	Methodology
Bunbury Outer Ring Road Northern and Central Section Targeted Fauna Assessment (Biota, 2020)	Surveyed of entire 625 ha Proposal Area	Day and night targeted field surveys conducted over the surveyed area (plus four WRP reference sites within an 18 km radius) in late winter and spring 2018. Methodology consistent with EPA Technical Guidance (EPA, 2016).

Survey / report name	Location / extent in survey area	Methodology
Bunbury Outer Ring Road Northern and Central Investigation Area: Targeted Conservation Significant Aquatic Fauna Survey (WRM, 2020)	12 assessment sites	Sampling of five creek/river sites and seven wetlands undertaken over four consecutive days in November 2018. Methodology was consistent with that used by others in similar surveys across Australia.
BORR Northern and Central Sections Drainage Strategy (BORR IPT, 2018)	BORR Northern and Central sections alignment	Outlines broad strategies for management of surface water throughout the Proposal Area, including flood mitigation and maintaining surface water flows to wetlands and agricultural land.
Bunbury Outer Ring Road (Northern and Central) WRP Surveys 2019 - on-going (unpublished survey results)	BORR Northern and Central sections alignment and two reference sites	Targeted field surveys conducted over the surveyed area in August 2019, October 2019, December 2019 and February 2020 consistent with EPA Technical Guidance (EPA, 2016). These surveys will be on-going during 2020.

### 1.2.2 Ecological Connectivity

The Proposal predominantly extends north-south, potentially disrupting east-west terrestrial and aquatic habitat connectivity, as well as reducing or removing terrestrial linkages north and south along existing road corridors, especially at the BORR / Forrest Highway interchange and the BORR / Boyanup Picton Road interchange.

### 1.2.3 Key assumptions and uncertainties

The key assumption and uncertainties within this plan include:

- Fauna underpasses and fauna bridges are effective in maintaining ecological linkages.
- 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 mortality during construction activities (clearing and plant movement).
- Mobile fauna will disperse in front of clearing activities.
- Possum fencing (combined with noise and screen walls) will exclude WRP and BTP from the road during construction and operations limiting the potential for mortality of these species.
- Road reserve boundary fencing will exclude fauna from the road during construction and operations limiting the potential for mortality of these species.
- The relevant studies and surveys have accurately recorded the presence of all conservation significant fauna species within the Proposal Area.
- Existing cleared areas within the Proposal Area 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 objective.
- If any conservation significant species assumed not to occur in the Proposal Area are subsequently recorded, the proposed management actions would ensure there are no additional impacts.

More information on the key assumptions and uncertainties are provided in the appendices of the BORR North and Central Environmental Referral Supporting Document (BORR IPT, 2019).

#### 1.2.4 Management approach

The management approach has been informed by best practice and Main Roads experience on road projects in Western Australia. The hierarchical approach taken focuses on avoiding ecologically sensitive areas through, for example, route selection and design refinement. Where not able to be avoided, management aims to minimise the intensity and/or extent of impacts on fauna during construction. Any significant unavoidable residual impacts on fauna will be offset through an Environmental Offset Strategy.

The management measures proposed are based on field studies and surveys, and relevant information provided in species Recovery Plans where they exist.

The following Recovery Plans and Conservation Advice have informed the development of this EMP:

- Department of Parks and Wildlife (2017). Western Ringtail Possum (*Pseudocheirus occidentalis*) Recovery Plan
- Threatened Species Scientific Community (TSSC) (2018a). Conservation Advice *Galaxiella nigrostriata* Black-stripe Minnow
- Threatened Species Scientific Community (TSSC) (2018b). Conservation Advice *Westralunio carteri* Carter's Freshwater Mussel
- Department of Conservation and Land Management(2002). Brush-tailed Phascogale *Phascogale tapoatafa* (Meyer, 1793) Species Profile.

It is noted that although there is no recovery plan in place for the brush-tailed phascogale:

*“in working towards effective conservation of the western ringtail possum, other species with similar habitat needs to the western ringtail possum are likely to benefit. Such threatened fauna species include Baudin's cockatoo, brush-tailed phascogale, Chuditch, Carnaby's cockatoo, forest red-tailed black cockatoo”* (DBCA, 2017)

#### 1.2.5 Rational for Choice of Provisions

##### 1.2.5.1 Western Ringtail Possum

Western Ringtail Possum (WRP) have been recorded throughout and adjacent to the Proposal Area as shown at Figure 2 (Appendix A).

During project planning, Main Roads has taken steps to avoid and / or minimise impacts to WRP, reducing the area of habitat to be cleared by approximately 26 ha (from approximately 70 ha to 44 ha), and therefore the number of WRP home ranges likely to be disrupted. A summary of the original impact, design changes and resulting impact is presented within the BORR North and Central Environmental Assessment on Referral Information (BORR IPT, 2019).

The Proposal will result in the loss of up to 44 ha of WRP habitat within the 625 ha Proposal Area. The habitat to be cleared is currently fragmented, dissected by existing roads, easements and cleared agricultural land as shown at Figure 2 (Appendix A).

The approach to WRP management during the clearing operations is focused on pre-clearing surveys, WRP monitoring during clearing works, timing of clearing (when WRP are at/near their expected seasonal low), sensitive clearing practises and staged clearing operations to encourage WRP to move into adjacent habitat beyond the clearing area. Although primarily arboreal, WRPs are known to move on the ground.

The approach of allowing WRP to self-relocate to adjacent habitat has been selected over the more traditional approach of animal translocation as it is considered to provide the best outcome in terms of animal welfare. The success rates of documented WRP translocation projects is poor, and as yet no successful methodology has been developed or implemented (Clarke 2011; De Tores 2004). Allowing WRP to relocate to adjacent habitat of their own accord avoids the need for translocation and handling animals, substantially reducing the likelihood of WRP being put under undue stress. Their mobile nature also makes their familiarity with adjacent habitat, which may be part of their existing home range likely. Given the linear nature of the majority of clearing and the size of individual home ranges, it is anticipated that WRPs will initially relocate into other parts of their home range.

WRP habitat clearing protocols have been developed based on WRP site surveys and observations, and the potential for WRP use. Habitat clearing categories within the Proposal Area have been developed in consultation with Barbara Jones and are based on her WRP knowledge and the results of recent targeted WRP surveys within the Proposal Area completed to date (August 2019, October 2019, December 2019 and February 2020).

The habitat clearing categories are shown at Figure 2 (Appendix A) and the habitat clearing protocols for each are detailed in Table 4. The habitat clearing category mapping may be updated based on the results of additional on-going WRP surveys of the Proposal Area to be conducted during 2020.

**Table 4 WRP Habitat Clearing Categories**

Habitat Clearing Category	Description	Clearing Management
1	Resident WRP regularly observed. Resident and transient WRP expected to be encountered during clearing.	<p>Clearing to be conducted during the period of February to August.</p> <p>Temporary supplementary watering points (a minimum of 2 per hectare) will be installed and maintained in potential WRP/BTP to be retained at least 6 weeks prior to clearing commencing.</p> <p>Temporary dreys (a minimum of 2 per hectare) will be installed and maintained in potential WRP/BTP habitat to be retained at least 6 weeks prior to clearing commencing.</p> <p>One clearing operation per Habitat Clearing Category 1 patch at a time.</p> <p>Maximum clearing area of 1 ha per day per Habitat Clearing Category 1 patches with a total of 5 ha per week.</p> <p>Temporary possum exclusion fencing to be install during staging to exclude WRP from re-entering the work area.</p> <p>Two fauna spotters per machine conducting clearing operations.</p> <p>Clearing to be conducted as per the Proposed Clearing and Clearing Staging Plans.</p> <p>(Note: Main Roads preliminary surveys suggest that for the Bunbury area, most mature females have pouch young or young at heel between August and December. This will be confirmed by on-going WRP monitoring to be conducted during 2020.)</p>
2	Monitored habitat patches that were often not utilised. These areas are considered not suitable for resident WRP breeding females but may be used by a transient animal for the short term. High probability of no WRP being encountered during clearing.	<p>Habitat Clearing Category 2 areas to be cleared prior to clearing Habitat Clearing Category 1 areas.</p> <p>One fauna spotter per machine conducting clearing.</p>
3	Other WRP habitat. These areas include small areas of isolated remnant vegetation and	<p>Habitat Clearing Category 3 areas to be cleared prior to clearing Habitat Clearing Category 1 and 2 areas.</p> <p>One fauna spotter per machine conducting clearing.</p>

Habitat Clearing Category	Description	Clearing Management
	<p>paddock trees. The habitat is considered to be unsuitable for resident WRP but may be used by a transient animal for the short term.</p> <p>Very high probability of no WRP being encountered during clearing.</p>	

WRP habitat connectivity will be retained / re-established in the longer term through the installation of underpasses/rope bridges (engineered movement structures) connected to adjacent habitat. Multiple structures at several locations have been proposed, as shown in Figure 4 (Appendix A). Four different designs are proposed to be used for WRP underpasses, as shown in Figure 4 (Appendix A). This includes one design that has been successfully utilised for a nearby Main Roads project, where an underpass connects the riparian zones along the Collie River in Australind. The proposed monitoring detailed below will assess the effectiveness / use of the different designs by WRP.

Possum fencing will be installed adjacent at known habitat areas to exclude WRP moving onto the road. The fencing will be 1.5 m high and be constructed to prevent possums being able to climb it or dig under it. Possum fencing is proposed to be both permanent and temporary (minimum of five years). Possum fencing has been located based on the Habitat Clearing Categories, targeted WRP surveys and adjacent habitat patches as shown on Figure 4 (Appendix A). The possum fence will be constructed in addition to noise and screen walls to exclude possum movements from adjacent habitat onto the road carriageway.

#### 1.2.5.2 Carter’s Freshwater Mussel

Carters Freshwater Mussel (CFM) were observed in the Proposal Area, see Figure 5 (Appendix A).

This species is acutely sensitive to salinity, >1.6 g/L, and its distribution has been reduced as a result of secondary salinisation of waterways in the south west of Western Australia (Kluzinger *et al.* 2012). Sedimentation to the point of burying mussels has been reported to cause mortality in CFM (IUCN 2019).

During the planning of the project and development of the BORR Drainage Strategy, consideration has been given to minimise the potential for impacts to waterways (and therefore habitat for CFM) by maintaining existing surface water flows during and following construction. Changes to the Proposal design have removed the requirement for bridge piers or abutments in any water courses. The Proposal will not directly impact any known CFM habitat.

The Proposal is considered unlikely to exacerbate any of the threats listed in the conservation advice for this species (Threatened Species Conservation Committee, 2017). The construction of new bridges across potential CFM habitat may provide positive outcomes for the species. Studies of habitat requirements for CFM indicate that bridges may create preferred habitat for the species (Klunzinger *et al.*, 2015; Hastie *et al.*, 2000), as the shade created by the bridge provides cooler conditions that are beneficial to the species.

Through the clearing controls and pre-clearing surveys, potential for impacts during construction will be carefully managed.

The risk of other potential impacts, such as contamination through spills and sedimentation of waterways will also be managed through implementation of appropriate procedures to be included in the CEMP.

#### 1.2.5.3 Black-stripe Minnow

The BSM was recorded within the referral boundary for the Proposal, see Figure 6 (Appendix A).

The Proposal may affect local populations of the BSM by reducing the connectivity between sections of habitat and reducing the overall areas of seasonal wetlands.



To reduce the potential indirect impacts on BSM, the BORR Drainage Strategy has been prepared to minimise the potential for impacts to wetlands and waterways (including as habitat for BSM) during and following construction of the Proposal.

Clearing and disturbance of BSM habitat will be carefully managed throughout construction. The proposed drainage related monitoring that will be undertaken for BSM is detailed below.

Impacts to existing hydrology will be mitigated through the implementation of the Drainage Strategy which aims to maintain hydrological conditions as far as possible, and connectivity between habitats through use of suitable drainage design e.g. culvert design and construction to allow movement of fish.

The risk of other potential impacts, such as contamination of waterways through spills, will also be managed through implementation of appropriate procedures to be included in the CEMP.

#### **1.2.5.4 Brush-tailed Phascogale**

BTP were recorded within the Proposal Area (Figure 7, Appendix A).

BTP habitat within the Proposal Area consists of jarrah woodland, which also comprises WRP habitat. Modifications to the detailed design and maintenance of movement pathways to avoid impacts to WRP will similar mitigate impacts to BTP.

Management measures proposed for WRP will also address potential impacts on BTP as the species share similar habitat types.

### **1.3 Index of Biodiversity Surveys for Assessments (IBSA)**

The electronic Index of Biodiversity Surveys for Assessments (IBSA) data package has been submitted with this EMP, in accordance with the EPA *Instructions for the Preparation of Data Packages for IBSA*.



## 3. ENVIRONMENTAL MANAGEMENT PLAN PROVISIONS

### 1.3 Management-based provisions

This section describes management actions that address potential impacts on conservation significant fauna species.

#### 1.3.1 Objectives

The management measures have been developed to achieve the EPA's objective *"to protect terrestrial fauna so that biological diversity and ecological integrity are maintained"* by minimising and managing impacts to terrestrial fauna species and provide fauna movement pathways. The key impacts and risks to conservation significant fauna associated with the construction of the Proposal are:

- Habitat Loss
- Mortality of conservation significant fauna
- Loss of ecological connectivity
- Disturbance of adjacent habitat
- Changes to exiting surface water hydrology and drainage patterns.

#### 1.3.2 Management Actions

The management measures developed 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.

**Table 5 Management actions for Key Impacts and Risks**

Key Impacts/Risks	Management action
<b>Habitat clearing</b>	<ul style="list-style-type: none"> <li>• All WRP and BTP habitat that is to be retained within the development envelope will be surveyed and delineated with temporary fencing prior to site works to ensure it is conserved.</li> <li>• No night time clearing of vegetation.</li> <li>• Cleared vegetation will be woodchipped immediately or transported at least 100 m from possum habitat before further processing.</li> <li>• Movement / disturbance of clearing stockpiles will be confined to the period one hour after sunrise and / or one hour prior to sunset.</li> </ul>
<b>Building demolition</b>	<ul style="list-style-type: none"> <li>• All buildings requiring demolition for the Proposal will be inspected for possums and BTP for two days prior to demolition works.</li> <li>• Where possums 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.</li> <li>• An experienced zoologist / environmental scientist / fauna-spotter will be on-site at all times during the demolition of buildings suspected or observed to house possum or BTP.</li> <li>• Machinery operators will maintain radio communication with their spotter.</li> <li>• Any pest animal baits used in buildings to be demolished will be in bait stations.</li> </ul>
<b>Mortality of Conservation Significant Fauna</b>	<p><b>Sensitive clearing protocols</b></p> <ul style="list-style-type: none"> <li>• Spotlighting of potential WRP and BTP habitat will be undertaken by a suitably experienced person for two nights immediately prior to clearing.</li> </ul>

Key Impacts/Risks	Management action
	<ul style="list-style-type: none"> <li>• Pre-clearing fauna searches shall be conducted immediately prior to and during clearing operations and will include hollows, dreys, ground debris, dense ground-level vegetation, fallen timber and logs.</li> <li>• Clearing will be conducted congruent with the habitat clearing categories as detailed at Table 3 and shown in Figure 3 (Appendix A).</li> <li>• Vacant dreys will be removed prior to clearing where they are accessible.</li> <li>• Vacant tree hollows suitable for possums will be removed or blocked prior to clearing where they are accessible.</li> <li>• If WRP or BTP are observed during clearing operations, the tree containing the animal shall be left for up to 48 hours to allow for the animal to vacate, while clearing continues in adjacent vegetation. If the tree continues to be occupied after 48 hours, the animal will be coerced / moved to a safe area outside of the clearing footprint by the appointed zoologist / environmental scientist / fauna spotter.</li> <li>• Trees, as noted above, that are observed to support WRP and / or BTP after 48 hours will be ‘bumped gently’ with a machine prior to felling. The operator and spotter will wait and observe the tree for a short time. If the animal remains in the tree it shall be pushed over slowly onto vegetation within the clearing area that is yet to be cleared. The ‘soft felling’ of habitat trees will provide a ‘cushion’ for the vegetation being felled, minimising the risk of injury to the animal and allowing any WRP and BTP present with the opportunity to safely vacate.</li> <li>• Felled trees with hollows will be checked immediately for fauna after felling and prior to further processing. If it is not possible to fully inspect the hollow the tree will be left on the ground overnight to allow time for any undetected fauna to vacate.</li> <li>• Habitat clearing is to be staged, commencing from existing edge lines / roads and progressing towards habitat that will be retained to direct WRP and BTP towards these areas as per the Clearing and Clearing Staging (Figure 3, Appendix A).</li> <li>• A post-clearing survey shall be undertaken immediately following each days clearing operations and the following morning to identify the presence of any injured animals.</li> <li>• Possum fencing (temporary and permanent) will be installed adjacent at known habitat areas to exclude WRP moving onto the road (Figure 4, Appendix A). The fencing will be 1.5 m high and be constructed to prevent possums being able to climb it or dig under it.</li> </ul> <p><b>Terrestrial Fauna Handling</b></p> <ul style="list-style-type: none"> <li>• Fauna handling will only be conducted by a suitably experienced persons ie zoologist / fauna spotter.</li> <li>• Any WRP and BTP showing signs of injury or illness will be caught, bagged and taken to an experienced veterinarian.</li> <li>• If an injured WRP and 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.</li> <li>• All treatment of injured fauna will be undertaken by a veterinarian.</li> <li>• Where clearing operations abut existing roads, in addition to standard traffic management measures, visual message boards will be installed to warn drivers of the potential for fauna to cross the road during clearing operations.</li> </ul> <p><b>Aquatic Fauna Relocation</b></p> <ul style="list-style-type: none"> <li>• Refinement to the Proposal design mean that no direct impact to CFM habitat is anticipated (no piers of bridge abutments located in water course).</li> <li>• Relocation of CFM would only be triggered in response to sedimentation of water ways resulting from construction activities. If required, relocation will be conducted in consultation with the Department of Biodiversity Conservation and Attractions or the Fisheries Branch of the Department of Primary Industries and Regional Development.</li> </ul>

Key Impacts/Risks	Management action
<b>Loss of Ecological Connectivity</b>	<ul style="list-style-type: none"> <li>• Install permanent possum rope bridges / underpasses at key location(s) to enable fauna including WRP and BTP to move between retained habitat areas, see Figure 4 (Appendix A), including but not limited to: <ul style="list-style-type: none"> <li>- Across the existing Forrest Highway to facilitate movement within existing habitat east and west of the highway.</li> <li>- Across Clifton Road to facilitate movement north to the Brunswick River.</li> <li>- Across the Proposal Area at the Paris Road interchange to facilitate movement to the Brunswick River.</li> <li>- At the Picton Boyanup interchange to connect retained vegetation.</li> <li>- At the Collie, Ferguson and Preston Rivers to facilitate movement along the riverine vegetation.</li> </ul> </li> <li>• The size and design of all movement devices will be based on MRWA Design of Fauna Underpass (MRWA, 2010), topography at the site, expert advice (Barbara Jones, pers. comm.) and information from relevant studies and reports (Van der Ree et al, 2008; QDMR, 2000).</li> <li>• Underpass dimensions will be based on the fauna recorded or expected to occur in the vicinity, Figure 4 Appendix A.</li> <li>• The final underpass designs will incorporate the following features known to encourage use by fauna and reduce the risk of predation: <ul style="list-style-type: none"> <li>- Connection to nearby habitat via overhead rope hawsers (100m diameter) and poles (minimum 2.5m high).</li> <li>- Objects for fauna to shelter on, under or in (furniture) will be locally sourced and will include sand, mulch, logs and rocks.</li> <li>- Revegetation using fast growing species at underpass entrances to provide cover for animals approaching, entering and leaving the underpasses.</li> <li>- Natural flooring such as sand or gravel.</li> <li>- Possum fencing to direct fauna towards the underpass entrance.</li> <li>- Dual-use underpasses will have a concrete substrate and will not contain furniture (furniture would be washed away by drainage flows).</li> </ul> </li> <li>• Install a suitable culvert at to maintain habitat connectivity for BSM during construction at the drainage line where it has been located at the southern end of the Proposal.</li> </ul>
<b>Impacts to fauna in adjacent habitat</b>	<ul style="list-style-type: none"> <li>• Install possum fence adjacent to known habitat areas to limit WRP access to the Proposal Area, see Figure 4, Appendix A.</li> <li>• The possum fence will be 1.5 m high and be constructed to prevent possums being able to climb it or dig under it.</li> <li>• Road construction activities (i.e. activities undertaken after clearing has been completed) adjacent to WRP and BTP habitat will only be undertaken during daylight hours until a fauna fence has been installed.</li> <li>• The Proposal Area boundary will be fenced according to the detailed design to restrict pedestrian and vehicular access to retained WRP and BTP habitat.</li> <li>• Install silt curtains up and downstream of the Collie, Ferguson and Preston River bridge construction areas.</li> <li>• Install silt fences as required at the Collie, Ferguson and Preston River bridge construction areas.</li> </ul>
<b>Hydrology and drainage changes</b>	<ul style="list-style-type: none"> <li>• Long term hydrocarbon storage (i.e. hydrocarbons which shall not be used that day or not stored within equipment waiting to be used) or re-fuelling of equipment (with the exception of stationary plant) will not be permitted within 50 m of CFM habitat.</li> <li>• The Construction Contractor will prepare a Spill Response Procedure for oil, chemical or hazardous material spill events to ensure any spill is contained effectively and cleaned up appropriately and efficiently with approved materials.</li> <li>• Through detailed design, maintain hydrologic connections between BSM habitat areas to enable fish movement.</li> </ul>

Key Impacts/Risks	Management action
	<ul style="list-style-type: none"> <li>Design and construction of drainage to maintain surface water flows and groundwater regimes consistent with the pre-disturbance condition (baseline) as far as practicable.</li> <li>Prior to any interruption of current surface water flows or fish pathways, culverts will be installed.</li> </ul>

### 1.3.3 Management Targets

Management targets will be used to measure and report achievement against the environmental objective (Table 6).

**Table 6 Management targets**

Key Impacts/risk	Management target
<b>Habitat clearing</b>	Compliance with pre-defined clearing limits and boundaries described within approvals documents.
<b>Mortality of Conservation Significant Fauna</b>	<p>No incidents of conservation significant fauna injury or death within the Proposal Area during construction that are attributable to clearing and construction activities.</p> <p>No incidents of WRP and BTP injury or death within the Proposal Area during construction due to vehicle strike.</p>
<b>Loss of Ecological Connectivity</b>	<p>WRP and BTP are able to access retained areas of habitat that were accessible prior to Proposal construction.</p> <p>Areas of WRP and BTP habitat that are severed as a result of Proposal construction are connected to allow WRP and BTP movement.</p>
<b>Impacts to fauna in adjacent habitat</b>	<p>Minimise disturbance of conservation significant fauna in adjacent areas due to secondary impacts.</p> <p>CFM continue to be present in areas they inhabited prior to construction.</p> <p>CFM continue to be present both up and downstream from the Proposal construction area.</p> <p>Integrity of habitat quality is maintained to sustain CFM.</p>
<b>Hydrology and drainage changes</b>	<p>Maintain existing surface water hydrology of CFM and BSM habitat.</p> <p>No impact from hydrocarbons or chemicals from accidental spills to CFM and BSM habitat.</p>

### 1.3.4 Monitoring

The purpose of monitoring is to inform, through the management targets, if the environmental objectives are being achieved, and whether management actions need to be reviewed or revised.

Monitoring will be undertaken for each management target as detailed in Table 7. The method, location, parameters and frequency of monitoring is specified. Early warning indicators provide advance warning that a management target may not be met. The results of monitoring will be compared against these indicators and will enable actions to be put in place to control the contributing processes so that the management objective can be met.

**Table 7 Monitoring to measure the efficacy of management actions against the management targets**

Key Impacts/risk	Monitoring	Reporting
<b>Habitat clearing</b>	Prior to clearing, the final road design will be assessed against the proposed clearing area to ensure the required clearing area is less than the approved amount.	Annual reporting of the amount of conservation significant fauna habitat cleared, and monitoring undertaken.
<b>Mortality of Conservation Significant Fauna</b>	<p>Daily construction area assessments to visually check / review clearing boundaries and assess vegetation clearing.</p> <p>Pre and post clearing fauna assessments conducted.</p> <p>Post-clearing assessments of fallen trees.</p> <p>Pre-demolition fauna assessments.</p> <p>Pre-removal checks of vegetation stockpile areas.</p>	Prepare report annually and or in response to exceedance of an agreed trigger or threshold.
<b>Loss of Ecological Connectivity</b>	<p>Review of design reports and drawings at 50% design and IFC (issued for construction) to ensure WRP and BTP bridges / underpasses are designed and incorporated into the Proposal.</p> <p>Bi-annual monitoring during construction to ensure WRP and BTP bridges / underpasses are installed as per the detailed design.</p> <p>Quarterly monitoring for scats beneath rope bridges and in underpasses for five years post-construction.</p> <p>Installation and monitoring of motion sensor IR cameras at rope bridges and in underpasses for five years post construction.</p> <p>During construction and for three years post construction, annual winter monitoring and maintenance program implemented to check for damage to BSM habitat and / or blockages to fish pathways.</p> <p>Monitor water quality parameters critical to BSM survival (including turbidity, pH, temperature, salinity, BOD) during construction (quarterly) of each section of BORR and for three years post construction (biannually).</p> <p>Monitor annually for presence of BSM in known habitat areas and in at least one reference area for three years post-construction.</p>	Prepare report annually and or in response to exceedance of an agreed trigger or threshold.
<b>Impacts to fauna in adjacent habitat</b>	<p>Biannual monitoring of WRP and BTP in potential impact sites (retained habitat at the Paris / Clifton interchange Boyanup Picton Rd interchange) and current reference sites (Lot 2 Boyanup Picton Road and Reserve 23 000 Bussell Highway) during construction and biannually for three years post construction.</p> <p>Monitor possum fence installation and maintenance during construction and biannually for five years post-construction.</p> <p>Monitor water quality parameters critical to CFM survival (including turbidity, pH, temperature, salinity, BOD) upstream of the Collie River bridge site during construction (quarterly) and for three years post construction (biannually).</p>	Prepare report annually and or in response to exceedance of an agreed trigger or threshold.

Key Impacts/risk	Monitoring	Reporting
	Monitor annually during construction and for three years post construction for presence of CFM in known habitat areas within the Proposal Area (Collie River) and in one reference site (Preston River).	
<b>Hydrology and drainage changes</b>	<p>Opportunistic and weekly visual inspection of offsite discharges from the Proposal Area into CFM habitat.</p> <p>Quarterly monitoring of surface and groundwater to detect any changes in hydrology impacting CFM and BSM habitat during construction.</p> <p>Opportunistic and weekly visual inspection during construction for evidence of erosion or sedimentation of CFM and BSM habitat attributable to the Proposal. Biannual inspections post –construction.</p>	Prepare report annually and or in response to exceedance of an agreed trigger or threshold.

### 1.3.5 Western Ringtail Possum and Brush-tailed Phascogale monitoring program

#### Objective

The objectives of the monitoring program are to

1. conduct WRP surveys in areas of retained habitat and compare the survey results with the reference sites,
2. obtain evidence of use by WRP of underpasses and possum rope bridges, and
3. obtain detected / undetected data for BTP and build a record of where BTP have been sighted.

Monitoring for impacts to WRP and BTP will be conducted at both reference sites and areas of retained habitat abutting the Proposal Area. The monitoring will comprise scat counts and nocturnal surveys to be conducted by a suitably experienced zoologist / environmental scientist.

#### Reference sites and potential impact sites

Main Roads has commenced monitoring of two reference sites outside of the Proposal Area. These two sites are located abutting the existing BORR Stage 1 (Lot 2 Boyanup Picton Road) and Reserve (23 000) abutting Bussell Highway in Gelorup. Any loss of WRP presence at potential impact sites will be compared with those in the reference sites. This will enable determination of the likelihood of impacts having resulted from Proposal.

#### Monitoring approach

The monitoring program is detailed in Table 8.

**Table 8 Monitoring approach for Western Ringtail Possum and Brush-tailed Phascogale**

Monitoring parameter	Methodology	Frequency and duration	Recording
Presence / absence	Nocturnal survey in monitored vegetation and reference sites	<p>Biannual survey of WRP and BTP in potential impact sites (retained habitat at the Paris / Clifton interchange, Boyanup Picton Rd interchange), Forrest Highway / Raymond Road intersection and current reference sites (Lot 2 Boyanup Picton Road and Reserve 23 000 Bussell Highway) during construction.</p> <p>Biannually for three years post construction.</p>	Field data recorded appropriately and stored electronically

Monitoring parameter	Methodology	Frequency and duration	Recording
Possum fence installation	Visual Assessment	Monitor possum fence installation and maintenance during construction and biannually for three years post-construction.	
Installation and utilisation of possum bridges and underpasses	Visual Assessment WRP and or BTP scats of varying ages detected in underpasses Motion sensor camera monitoring	Quarterly monitoring for scats beneath rope bridges and in underpasses for five years post-construction.  Installation and intermittent monitoring of motion sensor IR cameras at rope bridges and in underpasses for five years post construction.	

### Data analysis

Field data will be collated and reviewed after each monitoring survey. Analysis will include comparison of data and trends between seasons and years, and also between reference sites and potential impact sites.

#### 1.3.6 Carter's Freshwater Mussel monitoring program

Monitoring for impacts to CFM will be conducted at both reference sites and potential impact site (Collie River) within the Proposal Area. A reference site will be established at the Preston River for the purposes of providing comparative species and population trend data. Monitoring will comprise sampling and visual assessments, and will include photo monitoring. Monitoring will be conducted by a suitably experienced zoologist / environmental scientist.

### Reference sites and potential impact sites

Baseline data collection at monitoring sites will commence early 2020. Any changes in conditions at potential impact sites will be compared with those in the reference site. Note: if relocation should be required, monitoring of CFM during construction will focus on relocation and reference site and include the impact site following replacement of CFM following completion of construction (during operational phase). This will enable determination of the likelihood of impacts having resulted from Proposal.

The monitoring program is detailed in Table 9.

**Table 9 Monitoring approach for Carter's Freshwater Mussel**

Monitoring parameter	Methodology	Frequency and duration	Recording
Water quality The following water quality parameters, known to be significant to the species, will be monitored: <ul style="list-style-type: none"> <li>• Conductivity</li> <li>• Turbidity</li> <li>• pH</li> <li>• Temperature</li> <li>• Oxidation-reduction potential</li> <li>• BOD</li> </ul>	Sampling using appropriate water quality meters and / or laboratory analysis	Quarterly during construction and biannually for three years post construction upstream and downstream of the Collie River bridge site.	Field data recorded and stored electronically
Presence / absence	Visual assessment	Monitor annually during construction and for three years post construction for presence of CFM in known	Field data input to recording sheets and stored electronically



Monitoring parameter	Methodology	Frequency and duration	Recording
		habitat areas within the Proposal Area (Collie River) and in one reference site (Preston River).	
Habitat condition, including: <ul style="list-style-type: none"> <li>bank stability including evidence of erosion / sedimentation</li> <li>condition and functioning of installed silt curtain / fence</li> <li>condition / presence of adjacent riparian vegetation</li> </ul>	Visual assessment and photo-point	Opportunistically and weekly during construction and biannually for three years post construction	Photos labelled and stored appropriately  Habitat condition data input to recording sheets and stored electronically

### Data analysis

Data analysis will consist of the following:

#### Water quality

Assessment of change against baseline conditions and comparison with ANZECC guideline values.

#### Presence / absence

Assessment of presence / absence data and trends between monitoring periods and between potential impact sites and reference sites.

#### Habitat condition

Assessment of change against baseline and / or reference site condition between monitoring periods and seasonally, and trend analysis.

### 1.3.7 Black-stripe Minnow monitoring program

Monitoring for impacts to BSM will be conducted at a reference site (Manea Park) and potential impact site (drainage line at southern extent of the Proposal Area (approx. Ch.110.700)). The reference site will be established for the purposes of providing comparative species and population trend data. Monitoring will comprise sampling and visual assessment, and will include photo monitoring. Monitoring will be conducted by a suitably experienced zoologist / environmental scientist.

### Reference sites and potential impact sites

Reference sites for BSM will be identified prior to commencement of clearing activity. Baseline data collection at reference sites will commence early 2020. Any changes in conditions at potential impact sites will be compared with those in reference sites. This will enable determination of the likelihood of impacts having resulted from Proposal implementation to ensure surface water flows are maintained through the implementation of the Proposal. The monitoring program is detailed in Table 10.

**Table 10 Monitoring approach for Black-stripe Minnow**

Monitoring parameter	Methodology	Frequency and duration	Recording
Water levels (waterbody depth and groundwater bore monitoring)	Manual sampling and / or water level measurement.	Quarterly (where able e.g. winter /spring only for surface water) during construction of each section of BORR and biannually for three years post construction.	Quarterly sampling.  Field data recorded and stored electronically.
Water quality	Sampling using	Quarterly during construction of each section of BORR and	Field data recorded and stored electronically.



Monitoring parameter	Methodology	Frequency and duration	Recording
The following parameters, known to be significant to the species, will be monitored: <ul style="list-style-type: none"> <li>• Temperature</li> <li>• pH</li> <li>• Oxidation-reduction potential</li> <li>• Conductivity</li> <li>• Turbidity</li> <li>• BOD</li> </ul>	appropriate water quality meters and / or laboratory analysis.	biannually for three years post construction.	
Habitat condition, including: <ul style="list-style-type: none"> <li>• evidence of erosion / sedimentation</li> <li>• condition and function of installed culverts</li> </ul>	Visual assessment and photo point.	Opportunistically and Quarterly during construction and biannually for three years post construction.	Photos labelled and stored appropriately.  Site condition data input to specially developed recording sheets and stored electronically.
Presence / absence	Visual assessment.	Annually during construction and for three years post construction.	Field data input to specially developed recording sheets and stored electronically.

### Photo point design

Photo points will be used in assessing sedimentation and function of the culvert and will be established prior to construction commencing. Where possible, photo points will be marked permanently with a stake and their locations will be and recorded using a handheld GPS. All photographs will be taken from the top of the stake. Photo point monitoring will form part of each monitoring event.

### Data analysis

Data analysis will consist of the following:

#### Water quality

Assessment of change against baseline conditions and comparison with ANZECC guideline values.

#### Water levels

Assessment of change in water levels against baseline conditions and comparison with trends in reference monitoring sites (groundwater wells).

#### Presence / absence

Assessment of presence / absence data and trends between monitoring periods and between potential impact sites and reference sites.

#### Habitat condition

Assessment of change against baseline and or reference site condition between monitoring periods and seasonally, and trend analysis.

---

## 4. ADAPTIVE MANAGEMENT AND REVIEW OF THE EMP

The adaptive management approach aims to reduce impacts by embedding a cycle of monitoring, reporting and implementing change (where required). This EMP applies the principles of adaptive management through monitoring, corrective actions and implementing changes. The EMP is intended to be dynamic and will be updated to reflect changes in management practices over the life of the Proposal. This will also allow flexibility to respond to new environmental impacts and adopt new technologies / management measures. Adaptive management has been embedded throughout this document, with the key management processes described below.

### 1.1 Monitoring triggers, thresholds and contingency actions

Triggers, thresholds and contingency for each conservation significant species included in this EMP are detailed in Tables 11-13, based on the environmental monitoring previously described.

If environmental monitoring identifies a non-conformance / non-compliance with environmental conditions / EMP targets / relevant legislation or guidelines, the incident will be assessed and corrective actions implemented. The corrective actions are aimed at preventing recurrences of the incident taking place.

The contingency actions will include changes to equipment / processes / management measures if required. Any changes to processes / management will be updated in the EMP. These changes will be communicated through site inductions / toolbox meetings.

Environmental incidents are defined as events that cause or potentially cause harm to the environment. Environmental incidents are to be reported to the Construction Environmental Manager by the person responsible for the incident or the first person to observe the incident. The Construction Environmental Manager will assess the type and severity of the incident in accordance with Main Roads' standard incident procedures. Relevant personnel will be notified, including reporting to regulatory authorities.

The number and type of contingency actions to be implemented in the case of trigger exceedance will depend upon various factors, including the state of the natural surrounding environment, the location of the trigger and the works undertaken at the time of the exceedance.

**Table 11 Triggers, Thresholds and Contingency Actions - Western Ringtail Possum and Brush-tailed Phascogale**

Monitoring parameter	Trigger	Threshold	Contingency action
Clearing of WRP or BTP habitat is restricted to approved clearing area	Clearing or damage to WRP or BTP habitat outside of approved clearing area	Clearing or damage to WRP or BTP habitat outside of approved clearing area	<ul style="list-style-type: none"> <li>• Investigate cause and raise an incident report</li> <li>• Implement corrective actions which may include: <ul style="list-style-type: none"> <li>- Review practicality and relevance of management measures</li> <li>- Improve training and education for all personnel</li> <li>- Improve and implement increased protective measures as necessary</li> <li>- Improve methods for defining clearing lines</li> <li>- Install additional temporary fencing or signs.</li> </ul> </li> <li>• Monitor outcomes.</li> </ul>
Loss of WRP or BTP	WRP or BTP injured or killed by site activities	Injury or loss	<ul style="list-style-type: none"> <li>• All clearing and / or construction within known WRP and BTP habitat is immediately ceased</li> <li>• Investigate cause of injury or loss</li> <li>• Main Roads to consult with DBCA of the WRP and BTP injury or mortality occurring</li> <li>• Measures for minimising impacts to WRP and BTP as a result of clearing and construction are revised in consultation with DBCA to reduce the likelihood of any further WRP and BTP injury or mortality before clearing and construction recommences</li> <li>• Improve training and education for all personnel</li> <li>• Restart clearing within core habitat area and monitor outcomes.</li> </ul>
Presence of WRP	Loss of WRP in any monitoring period at monitored habitat areas but not in reference sites in two consecutive monitoring periods	Loss of WRP in any monitoring period at monitored habitat areas but not in reference sites in three consecutive monitoring periods	<ul style="list-style-type: none"> <li>• Investigate cause and consult with DBCA</li> <li>• Implement contingency actions which may include: <ul style="list-style-type: none"> <li>- Review practicality and relevance of management measures</li> <li>- Repair / alter design of fencing to block vehicular access if required</li> <li>- Install additional signage</li> <li>- Better connecting populations.</li> </ul> </li> <li>• Monitor outcomes.</li> </ul>
Use of possum bridges and or underpasses	Bridges / underpasses not used within 24 months of installation	Bridges / underpasses not used within 48 months of installation	<ul style="list-style-type: none"> <li>• Investigate cause and consult with DBCA</li> <li>• Implement contingency actions which may include: <ul style="list-style-type: none"> <li>- Assessment of bridge / underpass to determine reason for lack of utilisation</li> <li>- Modification of bridge / underpass structure if required.</li> </ul> </li> <li>• Monitor outcomes.</li> </ul>

Monitoring parameter	Trigger	Threshold	Contingency action
Possum fence installation	Possum fence not installed as per design or required timeframe	Possum fence not installed per design or required timeframe	<ul style="list-style-type: none"> <li>• Investigate cause and raise an incident report</li> <li>• Implement contingency actions which may include: <ul style="list-style-type: none"> <li>- Review practicality and relevant of management measures</li> <li>- Improve training and education for all personnel</li> <li>- Improve and implement increased protective measures/controls as necessary</li> <li>- Review monitoring frequency and method.</li> </ul> </li> <li>• Monitor outcomes.</li> </ul>

**Table 12 Triggers, Thresholds and Contingency Actions - Carter's Freshwater Mussel**

Monitoring parameter	Trigger	Threshold	Contingency action
Presence of CFM	CFM found in potential impact site	CFM found in potential impact site	CFM relocated to identified recipient habitat by a suitably qualified environmental scientist
Water quality parameters	Exceedance of ANZECC guideline values and/or significant difference from baseline conditions in one monitoring period	Exceedance of ANZECC guideline values and/or significant difference from baseline conditions in two consecutive monitoring periods	<ul style="list-style-type: none"> <li>Investigate the cause and raise an incident report if necessary. Include consideration of results from baseline monitoring and comparison with reference sites for the same period</li> <li>Remedial action controls will be undertaken if required – to be determined based on likely cause e.g. spills, sedimentation or erosion</li> <li>A review will be conducted of management measures and/or further education of staff / contractors to ensure that all possible steps are taken to prevent any reoccurrence</li> <li>Preventative actions such as modifications to infrastructure and additional engineering post-construction will be taken to prevent further non-compliance.</li> <li>Monitor the effectiveness of the control(s)</li> </ul>
Erosion / sedimentation	Evidence of new erosion / sedimentation in monitored CFM habitat	Evidence of new erosion / sedimentation in monitored CFM habitat	<ul style="list-style-type: none"> <li>Investigate the cause and raise an incident report if necessary</li> <li>Remedial action controls will be undertaken immediately to repair damage if required</li> <li>Preventative actions such as modifications to infrastructure and additional engineering post-construction will be taken to prevent further non-compliance. These may include:                             <ul style="list-style-type: none"> <li>Application of fill/mulch</li> <li>Installation of gabion cages</li> <li>Installation of jute matting to secure bank</li> </ul> </li> <li>A review will be conducted of management measures and/or further education of staff / contractors to ensure that all possible steps are taken to prevent any reoccurrence</li> <li>Monitor the effectiveness of the control(s).</li> </ul>
Condition and functioning of installed silt curtain / fence	Silt curtain / fence damaged or ineffective	Silt curtain / fence damaged or ineffective	<ul style="list-style-type: none"> <li>Investigate cause and raise an incident report</li> <li>Implement contingency actions which may include:                             <ul style="list-style-type: none"> <li>Inspect and repair any damaged/ineffective silt curtain / fencing</li> <li>Review practicality and relevance of management measures</li> <li>A review will be conducted of management measures and/or further education of staff / contractors to ensure that all possible steps are taken to prevent any reoccurrence</li> <li>Review monitoring frequency and method.</li> </ul> </li> <li>Monitor outcomes.</li> </ul>

**Table 13 Triggers, Thresholds and Contingency Actions - Black-stripe Minnow**

Monitoring parameter	Trigger	Threshold	Contingency action
Water levels	To be determined based on baseline monitoring	To be determined based on baseline monitoring	<ul style="list-style-type: none"> <li>Investigate the cause and raise an incident report if necessary. Include consideration of results from baseline monitoring and comparison with reference sites for the same period</li> <li>Refer to contingency actions for drainage structures (functioning of culverts etc).</li> <li>Monitor the effectiveness of the control(s)</li> </ul>
Water quality parameters	Exceedance of ANZECC guideline values and/or significant difference from baseline conditions in one monitoring period	Exceedance of ANZECC guideline values and/or significant difference from baseline conditions in two consecutive monitoring periods	<ul style="list-style-type: none"> <li>Investigate the cause and raise an incident report if necessary. Include consideration of results from baseline monitoring and comparison with reference sites for the same period</li> <li>Remedial action controls will be undertaken if required – to be determined based on likely cause eg spills, sedimentation or erosion</li> <li>A review will be conducted of management measures and/or further education of staff / contractors to ensure that all possible steps are taken to prevent any reoccurrence</li> <li>Preventative actions such as modifications to infrastructure and additional engineering post-construction will be taken to prevent further non-compliance.</li> <li>Monitor the effectiveness of the control(s)</li> </ul>
Erosion / sedimentation	Evidence of new erosion / sedimentation in monitored BSM habitat	Evidence of new erosion / sedimentation in monitored BSM habitat	<ul style="list-style-type: none"> <li>Investigate the cause and raise an incident report if necessary</li> <li>Remedial action controls will be undertaken immediately to repair damage if required</li> <li>Preventative actions such as modifications to infrastructure and additional engineering post-construction will be taken to prevent further non-compliance. These may include:                             <ul style="list-style-type: none"> <li>Application of fill/mulch</li> <li>Installation of gabion cages</li> <li>Installation of jute matting to secure bank</li> </ul> </li> <li>A review will be conducted of management measures and/or further education of staff / contractors to ensure that all possible steps are taken to prevent any reoccurrence.</li> <li>Monitor the effectiveness of the control(s)</li> </ul>
Condition and functioning of installed culverts	Culvert blocked or ineffective	Culvert blocked or ineffective 5 days after initial detection	<ul style="list-style-type: none"> <li>Investigate cause and raise an incident report</li> <li>Implement contingency actions which may include:                             <ul style="list-style-type: none"> <li>Unblocking the culvert</li> <li>Review practicality and relevance of management measures</li> <li>Revision of maintenance and weed control program to ensure culvert remains free of debris and other matter</li> <li>Preventative actions such as modifications to infrastructure and additional engineering post-construction to prevent further non-compliance</li> </ul> </li> </ul>

Monitoring parameter	Trigger	Threshold	Contingency action
			<ul style="list-style-type: none"> <li>- A review will be conducted of management measures and/or further education of staff / contractors to ensure that all possible steps are taken to prevent any reoccurrence</li> <li>- Review monitoring frequency and method</li> <li>• Monitor outcomes.</li> </ul>

## 1.1 EMP revision

This EMP will be reviewed on an annual basis during construction of the Proposal. The EMP review will take into account the adaptive management and continual improvement process. Potential reasons or triggers for revising management actions include:

- Changes to construction methods and timing.
- Trigger of early warning indicators.
- New or revised information becoming available about target species (specifically their behaviour and habitat requirements).
- Changes to action plans for target species developed under state or federal legislation.

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

The implementation of this plan will be audited annually during construction.

## 1.2 Audits

Environmental audits will be undertaken to ensure the management measures outlined in this EMP are being adequately implemented. Auditing of the commitments outlined in this EMP will be undertaken as follows:

- During construction regular system audits of management actions and compliance procedures, including:
  - Pre-construction: a review of the CEMP for compliance with this EMP and environmental approval conditions
  - Post-construction: correction of any non-conformances at completion of construction
- Annual third party audit of the CEMP and environmental approval conditions during construction
- Regular site CEMP compliance inspections including audits of key contractors environmental management and monthly inspections. The Construction Contractor will carry out weekly / daily compliance checks as per the CEMP.

Audit findings will be reported by Main Roads within four weeks of the audit being completed.



---

## 5. COMMUNICATION

### 1.3 Stakeholder consultation

MRWA has consulted with a number of stakeholders while developing this plan, consistent with the EPA's expectations to align the plan with the principles of environmental impact assessment. This section provides a summary of consultation that occurred. The comments raised during consultations with stakeholders were considered in preparing the plan. A summary of stakeholder consultation undertaken during preparation of this EMP is presented in Table 14.

**Table 14 Stakeholder consultation summary**

Stakeholders consulted	Advice received	Response
Biota (Mr. Roy Teale)	Advice regarding monitoring and management of WRP and BTP	Provided advice incorporated into the development of this EMP.
Wetland Research and Management	Advice regarding monitoring and management of CFM and BSM	Provided advice incorporated into the development of this EMP.
Ms. Barbara Jones	Advice regarding monitoring and management of WRP	Provided advice incorporated into the development of this EMP.
Stakeholder workshop 13 November 2019. Attendees included officers from Department of Water and Environment Regulation (EPA Services), DBCA, Commonwealth Department of Agriculture, Water and Environment).	Advice regarding the level of information to be included within Threatened Fauna EMP	Conservation Significant Fauna EMP to only include actions specific to the Proposal, with standard management measures to be implemented for Proposal but not included in plan.

### 1.4 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.

### 1.5 Reporting

Compliance with this management plan will be reported to DWER as part of the Proposal's annual compliance report during construction. The format of these reports will be consistent with requirements stipulated by individual regulatory authorities.

A Compliance Assessment Report (CAR) will be submitted to the Environmental Protection Authority (EPA) Services unit of DWER as prescribed by the EPA. The report will document compliance with conditions of approval including assessment of compliance with management plan requirements where management plans form part of approval conditions.

---

## 6. REFERENCES

- Biota Environmental Sciences (Biota) (2020). *Bunbury Outer Ring Road Northern and Central Section Targeted Fauna Assessment*. Unpublished report for Main Roads Western Australia.
- BORR IPT (2018). *Bunbury Outer Ring Road Northern and Central Sections Drainage Strategy*. Unpublished report for Main Roads Western Australia.
- BORR IPT (2019). *Bunbury Outer Ring Road Northern and Central Sections EPA Environmental Referral Supporting Document*. Unpublished report for Main Roads Western Australia.
- 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*. PhD Thesis. Murdoch University.
- 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*. Department of Conservation and Land Management. Perth, Western Australia.
- Department of Conservation and Land Management (2002). *Brush-tailed Phascogale *Phascogale tapoatafa* (Meyer, 1793) Species Profile*. Perth, Western Australia.
- Department of Parks and Wildlife (2017). *Western Ringtail Possum (*Pseudocheirus occidentalis*) Recovery Plan*.
- Environmental Protection Authority (EPA) (2016). *Technical Guidance: Terrestrial Fauna Surveys*. Environmental Protection Authority, Western Australia.
- Environmental Protection Authority (EPA) (2018). *Instructions on how to prepare Environmental Protection Act 1986 Part IV Environmental Management Plans*. Prepared for the Government of Western Australia. Retrieved August 2019 from: [<http://www.epa.wa.gov.au/forms-templates/instructions-part-iv-environmental-management-plans>]
- Freshwater Fish Group and Fish Health Unit (2017). *Baseline assessment of Carter's Freshwater Mussel, *Westralunio carteri*, at proposed bridge construction sites on the Lower Vasse River*. Unpublished report for Strategen Environmental.
- Government of Western Australia (2007). *Biosecurity and Agriculture Management Act*. Perth, Western Australia.
- IUCN (2019). *IUCN Red List of Threatened Species*. Version 2017.3. [www.iucnredlist.org](http://www.iucnredlist.org) Downloaded in September 2019.
- Klunzinger, M.W., Beatty, S.J., Morgan, D.L., Lymbery, A.J., Pinder, A.M. and Cale, D.J. (2012). *Distribution of *Westralunio carteri* Iredale 1934 (Bivalvia: Unionoida: Hyriidae) on the south coast of southwestern Australia, including new records of the species*. Journal of the Royal Society of Western Australia 95: 77-81.
- Minister for the Environment (2005). 'Greater Bunbury Region Scheme, Assessment No. 1048'.
- Shedley and Williams (2014). *An assessment of habitat for Western Ringtail Possum (*Pseudocheirus occidentalis*) on the southern Swan Coastal Plain (Binningup to Dunsborough)*. Department of Parks and Wildlife.
- Threatened Species Scientific Community (TSSC) (2018a). *Conservation Advice *Galaxiella nigrostriata* Black-stripe Minnow*.
- Threatened Species Scientific Community (TSSC) (2018b). *Conservation Advice *Westralunio carteri* Carter's Freshwater Mussel*.

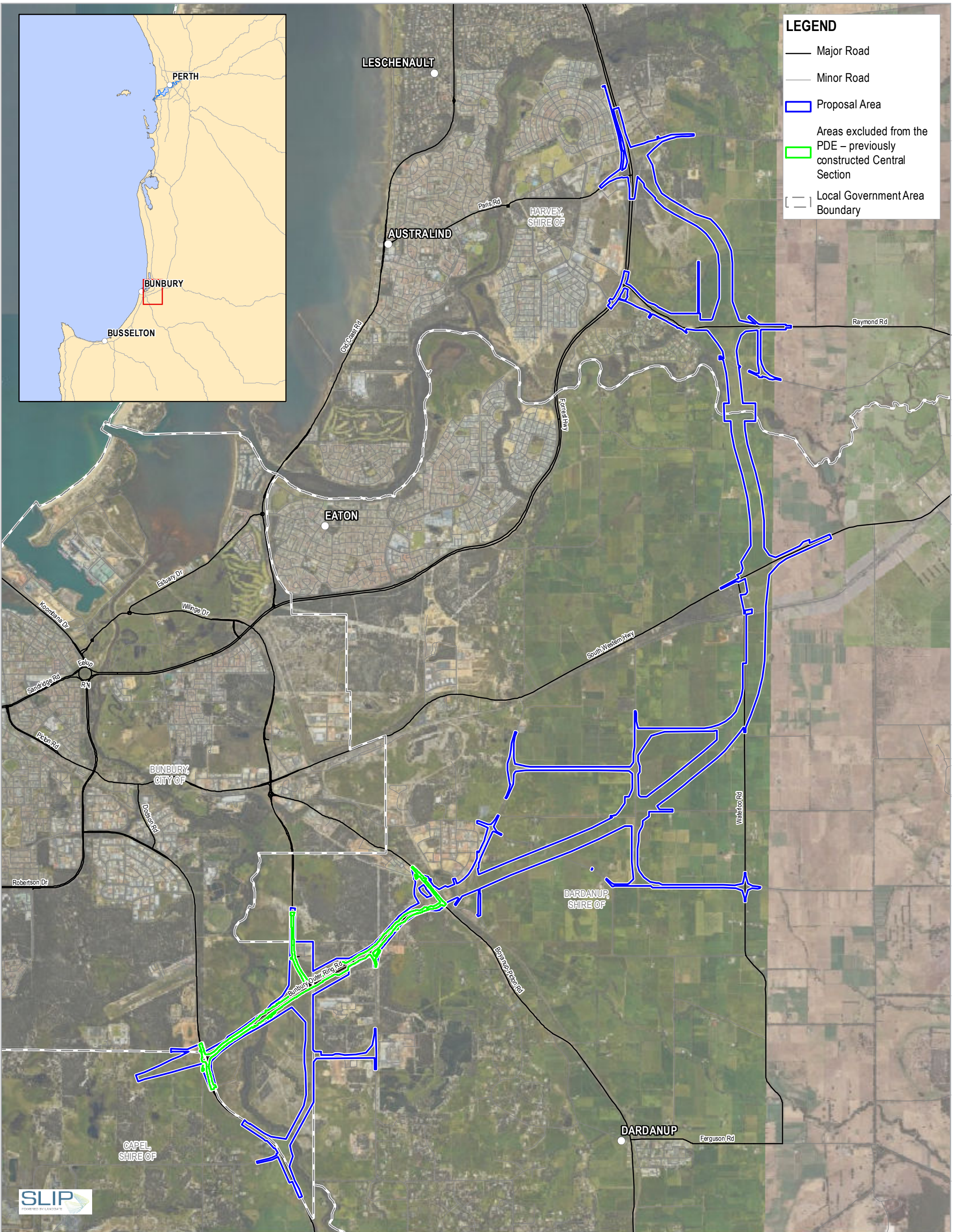
WRM (2020). *Bunbury Outer Ring Road Northern and Central Investigation Area: Targeted Conservation Significant Aquatic Fauna Survey*. Unpublished report prepared for Main Roads Western Australia.

# APPENDIX A FIGURES

---

- Figure 1**      **The Proposal – Bunbury Outer Ring Road – Northern and Central Sections**
- Figure 2**      **WRP observations and habitat clearing categories**
- Figure 3**      **Clearing Staging Plans**
- Figure 4**      **Proposed Engineered Movement Structures and Possum Fencing**
- Figure 5**      **Carter’s Freshwater Mussel Observations Within and Adjacent to the Proposal Area and Locations of Silt Curtains**
- Figure 6**      **Black Striped Minnow observations Within and Adjacent to the Proposal Area**
- Figure 7**      **Brush-tailed Phascogale Records Within and Adjacent to the Proposal Area**





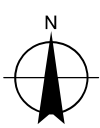
**LEGEND**

- Major Road
- Minor Road
- ▭ Proposal Area
- ▭ Areas excluded from the PDE – previously constructed Central Section
- [ - ] Local Government Area Boundary



Paper Size ISO A3  
 0 0.5 1 1.5 2  
 Kilometres

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



**Main Roads Western Australia**  
**Bunbury Outer Ring Road Northern and Central Section**  
**Fauna Environmental Management Plan**

Project No. 61-37041  
 Revision No. 0  
 Date 06/11/2019

**Proposal Area**

**FIGURE 1**





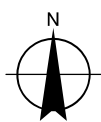
**LEGEND**

- Western ringtail possum observation
- Major road
- Clearing
  - 1
  - 3
- BORR Northern and Central Section Referral Boundary



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



mainroads  
 WESTERN AUSTRALIA  
 BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

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

Project No. 61-37041  
 Revision No. 1  
 Date 05/02/2020

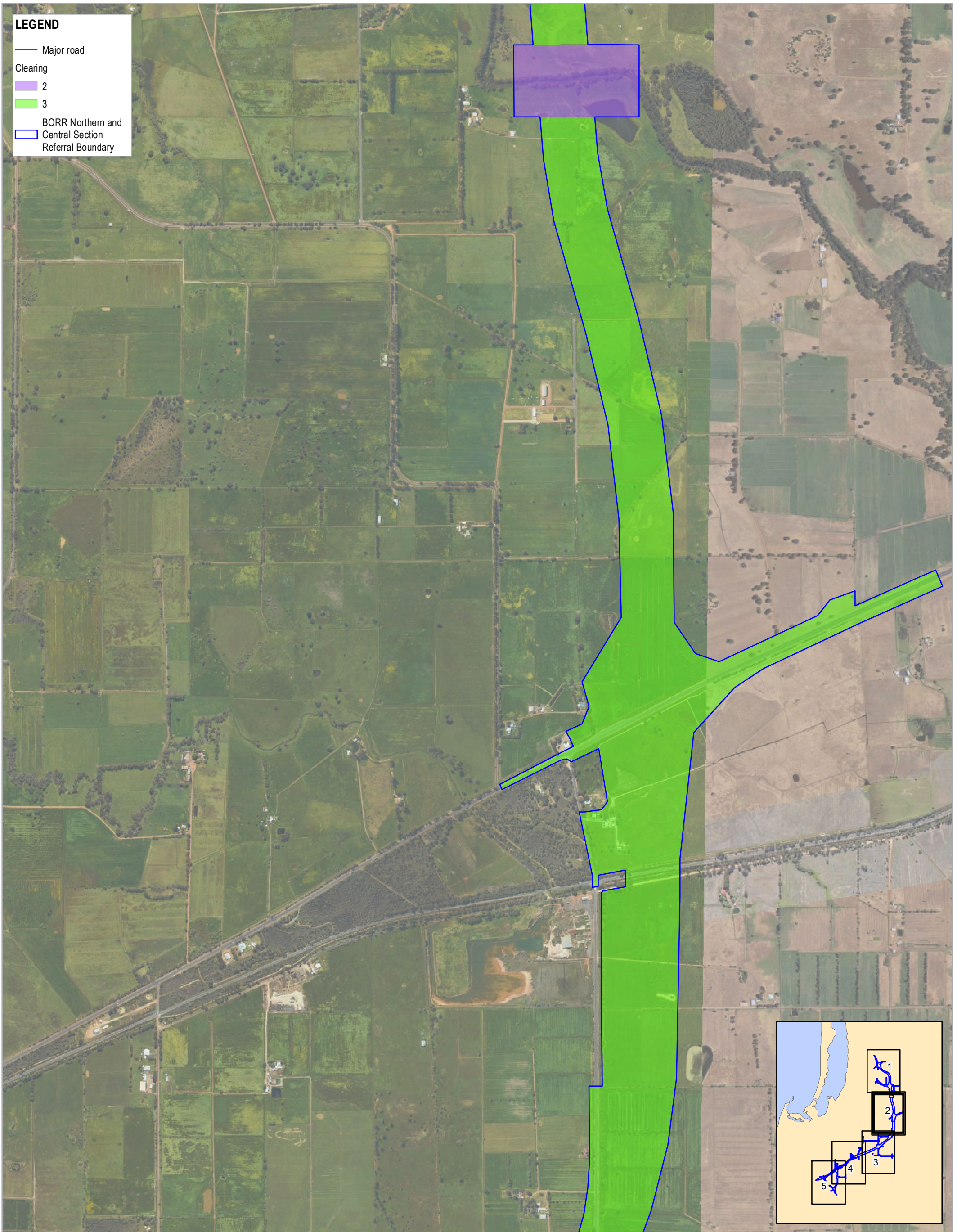
**WRP observations and  
 habitat clearing categories**

Page 1 of 5

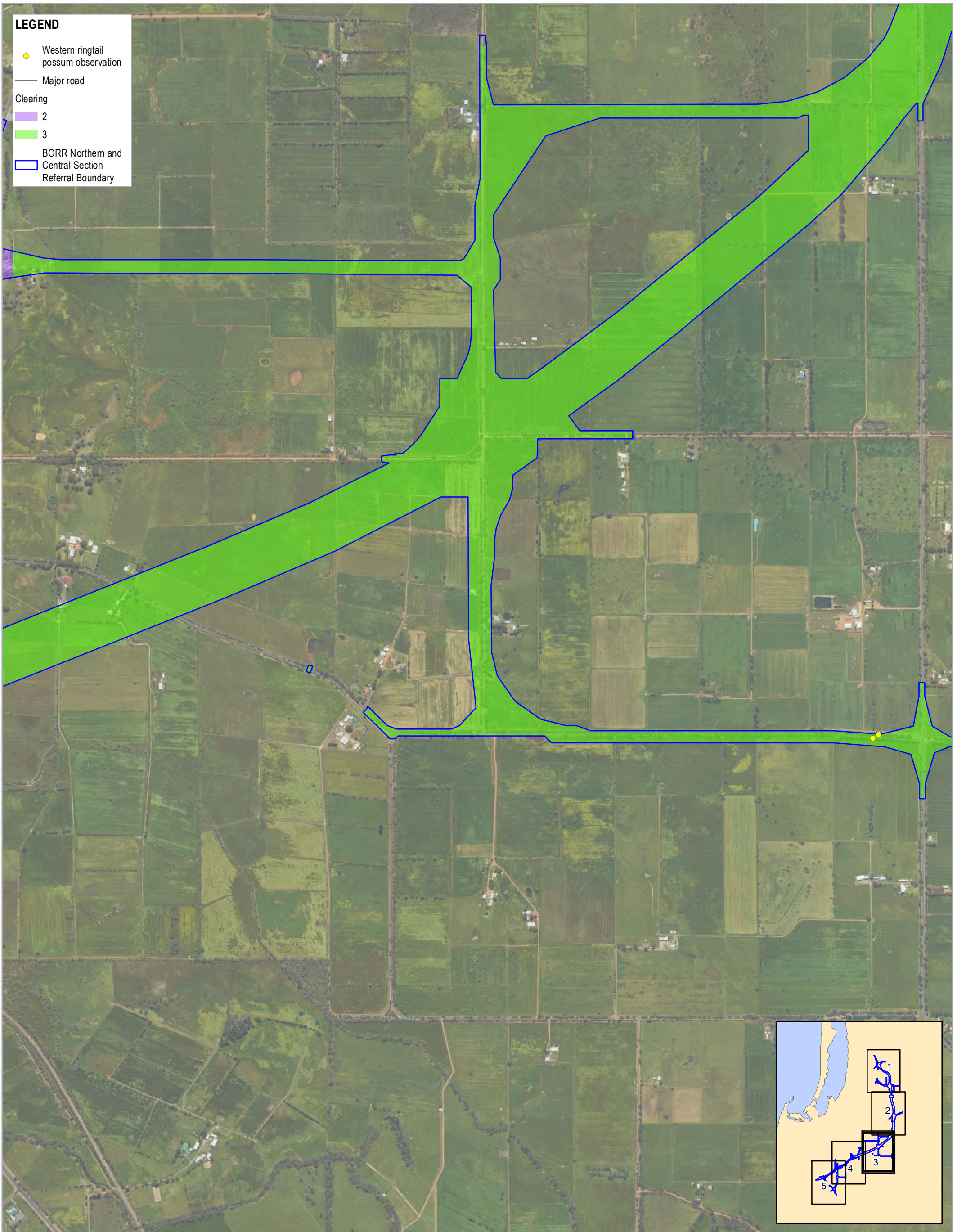
**FIGURE 2**

Data source: BORR team: North referral boundary - 20191016, Clearing categories - 20200131, Biota: WRP Observations - 201912, Landgate: Roads - 201805, Localities - 20180319, Imagery - WA Now accessed 20/20/20131. Created by: mmkkonen



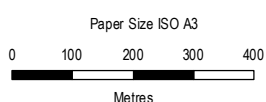




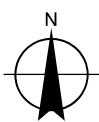


**LEGEND**

- Western ringtail possum observation
- Major road
- Clearing
- 2
- 3
- BORR Northern and Central Section Referral Boundary



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



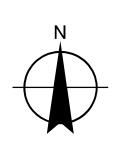
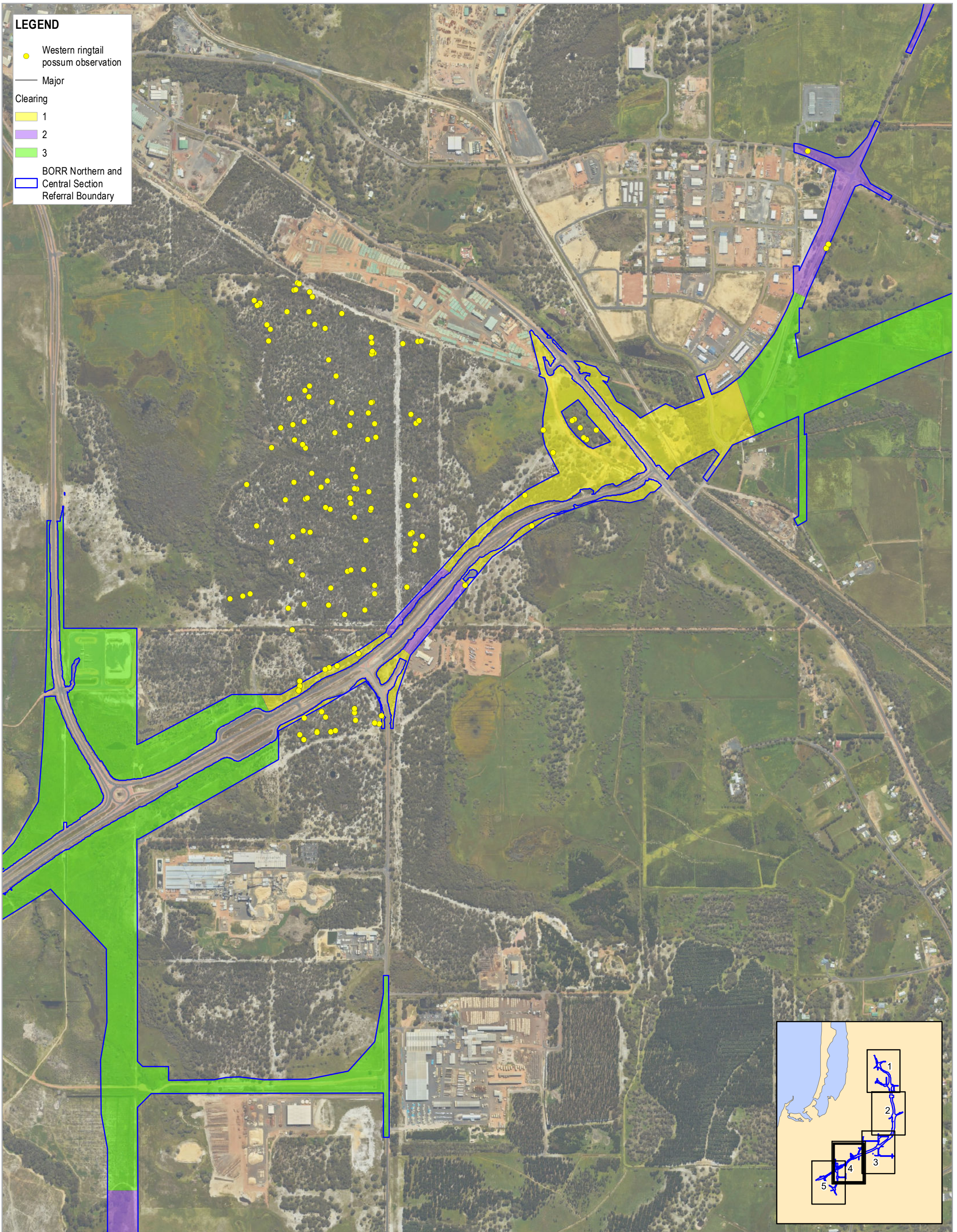
Main Roads Western Australia  
Bunbury Outer Ring Road Northern and Central Section  
Environmental Management Plan

**WRP observations and habitat clearing categories**

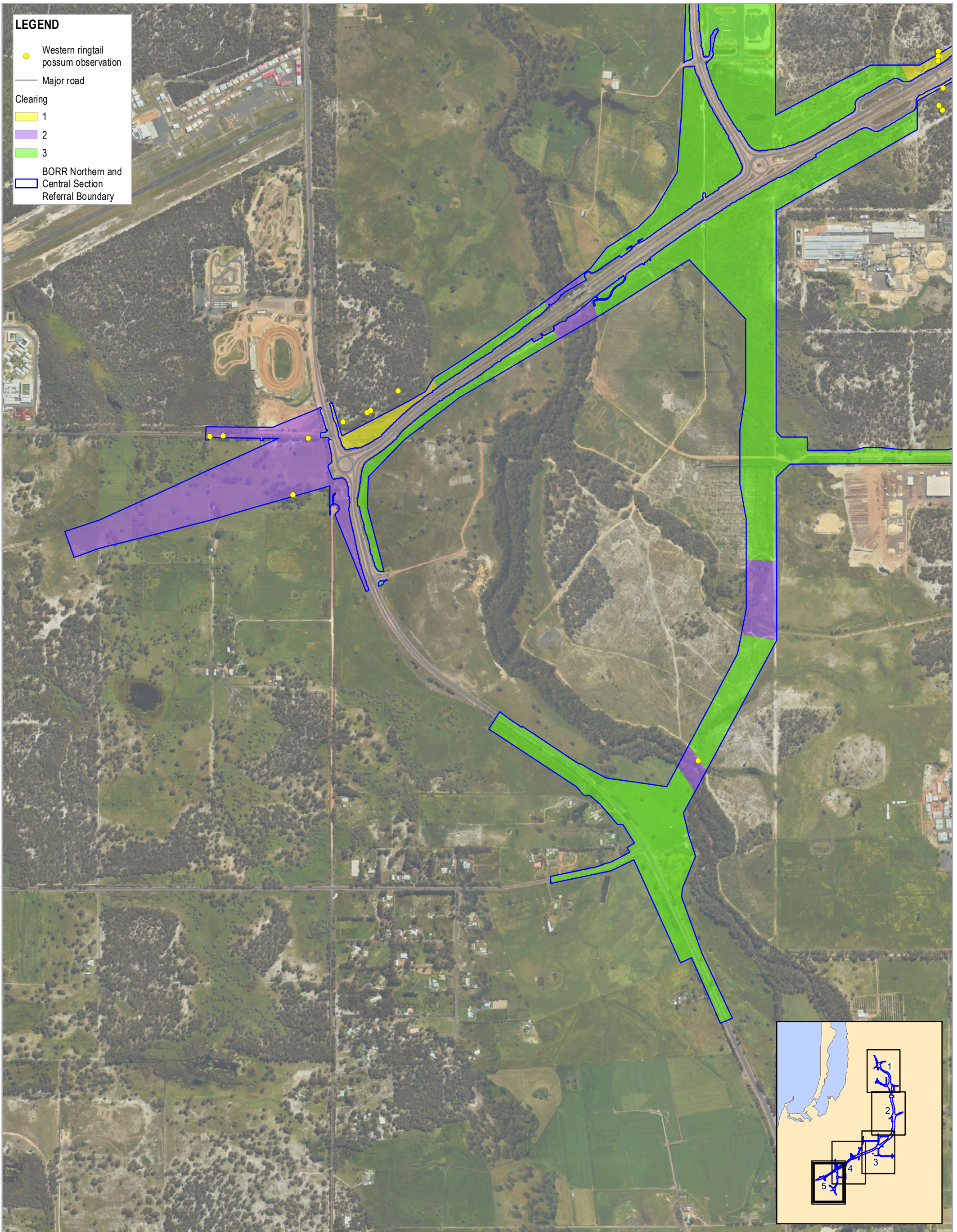
Project No. 61-37041  
Revision No. 1  
Date 05/02/2020

Data source: BORR team - North referral boundary - 20191016, Clearing categories - 20200131, Biot: WRP Observations - 201912, Landgate: Roads - 201805, Localities - 20180319, Imagery - WA Now accessed 20/20/20131. Created by: mmkkonen









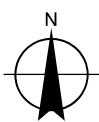
**LEGEND**

- Western ringtail possum observation
- Major road
- Clearing
  - 1
  - 2
  - 3
- BORR Northern and Central Section Referral Boundary



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



mainroads  
 WESTERN AUSTRALIA  
 BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

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

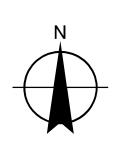
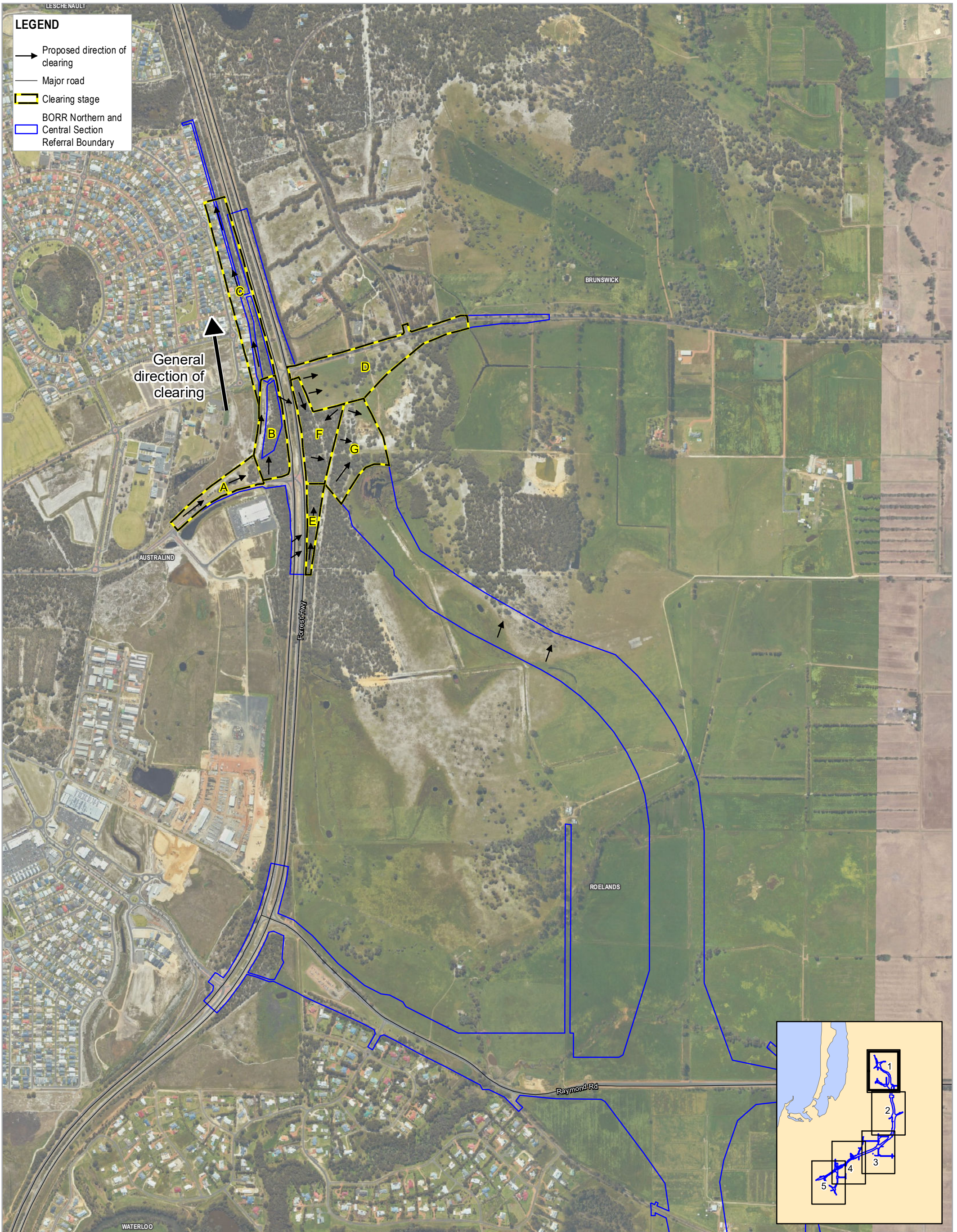
Project No. 61-37041  
 Revision No. 1  
 Date 05/02/2020

**WRP observations and  
 habitat clearing categories**

Page 5 of 5  
**FIGURE 2**

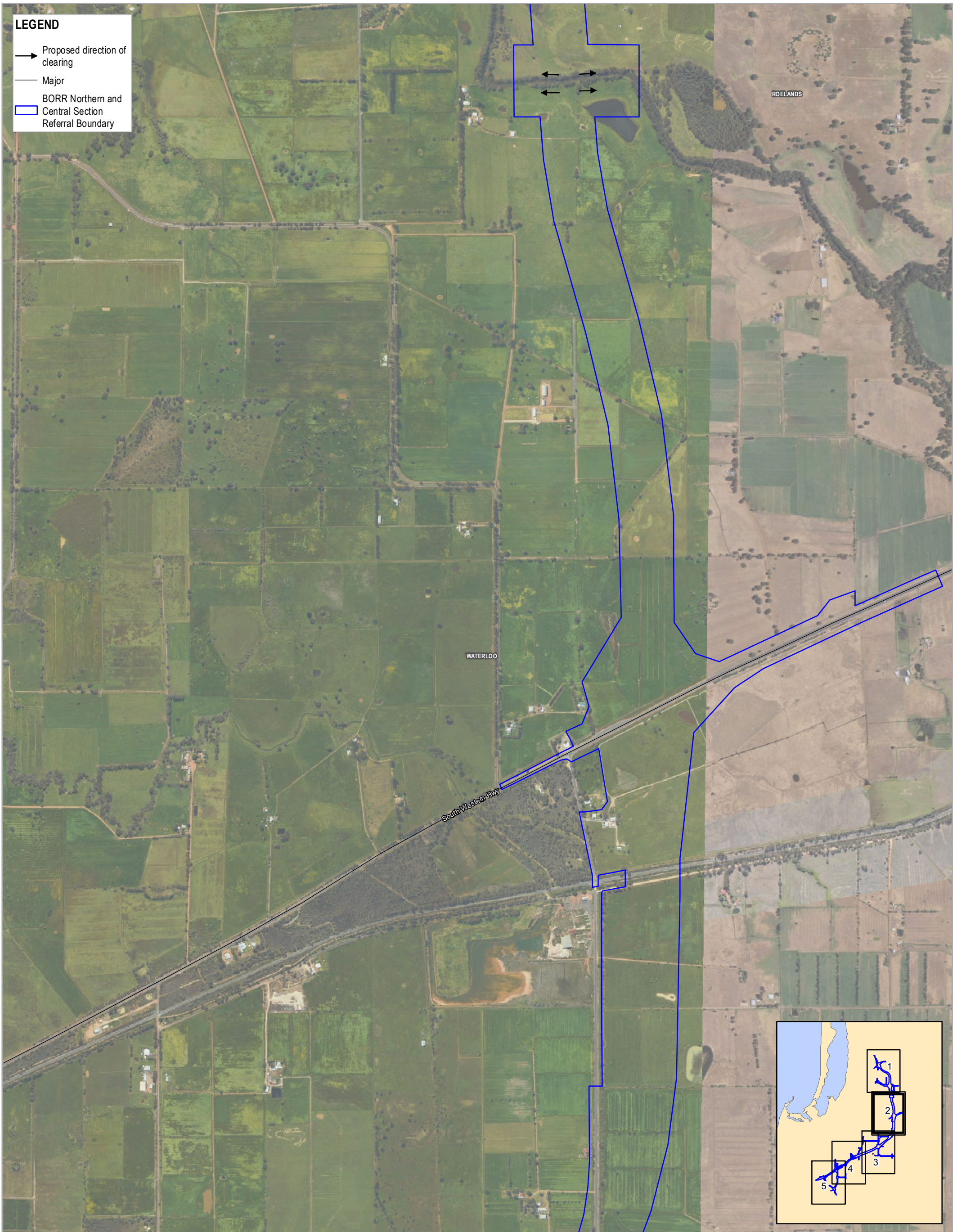
Data source: BORR team: North referral boundary - 20191016, Clearing categories - 20200131, Biot: WRP Observations - 201912, Landgate: Roads - 201805, Localities - 20180319, Imagery - WA Now accessed 20/20/20131. Created by: mmkkonen





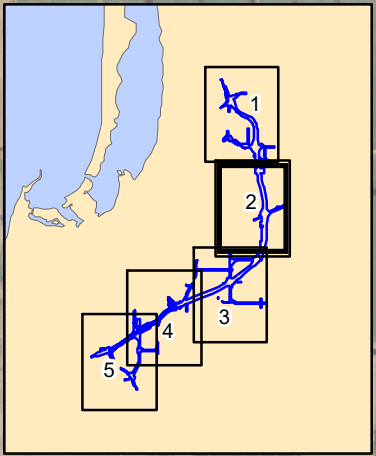
Data source: BORR team: North referral boundary - 20191016, Clearing stages, directions - 20200131; Biota: WRP Observations - 201912; Landgate: Roads - 201805, Localities - 20180319. Imagery - WA Now accessed 20/20/20131. Created by: mmkknonen





**LEGEND**

- Proposed direction of clearing
- Major
- ▭ BORR Northern and Central Section Referral Boundary



**SLIP**  
POWERED BY LANDIMATE

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

**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 Northern and Central Section  
Environmental Management Plan

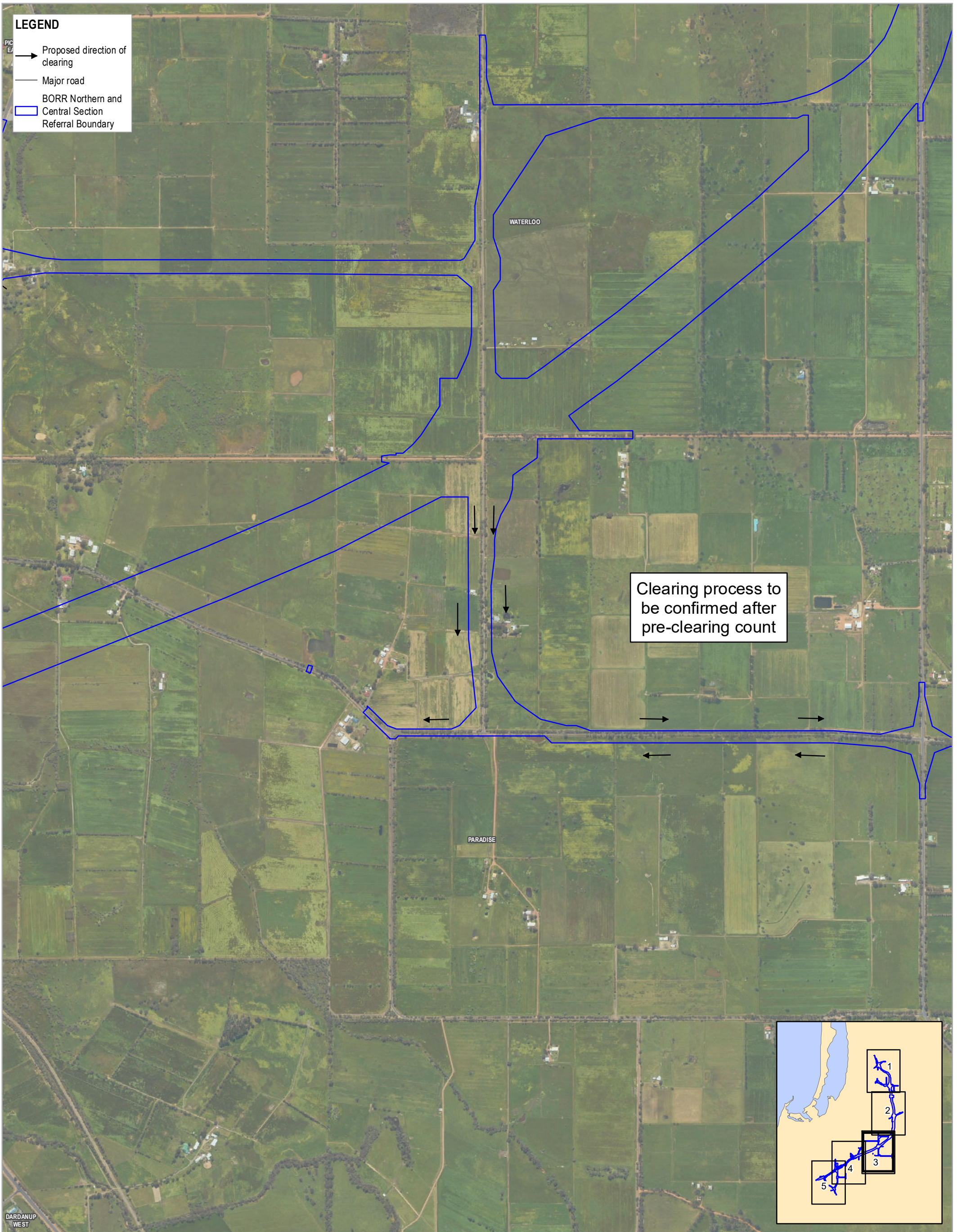
**Proposed Clearing and Clearing Staging**

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

Page 2 of 5  
**FIGURE 3**

Data source: BORR team: North referral boundary - 20191016, Clearing stages, directions - 20200131; Biota: WRP Observations - 201912; Landgate: Roads - 201805, Localities - 20180319; Imagery - WA Now accessed 20/20/20131. Created by: mmkknonen

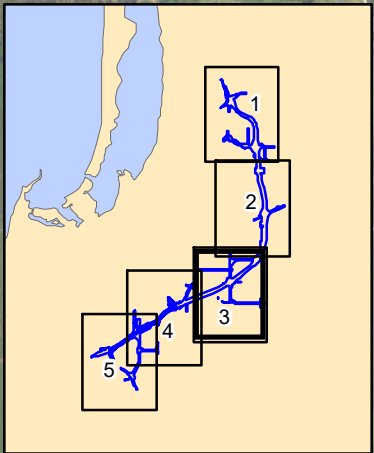




**LEGEND**

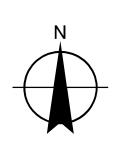
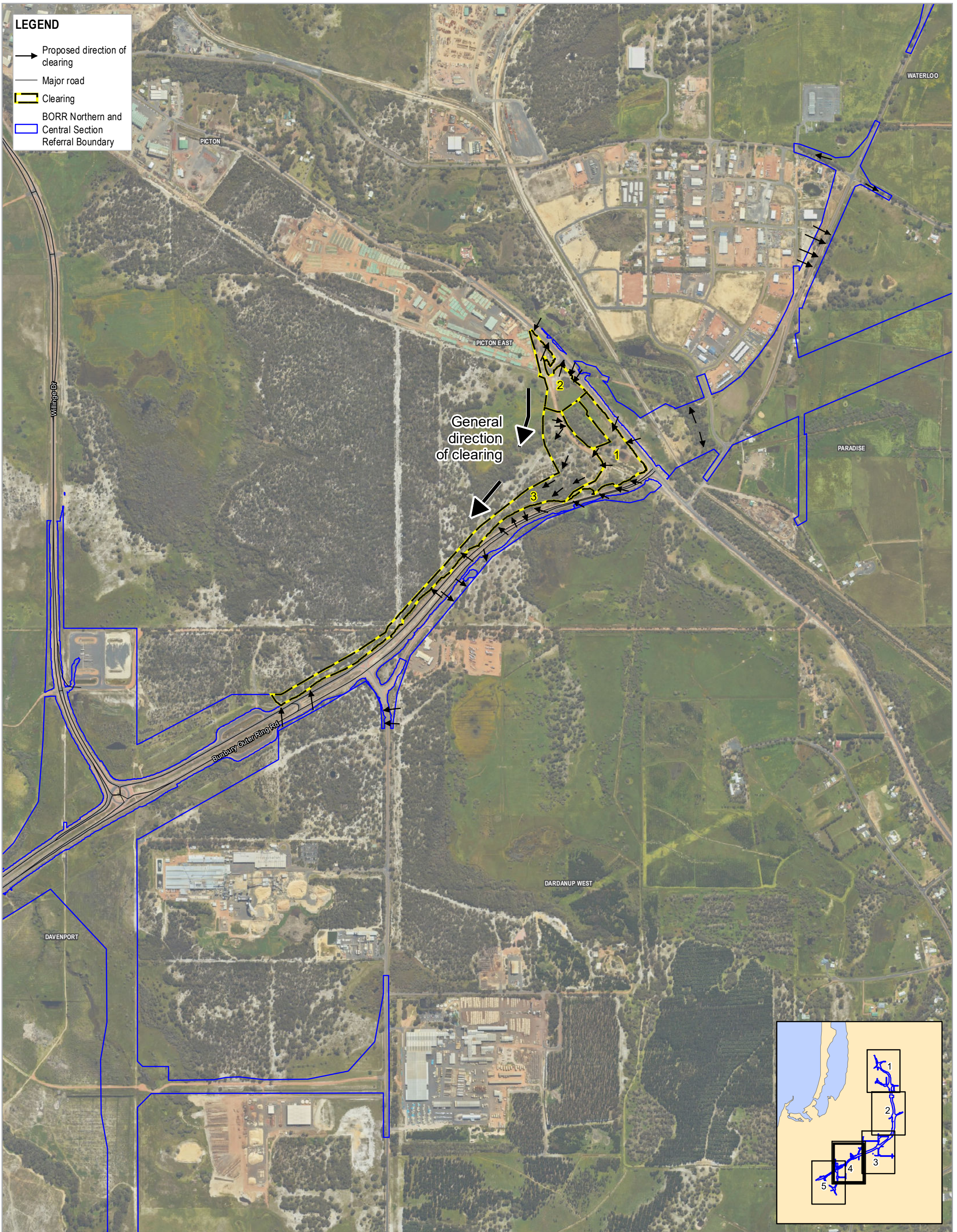
- Proposed direction of clearing
- Major road
- BORR Northern and Central Section
- ▭ Referral Boundary

Clearing process to be confirmed after pre-clearing count

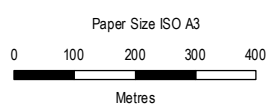
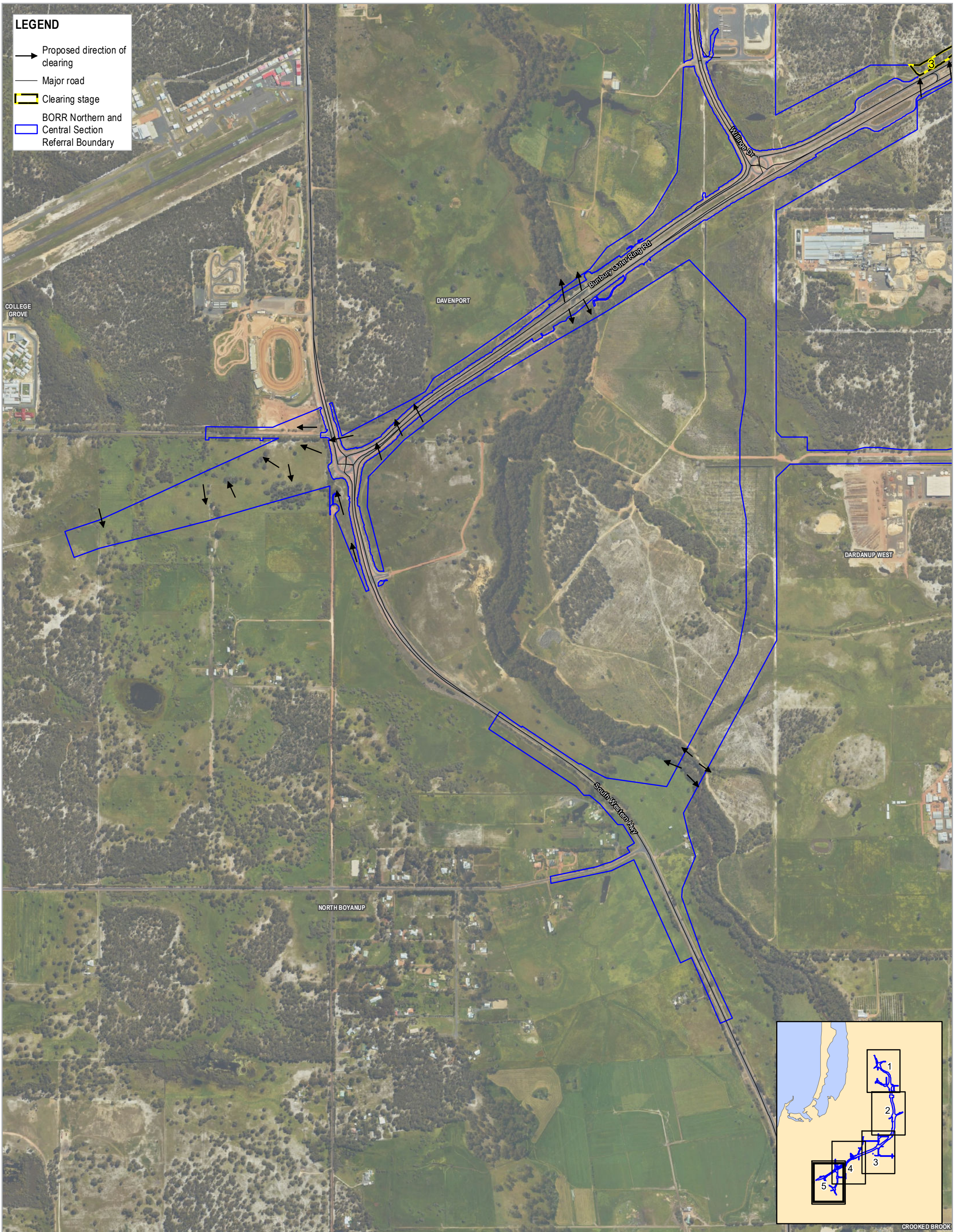


Data source: BORR team: North referral boundary - 20191016, Clearing stages, directions - 20200131; Biota: WRP Observations - 201912; Landgate: Roads - 201805, Localities - 20180319, Imagery - WA Now accessed 20/20/20131. Created by: mmkkonen

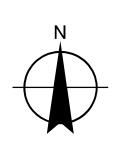








Map Projection: Transverse Mercator  
Horizontal Datum: GDA 1994  
Grid: GDA 1994 Perth Coastal Grid 1994



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

**Proposed Clearing and  
Clearing Staging**

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

Data source: BORR team: North referral boundary - 20191016, Clearing stages, directions - 20200131; Biota: WRP Observations - 201912; Landgate: Roads - 201805, Localities - 20180319. Imagery - WA Now accessed 20/20/20131. Created by: mmkkonen





**NOTES**

1. REFER TO SKETCH No. BORR-00-SK-RD-0244 FOR FAUNA CROSSING TYPICAL DETAILS.
2. REFER TO SKETCH No. BORR-00-SK-RD-0124 & 0125 FOR FAUNA CROSSING TYPE AND SIZES.

**LEGEND**

- - - SITE BOUNDARY
- - - POSSUM EXCLUSION FENCING (PERMANENT)
- - - POSSUM EXCLUSION FENCING (TEMPORARY)
- FAUNA ROPE BRIDGE
- FAUNA UNDERPASS (BOX)
- FAUNA UNDERPASS (ARCHED)
- FAUNA CULVERT
- NOISE WALL
- RETAINING WALL
- SCREEN WALL
- CADASTRAL BOUNDARY
- - - EASEMENT BOUNDARY
- PSP
- SHARED PATH

**SKETCH ONLY  
ULTIMATE PLANNING  
UNDER DEVELOPMENT**



**BUILDING OUR FUTURE**

DATE	04/03/2020	PREPARED	ET
------	------------	----------	----

SCALE	1:2500m @ A1	GRID	PCG 94
-------	--------------	------	--------

PROJECT  
BUNBURY OUTER RING ROAD (H058)

TITLE  
BUNBURY OUTER RING ROAD  
POSSUM EXCLUSION FENCING PLAN  
FIGURE 4 - SHEET 1

SKETCH No.	BORR-00-SK-RD-0135	REV	C
------------	--------------------	-----	---

1:2500  
 SCALES  
 A  
 1





- NOTES**
- REFER TO SKETCH No. BORR-00-SK-RD-0244 FOR FAUNA CROSSING TYPICAL DETAILS.
  - REFER TO SKETCH No. BORR-00-SK-RD-0124 & 0125 FOR FAUNA CROSSING TYPE AND SIZES.

- LEGEND**
- SITE BOUNDARY
  - POSSUM EXCLUSION FENCING (PERMANENT)
  - POSSUM EXCLUSION FENCING (TEMPORARY)
  - FAUNA ROPE BRIDGE
  - FAUNA UNDERPASS (BOX)
  - FAUNA UNDERPASS (ARCHED)
  - FAUNA CULVERT
  - NOISE WALL
  - RETAINING WALL
  - SCREEN WALL
  - CADASTRAL BOUNDARY
  - EASEMENT BOUNDARY
  - PSP
  - SHARED PATH

SKETCH ONLY  
ULTIMATE PLANNING  
UNDER DEVELOPMENT



**BUILDING OUR FUTURE**

DATE 4/03/2020 PREPARED ET

SCALE 1:2500m @ A1 GRID PCG 94

PROJECT BUNBURY OUTER RING ROAD (H058)

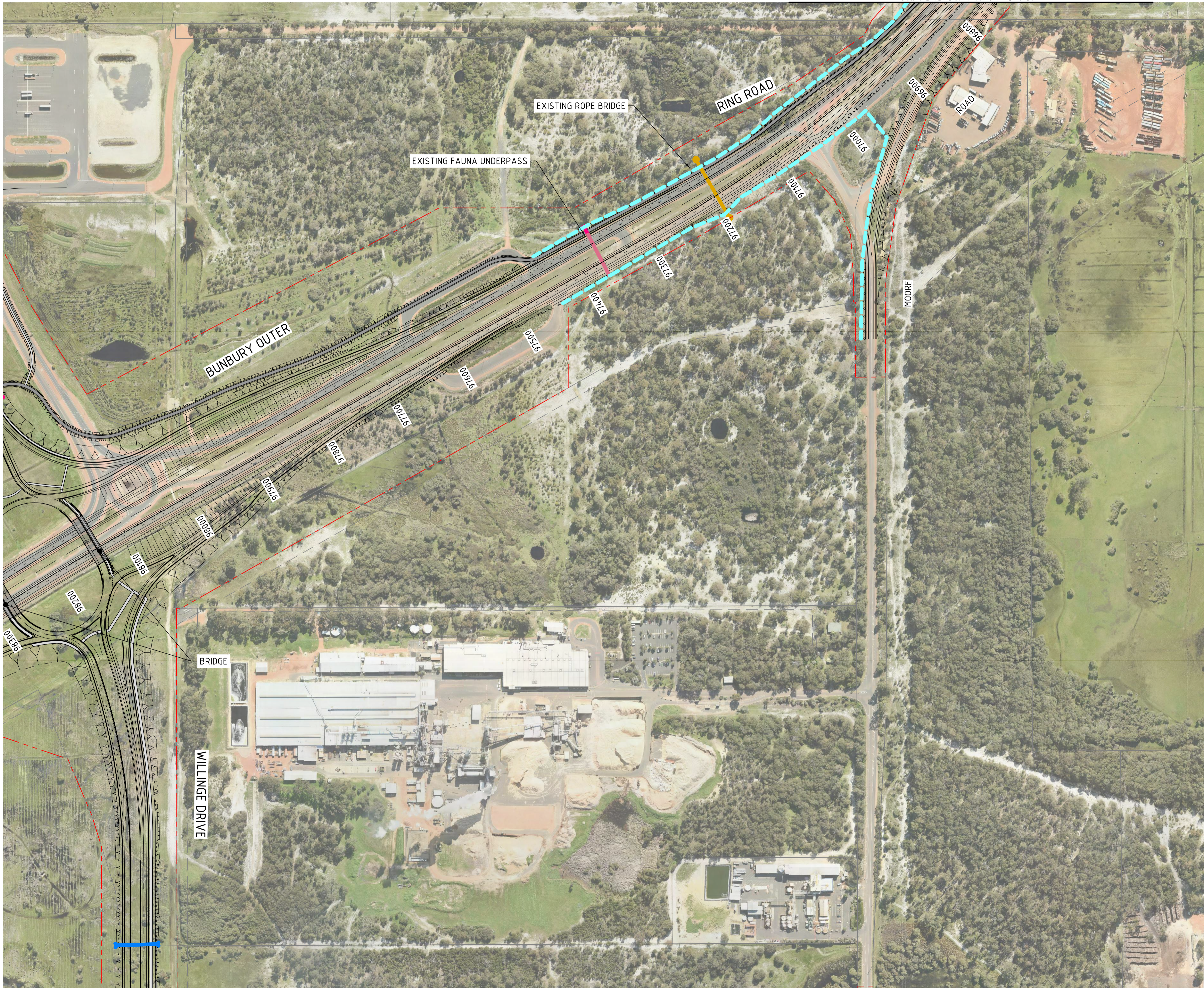
TITLE BUNBURY OUTER RING ROAD  
POSSUM EXCLUSION FENCING PLAN  
FIGURE 4 - SHEET 2

SKETCH No. BORR-00-SK-RD-0136 REV C

MATCH LINE JOINS DRG BORR-00-SK-RD-0137 CHA 96800

1:2500 SCALES A 1





- NOTES**
- REFER TO SKETCH No. BORR-00-SK-RD-0244 FOR FAUNA CROSSING TYPICAL DETAILS.
  - REFER TO SKETCH No. BORR-00-SK-RD-0124 & 0125 FOR FAUNA CROSSING TYPE AND SIZES.

- LEGEND**
- SITE BOUNDARY
  - POSSUM EXCLUSION FENCING (PERMANENT)
  - POSSUM EXCLUSION FENCING (TEMPORARY)
  - FAUNA ROPE BRIDGE
  - FAUNA UNDERPASS (BOX)
  - FAUNA UNDERPASS (ARCHED)
  - FAUNA CULVERT
  - NOISE WALL
  - RETAINING WALL
  - SCREEN WALL
  - CADASTRAL BOUNDARY
  - EASEMENT BOUNDARY
  - PSP
  - SHARED PATH

SKETCH ONLY  
 ULTIMATE PLANNING  
 UNDER DEVELOPMENT



**BUILDING OUR FUTURE**

DATE 4/03/2020 PREPARED ET

SCALE 1:1000m @ A1 GRID PCG 94

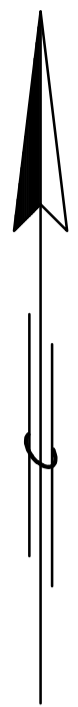
PROJECT BUNBURY OUTER RING ROAD (H058)

TITLE BUNBURY OUTER RING ROAD  
POSSUM EXCLUSION FENCING PLAN  
FIGURE 4 - SHEET 3

SKETCH No. BORR-00-SK-RD-0137 REV C

1:2500  
 SCALES  
 A  
 1





**NOTES**

1. REFER TO SKETCH No. BORR-00-SK-RD-0244 FOR FAUNA CROSSING TYPICAL DETAILS.
2. REFER TO SKETCH No. BORR-00-SK-RD-0124 & 0125 FOR FAUNA CROSSING TYPE AND SIZES.

**LEGEND**

- SITE BOUNDARY
- POSSUM EXCLUSION FENCING (PERMANENT)
- POSSUM EXCLUSION FENCING (TEMPORARY)
- FAUNA ROPE BRIDGE
- FAUNA UNDERPASS (BOX)
- FAUNA UNDERPASS (ARCHED)
- FAUNA CULVERT
- NOISE WALL
- RETAINING WALL
- SCREEN WALL
- CADASTRAL BOUNDARY
- EASEMENT BOUNDARY
- PSP
- SHARED PATH

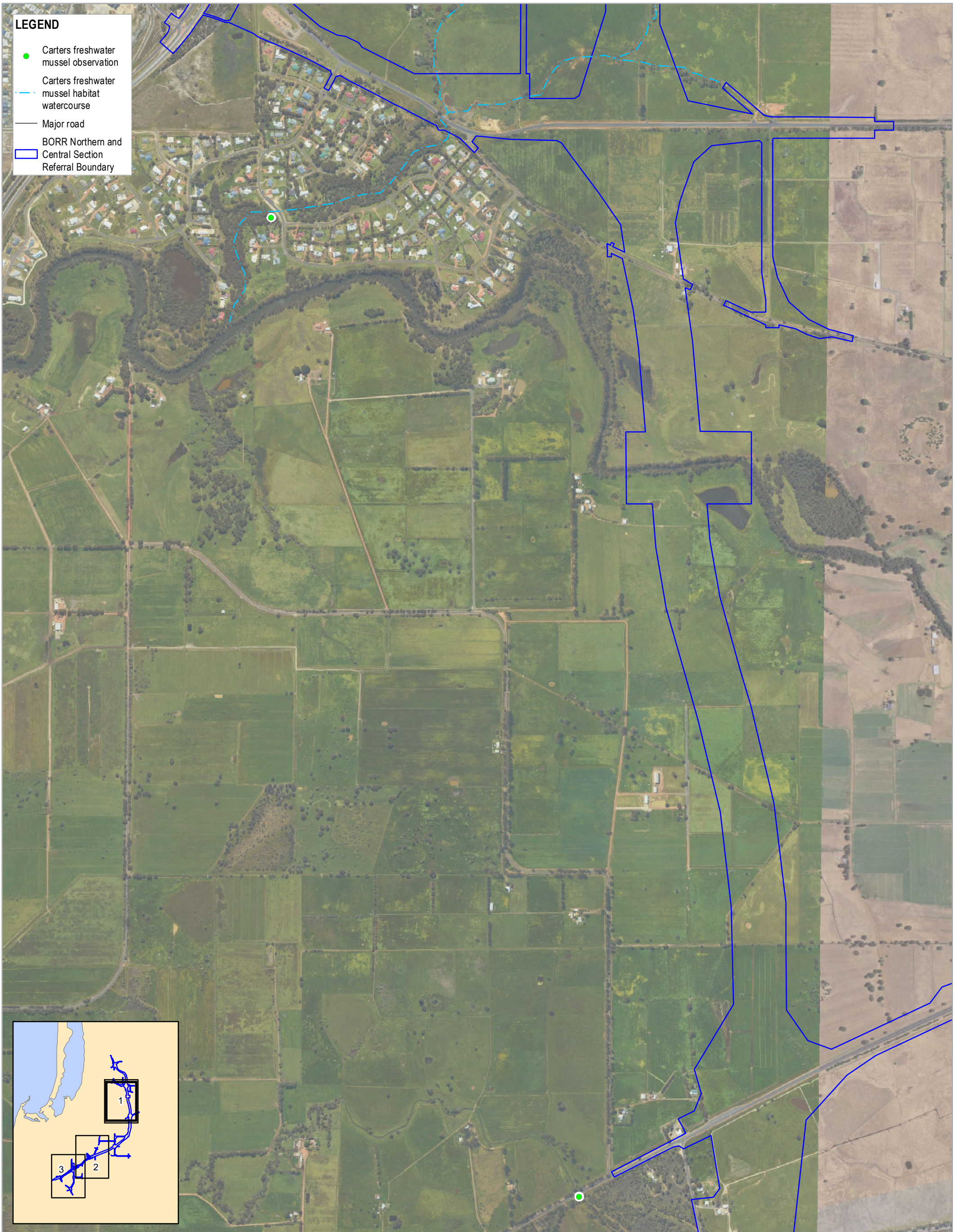
**SKETCH ONLY  
ULTIMATE PLANNING  
UNDER DEVELOPMENT**



DATE 4/03/2020		PREPARED ET
SCALE 1:1000m @ A1		GRID PCG 94
PROJECT BUNBURY OUTER RING ROAD (H058)		
TITLE BUNBURY OUTER RING ROAD POSSUM EXCLUSION FENCING PLAN FIGURE 4 - SHEET 4		
SKETCH No. BORR-00-SK-RD-0138	REV B	

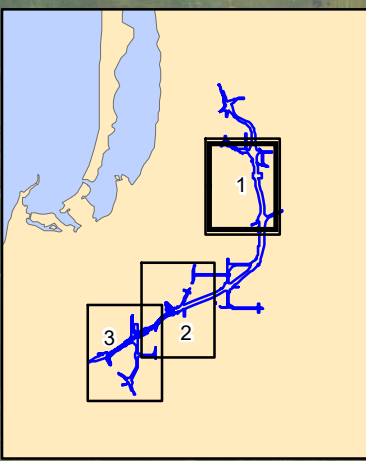
1:1000  
A  
1





**LEGEND**

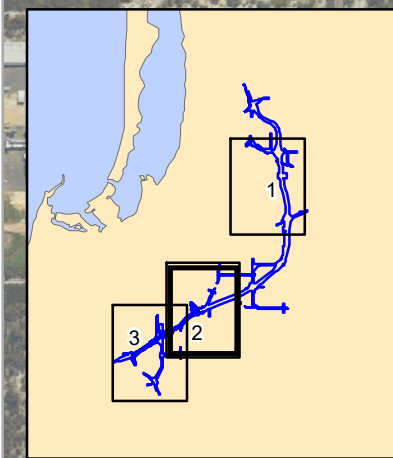
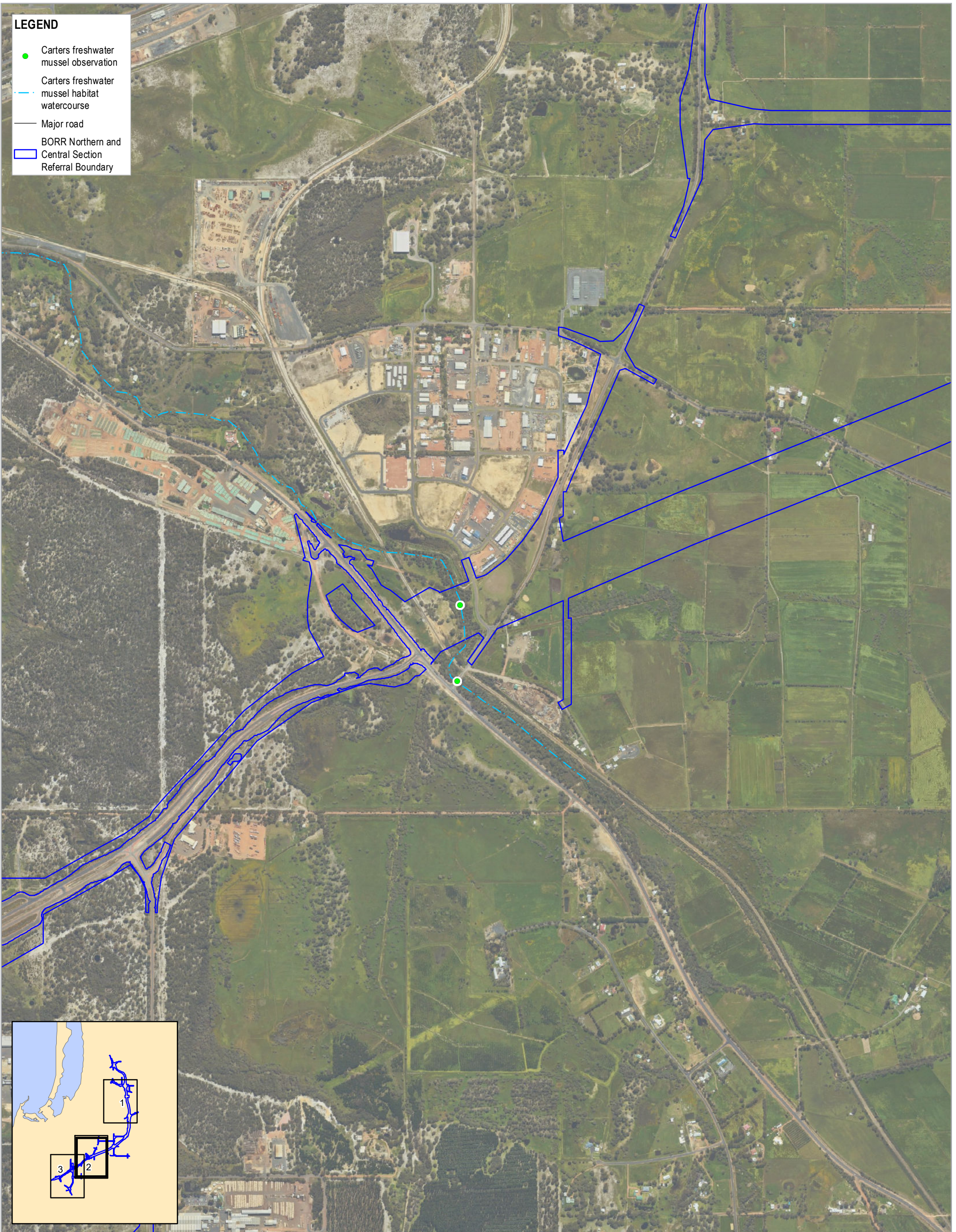
- Carters freshwater mussel observation
- Carters freshwater mussel habitat watercourse
- Major road
- BORR Northern and Central Section Referral Boundary





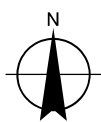
**LEGEND**

- Carters freshwater mussel observation
- - - Carters freshwater mussel habitat watercourse
- Major road
- ▭ BORR Northern and Central Section Referral Boundary



Paper Size ISO A3  
 0 100 200 300 400  
 Metres

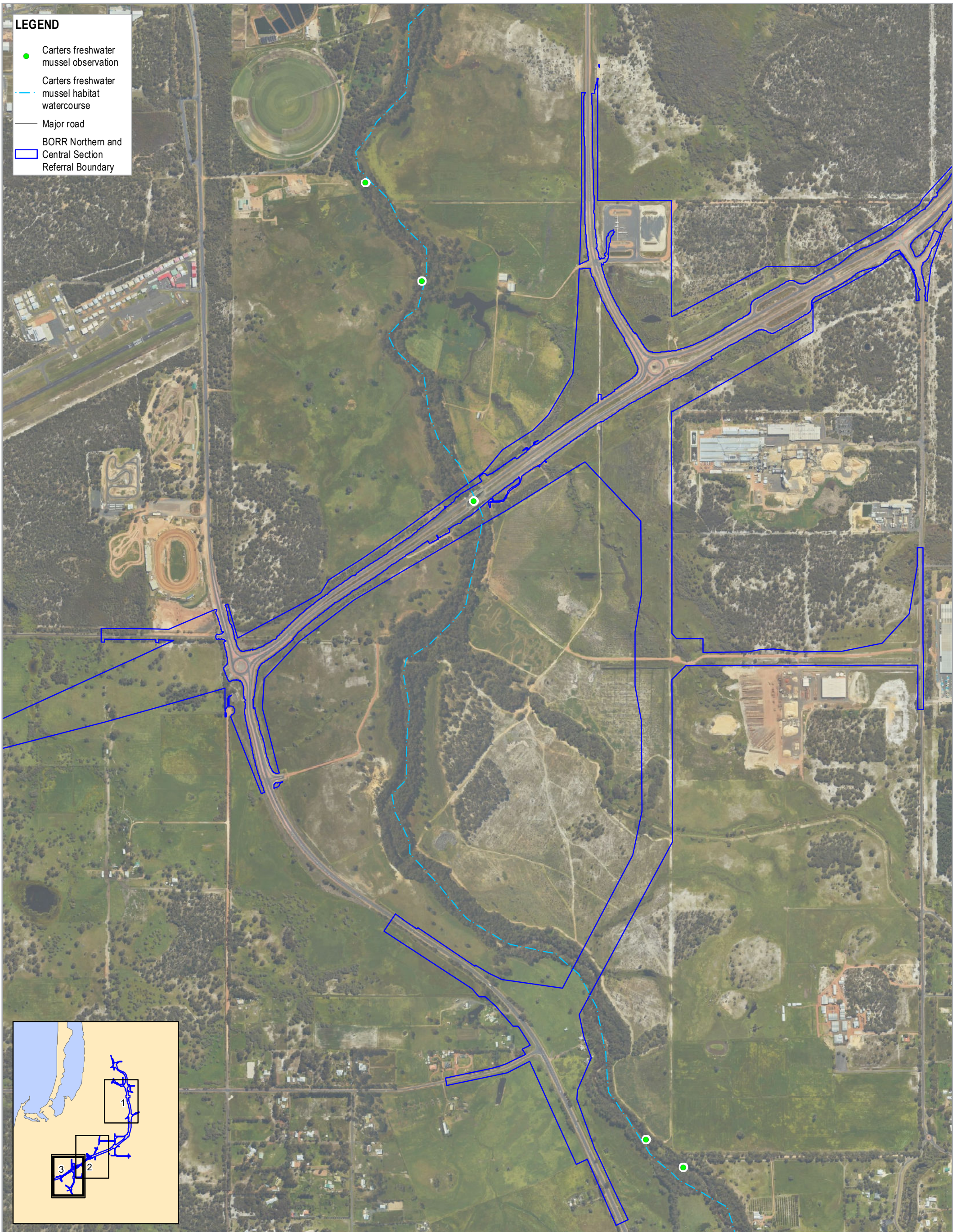
Map Projection: Transverse Mercator  
 Horizontal Datum: GDA 1994  
 Grid: GDA 1994 Perth Coastal Grid 1994



Main Roads Western Australia  
 Bunbury Outer Ring Road Northern and Central Section  
 Fauna Environmental Management Plan  
**Carter's Freshwater Mussel Observations  
 Within and Adjacent to the Proposal Area  
 and Locations of Silt Curtains**

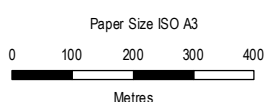
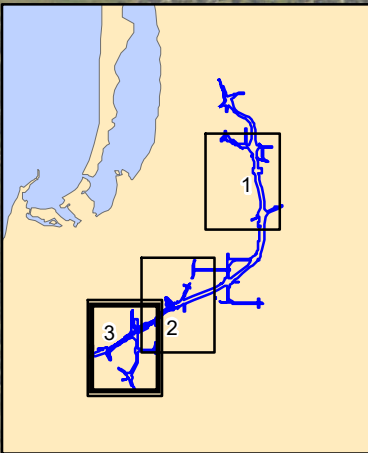
Project No. 61-37041  
 Revision No. 0  
 Date 05 Mar 2020



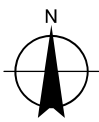


**LEGEND**

- Carters freshwater mussel observation
- - - Carters freshwater mussel habitat watercourse
- Major road
- BORR Northern and Central Section Referral Boundary



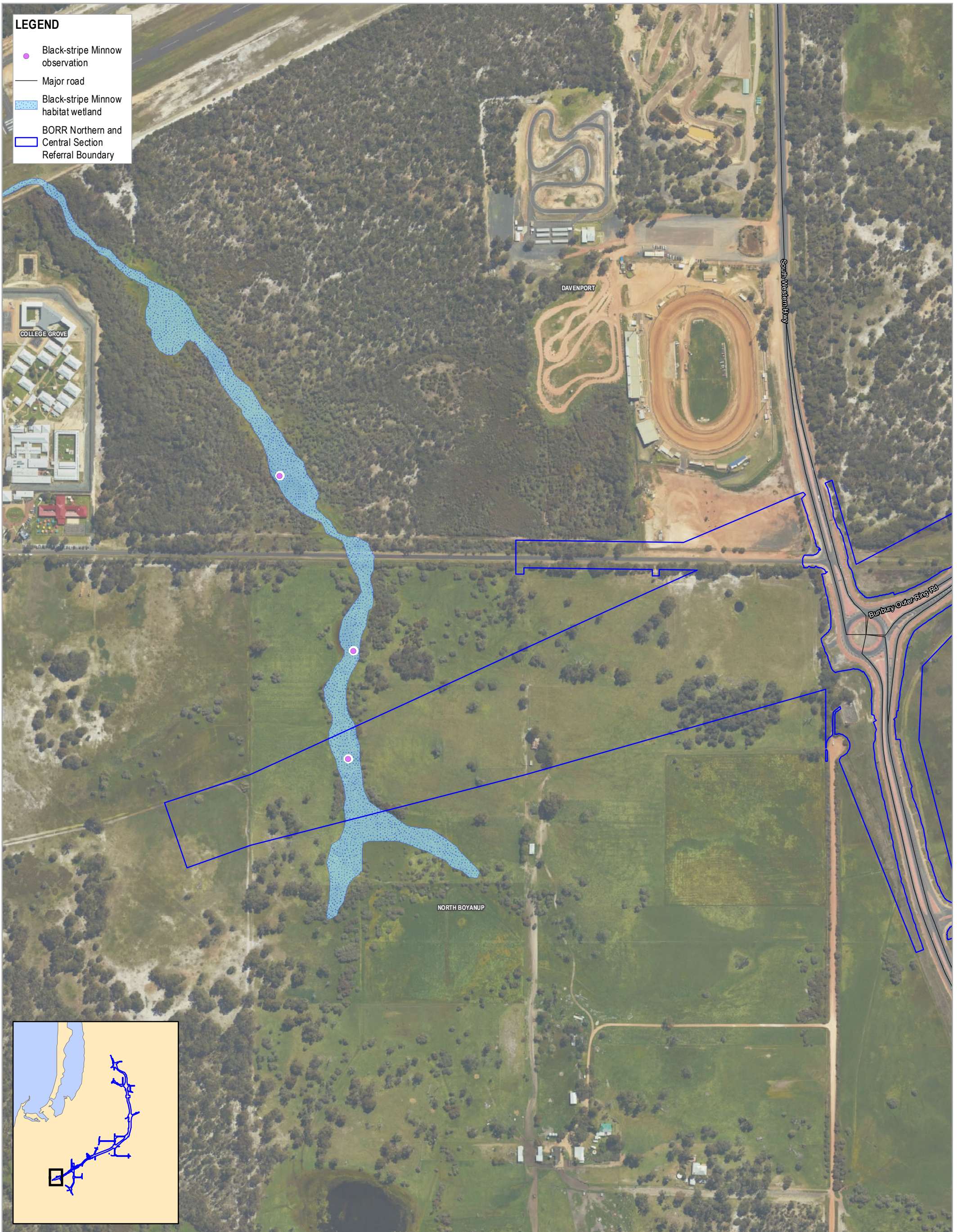
Map Projection: Transverse Mercator  
 Horizontal Datum: GDA 1994  
 Grid: GDA 1994 Perth Coastal Grid 1994



Main Roads Western Australia  
 Bunbury Outer Ring Road Northern and Central Section  
 Fauna Environmental Management Plan  
**Carter's Freshwater Mussel Observations  
 Within and Adjacent to the Proposal Area  
 and Locations of Silt Curtains**

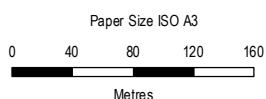
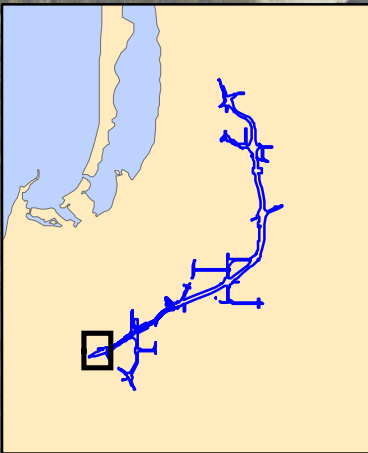
Project No. 61-37041  
 Revision No. 0  
 Date 05 Mar 2020



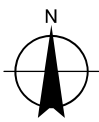


**LEGEND**

- Black-stripe Minnow observation
- Major road
- Black-stripe Minnow habitat wetland
- BORR Northern and Central Section Referral Boundary



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



Main Roads Western Australia  
Bunbury Outer Ring Road Northern and Central Section  
Fauna Environmental Management Plan

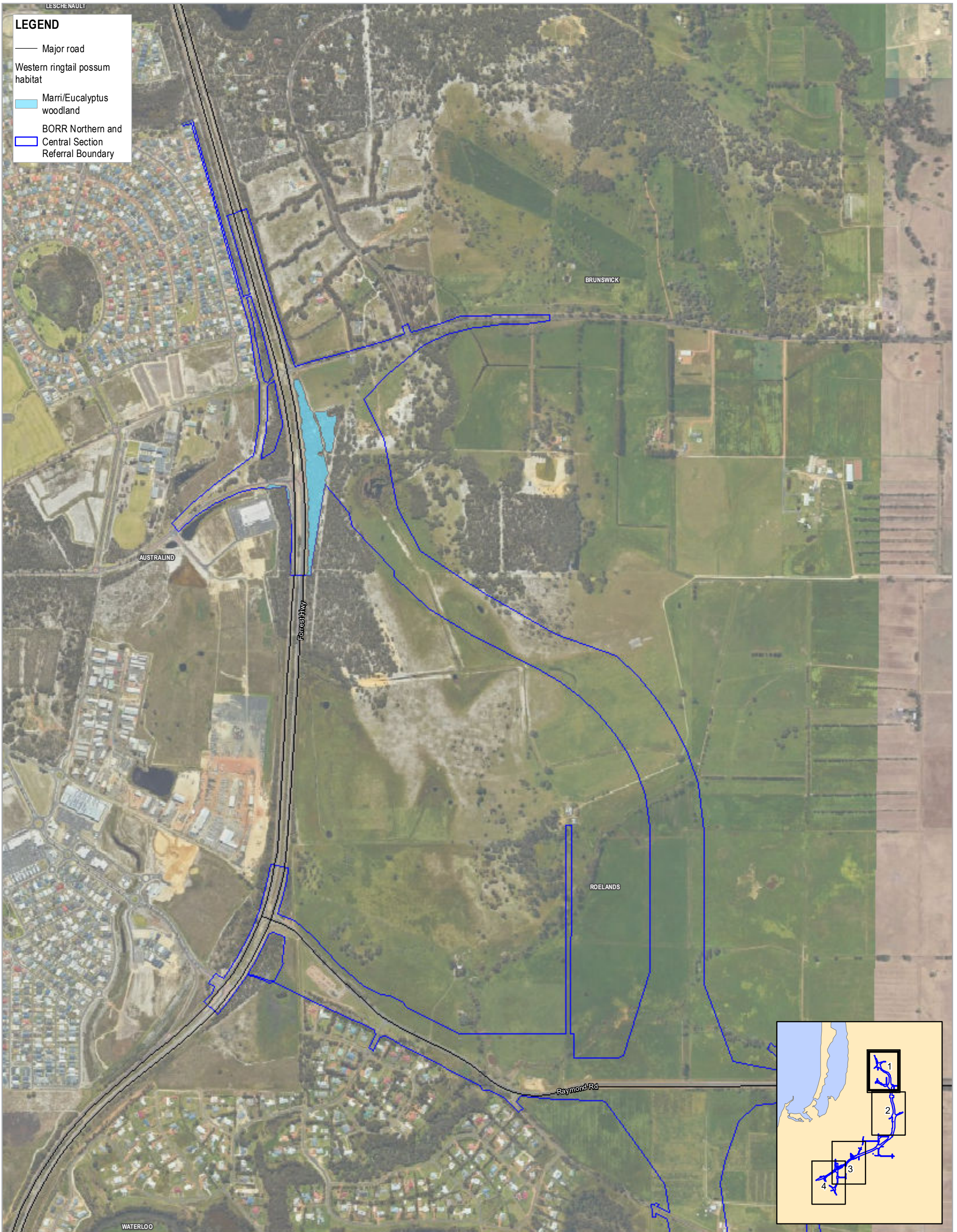
**Black-stripe Minnow observations  
Within and Adjacent to the Proposal Area  
and Location of Five Mile Brook Culvert**

Project No. 61-37041  
Revision No. 0  
Date 05 Mar 2020

**FIGURE 6**

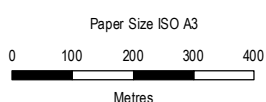
Data source: BORR team: North referral boundary - 20191016; WRM: Minnow habitat and observations - 201912; Landgate: Roads - 201805; Localities - 20180319; Imagery - WA Now accessed 20191217. Created by: m.mikkonen



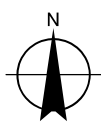


**LEGEND**

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



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



Main Roads Western Australia  
Bunbury Outer Ring Road Northern and Central Section  
Fauna Environmental Management Plan

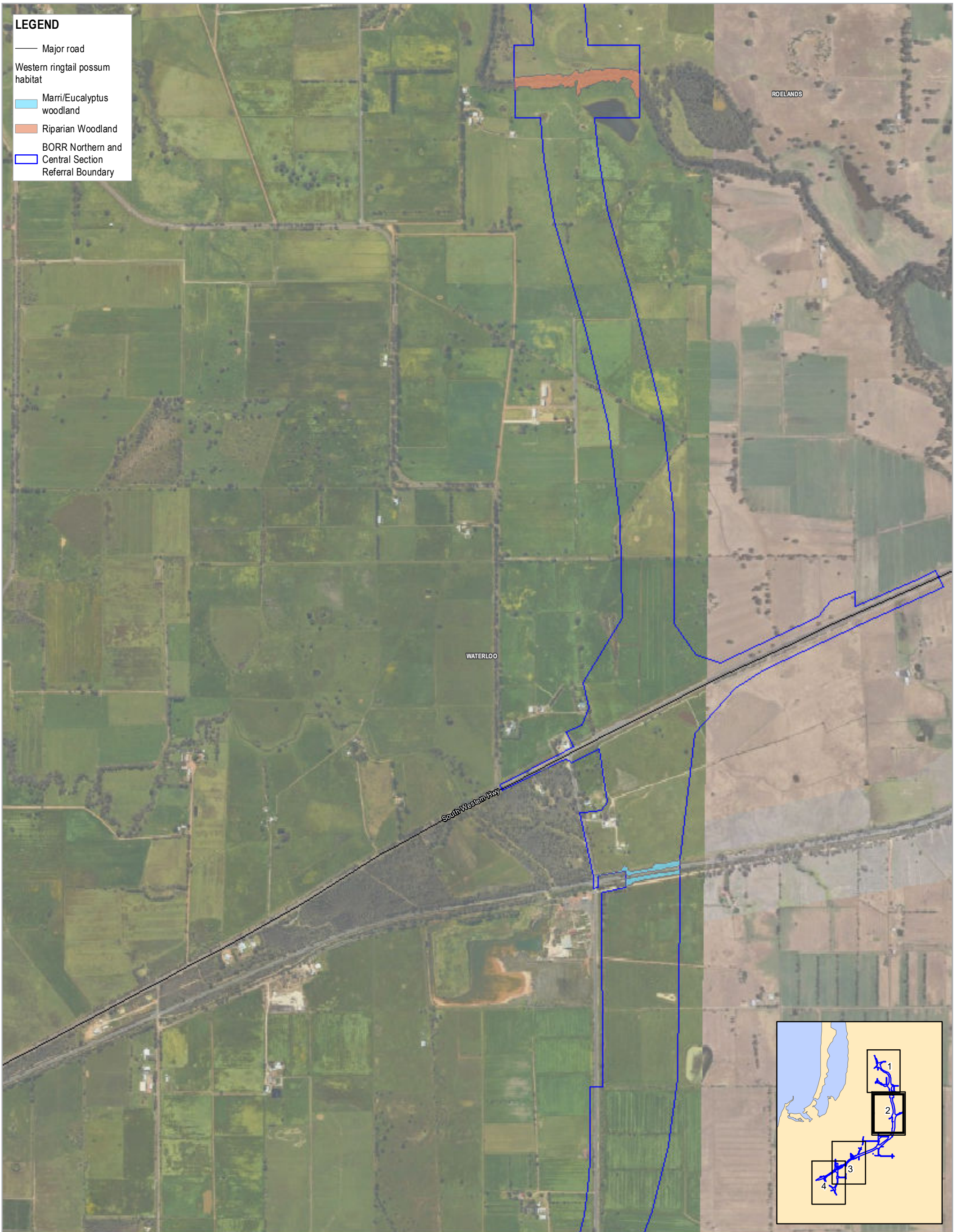
Project No. 61-37041  
Revision No. 0  
Date 19 Dec 2019

**Brush-tailed Phascogale Records  
Within and Adjacent to the Proposal Area**

Page 1 of 4

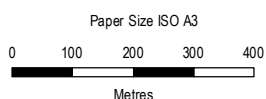
**FIGURE 7**



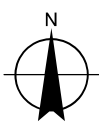


**LEGEND**

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



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

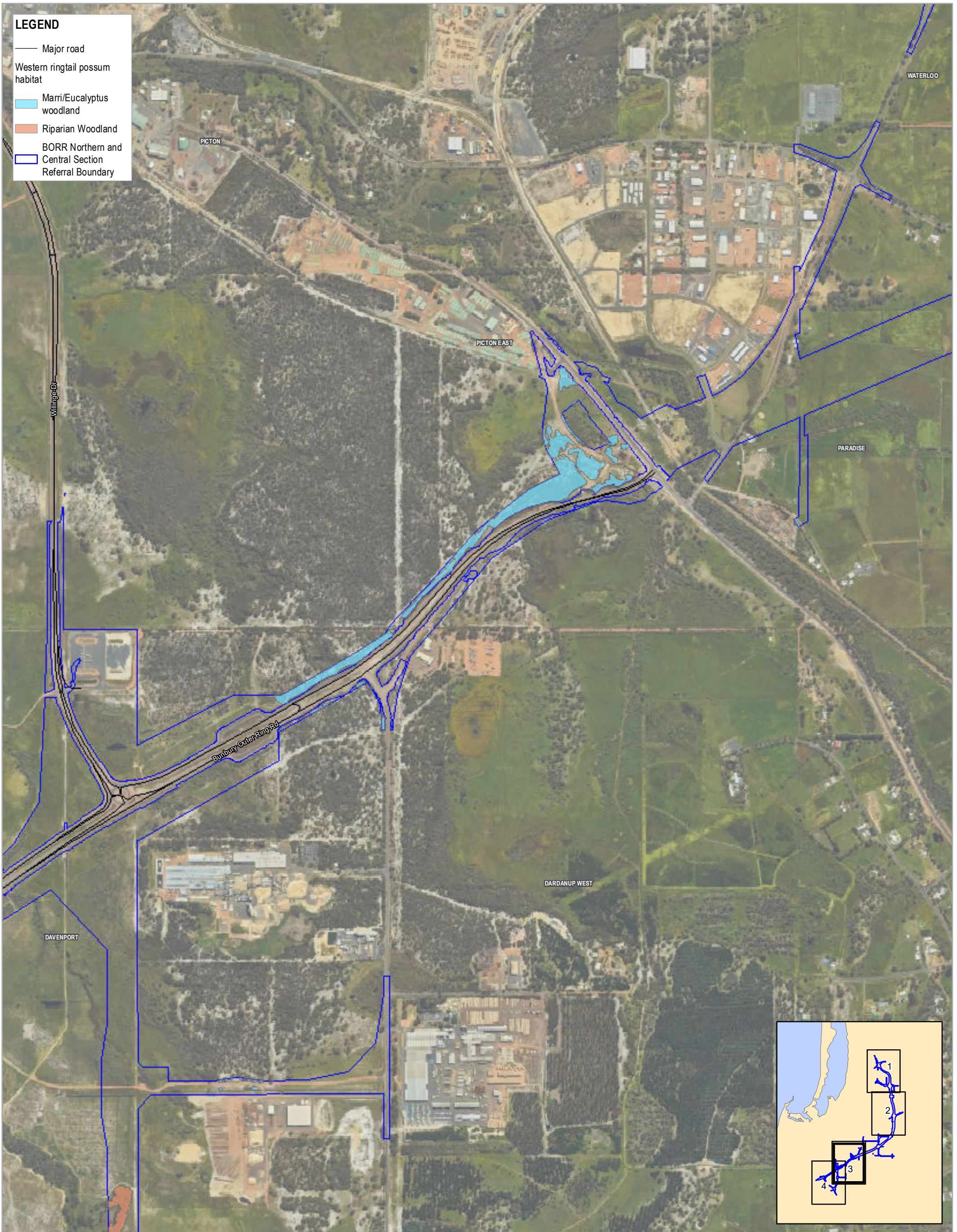


Main Roads Western Australia  
Bunbury Outer Ring Road Northern and Central Section  
Fauna Environmental Management Plan

**Brush-tailed Phascogale Records  
Within and Adjacent to the Proposal Area**

Project No. 61-37041  
Revision No. 0  
Date 19 Dec 2019



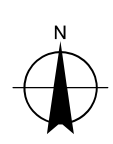


**LEGEND**

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



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

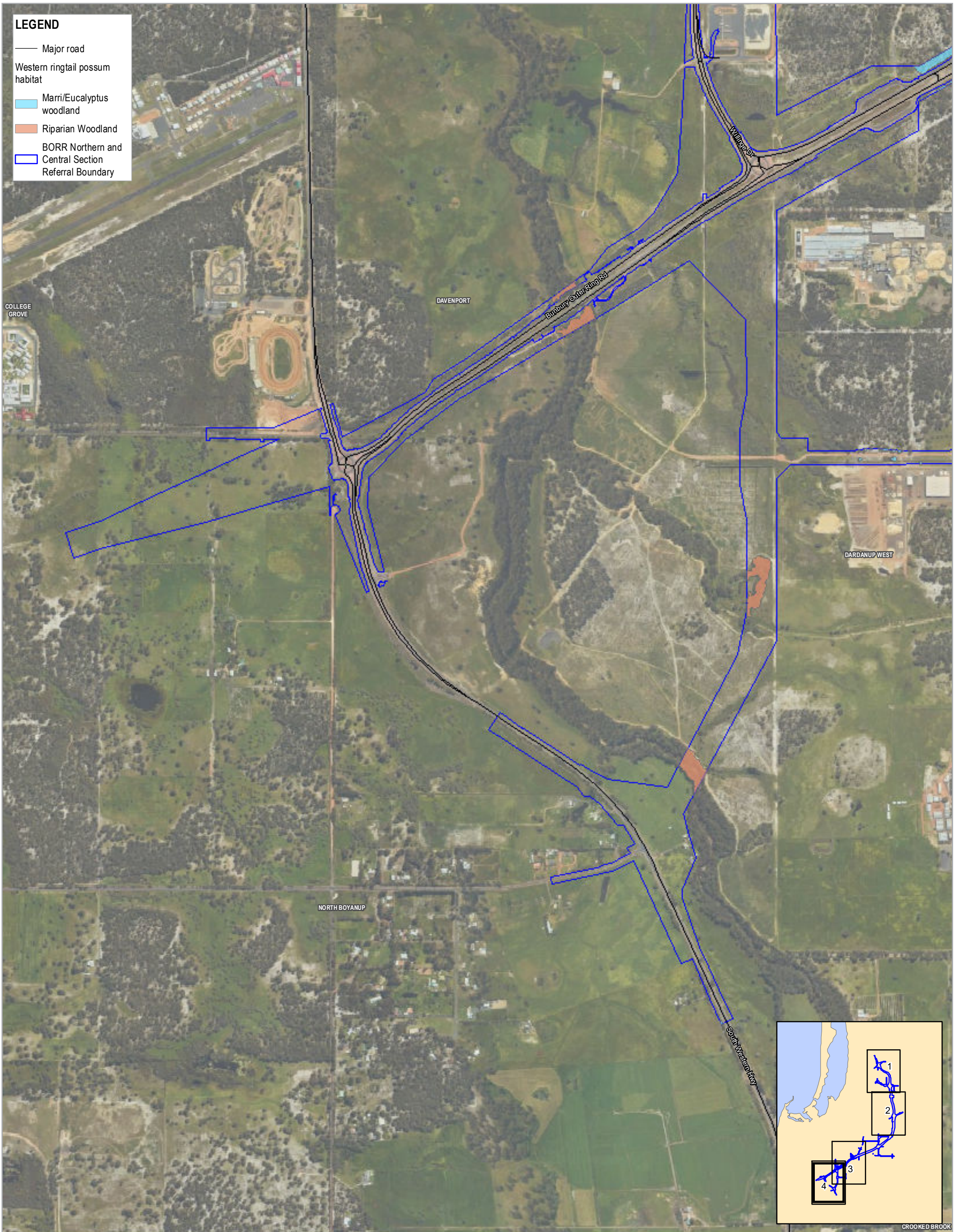


Main Roads Western Australia  
 Bunbury Outer Ring Road Northern and Central Section  
 Fauna Environmental Management Plan  
 Brush-tailed Phascogale Records  
 Within and Adjacent to the Proposal Area

Project No. 61-37041  
 Revision No. 0  
 Date 19 Dec 2019

Data source: BORR team: North referral boundary - 20191016; Biota: WRP Habitats and Observations - 201912; Landgate: Roads - 201805; Localities - 20180319; Imagery - WA Now accessed 20191217. Created by: bjpnes2



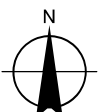


**LEGEND**

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



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



Main Roads Western Australia  
 Bunbury Outer Ring Road Northern and Central Section  
 Fauna Environmental Management Plan  
 Brush-tailed Phascogale Records  
 Within and Adjacent to the Proposal Area

Project No. 61-37041  
 Revision No. 0  
 Date 19 Dec 2019

Page 4 of 4  
**FIGURE 7**

Data source: BORR team: North referral boundary - 20191016; Biota: WRP Habitats and Observations - 201912; Landgate: Roads - 201805, Localities - 20180319, Imagery - WA Now accessed 20191217. Created by: b.pnes2





Australian Government

**BUILDING OUR FUTURE**



**mainroads**  
WESTERN AUSTRALIA

BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT