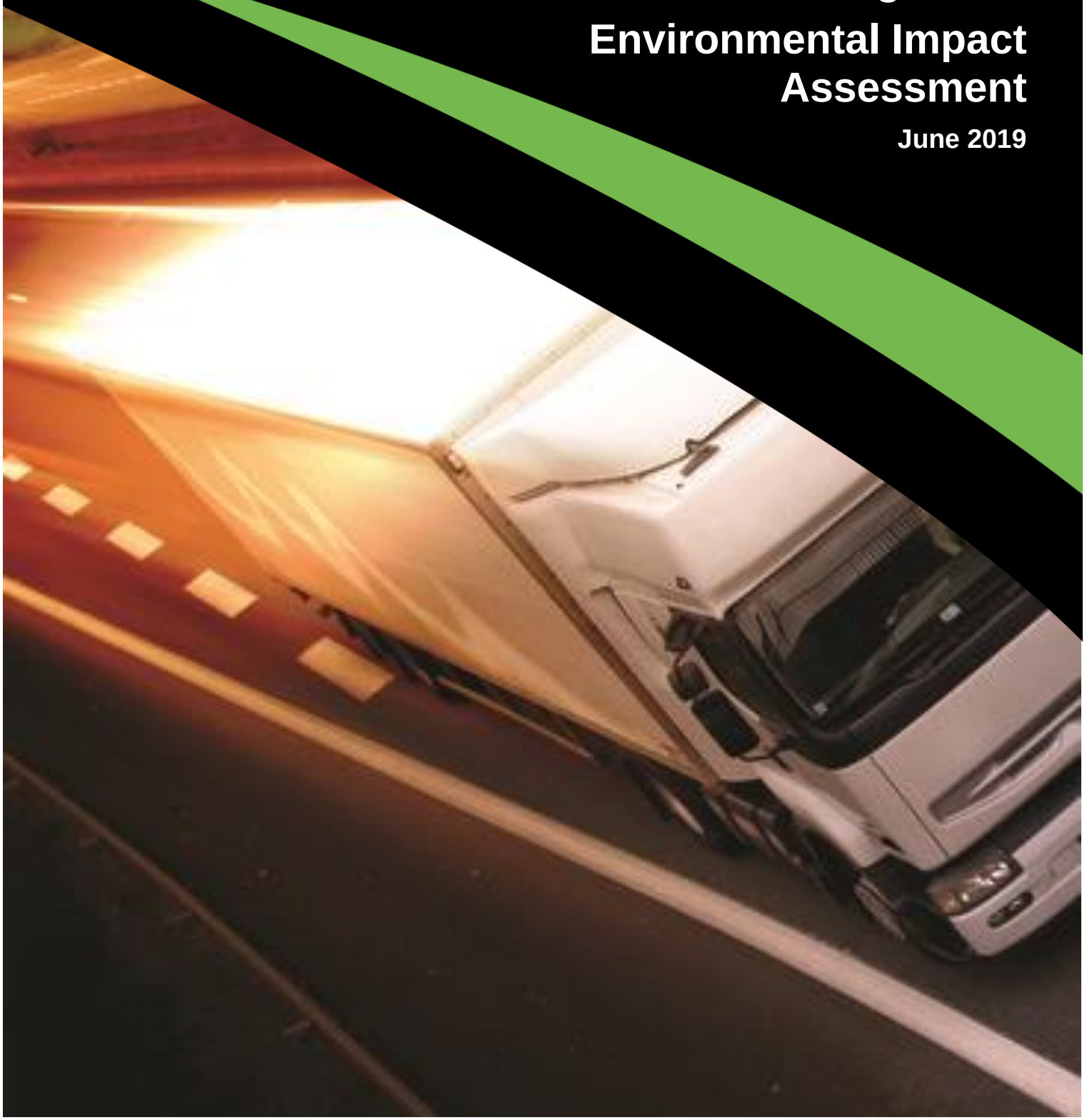
BORR Team

Bunbury Outer Ring Road Southern Section Alternative Alignment

Environmental Impact Assessment

June 2019



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1 INTRODUCTION

1.1 Background

The Commissioner of Main Roads Western Australia (Main Roads) is planning for the construction of the Bunbury Outer Ring Road (BORR). BORR is a planned Controlled Access Highway linking the Forrest Highway and Bussell Highway. The completed BORR will provide a high standard route for access to the Bunbury Port and facilitate proposed development to the east of the City of Bunbury. BORR will also provide an effective bypass of Bunbury for inter-regional traffic.

BORR forms a major component of the planned regional road network for the Greater Bunbury area. The land requirement for BORR was identified in the draft Greater Bunbury Region Scheme (GBRS), with the route advertised to the broader community as part of the GBRS assessment.

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 4 km section which was completed in May 2013, along with a 3 km extension of Willinge Drive southwards to South Western Highway
- 'BORR Southern Section' – South Western Highway (near Bunbury Airport) to Bussell Highway.

The alignment of the BORR Northern and Central Sections are planned from Forrest Highway to South Western Highway and will be referred to the Environmental Protection Authority (EPA) in Q1 2019. The BORR Southern Section will provide a highway link between South Western Highway and Bussell Highway, and will link with BORR Northern Section and Port Access Road (PAR).

In November 2012, Main Roads referred the BORR Southern Section to the EPA for assessment under Section 38 of the *Environmental Protection Act 1986* (EP Act). In February 2013, the EPA determined that the BORR Southern Section did not require formal environmental assessment under Part IV of the EP Act and that the BORR Southern Section could progress under Part V of the EP Act and other relevant legislation. Clearing of native vegetation for the Southern Section would be approved under a Purpose Clearing Permit. An application for the clearing permit was submitted in December 2015 and withdrawn prior to a decision being made in June 2017. Main Roads also referred the BORR Southern Section to the Commonwealth Minister for the Environment through the Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC, now DotEE) for a decision on the requirement for formal assessment under the provisions of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). In March 2013, the DotE (now DotEE) advised that the BORR Southern Section was considered a Controlled Action and would be assessed through preliminary documentation. Main Roads has since withdrawn the referral from DotEE assessment.

In response to changes to the EPBC Act's protection status of the Western Ringtail Possum in May 2018, from 'Vulnerable' to 'Critically Endangered', Main Roads identified that the approval to construct BORR Southern Section within the GBRS alignment may need to be reconsidered. To address this concern, Main Roads commissioned an Environmental Options Assessment of five options for BORR Southern Section (BORR IPT, 2018). The Environmental Options Assessment was a preliminary comparison document that was intended to be incorporated into the broader alignment selection planning process. The assessment confirmed that significant environmental factors for BORR Southern Section alignments included the clearing of native vegetation and the consequent removal of fauna habitat.

Two alignments were selected for further investigation, which were:

- BORR Southern Section GBRS Alignment
- BORR Southern Section Alternative Alignment.

A suite of field investigations was undertaken on both alignments in Q3 and Q4 of 2018. A 750 m wide corridor was investigated for the BORR Southern Section Alternative Alignment, in order to give the alignment flexibility to avoid any environmental constraints identified in the desktop and field investigations. This corridor was then narrowed down to approximately 100 m, which avoids the identified environmental constraints as far as practicable.

For the purposes of comparing the environmental impact of the two alignment options, this assessment considers a dual carriageway highway from Hasties Road in Gelorup to Yeardy Road in Stratham.

1.2 Purpose of this document

To inform the decision of the preferred project footprint, Main Roads commissioned an Environmental Impact Assessment (EIA) for each of the two alignments.

This EIA presents the environmental values and potential impact of the construction and operation of the BORR Southern Section Alternative Alignment (referred to as 'the Project' in this report).

Main Roads used the findings in this EIA to assist in their determination of the preferred BORR Southern Section alignment. The selected alignment will be subject to additional environmental assessment and reporting for the approvals process under the EP and EPBC acts.

This EIA addresses the Principles and Factors of Section 4A of the EP Act and is structured around the EPA's "*Instructions on how to prepare an Environmental Review Document"* (EPA, 2018a).

1.3 Project description

The Project is located 10 km south of Bunbury in the Shire of Capel and City of Bunbury. The Project is shown in Figure 1 and comprises the following elements:

- Construction of a 13.2 km dual carriageway highway between Hasties Road and Yeardy Mine Road
- Construction of interchanges at:
  - Bussell Highway (in the form of a Y-interchange)
  - Boyanup Road West (partial dumbbell interchange with north facing ramps only)
- Construction of two road underpasses to deal with access severance
- Upgrade of 23.5 km of service/local roads including:
  - Upgrade and sealing of Jilley Road
  - Upgrade and extension of Cable Mine Road to connect to Elgin Road
- Construction of drainage structures including basins and culverts
- Construction of 13.2 km of Principal Shared Path
- Installation of fencing and noise walls/treatments
- Service relocation and protection
- Construction of access roads to severed properties
- Pre-construction activities including geotechnical investigations and service utilities relocations
- Landscaping and rehabilitation works.

1.3.1 Project Area

The Project Area covers approximately 222 ha and is the boundary for this EIA (Figure 1). The Project Area includes an approximately 120-140 m wide corridor for the dual carriageway, as well as a number of ancillary roads. The majority of the land within the Project Area is cleared agricultural land with pockets of native vegetation present in road reserves or as isolated patches on agricultural land.

1.3.2 Surveyed and Unsurveyed areas

Access to the entire Project Area was not available when the environmental field surveys were completed in 2018 and the study areas differed slightly for each environmental field survey. As a result, approximately 21% of the Project Area was not surveyed during field investigations (Figure 2).

Unsurveyed Areas (identified in Sections 3.3.1 and 3.4.1) have undergone desktop investigations to inform this EIA. Additional field investigations will be completed in unsurveyed areas of the alignment if it is chosen for development as part of the formal environmental assessment.

The Southern Section (GBRS alignment) Study Area overlaps the Project Area by approximately 2 ha, therefore the total area surveyed within the Project Area was just over 174 ha.

Table 1-1 outlines the areas surveyed and gaps within the Project Area during the 2018 field surveys.

Table 1-1 Project Area, Surveyed and Unsurveyed Areas in the 2018 field surveys

DESCRIPTION	AREA
Project Area – Southern section (alternative alignment)	222.1 ha
Study Area – Southern section (alternative alignment) flora and fauna (excluding contextual sites) field surveys	Approx. 1,410 ha flora survey Approx. 1,463 ha fauna survey
Surveyed Area – (Southern section – alternative alignment) intersecting the Project Area	172.1 ha
Surveyed Area – (Southern section – GBRS alignment) intersecting the Project Area	2.2 ha
Unsurveyed Area – Gap in survey effort within the Project Area)	47.8 ha

1.4 Legislative framework

A summary of the anticipated regulatory approvals required for the establishment of the Project has been included in Table 1-2.

Table 1-2 Summary of regulatory approval requirements for the BORR Southern Section

PROJECT ACTIVITIES	TYPE OF APPROVAL	REGULATORY AGENCY	LEGISLATION REGULATING THE ACTIVITY
Potentially significant impacts to the environment	Division 1 of Part IV of the EP Act - referral and assessment of significant and strategic proposals Approval type to be determined if the Project is Assessed, Assessed on Referral Information or Not Assessed	Environmental Protection Authority (EPA)	EP Act
Impacts to matters of National Environmental Significance (MNES)	Referral of a Project to the Commonwealth – Approval type to be determined if the Project is deemed a Controlled Action	Department of the Environment and Energy (DotEE)	EPBC Act 1999
Clearing of Native Vegetation	Native Vegetation Clearing Permit 1	Department of Water and Environment Regulation (DWER)	EP Act 1986, Part V Div 2, EP (Clearing) Regulations 2004
Impacts to flora and fauna	Approval to take flora and fauna (if required)	Department of Biodiversity Conservation and Attractions	*Biodiversity Conservation Act 2016* (BC Act), Biodiversity Conservation Regulations 2018
Impacts to waterways	Bed and Banks Permit	DWER	*Rights in Water and Irrigation Act 1914* (RIWI Act)
Sourcing of construction water	Licence to take	DWER	RIWI Act
Impacts to Registered/Lodged Aboriginal Heritage sites	Section 18 consent	Department of Planning, Lands and Heritage (DPLH)	*Aboriginal Heritage Act 1972*
Impacts to Municipal heritage site	Consent from Shire	Shire of Capel	-

1.5 Limitations and assumptions

This report has been prepared by the Bunbury Outer Ring Road Integrated Project Team (BORR IPT) for Main Roads and may only be used and relied on by Main Roads for the purpose agreed between BORR IPT and the Main Roads, as set out in section 1.2 of this Report.

BORR IPT otherwise disclaims responsibility to any person other than Main Roads arising in connection with this report. BORR IPT also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by BORR IPT in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. BORR IPT has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by BORR IPT described in this report. BORR IPT disclaims liability arising from any of the assumptions being incorrect.

BORR IPT has prepared this report on the basis of information provided by Main Roads and others who provided information to BORR IPT (including Government authorities), which BORR IPT has not independently verified or checked beyond the agreed scope of work. BORR IPT does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

The opinions, conclusions and any recommendations in this report are based on information obtained from, and testing undertaken at or in connection with, specific sample points. Site conditions at other parts of the site may be different from the site conditions found at the specific sample points.

Investigations undertaken in respect of this report are constrained by the particular site conditions, such as the location of infrastructure, services and vegetation, and access. As a result, not all relevant site features and conditions may have been identified in this report.

Site conditions may change after the date of this report. BORR IPT does not accept responsibility arising from, or in connection with, any change to the site conditions. BORR IPT is also not responsible for updating this report if the site conditions change.

This report has assessed the environmental impact within the Project Area, as shown in Figure 1. Should the Project Area change or be refined, further assessment may be required.

Approximately 21% (~48 ha) of the Project Area was inaccessible during the 2018 environmental field investigation and not surveyed. Desktop assessments were undertaken to identify potential impacts of the Project in the following unsurveyed locations:

- Jilley Road
- Fishermans Road
- Calinup Road
- Bussell Highway section (southern end of Project Area)
- Local roads north of Yeardy Road, including Cable Mine Road, Nicholls Road and Elgin Road.

If this alignment is chosen for development, additional field investigations will be completed of the unsurveyed areas as part of the formal environmental assessment process.

2 STAKEHOLDER CONSULTATION

Main Roads has been engaged in consultation with key stakeholders since the mid-1990s for the entire 'BORR Proposal'. Previous consultation undertaken by Main Roads with key stakeholders has included:

- Technical Working Group: with engineering and planning representatives from Main Roads, the City of Bunbury, the Department of Planning, the Department of Environment and Conservation, the Shire of Capel and the Shire of Dardanup
- The BORR Stakeholder Group: state and local government agencies that met as required and included: City of Bunbury (CEO, Mayor), Shire of Capel (CEO, Shire President), Shire of Dardanup (CEO, Shire President), Bunbury Port Authority, South West Development Commission (SWDC), Bunbury Chamber of Commerce and John Castrilli (Member for Bunbury)
- Consultation with: Department of Planning, Lands and Heritage (DPLH) (formerly Department of Planning), Public Transport Authority, Local Government, Service Authorities
- Consultation with environmental stakeholders including:
  - Commonwealth DotEE (formerly Department of Sustainability Environment, Water, Population and Communities)
  - DBCA (formerly Department of Environment and Conservation)
  - DWER (formerly Department of Water and Office of the EPA).

Stakeholder and community engagement is continuing with landowners and local residents, communities of interest, local government authorities and State Government agencies. During 2018 Main Roads consulted with key stakeholders to discuss 'BORR Project' issues and potential impacts, including environmental, heritage (Aboriginal and European), social and economic impacts.

A summary of consultation completed to date is shown in Table 2-1. Regulatory agencies that have been consulted to date are shown in Table 2-2. A summary of the key concerns raised during the stakeholder consultation to date is provided in Table 2-3, along with Main Roads responses.

Table 2-1 Consultation summary to date

STAKEHOLDER CONSULTATION	DATE	PARTICIPANT AGENCIES
Investment Logic Mapping (ILM) Workshop	4 December 2017	• Main Roads • South West Development Commission • Great Southern Ports • Qube (bulk minerals sand transporter).
Project Steering Committee	June 2018 – ongoing (bi-monthly)	• Chaired by MD Main Roads • Main Roads' Project Director • Department of Treasury • DPLH • Department of Infrastructure, Regional Development and Cities • Others by invitation.
Project Enabling Group	June 2018 – ongoing (bi-monthly)	• Chaired by Main Roads' Executive Director Planning and Technical Services • City of Bunbury • Shire of Capel • Shire of Harvey

STAKEHOLDER CONSULTATION	DATE	PARTICIPANT AGENCIES
		• Shire of Dardanup • DPLH • BORR IPT.
BORR Regional Local Government Advisory Group (RLGAG)	August 2018 – ongoing (quarterly or at Key Milestones)	• Chaired by Main Roads' Executive Director Planning and Technical Services • City of Bunbury • Shire of Capel • Shire of Harvey • Shire of Dardanup • BORR IPT.
Economic Advisory Group	October 2018 – ongoing (at Key Milestones)	• City of Bunbury • Bunbury Geographe Economic Alliance (BGEA) • South West Development Commission (SWDC) • Regional Development Australia South West (RDASW) • Chamber of Minerals and Energy • Wespine • Bunbury Geographe Chamber of Commerce and Industry • Main Roads • BORR IPT.
Drainage Reference Group	August 2018 – ongoing (at Key Milestones)	• DBCA – Parks and Wildlife Service • DWER • Water Corporation • City of Bunbury • Shire of Capel • Shire of Dardanup • Shire of Harvey • Department of Primary Industries and Regional Development (DPIRD) • Harvey Water • Leschenault Catchment Council • South West Catchments Council • BORR Team • Main Roads.
Freight and Road Users Group	August 2018 – ongoing (at Key Milestones)	• City of Bunbury • Shire of Capel • Shire of Dardanup • Department of Fire and Emergency Services (DFES) • DPLH • Department of Transport (DoT) • Freight and Logistics Council WA • Livestock and Rural Transport Association • PTA • RAC WA • WA Pilot Drivers Association.
Local Members meetings	Ongoing	• Member for Bunbury, Don Punch • Member for Collie- Preston, Mick Murray • Member for Murray- Wellington, Robyn Clarke • Nola Marino - Federal Member • Adele Farina, MLC.

STAKEHOLDER CONSULTATION	DATE	PARTICIPANT AGENCIES
BORR – Bunbury Freight Access Enhancement – Options workshop	25 January 2018	• DoT.
Presentation to Chamber of Commerce	14 November 2018	• Main Roads • Chamber of Commerce • BORR IPT.
Shire Project Briefing Meetings	May 2018 – ongoing (at Key Milestones)	• City of Bunbury • Shire of Capel • Shire of Dardanup • Shire of Harvey • Main Roads • BORR IPT.
Gnaala Karla Boodja WC1998/058 Native Title Claim group (GKB NTC) meeting	7 May 2018, 29 October 2018	• Brad Goode & Associates • Nine representatives from the GKB NTC group • DPLH • Main Roads • BORR IPT.
General public and local residents drop in sessions	24, 25, 30 and 31 October 2018	• Community members.
Project newsletter	2018	• Local community (distribution) • General public (via website) • Local Government Areas (distribution) • MLAs (distribution).
Community Reference Group Southern Alignment	July 2018 – ongoing (monthly)	• Community members.
Local landowners and residents	23 Oct 2018	• Landowners within BORR Southern Section Alternative Alignment • Residents (if renting within BORR Southern Section Alternative Alignment).
	11 December 2018	• Landowners meeting at Elgin Community Hall.
Local Community Group	December 2018	• Landowners within the BORR Southern Section Alternative Alignment.

Table 2-2 Agency consultation

AGENCY	DATE	PURPOSE
DWER – EPA	13/03/18	Project update
	05/09/18	Project update
	13/02/19	Project update
DotEE	25/5/18	Project briefing
	26/5/18	BORR site walk through – BORR Southern Section Gelorup
	17/07/18	Meeting at Main Roads head office, Don Aitken Centre (DAC) Perth- Project update
	08/10/18	Meeting at DAC - Project update
	14/2/19	Meeting at DAC - Project update
DWER – Environmental Regulation	25/5/18	Briefing South West Regional Office
	26/5/18	BORR site walk through – BORR Southern Section Gelorup
DBCA	25/5/17	BORR Project update
	13/11/17	Site visit BORR south wetlands
	30/7/18	BORR Project Update
	24/5/18	BORR and Western Ringtail Possum issues
	14/9/18	Western Ringtail Possum issues
	28/11/18	BORR Project update

Table 2-3 Summary of key concerns raised during consultation

AGENCY	FORUM	CONCERN RAISED	MAIN ROADS RESPONSE
CRG Members, Community members	CRG Meetings, Community Drop in Sessions,	**Need for BORR and Strategic Traffic Modelling Basis** There have been numerous enquiries by CRG members into the basis of population statistics used to inform the traffic model. More broadly there have been questions relating to the need for BORR.	There is already significant pressure on the road network around Bunbury, and this is projected to increase due to a number of factors including: • Population growth in Greater Bunbury • Proposed development in Wanju, Waterloo and surrounding areas • Increased freight movements, due to mining activity and associated growth in Bunbury Port activities. The existing road network in and around Bunbury supports a range of vehicle movements, including freight and light vehicles, regional and local traffic. These combinations of vehicles on local road networks impact on road safety and amenity. As a Port City, Bunbury plays an important role in the WA economy. Twelve per cent of the world exports of alumina leave from the Port of Bunbury. The current access to Bunbury Port is problematic, and impacts on freight efficiency. Currently, vehicles travelling between the Bussell Highway and Forrest Highway have to navigate 13 sets of traffic lights and one rail level crossing. When complete, between 10,000 and 15,000 vehicles per day on average are expected to use the new road. These regional / port movements would otherwise mix with local traffic on local roads. Population forecasts used in strategic traffic modelling come from the land use planning by the Department of Planning, Land and Heritage and it considers the City of Bunbury, Shire of Dardanup and Shire of Harvey and is based on planned land use changes forecast for the ultimate design life of BORR.

AGENCY	FORUM	CONCERN RAISED	MAIN ROADS RESPONSE
Community members, CRG members, impacted businesses	CRG Meetings, Community Drop in Sessions, Public Enquiries, Landowner Briefings	**Alternative Southern Alignment Investigations** Questions have been raised around why an alternative alignment has been investigated, what were the triggers and what investigations have been undertaken to assist in making a decision. Community members within the green alternative southern alignment voiced anxiety and mental health concerns in regards to the alignment uncertainty and potential for direct impact to their properties. Confusion between the Environmental Impact Assessment process for the southern alignment and the environmental referral process for the northern and central alignment.	Land for the southern alignment of BORR has been reserved within the Greater Bunbury Region Scheme for many years. It contains habitat for the Western Ringtail Possum, Black Cockatoo and Banksia Woodland Threatened Ecological Community (TEC), which are Federally listed. In May 2018, the Commonwealth changed the status of the Western Ringtail Possum under the EPBC Act from Vulnerable to Critically Endangered. This is the highest classification level possible before a species is declared extinct. When referring a project for environmental assessment it is necessary to demonstrate that there are not feasible alternatives with lesser environmental impact. As a result of the reclassification of the Western Ringtail Possum and the presence of other Matters of National Environmental Significance (MNES) such as the Black Cockatoo, investigations into an alternate alignment located further to the east (green alignment) have been undertaken to support the environmental referral process. These investigations including detailed site surveys have been undertaken in addition to those in the existing GBRS alignment to support preparation of Environmental Impact Assessments. The project team has consulted with landowners potentially affected by this alternative alignment. Following the completion of the consultation and the environmental surveys the findings will be presented to the landowners, the Community Reference Groups established for the BORR project and the wider community. Once an alignment has been selected based on the results of the selection study and design progressed, then the southern alignment will be submitted for referral.
CRG members, Community members	Norther & Central and Southern CRG meetings	**Western Ringtail Possum** Management of impacts to Western Ringtail Possums.	The Western Ringtail Possum (WRP) is critically endangered which means the Commonwealth Minister for the Environment is responsible for ensuring any approved actions by The Minister will not put the species at further risk.

AGENCY	FORUM	CONCERN RAISED	MAIN ROADS RESPONSE
		What studies were undertaken and by whom?	Regional surveys of the WRP were commissioned to more accurately estimate the population size and determine the potential impact of the BORR project on the WRP population. The methodology for these surveys was agreed with the Department of Biodiversity, Conservation and Attractions and the WRP Recovery Team. WRP studies were completed by specialist zoological consultants Biota Environmental Sciences and GHD. Investigations have been undertaken in the Southern SCP, Cape to Capes, Southern Forrest and Albany Areas to get a total estimate for the species.
		Will possums be relocated/translocated?	There are examples of successful relocations in the region. If we could do it successfully that would be wonderful but we and the federal regulator must be confident that any relocation would be successful. That confidence does not exist currently. This is something we need to better understand to ensure it is successful if adopted with no perfect solution available.
		Offset areas – have they been selected, what offset ratios will be applied and is there a maintenance budget for offsets?	Offsets have not been identified yet. This comes later in the process when the nature and extent of the impacts are known. Main Roads has a bank of offsets available with further acquisitions likely to be required depending upon values impacted. There is calculator used for determining offsets, which are generally greater in area than the impact. Budgets would depend on the offsets selected. There are examples where there are contributions to maintenance.
		If relocation fails what else is there? Are animals euthanised?	One of the challenges with the WRP is that there is no approved translocation program currently in operation. Other measures are available for birds, such as cockatoos. The first steps are to avoid or minimise impacts wherever possible. Native fauna are not euthanised.
		Fragmentation of possum/ fauna habitats.	Any alignment resulting in fragmentation will consider mitigation measures including bridges or underpasses.

AGENCY	FORUM	CONCERN RAISED	MAIN ROADS RESPONSE
Community members, CRG Members	Enquiries, Northern & Central and Southern CRG meetings, Drop in Sessions	**Longevity of GBRS Alignment** Queries about investigating an even more eastern alignment have been raised by numerous newly concerned communities including concerns about the redundancy of the GBRS alignment between Hasties Road and Bussell Highway. This has been raised specifically in the context of a future north south freeway grade road.	Currently there is no planning or consideration for a further outer ring road. The capacity provided by the BORR and existing roads will service the region well into the future. BORR is being designed to cater for the long term planning needs which includes catering for the transport movements of a future population of 200,000 people living in the Greater Bunbury area. The transport movement basis is built upon the Greater Bunbury Strategy (2013) report and includes consideration of the planned expansion of residential and industrial areas at Wanju, Waterloo Industrial Park and Picton Industrial Park as well as other investigation areas for potential urban development rezoning.
CRG members, Community members	Northern & Central and Southern CRG meetings, Drop in Sessions	**Environmental Approvals Process and Studies** The community has been highly interested in the types of environmental studies being completed to support the project.	An environmental impact assessment study including multiple investigations has been undertaken for the two proposed southern alignments. We are committed to ensuring that all environmental aspects of the project are completed with great sensitivity and in accordance with all State and Commonwealth legislative requirements. Detailed reports were completed for the Project Area including: • Targeted fauna (including Matters of National Environmental Significance MNES) assessment • Aquatic Fauna • Flora and Vegetation assessment • Wetland study • European Heritage survey. There are three opportunities in the environmental approvals process for the public to provide feedback, they are: • At the start of the process when the level of assessment is set; • In review of the information submitted by the BORR Team to the regulator/s; and

AGENCY	FORUM	CONCERN RAISED	MAIN ROADS RESPONSE
			• In response to the Draft Ministerial Conditions that result if approval is granted.
		The process of submitting comments on the environmental referral. Concerns around the public comment period.	This is a formal process, managed by the responsible regulatory entity (Environmental Protection Authority) and is not a process managed by Main Roads. Detailed information can be found at www.epa.wa.gov.au .
CRG members, Community members	Northern & Central and Southern CRG meetings	**Flora and Fauna** How will impacts to flora and fauna be managed?	The alignment of BORR includes habitat for critically endangered species, as determined under the Commonwealth Governments *Environment Protection and Biodiversity Conservation Act 1999*. Avoidance is the first option for impacts, but where avoidance of impacts is not possible, minimisation of impacts is sought. In the BORR Northern Alignment selection report, the environmental criteria, alongside other criteria used in the multi criteria analysis, to assess options included: • Rare flora and native vegetation • Rare fauna, fauna habitat and TECs • Waterways or wetlands. When considering BORR interchange options and local connectivity options, assessment of the environmental criteria included: Wetlands (CCW and Resource Enhancement), remnant native vegetation, rare fauna (WRP), TEC's, European heritage and Aboriginal heritage.

AGENCY	FORUM	CONCERN RAISED	MAIN ROADS RESPONSE
CRG members (local residents, road users and property owners/ farmers)	Northern and Central Community CRG Meetings (10/18, 11/18, 12/18)	**Social and Economic Bypass Impacts** Primacy of Bunbury and economic impacts of 'bypass'. Consideration of social and economic impacts on community business, particularly of severance on farmers. Formation of an economic advisory group was first discussed in the October North and Central CRG.	An Economic Advisory Group (EAG) was subsequently developed and chaired by the SWDC. KPMG has been commissioned by Main Roads to undertake a Social and Economic Study for the project as a whole. Impacts for the local farming community will be part of the assessment. The study will be in line with NSW Road Maritime Services Environmental Impact Assessment Practice Note – Socio-economic Assessment (EIA-N05)
		Economic impacts of BORR and impacts on businesses.	Bunbury is the gateway to the South West Region that has a strong economy built on mining, manufacturing, building and construction, agriculture, viticulture, aquaculture, forestry, tourism and emerging smart and creative industries, generating $13 billion in the 2016-2017 financial year. (SWDC, 2018) In addition, the Port of Bunbury is a large deep sea port which allows the berthing of commercial cargo vessels and is supporting the development of tourism by welcoming large tourist cruising passengers to our shores. The construction phase of the project will create jobs and provide economic benefits to the region. Once constructed, BORR will provide more efficient access for freight to the Bunbury Port, and enable the expansion of industrial centres, leading to more manufacturing, agricultural processing and local employment.

AGENCY	FORUM	CONCERN RAISED	MAIN ROADS RESPONSE
Community members, CRG Members	Main Roads enquiries, CRG meetings and Community Drop In Sessions.	**Noise Impacts** Community members along the alignment have raised concerns in regards to noise from vehicle traffic (particularly trucks), braking vehicles at interchanges and roundabouts and vehicles travelling over bridge joints.	The BORR Team is committed to managing the impacts of noise in line with the State Planning Policy 5.4 "Road and Rail Transport Noise and Freight Considerations in Land Use Planning" with the aim to protect communities from unreasonable levels of transport noise. The BORR Team has committed to undertake a noise study for the Ultimate Planning Design Concept of the southern section of the BORR. This noise study will be informed by the development of a noise model that will help to identify locations where noise mitigation may be required to comply with State Planning Policy 5.4. The noise model will consider topography, distances between properties and the road, road design levels, gradients and surface type and consideration of future projected traffic volumes and types. Existing noise in the study area will be recorded to be used in the model development.
Community members, CRG Members	Main Roads enquiries, CRG meetings and Community Drop In Sessions.	**Future Development Noise Mitigation** Impacts and management of noise to any future developments.	Where houses pre-date the road it is Main Roads' responsibility to mitigate. Where the road pre-dates the development, it is the developer's responsibility to comply with the policy.
CRG Members	Main Roads enquiries, CRG meetings and Community Drop In Sessions.	**Noise Modelling Assumptions** Assumptions used in developing the noise model in regards to exclusion of mitigation measures and choice of road surface treatments.	The noise modelling process is conservative and assumes a worst-case noise scenario to ensure likely noise exceedances are identified and appropriate management implemented.

AGENCY	FORUM	CONCERN RAISED	MAIN ROADS RESPONSE
Community members, CRG members	Main Roads Enquiries line, CRG Meetings, Community Drop In Sessions	**Light pollution and Visual Amenity** Impact of light pollution from street lights and vehicle headlights, as well as impacts to visual amenity as the result of construction of roads, associated interchanges, bridges and overpasses.	The EIA process considers impacts to visual amenity including lighting. This includes reporting potential visual impacts and identifying likely locations where design measures may be required to mitigate the impacts. Mitigation may include providing screening, which can take a variety of forms, including the construction of walls, earth mounds and planting of vegetation. Strategies will be developed to comply with the Australian Standard for lighting of public roads (AS/NZS 1158). This will include consideration of light backspill and treatments such as backshades and reducing light pole height where possible to minimise impact on adjacent properties. Visual amenity is also a key consideration of the Urban and Landscape Design Framework that has been prepared for the BORR Project.
Property owners	Main Roads Enquiries, Southern CRG (07/18, 12/18)	**Air and Water Quality.** Residents of some farming and residential properties, are not connected to scheme water and rely upon rainwater tanks as their primary source of potable water. Impact of traffic pollution particulate matter on water tank water quality is a concern to the community.	There is no comparative air quality policy or legislative requirement for pollutants from traffic in comparison to SPP 5.4 that deals with noise from traffic. Air quality modelling to the relevant standards will be completed to establish baseline conditions. National standards for air and water quality apply for land and water managed under the EP Act but not necessarily water in rainwater tanks. It is recognised that pollutants are emitted from diesel and petrol powered vehicles. The concentration levels of those chemicals have decreased with improved engine and fuel technology. Fuel used to have lead and sulphur additives but these have been removed or reduced in current vehicle fuels. Vehicle age is another factor with the average vehicle age around 10 or 11 years in Perth. As a result, the pollutants coming out of an exhaust pipe are steadily reducing over time. Pollutants in water tanks is a separate issue that is up to the land owner with various potential pollutant sources to consider.

AGENCY	FORUM	CONCERN RAISED	MAIN ROADS RESPONSE
Directly impacted property owners	Southern CRG meetings, Main Roads Enquiries	**Land Acquisition and Compensation Process** Property owners, particularly famers, are concerned about the impact of severance on their properties and businesses. Concerns include land compensation process and valuation, impacts to current and future business operations as well as social & mental health impacts that this will have on their families.	Main Roads appoints up to three independent land valuers and pays for the land owner to appoint a valuer of their choice. That valuation process includes business compensation. Main Roads can only compulsorily acquire land needed for the Project but can acquire small remnant land parcels through negotiations. We provide access to small parcels and if unviable it would be part of the compensation calculation.
		Timeline of land acquisition and ability for impact on broader project implementation timeline.	Main Roads are planning to deliver the Project and will progress the enabling tasks including talking to the owners of property required for the Project to try and agree an early settlement as part of a voluntary acquisition process.
Local community and road users CRG Members	Southern CRG meetings	**Local Access Changes on Journey Times** Is compensation payable as a result of impacts of local road severance on journey times?	Compensation is only payable where land is required for the Project. Main Roads will endeavour to ensure connectivity remains but it will change.
Directly impacted property owners	Southern CRG meetings, Main Roads Enquiries	**Property Severance** Property owners who are likely to have access to their properties altered or their land parcels split are concerned about how they will access their properties/land and how business as usual will take place.	Main Roads will provide access to the portions of land that are severed. Any associated economic loss is included as part of the compensation payable and depends on individual circumstances. Under the Act, we can't resume land that isn't required for road purposes. Main Roads often finds that if a convoluted route to provide access results, compensation will be payable. In some cases, other measures are considered to walk or even truck cattle.
Directly impacted property owners	Southern CRG meetings, Main Roads Enquiries	**Property Access** Property owners who are likely to have access to their properties altered are concerned about what form new access will take.	Any existing accesses affected by the ultimate design of the highway will require consideration of alternative routes. The planning, construction and funding of alternative routes will be undertaken by Main Roads WA as part of the Project scope. These works can include the provision of new service roads and upgrades or realignment of existing driveways.

AGENCY	FORUM	CONCERN RAISED	MAIN ROADS RESPONSE
			Main Roads do not generally provide slip lanes for individual properties as they are usually only provided for local roads. However, in some instances where there is a need due to higher traffic volumes or presence of trucks or a road safety risk, a slip lane can be provided. This will be assessed on a case by case basis. If access is required via adjacent privately owned land – we will undertake discussions with the landowners around access routes, acquisition and compensation.
Gelorup residents, local road users	Southern CRG Meeting (07/18, 9/18, 10/18, 11/18, 12/18, 2/19)	**Traffic and Safety** BORR connection to Gelorup via Hasties Rd due to increased traffic through community and past community infrastructure, interaction with school traffic and narrow road reserve. Concern was raised at numerous CRG meetings.	Centenary Road connection concepts options were subsequently developed and assessed as part of the Gelorup connectivity assessment. The Centenary Road connection is the preferred connection recommended by the BORR Team.
CRG Members, Fire Emergency Service, Shire of Capel	Southern CRG meetings	**Emergency Service Access and Emergency Egress** The effects of road severance on emergency access eg to allow firefighting and provide emergency egress to the community either side of the alignment.	BORR Team has undertaken consultation with the Shire of Capel and the Bush Fire Service to determine issues which will arise from severance to local roads and determined the requirements for the provision of additional water tanks and stand pipes. Local and access roads connections are being planned where existing local and access roads will be disrupted.
CRG members	Southern CRG meetings	**Impacts to Cultural Heritage** Potential for loss of cultural heritage.	Two European heritage sites intersect the Project Area (D.G. Burnside and Associates, 2019).
CRG members	Southern CRG Meetings (03/19)	**Impacts to Aboriginal Heritage** What was the source of data used to show aboriginal sites used to inform field investigations.	The source of mapped Aboriginal Heritage sites used to inform field investigations was publicly available data from DPLH. Consultation with representatives of the Gnaala Karla Booja WC 1988/058 Native Title Claim group were undertaken in May 2018 to discuss the northern alignment options in October 2018 to undertake archaeological

AGENCY	FORUM	CONCERN RAISED	MAIN ROADS RESPONSE
		Concerns around the Aboriginal Heritage values and history of the assessment process and what additional studies are being completed.	surveys. Results of the studies identified that four river sites will be directly affected by bridge crossings. Two previously recorded archaeological sites and six heritage places were located, may be potentially be impacted. Archaeological reports will be submitted to the EPA alongside BORR Central and Northern referral documents.
CRG members	Southern CRG meetings	**Construction Impacts** Construction impacts on access to and from properties – particularly if there is an emergency such as a fire.	Bushfire and other emergency responses will be a prime consideration to manage during and after construction. Main Roads includes requirements to maintain emergency routes during construction in contracts. The same would apply to standpipes and other fire response assets.
		Construction noise/vibration and hours of works.	Point source noises (e.g. horns) and noises during construction are not subject to SPP 5.4. Details on the management of construction noises and vibrations will form part of the construction contract.
Drainage Reference Group (DRG)	DRG meetings	**Wetlands and Waterways** Concern in relation to two TEC (wetlands) located within the green alternative alignment. DBCA encouraged BORR Team to liaise with DBCA Wetlands unit.	The BORR Team has undertaken a wetland study within a portion of the Project Area as part of a survey located predominantly to the north. The BORR Team have liaised with DBCA officers where appropriate regarding TECs within the Project Area.
		Request for spill management for wetlands, outside of wetland buffers – and be based on risk based approach.	Main Roads has requirements around what is to be provided where spill control is required, but not around where spill control is required. Recommendations from DRG members were discussed.
Land owners	Landowner meetings	**Irrigation and Drainage** Concerns have been raised by landowners in relation to localised flooding impacting on access and egress to and from their properties under BORR.	BORR Team will undertake discussions with landowners to determine suitable alternate access where access will be directly impacted by BORR once a decision on the southern alignment has been made.
		Landowners have also raised concerns where investigations have been required in relation to use of	Prior to all investigations, landowners were contacted by BORR IPT for approval to access their land and landowners were consulted on the

AGENCY	FORUM	CONCERN RAISED	MAIN ROADS RESPONSE
		heavy machinery impacting on contours/ damaging drainage of their land.	proposed machinery details, size, weight etc to be used on their property. Investigations with machinery on land vulnerable to becoming waterlogged during wet months was timed to occur where possible prior to the onset of the wet season.
Drainage Reference Group (DRG) Members, Water Corporation	DRG (08/2018)	**Water Quality** Need for spill management (eg oil and chemical spills). Oil spill traps were initially only considered for water draining to sensitive environmental receptors (eg wetlands). Water Corporation indicated that spill protection was required upstream of their drains.	The BORR drainage strategy now includes the use of oil spill traps to Water Corporation drains.
DRG Members, Leschenault Catchment Council Inc.	DRG (08/2018)	**Water Quality** Nutrient stripping (via soil amendments using Iron Man Gypsum) in the buffer strip along the alignment.	Options were investigated, but it was identified that the major source of nutrients was farm land. Water, particularly in irrigated plots, is carefully managed on farms by paddock grading and is collected by drains and therefore, is unlikely to reach the road alignment. There is limited benefit and a very high cost for undertaking soil improvement measurements within the alignment.

3 ENVIRONMENTAL PRINCIPLES AND FACTORS

3.1 Principles

Section 4A of the EP Act establishes the object and principles of the Act. In accordance with the EPA's Statement of Environmental Principles, Factors and Objectives (EPA, 2018b), this section describes how each of the five principles of the EP Act has been applied to the Project (Table 3-1).

Table 3-1 *Environmental Protection Act 1986* Principles

PRINCIPLE	CONSIDERATION OF PRINCIPLE IN THE PROJECT
The precautionary principle Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. In the application of the precautionary principle, decision should be guided by: • Careful evaluation to avoid, where practicable, serious or irreversible damage to the environment; and An assessment of the risk-weighted consequences of various options.	A wide range of comprehensive desktop and field studies were undertaken to assess the impact of the Project. Studies included: • Flora and vegetation • Terrestrial fauna • Inland waters • Amenity (noise and vibration) • Heritage (Aboriginal and European) • Air quality. Information gathered during these studies was used to inform the EIA and has reduced the uncertainty surrounding the prediction of impacts for the assessment. Main Roads has committed that the Project's design (where possible) avoids serious or irreversible damage to the environment. Various studies have been undertaken within and adjacent to the alignment for the last two decades. Impacts have been identified and described under each key environmental factor, and mitigation and management measures have been proposed to ensure they are environmentally acceptable.
The principle of intergenerational equity The present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations.	The Project will commit to maintain the health, diversity and productivity of the environment through retaining as much habitat as possible, establishing noise walls to reduce noise related impacts and maintaining access for property owners.
The principle of the conservation of biological diversity and ecological integrity Conservation of biological diversity and ecological	The Southern Alternative Alignment has large patches of limited biological diversity and ecological integrity. Main Roads has sought to preserve as much of the remnant biodiversity as possible by avoiding areas of native vegetation where practicable.

PRINCIPLE	CONSIDERATION OF PRINCIPLE IN THE PROJECT
integrity should be a fundamental consideration.	
Principles relating to the improved valuation, pricing and incentive mechanisms Environmental factors should be included in the valuation of assets and services. The polluter pays principle – those who generate pollution and waste should bear the cost of containment, avoidance or abatement. The users of goods and services should pay prices based on the full life cycle costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any wastes. Environmental goals, having been established, should be pursued in the most cost effective way, by establishing incentive structures, including market mechanisms, which enable those best placed to maximise benefits and/or minimise costs to develop their own solutions and responses to environmental problems.	Main Roads acknowledges the need for improved valuation, pricing and incentive mechanisms and endeavours to pursue these principles when appropriate. For example, environmental factors will greatly determine the location of road corridors, with the project having a strong focus on reducing its direct and indirect clearing footprint. Impacts on flora, vegetation and terrestrial fauna have been assessed and mitigation and management measures proposed. Main Roads accepts that the cost of the Proposal must include environmental impact mitigation, management and maintenance activities. These requirements will be incorporated into the overall Project costs. The Project will be subject to a sustainability rating, which will assess the environmental, social and economic impacts of the Project, including its waste stream and the resources utilised for construction. The Infrastructure Sustainability Council of Australia (ISCA) rating scheme is designed such that goals are established for a Project, then the Project is assessed against the achievement of those goals.
The principle of waste minimisation All reasonable and practicable measures should be taken to minimise the generation of waste and its discharge into the environment.	The Project will be subject to an ISCA sustainability rating, which will assess the environmental, social and economic impacts of the Project, including waste minimisation and discharges resulting from the Project. Cut and fill principles will be utilised to minimise external fill requirements. Consideration of otherwise waste materials such as crushed concrete in road construction. The design for the Project includes drainage design to minimise the discharge of contaminated water into the environment. Management strategies will be implemented to ensure that the generation of waste during the construction phase is minimised. All activities shall be carried out with the principles of cleaner production and waste minimisation.

3.2 Identification of Key Environmental Factors

Environmental factors are those parts of the environment that may be impacted by an aspect of a Project. The EPA has 14 environmental factors, organised into five themes: Sea, Land, Water, Air and People.

The environmental factors and EPA objectives are provided in Table 3-2. The relevance of each factor to the Project is summarised and the Key Environmental Factors that require further consideration are identified.

Table 3-2 Identification of Key Environmental Factors

FACTOR	OBJECTIVE	RELEVANCE TO PROJECT	KEY ENVIRONMENTAL FACTOR?
Sea			
Benthic communities and Habitat	To protect benthic communities and habitat so that biological diversity and ecological integrity are maintained.	No benthic communities or habitats will be impacted by this Project.	No
Coastal Processes	To maintain the geophysical processes that shape coastal morphology so that the environmental values of the coast are protected.	No coastal processes are expected to be impacted by this Project.	No
Marine Environmental Quality	To maintain the quality of water, sediment and biota so that environmental values are protected.	No impacts to marine environmental quality are expected from this Project.	No
Marine Fauna	To protect marine fauna so that biological diversity and ecological integrity are maintained.	No impacts to marine fauna are expected.	No
Land			
Flora and Vegetation	To protect flora and vegetation so that biological diversity and ecological integrity are maintained.	Construction will result in clearing of native vegetation.	Yes
Landforms	To maintain the variety and integrity of distinctive physical landforms so that environmental values are protected.	No significant changes to landforms are expected, as the Project will be constructed in a disturbed farmland area. Fill of palusplain will be required to ensure the road is dry and allow for water passage under the road, however no changes to significant landforms are expected.	No
Subterranean Fauna	To protect subterranean fauna so that biological diversity and ecological integrity are maintained.	No impacts to subterranean fauna is expected from the road construction.	No

FACTOR	OBJECTIVE	RELEVANCE TO PROJECT	KEY ENVIRONMENTAL FACTOR?
Terrestrial Fauna	To protect terrestrial fauna so that biological diversity and ecological integrity are maintained.	Construction will result in clearing of fauna habitat.	Yes
Terrestrial Environmental Quality	To maintain the quality of land and soils so that environmental values are protected.	Construction may impact one contaminated site. Some Acid Sulfate Soils are expected within the Project Area. The Project is not expected to result in an increased risk of salinization.	Yes
Water			
Inland Waters	To maintain the hydrological regimes and quality of groundwater and surface water so that environmental values are protected.	The Project area contains Conservation Category Wetland (CCW), Resource Enhancement (RE) and Multiple Use (MU) Geomorphic Wetlands, Gynudup Brook and File Mile Brook. The southern half of the Project Area occurs within a proclaimed Surface Water Area (the Capel River System) under the RIWI Act.	Yes
Air			
Air Quality	To maintain and minimise emissions so that environmental values are protected.	Dust will be generated during construction of the Project.	Yes
People			
Social Surroundings	To protect social surroundings from significant harm.	Aboriginal and European heritage aspects may be impacted during construction of the Project. Noise will be generated during construction and operation of the Project. Light spill will be generated during the construction and operation of the Project. Dust will be generated during construction of the Project. Visual amenity will be altered due to the construction and operation of the Project. Rural community amenity and agricultural production including loss	Yes

FACTOR	OBJECTIVE	RELEVANCE TO PROJECT	KEY ENVIRONMENTAL FACTOR?
		of productive land, reducing carrying capacity and restricted access are potential consequences of the Project.	
Human Health	To protect human health from significant harm.	No impacts to human health are expected.	No

3.3 Key Environmental Factor – Flora and Vegetation

3.3.1 Studies undertaken

The following field investigations have been undertaken for this aspect:

- BORR Southern Section Alternative Alignment Vegetation and Flora Study (BORR IPT, 2019a), which covered approximately 172 ha (~78%) of the Project Area
- BORR Southern Section Vegetation and Flora Study (BORR IPT, 2019b), which covered just over 2 ha (1%) of the Project Area.

The following locations were not field surveyed and have been assessed based on desktop information:

- Jilley Road
- Fishermans Road
- Calinup Road
- Bussell Highway section (BORR interchange to Cable Mine Road)
- Local roads north of Yeardy Road, including Cable Mine Road, Nicholls Road and Elgin Road.

The gaps in the survey effort total approximately 48 ha (22% of the Project Area) and are shown in Figure 2. Additional flora and vegetation survey effort at these locations will be undertaken if the BORR Southern Section Alternative Alignment is selected for development. For the purposes of this EIA, vegetation types and condition have been extrapolated for the gaps. This extrapolation was based on:

- DPIRD Native Vegetation Extent dataset (GoWA, 2019a) – used as the initial identification of vegetated / cleared area
- The areas that were not mapped by the DPIRD native vegetation dataset (GoWA, 2019a) were digitised based on aerial photography
- Assigning likely vegetation types / condition types based on nearby vegetation types assigned by BORR IPT (2019a and 2019b), aerial photograph and desktop information (soil type / broad vegetation mapping).

3.3.2 Receiving environment

Regional biogeography

The Project Area is located in the South West Botanical Province of WA (Beard, 1990) and experiences a Mediterranean climate, with hot dry summers and cool wet winters, with the majority of the rain falling in winter. The Project Area is located in the Swan Coastal Plain (SCP) bioregion and Perth (SWA2) subregion as described by the Interim Biogeographic Region of Australia (IBRA) (DotEE, 2016).

The Perth subregion is composed of colluvial and aeolian sands, alluvial river flats and costal limestone. Heath and/or Tuart woodlands occur on limestone, Banksia and Jarrah-Banksia woodlands on Quaternary marine dunes of various ages and Marri on colluvial and alluvial soils. The subregion also includes a complex series of seasonal wetlands (Mitchell, Williams, & Desmond, 2002).

Broad scale (1:250,000) pre-European vegetation mapping (Beard, 1979) of the area has been completed at an association level. The mapping indicates that the Project Area intersects four vegetation associations:

- Medium woodland; Tuart and Jarrah (association 6) – occurs in the central and southern extents of the Project Area
- Shrublands; Teatree thicket (association 37) – very small portion in western extent of the Project Area
- Medium woodland; Jarrah, Marri and Wandoo (association 968) – occurs in the southern extent of the Project Area
- Mosaic: Medium forest; Jarrah-Marri / Low woodland; Banksia / Low forest; Teatree (*Melaleuca* spp.) (association 1000) – occurs predominantly in the northern extent of the Project Area.

Regional vegetation complex mapping, completed as an extension and consolidation of earlier mapping (Heddle, Loneragan, & Havel, 1980; Mattiske & Havel, 1998) indicates that four vegetation complexes are present within the Project Area (Webb, Kinloch, Keighery, & Pitt, 2016):

- Bassendean Complex – Central and South: Central and South: Vegetation ranges from woodland of *Eucalyptus marginata* (Jarrah) – *Allocasuarina fraseriana* (Sheoak) – *Banksia* species to low woodland of *Melaleuca* species, and sedgelands on the moister sites
- Karrakatta Complex – Central and South: Central and South: Predominantly open forest of *Eucalyptus gomphocephala* (Tuart) – *Eucalyptus marginata* (Jarrah) – *Corymbia calophylla* (Marri) and woodland of *Eucalyptus marginata* (Jarrah) – *Banksia* species. *Agonis flexuosa* (Peppermint) is co-dominant south of the Capel River
- Guilford Complex: A mixture of open forest to tall open forest of *Corymbia calophylla* (Marri) - *Eucalyptus wandoo* (Wandoo) – *Eucalyptus marginata* (Jarrah) and woodland of *Eucalyptus wandoo* (Wandoo) (with rare occurrences of *Eucalyptus lane-poolei* (Salmon White Gum)). Minor components include *Eucalyptus rudis* (Flooded Gum) – *Melaleuca rhaphiophylla* (Swamp Paperbark)
- Southern River Complex: Open woodland of *Corymbia calophylla* (Marri) - *Eucalyptus marginata* (Jarrah) - Banksia species with fringing woodland of *Eucalyptus rudis* (Flooded Gum) - *Melaleuca rhaphiophylla* (Swamp Paperbark) along creek beds.

Vegetation communities

BORR IPT (2019a and 2019b) mapped vegetation over approximately 174 ha (79 %) of the Project Area. The majority of the Project Area (~145 ha) has been cleared for agriculture and comprises of paddocks with isolated stands of native trees. Pockets of native vegetation are scattered throughout the Project Area. However, most of these vegetation remnants appear to have been subject to periodic grazing which has affected the diversity and structure of the mid and lower strata.

The Project Area is mostly low relief, flat to undulating plains with low-lying seasonally inundated depressions. Prior to clearing, much of the now agricultural areas would have comprised of *Eucalyptus marginata*/ *Corymbia calophylla* / *Banksia* spp. woodlands in higher relief areas with *Eucalyptus rudis* / *Melaleuca* spp. woodlands in the low, seasonally inundated areas.

A summary of the vegetation types, including potential corresponding SCP Floristic Community Types (FCTs) (Gibson, Keighery, Keighery, Burbridge, & Lyons, 1994), recorded within the Project Area during the BORR IPT (2019a and 2019b) assessments is presented in Table 3-3 and mapping is provided in Figure 3.

A summary of the unsurveyed areas and their vegetation descriptions (from desktop information) is presented in Table 3-4. Based on DPIRD Native Vegetation Extent mapping (GoWA, 2019a) and aerial photography it is estimated that approximately 17 ha of the 48 ha of unsurveyed area is native vegetation (~ 35%).

Table 3-3 Vegetation communities within the Project Area

VEGETATION TYPE DESCRIPTION	EXTENT WITHIN PROJECT AREA AND CONDITION	POTENTIAL CORRESPONDING GIBSON *ET AL.* (1994) SWAN COASTAL PLAIN FLORISTIC COMMUNITY TYPES (FCTS) AND INDICATIVE PHOTO
Cleared / Highly Disturbed This area is predominately agricultural paddocks but also includes; firebreaks, tracks, buildings, landscaping and yards. These areas had occasional isolated clumps of native trees, such as; *Eucalyptus* spp. *Corymbia calophylla, Agonis flexuosa* and/ or *Melaleuca* spp. There was little to no mid storey and the groundcover was dominated by introduced grasses (**Avena barbata*, **Bromus* diandrus and **Hordeum leporinum* and **Lolium rigidum*) and herbs (**Arctotheca calendula, *Ursinia anthemoides, *Hypochaeris glabra, *Lotus subbiflorus* and **Trifolium* spp.). Seasonally inundated areas, including man-made drains and dams, located within the lower lying areas of agricultural paddocks included patches of *Juncus pallidus*, *Leptocarpus* spp. *Typha orientalis* and **Rumex crispus.* Some areas of open water had aquatic species including *Lemna disperma*, **Callitriche stagnalis* and **Crassula natans*.	**144.7 ha** Completely Degraded	N/A 
Isolated native trees over a weedy herbland/grassland (VT01a-VT01c, BORR IPT (2018b) – VT09a, VT10) These areas had patches of native trees within agricultural paddocks. There was little to no mid storey and the groundcover was dominated by introduced grasses (**Avena barbata*, **Bromus diandrus* and **Hordeum leporinum* and **Lolium rigidum*) and herbs (**Arctotheca calendula, *Ursinia anthemoides, *Hypochaeris glabra, *Lotus subbiflorus* and **Trifolium* spp.). Variations included: • Isolated trees *Corymbia calophylla* and *Eucalyptus marginata* +/- *Agonis flexuosa* (VT01a) • Isolated trees *Eucalyptus rudis* and *Corymbia calophylla* (VT01b) • Isolated trees *Corymbia calophylla* and *Eucalyptus marginata* +/- *Banksia* spp. (VT01c) • *Corymbia calophylla* and *Eucalyptus marginata* +/- *Agonis flexuosa* with very occasional *E. gomphocephala* (VT9a) • Mixture of planted and native vegetation.	**9.3 ha** (1a: 3.5 ha 1b: 2.8 ha 1c: 2.5 ha 9a: 0.4 ha 10: 0.1) All Degraded / Completely Degraded	N/A 

VEGETATION TYPE DESCRIPTION	EXTENT WITHIN PROJECT AREA AND CONDITION	POTENTIAL CORRESPONDING GIBSON *ET AL.* (1994) SWAN COASTAL PLAIN FLORISTIC COMMUNITY TYPES (FCTS) AND INDICATIVE PHOTO
Open forest of *Eucalyptus marginata*, *Corymbia calophylla* and *Banksia attenuata* on Karrakatta deep sands (BORR IPT 2019 b - VT01) Open forest of *Eucalyptus marginata* and *Corymbia calophylla +/- Agonis flexuosa* with isolated occurrences of *Eucalyptus gomphocephala* over low open forest of *Banksia attenuata* over shrubland of *Hibbertia hypericoides*, *Macrozamia riedlei* and *Xanthorrhoea brunonis* over grassland of **Ehrharta* spp., *Briza maxima* over herbland of *Dasypogon bromeliifolius*, *Lomandra* spp. and *Phlebocarya ciliata* over open sedgeland of *Lepidosperma pubisquameum*.	**0.07 ha** 57% (0.04 ha) Very Good 43% (0.03 ha) Degraded to Completely Degraded	Southern *Eucalyptus gomphocephala-Agonis flexuosa* woodlands (FCT 25) 
Woodland of *Eucalyptus rudis* and *Melaleuca rhaphiophylla* (VT02) Woodland of *Eucalyptus rudis* and *Melaleuca rhaphiophylla* over sparse shrubland of *M. teretifolia* or *M. lateritia* over open sedgeland of *Juncus* spp. over herbland of **Rumex acetosella*, **Plantago lanceolata*, **Lotus subbiflorus* with **Callitriche stagnalis* in open water	**7.9 ha** 7% (0.6 ha) Good 27% (2.1 ha) Degraded 66% (5.2 ha) Completely Degraded	Wet forests and woodlands (FCT 11) 

VEGETATION TYPE DESCRIPTION	EXTENT WITHIN PROJECT AREA AND CONDITION	POTENTIAL CORRESPONDING GIBSON *ET AL.* (1994) SWAN COASTAL PLAIN FLORISTIC COMMUNITY TYPES (FCTS) AND INDICATIVE PHOTO
Woodland of *Melaleuca preissiana* and *M. rhaphiophylla* (VT03) Woodland of *Melaleuca preissiana* and *M. rhaphiophylla* over tall sparse shrubland of *Astartea scoparia* +/-*M. lateritia* over sedgeland of *Juncus pallidus* / *Lepidosperma longitudinale* over herbland of **Cotula coronopifolia*, **Lotus subbiflorus* and *Isolepis cernua* var. *setiformis* with **Callitriche stagnalis* in open water	**5.3 ha** All Degraded / Completely Degraded	Wet forests and woodlands (FCT 11) 
Woodland of *Banksia attenuata*, *Eucalyptus marginata* +/- *Agonis flexuosa* (VT06) Woodland of *Banksia attenuata, Eucalyptus marginata* and occasional *Agonis flexuosa* over occasional tall open shrubland of *Kunzea glabrescens* over a low open shrubland of *Hibbertia hypericoides* subsp. *hypericoides* over a herbland of *Desmocladus fasciculatus, *Ursinia anthemoides* and* *Hypochaeris glabra*	**6.4 ha** 44.1% (2.8 ha) Good 0.1% (0.004 ha) Good to Degraded 50.8% (3.3 ha) Degraded 5% (0.3 ha) Completely Degraded	Likely to be a degraded form of central *Banksia attenuata – Eucalyptus marginata* woodland (FCT 21a) 

VEGETATION TYPE DESCRIPTION	EXTENT WITHIN PROJECT AREA AND CONDITION	POTENTIAL CORRESPONDING GIBSON *ET AL.* (1994) SWAN COASTAL PLAIN FLORISTIC COMMUNITY TYPES (FCTS) AND INDICATIVE PHOTO
Woodland of *Agonis flexuosa, Eucalyptus marginata* and *Banksia attenuata* (VT07) and BORR IPT (2019b) – VT3) Low woodland of *Agonis flexuosa*, *Eucalyptus marginata* +/- *Banksia attenuata* over a grassland/ herbland of **Briza maxima, *Ursinia anthemoides* and* *Hypochaeris glabra*	**0.6 ha** 52% (0.3 ha) Degraded 48% (0.3 ha) Completely Degraded	FCT: Historically may have represented FCT25– Southern SCP *E. gomphocephala – A. flexuosa* woodlands 
Total Surveyed		**174.3 ha** **Native Vegetation (29.6 ha)** **Cleared (144.7 ha)**

Note: * introduced species

Table 3-4 Survey gaps – description of potential vegetation communities within the Project Area

SURVEY GAP	EXTENT WITHIN PROJECT AREA	NATIVE VEGETATION EXTENT	EXTRAPOLATED VEGETATION COMMUNITY	EXTRAPOLATED VEGETATION CONDITION
Jilley Road	2.1 ha	1.0 ha	Cleared and scattered native trees – *Corymbia calophylla* and *Eucalyptus marginata* +/- *Agonis flexuosa* with very occasional *E. gomphocephala* (VT09a) South of Manea Drive there is a dampland which is likely to be either VT 3 (Low open forest of *Melaleuca preissiana* and *Melaleuca rhaphiophylla*)	Degraded (6) to Completely Degraded (7)
Fishermans Road / Boyanup Road West	9.9 ha	3.0 ha	Initial section adjacent to cleared paddocks – cleared and Isolated trees *Corymbia calophylla* and *Eucalyptus marginata* +/- *Agonis flexuosa* (VT01a) 680m west of Ramsay Road – cleared and Open forest of *Eucalyptus marginata*, *Corymbia calophylla* and *Banksia attenuata* on Karrakatta deep sands (BORR IPT 2019b - VT 1). Section of Boyanup Road West – *Banksia attenuata*, *Eucalyptus marginata* woodland (BORR IPT 2019 a - VT6).	Degraded (6) to Completely Degraded (7) Sections may be Good (4) or better (approx. 1.3 ha) remainder likely to be Degraded (6) to Completely Degraded (7)
Calinup Road	0.6 ha	0.2 ha	Cleared and scattered native trees – *Corymbia calophylla* and *Eucalyptus marginata* +/- *Agonis flexuosa* with very occasional *E. gomphocephala* (BORR IPT 2019 b – VT09a)	Degraded (6) to Completely Degraded (7)
Bussell Highway	21.3 ha	5.8	Appears to be mostly scattered trees with some landscape plantings. Isolated trees *Corymbia calophylla* and *Eucalyptus marginata* +/- *Agonis flexuosa* (VT01a) / with some planted trees and revegetation.	Degraded (6) to Completely Degraded (7)
North of Yeardy Road, to Cable Mine Road and Nichols Road and up to Elgin Road	13.9 ha	6.8 ha	Cleared with a combination of Isolated trees *Corymbia calophylla* and *Eucalyptus marginata* +/- *Agonis flexuosa* (VT01a) and Isolated trees *Eucalyptus rudis* and *Corymbia calophylla* (VT01b) with the creekline likely to be woodland of *Eucalyptus rudis* and *Melaleuca rhaphiophylla* (VT02)	Degraded (6) to Completely Degraded (7) Creekline may be Good (4) to Degraded (6) (approx. 1 ha)
Total Unsurveyed gaps with the Project Area			**47.8 ha** **(Approx. 16.8 ha of vegetation and 31.0 ha Cleared)**	

Vegetation condition

The vegetation condition of the Surveyed Area within the Project Area ranged from Very Good (3) to Completely Degraded (7) (BORR IPT 2019a). The majority of the Project Area was in Completely Degraded condition (~156 ha, 89%) and comprised agricultural paddocks with isolated patches of trees.

Good (or better) vegetation was represented by three vegetation types, isolated trees of *Corymbia calophylla* and *Eucalyptus marginata*, *Eucalyptus rudis* and *Melaleuca rhaphiophylla* woodland, and *Banksia attenuata* woodland, totalling just over 3 ha (2%).

From interpretation of aerial imagery, the majority of the Unsurveyed Area is likely to be in Degraded or worse condition, with the creek-line along Cable Mine Road and vegetated sections of Fishermans Road potentially in Good condition (4).

A summary of the likely vegetation condition within the Project Area is provided in Table 3-5 and vegetation condition mapping is shown in Figure 4.

Table 3-5 Vegetation condition mapped (surveyed and estimated) within the Project Area

VEGETATION CONDITION	EXTENT MAPPED IN PROJECT AREA (ha)	EXTRAPOLATED EXTENT WITHIN UNSURVEYED AREA (ha)	TOTAL ESTIMATED EXTENT (ha)
Very Good	0.1	0.0	0.1
Good	3.4	2.3*	5.7
Good – Degraded	0.004	0.0	0.004
Degraded	14.7	0.0	14.7
Degraded - Completely Degraded	0.3	45.5	45.8
Completely Degraded	155.8	0.00	155.8
Total	**174.3**	**47.8**	**222.1**

* Approximate based on aerial photography (Good or better)

Dieback

No project specific dieback assessments or detailed mapping has been undertaken for the Project Area. However, the Project Area is considered to be a dieback susceptible area as it has water gaining areas and lies within the 600 – 800 mm rainfall zone (CALM, 2003a), receiving a mean annual rainfall of 726.1 mm (BoM, 2019). Given the level of previous disturbance it is expected that much of the Project Area would be dieback infested and/ or uninterpretable.

Threatened and Priority Ecological Communities

One Threatened Ecological Community (TEC) and two Priority Ecological Communities (PECs) were confirmed within the Project Area (BORR IPT 2019):

- Banksia Woodlands of the SCP TEC
- Banksia dominated woodlands of the SCP IBRA region PEC (FCT 21a)
- The Tuart (*Eucalyptus gomphocephala*) woodlands of the SCP PEC (FCT25).

The extent and condition of each of these communities within the surveyed portion of the Project Area is summarised in Table 3-6 and presented in Figure 5. The State PEC (FCT21a) forms part of the Federal Banksia Woodland TEC, when condition and size thresholds are met (see BORR IPT 2019b for further information). State FCT 25 can also form part of the Federal Banksia Woodland TEC when composition aligns with the TEC and condition and size thresholds are met.

A total of 3.5 ha of native vegetation within the surveyed portion of the Project Area is attributed to the 'Banksia Woodlands of the SCP' TEC. Of this vegetation, <0.1 ha is also representative of 'the Tuart (*Eucalyptus gomphocephala*) woodlands of the SCP' PEC and approximately 3.4 ha is representative of 'Banksia dominated woodlands of the SCP IBRA region' PEC.

The vegetation types 'Open forest of *Eucalyptus marginata*, *Corymbia calophylla*, *Banksia attenuata* and *Agonis flexuosa* on Karrakatta deep sands' (VT1) and 'Open forest of *Banksia attenuata* and *Agonis flexuosa*' (VT4) were inferred to be equivalent to FCT 25 based on geographic location, landforms and the species recorded within these vegetation types. These vegetation types contained isolated occurrences of *Eucalyptus gomphocephala*; however this is likely to be related to disturbance factors and the species is likely to have previously occurred within this area.

Mapping of the Tuart woodlands by DBCA (CALM, 2003b) shows that *Eucalyptus gomphocephala* woodlands with 0 to 9 % canopy cover and highly disturbed visible native understorey condition, have been mapped within this section of the Study Area, inferred to be equivalent to the PEC FCT 25. Consultation with Mr. Andrew Webb from DBCA (pers. comm. 2011 and 2015) has stated that the vegetation types with the Study Area represent FCT 25.

Based on aerial photography, there is the potential for Banksia TEC / Banksia PEC / Tuart PEC to occur along Fishermans Road and Boyanup Road West (1.3 ha).

An additional 2.4 ha of the 'Banksia dominated woodlands of the SCP IBRA region' PEC occurs that are not representative of the 'Banksia Woodlands of the SCP' TEC (these areas do not meet the condition / size thresholds for the TEC).

Table 3-6 Threatened and Priority Ecological Communities identified within the Project Area

COMMUNITY TYPE	EPBC ACT	DBCA	EXTENT IN STUDY AREA (ha)	POTENTIAL EXTENT IN UNSURVEYED AREA (ha)	APPROX. EXTENT WITHIN THE PROJECT AREA (ha)
Banksia woodlands of the SCP(TEC)	Endangered	Priority 3	**3.5** Very Good: 0.1 Good: 2.8 Degraded: 0.6	Possible along Boyanup Road West – 1.3	4.8
Banksia dominated woodlands of the SCP IBRA region (PEC) (VT6)	-	Priority 3	**5.9** Good: 2.9 Good to Degraded: 0.004 Degraded 3.0	Boyanup Road West – 1.0	6.9
The Tuart (*Eucalyptus gomphocephala*) woodlands of the SCP (PEC)	-	Priority 3	**<0.1** Very Good: <0.1	Possible along Fishermans Road (0.3)	0.4

Other significant vegetation

The Project Area traverses a number of waterways including tributaries of Five Mile Brook, Gynudup Brook, creeklines, small drainage lines and man-made drains, as well as seasonally inundated areas (wetlands). Vegetation associated with the riverine and wetland areas included remnant trees and shrubs (e.g. *E. rudis, Melaleuca preissiana* and *Melaleuca rhaphiophylla*) over introduced grasses and herbs, with mixed native sedges present.

There is approximately 13 ha of vegetation within the Project Area that occurs in association with a watercourse and/or wetland and is considered riparian. This vegetation has a restricted distribution and has been historically

impacted by extensive clearing throughout the area. Vegetation types that represent riparian/ wetland vegetation included:

- Woodland of *Eucalyptus rudis* and *Melaleuca rhaphiophylla* (VT02) – approximately 8 ha (<1 ha in Good, approximately 7 ha in Degraded/ Completely Degraded condition)
- Woodland of *Melaleuca preissiana* and *M. rhaphiophylla* (VT03) – approximately 5 ha (all in Degraded/ Completely Degraded condition. It is expected additional occurrence of this vegetation will be present in the Unsurveyed Area along Cable Mine Road.

Conservation reserves and areas

There are three conservation reserves within 5 km of the Project Area (GoWA, 2019a). Two reserves are Crown Land, vested to the Conservation Commission of WA and managed by DBCA. These reserves are:

- 'Roselands Nature Reserve', located adjacent to the Project Area on Boyanup West Road
- 'Un-named Nature Reserve', located 1.4 km south of the Project Area at Fishermans Road.

The third reserve is the Tuart Forest National Park, which is located 1 km south of the Project Area at Fishermans Road.

Environmentally Sensitive Areas

There are numerous Environmentally Sensitive Areas (ESAs) within 5 km of the Project Area and three ESAs which intersect the Project Area (GoWA, 2019a). The Project Area intersects:

- The buffered extent of one ESA associated with Roselands Nature Reserve on Boyanup West Road (note: buffered extent only, does not include Roselands Nature Reserve itself)
- An ESA which is associated with a Conservation Category Wetland (UFI 955) and Gynudup Brook, north of Cable Mine Road
- An ESA which is associated with a Conservation Category Wetland (UFI 778), on Cable Mine Road.

Flora diversity

BORR IPT (2019a) completed a desktop NatureMap database search for the Southern Alternative Alignment Study Area (1,410 ha), of which approximately 174 ha intersects the Project Area. The database search identified 597 plant taxa, representing 88 families and 288 genera. This total comprised 497 native and 100 introduced flora taxa (DBCA, 2007-).

During the field assessment, BORR IPT (2019a) recorded 249 flora taxa (including subspecies and varieties) representing 54 families and 146 genera. This was recorded over 1,410 ha, of which 174 ha intersects the Proposal Area. Total flora taxa comprised of 172 native taxa and 77 introduced flora taxa.

Whilst the BORR IPT (2019a) Study Area did not cover the entire Project Area, it is considered it can be used as an indicator of flora diversity within the Project Area. The Project Area is considered to have moderate floristic diversity.

Conservation significant flora

No EPBC Act or BC Act listed flora were recorded within the Project Area during the surveys conducted in October and November 2018 (BORR IPT 2019a and b).

Roselands Nature Reserve, which lies adjacent to the Project Area (Figure 6), is known to support *Eleocharis keigheryi* (listed as Vulnerable) and five Priority listed flora (DBCA pers. comm 22 Jan 2019).The Priority flora recorded during the BORR IPT (2019a) field survey were *Acacia semitrullata* (P4) and *Chamaescilla gibsonii* (P3). The additional Priority flora reported to occur within the Study Area are *Wurmbea* sp. Cranbrook (A.R. Annels 3819) (P3), *Schoenus capillifolius* (P3), *Schoenus* sp. Waroona (G.J. Keighery 12235) (P3), *Ornduffia submersa* (P4) and *Aponogeton hexatepalus* (P4) (DBCA pers comms).

The location of Priority flora records within the vicinity of the Project Area is shown in Figure 5.

BORR IPT (2019a) completed a likelihood of occurrence assessment post-field survey for all conservation significant flora taxa identified in the desktop assessment. This assessment took into account previous records, habitat requirements, efficacy of the survey, intensity of the survey, flowering times and the cryptic nature of

species. The likelihood of occurrence assessment concluded that eight taxa are known, three are likely to occur, 15 taxa may possibly occur and the remaining 24 taxa are unlikely to occur within the Study Area.

The taxa that are known and likely to occur in the Study Area (1,410 ha) are listed in Table 3-7. Species that occur more than 5 km from the Study Area and had habitat present that was heavily grazed were considered unlikely to occur (BORR IPT, 2019a). As a conservative approach, it is considered that this likelihood of occurrence assessment also applies to the Project Area.

Table 3-7 Threatened flora known and likely to occur within the Project Area

TAXA	STATUS	LIKELIHOOD ASSESSMENT
Acacia semitrullata	P4	Known – recorded during GHD (2015) survey and this assessment.
Aponogeton hexatepalus	P4	Known – not recorded during the BORR IPT (2019a) survey but is recorded within Roseland Nature Reserve (DBCA pers comm. 22 Jan 2019).
Caladenia speciosa	P4	Known – DBCA Database records show this species as occurring within the Study Area, however it was not located during this assessment.
Chamaescilla gibsonii	P3	Known – this species was recorded within Q23 (VT09). It is also recorded within Roseland Nature Reserve (DBCA pers comm. 22 Jan 2019).
Eleocharis keigheryi	T	Known – not recorded during the GHD survey but is recorded within Roseland Nature Reserve (DBCA pers comm. 22 Jan 2019).
Ornduffia submersa	P4	Known – not recorded during the GHD survey but is known to occur within Roseland Nature Reserve (DBCA pers comm. 22 Jan 2019).
Schoenus capillifolius	P3	Known – not recorded during the GHD survey but is known to occur within VT09.
Schoenus sp. Waroona (G.J. Keighery 12235)	P3	Known – not recorded during the GHD survey but is known to occur within VT09.
Schoenus benthamii	P3	Likely – this species occurs < 5 km from the Study Area and some habitat occurs within the Study Area.
Schoenus loliaceus	P2	Likely – this species occurs < 5 km from the Study Area and some habitat occurs within the Study Area.
Trithuria australis	P4	Likely – this species occurs < 5 km from the Study Area and some habitat occurs within the Study Area.
Wurmbea sp. Cranbrook (A.R. Annels 3819)	P3	Known – not recorded during the GHD survey but is known to occur with Roseland Nature Reserve (DBCA pers comm. 22 Jan 2019).

Introduced and invasive species

Two of the introduced taxa recorded by BORR IPT (2019a and b) within the Project Area, are listed as Declared Pests under the *Biosecurity and Management Act 2007* and one is also listed as a Weed of National Significance (WONS):

- **Asparagus asparagoides* (Bridal Creeper) – Declared Pest and WONS
- **Zantedeschia aethiopica* (Arum lily) – Declared Pest.

Two additional Declared Pests (one of which is also a WONS) have been previously recorded within and to the north of the Project Area (approx. 2.3 km), however were not identified in the Project Area during the 2018 field survey. These species are also considered likely to be at risk of spread within the Project Area:

- * *Lantana camara* – Declared Pest and WONS
- * *Moraea flaccida*– Declared Pest.

**Moraea flaccida* was recorded during the survey undertaken in 2016 (Biota, 2016), however was not recorded in the current survey (BORR IPT 2019a and b). The locations of the Declared Pests are shown in Figure 3. The remaining introduced taxa recorded during the current survey are considered environmental weeds and all have been previously recorded on the SCP.

Comparison with other mapped vegetation

The vegetation within the Study Area broadly aligns with the mapped Beard (1979) vegetation associations and the Webb *et al*. (2016) vegetation complexes. Based on a review of species present, where possible, vegetation types were assigned a FCT. The FCT comparisons are provided in Table 3-3.

3.3.3 Potential impacts

The Project will potentially result in the direct loss of vegetation and flora through clearing of up to:

- The Project Area (222 ha), includes approximately 30 ha of mapped native vegetation (within the Surveyed Area of the Project Area), and a further estimated 17 ha of native vegetation identified via aerial imagery (within the Unsurveyed Area of the Project Area). The remainder of the Project Area (~176 ha) is considered to be cleared or highly modified
  - Within the Surveyed Area, 89% of native vegetation is in Completely Degraded condition, while only 2% is in Good or better condition
  - Within the Unsurveyed Area, native vegetation is expected (based on interpretation of aerial imagery) to be extensively in a Degraded to Completely Degraded condition. There is potential for a section of the watercourse along Cable Mine Road and Fishermans Road to be in Good or better condition (2.3 ha)
- A total of 3.5 ha of native vegetation within the Surveyed Area attributed to the 'Banksia Woodlands of the SCP' TEC (83 % in Good or better condition). Of this vegetation:
  - <0.1 ha is also representative of the 'Tuart (*Eucalyptus gomphocephala*) woodlands of the SCP' PEC
  - 3.4 ha is representative of 'Banksia dominated woodlands of the SCP IBRA region' PEC
- An additional 2.4 ha of the 'Banksia dominated woodlands of the SCP IBRA region' PEC occurs that are not representative of the 'Banksia Woodlands of the SCP' TEC (these areas do not meet the condition / size thresholds for the TEC)
- 1.3 ha that may be representative of the 'Banskia Woodlands of the SCP' TEC in the unsurveyed area along Fishermans Road depending on the condition and vegetation type
- Approximately 13 ha of riparian vegetation, including < 1 ha (4 %) in Good and approximately 13 ha (96 %) in Degraded or worse condition
- No EPBC Act, BC Act or Priority listed flora species were identified within the Project Area, however 12 conservation significant species have been previously recorded or are likely to occur within the Study Area, including:
  - Known:
    - *Acacia semitrullata* (P4)
    - *Aponogeton hexatepalus* (P4)
    - *Caladenia speciosa* (P4)
    - *Chamaescilla gibsonii* (P3)
    - *Eleocharis keigheryi* (listed as Vulnerable)
    - *Ornduffia submersa* (P4)
    - *Schoenus capillifolius (P3)*
    - *Schoenus sp.* Waroona (G.J. Keighery 12235) (P3)
    - *Wurmbea sp.* Cranbrook (A.R. Annels 3819) (P3)
  - Likely:
    - *Schoenus benthamii* (P3)

- *Schoenus loliaceus* (P2)
- *Trithuria australis* (P4).

Clearing associated with the project may also impact:

- Native vegetation associations and complexes (Beard, 1979; Webb, Kinloch, Keighery, & Pitt, 2016) that have less than 30 % remaining at the local scale (Shire of Capel)
- Two ESAs (partial loss) associated with Conservation Category Wetlands.

The Project has the potential (if appropriate management and mitigation measures are not implemented) to result in the following indirect impacts to vegetation and flora:

- Fragmentation of native vegetation remnants within the local area
- Possible introduction and/or spread of dieback and weeds (WONS and Declared Pests) to adjacent native vegetation, including Roselands Nature Reserve
- Changes to vegetation structure and floristic composition in surrounding areas (including Roselands Nature Reserve) through altered surface water drainage patterns and flows
- Exposure of surrounding vegetation (including Roselands Nature Reserve) to greater indirect impacts, such as accidental generation of a bushfire.

3.3.4 Assessment of impacts

The assessment of impacts is presented (where possible) at a regional (Bioregion) and Local Government Area (LGA) scale. Information is also provided on the extent of vegetation within the broader BORR IPT (2019a) Study Area to supplement the local scale assessment.

For the purposes of this EIA, cumulative impacts have been assessed by comparing the known regional / local extents of vegetation associations / complexes and types against published information on their extent, to estimate the overall percent impact of the Project. Consideration of other future projects have not been included at this stage.

Regional and local significance

The pre-European vegetation mapping (Beard, 1979) has been adapted and digitised by Shepherd *et al.* (2002). The extent of the vegetation associations has been determined by the state-wide vegetation remaining extent calculations maintained by the DBCA (latest update March 2019 – GoWA 2019b).

The DPIRD Native Vegetation Extent database (GoWA, 2019a) was used as the basis to assess direct and cumulative impacts at a local, regional and bioregional scale for this EIA. To calculate the current extent remaining, intersects between the Native Vegetation Extent, and the Pre-European Vegetation and Vegetation Complexes – SCP datasets were completed (GoWA, 2019a).

As shown in Table 3-8, the current extents of vegetation associations 6, 37 and 1000 are less than 30% of their pre-European extent at the IBRA bioregion, IBRA subregion and within some of the Local Government Authority (LGA) levels. The current extent of vegetation association 968 is less than 10% of its pre-European extent at IBRA bioregion, IBRA subregion and within the Shire of Capel LGA.

GoWA (2019c) has assessed the vegetation complexes mapped by Webb *et al*. (2016) against presumed pre-European extents within the SWA IBRA bioregion (Table 3-9) and LGA levels (Table 3-10). All of the vegetation complexes within the Project Area have less than 30% of their pre-European extents remaining within the SWA IBRA bioregion. The Guildford Complex has less than 10% remaining within the SWA IBRA bioregion. Within the Shire of Capel, the Bassendean Complex – Central and South and the Southern River Complex both have less than 30% of their pre-European extents remaining. The Guildford Complex has less than 10% of its pre-European extent remaining within the Shire of Capel (GoWA, 2019c).

Table 3-8 Extent of vegetation associations mapped within the Project Area (GoWA, 2019b)

VEGETATION ASSOCIATION	SCALE	PRE-EUROPEAN EXTENT (ha)	CURRENT EXTENT (ha)	REMAINING (%)	CURRENT EXTENT IN ALL DBCA MANAGED LAND (%)	AMOUNT WITHIN THE PROJECT AREA (ha)	% OF CURRENT EXTENT WITHIN THE PROJECT AREA	% REMAINING AFTER PROJECT IMPACTS
Swan Coastal Plain IBRA Bioregion		1,501,221.9	579,813.5	38.6	38.5	26.2	<0.1	38.6
6	State: WA	56,343.0	13,362.3	23.7	39.8	2.3	<0.1	23.7
	IBRA Bioregion SCP	56,343.0	13,362.3	23.7	39.8	2.3	<0.1	23.7
	Sub-region: Perth	56,343.0	13,362.3	23.7	39.8	2.3	<0.1	23.7
	LGA: Shire of Capel	5,245.3	2,301.1	43.9	16.5	2.3	0.1	43.8
37	State: WA	39,296.5	24,727.2	62.9	20.9	<0.1	<0.1	62.9
	IBRA Bioregion SCP	15,617.9	5,404.7	34.6	41.0	<0.1	<0.1	34.6
	Sub-region: Perth	14,018.5	4,784.2	34.1	44.9	<0.1	<0.1	34.1
	LGA: Shire of Capel	1,737.0	484.6	27.9	9.9	<0.1	<0.1	27.9
968	State: WA	296,877.8	94,048.8	32.0	57.6	10.5	<0.1	31.7
	IBRA Bioregion SCP	136,188.2	9,017.3	6.6	21.6	10.5	0.1	6.6
	Sub-region: Perth	136,188.2	9,017.3	6.6	21.6	10.5	0.1	6.6
	LGA: Shire of Capel	6,657.3	660.4	9.9	3.5	10.5	1.6	9.8
1000	State: WA	99,835.9	27,768.8	27.8	18.6	13.5	<0.1	27.8
	IBRA Bioregion SCP	94,175.3	24,869.2	26.4	19.8	13.5	<0.1	26.4
	Sub-region: Perth	94,175.3	24,869.2	26.4	19.8	13.5	<0.1	26.4
	LGA: Shire of Capel	15,173.8	3,189.9	21.0	7.3	13.5	0.4	20.9

Table 3-9 Extent of vegetation complexes mapped within the Project Area (GoWA, 2019c)

VEGETATION COMPLEX	PRE-EUROPEAN EXTENT (ha)	CURRENT EXTENT (ha)	REMAINING EXTENT (%)	CURRENT EXTENT REMAINING WITHIN ALL DBCA MANAGED LAND (%)	AMOUNT WITHIN THE PROJECT AREA (ha)	% OF CURRENT EXTENT WITHIN THE PROJECT AREA	% REMAINING AFTER PROJECT IMPACTS
Bassendean Complex – Central and South	87,476.3	23,508.7	26.9	5.0	12.0	<0.1	26.9
Karrakatta Complex – Central and South	53,081.0	12,467.2	23.5	8.1	1.2	<0.1	23.5
Guildford Complex	90,513.1	4,607.9	5.1	0.3	10.6	0.2	5.1
Southern River Complex	58,781.5	10,832.2	18.4	1.6	2.4	<0.1	18.4

Table 3-10 Extent of vegetation complexes within the Project Area for the Shire of Capel (GoWA, 2019c)

VEGETATION COMPLEX	PRE-EUROPEAN EXTENT (ha)	CURRENT EXTENT (ha)	REMAINING EXTENT (%)	PROPORTION OF THE VEGETATION COMPLEX WITHIN THE LGA (%)	AMOUNT WITHIN THE PROJECT AREA (ha)	% OF CURRENT EXTENT WITHIN THE PROJECT AREA	% REMAINING AFTER PROJECT IMPACTS
Bassendean Complex – Central and South	4,946.6	1,162.2	23.5	5.7	12.0	1.0	23.3
Karrakatta Complex – Central and South	6,902.3	3,400.6	49.3	13.0	1.2	0.0	49.3
Guildford Complex	6,508.4	540.5	8.3	7.2	10.6	2.0	8.1
Southern River Complex	7,876.1	1,794.3	22.8	13.4	2.4	0.1	22.8

Note: red and orange indicate that less than 10% and 30%, respectively, of the pre-European extent remains before and after Project impacts.

Threatened and Priority Ecological Communities

Banksia Woodland TEC/ PEC

The Threatened Species Scientific Committee (TSSC 2016) provides information on the estimated extent of Banksia Woodland TEC within the SCP Bioregion. The TSSC advises that approximately 81,800 ha (~24 %) of the TEC occurs within reserves, most of which are in the Perth subregion of the SCP Bioregion (Table 3-11). This document also states that there is approximately 336,489.9 ha of Banksia TEC remaining within the SCP.

Table 3-11 Extent of the Banksia Woodlands ecological community estimated to be protected in reserves (TSSC, 2016)

SUBREGION	CURRENT EXTENT (ha)	EXTENT IN RESERVES (ha)	% PROTECTED
Dandaragan (SWA01)	81,067.8	24,671.2	30.4
Perth (SWA02)	253,540.6	57,054.9	23.0
Jarrah Forests (JAF01/02)	1,881.4	105.9	5.6
Total	336,489.9	81,832.2	24.3

Clearing associated with the Project would result in up to a 4.8 ha (0.001%) reduction in the reported extent of the Banksia TEC. Of this, 2.9 ha was rated as in Good or better condition. NB: Assessment of patches takes into account overall vegetation condition and therefore, areas of Banksia woodland can be included as part of a TEC patch if the condition is less than Good but the overall condition of the patch is rated Good or better.

This represents the maximum likely impact associated with the Project and includes 1.3 ha of potential Banksia woodland along Boyanup Road that requires additional survey to confirm if it meets the criteria for TEC condition and patch size.

Tuart Woodland PEC

The pre-European extent of the 'Tuart (*Eucalyptus gomphocephala*) woodlands of the SCP' PEC is estimated to be 125,400 ha with approximately 17,060 ha (2015 indicative extent) or 14% of the pre-European extent remaining. Of this, 5,535 ha is reserved in 20 reserves (IUCN management categories I-IV) and comprise 22% of the remaining extent of the ecological community (DotEE, 2017a).

A total of 0.4 ha of native vegetation associated with this PEC is located within the Project Area. Clearing of this amount for the Project would represent a 0.002% reduction in the remaining extent of the PEC.

This total includes 0.3 ha along Fishermans Road which requires additional survey to confirm if it meets the criteria for TEC condition and patch size.

Threatened Flora

No EPBC Act or BC Act listed flora were recorded within the Project Area during the surveys undertaken in October and November 2018 (BORR IPT 2019a and b).

The Project is not expected to result in negative impacts on any EPBC Act or BC Act listed flora.

Priority Flora

No State listed Priority flora were recorded within the Project Area during the surveys undertaken in October and November 2018 (BORR IPT 2019a and b).

The Project is not expected to impact on any Priority listed flora.

3.3.5 Mitigation

The mitigation of impacts will be refined during the formal environmental assessment process and developed in consultation with Main Roads and key stakeholders if the alignment is selected as the preferred option. The following management and mitigation measures will be developed for this Project.

Impacts to flora and vegetation will be minimised through the following mitigation and management measures:

- Developing a Project design to minimise environmental impacts as far as practicable
- The selection of engineering and drainage solutions to avoid and minimise environmental impacts
- Compliance with State and Commonwealth environmental legal requirements
- Preparation and implementation of a Project specific Construction Environmental Management Plan (CEMP) that addresses issues specific to flora and vegetation including:
  - Complaints response site management
  - Vegetation management, and clearing procedures and processes
  - Topsoil management
  - ASS management
  - Dieback and weed management
  - Wetlands, drainage and groundwater management
  - Construction management (noise, vibration and dust)
  - Fire risk management
  - Environmental incident reporting and management
- The CEMP will include targets and key performance indicators, management actions, monitoring requirements and contingency measures.

3.3.6 Predicted outcome

Based on the information available to support the EIA, the Project has the potential to result in residual impacts including:

- Clearing of approximately 46 ha of native vegetation, including:
  - Approximately 30 ha of mapped native vegetation, of which 2% is in Good or better condition and 89% is in Completely Degraded condition
  - Approximately 17 ha within the Unsurveyed Area that appears to include native vegetation (identified from aerial imagery), the majority of which is likely to be in Degraded or worse condition
- Clearing of vegetation associations (Beard, 1979) and complexes (Webb, Kinloch, Keighery, & Pitt, 2016) that are under-represented regionally and locally
- Permanent loss of TECs and PECs:
  - Banksia woodlands of the SCP (TEC) – approximately 3.5 ha
  - Banksia dominated woodlands of the SCP IBRA region (PEC) – approximately 6 ha
  - The Tuart (*Eucalyptus gomphocephala*) woodlands of the SCP (PEC) – less than 0.1 ha
- Loss of approximately 13 ha riparian vegetation associated with swamps and minor waterways / drainage lines
- Partial loss of two ESA's associated with Conservation Category Wetlands.

Given the extent of impacts to conservation significant communities (TECs/ PECs), loss of under-represented vegetation, riparian vegetation and Priority flora species, offsetting residual impacts may need to be investigated. Additional surveys will be required to address information gaps in unsurveyed area and confirm the likely outcome for flora and vegetation if this alignment is selected as the preferred option.

3.4 Key Environmental Factor – Terrestrial Fauna

3.4.1 Studies undertaken

The following field investigations have been undertaken for this aspect:

- BORR South GBRS Alignment Targeted Fauna Assessment and BORR Southern Alternative Alignment Targeted Fauna Assessment (Biota 2019a and 2019b respectively), which covered approximately 174 ha (77%) of the Project Area
- BORR Alternate Alignment: Targeted Conservation Significant Aquatic Fauna Survey (WRM, 2018).

The following locations were not surveyed and have undergone an assessment based on desktop information:

- Jilley Road
- Fishermans Road
- Calinup Road
- Bussell Highway section (BORR interchange to Cable Mine Road)
- North of Yeardy Road, around to Cable Mine Road and Nichols Road and up to Elgin Road.

The gaps in the survey effort total 47.82 ha and are shown in Figure 2. Additional fauna survey effort at these locations will be undertaken if the BORR Southern Section Alternative Alignment is selected as the preferred alignment option. For the purposes of the EIA, Biota 2019a and 2019b were used as the primary reference to identify fauna species occurring or likely to occur within the Project Area and fauna habitats occurring within the Project Area. The Biota field surveys included reference sites outside of the Project Area and all areas surveyed are referred to as the Biota Study Area. Parts of the Biota Study Area intersect the Project Area. These are referred to as Surveyed Areas. Sections of the Project Area were not covered by the Biota Study Area and are referred to as unsurveyed areas.

3.4.2 Receiving environment

Fauna habitat

Fauna habitat within the Surveyed Area were classified into three dominant habitat types (covering ~30 ha) (Biota 2019a and b) (Figure 7):

- Marri/Eucalyptus Woodland: Jarrah (*Eucalyptus marginata*) and Marri (*Corymbia calophylla*) dominated over storey, varying understorey of Banksia (*Banksia attenuata* and *B. grandis*) or Peppermint (*Agonis flexuosa*) dominance
- Marri/Eucalyptus in paddocks and road reserves: Overstorey consisting of a scattering of mature Jarrah (*Eucalyptus marginata*) and Marri (*Corymbia calophylla*) in upland areas, and Flooded Gum (*Eucalyptus rudis*) and Tuart (*Eucalyptus gomphocephala*) in low lying areas over introduced grasses
- Dampland with Melaleuca shrubland and/or woodland: dominated by *Melaleuca* spp. and sedges often in grazed paddocks. Vegetation comprised *Melaleuca raphiophylla* with scattered *Eucalyptus rudis* over mixed sedge species. In some wetland areas Peppermint *Agonis flexuosa* often co-dominant with *Melaleuca* spp.

The remainder of the Surveyed Area was classified as Cleared (~145 ha). The fauna habitat types are based on vegetation composition or features in the environment that fauna can utilise and includes scattered remnant paddock trees, as these are often suitable forging and or potential breeding (e.g. hollow-bearing trees) resources.

The description and area of each habitat type within the Surveyed Area is summarised in Table 3-12. A total area of approximately 30 ha fauna habitat occurs within the Surveyed Area. A total of approximately 17 ha of

potential fauna habitat has been estimated for the unsurveyed areas, based on interpretation of aerial imagery (Table 3-13). Therefore, the Project Area contains up to approximately 47 ha of fauna habitat.

Table 3-12 Fauna habitat types identified within the surveyed component of the Project Area

HABITAT TYPE AND DESCRIPTION	EXTENT WITHIN THE PROJECT AREA (ha)
Dampland with Melaleuca shrubland and/or woodland 	8.4
Marri/Eucalyptus woodland 	9.2
Marri/Eucalyptus in paddocks and road reserves 	12.0
Cleared	144.7
Total	174.3

Table 3-13 Survey gaps – description of potential fauna habitat within the Project Area

SURVEY GAP	EXTENT WITHIN PROJECT AREA	NATIVE VEGETATION EXTENT	POTENTIAL DESCRIPTION OF FAUNA HABITAT
Jilley Road	2.1 ha	1.0 ha	Marri/Eucalyptus in paddocks and road reserves. Dampland with Melaleuca shrubland and/or woodland (patch south of Manea Drive).
Fishermans / Boyanup West Road	9.9 ha	3.0 ha	Marri/Eucalyptus in paddocks and road reserves. Marri/Eucalyptus woodland (680 m west of Ramsay Road).
Calinup Road	0.6 ha	0.2 ha	Marri/Eucalyptus in paddocks and road reserves.
Bussell Highway (southern end of Project Area)	21.3 ha	5.8 ha	Marri/Eucalyptus in paddocks and road reserves.
North of Yeardy Road, around to Cable Mine Road and Nichols Road and up to Elgin Road	13.9 ha	6.8 ha	Marri/Eucalyptus in paddocks and road reserves. Dampland with Melaleuca shrubland and/or woodland (creekline).
Total Unsurveyed Gaps			**47.8 ha** (including an estimated 16.8 ha of fauna habitat and 31.0 ha Cleared/ High Modified land)

Fauna habitat value

The fauna habitat types recorded within the Project Area have both suitable foraging and potential breeding habitat for Black Cockatoos (Carnaby's Cockatoo, Forest Red-tailed Black Cockatoo and Baudin's Cockatoo) and Western Ringtail Possum (Biota 2019a and b).

Approximately 21 ha of suitable native vegetation mapped within the Project Area was assessed as Very High Quality for Black Cockatoo species (Biota, 2019b). Only those areas comprising uniform stands of Melaleuca shrubs and Peppermint woodland were considered unlikely to contain foraging or breeding habitat.

Western Ringtail Possums were observed utilising habitats ranging from relatively isolated trees through remnant strips (along road reserves and riparian belts) surrounded by cleared land, to larger remnants of native vegetation.

The fauna habitat within the Unsurveyed Area is estimated to comprise approximately 17 ha of native vegetation which may provide additional habitat for conservation significant fauna species. The fauna habitat types within the Study Area and how they are used by conservation significant fauna species (possibly, likely or known to occur) are presented in Table 3-14.

Ecological linkages

The Project Area intersects a patch of remnant native vegetation that forms part of a South West Regional Ecological Linkage (SWREL) axis line (Molloy, Wood, Wallrodt, & Whisson, 2009). The ecological linkage connects large vegetation remnants west of Bussell Highway to large vegetation remnants in South Boyanup (approximately 7 km to the east). The vegetation patch intersected by the Project Area is approximately 19 ha and located between Jilley Road and Ken Bell Road. Within the vegetation patch, the Project Area is parallel to an existing Western Power corridor which also fragments the vegetation patch. The existing local roads (Cokelup, Jilley and Ken Bell roads) also intersect this SWREL.

On a local scale, vegetation along road reserves File Mile Brook and Gynudup Brook provide local ecological linkages that will be intersected by the Project Area. These linkages are likely to be used by conservation significant fauna (e.g. Western Ringtail Possum) as well as a number of more common mammals, birds, reptiles and amphibians.

Fauna diversity

Biota (2019b) completed a desktop NatureMap database search on their Study Area, which covers 77% of the Project Area, and has been used an indicator of potential faunal diversity within the Project Area. The database search indicated a species inventory of 220 vertebrate fauna species, comprising 24 mammals (13 native non-volant, one bat and 10 non-native), 160 birds (63 of which are largely reliant on freshwater or marine habitats), 27 reptiles and nine amphibians.

More than 1,250 individual fish were caught during the 2018 aquatic study (WRM, 2018), including three native and two introduced species. A total of 113 Black-stripe Minnow (listed as Endangered under the EPBC Act) were recorded across four wetlands sampled (comprising approximately 68 ha) in the Study Area, which are hydrologically connected to areas within the Project Area (Figure 8).

Other native aquatic fauna recorded included:

- Two freshwater fish species
  - South-western goby (*Afurcagobius suppositus*)
  - Swan River goby (*Pseudogobius olorum*)
- Two south-west endemic freshwater crustaceans
  - Gilgie (*Cherax quinquecarinatus*)
  - Koonac (*Cherax preissii*).

Conservation significant terrestrial fauna

The desktop review identified 22 conservation significant terrestrial fauna species within 10 km of the Biota Study Area (Biota, 2019b). Six conservation significant fauna species are known to occur within the Biota Study Area, including:

- Western Ringtail Possum (Critically Endangered)
- Carnaby's Cockatoo (Endangered)
- Baudin's Cockatoo (Endangered)
- Forest Red-tailed Black Cockatoo (Vulnerable)
- South-western Brush-tailed Phascogale, Wambenger (Vulnerable)
- Quenda, Southern Brown Bandicoot (Priority 4).

A likelihood of occurrence assessment was undertaken for 14 conservation significant terrestrial fauna (Biota, 2019b). Conservation significant species considered likely to possibly occur, and their habitat preferences, are summarised in Table 3-14. This likelihood of occurrence assessment on the Study Area is assumed to apply within the Project Area.

Table 3-14 Likelihood of occurrence for terrestrial conservation significant fauna species and their habitat availability within the Project Area

SPECIES	COMMON NAME	LISTING UNDER BC ACT 2018 OR DPAW PRIORITY LIST	LISTING UNDER EPBC ACT	LIKELIHOOD OF OCCURRENCE ASSESSMENT	FAUNA HABITAT TYPE		
					MARRI/EUCALYPTUS WOODLAND	MARRI/EUCALYPTUS IN PADDOCKS AND ROAD RESERVES	DAMPLAND WITH MELALEUCA SHRUBLAND AND/OR WOODLAND
Mammals							
Pseudocheirus occidentalis	Western Ringtail Possum	S1	CR	Occurs	Breeding, Foraging	Breeding, Foraging	-
Isoodon fusciventer	Southern Brown Bandicoot/ Quenda	P4		Occurs	Breeding, Foraging	Breeding, Foraging	Breeding, Foraging
Notamacropus irma	Western Brush Wallaby	P4		Likely to occur	Foraging	Foraging	-
Phascogale tapoatafa wambenger	South-western Brush-tailed Phascogale, Wambenger	S6		Occurs	Breeding, Foraging	-	-
Dasyurus geoffroii	Chuditch, Western Quoll	S3	VU	Possible	Foraging	Foraging	-
Falsistrellus mackenziei	Western False Pipistrelle, Western Falsistrelle	P4		Possible	Breeding, Foraging	Foraging	-
Hydromys chrysogaster	Water-Rat	P4		Possible	-	-	Foraging

SPECIES	COMMON NAME	LISTING UNDER BC ACT 2018 OR DPAW PRIORITY LIST	LISTING UNDER EPBC ACT	LIKELIHOOD OF OCCURRENCE ASSESSMENT	FAUNA HABITAT TYPE		
					MARRI/EUCALYPTUS WOODLAND	MARRI/EUCALYPTUS IN PADDOCKS AND ROAD RESERVES	DAMPLAND WITH MELALEUCA SHRUBLAND AND/OR WOODLAND
Reptiles							
Ctenotus ora	Coastal Plains Skink	P3		Possible	Breeding, Foraging	Breeding, Foraging	-
Birds							
Calyptorhynchus banksii naso	Forest Red-tailed Black-Cockatoo	S3	VU	Occurs	Breeding, Foraging	Breeding, Foraging	-
Calyptorhynchus baudinii	Baudin's Cockatoo	S2	EN	Occurs	Breeding, Foraging	Breeding, Foraging	-
Calyptorhynchus latirostris	Carnaby's Cockatoo	S2	EN	Occurs	Breeding, Foraging	Breeding, Foraging	-
Falco peregrinus	Peregrine Falcon	S7		Likely to occur	Foraging	Foraging	-
Oxyura australis	Blue-billed Duck	P4		Possible	-	-	Foraging

Black Cockatoos

The Project Area (Surveyed Area) provides approximately 21 ha of suitable foraging and potential breeding habitat for Black Cockatoos (Carnaby's Cockatoo, Forest Red-tailed Black Cockatoo and Baudin's Cockatoo). During the field survey, Black Cockatoo individuals were recorded within the Study Area, as described below:

- 17 Forest Red-tailed Black Cockatoo individuals recorded from six observations
- 15 white-tailed Black Cockatoo individuals recorded from six observations (likely Carnaby's Cockatoo).

Black Cockatoo breeding habitat, as defined in the Commonwealth referral guidelines (DotEE, 2017b), includes:

- Relevant tree species with a suitable Diameter at Breast Height (DBH) to develop a nest hollow, where DBH is greater than or equal to 500 mm, herein referred to as 'Suitable DBH Trees'
- Trees with a hollow that meets the DotEE (2017) depth, width and angle criteria for nesting by Black Cockatoos, herein referred to as 'Trees with a Suitable Nest Hollow'
- 'Known Nesting Trees' are those trees that have secondary evidence of nesting i.e. feathers, eggs/ shells etc.

A total of 588 Suitable DBH Trees were identified within the surveyed component of the Project Area. The drone survey identified one Trees with a Suitable Nest Hollow. Two of these trees showed evidence as being Known Nesting Trees. Two trees with hollows were unable to be surveyed by the drone due to proximity to the road or foliage cover. Survey observations and future potential breeding tree locations are shown in Figure 9.

Due to their breeding distribution, Forest Red-tailed Black Cockatoo's are considered the most likely of the three cockatoo species to breed within the Project Area. However, all three species may potentially breed within the Project Area.

The unsurveyed area (~48 ha) is estimated to have approximately 17 ha of native vegetation which is potential Black Cockatoo breeding and/or foraging habitat.

Western Ringtail Possum

Biota (2019b) identified approximately 21 ha of suitable breeding and foraging habitat for Western Ringtail Possums within the Project Area (Surveyed Area), including Marri/Eucalyptus woodland and Marri/Eucalyptus in paddocks and road reserves. Western Ringtail Possums were recorded wherever woodland fragments (particularly mixed woodland) occurred (Biota 2019b).

Using possum density, Biota (2019b) assessed the importance of Western Ringtail Possum habitat within the targeted fauna Study Area, by direct comparison with habitat in four local contextual sites (within an 18 km radius of Bunbury town centre). Possum density was calculated based on the results of strip and distance sampling.

The estimated density and abundance of Western Ringtail Possums within the Biota Study Area is shown in Table 3-15. Based on the occurrence density, approximately nine individuals are estimated to occur within the Surveyed Area (~21 ha). The unsurveyed area (48 ha) is estimated to have approximately 17 ha of Western Ringtail Possum habitat. Based on a total potential habitat area of 38 ha (~21 ha within surveyed and ~17 ha within unsurveyed areas) and the occurrence density, the Project Area is conservatively estimated to support around 15 individual Western Ringtail Possums.

Biota (2019c) completed additional surveys to provide a regional context for the potential impacts from the Project on Western Ringtail Possums. At the time of writing, preliminary results from the additional surveys estimate the Western Ringtail Possum population for the southern SCP at 5,373 individuals. This estimate does not include suitable habitats in the semi-urban and urban environment that are known to be inhabited by Western Ringtail Possums, and is therefore considered to be a conservative estimate (i.e. lower than in reality). Based on the conservative estimate of Western Ringtail Possums within the Project Area (~15 individuals), the Project Area represents up to 0.3% of the regional population.

A summary of Western Ringtail Possum observations within the Study Area and within the contextual sites are shown in Figure 10.

Table 3-15 Western Ringtail Possum densities within the Study Area

STUDY AREA	WRP DENSITY RECORDED
Strip sampling (per hectare)	0.41
Lot 1 (Distance sampling) – contextual site	0.26 ± 0.16
Southern Lots	0.39 ± 0.11
Average density (WRP per ha)	0.4
Predicted abundance (across 21.2 ha surveyed area)	8.5

Quenda, Southern Brown Bandicoot

Evidence of Quenda was recorded within the Surveyed Area, in the form of diggings. The Surveyed Area provides suitable habitat for Quenda, which includes all three dominant fauna habitat types (Marri/Eucalyptus woodland, Marri/Eucalyptus in paddocks and road reserves and, Dampland with Melaleuca shrubland and/or woodland) (~30 ha).

The unsurveyed area (~48 ha) is estimated to have approximately 17 ha of potential Quenda habitat. From a review of aerial imagery, the remainder of the unsurveyed area (~31 ha) appears to be cleared land and is not likely to provide habitat for Quenda.

South-western Brush-tailed Phascogale, Wambenger

One South-western Brush-tailed Phascogale was observed within the Biota Study Area. The Surveyed Area provides approximately 9 ha of suitable habitat (Marri/Eucalyptus woodland) for the South-western Brush-tailed Phascogale.

Approximately 17 ha of native vegetation within the unsurveyed area (~48 ha) potentially represents South-western Brush-tailed Phascogale habitat. From a review of aerial imagery, the remaining 31 ha of the unsurveyed area appears to be cleared land and is not likely to provide habitat for South-western Brush-tailed Phascogales.

Conservation significant aquatic fauna

An aquatic fauna survey was undertaken by WRM in November 2018 (WRM, 2018). The survey focused on species of conservation significance within specific wetlands and waterbodies that were identified from aerial imagery to provide potential aquatic fauna habitat. No survey sites occurred within the Project Area, however all survey sites occurred within 600 m of the Project Area.

Black-Stripe Minnow and Western Mud Minnow

A total of 113 Black-stripe Minnow (*Galaxiella nigrostriata*) individuals were identified within the Study Area (WRM, 2018), although none were recorded within the Project Area. Two sites sampled recorded 29 Black-stripe Minnow from wetlands (site reference Wetland 2 and Wetland 3a) hydrologically connected to up to 0.3 ha of potential habitat within the Project Area (Figure 10).

The species population is known to disperse in years of high rainfall and have been historically recorded intermittently in some wetlands (MBS Environmental, 2009). Due to the high mobility of the species and high connectivity between wetlands in wetter years, it is likely that Black-stripe Minnow would migrate between wetlands, opportunistically utilising habitat within the Project Area.

Further field investigations will be undertaken if the alignment is chosen for development to further identify suitable habitat for Black-stripe Minnow and determine the likelihood of occurrence within the Project Area.

No Western Mud Minnows were recorded within the survey sites and are considered unlikely to occur within the Project Area.

Carter's Freshwater Mussel

Despite extensive survey effort, no Carter's Freshwater Mussel were recorded within the wider investigation area. This is likely due to the ephemeral nature of the sites sampled, and lack of suitable habitat (creek lines) within the investigation area.

South-Western Snake-Necked Turtle

The South-Western Snake-Necked Turtle (*Chelodina colliei*[1]) is endemic to the south-west of Western Australia and is listed on the IUCN Redlist of Threatened Species as Near Threatened (IUCN, 2018).

A total of seven South-Western Snake-Necked Turtles were recorded within the WRM Study Area.

This species is known to occur in both permanent and seasonal habitats, including rivers, lakes, farm dams, swamps, damplands and natural and constructed wetlands (Balla, 1994; Guyot & Kuchling, 1998). They can migrate relatively long distances overland if local conditions deteriorate (Dr Gerald Kuchling, UWA, pers. comm. (WRM, 2018)) and can aestivate to avoid drought in seasonal waterbodies for up to five to six months (Kuchling, 1998; Kuchling, 1989).

Since their diet includes tadpoles, fish, and aquatic invertebrates, South-Western Snake-Necked Turtles only eat when open water is present. In permanent waters, this species has two nesting periods (September-October and December-January), but in seasonal systems, nesting will only occur in spring. The main threats to these turtles are road deaths during movement in the nesting season and predation by feral animals (Bencini & Turnball, 2012).

Given the abundance of wetlands and surface water bodies in the area surrounding the Project Area, it is likely that South-Western Snake-Necked Turtles occur within the Project Area.

3.4.3 Potential impacts

The Project Area is predominantly cleared, with approximately 176 ha of the total 222 ha cleared or highly modified. The Project has the potential to directly and indirectly impact on fauna and fauna habitat in remaining areas during the construction and operational phases.

The potential direct impacts to species known to occur within the Project Area include:

- Clearing of approximately 46 ha of potential fauna habitat types across the Project Area (222 ha), which includes an estimated 30 ha of mapped fauna habitat (within the Surveyed Area), and a further approximate 17 ha of potential fauna habitat (within the unsurveyed area)
- Clearing of up to 38.0 ha of Black Cockatoo (Carnaby's Cockatoo (Endangered), Baudin's Cockatoo (Endangered) and Forest Red-tailed Black Cockatoos (Vulnerable)) breeding and foraging habitat (including 21.2 ha surveyed and 16.8 ha unsurveyed)
- A total of 588 Suitable DBH Trees, one of which is a Tree with a Suitable Nest Hollow, two of which showed evidence of past use as Known Nesting Trees and two that could not be assessed by drone
- Clearing of up to 38.0 ha of Western Ringtail Possum habitat (including 21 ha surveyed and 17 ha unsurveyed) and displacement of an estimated 15 individual Western Ringtail Possums, representing less than 0.3% of the regional population
- Clearing of up to 26.0 ha of South-western Brush-tailed Phascogale habitat (including 9.2 ha surveyed and 16.8 ha unsurveyed)
- Clearing of approximately 46 ha of Southern Brown Bandicoot, Quenda (Priority 4) habitat (including 30 ha surveyed and 17 ha unsurveyed).

Potential direct impacts to species that have potential to occur within the Project Area include:

[1] This species was referred to as *Chelodina oblonga* in the past. However, there was some debate over species names and distributions. In 2013, the ICZN handed down its decision on nomenclature, with *C. colliei* given to the south-western snake-necked turtle, and *C. oblonga* given to the northern snake-necked turtle (previously *C. rugosa*).

- Potential loss of habitat for Black-stripe Minnow including up to 0.3 ha of Geomorphic Wetland intersected by the Project Area (where the species was recorded adjacent to the Project Area)
- Mapped fauna habitat for a further six conservation significant species that possibly occur within the Project Area.

Other potential direct impacts to fauna during construction and operations (to be mitigated through implementation of a CEMP and other mitigation measures detailed in the following sections) include:

- Temporary, localised impacts on aquatic fauna due to disturbance of wetlands and waterways
- Death or displacement of native fauna species from vehicle movements.

The Project may also result in the following indirect impacts to fauna including:

- Incremental loss of fauna habitat (fragmentation, barrier effects and edge effects)
- Displacement of native fauna species due to traffic noise exposure
- Displacement of native fauna species due to light spill from street lighting and traffic.

3.4.4 Assessment of impacts

Approximately 79% the Project Area is predominantly cleared, with approximately 175.7 ha of the total 222.1 ha already cleared or highly modified. Reduction of potential impacts on the environment was a key consideration in the selection of the alignment and identification of the Project Area. Further reduction in the potential impacts will occur through the detailed design phase should this alignment be selected for development.

Clearing and loss of habitat

The Project will result in the potential clearing of up to 46.4 ha of potential fauna habitat across the 222.1 ha Project Area. Further reduction to the clearing area associated with the Proposal will be achieved through consideration of impacts during the detailed design process.

Further discussion on potential impacts to conservation significant fauna is provided below.

Impact to conservation significant fauna

Clearing and operation of the Proposal has the potential to impact conservation significant fauna including:

- Black Cockatoos (up to 38.0 ha of potential habitat), including Carnaby's Cockatoo (Endangered), Baudin's Cockatoo (Endangered) and Forest Red-tailed Black Cockatoos (Vulnerable)
- Western Ringtail Possum (up to 38.0 ha of potential habitat) (Critically Endangered)
- Southern Brown Bandicoot (up to 46.4 ha of potential habitat) (Priority 4)
- South-western Brush-tailed Phascogale (up to 26.0 ha of potential habitat (Schedule 6)
- Black-stripe Minnow (less than 0.3 ha of potential habitat) (Endangered).

Black Cockatoos

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

A total of 588 Suitable DBH Trees, one of which is a Tree with a Suitable Nest Hollow. Two trees showed evidence of past use as Known Nesting Trees and two could not be assessed by drone.

Western Ringtail Possum

An estimated 15 Western Ringtail Possums may be displaced from the Proposal Area. Based on assessment of local and regional context sites covering 4,211.7 ha, the potentially displaced WRPs represent 0.3 % of the estimated regional population (Biota, 2019c). Furthermore, the 2019 southern SCP estimate does not include suitable habitat in the semi-urban and urban environment, which are known to be utilised be Western Ringtail Possums. As such, the 2019 estimate is considered to be conservative (i.e. lower than in reality).

Black-stripe Minnow

The Project Area intercepts up to 0.3 ha of Geomorphic Wetlands where the Black-stripe Minnow was recorded adjacent to the Project Area. However, the area of wetland potentially impacted by the Project is likely to be less than 0.3 ha, as part of the area mapped as wetland is an existing unsealed road.

The transverse drainage design will include culverts (or similar) to maintain fish passage movement (including Black-stripe Minnow) through the drainage network i.e. the drainage design will be sympathetic to fish movement requirements

Other potential impacts

There will be a temporary increase in secondary impacts such as noise, vibration, light and dust during construction. Increased noise, vibration and dust may result in native fauna avoiding the area. However, this is unlikely to have a permanent impact on fauna species in the area.

Vehicle strike

Operation of the Project will result in an increase in traffic/vehicle movements and therefore result in a greater risk of fauna strike from vehicle movements.

Habitat fragmentation

Incremental reduction in fauna habitat has restricted the distribution of a number of conservation significant species known to occur within the Project Area including Western Ringtail Possum and Black-stripe Minnow. As habitat is cleared, patch sizes decrease and the impact of 'edge effect' increases with likely introduction of weeds and dieback, ultimately changing the species composition of the vegetation community and reducing suitability of habitat for local fauna species.

The Project Area has been largely cleared in the past for agriculture purposes. This has resulted in fragmentation of both terrestrial and riparian/ wetland vegetation and ecological linkages, thereby reducing connectivity of fauna habitat.

3.4.5 Mitigation

As detailed in section 3.3.5, the mitigation and management measures for the Project will be developed and refined in consultation with key stakeholders if this alignment is selected as the preferred option. Impacts to fauna will be minimised through the following mitigation and management measures:

- Developing a Project design to minimise environmental impacts as far as practicable
- The selection of engineering and drainage solutions to avoid and minimise environmental impacts
- Compliance with State and Commonwealth environmental legal requirements
- Preparation and implementation of a CEMP that addresses issues specific to fauna including:
  - Complaints response and management
  - Vegetation management, and clearing procedures and processes
  - Fauna management
  - Wetlands, drainage and groundwater management
  - Construction management (noise, vibration and dust)
  - Fire risk management
  - Environmental incident reporting and management
- The CEMP will include targets and key performance indicators, management actions, monitoring requirements and contingency measures.

3.4.6 Predicted outcome

Approximately 79% the Project Area is predominantly cleared, with approximately 176 ha of the total 222 ha already cleared or highly modified. The Project has the potential to directly impact fauna species known to occur with the Project area including:

- Clearing of an estimated 46 ha of potential fauna habitat types across the Project Area (222 ha), which includes approximately 30 ha of mapped fauna habitat (within the Surveyed Area), and a further approximate 17 ha of potential fauna habitat (within the unsurveyed area)
- Clearing of approximately 38 ha of Black Cockatoo (Carnaby's Cockatoo (Endangered), Baudin's Cockatoo (Endangered) and Forest Red-tailed Black Cockatoos (Vulnerable)) breeding and foraging habitat (including 21 ha surveyed and 17 ha unsurveyed)
- A total of 588 Suitable DBH Trees, one of which is a Tree with a Suitable Nest Hollow, two showed evidence of past use as Known Nesting Trees and two could not be assessed by drone
- Clearing of up to 38 ha of Western Ringtail Possum habitat (including 21 ha surveyed and 17 ha unsurveyed) and displacement of an estimated 15 individual Western Ringtail Possums, representing less than 0.3% of the regional population
- Clearing of approximately 26 ha of South-western Brush-tailed Phascogale habitat (including approximately 9 ha surveyed and 17 ha unsurveyed)
- Clearing of approximately 46 ha of Southern Brown Bandicoot, Quenda (Priority 4) habitat (including 30 ha surveyed and 17 ha unsurveyed).

Potential direct impacts to species that have potential to occur within the Project Area include:

- Potential loss of habitat for Black-stripe Minnow including less than 0.3 ha of Geomorphic Wetland intersected by the Project Area where the species was recorded adjacent to the Project Area (NB area of habitat potentially impacted by the Project is likely to be less than 0.3 ha, as part of the area mapped as wetland is an existing unsealed road)
- Mapped fauna habitat for a further six conservation significant species that possibly occur within the Project Area.

Given the potential for impact to conservation significant fauna (particularly Black Cockatoo species and Western Ringtail Possums) and loss of under-represented fauna habitat, environmental offsets to counter-balance the likely residual impacts of the Project will be investigated, should this alignment be selected for development. Additional surveys will be required to address information gaps in unsurveyed area and confirm the likely outcome for fauna if this alignment is selected as the preferred option.

3.5 Key Environmental Factor – Terrestrial Environmental Quality

3.5.1 Studies undertaken

Desktop data have been assessed for this aspect including DWER Contaminated Sites Database (DWER, 2018) and Acid Sulfate Soil risking mapping for the SCP (GoWA, 2019a).

No additional studies are considered likely to be required for this aspect.

3.5.2 Receiving environment

Geology

The SCP is comprised of five major geomorphological units, which lie more or less parallel to the coast. These geomorphological units are the Quindalup, Spearwood and Bassendean Dunes, the Pinjarra Plain and the Ridge Hill Shelf (McArthur & Bettenay, 1960; Churchward & McArthur, 1980). The Study Area lies within the Spearwood and Bassendean Dunes and the Pinjarra Plain. These three geomorphological units are broadly described as:

- Spearwood Dunes: Pleistocene and aeolian sands overlying Tamala limestone. Low dunes and swales of shallow pale grey sands over yellow sands are characteristic of the Spearwood system. Wetlands are associated with peats and carbonate sands, occasionally with clay overlaying sands
- Bassendean Dunes: Pleistocene sand dunes with very low relief, leached grey siliceous sand intervening sandy and clayey swamps and gently undulating plains. These occur immediately west of, and partly overlie, the Pinjarra Plain
- Pinjarra Plain: Broad low relief plain west of the foothills, comprising predominantly Pleistocene fluvial sediments and some Holocene alluvium associated with major current drainage systems. Major soils are naturally poorly drained with many swamps.

Desktop assessment of broad geological formations indicates that the Project Area occurs within three broad formations in addition to rivers and wetland areas (GSWA, 2009), which are outlined in Table 3-16.

Table 3-16 Geology, landform and soils information for the Project Area

FORMATION	GEOLOGICAL TYPE	GEOLOGICAL DESCRIPTION/ LANDFORM
Tamala Limestone	Qts	Sand associated with Tamala Limestone, high dunes
Guildford Formation	Qpa	Mainly alluvial sandy clay
Bassendean Sand	Qpb	Low rounded dunes

Acid Sulfate Soils

Acid Sulfate Soils (ASS) are naturally occurring soils and sediments containing sulphide minerals, predominantly pyrite (an iron sulphide). In an undisturbed state below the water table, these soils are benign. However, if the soils are drained, excavated or exposed by lowering of the water table, the sulphides will react with oxygen to form sulphuric acid. Disturbance of these soils can flush acidic leachate to groundwater and surface waters, and cause off site environmental impacts.

ASS Risk Mapping for the Project Area indicated low to moderate risk of ASS, with minor areas of high risk associated with wetlands and watercourses (GoWA, 2019a). ASS Risk Mapping is shown in Figure 11.

Contaminated sites

The DWER *Contaminated Sites Database* presents information on known contaminated sites that have been classified by the DWER as one of the following:

- Contaminated – remediation required
- Contaminated – restricted use

- Remediated for restricted use.

The DWER *Contaminated Sites Database* does not provide details of the Sites that are listed as 'Possibly contaminated – investigation required' (PC-IR).

A further limitation to the DWER *Contaminated Sites Database* are unreported contaminated sites.

A search of the DWER *Contaminated Sites Database* indicates that one contaminated site may be impacted by the Project; Lot 105 on Plan 301891 at 105 Cable Mine Road. This site is part of a 15 parcel site that is classified as contaminated with restricted use. Groundwater beneath the site is impacted with elevated concentrations of ammonia, boron, manganese, magnesium and nitrate (DWER, 2018). The location of this contaminated site is shown in Figure 11.

The Project Area also traverses agricultural land that may contain sources of contamination such as dumped building materials, kill pits, landfill sites, and chemical storage sites. Additional investigations will be required to identify and remediate these sites prior to construction.

3.5.3 Potential impacts

Project activities that have the potential to impact terrestrial environmental quality during construction include earthworks and storage and handling of environmentally hazardous materials.

The potential construction impacts that may occur to terrestrial environmental quality as a consequence of developing the Project are:

- Disturbance of ASS resulting in acid leachate into the receiving environment causing contamination of land and/or waters
- Disturbance of unknown contaminated sites resulting in spread of contamination
- Accidental release or spread of litter, hydrocarbons or chemicals resulting in contamination of land
- Alteration of soil and loss of soil structure due to fill requirements in low lying areas.

Operational impacts to Terrestrial Environmental Quality resulting from the Project are mainly limited to road users, including pollution and waste. Road drainage will be designed to prevent contamination of Terrestrial Environmental Quality from the road surface run-off.

Potential indirect impacts that could arise from the construction of the Project also include salinization and soil erosion. The risk of salinization on the SCP is considered to be low and clearing associated with the Project in the context of local and regional water tables is unlikely to result in increased risk of salinization of soils. Soil erosion has the potential to occur during construction, associated with heavy machinery and vegetation clearing and during operation as a consequence of stormwater runoff.

3.5.4 Assessment of impacts

Direct impacts

Acid Sulfate Soils

ASS can be disturbed either by excavation or lowering of the water table below natural seasonal levels (i.e. dewatering). Excavations occurring for the Project will be associated with construction of bridge footings. It is likely that ASS will be encountered within excavations greater than 1.0 m depth, particularly within riparian zones. Dewatering may also be required during construction of bridge footings, which may expose PASS.

When PASS are disturbed, sulfides present are exposed to air, allowing oxidisation and consequently, the formation of sulfuric acid (H_2SO_4). ASS are also capable of generating acidity in-situ in their natural state; disturbance is not required for acidic discharges to develop.

As a result of the presence of ASS, or the oxidation of PASS, surrounding land (soil) and nearby waterways may become acidic (pH<6.5). Under acidic conditions, metals such as aluminium (generally at pH<4.5) and iron, as well as trace heavy metals (including arsenic), become more mobile in the environment and can readily be transported offsite by infiltrating waters. As a result, concentrations of metals within surface and/ or groundwater may reach concentrations, which have the potential to cause acute or chronic toxicity to sensitive terrestrial and aquatic plants and animals.

Hazardous material and waste disposal

Direct contamination of soils and land could occur as a result of releases of hazardous materials (such as hydrocarbons, chemicals and reagents) from storage or handling areas. Storage of hazardous materials during the construction period will be limited to temporary storage areas holding minor quantities of oils and grease for maintenance, and fuel supply for small construction equipment.

Hazardous waste will be temporarily stored onsite prior to disposal to an appropriately licensed facility. All such materials will be stored within a sealed, covered and bunded area. Refuelling of larger equipment and generators will occur within the Project Area, but preference will be given to off-site refuelling for general vehicles, where practical, to limit storage and handling volumes within the Project Area. Due to the limited scale of hazardous material storage, any accidental releases are expected to be small. Further, any potential contamination will be localised and restricted to the surface of the soil profile. The depth of localised contamination could increase beyond the soil surface if releases are not rectified in a timely manner.

There will be no soil or land impacts within the Project Area relating to the disposal of waste products. Waste from all waste streams, including used oils/greases and municipal waste, will be disposed or recycled to an appropriate off-site waste management facility.

Contamination and erosion during operation

Stormwater is road run-off that occurs during and following rainfall. Stormwater runoff from the operational road is likely to include pollutants deposited on the tarmac by vehicles. Exhaust gases and lubricants release lead, hydrocarbons, nickel and bromine. Iron and chromium detach from corroded bodywork, while sulphur, chlorine and cyanide are dispersed via cooling liquids. In addition, tyres deposit rubber particles containing lead, cadmium and zinc on the tarmac (ENI School, n.d.).

Stormwater run-off can result in bank erosion and transport of contaminants to soils if not managed appropriately. Drainage infrastructure will be in place to contain and control stormwater, therefore direct release to soils or land is unlikely. Volumes of hydrocarbons on the road are not likely to be significant, however if a large-scale discharge does occur it could be released beyond the road infrastructure if not adequately managed.

Loss of soil function

The constructed Project will be a permanent bituminised road surface which will result in impairment of soil function below the road surface. Soil function may be retained if topsoil is separated, stockpiled and re-used for landscaping. Significant fill may be required in low lying areas to provide suitable elevation for the Project in relation to flood risk. This will also result in the loss or alteration of soil structure.

Indirect impacts

Salinisation and erosion of soils

Clearing of deep-rooted native vegetation has the potential to increase salinisation and erosion of soils, particularly in agricultural areas, which are prone to salinity and erosion. Vegetation helps to stabilize soil and restrict upward movement of water tables which bring salts up the soil profile. Clearing of native deep-rooted vegetation is a major driver of salinity in the south-west of WA and this can affect the productivity of agricultural crops (GoWA, 2018a).

Salinisation is a potential impact within the Project Area, particularly in the poorly drained areas on Pinjarra Plain soils. However, the risk of dryland salinity on the SCP as a result of clearing native vegetation is known to be low (Simons, George, & Raper, 2013).

Vegetation clearing and soil excavation can increase the potential for soil erosion because of altered surface water drainage patterns and the effect of wind on exposed dry soils. Erosion impacts can potentially lead to poor soil structure, reduced water infiltration and general loss of soil health.

3.5.5 Mitigation

The risks associated with potential impacts to Terrestrial Ecosystem Quality, specifically ASS and contaminated sites are considered relatively minor and manageable. Main Roads has extensive experience with the management of these risks in similar projects throughout the south west of WA. Impacts will be avoided and minimised through the following mitigation and management measures:

- Developing a Project design to minimise environmental impacts as far as practicable
- The selection of engineering and drainage solutions to avoid and minimise environmental impacts
- Compliance with State and Commonwealth environmental legal requirements
- Preparation and implementation of a Project specific CEMP that addresses issues specifically related to terrestrial ecosystem quality including:
  - Complaints response and management
  - Vegetation management, and clearing procedures and processes
  - Topsoil management
  - Acid Sulfate Soil (ASS) management
  - Dieback and weed management
  - Wetlands, drainage and groundwater management
  - Construction management (noise, vibration and dust)
  - Hazardous materials management
  - Fire risk management
  - Environmental incident reporting and management
- The CEMP will include targets and key performance indicators, management actions, monitoring requirements and contingency measures.

3.5.6 Predicted outcome

Based on the information available to support the EIA the potential risks to the terrestrial ecosystem quality associated with construction and operation of the Project are likely to be able to be effectively managed through implementation of mitigation measures.

Additional surveys would be required if this alignment is selected as the preferred option, however it is considered that the Project would meet the EPA objective to maintain the quality of land and soils so that environmental values are protected.

3.6 Key Environmental Factor – Inland Waters

3.6.1 Studies undertaken

The following studies have been undertaken for this aspect:

- Water quality sampling was undertaken as part of the BORR Alternate Alignment: Targeted Conservation Significant Aquatic Fauna Survey (WRM, 2018)
- Desktop information has been assessed for this aspect including the DWER datasets (GoWA, 2019a).

3.6.2 Receiving environment

Desktop searches of the DWER datasets (GoWA, 2019a) were undertaken and are summarised in Table 3-17.

Table 3-17 Hydrology queries within the Project Area

ASPECT	DETAILS	RESULT
Groundwater Areas	Groundwater areas proclaimed under the RIWI Act.	Bunbury Groundwater area Busselton-Capel Groundwater Area
Surface Water Areas	Surface water areas proclaimed under the RIWI Act.	Capel River System
Rivers	Rivers proclaimed under the RIWI Act.	None
Public Drinking Water Source Areas (PDWSAs)	PDWSA is a collective term used for the description of Water Reserves, Catchment Areas and Underground Pollution Control Areas declared (gazetted) under the provisions of the *Metropolitan Water Supply, Sewage and Drainage Act 1909* or the *Country Area Water Supply Act 1947.*	None
Waterways Conservation Areas	Areas proclaimed under the *Waterway Conservation Act 1976*.	None

Surface water

The southern half of the Project is in a proclaimed Surface Water Area; the Capel River System. Within the Project Area, the agricultural land is often flooded in the wetter months (i.e. palusplain wetlands) and is dissected with numerous minor drainage lines (GoWA, 2019a). Notably, two natural brooks are intersected by the Project Area; Gynudup Brook and Five Mile Brook, however these are not proclaimed under the RIWI Act (Figure 8).

Surface water quality

Four wetlands were sampled as part of the BORR Alternate Alignment Aquatic Fauna Survey (WRM, 2018). In situ water quality was generally good and characterised by slightly acidic pH (6.23 to 6.68), variable dissolved oxygen (DO) (28.7% to 170.8%), and warm temperatures (18.5 ºC to 25 ºC). All wetlands were fresh with electrical conductivity (EC) ranging from 183 µs/cm to 1422 µs/cm.

The pH at all wetlands was slightly below the guidelines (ANZECC & ARMCANZ, 2000) for the protection of slightly/moderately disturbed wetland ecosystems in the southwest of WA (pH 7 – 8.5) (Table 3-18).

Table 3-18 *In situ* water quality results from all wetlands sampled

WETLAND	WETLAND CODE	TEMP (°C)	CONDUCTIVITY (µS/cm)	PH	OXYGEN %	OXYGEN (mg/l)	CONSERVATION CATEGORY/ UFI
1	1a	22.0	1422	6.51	28.7	2.09	MU UFI 1189
	1b	25.0	983	6.67	95.5	8.55	RE UFI 1170
2	2	21.1	855	6.68	170.8	15.01	RE UFI 1180
3	3a	22.7	596	6.62	57.7	5.03	Unmapped however assumed to be a combination of CCW UFI 16075, 16076, 16077 and 16088) (previously RE UFI 1149)
	3b	21.0	365	6.57	103.9	7.77	CCW UFI 16079 and UFI 16080 (previously MU UFI 1150
	3c	19.0	380	6.61	100.0	7.80	MU UFI 1150
4	4a	18.8	278	6.42	49.5	4.43	MU UFI 1014
	4b	18.5	183	6.23	102.0	8.18	MU UFI 1014

Note: CCW – Conservation Category Wetland, RE – Resource Enhancement, MU – Multiple Use

Wetlands of international significance

There are no internationally significant (Ramsar) wetlands located within 10 km of the Project Area. The nearest Ramsar wetland (Vasse-Wonnerup System) is located approximately 13 km to the south west of the Project Area (GoWA, 2019a).

Geomorphic wetlands

Wetlands on the SCP have been classified (Hill, Semeniuk, Semeniuk, & del Marco, 1996) using a geomorphic-hydrologic approach to wetland classification (Semeniuk & Semeniuk, 1995). These wetlands have also been evaluated and assigned an appropriate management category which provides guidance on the nature of wetland management and protection that the wetland should be afforded.

There are 24 mapped Geomorphic Wetlands, comprising just under 75 ha, intersected by the Project Area including five Conservation Category Wetlands (CCW), three Resource Enhancement and 16 Multiple Use Geomorphic Wetlands (GoWA, 2019a). The mapped Geomorphic Wetlands include:

- Approximately 1 ha of Conservation Category Wetlands (0.5 % of the Project Area)
- < 1 ha of Resource Enhancement wetlands (0.1 % of the Project Area)
- Approximately 73 ha of Multiple Use wetlands (33 % of the Project Area).

In addition, the DBCA managed Roselands Nature Reserve lies directly adjacent to the Project Area. The Roselands Nature Reserve is known to support (BORR IPT, 2019a):

- Conservation Category Wetland
- *Eleocharis keigheryi* (listed as Vulnerable) and another five Priority listed flora taxa
- *Corymbia calophylla – Xanthorrhoea preissii* woodlands and shrublands (FCT3c) (TEC)
- Herb rich shrublands in clay pans (FCT08) (TEC).

The wetlands within the Project Area are detailed below in Table 3-19 and mapped in Figure 8.

Table 3-19 Geomorphic wetlands within the Project Area

GEOMORPHIC WETLAND IDENTIFICATION (UFI)	WETLAND TYPE	CLASSIFICATION	TOTAL AREA WETLAND (ha)	MAPPED WETLAND VEGETATION TYPE/ DESCRIPTION (BORR IPT 2019A AND B)	VEGETATION CONDITION (BORR IPT 2019A AND B)	EXTENT WITHIN PROJECT AREA (ha)
955	Palusplain	Conservation	5.0	VT02 Woodland *Eucalyptus rudis* and *Melaleuca rhaphiophylla* over sparse shrubland over open sedgeland. Cleared.	Degraded to Completely Degraded	1.2
16075	Sumpland	Conservation	<0.1	VT01b Isolated trees *Eucalyptus rudis* and *Corymbia calophylla* over closed grassland. VT03 Woodland *Melaleuca preissiana* and *M. rhaphiophylla* over tall sparse shrubland over sedgeland.	Degraded	<0.1
16076	Sumpland	Conservation	0.2	VT03 Woodland *Melaleuca preissiana* and *M. rhaphiophylla* over tall sparse shrubland over sedgeland. Cleared.	Degraded to Completely Degraded	<0.1
16077	Sumpland	Conservation	2.4	VT01b Isolated trees *Eucalyptus rudis* and *Corymbia calophylla* over closed grassland. VT03 Woodland *Melaleuca preissiana* and *M. rhaphiophylla* over tall sparse shrubland over sedgeland. Cleared.	Degraded to Completely Degraded	<0.1
16078	Sumpland	Conservation	0.4	VT03 Woodland *Melaleuca preissiana* and *M. rhaphiophylla* over tall sparse shrubland over sedgeland. VT07 Woodland *Agonis flexuosa* and *Eucalyptus marginata* with scattered *Banksia attenuata*. Cleared.	Degraded to Completely Degraded	<0.1

GEOMORPHIC WETLAND IDENTIFICATION (UFI)	WETLAND TYPE	CLASSIFICATION	TOTAL AREA WETLAND (ha)	MAPPED WETLAND VEGETATION TYPE/ DESCRIPTION (BORR IPT 2019A AND B)	VEGETATION CONDITION (BORR IPT 2019A AND B)	EXTENT WITHIN PROJECT AREA (ha)
1149	Sumpland	Resource Enhancement	0.2	VT03 Woodland *Melaleuca preissiana* and *M. rhaphiophylla* over tall sparse shrubland over sedgeland. Cleared.	Degraded to Completely Degraded	0.2
1164	Sumpland	Resource Enhancement	3.3	Cleared.	Completely Degraded	<0.1
1180	Sumpland	Resource Enhancement	3.4	VT02 Woodland *Eucalyptus rudis* and *Melaleuca rhaphiophylla* over sparse shrubland over open sedgeland. VT03 Woodland *Melaleuca preissiana* and *M. rhaphiophylla* over tall sparse shrubland over sedgeland.	Good to Completely Degraded	0.1
777	Sumpland	Multiple Use	20.4	VT02 Woodland *Eucalyptus rudis* and *Melaleuca rhaphiophylla*. Cleared.	Degraded to Completely Degraded	3.7
935	Dampland	Multiple Use	2.0	VT03 Woodland *Melaleuca preissiana* and *M. rhaphiophylla* over tall sparse shrubland over sedgeland. VT06 Woodland *Banksia attenuata*, *Eucalyptus marginata*, +/- *Agonis flexuosa* over occasional tall open shrubland. Cleared.	Completely Degraded	0.8
938	Dampland	Multiple Use	9.8	VT01a *Corymbia calophylla* and *Eucalyptus marginata* +/- *Agonis flexuosa* over closed grassland. VT01c Isolated trees *Corymbia calophylla* and *Eucalyptus marginata* +/- Banksia spp. over closed grassland. VT03 Woodland *Melaleuca preissiana* and *M. rhaphiophylla* over tall sparse shrubland over sedgeland. Cleared	Degraded to Completely Degraded	0.7

GEOMORPHIC WETLAND IDENTIFICATION (UFI)	WETLAND TYPE	CLASSIFICATION	TOTAL AREA WETLAND (ha)	MAPPED WETLAND VEGETATION TYPE/ DESCRIPTION (BORR IPT 2019A AND B)	VEGETATION CONDITION (BORR IPT 2019A AND B)	EXTENT WITHIN PROJECT AREA (ha)
953	Sumpland	Multiple Use	15.4	VT01b Isolated trees *Eucalyptus rudis* and *Corymbia calophylla* over closed grassland. VT03 Woodland *Melaleuca preissiana* and *M. rhaphiophylla* over tall sparse shrubland over sedgeland. VT06 Woodland *Banksia attenuata*, *Eucalyptus marginata*, +/- *Agonis flexuosa* over occasional tall open shrubland. Cleared.	Good to Completely Degraded	1.6
982	Dampland	Multiple Use	1.3	VT01b Isolated trees *Eucalyptus rudis* and *Corymbia calophylla* over closed grassland. Cleared.	Completely Degraded	1.2
1044	Dampland	Multiple Use	2.0	Cleared.	Completely Degraded	1.4
1159	Dampland	Multiple Use	2.6	VT06 Woodland *Banksia attenuata*, *Eucalyptus marginata*, +/- *Agonis flexuosa* over occasional tall open shrubland. Cleared.	Completely Degraded	0.2
1163	Sumpland	Multiple Use	21.1	Unsurveyed – aerial photography shows that this is gravel road and vegetated.	Unknown to Completely Degraded	0.5
1168	Dampland	Multiple Use	2.8	VT03 Woodland *Melaleuca preissiana* and *M. rhaphiophylla* over tall sparse shrubland over sedgeland. Cleared.	Degraded to Completely Degraded	0.2
1169	Dampland	Multiple Use	30.1	VT03 Woodland *Melaleuca preissiana* and *M. rhaphiophylla* over tall sparse shrubland over sedgeland.	Degraded to Completely Degraded	2.5

GEOMORPHIC WETLAND IDENTIFICATION (UFI)	WETLAND TYPE	CLASSIFICATION	TOTAL AREA WETLAND (ha)	MAPPED WETLAND VEGETATION TYPE/ DESCRIPTION (BORR IPT 2019A AND B)	VEGETATION CONDITION (BORR IPT 2019A AND B)	EXTENT WITHIN PROJECT AREA (ha)
				VT06 Woodland *Banksia attenuata*, *Eucalyptus marginata*, +/- *Agonis flexuosa* over occasional tall open shrubland. Cleared.		
1171	Dampland	Multiple Use	2.4	VT03 Woodland *Melaleuca preissiana* and *M. rhaphiophylla* over tall sparse shrubland over sedgeland. Cleared.	Completely Degraded	0.8
1177	Sumpland	Multiple Use	2.4	VT02 Woodland *Eucalyptus rudis* and *Melaleuca rhaphiophylla* over sparse shrubland over open sedgeland. Cleared.	Good to Completely Degraded	0.4
1178	Sumpland	Multiple Use	5.6	VT06 Woodland *Banksia attenuata*, *Eucalyptus marginata*, +/- *Agonis flexuosa* over occasional tall open shrubland. Cleared.	Completely Degraded	1.6
1179	Sumpland	Multiple Use	20.1	VT02 Woodland *Eucalyptus rudis* and *Melaleuca rhaphiophylla* over sparse shrubland over open sedgeland. VT03 Woodland *Melaleuca preissiana* and *M. rhaphiophylla* over tall sparse shrubland over sedgeland. VT07 Woodland *Agonis flexuosa* and *Eucalyptus marginata* with scattered *Banksia attenuata*. Cleared	Good to Completely Degraded	0.4
13229	Palusplain	Multiple Use	114.8	Unsurveyed – Aerial photography shows cleared paddock, roads and scattered trees.	Likely to be Degraded to Completely Degraded	3.8

GEOMORPHIC WETLAND IDENTIFICATION (UFI)	WETLAND TYPE	CLASSIFICATION	TOTAL AREA WETLAND (ha)	MAPPED WETLAND VEGETATION TYPE/ DESCRIPTION (BORR IPT 2019A AND B)	VEGETATION CONDITION (BORR IPT 2019A AND B)	EXTENT WITHIN PROJECT AREA (ha)
15809	Palusplain	Multiple Use	42,322.2	VT01a *Corymbia calophylla* and *Eucalyptus marginata* +/- *Agonis flexuosa* over closed grassland. VT01b Isolated trees *Eucalyptus rudis* and *Corymbia calophylla* closed grassland. VT02 Woodland *Eucalyptus rudis* and *Melaleuca rhaphiophylla* over sparse shrubland over open sedgeland. VT03 Woodland *Melaleuca preissiana* and *M. rhaphiophylla* over tall sparse shrubland over sedgeland. VT06 Woodland *Banksia attenuata*, *Eucalyptus marginata*, +/- *Agonis flexuosa* over occasional tall open shrubland. Cleared.	Degraded to Completely Degraded	53.6
Total						**74.8**

* Wetland observations are based on field surveys carried out for flora and vegetation (BORR IPT 2019 a and b), fauna surveys (WRM, 2018; Biota, 2019b) and aerial photographs (for wetlands not assessed during field surveys).

Groundwater

The Project is within the Bunbury Groundwater Area and the Busselton-Capel Groundwater Area, as proclaimed under the RIWI Act (GoWA, 2019a).

3.6.3 Potential impacts

The Project activities that have the potential to impact on Inland Waters during construction include vegetation clearing, earthworks and the construction of drainage structures.

In the absence of suitable mitigation and management, the potential impacts that may occur to Inland Waters as a consequence of developing the Project include:

- Loss of approximately 75 ha of mapped Geomorphic Wetlands, including:
  - Approximately 1 ha of Conservation Category Wetlands (0.5 % of the Project Area)
  - <1 ha of Resource Enhancement wetlands (0.1 % of the Project Area)
  - Approximately 73 ha of Multiple Use wetlands (33 % of the Project Area)
- Direct impacts to the bed and banks of waterways (erosion, sedimentation and scouring) at Five Mile Brook, Gynudup Brook, minor drainage lines, CCW and RE wetlands
- Impacts to surface water flows causing changes to wetland water quality, including the DBCA managed Roselands Nature Reserve which lies directly adjacent to the Project Area
- Indirect impacts from construction including dust and pollution
- Contamination of ground and/or surface water from exposure to PASS or contaminants.

3.6.4 Assessment of impacts

Direct Impacts

Dewatering for construction activities

Once detailed design has been completed, a detailed investigation will be carried out to determine final construction methods and dewatering requirements for construction of the Project. Dewatering activities will be temporary and impacts are likely to be restricted in spatial extent.

Changes to groundwater levels in the shallow aquifer associated with clearing

Vegetation clearing within the Project Area has the potential to allow the groundwater level to rise and flood the surrounding area. However, given that the majority of the Project Area has been cleared for farmland, proposed clearing requirements are linear and areas of contiguous vegetation outside of the Project Area will be retained, groundwater level rise as a result of the Project activities is considered unlikely to occur.

Erosion and sedimentation

Clearing of vegetation, construction earthworks and altered surface water regimes have the potential to destabilise soils and, if unmanaged, result in erosion of the Project Area and sedimentation of surrounding drainage infrastructure, vegetation, wetlands and waterways.

Contamination of surface water and groundwater

Contamination of surface water and groundwater may result during the construction phase as a result of the unintended release of environmentally hazardous materials during onsite works (construction materials and hazardous materials stored onsite), runoff during stormwater events and contaminated sediment or settled dust.

Surface and/or groundwater may also become contaminated through the exposure of ASS during construction (excavation). ASS disturbance may have a range of impacts including enhanced phosphorus leaching, death of vegetation irrigated with affected water, the smothering of benthic aquatic animals by the precipitation of iron, and metal bioaccumulation in aquatic plants and animals.

Contaminated surface water and groundwater has the potential to impact sensitive receptors including neighbouring properties, vegetation, fauna, wetlands and waterways. Impacts can also manifest downstream as loss of benthic habitat, fish deaths and damage to vegetation health.

Alteration of hydrological flow to Geomorphic Wetlands and minor waterways

Construction of the Project will involve the loss of wetlands within the Project Area. Filling the wetlands and clearing the vegetation will directly alter the existing surface water flow regime within the Project Area and adjacent wetlands. Significant fill may be required in low lying areas to provide suitable elevation for the Project in relation to flood risk. This has the potential to adversely affect the function of surrounding wetland and river systems, including changes in the vegetation structure of GDEs and surrounding agricultural properties.

Once constructed, the bituminised road will prevent infiltration from occurring, however, due to the localised management of stormwater where it will be collected, it is not considered that the Project will significantly restrict rainfall recharge to the superficial aquifer such as to significantly lower groundwater levels and/or change the volume of water available to surrounding wetlands.

Climate change

The drying climate in the South West region could result in reduced groundwater and surface water availability, increased seawater intrusion and a greater risk of impacts of abstraction on GDEs (DoW, 2015). Sea level rise is also a major consideration of infrastructure projects on the coastal zone.

In accordance with the Main Roads Guideline on Climate Change (MRWA Doc No. D10#97260), the impacts of climate change have been considered during the planning for the Proposal. The Main Roads Guideline specifies that the impacts of a 300 mm sea level rise is considered as part of planning, design and construction for all projects near coastal areas.

The Main Roads Guideline specifically addresses the potential impacts on rainfall patterns as a result of climate change. The guideline recommends that Intensity Frequency Duration (IFD) rainfall data are adjusted for future climate change. This recommendation will be incorporated in a review of the effects of rainfall intensification for transverse drainage at the detailed design stage.

3.6.5 Mitigation

Impacts to inland waters will be minimised through the following mitigation and management measures:

- Developing a Project design to minimise environmental impacts as far as practicable
- The selection of engineering and drainage solutions to avoid and minimise environmental impacts
  - In particular, detailed drainage design will maintain fish passage (Black-stripe Minnow) under the constructed road (culverts or other) to provide connection between Geomorphic Wetlands on either side of the road
- Compliance with State and Commonwealth environmental legal requirements
- Preparation and implementation of a Project specific CEMP that addresses issues related to inland waters including:
  - Complaints response and management
  - Vegetation management, and clearing procedures and processes
  - Topsoil management
  - Acid Sulfate Soil (ASS) management
  - Wetlands, drainage and groundwater management
  - Construction management (noise, vibration and dust)
  - Hazardous materials management
  - Environmental incident reporting and management
- The CEMP will include targets and key performance indicators, management actions, monitoring requirements and contingency measures.

3.6.6 Predicted outcome

The existing hydrological processes are in a largely modified state due to historical clearing and draining of land within the Project Area for agricultural purposes Based the information available to support the EIA it is anticipated that the potential impacts to inland waters associated with the Project are manageable with the implementation of the mitigation measures proposed and no residual impacts are anticipated. This will be confirmed as part of the studies undertaken once the alignment is finalised.

3.7 Key Environmental Factor – Air Quality

3.7.1 Studies undertaken

No specific studies have been undertaken for air quality to date.

3.7.2 Receiving environment

Climate

Bunbury is located on the south-western corner of Western Australia and the climate of the Project Area is broadly described as Mediterranean, with hot dry summers and cool wet winters. The nearest Bureau of Meteorology (BoM) official recording station is Bunbury (Station No. 9965), located approximately 8 km north of the Project Area.

The area has a mean annual rainfall of 726.1 mm. The area experiences a wide range of temperatures, with mean maximum temperatures of approximately 30°C in summer and 17°C in winter (BoM, 2019).

Table 3-20 Climate data – Bureau of Meteorology Bunbury Station No 9965

CLIMATIC VARIABLE	RANGE
Mean Annual Maximum Temperature Range	17.3°C in July to 30°C in February
Mean Annual Minimum Temperature Range	7.1°C in July to 15.9°C in February
Mean Annual Rainfall	726.1 mm
Mean Annual Rain days per year	84.5

Sensitive receptors

Sensitive receptors are any place where people are likely to reside in a non-occupational setting. This may include dwellings, schools, hospitals or public recreational areas (NSW Department of Environment and Conservation, 2005). As the majority of the Project Area is situated in Rural zoned land with a minimal number of dwellings within proximity, it is anticipated there is a low number of sensitive receptors.

Bunbury Regional Airshed

The Project is within the Bunbury Regional Airshed, which encompasses an area approximately 38,610 km^2 and includes 22 Shires, including the entire City of Bunbury and Shire of Capel.

The major economic activities in the Bunbury Regional Airshed are very diverse and include mining, agriculture, tourism, forestry and manufacturing. Motor vehicles dominate the emissions of carbon monoxide (CO), volatile organic carbon (VOC) and nitrous oxides (NO_x) (SKM, 2003).

3.7.3 Potential impacts

Potential direct construction impacts that may occur to Air Quality as a consequence of developing the Project are:

- Increased construction vehicle emissions
- Dust generated from construction activities
- Smoke from bushfires proximate to the Project
- Impacts from car emissions

- Increased greenhouse gas (GHG) emissions.

The construction of the Project has the potential to reduce air quality via increased road vehicle and GHG emissions.

The operation of the Project may reduce vehicle emissions in the local and regional airshed as a consequence of improved traffic flows and improved vehicle efficiency.

Major vehicle pollutants include products of combustion, such as CO, particulate matter with an aerodynamic diameter of 10 microns or less (PM10), NOx, and VOCs. The human health effects of these air pollutants range from mild airway irritations to major organ damage. Many of the emissions from motor vehicles react together and with pollutants from other sources to form secondary pollutants, such as photochemical oxidants (ozone; O3), which can also have significant effects.

Potential indirect impacts from dust generated during construction may include impacts to vegetation and changes to vegetation communities directly adjacent to construction works.

Indirect impacts may also include GHG emissions associated with operation of Main Roads buildings, depots and light vehicle fleet (emission from power generation and vehicles).

3.7.4 Assessment of impacts

Construction vehicle emissions

Construction works for the Project will involve operation of heavy machinery and vehicles. Some minor increase in emissions associated with the construction activities is expected but will be temporary – expected to occur for 2-3 years during construction. The impacts associated with these emissions is not considered likely to be significant.

Dust impacts during construction

Construction works for the Project will involve the operation of loaders, dozers, graders, excavators and trucks to clear vegetation (where present) from the Project Area, and to excavate and remove material from areas of the site for use as fill within other areas of the site. There will also be miscellaneous vehicle movements around the Project Area as part of the construction works.

If unmanaged, these activities can result in dust emissions due to:

- Movement of vehicles and heavy equipment on unsealed surfaces
- Excavating, spreading and compacting soils
- Wind erosion from exposed and disturbed soil surfaces.

Dust may be a nuisance to nearby sensitive receptors if unmitigated during construction activities, however is not considered to have an adverse impact on local air quality.

Reduced air quality due to bushfire

Construction activities have the potential to ignite bushfires through hot work and vehicle movements, which could cause a temporary reduction in local air quality. Potential risks associated with bushfires are considered low and will be managed through appropriate mitigation as part of the CEMP. No significant impacts resulting from accidental bushfires are expected.

Impacts from car emissions

Pollutant concentrations emitted from a vehicle, depends on the type of vehicle (passenger, light or heavy vehicle), fuel type (petrol, diesel or LPG) and driving conditions (grade of slope, congestion and road conditions). Emissions profiles will also vary over time as new vehicle emission standards become effective.

An Air Quality Impact Assessment will be undertaken if this alignment is selected for development.

Greenhouse gas emissions impacts

The operation of site offices, light diesel powered vehicles and heavy equipment for construction of the Proposal will result in indirect generation of GHG emissions.

An assessment of GHG emissions for the construction phase of the Project will be undertaken to quantify direct emissions and therefore, determine the requirement for management measures.

3.7.5 Mitigation

Main Roads has a carbon reduction target of 5% of 2010 carbon emission by 2020, with a stretch target reduction of 15% through improving energy efficiency. Opportunities to reduce ongoing energy include, but are not limited to the following, where practicable:

- Use of energy efficient electrical assets such as LED street lights
- Reducing the expansion of traffic signals and Main Roads has adopted a policy of alternative design treatments such as roundabouts or modified intersections to assist with reducing congestion
- Use of renewable energy sources
- Use of materials with lower embodied energy.

Impacts to air quality will be minimised through the following mitigation and management measures:

- Developing a Project design to minimise environmental impacts as far as practicable
- The selection of engineering solutions to avoid and minimise environmental impacts
- Compliance with State and Commonwealth environmental legal requirements
- Preparation and implementation of a Project specific CEMP that addresses issues related to air quality including:
  - Complaints response and management
  - Construction management (noise, vibration and dust)
  - Hazardous materials management
  - Fire risk management
  - Environmental incident reporting and management
- The CEMP will include targets and key performance indicators, management actions, monitoring requirements and contingency measures.

3.7.6 Predicted outcome

Dust is anticipated to be generated during construction. This impact will be controlled using standard mitigation measures, such as watering trucks. Appropriate measures will be implemented to ensure the short term construction related air quality impacts are effectively managed.

It is considered unlikely that ongoing street lighting, traffic signals and road maintenance activities would produce significant GHG emissions for the Project. However, construction and operation of the Project will be subject to an assessment for direct GHG emissions.

Given these proposed measures, no residual impacts are expected for this aspect.

3.8 Key Environmental Factor – Social Surroundings

3.8.1 Studies undertaken

The following studies have been undertaken for this aspect:

- European Heritage Assessment (D.G. Burnside and Associates, 2019).

3.8.2 Receiving environment

European heritage

A search of the EPBC Protected Matters Search Tool did not identify any Commonwealth listed heritage sites within the Project Area, or within 10 km of the Project Area (DotEE, 2018).

The State Heritage Office dataset indicated that there are no State Heritage sites within 200 m of the Project Area (GoWA, 2018b).

A European Heritage survey was undertaken of the BORR Southern Section Alternative Alignment in January 2019 (D.G. Burnside and Associates, 2019). The report was prepared using documentary information about the built heritage of the Gelorup-Stratham-Elgin area, and information provided from 13 interviews with landholders in the area. A total of eleven sites were identified that are of value to the interviewees, including two that occur in the Project Area (Figure 12) (and are listed on the Shire of Capel Municipal Heritage register):

- Elgin Sports Club, Boyanup West Road, Stratham
- Stratham School (2nd Site), Boyanup West Road, Stratham.

The remaining nine sites are also listed on the Shire of Capel Municipal Heritage register and occur in the local area surrounding the Project Area. These sites include:

- Stratham Park (corner Bussell Highway and Fishermans Road, Stratham)
- The Bridge Homestead, Elgin Road, Elgin
- All Souls Church, Boyanup West Road
- 'Roselands' former homestead
- 'Sunnyside', a current homestead
- Elgin Hall
- 'Rosemore' former homestead, Stratham
- Minninup Church, Lot 68 Minninup Road, Stratham
- Elgin PO and Phone Exchange, Elgin Road, Capel.

The complex family relationships in the area link back to an expressed strong sense of belonging to the land, and its agricultural use and features such as wetlands and drainage networks. The areas associated with this social heritage are the cultural traditions that were said to be important in sustaining the community (D.G. Burnside and Associates, 2019).

Aboriginal heritage

A search of the Aboriginal Heritage Inquiry System identified one Registered Aboriginal Heritage site; Capel Bussell Highway (Site 5813) (DPLH, 2019). This site will be directly impacted by the Project. Site 5813 is recorded as a Registered site, comprised of Artefacts / Scatter, Arch Deposit and Camp.

One 'Other Heritage Places' was identified within the Project Area (Place ID 37870) which is referred to as 'The Gelorup Corridor'. Place ID 37870 has been Lodged and is comprised of Artefacts/ Scatter, Ceremonial, Skeletal Material/ Burial (DPLH, 2019).

Gynudup Brook is located in the southern section of the Project Area and is intersected by the Project Area in three locations. The name of this waterway means "*good campground near water*" and therefore, highlights its importance to Aboriginal people (GeoCatch, 2004).

Land use

The GBRS indicates the Project Area is zoned as "Special rural", with the eastern part also zoned as "Rural" (DPLH, 2018). Land use is predominantly agricultural.

The Project traverses the Mineral and Basic Raw Materials Strategic Resource Area identified under the GBRS in the section south of Boyanup West Road to Bussell Highway.

Demography and economy

The Project Area is 9 km south-east of the Bunbury CBD and 0.8 km from the suburb of Gelorup and 3.3 km from the suburb of Dalyellup, in the Shire of Capel.

The Shire of Capel had an estimated resident population of 17,894 for June 2017 (ABS, 2018). Health care and social assistance is the main industry accounting for 13% of employment, followed by construction accounting for 12%.

The Greater Bunbury region, which includes the Shires of Capel, Dardanup and Harvey as well as the City of Bunbury, had a population of 89,628 in 2016 (ABS, 2018). Construction is the main industry accounting for 12.8% of employment, with manufacturing accounting for approximately 11.8%.

Visual amenity

The SCP is characterised as a low lying coastal plain mainly covered with woodlands, with rare landscape features such as Holocene dunes and wetlands. Bushland is often retained as a visual or spatial buffer between land uses (Mitchell, Williams, & Desmond, 2002). Changes to amenity are greatest in areas with a high perceived scenic amenity value and are visible from public locations, such as roads, walk trails and lookouts.

The existing amenity of the Proposal Area includes pockets of native vegetation, rural/ agricultural areas, existing roads and previously cleared areas.

Noise

The Project will result in a major highway being located within an existing rural environment. Noise sensitive receptors include approximately 10 residences within 200 m of the Project, between Hasties Road and Bussell Highway.

3.8.3 Potential impacts

Project activities that have the potential to impact social surroundings during construction include vegetation clearing, earthworks and off-site transport.

The potential construction impacts include:

- Heritage site disturbance during clearing and/or excavation works
- Changes to visual amenity
- Noise impacts to sensitive receptors, from noise emissions generated by construction
- Vibration generated by construction
- Increased traffic on local road network.

The potential operational impacts on social surroundings as a consequence of developing the Project are:

- Separation of sections of rural properties potentially resulting in loss of economies of scale for agricultural production and reduced viability
- Loss of productive agricultural land
- Impacts to visual amenity
- Noise impacts to sensitive receptors through noise emissions from the road.

3.8.4 Assessment of impacts

Direct Impacts

Heritage Site disturbance during clearing and/ or excavation works

Two European Heritage places will be impacted by the development of the Project; the Elgin Sports Club and the Stratham School (2nd Site). The area of the Elgin Sports Club that was historically used for cricket matches will likely need to be removed. Further investigation is required to determine the full extent of the impact (i.e. the exact location of the cricket pitch). No structures associated with the Stratham School (2nd Site) will need to be removed.

The buffered extent of one Registered Aboriginal Heritage site (Capel Bussell Highway, Site ID 5813) and one Other Heritage Place (The Gelorup Corridor, Place ID 37870) are intersected by the Project Area. However, the values of these sites are unlikely to apply within the Project Area. Further investigation of these heritage sites will be required if this Project is selected for further investigation.

Noise and vibration impacts resulting from construction and operation

Noise and vibration impacts are expected to result from the construction phase, however these impacts are expected to be short in duration and are not considered significant. Noise and vibration impacts during construction will be managed under a Project specific CEMP.

The Project will result in the exposure of noise sensitive residences to traffic noise from the highway. The extent of impact will be determined through a Traffic Noise Assessment for the Project, should it be selected as the preferred alignment. Noise management will be implemented to comply with SPP 5.4 (WAPC, 2009). Management measures may include the installation of noise walls and / or treatments to individual properties to comply with SPP 5.4 (WAPC, 2009).

Noise mitigation measures will be developed during the detailed design phase for operation of the Project to be compliant with the requirements of SPP 5.4 (WAPC, 2009).

Reduced visual amenity

Direct and permanent impacts to visual amenity of the existing rural area are expected to result from this Project.

An assessment of the impacts to visual amenity will be completed if this alignment is selected as the preferred option. The results of the assessment and potential mitigation measures will be included in relevant documentation to support the formal referral and assessment of the Project through the EP Act as necessary.

Glare or light spill on sensitive receptors

There will be minor change in the local light environment as a result of the Project. It is anticipated that only intersections and interchanges will be lit.

Indirect Impacts

Indirect impacts from the Project on social surrounds are anticipated. Loss of productive agricultural land and separation of sections of rural properties may affect the economic viability of affected agricultural properties.

3.8.5 Mitigation

Impacts to social surroundings will be minimised through the following mitigation and management measures:

- Developing a Project design to minimise environmental impacts as far as practicable
- Consider access to properties and separation of property sections through Project design
- The selection of engineering solutions to avoid and minimise environmental impacts
- Conduct a Traffic Noise Assessment and implement noise mitigation measures at noise sensitive receptors, to comply with State Planning Policy 5.4 Road and Rail Transport Noise and Freight Considerations in Land Use Planning

- Conduct visual impact assessment and implement mitigation measures
- Compliance with State and Commonwealth environmental legal requirements
- Preparation and implementation of a Project specific CEMP that addresses issues related to social surroundings including:
  - Complaints response and management
  - Heritage site management
  - Construction management (noise, vibration and dust)
  - Hazardous materials management
  - Fire risk management
  - Environmental incident reporting and management
- The CEMP will include targets and key performance indicators, management actions, monitoring requirements and contingency measures.

3.8.6 Predicted outcome

Potential impacts on Aboriginal and European Heritage sites associated with the Project will be managed through consultation with all relevant groups and undertaken in accordance with State and Commonwealth legislation. Potential impacts to Aboriginal Heritage will be managed through the AH Act.

Construction and operation of the Project has potential to result in impacts to visual amenity and localised change in the landscape and land use. If selected as the preferred alignment option, the potential impact of these changes will be assessed and mitigation measures developed. Impacts to visual amenity will be considered during the detailed design phase and mitigated through the implementation of landscaping and other measures during construction via the CEMP.

Mitigation measures identified in the Traffic Noise Assessment will be developed during the detailed design phase of the Project if the alignment is selected as the preferred option.

Impacts on rural community amenity and agricultural production including sterilisation of productive land, reducing carrying capacity and restricted access will be considered through the detailed design phase of the project and investigated further if the alignment is selected as the preferred option.

4 MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE

A search of the Protected Matters Search Tool (PMST) identified several Matters of National Environmental Significance that may be impacted by the Project (DotEE, 2018). An assessment of these has been undertaken in Table 4-1.

Table 4-1 Assessment against Matters of National Environmental Significance

MATTER OF NATIONAL ENVIRONMENTAL SIGNIFICANCE	IMPACT ASSESSMENT
Threatened Species and ecological communities	Impacts to a TEC was were confirmed within the Project Area during field investigations: • Banksia Woodlands of the SCP TEC (approximately 5 ha). No EPBC Act or BC Act listed flora were recorded within the Project Area during the surveys conducted in October and November 2018 (BORR IPT 2019a and b). Impacts to Carnaby's Cockatoo (Endangered), Baudin's Cockatoo (Endangered) and the Forest Red-Tailed Black Cockatoo (Vulnerable), including: • Removal of approximately 38 ha (21 ha surveyed and 17 ha unsurveyed) potential breeding and foraging habitat • Removal of 588 Suitable DBH Trees, one of which is a Tree with a Suitable Nest Hollow, two showed evidence of past use as Known Nesting Trees and two could not be assessed by drone. Impacts to Western Ringtail Possums (Critically Endangered), including: • Removal of approximately 38 ha (21 ha surveyed and 17 ha unsurveyed) breeding and foraging habitat, providing habitat for an estimated 15 individuals, which represent up to 0.3% of the regional population. Loss of less than 0.3 ha wetland habitat hydrologically connected to wetlands where Black-stripe Minnow were recorded.
Migratory Species	The desktop assessment (PMST) identified 42 migratory species potentially occurring within 5 km of the Project Area, including: • 26 birds (including 9 wetlands species) • 15 marine species • 1 terrestrial species. Impacts to these species are not considered likely from the Project.
Commonwealth Marine Areas	The Project will not impact any Commonwealth Marine Area. The closest is Geographe Commonwealth Marine Reserve, approximately 14 km west of Project Area.

MATTER OF NATIONAL ENVIRONMENTAL SIGNIFICANCE	IMPACT ASSESSMENT
World Heritage Properties	The Project will not impact any World Heritage Properties.
National Heritage Properties	The Project will not impact any National Heritage Properties.
Wetlands of International Importance	The Project will not impact any wetlands of international importance. The closest is the Vasse-Wonnerup System, approximately 20 km south of the Project Area.

5 SUMMARY

The BORR Project has been divided into three sections (Northern, Central and Southern Sections). Two alignments for the BORR Southern Section are currently being assessed by Main Roads (BORR Southern Section GBRS Alignment and BORR Southern Section Alternative Alignment) to determine the preferred alignment.

This data in this EIA were used to identify and assess the environmental impacts associated with the BORR Southern Section Alternative Alignment ('the Project'). Main Roads used the findings in this EIA to determine the preferred southern alignment for the BORR. The impacts of the Project have been summarised in Table 5-1 for the purposes of comparison.

Table 5-1 Summary of Environmental Impacts

ASPECT	BORR SOUTHERN SECTION ALTERNATIVE ALIGNMENT
Total Area	222 ha
VEGETATION AND FLORA	
Total Native Vegetation	Approximately 46 ha (30 ha surveyed, 17 ha unsurveyed)
Total non-native or cleared area	Approximately 176 ha
Total native Good or better condition	Approximately 6 ha (~3 % of the Project Area)
Total areas in Good – Degraded or worse condition	An estimated 216 ha (~97 % of the Project Area) (includes Cleared/parkland areas, which are classified as Completely Degraded)
Threatened and Priority Communities	Banksia Woodlands of the SCP TEC (up to 4.5 ha) Banksia dominated woodlands of the SCP IBRA region PEC (FCT 21a) (up to 6.9 ha) The Tuart (*Eucalyptus gomphocephala*) woodlands of the SCP PEC (FCT25) (up to 0.4 ha).
Other significant	Approximately 13 ha of riparian vegetation
Conservation significant flora	12 conservation significant flora species previously recorded or likely to occur within the Project Area, from desktop investigations. No EPBC or BC Act species recorded during field investigations. No Priority Flora recorded during field investigations.
FAUNA	
EPBC / BC Fauna - confirmed - Black Cockatoos	Approximately 38 ha of potential Black Cockatoo habitat (including 21 ha surveyed and 17 ha unsurveyed)

ASPECT	BORR SOUTHERN SECTION ALTERNATIVE ALIGNMENT
	Up to 588 Suitable DBH Trees, one of which is a Tree with a Suitable Nest Hollow, two showed evidence of past use as Known Nesting Trees and two could not be assessed by drone.
- Western Ringtail Possum (Critically Endangered)	Approximately 38 ha of potential Western Ringtail Possum habitat (including 21 ha surveyed and 17 ha unsurveyed), supporting up to 15 individual possums.
- South-western Brush-tailed Phascogale (Schedule 6)	Approximately 26 ha of potential Southern Brush-tailed Phascogale (including 9 ha surveyed and 17 ha unsurveyed).
Priority Fauna – confirmed - Southern Brown Bandicoot / Quenda (Priority 4)	An estimated 46 ha of potential Southern Brown Bandicoot habitat (including 30 ha surveyed and 17 ha unsurveyed).
Threatened species likely to occur - Black-stripe Minnow (Endangered)	Loss of less than 0.3 ha wetland habitat hydrologically connected to wetlands where Black-stripe Minnow were recorded.
- Peregrine Falcon (Schedule 7)	Approximately 46 ha of potential Peregrine Falcon habitat (including 30 ha surveyed and 17 ha unsurveyed)
Migratory birds	A small number (< 50) of migratory bird species were considered to be potentially transient visitors to the Project Area at times when wetlands are supporting water.
TERRESTRIAL ENVIRONMENT QUALITY	
Acid Sulphate Soils	There is a low to moderate risk of ASS, with minor areas of high risk associated with watercourses.
Contaminated Sites	One site classified as contaminated with restricted use occurs within the Project Area, which is unlikely to be impacted by the Project.
RIVERS AND WETLANDS	
Rivers	No rivers protected under the RIWI Act will be impacted by the Project, however a number of minor waterways will be impacted including Gynudup Brook and Five Mile Brook.
Geomorphic wetlands	Loss of approximately 75 ha of mapped Geomorphic Wetlands including: Conservation: 1 ha Resource Enhancement: <1 ha Multiple use: 73 ha
AIR QUALITY	
Air quality	No significant impacts.
SOCIAL	
State and Municipal heritage	Land associated with two sites on the Shire of Capel Municipal Heritage register will be impacted.

ASPECT	BORR SOUTHERN SECTION ALTERNATIVE ALIGNMENT
	• Elgin Sports Club, Boyanup West Road, Stratham • Stratham School (2nd Site), Boyanup West Road, Stratham. No structures associated with these sites will be impacted.
Aboriginal Heritage	The buffered extent of 'Capel Bussell Highway' (ID 5813). Site 5813 is recorded as a Registered site, comprised of Artefacts / Scatter, Archaeological Deposit and Camp. The buffered extent of 'The Gelorup Corridor' (ID 37870) is recorded as an Other Heritage Place, comprised of Artefacts/ Scatter, Ceremonial, Skeletal Material/ Burial.
Noise	Noise and vibration impacts are expected to result from the construction phase, however the Project is in a rural location and these impacts are not considered significant. Noise mitigation measures will be developed during the detailed design phase to be compliant with the requirements of SPP 5.4 (WAPC, 2009).
Visual	Direct and permanent impacts to visual amenity of the existing rural area are expected to result from this Project. An assessment of the impacts to visual amenity will be completed if this alignment is selected as the preferred option.
Amenity	Impacts on rural community amenity and agricultural production including loss of productive land, reducing carrying capacity and restricted access are potential consequences of the Project. The detailed design phase will consider provision of access and separation of properties and impacts will be investigated further if the alignment is selected as the preferred option.

It is considered likely that the Project will require the following environmental approvals:

- Referral to EPA under Section 38 of the EP Act
- Referral to DotEE under the EPBC Act for assessment as a Controlled Action
- Native Vegetation Clearing Permit (DWER)
- Bed and Banks Permit (DWER)
- Licence to take water for construction purposes (DWER)
- Section 18 consent to disturb Aboriginal heritage sites (Minister for Aboriginal Heritage)
- Permission from the Shire of Capel to disturb European heritage sites.

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- Geomorphic Wetlands, Swan Coastal Plain (DBCA-019)
- Groundwater Salinity Statewide (DWER-026)
- Heritage Council WA – State Register (SHO-003)
- Hydrographic Catchments – Catchments (DWER-028)
- Legislated Lands and Waters (DBCA-011)
- Pre-European Vegetation (DPIRD-006)
- Public Drinking Water Source Areas (DWER-033)
- Ramsar Sites (DBCA-010)
- RIWI Act, Groundwater Areas (DWER-019)
- RIWI Act, Rivers (DWER-036)
- RIWI Act, Surface Water Areas and Irrigation Districts (DWER-037)
- Soil Landscape Mapping – Best Available (DPIRD-027)
- Threatened Ecological Communities (DBCA-038)
- Vegetation Complexes – Swan Coastal Plain (DBCA-046)

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Legend

- Major Road
- Minor Road
- Project Area

DALYELLUP
GELORUP
NORTH BOYANUP
STRATHAM
BOYANUP
STIRLING ESTATE
ELGIN
THE PLAINS

Athena St
Driver Rd
Dalyellup Blvd
Sapphire Rd
Robinhood Rd
Sherwood Dr
Harewoods Rd
Heathridge Rd
Speed Rtt
Hawkins Dr
Hasties Rd
Zinnia Rd
Brookview Av
Tamarind Cr
Serene Dr
Jules Rd North
Allenville Rd
Jules Rd
Ducane Rd
Maidment Pde
Hampstead St
Watkins Rd
Gelorup Rise
Yalinda Dr
Marchetti Rd
Eucalypt Dr
Cokelup Rd
Banksia Rd
Woods Rd
Ken Bell Rd
Brockway Dr
Manea Dr
Quambi Dr
Lakes Rd
Calinup Rd
Jaymon Rd
Hilduna Dr
Rich Rd
Minninup Rd
Ramsay Rd
Mewett Dr
Murname Ct
Kent Rd
Jilley Rd
Brisden Rd
Brookdale Rd
Fishermans Rd
Chislehurst Av
Stafford Dr
Venus Rd
Bussell Hwy
Roselands Rd
Boyanup Rd West
Skippings Rd
Penn St
Mangles Rd
Roberts Rd
Dowgup Rd
Mallokup Rd
Edwards Rd
King Rd
Cable Mine Rd
Nicholls Rd
Yeardy Rd
John Hogg Rd
Clapp Rd
Matthews Rd
Vickery Rd
Railway Rd
Elgin Rd
Clarke Rd
Malatesta Rd
Lowrie Rd
Washers Rd
Bell Rd
Cain Rd
Norman Rd
Gynudup Rd
Summerfea Rd
Gavins Rd
Wells Rd

BINNINGUP
BRUNSWICK JUNCTION
LESCHENAULT
AUSTRALIND
EATON
BUREKUP
BUNBURY
GELORUP
DARDANUP
STRATHAM
BOYANUP
PEPPERMINT GROVE
CAPEL
DONNYBROOK
BUSSELTON

SLIP

Paper Size ISO A3

0 0.5 1 1.5

Kilometres

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

N

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Australian Government
BUILDING OUR FUTURE

BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

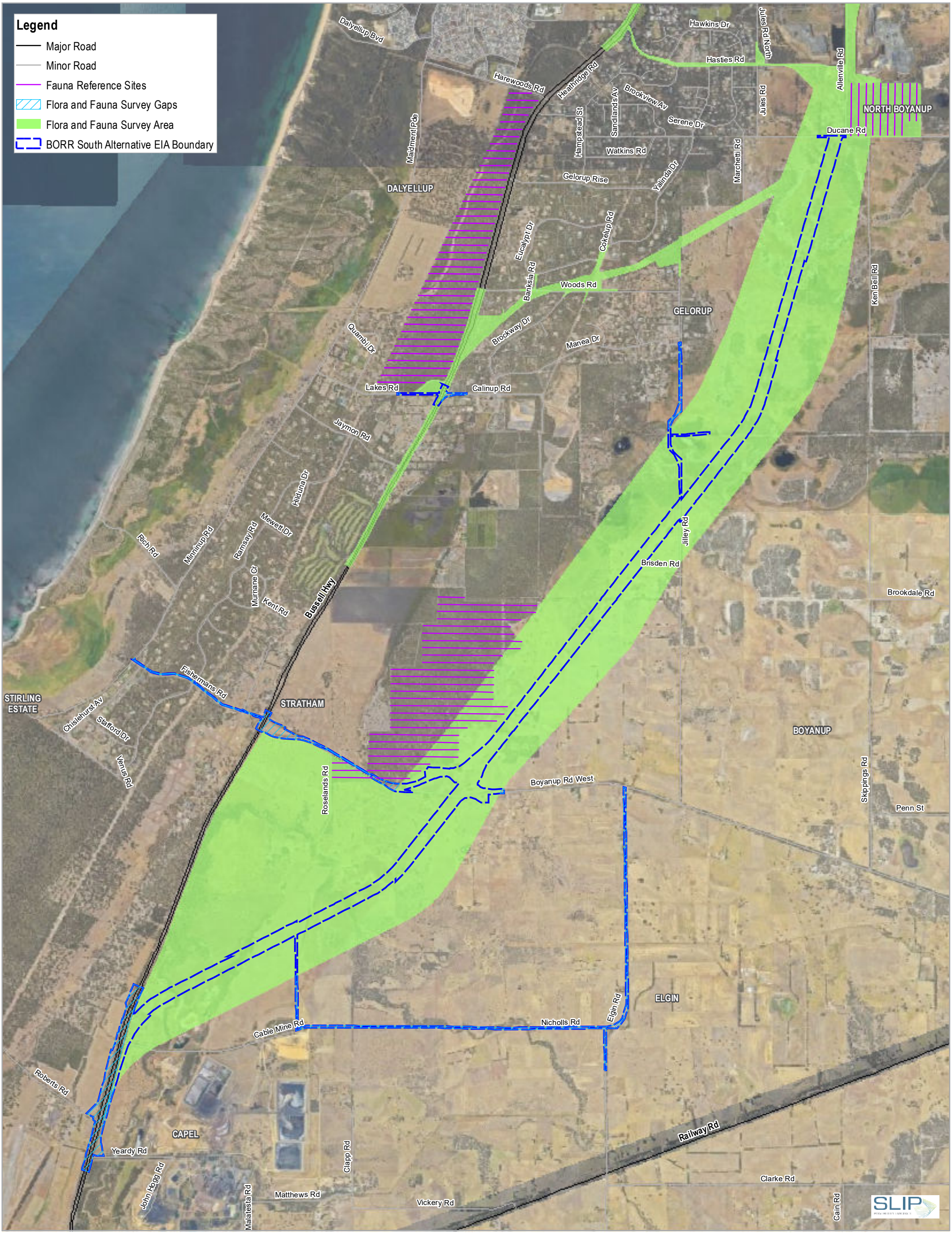
Main Roads Western Australia
Bunbury Outer Ring Road
Southern Section Alternative Alignment
Environmental Impact Assessment

BORR Southern Section Alternative Alignment

Project No. **61-37041**
Revision No. **1**
Date **24/06/2019**

FIGURE 1

Data source: BORR: South Alternate EIA Boundary - 20181212; MRWA: Road Network - 20180519; Landgate: Imagery accessed on 20190507, Locality names - 2018; Geoscience Australia: Geodata Topo 250k.. Created by: slei



Paper Size ISO A3

0 0.25 0.5 0.75 1

Kilometres

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

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BUILDING OUR FUTURE

mainroads WESTERN AUSTRALIA
BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

Main Roads Western Australia
Bunbury Outer Ring Road
Southern Section Alternative Alignment
Environmental Impact Assessment

Surveyed and Unsurveyed Areas

Project No. **61-37041**
Revision No. **1**
Date **24/06/2019**

FIGURE 2

G:\61\37041\19_0_GIS\Maps\Working\EIASouthAlternative\6137041_002_GapsInSurveyEffort_Rev1.mxd
Print date: 24 Jun 2019 - 15:13

Data source: BORR: South Alternate Boundary - 20181212, Survey areas and gaps - 20190213, Fauna Reference Sites - 20190122; MRWA: Road Network - 20180519; Landgate: Imagery accessed on 20190415, Locality names - 2018; Geoscience Australia: Geodata Topo 250k.. Created by: slei

Legend
Major Road
Minor Road
Project Area
Map sheet

DALYELLUP
GELORUP
NORTH BOYANUP
Map 1
Map 2
Map 3
Bussell Hwy
STRATHAM
BOYANUP
Map 4
Map 5
STIRLING ESTATE
ELGIN
Railway Rd
CAPEL
THE PLAINS
SLIP

Paper Size ISO A3
0 0.5 1 1.5
Kilometres
Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 Perth Coastal Grid 1994

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BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

Main Roads Western Australia
Bunbury Outer Ring Road
Southern Section Alternative Alignment
Environmental Impact Assessment

Vegetation Type

Project No. 61-37041
Revision No. 1
Date 24/06/2019

OVERVIEW

FIGURE 3

Data source: BORR: South EIA Boundary - 20181212; MRWA: Road Network - 20180519; Landgate: Imagery accessed on 20190522, Locality names - 2018; Geoscience Australia: Geodata Topo 250k..
Created by: slei

Legend

- Significant weed
- Minor Road
- Project Area
- Unsurveyed gaps (white)
- Vegetation cover in unsurveyed gaps

Vegetation Type

- 1a - Marri and Jarrah +/- Peppermint over closed grassland
- 1b - Isolated Flooded Gum and Marri closed grassland
- 1c - Isolated Marri and Jarrah +/- Banksia closed grassland
- 2 - Open forest of Jarrah, Marri, Banksia and Peppermint
- 3 - Scattered Jarrah, Marri +/- Peppermint over tall open shrubland Banksia, Xylomelum, *Kunzea* sp.
- 6 - Woodland Banksia, Jarrah +/- Peppermint over occasional shrubland Kunzea
- 7 - Woodland of Paperbark over tall sparse shrubland
- Cleared

Coachwood Wy
Jules Rd
Allenville Rd
Ducane Rd
Zanadu Ct
Marchetti Rd
Woods Rd
Ken Bell Rd
Hair Pl
Manea Dr
Stable Ct
Jilley Rd
Skippings Rd
1a
1c
7
2
Cleared
*Zantedeschia aethiopica (DP/WONS)
1b
6
3

GELORUP
STRATHAM
1
2
3
4
5

Paper Size ISO A3

0 90 180 270 360

Metres

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

N

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BUILDING OUR FUTURE

mainroads WESTERN AUSTRALIA
BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

Main Roads Western Australia
Bunbury Outer Ring Road
Southern Section Alternative Alignment
Environmental Impact Assessment

Vegetation Type

Project No. **61-37041**
Revision No. **1**
Date **24/06/2019**

FIGURE 3

G:\61\37041\19_0_GIS\Maps\Working\EIASouthAlternative\6137041_003_SouthAlternateVegetationTypeMapbook_Rev1.mxd
Print date: 24 Jun 2019 - 16:35

Data source: BORR: South Alternate Boundary - 20181212, Vegetation type, Additional non-surveyed vegetation extent - 20190220, Significant Weeds - 2019; Landgate: Imagery accessed on 20190415, Roads - 2018; DPIRD: Native vegetation extent - 20171026. Landgate / SLIP. Created by: mmikkonen

Quambi Dr
Lakes Rd
Tamra Cl
Brockway Dr
Manea Dr
Calinup Rd
Rd No 308
Brisden Rd
Jilley Rd
Cleared
Roselands Nature Reserve
Boyanup Rd West
*Zantedeschia aethiopica (DP/WONS)
*Zantedeschia aethiopica (DP/WONS)
*Zantedeschia aethiopica (DP/WONS)
1
9a
10
7
3
2
1a
6
1b

Legend

- Significant weed
- Major Road
- Minor Road
- Project Area
- Unsurveyed gaps (white)
- Vegetation cover in unsurveyed gaps

Vegetation Type

- 1 - Open forest of Jarrah, Marri and Banksia
- 1a - Marri and Jarrah +/- Peppermint over closed grassland
- 1b - Isolated Flooded Gum and Marri closed grassland
- 2 - Open forest of Jarrah, Marri, Banksia and Peppermint
- 3 - Scattered Jarrah, Marri +/- Peppermint over tall open shrubland Banksia, Xylomelum, *Kunzea* sp.
- 6 - Woodland Banksia, Jarrah +/- Peppermint over occasional shrubland Kunzea
- 7 - Woodland of Paperbark over tall sparse shrubland
- 9a - Marri and Jarrah +/- Peppermint with very occasional Tuart
- 10 - Parkland cleared with occasional Marri, Jarrah and Peppermint
- Cleared

GELORUP
STRATHAM
1
2
3
4
5

Paper Size ISO A3
0 90 180 270 360
Metres
Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 Perth Coastal Grid 1994

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Australian Government
BUILDING OUR FUTURE
mainroads WESTERN AUSTRALIA
BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

Main Roads Western Australia
Bunbury Outer Ring Road
Southern Section Alternative Alignment
Environmental Impact Assessment

Vegetation Type

Project No. **61-37041**
Revision No. **1**
Date **24/06/2019**

FIGURE 3

G:\61\37041\19_0_GIS\Maps\Working\EIASouthAlternative\6137041_003_SouthAlternateVegetationTypeMapbook_Rev1.mxd
Print date: 24 Jun 2019 - 16:41

Data source: BORR: South Alternate Boundary - 20181212, Vegetation type, Additional non-surveyed vegetation extent - 20190220, Significant Weeds - 2019; Landgate: Imagery accessed on 20190415, Roads - 2018; DPIRD: Native vegetation extent - 20171026. Landgate / SLIP. Created by: mmikkonen

Legend

- Major Road
- Minor Road
- Project Area
- Unsurveyed gaps (white)
- Vegetation cover in unsurveyed gaps

Lakes Rd
Quambi Dr
Jaymon Rd
Rosemore Wy
Hilduna Dr
Mewett Dr
Ramsay Rd
Rich Rd
Minninup Rd
Child Pl
Murnane Cr
Kent Rd
Cheriton Ct
Stratham Cl
Bussell Hwy
Fishermans Rd
Boyanup Rd West
Venus Rd
Roselands Rd
Roselands Nature Reserve

GELORUP
STRATHAM
1
2
3
4
5

Paper Size ISO A3

0 90 180 270 360

Metres

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

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BORR Team

Australian Government
BUILDING OUR FUTURE

BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

Main Roads Western Australia
Bunbury Outer Ring Road
Southern Section Alternative Alignment
Environmental Impact Assessment

Vegetation Type

Project No. **61-37041**
Revision No. **1**
Date **24/06/2019**

FIGURE 3

G:\61\37041\19_0_GIS\Maps\Working\EIASouthAlternative\6137041_003_SouthAlternateVegetationTypeMapbook_Rev1.mxd
Print date: 24 Jun 2019 - 16:43

Data source: BORR: South Alternate Boundary - 20181212, Vegetation type, Additional non-surveyed vegetation extent - 20190220, Significant Weeds - 2019; Landgate: Imagery accessed on 20190415, Roads - 2018; DPIRD: Native vegetation extent - 20171026. Landgate / SLIP. Created by: mmikkonen

Boyanup Rd West

Boyanup Rd West

1b

Cleared

3

2

Cable Mine Rd

Nicholls Rd

Elgin Rd

Clapp Rd

Vickery Rd

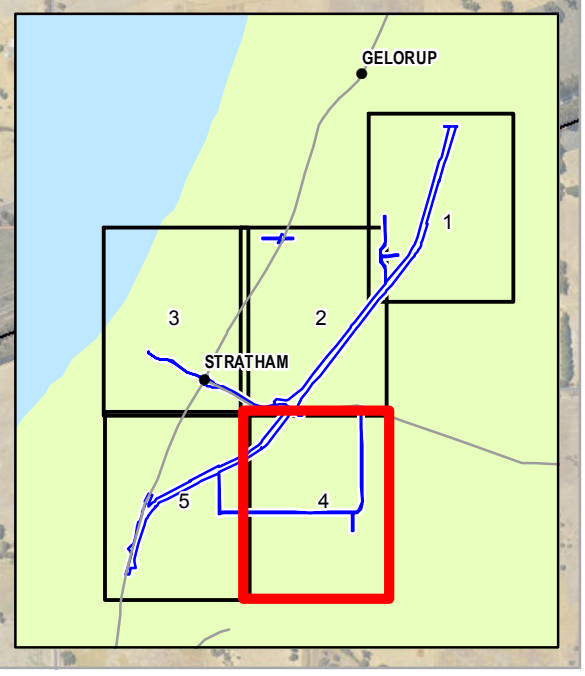
Boyanup Capel

Legend

- Major Road
- Minor Road
- Project Area
- Unsurveyed gaps (white)
- Vegetation cover in unsurveyed gaps

Vegetation Type

- 1b - Isolated Flooded Gum and Marri closed grassland
- 2 - Open forest of Jarrah, Marri, Banksia and Peppermint
- 3 - Scattered Jarrah, Marri +/- Peppermint over tall open shrubland Banksia, Xylomelum, *Kunzea* sp.
- Cleared



Paper Size ISO A3

0 90 180 270 360

Metres

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

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BUILDING OUR FUTURE

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BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

Main Roads Western Australia
Bunbury Outer Ring Road
Southern Section Alternative Alignment
Environmental Impact Assessment

Project No. **61-37041**
Revision No. **1**
Date **24/06/2019**

FIGURE 3

Vegetation Type

G:\61\37041\19_0_GIS\Maps\Working\EIASouthAlternative\6137041_003_SouthAlternateVegetationTypeMapbook_Rev1.mxd
Print date: 24 Jun 2019 - 16:44

Data source: BORR: South Alternate Boundary - 20181212, Vegetation type, Additional non-surveyed vegetation extent - 20190220, Significant Weeds - 2019; Landgate: Imagery accessed on 20190415, Roads - 2018; DPIRD: Native vegetation extent - 20171026. Landgate / SLIP. Created by: mmikkonen

Legend

- Significant weed
- Major Road
- Minor Road
- Project Area
- Unsurveyed gaps (white)
- Vegetation cover in unsurveyed gaps

Vegetation Type

- 1b - Isolated Flooded Gum and Marri closed grassland
- 2 - Open forest of Jarrah, Marri, Banksia and Peppermint
- Cleared

*Zantedeschia aethiopica (DP/WONS)

*Zantedeschia aethiopica (DP/WONS)

*Asparagus asparagoides (DP/WONS)

Roselands Rd

Bussell Hwy

Cable Mine Rd

Roberts Rd

Yeardy Rd

John Hogg Rd

Malatesta Rd

1b

2

Cleared

GELORUP

STRATHAM

1

2

3

4

5

Paper Size ISO A3

0 90 180 270 360

Metres

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

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BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

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Bunbury Outer Ring Road
Southern Section Alternative Alignment
Environmental Impact Assessment

Vegetation Type

Project No. **61-37041**
Revision No. **1**
Date **24/06/2019**

FIGURE 3

G:\61\37041\19_0_GIS\Maps\Working\EIASouthAlternative\6137041_003_SouthAlternateVegetationTypeMapbook_Rev1.mxd
Print date: 24 Jun 2019 - 16:36

Data source: BORR: South Alternate Boundary - 20181212, Vegetation type, Additional non-surveyed vegetation extent - 20190220, Significant Weeds - 2019; Landgate: Imagery accessed on 20190415, Roads - 2018; DPIRD: Native vegetation extent - 20171026. Landgate / SLIP. Created by: mmikkonen

Legend
Major Road
Minor Road
Project Area
Map sheet

DALYELLUP
GELORUP
NORTH BOYANUP
Map 1
Map 2
Map 3
Bussell Hwy
STRATHAM
BOYANUP
Map 4
Map 5
STIRLING ESTATE
ELGIN
Railway Rd
CAPEL
THE PLAINS

Paper Size ISO A3
0 0.5 1 1.5
Kilometres
Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 Perth Coastal Grid 1994

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BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

Main Roads Western Australia
Bunbury Outer Ring Road
Southern Section Alternative Alignment
Environmental Impact Assessment

Vegetation Condition

Project No. 61-37041
Revision No. 1
Date 24/06/2019

OVERVIEW

FIGURE 4

Data source: BORR: South EIA Boundary - 20181212; MRWA: Road Network - 20180519; Landgate: Imagery accessed on 20190522, Locality names - 2018; Geoscience Australia: Geodata Topo 250k..
Created by: slei

Legend

- Minor Road
- Project Area
- Unsurveyed gaps (white)
- Vegetation cover in unsurveyed gaps

Vegetation Condition

- 4 - Good
- 4-6 - Good - Degraded
- 6 - Degraded
- 7 - Completely Degraded

Coachwood Wy
Jules Rd
Allenville Rd
Ducane Rd
Zanadu Ct
Marchetti Rd
Woods Rd
Ken Bell Rd
Hair Pl
Manea Dr
Stable Cl
Jilley Rd
Skippings Rd
4-6
7
6
4

GELORUP
STRATHAM
1
2
3
4
5

Paper Size ISO A3

0 90 180 270 360

Metres

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

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BUILDING OUR FUTURE

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BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

Main Roads Western Australia
Bunbury Outer Ring Road
Southern Section Alternative Alignment
Environmental Impact Assessment

Vegetation Condition

Project No. **61-37041**
Revision No. **1**
Date **24/06/2019**

FIGURE 4

Data source: BORR: South Boundary - 20181212, Vegetation Condition- 20190221; Landgate: Imagery accessed on 20190614, Roads - 20180519; Geoscience Australia: Topo 250k - 2006. Landgate / SLIP.
Created by: mmikkonen

Quambi Dr
Lakes Rd
Tamra Cl
Manea Dr
Brockway Dr
Calinup Rd
Rd No 308
Brisden Rd
Jilley Rd
Boyanup Rd West
3
6-7
4
1
7
6

Legend

- Major Road
- Minor Road
- Project Area
- Unsurveyed gaps (white)
- Vegetation cover in unsurveyed gaps

Vegetation Condition

- 3 - Very Good
- 4 - Good
- 6 - Degraded
- 6-7 - Degraded - Completely Degraded
- 7 - Completely Degraded

GELORUP
STRATHAM
1
2
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4
5

Paper Size ISO A3

0 90 180 270 360

Metres

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

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Australian Government
BUILDING OUR FUTURE

BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT
mainroads WESTERN AUSTRALIA

Main Roads Western Australia
Bunbury Outer Ring Road
Southern Section Alternative Alignment
Environmental Impact Assessment

Vegetation Condition

Project No. **61-37041**
Revision No. **1**
Date **24/06/2019**

FIGURE 4

Data source: BORR: South Boundary - 20181212, Vegetation Condition- 20190221; Landgate: Imagery accessed on 20190614 , Roads - 20180519; Geoscience Australia: Topo 250k - 2006. Landgate / SLIP.
Created by: mmikkonen

Legend

- Major Road
- Minor Road
- Project Area
- Unsurveyed gaps (white)
- Vegetation cover in unsurveyed gaps

Lakes Rd
Quambi Dr
Jaymon Rd
Rosemore Wy
Hillduna Dr
Mewett Dr
Ramsay Rd
Rich Rd
Minninup Rd
Child Pl
Mumane Cr
Kent Rd
Cherton Ct
Strathan Cl
Bussell Hwy
Fishermans Rd
Boyanup Rd West
Venus Rd
Roselands Rd
Roselands Nature Reserve

GELORUP
STRATHAM
1
2
3
4
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Paper Size ISO A3

0 90 180 270 360

Metres

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

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Australian Government
BUILDING OUR FUTURE

BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

mainroads WESTERN AUSTRALIA

Main Roads Western Australia
Bunbury Outer Ring Road
Southern Section Alternative Alignment
Environmental Impact Assessment

Vegetation Condition

Project No. **61-37041**
Revision No. **1**
Date **24/06/2019**

FIGURE 4

Data source: BORR: South Boundary - 20181212, Vegetation Condition- 20190221; Landgate: Imagery accessed on 20190614, Roads - 20180519; Geoscience Australia: Topo 250k - 2006. Landgate / SLIP.
Created by: mmikkonen

Boyanup Rd West

Boyanup Rd West

Jilley Rd

7

6

Elgin Rd

Cable Mine Rd

Nicholls Rd

Clann Rd

Vickery Rd

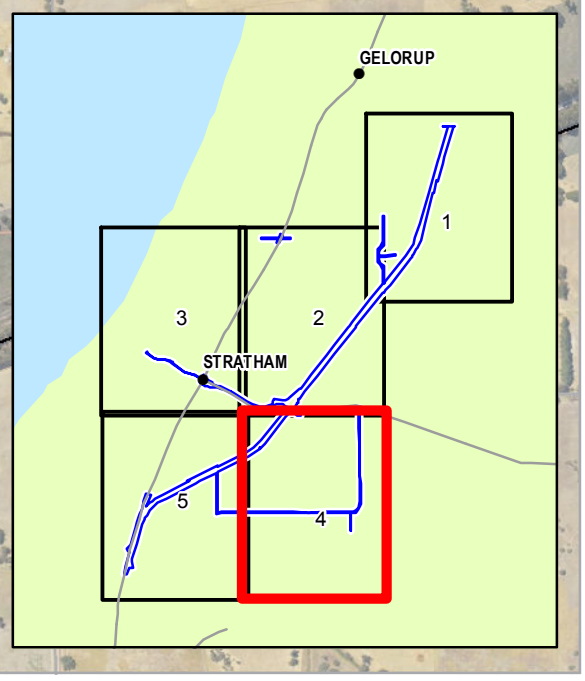
Boyanup Capel

Legend

- Major Road
- Minor Road
- Project Area
- Unsurveyed gaps (white)
- Vegetation cover in unsurveyed gaps

Vegetation Condition

- 6 - Degraded
- 7 - Completely Degraded



Paper Size ISO A3

0 90 180 270 360

Metres

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

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BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

mainroads WESTERN AUSTRALIA

Main Roads Western Australia
Bunbury Outer Ring Road
Southern Section Alternative Alignment
Environmental Impact Assessment

Vegetation Condition

Project No. **61-37041**
Revision No. **1**
Date **24/06/2019**

FIGURE 4

Data source: BORR: South Boundary - 20181212, Vegetation Condition- 20190221; Landgate: Imagery accessed on 20190614, Roads - 20180519; Geoscience Australia: Topo 250k - 2006. Landgate / SLIP.
Created by: mmikkonen

Legend

- Major Road
- Minor Road
- Project Area
- Unsurveyed gaps (white)
- Vegetation cover in unsurveyed gaps

Vegetation Condition

- 6 - Degraded
- 7 - Completely Degraded

Roselands Rd
Bussell Hwy
Cable Mine Rd
Roberts Rd
Yeardy Rd
John Hogg Rd
Malaresta Rd
6
7

GELORUP
STRATHAM
1
2
3
4
5

Paper Size ISO A3

0 90 180 270 360

Metres

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

N

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BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

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Bunbury Outer Ring Road
Southern Section Alternative Alignment
Environmental Impact Assessment

Vegetation Condition

Project No. **61-37041**
Revision No. **1**
Date **24/06/2019**

FIGURE 4

Data source: BORR: South Boundary - 20181212, Vegetation Condition- 20190221; Landgate: Imagery accessed on 20190614 , Roads - 20180519; Geoscience Australia: Topo 250k - 2006. Landgate / SLIP.
Created by: mmikkonen

Legend
Major Road
Minor Road
Project Area
Map sheet

DALYELLUP
GELORUP
NORTH BOYANUP
Map 1
Map 2
Map 3
Bussell Hwy
STRATHAM
BOYANUP
Map 4
Map 5
STIRLING ESTATE
ELGIN
Railway Rd
CAPEL
THE PLAINS
SLIP

Paper Size ISO A3
0 0.5 1 1.5
Kilometres
Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 Perth Coastal Grid 1994

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Conservation Significant Ecological Communities and Flora

Project No. 61-37041
Revision No. 1
Date 24/06/2019

OVERVIEW

FIGURE 5

Data source: BORR: South EIA Boundary - 20181212; MRWA: Road Network - 20180519; Landgate: Imagery accessed on 20190522, Locality names - 2018; Geoscience Australia: Geodata Topo 250k..
Created by: slei

Legend

Conservation Significant Flora

- *Acacia semitrullata* (P4)
- Minor Road
- Project Area
- Unsurveyed gaps (white)
- Vegetation cover in unsurveyed gaps (not considered likely to represent TEC/PEC)
- Banksia Woodlands TEC
- Banksia Woodlands PEC

Coachwood Wy
Jules Rd
Allenville Rd
Ducane Rd
Zanadu Ct
Marchetti Rd
Gelorup Rise
Woods Rd
Ken Bell Rd
Hair Pl
Stable Cl
Manea Dr
Jilley Rd
Skippings Rd

GELORUP
STRATHAM
1
2
3
4
5

Paper Size ISO A3

0 90 180 270 360

Metres

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

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Project No. **61-37041**
Revision No. **1**
Date **24/06/2019**

FIGURE 5

G:\61\37041\19_0_GIS\Maps\Working\EIASouthAlternative\6137041_005_TECPEC_Consigs_Mapbook_Rev1.mxd
Print date: 24 Jun 2019 - 16:59

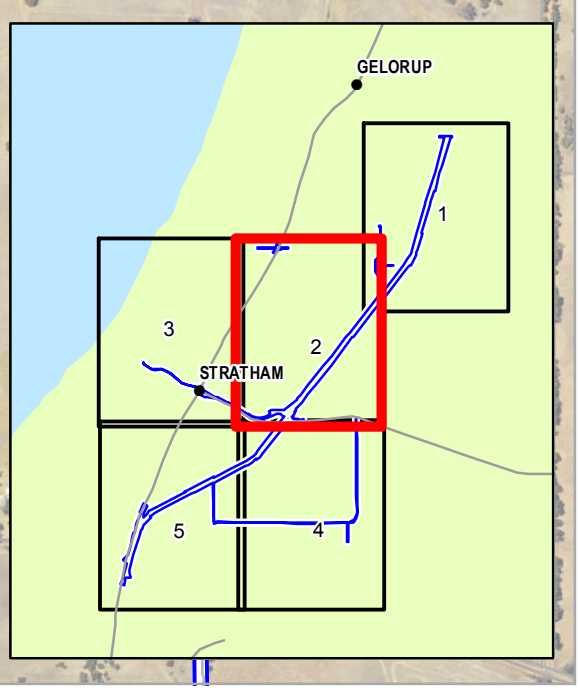
Data source: BORR: South Alternative Boundary - 20181212, TEC/PEC - 201902; Landgate: Imagery accessed on 20190415; MRWA: Road Network - 20180519; Geoscience Australia: Topo 250k - 2006. Landgate / SLIP. Created by: mmikkonen

Quambi Dr
Lakes Rd
Tamra Cl
Manea Dr
Brockway Dr
Calinup Rd
Rd No 303
Brisden Rd
Jilley Rd
Boyanup Rd West

Legend

Conservation Significant Flora

- *Chamaescilla gibsonii* (P3)
- Major Road
- Minor Road
- Project Area
- Unsurveyed gaps (white)
- Vegetation cover in unsurveyed gaps (not considered likely to represent TEC/PEC)
- Potentially Banksia dominated woodlands of the SCP IBRA region (PEC)
- Banksia Woodlands TEC
- Tuart Woodlands PEC



Paper Size ISO A3

0 90 180 270 360

Metres

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

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BUILDING OUR FUTURE

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BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

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FIGURE 5

G:\61\37041\19_0_GIS\Maps\Working\EIASouthAlternative\6137041_005_TECPEC_Consigs_Mapbook_Rev1.mxd
Print date: 24 Jun 2019 - 17:01

Data source: BORR: South Alternative Boundary - 20181212, TEC/PEC - 201902; Landgate: Imagery accessed on 20190415; MRWA: Road Network - 20180519; Geoscience Australia: Topo 250k - 2006. Landgate / SLIP. Created by: mmikkonen

Legend

- Major Road
- Minor Road
- Project Area
- Unsurveyed gaps (white)
- Vegetation cover in unsurveyed gaps (not considered likely to represent TEC/PEC)
- Potentially Banksia woodlands of the SCP(TEC)
- Potentially Tuart (*Eucalyptus gomphocephala*) woodlands of the SCP(PEC)

Lakes Rd
Quambi Dr
Jaymon Rd
Rosemore Wy
Hillduna Dr
Mewett Dr
Ramsay Rd
Rich Rd
Minninup Rd
Child Pl
Murnane Cr
Kent Rd
Cherion Ct
Strathan Cl
Bussell Hwy
Fishermans Rd
Boyanup Rd West
Venus Rd
Roselands Rd
Roselands Nature Reserve

GELORUP
STRATHAM
1
2
3
4
5

Paper Size ISO A3

0 90 180 270 360

Metres

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

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BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

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Project No. **61-37041**
Revision No. **1**
Date **24/06/2019**

FIGURE 5

G:\61\37041\19_0_GIS\Maps\Working\EIASouthAlternative\6137041_005_TECPEC_Consigs_Mapbook_Rev1.mxd
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Data source: BORR: South Alternative Boundary - 20181212, TEC/PEC - 201902; Landgate: Imagery accessed on 20190415; MRWA: Road Network - 20180519; Geoscience Australia: Topo 250k - 2006. Landgate / SLIP. Created by: mmikkonen

Boyanup Rd West

Boyanup Rd West

Jilley Rd

Elgin Rd

Cable Mine Rd

Nicholls Rd

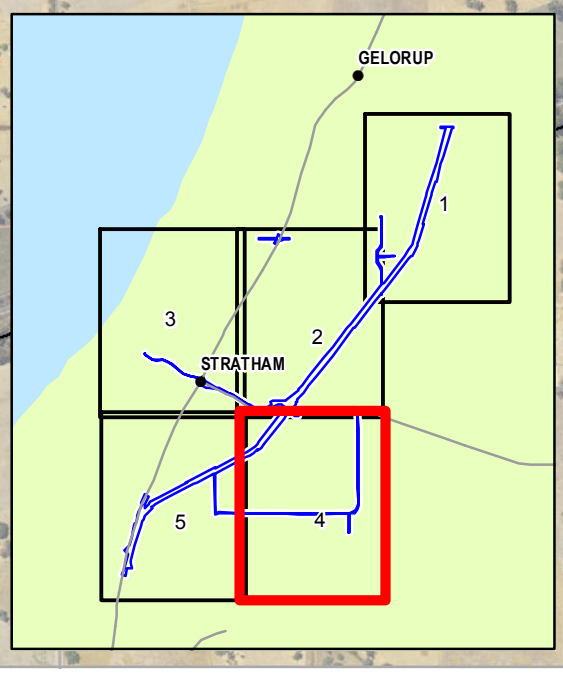
Clapp Rd

Vickery Rd

Boyanup Capel

Legend

- Major Road
- Minor Road
- Project Area
- Unsurveyed gaps (white)
- Vegetation cover in unsurveyed gaps (not considered likely to represent TEC/PEC)
- Potentially Banksia dominated woodlands of the SCP IBRA region (PEC)



Paper Size ISO A3

0 90 180 270 360

Metres

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

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Conservation Significant Ecological Communities and Flora

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Date **24/06/2019**

FIGURE 5

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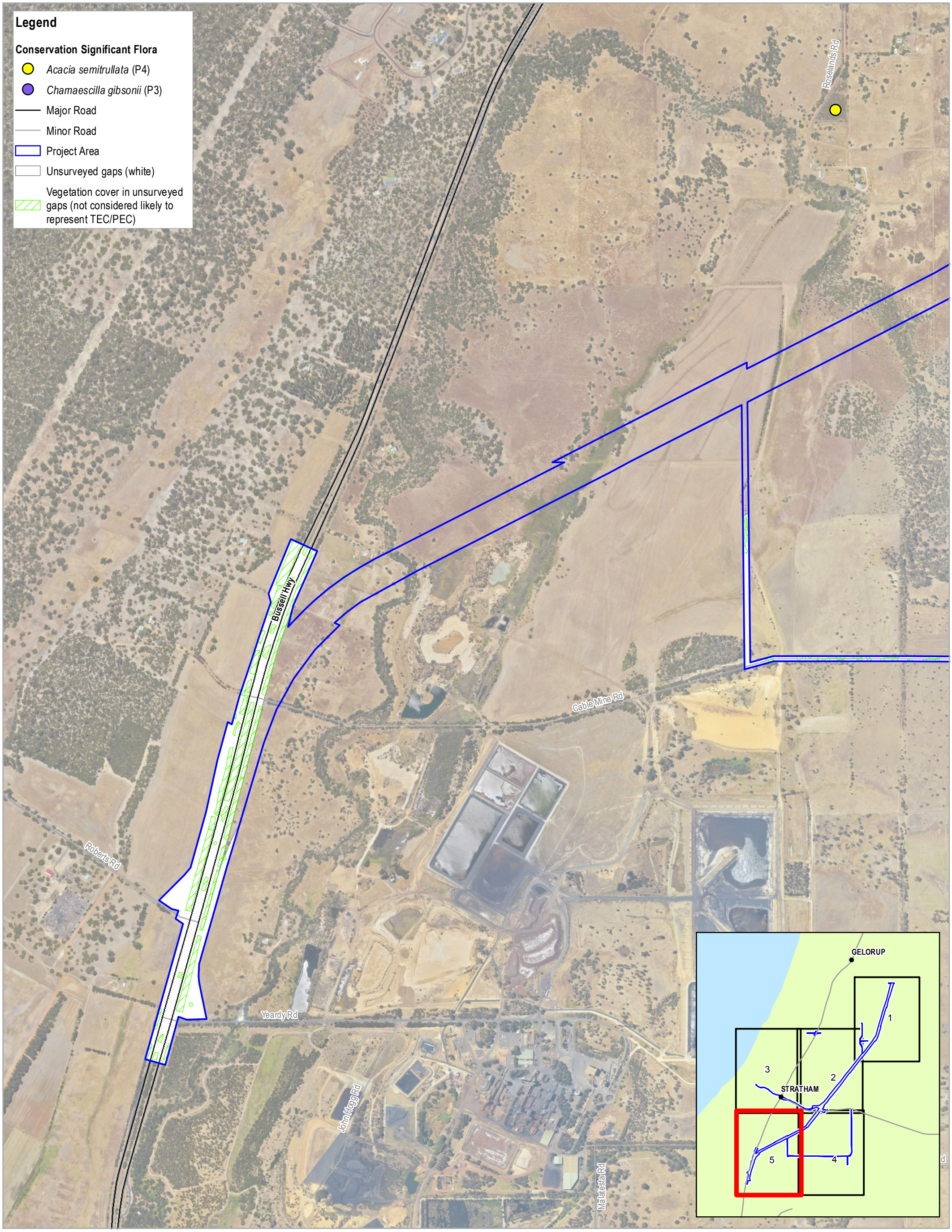
Print date: 24 Jun 2019 - 17:02

Data source: BORR: South Alternative Boundary - 20181212, TEC/PEC - 201902; Landgate: Imagery accessed on 20190415; MRWA: Road Network - 20180519; Geoscience Australia: Topo 250k - 2006. Landgate / SLIP. Created by: mmikkonen



Paper Size ISO A3

0 90 180 270 360

Metres

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

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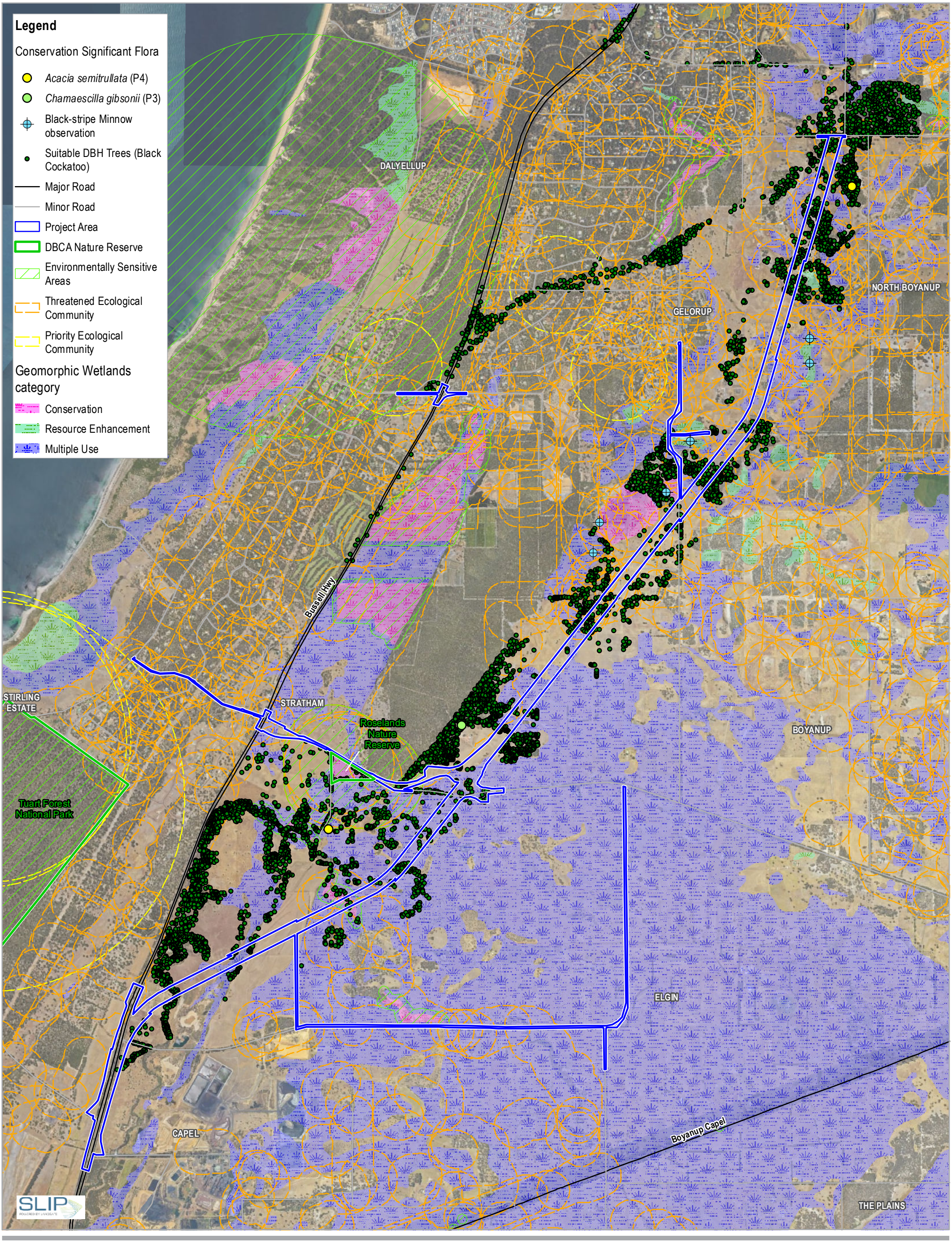
Revision No. **1**
Date **24/06/2019**

FIGURE 5

G:\61\37041\19_0_GIS\Maps\Working\EIASouthAlternative\6137041_005_TECPEC_Consigs_Mapbook_Rev1.mxd
Print date: 24 Jun 2019 - 17:00

Data source: BORR: South Alternative Boundary - 20181212, TEC/PEC - 201902; Landgate: Imagery accessed on 20190415; MRWA: Road Network - 20180519; Geoscience Australia: Topo 250k - 2006. Landgate / SLIP. Created by: mmikkonen



Paper Size ISO A3

0 0.25 0.5 0.75 1

Kilometres

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

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Date **24/06/2019**

FIGURE 6

G:\61\37041\19_0_GIS\Maps\Working\EIASouthAlternative\6137041_012_EnvConstraints_Rev1.mxd
Print date: 24 Jun 2019 - 17:50

Data source: BORR Team: Conservation significant flora - 20190212, Project Area - 201812; Biota: Cockatoo trees - 20190208; DBCA: TEC/PEC boundaries - 20180605, Geomorphic wetlands - 20190604, Nature Reserves - 20170730; DWER: ESAs - 20151012; Landgate: Roads, Localities - 2018, Imagery: WA Now accessed 20190620. . Created by: mmikkonen

Legend
Major Road
Minor Road
Project Area
Map sheet

DALYELLUP
GELORUP
NORTH BOYANUP
Map 1
Map 2
Map 3
Bussell Hwy
STRATHAM
BOYANUP
Map 4
Map 5
STIRLING ESTATE
ELGIN
Railway Rd
CAPEL
THE PLAINS
SLIP

Paper Size ISO A3
0 0.5 1 1.5
Kilometres
Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 Perth Coastal Grid 1994

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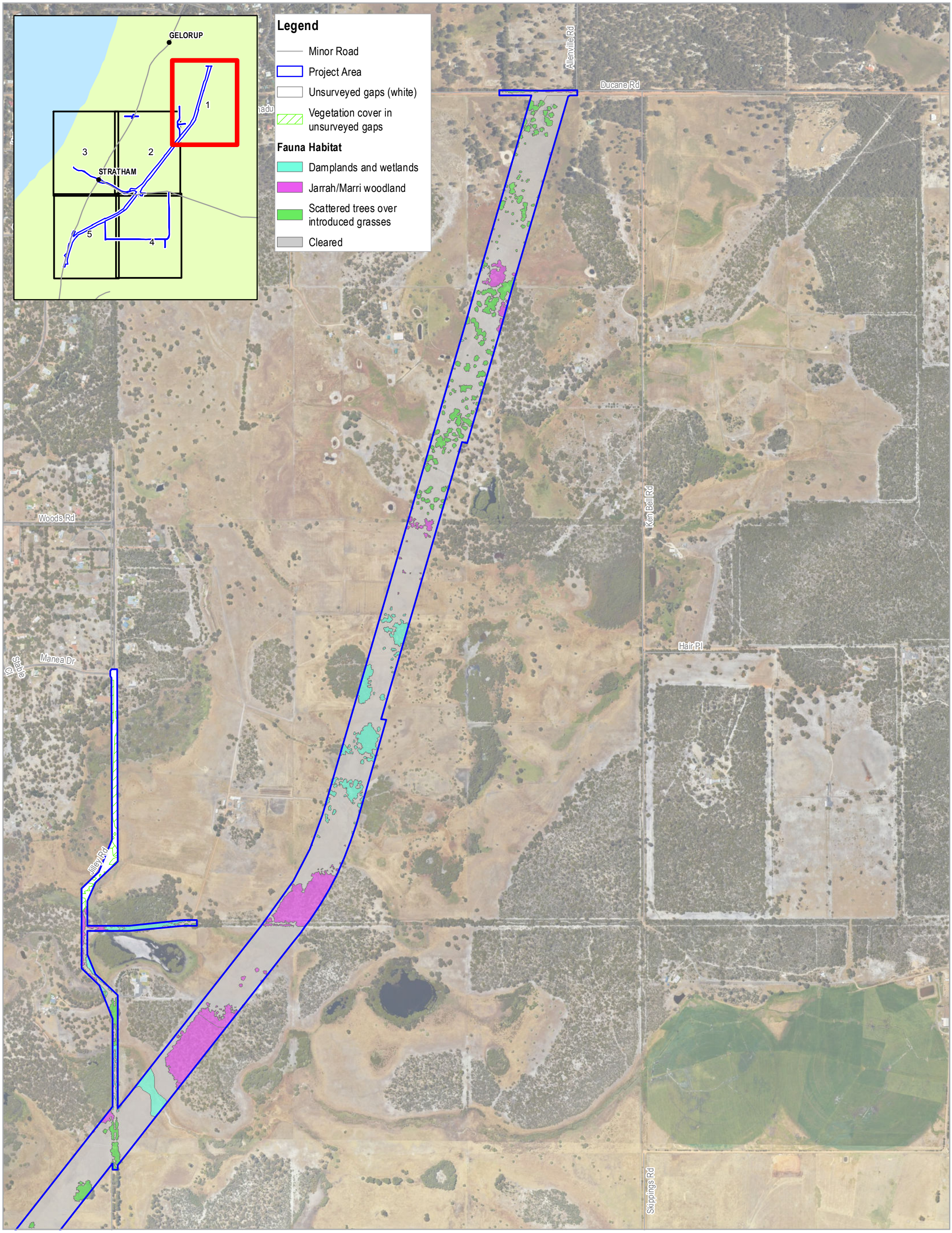
OVERVIEW

FIGURE 7

Data source: BORR: South EIA Boundary - 20181212; MRWA: Road Network - 20180519; Landgate: Imagery accessed on 20190522, Locality names - 2018; Geoscience Australia: Geodata Topo 250k..
Created by: slei



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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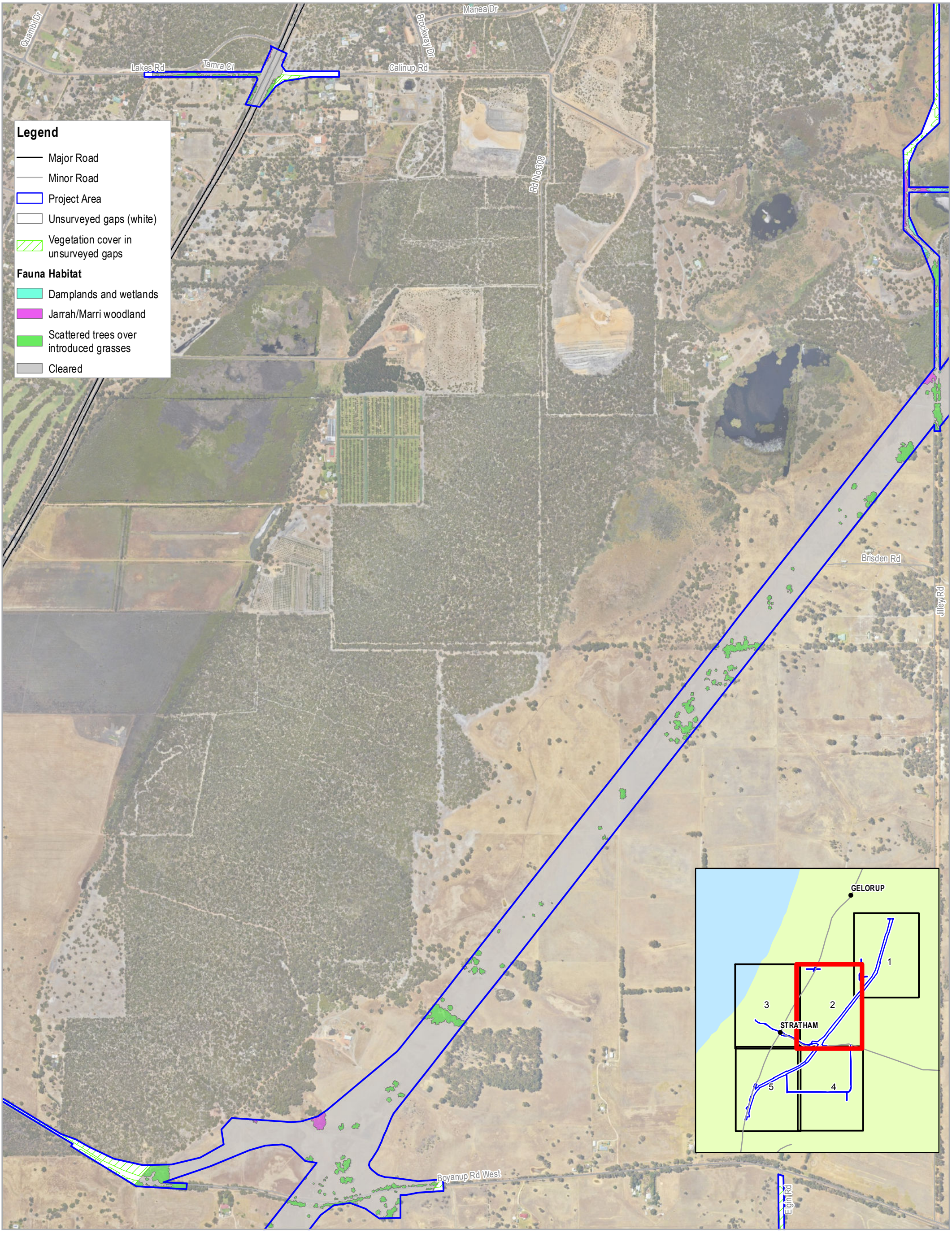
Date	**24/06/2019**

FIGURE 7

G:\61\37041\19_0_GIS\Maps\Working\EIASouthAlternative\6137041_006_SouthAlternateFaunaHabitatMapbook_Rev1.mxd
Print date: 24 Jun 2019 - 17:05

Data source: BORR: South Alternate Boundary - 20181212, Additional non-surveyed vegetation extent - 20190220; Landgate: Roads - 2018, imagery acessed on 20190415; Biota: Fauna habitat - 20190220; Geoscience Australia: Geodata Topo 250k - 2006; DPIRD: Native vegetation extent - 20171026. Landgate / SLIP. Created by: mmikkonen



Paper Size ISO A3

0 90 180 270 360

Metres

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

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Project No. **61-37041**
Revision No. **1**
Date **24/06/2019**

FIGURE 7

G:\61\37041\19_0_GIS\Maps\Working\EIASouthAlternative\6137041_006_SouthAlternateFaunaHabitatMapbook_Rev1.mxd
Print date: 24 Jun 2019 - 17:07

Data source: BORR: South Alternate Boundary - 20181212, Additional non-surveyed vegetation extent - 20190220; Landgate: Roads - 2018, imagery acessed on 20190415; Biota: Fauna habitat - 20190220; Geoscience Australia: Geodata Topo 250k - 2006; DPIRD: Native vegetation extent - 20171026. Landgate / SLIP. Created by: mmikkonen

Paper Size ISO A3

0 90 180 270 360

Metres

N

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

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FIGURE 7

G:\61\37041\19_0_GIS\Maps\Working\EIASouthAlternative\6137041_006_SouthAlternateFaunaHabitatMapbook_Rev1.mxd
Print date: 24 Jun 2019 - 17:05

Data source: BORR: South Alternate Boundary - 20181212, Additional non-surveyed vegetation extent - 20190220; Landgate: Roads - 2018, imagery acessed on 20190415; Biota: Fauna habitat - 20190220; Geoscience Australia: Geodata Topo 250k - 2006; DPIRD: Native vegetation extent - 20171026. Landgate / SLIP. Created by: mmikkonen

Boyanup Rd West

Boyanup Rd West

Jilley Rd

Elgin Rd

Cable Mine Rd

Nicholls Rd

Boyanup Capel

Clapp Rd

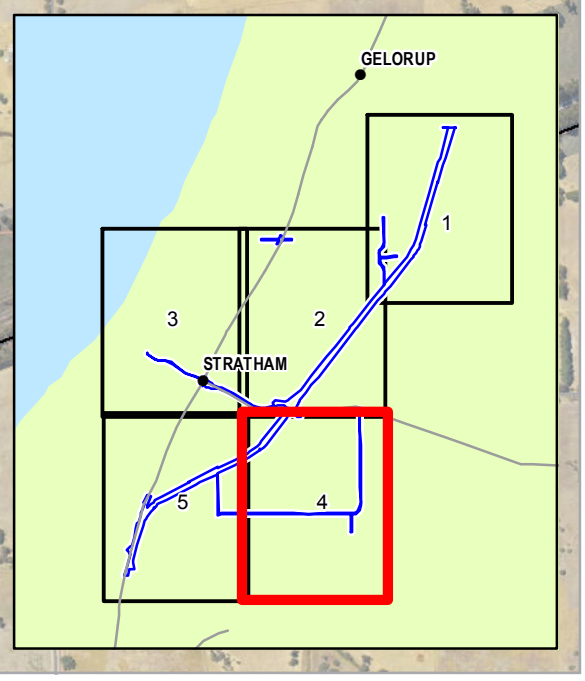
Vickery Rd

Legend

- Major Road
- Minor Road
- Project Area
- Unsurveyed gaps (white)
- Vegetation cover in unsurveyed gaps

Fauna Habitat

- Jarrah/Marri woodland
- Scattered trees over introduced grasses
- Cleared



Paper Size ISO A3

0 90 180 270 360

Metres

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

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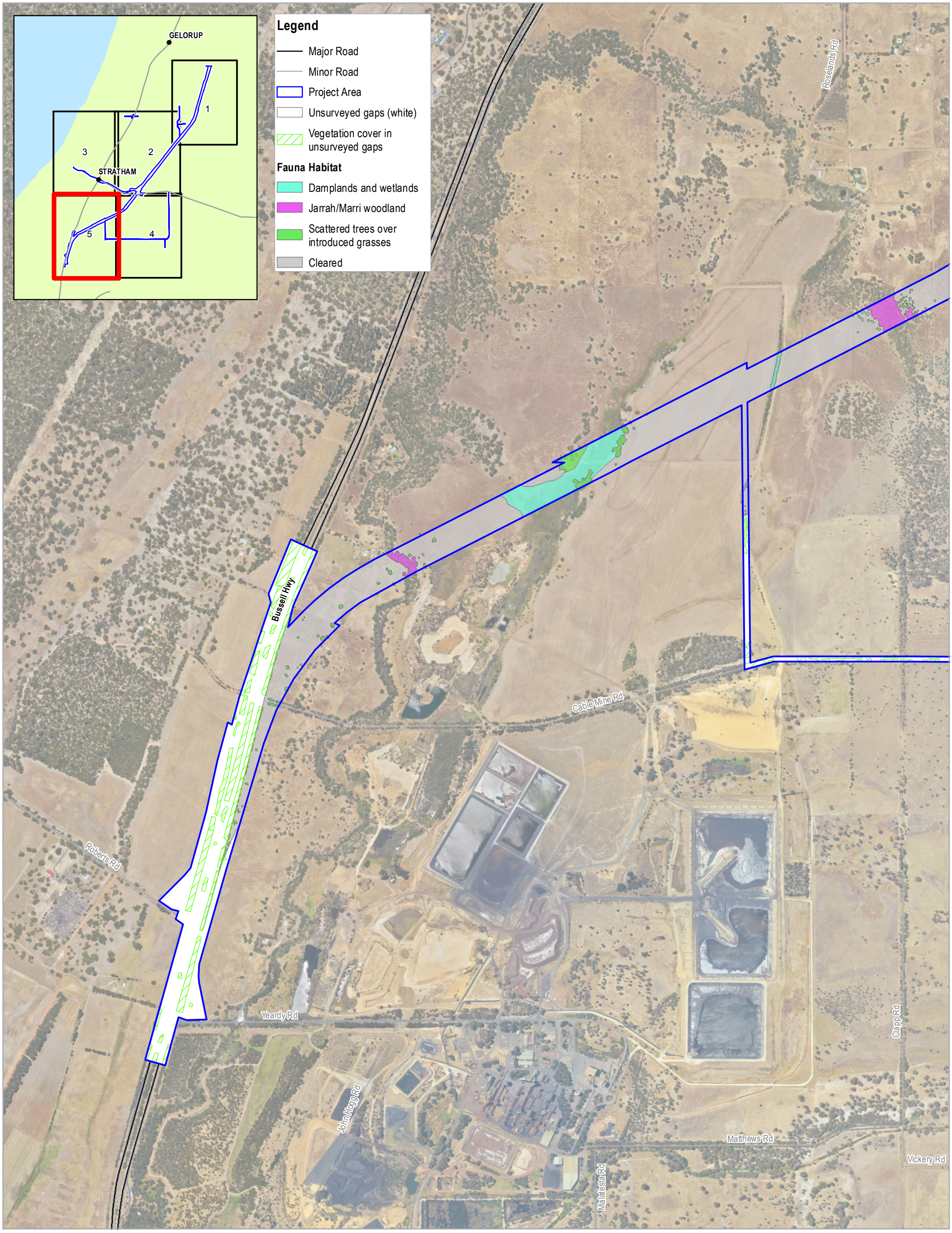
FIGURE 7

G:\61\37041\19_0_GIS\Maps\Working\EIASouthAlternative\61370 41_006_SouthAlternateFaunaHabitatMapbook_Rev1.mxd
Print date: 24 Jun 2019 - 17:09

Data source: BORR: South Alternate Boundary - 20181212, Additional non-surveyed vegetation extent - 20190220; Landgate: Roads - 2018, imagery acessed on 20190415; Biota: Fauna habitat - 20190220; Geoscience Australia: Geodata Topo 250k - 2006; DPIRD: Native vegetation extent - 20171026. Landgate / SLIP. Created by: mmikkonen



Paper Size ISO A3

0 90 180 270 360

Metres

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

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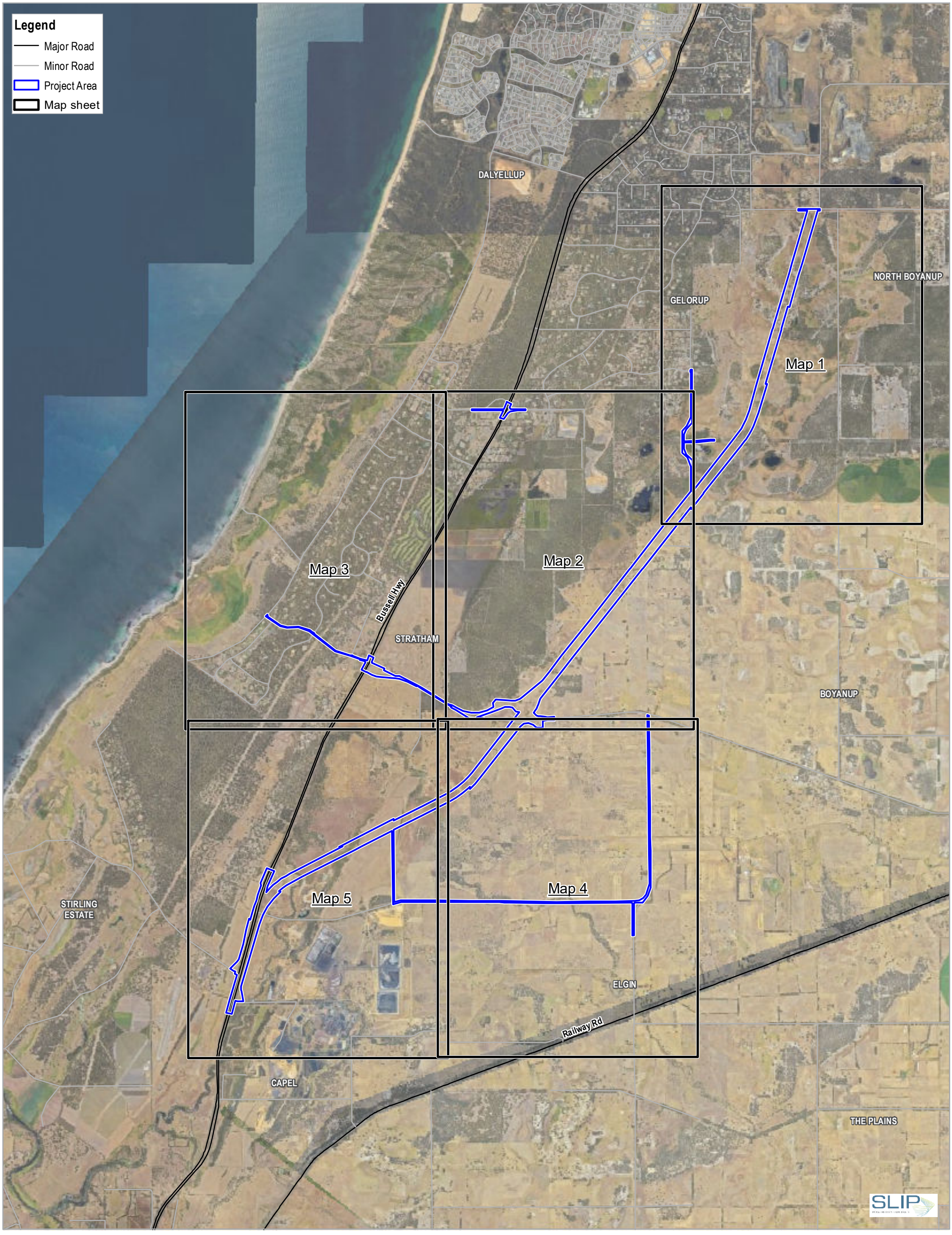
FIGURE 7

G:\61\37041\19_0_GIS\Maps\Working\EIASouthAlternative\6137041_006_SouthAlternateFaunaHabitatMapbook_Rev1.mxd
Print date: 24 Jun 2019 - 17:06

Data source: BORR: South Alternate Boundary - 20181212, Additional non-surveyed vegetation extent - 20190220; Landgate: Roads - 2018, imagery acessed on 20190415; Biota: Fauna habitat - 20190220; Geoscience Australia: Geodata Topo 250k - 2006; DPIRD: Native vegetation extent - 20171026. Landgate / SLIP. Created by: mmikkonen



Paper Size ISO A3

0 0.5 1 1.5

Kilometres

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

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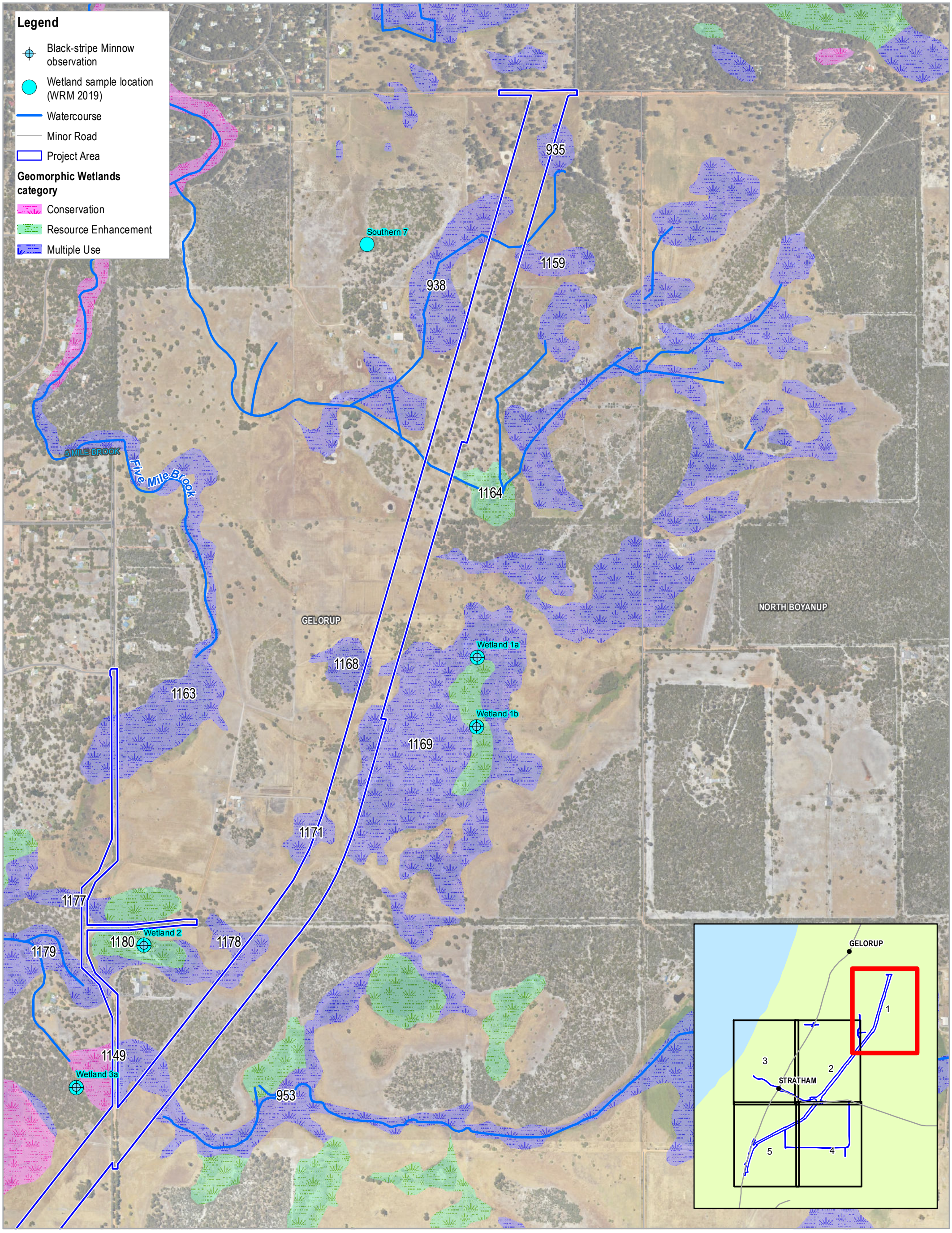
OVERVIEW

FIGURE 8

Data source: BORR: South EIA Boundary - 20181212; MRWA: Road Network - 20180519; Landgate: Imagery accessed on 20190522, Locality names - 2018; Geoscience Australia: Geodata Topo 250k..
Created by: slei



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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Bunbury Outer Ring Road
Southern Section Alternative Alignment
Environmental Impact Assessment

Inland Waters

Project No. **61-37041**
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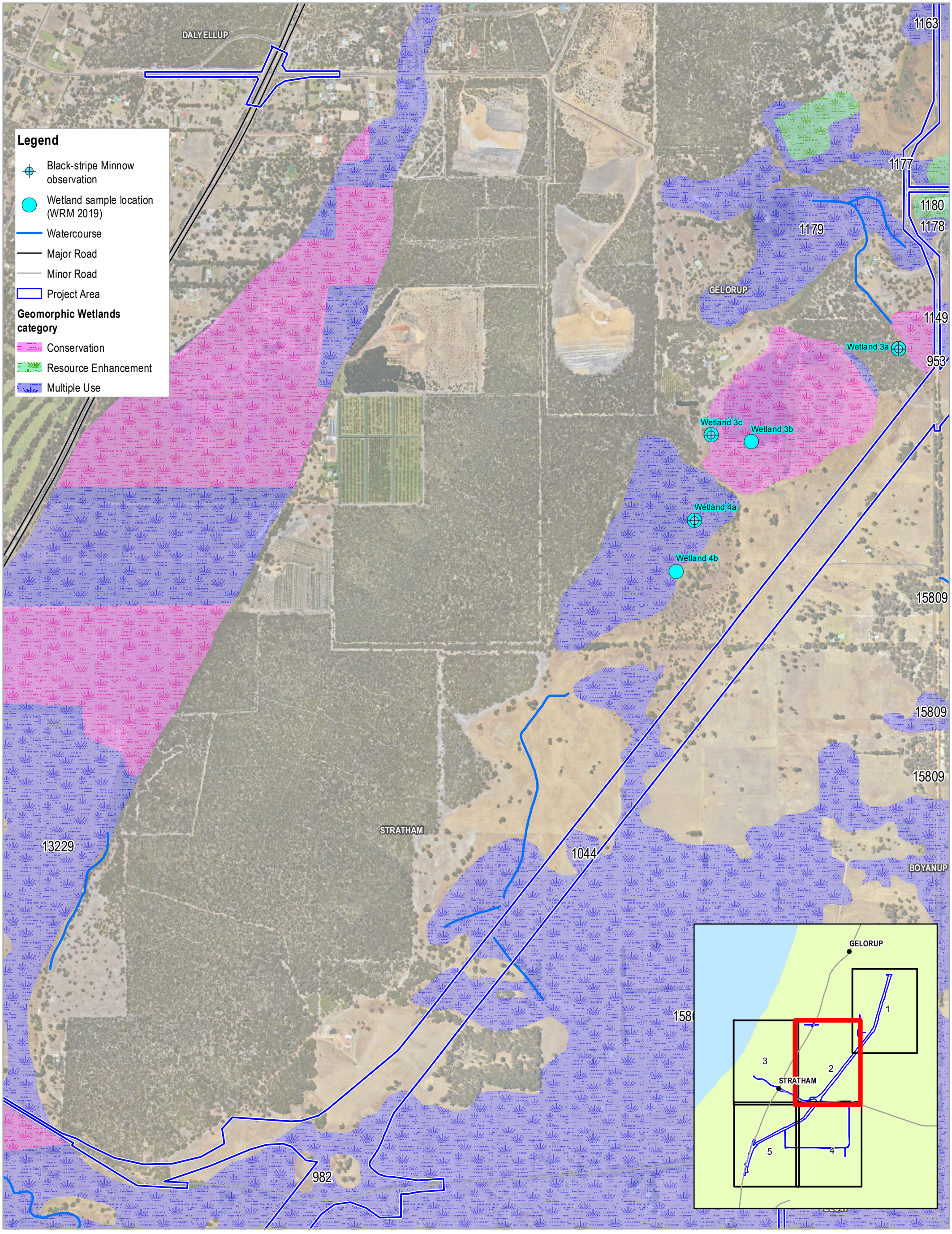
Date **24/06/2019**

FIGURE 8

G:\61\37041\19_0_GIS\Maps\Working\EIASouthAlternative\6137041_010_InlandWaters_Rev1.mxd
Print date: 24 Jun 2019 - 17:37

Data source: BORR: South Alt Boundary - 20181212; MRWA: Road Network - 20180519; Landgate: Imagery accessed on 20190620; DBCA: Geomorphic wetlands - 20190604; LGATE: Rivers - 2018; Geoscience Australia: Geodata Topo 250k - 2006; WRM: Minnow observations, Wetland samples - 2019. . Created by: mmikkonen



SLIP

Paper Size ISO A3

0 80 160 240 320

Metres

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

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Inland Waters

Project No. **61-37041**
Revision No. **1**
Date **24/06/2019**

FIGURE 8

G:\61\37041\19_0_GIS\Maps\Working\EIASouthAlternative\6137041_010_InlandWaters_Rev1.mxd
Print date: 24 Jun 2019 - 17:46

Data source: BORR: South Alt Boundary - 20181212; MRWA: Road Network - 20180519; Landgate: Imagery accessed on 20190620; DBCA: Geomorphic wetlands - 20190604; LGATE: Rivers - 2018; Geoscience Australia: Geodata Topo 250k - 2006; WRM: Minnow observations, Wetland samples - 2019. . Created by: mmikkonen

Legend

- Watercourse
- Major Road
- Minor Road
- Project Area

Geomorphic Wetlands category

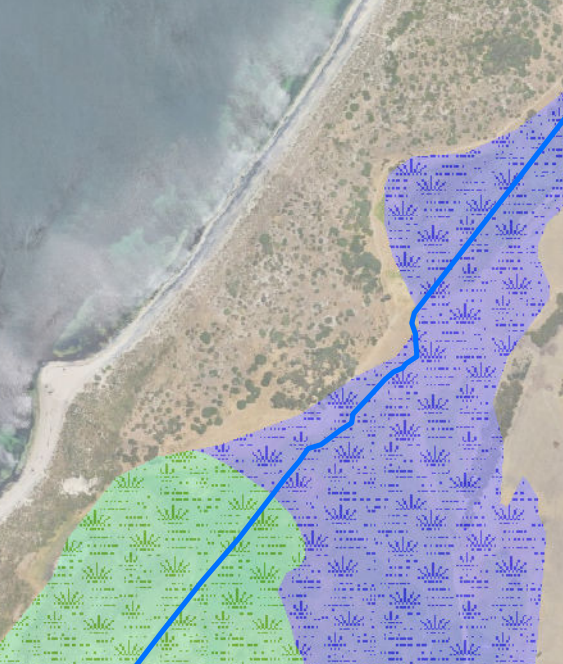
- Conservation
- Resource Enhancement
- Multiple Use

STRATHAM

Bussell Hwy

13229

15809



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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mainroads WESTERN AUSTRALIA
BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

Main Roads Western Australia
Bunbury Outer Ring Road
Southern Section Alternative Alignment
Environmental Impact Assessment

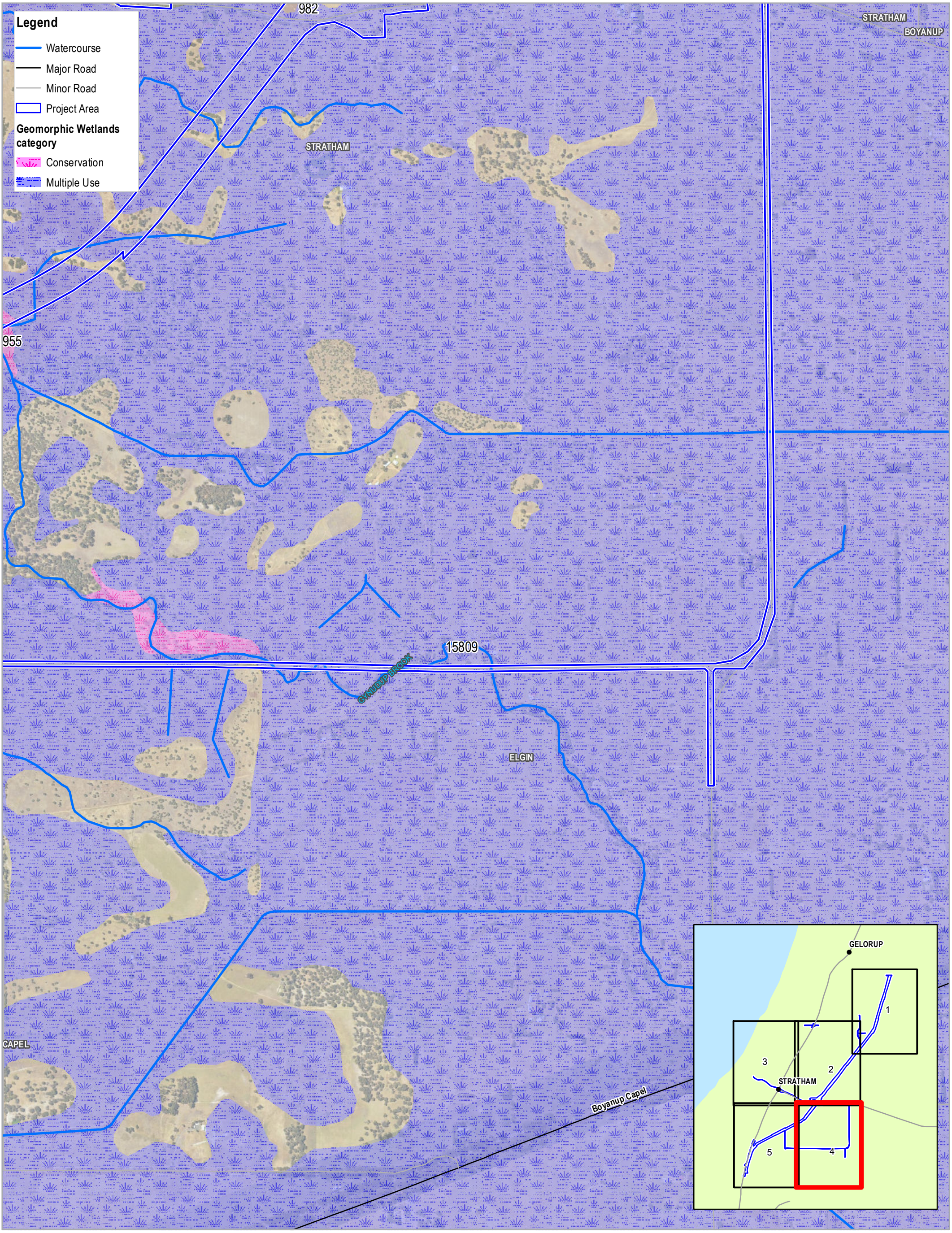
Inland Waters

Project No. **61-37041**
Revision No. **1**
Date **24/06/2019**

FIGURE 8

G:\61\37041\19_0_GIS\Maps\Working\EIASouthAlternative\6137041_010_InlandWaters_Rev1.mxd
Print date: 24 Jun 2019 - 17:47

Data source: BORR: South Alt Boundary - 20181212; MRWA: Road Network - 20180519; Landgate: Imagery accessed on 20190620; DBCA: Geomorphic wetlands - 20190604; LGATE: Rivers - 2018; Geoscience Australia: Geodata Topo 250k - 2006; WRM: Minnow observations, Wetland samples - 2019. . Created by: mmikkonen



SLIP

Paper Size ISO A3

0 80 160 240 320

Metres

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

N

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BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

Main Roads Western Australia
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Southern Section Alternative Alignment
Environmental Impact Assessment

Inland Waters

Project No. **61-37041**
Revision No. **1**
Date **24/06/2019**

FIGURE 8

G:\61\37041\19_0_GIS\Maps\Working\EIASouthAlternative\6137041_010_InlandWaters_Rev1.mxd
Print date: 24 Jun 2019 - 17:38

Data source: BORR: South Alt Boundary - 20181212; MRWA: Road Network - 20180519; Landgate: Imagery accessed on 20190620; DBCA: Geomorphic wetlands - 20190604; LGATE: Rivers - 2018; Geoscience Australia: Geodata Topo 250k - 2006; WRM: Minnow observations, Wetland samples - 2019. . Created by: mmikkonen

Legend

- Watercourse
- Major Road
- Minor Road
- Project Area

Geomorphic Wetlands category

- Conservation
- Multiple Use

STRATHAM

955

15809

Bussell Hwy

GYNUDUP BROOK

777

CAPEL

ELGIN

15809

15809

GELORUP

STRATHAM

1

2

3

4

5

SLIP

Paper Size ISO A3

0 80 160 240 320

Metres

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

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Inland Waters

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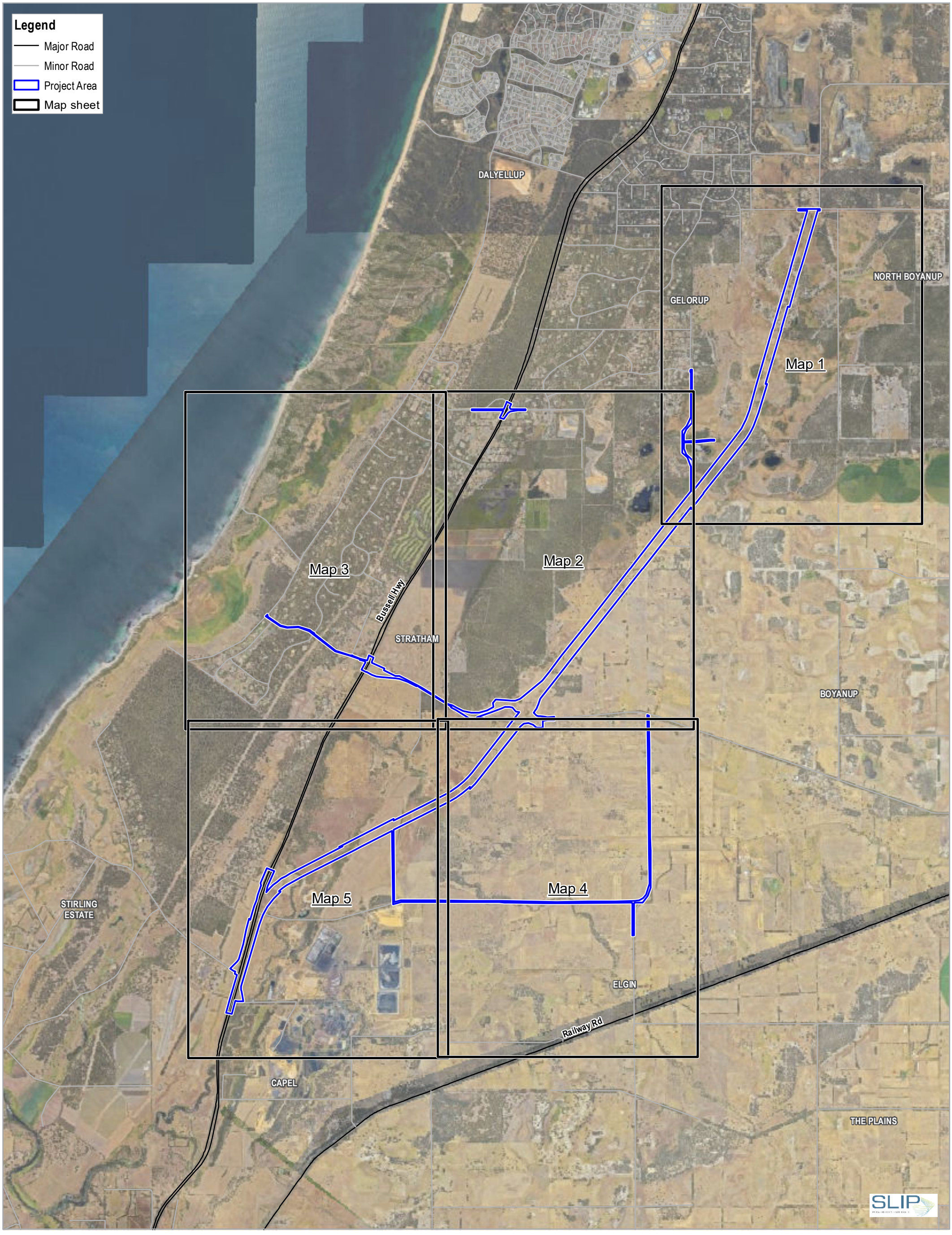
Date **24/06/2019**

FIGURE 8

G:\61\37041\19_0_GIS\Maps\Working\EIASouthAlternative\6137041_010_InlandWaters_Rev1.mxd
Print date: 24 Jun 2019 - 17:38

Data source: BORR: South Alt Boundary - 20181212; MRWA: Road Network - 20180519; Landgate: Imagery accessed on 20190620; DBCA: Geomorphic wetlands - 20190604; LGATE: Rivers - 2018; Geoscience Australia: Geodata Topo 250k - 2006; WRM: Minnow observations, Wetland samples - 2019. . Created by: mmikkonen



Paper Size ISO A3

0 0.5 1 1.5

Kilometres

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

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Southern Section Alternative Alignment
Environmental Impact Assessment

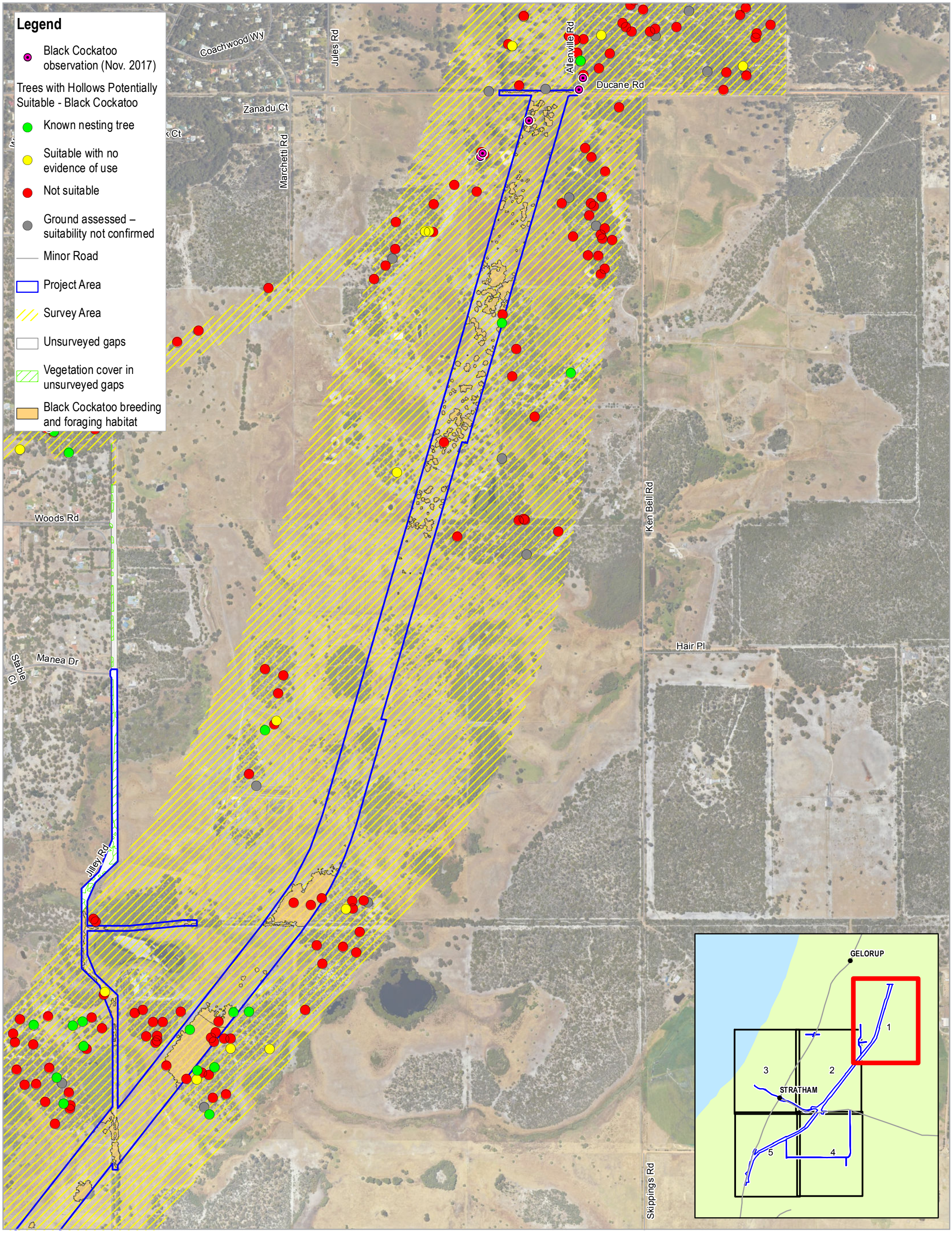
Black Cockatoos

Project No. **61-37041**
Revision No. **1**
Date **24/06/2019**

OVERVIEW

FIGURE 9

Data source: BORR: South EIA Boundary - 20181212; MRWA: Road Network - 20180519; Landgate: Imagery accessed on 20190522, Locality names - 2018; Geoscience Australia: Geodata Topo 250k..
Created by: slei



Paper Size ISO A3

0 90 180 270 360

Metres

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

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Date **24/06/2019**

FIGURE 9

G:\61\37041\19_0_GIS\Maps\Working\EIASouthAlternative\6137041_007_BCsMapbook_Rev1.mxd
Print date: 24 Jun 2019 - 17:16

Data source: BORR: South Alternative Boundary - 20181212; MRWA: Road Network - 20180519; Landgate: Imagery accessed on 20190415; Biota: Fauna habitat, BC trees - 20190220, BC observations - 201711; Geoscience Australia: Geodata Topo 250k - 2006. Landgate / SLIP. Created by: mmikkonen

Quambi Dr
Lakes Rd
Tamra Cl
Brockway Dr
Manea Dr
Calinup Rd
Rd No 308
Brisden Rd
Jilley Rd
Boyanup Rd West

Legend

Trees with Hollows Potentially Suitable - Black Cockatoo

- Known nesting tree
- Suitable with no evidence of use
- Not suitable
- Ground assessed – suitability not confirmed
- Major Road
- Minor Road
- Project Area
- Survey Area
- Unsurveyed gaps
- Vegetation cover in unsurveyed gaps
- Black Cockatoo breeding and foraging habitat

GELORUP
STRATHAM
1
2
3
4
5

Paper Size ISO A3

0 90 180 270 360

Metres

N

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

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Black Cockatoos

Project No. **61-37041**
Revision No. **1**
Date **24/06/2019**

FIGURE 9

G:\61\37041\19_0_GIS\Maps\Working\EIASouthAlternative\6137041_007_BCsMapbook_Rev1.mxd
Print date: 24 Jun 2019 - 17:18

Data source: BORR: South Alternative Boundary - 20181212; MRWA: Road Network - 20180519; Landgate: Imagery accessed on 20190415; Biota: Fauna habitat, BC trees - 20190220, BC observations - 201711; Geoscience Australia: Geodata Topo 250k - 2006. Landgate / SLIP. Created by: mmikkonen

Legend

Trees with Hollows Potentially Suitable - Black Cockatoo

- Known nesting tree
- Suitable with no evidence of use
- Not suitable
- Ground assessed – suitability not confirmed
- Major Road
- Minor Road
- Project Area
- Survey Area
- Unsurveyed gaps
- Vegetation cover in unsurveyed gaps
- Black Cockatoo breeding and foraging habitat

Lakes Rd
Quambi Dr
Jaymon Rd
Rosemore Wy
Hilduna Dr
Mewett Dr
Ramsay Rd
Rich Rd
Minninup Rd
Child Pl
Murnane Cr
Kent Rd
Cheriton Ct
Stratham Cl
Bussell Hwy
Fishermans Rd
Boyanup Rd West
Venus Rd
Roselands Rd

GELORUP
STRATHAM
1
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Paper Size ISO A3

0 90 180 270 360

Metres

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

N

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Southern Section Alternative Alignment
Environmental Impact Assessment

Black Cockatoos

Project No. **61-37041**
Revision No. **1**
Date **24/06/2019**

FIGURE 9

G:\61\37041\19_0_GIS\Maps\Working\EIASouthAlternative\6137041_007_BCsMapbook_Rev1.mxd
Print date: 24 Jun 2019 - 17:19

Data source: BORR: South Alternative Boundary - 20181212; MRWA: Road Network - 20180519; Landgate: Imagery accessed on 20190415; Biota: Fauna habitat, BC trees - 20190220, BC observations - 20171; Geoscience Australia: Geodata Topo 250k - 2006. Landgate / SLIP. Created by: mmikkonen

Boyanup Rd West

Boyanup Rd West

Elgin Rd

Cable Mine Rd

Nicholls Rd

Clapp Rd

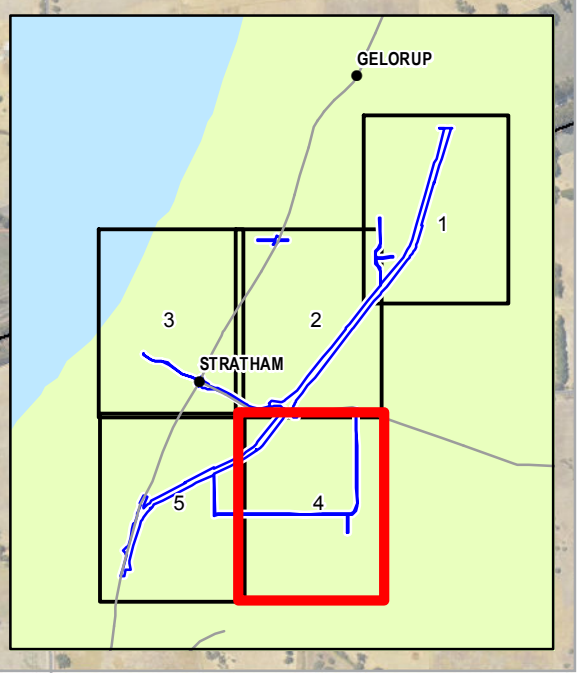
Vickery Rd

Boyanup Capel

Legend

Trees with Hollows Potentially Suitable - Black Cockatoo

- Known nesting tree
- Suitable with no evidence of use
- Not suitable
- Ground assessed – suitability not confirmed
- Major Road
- Minor Road
- Project Area
- Survey Area
- Unsurveyed gaps
- Black Cockatoo breeding and foraging habitat



Paper Size ISO A3

0 90 180 270 360

Metres

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

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BUILDING OUR FUTURE

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Bunbury Outer Ring Road
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Black Cockatoos

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Revision No. **1**
Date **24/06/2019**

FIGURE 9

G:\61\37041\19_0_GIS\Maps\Working\EIASouthAlternative\6137041_007_BCsMapbook_Rev1.mxd
Print date: 24 Jun 2019 - 17:20

Data source: BORR: South Alternative Boundary - 20181212; MRWA: Road Network - 20180519; Landgate: Imagery accessed on 20190415; Biota: Fauna habitat, BC trees - 20190220, BC observations - 201711; Geoscience Australia: Geodata Topo 250k - 2006. Landgate / SLIP. Created by: mmikkonen

Legend

Trees with Hollows Potentially Suitable - Black Cockatoo

- Known nesting tree
- Suitable with no evidence of use
- Not suitable
- Ground assessed – suitability not confirmed
- Major Road
- Minor Road
- Project Area
- Survey Area
- Unsurveyed gaps
- Vegetation cover in unsurveyed gaps
- Black Cockatoo breeding and foraging habitat

Roselands Rd
Bussell Hwy
Cable Mine Rd
Roberts Rd
Yeardy Rd
John Hogg Rd
Malatesta Rd
Rd

GELORUP
STRATHAM
1
2
3
4
5

Paper Size ISO A3

0 90 180 270 360

Metres

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

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Bunbury Outer Ring Road
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Black Cockatoos

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Revision No. **1**
Date **24/06/2019**

FIGURE 9

G:\61\37041\19_0_GIS\Maps\Working\EIASouthAlternative\6137041_007_BCsMapbook_Rev1.mxd
Print date: 24 Jun 2019 - 17:17

Data source: BORR: South Alternative Boundary - 20181212; MRWA: Road Network - 20180519; Landgate: Imagery accessed on 20190415; Biota: Fauna habitat, BC trees - 20190220, BC observations - 20171; Geoscience Australia: Geodata Topo 250k - 2006. Landgate / SLIP. Created by: mmikkonen

Legend
Major Road
Minor Road
Project Area
Map sheet

DALYELLUP
GELORUP
NORTH BOYANUP
Map 1
Map 2
Map 3
Bussell Hwy
STRATHAM
BOYANUP
Map 4
Map 5
STIRLING ESTATE
ELGIN
Railway Rd
CAPEL
THE PLAINS
SLIP

Paper Size ISO A3
0 0.5 1 1.5
Kilometres
Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 Perth Coastal Grid 1994
N

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Main Roads Western Australia
Bunbury Outer Ring Road
Southern Section Alternative Alignment
Environmental Impact Assessment

Western Ringtail Possums

Project No. 61-37041
Revision No. 1
Date 24/06/2019

OVERVIEW

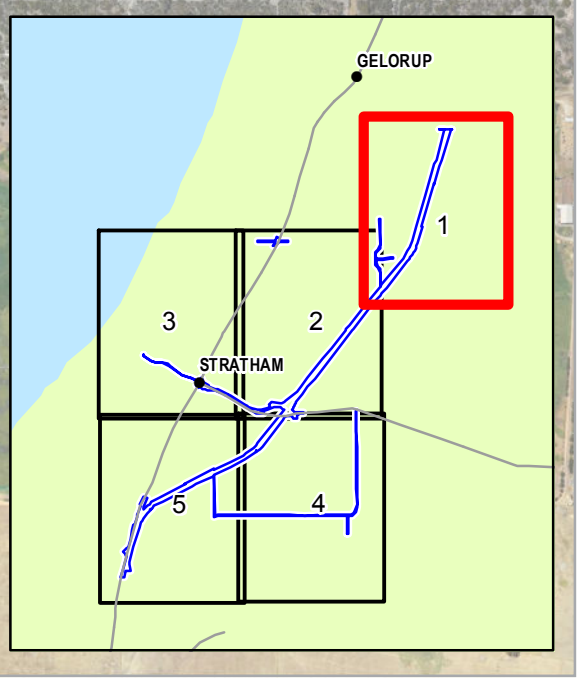
FIGURE 10

Data source: BORR: South EIA Boundary - 20181212; MRWA: Road Network - 20180519; Landgate: Imagery accessed on 20190522, Locality names - 2018; Geoscience Australia: Geodata Topo 250k..
Created by: slei

Brookview Av
Serene Dr
Coachwood Wy
Jules Rd
Allenville Rd
Ducane Rd
Ducane Rd
Watkins Rd
Ridge Pl
Zanadu Ct
Tarrock Ct
Marchetti Rd
Yalinda Dr
Gelorup Rise
Woods Rd
Ken Bell Rd
Hair Pl
Stable Cl
Manea Dr
Jilley Rd
Skippings Rd

Legend

- Western Ringtail Possum observation
- Possum sampling transect
- Minor Road
- Unsurveyed gaps (white)
- Vegetation cover in unsurveyed gaps
- Project Area
- Survey Area
- Western Ringtail Possum breeding and foraging habitat



SLIP POWERED BY LANDGATE

Paper Size ISO A3

0 90 180 270 360

Metres

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

N

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Main Roads Western Australia
Bunbury Outer Ring Road
Southern Section Alternative Alignment
Environmental Impact Assessment

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Western Ringtail Possums

FIGURE 10

G:\61\37041\19_0_GIS\Maps\Working\EIASouthAlternative\6137041_008_WRPsMapbook_Rev1.mxd
Print date: 24 Jun 2019 - 17:25

Data source: BORR: South Alternative Boundary - 20181212, Gaps, Vegetation in gaps - 2019; MRWA: Road Network - 20180519; Landgate: Imagery accessed on 20190417; Biota: Fauna habitat, Possum observations, Sampling transects - 20190220; Geoscience Australia: Geodata Topo 250k - 2006. Landgate / SLIP. Created by: mmikkonen

Quambi Dr
Lakes Rd
Tamra Cl
Calinup Rd
Brockway Dr
Manea Dr
Rd No 308
Jaymon Rd
Bussell Hwy
Brisden Rd
Jilley Rd
Boyanup Rd West

Legend

- Western Ringtail Possum observation
- Possum sampling transect
- Major Road
- Minor Road
- Unsurveyed gaps (white)
- Vegetation cover in unsurveyed gaps
- Project Area
- Survey Area
- Western Ringtail Possum breeding and foraging habitat

GELORUP
STRATHAM
1
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3
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SLIP POWERED BY LANDGATE

Paper Size ISO A3
0 90 180 270 360
Metres

N

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

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Date **24/06/2019**

Western Ringtail Possums

FIGURE 10

G:\61\37041\19_0_GIS\Maps\Working\EIASouthAlternative\6137041_008_WRPsMapbook_Rev1.mxd
Print date: 24 Jun 2019 - 17:25

Data source: BORR: South Alternative Boundary - 20181212, Gaps, Vegetation in gaps - 2019; MRWA: Road Network - 20180519; Landgate: Imagery accessed on 20190417; Biota: Fauna habitat, Possum observations, Sampling transects - 20190220; Geoscience Australia: Geodata Topo 250k - 2006. Landgate / SLIP. Created by: mmikkonen

Legend

- Possum sampling transect
- Major Road
- Minor Road
- Unsurveyed gaps (white)
- Vegetation cover in unsurveyed gaps
- Project Area
- Survey Area
- Western Ringtail Possum breeding and foraging habitat

Lakes Rd
Quambi Dr
Jaymon Rd
Rosemore Wy
Hilduna Dr
Mewett Dr
Ramsay Rd
Rich Rd
Minninup Rd
Child Pl
Murnane Cr
Kent Rd
Cheriton Ct
Stratham Cl
Bussell Hwy
Fishermans Rd
Boyanup Rd West
Venus Rd
Roselands Rd

GELORUP
STRATHAM
1
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SLIP POWERED BY LANDGATE

Paper Size ISO A3
0 90 180 270 360
Metres

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

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Western Ringtail Possums

FIGURE 10

G:\61\37041\19_0_GIS\Maps\Working\EIASouthAlternative\6137041_008_WRPsMapbook_Rev1.mxd
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Data source: BORR: South Alternative Boundary - 20181212, Gaps, Vegetation in gaps - 2019; MRWA: Road Network - 20180519; Landgate: Imagery accessed on 20190417; Biota: Fauna habitat, Possum observations, Sampling transects - 20190220; Geoscience Australia: Geodata Topo 250k - 2006. Landgate / SLIP. Created by: mmikkonen

Boyanup Rd West

Boyanup Rd West

Elgin Rd

Cable Mine Rd

Nicholls Rd

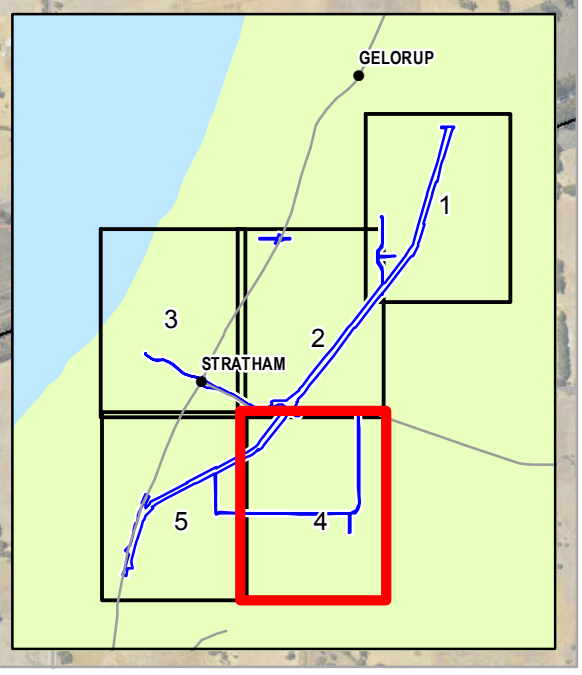
Clapp Rd

Vickery Rd

Boyanup Capel

Legend

- Western Ringtail Possum observation
- Possum sampling transect
- Major Road
- Minor Road
- Unsurveyed gaps (white)
- Vegetation cover in unsurveyed gaps
- Project Area
- Survey Area
- Western Ringtail Possum breeding and foraging habitat



SLIP POWERED BY LANDGATE

Paper Size ISO A3

0 90 180 270 360

Metres

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

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Western Ringtail Possums

FIGURE 10

G:\61\37041\19_0_GIS\Maps\Working\EIASouthAlternative\6137041_008_WRPsMapbook_Rev1.mxd
Print date: 24 Jun 2019 - 17:30

Data source: BORR: South Alternative Boundary - 20181212, Gaps, Vegetation in gaps - 2019; MRWA: Road Network - 20180519; Landgate: Imagery accessed on 20190417; Biota: Fauna habitat, Possum observations, Sampling transects - 20190220; Geoscience Australia: Geodata Topo 250k - 2006. Landgate / SLIP. Created by: mmikkonen

Legend

- Western Ringtail Possum observation
- Possum sampling transect
- Major Road
- Minor Road
- Unsurveyed gaps (white)
- Vegetation cover in unsurveyed gaps
- Project Area
- Survey Area
- Western Ringtail Possum breeding and foraging habitat

Roselands Rd
Bussell Hwy
Cable Mine Rd
Roberts Rd
Yeardy Rd
John Hogg Rd
Malatesta Rd

GELORUP
STRATHAM
1
2
3
4
5

SLIP POWERED BY LANDGATE

Paper Size ISO A3
0 90 180 270 360
Metres

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

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Bunbury Outer Ring Road
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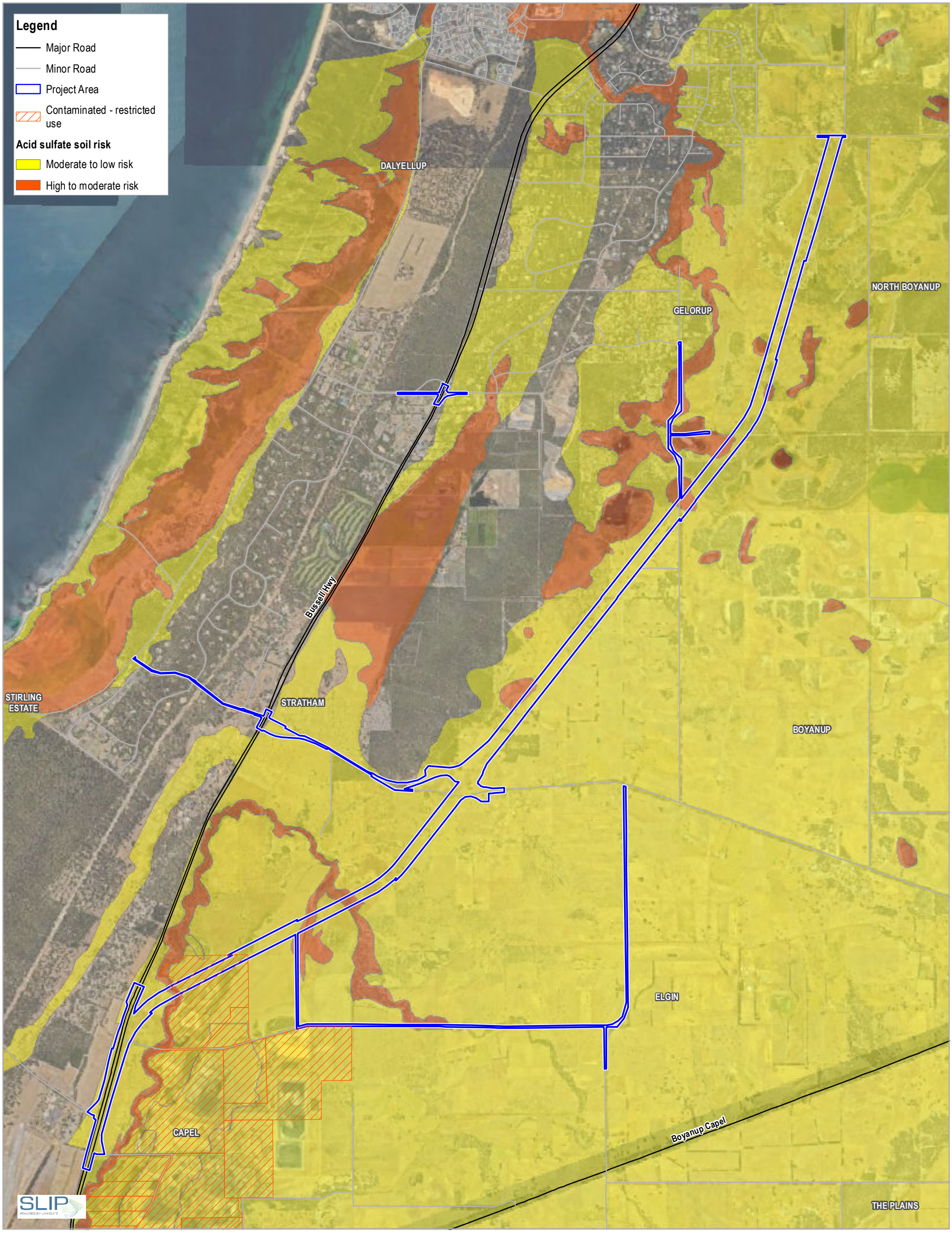
Western Ringtail Possums

Project No. **61-37041**
Revision No. **1**
Date **24/06/2019**

FIGURE 10

G:\61\37041\19_0_GIS\Maps\Working\EIASouthAlternative\6137041_008_WRPsMapbook_Rev1.mxd
Print date: 24 Jun 2019 - 17:31

Data source: BORR: South Alternative Boundary - 20181212, Gaps, Vegetation in gaps - 2019; MRWA: Road Network - 20180519; Landgate: Imagery accessed on 20190417; Biota: Fauna habitat, Possum observations, Sampling transects - 20190220; Geoscience Australia: Geodata Topo 250k - 2006. Landgate / SLIP. Created by: mmikkonen



Paper Size ISO A3

0 0.25 0.5 0.75 1

Kilometres

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

N

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Bunbury Outer Ring Road
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Acid Sulfate Soils and Contaminated Sites

Project No. **61-37041**
Revision No. **1**
Date **24/06/2019**

FIGURE 11

G:\61\37041\19_0_GIS\Maps\Working\EIASouthAlternative\6137041_009_ASSContam_Rev1.mxd
Print date: 24 Jun 2019 - 15:18

Data source: BORR: South Alternative Boundary - 20181212; Landgate: Imagery accessed on 20190612; MRWA: Road Network - 20180519; DWER: Acid sulphate soils - 201409, Contaminated Land - 20180615; Geoscience Australia: Geodata Topo 250k - 2006. . Created by: slei

Legend

- Major Road
- Minor Road
- Project Area
- Aboriginal Heritage Sites (Registered and Lodged category)
- European Heritage Sites

DALYELLUP
STIRLING BEACH DALYELLUP
Paper bark wetlands
Bunbury Grammar School
BUNBURY 24
Bunbury Bypass Archaeological Site 1
NORTH BOYANUP
The Gelorup Corridor
GELORUP
Jilley Rd
Bussell Hwy
Minninup Church
Minninup Church
Stratham Park
STRATHAM
Rosemore
Elgin Sports Club
Boyanup Rd West
Stratham School (1st Site)
Sunnyside
Stratham School (2nd Site)
All Souls Church
Roselands
BOYANUP
CAPEL BUSSELL HIGHWAY.
Elgin Rd
ELGIN
Trig Sol Settler
Elgin PO & Phone Exchange
The Bridge Homestead
Boyanup Capel
CAPEL
Capel/01 - Northern Creek
Elgin Siding
Elgin School
Elgin Hall
THE PLAINS
Capel Cemetery

SLIP POWERED BY LANDGATE

Paper Size ISO A3

0 0.5 1 1.5 Kilometres

N

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

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Bunbury Outer Ring Road
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Environmental Impact Assessment

Heritage Constraints

Project No. **61-37041**
Revision No. **1**
Date **27/06/2019**

FIGURE 12

Data source: BORR Team: South Alternative Boundary - 201812, Investigation Corridor - 20180706; State Heritage Office: European heritage sites - 20190115; DAA: Aboriginal Heritage Sites - 20190627; Landgate: Aerial photography - Virtual Mosaic accessed 20190627, Roads - 2018. . Created by: mmikkonen

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