



mainroads
WESTERN AUSTRALIA

Bunbury Outer Ring Road – Southern Section

Vegetation Management Plan

July 2022

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Western Australia.*

AMENDMENTS

Revision Number	Revision Date	Description of Key Changes	Section / Page No.
A	June 2022	Review Draft	All
0	July 2022	Final for Issue	All
0.1	July 2022	Revised Final for Approval	All
1	July 2022	Revised Final for Approval	All

EXECUTIVE SUMMARY

Bunbury Outer Ring Road Southern Section Proposal

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

The 200 ha Development Envelope is within the City of Bunbury and Shire of Capel. Approximately 62 % of land within the Development Envelope is cleared. The Development Envelope comprises 76 ha of native vegetation and 124 ha of cleared agricultural land.

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

The Proposal was formally referred to the then Commonwealth Department of the Environment and Energy (DoEE) on 3 December 2019 (EPBC Act referral 2019/8543) as a potential Controlled Action under the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) due to impacts on Matters of National Environmental Significance (MNES).

EPBC Act approval for EPBC 2019/8543 was granted on 29 June 2022.

Purpose of this Vegetation Management Plan

This Vegetation Management Plan (VMP) has been prepared to document measures to minimise and manage potential adverse impacts on threatened ecological communities (TECs) and the habitat of listed threatened species that may result from clearing, construction and operation of the Proposal, as required under condition 12 of the EPBC Act approval for EPBC 2019/8543.

This VMP sets out the environmental management actions to manage, monitor and mitigate direct and potential indirect impacts of the Proposal on the following TECs:

- Banksia Woodlands of the Swan Coastal Plain (SCP) TEC – *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) listed as Endangered, also State-listed as a Priority 3 ecological community ('Banksia Woodlands TEC')
- Tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain TEC, EPBC Act listed as Critically endangered, also State-listed as a Priority 3 ecological community ('Tuart Woodlands TEC')

Management measures relating to habitat for listed threatened (fauna) species included in condition 12 of the EPBC Act approval for EPBC 2019/8543 are detailed in the *Matters of National Significance Fauna Management Plan* (Main Roads Western Australia, 2022a).

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

- Department of the Environment (DoE) (2014) *Environmental Management Plan Guidelines*
- Department of the Environment and Energy (DoEE) (2019) *Action Management Plan Criteria*.

The management plan structure and content has been prepared to align to DoE (2014), with the content then incorporating the additional criteria outlined by DoEE (2019).

This plan should be read in conjunction with the Matters of National Environmental Significance Fauna Management Plan (MNES FMP), Habitat Fragmentation Plan, Offset Strategy and Offset Management Plan required under conditions 8, 10, 14 and 18 respectively.

The plan will achieve its objective primarily through implementation of the following actions:

- Clearing protocols designed to minimise direct impacts to threatened ecological community vegetation
- Surface water, groundwater abstraction, hygiene (weed and pathogen), hydrocarbon and fire management to maintain the baseline condition of threatened ecological community vegetation adjacent to Development Envelope.
- Implementing an adaptive management approach comprised of transect, photopoint and drainage monitoring so that the plan's objectives are achieved.

Glossary of terms

TERM	DEFINITIONS
Biannual	Taking place twice a year
BORR Sections	<p>The BORR Project includes three sections (North, Central and South), which are referred to as:</p> <ul style="list-style-type: none"> • ‘BORR Northern Section’ – section between Forrest Highway (north) and Boyanup-Picton Road (south) • ‘BORR Central Section’ – section that has already been constructed, between Boyanup-Picton Road (north) and South Western Highway (south) • ‘BORR Southern Section’ – section between South Western Highway (north) and Bussell Highway (south).
Clearing exclusion areas	As shown in Figure 1
Development Envelope	As per the Proposal Area
Main Roads	Main Roads Western Australia
Monitoring Period	The monitoring event occurring at a defined timeframe (e.g., monthly, bi-monthly, biannual, annual, biennial) for each respective monitoring aspect.
Monitored TEC vegetation areas	Banksia Woodland TEC within 20 metres of the proposal area and Tuart Woodlands TEC within 60 metres of the Development Envelope and clearing exclusion areas
Prior to Clearing	Prior to clearing is a trigger for a range of management measures. For clarity, prior to clearing relates to the clearing of a specific area/stage, rather than the commencement of the proposals clearing, i.e not only the first-time clearing commences for the proposal.
Proposal	Main Roads proposes to construct the Bunbury Outer Ring Road (BORR) Southern Section from South West Highway (north) to Bussell Highway (south), at its closest point approximately six km from East Bunbury, in the South West Region of Western Australia (WA) (referred to as the Proposal)
Proposal Area	The Proposal Area is located within the City of Bunbury and Shire of Capel, at its closest point approximately six km south-east of Bunbury and 200 km south of Perth. The Proposal Area extends 10.5 km between South Western Highway and Bussell Highway. The Proposal Area covers 200 hectares (ha) and includes existing road reserves, agricultural land and native vegetation.
Site	As per the Proposal Area

Standard construction management	Measures that have been applied successfully to other large scale projects that are considered appropriate in minimising the environmental impacts. These measures ensure that clearing is implemented properly, that erosion does not occur, and that spills are minimised and managed appropriately
Survey Area	The Survey Area includes all sites of significance that occur both within the Proposal Area and wherever relevant, outside the Proposal Area, in order to determine both direct and indirect impacts

Acronyms / Abbreviations

ACRONYMS	
ANZECC	Australian and New Zealand Environment and Conservation Council
ARMCANZ	Agriculture and Resource Management Council of Australia and New Zealand
BC Act	<i>Biodiversity Conservation Act 2016</i>
BORR	Bunbury Outer Ring Road
BORR IPT	Bunbury Outer Ring Road Integrated Project Team
CEMP	Construction environmental management plan
DCCEEW	Department of Climate Change and Energy, the Environment and Water (previously Department of Agriculture, Water and the Environment)
DBH	Diameter Breast Height
DoEE	Department of the Environment and Energy
EP Act	<i>Environmental Protection Act 1986</i>
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
MNES	Matters of National Environmental Significance
WA	Western Australia
WoNS	Weeds of National Significance

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- Appendix A Figures
- Appendix B Risk and Management Matrices
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- Appendix D Monitoring Methodology

COVER PAGE AND DECLARATION OF ACCURACY

- **EPBC number:** 2019/8543
- **Project name:** Bunbury Outer Ring Road Southern Section
- **Action management plan title:** Bunbury Outer Ring Road Southern Section Vegetation Management Plan Rev0.1
- **Proponent / approval holder and ACN or ABN:** Main Roads Western Australia, ABN 50860676021
- **Proposed / approved action:** Construction and operation of the Southern Section of the Bunbury Outer Ring Road (BORR) project
- **Location of the action:** South Western Highway (near Bunbury Airport) to Bussell Highway, within the Shire of Capel and City of Bunbury
- **Date of preparation of the action management plan:** July 2022
- **Person accepting responsibility for the action management plan:** Martine Scheltema, Manager Environment, Main Roads Western Australia

Declaration of accuracy

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

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

Signed: 
Full name: Martine Scheltema, Manager Environment
Organisation: Main Roads Western Australia (ABN 50 860 676 021)
Date: 20 / 07 / 2022

1 PROPOSAL DESCRIPTION

1.1 Proposal

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

The 200 ha Development Envelope is within the City of Bunbury and Shire of Capel. Approximately 62 % of land within the Development Envelope is cleared. The Development Envelope comprises 76 ha of native vegetation and 124 ha of cleared agricultural land.

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

1.2 Environmental assessment

1.2.1 Commonwealth assessment

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

EPBC Act approval for this project, EPBC 2019/8543, was granted on 29 June 2022.

1.2.2 State assessment

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

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

On 9 August 2021, Main Roads submitted a request to the EPA to, under Section 43A of the EP Act, to change the Proposal to document improvements to the Proposal to improve social and ecological connectivity, minimise the potential environmental impacts to flora and vegetation and fauna and substantially expand the scale and nature of the Offset Strategy. The changes include avoidance and management measures including establishing Clearing Exclusion Areas within the Proposal Area Figure 1. Three Clearing Exclusion Areas have been established within Gelorup, one

of which will avoid 1.47 ha of Banksia Woodlands of the Swan Coastal Plain Threatened Ecological Community (TEC).

Following appeal, the Project was approved by the EPA under Ministerial Statement 1191 (MS 1191) on 31 May 2022.

1.3 Relevant Protected Matters

This Vegetation Management Plan (VMP) has been prepared to document measures to avoid, minimise and manage impacts of clearing, construction and operation on threatened ecological communities (TECs) and the habitat of listed threatened species that may occur during or as a result of construction of the BORR Southern Section, as required under condition 12 of the EPBC Act approval for EPBC 2019/8543.

Management measures relating to habitat for listed threatened (fauna) species included in condition 12 of the EPBC Act approval for EPBC 2019/8543 are detailed in the *Matters of National Significance Fauna Management Plan* (Main Roads Western Australia, 2022a).

This VMP sets out the environmental management actions to avoid, mitigate and manage direct and potential indirect impacts of the Proposal on the following TECs:

- Banksia Woodlands of the Swan Coastal Plain (SCP) TEC – *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) listed as Endangered, also State-listed as a Priority 3 ecological community ('Banksia Woodlands TEC')
- Tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain TEC, EPBC Act listed as Critically endangered, also State-listed as a Priority 3 ecological community ('Tuart Woodlands TEC').

The key management and monitoring measures and corrective actions proposed in this VMP align with best available practice as they have been collaboratively developed by subject matter experts, workshopped several times with key regulators and agencies and have been subject to several lengthy periods of public and government consultation. The revegetation methodology and drainage strategies are based on Main Roads extensive experience in building large road projects and managing the WA state road network. In addition to Main Roads extensive experience, the experienced consultants engaged to assess and manage potential impacts, and the vast agency and public consultation that has been undertaken regarding vegetation management, the following conservation advices, standards and guidelines were also utilised to help develop the plan's key management and monitoring measures and corrective actions:

- *Approved Conservation Advice (incorporating listing advice) for the Banksia Woodlands of the Swan Coastal Plain ecological community* (TSSC, 2016) (to inform TEC management actions and monitoring methodology)
- *Approved Conservation Advice (incorporating listing advice) for the Tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain ecological community* (TSSC, 2019) (to inform TEC management actions and monitoring methodology)
- *Technical Guidance Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA, 2016) (to inform monitoring methodologies and completion criteria)
- *Guidance Statement No. 6 Rehabilitation of Terrestrial Ecosystems* (EPA, 2006) (to inform rehabilitation actions, monitoring methodology and completion criteria)

- *Environmental Guidelines Vegetation Placement within the Road Reserve* (Main Roads Western Australia, 2016a) (to inform rehabilitation methodology) *Environmental Guidelines Revegetation Planning and Techniques* (Main Roads Western Australia, 2016b) (to inform rehabilitation actions, monitoring methodology and completion criteria)
- ANZECC & ARMCANZ water quality guidelines (ANZECC & ARMCANZ, 2000) (to inform ground and surface water monitoring methodology and completion criteria)
- *Phytophthora Dieback Management Manual* (DBCA, 2017) (to inform hygiene measures).

1.4 Protected Matter descriptions

1.4.1 Banksia Woodlands TEC

1.4.1.1 TEC description

Banksia Woodlands TEC was listed as an Endangered TEC under the EPBC Act in September 2016. The TSSC (2016) describes the key structural features of the community as:

- A prominent tree layer of *Banksia*, with scattered eucalypts and other tree species often present among, or emerging above, the canopy
- The understorey is a species rich mix of sclerophyllous shrubs, graminoides and forbs
- High endemism and considerable localised variation in species composition across its range
- The community is a low woodland to forest, but may also include shrubland, open woodland or forest under some classification systems. The percentage canopy cover is more than 2% and typically less than 50%. The structure and appearance may also vary due to disturbance history (TSSC, 2016).

The Banksia Woodlands TEC occurs within the SCP IBRA Bioregion and typically occurs on well drained, low nutrient soils on sandplains landforms, particularly in deep Bassendean and Spearwood sands and occasionally on Quindalup sands (TSSC, 2016).

1.4.1.2 TEC within and adjacent to Proposal Area

The Development Envelope contains up to 23.4 ha of vegetation representing Banksia Woodlands TEC that will be cleared as a result of Proposal implementation (Figure 2). A further 4.9 ha of the TEC is located within 20 m of the Development Envelope boundary, and 1.47 ha is contained within the Clearing Exclusion Areas (Figure 3). No TEC vegetation will remain in the Development Envelope outside of the Clearing Exclusion Areas after clearing has been conducted.

1.4.2 Tuart Woodlands TEC

1.4.2.1 TEC description

The Tuart Woodlands TEC was listed as a TEC under the EPBC Act in 2019 at the level of Critically Endangered as assessed using the criteria of the IUCN (IUCN, 2012) and guidance of (TSSC, 2019).

The TSSC (2019) describes the key structural features of the Tuart Woodlands TEC as comprising:

- Woodlands or forests or other structural forms where the primary defining feature is the presence of (Tuart) trees in the uppermost canopy layer (comprising at least two living established individuals and > 0.5 ha in area)
- Co-occurring with other tree species such as *Banksia attenuata* (Candlestick Banksia), *Agonis flexuosa* (Peppermint), *Eucalyptus marginata* (Jarrah) or *Corymbia calophylla* (Marri)

- An understorey of native plants is typically present, which may include grasses, herbs and shrubs, although this is often modified by disturbance.

The Tuart TEC occurs on the SCP in the SCP IBRA Bioregion, from Jurien, approximately 200 km north of Perth, to the Sabina River, near Busselton, 225 km south of Perth (TSSC, 2019).

1.4.2.2 TEC within and adjacent to Proposal Area

The Development Envelope contains up to 4.4 ha of vegetation representing Tuart Woodlands TEC that will be cleared as a result of Proposal implementation (Figure 2). A further 8.9 ha of the TEC is located within 60 m of the Development Envelope boundary (Figure 3). No TEC vegetation will remain in the Development Envelope after clearing has been conducted.

2 PURPOSE AND OBJECTIVE

2.1 Purpose

This VMP has been prepared to address condition 12 of EPBC Act approval for EPBC 2019/8543.

This VMP sets out the environmental management actions proposed to avoid, mitigate and manage direct and potential indirect impacts of the Proposal on listed TECs. It has been prepared consistent with the conservation advice specified in Section 1.1, and includes the environmental management and monitoring activities to be undertaken by Main Roads, its employees and contractors.

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

- Department of the Environment (DotE) (2014) *Environmental Management Plan Guidelines*
- Department of the Environment and Energy (DoEE) (2019) *Action Management Plan Criteria*.

A Construction Environmental Management Plan (CEMP) will be prepared by the Construction Contractor and include the management actions detailed in this VMP and Main Roads 'business as usual' environmental management measures.

2.2 Objective

This VMP has been prepared to achieve the following objective:

- To ensure that impacts to TECs are avoided, mitigated and managed during clearing, construction and operation of the Proposal.

It is a 'management-based' VMP to document management actions required during Proposal implementation and operation. Management measures within this VMP are specific to the Proposal.

2.3 Condition requirements

This plan has been prepared to meet the requirements of condition 12 of the EPBC Act approval for EPBC 2019/8543 for Main Roads to prepare a VMP (Table 2-1). Condition 12 prescribed a requirement for Main Roads to detail the proposed management measures to avoid, mitigate and manage the impacts of clearing, construction and operation of the proposal on listed threatened ecological communities. In doing so, this VMP contributes to avoiding, mitigating and managing those impacts on the habitat of listed threatened fauna species.

Measures to avoid and mitigate impacts to habitat for listed threatened fauna species as defined in condition 12 are detailed in the *Matters of National Environmental Significance Fauna Management Plan* (Main Roads Western Australia, 2022a) and are not repeated in this plan.

Impacts of the Proposal to other conservation significant fauna values are addressed within a separate *Habitat Fragmentation Plan* (Main Roads Western Australia, 2022b).

No listed threatened flora were recorded within or adjacent to the Development Envelope during field surveys conducted for the Proposal. As such, no direct impact to threatened flora will occur as a result of the Proposal. Based on the outcomes of the impact assessment (BORR IPT, 2022), no impact to potential threatened flora habitat adjacent to the Development Envelope is likely to

occur as a result of implementation of the Proposal. In consideration of the above, the protection of listed threatened flora is not addressed in this plan.

Table 2-1. Condition 12 of EPBC Act approval for EPBC 2019/8543

Condition no.	Condition	Applicable Section
12.	<p>Vegetation Management Plan</p> <p>To minimise the impacts of clearing, construction and operation on listed threatened ecological communities and the habitat of listed threatened species, the approval holder must submit a Vegetation Management Plan to the Department for the Minister’s approval. The Vegetation Management Plan must specify, to the Minister’s satisfaction, measures to avoid, mitigate and manage impacts of the action on listed threatened ecological communities and the habitat of listed threatened species and be consistent with the Environmental Management Plan Guidelines. The Vegetation Management Plan must:</p>	This plan
a.	be prepared by a suitably qualified plant ecologist ;	
b.	<p>detail measures that will be undertaken in the proposal area to avoid, mitigate and manage impacts to plant and threatened ecological community protected matters and their habitat during clearance, construction and operation, including but not limited to:</p> <ul style="list-style-type: none"> <li data-bbox="343 1115 1259 1272">i. identifying the baseline habitat quality of any Banksia Woodland TEC within 20 metres of the proposal area and any Tuart Woodlands and Forests TEC within 60 metres of the proposal area prior to commencement of the action. <li data-bbox="343 1272 1259 1552">ii. hygiene management measures to be implemented during clearing, construction and during operation for 5 years post-construction to prevent the spread of <i>Phytophthora cinnamomi</i> dieback and weeds to any Banksia Woodland TEC within 20 metres of the proposal area and any Tuart Woodlands and Forests TEC within 60 metres of the proposal area and clearing exclusion areas. <li data-bbox="343 1552 1259 1675">iii. fire management measures to be implemented during clearing, construction and during operation for 5 years post-construction <li data-bbox="343 1675 1259 1798">iv. details of the design, location, methods and maintenance of revegetation and landscaping within the proposal area for 5 years post-construction. <li data-bbox="343 1798 1259 1921">v. details of the design, location and methods of installation and maintenance of sediment, pollutant and erosion controls for the duration of the approval <li data-bbox="343 1921 1259 2033">vi. ensure that no construction waste or pollutants arising from operation can fall or be deposited into drainage lines or waterways, 	<p>This plan</p> <p>5.3.1</p> <p>5.1.1.1, Table 5-3</p> <p>5.1.1.3, Table 5-3</p> <p>5.1.1.4</p> <p>5.1.1.2, Figure 4</p> <p>5.1.1.2, Table 5-3</p>

Condition no.	Condition	Applicable Section
	vii. specify the pumping out of sediment/pollutant basins and/or flocculating turbid water in basins prior to and during periods of anticipated heavy or prolonged rainfall,	5.1.1.2, Table 5-3
	viii. specify not sourcing water for construction and operational activities from, or disposing of water from sediment basins or flocculating turbid water into, wetlands, and	5.1.1.2, Table 5-3
	ix. implementing Surface Water and Groundwater Monitoring to inform the effective management of risks to water quality during construction and operation to ensure that there is no adverse impact of water quality on protected matters .	5.3.2, Appendix D
c.	specify the timing of implementation, frequency and duration of the measures to be implemented,	5.1, Table 5-3, Appendix B
d.	include evidence of how the measures and corrective actions are based on best available practices, appropriate standards, and supported by scientific evidence,	5.1.1
e.	include a monitoring program, which must include:	N/A
	i. measurable performance indicators,	5.3, Table 5-5
	ii. trigger values for corrective actions,	Table 5-4
	iii. the timing and frequency of monitoring to detect trigger values and changes in the performance indicators, and	Table 5-5
	iv. proposed corrective actions, if trigger values are reached,	Table 5-4
f.	include a risk analysis and a risk management and mitigation strategy for all risks to the successful implementation of the Vegetation Management Plan and timely achievement of the required outcomes, including a rating of all initial and post-mitigation residual risks in accordance with the risk assessment matrix .	4.4, Table 4-3, Appendix B
g.	The approval holder must not commence the action unless the Minister has approved the Vegetation Management Plan in writing. The approval holder must implement the approved Vegetation Management Plan until the completion of the action	N/A

3 REPORTING AND ACCOUNTABILITY

3.1 Roles and responsibility

This VMP identifies environmental management activities that will be implemented by Main Roads during the implementation of the Proposal to meet the requirements of Condition 12 of the EPBC Act approval. Main Roads acknowledges that the environmental management actions contained within this VMP are legal requirements to be met by Main Roads.

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

Where management actions are undertaken by employees and / or contractors of Main Roads, these will be communicated and documented to the relevant personnel through relevant environmental training and induction processes (refer to Section 3.3).

3.2 Reporting

Main Roads will report to DCCEEW on the implementation of this VMP as part of annual compliance reporting under the conditions of approval for the Proposal.

Where compliance audits undertaken by Main Roads identify that the environmental management actions and / or the environmental objectives are not being achieved (i.e. non-compliance or an environmental incident), Main Roads will notify DCCEEW as soon as practicable. Consistent with standard document control procedures, Main Roads will maintain copies of all reports submitted to DCCEEW.

The reporting requirements for this VMP are identified in Table 3-1. A template for the annual compliance report is included in Appendix C.

Table 3-1 Reporting requirements

Aspect	Report from	Report to	Reporting frequency
Implementation of VMP	Manager Environment	DCCEEW	Annually (as part of annual compliance reporting)
Non-compliance with VMP or Environmental Incident	Manager Environment	DCCEEW	As soon as practicable but not more than seven days

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

3.3 Environmental training

Main Roads will ensure that all personnel undertaking works for the Proposal, including visitors, have undertaken a site induction training program, or are escorted to the site. Main Roads will

evaluate all personnel undertaking the site induction training program to ensure that all personnel have an understanding of the environmental requirements for the Proposal.

Where it is identified that personnel have not undertaken the works in accordance with the environmental requirements for the Proposal, Main Roads will as a minimum require such personnel to repeat the site induction training program and / or engage alternative, suitably trained personnel.

The general content of the site induction training program for the Proposal is outlined in Table 3-2.

Table 3-2 Site induction training program content

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

3.4 Emergency contacts and procedures

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

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

Main Roads general and emergency contacts for the Proposal are provided in Table 3-3.

Table 3-3 Emergency contact details

Aspect	Contact details
General contact	<ul style="list-style-type: none"> • Main Roads Head Office Address: Don Aitken Centre, Waterloo Crescent, EAST PERTH WA 6004 Mail: PO Box 6202, EAST PERTH WA 6002 Email: enquiries@mainroads.wa.gov.au Phone: 138 138 • Main Roads South West Region Address: Robertson Drive, BUNBURY WA 6231 Mail: PO Box 5010, EAST PERTH WA 6231 Email: enquiries@mainroads.wa.gov.au Phone: 138 138 / (08) 9724 5600
Emergency contact	<ul style="list-style-type: none"> • Manager Environment, Main Roads Email: Martine.Scheltema@mainroads.wa.gov.au Phone: (08) 9323 4614 • Regional Manager, Main Roads South West Region Email: robert.barnsley@mainroads.wa.gov.au Phone: (08) 9724 5600

4 POTENTIAL ENVIRONMENTAL IMPACTS AND RISKS

4.1 Threats to Protected Matters

A summary of key threats to each Protected Matter included in this VMP is provided below. More detailed information is contained within [BORR Southern Section Additional Information for Preliminary Documentation](#) (BORR IPT, 2022).

4.1.1 Banksia Woodlands TEC

Key threats to the Banksia Woodlands TEC identified in the Approved Conservation Advice (TSSC, 2016) include clearing and fragmentation, dieback, invasive species, changes to fire regime, hydrological degradation, climate change, grazing, decline in pollination and seed dispersing fauna and loss of keystone Banksia species.

4.1.2 Tuart Woodlands TEC

Key potential threats to the Tuart Woodlands TEC identified in the (TSSC, 2019) conservation advice include vegetation clearing and fragmentation, invasive introduced flora and fauna taxa, *Phytophthora* dieback, altered fire regimes, climate change, and hydrological change including groundwater abstraction.

4.2 Key assumptions and uncertainties

This VMP has been prepared on the basis of information provided in the environmental surveys for the Proposal (Table 4-1) and the experience and knowledge that has been gained by Main Roads in the construction and operation of similar linear infrastructure works.

Table 4-1 Environmental surveys relevant to this VMP

Survey / report name	Location / extent in survey area	Methodology
<i><u>Bunbury Outer Ring Road Southern Section Vegetation and Flora Study</u></i> (BORR IPT, 2020c)	Flora and vegetation survey to identify vegetation types and vegetation condition for the Proposal	Detailed and targeted field surveys conducted between August 2018 and November 2019 in accordance with relevant State survey guidelines
<i><u>Phytophthora Dieback Survey Bunbury Outer Ring Road South</u></i> (Great Southern Bio Logic, 2020)	<i>Phytophthora</i> dieback survey of the Bunbury Outer Ring Road southern section alignment	Survey undertaken in accordance with DBCA guidelines

The key assumptions and uncertainties relevant to the Proposal and TECs are:

- Environmental survey reports have not been independently verified. These surveys were undertaken by suitably qualified individuals experienced in flora and vegetation survey and plant ecology and are therefore assumed to have accurately recorded the presence and locations of TECs. It is acknowledged that flora and vegetation survey results may change over time.
- The Proposal may have the potential for indirect impacts to TECs.

- All significant direct and indirect impacts to TECs that may result from the Proposal have been identified.

More information on the key assumptions and uncertainties are provided in the appendices of BORR IPT (2022).

4.3 Potential impacts

A summary of potential impacts of the Proposal to TECs included in this VMP is provided below. A complete assessment of the potential impacts of the Proposal to listed TECs and impacts to other matters protected under Part 3 of the EPBC Act, is contained within *BORR Southern Section Additional Information for Preliminary Documentation* (BORR IPT, 2022).

Potential direct and indirect impacts of the proposal on TECs have been informed through targeted environmental surveys undertaken for the Proposal. These are outlined in Table 4-2. Flora and vegetation surveys were undertaken in accordance with relevant guidelines.

Table 4-2 Environmental impacts of the Proposal

Protected matter	Impact
Banksia Woodlands TEC	Up to <ul style="list-style-type: none"> • 23.4 ha of clearing (direct impact) • 6.37 ha within 20 m of the Development Envelope and Clearing Exclusion Areas (potential indirect impact)
Tuart Woodlands TEC	Up to <ul style="list-style-type: none"> • 4.4 ha of clearing (direct impact) • 8.9 ha within 60 m of the Development Envelope (potential indirect impact)

4.3.1 Banksia Woodlands TEC

Direct impacts

Up to 23.4 ha of vegetation representing Banksia Woodlands TEC in three separate patches will be cleared as a result of the Proposal’s implementation. This represents all of the TEC extent within the Development Envelope, excluding that within clearing exclusion areas, as shown in Figure 2. No Banksia Woodlands TEC vegetation will remain within the Development Envelope outside of the Clearing Exclusion Areas once clearing has been completed.

Across the three TEC patches that will be cleared for the Proposal, the condition of vegetation in the largest site (20.0 ha) ranges from Excellent-Very Good to Completely Degraded, with the two smaller sites ranging from Excellent to Very Good condition.

Indirect impacts

Surveys conducted for the Proposal indicate that 4.9 ha of the TEC is located within 20 m of the Development Envelope boundary, plus 1.47 ha within the Clearing Exclusion Areas (Figure 3). Potential indirect impacts to this TEC vegetation that may result from the Proposal are:

- Possible introduction and / or spread of *Phytophthora* dieback and weeds
- Damage through accidental generation of a bushfire during construction.

Main Roads standard construction practices combined with the management actions detailed in Section 5.1 will specifically and effectively manage the potential for these indirect impacts to occur.

Alteration of existing surface water flow paths has the potential to negatively impact the hydrological regime (most notably drying) of Banksia Woodlands TEC occurrences. Temporary changes to surface hydrology during construction at significant cutting locations may occur, however these would be unlikely to have a significant long-term impact. Drawing on Main Roads recent experience, construction of the Forrest Highway (north of the BORR Southern Section) resulted in several significant road cuttings adjacent to Banksia and Tuart woodland vegetation, as is required for the Proposal. No significant impact from changes to surface hydrology has been detected at these sites over the medium term (i.e. thirteen years).

Sand batters will be constructed adjacent to cuttings and revegetated using local provenance species representative of the adjacent vegetation. The revegetation methodology to be implemented for the BORR Southern Section is the same as that undertaken along the Forrest Highway, and is outlined in Section 5.1.1.4 (Main Roads Western Australia, 2016a; 2016b). The establishment of sand batters and subsequent revegetation of batters will mitigate any edge effects that result from the clearing and cuttings. Where revegetation is not practicable, retaining walls may be used and would minimise impacts from changed surface water hydrology and soil moisture conditions.

Through implementation of the Drainage Strategy developed for the Proposal (BORR IPT, 2019), and the management actions listed in Sections 5.1.1.2 and 5.1.1.4 and in Table 5-3, existing drainage patterns to adjacent TEC vegetation will be maintained. Impacts from changes to flow paths are therefore not expected to result from the Proposal and indirect impact to the TEC from long-term changes in hydrology is not expected.

With regard to fragmentation, all occurrences of Banksia Woodlands TEC remaining after Proposal implementation will continue to meet the minimum patch size criteria for the TEC as defined in TSSC (2016).

4.3.2 Tuart Woodlands TEC

Direct impacts

Up to 4.4 ha of vegetation representing Tuart Woodlands TEC will be cleared as a result of Proposal implementation (Figure 2). This represents all of the Tuart Woodlands TEC extent within the Development Envelope. No Tuart Woodlands TEC vegetation will remain within the Development Envelope once clearing has been conducted. Tuart Woodlands TEC is contained within one occurrence in the Proposal Area, comprising vegetation ranging in condition from Excellent-Very Good to Completely Degraded.

Indirect impacts

Surveys conducted for the Proposal indicate that 8.9 ha of the TEC is located within 60 m of the Development Envelope boundary (Figure 3).

Indirect impacts that may potentially result for Tuart Woodlands TEC occurrences adjacent to the Development Envelope mirror those described for the Banksia Woodlands TEC, as described in Section 4.3.1, with the exception of *Phytophthora* dieback. Tuart Woodlands vegetation is not as

susceptible to *Phytophthora* dieback as Banksia Woodlands, however a risk still remains from one strain of the pathogen, *P. multivora*.

With regard to fragmentation, all occurrences of Tuart Woodlands TEC remaining after Proposal implementation will still meet the minimum patch size criteria for the TEC as defined in TSSC (2019).

4.4 Risk assessment

The DoE (2014) and DoEE (2019) identify a requirement for a risk assessment to assess the likelihood and consequence of each potential impact in order to ensure that risks are adequately managed through appropriate management controls, monitoring and corrective actions.

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

Main Roads has completed a risk assessment in preparation of this VMP. The likelihood and consequence assessment, with the resulting 'risk outcome', are based upon the residual risk levels after management and monitoring activities are implemented. The assessment has applied the definitions for both likelihood and consequence as prescribed within DoEE (2019). The full risk matrix, including both pre- and post- control risk levels, including DCCEEW 's Risk Matrix, is included in Appendix B.

The outcome of the risk assessment for the Proposal for TECs is identified in Table 4-3.

Table 4-3 Risk assessment

Objective: To ensure that impacts to TECs are avoided, mitigated and managed during clearing, construction and operation of the Proposal.				
Environmental objective	Risk	Post control risk assessment	Management	Monitoring
Minimise the area of TEC vegetation cleared during construction	Clearing or disturbance of TEC vegetation exceeds the approved clearing limits	Likelihood: Unlikely Consequence: Moderate Risk outcome: Low	Standard construction management to control construction clearing	Standard construction monitoring to verify construction clearing (not specific to VMP)
No significant indirect impacts to monitored TEC vegetation adjacent to the Development Envelope attributable to Proposal implementation	Reduction in TEC vegetation condition adjacent to the Proposal	Likelihood: Possible Consequence: Moderate Risk outcome: Medium	Implement WONS, Declared plant, surface water and <i>Phytophthora</i> dieback management measures within Development Envelope revegetation areas and monitored TEC vegetation Construction of Development Envelope boundary fence Implement waste management measures as per Table 5-3 and Waste Management Plan	Pre-construction, construction and post-construction monitoring to assess monitored TEC vegetation condition Monitoring to verify efficacy of applied management measures and corrective actions

Objective: To ensure that impacts to TECs are avoided, mitigated and managed during clearing, construction and operation of the Proposal.

Environmental objective	Risk	Post control risk assessment	Management	Monitoring
	Bushfire occurrence as a result of Proposal construction resulting in loss or decline of monitored TEC vegetation condition	Likelihood: Possible Consequence: Moderate Risk outcome: Medium	Standard construction management to control potential ignition sources during construction Implement Fire Management Plan	Standard construction monitoring to verify management of potential ignition sources and fire response during construction clearing (not specific to VMP)
	Groundwater drawdown impacts on or changes hydrology of monitored TEC vegetation	Likelihood: Unlikely Consequence: Moderate Risk outcome: Low	Standard construction management to control groundwater water abstraction consistent with WA Government water supply approvals (not specific to VMP)	Standard construction monitoring to verify groundwater water abstraction consistent with WA Government water supply approvals (not specific to VMP) Pre-construction, construction and post-construction monitoring to assess monitored TEC vegetation condition

Objective: To ensure that impacts to TECs are avoided, mitigated and managed during clearing, construction and operation of the Proposal.				
Environmental objective	Risk	Post control risk assessment	Management	Monitoring
	Impact to water quality in monitored TEC vegetation adjacent to the Development Envelope	Likelihood: Unlikely Consequence: Minor Risk outcome: Low	Management to control sedimentation and erosion during construction Management of hydrocarbon storage during construction Management of hazardous material waste during construction	Pre-construction, construction and post-construction monitoring to assess water quality
	Impact to surface water levels in monitored TEC vegetation adjacent to the Development Envelope	Likelihood: Unlikely Consequence: Minor Risk outcome: Low	Standard construction management to control surface water and drainage during construction (not specific to VMP)	Pre-construction, construction and post-construction monitoring to assess water levels Standard construction monitoring to verify groundwater water abstraction consistent with WA Government water supply approvals (not specific to VMP)
	Drainage basins lack capacity causing impact to monitored TEC vegetation	Likelihood: Unlikely Consequence: Moderate Risk outcome: Low	Standard construction management to control surface water and drainage during construction (not specific to VMP)	Standard construction monitoring of surface water and drainage Pre-construction, construction and post-construction monitoring to assess monitored TEC vegetation condition

Objective: To ensure that impacts to TECs are avoided, mitigated and managed during clearing, construction and operation of the Proposal.				
Environmental objective	Risk	Post control risk assessment	Management	Monitoring
	Landholder access approval for monitoring not granted	Likelihood: Possible Consequence ¹ : Moderate Risk outcome: Medium	Ongoing liaison with landholders	Large areas of TEC vegetation on non-freehold land occurs adjacent to the Development Envelope. The monitoring of indirect impacts does not rely on monitoring TEC vegetation on private property. Where landholder approval is granted, the monitoring of TEC vegetation on this property will be considered.
Establish fauna habitat, bank stabilisation or sediment / pollutant mitigation in identified rehabilitation areas as per design specifications	Failure to establish revegetation appropriate to requirements (fauna habitat, bank stabilisation or sediment / pollutant mitigation)	Likelihood: Unlikely Consequence: Moderate Risk outcome: Low	Management to establish and maintain rehabilitation	Field survey by suitably experienced personnel bi-annually once rehabilitation works have been completed

¹ Consequence is on ability to conduct monitoring, not on the TEC vegetation.

5 ENVIRONMENTAL MANAGEMENT MEASURES

In order to comply with relevant environmental legislation and manage impacts to the local environment, Main Roads has defined objectives, outcomes and management-based provisions to ensure that impacts to TEC vegetation are avoided and minimised during the implementation of the Proposal.

5.1 Environmental management activities, controls and performance targets

Main Roads has taken a 'hierarchical approach' to the mitigation of potential impacts associated with the Proposal, and in the first instance, has sought to avoid areas of TECs through route selection and design refinement. Where impacts cannot be avoided, Main Roads has designed the Proposal to reduce the intensity and / or extent of impacts on TECs.

Main Roads has identified a range of management actions to be implemented to control and minimise direct and potential indirect impacts of the Proposal to TECs. These have been informed by the results of field studies (Table 4-1), best practice and recent experience on similar road projects in Western Australia. The majority of these actions are included in the Main Roads Standard Scope of Work and Technical Criteria and have been formulated in consideration of the specific TEC occurrences that will remain after Proposal implementation. These will minimise potential residual impacts and achieve the plan's objectives.

Based on the controls identified above and these management actions, Main Roads has developed performance targets to identify the outcomes sought from the management actions. These, along with the proposed management actions, are identified in Table 5-3. Unless otherwise specified, each measure specified in Table 5-3 will be ongoing and be applied throughout the relevant phase indicated by the table subsection divisions.

5.1.1 Information to guide the management approach

As identified in Table 4-2, direct impacts of the Proposal to TECs result from the clearing of:

- 23.4 ha and 4.4 ha of Banksia Woodlands TEC and Tuart Woodlands TEC respectively.

In relation to potential indirect impacts from the Proposal, Banksia woodland TEC vegetation is susceptible to degradation through weed invasion, altered fire and hydrological regimes, and the introduction and spread of *Phytophthora* dieback. Tuart woodland TEC vegetation is susceptible to degradation through weed invasion, and altered fire and hydrological regimes. The introduction and spread of *Phytophthora* dieback poses a lower risk to Tuart vegetation than to Banksia woodland vegetation.

The approach to management of indirect impacts to TEC vegetation adjacent to the Development Envelope during clearing, construction and operation is therefore focussed on:

- Weed management
- Drainage and hydrological management
- Hygiene management including vehicle hygiene and management of *Phytophthora* Dieback risk
- Fire management
- Targeted revegetation of fauna crossing structure access / egress points and land bridges, banks and batters of significant cuttings, drainage basins and where space and access allows, revegetating Black Cockatoo habitat.

5.1.1.1 Hygiene management

Hygiene management for the Proposal has two aspects – weeds and *Phytophthora* Dieback.

Weed management

The main objectives of the weed management measures are to prevent the introduction of new Declared and WONS species from Proposal activities into the Development Envelope and adjacent TEC vegetation areas (as shown in Figure 3), and to ensure that existing infestations are controlled and are not spread by Proposal activities.

The Proposal hygiene management protocols will be included in the CEMP and associated Hygiene Management Plan, and include (but are not limited to) the following:

- Ensuring that no known weed, pest or diseased affected soil, mulch, fill or other material is brought into the site
- The Development Envelope boundary is fenced to restrict access and therefore minimise the introduction of weeds to adjacent TEC vegetation
- Implementing the vehicle and mobile plant hygiene measures described in Section 5.1.1.1.

Declared weeds and WONS will be controlled in monitored TEC vegetation during clearing, construction and for five years post-construction (i.e. operation). Control methods will be either mechanical removal or treatment with herbicide, depending on the physiology of the weed species present, and based on Main Roads substantial experience on similar road projects in Western Australia.

Phytophthora Dieback management

The objectives of the *Phytophthora* Dieback management measures are to prevent the introduction and spread of pathogens such as *Phytophthora* Dieback into disease-free areas in the Development Envelope and adjacent TEC vegetation areas by Proposal activities, and to ensure that any existing infestations are not spread by Proposal activities.

Hygiene management protocols will be included in the CEMP and associated Hygiene Management Plan, and include (but are not limited to) the following:

- All mobile plant, machinery, heavy vehicles and earthmoving equipment will be inspected and cleaned of vegetation, mud and soil prior to initial mobilisation to site. Cleaning shall be done off-site prior to entry.
- Vehicles and machinery will only use designated tracks / roads
- Weed hygiene measures will be observed when moving earth moving equipment from weed contaminated to non-contaminated areas within the Development Envelope
- Imported fill, mulch or quarry material or other material will be assessed for weed risk prior to entry to site
- Hygiene protocols will be consistent with the 'Management of *Phytophthora cinnamomi* for Biodiversity Conservation in Australia, Part 2, National Best Practice Guidelines' (O'Gara, 2005)
- Locations of *Phytophthora* dieback infested or dieback free areas and hygiene control locations will be marked on site
- Movement of machines and other vehicles will be restricted to the approved limits of vegetation clearing

- All mobile plant, machinery, heavy vehicles and earthmoving equipment will be clean on exit (i.e. free of soil and vegetation).

5.1.1.2 Drainage and hydrological management

A Drainage Strategy (BORR IPT, 2019) has been developed with the objectives of maintaining the surface water hydrology within the Development Envelope and improving surface and groundwater quality.

Water sourcing and disposal

Water for construction and operational activities of the Proposal will not be sourced from wetlands. Water from sediment basins or flocculating turbid water will not be disposed of into wetlands.

Drainage design

Transverse drainage design will be developed at the detailed design stage to achieve the objective of maintaining the existing (pre-development) water cycle balance of the Development Envelope (i.e. minimising drainage shadow effects on (i.e. redirection of water that would once have drained into) surrounding wetlands, waterways, TECs, vegetation and agricultural properties) and to prevent adverse impacts to the existing built environment (e.g, erosion). Proposal design and proposed drainage management measures will ensure there is no significant difference over baseline hydrology.

All drainage structures will be constructed to Australian standards.

No surface run-off will drain directly into adjacent watercourses, wetlands or TECs. Drainage for the Proposal will be largely through infiltration using table drains and sumps with the majority of the road being unkerbed, and will ensure effective sediment, pollution and erosion control. Detention / infiltration basins will be installed where there is potential for discharge of hazardous spills into the major waterways (Figure 4). Information provided in Figure 4 is based on this drainage concept and strategy. The final design is currently in development. Design of the road will be based on other major successful Main Roads projects that have managed the movement of water across and along road infrastructure.

Management of the risk of erosion, pollution and sedimentation during construction will include (but is not limited to) the following site-specific controls:

- Ensure there is no direct run-off to adjacent watercourses and wetlands
- Installing temporary erosion and sediment control measures during bridge construction (such as silt fences and / or curtains as required at, up and downstream of the Five Mile Brook bridge construction area)
- Designing watercourse crossings to include erosion control and scour protection measures
- Implementing erosion controls at drainage discharge points
- Where sufficient capacity is not available to store or infiltrate the peak 24 hour storm event, sediment / pollutant basins and / or flocculating turbid water in basins will be pumped out prior to and during periods of anticipated heavy or prolonged rainfall.

The risk of contamination from poor hydrocarbon and chemical and waste management during construction will be managed via the measures outlined in Table 5-3, and include the following:

- As part of the CEMP, a Spill Response Procedure will be prepared for hazardous material spill events to ensure any spill is contained and cleaned up appropriately
- Hydrocarbon storage and re-fuelling will not be permitted within 200 m of a natural watercourse or wetland or within 100 m of TEC vegetation
- All hazardous material waste shall be managed in accordance with the Environmental Protection (Controlled Waste) Regulations 2004. This includes managing hydrocarbons and oily waste such as fuels, grease, de- greasers, emulsified oil and oily waste water
- Ensuring that no construction waste or pollutants arising from operation can fall or be deposited into drainage lines or waterways
- General construction waste and other rubbish shall be covered or contained in bins with lids (where practicable) and removed regularly, disposed of in accordance with the relevant legislation.

The risk of other potential impacts will also be managed by implementing procedures specified in the CEMP.

Location of sediment, pollutant and erosion controls

The location of all sediment, pollution and erosion controls (the retention / detention basins), are shown in Figure 4. At the 85% final design, five basins have been designed and sized to manage drainage from the alignment, however the requirement for two additional basins (GY4 and GY11, see Figure 4) is still to be determined. The design details for the five proposed basins is shown in Table 5-1.

Table 5-1. 85 % Final Design Basin Details

Basin No.	Contributing Pervious Area (ha)	Contributing Impervious Area (ha)	Volume Required (m ³)	Basin Base Level (mAHD)	Purpose/function
GY1	1.63	1.20	640	8.30	Detention Basin
GY6	0.48	1.17	733	10.50	Detention Basin
GY5	1.19	1.58	1030	15.00	Detention Basin
GY9	1.10	0.73	135	14.75	Five Mile Brook – Water Quality
GY10	0.46	0.53	139	15.35	Five Mile Brook – Water Quality

Where the highway and associated interchanges require kerbing for delineation / to meet road design standards or for the control of scour, the outlet of the drainage networks will either be directed to retention / detention basins sized for the small frequent rainfall event (defined by DWER as up to 15mm of rainfall) or to the adjacent vegetated verge areas to spread out and infiltrate or to flow into existing road drainage systems. Basins have been provided upstream of sensitive receptors or where large networks and / or those featuring steeper grades are being discharged.

Waterways

At the Five Mile Brook crossing, runoff from the highway will be controlled and discharged via water quality basins designed to contain the runoff from the small frequent rainfall event. The basins will, as a minimum have sufficient capacity to retain a 20m³ spill of floating pollutants.

Wetlands

There are three Conservation Category and three Resource Enhancement category wetlands in proximity to the highway and side roads for the southern section, as shown in Figure 6 of the Proposal MNES FMP. The proposed highway also crosses a Multiple Use wetland. This Multiple Use wetland is hydraulically connected to a Resource Enhancement category wetland to the south / west and runoff towards this wetland has been treated the same as it would be for a Resource Enhancement Category wetland.

Runoff from the highway that flows towards Conservation Category and Resource Enhancement category wetlands will first be treated by a vegetated retention or detention basin sized for the small frequent rainfall event. The hydrology of runoff towards the wetland will be maintained for minor events (up to the 1 Exceedance per Year (EY) event).

Environmentally Sensitive Areas

There are environmentally sensitive areas (Banksia Woodland) between Five Mile Brook and Bussell Highway. The drainage design has minimised impacts to these areas, including locating basins to avoid / minimise clearing of the banksia vegetation, see Figure 4.

Methods of installation of sediment, pollutant and erosion controls

All drainage structures, including basins that provide sediment, pollutant and erosion control, will be constructed to Australian standards. The basins will be installed using excavators and graders and shaped and designed to contain the runoff from the small frequent rainfall event (defined by DWER as up to 15mm of rainfall) and have sufficient capacity to retain a 20m³ spill of floating pollutants.

Methods of maintenance of sediment, pollutant and erosion controls

All basins will be inspected and maintained annually prior to winter. Inspections will include monitoring for risk of structural failure, assessing whether there are signs of erosion that may affect the integrity of the structure and whether the basin maintains a holding capacity of more than 75% of its designed capacity.

The annual inspection and maintenance of the sediment, pollutant and erosion controls will involve the following activities as required:

- Removal of dirt, weeds and debris to restore full capacity of structures including the repair of minor defects to maintain structural integrity
- Cleaning and reforming surface drains to restore original grade, provide adequate flow capacity and allow the free flow of water without ponding
- Remediating all signs of erosion and scour.

Hydrological management

Impacts to TEC vegetation from changes in hydrology primarily relate to drying from a decrease in soil moisture levels (such as at the locations of significant cuttings), or saturation from prolonged inundation and flooding. These are addressed below.

Potential drying effects

Significant cuttings are required in the Centenary Road area and at the southern extent of the works near the connection to Bussell Highway. Soil profiles exposed by cuttings will have altered soil moistures (i.e. more rapid seasonal drying) which may impact the fringing remnant vegetation that is comprised of TEC vegetation.

Temporary changes to surface hydrology during construction at significant cutting locations may occur however these would be temporary and unlikely to have a significant long-term impact. Drawing on Main Roads recent experience, construction of the Forrest Highway resulted in several significant road cuttings adjacent to Banksia and Tuart woodland vegetation, as is required for BORR. Construction of Forrest Highway was constructed in 2009. Banksia and Tuart woodland vegetation occurred at the southern end of Forrest Highway in sandy soils, near Lake Clifton (Ecologia, 1997). No observable impacts from changes to surface hydrology has been detected at these sites, including where sand batters were constructed. Sand batters will be constructed adjacent to cuttings and revegetated using local provenance species representative of the adjacent vegetation. The revegetation methodology to be implemented for BORR Southern is the same as that undertaken along the Forrest Highway, and is outlined in Section 5.1.1.4 (Main Roads Western Australia, 2016a; Main Roads Western Australia, 2016b). The establishment of sand batters and subsequent revegetation of batters will mitigate any edge effects that result from the clearing and cuttings. Where revegetation is not practicable, retaining walls may be used to minimise hydrological changes and impacts from changed surface water hydrology and soil moisture conditions.

Monitoring transects and monitoring points have been established in these areas to enable the assessment of stress evident in trees and shrubs (understorey) due to altered hydrological regimes (refer to section 5.3). Baseline data has been collected for these monitoring points and will be used as a reference for ongoing monitoring

Results of the steady-state two-dimensional groundwater model run for the Proposal demonstrated that for southern portions of the Development Envelope with high groundwater levels where the upper soil profile is dominated by sands, compaction associated with the road footprint will likely have a marginal impact on existing groundwater levels. In these areas, despite the shallow groundwater, the relative thickness of this sand layer with comparison to the depth of compaction impacts does not significantly alter the throughflow of groundwater, and hence minor groundwater level change is expected, and to be less than 0.1 m.

Potential flooding / inundation effects

In the vicinity of the Proposal Area, TEC vegetation occurs in upland areas on free draining sandy soil. Inundation or flooding of these areas would therefore naturally occur infrequently and for short duration, and as such, it is in these communities where continued inundation would be expected to have the most significant impact.

No published information regarding the tolerance of Tuart or Banksia Woodlands to inundation is available however one study (Groom, 2004) has shown that *Banksia prionotes*, a species common to the Banksia Woodland community in the Perth region is impacted by inundation after 28 days, with 22 % mortality of seedlings recorded, and another (Heliyanto, 2006) indicates that *B. ilicifolia*, which occurs in Banksia Woodlands adjacent to the Proposal Area, shows reduced seedling growth and root development as well as leaf senescence after 42 days of waterlogging. These results, and the fact that this community occurs on uplands not frequently subject to inundation, leads to the assumption that the community's inundation tolerance is low.

Cognisant of these factors and the low risk of this impact occurring, the requirement of a response after three consecutive days of inundation is considered a reasonable amount of time with regard to organising the response and mitigating the impact. Therefore, the threshold identified for flooding / inundation of TEC vegetation is three days of inundation. Inundation or flooding of these TEC areas for three consecutive days as a result of Proposal implementation is highly unlikely.

5.1.1.3 Fire management

The objective of the fire management is to minimise risk of ignition from clearing and construction activities and to effectively manage any fire / wildfire that occurs. During operation, the fire risk on BORR will be equivalent to that of similar roads on the network and no additional measures are proposed or deemed necessary beyond the weed control measures outlined in Section 5.1.1.1, including fencing of the Development Envelope to restrict access to monitored TEC vegetation.

The Proposal fire management protocols will be included in the CEMP and associated Fire Management Plan, and include (but are not limited to) the following commitments:

- That no fires are intentionally lit by any site personnel for any reason
- That all vehicles, plant and equipment to be fitted with fire extinguishers and restricted and to designated cleared areas
- That a water tanker and or fire fighter unit will be on site at all times during project construction.

5.1.1.4 Targeted revegetation

Targeted revegetation activities will be undertaken within the Development Envelope to:

- Create new habitat for Western Ringtail Possum and South-Western Brush-tailed Phascogale at or around fauna crossing structures (refer to Proposal HMP)
- Create new habitat for Black Cockatoos (where space allows) (refer to Proposal MNES FMP)
- Provide bank stabilisation at significant cuttings (as detailed in this plan below)
- Provide sedimentation and pollution mitigation at drainage basins, roadsides and medians (as detailed in this plan below)

These commitments are outlined below. All revegetation will be undertaken in accordance with Main Roads revegetation standards and specifications (Main Roads Western Australia, 2016a; Main Roads Western Australia, 2016b).

Fauna habitat revegetation

The objective of the targeted fauna habitat revegetation measures is to establish habitat for threatened fauna. For Western Ringtail Possum and South-Western Brush-tailed Phascogale, revegetation will be undertaken on fauna land bridge decks and bridge forecourt areas, and at

fauna crossing structure access and egress points. For Black Cockatoos, where space and access allows, revegetation and landscaping of cleared areas within the Development Envelope with suitable endemic native species will be undertaken to provide foraging habitat for Black Cockatoos (excluding 10 m buffer from nearest traffic lane).

The revegetation methodology for the fauna land bridge decks and bridge forecourt areas, and at fauna crossing structure access and egress points, is detailed in the Proposal Habitat Fragmentation Management Plan (Main Roads Western Australia, 2022b), and is not repeated here.

The revegetation methodology for Black Cockatoo habitat is outlined below, to be implemented for revegetating banks, batters and drainage basins.

Banks, batters, drainage areas and other revegetation

Targeted revegetation will also be undertaken on the batters of significant cuttings in the Centenary Road area and at the southern extent of the works near the connection to Bussell Highway, and to provide biological filter for run-off at drainage basins, roadsides and medians where site assessment deems it necessary and where space allows. The revegetation methodology for these areas will be in accordance with Main Roads guidance, and is outlined below. These are directly linked to the stated completion criteria (see Table 5-2 and Table 5-4) to ensure that the revegetation completion criteria will be achieved.

Earthworks (site preparation)

For banks, batters and drainage basins, site preparation works will form part of the associated construction works, and may include terracing to minimise erosion risk. Manual planting using hand-held equipment such as powered augers may be used in some areas.

Planting / seeding

Planting and seeding requirements are specified within the completion criteria listed in Table 5-2 and Table 5-4 as a minimum standard. Native species typical of the vegetation complexes mapped for the cuttings and of the surrounding vegetation as determined through the Proposal flora and vegetation survey (BORR IPT, 2020c) will form the revegetation species list. Local provenance seed will be collected or sourced for revegetation, and provided to registered nurseries for propagation.

Planting and direct seeding density will be managed to ensure at the completion of the project, the revegetation completion criteria are met. On batters and banks, vegetation coverage will include a variety of species, with a focus on mid-storey and lower layers to aid in soil stabilisation. At the drainage basins, the focus will be on the lower and ground layers to aid in mitigation of potential sedimentation and pollution impacts. Plant density will vary across the sites in response to revegetation aims and local soil types.

Mulching

Natural mulch material will be applied where site assessment deems it necessary to the revegetation areas to assist with soil stabilisation and erosion control.

Maintenance

Main Roads standard revegetation maintenance protocols will be implemented at the revegetation sites and include weed control and rubbish removal. Targeted infill planting will be undertaken where required to achieve the stated completion criteria.

Completion of rehabilitation

The completion of revegetation will be evaluated against the revegetation completion criteria presented in Table 5-2 and Table 5-4, which will be evaluated after five years. Revegetation activities will continue until the rehabilitation criteria are achieved.

Table 5-2. Revegetation completion criteria

Parameter	Performance indicator	Completion criteria (as defined in Section 5.1.2)
Weed cover	Weed cover by area	Weed cover less than 20 % by area
Plant density	Plant density	Plant density equivalent to a minimum of 2,500 stems / ha
Revegetation structure	Native vegetation cover by area	For bank stabilisation, native vegetation cover at least 65 % by area across all strata
		For sedimentation / pollution mitigation, native vegetation cover at least 50 % by area across all strata
		For Black Cockatoo habitat, native vegetation cover at least 50 % in combined upper (canopy) and mid storey strata
Species diversity	Diversity of species present	For bank stabilisation and Black Cockatoo habitat revegetation, at least six species per 2 m x 2 m quadrat
		For sedimentation / pollution mitigation, at least five species per quadrat

Table 5-3 Management actions and performance targets

Timing	Management actions	Performance targets
<p>Prior to construction</p>	<p>Avoid</p> <ul style="list-style-type: none"> Design refinement to minimise area of TEC vegetation needed to be cleared for the Proposal <p>Mitigate</p> <ul style="list-style-type: none"> As part of the contractor’s CEMP, development of a Hygiene Management Plan to prevent the spread of dieback and weeds to monitored TEC vegetation. The CEMP will include procedures such as machinery / vehicle clean down, weed treatments and restrictions on vehicle / machinery movements As part of the contractor’s CEMP, development of a Fire Management Plan Declared Plants and WONS within the Development Envelope and monitored TEC vegetation (in reserve or on land under Main Roads jurisdiction) will be removed or treated with herbicide 	<ul style="list-style-type: none"> Reduce clearing of TEC vegetation to the extent practicable in final design Maintain pre-construction condition rating in monitored TEC vegetation adjacent to Development Envelope
<p>During construction</p>	<p>Avoid</p> <ul style="list-style-type: none"> Prior to clearing, the final road design will be assessed against the proposed clearing area to ensure the required clearing area is no more than the approved area Low impact temporary fencing will be installed on the active construction front of TEC vegetation areas prior to clearing and maintained during construction phase The Development Envelope boundary will be fenced to restrict access. The fence will be installed inside the approved Development Envelope Contractor induction will include familiarisation with and discussion of TEC vegetation, <i>Phytophthora</i> dieback management, fire management and hygiene management As far as practical, clearing activities will occur during the dry months to reduce the risk of spreading <i>Phytophthora</i> dieback Movement of machines and other vehicles to be restricted to the limits of the areas cleared within the Proposal Area or on designated tracks outside the area No re-fuelling of equipment will be conducted within 200 m of a wetland or watercourse or within 100 m of TEC vegetation 	<ul style="list-style-type: none"> Clearing is within approved clearing limits Maintain pre-construction condition rating in monitored TEC vegetation adjacent to Development Envelope Reduce clearing of TEC vegetation to the extent practicable in final design

Timing	Management actions	Performance targets
	<ul style="list-style-type: none"> • Where sufficient capacity is not available to store or infiltrate the peak 24 hour storm event, sediment / pollutant basins and / or flocculating turbid water in basins will be pumped out prior to and during periods of anticipated heavy or prolonged rainfall • All hazardous material waste shall be managed in accordance with the Environmental Protection (Controlled Waste) Regulations 2004. This includes managing hydrocarbons and oily waste such as fuels, grease, de- greasers, emulsified oil and oily waste water • General construction waste and other rubbish shall be covered or contained in bins with lids (where practicable) and removed regularly, disposed of in accordance with the Waste Management Plan and legislative requirements • All Department of Fire and Emergency Services (DFES) and LGA restrictions on fire and machinery movement will be strictly adhered to • Implement Drainage Strategy and ground and surface water management measures to avoid impact to monitored TEC vegetation <p>Mitigate</p> <ul style="list-style-type: none"> • Declared Plants and WONS within the Development Envelope and monitored TEC vegetation (in reserve or on land under Main Roads jurisdiction) will be removed and/or treated with herbicide 	
Post construction	<p>Mitigate</p> <ul style="list-style-type: none"> • For five years post-construction, Declared Plants and WONS within the Development Envelope and in monitored TEC vegetation will be removed and/or treated with herbicide • Where site assessment deems it necessary, revegetation of batters of significant cuttings with suitable endemic native species will be undertaken for bank stabilisation • Where appropriate, revegetation of drainage basins for sediment / pollutant mitigation in accordance with the landscape design • Where space and access allows, revegetation and landscaping of cleared areas within the Proposal Area with suitable endemic native species will be undertaken to provide foraging habitat for Black Cockatoos (excluding 10 m buffer from nearest traffic lane). 	<ul style="list-style-type: none"> • Maintain pre-construction condition rating in monitored TEC vegetation adjacent to Development Envelope • Revegetation provides bank stabilisation, sediment / pollutant mitigation and Black Cockatoo habitat

5.1.2 SMART performance standards

The DoEE (2019) *Action Management Plan Criteria* identifies the application of ‘SMART’ (specific, measurable, achievable, relevant and time-bound) performance standards to be applied to Action Management Plans such as this VMP, in addition to the management and monitoring actions identified within the DotE (2014) guideline.

SMART performance standards are intended to relate to measurable (numerical) values which can be applied to a Proposal (rather than qualitatively measured management / monitoring actions), and may include measurements such as ‘performance indicators’, ‘corrective actions’ and ‘completion criteria’. Smart performance related terms are defined in Table 5-4.

Table 5-4 SMART performance terminology

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

In relation to monitored TEC vegetation, Main Roads has prepared SMART performance standards directly related to the measurable impacts of the Proposal as identified in Table 4-2. The proposed SMART performance standards for the Proposal, including corrective actions, are identified in Table 5-4.

These SMART performance standards are aligned to the management actions and performance targets identified in Table 5-3, and the monitoring actions identified in Table 5-5.

The number and type of corrective 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.

The ‘triggers’ and ‘completion criteria’ are considered to be achievable, with the risk potential of not achieving the proposed SMART performance standards captured by the risk assessment presented in Table 4-3 and in Appendix B.

As the proposed SMART performance standards for 'completion criteria' relate to physical measures which can be readily controlled through standard construction management processes², it is considered the proposed SMART performance standards have a low level of uncertainty, with additional margins for safety not required.

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

5.1.3 Contingency and corrective actions

Consistent with the DoE (2014) guideline, performance targets, triggers and corrective actions have been considered in the event that monitoring / observation identifies that the management actions have not achieved the environmental objectives.

Potential contingency and corrective actions to be undertaken should a trigger value be reached or exceeded are listed but not limited to those outlined in Table 5-5. Monitoring (parameters, data collection method, location of sites, frequency and timing) and reporting of corrective actions will follow the methodologies described in Section 5.3. In the event that an environmental incident has resulted in a significant environmental impact to TEC vegetation, the environmental incident will be reported to DCCEEW (as identified within Section 3.2).

² Measures that have been applied successfully to other large scale projects that are considered appropriate in minimising the environmental impacts. These measures ensure that clearing is implemented properly, that erosion does not occur, and that spills are minimised and managed appropriately.

Table 5-5 SMART performance standards

Performance target/outcome	Trigger /Early warning indicator	Performance indicators	Corrective actions/contingency actions	Completion criteria
<p>No clearing outside of the approved footprint</p> <p>Reduce clearing of TEC vegetation to the extent practicable in final design</p>	Clearing of TEC vegetation at 75% of approved limit	Amount of TEC vegetation cleared	<ul style="list-style-type: none"> Review clearing program progress against design to confirm clearing of WRP habitat will not exceed the approved limit 	<p>Not more than: 23.4 ha of Banksia Woodlands TEC and 4.4 ha of Tuart Woodlands is cleared</p>
	<p>Clearing of TEC vegetation outside of the approved works area</p> <p>Unauthorised clearing of TEC vegetation within the approved Development Envelope</p>	<p>Area (location) of TEC vegetation clearing</p> <p>Amount of TEC vegetation cleared</p>	<ul style="list-style-type: none"> Stop works (temporary) Record environmental incident Investigate cause Update environmental training of personnel (if appropriate) Report incident to DCCEEW Undertake remediation works (if appropriate, following consultation with DCCEEW) Monitor outcomes of corrective actions Review Offset Strategy to account for additional area cleared. 	

Performance target/outcome	Trigger /Early warning indicator	Performance indicators	Corrective actions/contingency actions	Completion criteria
<p>Maintain pre-construction condition rating in monitored TEC vegetation adjacent to Development Envelope</p>	<p>Development Envelope boundary fence not installed to specification</p>	<p>Presence and effectiveness of Development Envelope boundary fence</p> <p>Access to monitored TEC vegetation from the Development Envelope</p>	<ul style="list-style-type: none"> • Investigate cause and raise an incident report if necessary • Review and / or revise management procedures, including fence design and installation • Update training of relevant personnel • Monitor outcomes of corrective actions. 	<p>Monitored TEC vegetation is maintained at baseline condition or any change is commensurate (i.e. not significantly different to) with that at TEC reference sites</p>
	<p>Erosion / sedimentation cause has not been remediated within 8 days of detection</p>	<p>Number of days before erosion / sedimentation is remediated after detection</p>	<ul style="list-style-type: none"> • Investigate cause to determine whether the impact is project attributable and raise an incident report if necessary • Remedial action controls will be undertaken immediately to repair damage (if required) 	
	<p>Monitored TEC vegetation is inundated or flooded as a result of Proposal activities for three consecutive days</p>	<p>Number of days of flooding or inundation in monitored TEC vegetation</p>	<ul style="list-style-type: none"> • Preventative actions such as modifications to infrastructure and additional engineering post-construction will be taken to prevent further non-compliance. These may include controls outside of monitored TEC vegetation, and may include: <ul style="list-style-type: none"> ○ Application of fill / mulch ○ Installation of gabion cages 	
	<p>Drying effects in monitored TEC vegetation as a result of Proposal activities (as described in Appendix D) persist for</p>	<p>Duration of observed drying effects in monitored TEC vegetation (as</p>		

Performance target/outcome	Trigger /Early warning indicator	Performance indicators	Corrective actions/contingency actions	Completion criteria
	two months after management / mitigation measures are implemented	described in Appendix D)	<ul style="list-style-type: none"> ○ Installation of jute matting to secure bank ● Conduct review of management measures and/or further education of staff / contractors to ensure that all possible steps are taken to prevent any reoccurrence ● Monitor outcomes of corrective actions ● Revise this VMP if required by DCCEEW to do so. 	
	For two consecutive monitoring periods, monitoring parameters ³ (detailed in Section 5.3) in monitored TEC vegetation show a change of more than 20 percent or one category on relevant scales in comparison to baseline scores and / or reference sites	Change in monitoring parameter scores / values (as described in Appendix D)		
	Fire Management Plan not prepared	Fire Management Plan	<ul style="list-style-type: none"> ● Review and / or revise management procedures ● Update training of relevant personnel ● Monitor outcomes. 	Fire Management Plan prepared
	Sparks or unplanned fire resulting from Proposal activity that have the potential to impact monitored TEC vegetation	Evidence of sparks or unplanned fire	<ul style="list-style-type: none"> ● Implement emergency response plans ● Investigate cause and raise an incident report ● Review management procedures ● Monitor outcomes. 	Monitored TEC vegetation is maintained at baseline condition or any change is commensurate (i.e. not significantly different to)

³ Species diversity and cover, plant stress and vegetation condition.

Performance target/outcome	Trigger /Early warning indicator	Performance indicators	Corrective actions/contingency actions	Completion criteria
				with that at TEC reference sites
	New WONS or Declared Plants detected in monitored TEC vegetation as a result of Proposal activities	New WONS or Declared Plants detected in monitored TEC vegetation as a result of Proposal activities	<ul style="list-style-type: none"> • Investigate cause and raise an incident report if necessary • Update environmental training of personnel (if appropriate) • Undertake remediation works • Review and / or revise management measures • Monitor outcomes of corrective actions. 	No new WONS or Declared Plants establish in monitored TEC vegetation as a result of Proposal activities
	Waste Management Plan not prepared	Treatment of hazardous material waste	<ul style="list-style-type: none"> • Investigate the cause and raise an incident report if necessary • Update environmental training of personnel (if appropriate) • Undertake remediation works (if required) • Review and / or revise management measures • Monitor outcomes of corrective actions 	Waste Management Plan prepared Management of hazardous material waste in accordance with regulations and Waste Management Plan
	Waste Management Plan not prepared	Treatment of general construction waste and other rubbish	<ul style="list-style-type: none"> • Investigate the cause and raise an incident report if necessary • Update environmental training of personnel (if appropriate) • Undertake remediation works (if required) • Review and / or revise management measures • Monitor outcomes of corrective actions 	Waste Management Plan prepared Containment and appropriate disposal of general construction waste and other rubbish

Performance target/outcome	Trigger /Early warning indicator	Performance indicators	Corrective actions/contingency actions	Completion criteria
<p>Maintain water quality levels within specified guidelines</p>	<p>ANZECC and ARMCANZ guidelines Vol 1 standard⁴ triggers on one occasion and / or significant difference from baseline conditions in one monitoring period (South Creek 4 (surface water) monthly only)</p>	<p>Water quality levels at South Creek 4 (surface water)</p>	<ul style="list-style-type: none"> • Investigate cause to determine whether the impact is project attributable and raise an incident report if necessary. • Review results from baseline monitoring and comparison with reference sites for the same period • Remedial action controls will be undertaken if required – to be determined based on likely cause e.g. spills, sedimentation or erosion • Conduct review of management measures and / or further education of staff / contractors to ensure that all possible steps are taken to prevent any reoccurrence • Preventative actions such as modifications to infrastructure and additional engineering post-construction will be taken to prevent further non-compliance • Monitor outcomes of corrective actions • Revise this VMP if required by DCCEEW to do so. 	<p>Water quality levels are maintained within specified guidelines</p>
	<p>75 % of basin capacity exceeded in any 24 hour period</p>	<p>Capacity of drainage basins to store or</p>	<ul style="list-style-type: none"> • Investigate the cause and raise an incident report if necessary 	<p>Water quality levels are maintained within specified guidelines</p>

⁴ [ANZECC & ARMCANZ \(2000\) guidelines \(waterquality.gov.au\)](http://www.waterquality.gov.au)

Performance target/outcome	Trigger /Early warning indicator	Performance indicators	Corrective actions/contingency actions	Completion criteria
		infiltrate the peak 24 hour storm event	<ul style="list-style-type: none"> Review and / or revise management procedures Update training of relevant personnel Monitor outcomes of corrective actions 	Drainage basins have capacity to store or infiltrate the peak 24 hour storm event
Maintain hydrology baseline functions and value	Change in hydrology from baseline functions and values (quantum to be determined based on baseline monitoring)	Groundwater levels	<ul style="list-style-type: none"> Investigate the cause to determine whether the impact is project attributable and raise an incident report if necessary. Review results from baseline monitoring and comparison with reference sites for the same period Remedial action controls will be undertaken if required – to be determined based on likely cause Conduct review of management measures and / or further education of staff / contractors to ensure that all possible steps are taken to prevent any reoccurrence Preventative actions such as modifications to infrastructure and additional engineering post-construction will be taken to prevent further non-compliance Monitor outcomes of corrective actions 	Hydrology baseline functions and values are maintained

Performance target/outcome	Trigger /Early warning indicator	Performance indicators	Corrective actions/contingency actions	Completion criteria
<p>Revegetation provides fauna habitat, bank stabilisation or sediment / pollutant mitigation within 10 years of completion</p>	<p>Revegetation works not commenced within three years of construction commencing</p>	<p>Evidence of appropriate preparatory site works and / or revegetation in identified revegetation areas</p>	<ul style="list-style-type: none"> • Investigate the cause and raise an incident report if necessary • Update environmental training of personnel (if appropriate) • Report incident to DCCEEW • Undertake remediation works (if appropriate, following consultation with DCCEEW) which may include refinement of species lists and methodologies or infill planting in failed areas • Review management measures • Monitor outcomes of corrective actions • Revise this VMP if required by DCCEEW to do so. 	<p>Revegetation achieves parameters outlined in Table 5-2</p> <p>Provision of suitable fauna habitat, bank stabilisation or sediment / pollutant mitigation within 10 years of completion</p>

5.2 Environmental maps and diagrams

Appendix A contains figures showing the Proposal location and the locations of TEC vegetation.

- Figure 1 shows the Proposal Area
- Figure 2 identifies TEC vegetation within the Development Envelope
- Figure 3 identifies monitored TEC vegetation adjacent to Development Envelope
- Figure 4 shows the drainage concept design
- Figure 5 identifies TEC vegetation monitoring and reference sites as well as groundwater and surface water monitoring locations.

5.3 Environmental monitoring

Main Roads has identified key monitoring actions to monitor the potential impacts of the Proposal to monitored TEC vegetation during and post construction. These encompass monitoring of both direct and indirect impacts of the Proposal. The purpose of monitoring is to inform whether the objective stated in Condition 12 of the EPBC Act approval, and Section 2.2 of this VMP, is being achieved or whether management actions need to be reviewed and revised.

The comprehensive monitoring approach and detailed methodology described in this Section provides for an early control function to inform timely decisions on corrective actions to ensure that performance targets and / or completion criteria area achieved.

Monitoring the condition of Banksia Woodlands TEC vegetation will be undertaken within 20 m of the Development Envelope boundary, while monitoring the condition of Tuart Woodlands TEC will be undertaken with 60 m of the Development Envelope boundary. Monitoring will be undertaken by suitably qualified individuals for the methodology type specified. The monitoring methodology is outlined below. The proposed monitoring program for the Proposal is identified in Table 5-5. The detailed monitoring methodologies are presented in Appendix D.

The monitoring program has been designed to enable the detection of a decline in vegetation condition using species composition and vegetation health attributes as measurement parameters. It includes assessment of both potential impact sites (those adjacent to the Development Envelope) and reference sites. Monitoring and reference sites are shown in Figure 5 (noting that some sites are yet to be monitored, as described below).

Reference sites on Crown land or road reserve known to support the relevant TEC vegetation that are located in close proximity to the monitored TEC vegetation have been identified and are shown in Figure 5. The purpose of reference sites is to enable comparison of monitored TEC vegetation site data with data from sites located away from the Development Envelope and to assist in determining whether any impacts have resulted from Proposal implementation. Permission to establish monitoring transects in these sites has been secured. To provide a robust sample size and to minimise risk of loss of reference sites through fire or other unanticipated events, two Reference Sites⁵ have been identified for Tuart Woodland TEC, three for Banksia Woodland TEC.

Baseline monitoring of Banksia Woodlands TEC and Tuart Woodlands TEC vegetation adjacent to and within 20 m of the Development Envelope has been conducted, as well as identified TEC reference sites. Baseline monitoring of the Clearing Exclusion Areas and Tuart Woodlands TEC

⁵ Two reference sites meet the description of both the Banksia and Tuart Woodlands TECs and function as reference sites for both community types.

beyond 20 m of the Development Envelope boundary (out to 60 m) will be conducted in June / July 2022, and prior to clearing commencing.

5.3.1 TEC vegetation monitoring

5.3.1.1 Vegetation condition and plant health

The monitoring method and parameters selected comprise a combination of quantitative and qualitative measures that will provide an overall assessment of the health of TEC vegetation and any evidence of disturbance from the Proposal.

The transect vegetation monitoring program will be undertaken annually in spring prior to and during construction, and for the period of EPBC Act approval (or as otherwise agreed by the Minister). Photopoint monitoring will be conducted bi-annually prior to and during construction, and for the same duration.

Vegetation monitoring consists of transect and photopoint monitoring. A concept diagram of the transect layout is included in Appendix D. Two types of photopoints are used, those located at each end of transects and independent photopoints not associated with transects. A wider suite of information is recorded at independent photopoints than transect photopoints, to account for the additional information collected in the assessment of transect plots.

Parameters recorded for transect photopoints and / or transect plots include:

- Species diversity and cover
- Plant deaths
- Level of plant stress
- Ground characteristics (% bare ground, leaf litter, etc).
- Level of tree stress
- Site conditions
- Evidence of erosion or inundation
- Vegetation community structure

Parameters recorded at independent photopoints include:

- Site conditions including vegetation cover
- Dominant species in each structural layer
- Weed species present and overall cover
- Evidence of erosion or inundation
- Evidence of plant disease
- Evidence of other physical disturbance such as grazing, rubbish dumping, etc.

A reportable decline is evidenced where monitoring shows a 20 per cent decline in the species diversity, stress or vegetation condition attributes of the monitored TEC vegetation against the change at reference sites, as described in the monitoring methodology presented in Appendix D.

5.3.1.2 Drainage impacts

Monitoring for changes to hydrology and drainage will be undertaken through a combination of visual assessments and assessment of data collected from monitoring wells (Figure 5). Analysis of data collected will determine the impact, if any, of Proposal implementation on groundwater levels

and quality, and any resulting effect on monitored TEC vegetation through comparison with baseline data and data recorded from reference sites.

The aim of this monitoring is to detect any flooding, erosion, inundation or drying of the TEC vegetation so that necessary remedial action can be taken. Flooding, inundation and erosion are all more visually apparent than the effects of drying on vegetation. Impacts from drying are more likely to be evident from late spring through to late autumn, and will likely comprise yellowing, wilting and dying off of vegetation, as well as the site drying out at a faster rate after winter. Comparison with groundwater data (see Appendix D) will be used to inform the assessment and attribution of cause of vegetation response.

Visual assessments will be conducted quarterly prior to and during construction, and for the period of EPBC Act approval (or as otherwise agreed by the Minister)..

Drainage impact monitoring will involve visual assessment for Proposal attributable evidence of:

- Flooding and / or inundation
- Erosion, or
- Drying

The visual assessments are complemented by monitoring of water quality and water levels in groundwater wells and surface water locations within or nearby the Development Envelope and at reference site locations. Ground and surface water monitoring well locations are shown in Figure 4. The ground and surface water monitoring program is detailed in Section 5.3.2 and in Appendix D.

5.3.1.3 Weed and *Phytophthora* Dieback (hygiene) monitoring

Weed and *Phytophthora* Dieback monitoring will be conducted as part of the vegetation condition monitoring at both transect and photopoint monitoring sites, as outlined in the monitoring methodology presented in Appendix D.

5.3.2 Ground and surface water monitoring

Monitoring of groundwater and surface water will be required and managed under the CEMP, *Matters of National Environmental Significance Fauna Management Plan* (Main Roads Western Australia, 2022a) and this plan. This monitoring will inform the effective management of risks to water quality during construction and operation to ensure that there is no adverse impact of water quality on protected matters, and will include the following:

- Baseline water quality monitoring event prior to commencing construction, which will be used to set baseline water quality values
- Evidence of erosion on embankments to be monitored opportunistically and weekly during construction
- Run-off from construction areas into wetlands and watercourses to be monitored during run-off events and weekly during construction
- Daily surface water quality monitoring during construction over rivers
- If dewatering is required:
 - Fortnightly groundwater and surface water quality monitoring
 - Daily monitoring and reporting of dewater effluent, undertaken by the Contractor, with reference to specific trigger criteria (as outlined in the CEMP)
 - Twice per week groundwater monitoring undertaken by the Contractor

- Monitoring as per individual ground and / or surface water abstraction and dewatering licence conditions (if required)
- Post-construction monitoring of surface and groundwater undertaken by the Contractor (as outlined in the CEMP).

The above-listed monitoring actions are detailed in Table 5-6 and Appendix D, and will enable determination of achievement against the environmental objective and associated performance targets in Table 5.5.

Main Roads has completed a 12 month groundwater and surface water quality monitoring programme. This dataset provides the baseline data from which potential contamination may be monitored. Main Roads will continue to monitor groundwater and surface water levels and analytes on a monthly or quarterly basis at the locations detailed in Appendix D.

5.3.3 Revegetation monitoring

Revegetation monitoring will include assessment of the parameters outlined in Table 5-6.

Table 5-6 Proposed monitoring program

Performance Target(s)	Parameter to be Monitored	Methodology	Frequency and duration	Recording and Reporting
TEC vegetation				
<p>Reduce clearing of TEC vegetation to the extent practicable in final design</p> <p>Avoid direct and indirect impacts to monitored TEC vegetation</p>	Area (ha) of TEC vegetation cleared	<p>Pre-clearing: Desktop assessment of current design against approved clearing area</p> <p>During construction: Construction area assessment to visually check / review clearing boundaries, temporary fencing and measure area of TEC vegetation cleared</p>	<p>During construction: Prior to clearing and daily</p> <p>Post-construction: Not applicable</p>	<p>Area of TEC vegetation cleared recorded by construction contractor and reported to Manager Environment monthly</p> <p>Report annually to DCCEEW as part of annual compliance reporting or in response to exceedance of an approved trigger</p>
<p>Avoid direct and indirect impacts to monitored TEC vegetation</p>	<p>Presence and effectiveness of Development Envelope boundary fence</p> <p>Access to TEC vegetation from Development Envelope</p>	<p>Visual inspection of fence and access points (driving the alignment and on foot as necessary)</p>	<p>During construction: Monthly and opportunistically</p> <p>After fence installation: Quarterly and opportunistically</p> <p>Post construction: Quarterly for five years</p>	<p>Report annually to DCCEEW as part of annual compliance reporting or in response to exceedance of an approved trigger</p>
	Evidence of erosion / sedimentation, flooding / inundation or drying effects	<p>Visual assessment and photopoints of monitored TEC vegetation, transects (including plots) and</p>	<p>Prior to, during and for five years post-construction: Transects annually in spring, photopoints biannually, in addition to opportunistic</p>	

Performance Target(s)	Parameter to be Monitored	Methodology	Frequency and duration	Recording and Reporting
		photopoints (per the methods detailed in Appendix D)	monitoring for the period of EPBC Act approval or as otherwise agreed by the Minister	
	Species diversity and cover, plant stress and vegetation condition scores	Inspecting known/previously detected and controlled WONS or Declared Plants infestations	Prior to, during and for five years post-construction: Transects annually in spring, photopoints biannually, in addition to opportunistic monitoring for the period of EPBC Act approval or as otherwise agreed by the Minister	
	Presence of WONS or Declared Plants			
	Evidence of new <i>Phytophthora</i> infestation			
	Evidence of sparks or unplanned fire	Visual assessment	During construction: opportunistically	
	Hazardous material waste management	Visual assessment for signs of contamination and spills within construction area.	During construction: Weekly and opportunistically Post construction: Not applicable	
	General construction waste and other rubbish management	Visual assessment for signs of general waste and rubbish within construction area.	During construction: Weekly and opportunistically Post construction: Not applicable	

Drainage and hydrology

Performance Target(s)	Parameter to be Monitored	Methodology	Frequency and duration	Recording and Reporting
Maintain water quality levels within specified guidelines	Water quality parameters at South Creek 4 (surface water)	Water sampling as described in Appendix D and visual assessment for sedimentation / erosion in South Creek 4	Prior to, during and post-construction: Monthly or quarterly as detailed in Appendix D	Report annually to DCCEEW as part of annual compliance reporting or in response to exceedance of an approved trigger
	Drainage basin capacity	Visual assessment for sedimentation / erosion of drainage basins	During construction: Weekly and opportunistically Post construction: Annually for the period of approval or otherwise agreed by the Minister for the Environment	
Maintain hydrology baseline functions and value	Groundwater levels	Water sampling as described in Appendix D	Prior to, during and post-construction: Monthly or quarterly as detailed in Appendix D	
Revegetation				
Revegetation provides fauna habitat, bank stabilisation or sediment / pollutant mitigation within 10 years of completion	<ul style="list-style-type: none"> • Commencement of revegetation (confirmation of commencement) • Timing of revegetation works (to confirm optimal) • Revegetation species mix (to confirm optimal) 	Visual assessment of revegetation progress and identify presence of threats, eg erosion, weeds, etc.	During and post-construction: Weekly during revegetation	Report annually to DCCEEW as part of annual compliance reporting or in response to exceedance of an approved trigger

Performance Target(s)	Parameter to be Monitored	Methodology	Frequency and duration	Recording and Reporting
	<ul style="list-style-type: none"> • Weed cover by area • Plant density • Native vegetation cover by area • Diversity of species present. 	<p>2 m x 2 m quadrats, visual assessment of revegetation progress and identify presence of threats, eg erosion, weeds, etc.</p>	<p>Post construction: Quarterly for two years after revegetation commenced, biannually thereafter for three years.</p> <p>Once completion criteria has been achieved, revegetation surveys will occur every 5 years (in spring) for the period of EPBC Act approval or as otherwise agreed by the Minister to ensure completion criteria is being maintained.</p>	<p>Report annually to DCCEEW as part of annual compliance reporting or in response to exceedance of an approved trigger.</p>

6 ADAPTIVE MANAGEMENT, AUDIT AND REVIEW

This VMP adopts an ‘adaptive management’ approach which seeks to embed a cycle of monitoring, reporting and implementing change, where required. Accordingly, it is intended that this VMP may be updated (as required) over the life of the Proposal to reflect changes in the monitoring and management practices, subject to the results of the monitoring to identify that the environmental objectives are being achieved. The VMP may also be revised to address learnings from the implementation of corrective actions, should this occur.

In addition, auditing and review schedules are necessary to embed a formal process to identify and consider any need to update the VMP in order to achieve improved environmental performance (which may not otherwise be triggered by management or monitoring outcomes).

6.1 Environmental auditing

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

The proposed auditing schedule for this VMP is identified in Table 6-1.

Table 6-1 Environmental audit schedule

Timing	Action	Schedule
Pre-construction	Review of construction procedures to ensure VMP management / monitoring actions are incorporated within the Proposal’s works procedures	Prior to construction (single event)
Construction	Inspections by site environmental personnel to identify compliance with VMP	Periodic (fortnightly)
	Independent ‘third-party’ audit for assessment of compliance with VMP	Annually (once per calendar year)
Post construction	Independent ‘third-party’ audit for assessment of compliance with VMP	Annually (once per calendar year) for the period of approval or otherwise agreed by the Minister for the Environment)

The results of the construction and post construction independent ‘third-party’ audit findings will be reported by Main Roads to DCCEEW as part of annual compliance reporting as outlined in Section 3.2.

6.2 Environmental review

Main Roads proposes to review this VMP annually in order to consider:

- The management and monitoring actions

- Opportunities to improve environmental performance (for example, changes to construction methodology or timing)
- Identify a need to update this VMP to capture changes to the management and / or monitoring actions
- Identify any general need to update this VMP (for example, to capture new information on Black Cockatoos knowledge or management).
- Main Roads acknowledge that a revision to this VMP may trigger a need for additional EPBC Act approval prior to implementing any changes to the specified management or monitoring actions.

The proposed VMP review schedule for the Proposal is identified in Table 6-2.

Table 6-2 VMP review schedule

Timing	Action	Schedule
Pre-construction, Construction and Post construction	Review of VMP management and monitoring actions Review of opportunities to improve environmental performance Revise VMP (if appropriate) and seek EPBC Act approval of revised VMP	Annually (once per calendar year)

6.3 Data management

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

Data will be provided to DCCEEW in accordance with condition 27 of the EPBC Act approval for EPBC 2019/8543.

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

7 STAKEHOLDER CONSULTATION

7.1 Stakeholder consultation

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

A list summary of the stakeholders consulted on the Proposal (for which the environmental impact and management of Black Cockatoos were discussed) is identified in Table 7-1.

Table 7-1 Stakeholder consultation

Type	Stakeholder	Consultation issues
Community	BORR Southern Community Reference Group	<ul style="list-style-type: none"> • Proposal design to minimise impact to TEC vegetation • Residual direct and potential indirect impacts to TEC vegetation • Management and monitoring of TEC vegetation • Environmental assessment processes relevant to TEC vegetation
Government	<ul style="list-style-type: none"> • Western Australian Department of Water and Environment Regulation (EPA Services) • Western Australian Department of Biodiversity, Conservation and Attractions (DBCA) 	<ul style="list-style-type: none"> • Proposal design to minimise impact to TEC vegetation • Residual direct and potential indirect impacts to TEC vegetation • Preparation / implementation of plan to manage and monitor impacts to TEC vegetation

7.2 External communications / concerns

Main Roads and /or its Contractors will maintain a register of communications (including any public concerns / complaints) for the Proposal. Records to be obtained for external communications will include:

- Contact details for the person making the complaint (name, address and phone number as a minimum)
- Date, time and relevant location (if specific to part of the Proposal)
- Details of the communication (with sufficient detail to enable investigation / response, if appropriate)

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

8 REFERENCES

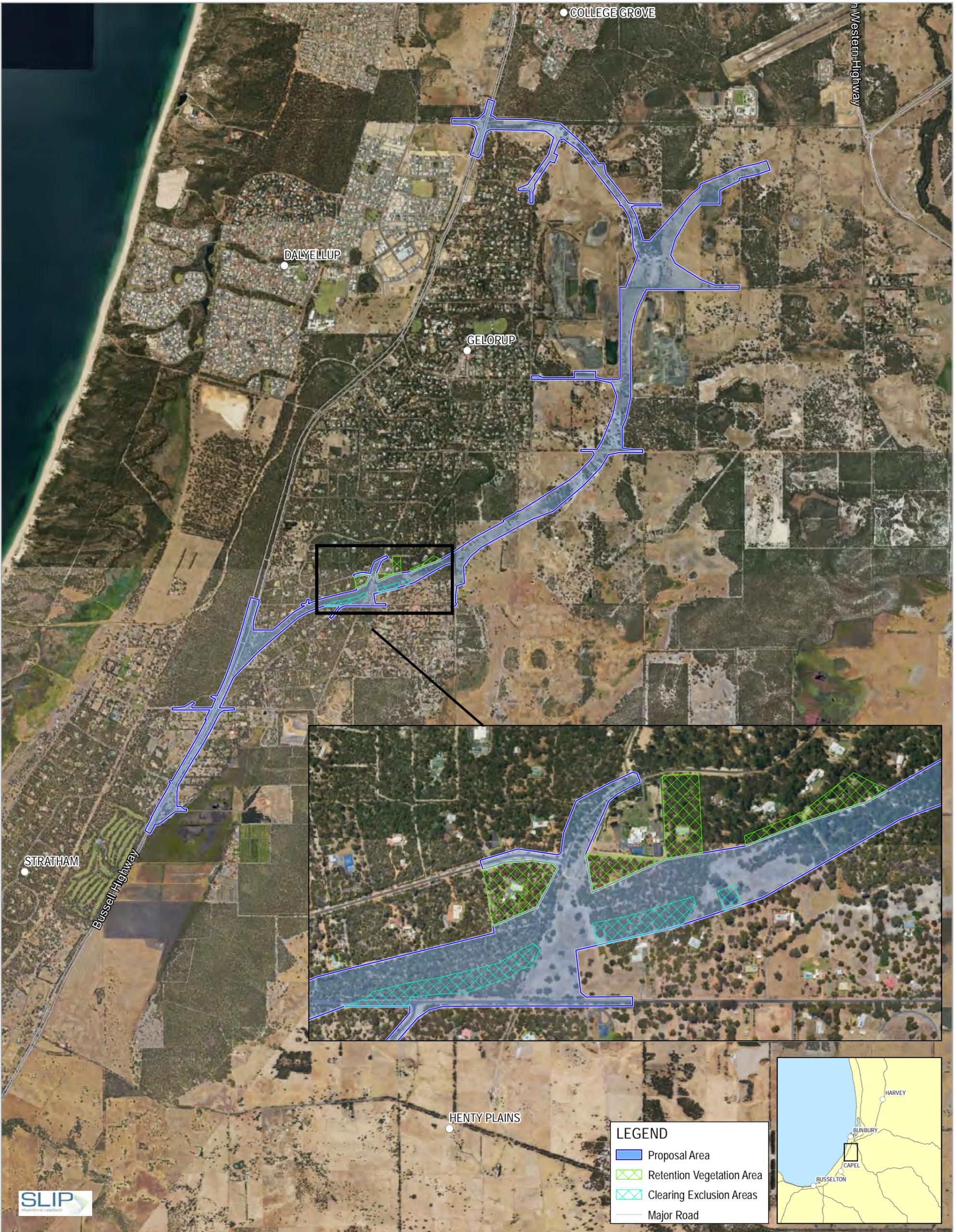
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Appendix A Figures

- Figure 1** **Proposal Area**
- Figure 2** **TEC vegetation within the Development Envelope**
- Figure 3** **Monitored TEC vegetation adjacent to Development Envelope**
- Figure 4** **Drainage concept design**
- Figure 5** **TEC vegetation monitoring and reference sites, groundwater and surface water monitoring locations**



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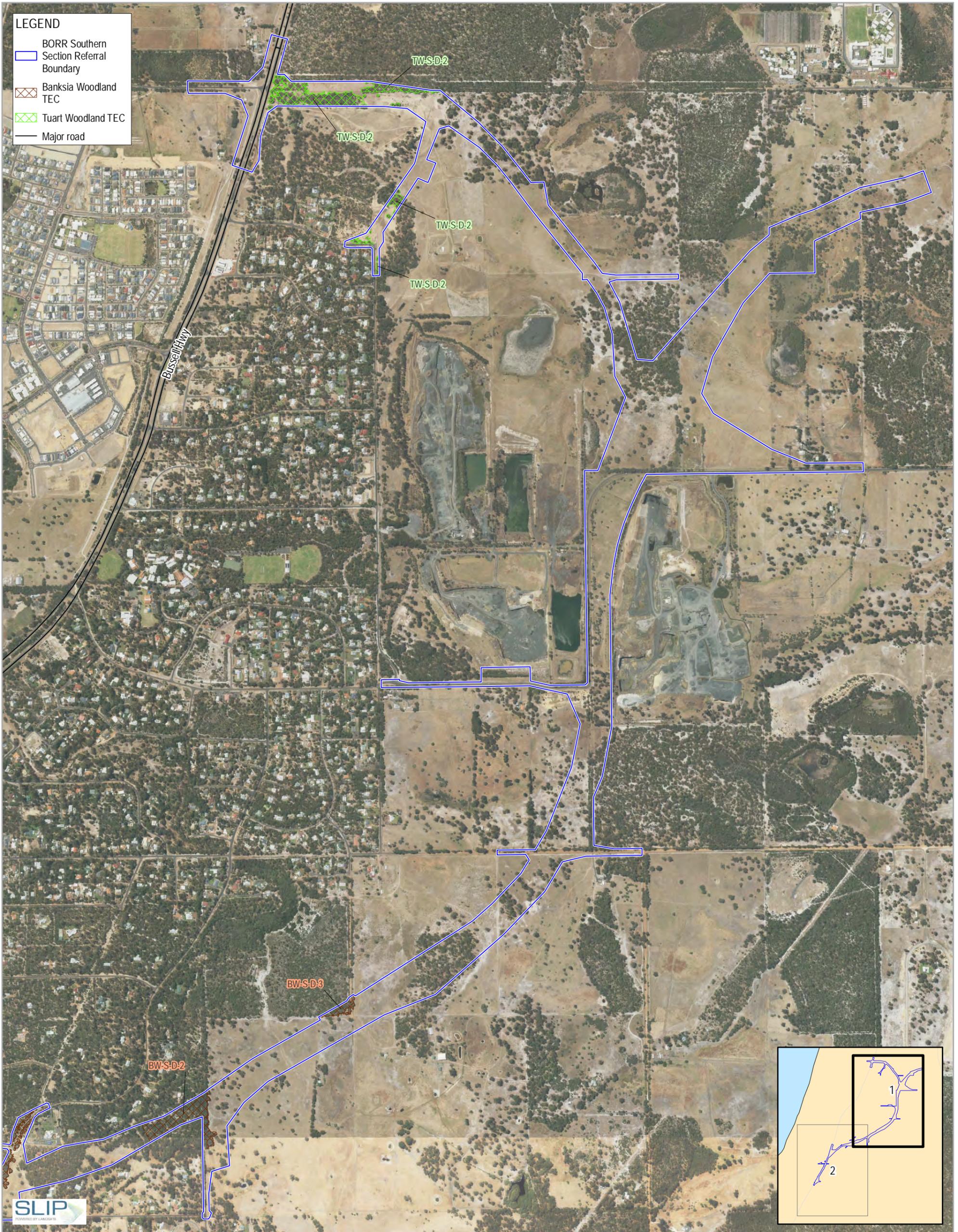
Main Roads Western Australia
 Bunbury Outer Ring Road Southern Section

Proposal Area

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

[Overview](#)

FIGURE 1



LEGEND

- BORB Southern Section Referral Boundary
- Banksia Woodland TEC
- Tuart Woodland TEC
- Major road



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BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

Main Roads Western Australia
Bunbury Outer Ring Road Southern Section
EPBC ARI

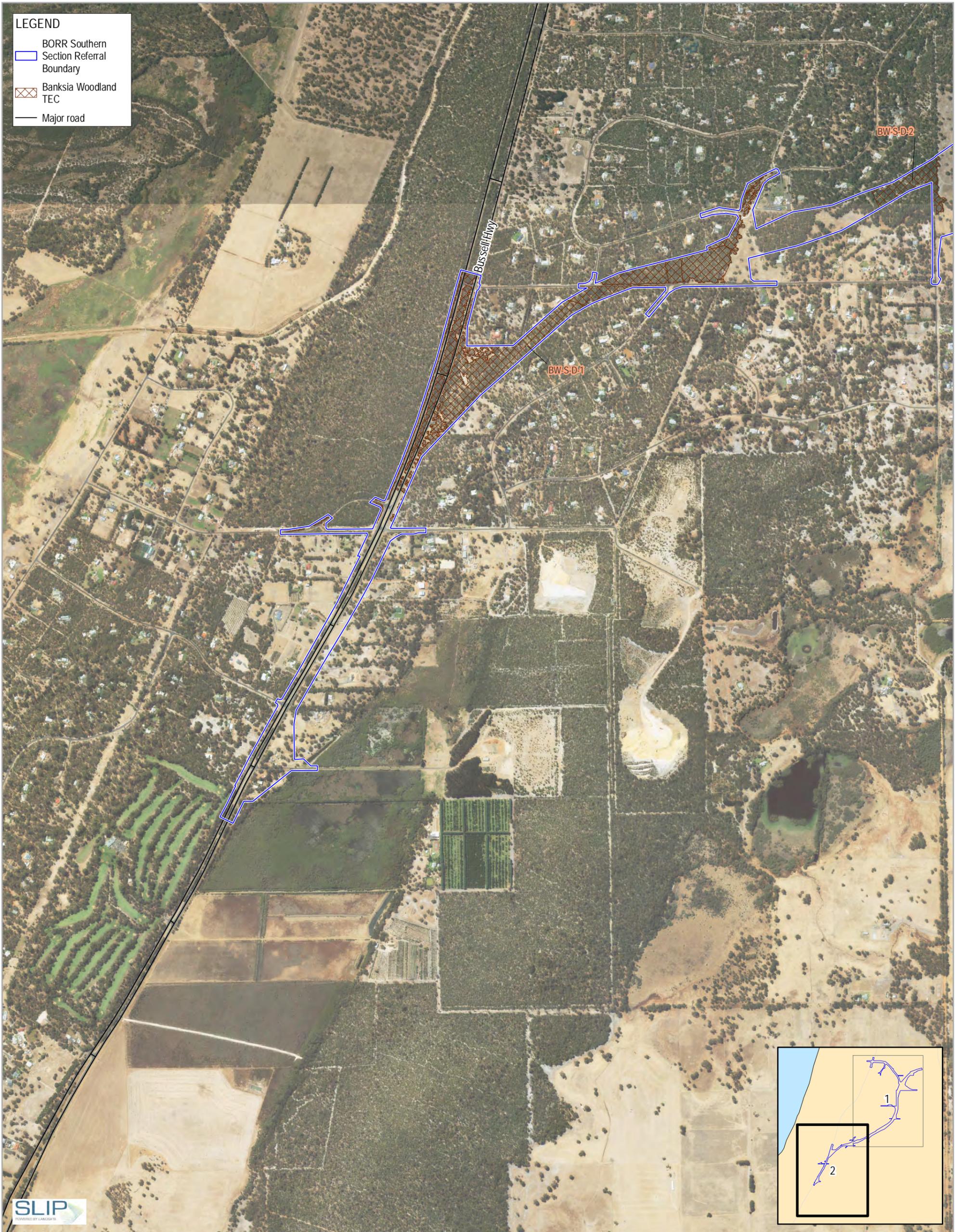
TEC within the Development Envelope

Project No. 61-37041
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FIGURE 2

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LEGEND

- BORR Southern Section Referral Boundary
- Banksia Woodland TEC
- Major road



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BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

Main Roads Western Australia
Bunbury Outer Ring Road Southern Section
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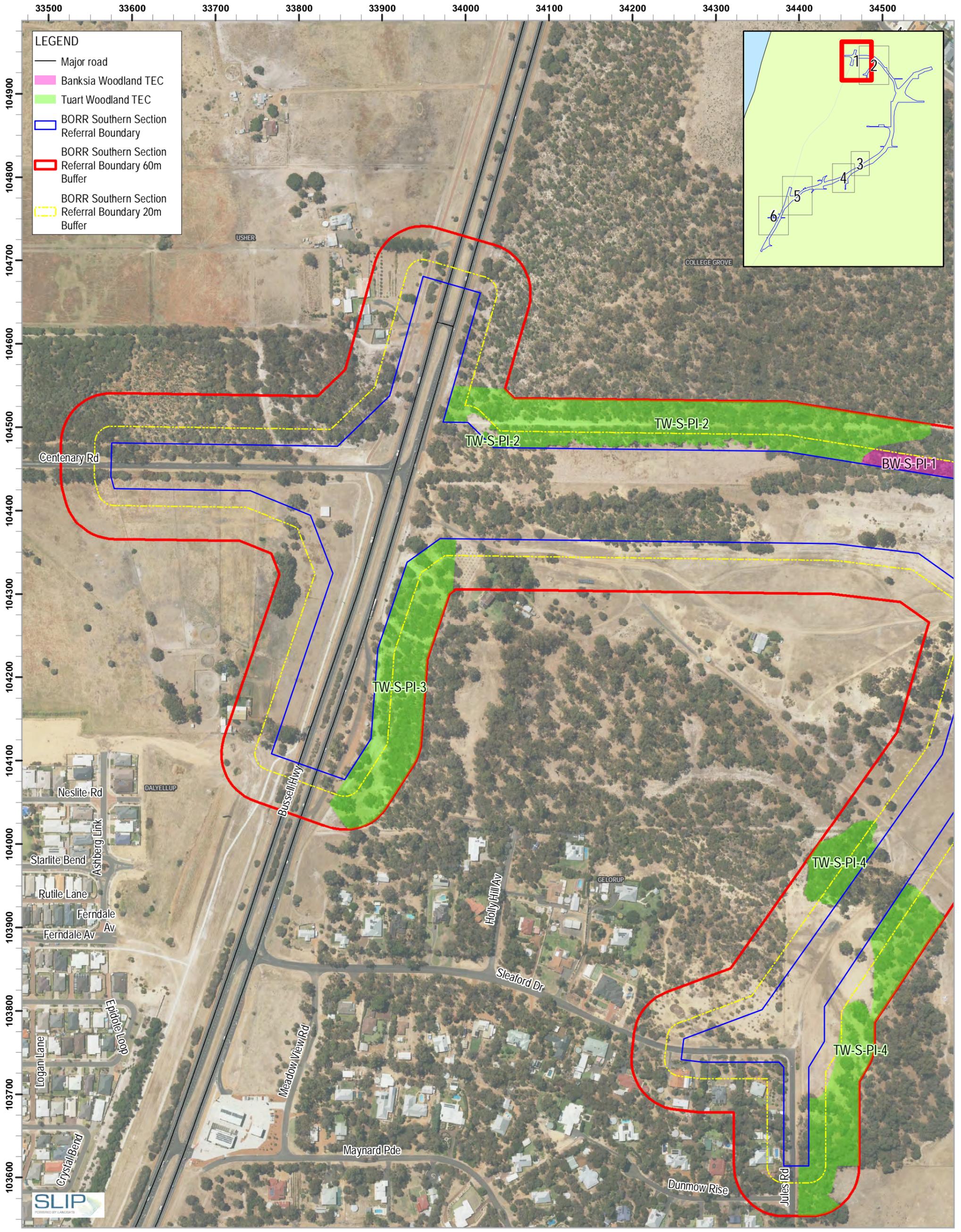
TEC within the Development Envelope

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FIGURE 2

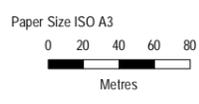
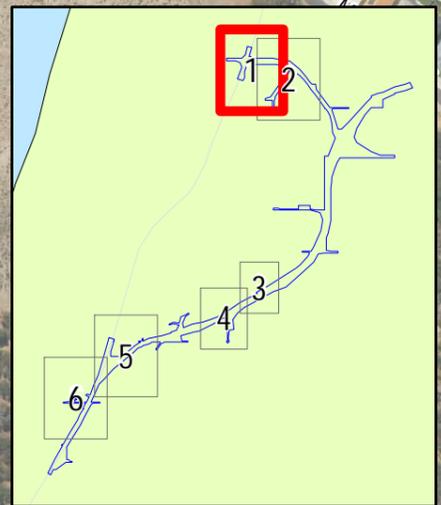
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LEGEND

- Major road
- Banksia Woodland TEC
- Tuart Woodland TEC
- BORR Southern Section Referral Boundary
- Referral Boundary 60m Buffer
- BORR Southern Section Referral Boundary 20m Buffer



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



Main Roads Western Australia
 Bunbury Outer Ring Road Southern Section

TECs adjacent to the
 Development Envelope

Project No. 61-37041
 Revision No. 6
 Date 30/06/2022

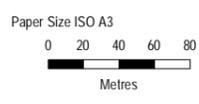
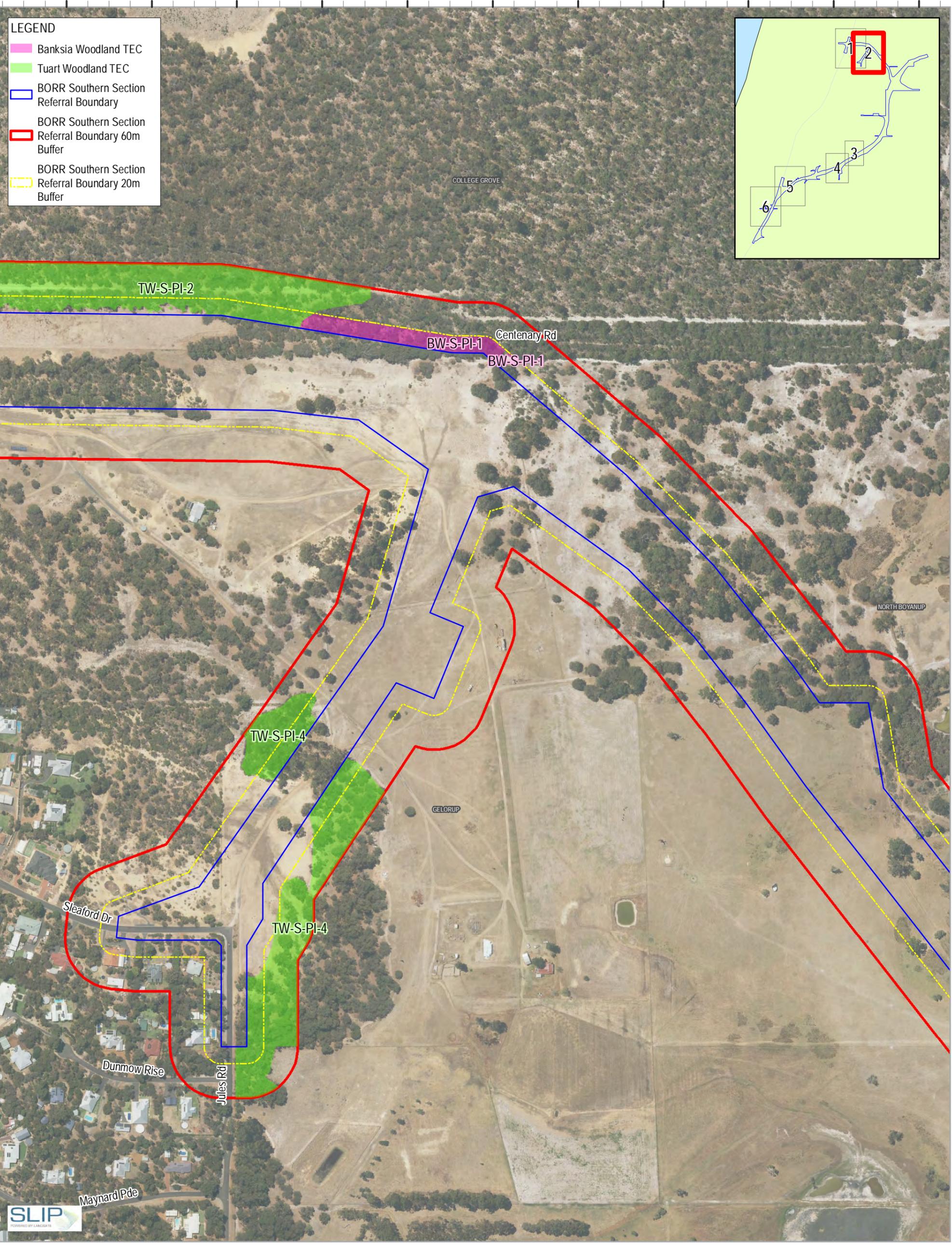
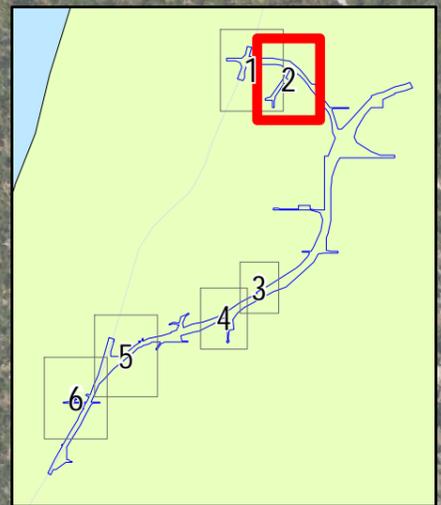
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FIGURE 3

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LEGEND

- Banksia Woodland TEC
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- BORR Southern Section Referral Boundary
- BORR Southern Section Referral Boundary 60m Buffer
- BORR Southern Section Referral Boundary 20m Buffer



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Main Roads Western Australia
Bunbury Outer Ring Road Southern Section

TECs adjacent to the
Development Envelope

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FIGURE 3

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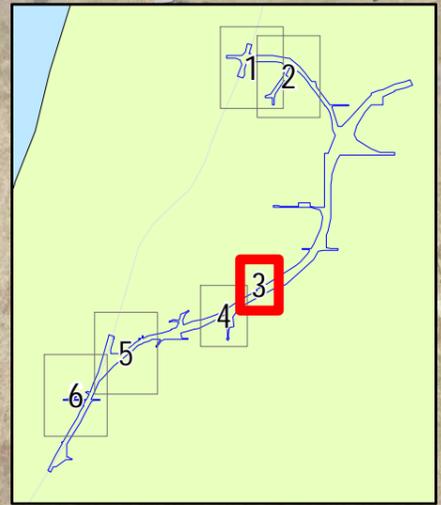
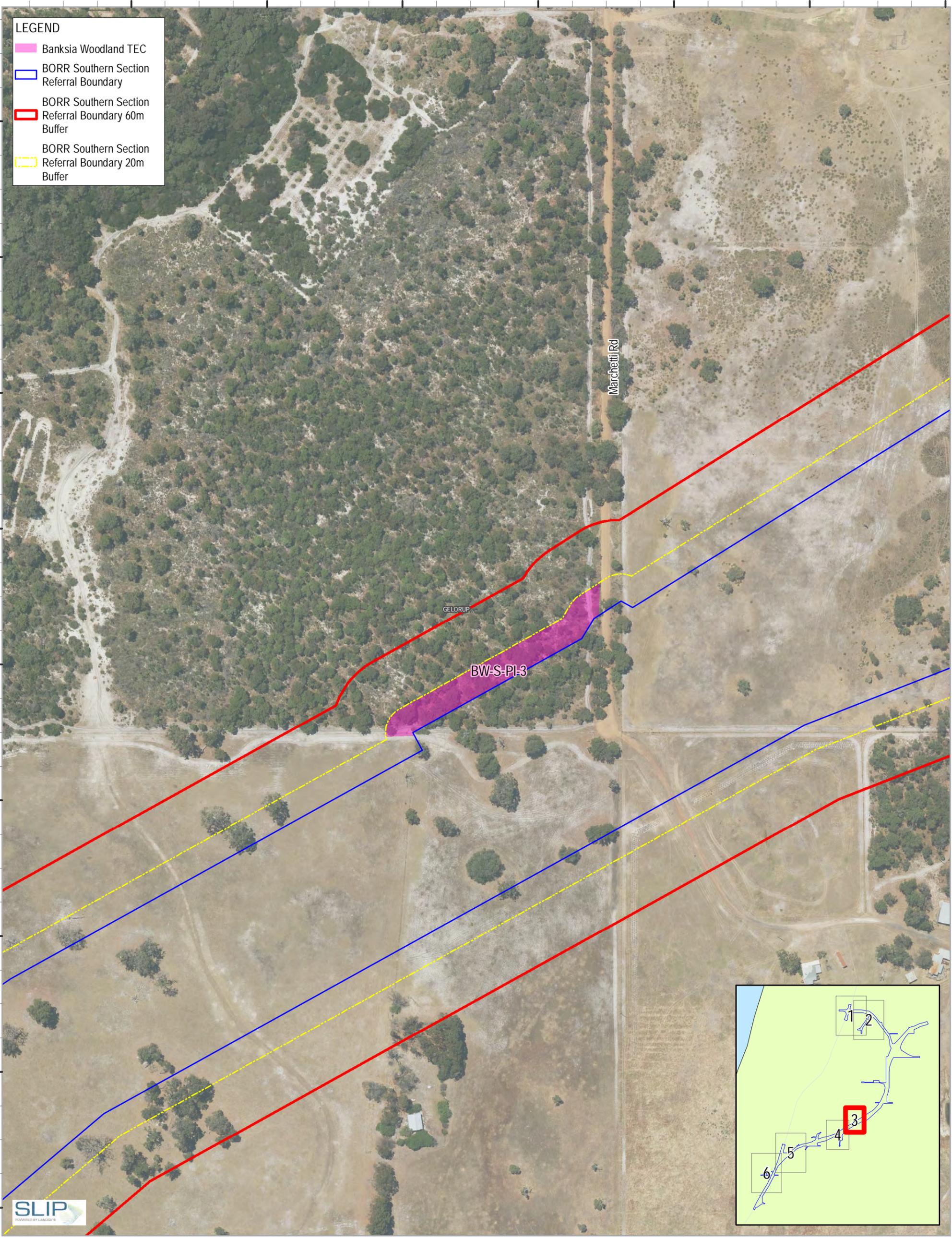
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LEGEND

- Banksia Woodland TEC
- BORR Southern Section Referral Boundary
- BORR Southern Section Referral Boundary 60m Buffer
- BORR Southern Section Referral Boundary 20m Buffer



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BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

Main Roads Western Australia
Bunbury Outer Ring Road Southern Section

TECs adjacent to the
Development Envelope

Project No. 61-37041
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FIGURE 3

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LEGEND

- Banksia Woodland TEC
- BORR Southern Section Referral Boundary
- BORR Southern Section Referral Boundary 60m Buffer
- BORR Southern Section Referral Boundary 20m Buffer

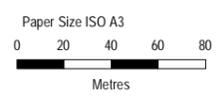
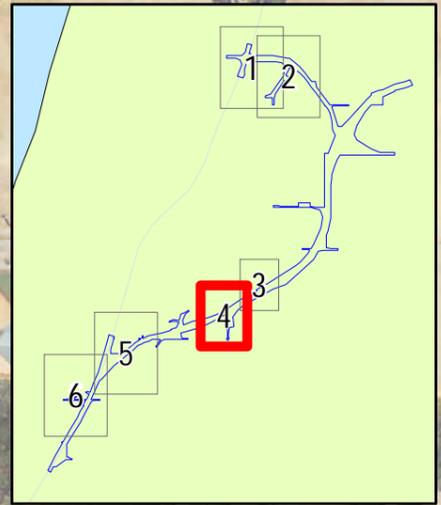
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Main Roads Western Australia
Bunbury Outer Ring Road Southern Section

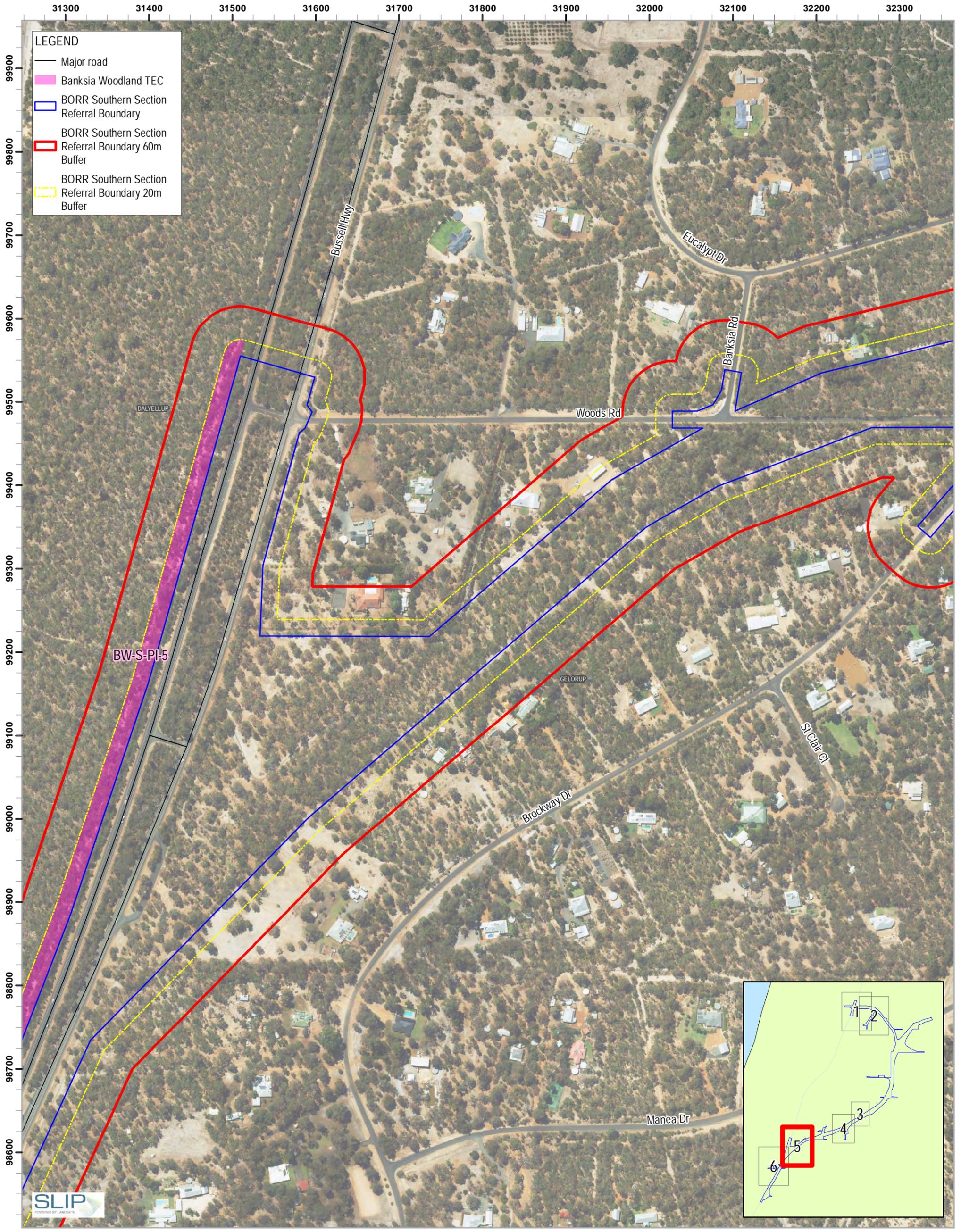
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FIGURE 3

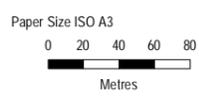
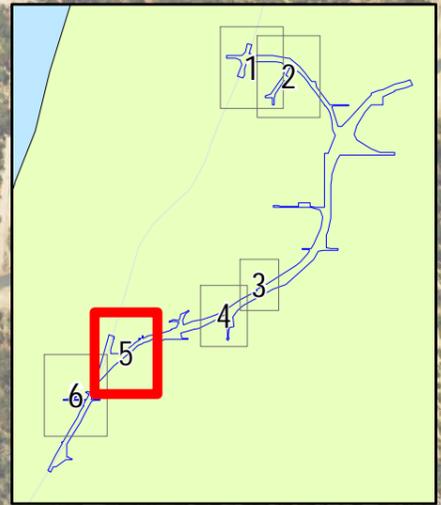
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LEGEND

- Major road
- Banksia Woodland TEC
- BORR Southern Section Referral Boundary
- BORR Southern Section Referral Boundary 60m Buffer
- BORR Southern Section Referral Boundary 20m Buffer



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Main Roads Western Australia
 Bunbury Outer Ring Road Southern Section

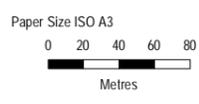
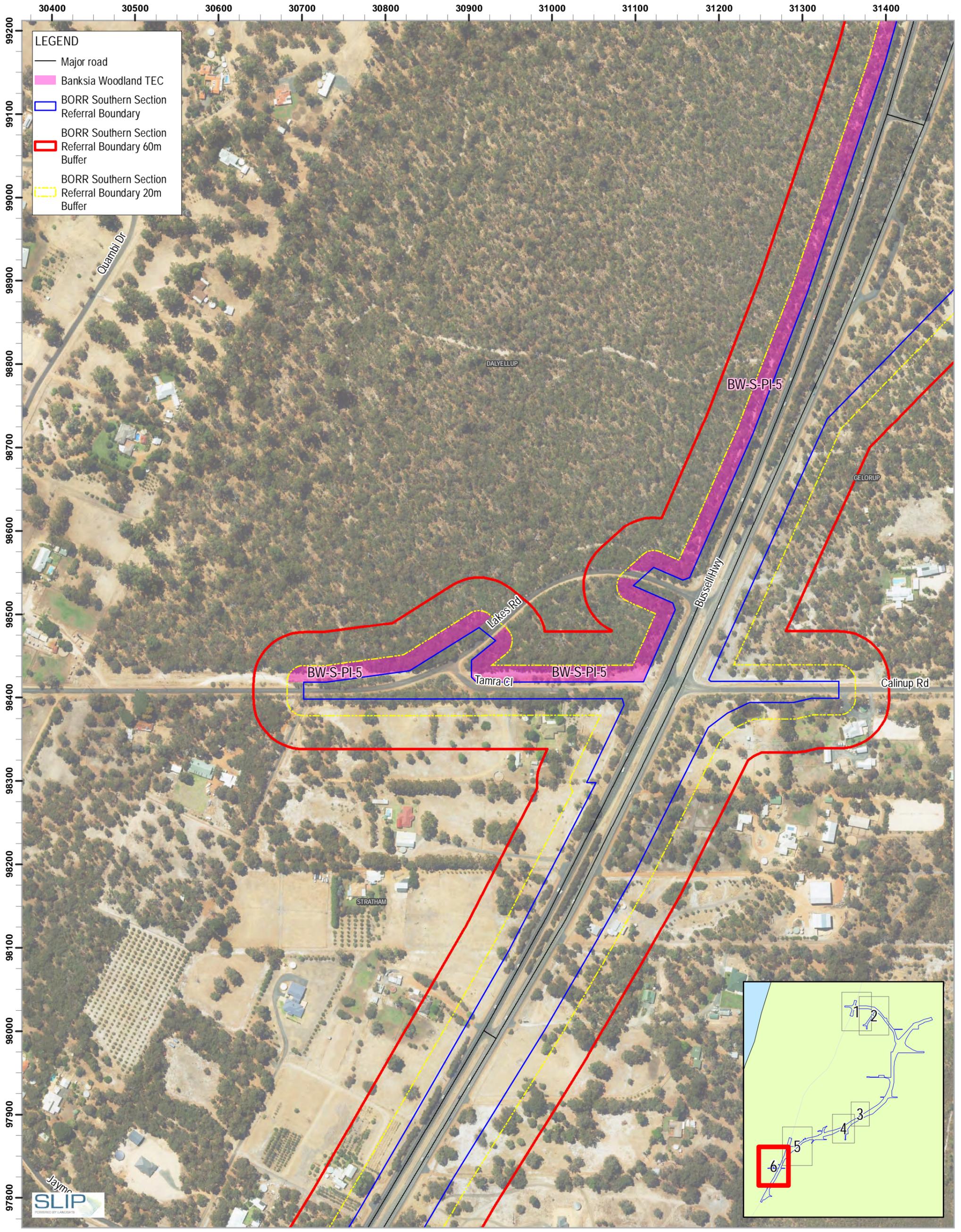
TECs adjacent to the
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FIGURE 3

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Main Roads Western Australia
Bunbury Outer Ring Road Southern Section

TECs adjacent to the
Development Envelope

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FIGURE 3

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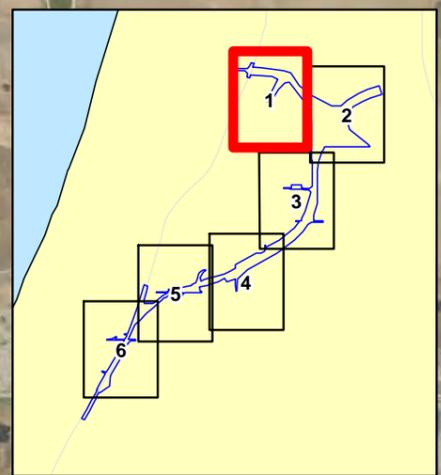
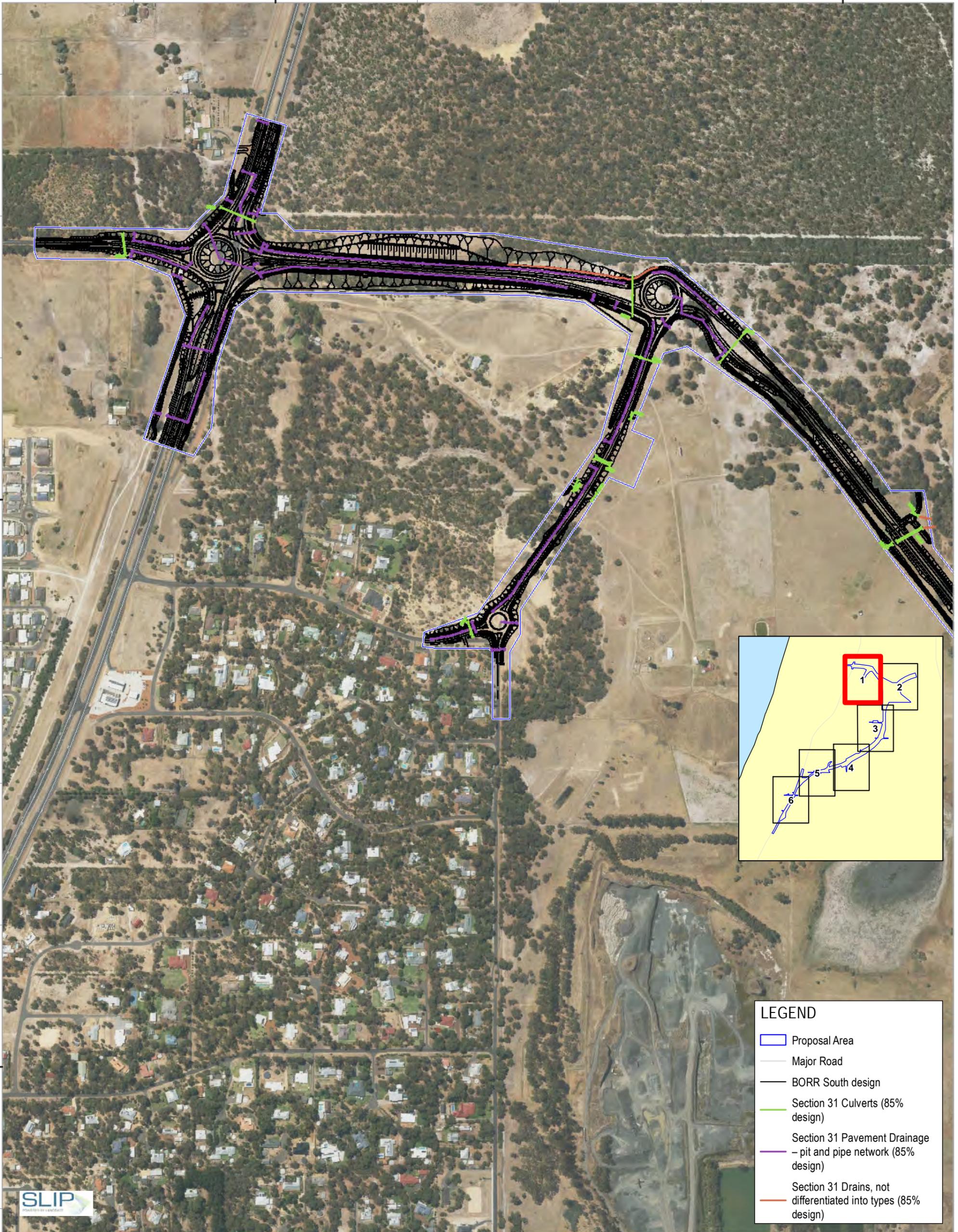
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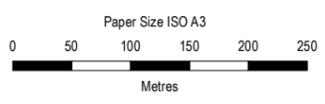
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LEGEND	
	Proposal Area
	Major Road
	BORR South design
	Section 31 Culverts (85% design)
	Section 31 Pavement Drainage – pit and pipe network (85% design)
	Section 31 Drains, not differentiated into types (85% design)



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



Main Roads Western Australia
 Bunbury Outer Ring Road Southern Section

**BORR Southern Section
 Drainage Elements**

Project No. 61-37041
 Revision No. 0
 Date 20/06/2022

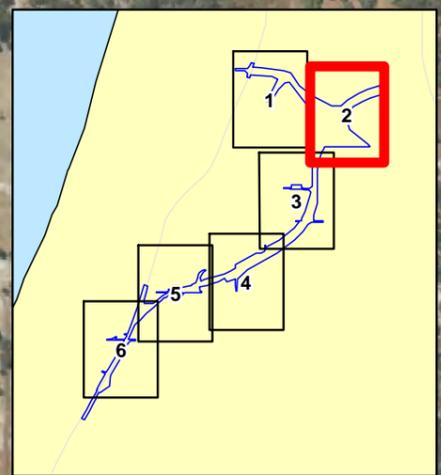
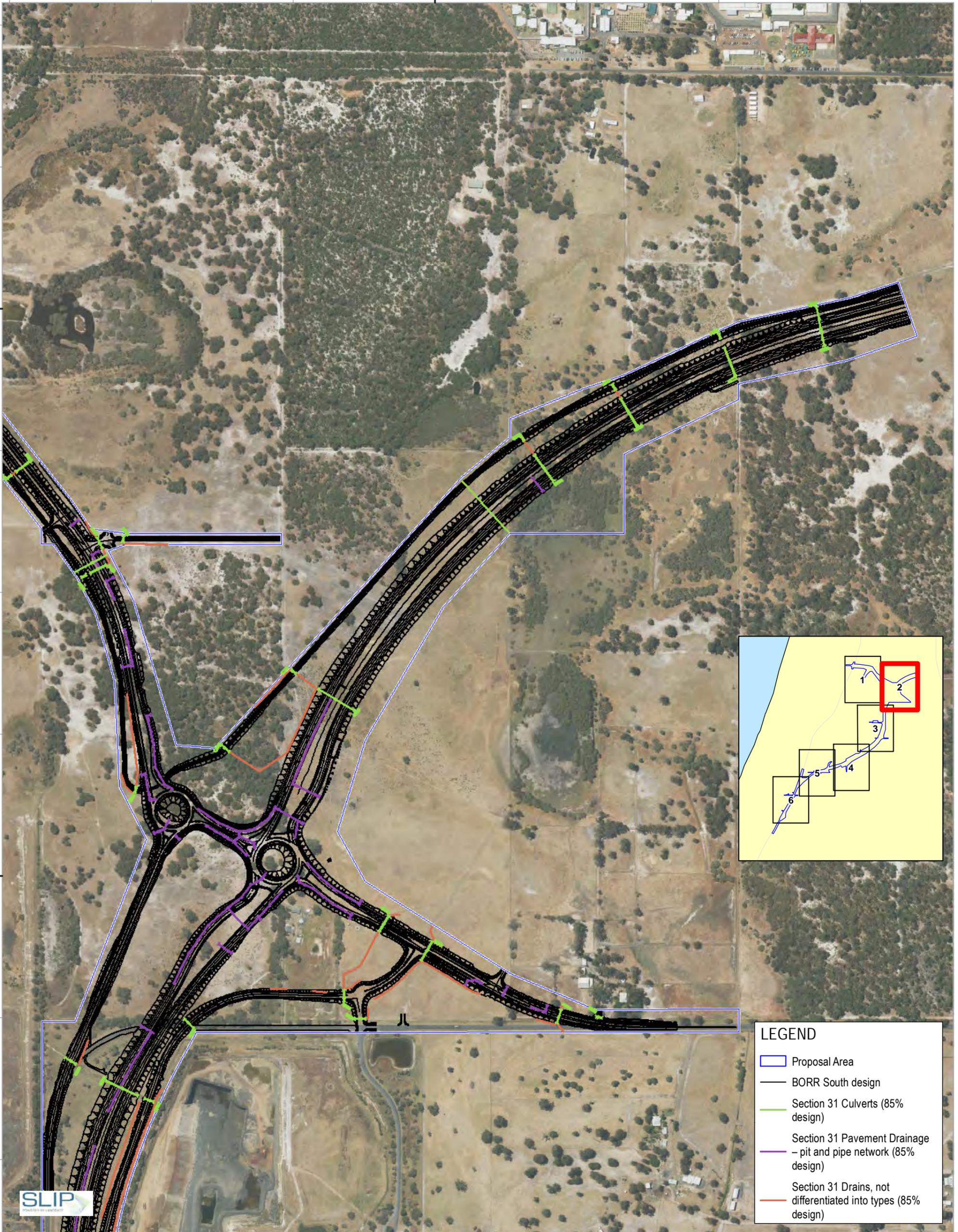
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Data source: Geoscience Australia: GeoData Topo 250k Series II - 2006; Landgate: Roads - 20180501; Imagery - WA Now accessed 20220620; BORR: Proposal Area - 20191212. Created by: bmorgan

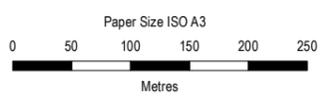
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LEGEND	
	Proposal Area
	BORR South design
	Section 31 Culverts (85% design)
	Section 31 Pavement Drainage – pit and pipe network (85% design)
	Section 31 Drains, not differentiated into types (85% design)



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



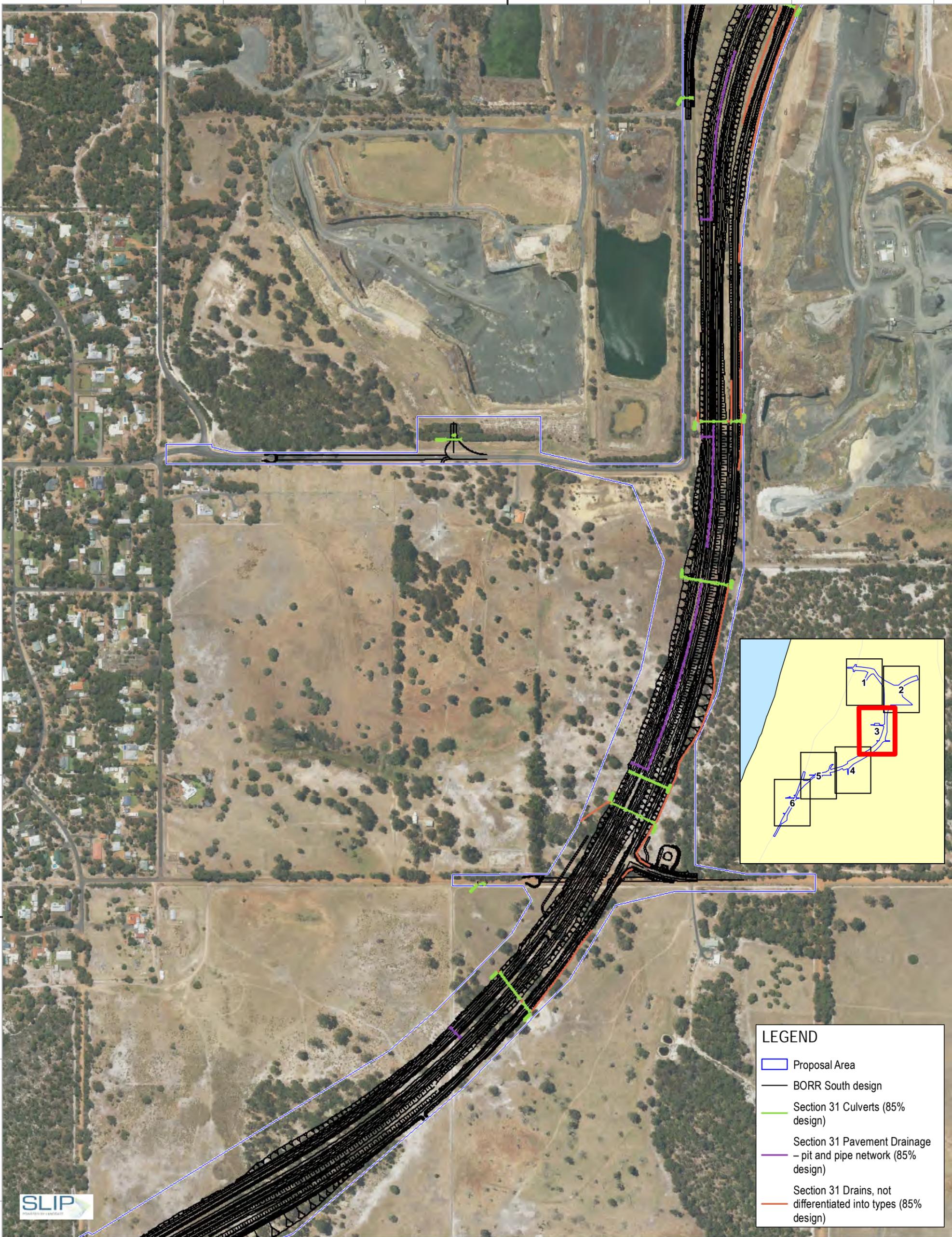
Main Roads Western Australia
 Bunbury Outer Ring Road Southern Section

**BORR Southern Section
 Drainage Elements**

Project No. 61-37041
 Revision No. 0
 Date 20/06/2022

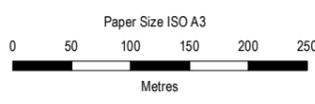
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Data source: Geoscience Australia: GeoData Topo 250k Series III - 2006; Landgate: Roads - 20180501; Imagery - WA Now accessed 20220620; BORR: Proposal Area - 20191212. Created by: bmorgan



LEGEND

- Proposal Area
- BORR South design
- Section 31 Culverts (85% design)
- Section 31 Pavement Drainage – pit and pipe network (85% design)
- Section 31 Drains, not differentiated into types (85% design)



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



Main Roads Western Australia
Bunbury Outer Ring Road Southern Section

**BORR Southern Section
Drainage Elements**

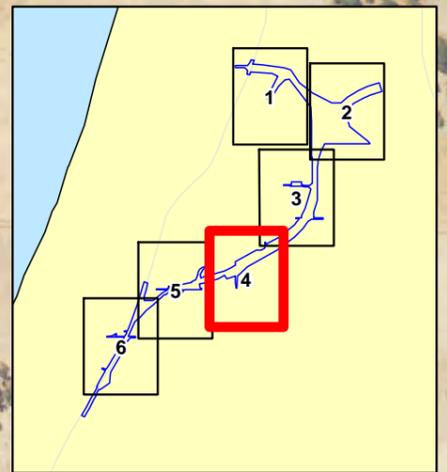
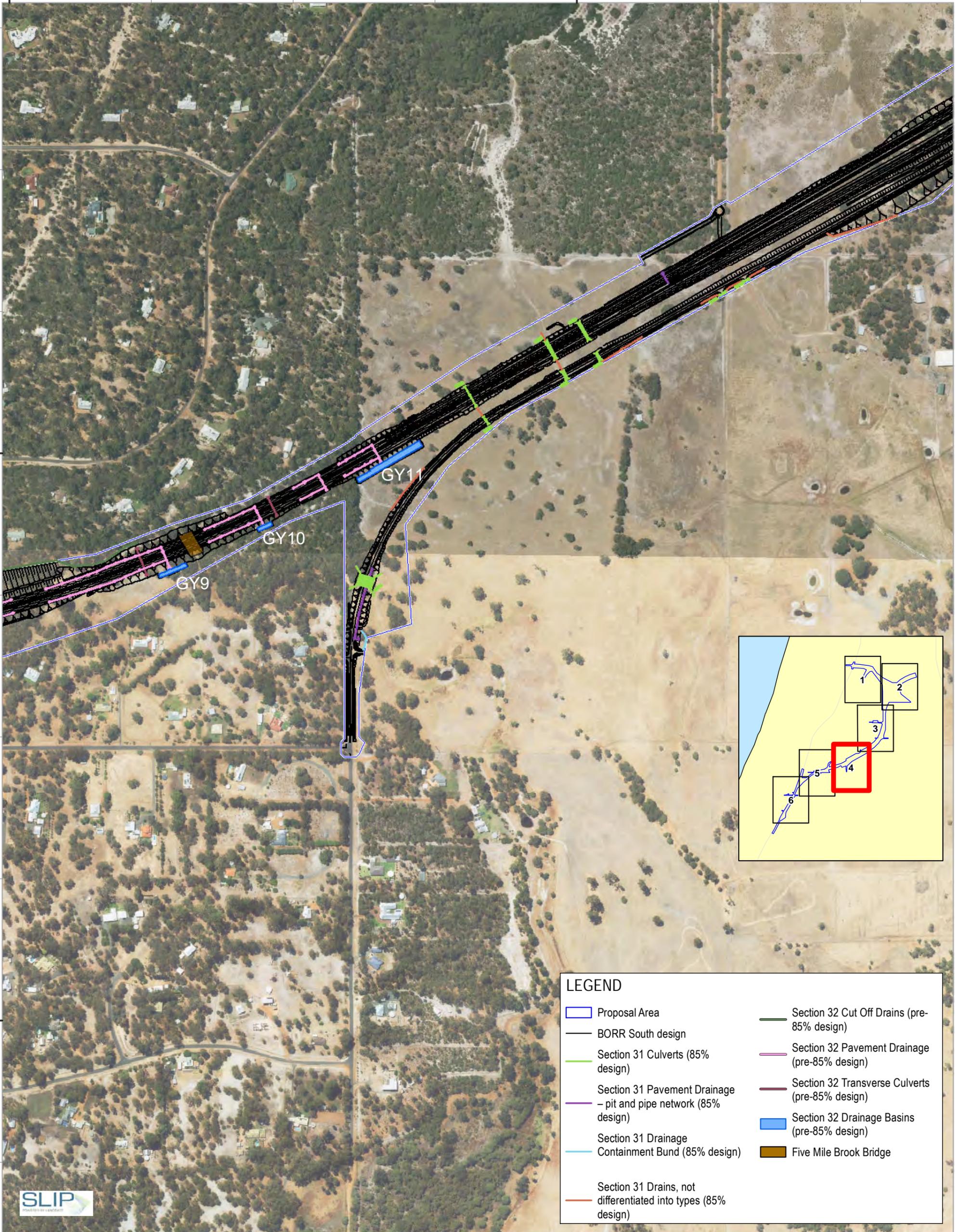
Project No. 61-37041
Revision No. 0
Date 20/06/2022

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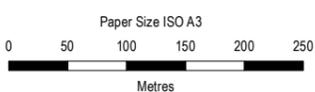
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LEGEND	
Proposal Area	Section 32 Cut Off Drains (pre-85% design)
BORR South design	Section 32 Pavement Drainage (pre-85% design)
Section 31 Culverts (85% design)	Section 32 Transverse Culverts (pre-85% design)
Section 31 Pavement Drainage - pit and pipe network (85% design)	Section 32 Drainage Basins (pre-85% design)
Section 31 Drainage Containment Bund (85% design)	Five Mile Brook Bridge
Section 31 Drains, not differentiated into types (85% design)	



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

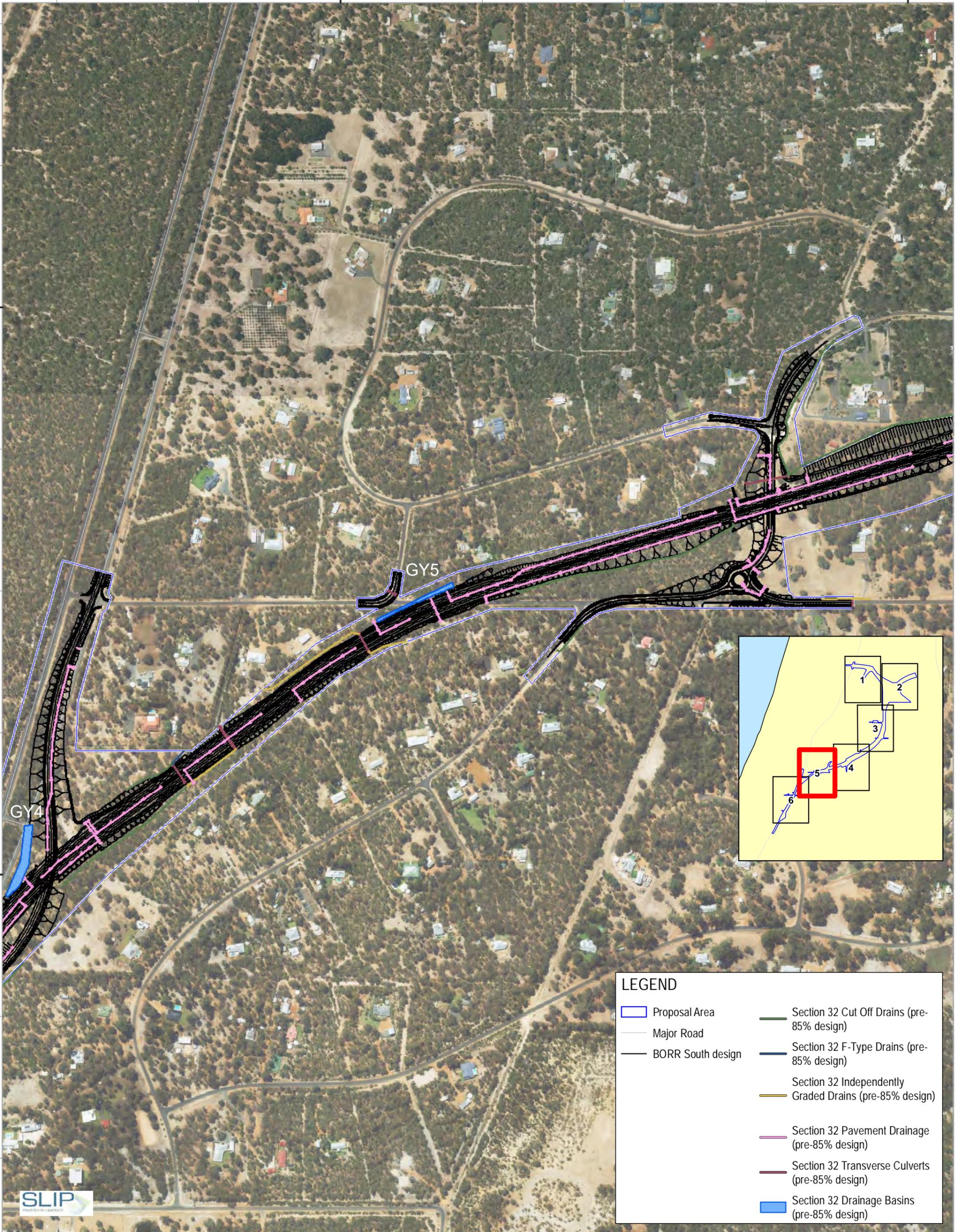


Main Roads Western Australia
Bunbury Outer Ring Road Southern Section

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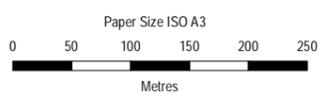
BORR Southern Section
Drainage Elements

Page 4 of 6
FIGURE 4



LEGEND

Proposal Area	Section 32 Cut Off Drains (pre-85% design)
Major Road	Section 32 F-Type Drains (pre-85% design)
BORR South design	Section 32 Independently Graded Drains (pre-85% design)
	Section 32 Pavement Drainage (pre-85% design)
	Section 32 Transverse Culverts (pre-85% design)
	Section 32 Drainage Basins (pre-85% design)



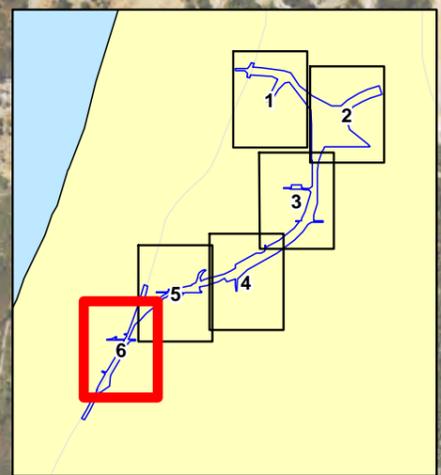
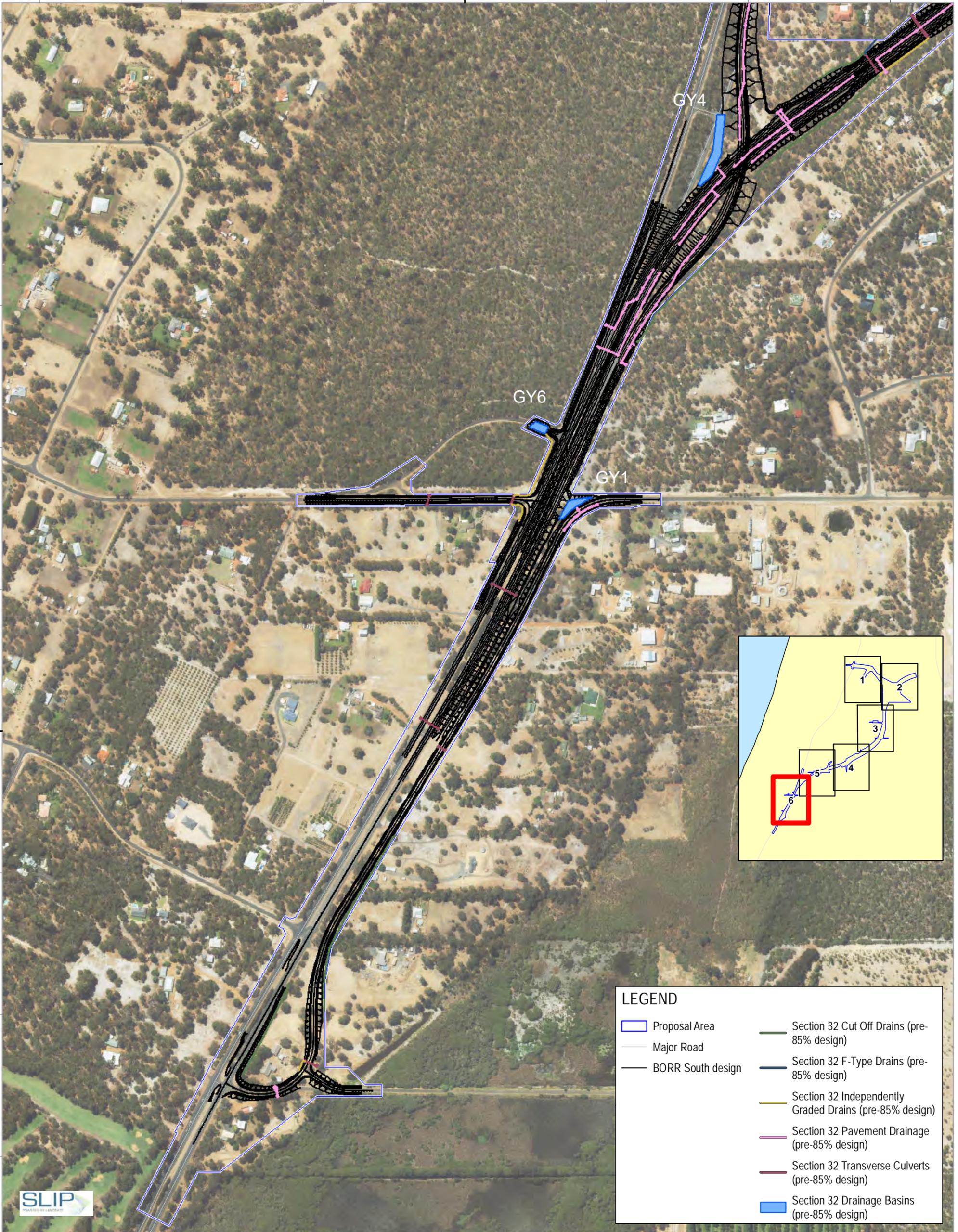
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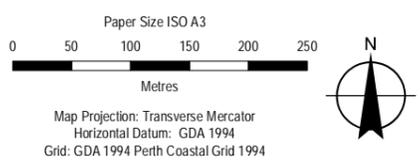
Main Roads Western Australia
Bunbury Outer Ring Road Southern Section

**BORR Southern Section
Drainage Elements**

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Date 20/06/2022



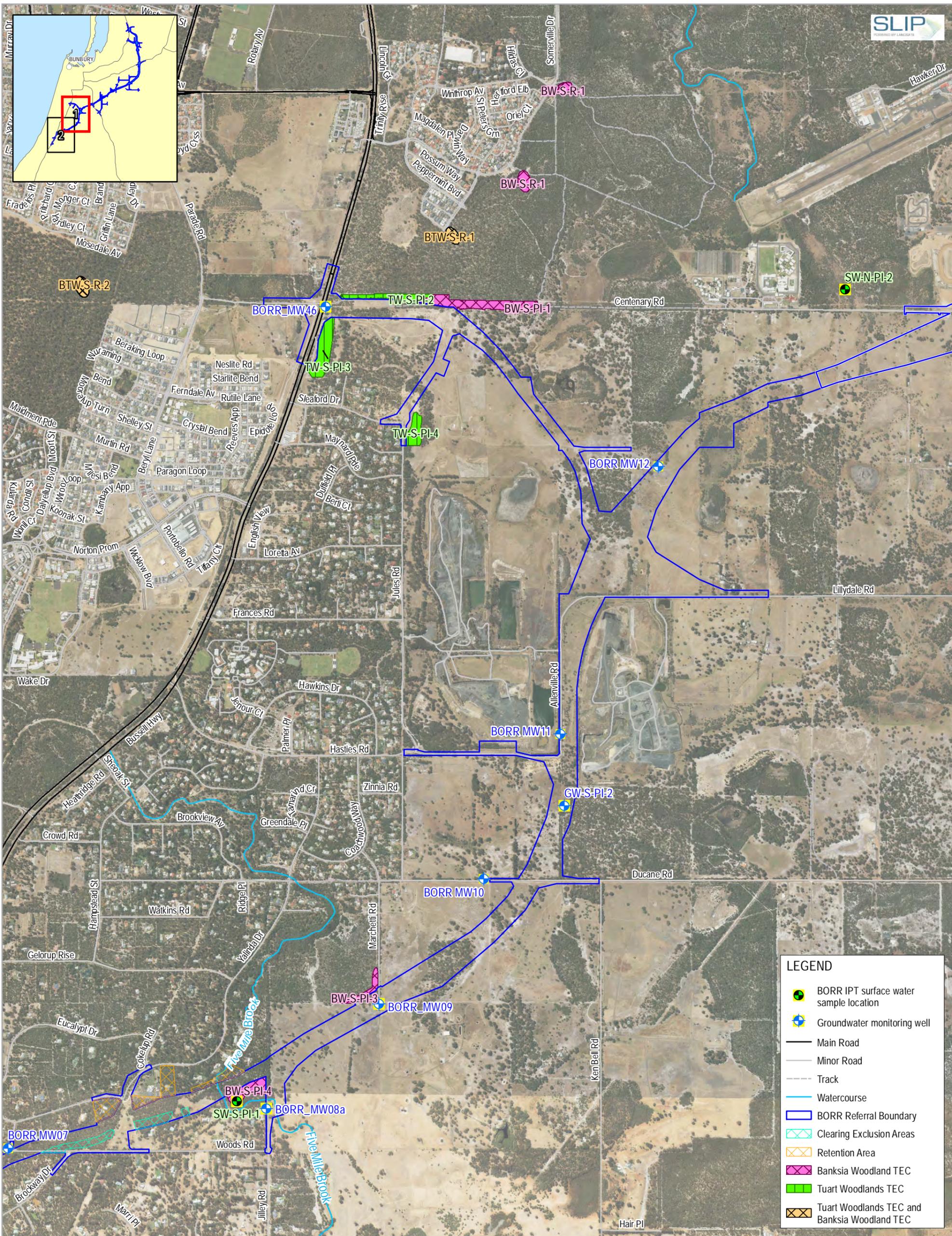
LEGEND	
Proposal Area	Section 32 Cut Off Drains (pre-85% design)
Major Road	Section 32 F-Type Drains (pre-85% design)
BORR South design	Section 32 Independently Graded Drains (pre-85% design)
	Section 32 Pavement Drainage (pre-85% design)
	Section 32 Transverse Culverts (pre-85% design)
	Section 32 Drainage Basins (pre-85% design)



Main Roads Western Australia
Bunbury Outer Ring Road Southern Section

**BORR Southern Section
Drainage Elements**

Project No. 61-37041
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LEGEND

- BORR IPT surface water sample location
- Groundwater monitoring well
- Main Road
- Minor Road
- Track
- Watercourse
- BORR Referral Boundary
- Clearing Exclusion Areas
- Retention Area
- Banksia Woodland TEC
- Tuart Woodlands TEC
- Tuart Woodlands TEC and Banksia Woodland TEC

Paper Size ISO A3
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Metres

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

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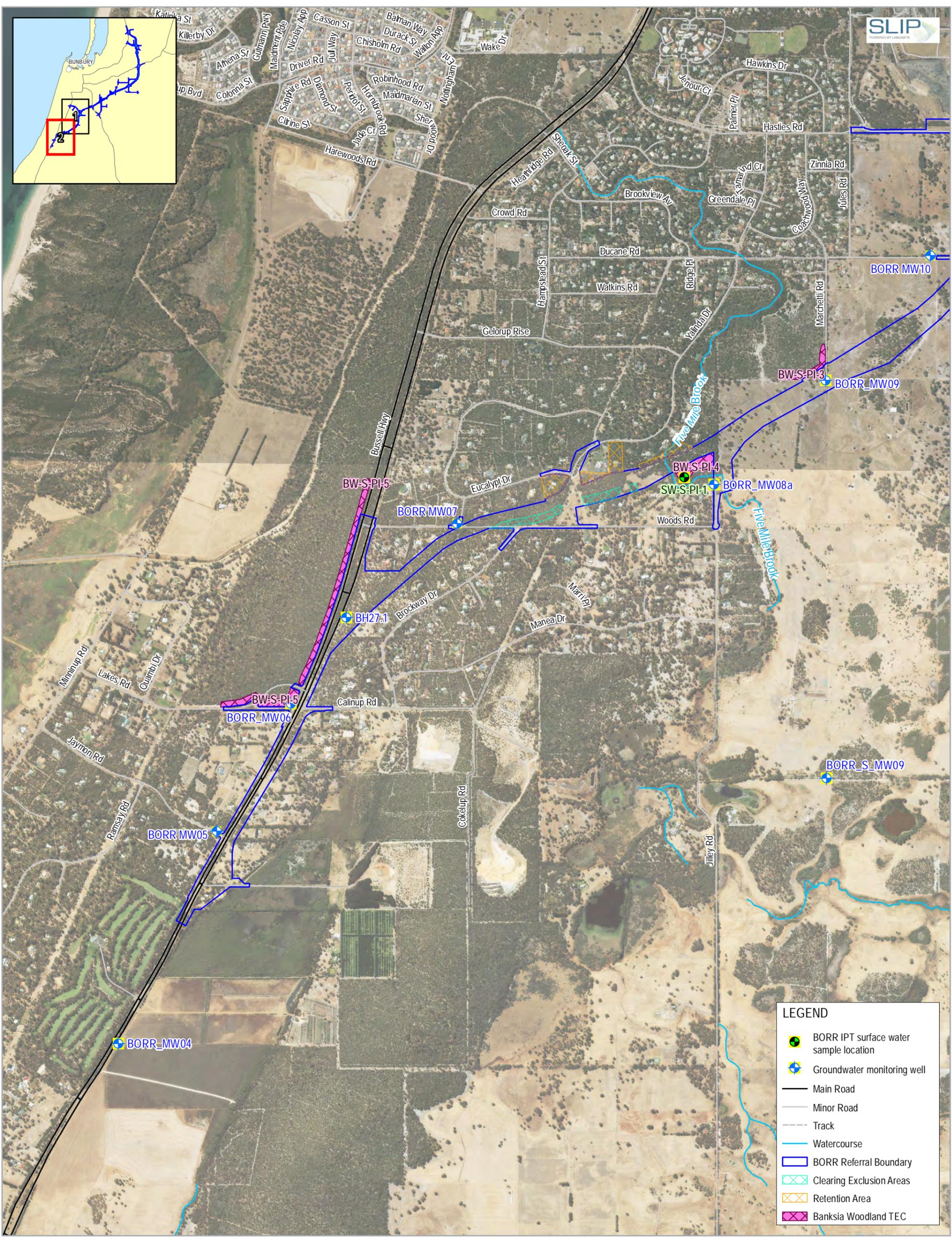
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Bunbury Outer Ring Road

TEC habitat potential impact
monitoring locations

Project No. 61-37041
Revision No. 0
Date 30/06/2022

Page 1 of 2
FIGURE 5



LEGEND

- BORR IPT surface water sample location
- Groundwater monitoring well
- Main Road
- Minor Road
- Track
- Watercourse
- BORR Referral Boundary
- Clearing Exclusion Areas
- Retention Area
- Banksia Woodland TEC

Paper Size ISO A3
0 200 400 600
Metres

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

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Main Roads Western Australia
Bunbury Outer Ring Road

TEC habitat potential impact
monitoring locations

Project No. 61-37041
Revision No. 0
Date 30/06/2022

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Data source: BORR: BORR North Referral Boundary - 20191016; BORR South Referral Boundary - 20191212; TECPEC: 2020; Biota: Western Ringtail Possum reference sites - 20200714; WRM: Sampling sites - 20200713; Geoscience Australia: GeoData Topo 250k Series III - 2006; Landgate: Roads, LGA Boundaries - 20180501; Imagery - WA Now accessed 20220630. Created by: mmikozian

Appendix B Risk and Management Matrices

Taken from the Conservation Significant Fauna Action Management plan (August 2021).

Management matrix for TEC vegetation

Management actions	Relevant protocols	Location	Performance target	Performance indicator	Completion criteria	Potential risks / threats	Risk mitigation	Monitoring	Reporting
Prior to construction									
Avoid: Design refinement to minimise area of TEC vegetation needed to be cleared for the Proposal	Detailed design	Within Development Envelope	Reduce clearing of TEC vegetation to the extent practicable in final design Minimise the area of TEC vegetation cleared during construction	Amount of TEC vegetation required to be cleared	Not more than 23.4 ha of Banksia Woodlands TEC and 4.4 ha of Tuart Woodlands TEC cleared	Not applicable	Not applicable	Not applicable	Report annually to DAWE as part of annual compliance reporting or in response to exceedance of an agreed trigger or threshold
Mitigate: As part of the contractor's CEMP, the construction contractor will prepare a Hygiene Management Plan to prevent the spread of <i>Phytophthora</i> dieback and weeds to monitored TEC vegetation. The Plan will include procedures such as machinery / vehicle clean down, weed treatments and restrictions on vehicle / machinery movements	Standard construction protocols in accordance with CEMP	Within Development Envelope	Minimise direct and indirect impacts to monitored TEC vegetation	CEMP and associated plans prepared	Baseline condition of monitored TEC vegetation is maintained	Plans not prepared	Review and / or revise management procedures Update training of relevant personnel	Parameters: WONS or Declared Plants in monitored TEC vegetation and revegetation within the Development Envelope Methodology: Visual assessment, transects (including plots) and photopoints Frequency: Prior to construction: Baseline monitoring to determine pre-construction conditions comprising <ul style="list-style-type: none"> • Bi-annual vegetation photopoints • Quarterly drainage photopoints • Annual vegetation transects and plots During construction: As above and opportunistically Post construction: As above for two years post-construction with a possible third year depending on results	Report annually to DAWE as part of annual compliance reporting or in response to exceedance of an agreed trigger or threshold
Mitigate: As part of the CEMP, the construction contractor will prepare a Fire Management Plan to minimise risk of ignition from construction activities and effectively manage any resulting fire / wildfire	Standard construction protocols in accordance with CEMP and Fire Management Plan	Within Development Envelope	Minimise direct and indirect impacts to monitored TEC vegetation	Preparation of Fire Management Plan	Fire Management Plan prepared	Fire Management Plan not prepared Fire Management Plan not implemented or effective	Review and / or revise management procedures Update training of relevant personnel	Not applicable	Report annually to DAWE as part of annual compliance reporting or in response to exceedance of an agreed trigger or threshold
Mitigate: Infestations of Declared Plants and WONS within the Development Envelope and in monitored TEC vegetation (in reserve	In accordance with CEMP, Hygiene Management Plan and Vegetation Monitoring Program	Within and adjacent to Development Envelope	Minimise direct and indirect impacts to monitored TEC vegetation	Presence of WONS or Declared Plants in monitored TEC vegetation	No new WONS or Declared Plants establish in monitored TEC vegetation as a result of Proposal	Presence of WONS or Declared Plants not identified	Review and / or revise management procedures	Parameters: WONS or Declared Plants in monitored TEC vegetation and revegetation within the Development Envelope Methodology:	Report annually to DAWE as part of annual compliance reporting or in response to exceedance of an agreed trigger or threshold

Management actions	Relevant protocols	Location	Performance target	Performance indicator	Completion criteria	Potential risks / threats	Risk mitigation	Monitoring	Reporting
or on land owned by Main Roads or where access is granted) will be removed or treated with herbicide					activities Envelope is maintained	Control measures not implemented	Update training of relevant personnel	Visual assessment, transects (including plots) and photopoints Frequency: Prior to construction: Baseline monitoring to determine pre-construction conditions comprising <ul style="list-style-type: none"> • Bi-annual vegetation photopoints • Quarterly drainage photopoints • Annual vegetation transects and plots During construction: As above and opportunistically Post construction: As above for two years post-construction with a possible third year depending on results	
During construction									
Avoid: Prior to clearing, the final road design will be assessed against the proposed clearing area to ensure the required clearing area is no more than the approved area	Standard construction protocols in accordance with CEMP	Within Development Envelope	Minimise the area of TEC vegetation cleared during construction	Extent of TEC vegetation clearing required	Not more than 23.4 ha of Banksia Woodlands TEC and 4.4 ha of Tuart Woodlands TEC cleared	Not applicable	Not applicable	Not applicable	Area of TEC vegetation cleared recorded by construction contractor and reported to Manager Environment monthly Report annually to DAWE as part of annual compliance reporting or in response to exceedance of an agreed trigger or threshold
Avoid: Low impact temporary fencing will be installed on the active construction front of TEC vegetation areas prior to clearing and maintained during construction phase	Standard construction protocols in accordance with CEMP	Within Development Envelope	Minimise the area of TEC vegetation cleared during construction	Clearing of TEC vegetation t outside of approved clearing area	Not more than 23.4 ha of Banksia Woodlands TE or 4.4 ha of Tuart Woodlands TEC cleared	Temporary fence not installed or ineffective	Daily inspections during clearing operations Review and / or revise management procedures Update training of relevant personnel	Parameters: Presence and effectiveness of temporary fence Methodology: Visual assessment Frequency: During construction: Daily during clearing operations Post construction: Not applicable	Report annually to DAWE as part of annual compliance reporting or in response to exceedance of an agreed trigger or threshold
Avoid: The Development Envelope boundary will be fenced to restrict access. The fence will be installed inside the	Standard construction protocols in accordance with CEMP	Within Development Envelope	Minimise direct and indirect impacts to monitored TEC vegetation	Access to TEC vegetation	Fence installed per specification Access controlled	Fence not installed Fence ineffective	Review and / or revise management procedures, including fence	Parameters: Presence and effectiveness of Development Envelope boundary fence Methodology: Visual assessment Frequency:	Report annually to DAWE as part of annual compliance reporting or in response to exceedance of an

Management actions	Relevant protocols	Location	Performance target	Performance indicator	Completion criteria	Potential risks / threats	Risk mitigation	Monitoring	Reporting
approved Development Envelope							design and installation Update training of relevant personnel	During construction: After installation of Development Envelope boundary fence Post construction: Quarterly for five years	agreed trigger or threshold
Avoid: Contractor induction will include familiarisation with and discussion of TEC vegetation, <i>Phytophthora dieback</i> management and hygiene management	Standard construction protocols in accordance with CEMP	Within Development Envelope	Minimise direct and indirect impacts to monitored TEC vegetation	Contractors adhere to relevant plans and procedures	Baseline condition of monitored TEC vegetation is maintained	Familiarisation not included in induction materials Contractor not compliant with requirements	Review and / or revise management procedures Update training of relevant personnel	Not applicable	Report annually to DAWE as part of annual compliance reporting or in response to exceedance of an agreed trigger or threshold
Avoid: As far as practical, clearing activities will occur during the dry months to reduce the risk of spreading <i>Phytophthora dieback</i>	In accordance with CEMP and Hygiene Management Plan	Within Development Envelope	Minimise direct and indirect impacts to monitored TEC vegetation	Timing of clearing operations	Baseline condition of monitored TEC vegetation is maintained	Clearing operations unable to occur during the dry months	Not applicable	Not applicable	Report annually to DAWE as part of annual compliance reporting or in response to exceedance of an agreed trigger or threshold
Avoid: Movement of machines and other vehicles to be restricted to the limits of the areas cleared within the Development Envelope or on designated tracks outside the area	Standard construction protocols in accordance with CEMP and Hygiene Management Plan	Within Development Envelope	Minimise direct and indirect impacts to monitored TEC vegetation	Vehicle access and movement	Baseline condition of monitored TEC vegetation is maintained	Access is not restricted as required	Daily inspections during clearing operations Review and / or revise management procedures Update training of relevant personnel	Parameters: Machinery and vehicle access and movement within the Development Envelope and on designated tracks outside the area Methodology: Visual assessment Frequency: During construction: Daily during clearing operations. Weekly during construction Post construction: Not applicable	Report annually to DAWE as part of annual compliance reporting or in response to exceedance of an agreed trigger or threshold
Avoid: No re-fuelling of equipment will be conducted within 200 m of wetlands and watercourses or 100 m of TEC vegetation	In accordance with CEMP	Within Development Envelope	Minimise direct and indirect impacts to monitored TEC vegetation	Location of re-fuelling equipment	Baseline condition of monitored TEC vegetation is maintained	Re-fuelling equipment is installed within 200 m of wetlands/ watercourses or 100 m of monitored TEC vegetation Hydrocarbon contamination of monitored TEC vegetation	Review and / or revise management procedures Update training of relevant personnel	Parameters: Hydrocarbon storage and re-fuelling locations Methodology: Visual assessment Frequency: During construction: Weekly and opportunistically Post construction: Not applicable	Report annually to DAWE as part of annual compliance reporting or in response to exceedance of an agreed trigger or threshold

Management actions	Relevant protocols	Location	Performance target	Performance indicator	Completion criteria	Potential risks / threats	Risk mitigation	Monitoring	Reporting
Mitigate: Where sufficient capacity is not available to store or infiltrate the peak 24 hour storm event, sediment / pollutant basins and / or flocculating turbid water in basins will be pumped out prior to and during periods of anticipated heavy or prolonged rainfall	In accordance with Vegetation Management Plan and CEMP	Within Development Envelope	Minimise direct and indirect impacts to monitored TEC vegetation	Capacity of drainage basins to store or infiltrate the peak 24 hour storm event	Water quality levels are maintained within specified guidelines Drainage basins have capacity to store or infiltrate the peak 24 hour storm event	Drainage basins lack capacity causing impact to monitored TEC vegetation	Review and / or revise management procedures Update training of relevant personnel	Parameters: Drainage basin capacity Methodology: Visual assessment Frequency: During construction: Weekly and opportunistically Post construction: Not applicable	Report annually to DAWE as part of annual compliance reporting or in response to exceedance of an agreed trigger or threshold
Mitigate: All hazardous material waste shall be managed in accordance with the Environmental Protection (Controlled Waste) Regulations 2004. This includes managing hydrocarbons and oily waste such as fuels, grease, de- greasers, emulsified oil and oily waste water	In accordance with Vegetation Management Plan and CEMP (Waste Management Plan)	Within Development Envelope	Minimise direct and indirect impacts to monitored TEC vegetation	Treatment of hazardous material waste	Waste Management Plan prepared Management of hazardous material waste in accordance with regulations and Waste Management Plan	Contamination of monitored TEC vegetation	Review and / or revise management procedures Update training of relevant personnel	Parameters: Hazardous material waste management Methodology: Visual assessment Frequency: During construction: Weekly and opportunistically Post construction: Not applicable	Report annually to DAWE as part of annual compliance reporting or in response to exceedance of an agreed trigger or threshold
Mitigate: General construction waste and other rubbish shall be covered or contained in bins with lids (where practicable) and removed regularly, disposed of in accordance with the relevant legislation	In accordance with Vegetation Management Plan and CEMP	Within Development Envelope	Minimise direct and indirect impacts to monitored TEC vegetation	Treatment of general construction waste and other rubbish	Waste Management Plan prepared Containment and appropriate disposal of general construction waste and other rubbish	Contamination of monitored TEC vegetation	Review and / or revise management procedures Update training of relevant personnel	Parameters: General construction waste and other rubbish management Methodology: Visual assessment Frequency: During construction: Weekly and opportunistically Post construction: Not applicable	Report annually to DAWE as part of annual compliance reporting or in response to exceedance of an agreed trigger or threshold
Avoid: All Department of Fire and Emergency Services (DFES) and LGA restrictions on fire and machinery movement will be strictly adhered to	Standard construction protocols in accordance with CEMP	Within Development Envelope	Minimise direct and indirect impacts to monitored TEC vegetation	Adherence to DFES and LGA fire restrictions	Baseline condition of monitored TEC vegetation is maintained	Fire restrictions not observed	Review and / or revise management procedures Update training of relevant personnel	Parameters: DFES and LGA fire restrictions Methodology: Visual assessment Frequency: During construction: Daily and opportunistically Post construction: Not applicable	Report annually to DAWE as part of annual compliance reporting or in response to exceedance of an agreed trigger or threshold
Avoid: Implement Drainage Strategy and ground and surface water	In accordance with CEMP, Drainage Strategy	Within and adjacent to Development Envelope	Minimise direct and indirect impacts to monitored TEC vegetation	Monitored TEC vegetation	Condition of monitored TEC vegetation is maintained at	Groundwater drawdown impacts on, or changes in	Review and / or revise management procedures	Parameters: Monitored TEC vegetation condition Methodology:	Report annually to DAWE as part of annual compliance reporting or in response to

Management actions	Relevant protocols	Location	Performance target	Performance indicator	Completion criteria	Potential risks / threats	Risk mitigation	Monitoring	Reporting
management measures to avoid impact to monitored TEC vegetation	and Hygiene Management Plan				baseline or any change is commensurate with that at reference site	hydrology of, monitored TEC vegetation	including modification of drainage infrastructure as required	Visual assessment, transects (including plots) and photopoints Frequency: Prior to construction: Baseline monitoring to determine pre-construction conditions comprising <ul style="list-style-type: none"> • Bi-annual vegetation photopoints • Quarterly drainage photopoints • Annual vegetation transects and plots During construction: As above and opportunistically Post construction: As above for two years post-construction with a possible third year depending on results	exceedance of an agreed trigger or threshold
Mitigate: Infestations of Declared Plants and WONS in monitored TEC vegetation (in reserve or under Main Roads jurisdiction or where access is granted) and revegetation within the Development Envelope will be removed or treated with herbicide	In accordance with CEMP, Hygiene Management Plan and Vegetation Management Plan	Within and adjacent to Development Envelope	Minimise direct and indirect impacts to monitored TEC vegetation	Presence of WONS or Declared Plants in monitored TEC vegetation	Baseline condition of monitored TEC vegetation is maintained	Presence of WONS or Declared Plants not identified Control measures not implemented	Review and / or revise management procedures Update training of relevant personnel	Parameters: WONS or Declared Plants in monitored TEC vegetation and revegetation within the Development Envelope Methodology: Visual assessment, transects (including plots) and photopoints Frequency: Prior to construction: Baseline monitoring to determine pre-construction conditions comprising <ul style="list-style-type: none"> • Bi-annual vegetation photopoints • Quarterly drainage photopoints • Annual vegetation transects and plots During construction: As above and opportunistically	Report annually to DAWE as part of annual compliance reporting or in response to exceedance of an agreed trigger or threshold
Post construction									
Mitigate: For five years post construction, undertake control of Declared Plants and WONS in monitored TEC vegetation (in reserve or under Main Roads jurisdiction or where access is granted) and in revegetation within the Development Envelope	In accordance with CEMP and Vegetation Monitoring Plan	Within and adjacent to Development Envelope	Minimise direct and indirect impacts to monitored TEC vegetation	Presence of WONS or Declared Plants in monitored TEC vegetation	Baseline condition of TEC vegetation adjacent to the Development Envelope is maintained	Presence of WONS or Declared Plants not identified Control measures not implemented	Review and / or revise management procedures Update training of relevant personnel	Parameters: WONS or Declared Plants in monitored TEC vegetation or revegetation within the Development Envelope Methodology: Visual assessment and field survey Frequency: Post construction: Biannually for five years post-construction	Report annually to DAWE as part of annual compliance reporting or in response to exceedance of an agreed trigger or threshold
Mitigate: Where appropriate:	In accordance with Vegetation	Within and adjacent to	Revegetation provides fauna	Evidence of appropriate	Revegetation achieves	Failure to establish	Review and / or revise	Parameters: As outlined in Table 5-4 of the VMP	Report annually to DAWE as part of annual

Management actions	Relevant protocols	Location	Performance target	Performance indicator	Completion criteria	Potential risks / threats	Risk mitigation	Monitoring	Reporting
<ul style="list-style-type: none"> • revegetation of batters of significant cuttings with suitable endemic native species will be undertaken for bank stabilisation • revegetation of drainage basins for sediment / pollutant mitigation <p>Where space and access allows, revegetation and landscaping of cleared areas within the Proposal Area with suitable endemic native species will be undertaken to provide foraging habitat for Black Cockatoos (excluding 10 m buffer from nearest traffic lane).</p>	<p>Monitoring Plan and Main Roads <i>Environmental Guidelines Vegetation Placement within the Road Reserve</i>¹ and <i>Environmental Guidelines Revegetation Planning and Techniques</i>²</p>	Development Envelope	habitat, bank stabilisation or sediment / pollutant mitigation (as appropriate) within 10 years of completion	preparatory site works and / or revegetation in identified revegetation areas	<p>parameters outlined in Table 5-4 of the VMP</p> <p>Provision of suitable fauna habitat, bank stabilisation or sediment / pollutant mitigation (as appropriate) within 10 years of completion</p>	revegetation appropriate to requirements (fauna habitat, bank stabilisation or sediment / pollutant mitigation)	management procedures including modification of timing, species selection and maintenance activities as required	<p>Methodology: Visual assessment, field survey (including 10 m x 10 m quadrats) by suitably experienced personnel</p> <p>Frequency: Post construction: Quarterly for two years after revegetation commenced, biannually thereafter for three years.</p> <p>Once completion criteria has been achieved, revegetation surveys will occur every 5 years (in spring) for the life of the Approval to ensure completion criteria is being maintained</p>	compliance reporting or in response to exceedance of an agreed trigger or threshold

¹ Main Roads Western Australia, 2016a in VMP

² Main Roads Western Australia 2016b in VMP

Risk assessment for TEC vegetation

Objective: To ensure that impacts to TEC vegetation are avoided and minimised as far as practicable during clearing, construction and operation of the Proposal										
Key environmental values: TEC vegetation										
PERFORMANCE TARGET / OUTCOME	POTENTIAL IMPACT	NATURE OF IMPACT	PRE-CONTROL RISK			MANAGEMENT	POST CONTROL RISK			CONFIDENCE LEVEL
			LIKELIHOOD	CONSEQUENCE / SCALE	RISK OUTCOME		LIKELIHOOD	CONSEQUENCE / SCALE	RISK OUTCOME	
<p>Reduce clearing of TEC vegetation to the extent practicable in final design</p> <p>Minimise the area of TEC vegetation cleared during construction</p>	Clearing or disturbance of TEC vegetation outside of the approved clearing area	Known, predictable, irreversible	Possible	Moderate	Medium	Standard construction management to control construction clearing	Unlikely	Moderate	Low	High
<p>Minimise direct and indirect impacts to monitored TEC vegetation</p>	Reduction in condition of monitored TEC vegetation	<p>Known, predictable</p> <p>Irreversible for <i>Phytophthora</i> dieback</p> <p>Potentially irreversible for surface water</p> <p>Reversible for WONS and Declared Plants</p>	Possible	Moderate	Medium	<p>Implement WONS, Declared plant, surface water and <i>Phytophthora</i> dieback management measures within Development Envelope revegetation areas, monitored TEC vegetation</p> <p>Construction of Development Envelope boundary fence</p> <p>Implement waste management measures as per Table 5-3 of the VMP and Waste Management Plan</p>	Unlikely	Minor	Low	High
	Bushfire occurrence as a result of Proposal construction resulting in loss of monitored TEC vegetation	Known, unpredictable, irreversible	Possible	Moderate	Medium	<p>Standard construction management to control potential ignition sources during construction</p> <p>Implement Fire Management Plan</p>	Possible	Moderate	Medium	High
	Groundwater drawdown impacts on or changes in hydrology of monitored TEC vegetation	Known, predictable, potentially irreversible	Unlikely	Moderate	Low	Standard construction management to control groundwater water abstraction consistent with WA Government water supply approvals (not specific to AMP)	Unlikely	Moderate	Low	High
	Failure to establish revegetation appropriate to requirements (fauna habitat, bank stabilisation or sediment / pollutant mitigation)	Known, predictable, reversible	Unlikely	Moderate	Low	Management to establish and maintain rehabilitation	Unlikely	Moderate	Low	High
<p>Minimise direct and indirect impacts to monitored TEC vegetation</p> <p>Maintain water quality levels within specified guidelines</p> <p>Hydrology baseline functions and values are maintained</p>	Impact to water quality in monitored TEC vegetation adjacent to the Development Envelope	Known, predictable, reversible	Possible	Moderate	Medium	<p>Management to control sedimentation and erosion during construction</p> <p>Management of hydrocarbon storage during construction</p> <p>Management of hazardous material waste during construction</p>	Unlikely	Minor	Low	High
	Impact to surface water levels in monitored TEC vegetation adjacent to the Development Envelope	Known, predictable, reversible	Possible	Moderate	Medium	Standard construction management to control surface water and drainage during construction (not specific to VMP)	Unlikely	Minor	Low	High

Objective: To ensure that impacts to TEC vegetation are avoided and minimised as far as practicable during clearing, construction and operation of the Proposal

Key environmental values: TEC vegetation

PERFORMANCE TARGET / OUTCOME	POTENTIAL IMPACT	NATURE OF IMPACT	PRE-CONTROL RISK			MANAGEMENT	POST CONTROL RISK			CONFIDENCE LEVEL
			LIKELIHOOD	CONSEQUENCE / SCALE	RISK OUTCOME		LIKELIHOOD	CONSEQUENCE / SCALE	RISK OUTCOME	
	Drainage basins lack capacity causing impact to monitored TEC vegetation	Known, predictable, reversible	Possible	Moderate	Medium	Standard construction management to control surface water and drainage during construction (not specific to VMP)	Unlikely	Minor	Low	High

Attachment B

RISK MATRIX						
Qualitative measure of likelihood (how likely is it that this event/circumstances will occur after management activities are implemented)						
Highly Likely	Is expected to occur in most circumstances					
Likely	Will probably occur during the life of the project					
Possible	Might occur during the life of the project					
Unlikely	Could occur but considered unlikely or doubtful					
Rare	May occur in exceptional circumstances					
Qualitative measure of consequences (what will be the consequence/result if the issue does occur)						
Minor	Minor incident of environmental damage that can be reversed <i>(e.g. short-term delays to achieving plan objectives, implementing low-cost, well-characterised corrective actions)</i>					
Moderate	Isolated but substantial instances of environmental damage that could be reversed with intensive efforts <i>(e.g. short term delays to achieving plan objectives, implementing well-characterised, high-cost/effort corrective actions)</i>					
High	Substantial instances of environmental damage that could be reversed with intensive efforts <i>(e.g. medium-long term delays to achieving objectives, implementing uncertain, high-cost/effort corrective actions)</i>					
Major	Major loss of environmental amenity and real danger of continuing <i>(e.g. plan objectives are unlikely to be achieved, with significant legislative, technical, ecological and/or administrative barriers to attainment that have no evidenced mitigation strategies)</i>					
Critical	Severe widespread loss of environmental amenity and irrecoverable environmental damage <i>(e.g. plan objectives are unable to be achieved, with no evidenced mitigation strategies)</i>					
		Consequence				
		Minor	Moderate	High	Major	Critical
Likelihood	Highly Likely	Medium	High	High	Severe	Critical
	Likely	Low	Medium	High	High	Severe
	Possible	Low	Medium	Medium	High	Severe
	Unlikely	Low	Low	Medium	High	High
	Rare	Low	Low	Low	Medium	High

Appendix C Annual Compliance Report Template



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WESTERN AUSTRALIA

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Western Australia.*

EPBC 2019/8543 Annual Compliance Report

Bunbury Outer Ring Road
Southern Section
Month/Year

Contents

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1. Introduction

Main Roads Western Australia (Main Roads) is proposing to construct and operate the Southern Section of the Bunbury Outer Ring Road (BORR) project. BORR is a planned Controlled Access Highway linking the Forrest Highway and Bussell Highway. The completed project will provide a high standard route for access to the Bunbury Port, improve road user safety and facilitate proposed development to the east of the City of Bunbury. BORR provides 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 three km extension of Willinge Drive southwards to South Western Highway)
- 'BORR Southern Section' – South Western Highway (near Bunbury Airport) to Bussell Highway.

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

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

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

1.1 Approval under the Environment Protection and Biodiversity Conservation Act 1999

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

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

The Additional Information Request for Preliminary Documentation was submitted to DAWE for assessment in October 2020 and subsequently advertised for public comment for four weeks

commencing 20 November 2020 and ending 18 December 2020. Commonwealth Approval Notice 2019/8543 under the EPBC Act was granted on Day Month 2022 and included a number of conditions that Main Roads Western Australia (Main Roads) is required to fulfil.

1.2 Purpose of this Report

Construction of the Project commenced on Day/Month/Year. This compliance report has been produced as required by Condition X of EPBC approval 2019/8543. Table 1 of this report outlines the compliance with each approval condition over the past 12 month period, Day/Month/Year to Day/Month/Year. The clearing area of TEC vegetation is shown in Figure 1 and that of conservation significant fauna habitat in Figure 2.

3. Compliance

Table 2: Year - Year compliance with EPBC Approval 2019/8543

Condition Number	Condition Description	Status

Figure 1 Total Clearing of TEC vegetation from Project Area

Figure 2 Total clearing of conservation significant fauna habitat from Project Area

4. Attachments

Attachment	Title
Attachment 1	
Attachment 2	
Attachment 3	
Attachment 4	
Attachment 5	
Attachment 6	
Attachment 7	

Attachment 1:

Attachment 2:

Attachment 3:

Attachment 4:

Attachment 5:

Attachment 6:

Attachment 7:

Appendix D Monitoring Methodology

APPENDIX D. TEC VEGETATION MONITORING METHODOLOGY

The purpose of monitoring is to inform, through the management targets detailed in this Vegetation Management Plan (VMP), whether the environmental objective stated in Section 2.2 being achieved or whether management actions need to be reviewed and revised.

The monitoring program comprises:

- TEC vegetation monitoring methods
- Drainage monitoring methods for TEC vegetation

TEC VEGETATION MONITORING METHODS

The monitoring program has been designed to enable the detection of a decline in vegetation condition using species composition and vegetation health attributes as measurement parameters.

The Threatened and ecological community (TEC) vegetation targeted in this monitoring plan comprises occurrences of the following Commonwealth listed TECs and State listed TECs and PECs:

- Banksia Woodlands of the Swan Coastal Plain (SCP) TEC – EPBC Act listed, also listed as a Priority 3 PEC ('Banksia Woodlands TEC')
- Tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain TEC, also listed as a Priority 3 PEC ('Tuart Woodlands TEC')

Potential impact monitoring sites listed in Table 1 and shown in Figure 3 of the VMP will be monitored in comparison to Reference Sites. Potential impact sites are located adjacent to the Development Envelope, and are referred to as 'monitored TEC vegetation'.

Reference Sites on Crown land or road reserves that are known to contain vegetation comprising the two TECs listed above have been identified. These sites are located in close proximity but separate to the monitored TEC vegetation. The purpose of reference sites is to enable comparison of monitored TEC vegetation data with data from sites located away from the Development Envelope and to assist in determining whether any impacts have resulted from Proposal implementation. Permission to establish monitoring transects in these sites has been secured and monitoring has been being conducted since 2019.

To facilitate comprehensive data analysis, and to minimise risk of loss of reference sites through fire or other unanticipated events, two reference sites¹ have been identified for Tuart Woodlands TEC and three for Banksia Woodlands TEC.

Monitoring sites are listed in Table 1 and shown on Figure 3.

¹ BTW-S-R-1 and BTW-S-R-2 meet the description of both the Banksia Woodlands TEC and Tuart Woodlands TEC and function as reference sites for these community types.

Table 1 Monitored TEC vegetation site details

Site code and tenure	TEC type	Location and Lot number
TW-S-PI-2 Road reserve and Reserve	Tuart Woodland TEC	Road reserve on the north side of Centenary Road east of Bussell Hwy, and extending into the adjacent reserve to the north (Road reserve, and P061603 / 9000)
TW-S-PI-3	Tuart Woodland TEC	South side of Centenary Rd east of and adjacent to Bussell Hwy, north westernmost part of Proposal Area (P419255 / 108)
TW-S-PI-4	Tuart Woodland TEC	South side of Centenary Rd east of Bussell Hwy, north westernmost part of Proposal Area (P419254 / 105)
BW-S-PI-1 Road reserve	Banksia Woodland TEC	Road reserve along Centenary Road east of Bussell Hwy, east of Site TW-S-PI-2 (No Lot or Location number)
BW-S-PI-3 Private property	Banksia Woodland TEC	East of Yalinda Drive, west of Marchetti Road (P232768 / 156)
BW-S-PI-4 Road isolation	Banksia Woodland TEC	Jilley Road north of Woods Road (Road isolation)
BW-S-PI-5 Reserve	Banksia Woodland TEC	West of Bussell Hwy (two land parcels) (R23000 (land_id_nu: 3415480))

Reference sites are listed in Table 2 and shown in Figure 5.

Table 2 Reference site details

Reference site name	TEC type	Location
BW-S-R-1	Banksia Woodland TEC	Manea Park (R 32963)
BTW-S-R-1	Tuart Woodland TEC and Banksia Woodland TEC	North side of Centenary Rd west of Bussell Hwy, north westernmost part of PA (away from alignment) (P061603 / 9000)
BTW-S-R-2	Tuart Woodland TEC and Banksia Woodland TEC	North side of Centenary Rd east of Bussell Hwy (P003097 / 303 or 304)

The monitoring program has been developed with reference to the following documents:

- *Environmental Factor Guideline: Flora and Vegetation* (Environmental Protection Authority 2016a)
- *Technical Guidance Flora and Vegetation Surveys for Environmental Impact Assessment* (Environmental Protection Authority 2016b)
- *Banksia Woodlands of the Swan Coastal Plain TEC Conservation Advice* (Threatened Species Scientific Community 2016)
- *Tuart (Eucalyptus gomphocephala) Woodlands and Forests of the Swan Coastal Plain TEC Conservation Advice* (Threatened Species Scientific Community 2019).

1.1 Personnel

Surveys will be conducted by a botanist with appropriate experience and qualifications, including demonstrated experience as a field botanist on the Swan Coastal Plain.

1.2 Optimal timing

To maximise the proportion of native species recorded during the field surveys, monitoring of Banksia and Tuart Woodland vegetation will be carried out in spring.

1.3 Monitoring type and locations

The monitoring method and parameters selected comprise a combination of quantitative and qualitative measures that will provide an overall assessment of the health of TEC vegetation and any evidence of disturbance from the Proposal. Monitoring comprises a combination of transects (including plots) and photopoints.

1.4 Frequency

The transect vegetation monitoring program will be undertaken annually in spring prior to and during construction, and for the period of EPBC Act approval unless otherwise agreed by the Minister. Photopoint monitoring will be conducted bi-annually prior to and during construction, and for the same duration.

1.5 Site locations

Suitable monitoring reference site locations have been determined through desktop assessment and local knowledge of the vegetation surrounding the Proposal Area. Banksia Woodlands TEC reference sites situated on Spearwood dunes have been selected for this Proposal because the great majority of Banksia Woodlands TEC occurrences (all but one) either directly or potentially impacted by the Proposal are situated on Spearwood dunes. DBCA have indicated the selected sites are suitable for use as Reference sites in the monitoring program (pers. comm. Andrew Webb, 12/08/2019; 20/08/2019). Reference site locations are shown in Figure 5.

1.6 Monitoring methodology

The vegetation monitoring program is comprised of monitoring transects and photopoints. The methodologies for each approach are detailed below. Transect start and end points are denoted by inclusion of 'T' in the site name and photopoint locations are denoted by inclusion of 'P' in the site name.

1.6.1 Banksia Woodlands TEC

One transect was established in each of the Banksia Woodland sites BW-S-PI-1 and BW-S-PI-5 (Figure 5). Two transects were established in Reference Site BW-S-R-1 and one each in Reference Sites BTW-S-R-1 and BTW-S-R-2 (Figure 5). Transect locations were finalised during an initial site visit prior to commencing the first round of monitoring, and are located within Banksia Woodland TEC. Transect design is described in section 1.7 and shown in Plate 1. The remaining sites are monitored via photopoints.

Photopoints have been established in both monitored TEC vegetation and reference sites as detailed in section 1.8.

1.6.2 Tuart Woodlands TEC

One transect was established at Tuart Woodland site TW-S-PI-2 (Figure 5). One transect was established in each of the Reference Sites BTW-S-R-1 and BTW-S-R-2 (Figure 5). Transect locations were finalised during an initial site visit prior to commencing the first round of monitoring, and are located within the Tuart Woodlands TEC vegetation. The remaining sites are monitored via photopoints.

Photopoints have been established in both monitored TEC vegetation and reference sites as detailed in section 1.8, noting that additional baseline survey is required to extend the monitoring beyond the current 20 m from the Development Envelope boundary out to 60 m, in accordance with condition 12.b.ii of DAWE Approval Notice 2019/8543.

1.7 Transect design

Monitoring transects 30 m in length were established within both monitored TEC vegetation and reference sites. Along each transect, 2 x 2 m plots were established at 10 m intervals, the first at 0 m and the last at 30 m. Each plot was placed alternately left and right of the transect line. A total of 4 plots were established per transect.

Each plot was measured using a tape. Corners were marked with a galvanised steel post. The layout of a transect is shown in Plate 1.

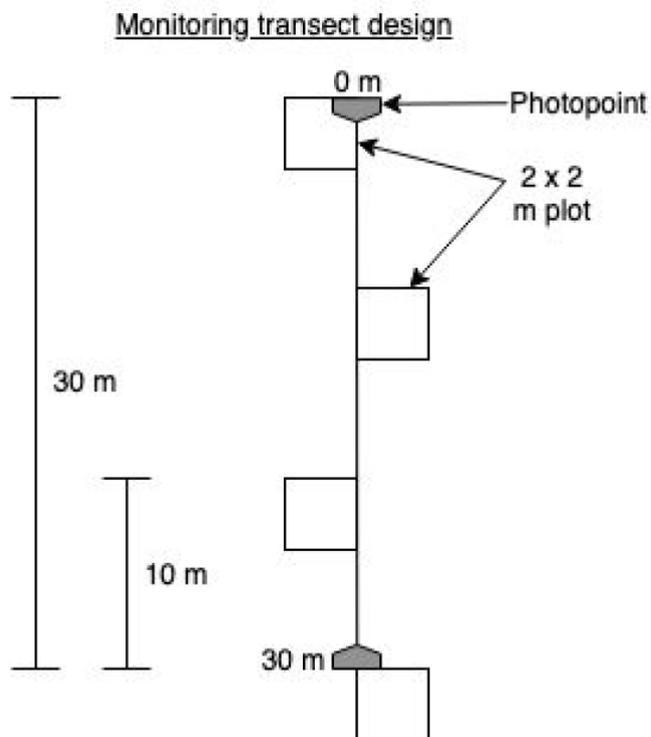


Plate 1. Layout of a monitoring transect.

1.8 Photo point design

Photopoints were established at the following locations:

- At the start and end point of each transect
- At each plot
- 5 m distance from the existing vegetation line at 50 m intervals around the Development Envelope boundary adjoining the sites listed above.

Where allowed, photopoints were marked permanently with a stake and their locations geo-referenced (recorded using a handheld GPS). All photographs are taken from the top of the stake. Photopoint monitoring will form part of each monitoring event. Where permanent stakes could not be installed, such as in roadside vegetation, the locations of these points was marked on the adjacent fence/fence post, and the stake installed for each monitoring event, and removed prior to leaving the site.

Where photopoints are linked to a transect, photographs are taken facing towards the middle of the transect. For photopoints not linked to a transect, photographs are taken facing towards, and left and right of the vegetation being monitored.

At independent photopoints, i.e. those not linked to transects, the following parameters are recorded:

- Site conditions including vegetation cover
- Dominant species in each structural layer

- Weed species present and overall cover
- Evidence of erosion
- Evidence of plant disease
- Evidence of other physical disturbance such as grazing, rubbish dumping, etc.

Fewer parameters are recorded in photopoints linked to transects, because in addition to photopoints, transects contain plots at which data for numerous additional parameters is recorded (refer section 1.9).

The plant cover scale used for the photopoint monitoring (the Specht scale, a modified version of the Braun-Blanquet scale (Chytry *et al.* 2011)) is presented in Table 3.

Table 3 Photopoint plant cover scale

COVER SCORE	DESCRIPTION
1	Rare or of low cover (one or two or <2%)
2	Present but in low numbers (a few, 2% - 10%)
3	Common locally, not uniform over whole area (10% - 30%)
4	Common over whole area (30% - 70%)
5	Completely dominating overstorey or understorey (> 70%)

1.8.1 Additional site-specific parameters

The following site-specific parameters were added to the vegetation monitoring methodology in March 2021 in response to feedback from the Department of Biodiversity, Conservation and Attractions.

'BTW' reference sites

To ensure that sufficient contextual information on tree health is collected at sites that are used as reference sites for both Banksia and Tuart Woodlands TEC / PEC (BTW-S-R-1 and BTW-S-R-2), at these sites, a plant health / stress assessment will be conducted for individual trees (*Eucalyptus*, *Corymbia* and *Banksia* species) located within 15 m of both the start and end points of each transect.

Monitoring TEC vegetation

In order to monitor for changes in vegetation condition adjacent to significant cutting locations (i.e. Centenary Road (TW-S-I-2) and near the tie-in to the existing Bussell Highway (the central portion of BW-S-I-4)), boundary photopoint monitoring will include plant health / stress assessment(s) of trees (*Eucalyptus*, *Corymbia* and *Banksia* species) within a 15 m radius of each photopoint.

1.9 Transect monitoring parameters

The monitoring parameters selected comprise a combination of quantitative and qualitative vegetation measures that will provide an overall assessment of the health of the vegetation. The selected monitoring parameters are described below. Data is collected using standardised data sheets.

Within each transect plot, the following parameters are recorded:

- Species diversity and cover
- Plant deaths
- Level of plant stress
- Ground characteristics (% bare ground, leaf litter, etc).

At photopoints located at the start and end point of each transect, assessing the each transect as a whole, the following parameters are recorded:

- Site conditions
- Evidence of erosion
- Vegetation community structure.

Where required, a description of the approach used for each parameter is set out below.

1.9.1 Species diversity and cover

In each transect plot (2 x 2 m) the following information will be collected:

- Species present – identify all species present within the quadrat
- An estimate of cover and abundance of species using a slightly modified version of the Domin-Krajina scale², as shown in Table 4. The Domin-Krajina scale is appropriate for use at this fine scale.

Table 4 Modified Domin-Krajina scale

Cover score	Description
1	Seldom found species with insignificant cover
2	Very scattered individuals of a species with less than 1% cover
3	Scattered individuals of a species with 1-5% cover
4	Any number of individuals of a species with 5-10% cover
5	Any number of individuals of a species with 10-25% cover
6	Any number of individuals of a species with 25-33% cover
7	Any number of individuals of a species with 33-50% cover
8	Any number of individuals of a species with 50-75% cover
9	Any number of individuals of a species with greater than 75 % but less than 100%
10	Any number of individuals of a species with complete cover (100%) in the stand

1.9.2 Level of plant stress

In each transect plot and at selected photopoint monitoring sites (see Section 1.8.1), plant stress is measured on a five-point scale as detailed in Table 5.

Table 5 Plant stress scale

² The scale was modified for use in electronic data capture software that did not recognise a score of zero.

Plant stress level	Description
5	Plant with >81 % of the original canopy present; healthy overall; little or no leaf yellowing. No evidence of wilting of foliage. Plants not stressed.
4	Plant with 61-80% of the original canopy present; occasional dead branches (< 20 % of canopy); small patches of leaf yellowing. Plant leaves may show signs of wilting at periphery. Plants potentially stressed.
3	Plant with 41-60 % of the original canopy present; some smaller dead branches evident (21-40 % of canopy); moderate amount of leaf yellowing (21-40 % of canopy). Plant leaves may show signs of wilting with noticeable curling of leaf periphery. Plants exhibiting symptoms of stress.
2	Plant with 21-40 % of original canopy present; some main branches dead (50 – 80 % of canopy); abundant leaf yellowing (> 41 % of canopy). Plant leaves may show signs of wilting with noticeable curling of leaf. Plants exhibiting signs of stress.
1	Plant with <20 % of original canopy; most main branches dead; remaining leaves mostly dying off. Plant leaves may show signs of wilting with noticeable curling of leaf (approaching closure). Plants clearly stressed.

1.9.3 Ground characteristics

In each transect plot, the percentage of bare ground, leaf litter, twig and logs are recorded in 5 % categories (i.e. 0-5 %, 5-10 % etc.).

1.9.4 Site conditions

- Vegetation condition in accordance with the rating scale (EPA 2016)
- Pathogen attack (including plant disease) – visual evidence of dieback / disease
- Fire history – visual evidence of fire history
- Evidence of unauthorised access
- Other disturbances (e.g. rubbish dumping, access tracks, grazing).

1.9.5 Evidence of erosion or inundation

A description and photograph of erosion or inundation are recorded if present. Description includes depth and width characteristics of any erosion, and depth of any standing water.

1.9.6 Vegetation community structure

For each transect, vegetation is described based on structure, dominant taxa and cover characteristics. Vegetation unit descriptions follow the National Vegetation Information System (NVIS) and are consistent with NVIS Level V (Association). At Level V up to three taxa per stratum are used to describe the association (Executive Steering Committee for Australian Vegetation Information (ESCAVI 2003)).

1.10 Data analysis

Data collected from monitoring is to be entered into electronic spreadsheets to be analysed for trends in vegetation health. Table 6 provides a summary of the calculations to be completed for

each parameter. Photographs from each transect will be appropriately labelled and stored. For the monitoring quadrats and transect plots, where required to determine a significant difference between baseline and reference site data, data analysis will include the use of parametric univariate statistical tests including a paired t-test (two sampling events) or repeated measures ANOVA (more than two sampling events) when testing for change between years at sites or between sites within a single survey event.

Table 6 Summary of analysis

Parameter	Description
Species diversity	Diversity calculated by counting the number of different species present in the quadrat / plot
Species composition	Percent composition calculated dividing the percent cover for each species by the total cover for all species
Level of plant stress	Comparison of the previous monitoring periods to note change over time
Weed species	Number and total cover calculated
Plant deaths	Total number counted and comparison of the previous monitoring periods to note change over time
Vegetation health	Visual comparison of photographs taken from each permanent photopoint. Comparison of the previous monitoring periods to note change over time
Ground characteristics	Comparison of the previous monitoring periods to note change over time

DRAINAGE MONITORING PLAN FOR TEC VEGETATION

Monitoring for changes to hydrology and drainage will be undertaken through a combination of visual assessments and assessment of data collected from monitoring wells (Figure 5). The drainage monitoring will be conducted in addition to the vegetation monitoring included above. Analysis of data collected will aim to determine the impact, if any, of Proposal implementation in regards to groundwater levels and quality, and any resulting effect on TEC vegetation.

1.11 Monitoring strategy – visual assessment

The purpose of visual assessment monitoring is to detect any flooding, erosion, inundation or drying of the monitored TEC vegetation so that necessary remedial action can be taken. Visual assessments will be conducted by a suitably qualified and experienced environmental officer.

1.11.1 Monitoring design and frequency

Visual assessments will involve opportunistic visual inspection during construction for evidence of

- Flooding and / or inundation
- Erosion, or
- Drying

of TEC vegetation that is attributable to the Proposal. A field recording sheet will be prepared to capture relevant site condition data including:

- presence / absence of standing water
- % of TEC / PEC occurrence impacted.

Should signs of plant stress be evident at any of the monitored TEC vegetation or reference sites, the Plant Stress Scale (Table 5) will be completed.

Comparison with reference site monitoring results will be used to assess whether any impacts are attributable to the Proposal implementation or to climatic or other conditions. Should any such impacts be present, a photograph clearly showing the site condition will be taken. Site condition and plant health information will also be recorded at the site using the photopoint monitoring and vegetation health field recording sheets prepared for the VMP.

Flooding, inundation and erosion are all more visually apparent than the effects of drying on vegetation. Impacts from drying are more likely to be evident from late spring through to late autumn, and will likely comprise yellowing, wilting and dying off of vegetation, as well as the site drying out at a faster rate after winter. Comparison with groundwater data (see section 2.2) will be used to inform the assessment and attribution of cause of vegetation response.

1.11.2 Visual assessments will be conducted quarterly prior to and during construction, for the period of effect of EPBC Act approval or as otherwise agreed by the Minister.

Photopoint monitoring will be conducted bi-annually prior to and during construction, for the same duration. Data analysis

Data analysis will involve comparison of conditions between Potential Impact sites and Reference Sites as well as between seasons, and trend analyses.

1.12 Monitoring strategy – ground and surface water wells

Main Roads has completed a 12 month groundwater and surface water monitoring programme. This dataset provides the baseline data from which potential contamination may be monitored.

The dates of the 12 month monitoring program are provided in Table 7. The analytical suites are provided in Table 8. Main Roads will continue to monitor groundwater and surface water levels and analytes on a quarterly basis at the locations listed in Table 9.

Table 7 Surface water and groundwater monitoring dates for BORR

Monitoring Event	Survey dates
1	19 to 22 August 2019
2	16 to 19 September 2019
3	21 to 28 October 2019
4	18 to 21 November 2019
5	16 to 19 December 2019
6	20 to 23 January 2020
7	17 to 20 February 2020
8	16 to 19 March 2020
9	20 to 23 April 2020
10	18 to 21 May 2020
11	15 to 18 June 2020
12	20 to 27 July 2020
13	19 to 21 October 2020
14	18 to 20 January 2020

Table 8 Suite of analytes tested throughout the 12 month GW and SW monitoring program

LABORATORY ANALYTICAL SUITES
Groundwater analytical suites

LABORATORY ANALYTICAL SUITES	
Field parameters	pH, EC, DO (mg/L, % sat), redox, temperature (°C), TDS ³
Inorganics	pH, EC (laboratory by titration), TDS (laboratory by gravimetric) ⁴
Acidity and alkalinity	Alkalinity (carbonate as CaCO ₃), alkalinity (bicarbonate as CaCO ₃), alkalinity (hydroxide as CaCO ₃), alkalinity (total as CaCO ₃), acidity (as CaCO ₃)
Major ions	Calcium, magnesium, potassium, sodium, chloride, sulfate, cations total, anions total, ionic balance, sulfide
Nutrients	Ammonium (as N), ammonia (as N), nitrogen (total oxidised) (as N), nitrogen (total), reactive phosphorus (as P), Kjeldahl nitrogen total, phosphorus (total).
Metals	Aluminium, cadmium, chromium, cobalt, copper, iron, lead, manganese, nickel, selenium, zinc
BTEXN	Benzene, toluene, ethylbenzene, xylene, naphthalene (sum of total)
TRH	Total recoverable hydrocarbons
Surface water analytical suites	
Field parameters	pH, EC, DO (mg/L, % sat), redox, temperature (°C), TDS*, turbidity (NTU)
Inorganics	pH, EC (laboratory by titration), TDS (laboratory by gravimetric)**
Acidity and alkalinity	Alkalinity (carbonate as CaCO ₃), alkalinity (bicarbonate as CaCO ₃), alkalinity (hydroxide as CaCO ₃), alkalinity (total as CaCO ₃), acidity (as CaCO ₃)
Major ions	Calcium, magnesium, potassium, sodium, chloride, sulfate, cations total, anions total, ionic balance, sulfide
Nutrients	Ammonium (as N), ammonia (as N), nitrogen (total oxidised) (as N), nitrogen (total), reactive phosphorus (as P), Kjeldahl nitrogen total, phosphorus (total)
Metals	Aluminium, cadmium, chromium, cobalt, copper, iron, lead, manganese, nickel, selenium, zinc
BTEXN	Benzene, toluene, ethylbenzene, xylene, naphthalene (sum of total)
TRH	Total recoverable hydrocarbons
Pesticides and herbicides	OP pesticides, glyphosate

1.12.1 Potential impact site wells

Monthly monitoring of water quality and water levels in groundwater wells and surface water locations within or nearby the Development Envelope commenced in August 2019, to enable the collection of baseline data (Table 9). Some of these wells are located in close proximity to the monitored TEC vegetation sites. Location and depth information is provided in Table 10.

The monitoring program will be undertaken as per Table 9 during and post construction. Water levels and quality will continue to be monitored to determine impacts of Proposal implementation on ground and surface water. Sample analysis will be conducted using appropriate field test equipment and laboratory samples will be tested in a NATA accredited laboratory.

Table 9 Monitoring points (TEC vegetation) and monitoring design

³ Field TDS recorded from YSI ProDSS water quality meter - calculated from conductivity and temperature

⁴ Where available laboratory results for pH, EC and TDS have been reported. If laboratory results are missing or otherwise not available, field results are reported.

Location	TEC site location	Monitoring site type	Parameter being monitored	Monitoring frequency	
				During construction	Post construction
Surface water					
SW10 (surface water)	BW-S-PI-4	Surface water	Water depth	Monthly	Quarterly for one year
			Physical and water chemistry ⁵		
Groundwater					
BORR_MW46	TW-S-PI-1, TW-S-PI-2, BW-S-PI-1	Ground water	Water level	Monthly	Monthly for one year
BH27.1	BW-S-PI-5				
MR MW05	Not TEC				
BORR_MW06	BW-S-PI-5		Physical and water chemistry	Quarterly Monthly if Field TTA 40-100mg/L and pH less than 6	Quarterly for one year
BORR_MW08	BW-S-PI-4				
BORR_MW08a	BW-S-PI-4				
BORR_MW09	BW-S-PI-3	Ground water	Physical and water chemistry	Quarterly	Quarterly for one year
BORR_MW05, BORR_MW07, BORR_MW10, BORR_MW11, BORR_MW12	Reference monitoring wells outside of the Development Envelope				

⁵ Monitoring includes a comprehensive suite of physical and water chemistry parameters (BORR, 2020b).

Table 10 Monitoring site (TEC vegetation) location and depth information

Name	Easting	Northing	Depth (m)
Surface water			
SW10	373337	6300496	NA
Groundwater			
BORR_MW46	373883	6305094	Depth to water (March 2020): 4.514 m Total depth: 5.994 m
BH27.1	-	-	TBC
MR_MW05	375313	6302189	Depth to water (March 2020): 2.867 Total depth: 4.981 m
BORR_MW06	371109	6299068	Depth to water (September 2019): 6.730 m Total depth: 7.841 m
BORR_MW08	373588	6300392	TBC
BORR_MW08a	373588	6300392	Depth to water (September 2019): 3.971 m Total depth: 5.731 m
BORR_MW09	374241	6301013	Depth to water (March 2020): 4.145 m Total depth: 5.32 m

1.12.2 Reference site wells

Five monitoring wells outside for the Proposal Area and outside of the potential zone of influence of the Proposal construction activities (dewatering) have been identified and included in the monitoring program, as listed in Table 9. These monitoring wells will provide regional reference for groundwater levels and be used to compare against changes in groundwater levels in the Development Envelope.

1.12.3 Data analysis

Ground and surface water levels from monitoring sites will be compared against pre-construction baseline and trends in reference monitoring wells. Development of trigger values for ground and surface water levels will be considered at the completion of the baseline monitoring period.

Water quality parameters will be compared against ANZECC/ARMCANZ (2000) guideline values for the protection of slightly/moderately disturbed wetland ecosystems in the south west of Western Australia (development of site specific guideline values will considered once adequate baseline data has been collected). Descriptive statistics (range, maximum, minimum, median) will also be calculated for water quality results and used to identify water quality parameters that differ between potential impact sites and reference sites. A graphical trend analysis of each analyte over each 12 month period will also be conducted.

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