STRUCTURE PLAN

LOT 500 WIRRING ROAD
COWARAMUP



LB PLANNING
TOWN PLANNING | URBAN DESIGN | LAND DEVELOPMENT CONSULTING

ROWE GROUP DESIGN

OUR REF: 9449_IND01C

This page has been left blank intentionally.

Document Control

Printed 24 May 2024
9449_IND01B_20240523

VERSION	FILE NAME	PREPARED BY	APPROVED BY	DATE
1	9449_IND01A	Madison Mackenzie	Rod Dixon	5 August 2022
2	9449_IND01B	Isabelle Scarfone	Rod Dixon	23 March 2024
3	9449_IND01C	Isabelle Scarfone	Rod Dixon	28 June 2024

This report has been authorised by;

Rod Dixon
Director

Rebecca Thompson
Manager Urban Design

Jamie Baxter
Quality Control

CONTACT ROWE GROUP

p 9221 1991 **e** info@rowegroup.com.au
a 3/369 Newcastle Street, Northbridge 6003

CONTACT LB PLANNING

p 9750 5925 **e** stan@lbplanning.com.au
a 191 Naturaliste Terrace, Dunsborough 6281

Although all care has been taken on the compilation of this document Greg Rowe Pty Ltd and all parties associated with its preparation disclaim any responsibility for any errors or omissions. The right is reserved to change this document at any time. This document does not constitute an invitation, agreement or contract (or any part thereof) of any kind whatsoever. Liability is expressly disclaimed by Greg Rowe Pty Ltd for any loss or damage which may be sustained by any person acting on this document.

© 2024 Greg Rowe Pty Ltd All Rights Reserved. Copyright in the whole and every part of this document belongs to Greg Rowe Pty Ltd and may not be used, sold, transferred, copied or reproduced in whole or in part in any manner or form or in or on any media to any person without the prior written consent of Greg Rowe Pty Ltd.

Record of Endorsement

This structure plan is prepared under the provisions of the Shire of Augusta-Margaret River Local Planning Scheme No.1.

IT IS CERTIFIED THAT THIS STRUCTURE PLAN WAS APPROVED BY RESOLUTION OF THE WESTERN AUSTRALIAN PLANNING COMMISSION ON:

10 July 2024

Signed for and on behalf of the Western Australian Planning Commission:



an officer of the Commission duly authorised by the Commission pursuant to section 24 of the *Planning and Development Act 2005* for that purpose, in the presence of:



Witness	
Date	11 July 2024
Date of Expiry	11 July 2034

Table of Amendments

Amendment No.	Summary of The Amendment	Amendment Type	Date Approved by WAPC

Executive Summary

This Structure Plan applies to Lot 500 Wirring Road, Cowaramup ('the subject land'). The subject land comprises approximately 40.9 hectares of land located on the eastern edge of the Cowaramup Townsite, north of Wirring Road. The land is zoned 'Future Development' under the Shire of Augusta-Margaret River Local Planning Scheme No. 1 ('LPS 1'), subject of a recently approved Local Planning Scheme Amendment (Amendment 76) that rezoned the land from 'General Agriculture'.

The Structure Plan area is located immediately south-east of the established Cowaramup Townsite, 10 kilometres north of the Margaret River Townsite and approximately 31 kilometres south-west of the Busselton Regional Centre. Bussell Highway is located approximately 300 metres west of the site.

The objective of this Structure Plan is to facilitate the development of the subject land for residential purposes, in a manner that reflects the existing character of Cowaramup and provides an appropriate transition to the adjoining agricultural land.

The Structure Plan has been prepared to satisfy the requirements of LPS 1 (including the specific provisions proposed by Amendment 76), as well as the *Planning and Development (Local Planning Schemes) Regulations 2015*.

The Structure Plan will ultimately provide for the logical extension of the established residential development area in Cowaramup.

Structure Plan Summary

Item	Data	Section Number Referenced in Part 2 of Report
Total area covered by the Structure Plan	40.9 hectares	1.2.2
Area of each land use proposed: Residential	24.7 hectares	4.3
Total estimated lot yield	371 lots	4.3
Estimated number of dwellings	371 dwellings	4.3
Estimated residential site density (at 350m² average)	15 dwellings per site hectare	4.3
Estimated population	1002 people	4.3
Estimated area of public open space given over to: Neighbourhood parks	4.73 hectares, 3 parks	4.4.2

Note: All information and areas are approximate only and are subject to survey and detailed design.

Contents

EXECUTIVE SUMMARY ..... **IV**

STRUCTURE PLAN SUMMARY ..... **V**

PART ONE IMPLEMENTATION

1. Structure Plan Area **14**

2. Operation **14**

3. Staging **14**

4. Subdivision & Development Requirements **14**

4.1. Land Use & Zones 14

4.2. Residential Density 14

4.3. Public Open Space 14

4.4. Vegetation Retention 17

4.5. Landscape Interface 17

4.6. Local Development Plan/s 17

4.7. Stormwater Management 17

4.8. Road Reserve 18

5. Other Requirements **19**

5.1. Fire Management 19

5.2. Development Contributions 19

5.3. Traffic 19

6. Additional Information **19**

PART TWO IMPLEMENTATION

1. Planning Background **22**

1.1. Introduction & Purpose 22

1.2. Land Description 23

1.2.1. Location 23

1.2.2. Legal Description & Ownership 23

2. Planning Framework **30**

2.1. Zoning & Reservations 30

2.1.1. Shire of Augusta-Margaret River Local Planning Scheme No. 1 30

2.1.1.1. Scheme Amendment No. 76 30

2.2. Planning Strategies 33

2.2.1. Shire of Augusta-Margaret River Local Planning Strategy 33

2.2.2. Cowaramup Village Strategy 33
2.3. State Planning Policies & Guidelines 35
2.3.1. State Planning Policy 3 – Urban Growth and Settlement 35
2.3.2. State Planning Policy 3.7 – Planning in Bushfire Prone Areas 35
2.3.3. Liveable Neighbourhoods 36
2.4. Local Planning Policies 36
3. Site Conditions & Constraints 38
3.1. Biodiversity & Natural Area Assets 38
3.1.1. Flora & Vegetation 38
3.1.2. Fauna 38
3.2. Landform & Soils 39
3.2.1. Acid Sulphate Soils 39
3.3. Groundwater & Surface Water 39
3.3.1. Groundwater 39
3.3.2. Surface Water 40
3.4. Heritage 40
3.4.1. Indigenous Heritage 40
3.4.2. European Heritage 40
3.5. Surrounding Land Use 40
3.6. Bushfire Hazard 41
4. Land Use & Subdivision Requirements 42
4.1. Land Use 42
4.2. Design Rationale 43
4.3. Residential 46
4.3.1. Central Development Site (Retirement Village) 46
4.3.2. Landscape Interface 46
4.4. Public Open Space 48
4.4.1. Landscape Strategy 48
4.4.2. Public Open Space 49
4.5. Movement Network 52
4.5.1. Existing Road Network 52
4.5.2. Pedestrian & Cycle Network 52
4.6. Water Management 53
4.6.1. Local Water Management Strategy 53
4.6.2. Stormwater Management Strategy 53
4.6.3. Groundwater Management Strategy 54
4.6.4. Landscaping & Irrigation 54

4.6.5. Urban Water Management Plan 54
4.7. Infrastructure Coordination, Servicing & Staging 55
4.7.1. Power 55
4.7.2. Water 55
4.7.3. Reticulated Sewer 55
4.7.4. Reticulated Gas 56
4.7.5. Telecommunications 56
4.8. Education Facilities 56
4.9. Activity Centres & Employment 56
4.10. Developer Contribution Arrangements 56

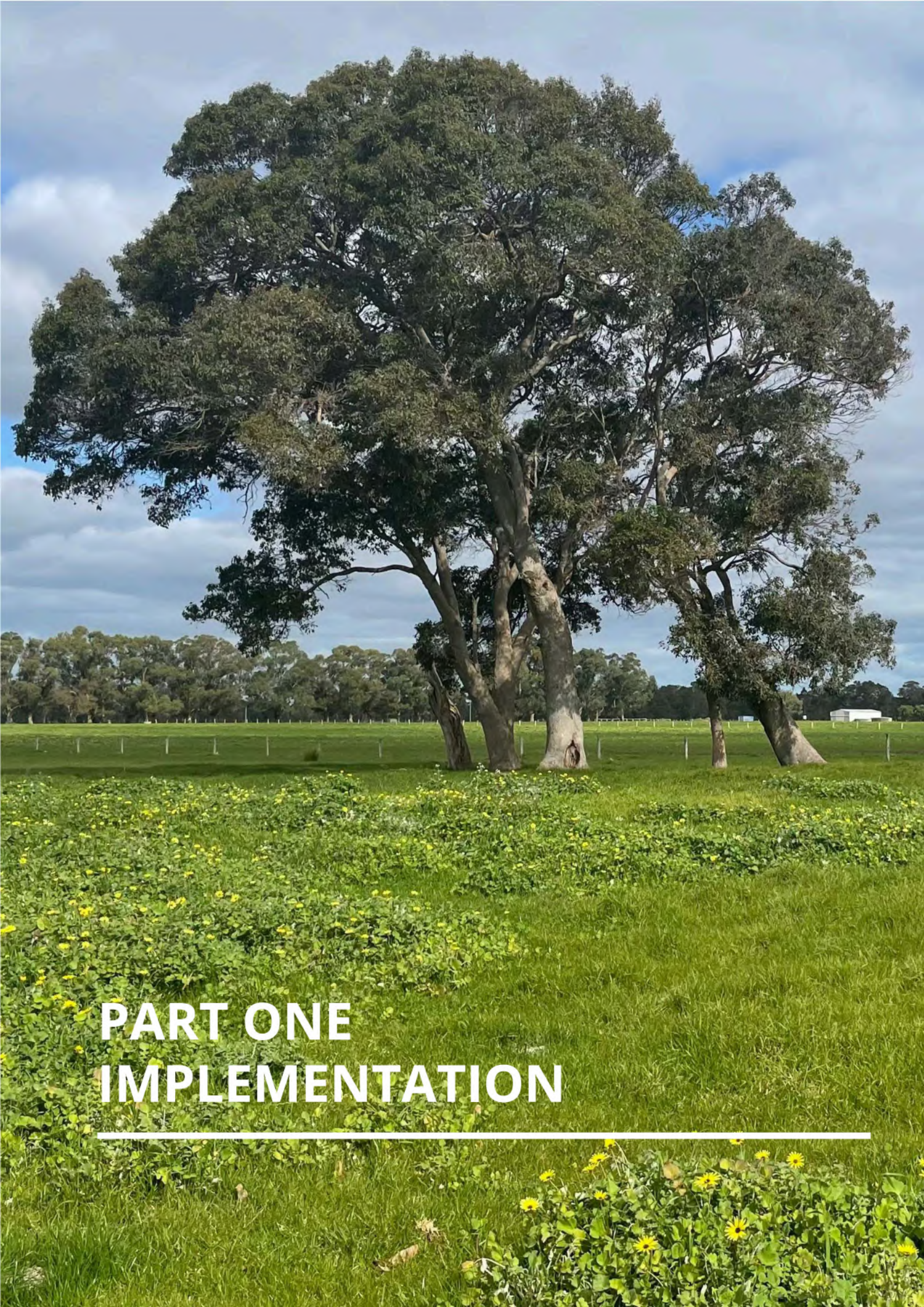
Figures

Figure 1 - Regional Location 26
Figure 2 - Local Context 27
Figure 3 - Site Plan 28
Figure 4 - Context Plan 29
Figure 5 - Local Planning Scheme No. 1 Map 31
Figure 6 - Proposed Amendment Plan 32
Figure 7 - Local Planning Strategy Map 34
Figure 8 - Landscape Transition Lots Concept 47
Figure 9 - Public Open Space Plan 50

Technical Appendices

No.	Document Title	Nature of Document	Referral/ Approval Agency	Approval Status & Modifications
1	Certificate of Title	Supporting	-	-
2	Feature Survey	Supporting	-	-
3	Bushfire Management Plan	Requires Approval	Shire of Augusta-Margaret River	Awaiting Approval
4	Environmental Assessment Report	Supporting	-	-
5	Local Water Management Strategy	Requires Approval	Shire of Augusta-Margaret River & DWER	Awaiting Approval
6	Indicative Concept Plan	Supporting	-	-
7	Landscape Master Plan	Supporting	-	-
8	Traffic Impact Assessment	Supporting	-	-
9	Engineering Servicing Report	Supporting	-	-

This page has been left blank intentionally.



PART ONE
IMPLEMENTATION

1. Structure Plan Area

This Structure Plan shall apply to Lot 500 Wirring Road, Cowaramup, being the land contained within the inner edge of the line denoting the Structure Plan boundary on the Structure Plan Map (Refer Plan 1 situated at the end of Part 1 of this Structure Plan report).

2. Operation

The plan is in effect from the date stated on the cover and for a period of 10 years.

3. Staging

Staging of the proposed Structure Plan is anticipated to occur from the west to the east and in accordance with the provision of services. Staging is to be further considered and addressed through the subdivision and detailed design phases.

4. Subdivision & Development Requirements

4.1. Land Use & Zones

The Structure Plan Map (Plan 1) outlines the land uses, zones and reserves applicable to the Structure Plan area. Land use permissibility within the Structure Plan area shall be in accordance with the corresponding zone or reserve under the Shire of Augusta-Margaret River Local Planning Scheme No. 1.

4.2. Residential Density

Subdivision within the Structure Plan area is to be in accordance with the residential density code prescribed by the Structure Plan.

In accordance with the Shire of Augusta-Margaret River Local Planning Strategy, the Structure Plan area shall provide a minimum of 300 residential lots.

4.3. Public Open Space

As a condition of subdivision, the applicant will be required to cede and reserve land identified for public open space free of cost.

Public open space is to be provided generally in accordance with the Structure Plan Map (Plan 1).

Refer Figure 9 – Public Open Space Plan and Table 4 – Public Open Space Schedule.



Figure 9 - Public Open Space Plan

Lot 500 Wirring Road, Cowaramup Public Open Space Schedule				
Site Area (Structure Plan Boundary)				40.93 ha
Deductions				
Drainage (1:1 year) - Swales in POS		0.17		
Drainage (1:1 year) - Dedicated Drainage Basins		0.902		
Total			1.073	
Gross Subdivisible Area				**39.857 ha**
Public Open Space @ 10%				3.986 ha
Public Open Space Contribution				
May Comprise:				
Minimum 80% unrestricted POS			3.189ha	
Maximum 20% restricted POS			0.797ha	
Total Required Public Open Space				**3.986 ha**
POS Reference Number	**Total POS Area**	**1:1 Year Drainage**	**Unrestricted POS**	**Restricted POS**
POS A	16,359m^2	0	16,359m^2	0
POS B	15,284m^2	0	15,284m^2	0
POS C	15,703m^2	1,710m^2	13,213m^2	2,490m^2
Total	47,346m^2	1,710m^2	44,856m^2	2,490m^2
Percentage of gross sub-divisible area	11.88%	0.43%	11.25%	0.62%
Total Public Open Space Provided				**11.88%**

Notes:

This Public Open Space Schedule is based on the Public Open Space Plan prepared by Rowe Group (Plan ID: 9449-FIG-09-C).

This Public Open Space Schedule is based on the drainage assumptions as per the Local Water Management Strategy prepared by Local Water Management Strategy prepared by RPS dated 1 August 2022 (Ref: AU2130002398.001).

Table 4: Public Open Space Schedule.

4.4. Vegetation Retention

The Structure Plan proposes to retain the majority of the mature trees within the subject land and the Wirring Road reserve. As a condition of subdivision approval, the proponent will be required to:

a. Ensure the fill and earthwork programmes protect the existing vegetation where possible; and

b. Ensure measures are taken to protect all mature trees within the Wirring Road reserve during subdivisional works.

No development is permitted within 'Vegetation Protection' areas identified on structure plan map

4.5. Landscape Interface

The Structure Plan is surrounded by agricultural land to its eastern and southern boundaries. To ensure appropriate management of the rural interface, the following design mechanisms will be applied to all R10 coded lots;

a. The landscape interface area is to contain a vegetated earth mound as required by the Local Water Management Strategy, to be constructed and landscaped by the developer;

b. Rear boundary fencing is to comprise uniform open style, rural fencing;

c. Side boundary fencing within the landscape interface area is to comprise uniform open style, rural fencing; and

d. The rear setback to the dwelling must be taken from the 10-metre landscape interface line.

4.6. Local Development Plan/s

Local Development Plans are to be prepared for lots with one or more of the following attributes:

a. Lots with an irregular configuration;

b. Lots where specific vehicle access control is required;

c. Lots abutting public open space, a pedestrian access way or an area of landscape interface;

d. Lots with particular site constraints;

4.7. Stormwater Management

At the time of subdivision, an Urban Water Management Plan will be required as a condition of subdivision approval.

At subdivision stage a bund to manage stormwater flow from the adjoining rural catchment is to be installed at the rear of the R10 lots.

All new dwellings to be fitted with an under-eave rainwater tank with a storage capacity of at least 2,500 litres or 5,000 litres on R10 lots, between the overflow and the slow-release pipe, to be plumbed into the home.

All dwellings are required to be constructed at a finished floor level to provide a minimum separation of 0.3 meters above 1% AEP stormwater storage water level.

4.8. Road Reserve

One of the key planning matters to be addressed for the site, as identified within the Shire's Local Planning Strategy, is creating key road linkages with the existing network. In this regard, concept planning for the Structure Plan was guided by the existing road linkages surrounding the site, including Roy Earl Drive, Wirring Road, Lions Drive, Duggan Drive and Waverley Road, which all intersect with the site. Future long term eastward connections have also been provided for to provide the eastward townsite extension (if required).

The internal road hierarchy proposed for the Structure Plan has been determined by modelling based on the Indicative Concept Plan. This provides for simple and efficient vehicle movements throughout the site, and externally, and allows for regular shaped lots. As such, the Structure Plan area generally comprises a grid network of access streets. The indicative road network is proposed to comprise the following road classifications:

Road Classification	Indicative Upper Traffic Volume	Indicative Road Width
Access Street A (Roy Earl Drive Extension)	<3,000 vehicles per day	20-25 metres
Access Street C	<3,000 vehicles per day	16.5-18 metres
Access Street D	<1,000 vehicles per day	14.2 metres

Table 5: Road Classifications

The Structure Plan area will predominantly be accessed via the extension to Roy Earl Drive, which will comprise an Access Street A classified road designed to a 25-metre cross section (shown indicatively below). A new Access Street C connection, designed to an 18-metre cross section, will provide a new intersection to Wirring Road and Lions Drive. The majority of the residential lots will be serviced by 'Access Street D' classified roads, designed to a 15-metre cross section. Where services are only required to one side of the road (i.e., adjacent to areas of public open space) a reduced cross section of 13.2-metres is proposed.

The attached TIA includes an analysis of the current and future performance of surrounding intersections (SIDRA Analysis). In this regard, the Wirring Road-Bussell Highway intersection was found to have an existing Level of Service ('LOS') of 'C' during the PM peak period, meaning commuters have a 17 second delay on the Wirring Road (east) approach. Upon complete development of the Structure Plan Area, the LOS at this approach would increase to "E", with an approximate 38 second delay. Based on the analysis, the TIA indicates the LOS would trigger the upgrade of this intersection to reflect an AUR ('Auxiliary Right Turn'), at the time of construction of the new intersection to Wirring Road, which is likely to be in the final stages of development of the Structure Plan area.

Refer Attachment 8 - Traffic Impact Assessment.

5. Other Requirements

5.1. Fire Management

Any application for subdivision approval is to be accompanied by an updated bushfire management plan and BAL contour map.

5.2. Development Contributions

The Structure Plan area is subject to contribution toward the costs of common infrastructure in accordance with a Development Contribution Plan No. 5 (Cowaramup) and Cost Apportionment Schedule prepared pursuant to Part 6.3: Development Contribution Areas and Schedule 10 of LPS 1.

5.3. Traffic

Prior to the first subdivision application, the proponent will be required to prepare and provide an updated Traffic Impact Assessment outlining the impact of the proposed subdivision and structure plan on the intersections of Roy Earl Drive/Bussell Highway and Wirring Road/Bussell Highway, taking into account the findings of the Cowaramup Integrated Transport Strategy prepared for the Shire.

As a condition of subdivision, the proponent will be required to provide a proportionate contribution, based on traffic generation levels, for upgrades to the Roy Earl Drive/ Bussell Highway and Wirring Road/ Bussell Highway intersections, in accordance with an agreed Traffic Impact Assessment and to the satisfaction of the relevant road control authority.

6. Additional Information

The details of additional information required to be submitted with the Structure Plan and the stage which it is to be submitted, are summarised below.

Additional Information	Approval Stage	Consultation Required
Bushfire Management Plan	In support of subdivision or development application.	Shire of Augusta-Margaret River
Urban Water Management Plan	Condition of subdivision or development approval.	Shire of Augusta-Margaret River
Local Development Plan	Condition of subdivision approval.	Shire of Augusta-Margaret River



STRUCTURE PLAN MAP (PLAN 1)

LOT 500 WIRRING ROAD
COWARAMUP

N

0 100 m

SCALE @ A3: 1:4000

9449-LSP-01-I

DRAWN: VR
DATE CREATED: 2024.06.28
PROJECTION: MGA50 GDA94
CADASTRE: LANDGATE
SURVEY: SURVEY SOUTH - 28/03/22
AERIAL: 15/10/2021

This document may not be reproduced without the written consent of Rowe Group. All areas and dimensions are subject to survey.

ROWE GROUP DESIGN

This page has been left blank intentionally.

PART TWO
EXPLANATORY SECTION



1. Planning Background

1.1. Introduction & Purpose

This Structure Plan is prepared on behalf of R.W. Duggan, the owner of Lot 500 Wirring Road, Cowaramup (the 'subject land' or 'Structure Plan area'). The Structure Plan area is bound by Wirring Road on its southern boundary, Waverley Road on its northern boundary, existing residential development to its west and existing agricultural land to the east.

The Structure Plan has been prepared to satisfy the requirements of LPS 1 (including the specific provisions proposed by Amendment 76), as well as the *Planning and Development (Local Planning Schemes) Regulations 2015.*

The objectives of the Structure Plan are to:

- Provide a framework to guide the use, subdivision and development of the land to create a high quality, liveable urban precinct;
- Provide for a residential environment that responds to the existing Cowaramup Townsite character and the surrounding rural landscape;
- Protect the existing vegetation both on site, and within the Wirring Road reserve;
- Provide for a linear public open space reserve promoting pedestrian connectivity to the Cowaramup Townsite.

The following multidisciplinary project team has been engaged by the Proponent to progress the preparation of the Structure Plan:

Discipline	Consultant
Town Planning	Rowe Group and LB Planning
Urban Design	Rowe Group
Project Management	PGPM
Water Management	RPS
Bushfire Management	Ecosystem Solutions
Environmental	Ecosystem Solutions
Engineering Servicing	Stantec
Traffic	Stantec
Landscape	SW Collective

Table 1: Project Team.

Rowe Group and LB Planning are the primary contacts for all matters relating to the Structure Plan.

1.2. Land Description

1.2.1. Location

The site is located within the municipality of the Shire of Augusta-Margaret River, in the locality of Cowaramup. It is located approximately 240-metres south-east of the Cowaramup Townsite, 10 kilometres north of the Margaret River Townsite and approximately 31 kilometres south-west of the Busselton Regional Centre. The land lies approximately 300-metres east of Bussell Highway.

Refer Figure 1 – Regional Location and Figure 2 – Local Location.

The site is bound by Waverley Road to on north-east boundary, Wirring Road to the south, established residential development to the west and existing agricultural land to the east.

The subject land is currently (and has historically) been used for cattle grazing. The land is vacant of all buildings and contains a cluster of mature trees in the north-west corner of the site, and rows of paddock trees along the north-west boundary and through the centre of the site. Site photographs are included overleaf.

Refer Figure 3 – Site Plan and Figure 4 - Context Plan.

1.2.2. Legal Description & Ownership

The site comprises a single landholding comprising a total area of 40.929ha, legally described in Table 2.

Lot	Deposited Plan	Volume	Folio	Area	Landowner
500	Plan 422719	4012	462	40.929 ha	Rodney Duggan

Table 2: Cadastral Summary.

Refer Attachment 1 - Certificate of Title and Attachment 2 - Feature Survey.



EXISTING PADDOCK TREES - FACING EAST



EXISTING RESIDENTIAL - FACING NORTH



SYMPHONY WATERS ESTATE - FACING NORTH



WIRRING ROAD - FACING SOUTH



Figure 1 - Regional Location

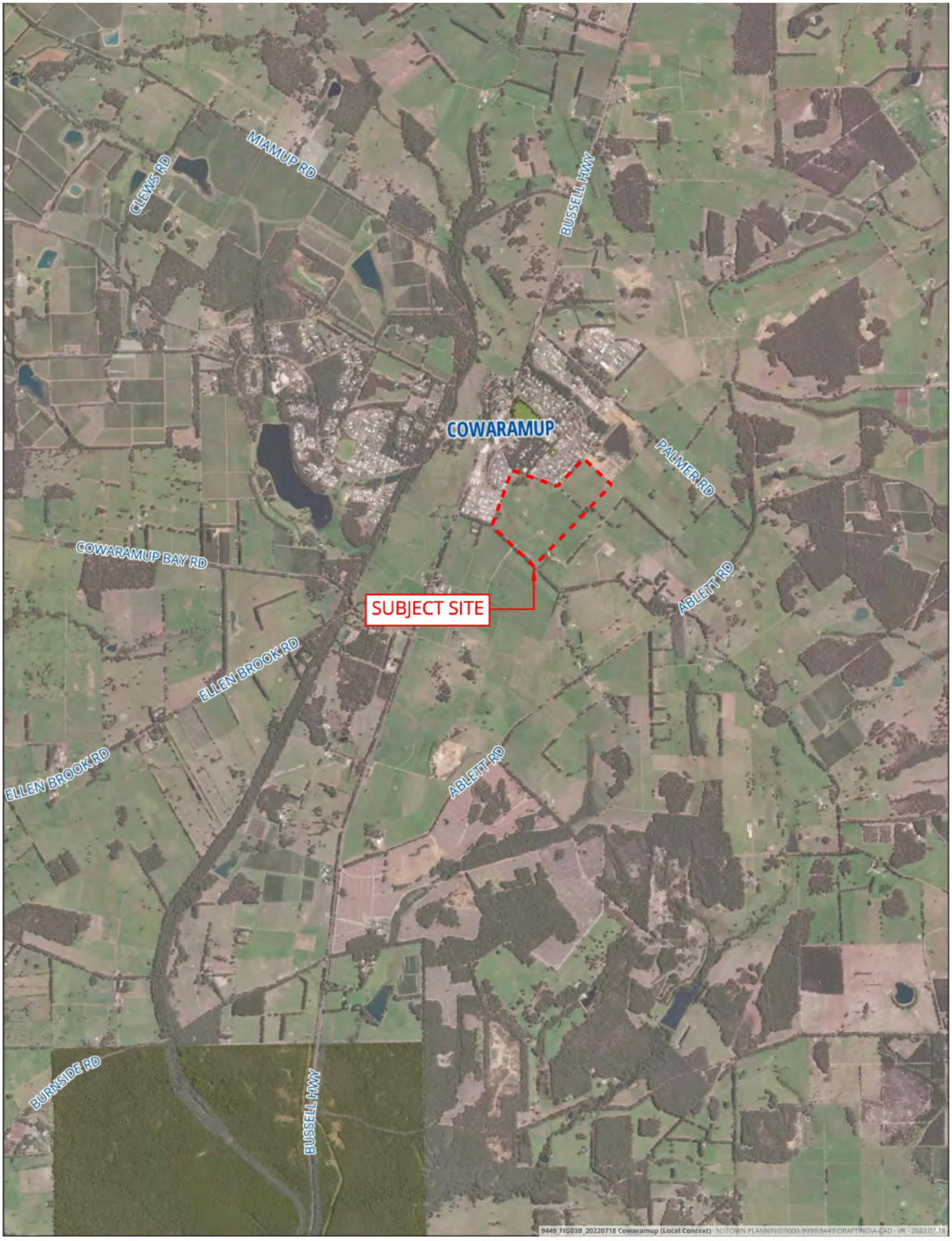


Figure 2 - Local Context

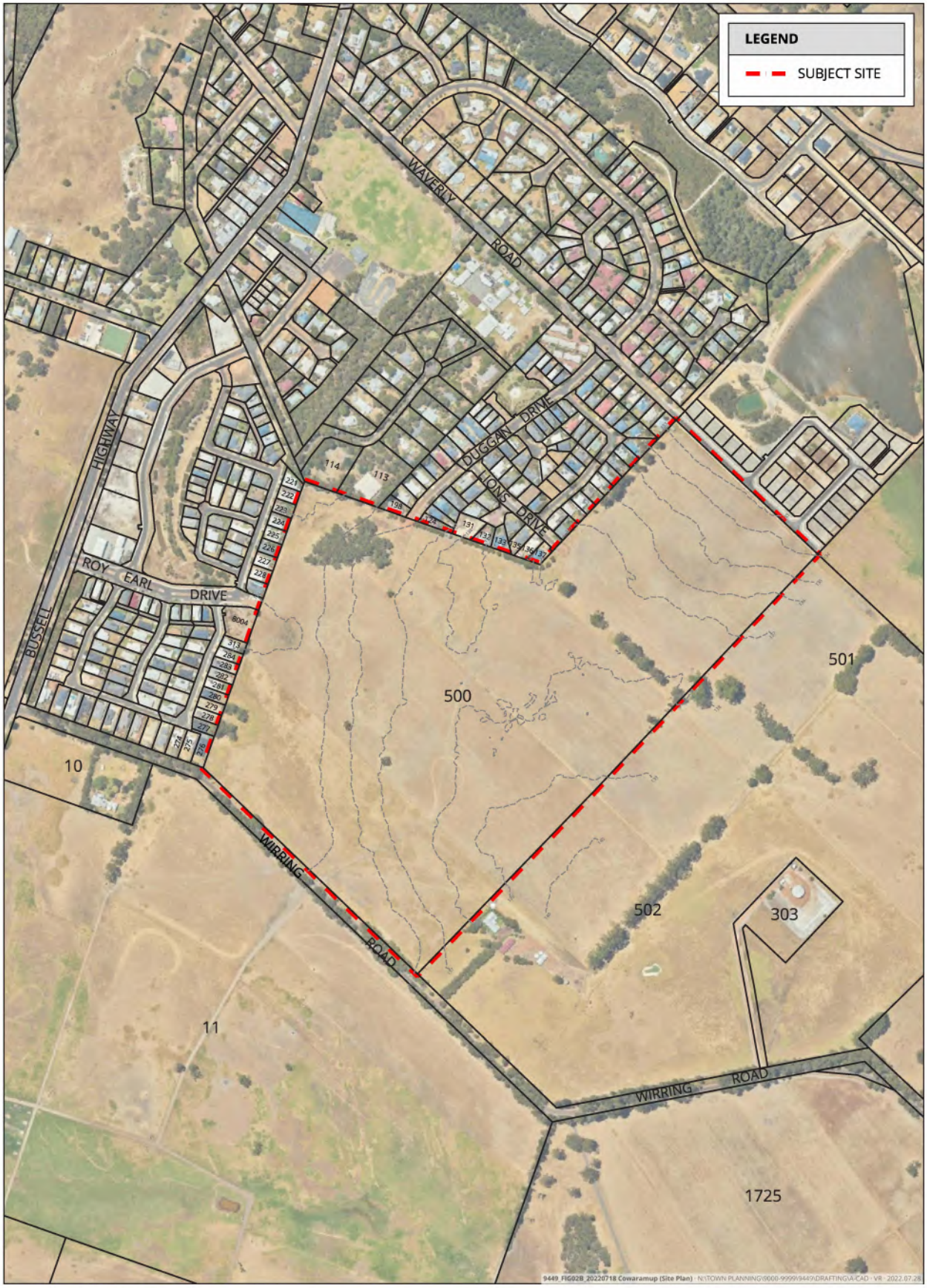


Figure 3 - Site Plan

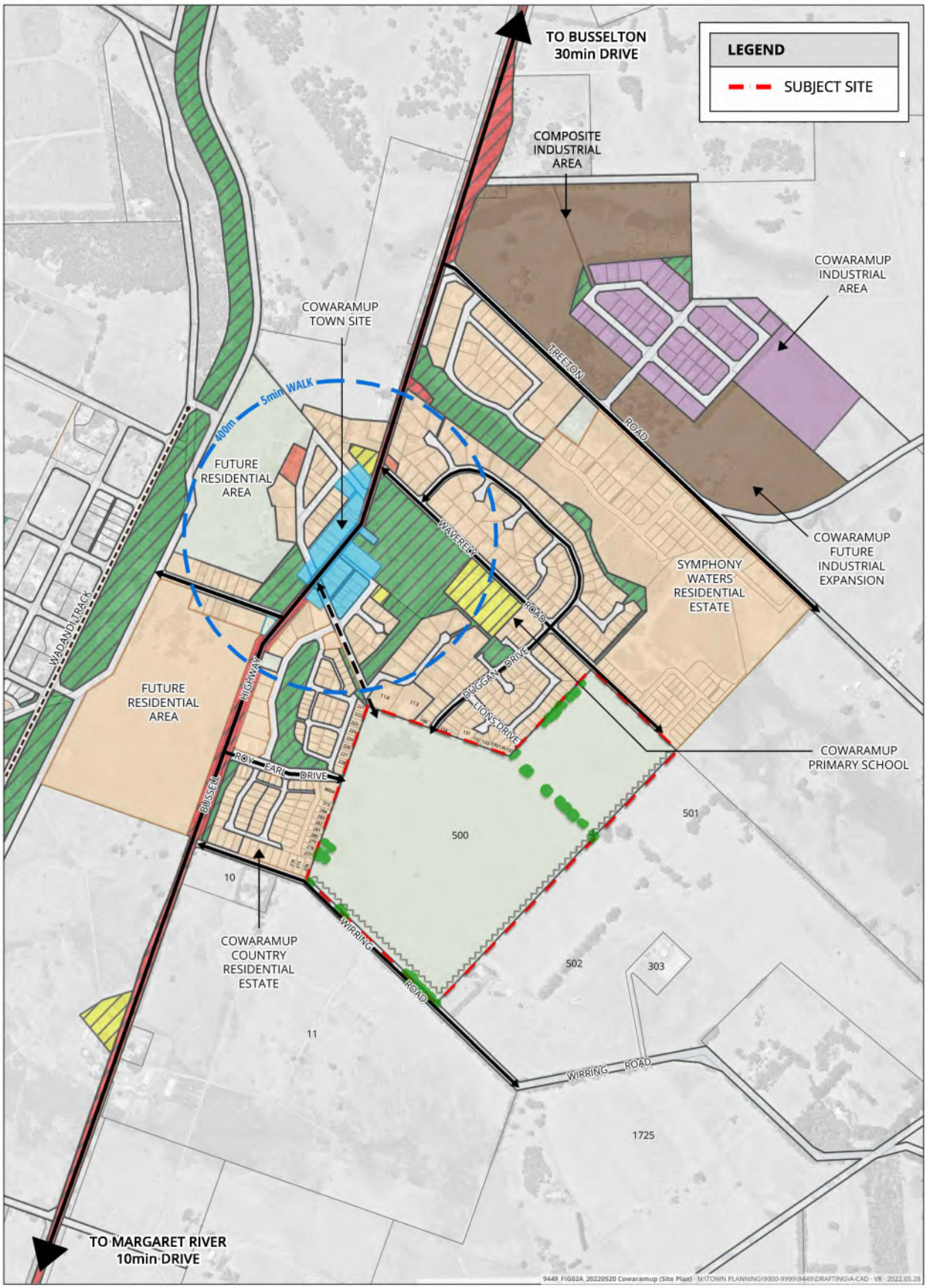


Figure 4 - Context Plan

2. Planning Framework

2.1. Zoning & Reservations

2.1.1. Shire of Augusta-Margaret River Local Planning Scheme No. 1

The subject land is currently zoned 'Future Development' under the provisions of the Shire of Augusta-Margaret River Local Planning Scheme No. 1 ('LPS 1') Amendment 76. Land to the east and south of the subject land are zoned 'Priority Agriculture' under LPS 1, and land to the north and the west of the subject land is zoned 'Residential' and 'Future Development' under LPS 1.

Refer Figure 5 – LPS 1 Zoning Plan.

2.1.1.1. Scheme Amendment No. 76

Rowe Group and LB Planning, on behalf of the Landowner, prepared and submitted a Request to amend the Shire of Augusta-Margaret River Local Planning Scheme No. 1 ('Amendment 76') on 14 June 2022. Amendment 76 seeks, in essence, to rezone the land to 'Future Development' and include it within Schedule 11 – Structure Plan Areas of LPS1, ultimately providing the head of power for the proposed Structure Plan to be adopted. The land is proposed to be included as Structure Plan Area No. 36 ('SPA 36'), along with the following associated provisions:

Area No. (SPA)	Description of Land Area	Land Use Expectation	Matters to be Addressed (in Addition to Part 4 of the Deemed Provisions)	Associated Provisions
36	Lot 500 Wirring Road, Cowaramup	Residential	The Structure Plan is to be prepared in accordance with Clause 6.2 of the Scheme and is to address the following: 1. Preparation, adoption and implementation of an endorsed Bushfire Management Plan. 2. Urban water management. 3. The rural-urban interface. 4. Protection of the remnant vegetation within the subject land and the Wirring Road reserve.	1. For lots coded R10 on the Structure Plan, the required rear setback to the dwelling must be taken from the 10m Landscape Buffer line. 2. For lots coded R10 on the Structure Plan, rear and side boundary fencing shall comprise open style, rural fencing.

It is requested that proposed Amendment 76 and this Structure Plan be considered concurrently.

Refer Figure 6 – Proposed Amendment Plan.

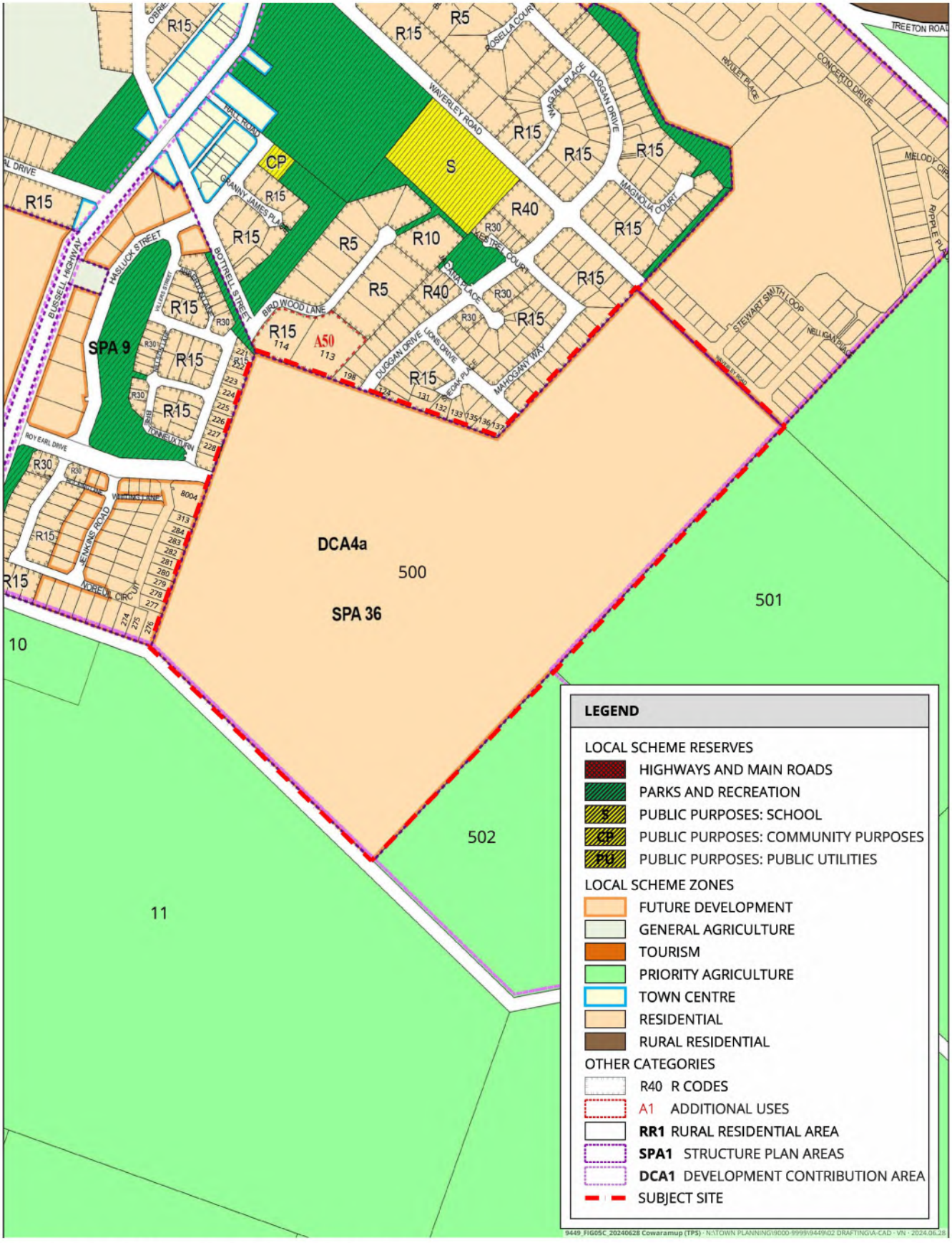


Figure 5 - Local Planning Scheme No. 1 Map

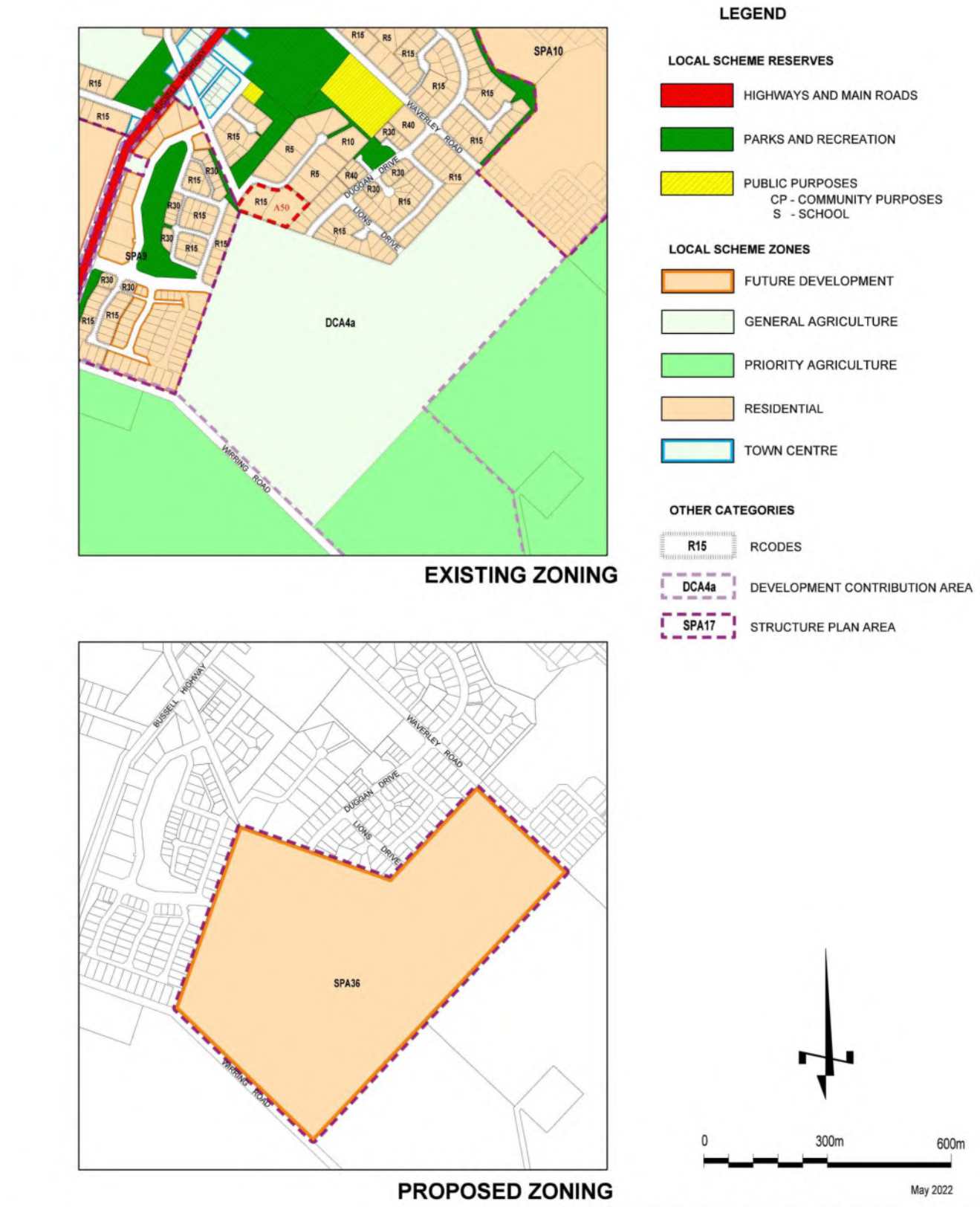


Figure 6 - Proposed Amendment Plan

2.2. Planning Strategies

2.2.1. Shire of Augusta-Margaret River Local Planning Strategy

The Shire of Augusta-Margaret River Local Planning Strategy was prepared by the Shire and endorsed by the Western Australian Planning Commission ('WAPC') on 18 January 2022, setting out the strategic framework for development within the Shire municipality to 2036.

The subject land is identified within the Strategy as a 'Future Urban Growth Area' and contained within Planning Precinct C5. The Strategy sets out a target lot yield of 300 lots at residential densities between R10 – R30, in addition to the required public open space reserves.

The Strategy sets out the following key planning matters to be addressed:

- Opportunity to create road linkages with existing network;
- Stands of remnant vegetation located on site shall be retained;
- Need to provide attractive entrance to Cowaramup from the south and buffers to adjoining agricultural land; and
- Sufficient buffers to surrounding agricultural properties such that their operations are not prejudiced.

These key considerations will be the key driver of the design of the Local Structure Plan for the subject land.

Refer Figure 7 – Local Planning Strategy Map.

2.2.2. Cowaramup Village Strategy

The Cowaramup Village Strategy was originally approved by the WAPC in 2005 and updated in 2010. The Strategy was prepared as the strategic planning framework guiding the growth of the Cowaramup Townsite.

The Strategy identifies the subject land as generally 'Residential R10 – 15' with an area of Public Open Space in the northern corner of the site. It also identifies the need for a 'transition' to the adjacent rural land, suggesting lower density be applied to facilitate this.

The rezoning of the subject land to 'Future Development' will facilitate the approval of this proposed Structure Plan enabling the development of the site for residential land use, consistent with the Cowaramup Village Strategy.

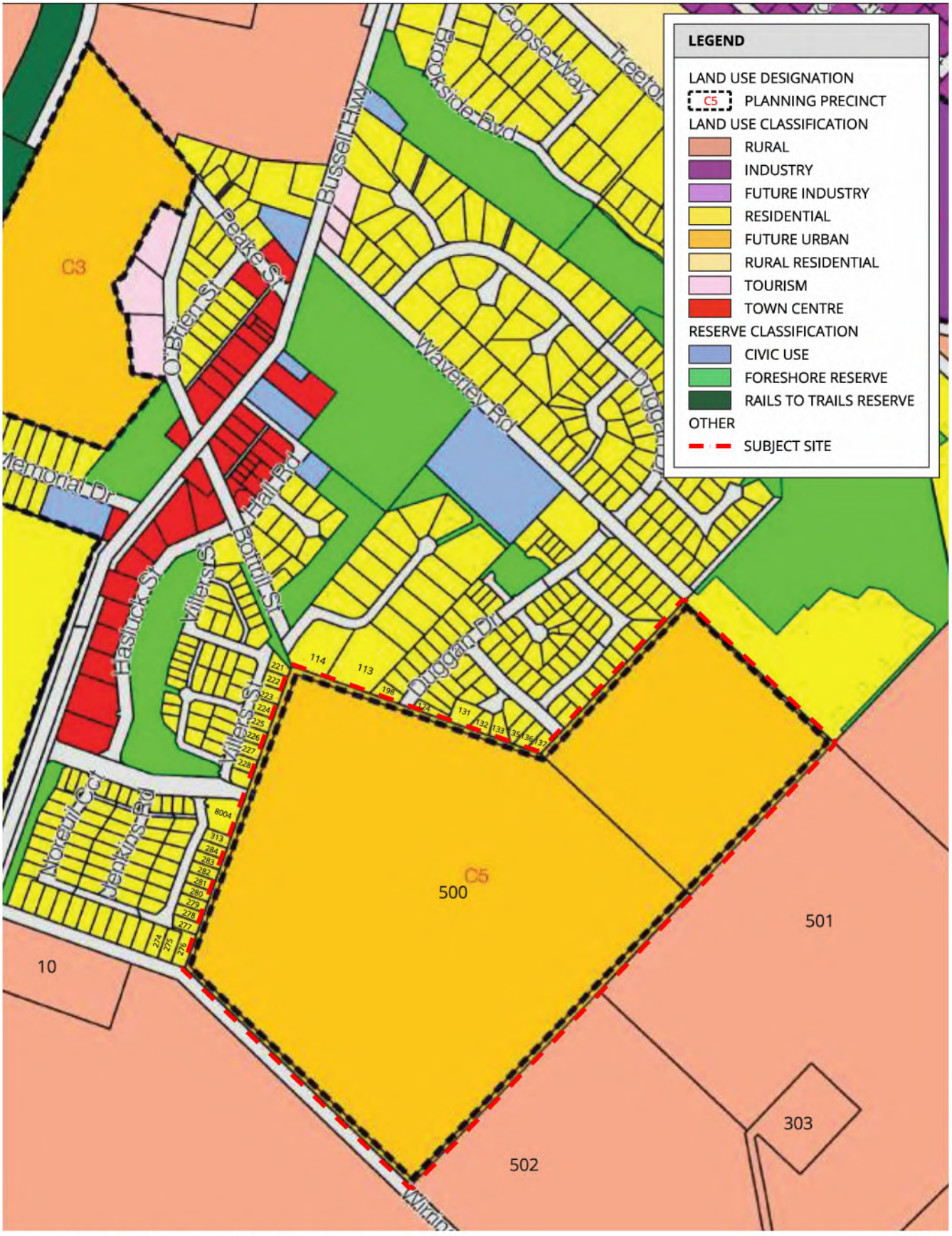


Figure 7 - Local Planning Strategy Map

2.3. State Planning Policies & Guidelines

2.3.1. State Planning Policy 3 – Urban Growth and Settlement

State Planning Policy 3.0 – Urban Growth and Settlement ('SPP 3') sets out the principles and considerations which apply to urban growth and settlement planning in Western Australia. A number of the key objectives of SPP 3, as outlined below, are relevant to this Structure Plan:

- To promote a sustainable and well-planned pattern of settlement across the State, with sufficient and suitable land to provide for a wide variety of housing, employment, recreation facilities and open space;
- To build on existing communities with established local and regional economies, concentrate investment in the improvement of services and infrastructure and enhance the quality of life in those communities;
- To manage the growth and development of urban areas in response to the social and economic needs of the community in recognition of the relevant climatic, environmental, heritage and community values and constraints.

The proposed Structure Plan satisfies the criteria set out in the above objectives. Specifically, the subject land's capacity to assist in providing a diversity in housing, taking advantage of the proximity of the land to the established Cowaramup town centre and associated community and commercial infrastructure. This Structure Plan has been prepared having regard to the local identity and the surrounding area, with transition to the surrounding agricultural operations.

With the subject land being located in very close proximity to the existing services offered within the Cowaramup Townsite, it is well placed to access employment, commercial, recreation and other essential infrastructure and human services. Development of the subject land for residential purposes will provide support to the existing services, as well as providing support for the provision of new services and recreational areas to be developed.

The proposed Structure Plan is consistent with SPP 3.

2.3.2. State Planning Policy 3.7 – Planning in Bushfire Prone Areas

State Planning Policy 3.7 – Planning in Bushfire Prone Areas ('SPP 3.7') outlines the measures for strategic planning, subdivision and development applications to reduce the impact of bushfire on property and infrastructure.

The subject land is identified as a Bushfire Prone Area on the Department of Fire and Emergency Services ('DFES') mapping. Accordingly, a Bushfire Management Plan ('BMP') is required to support any future planning and development of the subject land, prepared in accordance with the requirements of SPP 3.7. A BMP has therefore been prepared by Ecosystem Solutions in support of this Structure Plan.

Refer Attachment 3 – Bushfire Management Plan.

The outcomes of the BMP demonstrate that, as the residential development progresses, each stage is capable of achieving compliance with each of the four bushfire protection criteria outlined in the Appendices to the Guidelines for Planning in Bushfire Prone Areas. This is further discussed in Section 3.4 of this report.

2.3.3. Liveable Neighbourhoods

Liveable Neighbourhoods represents the WAPC's primary policy to guide the design and assessment of residential structure plans and subdivision. The underlying objective of Liveable Neighbourhoods is to create safe, sustainable and attractive neighbourhoods with a strong site responsive identity that reduces dependency on private vehicles and are more energy and land efficient. As such, Liveable Neighbourhoods seeks to promote an urban structure based on walkable, mixed-use neighbourhoods with interconnected street patterns. It functions by drawing together key policy aspects into a single 'integrated planning and assessment policy' to provide for a performance-based approach to planning assessment. These aspects include:

- Community;
- Movement;
- Lot Layout;
- Urban Water Management;
- Public Open Space; and
- Schools.

Liveable Neighbourhoods identifies a series of objectives and requirements for structure plans that, when met, demonstrate compliance with the overall outcomes sought by Liveable Neighbourhoods. These objectives and requirements relate to items such as road layout, relationship of housing to open space and schools, school location and distribution, public open space layout and location and housing densities.

Working with the site constraints, the Structure Plan has been prepared to satisfy the various objectives and requirements of Liveable Neighbourhoods to ensure subsequent subdivision design is also capable of satisfying the relevant criteria.

2.4. Local Planning Policies

A number of Shire of Augusta-Margaret River local planning policies have been reviewed to inform the future subdivision and development of the subject land, including:

- Local Planning Policy 4 – Boundary Fencing;
- Local Planning Policy 16 – Subdivision for Conservation; and
- Local Planning Policy 23 – Renewable Energy Systems.

A more detailed review and response to these policies will occur in support of the future subdivision and development stage.



3. Site Conditions & Constraints

The following provides a summary of the environmental site conditions and constraints, based on the findings of the Environmental Assessment Report prepared by Ecosystem Solutions.

Refer Attachment 4 – Environmental Assessment Report.

3.1. Biodiversity & Natural Area Assets

3.1.1. Flora & Vegetation

Due to the historic clearing and agricultural activities undertaken across the site, the subject land is not considered likely to contain any flora or vegetation of ecological significance. The site generally comprises 'open paddock' vegetation type, though a small cluster of trees in the northern portion of the site is identified as the Cowaramup Uplands Complex.

- **The Cowaramup Uplands Complex (C2)** is defined as 'Open forest of *Eucalyptus marginata subsp. Marginata-Corymbia calophylla-Banksia grandis*.

The Cowaramup Uplands Complex has a 32.45% representation in the region.

Ecosystem Solutions undertook a field survey on 9 March 2022 to determine whether any conservation listed flora species were located within the subject land. There were no threatened flora species recorded during the survey, and it was found that the site did not have the characteristics of any Threatened Ecological Communities, including Banksia Woodlands and Tuart Threatened Ecological Communities.

The vegetation condition of the land is 'completely degraded', with the exception of approximately 3% of the land in the northern corner of the site. This area contains the remnant forest/ woodland vegetation, though is considered to be 'degraded' condition based on the lack of native understorey. Notwithstanding this, the existing vegetation is proposed to be retained within an area of Public Open Space.

3.1.2. Fauna

Ecosystem Solutions undertook a field survey in support of the Environmental Assessment Report, to determine the presence or likely presence of the identified Threatened, Priority or Specifically Protected Species within the region. Having regard to the vegetation communities and vegetation condition of the site, the following species were the subject of the field survey:

- Western Ringtail Possum;
- Three (3) Black Cockatoo Species (Forest Red-Tailed Black Cockatoo, Baudin's Cockatoo and the Carnaby's Cockatoo).

The field survey was undertaken over two days, two dusk periods and two-night periods between 8 March 2022 and 9 March 2022 and 24 March 2022 and 27 March 2022. No animals were observed during any period of survey.

A total of 142 trees within the subject land and on the boundary (Wirring Road) were also inspected for signs of use by cockatoos, including wear around the hollow, chewing, scarring and scratch marks on the trunks or branches. Of the 142 trees inspected, 9 trees contained a hollow, 1 tree contained 2 hollows, and 7 trees had potential hollows. Having regard to the larger areas of preferred habitat within the region, it is not considered that Black Cockatoo species are reliant on the limited trees within the subject land for nesting or roosting habitat.

The majority of the existing trees on site are proposed to be retained within areas of Public Open Space and within the rear of residential lots.

3.2. Landform & Soils

The subject land is generally flat at approximately 138 metres Australian Height Datum ('AHD'), with a gentle slope down to 134 metres AHD generally to the north of the south. There's a slight elevated point of approximately 140 metres AHD located in the south-east corner of the site.

The surface geology of the subject land as mapped as being within the Cowaramup Uplands System, which comprises the following soil systems:

- **Cowaramup Flats Phase** (majority of the site) – Flats with gravelly duplex (Forest Grove) and pale grey mottled (Mungite); and
- **Cowaramup Wet Flats Phase** (small portion on western boundary) – Poorly drained flats and slight depressions with pale grey mottled (Mungite).

3.2.1. Acid Sulphate Soils

The Department of Water and Environmental Regulation ('DWER') Acid Sulphate Soil Risk Mapping identifies a portion of the land as having a 'Low to Moderate' risk of acid sulphate soils occurring within 3-metres of the natural ground surface. The Indicative Subdivision Plan shows this area as comprising a residential lot and drainage basin.

An Acid Sulphate Soil Management Plan may be required to support excavation of the land.

3.3. Groundwater & Surface Water

3.3.1. Groundwater

RPS has undertaken monthly groundwater level monitoring at six bores on the subject land from May to November 2021. The groundwater bore locations are presented in Figure 5 of the Local Water Management Strategy ('LWMS').

Refer Attachment 5 – Local Water Management Strategy.

This monitoring program has captured the 2021 winter peak, with the data indicating that the subject land is frequently boggy in winter with a perched water table. The monitoring results are consistent with the groundwater findings from the geotechnical investigations prepared by Galt Geotechnics in December 2021 (and forming Appendix A to the LWMS). Monitoring and geotechnical reporting have been used to better understand the localised groundwater conditions.

A summary of the groundwater conditions is provided as follows:

- The critical water levels at the subject land are likely to be governed by perched water overlying impermeable layers. The presence of relatively shallow farm soaks in the vicinity of the subject land confirms this.
- Registered bores present at the subject land and in the surrounding area typically indicate that the static water level is between approximately 1.9-metres and 2.3-metres below ground level.
- The groundwater level should be assumed to be at the top of any impermeable clay layer to allow for seasonal perched water.

3.3.2. Surface Water

There are no surface water features within the subject land.

3.4. Heritage

3.4.1. Indigenous Heritage

A search of the Department of Planning, Lands and Heritage ('DPLH') Aboriginal Inquiry System identified no registered Aboriginal Heritage Sites or Lodged Sites within the subject land or immediate surrounds.

3.4.2. European Heritage

A search of the Council of Western Australia's Register of Heritage Places identified no sites of State heritage significance within the subject land or immediate surrounds.

A search of the Shire of Augusta-Margaret River Municipal Heritage Inventory identified no sites of local heritage significance within the subject land or immediate surrounds.

3.5. Surrounding Land Use

The Structure Plan area abuts operational agricultural land to its eastern and southern boundaries. Both landholdings accommodate cattle grazing (dairy cows), which is considered a low intensity agricultural land use. In this regard, no separation distances between this activity and the proposed residential development are required by DWER and EPA Guidelines. Notwithstanding, transitional design measures are included as part of this Structure Plan to further ensure no land use conflict is experienced at these interfaces (refer Section 4.3.2 of the Report).



3.6. Bushfire Hazard

The subject land is identified as a 'Bushfire Prone Area' on the Department of Fire and Emergency Services ('DFES') Map of Bushfire Prone Areas. Accordingly, a Bushfire Management Plan ('BMP') has been prepared by Ecosystem Solutions in support of this Request to Amend the Local Planning Scheme No. 1. The BMP has been prepared to address the requirements of SPP 3.7 and the associated Guidelines for Planning in Bushfire Prone Areas.

Refer Attachment 3 – Bushfire Management Plan.

The BMP confirms the risk of bushfire is capable of being appropriately mitigated to achieve compliance with the Guidelines. The main considerations relating to bushfire management of the subject land are set out in **Table 3**.

Bushfire Protection Criteria	Proposed Bushfire Management Strategies
Element 1: Location	Based on the indicative subdivision layout, all future dwellings constructed within the subject land can be located such that the maximum BAL ratings within the site area BAL-29 or less (subject to future staging boundaries). A large portion of the land has a post development rating of BAL-LOW due to the expansive residential area and managed public open space.
Element 2: Siting and Design	Based on the indicative subdivision layout, all future dwellings constructed within the subject land can be located such that the maximum BAL ratings are BAL-29 or less.
Element 3: Vehiclar Access	Based on the indicative subdivision layout, the subject land will have good access both internally and to the existing road network. Wirring Road, Roy Earl Drive and Waverley Road all provide direct connection to Bussell Highway.
Element 4: Water	Future residential lots will be serviced by reticulated water supply and a water hydrant network.

Table 3: Bushfire Protection Criteria Compliance Table.

4. Land Use & Subdivision Requirements

4.1. Land Use

This Structure Plan has been prepared to guide the future use and development of the land for residential and associated public open space reserves.

The Structure Plan comprises residential density ranging from R10 to R25, with a central development site suited to accommodate a retirement village designated as R60.

The following describes the design response underpinning the Structure Plan and addresses the relevant elements of Liveable Neighbourhoods. Please also refer to the Land Use Summary Table provided within the Executive Summary on Page IV of this report.

The Structure Plan layout has been carefully considered in the context of the site's location. The proposed Structure Plan will provide for an extension to the existing Cowaramup residential area and represent the rural/urban interface. The subject land is well located to accommodate sensitively designed residential development.

Refer Plan 1 – Structure Plan Map.



Plan 1 - Structure Plan Map

4.2. Design Rationale

The subject land benefits from a high degree of existing amenity afforded by proximity to the established Cowaramup Townsite and established urban residential development to both the west and north of the land. The Structure Plan area forms the logical eastward extension of the existing Cowaramup residential area. The Structure Plan has been prepared to provide for the townsite extension, while respecting the rural amenity of the area by providing the appropriate land use interface measures.

The key objectives driving the preparation of this Structure Plan area:

- Preserving the rural amenity and providing for an appropriate rural/urban transition;
- Maintaining the existing amenity of Wirring Road;
- Retaining the limited existing vegetation on the site;
- Connecting into the existing linear public open space network located west of the Structure Plan area; and
- Providing for a diversity of residential lot product, including provision for a retirement village development site.

The above objectives have been considered within the Structure Plan to provide for a site responsive design that integrates with, and is in keeping with, the characteristics of the existing Cowaramup residential area. The anticipated increase to the Cowaramup population will contribute to additional and improved community facilities (including public open space) and services.

The Structure Plan provides for:

- An indicative residential yield of approximately 350 lots of residential densities between R10 and R25;
- The introduction of rural-residential transition mechanisms, including larger "lifestyle" (R10) lots along the eastern and southern site boundaries, landscape buffers and fencing requirements;
- A central development site, ideally suited to a retirement village development of approximately 1.1 hectares;
- Approximately 4.73 hectares of unrestricted public open space, sited over three reserves, and including a linear public open space network as an extension to the existing network;
- Access via an extension to the existing Roy Earl Drive, Duggan Drive and Lions Drive, and the associated lower order grid movement network; and
- A new intersection to Wirring Road, provided in a location that ensures the retention of all existing vegetation (trees) within the reserve.

The design considerations have been addressed through the following sections.



MASTER PLAN CONCEPT


WAVERLEY
ROAD

4.3. Residential

The Structure Plan proposes a residential density code of R10 – R25 generally applied throughout the extent of the subject land, with the exception of the central development site which is subject to the R60 density code. The range of densities provided is in response to the market expectations for the locality, the objective to provide a diverse range of lots (and therefore provide for housing choice) and informed by an Indicative Concept Plan prepared in support of the Structure Plan. This Concept Plan has been designed to ensure an efficient and logical configuration of lot sizes, with dimensions that are consistent with the market standard for home builders.

Refer Attachment 6 – Indicative Concept Plan.

The Structure Plan provides for a gradual transition of residential density throughout the site, ranging from R60 and R25 for lots closest to the Cowaramup Townsite (between 400m – 600m), decreasing to R10 on the eastern and southern edges of the Structure Plan area.

Based on the Indicative Concept Plan, the proposed Structure Plan is anticipated to achieve a yield of approximately 350 single residential lots, which would be likely to accommodate in the order of 977 persons, based on the average household of 2.8 persons (2021 Census).

4.3.1. Central Development Site (Retirement Village)

The Structure Plan provides for a potential retirement village development site in the north-west corner of the Structure Plan area. The site is approximately 1.1 hectares and is subject to an R60 density code. The site is shown as R60 on the Structure Plan to provide for future flexibility.

This site has been included at this location to ensure that its future residents are within walking distance of the established Cowaramup Townsite, and benefit from the adjacent public open space (POS A). Future development of this site will be subject to a separate Development Application.

4.3.2. Landscape Interface

The interface with the existing and functioning rural / agricultural land adjoining the site has informed the Structure Plan design and the inclusion of larger transition lots at a lower density (R10) along the southern and eastern edges of the Structure Plan area. These lots will subject to a range of specific design measures to reduce the visual impact of residential development and provide for an appropriate rural / urban transition.

Consistent with the proposed associated provisions to be inserted into the Local Planning Scheme No. 1, the following design principles will be required to be implemented:

- The landscape interface area is to contain a vegetated earth mound as required by the Local Water Management Strategy, to be constructed and landscaped by the developer;
- Rear boundary fencing is to comprise uniform open style, rural fencing;
- Side boundary fencing within the landscape interface area is to comprise uniform open style, rural fencing; and
- The rear setback to the dwelling must be taken from the 10-metre landscape interface line.

Refer Figure 8 - Landscape Transition Lots Concept.

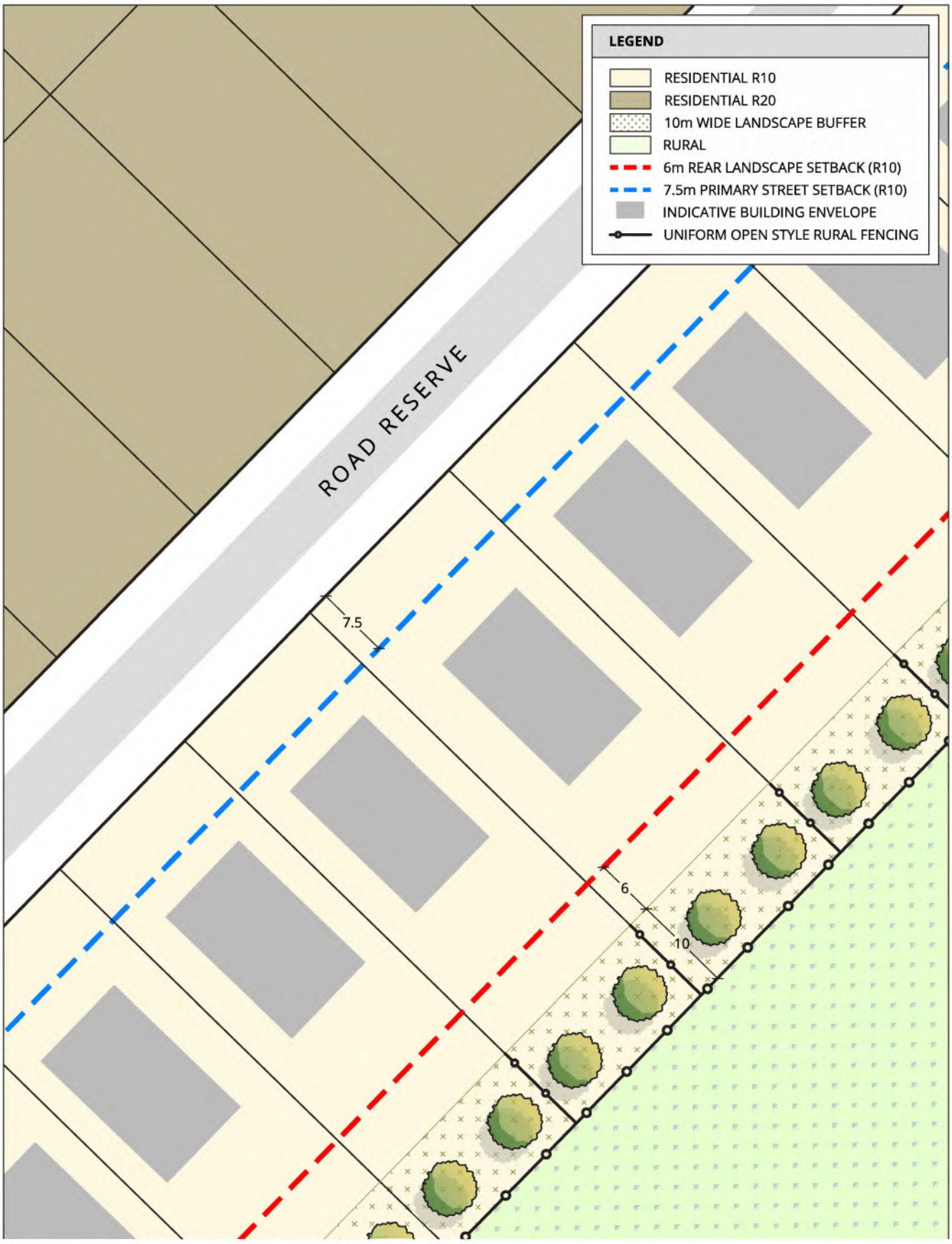


Figure 8 - Landscape Transition Lots Concept

4.4. Public Open Space

4.4.1. Landscape Strategy

The landscape and public open space strategy for the site has considered the existing vegetation on site, the locality's surrounds and water management requirements. The overall landscape design strategy aims to:

- Reflect and respond to the existing landscape elements in the broader Cowaramup locality, including the linear public open space/drainage corridor to the west of the land;
- Provide a safe external environment for the quiet enjoyment of the residents, guests and general public;
- Retain as many mature trees on site as possible within road reserves and public open space areas;
- To minimise the visual impact of the development on the surrounding rural areas;
- Provide for a range of recreational opportunities;
- Manage fire risk in a creative and aesthetic manner, while meeting the required standards and obligations; and
- Facilitate and promote the principles of water sensitive urban design in drainage areas.

Refer Attachment 7 – Landscape Concept Plan.



4.4.2. Public Open Space

The Structure Plan provides for a total of 4.28 hectares of public open space contained within three (3) separate reserves, which equates to approximately 11.88 per cent of the subdivisible area. SW Landscape Collective has prepared a Landscape Concept Plan in support of the Structure Plan. This includes street trees and road reserves, public open spaces, drainage reserves, the pedestrian access ways, and includes the 10-metre-wide landscape buffer within the R10 coded lots. Each of the POS reserves are further described as follows.

A – North-West Corner Public Open Space

POS A is located in the north-west corner of the Structure Plan area, providing for 1.64 hectares of public open space. This reserve is sited to retain the existing mature trees in this location, provide a connection to an existing pedestrian access way that links to the Townsite, and an area that will be afforded passive surveillance by the future retirement village development site.

POS A will function as a Neighbourhood Park under the Liveable Neighbourhoods framework. It is envisaged to be landscaped to retain the existing vegetation including rehabilitation of the native understorey and include an informal open kick about space (turfed), and picnic areas, as well as a path connection through the existing pedestrian footpath connection to the Cowaramup Townsite. Refer Sheet 2 of the attached Landscape Concept Plan.

B – Central Linear Public Open Space

POS B is located on the southern side of the extension to Roy Earl Drive and will provide for an extension to the existing linear public open space/ drainage reserve that have been developed to the west of the Structure Plan area. The reserve comprises approximately 1.52 hectares and is envisaged to be landscaped to include a living stream with walking paths, as well as including opportunities for passive recreation (barbeque/ picnic facilities), a playground and an informal kickabout (turfed) area. POS B is intended to provide the "point of arrival" to the estate when accessed via both Wirring Road and Roy Earl Drive. Refer Sheet 3 of the attached Landscape Master Plan.

C – North-East Public Open Space

POS C is located within the north-east portion of the Structure Plan area, sited to accommodate the existing strand of paddock trees. POS C is 1.57 hectares in area and will function as a Neighbourhood Park. The attached Landscape Master Plan identifies the reserve being landscaped to accommodate the existing strand of paddock trees, a living stream / vegetated swale function, and including a range of landscaped spaces for passive and recreational recreation. Refer Sheet 4 of the attached Landscape Master Plan.

Refer Figure 9 – Public Open Space Plan and Table 4 – Public Open Space Schedule.



Figure 9 - Public Open Space Plan

Lot 500 Wirring Road, Cowaramup Public Open Space Schedule				
Site Area (Structure Plan Boundary)				40.93 ha
Deductions				
Drainage (1:1 year) - Swales in POS		0.17		
Drainage (1:1 year) - Dedicated Drainage Basins		0.902		
Total			1.073	
Gross Subdivisible Area				**39.857 ha**
Public Open Space @ 10%				3.986 ha
Public Open Space Contribution				
May Comprise:				
Minimum 80% unrestricted POS			3.189ha	
Maximum 20% restricted POS			0.797ha	
Total Required Public Open Space				**3.986 ha**
POS Reference Number	**Total POS Area**	**1:1 Year Drainage**	**Unrestricted POS**	**Restricted POS**
POS A	16,359m²	0	16,359m²	0
POS B	15,284m²	0	15,284m²	0
POS C	15,703m²	1,710m²	13,213m²	2,490m²
Total	47,346m²	1,710m²	44,856m²	2,490m²
Percentage of gross sub-divisible area	11.88%	0.43%	11.25%	0.62%
Total Public Open Space Provided				**11.88%**

Notes:

This Public Open Space Schedule is based on the Public Open Space Plan prepared by Rowe Group (Plan ID: 9449-FIG-09-C).

This Public Open Space Schedule is based on the drainage assumptions as per the Local Water Management Strategy prepared by Local Water Management Strategy prepared by RPS dated 1 August 2022 (Ref: AU2130002398.001).

Table 4: Public Open Space Schedule.

4.5. Movement Network

4.5.1. Existing Road Network

Roy Earl Drive

Roy Earl Drive intersects with the subject land at its western boundary and will be extended through the site to service the future dwellings. It is classified as an 'Access Road' under the Main Roads WA ('MRWA') Road Hierarchy, comprising a reserve width of between 20 and 22-metres, with a road pavement width of 15-metres and a posted speed limit of 50km/hr.

Wirring Road

Wirring Road runs along the south-western boundary of the site and is classified an 'Access Road' under the MRWA road hierarchy. Wirring Road has a reserve width of 20-metres and a pavement width of approximately 7.5-metres. The Wirring Road reserve contains existing mature trees which will be retained and not affected by this proposal.

Waverley Road

Waverley Road abuts the subject land along its north-east boundary, comprising an 'Access Street' classified road, with a reserve width of 18-metres and pavement width of 6.6-metres. Waverley Road terminates at the site boundary (being the extent of the Residential zoned land), though provides for a future eastward connection if ever required.

Bussell Highway

Bussell Highway is located approximately 300-metres west of the subject land and is classified a 'Primary Distributor' road under the MRWA road hierarchy. Bussell Highway is located within a 40-metre road reserve, with a pavement width of between 9.5-metres and 13-metres. Its speed limit varies from 50km/hour to 110km/hour.

4.5.2. Pedestrian & Cycle Network

In accordance with the requirements of Liveable Neighbourhoods, footpaths will be provided on at least one side of every street and connect in with the existing pedestrian paths within the surrounding residential estates.

Given the relatively low traffic volumes anticipated within the Structure Plan area, no designated cycle paths are proposed.

The proposed path network is indicatively shown on the Landscape Master Plan at **Attachment 7** to this Report.

4.6. Water Management

4.6.1. Local Water Management Strategy

A Local Water Management Strategy ('LWMS') has been prepared in support of this Structure Plan and is appended at **Attachment 5** to this report.

The LWMS has been prepared to provide guidance on wastewater, groundwater and stormwater management practices to inform the detailed design of the Structure Plan Area. The LWMS has been prepared to achieve integrated water management through the following design objectives:

- Minimise irrigation requirements for public open space and other landscaping components;
- Effectively manage the risk to human life, property damage and environmental degradation from water contamination and stormwater flooding;
- Maintain and if possible, improve water quality within the development in relation to pre-development water quality;
- Implement best practice in regard to stormwater management; and
- Incorporate where possible, low maintenance, cost-effective landscaping and stormwater treatment systems.

In accordance with the processes defined under the Better Urban Water Management, an Urban Water Management Plan ('UWMP') will be required to be prepared and implemented as a condition of subdivision approval.

Refer Attachment 5 – Local Water Management Strategy.

4.6.2. Stormwater Management Strategy

The LWMS proposes the following stormwater management strategy, demonstrating the Structure Plan area is capable of managing both minor and major rainfall events.

Small Storm Events (1 in 1 year ARI)

The small storm events (the first 15mm of stormwater runoff) will be infiltrated at source through the use of on-lot rainwater tanks, basins and swales.

All lots will be required to be fitted with a rainwater tank with a minimum storage capacity of 2,500 litres between the overflow and slow-release pipe and plumbed to the dwelling. Larger lots (those coded R10 on the Structure Plan) will require a connection to a 5,000L rainwater tank is required. It is anticipated that a Section 70A notification on title will be utilised to ensure all landowners comply with the water tank requirement.

Minor Storm Events (1 in 5-year ARI)

The minor (20%) Annual Exceedance Probability ('AEP') rainfall event will be conveyed via a piped drainage system or overland flow into a network of detention basins.

The run-off from external rural catchments will be managed through structural controls (a vegetated earth bund located within the rear landscape buffer area of R10 lots) to manage flow to detention basins prior to discharge through the existing stormwater infrastructure.

Major Storm Events (1 in 100-year ARI)

The major (1%) AEP rainfall event will be detained within drainage basins located throughout the Structure Plan area, and through existing infrastructure capacity to maintain pre-development flows. These flows will be discharged to basins and swales prior to discharge at either Wirring Road, Roy Earl Drive and Waverley Road.

All dwellings are required to be constructed at a finished floor levels to provide a minimum separation of 0.3-metres above the 1% AEP stormwater storage water level.

4.6.3. Groundwater Management Strategy

RPS has undertaken monthly groundwater monitoring at six locations across the Structure Plan area in support of the LWMS, capturing the 2021 winter peak. The monitoring indicates that the site is frequently boggy in winter with a perched water table. Galt Geotechnics also undertook a geotechnical investigation in December 2021, which indicated that the critical water levels on the subject land are governed by perched water overlying impermeable layers, and the static water level is generally between 1.9-metres and 2.3-metres below ground level.

In this regard, a combination of the following design mechanisms is proposed to eliminate the risk of potential groundwater inundation and protect future dwellings and infrastructure:

- Inter-allotment drainage for all lots is to be provided, which will direct the excess roof run-off to connect into a free-flowing outlet, and reduce point recharge of the upper granular soil layer and water table within lots;
- Subsoil drainage will be installed within road reserves to control any groundwater rise to the perched aquifer recharging in response to rainfall. Subsoil drains will discharge into the bioremediation basins prior to discharge.

4.6.4. Landscaping & Irrigation

Given the Landscape Master Plan for the Structure Plan area identifies some areas of turfed public open space, there is an expectation for irrigation to be provided to maintain these areas. The Structure Plan area is likely to have a total irrigation demand of approximately 15,000 and 20,000kL/year.

Preliminary consultation with Department of Water and Environmental Regulation ('DWER') has confirmed groundwater capacity in the region is limited and a license to facilitate irrigation of the Structure Plan area is unlikely to be granted. It is therefore proposed the irrigation requirements would be drawn and extended via a piped network from the existing dam located on the Wilyabrup watercourse (north of the Structure Plan area within the Symphony Waters Estate).

4.6.5. Urban Water Management Plan

Consistent with the requirements of the LWMS and the Better Urban Water Management framework, an Urban Water Management Plan ('UWMP') will be required as a condition of approval. While strategies have been provided within the LWMS that address planning for water management within the site, it is a logical progression that future subdivision designs and the supporting UWMP clarify details not provided within the LWMS.

4.7. Infrastructure Coordination, Servicing & Staging

An Engineering Servicing Report has been prepared in support of the Structure Plan by Stantec. The findings of the Engineering Report are summarised below.

Refer Attachment 9 – Engineering Servicing Report.

4.7.1. Power

The existing Western Power network surrounding the subject land consists of the following:

- High Voltage ('HV') Ring Main Unit ('RMU') installed at the south-eastern end of Lions Drive. This RMU will be extended to provide an HV take off point for subdivision within the Structure Plan area.
- There is an existing HV underground cable within the northern verge of Wirring Road, which extends to the western side of Bussell Highway. This HV network will be extended to be extended within the Structure Plan area to service future residential subdivision.
- Another HV Ring Main Unit is located within Stewart Smith Loop (adjacent Lot 7) on the eastern side of Waverley Road to service the adjacent Symphony Waters Estate. Where required, this RMU will be extended to service the northern portion of the Structure Plan area.

Based on the attached Indicative Concept Plan (Attachment 6), it is anticipated the ultimate electricity demand will be in the order of 1.65 MVA. This is based on the standard Western Power load allocation of 4.7kVA per residential lot. Western Power Capacity Mapping indicates there is sufficient capacity within the existing system to accommodate the proposed development, as contemplated by this amendment.

4.7.2. Water

The Water Corporation operates a reticulated potable water network within the Cowaramup townsite, including the existing residential area surrounding the subject land. There are existing water mains located within Roy Earl Drive and Duggan Drive, terminating on the boundary of the subject land.

Additionally, there are two existing DN250 water distribution mains that traverse the subject land, with one following the south-west boundary and the other located in its north-east portion of the site.

The Water Corporation has confirmed the existing infrastructure has the capacity to service the full development of the site as contemplated.

4.7.3. Reticulated Sewer

The existing surrounding Water Corporation gravity sewer network is located to the north and west of the subject land, with no existing sewerage infrastructure to its south-east.

There are three potential connection locations to the existing sewerage network where sewer stub lines have previously been extended into the subject land.

The subject land is also located within Water Corporation's SD242 Cowaramup Long Term Sewer Planning (SD242) scheme boundary, meaning that allowance has been made within Water Corporation's planning and infrastructure to service the Structure Plan area with reticulated gravity sewerage connection. Connection to future gravity sewer infrastructure can be achieved as subdivision stages progressively occur.

4.7.4. Reticulated Gas

There is no reticulated gas network in the Cowaramup area.

It is understood that some developments in the Margaret River region utilise internal reticulated liquified petroleum gas ('LPG') networks internally fed from a storage vessel on site and operated by a retailer such as Kleenheat. This is an option the development could consider as an alternative to bottled gas.

4.7.5. Telecommunications

Development of the subject land for residential lots will require a 'fibre ready' pit and conduit network to be installed at the developer's cost. There are existing telecommunications networks within the Waverley Road, Duggan Drive, Lions Drive and Roy Earl Drive reserves.

The pit and conduit will be designed in accordance with National Broadband Network ('NBN') standards and will be extended from the existing network and installed within the service alignment of subdivisional road reserves. Once installed and inspected, ownership of the pit and conduit network will be transferred to NBN.

4.8. Education Facilities

No educational facilities are proposed within the Structure Plan area. The Proponent, as part of the preparation of this Structure Plan, met with the Department of Education regarding the need for a school site within the Structure Plan area. The meeting established that while the existing primary school is nearing capacity, the demand for a second primary school would likely be considered west of the highway and not within the subject land (which would be within the existing primary school catchment).

The site is catered for by the existing and planned public education facilities within the surrounding areas. The site currently falls within the Cowaramup Primary School local intake area, located approximately 750 metres north of the subject land. Margaret River Senior High School is the closest secondary school, located approximately 11 kilometres south of the Structure Plan Area.

4.9. Activity Centres & Employment

The Structure Plan does not propose any activity centres or employment nodes.

The subject land is located approximately 240-metres south-east of the established Cowaramup Townsite, 10 kilometres north of the Margaret River Townsite and approximately 31 kilometres south-west of the Busselton Regional Centre. The existing Cowaramup Industrial and Composite Industrial areas are located approximately 720-metres north of the land on Treeton Road.

4.10. Developer Contribution Arrangements

The subject land is situated within Development Contribution Area 4a ('DCA 4a') under LPS 1.

DCA 4a are the subject of Development Contribution Plan 4 ('DCP') contained within Schedule 10 of LPS 1. The DCP requires landowners within the DCA 4 area to contribute financially towards the provision of key infrastructure upon further subdivision and development of the land. The landowner (developer) is required to make a cost contribution payment (typically as a condition of subdivision approval) based on the number of lots they develop, in accordance with the contribution rate set by the DCP.

This page has been left blank intentionally.

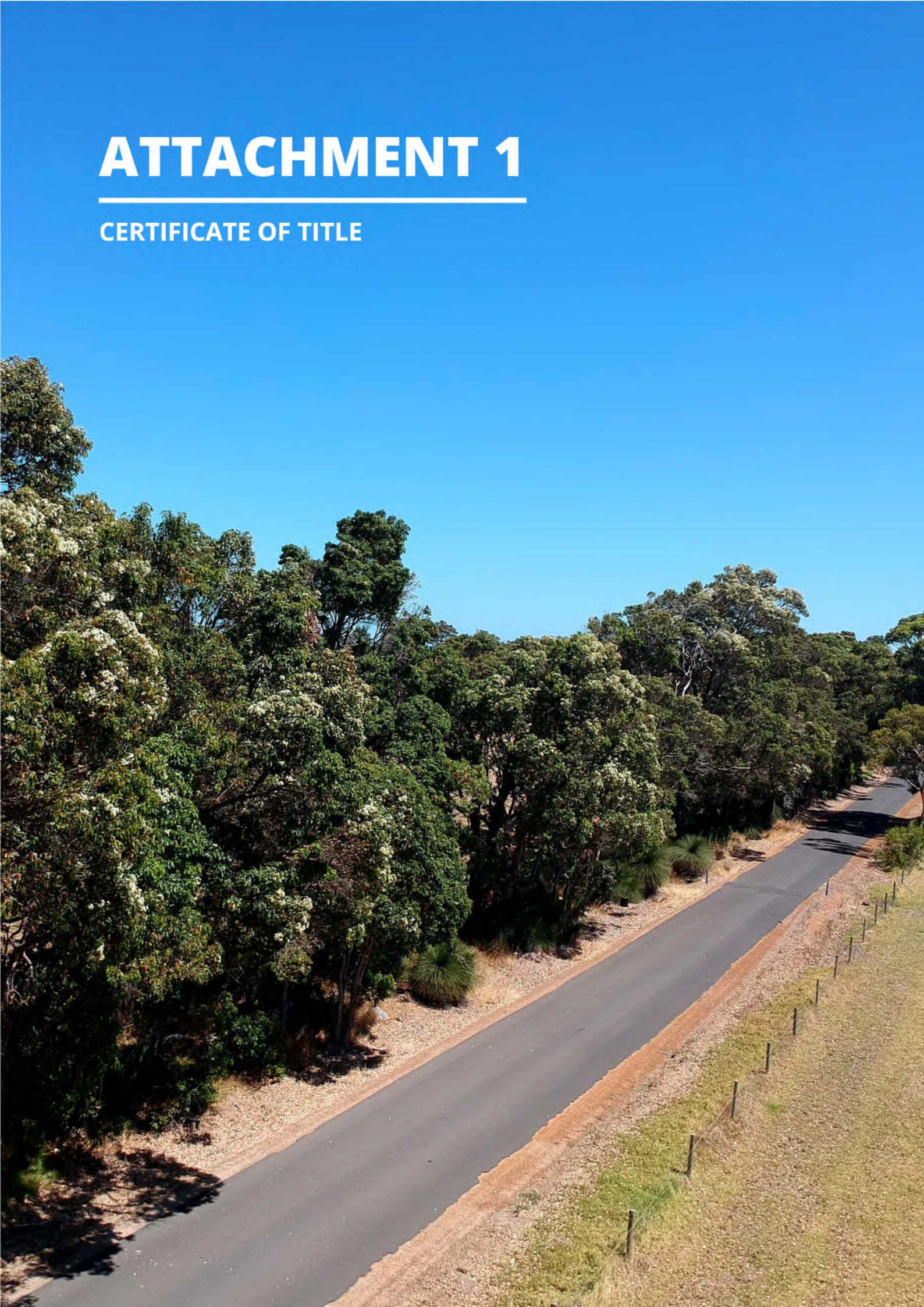
PART THREE
TECHNICAL APPENDICES



This page has been left blank intentionally.

ATTACHMENT 1

CERTIFICATE OF TITLE



This page has been left blank intentionally.

WESTERN AUSTRALIA

REGISTER NUMBER	
500/DP422719	
DUPLICATE EDITION **N/A**	DATE DUPLICATE ISSUED **N/A**

VOLUME **4012** FOLIO **462**

RECORD OF CERTIFICATE OF TITLE

UNDER THE TRANSFER OF LAND ACT 1893

The person described in the first schedule is the registered proprietor of an estate in fee simple in the land described below subject to the reservations, conditions and depth limit contained in the original grant (if a grant issued) and to the limitations, interests, encumbrances and notifications shown in the second schedule.

BGRoberts

REGISTRAR OF TITLES

REGISTRAR OF TITLES WESTERN AUSTRALIA

LAND DESCRIPTION:

LOT 500 ON DEPOSITED PLAN 422719

REGISTERED PROPRIETOR:
(FIRST SCHEDULE)

RODNEY WILLIAM DUGGAN OF CARE OF POST OFFICE, COWARAMUP

(AF O947355) REGISTERED 19/11/2021

LIMITATIONS, INTERESTS, ENCUMBRANCES AND NOTIFICATIONS:
(SECOND SCHEDULE)

1. *EASEMENT BURDEN CREATED UNDER SECTION 27A T.P. & D. ACT FOR WATER, SEWERAGE OR DRAINAGE PURPOSES TO WATER CORPORATION OF WA - SEE DEPOSITED PLAN 422719 - AS CREATED ON DEPOSITED PLAN 63875.
2. *K121670 EASEMENT TO WATER CORPORATION FOR WATER SUPPLY PURPOSES - SEE DEPOSITED PLAN 422719. REGISTERED 15/3/2007.

Warning: A current search of the sketch of the land should be obtained where detail of position, dimensions or area of the lot is required.
* Any entries preceded by an asterisk may not appear on the current edition of the duplicate certificate of title.
Lot as described in the land description may be a lot or location.

----------END OF CERTIFICATE OF TITLE----------

STATEMENTS:

The statements set out below are not intended to be nor should they be relied on as substitutes for inspection of the land and the relevant documents or for local government, legal, surveying or other professional advice.

SKETCH OF LAND:	DP422719
PREVIOUS TITLE:	2655-14, 2741-93
PROPERTY STREET ADDRESS:	NO STREET ADDRESS INFORMATION AVAILABLE.
LOCAL GOVERNMENT AUTHORITY:	SHIRE OF AUGUSTA MARGARET RIVER

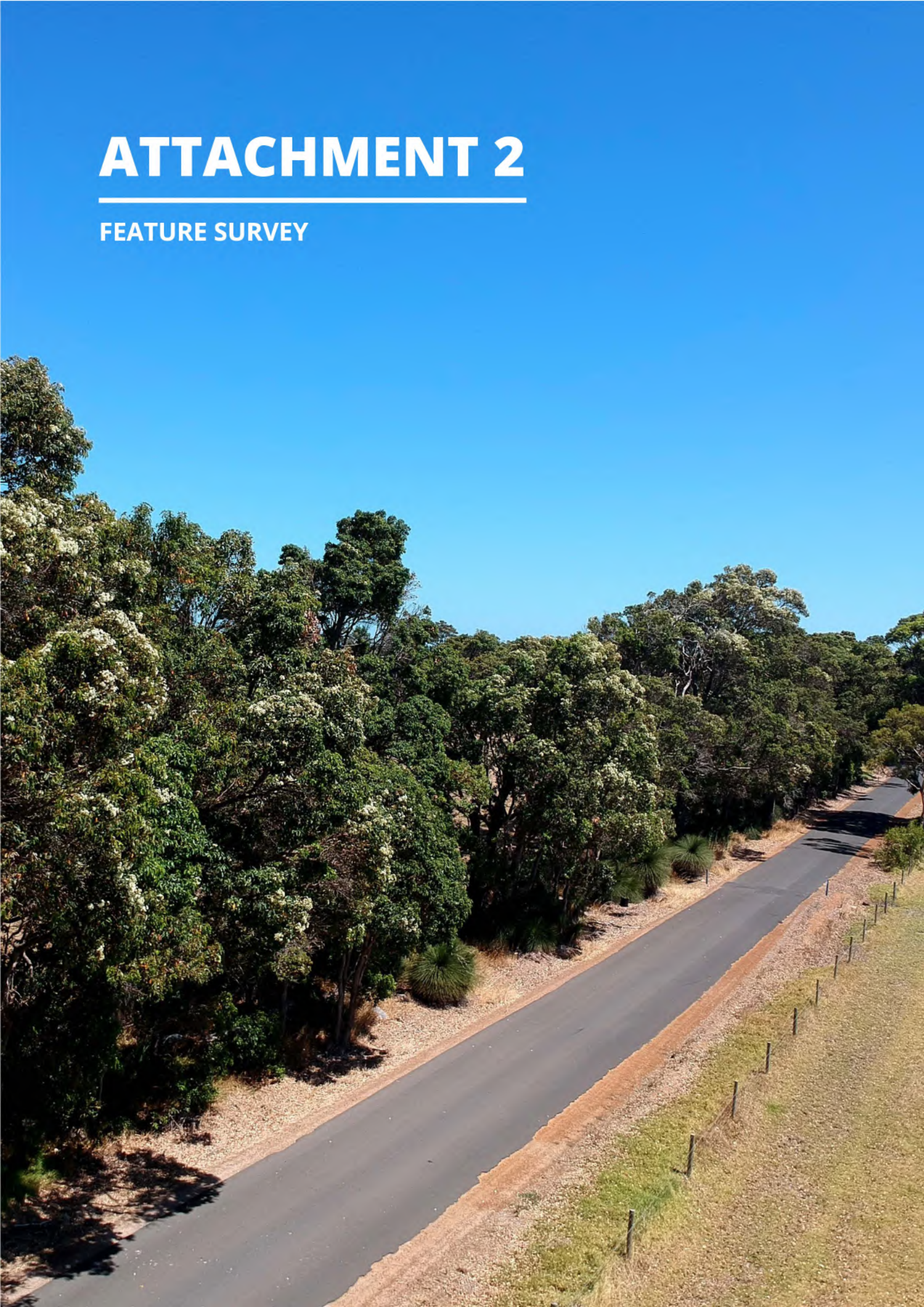
NOTE 1: DUPLICATE CERTIFICATE OF TITLE NOT ISSUED AS REQUESTED BY DEALING L232558

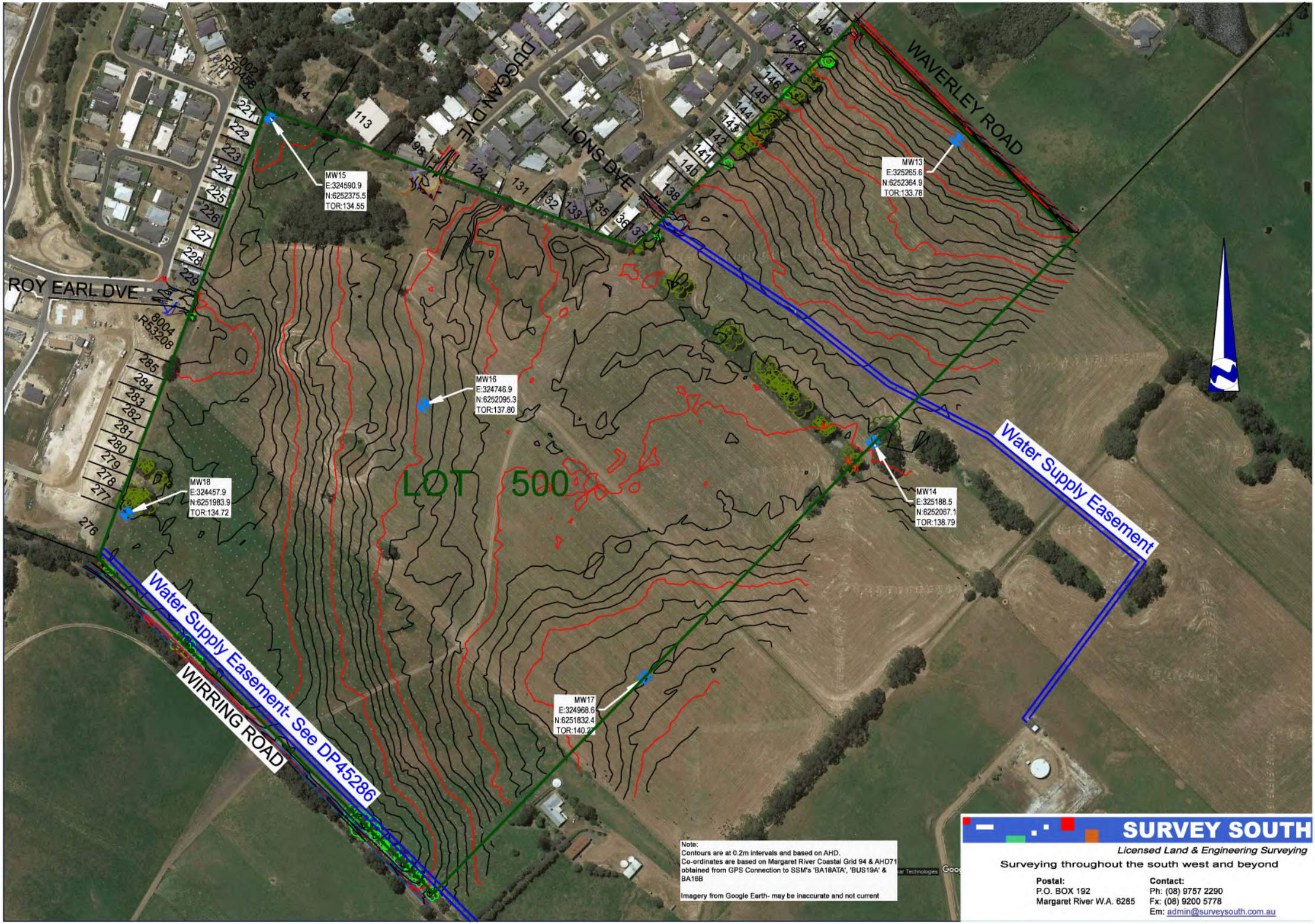
LANDGATE COPY OF ORIGINAL NOT TO SCALE 13/06/2022 06:06 PM Request number: 63720320

Landgate
www.landgate.wa.gov.au

ATTACHMENT 2

FEATURE SURVEY





SURVEY SOUTH
Licensed Land & Engineering Surveying
Surveying throughout the south west and beyond

Postal:
P.O. BOX 192
Margaret River W.A. 6285

Contact:
Ph: (08) 9757 2290
Fx: (08) 9200 5778
Em: admin@surveysouth.com.au

This page has been left blank intentionally.

ATTACHMENT 3

BUSHFIRE MANAGEMENT PLAN



Bushfire Management Plan Coversheet

This Coversheet and accompanying Bushfire Management Plan has been prepared and issued by a person accredited by Fire Protection Association Australia under the Bushfire Planning and Design (BPAD) Accreditation Scheme.

Bushfire Management Plan and Site Details

Site Address / Plan Reference: Lot 500 Wirring Road		
Suburb: Cowaramup	**State:** WA	**P/code:** 6284
Local government area: Shire of Augusta Margaret River		
Description of the planning proposal: Structure Plan and Rezoning		
BMP Plan / Reference Number: 221273	**Version:** Rev C	**Date of Issue:** 11/05/2023
Client / Business Name: LB Planning		

Reason for referral to DFES	Yes	No
Has the BAL been calculated by a method other than method 1 as outlined in AS3959 (tick no if AS3959 method 1 has been used to calculate the BAL)?	☐	☑
Have any of the bushfire protection criteria elements been addressed through the use of a performance principle (tick no if only acceptable solutions have been used to address all of the BPC elements)?	☐	☑
Is the proposal any of the following special development types (see SPP 3.7 for definitions)?		
Unavoidable development (in BAL-40 or BAL-FZ)	☐	☑
Strategic planning proposal (including rezoning applications)	☑	☐
Minor development (in BAL-40 or BAL-FZ)	☐	☑
High risk land-use	☐	☑
Vulnerable land-use	☐	☑

If the development is a special development type as listed above, explain why the proposal is considered to be one of the above listed classifications (E.g. considered vulnerable land-use as the development is for accommodation of the elderly, etc.)?

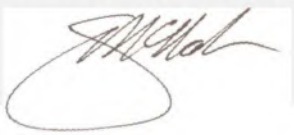
Rezoning of Land for future urban development

Note: The decision maker (e.g. local government or the WAPC) should only refer the proposal to DFES for comment if one (or more) of the above answers are ticked "Yes".

BPAD Accredited Practitioner Details and Declaration

Name	Accreditation Level	Accreditation No.	Accreditation Expiry
Gary McMahon	Level 3	35078	11/2023
Company Ecosystem Solutions		**Contact No.** (08) 9759 1960	

I declare that the information provided within this bushfire management plan is to the best of my knowledge true and correct

Signature of Practitioner  **Date** 11/05/2023

ecosystem solutions

PO Box 685
DUNSBOROUGH WA 6281
Ph: +61 8 9759 1960
Fax: +61 8 9759 1920
Mobile: 0427 591 960
info@ecosystemsolutions.com.au
www.ecosystemsolutions.com.au

Bushfire Management Plan

Lot 500 Wirring Road, Cowaramup

11 May 2023

Prepared for:

R.W Duggan

C/- Stan Lawrence-Brown



Limitations Statement

This report has been prepared in accordance with the Agreement between Ecosystem Solutions Pty Ltd and R.W Duggan C/- LB Planning (**"Client"**). It has been solely prepared for Bushfire Management Plan to progress structure planning and rezoning Lot 500 Wirring Road, Cowaramup (**"Site"**).

Information

In undertaking this work the authors have made every effort to ensure the accuracy of the information used. Unless otherwise stated in the report, Ecosystem Solutions Pty Ltd has not independently verified such information and cannot guarantee its accuracy or completeness.

Conclusions

Within the limitations imposed by the scope of work, preparation of this report has been undertaken and performed in a professional manner, in accordance with generally accepted practices and using a degree of skill and care ordinarily exercised by reputable bushfire consultants under similar circumstances. No other warranty, expressed or implied, is made.

Reliance

This report is solely for the use of the Client and any reliance on this report by third parties will be at such party's sole risk. This report must only be presented in full and may not be used to support any other purpose than those set out in the report and the Agreement, except where prior written approval with comments are provided by Ecosystem Solutions Pty Ltd. All intellectual property rights in documents created by Ecosystem Solutions Pty Ltd remain the property of Ecosystem Solutions Pty Ltd.

Other parties should not rely on the report or the accuracy or completeness of any conclusions and should make their own enquiries and obtain independent advice in relation to such matters. Ecosystem Solutions Pty Ltd accepts no Liability, or responsibility whatsoever for or in respect of any use or reliance upon this report and its supporting material subsequently used by others. Please note that the contents of this report may not be directly applicable towards another organisation's needs and may not contain sufficient information for purposes of other parties or for other uses.

Ecosystem Solutions Pty Ltd will not be liable to update or revise the report to take into account any events or emergent circumstances or facts occurring or becoming apparent after the date of this report.

Other limitations

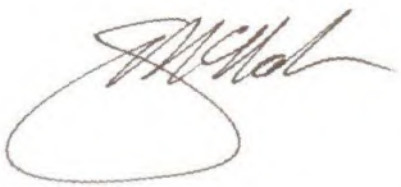
The measures contained in this report cannot guarantee that a structure or building will not be damaged or would survive a bushfire event on every occasion. This is due to the degree of vegetation management,

the unpredictable nature of fire behaviour (knowledge in this field continues to develop) and the unpredictable nature of extreme weather conditions.
The growth, planting or removal of vegetation, poor maintenance of any fire prevention/mitigation measures, addition of structures not included in this report, or other activity can and will change the bushfire threat to all properties detailed in this report. The implementation of fire precautions will depend on the actions of the landowner or occupiers of the land, over which Ecosystem Solutions Pty Ltd has no control. Should changes be made to the Site, a new Bushfire Management Plan is required.
Ecosystem Solutions Pty Ltd accepts no Liability, including Liability for any Loss in connection with:

- a Claim, damage, or injury to property, or persons caused by fire;
- further growth, planting, or removal of vegetation on the Site;
- poor maintenance of any fire protection measures;
- additional structures not included in this assessment; or
- any other activity that may change the bushfire threat level.

The Client and owner of the Site each acknowledge that they have been made aware of the exclusions above and that such exclusion of Liability is reasonable in all the circumstances.
This report is valid for a period of two years only from the date of its issue. All BAL ratings identified in this report are indicative and are required to be verified at the time of construction of individual buildings to ensure appropriate setbacks identified in the Site/building have been achieved.

STATEMENT OF CONFORMITY - PLANNING AND DEVELOPMENT ACT 2005



BPAD
Bushfire
Planning & Design
Accredited Practitioner
Level 3

Gary McMahon
B.Sc. M. Env Mgmt. PG Dip Bushfire Protection. C.EnvP, BPAD Level 3 (35078)

The signatory declares that this Bushfire Management Plan meets the requirements of State Planning Policy 3.7 and the Guidelines for Planning in Bushfire Prone Areas V1.4.

DISCLAIMER

**All capitalised terms used in the Limitations Statement above that are not defined are defined in the Agreement between Ecosystem Solutions Pty Ltd and the Client.*
*** The limitations above are subject to any relevant rights or remedies that the Client may be entitled to under legislation, including Schedule 2 of the Competition and Consumer Act 2010 (Cth).*

Document Control

Client - R.W Duggan

Site - Lot 500 Wirring Road, Cowaramup

Version	Revision	Purpose	Author	Reviewer	Submitted	
					Form	Date
Report	Rev A	Initial Report	DC (BPAD 48409 – Level 1)	GM (BPAD 35078 – Level 3)	Electronic (email)	9/06/2022
Report	Rev B	Included Landscape Plan	DP (BPAD 46554 – Level 2)	GM (BPAD 35078 – Level 3)	Electronic (email)	10/08/2022
Report	Rev c	AMR Shire / DFES Comments	DC (BPAD 48409 – Level 2)	GM (BPAD 35078 – Level 3)	Electronic (email)	11/05/2023

Filename: Z:\PROJECTS\221273 Part Lots 51 and 304 Wirring Road, Cowaramup BMP and F&F\Reports\Lot 500 Wirring Road, Cowaramup BMP Rev C.docx

Contents

Document Control		**4**
1	**Proposal**	**7**
2	**Bushfire Assessment Results**	**10**
2.1	Assessment Inputs	10
2.2	Assessment Outputs	22
3	**Environmental Considerations**	**26**
3.1	Native Vegetation - modification and clearing	26
3.2	Re-vegetation / Landscape Plans	28
4	**Assessment Against the Bushfire Protection Criteria**	**31**
4.1	Compliance with the Acceptable Solutions for each Element	31
4.2	Performance Based Solutions	40
4.3	Summary of the Assessment Outcomes	40
5	**Responsibilities for Implementation and Management of the Required Bushfire Measures**	**42**
6	**Glossary**	**45**

Appendices

Appendix A Shire of Augusta Margaret River Firebreak Notice and Bushfire Information
Appendix B Asset Protection Zone Standards
Appendix C Vehicular Access Technical Standards
Appendix D Landscape Management Plan

List of Figures

Figure 1 Extract Map of Bushfire Prone Areas for Lot 500 Wirring Road, Cowaramup, within the blue polygon, accessed 09 March 2022 8
Figure 2 Concept Layout Plan for Subdivision of Lot 500 Wirring Road, Cowaramup 9
Figure 3 Vegetation Classification - Pre-Development 20
Figure 4 Vegetation Classification - Post Development 21
Figure 5 BAL Contour Map 24
Figure 6 BAL Contour - Detailed View 25
Figure 7 Landscape Master Plan for Lot 500 Wirring Road, Cowaramup 30
Figure 8 Map of Bushfire Management Strategies 41

List of Tables

Table 1 Site Assessment Result 22
Table 2 Significant environmental values identified within the Site 27
Table 3 Developer Responsibilities 42
Table 4 Shire of Augusta Margaret River's Responsibilities 43
Table 5 Landowner Responsibilities 44

1 Proposal

This Bushfire Management Plan (BMP) has been prepared for Lot 500 Wirring Road, Cowaramup (hereafter referred to as the 'Site') by Ecosystem Solutions Pty Ltd, Dani Cuthbert (Dip BM, Dip TM, BPAD 48409 - Level 1) and Gary McMahon (B.Sc. M. Env Mgmt. PG Dip Bushfire Protection. C.EnvP, BPAD 35078 - Level 3). An assessment of the proposal against the requirements for *State Planning Policy (SPP) 3.7* and *Guidelines for Planning in Bushfire Prone Areas* (WAPC, V 1.4 December 2021) is included.

The Site is located within the Shire of Augusta-Margaret River. The Cowaramup town centre is to the north of the Site. The Site is located within a bushfire prone area, as declared by *State Planning Policy 3.7* (Figure 1) and contains areas of remnant native vegetation and pasture grasses.

The proposal is to progress a structure plan and for the rezoning of the Site for future urban development, with the concept plan provided in Figure 2.

The purpose of this BMP is to detail the fire management methods and requirements that will be implemented within the Site as part of the rezoning of the Site. The aim of the BMP is to reduce the threat to residents and fire fighters in the event of a fire within or near the Site through assessment against the four Bushfire Protection criteria.



Figure 1 Extract Map of Bushfire Prone Areas for Lot 500 Wirring Road, Cowaramup, within the blue polygon, accessed 09 March 2022



Figure 2 Concept Layout Plan for Subdivision of Lot 500 Wirring Road, Cowaramup

2 Bushfire Assessment Results

2.1 Assessment Inputs

A Site inspection was conducted on 9th March by Kelly Lamp (B.Env Mgt Hons. BPAD Level 2) and Lorraine Duffy (B.Sc Env Biology, B.Arts Geo), for the purpose of determining the Bushfire Attack Level in accordance with AS 3959-2018 Simplified Procedure (Method 1).

All vegetation within 150 m of the Site was classified and the slope under the vegetation determined in accordance with AS 3959-2018, shown in the photos below with map provided in Figure 3 for the current vegetation and Figure 4 for post development.

Plot	1	**Vegetation Classification or Exclusion Clause - Predevelopment**	Class A Forest Downslope >0 to 5 Degrees
Plot	1	**Vegetation Classification or Exclusion Clause - Post Development**	Class A Forest Downslope >0 to 5 Degrees



Photo ID: 1



Photo ID: 2

Description / Justification for Classification:	Trees 10 to 30 m high with more than 30% canopy cover over an unmanaged understory. This vegetation is located outside of the subject site, therefore will remain as Class A Forest Downslope >0 to 5 Post Development.

Plot	2	**Vegetation Classification or Exclusion Clause - Predevelopment**	Class A Forest Downslope >0 to 5 Degrees
Plot	2	**Vegetation Classification or Exclusion Clause - Post Development**	Excluded S 2.2.3.2 (f)



Photo ID: 3



Photo ID: 4

Description / Justification for Classification:	Trees 10 to 30 m high with more than 30% canopy cover over an unmanaged understory. This vegetation is within a proposed Public Open Space which will be maintained to Asset Protection Zone standards, detailed in Section 3.2, and excluded as low fuel vegetation in Figure 4.

Plot	3	**Vegetation Classification or Exclusion Clause - Predevelopment**	Class A Forest Upslope/Flat
Plot	3	**Vegetation Classification or Exclusion Clause - Post Development**	Excluded S 2.2.3.2 (e)
			
Photo ID: 5			Photo ID: 6
Description / Justification for Classification:			Trees 10 to 30 m high with more than 30% canopy cover over an unmanaged understory. This vegetation will be removed as it is located within proposed residential lots, as illustrated in the Vegetation Classification - Post Development Map (Figure 4) and will be Excluded under S 2.2.3.2 (e) post development as this will be an area of proposed lots.

Plot	4	**Vegetation Classification or Exclusion Clause - Predevelopment**	Class A Forest Downslope > 0 to 5 Degrees
Plot	4	**Vegetation Classification or Exclusion Clause - Post Development**	Class A Forest Downslope > 0 to 5 Degrees
			
Photo ID: 7			
Description / Justification for Classification:			Vegetation within the road reserve comprising of trees 10 to 30 m high with more than 30% canopy cover over an unmanaged understory. This vegetation is located outside of the subject site, therefore will remain as Class A Forest Downslope >0 to 5 Post Development.

Plot	5	**Vegetation Classification or Exclusion Clause - Predevelopment**	Class A Forest Downslope > 0 to 5 Degrees
Plot	5	**Vegetation Classification or Exclusion Clause - Post Development**	Excluded S 2.2.3.2 (f)
			
Photo ID: 8			
Description / Justification for Classification:			Trees 10 to 30 m high with more than 30% canopy cover over an unmanaged understory. Vegetation is being retained within Public Open Space and will be managed in a low fuel state, as described in Section 3.2.

Plot	6	**Vegetation Classification or Exclusion Clause - Predevelopment**	Class A Forest > 0 to 5 Degrees
Plot	6	**Vegetation Classification or Exclusion Clause - Post Development**	Excluded S 2.2.3.2 (e)



Photo ID: 9



Photo ID: 10

Description / Justification for Classification:	Trees 10 to 30 m high with more than 30% canopy cover over an unmanaged understory. This vegetation will be removed as it is located within proposed residential lots, as illustrated in the Vegetation Classification - Post Development Map (Figure 4) and will be Excluded under S 2.2.3.2 (e) post development as this area will become proposed lots.

Plot	7	**Vegetation Classification or Exclusion Clause - Predevelopment**	Class A Forest Upslope/Flat
Plot	7	**Vegetation Classification or Exclusion Clause - Post Development**	Class A Forest Upslope/Flat



Photo ID: 11



Photo ID: 12

Description / Justification for Classification:	Trees 10 to 30 m high with more than 30% canopy cover over an unmanaged understory. This vegetation is located outside of the subject site, therefore will remain as Class A Forest Upslope/Flat Post Development.

Plot	8	**Vegetation Classification or Exclusion Clause - Predevelopment**	Class B Woodland Downslope >0 to 5 Degrees
Plot	8	**Vegetation Classification or Exclusion Clause - Post Development**	Class B Woodland Downslope >0 to 5 Degrees
			
Photo ID: 13			
Description / Justification for Classification:			Scattered trees 10 to 30 m high with less than 30% canopy cover over a grass understory. This vegetation is located outside of the subject site, therefore will remain as Class B Woodland Downslope >0 to 5 Degrees Post Development.

Plot	9	**Vegetation Classification or Exclusion Clause - Predevelopment**	Class D Scrub Downslope >0 to 5 Degrees
Plot	9	**Vegetation Classification or Exclusion Clause - Post Development**	Class D Scrub Downslope >0 to 5 Degrees
			
Photo ID: 14			
Description / Justification for Classification:			Scrub vegetation up to 6 metres in height. This vegetation is located outside of the subject site, therefore will remain as Class D Scrub Downslope >0 to 5 Post Development.

Plot	10	**Vegetation Classification or Exclusion Clause - Predevelopment**	Class G Grassland >0 to 5 Degrees
Plot	10	**Vegetation Classification or Exclusion Clause - Post Development**	Class G Grassland >0 to 5 Degrees or Excluded S 2.2.3.2 (e) or (f)
			
Photo ID: 15			Photo ID: 16
Description / Justification for Classification:			Unmanaged grasses. The Vegetation Classification - Post Development map takes into account the post development firebreak category of the lots, with those being Residential under 4,000m^2, requiring grasses to be maintained at under 10cm in height, therefore these areas are excluded in the post development map. The areas within the neighbouring rural lots remain as Class G - Grassland post development.

Plot	11	**Vegetation Classification or Exclusion Clause - Predevelopment**	Class G Grassland Upslope/Flat
Plot	11	**Vegetation Classification or Exclusion Clause - Post Development**	Class G Grassland Upslope/Flat or Excluded S 2.2.3.2 (e) or (f)



Photo ID: 17



Photo ID: 18

Description / Justification for Classification:	Unmanaged grasses. The Vegetation Classification - Post Development map takes into account the post development firebreak category of the lots, with those being Residential under 4,000m^2, requiring grasses to be maintained at under 10cm in height, therefore these areas are excluded in the post development map. The areas within the neighbouring rural lots remain as Class G - Grassland post development.

Plot	12	**Vegetation Classification or Exclusion Clause - Predevelopment**	Class B Woodland Downslope >0 to 5 Degrees
Plot	12	**Vegetation Classification or Exclusion Clause - Post Development**	Excluded S 2.2.3.2 (f)



Photo ID: 19



Photo ID: 20

Description / Justification for Classification:	Scattered trees 10 to 30 m high with less than 30% canopy cover over a grass understory. This vegetation is being retained in Public Open Space and will be established and maintained in a low fuel state, as described in Section 3.2 .

Plot	13	**Vegetation Classification or Exclusion Clause - Predevelopment**	Excluded S 2.2.3.2 (a), (e) or (f)
Plot	13	**Vegetation Classification or Exclusion Clause - Post Development**	Excluded S 2.2.3.2 (a), (e) or (f)



Photo ID: 21



Photo ID: 22



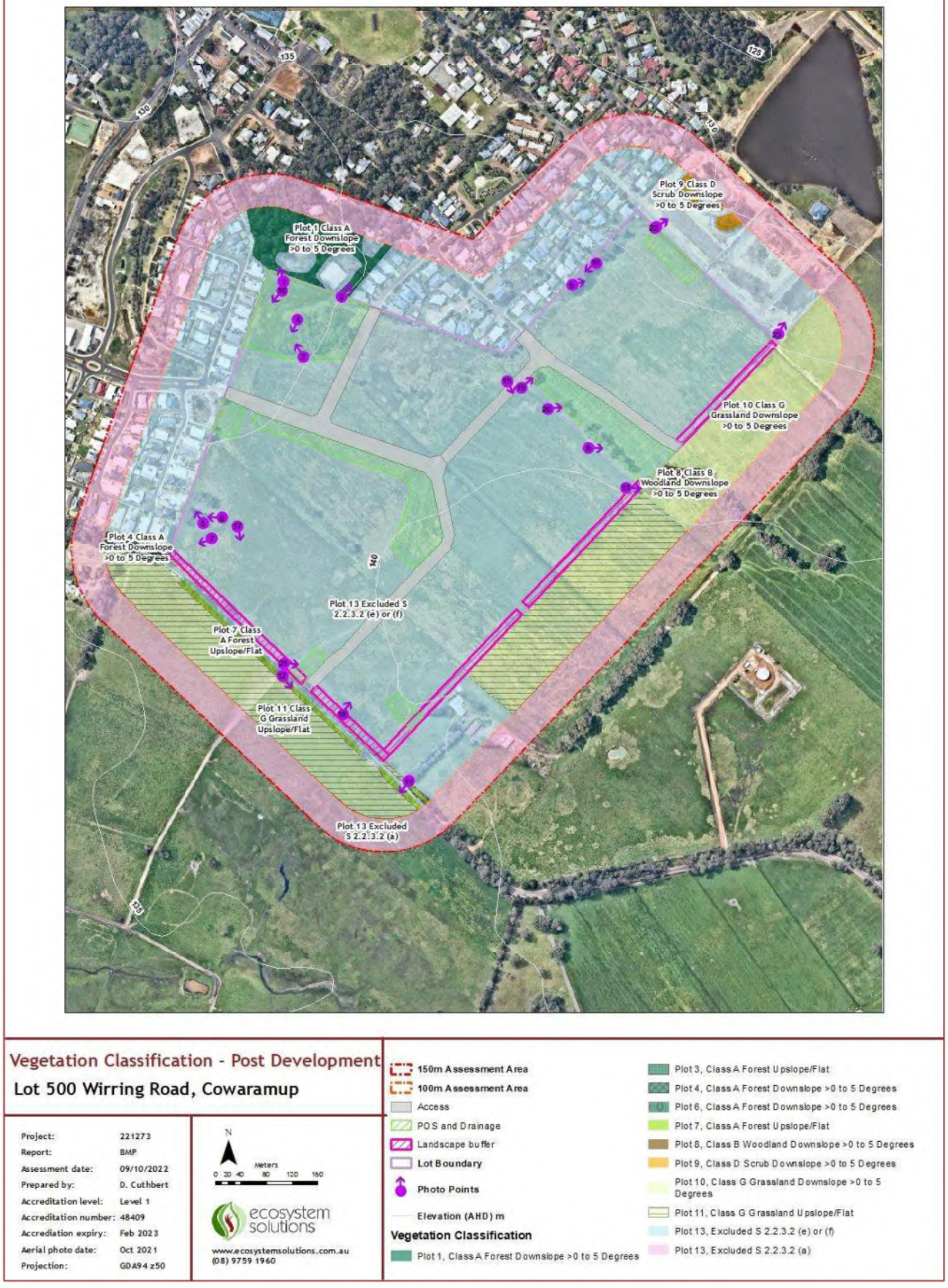
Photo ID: 23

Description / Justification for Classification:	Areas greater than 100m from the Site are excluded under S 2.2.3.2 (a). Non-vegetated areas including bare earth, roads and buildings are excluded under S 2.2.3.2 (e). Low threat vegetation including grasses managed at under 10cm in height, managed lawns and gardens and nature strips are excluded under S 2.2.3.2 (f). The Vegetation Classification - Post Development Map excludes grassland within the Site, as these must be managed under 10cm in height under the All Lots 4000m^2 and under category of the Shire of Augusta Margaret River's Firebreak Notice and Bushfire Information. The developer is responsible for maintaining all grasses at under 10cm in height until individual lots are sold, when this will become the responsibility of the individual landowners.

	The Public Open Spaces, Drainage Reserves and Landscape buffers within the Site will be established in a low fuel state, as described in Section 3.2.



Figure 3 Vegetation Classification - Pre-Development



Vegetation Classification - Post Development

Lot 500 Wirring Road, Cowaramup

Project:	221273
Report:	BMP
Assessment date:	09/10/2022
Prepared by:	D. Cuthbert
Accreditation level:	Level 1
Accreditation number:	48409
Accrediation expiry:	Feb 2023
Aerial photo date:	Oct 2021
Projection:	GDA94 z50

N

Meters
0 20 40 80 120 160

ecosystem solutions

www.ecosystemsolutions.com.au
(08) 9759 1960

- 150m Assessment Area
- 100m Assessment Area
- Access
- POS and Drainage
- Landscape buffer
- Lot Boundary
- Photo Points
- Elevation (AHD) m

Vegetation Classification

- Plot 1, Class A Forest Downslope >0 to 5 Degrees
- Plot 3, Class A Forest Upslope/Flat
- Plot 4, Class A Forest Downslope >0 to 5 Degrees
- Plot 6, Class A Forest Downslope >0 to 5 Degrees
- Plot 7, Class A Forest Upslope/Flat
- Plot 8, Class B Woodland Downslope >0 to 5 Degrees
- Plot 9, Class D Scrub Downslope >0 to 5 Degrees
- Plot 10, Class G Grassland Downslope >0 to 5 Degrees
- Plot 11, Class G Grassland Upslope/Flat
- Plot 13, Excluded S 2.2.3.2 (e) or (f)
- Plot 13, Excluded S 2.2.3.2 (a)

Figure 4 Vegetation Classification - Post Development

2.2 Assessment Outputs

The results from the Site assessment are provided in Table 1. The Determined Bushfire Attack Level (highest BAL) for the Site has been determined in accordance with clause 2.5 of AS 3959- 2018 with map provided based on the Post Development Vegetation (Figure 4) in Figure 5 and detailed BAL Contour map provided in Figure 6.

Table 1 Site Assessment Result

Method 1 BAL Determination					
Fire Danger Index - 80 (AS 3959-2018 Table 2.1)					
Plot	Vegetation Classification	Maximum effective Slope Under the Classified Vegetation (degrees)	Required Distance Classified (metres)	Separation to the Vegetation	Bushfire Attack Level
1	Class A Forest	Downslope >0 to 5	27m*		BAL-29
2	Class A Forest	Downslope >0 to 5	N /A***		BAL-LOW
3	Class A Forest	Upslope/Flat	N /A***		BAL-LOW
4	Class A Forest	Downslope >0 to 5	27m*		BAL-29
5	Class A Forest	Downslope >0 to 5	N /A***		BAL-LOW
6	Class A Forest	Downslope >0 to 5	N /A***		BAL-LOW
7	Class A Forest	Upslope/Flat	21m*		BAL-29
8	Class B Woodland	Downslope >0 to 5	17m*		BAL-29
9	Class D Scrub	Downslope >0 to 5	15m*		BAL-29
10	Class G Grassland	Downslope >0 to 5	9m*		BAL-29
11	Class G Grassland	Upslope/Flat	8m*		BAL-29
12	Class B Woodland	Downslope >0 to 5	N /A***		BAL-LOW
13	Excluded S 2.2.3.2 (a), (b), (e) & (f)	N/A	N/A		BAL-LOW
Determined Bushfire Attack Level					BAL-29**

* This separation distance must be managed to the standards in the Guidelines for Planning in Bushfire Prone Areas as an Asset Protection Zone.

** A lower BAL rating can be achieved based on an increased separation distance from the classified vegetation, depending on the location of the dwelling within the Lot. This determination is found using the worst-case scenario based on the plan. A detailed BAL assessment will be required prior to the construction of any dwelling.

***Plots 3 and 6 will be cleared as part of the development to establish residential lots, as described in Section 3.1. Plots 2, 5 and 12 will be located within a Public Open Space and will be established in a low fuel state as described Section 3.2. These plots are therefore excluded from classification in the post development assessment under Section 2.2.3.2 (e) & (f) of AS3959-2018.



BAL Contour Map

Lot 500 Wirring Road, Cowaramup

Project:	221273
Report:	BMP
Assessment date:	09/10/2022
Prepared by:	D. Cuthbert
Accreditation level:	Level 1
Accreditation number:	48409
Accrediation expiry:	Feb 2023
Aerial photo date:	Oct 2021
Projection:	GDA94 z50

N

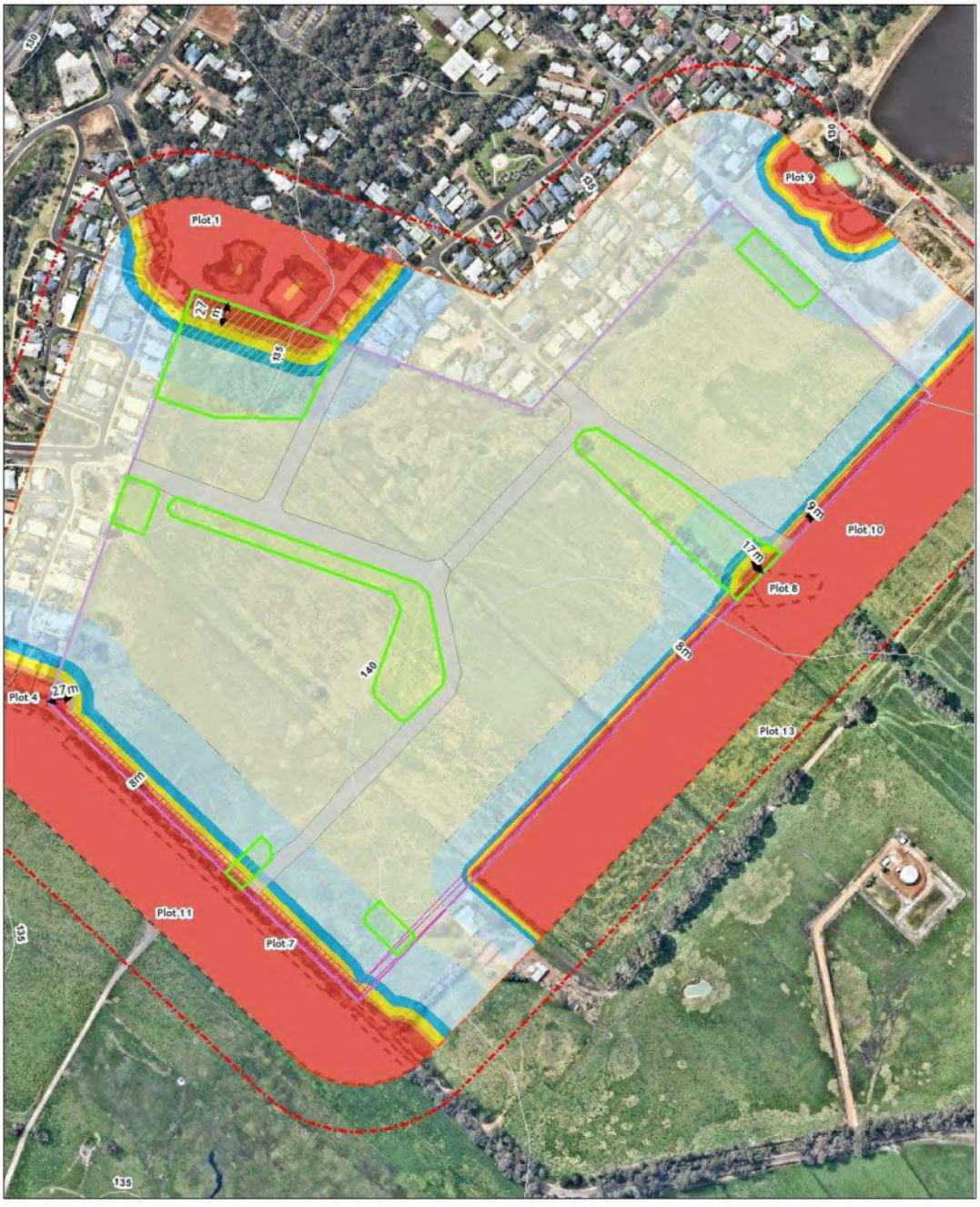
Meters
0 25 50 100 150 200

ecosystem solutions

www.ecosystemsolutions.com.au
(08) 9759 1960

150m Assessment Area	Indicative BAL
100m Assessment Area	BAL-LOW
Lot Boundary	BAL-12.5
POS and Drainage	BAL-19
Access	BAL-29
Landscape buffer	BAL-40
Classified Vegetation	BAL-FZ
Elevation (AHD) m	
Distance BAL29	
BAL-29 setback	

Figure 5 BAL Contour Map



BAL Contour Map - Detailed View

Lot 500 Wirring Road, Cowaramup

Project:	221273
Report:	BMP
Assessment date:	09/10/2022
Prepared by:	D. Cuthbert
Accreditation level:	Level 1
Accreditation number:	48409
Accrediation expiry:	Feb 2023
Aerial photo date:	Oct 2021
Projection:	GDA94 z50

N

Meters 0 15 30 60 90 120

ecosystem solutions

www.ecosystemsolutions.com.au
(08) 9759 1960

	Indicative BAL
150m Assessment Area	BAL-LOW
100m Assessment Area	BAL-12.5
Lot Boundary	BAL-19
POS and Drainage	BAL-29
Access	BAL-40
Landscape buffer	BAL-FZ
Classified Vegetation	
Elevation (AHD) m	
Distance BAL29	
BAL-29 setback	

Figure 6 BAL Contour - Detailed View

3 Environmental Considerations

3.1 Native Vegetation – modification and clearing

Lot 500 Wirring Road contains areas of remnant vegetation. The extent of the vegetation modification will be determined at subdivision stage. Some areas of vegetation will be retained in Public Open Space which will be maintaining in a low fuel state (Plots 2, 5 and 12). Some vegetation modification is proposed, including the removal of vegetation within Plot 3 and 6. The condition of this vegetation is detailed in the Flora and Fauna Significance Assessment that has been prepared by Ecosystem Solutions (Ecosystem Solutions, 2022), which should be read in conjunction with this BMP.

Establishment of an Asset Protection Zone does not mean the removal of all vegetation within this area, trees can be retained if the trunks at maturity are 6 metres from all elevations from the building, branches at maturity do not touch or overhang the building, lower branches are removed to a height of 2 metres above the ground or surface vegetation and canopy cover is less than 15%, with tree canopies at maturity well spread to at least 5 metres apart as to not form a continuous canopy. Shrubs and ground covers can also be retained if they are managed to APZ requirements.

This bushfire assessment assumes that relevant government approvals for any vegetation modification will be achieved prior to the commencement of any clearing.

The Site and the surrounding 150m buffer have been assessed for environmental values using a simple desktop review (Table 2). The Protected Matters Search Tool and public state databases, searched 14th March 2022, identifies conservation significant flora, fauna and vegetation with a number of threatened flora and fauna species or species habitat that may occur in the area.

Table 2 Significant environmental values identified within the Site

Environmental Value	Yes or No	If Yes - describe
Conservation Covenants (DPIRD-023)	No	Not applicable
Bushfire Forever Sites (DOP-071)	No	Not applicable
Conservation Category Wetlands and Buffer (DBCA-010, DBCA-017, DBCA-019 or DBCA-043)	No	Not applicable
Threatened Ecological Communities (TECs) (DBCA-038)	No	Nil
Threatened Flora (DBCA-036)	Yes	A number of Threatened flora species or species habitat are known to occur in the area.
Threatened Fauna (DBCA-037)	Yes	A number of threatened fauna species or species habitat are known to occur in the area including: • Western Ringtail Possum (*Pseudocheirus occidentalis* - Critically Endangered); and • Black Cockatoo species (Calyptorhynchus banksii naso - Vulnerable, Calyptorhynchus baudinii - Endangered & Calyptorhynchus latirostris - Endangered).
Environmentally Sensitive Area (DWER-046)	No	Nil
Significant through Local Planning or Biodiversity Strategy	No	Not applicable

3.2 Re-vegetation / Landscape Plans

A Landscape Management Plan (Figure 7 with detailed plan provided in Appendix D) has been prepared and incorporated into the Bushfire Management Plan to ensure that the vegetation within the areas of Public Open Space (POS) and Drainage Reserves are maintained to an appropriate level in perpetuity as to not increase the BAL rating of the proposed lots.

The Plan includes the following:

- POS 1 - a total of 1.81 ha including a passive open space centred around the retention of a large stand of existing mature trees. The large stand of existing mature trees are classified as Class A Forest in the current vegetation map (Figure 3, labelled Plot 2). This vegetation will be required to be established in a low fuel state according to Asset Protection Zone (APZ) standards, specified in the Guidelines for Planning in Bushfire Prone Areas v1.4, Dec 2021. The surrounding area of POS 1 will be established in a low fuel state by the Developer with grass maintained under 10 cm and planting of shrubs and trees to APZ standards, specified in the Guidelines. This POS is excluded from classification in the Post Development Vegetation Classification (Figure 4) under Section 2.2.3.2 (f) from AS3959-2018.
- POS 2 – a total of 1.24 ha which includes a drainage line with planting of sedges and rushes to establish a living stream. The remaining POS will include lawn, a playground and some further planting areas. POS 2 is excluded from vegetation classification under Section 2.2.3.2 (f) in the post development vegetation classification (Figure 4) and will be established in a low fuel state by the Developer with grass maintained under 10 cm and planting of trees and shrubs to Asset Protection Zone standards, specified in the Guidelines for Planning in Bushfire Prone Areas v1.4, Dec 2021.
- POS 3 – a total of 1.23 ha will also be a passive open space with retention of large trees along the south western boundary. These existing trees are classified as Plot 5, Class A Forest, and Plot 12, Class B Woodland under the current extent vegetation map (Figure 3). These plots are excluded from classification under Section 2.2.3.2 (f) in the post development vegetation classification (Figure 4) as these areas be established in a low fuel state and managed as a nature strip within the POS. The remainder of the POS will contain lawn and planting of sedges and rushes along a drainage line, established and managed in a low fuel state, specified in the Guidelines for Planning in Bushfire Prone Areas v1.4, Dec 2021.
- Drainage reserves will be established with sedges and rushes and less than 10% trees. They will be established in a low fuel state by the Developer, according to APZ requirements in the Guidelines. There are four drainage reserves proposed which are excluded from classification under Section 2.2.3.2 (f). in the post development vegetation classification (Figure 5).
- Landscape buffers will be established along the south east and south west boundary by the Developer. These buffers will include a 5 m earth bund with trees and shrubs planted on and adjacent to the earth bund. These will be established by the Developer in a low fuel state, according to APZ standards in the Guidelines. These landscape buffers are excluded from classification under Section 2.2.3.2 (f). in the post development vegetation classification (Figure 5).

The POS and drainage areas will be maintained in a low fuel state by the Developer for 2 years post planning approval, where responsibility will be transferred to the Shire of Augusta Margaret River for

management in perpetuity. The Landscape buffers will be maintained in a low fuel state by the Developer until the lots become sold, where it would become the responsibility of the individual lot owners.

The Developer is responsible for maintaining all grasses within the Site at under 10 cm in height until individual lots are sold, when this will become the responsibility of the individual landowners, to ensure lots are maintained in a low fuel state and do not increase the BAL rating on the neighbouring lots.



Figure 7 Landscape Master Plan for Lot 500 Wirring Road, Cowaramup

4 Assessment Against the Bushfire Protection Criteria

4.1 Compliance with the Acceptable Solutions for each Element

Bushfire Protection Criteria – Element 1 - Location	
Intent: To ensure that strategic planning proposals, subdivision and development applications are located in areas with the least possible risk of bushfire to facilitate the protection of people, property, and infrastructure.	
Acceptable Solution	**Assessment Statements**
A1.1 Development location *The strategic planning proposal, subdivision and development application is located in an area that is or will, on completion, be subject to either a moderate or low bushfire hazard level, or BAL-29 or below.*	**Compliance with this element is achieved.** The BAL Contour for the Site (Figure 5 & 6) shows the areas on the Lot were a BAL-29 or lower rating can be achieved. Residential lots will be confined to areas that are BAL-29 or lower. There are areas of BAL-40 and BAL-FZ that encroach the Site from vegetation outside the lot boundary and outside the control of the Developer. These areas are predominately contained in Public Open Space, POS 1 and POS 3, and the landscape buffers, which does not allow any habitable dwelling to be located in an area greater than BAL-29. There is one portion of the Site, located in the south east, which requires a 27 m development setback within any residential lot resulting in this location, to ensure habitable dwellings are located in an area of BAL-29 or lower. This setback could occur through a Local Development Plan which establishes a Habitable Building Exclusion within this 27 m setback. The entire Site will be maintained by the developer, with grasses maintained under 10cm in height as a requirement of this Bushfire Management Plan, until they are sold, when this maintenance will become the responsibility of the individual landowners in perpetuity.

Bushfire Protection Criteria – Element 2 – Siting and Design	
Intent: To ensure that the siting and design of development minimises the level of bushfire impact.	
Acceptable Solution	**Assessment Statements**
A2.1 Asset Protection Zone (APZ) *Every habitable building is surrounded by, and every proposed lot can achieve, an APZ depicted on submitted plans, which meets the following requirements:* • *Width: Measured from any external wall or supporting post or column of the proposed building, and of sufficient size to ensure the potential radiant heat impact of a bushfire does not exceed 29kW/m² (BAL-29) in all circumstances.* • *Location: the APZ should be contained solely within the boundaries of the lot on which the building is situated, except in instances where the neighbouring lot or lots will be managed in a low-fuel state on an ongoing basis, in perpetuity.* • *Management: the APZ is managed in accordance with the requirements of 'Standards for Asset Protection Zones.' (Appendix B).*	**Compliance with this element is achieved.** Asset Protection Zones surrounding each habitable building will be established and maintained in perpetuity to meet the criterial in the Guidelines (Appendix B) with the following minimum distances required to achieve BAL-29; • 27m to the Class A Forest Downslope >0 to 5 degrees; • 21m to the Class A Forest Upslope/Flat; • 17m to the Class B Woodland Downslope >0 to 5 degrees; • 15m to Class D Scrub Downslope >0 to 5 degrees; • 9m to the Class G Grassland Downslope >0 to 5 degrees; and • 8m to the Class G Grassland Upslope/Flat Depending on the final lot layout, some APZ's may overlap lot boundaries. To ensure any dwelling constructed with the Site can achieve a BAL-29 or lower rating, all grasses must be maintained under 10cm in height by the developer as a requirement of this Bushfire Management Plan. As individual lots are sold, management for each lot will become the responsibility of the individual landowner, in perpetuity, as a requirement of this Bushfire Management Plan. Establishment and management of the Public Open Spaces and Drainage Reserves will occur in accordance with a Landscape Management Plan for a period of two years by the developer. After this period, the land will be ceded to the Crown and vested to the Shire of Augusta Margaret River, with ongoing management in perpetuity the responsibility of the Shire of Augusta Margaret River.

Bushfire Protection Criteria – Element 2 – Siting and Design	
	Landscape buffers will be established in accordance with a Landscape Management Plan by the Developer. These will become the responsibility of individual lot owners when they become sold. In addition to the requirements of this Bushfire Management Plan, the Shire of Augusta Margaret River's Firebreak Notice and Bushfire Information (*which may be subject to review from time to time)* must be complied with, including maintaining grasses at under 10cm in height.

Bushfire Protection Criteria – Element 3 – Vehicular Access	
Intent: To ensure that the vehicular access serving a subdivision/development is available and safe during a bushfire event.	
Acceptable Solution	**Assessment Statements**
A3.1 Public Roads *Public roads are to meet the minimum technical requirements in Table 6, Column 1 (Appendix C).* *The trafficable (carriageway/ pavement) width is to be in accordance with the relevant class of road in the Local Government Guidelines for Subdivisional Development (IPWEA Subdivision Guidelines), Liveable Neighbourhoods, Austroad standards and/or any applicable standards for the local government.*	**Compliance with this element can be achieved.** The developer will construct public roads to meet the requirements of the relevance class of road in the Local Government Guidelines for Subdivisional Developments, Liveable Neighbourhoods, Austroads standards and/or applicable standards for the local government. Existing public roads in proximity to the Site are in good condition.

Bushfire Protection Criteria – Element 3 – Vehicular Access	
A3.2a Multiple access routes *Public road access is to be provided in two different directions to at least two different suitable destinations with an all-weather surface (two-way access).* *If the public road access to the subject site is via a no-through road which cannot be avoided due to demonstrated site constraints, the road access is to be a maximum of 200 metres from the subject lot(s) boundary to an intersection where two-way access is provided.* *The no-through road may exceed 200 metres if it is demonstrated that an alternative access, including an emergency access way, cannot be provided due to site constraints and the following requirements are met:* • *The no-through road travels towards a suitable destination; and* • *The balance of the no-through road, that is greater than 200 metres from the subject site, is wholly within BAL-LOW, or is within a residential built-out area.*	**Compliance with this element is achieved.** All proposed lots will have two access/egress routes from the lot boundary. The internal road network will allow two-way access for all lots via various public roads and connecting to Bussell Highway, which connects to both the Margaret River and Busselton townships. The Concept Plan, Figure 1, shows Access roads which will be used to connect the lots within the development to the public road network and ensures multiple access routes. Alternatively, the public road network can be used to access an alternative location in the event of a bushfire. No no-through roads are proposed as part of this development. If the subdivision is to be staged, the stages are to be designed to ensure all lots within each stage have two access and egress routes via the public road network.
A3.2a Emergency Access Way	**Not applicable to this Site.** No Emergency access ways are proposed or required as part of this development.

Bushfire Protection Criteria – Element 3 – Vehicular Access	
A3.3 Through-roads *All public roads should be through roads. No-through roads should be avoided and should only be considered as an acceptable solution where:* • *It is demonstrated that no alternative road layout exists due to site constraints; and* • *The no-through road is a maximum length of 200 metres to an intersection providing two-way access unless it satisfies the exemption provisions in A3.2a of this table.* *A no-through road is to meet all the following requirements:* • *Requirements of a public road (Table 6, Column 1) (Appendix C); and* • *Turn-around area as shown* in Figure 24 (Appendix C)	**Compliance with this element can be achieved.** All proposed roads will be through roads, providing all lots with two access and egress routes as detailed in A3.2a above. The Concept plan includes Access roads which connect the Site to the public road network. Further internal roads will be established to ensure each proposed lot will have two way access which will all be through roads.

Bushfire Protection Criteria – Element 3 – Vehicular Access

A3.4a Perimeter roads

A perimeter road is a public road and should be provided for greenfield or infill development where 10 or more lots are being proposed (including as part of a staged subdivision) with the aim of:

- *Separating areas of classified vegetation under AS3959, which adjoin the subject site, from the proposed lot(s); and*
- *Removing the need to battle-axe lots that back onto areas of classified vegetation.*
- *A perimeter road is to meet the requirements contained in Table 6, Column 1 (Appendix C).*

A perimeter road may not be required where;

- *The adjoining classified vegetation is Class G Grassland;*
- *Lots are zoned for rural living or equivalent;*
- *It is demonstrated that it cannot be provided due to site constraints; or*
- *All lots have frontage to an existing public road.*

Compliance with this element can be achieved.

Perimeter roads will be considered within the Subdivision Plan where the Site abuts classified vegetation.

It is noted that the surrounding areas are predominately existing lots, excluded from vegetation classification, or classified as Class G Grassland which does not require a perimeter road.

A perimeter road will be constructed to the standards of a Public Road, as per Table 6, Column 1 (Appendix C).

Bushfire Protection Criteria – Element 3 – Vehicular Access	
A3.4b Fire Service Access Route *Where proposed lots adjoin classified vegetation under AS3959 (excluding Class G Grassland)', and a perimeter road is not required in accordance with A3.4a, a fire service access route can be considered as an acceptable solution to provide firefighter access, where access is not available, to the classified vegetation.* *A fire service access route is to meet all the following requirements:* • *Requirements in Table 6, Column 3;* • *Be through-routes with no dead-ends;* • *Linked to the internal road system at regular intervals, every 500 metres; must be signposted; no further than 500 metres from a public road; if gated, gates must open the required trafficable width and can be locked by the local government and/or emergency services, if keys are provided for each gate; and* • *Turn-around areas designed to accommodate type 3.4 fire appliances and to enable them to turn around safely every 500 metres*	**Not applicable to this Site.** No Fire Service Access Routes are proposed or required as part of this development.

Bushfire Protection Criteria – Element 3 – Vehicular Access	
A3.5 Battle-axe access legs *Where it is demonstrated that a battle-axe cannot be avoided due to the site constraints, it can be considered as an acceptable solution.* *There are no battle-axe technical requirements where the point of the battle-axe access leg joins the effective area of the lot, is less than 50 metres from a public road in a reticulated area.* *In circumstances where the above condition is not met, or the battle-axe is in a non-reticulated water area, the battle-axe is to meet all the following requirements:* • *Requirements in Table 6, Column 4; and* • *Passing bays every 200 metres with a minimum length of 20 metres and a minimum additional trafficable surface width of two metres (i.e., the combined trafficable width of the passing bay and constructed driveway to be a minimum six metres).*	**Compliance with this element is achieved** The Subdivision Lot Layout should be designed to avoid battle-axe access legs.

Bushfire Protection Criteria – Element 4 - Water	
Intent: To ensure that water is available to the subdivision, development, or land use to enable people, property, and infrastructure to be defended from bushfire.	
Acceptable Solution	Assessment Statements
A4.1 Identification of future water supply *Evidence that a reticulated or non-reticulated water supply for bushfire fighting can be provided at the subdivision and/or development application stage, in accordance with the specifications of the relevant water supply authority or the requirements of Schedule 2.*	**Compliance with this element is achieved.** The Site will be reticulated. Reticulated water will be supplied in accordance with the Water Corporation's No. 63 Water Reticulation Standards by the Developer. Water Hydrants will be supplied in accordance with Water Corporations Requirements by the Developer.

4.2 Performance Based Solutions

The Site assessment was conducted in accordance with AS 3959-2018 Simplified Procedure (Method 1). The Proposal meets all the compliance requirements for the four Bushfire Protection Criteria Elements. There are no performance-based solutions proposed.

4.3 Summary of the Assessment Outcomes

This plan provides acceptable solutions and responses to the performance criteria outlined in the *Guidelines for Planning in Bushfire Prone Areas* (WAPC, Dec 2017).

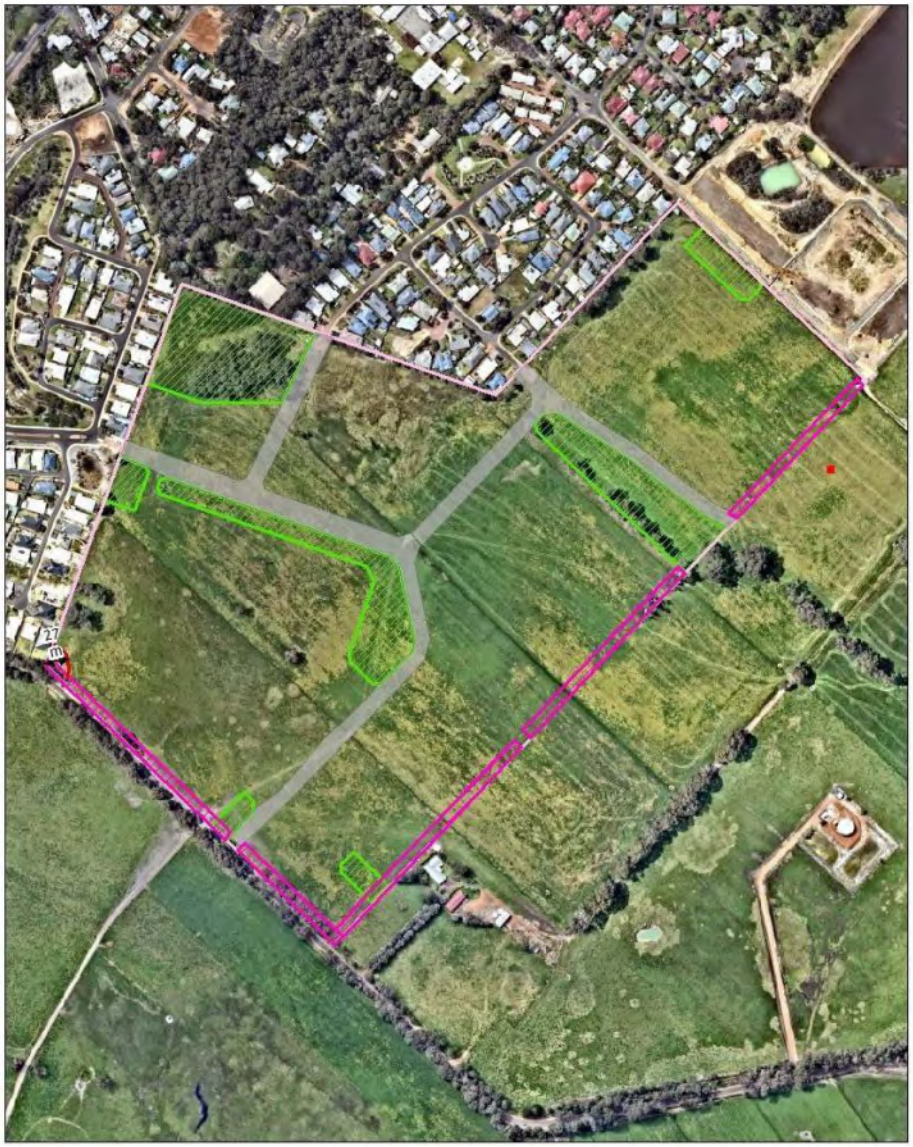
The layout and design of the development is such that no structure will be required to be exposed to a radiant heat flux in excess of 29kW/m^2 (BAL-29) provided the management as outlined in this Plan is adopted.

Any class 1, 2, 3 or associated 10a structure that are to be constructed, or additions planned to existing dwellings shall be designed and built to conform with Australian Standards AS 3959-2018:

- BAL-29: sections 3 & 7;
- BAL-19 sections 3 & 6; and
- BAL 12.5 sections 3 & 5.

A summary of the Bushfire Management Strategies to be implemented is provided in Figure 8. An individual BAL assessment may achieve a lower BAL rating, based on the exact location of a dwelling within a lot and classified vegetation.

Spatial representation of the proposed risk management measures



NOTES

The lot layout will be designed to ensure any dwellings eventuating within the Lot can achieve a BAL-29 or lower rating. The BAL-29 setback line is illustrated in this map, which may require a Habitable Building Exclusion for 27 m for any residential lot eventuating within this location, included in a Local Development Plan.

The Developer will establish and maintain the areas of Public Open Space and Drainage Reserves according to the Landscape Management Plan for a minimum of two years, when these areas will be ceded to the Crown and vested to the Shire of Augusta Margaret River, who will be the party responsible for maintaining these areas in a low fuel state in perpetuity.

The Developer will establishthe landscape buffers according to the Landscape Management Plan, until the lots are sold, where it will become the responsibility of the individual lot owners. The Developer will maintain all lots in a low fuel state until lots are sold, where it is the responsibility of the Landowner.

Public Roads will be constructed according to the Guidelines and will ensure every residential lot achieves two access routes.

Reticulated water and fire hydrants will be provided in accordance with the Water Corporations No. 63 Water Reticulation Standard.

Establishment of the Site in a low fuel state and the design of the lot layout, water supply and public roads are the responsibility of the Developer.

LEGEND

- Lot Boundary
- POS / Drainage
- Landscape buffer
- Access
- Habitable Building Exclusion
- Distance

PROPERTY / ASSESSMENT DETAILS

Property Address: Lot 500 Wirring Road, Cowaramup
Project No: 221273
Prepared by: D Cuthbert
Accreditation Level: Level 1
Accreditation Number: 48409
Accreditation Expiry Date: 02/23

N

0 25 50 100 150 200
Meters

ecosystem solutions
www.ecosystemsolutions.com.au
(08) 9759 1960

Figure 8 Map of Bushfire Management Strategies

5 Responsibilities for Implementation and Management of the Required Bushfire Measures

The responsibilities for the Developer and Local Government are outlined in Table 3 and Table 4, respectively.

Table 3 Developer Responsibilities

Number	Action	Due	Completed
1	Design the lot layout to ensure any dwellings eventuating within the Site can achieve a BAL-29 or lower rating.	At Subdivision application stage	☐
2	Design the road layout to ensure each lot is provided two access and egress routes	At Subdivision application stage	☐
3	Design all roads to the standards of Element 3 in accordance with the relevant class of road in the Local Government Guidelines for Subdivisional Development, Liveable Neighbourhoods, Austroad standards and/or any applicable standards for the local government area.	At Subdivision application stage	
4	Design the reticulated water and fire hydrants in accordance with the Water Corporation's No. 63 Water Reticulation Standards.	At Subdivision application stage	☐
5	Establish and maintain the public open space and drainage reserves in accordance with the Landscape Management Plan, after a period of two years the land will be ceded to the Crown and vested to the Shire of Augusta Margaret River, with management responsibilities handed over to the Shire of Augusta Margaret River	Post Planning approval and prior to lot sale / until handover to the Shire of Augusta Margaret River	☒

Number	Action	Due	Completed
6	Establish and maintain the Landscape buffers in accordance with the Landscape Management Plan, with management responsibilities handed over to the Landowner when lots become sold.	Post planning approval and prior to lot sale	
7	Maintain all grass in a low threat with grass under 10 cm, year around until the lots are sold, where it becomes the responsibility by the landowners.	Post planning approval and prior to lot sale	
8	Provide a copy and obtain endorsement of this Bushfire Management Plan by those with responsibility under this plan including Builders, Landowners/Occupiers and Shire of Augusta Margaret River	Post planning approval and prior to lot sale	☐
9	Place a notice on the Certificate of Title, advising of the existence of this Bushfire Management Plan and associated maintenance obligations.	Creation of titles and deposited plan	☐

Table 4 Shire of Augusta Margaret River's Responsibilities

Number	Action	Due
1	Monitor landowner compliance with the annual firebreak notice.	Ongoing
2	Maintain areas of Public Open Space and Drainage Reserves in accordance with the Landscape Management Plan in perpetuity.	Two years post planning approval - once responsibility is transferred from the developer.

Table 5 Landowner Responsibilities

Number	Action	Due
1	Maintain the lot to Asset Protection Zone standards and grass under 10 cm in height, year-round.	Year Round / In perpetuity
2	Maintain landscape buffers according to the Landscape Management Plan in perpetuity.	Ongoing

6 Glossary

All weather surface: Compacted gravel surface to the standard prescribed in the Austroads Guide to Pavement Technology as a minimum. An all-weather surface does not need to be sealed.

AS 3959: Australian Standard 3959 Construction of Buildings in Bushfire-Prone Areas.

Asset Protection Zone (APZ): A low fuel area immediately surrounding a building.

BAL: Bushfire Attack Level (BAL) as set out in the Australian Standard 3959 Construction of Buildings in Bushfire-Prone Areas (AS 3959), as referenced in the Building Code of Australia (as amended).

BAL Assessment: An assessment prepared in a manner and form set out in AS 3959 to determine a BAL. It is strongly recommended that BAL assessments are prepared by accredited Level 1 BAL Assessors, unless otherwise exempted in these Guidelines.

BAL Contour Map: A BAL Contour Map is a scale map of the subject lot/s illustrating the potential radiant heat impact and associated indicative BAL ratings in reference to any classified vegetation remaining within 100 metres of the assessment area after the development is complete. The intent of the BAL contour map is to identify land suitable for development based on the indicative BAL rating. It is strongly recommended that BAL Contour Maps are prepared by an accredited Bushfire Planning Practitioner.

Bushfire: An unplanned fire burning in vegetation. A generic term which includes grass fires, forest fires and scrub fires both with and without a suppression objective.

Bushfire hazard: The potential or existing flammability of vegetation that, in association with topography and slope, when ignited may cause harm to people and/or damage property and/or infrastructure.

Bushfire Hazard Level (BHL) assessment: A BHL assessment provides a measure of the likely intensity of a bushfire and the likely level of a bushfire attack on a Site determined by categorising and mapping land as having a low, moderate, or extreme Bushfire Hazard Level in accordance with the methodology set out in the Guidelines. It is strongly recommended that Bushfire Hazard Level assessments are prepared by an accredited Bushfire Planning Practitioner.

Bushfire Management Plan (BMP): A document that sets out short, medium and long term risk management strategies for the life of the development. It is strongly recommended that Bushfire Management Plans are prepared by accredited Bushfire Planning Practitioners in accordance with the requirements set out in the Guidelines on behalf of the landowner/proponent with the assistance of the responsible authority for emergency services where required.

Bushfire Planning Practitioner: A person who holds Level Two or Level Three accreditation under the

Western Australian Bushfire Association Framework.

Bushfire prone area: An area that has been designated by the Fire and Emergency Services Commissioner under s. 18P of the Fire and Emergency Services Act 1998 as an area that is subject, or likely to be subject, to bushfires. Such areas are identified on the Map of Bush Fire Prone Areas and can be found on the Department of Fire and Emergency Services website.

Bushfire Protection Criteria: A performance-based system of assessing bushfire risk management measures contained in the Guidelines and applied to all strategic planning proposals, subdivisions, and development applications.

Bushfire risk: The chance of a bushfire igniting, spreading, and causing damage to people, property, and infrastructure.

Bushfire risk management: Means the application of the bushfire protection criteria contained in the Guidelines.

Carriageway: Means a portion of a road that is improved, designed or ordinarily used for vehicular traffic, and includes the shoulders, and areas, including embayments, at the side or centre of the carriageway, used for the stopping or parking of vehicles; and, where a road has 2 or more of those portions divided by a medium strip, the expression means each of those portions, separately.

Development application: An application for approval to carry out development or change a land use under either a local planning scheme or region planning scheme. This includes local development plans but excludes application for single houses and ancillary dwellings on a lot or lots less than 1,100m^2.

Decision-maker: The Minister for Planning, State Administrative Tribunal, Western Australian Planning Commission, Development Assessment Panel, any other State decision-making authorise, and/or the relevant local government and their delegates that make decisions regarding the application of these Guidelines.

Defendable Space: A three-metre-wide area adjacent to a building that is kept free from vegetation (excluding groundcovers and grasses) and provides a relatively safe space from which firefighters and appropriately prepared homeowners may defend the property.

Guidelines: Refers to the Guidelines for Planning in Bushfire Prone Areas (WAPC 2015), as amended.

IPWEA Subdivision Guidelines: Refers to the Local Government Guidelines for Subdivisional Development (Institute of Public Works Engineering Australasia, WAPC, 2017).

Site: The entirety of the land subject to the planning proposal. This includes lot(s) affected by the proposal.

Trafficable: Can be travelled upon by vehicles at the posted speed limit.

Traversable: Means can be moved over safely by a vehicle.

Two-way access: Vehicular access from a site in two different directions to at least two different destinations.

WAPC: Western Australian Planning Commission.

Weight Capacity: Applied to the trafficable surface construction, including all bridges or culvers on the site and access routes.

Appendix A Shire of Augusta Margaret River Firebreak Notice and Bushfire Information

Firebreak Notice Requirements and Bushfire Information 2022–23



amrshire.wa.gov.au

Firebreak Notice Requirements

Important Dates

Fire Control Officers

Permits to Burn

Firebreak Notice Requirements

This document contains the requirements from the Notice along with other bushfire information for property owners and occupiers.

All land is to be maintained from **30 November 2022** up to and including **12 May 2023** as specified in the Notice. Properties subject to an approved Bushfire Management Plan must comply with the requirements of their Plan.

APPOINTMENTS AND INSPECTIONS

Owners and occupiers who would like an early inspection by appointment, for reasons including bio-security, locked gates, and dangerous animals, or for explanation on the requirements of the Notice, should contact Rangers as soon as possible and by no later than **1 November 2022**. Where inspections by appointment are not requested, Rangers are appointed as Bush Fire Control Officers with the power to enter land under the *Bush Fires Act 1954* and will be inspecting properties for compliance without further notice from **1 December 2022**.

VARIATIONS

Where compliance with the Firebreak Notice is not practical due to environmental considerations or site specific constraints such as water course or steep gradients, owners may apply to the Shire of Augusta Margaret River for a **Variation to the Firebreak Notice.** Variations must provide an alternative means of meeting the objectives of the Notice, including bushfire risk mitigation and property access, taking into account site specific constraints and advantages and not all properties will be able to accommodate Variations.

Applications must be completed on the approved form, which is available upon request or can be downloaded via the Shire's website. Applications for a Variation have a $30 fee unless they are submitted before **1 November 2022** in which case they are processed free of charge.

COMPLIANCE

People who do not comply with the Notice or a Variation to the Notice may be issued with an infringement Notice ($250) or prosecuted with a penalty up to $5,000. The Shire of Augusta Margaret River may carry out the required work on the land at cost to the owner/occupier.

Definitions

For the purpose of the Notice the following definitions apply:

Asset Protection Zone (APZ) means the area of land within 20 metres from the external walls of any habitable building. The fuel loading (flammable material) in the APZ is to be reduced and maintained to less than 2 tonnes per hectare. Trees must not be closer than 2 metres to a building, and trees must not overhang a building within 4 metres of the external roof. **APZ requirements apply to all properties (excluding vacant lots), regardless of size, and must be maintained all year round.**

Bushfire Management Plan is a plan prepared in satisfaction of a development approval or subdivision condition. Properties subject to an approved Bushfire Management Plan must comply with the requirements of their plan in addition to the requirements of the Notice.

PLEASE NOTE

- At the Shire of Augusta Margaret River's discretion, Variations may recognise alternate methods and requirements for compliance in an approved Bushfire Management Plan.

Driveway / Access Way means the access route from the road to your main dwelling. This should be a minimum of 4 metres wide with a minimum 4 metre vertical clearance to allow emergency vehicles to access your property.

Firebreak means an area of land that has been cleared of all trees, bushes, grasses, and any other object or thing which may be flammable, leaving a bare surface to the prescribed width as outlined in the table on page 4, and with a 4 metre high vertical clearance.

Plantation means any area of planted pines, eucalypt, hardwood or softwood trees exceeding 3 hectares in area.

Trafficable Where a Firebreak is required to be 'trafficable' under the Notice, it must be a firm, stable surface capable of allowing a 4WD fire appliance to enter, exit and turn any corner (10m radius) without reversing.

Summary of Firebreak Notice Requirements

All landowners/occupiers must carry out fire prevention work in accordance with the requirements of the Notice on or before **30 November 2022**. All land is to be maintained up to and including **12 May 2023**.

Property Type	Firebreak Requirements
All Lots 4000m² and under	• 2 metre wide firebreaks around all piles of garden refuse and/or wood stacks
Residential/ Rural Residential Lots 4001m² and over	• Minimum 3 metre wide trafficable firebreaks within 10 metres of all boundaries • 2 metre wide firebreaks around all piles of garden refuse/wood stacks, fuel and fodder
Rural Lots (excluding plantations, vineyards, orchards and olive groves)	• Minimum 3 metre wide trafficable firebreak required within 100 metres of a boundary that abuts a road reserve • Where land is actively grazed or maintained to less than 10cm, a 2 metre firebreak is required • 2 metre wide firebreaks around all piles of garden refuse/wood stacks, fuel and fodder
Plantations	• 10 metre wide mineral earth firebreak around each cell or block - minimum 3 metres must be trafficable • 2 metre wide firebreaks around all piles of garden refuse/wood stacks, fuel and fodder
Vineyards, Orchards and Olive Groves	• 5 metre wide mineral earth firebreak around each cell or block - minimum 3 metres must be trafficable • 2 metre wide firebreaks around all piles of garden refuse/wood stacks, fuel and fodder

Please Note: Asset Protection Zone (APZ) requirements apply to all properties (excluding vacant lots), regardless of size, and must be maintained all year round. Clearing in excess of the requirements in this FBN or a BMP will be required to comply with the Local Planning Scheme and Clearing Regulations and may require a permit.

	Asset Protection Zone (APZ)	Grass slashed/ mowed to less than 10cm	Driveway/ Access way	Gutters and rooftops free of debris
	✓	✓	✓	✓
	✓	Vacant/ cleared land that is not being actively grazed	✓	✓
	✓	Vacant/ cleared land that is not being actively grazed	✓	✓
	✓	✓	✓	✓
	✓	✓	✓	✓



Can We Access Your Property?

DID YOU KNOW?

In order for fire appliances to access your property safely, firebreaks must be 3 metres wide and have at least 4 metres vertical clearance. Fire appliances must be able to fit through gates on your property. The average fire appliance is 9 metres in length.

DON'T FUEL FIRES

× Don't have thick vegetation near your home.

✓ Clear all flammable material from around all structures.

✓ Store firewood, timber, petrol, kerosene and all flammable liquids well away from the house.

✓ Clear all dead leaves out of gutters regularly.

✓ Remove dead trees and branches which, when burning, could drop on your roof.

✓ Rake up leaves, twigs and dead material regularly.

✓ Burn off dry grass and vegetation at the approved times and in the approved manner or consider using alternative methods to burning.

Up to 1 cubic metre (a 6x4 trailer load) of uncontaminated green waste can be disposed of at the Davis Road Waste Management Facility at no cost to Shire residents. Check the Shire website for Green Waste Open Days.

Important Dates

Firebreak Notice Requirements on Private Property to be Completed

Firebreaks must be installed on or before 30 November 2022
Firebreaks must be maintained up to and including 12 May 2023
APZs must be maintained all year round

RESTRICTED BURNING PERIOD - Spring / Summer

Permits Required
9 November 2022 to 22 December 2022

PROHIBITED BURNING PERIOD

Burning Prohibited
23 December 2022 to 14 March 2023

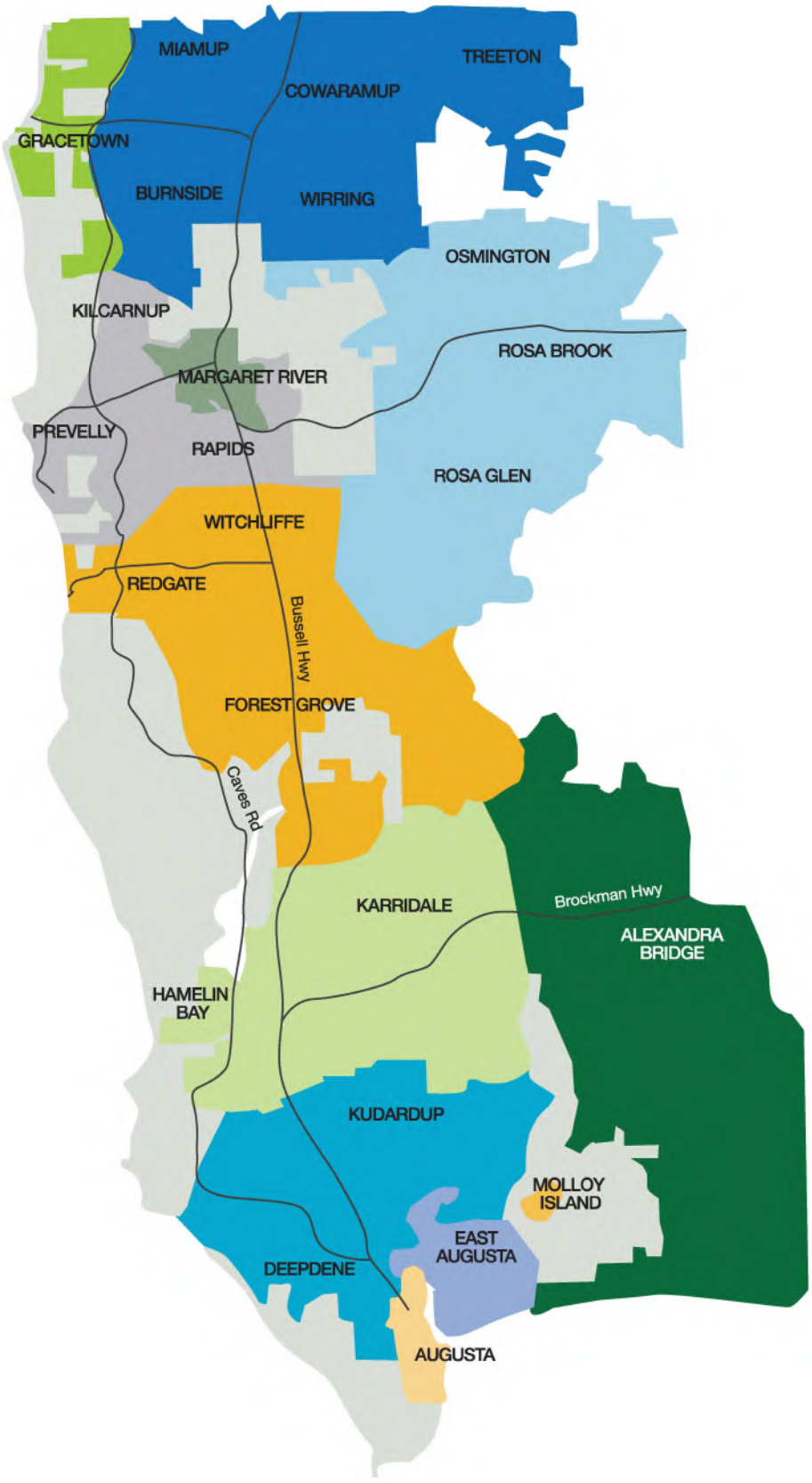
RESTRICTED BURNING PERIOD - Autumn

Permits Required
15 March 2023 to 12 May 2023

PLEASE NOTE

- These dates can change at short notice due to variable weather conditions. Always call your area Fire Control Officer (FCO) or the Shire Rangers to check prior to lighting up.
- Burning is **PROHIBITED** on days where the Fire Danger Rating (FDR) is **HIGH** or above.
- A **TOTAL FIRE BAN (TFB)** may be declared by the DFES Commissioner at any time. If declared, you must not light any fire or undertake any activity that may cause a fire.
- A **HARVEST AND VEHICLE MOVEMENT BAN (HVMB)** may be declared separately or in conjunction with a TFB by the Shire at any time. If declared, the use of engines, vehicles, plant or machinery are prohibited at particular times of the day.
- To register for HVMB SMS notifications, please email amrfire@amrshire.wa.gov.au and include **SMS notification** as the subject line and your **first name, surname** and **mobile phone number** in the body of the email.
- Fire Danger Ratings change daily. To check the FDR go to emergency.wa.gov.au or contact Shire Rangers on (08) 9780 5695.

Fire Control Officer Area Map



Fire Control Officer Contact Details

Brigade	Fire Control Officer(s)
Alexandra Bridge	**Alexandra Bridge** Tony Mostert: 0428 461 388
Augusta	**Augusta** Brendan Jordan: 0477 970 415
Cowaramup	**Burnside** Tim Garstone: 0428 555 292 **Cowaramup** Ian Earl: 0418 932 847 **Miamup** Billy Pascoe: 0405 965 447 **Treeton** Geoff Jenkins: 0407 776 920 **Wirring** Greg Tennant: 0487 677 062
East Augusta	**East Augusta** Frank Bartoll: 0458 582 350
Gracetown	**Gracetown** Peter Delfs: 0427 555 491
Karridale	**Hamelin Bay** Simon Hanson: 0428 147 001 **Karridale** Paul Vanzetti: 0447 929 057
Kudardup	**Deepdene** Scott Hamilton: 0427 778 840 **Kudardup** Matthew Nield: 0427 772 719
Margaret River	**Margaret River** Garth Baxter: 0407 755 253
Molloy Island	**Molloy Island** Peter Nash: 0428 955 633
Rosa Brook	**Osmington** Shaun Palmer: 0448 979 041 **Rosa Brook** Mark Ridge: 0408 945 684 **Rosa Glen** Andrew Newnham: 0491 313 968
Wallcliffe	**Kilcarnup** Rodney Dilkes: 0428 321 865 **Prevelly** Jenny Colquhoun: 0458 231 272 **Rapids** David Kelly: 0428 387 286
Witchcliffe	**Forest Grove** Larry Brennan: 0419 938 923 **Redgate** Richard Nash: 0419 951 511 **Witchcliffe** Diane Holland: 0427 930 735

General Information

UPDATE: These requirements have changed in the past 12 months due to Australian wide standards.

BURNING OF GARDEN REFUSE

RESTRICTED BURNING PERIOD - Spring / Summer

You may burn one small heap of up to 1 cubic metre of garden refuse during the Spring/Summer Restricted Burning Period without a Permit. It cannot be lit before 6pm and must be fully extinguished by 11pm. A courtesy call to your area Fire Control Officer (FCO) is recommended.

RESTRICTED BURNING PERIOD - Autumn

A Permit is required to burn all garden refuse during the Autumn Restricted Burning Period.

Burning is PROHIBITED on days where the Fire Danger Rating is HIGH or above.

WOOD/SOLID FUEL BBQS AND PIZZA OVENS

The use of wood/solid fuel BBQs and pizza ovens is prohibited on days where the Fire Danger Rating is HIGH or above. The use of any wood/solid fuel BBQ or pizza oven is prohibited during a TOTAL FIRE BAN (TFB).

CAMPFIRES AND FIREPITS

Campfires and firepits are NOT permitted;

- at any time during the PROHIBITED Burning Period
- on days where the Fire Danger Rating is HIGH or above
- on public land, unless purpose built campfire pits have been provided by the owner of the land and permission to use them has been given by the landowner.

Campfires and firepits are permitted on private property during the RESTRICTED Burning Periods without a Permit, but cannot be lit before 6pm and must be fully extinguished by 11pm. A Permit is required outside of these times. Consent from the landowner must be given (and proof of consent available if requested by an Authorised Person).

You MUST check the Burning Period dates and the Fire Danger Rating (FDR) before lighting up. PLEASE NOTE, the FDR changes regularly and the Important Dates listed on page 7 can also change. For the current Fire Danger Rating visit www.emergency.wa.gov.au or contact Shire Rangers on (08) 9780 5695.

Permits to Burn

A Permit to burn is required during the RESTRICTED Burning Periods.

To obtain a Permit, contact your area FCO by referring to the FCO map in this booklet. Where the FCO is unavailable the Chief Bush Fire Control Officer or the Shire Rangers can also issue Permits. **Please allow up to 72 hours for an FCO to attend your property to assess your Permit application.**

When contacting the FCO to request a Permit, please have the following information ready to provide;

- the size of your burn
- what you are burning
- the address of the burn
- the name and contact number of the Permit holder

You must notify your adjoining landowners 24 hours in advance of your intention to burn.

Prior to burning, you MUST register your Permit with the Shire Rangers, DBCA and DFES. To do this call the numbers on the Permit and have your Permit handy as the operator will need the Permit details. If you leave a message, please state the **Permit number, property details, Permit holders name, phone number** and **time/date** of intention to burn.

Failure to;

- obtain a Permit
- comply with all Permit conditions
- burn without a Permit, or
- burn in contravention to any information provided in the Notice,

may result in a modified penalty of $250 and up to $5,000 should legal action be undertaken.

BE PREPARED!

The preparedness of your property can make all the difference between minor damage and devastation.

For advice on preparing your property for the fire season, please call your local Bushfire Ready Facilitator Gordon Temby (North) on 0419 954 658 or Shire Rangers on (08) 9780 5695.

Key Contacts

FIREBREAKS, INSPECTIONS AND VARIATIONS

Shire Rangers
(08) 9780 5695
Ranger Coordinator
0457 511 430

BURNING AND PERMITS

Fire Control Officers
See page 9 for contact details

OTHER CONTACTS

Chief Bush Fire Control Officer
0419 525 843

Deputy Chief Bush Fire Control Officer
0419 628 465

DFES Emergency Info Line
13 DFES (133 337)
Follow DFES on Twitter and Facebook

DIAL 000

TO REPORT ALL FIRES OR LIFE THREATENING EMERGENCIES

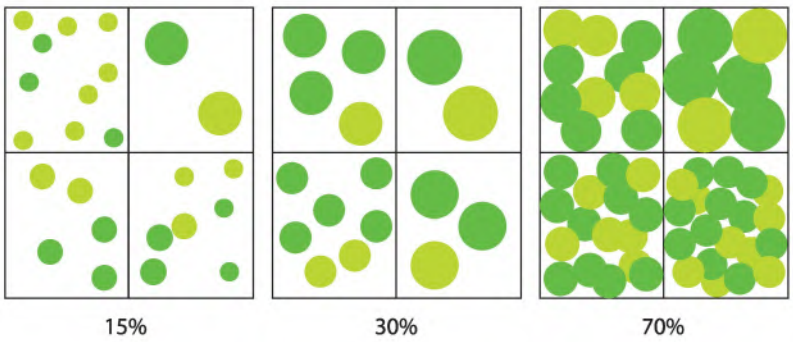
PO Box 61, Margaret River, Western Australia 6285
T (08) 9780 5695 | F (08) 9757 2512
amrshire@amrshire.wa.gov.au | **amrshire.wa.gov.au**

FSC www.fsc.org
MIX
Paper from responsible sources
FSC® C111891

Appendix B Asset Protection Zone Standards

ELEMENT 2: SITING AND DESIGN OF DEVELOPMENT

SCHEDULE 1: STANDARDS FOR ASSET PROTECTION ZONES

OBJECT	REQUIREMENT
Fences within the APZ	• Should be constructed from non-combustible materials (for example, iron, brick, limestone, metal post and wire, or bushfire-resisting timber referenced in Appendix F of AS 3959).
Fine fuel load (Combustible, dead vegetation matter <6 millimetres in thickness)	• Should be managed and removed on a regular basis to maintain a low threat state. • Should be maintained at <2 tonnes per hectare (on average). • Mulches should be non-combustible such as stone, gravel or crushed mineral earth or wood mulch >6 millimetres in thickness.
Trees* (>6 metres in height)	• Trunks at maturity should be a minimum distance of six metres from all elevations of the building. • Branches at maturity should not touch or overhang a building or powerline. • Lower branches and loose bark should be removed to a height of two metres above the ground and/or surface vegetation. • Canopy cover within the APZ should be <15 per cent of the total APZ area. • Tree canopies at maturity should be at least five metres apart to avoid forming a continuous canopy. Stands of existing mature trees with interlocking canopies may be treated as an individual canopy provided that the total canopy cover within the APZ will not exceed 15 per cent and are not connected to the tree canopy outside the APZ. **Figure 19:** Tree canopy cover – ranging from 15 to 70 per cent at maturity 
Shrub* and scrub* (0.5 metres to six metres in height). Shrub and scrub >6 metres in height are to be treated as trees.	• Should not be located under trees or within three metres of buildings. • Should not be planted in clumps >5 square metres in area. • Clumps should be separated from each other and any exposed window or door by at least 10 metres.
Ground covers* (<0.5 metres in height. Ground covers >0.5 metres in height are to be treated as shrubs)	• Can be planted under trees but must be maintained to remove dead plant material, as prescribed in 'Fine fuel load' above. • Can be located within two metres of a structure, but three metres from windows or doors if >100 millimetres in height.



ELEMENT 2: SITING AND DESIGN OF DEVELOPMENT

SCHEDULE 1: STANDARDS FOR ASSET PROTECTION ZONES

OBJECT	REQUIREMENT
Grass	• Grass should be maintained at a height of 100 millimetres or less, at all times. • Wherever possible, perennial grasses should be used and well-hydrated with regular application of wetting agents and efficient irrigation.
Defendable space	• Within three metres of each wall or supporting post of a habitable building, the area is kept free from vegetation, but can include ground covers, grass and non-combustible mulches as prescribed above.
LP Gas Cylinders	• Should be located on the side of a building furthest from the likely direction of a bushfire or on the side of a building where surrounding classified vegetation is upslope, at least one metre from vulnerable parts of a building. • The pressure relief valve should point away from the house. • No flammable material within six metres from the front of the valve. • Must sit on a firm, level and non-combustible base and be secured to a solid structure.

** Plant flammability, landscaping design and maintenance should be considered – refer to explanatory notes*

Appendix C Vehicular Access Technical Standards

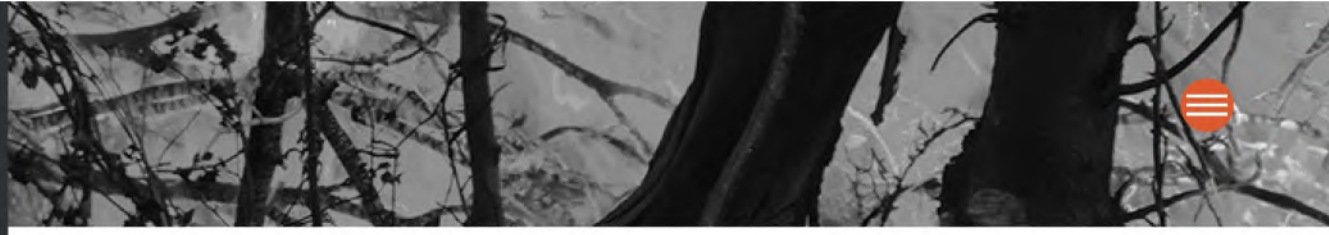


Table 6: Vehicular access technical requirements

TECHNICAL REQUIREMENTS	1 Public roads	2 Emergency access way[1]	3 Fire service access route[1]	4 Battle-axe and private driveways[2]
Minimum trafficable surface (metres)	In accordance with A3.1	6	6	4
Minimum horizontal clearance (metres)	N/A	6	6	6
Minimum vertical clearance (metres)	4.5			
Minimum weight capacity (tonnes)	15			
Maximum grade unsealed road[3]	As outlined in the IPWEA Subdivision Guidelines	1:10 (10%)		
Maximum grade sealed road[3]		1:7 (14.3%)		
Maximum average grade sealed road		1:10 (10%)		
Minimum inner radius of road curves (metres)		8.5		

Notes:

[1] To have crossfalls between 3 and 6%.

[2] Where driveways and battle-axe legs are not required to comply with the widths in A3.5 or A3.6, they are to comply with the Residential Design Codes and Development Control Policy 2.2 Residential Subdivision.

[3] Dips must have no more than a 1 in 8 (12.5% -7.1 degree) entry and exit angle.

EXPLANATORY NOTES

E3.6 Private driveways

In areas serviced by reticulated water, where the road speed limit is not greater than 70 km/h, and where the distance from the public road to the further part of the habitable building is no greater than 70 metres, emergency service vehicles typically operate from the street frontage.

In the event the habitable building cannot be reached by hose reel from the public road, then emergency service vehicles will need to gain access within the property. Emergency service vehicles will also need to gain access within the property, where access to reticulated water (fire hydrants) is not possible. In these situations, the driveway and battle-axe (if applicable) will need to be wide enough for access for an emergency service vehicle and a vehicle to evacuate.

Turnaround areas should be available for both conventional two-wheel drive vehicles of residents and Type 3.4 fire appliances. Turn-around areas should be located within 30 metres of habitable buildings. Circular and loop driveway design may also be considered.

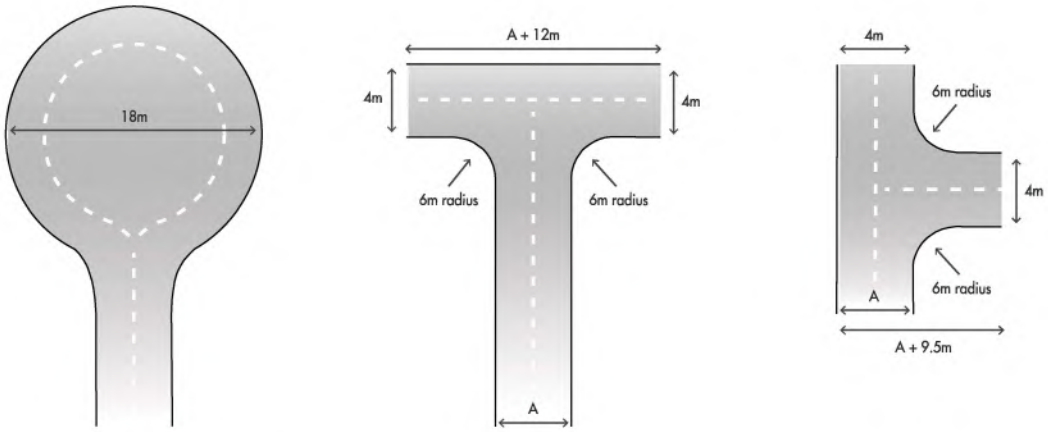


Figure 28: Design requirements for a turn-around area for a private driveway or battle-axe

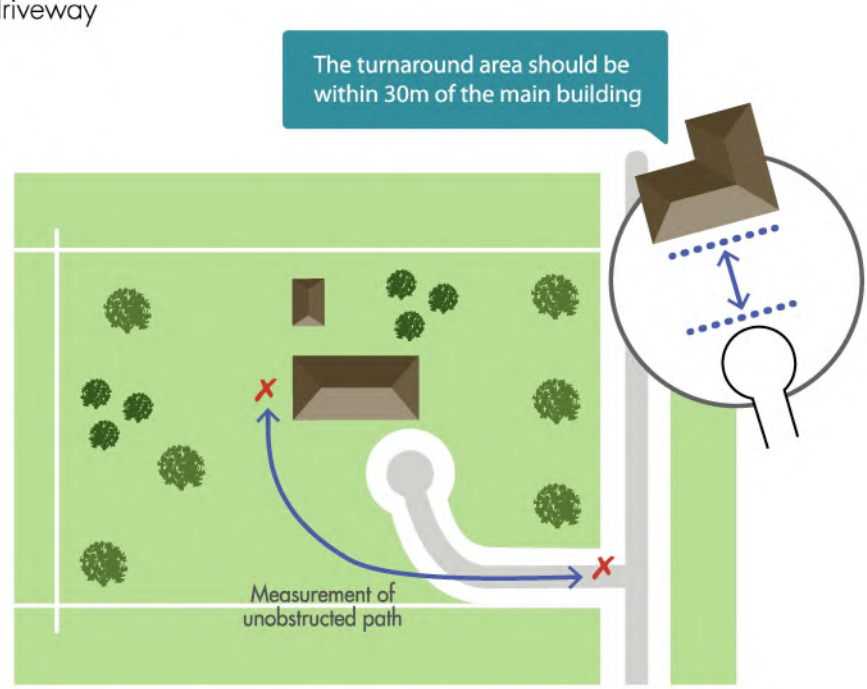


Figure 29: Design requirements for a private driveway where required under A3.6

Appendix D Landscape Management Plan



LEGEND

01 POS 1 - 1.81Ha PASSIVE OPEN SPACE CENTRED AROUND RETENTION OF LARGE STAND OF EXISTING MATURE TREES AND PROVIDING DIRECT ACCESS TO RECREATIONAL SPACE FOR THE PROPOSED LIFESTYLE VILLAGE / R60 LOT. IT ALSO PROVIDES KEY CONNECTION THROUGH TO THE EXISTING COWARAMUP TOWNSITE - REFER DETAIL PLAN.

02 POS 2 - 1.24Ha LINEAR POS PROVIDING GREEN LINK THROUGH THE PROPOSED NEW SUBDIVISION AND A FOCAL POINT FOR KEY PEDESTRIAN MOVEMENTS. LIVING STREAM ALONG ENTRY ROAD PROVIDES NATURAL VISUAL AESTHETIC AND DRAINAGE FUNCTION IN ACCORDANCE WITH LWMS. FOOTPATHS AND SEATING AREAS CONNECT THROUGH TO MAIN ACTIVE OPEN SPACE WITH LARGE TURF KICK-ABOUT SPACE, PLAYGROUND AND PICNIC SHELTER / SEATING AREA AT SOUTHERN END - REFER DETAIL PLAN

03 POS 3 - .1.23Ha PASSIVE OPEN SPACE WITH RETENTION OF LARGE EXISTING TREES ALONG THE SOUTHERN / WESTERN BOUNDARY TO BE RETAINED AND PROTECTED. LIVING STREAM ALONG THE NORTHERN BOUNDARY PROVIDES NATURAL VISUAL AESTHETIC AND DRAINAGE FUNCTION IN ACCORDANCE WITH LWMS. FOOTPATHS AND SEATING AREAS CONNECT TO AN OPEN INFORMAL TURF AREA AT THE WESTERN END FOR INFORMAL ACTIVE RECREATION AND POSSIBLE DOG OF LEASH AREA - REFER DETAIL PLAN

04 DRAINAGE RESERVES - FOUR SEPARATE RESERVES ARE NOMINATED FOR DRAINAGE TO PROVIDE STORMWATER RETENTION AND TREATMENT OF THE PROPOSED PIT AND PIPE DRAINAGE SYSTEM WITHIN THE STREETSCAPES. PLANTED WITH NATIVE RUSHES AND SEDGES LESS THAN 1.0m IN HEIGHT AND CLUSTERS OF MELALEUCA AND WA PEPPERMINT TREES TO PROVIDE A NATURAL WETLAND WETLAND AESTHETIC BUT TO BE MANAGED IN ACCORDANCE WITH BUSHFIRE MANAGEMENT AND LWMS REQUIREMENTS.

05 10m WIDE LANDSCAPE BUFFER TO SOUTH-EAST BOUNDARY - VISUAL LANDSCAPE BUFFER TO PROVIDE SCREEN AND VISUAL SEPARATION BETWEEN RURAL AND DEVELOPED LAND AREAS. CONSISTING OF NATIVE TREE AND SHRUB PLANTING BY THE DEVELOPER IN THE REAR OF PRIVATE LOTS BUT TO BE MAINTAINED BY THE LOT OWNERS IN ACCORDANCE WITH THE BUSHFIRE MANAGEMENT PLAN REQUIREMENTS. THIS BUFFER INCLUDES A 0.5m HIGH EARTH MOUND AS A PHYSICAL DRAINAGE BARRIER BETWEEN THE RURAL AND RESIDENTIAL LAND AREAS.

06 10m WIDE LANDSCAPE BUFFER TO SOUTH-WEST BOUNDARY - VISUAL LANDSCAPE BUFFER TO PROVIDE SCREEN AND VISUAL SEPARATION FROM WIRRING ROAD TO THE NEW DEVELOPED LAND AREAS. CONSISTING OF NATIVE TREE AND SHRUB PLANTING BY THE DEVELOPER IN THE REAR OF PRIVATE LOTS BUT TO BE MAINTAINED BY THE LOT OWNERS IN ACCORDANCE WITH THE BUSHFIRE MANAGEMENT PLAN REQUIREMENTS.

- EXTENT OF PROJECT SITE
- REFER DETAIL PLAN
- CONNECTION TO EXISTING ROAD NETWORK
- POSSIBLE ROAD CONNECTION FOR FUTURE SUBDIVISION
- PEDESTRIAN PATHWAY CONNECTION
- PROPOSED PLAYGROUND
- PROPOSED PICNIC SETTING
- PROPOSED SHADE STRUCTURE / SHELTER
- PROPOSED SEATING NODE / BENCH SEAT
- MIN. 2.0m WIDE CONCRETE PATH
- FEATURE EXPOSED AGGREGATE PAVING NODE
- PROPOSED SHADE STRUCTURE / SHELTER
- PROPOSED SHADE SAILS OVER PLAYGROUND
- PLAYGROUND MULCH SOFTFALL
- IRRIGATED TURF
- 10m WIDE LANDSCAPE BUFFER PLANTING
- MIXED NATIVE POS PLANTING
- LOW FUEL / FIRE RESISTANT PLANTING
- DRAINAGE BASIN BATTER PLANTING
- DRAINAGE BASIN AND SWALE INVERT PLANTING
- FEATURE GRANITE BOULDERS AND RIFFLES

STREET TREE LEGEND

- EXISTING TREES TO BE RETAINED AND PROTECTED
- FRAXINUS RAYWOODII - Claret Ash
- LAGERSTROEMIA INDICA - Crepete Myrtle
- AGONIS FLEXUOSA - WA Peppermint
- CORYMBIA CALOPHYLLA - Grafted Cultivar Varieties
- POS TREE PLANTING - Mixed Species

NOTE: ALL STREET TREE PLANTING IS SUBJECT TO RESOLUTION OF CIVIL ENGINEERS SERVICING LAYOUT. ALL STREET PLANTING WILL REQUIRE INSTALLATION OF SUITABLE ROOT CONTROL BARRIERS.

LOT 500 WIRRING ROAD, COWARAMUP

LANDSCAPE MASTERPLAN

CLIENT: RW Duggan C/- PGPM Pty Ltd

DATE: 20 July 2022
REVISION: A

SCALE: 1:750 @ A1

SW LANDSCAPE COLLECTIVE



LEGEND

01 EXISTING STAND OF DEGRADED JARRAH AND MARRI WOODLAND TO BE RETAINED AND PROTECTED. UNDERSTOREY TO BE RE-ESTABLISHED WITH LOW GROUND COVERS AND SHRUBS AND MAINTAINED AS LOW FUEL STATE WITH CANOPY PRUNING TO ACHIEVE MINIMUM 2.0m SEPARATION FROM GROUND LEVEL OR UNDERSTOREY

02 MIXED NATIVE POS PLANTING AREAS TO REPLACE DEGRADED PADDOCK GRASSLAND WITH MIX OF LOCAL NATIVE LANDSCAPE SPECIES. TREE PLANTING TO OCCUR IN CLUMPS WITH MINIMUM 5.0m BETWEEN CANOPIES AT MATURITY. PLANTING AREAS TO BE MULCHED AND MAINTAINED TO CONTROL WEEDS AND ACHIEVE A NATURAL LANDSCAPE APPEARANCE

03 LOW FUEL PLANTING AREAS TO OUTER SURROUNDS OF POS AND BACKING ONTO EXISTING AND PROPOSED NEW LOTS. MIXTURE OF LOW NATIVE GROUNDCOVER AND FIRE RESISTANT PLANT SPECIES PLANTED IN CLUMPS WITH OPEN MULCH ONLY AREAS BETWEEN. TREE PLANTING TO OCCUR IN CLUMPS WITH MINIMUM 20.0m SEPARATION BETWEEN CANOPIES AT MATURITY ALSO TO ALLOW VIEWS FOR EXISTING DWELLINGS INTO THE POS

04 INFORMAL OPEN TURF AREA FOR ACTIVE RECREATION OPPORTUNITIES AND KICK-ABOUT SPACE. DIRECT ACCESS FROM PROPOSED LIFESTYLE VILLAGE / R60 LOT ENABLES BREAK-OUT ACTIVITY SPACE AND CONNECTION TO CIRCUIT WALKING PATHS AROUND THE EXISTING RETAINED VEGETATION.

EXTENT OF PROJECT SITE

PROPOSED SEATING NODE / BENCH SEATING AT POINT OF INTEREST AND WITH NATURAL SHADE

MIN. 2.0m WIDE CONCRETE PATH MEANDERING THROUGH POS PROVIDING CONNECTION BETWEEN KEY ACCESS POINTS AND WALKING CIRCUITS FOR EXERCISE ROUTES

IRRIGATED TURF (Subject ot Availability of Water Source)

MIXED NATIVE POS PLANTING AREAS

LOW FUEL / FIRE RESISTANT PLANTING AREAS

POS TREE PLANTING UTILISING A MIX OF LOCAL ENDEMIC AND NON-ENDEMIC SPECIES FOR SHADE, SHELTER, HABITAT AND AESTHETICS

STREET TREE LEGEND

EXISTING TREES TO BE RETAINED AND PROTECTED

FRAXINUS RAYWOODII - Claret Ash

LAGERSTROEMIA INDICA - Crepete Myrtle

AGONIS FLEXUOSA - WA Peppermint

CORYMBIA CALOPHYLLA - Grafted Cultivar Varieties

EXISTING STAND OF JARRAH / MARRI WOODLAND TO BE RETAINED AND PROTECTED AS CENTRAL FEATURE OF POS



EXISTING FOOTPATH CONNECTION TO COWARAMUP TOWNSITE IN NORTH WEST CORNER OF POS

LOT 500 WIRRING ROAD, COWARAMUP

LANDSCAPE CONCEPT PLAN - POS 1

CLIENT: RW Duggan C/- PGPM Pty Ltd

DATE: 20 July 2022
REVISION: A

SCALE: 1:200 @ A1

SW LANDSCAPE COLLECTIVE



LOT 500 WIRRING ROAD, COWARAMUP

LANDSCAPE CONCEPT PLAN - POS 2

CLIENT: RW Duggan C/- PGPM Pty Ltd

DATE: 20 July 2022
REVISION: A

SCALE: 1:200 @ A1

SW LANDSCAPE COLLECTIVE

SHADE SHELTER WITH BENCH SEATING OVERLOOKING CONSTRUCTED DRAINAGE BASIN WITH NATURAL WETLAND FUNCTION AND AESTHETIC AT MAIN ENTRY TO NEW DEVELOPMENT AREA

EXISTING SITE BOULDERS USED TO CREATE POOLS AND RIFFLES WITHIN CONSTRUCTED LIVING STREAM / DRAINAGE SWALE

LOW FUEL / FIRE RESISTANT PLANTING OCCURRING IN CLUMPS AND SEPARATED BY MULCH ONLY AREAS TO PROVIDING SETBACK FOR LOTS DIRECTLY FRONTING ONTO POS

SHADE SHELTER AND BENCH / PICNIC SETTING AT FOCAL NODE OF POS OVERLOOKING LIVING STREAM AND INFORMAL TURF KICK-ABOUT SPACE

EXISTING WATER CORP EASEMENT TO REMAIN CLEAR OF TREE PLANTING AND LOCATION OF POSSIBLE FUTURE ROAD CONNECTION TO EAST

NODES OF MIXED POS PLANTING CONTAINING CLUMPS OF SHADE TREE PLANTING PROVIDING SHADE AND SHELTER TO FOOTPATH AND PROVING VISUAL AMENITY

MIN 2.0m WIDE CONCRETE FOOTPATHS PROVIDE WALKING CIRCUITS THROUGH POS AND SEPARATE TURF FROM PLANTING AREAS FOR EASE OF MAINTENANCE

NODES OF MIXED POS PLANTING CONTAINING CLUMPS OF SHADE TREE PLANTING PROVIDING SHADE AND SHELTER TO FOOTPATH AND PROVING VISUAL AMENITY

STREET TREE LEGEND

- EXISTING TREES TO BE RETAINED AND PROTECTED
- LAGERSTROEMIA INDICA - Crepete Myrtle
- CORYMBIA CALOPHYLLA - Grafted Cultivar Varieties
- FRAXINUS RAYWOODII - Claret Ash
- AGONIS FLEXUOSA - WA Peppermint

LEGEND

01 EXISTING LINE OF MATURE EXISTING TREES TO BE RETAINED AND PROTECTED. UNDERSTOREY TO BE RE-ESTABLISHED WITH LOW GROUND COVERS AND SHRUBS AND MAINTAINED AS LOW FUEL STATE WITH CANOPY PRUNING TO ACHIEVE MINIMUM 2.0m SEPARATION FROM GROUND LEVEL OR UNDERSTOREY

02 MIXED NATIVE POS PLANTING AREAS TO REPLACE DEGRADED PADDOCK GRASSLAND WITH MIX OF LOCAL NATIVE LANDSCAPE SPECIES. TREE PLANTING TO OCCUR IN CLUMPS WITH MINIMUM 5.0m BETWEEN CANOPIES AT MATURITY. PLANTING AREAS TO BE MULCHED AND MAINTAINED TO CONTROL WEEDS AND ACHIEVE A NATURAL LANDSCAPE APPEARANCE

03 LOW FUEL PLANTING AREAS TO OUTER SURROUNDS OF POS AND BACKING ONTO EXISTING AND PROPOSED NEW LOTS. MIXTURE OF LOW NATIVE GROUNDCOVER AND FIRE RESISTANT PLANT SPECIES PLANTED IN CLUMPS WITH OPEN MULCH ONLY AREAS BETWEEN. TREE PLANTING TO OCCUR IN CLUMPS WITH MINIMUM 20.0m SEPARATION BETWEEN CANOPIES AT MATURITY ALSO TO ALLOW VIEWS FOR EXISTING DWELLINGS INTO THE POS

04 INFORMAL OPEN TURF AREA FOR ACTIVE RECREATION OPPORTUNITIES AND KICK-ABOUT SPACE. ALTERNATE USES TO POS 2 PROPOSED INCLUDING POSSIBLE DOG OFF LEASH AREA TO BE CONSIDERED IN DISCUSSION WITH SHIRE OF AUGUSTA-MARGARET RIVER

05 LIVING STREAM TO BE CONSTRUCTED AS AN OPEN DRAINAGE SWALE CAPTURING ROAD RUN OFF FROM THE EXTENSION OF ROY EARL DRIVE AND ANY PIT AND PIPE STORMWATER WHERE REQUIRED. PLANTED WITH RUSHES AND SEDGES LESS THAN 1.0m In HEIGHT AND CONSTRUCTED POOLS AND ROCK RIFFLES TO ASSIST WITH WATER FLOW, EROSION CONTROL, INFILTRATION AND NUTRIENT STRIPPING. THIS IS ALSO KEY VISUAL LANDSCAPE FEATURE ALONG THE MAIN ENTRANCE ROAD

- EXTENT OF PROJECT SITE
- PROPOSED SHADE STRUCTURE / SHELTER
- PROPOSED PICNIC SETTING / FACILITIES
- PROPOSED PLAYGROUND
- PROPOSED SEATING NODE / BENCH SEATING AT POINT OF INTEREST AND WITH NATURAL SHADE
- MIN. 2.0m WIDE CONCRETE PATH MEANDERING THROUGH POS PROVIDING CONNECTION BETWEEN KEY ACCESS POINTS AND WALKING CIRCUITS FOR EXERCISE ROUTES
- FEATURE EXPOSED AGGREGATE TO DEFINE KEY ACTIVITY NODES AND SEATING AREAS
- PROPOSED SHADE STRUCTURE / SHELTER, PREFERABLY CUSTOM MADE OF LOCAL MATERIALS SUCH AS HARD AND ALUMINIUM TO MAINTAIN LOCAL CHARACTER
- FEATURE GRANITE BOULDERS AND RIFFLES TO LIVING STREAM FOR STRUCTURAL AND AESTHETIC FUNCTION
- IRRIGATED TURF (Subject ot Availability of Water Source)
- MIXED NATIVE POS PLANTING AREAS
- LOW FUEL / FIRE RESISTANT PLANTING AREAS
- DRAINAGE BASIN BATTER PLANTING
- DRAINAGE BASIN AND SWALE INVERT PLANTING
- POS TREE PLANTING UTILISING A MIX OF LOCAL ENDEMIC AND NON-ENDEMIC SPECIES FOR SHADE, SHELTER, HABITAT AND AESTHETICS





EXISTING MATURE TREES TO BE RETAINED ALONG SOUTHERN BOUNDARY OF POS

LOT 500 WIRRING ROAD, COWARAMUP

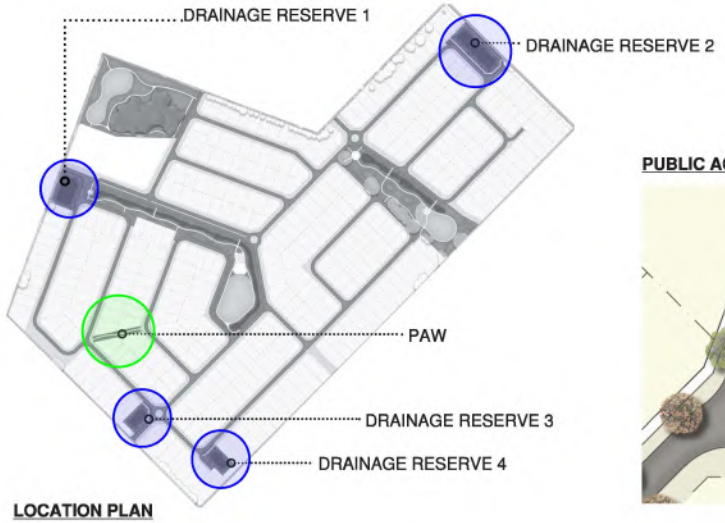
LANDSCAPE CONCEPT PLAN - POS 3

CLIENT: RW Duggan C/- PGPM Pty Ltd

DATE: 20 July 2022
REVISION: A

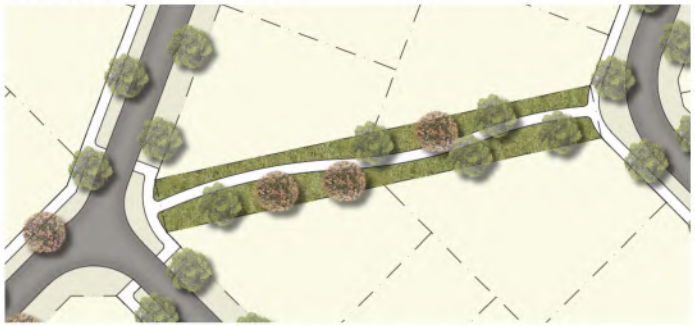
SCALE: 1:200 @ A1

SW LANDSCAPE COLLECTIVE



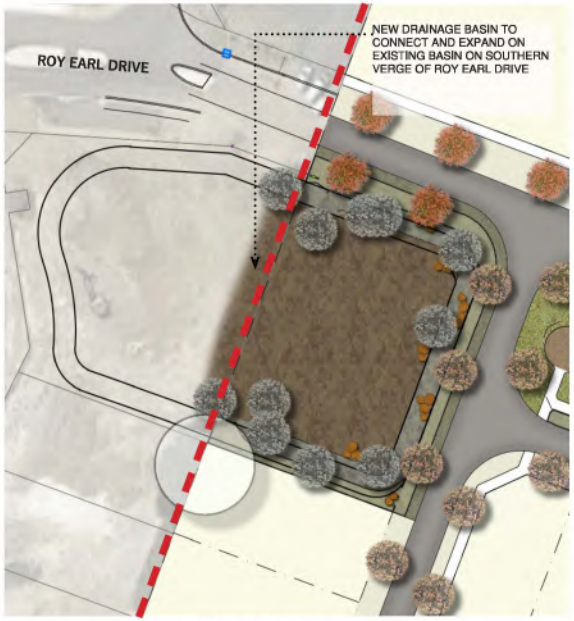
LOCATION PLAN

PUBLIC ACCESS WAY - DETAIL PLAN

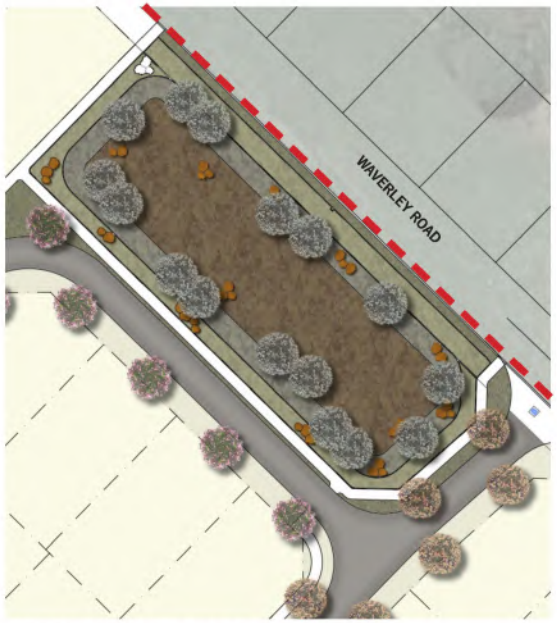


LEGEND

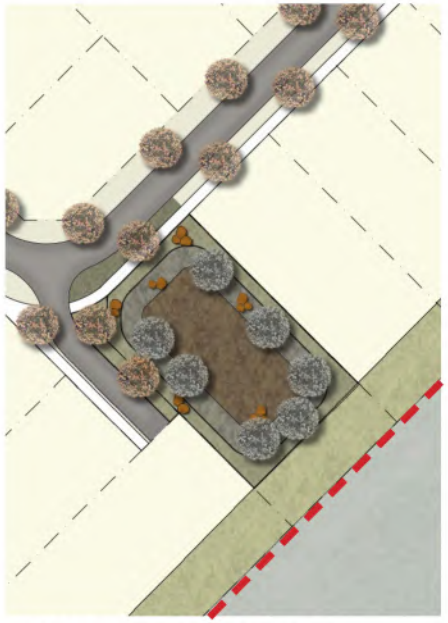
- MIN. 2.0m WIDE CONCRETE PATH
- IRRIGATED TURF (Subject ot Availability of Water Source)
- MIXED NATIVE POS PLANTING AREAS
- LOW FUEL / FIRE RESISTANT PLANTING AREAS
- DRAINAGE BASIN BATTER PLANTING
- DRAINAGE BASIN AND SWALE INVERT PLANTING
- POS TREE PLANTING UTILISING A MIX OF LOCAL ENDEMIC AND NON-ENDEMIC SPECIES FOR SHADE, SHELTER, HABITAT AND AESTHETICS
- FEATURE GRANITE BOULDERS AND RIFFLES TO LIVING STREAM FOR STRUCTURAL AND AESTHETIC FUNCTION
- EXISTING TREES TO BE RETAINED AND PROTECTED
- LAGERSTROEMIA INDICA - Crepete Myrtle
- CORYMBIA CALOPHYLLA - Grafted Cultivar Varieties
- FRAXINUS RAYWOODII - Claret Ash
- AGONIS FLEXUOSA - WA Peppermint
- MELALEUCA RAPHIOPHYLLA - Swamp Paperbark



DRAINAGE RESERVE 1 - DETAIL PLAN



DRAINAGE RESERVE 2 - DETAIL PLAN



DRAINAGE RESERVE 3 - DETAIL PLAN



DRAINAGE RESERVE 4 - DETAIL PLAN

0 2 4 6 8 10 m

LOT 500 WIRRING ROAD, COWARAMUP

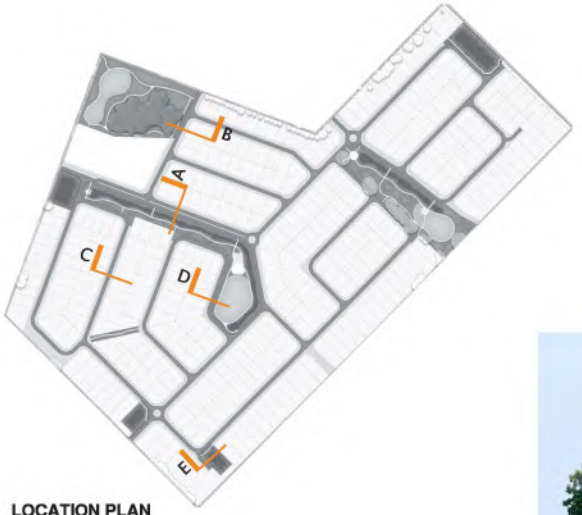
LANDSCAPE CONCEPT PLAN - DRAINAGE RESERVES AND PUBLIC ACCESS WAY

CLIENT: RW Duggan C/- PGPM Pty Ltd

DATE: 20 July 2022
REVISION: A

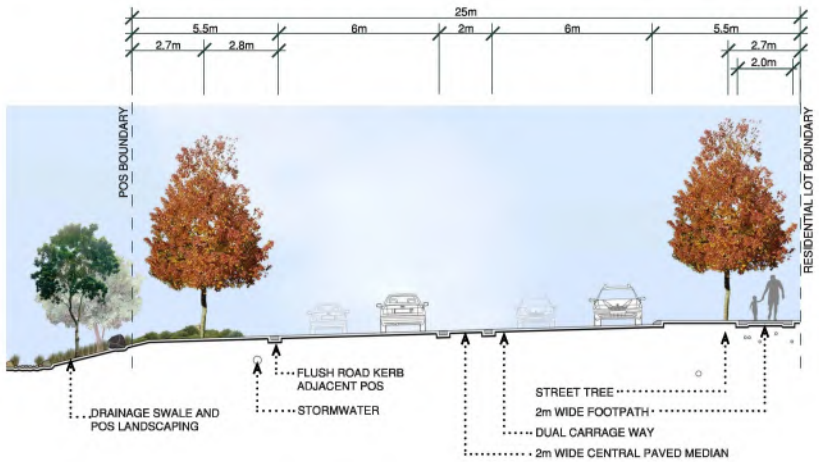
SCALE: 1:200 @ A1

SW LANDSCAPE COLLECTIVE

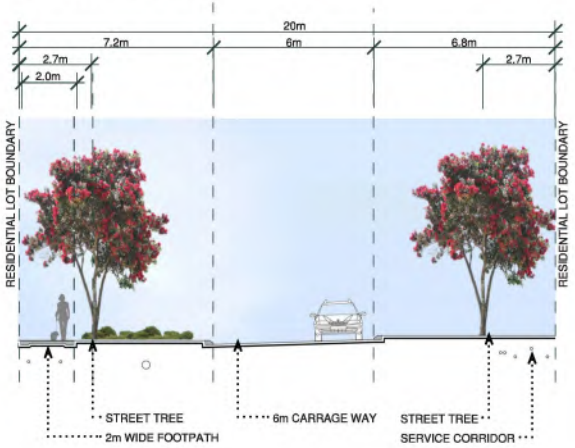


LOCATION PLAN

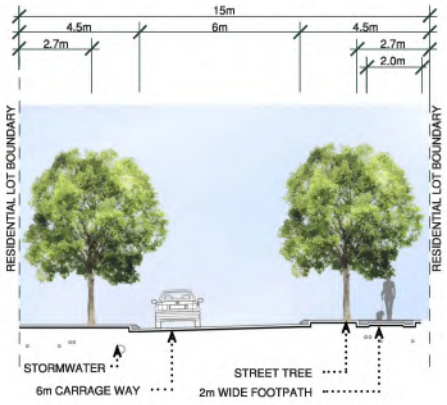
A) 25m ROAD RESERVE



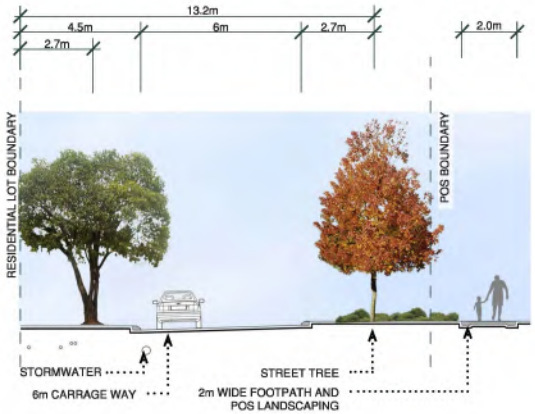
B) 20m ROAD RESERVE



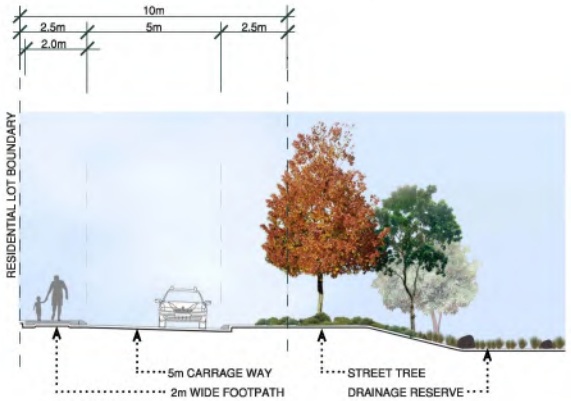
C) 15m ROAD RESERVE



D) 13.2m ROAD RESERVE



E) 10m ROAD RESERVE - BATTLEAXE





LOT 500 WIRRING ROAD, COWARAMUP

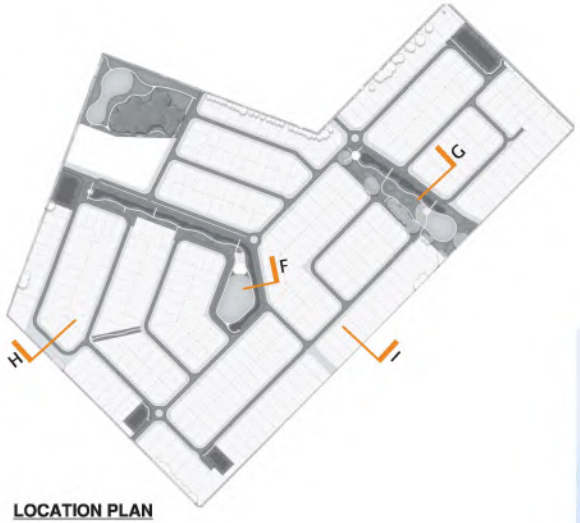
LANDSCAPE CONCEPT PLAN - TYPICAL ROAD SECTIONS

CLIENT: RW Duggan C/- PGPM Pty Ltd

DATE: 20 July 2022
REVISION: A

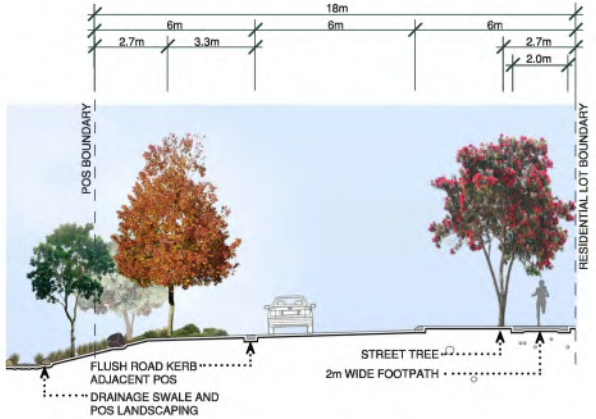
SCALE: 1:100 @ A1

SW LANDSCAPE COLLECTIVE

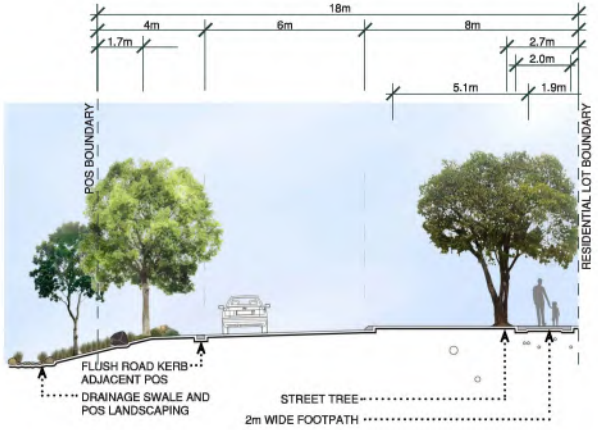


LOCATION PLAN

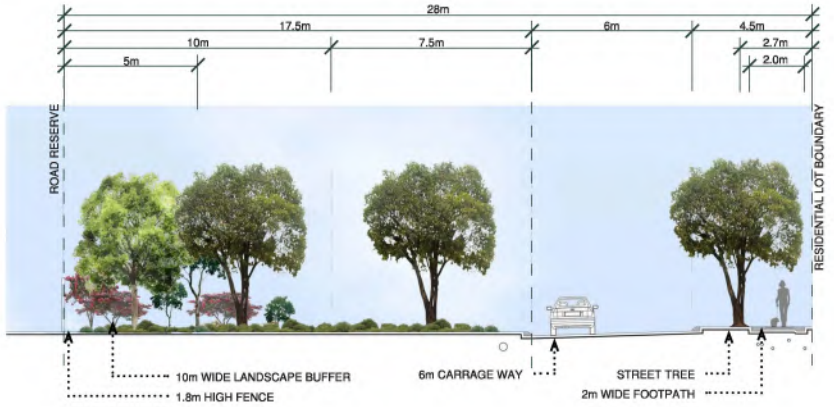
F) 18m ROAD RESERVE (A)



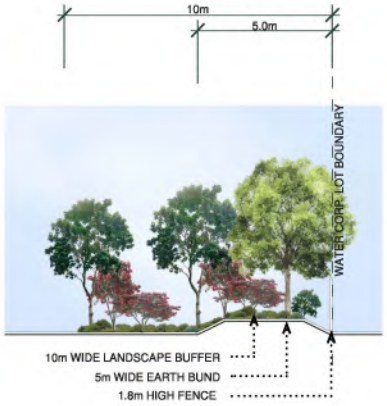
G) 18m ROAD RESERVE (B)



H) 28m ROAD RESERVE



I) 10m BUFFER PLANTING



LOT 500 WIRRING ROAD, COWARAMUP

LANDSCAPE CONCEPT PLAN - TYPICAL ROAD SECTIONS

CLIENT: RW Duggan C/- PGPM Pty Ltd

DATE: 20 July 2022
REVISION: A

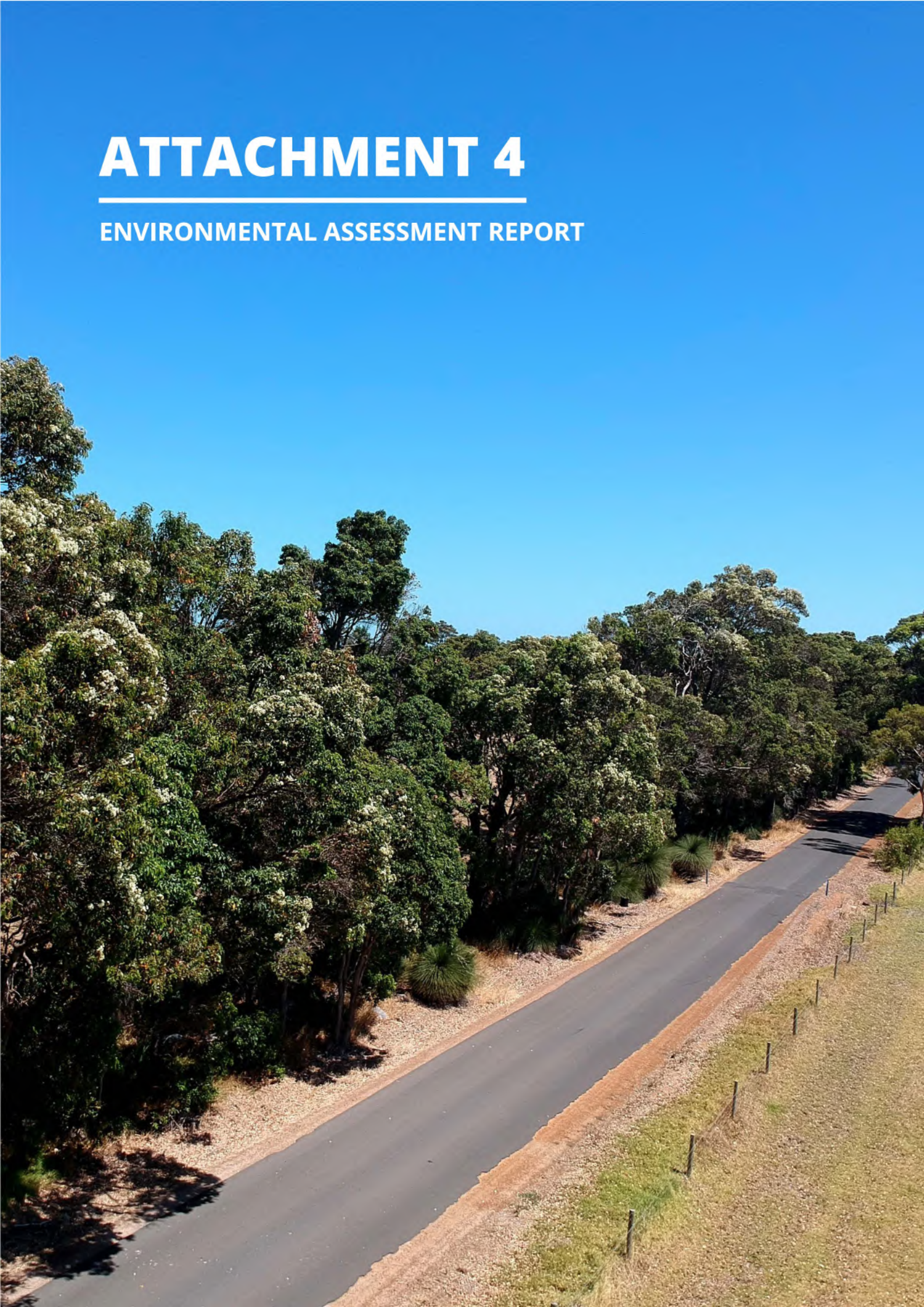
SCALE: 1:100 @ A1

SW LANDSCAPE COLLECTIVE

This page has been left blank intentionally.

ATTACHMENT 4

ENVIRONMENTAL ASSESSMENT REPORT



ecosystem solutions

PO Box 685
DUNSBOROUGH WA 6281
Ph: +61 8 9759 1960
Fax: +61 8 9759 1920
Mobile: 0427 591 960
info@ecosystemsolutions.com.au
www.ecosystemsolutions.com.au

Environmental Assessment Report

Lot 500 Wirring Road, Cowaramup

4 August 2022

Prepared for:

R.W. Duggan



Limitations Statement

This report has been prepared in accordance with the Agreement between Ecosystem Solutions Pty Ltd and R.W. Duggan (**"Client"**). It has been solely prepared for a Local Planning Scheme Amendment Request at Lot 500 Wirring Road, Cowaramup (**"Site"**).

Information

In undertaking this work the authors have made every effort to ensure the accuracy of the information used. Unless otherwise stated in the report, Ecosystem Solutions Pty Ltd has not independently verified such information and cannot guarantee its accuracy or completeness.

Conclusions

Within the limitations imposed by the scope of work, preparation of this report has been undertaken and performed in a professional manner, in accordance with generally accepted practices and using a degree of skill and care ordinarily exercised by reputable ecological consultants under similar circumstances. No other warranty, expressed or implied, is made.

Reliance

This report is solely for the use of the Client and any reliance on this report by third parties will be at such party's sole risk. This report must only be presented in full and may not be used to support any other purpose than those set out in the report and the Agreement, except where prior written approval with comments are provided by Ecosystem Solutions Pty Ltd. All intellectual property rights in documents created by Ecosystem Solutions Pty Ltd remain the property of Ecosystem Solutions Pty Ltd.

Other parties should not rely on the report or the accuracy or completeness of any conclusions and should make their own enquiries and obtain independent advice in relation to such matters. Ecosystem Solutions Pty Ltd accepts no Liability, or responsibility whatsoever for or in respect of any use or reliance upon this report and its supporting material subsequently used by others. Please note that the contents of this report may not be directly applicable towards another organisation's needs and may not contain sufficient information for purposes of other parties or for other uses.

Ecosystem Solutions Pty Ltd will not be liable to update or revise the report to take into account any events or emergent circumstances or facts occurring or becoming apparent after the date of this report.

Document Control

R.W. Duggan

Lot 500 Wirring Road, Cowaramup

Version	Revision	Purpose	Author	Reviewer	Submitted	
					Form	Date
Report	Rev A	Initial Report	DP/LD	GM	Electronic (email)	5/04/2022
Report	Rev B	Amendments	HD	KL	Electronic (email)	26/04/2022
Report	Rev C	MM Comments	DC	GM	Electronic (email)	09/06/2022
Report	Rev D	MM Comments	KL	GM	Electronic (email)	04/08/2022
Report	Rev E	Final Concept Plan	HD	GM	Electronic (email)	05/08/2022

Filename: z:\projects\221273 part lots 51 and 304 wirring road, cowaramup bmp and f&f\reports\lot 500 wirring road, cowaramup - flora and fauna significance report rev d.docx

Contents

Contents		**4**
1	**Introduction**	**7**
2	**Site Details**	**9**
3	**Flora and Vegetation**	**10**
3.1	Desktop analysis	10
3.1.1	Soil Landscape	11
3.1.2	Acid Sulfate Soils	13
3.1.3	Regional Vegetation	15
3.1.4	Environmentally Sensitive Areas	17
3.1.5	Hydrology and Wetlands	17
3.1.6	Threatened and Priority Flora	19
3.1.7	Threatened and Priority Ecological Communities	19
3.1.8	Aboriginal Heritage	20
3.2	Field Survey	21
3.3	Results	21
3.3.1	Threatened, Priority and Significant Flora	21
3.3.2	Vegetation Communities	26
3.3.3	Vegetation Condition	27
4	**Fauna**	**31**
4.1	Desktop Analysis	31
4.2	Field Survey	34
4.3	Results	35
4.3.1	Black Cockatoos	36
4.3.2	Western Ringtail Possums	36
5	**Survey Constraints**	**39**
6	**Significance**	**43**
7	**Summary and Recommendations**	**48**
7.1	Conservation Significant Flora	48
7.2	Vegetation	48

7.3	Acid Sulfate Soils	48
7.4	Black Cockatoos	49
7.5	Western Ringtail Possum	49
8	**References (not all cited)**	**50**

List of Figures

Figure 1	Concept Plan for Lot 500 Wirring Road, Cowaramup	8
Figure 2	Soil Landscape for Lot 500 Wirring Road, Cowaramup	12
Figure 3	Potential Acid Sulphate Soil Risk for Lot 500 Wirring Road, Cowaramup	14
Figure 4	Vegetation Complex for Lot 500 Wirring Road, Cowaramup	16
Figure 5	Hydrology for Lot 500 Wirring Road, Cowaramup	18
Figure 6	Vegetation Community for Lot 500 Wirring Road, Cowaramup	30
Figure 7	Vegetation Condition for Lot 500 Wirring Road, Cowaramup	31
Figure 8	Identified Trees (>50cm DBH) - Map 1 for Lot 500 Wirring Road, Cowaramup	39
Figure 9	Identified Trees (>50cm DBH) - Map 1 for Lot 500 Wirring Road, Cowaramup	40

List of Tables

Table 1	Vegetation Complex Statistics (2018)	15
Table 2	Conservation significant flora species recorded within 10 km of the Site	22
Table 3	Keighery Condition Scale (Keighery 1994)	28
Table 4	Conservation significant fauna species recorded within 10 km of the Site	32
Table 5	Fauna survey times and observations	35
Table 6	Summary of flora survey limitations	39
Table 7	Summary of fauna survey limitations	41
Table 8	Significant Impact Criteria for Key Protected Species	44
Table 9	Assessment of Significant Impact to Black Cockatoo	47

Appendices

Appendix A	NatureMap Extract
Appendix B	Protected Matters Search Tool Extract
Appendix C	Conservation Codes for WA Flora and Fauna
Appendix D	Relevé Field Sheet
Appendix E	Identified Trees (>50cm DBH)

1 Introduction

Ecosystem Solutions were contracted by R.W Duggan to survey Lot 500 Wirring Road, Cowaramup (hereafter called the "Site") within the Shire of Augusta-Margaret River. A survey was undertaken to assess the vegetation condition and document the presence and distribution of flora and fauna on the Site to support a request to amend the Shire of Augusta-Margaret River Local Planning Scheme No.1 and subsequent Structure Plan of the Site. This will ultimately facilitate residential subdivision of the site, generally as envisaged on the attached Concept Plan (Figure 1).

The fauna species specifically targeted are the Western Ringtail Possum (*Pseudocheirus occidentalis*) and signs or suitable habitat for Black Cockatoo Species (*Calyptorhynchus baudinii*, C. *latirostris and C. banksii subsp. naso*) as well as any other conservation significant fauna likely to occur within the Site.

The flora elements specifically targeted include Threatened and Priority species and Threatened and Priority Ecological Communities. However, a flora survey was not conducted in the optimal time for all plant identification and there is a potential for conservation significant annual species to be present that have not been recorded.

This flora and fauna assessment was limited to observing species present during the time of the surveys.



Figure 1 Concept Plan for Lot 500 Wirring Road, Cowaramup

2 Site Details

The Site is zoned as 'General Agriculture' under the Shire of Augusta-Margaret River Local Planning Scheme 1 and 'Future Urban', under the Local Planning Scheme 2020. The land is currently operated as a rural farming operation. This report is prepared in support of a request to amend the zoning of the Site to 'Urban Development'.

The Lot is 40.82 ha in area and includes a predominately cleared area of vegetation with scattered trees. The vegetated area in the north-west corner of the Lot and the scattered trees on the central northern area are envisaged to be retained in an area of Public Open Space (POS A & POS C). The trees in the northern area of the Site will be retained within the proposed lots. There are also scattered trees within the development footprint which will require removal.

The surrounding landscape includes farming operations to the north-east, east, south, and south-east of the Lot. These operations are low intensity agriculture including cattle grazing, and therefore no separation distances are required (DWER, 1986; EPA, 2005). Rural residential lots and pockets of remanent vegetation are to the west and north of the Lot, which make up parts of the Cowaramup townsite. A Water Corporation lot is to the south-east of the Site.

The Site sits at approximately 140 m AHD in the south-east with a gentle slope down to 135 m AHD to the south-west, north-west and north-east. The Site is located to the north-east of Wirring Road and east of Bussell Highway.

3 Flora and Vegetation

3.1 Desktop analysis

The desktop investigation used datasets available from government sources and Ecosystem Solutions own databases to map environmental parameters onto the study area. Information sourced included the following:

- Department of Biodiversity Conservation and Attractions' NatureMap for Threatened and Priority Flora and wetland mapping
- Department of Agriculture, Water and of the Environments', Environment Protection and Biodiversity Conservation (EPBC) Protected Matters Search Tool
- Department of Primary Industries and Regional Developments', Soil Subsystem mapping
- Department of Water and Environmental Regulations', Acid Sulphate Soils risk (DWER_052) and environmentally sensitive areas mapping
- Department of Planning, Lands and Heritages', Aboriginal Heritage Places mapping.

Environmental aspects included in this investigation are as follows:

- Soil landscape systems
- Presence of potential acid sulphate soils (ASS)
- Regional vegetation complexes
- Presence of environmentally sensitive areas (ESA's)
- Hydrology and categorised wetlands
- Presence of conservation significant flora
- Presence of threatened and priority ecological communities
- Presence of Aboriginal heritage sites

3.1.1 Soil Landscape

Soil-Landscape systems are areas with recurring patterns of landforms, soils and vegetation and are used by the Department of Agriculture to maintain a consistent approach to land resource surveys.

The Site is located within the Cowaramup Uplands System with the Wilyabrup Valleys System located to the east of the Lot (Department of Primary Industries and Regional Development, 2021):

- Cowaramup Uplands System (216Co) – Lateritic plateau, in the Leeuwin Zone. Sandy gravel, loamy gravel and grey sandy duplex. Jarrah-marri forest.

These soil systems are further divided into mapping units. There are two Phases in the Lot with Cowaramup flats Phase comprising the greatest area of the Site (Figure 2):

- Cowaramup flats Phase (216CoCO1) - Flats (0-2% gradient) with gravelly duplex (Forest Grove) and pale grey mottled (Mungite) soils.
- Cowaramup wet flats Phase (216CoCOw) - Poorly drained flats and slight depressions with pale grey mottled (Mungite).

The following unit is located in close proximity to the Lot (Figure 2):

- Cowaramup wet vales Phase (216CoCOvw) - Small, broad U-shaped drainage depressions with swampy floors. Gravelly duplex (Forest Grove) soils on sideslopes and poorly drained alluvial soils on valley floor.

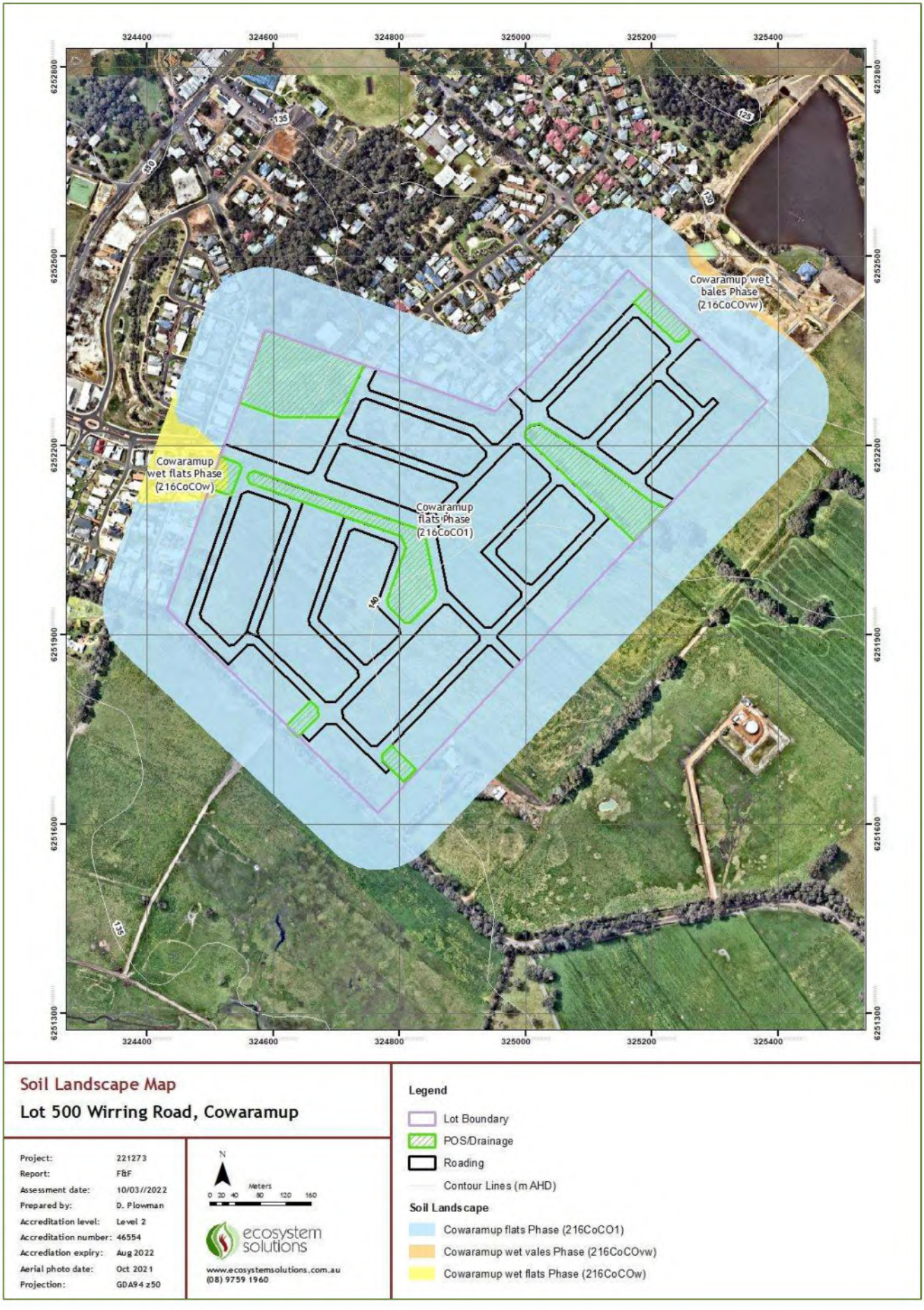


Figure 2 Soil Landscape for Lot 500 Wirring Road, Cowaramup

3.1.2 Acid Sulfate Soils

Acid sulfate soils (ASS) are naturally occurring soils, sediments and peats that contain iron sulphides. When exposed to air (oxygen), these sediments can form sulfuric acid and release metals (including arsenic) into the soil profile. The release of these substances have potential to cause significant environmental and economic impacts by contaminating soil and groundwater. These soils are predominantly found in low-lying land bordering the coast, estuarine or saline wetlands, and freshwater ground water dependent wetlands throughout the State.

The Department of Water and Environmental Regulation (2017) developed a map, *Acid Sulfate Soil Risk Map (DWER-052)* indicating risk level of ASS materials based on the likelihood of ASS materials occurring within soil profiles.

This mapping indicates an area of Risk Class 2 (1,270m^2 / 0.127ha) on the western edge of the Site that encroaches on one lot and Drainage Basin. Risk Class 2 indicates a moderate to low-risk likelihood of ASS occurring within 3m of natural soil surface but a high to moderate risk of ASS beyond 3m of natural soil surface (DWER-052).

If there is any disturbance greater than 100m^3 required of the Risk Class 2 area, with excavation proposed below the water table, than an Acid Sulfate Soil Management Plan should be prepared and implemented with actions to mitigate the potential impacts provided in the 'Treatment and management of soils and water in acid sulfate soil landscapes' (DER 2015).

There are a further two areas of ASS Risk Class 2 outside the Lot Boundary. One, located 165m northeast of the Lot Boundary and another 115m to the South.

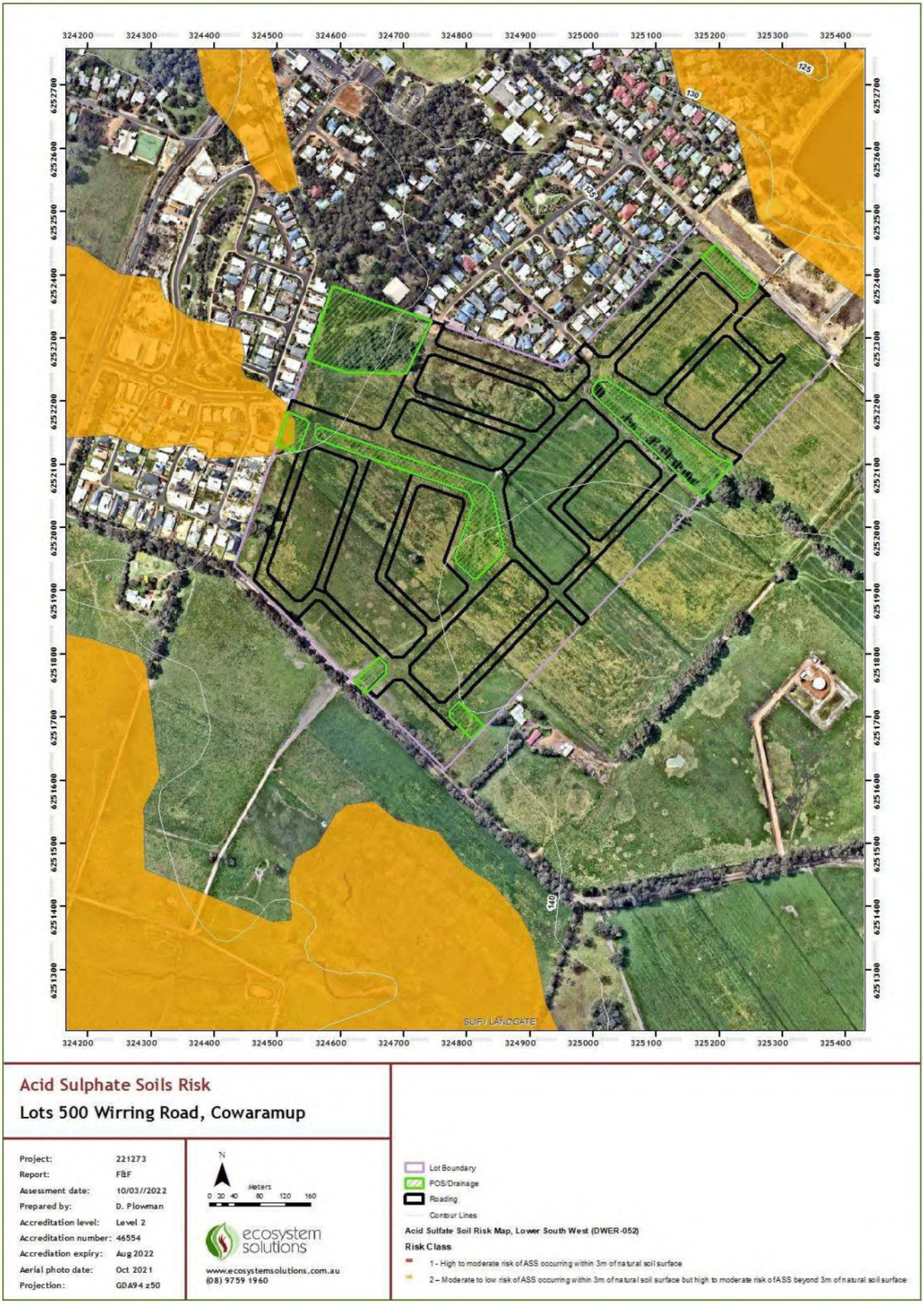


Figure 3 Potential Acid Sulphate Soil Risk for Lot 500 Wirring Road, Cowaramup

3.1.3 Regional Vegetation

The vegetation complexes of the Southwest Forest region have been mapped by Havel and Mattiske (2000). This dataset identifies Cowaramup Complex as the only complex within the Site (Figure 4):

- Cowaramup Uplands (C2) - Open forest of *Eucalyptus marginata* subsp. *marginata-Corymbia calophylla-Banksia grandis* on lateritic uplands in peri humid and humid zones.

The 2018 South West Vegetation Complex Statistics (Government of Western Australia, 2018) for the Cowaramup Uplands (C2) complex is shown in Table 1.

The National Objectives and Targets for Biodiversity Conservation (DEH, 2001) intends to retain and protect those vegetation communities with less than 30% extent remaining. The Cowaramup Uplands (C2) complex narrowly achieves this target, having 32.45% remaining with 4.83% in secure tenure.

The vegetation that is mapped as Cowaramup Uplands is intended to be retained in an area of Public Open Space.

Table 1 Vegetation Complex Statistics (2018)

Vegetation Complex	Pre-European Extent	Current Extent	Extent Remaining	Vegetation Complex Extent within Lands Protected for Conservation (IUCN I-IV)
Cowaramup Uplands	13,692.45 ha	4,442.60 ha	32.45%	4.83%



Figure 4 Vegetation Complex for Lot 500 Wirring Road, Cowaramup

3.1.4 Environmentally Sensitive Areas

Environmentally sensitive areas (ESAs) are classes or areas of native vegetation, where the exemptions for clearing vegetation under the Environmental Protection (Clearing of Native Vegetation) Regulations 2004 (Clearing Regulations) do not apply. ESA's include but are not limited to declared World Heritage properties, defined wetlands and buffer area, threatened flora and buffer, Threatened Ecological Communities, a Bush Forever Site and lakes, wetlands and fringing native vegetation covered under Environmental Protection Policies (e.g., Swan Coastal Plain Lakes).

A search of the Department of Water and Environmental Regulation's Clearing Regulations - Environmentally sensitive areas mapping indicated that there is no ESA within or around the Site (DWER-046).

3.1.5 Hydrology and Wetlands

Wetlands include areas of seasonally or permanently waterlogged soils, or inundated land, with fresh or saline, flowing or static water (Wetlands Advisory Committee, 1977). They are important as they support a large proportion of the States flora and fauna.

DBCA manages and protects Ramsar wetlands, which are of international importance, listed under the Ramsar Convention. There are no Ramsar wetlands within proximity to the Site (DBCA-012)

The Site is located within the upper catchment of Wilyabrup Brook (Figure 5), which is a minor river located north and south of the Site (DWER-031). Wilyabrup Brook has a total stream length of nearly 20 km, commencing within 1 km east of the Site, flowing northwest to an estuary located between Yallingup and Gracetown (Green & Donohue, 2015).

A minor local waterway is located within the Site, in an area designated to become a Drainage Basin, shown in Figure 5.



Figure 5 Hydrology for Lot 500 Wirring Road, Cowaramup

3.1.6 Threatened and Priority Flora

Extracts from the following databases have been obtained, using a 10 km buffer, to determine if records of any conservation listed flora species are known within the boundary or surrounding the Site:

- NatureMap database showing listed species under the *Biodiversity Conservation (BC) Act 2016* managed by Department of Biodiversity, Conservation and Attractions (DBCA), provided in Appendix A.
- Protected Matters Search Tool (PMST) showing species listed under the commonwealth *Environmental Protection and Biodiversity Conservation (EPBC) Act 1999* (Appendix B).

Flora species are protected based on their conservation status. DBCA recognises threats of extinction and consequently applies regulations towards population and species protection. Protected species are gazetted under the *Biodiversity Conservation Act (2016)*, and it is an offence to "take" or damage rare flora without Ministerial approval. The act defines "to take" as "… to gather, pick, cut, pull up, destroy, dig up, remove or injure the flora or to cause or permit the same to be done by any means" (Government of Western Australia, 2010).

Appendix C presents the definitions for conservation status under the *BC Act* 2016, which was previously the *Wildlife Conservation Act 1950*, and *EPBC Act 1999*.

3.1.7 Threatened and Priority Ecological Communities

An ecological community is a naturally occurring biological assemblage that occurs in a particular type of habitat. A Threatened Ecological Community (TEC) is one which is found to fit into one of the following categories: Presumed Totally Destroyed; Critically Endangered; Endangered, or Vulnerable.

Possible TECs that do not meet survey criteria are added to the Department of Parks and Wildlife's Priority Ecological Community Lists, under Priority 1, 2 and 3. These are ranked in order of priority for survey and/or definition of the community type and evaluation of its conservation status.

The PMST report has identified the following TEC as likely to occur (within the buffer area only):

- Banksia woodlands of the Swan Coastal Plain ecological community (Endangered)
- Tuart (*Eucalyptus gomphocephala*) Woodlands and Forests of the Swan Coastal Plain ecological community (Critically Endangered)

3.1.8 Aboriginal Heritage

Department of Planning, Lands and Heritage (DPLH) developed a data set containing places within Western Australia that have been reported to the Registrar of Aboriginal Sites as possible sites within the meaning of the *Aboriginal Heritage Act 1972* (AHA). This includes Registered Sites (those that meet criteria of Section 5 of AHA), Lodged places (those yet to be formally assessed against Section 5 criteria) and Stored data (places to which Section 5 of AHA does not apply). This data is the same as that accessed through the Aboriginal Heritage Inquiry System (AHIS).

A search of the Aboriginal Heritage Places (DPLH-001) dataset showed no Aboriginal sites, within the Site. The nearest known Aboriginal sites are located 640m to the north-west of the Site and named Place 25909 - Cowaramup Sale Yards Camp and Corroboree Grounds, located 640m to the north-west of the Site.

The DPLHs' Aboriginal Heritage Survey dataset (DPLH-080) was also accessed to determine if the Site was included in Aboriginal Heritage Survey Area information from Heritage Survey Reports submitted to the department.

The search identified the Site as an area covered under an Aboriginal Heritage survey (Report ID 101971, *National Estates Grants Programme Aboriginal Sites in the Lower Southwest Heritage Study*. July 1995.). The study area of this archaeological and ethnographic survey encompassed approximately 5,600 km^2 bounded by Capel River to the north, the Indian Ocean to the west, the Vasse Hwy to the east and the Donnelly River and Southern Ocean to the South.

3.2 Field Survey

The Site was surveyed on 9 March 2022 by Kelly Lamp (B.Sc Hons. Nat Rs Mgmt., FB62000182 / TFL 54-2021) and Lorraine Duffy (B.Sc Env Biology, B. Arts Geo, FB62000280) from Ecosystem Solutions.

The Site was walked in a systematic manner to cover the entire area. Zones with consistent vegetation structure and composition were noted and the main species in each of the strata were identified. Due to the small area and disturbed condition of the vegetation, only one relevé was completed (Figure 4, Appendix D). The condition of the vegetation based on Keighery (1994) was also recorded across the Site (Figure 5).

3.3 Results

3.3.1 Threatened, Priority and Significant Flora

A total of 12 Threatened (T) species and 23 Priority (P) species have been identified within a 10 km radius of the Site according to the BC Act. Two are considered Critically Endangered (CE) species, seven Endangered (E) species and three vulnerable (V) species under the EPBC Act. (Appendix A & B). The results for all database searches are summarised in Table 2.

The likelihood of the species occurring within the Site is determined based on known distribution, last known records and the habitat expected within the Site or buffer area.

There were no Threatened flora species recorded during the field surveys. While the flora survey was not conducted during the optimal time for plant identification (Spring), the Site has been heavily grazed and has a very sparse understorey and so it is unlikely conservation significant species are present that have not been recorded.

Table 2 Conservation significant flora species recorded within 10 km of the Site

Species	Conservation status*	Life Form	Habitat / Known Distribution	Likelihood of occurrence within the Site
Caladenia lodgeana	T/CE	Herb	Seasonally moist wet clay /sand on laterite or margin of granite outcrops in low scrub or open forest with low scrub. Known from populations near Augusta and south east of Collie. Population south west of Margaret River extinct.	Unlikely
Grevillea brachystylis subsp. grandis	T/CE	Shrub	Narrow band, 10 km long, of degraded habitat at the base of Whicher Scarp. Brown lateritic clay loam soils in Marri woodland.	Unlikely
Banksia nivea subsp. uliginosa	T/E	Shrub	Sandy clay, gravel. Occurs in two areas, near Busselton and Scott River Plain on clay over laterite in thick scrub, in winter wet southern ironstones.	Unlikely
Caladenia excelsa	T/E	Herb	White, grey or brown sands, sandy loams, loam, clay, laterite and granite. Hilltops, ridges, slopes, swales and low plains in deep pale yellow or grey sandy soils.	Possible
Caladenia hoffmanii	T/E	Herb	Clay, loam, laterite, granite. Rocky outcrops and hillsides, ridges, swamps and gullies. All known populations are located north of Geraldton.	Unlikely
Caladenia huegelii	T/E	Herb	Grey or brown sand, clay loam. Current distribution confined to Dunsborough and north of Busselton.	Possible
Eucalyptus x phylacis	T/E	Tree	Mallee-heath or woodland on lateritic soils. Known from a single clonal population in Meelup Regional Park, Dunsborough.	Unlikely
Gastrolobium papilio	T/E	Shrub	Sandy clay over ironstone and laterite. Flat plains. Species is restricted to Hithergreen and Walsall area in Busselton.	Unlikely

Species	Conservation status*	Life Form	Habitat / Known Distribution	Likelihood of occurrence within the Site
Lambertia echinata subsp. occidentalis	T/E	Shrub	White sandy soils over laterite, orange/brown-red clay over ironstone. Flats to foothills, winter wet sites.	Unlikely
Banksia squarrosa subsp. argillacea	T/E	Shrub	White/grey sand, gravelly clay or loam. Winter -wet flats, clay flats. Confined to the western base of the Whicher scarp, east of Busselton.	Unlikely
Daviesia elongata subsp. elongata	T/V	Shrub	Jarrah forest or woodland, on sandy soil, laterite.	Unlikely
Drakaea micrantha	T/V	Herb	White - grey sand.	Possible
Netrostylis sp. Nannup (P.A. Jurjevich 1133)	P1	Herb	Lowland areas, pale yellow-grey sand, laterite/rock.	Possible
Gastrolobium whicherense	P2	Shrub	Red-grey sandy clay over quartzite. Steep westerly slopes.	Unlikely
Leptomeria furtiva	P2	Shrub	Grey or black peaty sand. Winter-wet flats.	Possible
Xyris maxima	P2	Shrub	Seasonally wet black peaty sand -brown sandy loam, drainage flats.	Possible
Acacia inops	P3	Shrub	Grey-Black peaty sand, clay, swamps, creeks. Grows along watercourses and swamps.	Unlikely
Boronia anceps	P3	Herb	White sand, gravelly laterite. Seasonally swampy heaths. Known from populations in Augusta and Scott River region.	Unlikely
Boronia tetragona	P3	Herb	White/grey or black sand or brown sandy loam. Winter wet flats, swamps, hillslopes.	Possible
Chamaescilla gibsonii	P3	Herb	Clay to sandy clay, winter wet flats, shallow water-filled claypans.	Unlikely

Species	Conservation status*	Life Form	Habitat / Known Distribution	Likelihood of occurrence within the Site
Dampiera heteroptera	P3	Herb/ Shrub	Sandy - Grey sandy clay/grey-brown sandy loam soils. Swampy areas.	Possible
Gastrolobium formosum	P3	Shrub	Clay brown loams, along river backs or in swamps.	Unlikely
Grevillea brachystylis subsp. brachystylis	P3	Shrub	Black sand/brown sandy loam/ sandy clay/white-grey clay sand. Seasonally inundated/swampy situations.	Possible
Grevillea bronwenae	P3	Shrub	White -Grey sand over laterite/brown sand/loam, lateritic loams. Hillslopes, seasonally inundated/creekline areas. Known location <0.8km from the Site.	Possible
Grevillea manglesioides subsp. ferricola	P3	Shrub	Red sandy clay over ironstone/gravelly grey, brown sandy loam/brown clay to sandy clay. Winter wet flats.	Possible
Johnsonia inconspicua	P3	Herb	White-grey or black sand. Sedgeland and banksia or jarrah woodland. Low dunes, winter-wet flats.	Unlikely
Lasiopetalum laxiflorum	P3	Shrub	Grey-brown clayey loam occasionally over laterite/gravel	Possible
Pimelea ciliata subsp. longituba	P3	Shrub	Grey sand over clay, loam.	Possible
Pultenaea pinifolia	P3	Shrub	Loams or clay, floodplains, swampy areas. Known location <0.6km from the Site.	Possible
Synaphea decumbens	P3	Shrub	Sand over laterite. Known location < 1.5km from the Site.	Possible
Acacia flagelliformis	P4	Shrub	Sandy soils and winter-wet areas.	Possible
Acacia tayloriana	P4	Shrub	Grey or yellow/orange sandy soils, lateritic gravel, clay loam. Winter wet areas.	Possible

Species	Conservation status*	Life Form	Habitat / Known Distribution	Likelihood of occurrence within the Site
Chamelaucium erythrochlorum	P4	Shrub	Variable soil, sand/ brown sandy loams/ white clayey sands on slopes and flats. Ridge/creek embankments.	Possible
Drosera fimbriata	P4	Herb	White/grey/black sand/ granite. Hillslope/flat	Unlikely
Franklandia triaristata	P4	Shrub	Variable soil, brown-grey clay over white or grey sand, white /grey sand or brown gravel soils common on slope but also found on flats. Known locations in Margaret River, east of Busselton, Nannup and South of Bunbury.	Possible
Thysanotus isantherus	P4	Herb	Granite/ dry grey loam over laterite/ clay-loam on granite/ grey sand over gneiss. Jarrah/Marri woodland/ open mixed shrubland/heath. Known locations predominantly coastal granite locations.	Unlikely

* BC Act: T = Threatened, P = Priority; / EPBC Act: CE = Critically Endangered, E= Endangered, V = Vulnerable

3.3.2 Vegetation Communities

A relevé was completed within the only area of remnant vegetation on Site which has understorey vegetation (Figure 4, Appendix D).

During the Site assessment, vegetation within the relevé was observed to comprise of a single vegetation community (described according to Keighery, 1994, adapted Muir, 1977, and Aplin, 1979, Table 2 below):

- *Corymbia calophylla, Eucalyptus marginata* open forest over *Corymbia calophylla, Eucalyptus marginata* low open woodland over *Xylomelum occidentale, Banksia grandis* scattered tall shrubs over *Xylomelum occidentale, *Solanum linnaeanum, Corymbia calophylla* scattered low shrubs over scattered herbs and grasses.

The species identified within the relevé are characteristic of the Cowaramup Uplands (C2) vegetation complex as described by Havel and Matiske (2000) as;

- Cowaramup Uplands (C2) - Open forest of *Eucalyptus marginata* subsp. *marginata-Corymbia calophylla-Banksia grandis* on lateritic uplands in perhumid and humid zones.

The Site does not have characteristics of any Threatened Ecological Communities including the Banksia woodlands and Tuart Threatened Ecological Communities listed within the PMST report for the area (Appendix B).

3.3.3 Vegetation Condition

Using the scale of condition developed by Keighery (1994, Table 4), vegetation within the Site was ranked from Degraded to Completely Degraded (Figure 5).

Completely degraded vegetation represents the greatest area of the Site at 40 ha (39,9415 m^2) or 97% of the Site. This area has been cleared of almost all native vegetation with a few isolated trees remaining over sown pasture grass species. Currently the area is being used for grazing.

An area of degraded vegetation represents less than 3% of the total Site at 1 ha (9,912 m^2) or 97% of the Site. This area contains an area of remnant forest/woodland vegetation that has been largely cleared of native understory with a few native shrub species remaining and several areas of native trees planted in single/double rows.

Table 3 Keighery Condition Scale (Keighery 1994)

Category	Description
Pristine	Pristine or nearly so, no obvious signs of destruction.
Excellent	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species. For example, damage to trees caused by fire, the presence of non-aggressive weeds and occasional vehicle track.
Very Good	Vegetation structure altered, No obvious signs of disturbance. For example, disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.
Good	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate to it. For example, disturbance to vegetation structure caused by very frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback and grazing.
Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration, but not to a state approaching good condition without intensive management. For example, disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.
Completely Degraded	The structure of the vegetation in no longer intact and the area is completely or almost completely without native species. These areas are often described as "parkland cleared" with the flora composing weed or crop species with isolated native trees or shrubs.

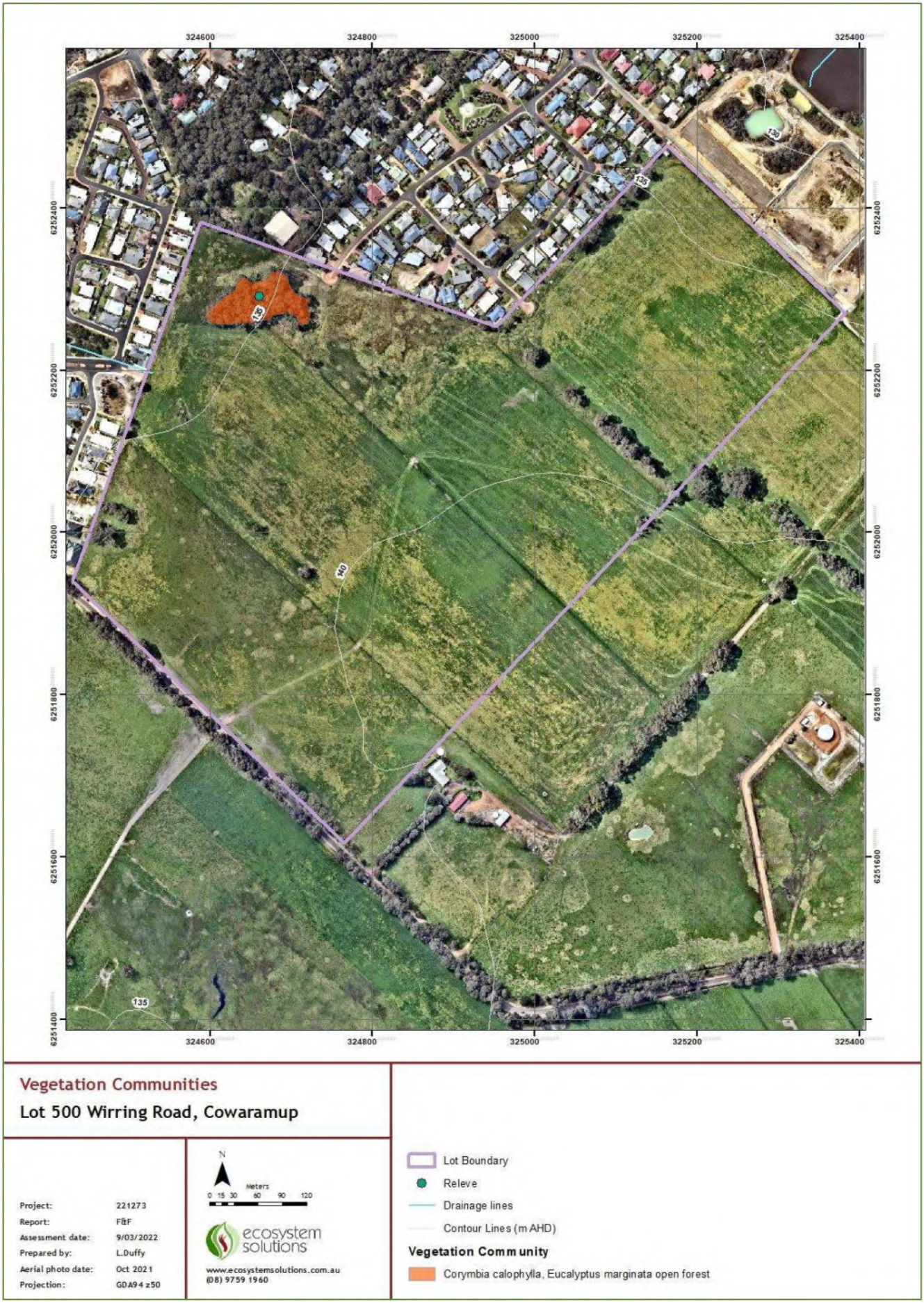


Figure 6 Vegetation Communities for Lot 500 Wirring Road, Cowaramup



Figure 7 Vegetation Condition for Lot 500 Wirring Road, Cowaramup

4 Fauna

4.1 Desktop Analysis

The conservation status of fauna within WA is determined by two acts of legislation, the *Commonwealth Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act) and the State *Western Australian Biodiversity Conservation Act 2016* (WA) (BC Act). The conservation codes for fauna under the *BC Act* are presented in Appendix C. These categories are consistent with the International Union for Conservation of Nature (IUCN) classifications and link into a global ranking system for taxa at risk of extinction.

A desktop study and analysis of the records of NatureMap and the Protected Matters Search Tool (Appendix A & B) were made to determine the presence or likely presence of fauna or fauna assemblages within the Site. The analysis primarily targeted terrestrial threatened vertebrate species listed under the *Biodiversity Conservation Act 2016* (WA) and *Environmental Protection Biodiversity Conservation Act 1999* (Commonwealth). A list of fauna expected to occur within a 10-kilometre radius of the Site was compiled from searches conducted on the DBCA database (NatureMap) and the Commonwealth EPBC Protected Matters Search Tool (Table 5).

Marine species and freshwater fish have been excluded due to the location of the Site. Invertebrates have also been excluded as this is a specialist area not covered under the Scope of this report.

The NatureMap Database identified seven Threatened (T) species, which are rare or are likely to become extinct, three Priority (P) listed species and one other Specifically Protected (S) species within a 10 km radius of the Site. The Protected Matters Search Tool identified eight Threatened (T) species, within a 10 km radius of the Site. One of which is a Critically endangered (CE) species, four Endangered (E) species and three Vulnerable (V) species.

Review of the database searches and the expected vegetation communities and vegetation condition of the Site indicate the conservation significant fauna species likely to be within or utilising the Site include *Pseudocheirus occidentalis* (Western Ringtail Possum).

The three Black Cockatoo species, *Calyptorhynchus banksii* naso (Forest Red-tailed Black Cockatoo), *Calyptohrynchus baudinii* (Baudin's Cockatoo) and *Calyptorhynchus latirostris* (Carnaby's Cockatoo) or habitat of the species are also likely to occur within the area.

Other conservation significant fauna may use the Site however these have not been targeted under the scope of this report.

Table 4 Conservation significant fauna species recorded within 10 km of the Site

Species	Conservation Status*	Habitat	Likelihood of occurrence within the Site
Pseudocheirus occidentalis Western Ringtail Possum	T/CE	Coastal Areas of Peppermint woodland and peppermint woodland and peppermint / tuart associations.	Likely
Bettongia penicillata ogilbyi Woylie	T/E	Open forest and woodland with low understory of woody scrub. Woodlands and adjacent heaths with a dense understorey of shrubs. Tall eucalypt forest and woodland, dense myrtaceous shrubland, kwongan or mallee heath.	Possible
Botaurus poiciloptilus Australasian Bittern	T/E	Wetlands with tall, dense vegetation, favours permanent and seasonal freshwater habitats, dominated by sedges rushes and reeds, growing over a muggy or peaty substrate.	Possible
Calyptorhynchus baudinii Baudin's Cockatoo	T/E	Dense Jarrah, Karri and Marri forests. Species nest in large hollows in these species.	Likely
Calyptorhynchus latirostris Carnaby's Cockatoo	T/E	Dense Jarrah, Karri and Marri forests. Species nest in large hollows in these species.	Likely
Calyptorhynchus banksii subsp. naso Forest Red-tailed Black Cockatoo	T/V	Dense Jarrah, Karri and Marri forests. Species nest in large hollows in these species.	Likely
Dasyurus geoffroii Western Quoll, Chuditch	T/V	Variety, most dense in riparian jarrah forests. Require large, unfragmented habitats.	Possible

Species	Conservation Status*	Habitat	Likelihood of occurrence within the Site
Setonix brachyurus *Quokka*	T/V	Mainly dense riparian vegetation, other areas with dense vegetated understory with proximity to freshwater.	Possible
Psophodes nigrogularis subsp. *nigrogularis* Western Whipbird	T	Occurs in heath-like thicket associations on coastal dunes and in low, dense mallee woodland or shrubland with understorey of dense, stunted shrubs. Preferred habitat is thicket, 2-3m high of varied floristic composition.	Possible
Falco hypoleucos Grey Falcon	V	Areas where annual rainfall is less than 500 mm. Timbered lowland plains and acacia shrublands crossed by tree lined water courses.	Possible
Hydromys chrysogaster Rakali	P4	Found near permanent fresh or brackish waters.	Possible
Isoodon fusciventer Quenda	P4	Forest, woodland, shrub, and heath, usually in sandy soils with dense healthy vegetation in lower stratum.	Possible
Notamacropus irma Western Brush Wallaby	P4	Some areas of mallee and heathland. Uncommon in wet sclerophyll forests.	Possible
Phascogale tapoatafa subsp. *wambenger* South-western Brush-tailed Phascogale	S	Highly arboreal, prefers open forest with sparse groundcover.	Possible

* BC Act: T = Threatened, P = Priority; EPBC Act: CE = Critically Endangered, E= Endangered, V = Vulnerable, S = Other Specially Protected Fauna

4.2 Field Survey

With these species in mind, a field study of the site was conducted. The approach adopted for this survey was:

- A Satellite Image of the Site was acquired.
- A daytime visual inspection of the property and adjoining vegetation for any signs of fauna (e.g., scats, diggings, dreys, nests, burrows, feeding signs) was conducted.
- Hollow bearing trees or trees suitable for Black Cockatoos (>50cm Diameter at Breast Height (DBH)) were recorded.
- Direct observations of fauna and signs of fauna were recorded using a Trimble Global Positioning System (GPS) and ArcPad© (Version 8- ESRI).
- Two dawn and two dusk surveys were conducted to determine Black Cockatoo and Western Ringtail Possum activity. A 40 w LightForce hand-held spotlight was used with white light to observe nocturnal mammals. Observations were recorded using GPS and ArcPad©.
- Field observations were analysed and mapped with ArcGis (ArcMap V10.6.1©).

The Site was inspected via a walked transect and the trees were inspected via a physical inspection for hollows or signs of fauna usage.

All trees with large hollows were inspected for any signs of use by cockatoos. These include wear around the hollow, chewing, scarring and scratch marks on the trunks or branches. Old or recent evidence of cockatoo's feeding or roosting sites (feathers, droppings etc.) were also searched for.

This type of survey has minimal impact on the fauna within the property and provides sufficient data on the presence and relative abundance and distribution of taxa. During the field surveys, the habitat at the site was assessed to determine its potential suitability to host any of the anticipated threatened or rare species. This approach is consistent with a Level 1 survey under the EPA's Technical Guidance: Sampling methods for Terrestrial vertebrate fauna (2016) which specifies a minimum requirement of a desktop study to gather information on the subject site and a reconnaissance survey to verify the accuracy of the background study and delineate fauna and faunal assemblages.

The survey's protocol is also consistent with the requirements outlined in the Development Planning Guidelines for Western Ringtail Possums (CALM 2003, now DBCA).

The draft referral guideline for the three threatened black cockatoo species (Department of Environment and Energy, 2017) outline requirements for appropriate level of surveys for these species. This survey's intensity and design comply with these guidelines.

4.3 Results

The Site was surveyed for fauna over two days, two dusk and two night surveys from Thursday 24th March 2022 to Sunday 27th March 2022 by Ecosystem Solutions Gary McMahon (B.Sc. M. Env Mgmt).

Kelly Lamp (B.Sc Hons. Nat Rs Mgmt), Dani Cuthbert (Dip Bus & Dip TM) and Lorraine Duffy (B.Sc Env Biology, B. Arts Geo) conducted day surveys on the 8th and 9th March 2022. The Site was traversed in a systematic manner, focussing on the vegetated areas.

Dawn and dusk surveys were conducted by Gary McMahon for any sign of Black Cockatoos, Western Ringtail Possums or other conservation listed species, as described in Table 5.

Table 5 Fauna survey times and observations

Survey Type	Date and Time	Sunrise / Sunset Time	Observations
Dawn	25 March 2022 5:20 am to 7:35 am	First Light 6:01 am Sunrise 6:26 am	No animals observed.
Dawn	27 March 2022 5:30 am to 7:30 am	First Light 6:03 am Sunrise 6:27 am	No animals observed.
Dusk/Nocturnal	24 March 2022 5:30 pm to 8.45 pm	Sunset 6:26 pm Last light 6:51 pm	No animals observed.
Dusk/Nocturnal	27 March 2022 5.30 pm to 8.00 pm	Sunset 6:22 pm Last light 6:46 pm	No animals observed.
Daytime surveys	8 March 2022 9 March 2022	N/A	No animals or dreys observed.

4.3.1 Black Cockatoos

There were no observations of Black Cockatoos during the day, dawn or dusk surveys indicating they are not likely to be using the Site currently.

All trees on the Site with a diameter at breast height (DBH) over 50cm, of a suitable species known to support breeding (i.e., Karri, Marri) and having the capacity to support nesting of any Black Cockatoo species were recorded (Figure 6). A total of 142 trees were identified within or on the Lot boundary while a further 4 trees with hollows and an additional 4 with potential hollows were recorded immediately outside the Lot boundary.

Of the 142 Identified Trees (>50cm DBH) within or on the Lot boundary, 9 trees contained a hollow, 1 tree contained 2 hollows and 7 trees had potential hollows (Figures 6 & 7).

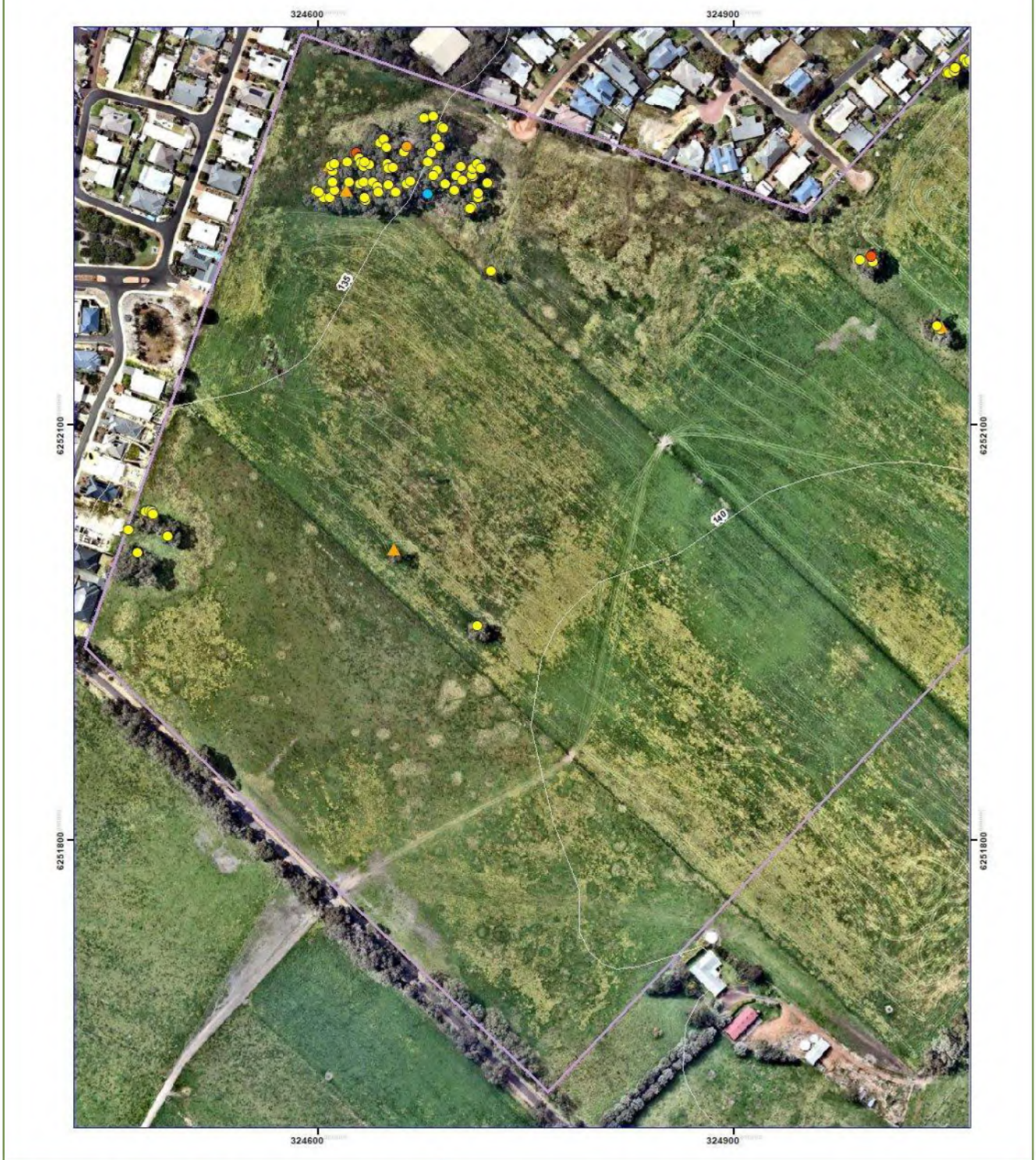
All local species of Black Cockatoos can forage over extensive areas (up to 15 – 20 km from their nesting sites (Saunders, 1980)) and given that there are large areas of preferred habitat within their range, it could be assumed that Black Cockatoo species are not reliant on the Site for nesting or roosting habitat. Table 8 and Table 9 discuss the and impact on Black Cockatoos in relation to significance criteria under the EPBC Act.

4.3.2 Western Ringtail Possums

There were no observations of Western Ringtail Possums during the day, dawn or dusk surveys indicating they are not likely to be using the Site currently.

During day surveys on 8th March 2022, the canopy of the vegetation within the Site was also thoroughly inspected and no dreys were observed. (Figure 6).

Table 8 discusses further the likely presence and impact on Western Ringtail Possums relative to EPBC significance criteria.



Identified Trees - Map 1

Lot 500 Wirring Road, Cowaramup

Project:	221273
Report:	BMP & F&F
Assessment date:	9/03/2022
Prepared by:	L.Duffy
Aerial photo date:	Oct 2021
Projection:	GDA94 z50

N

Meters
0 10 20 40 60 80

ecosystem solutions
www.ecosystemsolutions.com.au
(08) 9759 1960

Identified Tree Hollows (>50cm)

- No Hollow
- Hollows x 2
- Potential Hollow
- Hollow
- Chimney Hollow
- Contour Lines
- Lot Boundary

Figure 8 Identified Trees (Map 1), Lot 500 Wirring Road, Cowaramup



Figure 9 Identified Trees (Map 2), Lot 500 Wirring Road, Cowaramup

5 Survey Constraints

Survey limitations are summarised in Table 6 and 7 below:

Table 6 Summary of flora survey limitations

Constraint	Impact	Comment
Availability of contextual information at a regional and local scale	Nil	Broad scale vegetation and soil mapping data were available. DBCA, NatureMap and PMST database extracts for conservation significant flora and ecological communities were obtained. A search of relevant databases also occurred.
Competency / experience of the survey team	Nil	The ecologist leading the field survey has conducted numerous flora and fauna surveys across the southwest of WA and has over 10 years' experience. The ecologist completing the flora identifications has over 10 years' experience identifying Western Australian and specialising in southwest flora, with any potential conservation significant flora being submitted to the Western Australian Herbarium for identification.
Proportion of flora recorded and/or collected, any identification issues	Nil	A focus was placed on identifying any potential conservation significant flora species, with specimens all identified to species level. Specimens that were not potentially conservation significant species have been identified to genus level, or species where this is easily ascertained.
Was the appropriate area fully surveyed (effort and extent)	Nil	A relevé was conducted within the only remaining area of remnant vegetation on the Site which contained an understorey. Other remnant vegetation included scattered trees only. All areas of remnant vegetation were surveyed on foot for Conservation Significant vegetation communities and flora species.
Access restrictions within the survey area	Nil	All parts of the Site were accessible by vehicle and foot.

Constraint	Impact	Comment
Survey timing, rainfall, season of survey	Moderate	The survey was conducted in Autumn which is not the optimal time to observe all conservation significant flora species. Given the heavily grazed and modified nature of the remnant vegetation, it is considered unlikely that any conservation significant flora species will be located within the proposed clearing area.
Inconsistent flowering habit of some species	Moderate	Some species do not flower every season and may require environmental triggers to promote flowering such as rainfall, fire, presence of suitable pollinators etc.
Disturbance that may have affected the results of the survey, such as fire, flood or clearing	Nil	There were no recent disturbances that constrained the survey of the Site.

Table 7 Summary of fauna survey limitations

Constraint	Impact	Comment
Availability of data and information	Nil	DBCA, NatureMap and PMST database extracts for conservation significant fauna were obtained.
Competency / experience of the survey team, including experience in the bioregion surveyed	Nil	The ecologist leading the field surveys has conducted numerous fauna surveys across the southwest of Western Australia and has over 20 years' experience.
Scope of the survey, e.g., where faunal groups were excluded from the survey	Minor	This survey focussed on birds, mammals and other vertebrate species. Aquatic species were not included as habitat was not present. Invertebrates were not included in the scope of this survey.
Timing, weather and season	Minor	The surveys were conducted in Autumn, with September being an optimum time for bird and mammal surveys in the southwest. Weather conditions did not impact surveys.
Timing Western Ringtail Possums (WRP) may arise from rest sites & likelihood of rest sites being located outside the Site	Moderate	As WRP use up to 2-7 rest sites at any one time and up to 20 throughout the year there is potential that they are not observed on Site at time of survey even though they are utilising the Site. The time WRP arise from a rest Site is also variable and may prevent WRP being observed during survey.
Disturbance that may have affected results, e.g., fire, flood	Nil	There were no disturbances that constrained the survey of the Site.
The proportion of fauna identified, recorded or collected	Nil	Any potential conservation significant fauna species observed during the surveys have been identified.
Determination of hollow suitability from the ground	Nil	Factors including entrance size, hollow depth, floor, and orientation of the hollow are important factors to nesting hollow suitability and which are difficult to assess from the ground. Therefore, there is potential for the number of hollows recorded to be an over estimation of those suitable as nesting hollows.

Constraint	Impact	Comment
Adequacy of the survey intensity and proportion of survey achieved, e.g., the extent to which the area was surveyed	Nil	All areas of remnant vegetation of the Site were surveyed on foot for Conservation Significant fauna species, during day, dawn and dusk / nocturnal surveys.
Access problems	Nil	All parts of the Site were accessible by vehicle and foot.

6 Significance

Under the EPBC Act, an action that has, will have, or is likely to have, a significant impact on a matter of national environmental significance, requires approval from the Minister. A significant impact is defined as an impact which is important or of consequence, having regard for its context or intensity (Commonwealth of Australia, 2009).

Matters of environmental significance include listed threatened species and ecological communities. For this proposal, there is a limited potential for impact on threatened species. Significant Impact Guidelines 1.1 (Commonwealth of Australia, 2009) lists significant impact criteria for the assessment for activities which may impact on threatened species.

Table 8 and Table 9 discuss the referral triggers and the likely presence and impact on Black Cockatoos and Western Ringtail Possums.

Table 8 Significant Impact Criteria for Key Protected Species

Significant Impact Criterion	Discussion		Meets Criterion
	Black Cockatoo Species	Western Ringtail Possum	
Lead to a long-term decrease in the size of an important population[1] of a species	Unlikely. No Cockatoos were observed foraging, nesting or roosting within the Site. No observable signs of foraging were evident.	Unlikely. No WRP or observable signs (Dreys, droppings) of WRP were observed on the Site. It is unlikely this proposal will lead to a long-term decrease of the species.	No
Reduce the area of occupancy of an important population	Unlikely. No Cockatoos were observed foraging, nesting or roosting within the Site. No observable signs of foraging were evident.	Unlikely. No WRP or observable signs (Dreys, droppings) of WRP were observed on the Site. It is unlikely this proposal will lead to a long-term decrease of the species.	No
Fragment an existing important population into two or more populations	Unlikely. No Cockatoos were observed foraging, nesting or roosting within the Site. No observable signs of foraging were evident.	Unlikely. No WRP or observable signs (Dreys, droppings) of WRP were observed on the Site. It is unlikely this proposal will lead to a long-term decrease of the species.	No

[1] *An 'important population' is a population that is necessary for a species' long-term survival and recovery.*

Adversely affect habitat critical to the survival of a species	Unlikely. No Cockatoos were observed foraging, nesting or roosting within the Site. No observable signs of foraging were evident.	Unlikely. No WRP or observable signs (Dreys, droppings) of WRP were observed on the Site. It is unlikely this proposal will lead to a long-term decrease of the species.	No
Disrupt the breeding cycle of an important population	Unlikely. No Cockatoos were observed foraging, nesting or roosting within the Site. No observable signs of foraging were evident.	Unlikely. No WRP or observable signs (Dreys, droppings) of WRP were observed on the Site. It is unlikely this proposal will lead to a long-term decrease of the species.	No
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Unlikely. No Cockatoos were observed foraging, nesting or roosting within the Site. No observable signs of foraging were evident.	Unlikely. No WRP or observable signs (Dreys, droppings) of WRP were observed on the Site. It is unlikely this proposal will lead to a long-term decrease of the species.	No
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	Unlikely. No Cockatoos were observed foraging, nesting or roosting within the Site. No observable signs of foraging were evident.	The Site does not appear to contain WRP. It is unlikely that further introduction of invasive species will impact the species.	No
Introduce disease that may cause the species to decline	Highly unlikely to occur.	Highly unlikely to occur.	No

Interfere substantially with the recovery of the species.	Unlikely. The clearing of on-Site vegetation will not impact significantly on the recovery of the species.	Unlikely. The clearing of vegetation within the Site will not impact significantly on the recovery of the species.	No

Referral guidelines for the three threatened Black Cockatoo species (Commonwealth of Australia. 2011) uses a decision tree and a set of criteria to determine whether actions significantly impact on Black Cockatoos. These are set out in Table 9, based on the details of the development and the data obtained from the surveys. Notes on the flow chart follow.

Table 9 Assessment of Significant Impact to Black Cockatoo

Question	Answer
1. Could the impacts of your action occur within the modelled distribution of the Black Cockatoos?	Yes – Action occurs within the modelled distribution area of all three species.
2. Could the impacts of your action affect any Black Cockatoo habitat or individuals?	No.
3. Have you surveyed for Black Cockatoos using the recommended methods?	Yes.
4. Is Black Cockatoo habitat present?	Yes.
5. Is your impact mitigation best practice so that it may reduce the significance of your impacts on Black Cockatoos?	Yes - Majority of the vegetation and foraging habitat will be conserved within the Site.
6. Could your action require a referral to the federal environmental Minister for significant impact on Black Cockatoos?	No - As the area for clearing is relatively small. It is unlikely that the species is dependent on the Site.

Using the flow chart and criteria it is determined that there is a low risk of actions resulting in an impact upon Black Cockatoos and Western Ringtail Possums within the Site.

It is recommended that a referral pursuant to the *EPBC Act* is not required for the Site, as actions involved do not constitute a significant impact on any of the threatened species present.

7 Summary and Recommendations

7.1 Conservation Significant Flora

- There were no Threatened Flora or conservation significant flora identified within the Site
- This proposal will not impact on any potential conservation significant species present within the highly vegetated areas as remnant vegetation of the Site will be conserved. A referral under the EPBC Act is not recommended.

7.2 Vegetation

- There were no Threatened Ecological Communities observed within the Site.
- One vegetation community was identified within the Site (Figure 4):

  Cowaramup Uplands (C2) - Open Forest of *Eucalyptus marginata* subsp. *marginata-Corymbia calophylla-Banksia grandis* on lateritic uplands in peri humid and humid zones.

- Completely degraded vegetation represents the greatest area of the Site at 40 ha (39,9415 m ^{2}) or 97% of the Site (Figure 5). This area has been cleared of almost all native vegetation with a few isolated trees remaining over sown pasture grass species. The Site is being used for grazing.
- An area of degraded vegetation represents less than 3% of the total Site at 1 ha (9,912 m ^{2}) or 97% of the Site. This area contains an area of remnant forest/woodland vegetation, largely cleared of native understory with a few native shrub species remaining and a further three areas of native trees planted in single/double rows. Two of these areas are intended to be retained in an area of Public Open Space, while the rows of trees on the north-western boundary will be retained within the Lots.

7.3 Acid Sulfate Soils

- An area of Acid Sulfate Soil Risk Class 2 is present on the western edge of the Site that encroaches on one lot and a drainage reserve. Risk Class 2 indicates a moderate to low-risk likelihood of ASS occurring within 3m of natural soil surface but a high to moderate risk of ASS beyond 3m of natural soil surface (DWER-052).
- If there is any disturbance greater than 100m^3 required of the Risk Class 2 area, with excavation proposed below the water table, than an Acid Sulfate Soil Management Plan should be prepared and

implemented with actions to mitigate the potential impacts provided in the 'Treatment and management of soils and water in acid sulfate soil landscapes' (DER 2015).

7.4 Black Cockatoos

- No Black Cockatoos were observed on the Site. No signs of nesting or roosting were evident at the time of survey.
- A total of 142 trees with a diameter at breast height >50cm were identified on the Site. 9 trees contained a hollow, 1 tree contained 2 hollows and 7 trees had potential hollows (Figure 8 & 9).
- Of the 142 Identified Trees (>50cm DBH) within or on the Lot boundary, 9 trees contained a hollow, 1 tree contained 2 hollows and 7 trees had potential hollows (Figures 6 & 7).
- As the area of remnant vegetation to be cleared is small, it is unlikely this proposal will significantly impact the local Black Cockatoo population. A referral under the EPBC Act is not recommended.

7.5 Western Ringtail Possum

- No Western Ringtail Possums or dreys were observed within the Site.
- As WRP were not observed on Site and the area of remnant vegetation to be cleared is small, it is unlikely this proposal will significantly impact WRP populations. A referral under the EPBC Act is not recommended.

8 References (not all cited)

Aplin, T. E. H. (1977). The Flora. University of Western Australia Press.

Beard J. S., Beeston G.R., Harvey J.M., Hopkins A.J.M., & Shepherd D.P. (2013). The vegetation of Western Australia at the 1:3,000,000 scale. Explanatory memoir. Second edition. Conservation Science Western Australia, 9(1), 152.

Commonwealth of Australia & Department of Sustainability, Environment, Water, Heritage and the Arts. (2013). The Action Plan for Australian Birds 2000. Commonwealth of Australia Retrieved from https://webarchive.nla.gov.au/awa/20130329024325/http://www.environment.gov.au/biodiversity/threatened/publications/action/birds2000/index.html

Cooper, C. (2000). Food manipulation by southwest Australian cockatoos. Eclectus(8), 3-9.

DBCA (Department of Biodiversity, Conservation and Attractions) https://catalogue.data.wa.gov.au/dataset/dbca-statewide-vegetation-statistics

Department of Biodiversity, Conservation and Attractions (2017). Fauna Profile - Western Ringtail Possum Pseudocheirus occidentalis. Perth, Western Australia: State of Western Australia Retrieved from http://www.dbca.wa.gov.au/

Department of Environment, (2015) Treatment and management of soils and water in acid sulfate soil landscapes.

Department of Parks and Wildlife (2013). Carnaby's cockatoo (Calyptorhynchus latirostris) Recovery Plan. Perth, Western Australia: State of Western Australia Government Department of Parks and Wildlife.

Department of Sustainability, Environment, Water, Populations and Communities (2012). EPBC Act referral guidelines for three threatened black cockatoo species: Carnaby's cockatoo (endangered) Calyptorhynchus latirostris, Baudin's cockatoo (vulnerable) Calyptorhynchus baudinii, Forest red-tailed black cockatoo (vulnerable) Calyptorhynchus banksii naso. Australia: Commonwealth of Australia.

Department of Water and Environmental Regulation (1986) Environmental Protection Act. Western Australia.

Environmental Protection Authority (2005) Guidance for the Assessment of Environmental Factors (in accordance with the Environmental Protection Act 1986) Separation Distances between Industrial and Sensitive Land Uses No. 3.

Environmental Protection Authority (2016). Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment. Western Australia: Environmental Protection Authority.

Environmental Protection Authority (2016). Technical Guidance Terrestrial Fauna Surveys. Western Australia: Environmental Protection Authority.

Geoff Barrett, A. S., Barry, S., Cunningham, R., & Poulter, R. (2003). The New Atlas of Australian Birds. CSIRO Publishing.

Green, A. & Donohue,R. (2015), Determining the environmental flow for Wilyabrup Brook, Department of Water, Government of Western Australia, Environmental Water Report No.28.

Havel, J. J., & Mattiske, E.M. (2000). Vegetation mapping of south west forest region of Western Australia. Part 6, maps (MAP). Department of Conservation and Land Management, 7 maps.

Heddle, E. M., Lonergan, O.W., & Havel, J.J. (1980). Vegetation of the Darling System. Department of Conservation and Environment, Perth.

Johnstone, R. E., Johnstone, C., Kirkby, T., & Humphreys, G. (2006). Perth-Bunbury Highway (Kwinana Freeway Extension and Peel Deviation): Targeted Threatened Fauna Survey. Unpublished Report to Main Roads Western Australia.

Keighery, B. J., & Wildflower Society of Western Australia (1994). Bushland Plant Survey: A guide to plant community survey for the community. Wildflower Society of Western Australia (Inc.). Nedlands, WA.

Mawson, P. (1997). A captive breeding program for Carnaby's Cockatoo Calyptorhynchus latirostris. Eclectus, 3, 21—23.

Mawson, P., & Johnstone R. (1997). Conservation status of parrots and cockatoos in Western Australia. Eclectus, 2, 4-9.

Muir, B. G. (1977). Biological Survey of the Western Australian Wheatbelt Part 2: Vegetation and Habitat of Bendering Reserve (A. F. Lovell, Ed.). Western Australian Museum.

Saunders, D. A. (1974). The Function of Displays in the Breeding of the White-Tailed Black Cockatoo. Emu - Austral Ornithology, 74(1), 43-46. https://doi.org/10.1071/MU974043

Saunders, D. A. (1977). The Effect of Agricultural Clearing on the Breeding Success of the White-Tailed Black Cockatoo. Emu - Austral Ornithology, 77(4), 180-184. https://doi.org/10.1071/MU9770180

Saunders, D. (1979). The Availability of Tree Hollows for Use as Nest Sites by White-tailed Black Cockatoos. Wildlife Research, 6, 205-216.

Saunders, D. A. (1979). Distribution and Taxonomy of the White-Tailed and Yellow-Tailed Black-Cockatoos Calyptorhynchus Spp. Emu - Austral Ornithology, 79(4), 215-227. https://doi.org/10.1071/MU9790215

Saunders, D. A. (1980). Food and Movements of the Short-Billed Form of the White-Tailed Black Cockatoo. Wildlife Research, 7. https://doi.org/10.1071/WR9800257

Saunders, D. A. (1982). The Breeding Behaviour and Biology of The Short-Billed Form of The White-Tailed Black Cockatoo Calyptorhynchus Funereus. Ibis, 124(4), 422-455. https://doi.org/https://doi.org/10.1111/j.1474-919X.1982.tb03790.x

Saunders, D. A. (1986). Breeding-Season, Nesting Success and Nestling Growth in Carnabys Cockatoo, Calyptorhynchus-Funereus-Latirostris, Over 16 Years at Coomallo Creek, and a Method for Assessing the Viability of Populations in Other Areas. Wildlife Research, 13(2), 261-273. https://doi.org/https://doi.org/10.1071/WR9860261

Saunders, D. A. & Ingram, J. A. (1987). Factors affecting survival of breeding populations of Carnaby's cockatoo Calyptorhynchus funereus latirostris in remnants of native vegetation. In Nature Conservation : the Role of Remnants of Native Vegetation (pp. 249-258). Surrey Beatty and Sons.

Saunders, D. A. (1988). Patagial Tags - Do Benefits Outweigh Risks to the Animal. Wildlife Research, 15(5), 565-569. https://doi.org/https://doi.org/10.1071/WR9880565

Saunders, D. A. (1990). Problems of survival in an extensively cultivated landscape: the case of Carnaby's Cockatoo Calyptorhynchus funereus latirostris. Biological Conservation, 54, 277-290.

Saunders, D. A. (1995). Birds of southwestern Australia: an atlas of changes in the distribution and abundance of wheatbelt avifauna / Denis A. Saunders and John A. Ingram. Surrey Beatty & Sons in association with Western Australian Laboratory, CSIRO Division of Wildlife and Ecology.

Saunders, D. A., & Ingram, J. (1998). Twenty-eight years of monitoring a breeding population of Carnaby's Cockatoo. Pacific Conservation Biology, 4, 261-270. https://doi.org/10.1071/PC980261

Triggs, B. (2004). Tracks, scats and other traces: a field guide to Australian mammals. Oxford University Press.

Wayne, A. (2005). The ecology of the koomal (Trichosurus vulpecula hypoleucus) and ngwayir (Pseudocheirus occidentalis) in the jarrah forests of South-Western Australia

Wayne, A. F., Cowling, A., Ward, C.G., Rooney, J.F., Vellios, C.V., Lindenmayer, D.B., & Donnely, C.F. (2005). A comparison of survey methods for arboreal possums in jarrah forest, Western Australia. Wildlife Research 32(8), 701-714. https://doi.org/https://doi.org/10.1071/WR04094

Wayne, A. F., Cowling, A., Rooney, J.F., Ward, C.G., Wheeler, I.B., Lindenmayer, D.B., & Donnely, C.F. (2005). Factors affecting the detection of possums by spotlighting in Western Australia. Wildlife Research, 32(8), 689-700. https://doi.org/https://doi.org/10.1071/WR04089

Wayne, A. F., Cowling, A., Lindenmayer, D. B., Ward, C. G., Vellios, C. V., Donnelly, C. F., & Calver, M. C. (2006). The abundance of a threatened arboreal marsupial in relation to anthropogenic disturbances at local and landscape scales in Mediterranean-type forests in south-western Australia. Biological Conservation, 127(4), 463-476. https://doi.org/https://doi.org/10.1016/j.biocon.2005.09.007

Webb, A., Keighery, B., Keighery, G., Longman, V., Black, A., & O'Connor, A. (2009). The Flora and Vegetation of the Busselton Plain (Swan Coastal Plain). Western Australia: State of Western Australia

Wetlands Advisor Committee (1977) Report of the Wetlands Advisory Committee to the Environmental Protection Authority: The status of reserves in System Six, Environmental Protection Authority, Perth

Whitford, K. R. (2002). Hollows in jarrah (Eucalyptus marginata) and marri (Corymbia calophylla) trees I. Hollow sizes, tree attributes and ages. Forest Ecology and Management, 106, 201-214.

Appendix A NatureMap Extract

NatureMap
Mapping Western Australia's biodiversity

42-0322NM Flora 10km Buffer Report

Created By Guest user on 03/03/2022

Kingdom Plantae
Current Names Only Yes
Core Datasets Only Yes
Method 'By Circle'
Centre 115° 06' 26" E,33° 51' 25" S
Buffer 10km
Group By Conservation Status

Conservation Status	Species	Records
Non-conservation taxon	571	1056
Priority 1	1	1
Priority 2	3	3
Priority 3	14	34
Priority 4	6	8
Rare or likely to become extinct	1	10
TOTAL	**596**	**1112**

	Name ID	Species Name	Naturalised	Conservation Code	Endemic To Query Area
Rare or likely to become extinct					
1.	13619	*Caladenia excelsa*		T	
Priority 1					
2.	33282	*Tetraria sp. Nannup (P.A. Jurjevich 1133)*		P1	
Priority 2					
3.	20474	*Gastrolobium whicherense*		P2	
4.	17702	*Leptomeria furtiva*		P2	
5.	17481	*Xyris maxima*		P2	
Priority 3					
6.	3386	*Acacia inops*		P3	
7.	16313	*Boronia anceps*		P3	
8.	17804	*Boronia tetragona*		P3	
9.	19338	*Chamaescilla gibsonii*		P3	
10.	7446	*Dampiera heteroptera*		P3	
11.	20504	*Gastrolobium formosum*		P3	
12.	14011	*Grevillea brachystylis subsp. brachystylis*		P3	
13.	12219	*Grevillea bronwenae*		P3	
14.	18436	*Grevillea manglesioides subsp. ferricola*		P3	
15.	1296	*Johnsonia inconspicua*		P3	
16.	45084	*Lasiopetalum laxiflorum*		P3	
17.	12077	*Pimelea ciliata subsp. longituba*		P3	
18.	4179	*Pultenaea pinifolia*		P3	
19.	16937	*Synaphea decumbens*		P3	
Priority 4					
20.	3339	*Acacia flagelliformis*		P4	
21.	3571	*Acacia tayloriana*		P4	
22.	35657	*Chamelaucium sp. Yoongarillup (G.J. Keighery 3635)*		P4	
23.	3096	*Drosera fimbriata (Manypeaks Sundew)*		P4	
24.	1945	*Franklandia triaristata (Lanolme Bush)*		P4	
25.	1336	*Thysanotus isantherus*		P4	
Non-conservation taxon					
26.	15429	*Acacia alata var. alata*			
27.	3233	*Acacia barbinervis*			
28.	3247	*Acacia browniana*			
29.	11731	*Acacia browniana var. browniana*			
30.	3307	*Acacia divergens*			
31.	3331	*Acacia extensa (Wiry Wattle)*			
32.	3347	*Acacia gilbertii*			
33.	3374	*Acacia huegelii*			

	Name ID	Species Name	Naturalised	Conservation Code	Endemic To Query Area
34.	3410	*Acacia lateriticola*			
35.	3424	*Acacia littorea*			
36.	3448	*Acacia mooreana*			
37.	3453	*Acacia myrtifolia*			
38.	3464	*Acacia obovata*			
39.	3502	*Acacia pulchella (Prickly Moses)*			
40.	15481	*Acacia pulchella var. glaberrima*			
41.	15483	*Acacia pulchella var. pulchella*			
42.	30036	*Acacia saligna subsp. stolonifera*			
43.		*Acacia sp.*			
44.	3557	*Acacia stenoptera (Narrow Winged Wattle)*			
45.	3567	*Acacia subracemosa*			
46.	3588	*Acacia uliginosa*			
47.	3591	*Acacia urophylla*			
48.	15487	*Acacia varia var. varia*			
49.	6203	*Actinotus glomeratus*			
50.	14970	*Adenanthos barbiger*			
51.	1790	*Adenanthos meisneri*			
52.	1791	*Adenanthos obovatus (Basket Flower)*			
53.	28281	*Adenanthos sp. Whicher Range (G.J. Keighery 9736)*			
54.	5316	*Agonis flexuosa (Peppermint, Wonil)*			
55.	17202	*Agonis flexuosa var. flexuosa*			
56.	23474	*Agrostocrinum hirsutum*			
57.	185	*Aira cupaniana (Silvery Hairgrass)*	Y		
58.	1728	*Allocasuarina fraseriana (Sheoak, Kondil)*			
59.	1732	*Allocasuarina humilis (Dwarf Sheoak)*			
60.	1734	*Allocasuarina microstachya*			
61.	1739	*Allocasuarina thuyoides (Horned Sheoak)*			
62.	1489	*Amaryllis belladonna (Belladonna Lily)*	Y		
63.	4585	*Amperea ericoides*			
64.	13101	*Amperea simulans*			
65.	194	*Amphipogon amphipogonoides*			
66.	197	*Amphipogon debilis*			
67.	198	*Amphipogon laguroides*			
68.	20184	*Amphipogon laguroides subsp. laguroides*			
69.	1058	*Anarthria gracilis*			
70.	1062	*Anarthria prolifera*			
71.	1063	*Anarthria scabra*			
72.	6306	*Andersonia caerulea (Foxtails)*			
73.	6312	*Andersonia involucrata*			
74.	6317	*Andersonia micrantha*			
75.	1407	*Anigozanthos flavidus (Tall Kangaroo Paw)*			
76.	11261	*Anigozanthos manglesii subsp. manglesii*			
77.	1416	*Anigozanthos viridis (Green Kangaroo Paw, Kurulbardang)*			
78.	7411	*Anthotium humile (Dwarf Anthotium)*			
79.	202	*Anthoxanthum odoratum (Sweet Vernal Grass)*	Y		
80.	3688	*Actus gracillima*			
81.	3689	*Actus intermedia*			
82.	1117	*Aphelia cyperoides*			
83.	7838	*Arctotheca calendula (Cape Weed, African Marigold)*	Y		
84.	46393	*Arctotheca calendula x populifolia*	Y		
85.	26484	*Areschougia ligulata*			
86.	64	*Asplenium trichomanes (Maidenhair Spleenwort)*			
87.	20350	*Astartea affinis (West-coast Astartea)*			
88.	45213	*Astartea pulchella*			
89.	4401	*Asterolasia squamuligera*			
90.	6323	*Astroloma ciliatum (Candle Cranberry)*			
91.	6334	*Astroloma pallidum (Kick Bush)*			
92.	20013	*Axonopus fissifolius*	Y		
93.	1800	*Banksia attenuata (Slender Banksia, Piara)*			
94.	49039	*Banksia dallanneyi subsp. dallanneyi*			Y
95.	32577	*Banksia dallanneyi subsp. dallanneyi var. mellicula*			
96.	32616	*Banksia dallanneyi subsp. sylvestris*			
97.	1819	*Banksia grandis (Bull Banksia, Pulgarla)*			
98.	1822	*Banksia ilicifolia (Holly-leaved Banksia)*			
99.	32315	*Barbula calycina*			
100.	739	*Baumea acuta (Pale Twig-rush)*			
101.	5392	*Beaufortia sparsa (Swamp Bottlebrush)*			
102.	3157	*Billardiera floribunda (White-flowered Billardiera)*			
103.	25798	*Billardiera fusiformis (Australian Bluebell)*			

	Name ID	Species Name	Naturalised	Conservation Code	Endemic To Query Area
104.	3159	*Billardiera laxiflora*			
105.	3165	*Billardiera variifolia*			
106.	11503	*Boronia crenulata subsp. crenulata var. crenulata*			
107.	17653	*Boronia crenulata subsp. pubescens*			
108.	4414	*Boronia cymosa (Granite Boronia)*			
109.	4415	*Boronia defoliata*			
110.	4417	*Boronia dichotoma*			
111.	4422	*Boronia gracilipes (Karri Boronia)*			
112.	4428	*Boronia megastigma (Scented Boronia)*			
113.	4429	*Boronia molloyae (Tall Boronia)*			
114.	4442	*Boronia stricta*			
115.	20392	*Boronia tenuior*			
116.	1267	*Borya constricta*			
117.	14396	*Bossiaea aquifolium subsp. aquifolium*			
118.	3708	*Bossiaea disticha*			
119.	3713	*Bossiaea linophylla*			
120.	3714	*Bossiaea ornata (Broad Leaved Brown Pea)*			
121.	3718	*Bossiaea rufa*			
122.	245	*Briza minor (Shivery Grass)*	Y		
123.	250	*Bromus hordeaceus (Soft Brome)*	Y		
124.		*Bryum sp.*			
125.	12770	*Burchardia congesta*			
126.	1385	*Burchardia multiflora (Dwarf Burchardia)*			
127.	13853	*Caladenia arrecta*			
128.	15332	*Caladenia attingens subsp. attingens*			
129.	1580	*Caladenia cairnsiana (Zebra Orchid)*			
130.	15341	*Caladenia citrina*			
131.	1581	*Caladenia corynephora*			
132.	1590	*Caladenia ferruginea (Rusty Spider Orchid)*			
133.	1597	*Caladenia infundibularis*			
134.	15366	*Caladenia longicauda subsp. merrittii*			
135.	1603	*Caladenia longiclavata (Clubbed Spider Orchid)*			
136.	15503	*Caladenia paludosa*			
137.	10830	*Caladenia rhomboidiformis*			
138.		*Caladenia sp.*			
139.	18040	*Caladenia thinicola*			
140.	45758	*Calectasia demarzii (Demarz's Tinsel Lily)*			
141.	10861	*Callistachys lanceolata (Wonnich)*			
142.	26536	*Callophycus oppositifolius*			
143.	35163	*Calothamnus planifolius var. pallidifolius*			
144.	5429	*Calothamnus sanguineus (Silky-leaved Blood flower, Pindak)*			
145.	5439	*Calytrix angulata (Yellow Starflower)*			
146.	5458	*Calytrix flavescens (Summer Starflower)*			
147.	32338	*Campylopus introflexus*	Y		
148.	2951	*Cassytha flava (Dodder Laurel)*			
149.	2952	*Cassytha glabella (Tangled Dodder Laurel)*			
150.	2957	*Cassytha racemosa (Dodder Laurel)*			
151.	11242	*Cassytha racemosa forma pilosa*			
152.	26556	*Caulerpa cactoides*			
153.	6542	*Centaurium tenuiflorum*	Y		
154.	7367	*Centranthus ruber (Red Valerian)*	Y		Y
155.	1128	*Centrolepis fascicularis*			
156.	1133	*Centrolepis pilosa*			
157.	18156	*Chamaecytisus palmensis (Tagasaste)*	Y		
158.	1280	*Chamaescilla corymbosa (Blue Squill)*			
159.	31	*Cheilanthes austrotenuifolia*			
160.	2494	*Chenopodium murale (Nettle-leaf Goosefoot)*	Y		
161.	762	*Chorizandra cymbaria (Heron Bristle Rush)*			
162.	3754	*Chorizema diversifolium*			
163.	3757	*Chorizema glycinifolium*			
164.	12765	*Chorizema nanum*			
165.	3760	*Chorizema reticulatum (Showy Flame Pea)*			
166.	3761	*Chorizema rhombeum*			
167.	14586	*Chorizema spathulatum*			
168.	2929	*Clematis pubescens (Common Clematis)*			
169.	4550	*Comesperma calymega (Blue-spike Milkwort)*			
170.	4551	*Comesperma ciliatum*			
171.	4564	*Comesperma virgatum (Milkwort)*			
172.	16875	*Conospermum caeruleum subsp. debile*			
173.	16854	*Conospermum capitatum subsp. capitatum*			

	Name ID	Species Name	Naturalised	Conservation Code	Endemic To Query Area
174.	16853	*Conospermum capitatum subsp. glabratum*			
175.	16847	*Conospermum paniculatum*			
176.	1418	*Conostylis aculeata (Prickly Conostylis)*			
177.	11826	*Conostylis aculeata subsp. aculeata*			
178.	1438	*Conostylis laxiflora*			
179.	11597	*Conostylis setigera subsp. setigera*			
180.	17104	*Corymbia calophylla (Marri)*			
181.	17105	*Corymbia haematoxylon (Mountain Marri)*			
182.	7945	*Cotula coronopifolia (Waterbuttons)*	Y		
183.	13354	*Craspedia variabilis*			
184.	13484	*Cryptandra arbutiflora var. tubulosa*			
185.	768	*Cyathochaeta avenacea*			
186.	769	*Cyathochaeta clandestina*			
187.	7444	*Dampiera hederacea (Karri Dampiera)*			
188.	7454	*Dampiera linearis (Common Dampiera)*			
189.	5508	*Darwinia citriodora (Lemon-scented Darwinia)*			
190.	1218	*Dasypogon bromeliifolius (Pineapple Bush)*			
191.	1219	*Dasypogon hookeri (Pineapple Bush)*			
192.	6218	*Daucus glochidiatus (Australian Carrot)*			
193.	19747	*Daviesia decurrens subsp. decurrens*			
194.	18560	*Daviesia divaricata subsp. divaricata*			
195.	3815	*Daviesia horrida (Prickly Bitter-pea)*			
196.	3817	*Daviesia inflata*			
197.	3819	*Daviesia longifolia*			
198.	17691	*Desmocladus fasciculatus*			
199.	299	*Deyeuxia quadriseta (Reed Bentgrass)*			
200.	7487	*Diaspasis filifolia (Thread-leaved Diaspasis)*			
201.	6616	*Dichondra repens (Kidney Weed)*			
202.	20367	*Dillwynia laxiflora*			
203.	4757	*Dodonaea ceratocarpa*			
204.	1640	*Drakaea glyptodon (King-in-his-carriage)*			
205.	11156	*Drakaea livida*			
206.	3094	*Drosera dichrosepala (Rusty Sundew)*			
207.	3095	*Drosera erythrorhiza (Red Ink Sundew)*			
208.	3109	*Drosera menziesii (Pink Rainbow)*			
209.	3118	*Drosera pallida (Pale Rainbow)*			
210.	3123	*Drosera platystigma (Black-eyed Sundew)*			
211.	3124	*Drosera pulchella (Pretty Sundew)*			
212.	13385	*Drosera stelliflora*			
213.	3131	*Drosera stolonifera (Leafy Sundew)*			
214.	33480	*Dysphania pumilio (Clammy Goosefoot)*			
215.	340	*Echinopogon ovatus (Hedgehog Grass)*			
216.	349	*Ehrharta longiflora (Annual Veldt Grass)*	Y		
217.	1067	*Empodisma gracillimum*			
218.	15412	*Eriochilus dilatatus subsp. multiflorus*			
219.	15414	*Eriochilus helonomos*			
220.	5605	*Eucalyptus cornuta (Yate, Yeid)*			
221.	5625	*Eucalyptus diversicolor (Karri)*			
222.	5628	*Eucalyptus drummondii (Drummond's Gum)*			
223.	5708	*Eucalyptus marginata (Jarrah, Djara)*			
224.	13547	*Eucalyptus marginata subsp. marginata (Jarrah)*			
225.	5739	*Eucalyptus patens (Swan River Blackbutt, Dwuda)*			
226.	19088	*Euchiton collinus*			
227.	15137	*Euchiton sphaericus*			
228.	3876	*Eutaxia epacridoides*			
229.	20214	*Eutaxia myrtifolia*			
230.	3879	*Eutaxia parvifolia*			
231.	834	*Evandra aristata*			
232.	10765	*Exocarpos sparteus (Broom Ballart, Djuk)*			
233.	8850	*Fallopia convolvulus*	Y		
234.	900	*Gahnia aristata*			
235.	902	*Gahnia decomposita*			
236.	3891	*Gastrolobium bilobum (Heart Leaf Poison)*			
237.	20475	*Gastrolobium capitatum*			
238.	19733	*Gastrolobium retusum*			
239.	3936	*Genista linifolia (Flaxleaf Broom)*	Y		
240.	18143	*Genista monspessulana*	Y		
241.	17043	*Glyceria declinata*	Y		
242.	3948	*Gompholobium capitatum*			
243.	10909	*Gompholobium confertum*			

	Name ID	Species Name	Naturalised	Conservation Code	Endemic To Query Area
244.	19216	*Gompholobium cyaninum*			
245.	3950	*Gompholobium knightianum*			
246.	3951	*Gompholobium marginatum*			
247.	3954	*Gompholobium polymorphum*			
248.	3955	*Gompholobium preissii*			
249.	11083	*Gompholobium scabrum*			
250.	3957	*Gompholobium tomentosum (Hairy Yellow Pea)*			
251.	11115	*Gompholobium villosum*			
252.	16746	*Gonocarpus benthamii subsp. benthamii*			
253.	29362	*Goodenia coerulea*			
254.	13165	*Goodenia pusilla*			
255.	1967	*Grevillea brachystylis (Short-styled Grevillea)*			
256.	15990	*Grevillea pulchella subsp. ascendens*			
257.	2112	*Grevillea trifida*			
258.	908	*Gymnoschoenus anceps*			
259.	1465	*Haemodorum discolor*			
260.	1468	*Haemodorum laxum*			
261.	2128	*Hakea amplexicaulis (Prickly Hakea)*			
262.	2137	*Hakea ceratophylla (Horned Leaf Hakea)*			
263.	2170	*Hakea lasianthoides*			
264.	2175	*Hakea lissocarpha (Honey Bush)*			
265.	2191	*Hakea oleifolia (Dungyn)*			
266.	2203	*Hakea ruscifolia (Candle Hakea)*			
267.	2212	*Hakea sulcata (Furrowed Hakea)*			
268.	2214	*Hakea trifurcata (Two-leaf Hakea)*			
269.	26900	*Haloplegma preissii*			
270.	6855	*Hemigenia humilis*			
271.	6865	*Hemigenia podalyrina*			
272.	6866	*Hemigenia pritzelii*			
273.	26925	*Heterocladia caudata*			
274.	5109	*Hibbertia amplexicaulis*			
275.	5114	*Hibbertia commutata*			
276.	5117	*Hibbertia cuneiformis (Cutleaf Hibbertia)*			
277.	5118	*Hibbertia cunninghamii*			
278.	20051	*Hibbertia diamesogenos*			
279.	5126	*Hibbertia furfuracea*			
280.	5132	*Hibbertia grossularifolia*			
281.	45534	*Hibbertia hypericoides subsp. hypericoides*			
282.	5137	*Hibbertia inconspicua*			
283.	19687	*Hibbertia notibractea*			
284.	5159	*Hibbertia pulchra*			
285.	5161	*Hibbertia quadricolor*			
286.	5169	*Hibbertia serrata (Serrate Leaved Guinea Flower)*			
287.	1294	*Hodgsoniola junciformis*			
288.	445	*Holcus setiger (Annual Fog)*	Y		
289.	5816	*Homalospermum firmum*			
290.	3964	*Hovea chorizemifolia (Holly-leaved Hovea)*			
291.	3965	*Hovea elliptica (Tree Hovea)*			
292.	3967	*Hovea stricta*			
293.	3968	*Hovea trisperma (Common Hovea)*			
294.	5218	*Hybanthus debilissimus*			
295.	452	*Hyparrhenia hirta (Tambookie Grass)*	Y		
296.	5182	*Hypericum perforatum (St John's Wort)*	Y		
297.	31234	*Hypericum perforatum subsp. veronense (St John's Wort)*	Y		
298.	5817	*Hypocalymma angustifolium (White Myrtle, Kudjid)*			
299.	5818	*Hypocalymma cordifolium*			
300.	5819	*Hypocalymma ericifolium*			
301.	5825	*Hypocalymma robustum (Swan River Myrtle)*			
302.	9352	*Hypochaeris radicata (Flat Weed, Cats-ear)*	Y		
303.	1070	*Hypolaena exsulca*			
304.	1531	*Iris germanica (Flag Iris)*	Y		
305.	912	*Isolepis cyperoides*			
306.	10831	*Isolepis prolifera (Budding Club-rush)*	Y		
307.	2237	*Isopogon sphaerocephalus (Drumstick Isopogon)*			
308.	7396	*Isotoma hypocrateriformis (Woodbridge Poison)*			
309.	1532	*Ixia maculata (Yellow Ixia)*	Y		
310.	8092	*Ixiolaena viscosa (Sticky Ixiolaena)*			
311.	4017	*Jacksonia horrida*			
312.	1295	*Johnsonia acaulis*			
313.	1297	*Johnsonia lupulina (Hooded Lily)*			

	Name ID	Species Name	Naturalised	Conservation Code	Endemic To Query Area
314.	8328	*Juncus amabilis*			
315.	1177	*Juncus articulatus (Jointed Rush)*	Y		
316.	1180	*Juncus capitatus (Capitate Rush)*	Y		
317.	1184	*Juncus holoschoenus (Jointleaf Rush)*			
318.	11922	*Juncus kraussii subsp. australiensis*			
319.	1186	*Juncus microcephalus*	Y		
320.	1190	*Juncus planifolius (Broadleaf Rush)*			
321.	1195	*Juncus subsecundus (Finger Rush)*			
322.	4036	*Kennedia carinata*			
323.	4037	*Kennedia coccinea (Coral Vine)*			
324.	15674	*Kunzea ciliata*			
325.	5835	*Kunzea micrantha*			
326.	5841	*Kunzea recurva*			
327.	14776	*Kunzea rostrata*			
328.	3669	*Labichea punctata (Lance-leaved Cassia)*			
329.	18585	*Lagenophora huegelii*			
330.	467	*Lagurus ovatus (Hare's Tail Grass)*	Y		
331.	48345	*Lasiopetalum occidentale*			
332.	6879	*Lavandula stoechas (Italian Lavender)*	Y		
333.	11464	*Laxmannia sessiliflora subsp. australis*			
334.	7568	*Lechenaultia biloba (Blue Leschenaultia)*			
335.	7572	*Lechenaultia expansa*			
336.	8099	*Leontodon saxatilis (Hairy Hawkbit)*	Y		
337.	42741	*Lepidosperma apricola*			
338.	929	*Lepidosperma carphoides (Black Rapier Sedge)*			
339.	932	*Lepidosperma effusum (Spreading Sword-sedge)*			
340.	934	*Lepidosperma gracile (Slender Sword Sedge)*			
341.	940	*Lepidosperma pubisquameum*			
342.	20398	*Lepidosperma sp. Blackwood (R. Davis 7696)*			
343.	29150	*Lepidosperma sp. Margaret River (B.J. Lepschi 1841)*			
344.	46376	*Leptocarpus denmarkicus*			
345.	1080	*Leptocarpus scariosus*			
346.	46379	*Leptocarpus thysananthus*			
347.	2342	*Leptomeria cunninghamii*			
348.	2355	*Leptomeria squarrulosa*			
349.	6358	*Leucopogon assimilis*			
350.	6360	*Leucopogon australis (Spiked Beard-heath)*			
351.	6367	*Leucopogon capitellatus*			
352.	6375	*Leucopogon cordatus*			
353.	6396	*Leucopogon glabellus*			
354.	6402	*Leucopogon hirsutus*			
355.	33380	*Leucopogon interstans*			
356.	6425	*Leucopogon oxycedrus*			
357.	6427	*Leucopogon parviflorus (Coast Beard-heath)*			
358.	6428	*Leucopogon pendulus*			
359.	6439	*Leucopogon pulchellus (Beard-heath)*			
360.	19662	*Leucopogon sp. Margaret River (J. Scott 207)*			
361.	6451	*Leucopogon tenuis*			
362.	6454	*Leucopogon verticillatus (Tassel Flower)*			
363.	7676	*Levenhookia pusilla (Midget Stylewort)*			
364.	49103	*Levenhookia sp. Whicher Range (J.A. Wege 2090)*			
365.	7677	*Levenhookia stipitata (Common Stylewort)*			
366.	59	*Lindsaea linearis (Screw Fern)*			
367.	36180	*Liparophyllum latifolium*			
368.	9289	*Lobelia anceps (Angled Lobelia)*			
369.	7402	*Lobelia gibbosa (Tall Lobelia)*			
370.	6515	*Logania vaginalis (White Spray)*			
371.	9356	*Logfia gallica*	Y		
372.	475	*Lolium multiflorum (Italian Ryegrass)*	Y		
373.	1222	*Lomandra brittanii*			
374.	1223	*Lomandra caespitosa (Tufted Mat Rush)*			
375.	1225	*Lomandra drummondii*			
376.	1228	*Lomandra hermaphrodita*			
377.	1229	*Lomandra integra*			
378.	1234	*Lomandra nigricans*			
379.	1238	*Lomandra pauciflora*			
380.	1243	*Lomandra sericea (Silky Mat Rush)*			
381.	1244	*Lomandra sonderi*			
382.	4059	*Lotus angustissimus (Narrowleaf Trefoil)*	Y		
383.	8564	*Lotus subbiflorus*	Y		

	Name ID	Species Name	Naturalised	Conservation Code	Endemic To Query Area
384.	1092	*Loxocarya cinerea*			
385.	15835	*Loxocarya striata*			
386.	1198	*Luzula meridionalis (Field Woodrush)*			
387.	1097	*Lyginia barbata*			
388.	18049	*Lyginia imberbis*			
389.	1656	*Lyperanthus serratus (Rattle Beak Orchid)*			
390.	36373	*Lysimachia minima*	Y		
391.	34736	*Lysinema pentapetalum*			
392.	5281	*Lythrum hyssopifolia (Lesser Loosestrife)*	Y		
393.	85	*Macrozamia riedlei (Zamia, Djiridji)*			
394.	17630	*Marianthus tenuis*			
395.	13273	*Melaleuca incana subsp. incana*			
396.	5952	*Melaleuca preissiana (Moonah)*			
397.	5980	*Melaleuca thymoides*			
398.	5987	*Melaleuca viminea (Mohan)*			
399.	953	*Mesomelaena graciliceps*			
400.	957	*Mesomelaena tetragona (Semaphore Sedge)*			
401.	485	*Microlaena stipoides (Weeping Grass)*			
402.	4090	*Mirbelia dilatata (Holly-leaved Mirbelia)*			
403.	37440	*Monopsis debilis var. depressa*	Y		
404.	2412	*Muehlenbeckia adpressa (Climbing Lignum)*			
405.	12778	*Myosotis discolor*	Y		
406.	492	*Neurachne alopecuroidea (Foxtail Mulga Grass)*			
407.	27103	*Nuytsia floribunda (Christmas Tree, Mudja)*			
408.	2401	*Nuytsia floribunda (Christmas Tree, Mudja)*			
409.	2365	*Olax benthamiana*			
410.	7346	*Opercularia echinocephala (Bristly Headed Stink Weed)*			
411.	7348	*Opercularia hispidula (Hispid Stinkweed)*			
412.	7354	*Opercularia volubilis (Twining Stinkweed)*			
413.	46316	*Orianthera serpyllifolia subsp. angustifolia*			
414.	46315	*Orianthera serpyllifolia subsp. serpyllifolia*			
415.	4114	*Ornithopus pinnatus (Slender Serradella)*	Y		
416.	7122	*Orobanche minor (Lesser Broomrape)*	Y		
417.	1537	*Orthrosanthus laxus (Morning Iris)*			
418.	11749	*Orthrosanthus laxus var. laxus (Morning Iris)*			
419.	4358	*Oxalis purpurea (Largeflower Wood Sorrel)*	Y		
420.	29834	*Ozothamnus diosmifolius*	Y		
421.	7117	*Pandorea pandorana*			
422.	2966	*Papaver somniferum (Opium Poppy)*	Y		
423.	527	*Paspalum dilatatum*	Y		
424.	1542	*Patersonia babianoides*			
425.	1546	*Patersonia juncea (Rush Leaved Patersonia)*			
426.	1548	*Patersonia limbata*			
427.	1550	*Patersonia occidentalis (Purple Flag, Koma)*			
428.	30472	*Patersonia occidentalis var. occidentalis*			
429.	11550	*Patersonia umbrosa var. xanthina (Yellow Flags)*			
430.	4343	*Pelargonium capitatum (Rose Pelargonium)*	Y		
431.	6245	*Pentapeltis peltigera*			
432.	16477	*Pericalymma ellipticum var. ellipticum*			
433.	11020	*Persicaria hydropiper*			
434.	2262	*Persoonia elliptica (Spreading Snottygobble)*			
435.	2267	*Persoonia longifolia (Snottygobble)*			
436.	2273	*Persoonia saccata (Snottygobble)*			
437.	2293	*Petrophile diversifolia*			
438.	2299	*Petrophile linearis (Pixie Mops)*			
439.	2309	*Petrophile serruriae*			
440.	551	*Phalaris minor (Lesser Canary Grass)*	Y		
441.	18529	*Philotheca spicata (Pepper and Salt)*			
442.	1478	*Phlebocarya ciliata*			
443.	5231	*Pimelea angustifolia (Narrow-leaved Pimelea)*			
444.	5232	*Pimelea argentea (Silvery Leaved Pimelea)*			
445.	5249	*Pimelea hispida (Bristly Pimelea)*			
446.	18117	*Pimelea rosea subsp. rosea*			
447.	5264	*Pimelea spectabilis (Bunjong)*			
448.	12041	*Pimelea suaveolens subsp. suaveolens*			
449.	5269	*Pimelea sylvestris*			
450.	88	*Pinus radiata (Radiata Pine)*	Y		
451.	16322	*Pittosporum undulatum*	Y		
452.	7303	*Plantago lanceolata (Ribwort Plantain)*	Y		
453.	6249	*Platysace compressa (Tapeworm Plant)*			

	Name ID	Species Name	Naturalised	Conservation Code	Endemic To Query Area
454.	6253	*Platysace filiformis*			
455.	11160	*Platysace haplosciadia*			
456.	6259	*Platysace tenuissima*			
457.	577	*Poa poiformis (Coastal Poa)*			
458.	578	*Poa porphyroclados*			
459.	86	*Podocarpus drouynianus (Wild Plum, Kula)*			
460.	2905	*Polycarpon tetraphyllum (Fourleaf Allseed)*	Y		
461.	4690	*Poranthera huegelii*			
462.	1683	*Prasophyllum triangulare (Dark Leek Orchid)*			
463.	44527	*Pterostylis erubescens*			
464.	44526	*Pterostylis karri*			
465.	1693	*Pterostylis recurva (Jug Orchid)*			
466.		*Pterostylis sp.*			
467.	18655	*Pterostylis sp. crinkled leaf (G.J. Keighery 13426)*			
468.	1698	*Pterostylis vittata (Banded Greenhood)*			
469.	20195	*Pultenaea brachytropis*			
470.	4181	*Pultenaea reticulata*			
471.	48316	*Quercus suber*	Y		Y
472.	2932	*Ranunculus colonorum (Common Buttercup)*			
473.	2933	*Ranunculus muricatus (Sharp Buttercup)*	Y		
474.	18547	*Rhadinothamnus anceps*			
475.	2578	*Rhagodia baccata (Berry Saltbush)*			
476.	13300	*Rhodanthe citrina*			
477.	4695	*Ricinocarpos glaucus*			
478.	16243	*Rosa canina*	Y		
479.	32426	*Rosulabryum campylothecium*			
480.	20506	*Rubus anglocandicans*	Y		
481.	2429	*Rumex acetosella (Sorrel)*	Y		
482.	2430	*Rumex brownii (Swamp Dock)*	Y		
483.	40431	*Rytidosperma acerosum*			
484.	40425	*Rytidosperma caespitosum*			
485.	40426	*Rytidosperma occidentale*			
486.	7602	*Scaevola calliptera*			
487.	7613	*Scaevola glandulifera (Viscid Hand-flower)*			
488.	7624	*Scaevola microphylla (Small-leaved Scaevola)*			
489.	984	*Schoenus curvifolius*			
490.	992	*Schoenus grandiflorus (Large Flowered Bogrush)*			
491.	1005	*Schoenus obtusifolius*			
492.	1020	*Schoenus sublateralis*			
493.	6	*Selaginella gracillima (Tiny Clubmoss)*			
494.	8203	*Senecio diaschides*			
495.	7362	*Sherardia arvensis (Field Madder)*	Y		
496.	8225	*Siloxerus humifusus (Procumbent Siloxerus)*			
497.	10920	*Soliva sessilis (Jo-jo, Onehunga Weed)*	Y		
498.	8230	*Sonchus asper (Rough Sowthistle)*	Y		
499.	8231	*Sonchus oleraceus (Common Sowthistle)*	Y		
500.	1558	*Sparaxis bulbifera*	Y		
501.	17551	*Sphaerolobium drummondii*			
502.	4207	*Sphaerolobium medium*			
503.	4209	*Sphaerolobium racemulosum*			
504.	31952	*Sphenotoma gracilis (Swamp Paper-heath)*			
505.	31951	*Sphenotoma parviflora*			
506.	14917	*Sporadanthus rivularis*			
507.	6930	*Stachys arvensis (Staggerweed)*	Y		
508.	20537	*Stachystemon virgatus*			
509.	7684	*Stylidium amoenum (Lovely Triggerplant)*			
510.	30278	*Stylidium androsaceum*			
511.	39880	*Stylidium angustifolium subsp. glaucifolium*			
512.	7688	*Stylidium barleei (Tooth-leaved Triggerplant)*			
513.	7708	*Stylidium crassifolium (Thick-leaved Triggerplant)*			
514.	7713	*Stylidium dichotomum (Pins-and-needles)*			
515.	7718	*Stylidium diversifolium (Touch-me-not)*			
516.	7719	*Stylidium ecorne (Foot Triggerplant)*			
517.	19251	*Stylidium eriopodum*			
518.	7733	*Stylidium glaucum (Grey Triggerplant)*			
519.	25801	*Stylidium hesperium*			
520.	25829	*Stylidium neurophyllum (Coastal Plain Triggerplant)*			
521.	7774	*Stylidium piliferum (Common Butterfly Triggerplant)*			
522.	7785	*Stylidium repens (Matted Triggerplant)*			
523.	7787	*Stylidium rhynchocarpum (Black-beaked Triggerplant)*			

	Name ID	Species Name	Naturalised	Conservation Code	Endemic To Query Area
524.		*Stylidium sp.*			
525.	7799	*Stylidium spathulatum (Creamy Triggerplant)*			
526.	1260	*Stypandra glauca (Blind Grass)*			
527.	6476	*Styphelia tenuiflora (Common Pinheath)*			
528.	16883	*Synaphea damopsis*			
529.	2323	*Synaphea gracillima*			
530.	12911	*Synaphea obtusata*			
531.	2324	*Synaphea petiolaris (Synaphea)*			
532.	16863	*Synaphea petiolaris subsp. triloba*			
533.	32437	*Syntrichia antarctica*			
534.	15827	*Taraxis grossa*			
535.	20114	*Taxandria fragrans*			
536.	20135	*Taxandria linearifolia*			
537.	20133	*Taxandria parviceps*			
538.	4256	*Templetonia retusa (Cockies Tongues)*			
539.	1034	*Tetraria capillaris (Hair Sedge)*			
540.	1036	*Tetraria octandra*			
541.	35579	*Tetraria sp. Jarrah Forest (R. Davis 7391)*			
542.	667	*Tetrarrhena laevis (Forest Ricegrass)*			
543.	48341	*Tetratheca hirsuta subsp. viminea*			
544.	4544	*Tetratheca setigera*			
545.	1707	*Thelymitra flexuosa (Twisted Sun Orchid)*			
546.	11143	*Thelymitra graminea*			
547.	18248	*Thelymitra granitora*			
548.	11053	*Thelymitra macrophylla*			
549.	1710	*Thelymitra mucida (Plum Orchid)*			
550.	20731	*Thelymitra vulgaris*			
551.	5080	*Thomasia foliosa*			
552.	5087	*Thomasia macrocarpa (Large Fruited Thomasia)*			
553.	5091	*Thomasia paniculata*			
554.	5092	*Thomasia pauciflora (Few Flowered Thomasia)*			
555.	5097	*Thomasia rhynchocarpa*			
556.	1339	*Thysanotus multiflorus (Many-flowered Fringe Lily)*			
557.		*Thysanotus sp.*			
558.	1354	*Thysanotus tenellus*			
559.	8248	*Tolpis barbata (Yellow Hawkweed)*	Y		
560.	6280	*Trachymene pilosa (Native Parsnip)*			
561.	4547	*Tremandra diffusa*			
562.	4548	*Tremandra stelligera*			
563.	1485	*Tribonanthes violacea (Violet Tiurndin)*			
564.	8251	*Trichocline spathulata (Native Gerbera)*			
565.	17541	*Trifolium incarnatum var. incarnatum*	Y		
566.	4302	*Trifolium ligusticum (Ligurian Clover)*	Y		
567.	35016	*Trihaloragis hexandra subsp. integrifolia*			
568.	34965	*Trihaloragis hexandra subsp. serrata*			
569.	4737	*Tripterococcus brunonis (Winged Stackhousia)*			
570.	11665	*Trymalium ledifolium var. ledifolium*			
571.	13479	*Trymalium ledifolium var. rosmarinifolium*			
572.	33438	*Trymalium odoratissimum subsp. trifidum*			
573.	4317	*Ulex europaeus (Gorse)*	Y		
574.	38388	*Ursinia anthemoides subsp. anthemoides*	Y		
575.	33537	*Vallisneria australis*	Y		
576.	7665	*Velleia trinervis*			
577.	8257	*Vellereophyton dealbatum (White Cudweed)*	Y		
578.	15618	*Verticordia plumosa var. plumosa*			
579.	4325	*Viminaria juncea (Swishbush, Koweda)*			
580.	6575	*Vinca major (Blue Periwinkle)*	Y		
581.	7388	*Wahlenbergia multicaulis*			
582.	18118	*Watsonia meriana var. meriana*	Y		
583.	1569	*Watsonia versfeldii*	Y		
584.	1394	*Wurmbea dioica (Early Nancy)*			
585.	20737	*X Cyanthera glossodioides*			
586.	1253	*Xanthorrhoea gracilis (Graceful Grass Tree, Mimidi)*			
587.	1256	*Xanthorrhoea preissii (Grass tree, Palga)*			
588.	6284	*Xanthosia candida*			
589.	6289	*Xanthosia huegelii*			
590.	19330	*Xanthosia tasmanica*			
591.	2331	*Xylomelum occidentale (Woody Pear, Djandin)*			
592.	15819	*Xyris atrovirida*			
593.	1145	*Xyris gracillima*			

NatureMap
Mapping Western Australia's biodiversity

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
594.	1146	*Xyris inaequalis*			
595.	1150	*Xyris lanata*			
596.	1049	*Zantedeschia aethiopica (Arum Lily)*	Y		

Conservation Codes
T - Rare or likely to become extinct
X - Presumed extinct
IA - Protected under international agreement
S - Other specially protected fauna
1 - Priority 1
2 - Priority 2
3 - Priority 3
4 - Priority 4
5 - Priority 5

[1] For NatureMap's purposes, species flagged as endemic are those whose records are wholely contained within the search area. Note that only those records complying with the search criterion are included in the calculation. For example, if you limit records to those from a specific datasource, only records from that datasource are used to determine if a species is restricted to the query area.

NatureMap
Mapping Western Australia's biodiversity

42-0322NM Fauna 10km Buffer Report

Created By Guest user on 03/03/2022

Kingdom Animalia
Current Names Only Yes
Core Datasets Only Yes
Method 'By Circle'
Centre 115° 06' 26" E,33° 51' 25" S
Buffer 10km
Group By Conservation Status

Conservation Status	Species	Records
Non-conservation taxon	231	1684
Other specially protected fauna	1	24
Priority 3	1	1
Priority 4	3	15
Rare or likely to become extinct	13	171
TOTAL	**249**	**1895**

	Name ID	Species Name	Naturalised	Conservation Code	Endemic To Query Area
Rare or likely to become extinct					
1.	34110	*Austroassiminea letha (Cape Leeuwin Freshwater Snail)*		T	
2.	24731	*Calyptorhynchus banksii subsp. naso (Forest Red-tailed Black Cockatoo)*		T	
3.	24733	*Calyptorhynchus baudinii (Baudin's Cockatoo, White-tailed Long-billed Black Cockatoo)*		T	
4.	24734	*Calyptorhynchus latirostris (Carnaby's Cockatoo, White-tailed Short-billed Black Cockatoo)*		T	
5.	48400	*Calyptorhynchus sp. (white-tailed black cockatoo)*		T	
6.	25335	*Caretta caretta (Loggerhead Turtle)*		T	
7.	24092	*Dasyurus geoffroii (Chuditch, Western Quoll)*		T	
8.	33945	*Engaewa pseudoreducta (Margaret River Burrowing Crayfish)*		T	
9.	33946	*Engaewa reducta (Dunsborough Burrowing Crayfish)*		T	
10.	24166	*Pseudocheirus occidentalis (Western Ringtail Possum, ngwayir)*		T	
11.	24388	*Psophodes nigrogularis subsp. nigrogularis (Western Whipbird (western heath))*		T	
12.	24145	*Setonix brachyurus (Quokka)*		T	
13.	34113	*Westralunio carteri (Carter's Freshwater Mussel)*		T	
Other specially protected fauna					
14.	48070	*Phascogale tapoatafa subsp. wambenger (South-western Brush-tailed Phascogale, Wambenger)*		S	
Priority 3					
15.	34030	*Geotria australis (Pouched Lamprey)*		P3	
Priority 4					
16.	24215	*Hydromys chrysogaster (Water-rat, Rakali)*		P4	
17.	48588	*Isoodon fusciventer (Quenda, southwestern brown bandicoot)*		P4	
18.	48022	*Notamacropus irma (Western Brush Wallaby)*		P4	
Non-conservation taxon					
19.	24260	*Acanthiza apicalis (Broad-tailed Thornbill, Inland Thornbill)*			
20.	24261	*Acanthiza chrysorrhoa (Yellow-rumped Thornbill)*			
21.	24262	*Acanthiza inornata (Western Thornbill)*			
22.	24560	*Acanthorhynchus superciliosus (Western Spinebill)*			
23.		*Acariformes sp.*			
24.	25535	*Accipiter cirrocephalus (Collared Sparrowhawk)*			
25.	25536	*Accipiter fasciatus (Brown Goshawk)*			
26.		*Acritoptila globosa*			
27.		*Aeshnidae sp.*			
28.		*Aetapcus maculatus*			
29.		*Alotanypus dalyupensis*			
30.		*Amphisopodidae sp.*			
31.		*Aname mainae*			
32.		*Aname tepperi*			

	Name ID	Species Name	Naturalised	Conservation Code	Endemic To Query Area
33.	24312	*Anas gracilis (Grey Teal)*			
34.	24313	*Anas platyrhynchos (Mallard)*			
35.	24316	*Anas superciliosa (Pacific Black Duck)*			
36.		*Ancylidae sp.*			
37.	47414	*Anhinga novaehollandiae (Australasian Darter)*			
38.	24088	*Antechinus flavipes subsp. leucogaster (Yellow-footed Antechinus, Mardo)*			
39.	24561	*Anthochaera carunculata (Red Wattlebird)*			
40.	24562	*Anthochaera lunulata (Western Little Wattlebird)*			
41.	24285	*Aquila audax (Wedge-tailed Eagle)*			
42.		*Archaeosynthemis leachii*			
43.		*Archaeosynthemis occidentalis*			
44.		*Archaeosynthemis spiniger*			
45.		*Archichauliodes sp.*			
46.	25558	*Ardea ibis (Cattle Egret)*			
47.		*Arkys walckenaeri*			
48.		*Arrenuridae sp.*			
49.	24353	*Artamus cyanopterus (Dusky Woodswallow)*			
50.		*Aturidae sp.*			
51.		*Austracantha minax*			
52.		*Austroaeschna anacantha*			
53.		*Austrochiltonia sp.*			
54.		*Baetidae sp.*			
55.		*Barnardius zonarius*			
56.		*Bibulmena kadjina*			
57.	24319	*Biziura lobata (Musk Duck)*			
58.		*Botryocladius freemani*			
59.	25716	*Cacatua sanguinea (Little Corella)*			
60.	25598	*Cacomantis flabelliformis (Fan-tailed Cuckoo)*			
61.	42307	*Cacomantis pallidus (Pallid Cuckoo)*			
62.		*Caenidae sp.*			
63.	25717	*Calyptorhynchus banksii (Red-tailed Black-Cockatoo)*			
64.		*Ceratopogonidae sp.*			
65.		*Cercophonius sulcatus*			
66.	24186	*Chalinolobus gouldii (Gould's Wattled Bat)*			
67.	24187	*Chalinolobus morio (Chocolate Wattled Bat)*			
68.	24321	*Chenonetta jubata (Australian Wood Duck, Wood Duck)*			
69.	33939	*Cherax calnii (Marron)*			
70.		*Cherax destructor*			
71.		*Cherax quinquecarinatus*			
72.		*Chironominae sp.*			
73.		*Chironomus aff. alternans (V24) (CB)*			
74.		*Chironomus tepperi*			
75.	24980	*Christinus marmoratus (Marbled Gecko)*			
76.		*Cladocera (non-daphniidae)*			
77.		*Cladocera (unident.)*			
78.	25675	*Colluricincla harmonica (Grey Shrike-thrush)*			
79.	24399	*Columba livia (Domestic Pigeon)*	Y		
80.		*Copepoda sp.*			
81.	25568	*Coracina novaehollandiae (Black-faced Cuckoo-shrike)*			
82.		*Cordulidae sp.*			
83.		*Corixidae sp.*			
84.		*Cormocephalus aurantiipes*			
85.	25592	*Corvus coronoides (Australian Raven)*			
86.		*Corydalidae sp.*			
87.	25595	*Cracticus tibicen (Australian Magpie)*			
88.	25596	*Cracticus torquatus (Grey Butcherbird)*			
89.		*Cricotopus 'parbicinctus'*			
90.	25398	*Crinia georgiana (Quacking Frog)*			
91.	25399	*Crinia glauerti (Clicking Frog)*			
92.	25401	*Crinia pseudinsignifera (Bleating Froglet)*			
93.		*Culicidae sp.*			
94.		*Curculionidae sp.*			
95.	30901	*Dacelo novaeguineae (Laughing Kookaburra)*	Y		
96.	25673	*Daphoenositta chrysoptera (Varied Sittella)*			
97.		*Dicrotendipes sp. A (V47) (SAP)*			
98.		*Dugesiidae sp.*			
99.		*Dytiscidae sp.*			
100.	25096	*Egernia kingii (King's Skink)*			
101.	25100	*Egernia napoleonis*			
102.		*Egretta novaehollandiae*			

	Name ID	Species Name	Naturalised	Conservation Code	Endemic To Query Area
103.		*Emertonella maga*			
104.		*Empididae sp.*			
105.		*Enchytraeidae sp.*			
106.		*Eolophus roseicapillus*			
107.	24652	*Eopsaltria georgiana (White-breasted Robin)*			
108.		*Ephydridae sp.*			
109.	25621	*Falco berigora (Brown Falcon)*			
110.	25622	*Falco cenchroides (Australian Kestrel, Nankeen Kestrel)*			
111.	34028	*Galaxias occidentalis (Western Minnow)*			
112.	25530	*Gerygone fusca (Western Gerygone)*			
113.		*Glossiphoniidae sp.*			
114.	24443	*Grallina cyanoleuca (Magpie-lark)*			
115.		*Gripopterygidae sp.*			
116.		*Gyrinidae sp.*			
117.		*Harrisius sp. B (SFM)*			
118.	25410	*Heleioporus eyrei (Moaning Frog)*			
119.		*Hemicorduliidae sp.*			
120.	25118	*Hemiergis peronii subsp. tridactyla*			
121.	47965	*Hieraaetus morphnoides (Little Eagle)*			
122.	24491	*Hirundo neoxena (Welcome Swallow)*			
123.		*Hydraenidae sp.*			
124.		*Hydrometridae sp.*			
125.		*Hydrophilidae sp.*			
126.		*Hydroptilidae sp.*			
127.		*Hyriidae sp.*			
128.		*Isopeda leishmanni*			
129.		*Kiefferulus intertinctus*			
130.		*Lampona cylindrata*			
131.		*Lectrides parilis*			
132.		*Lepidoptera (non-pyralid)*			
133.		*Leptoceridae sp.*			
134.		*Leptoperla australica*			
135.		*Leptophlebiid genus S sp. AV1*			
136.		*Leptophlebiidae sp.*			
137.		*Libellulidae sp.*			
138.	25661	*Lichmera indistincta (Brown Honeyeater)*			
139.	25415	*Limnodynastes dorsalis (Western Banjo Frog)*			
140.	41416	*Liopholis pulchra subsp. pulchra (South-western Rock Skink, Spectacled Rock Skink)*			
141.	25378	*Litoria adelaidensis (Slender Tree Frog)*			
142.	25388	*Litoria moorei (Motorbike Frog)*			
143.		*Lycosa gilberta*			
144.	25650	*Malurus elegans (Red-winged Fairy-wren)*			
145.	25654	*Malurus splendens (Splendid Fairy-wren)*			
146.		*Megaloptera sp.*			
147.		*Megapodagrionidae sp.*			
148.	24598	*Merops ornatus (Rainbow Bee-eater)*			
149.		*Mesoveliidae sp.*			
150.		*Microcarbo melanoleucos*			
151.		*Microvelia (Austromicrovelia) australiensis*			
152.		*Microvelia sp.*			
153.	25240	*Morelia spilota subsp. imbricata (Carpet Python)*			
154.	25191	*Morethia lineocellata*			
155.		*Naididae sp.*			
156.		*Nannoperca vittata*			
157.		*Neboissophlebia occidentalis*			
158.		*Nematoda sp.*			
159.		*Neophargidae sp.*			
160.		*Newmanoperla exigua*			
161.		*Notalina sp.*			
162.		*Notalina sp. AV15 (PSW)*			
163.	25252	*Notechis scutatus (Tiger Snake)*			
164.		*Notonectidae sp.*			
165.		*Notoperata tenax*			
166.		*Nousia sp. AV16*			
167.		*Nunciella aspera*			
168.	24194	*Nyctophilus geoffroyi (Lesser Long-eared Bat)*			
169.		*Nyungara bunni*			
170.		*Ochthebius sp.*			
171.		*Oligochaeta sp.*			
172.		*Oniscidae sp.*			

	Name ID	Species Name	Naturalised	Conservation Code	Endemic To Query Area
173.		*Orthocladiinae 'woodminer' (SAP)*			
174.		*Orthocladiinae sp.*			
175.		*Ostracoda (unident.)*			
176.		*Oxidae sp.*			
177.	25680	*Pachycephala rufiventris (Rufous Whistler)*			
178.		*Palaemonidae sp.*			
179.		*Paralimnophyes pullulus (V42)*			
180.		*Paramerina levidensis*			
181.		*Parastacidae sp.*			
182.	25681	*Pardalotus punctatus (Spotted Pardalote)*			
183.	25682	*Pardalotus striatus (Striated Pardalote)*			
184.	24648	*Pelecanus conspicillatus (Australian Pelican)*			
185.		*Perthiidae sp.*			
186.	48061	*Petrochelidon nigricans (Tree Martin)*			
187.	48066	*Petroica boodang (Scarlet Robin)*			
188.	24667	*Phalacrocorax sulcirostris (Little Black Cormorant)*			
189.	25699	*Phalacrocorax varius (Pied Cormorant)*			
190.	24409	*Phaps chalcoptera (Common Bronzewing)*			
191.		*Phreatoicidae sp.*			
192.		*Phreodrilidae sp.*			
193.	24596	*Phylidonyris novaehollandiae (New Holland Honeyeater)*			
194.		*Planorbidae sp.*			
195.	25720	*Platycercus icterotis (Western Rosella)*			
196.	25703	*Podargus strigoides (Tawny Frogmouth)*			
197.		*Polypedilum nr. convexum (SAP)*			
198.		*Polypedilum watsoni*			
199.	25722	*Polytelis anthopeplus (Regent Parrot)*			
200.	25259	*Pseudonaja affinis subsp. affinis (Dugite)*			
201.		*Purpureicephalus spurius*			
202.		*Pyralidae sp.*			
203.	24245	*Rattus rattus (Black Rat)*	Y		
204.		*Rheotanytarsus sp. (SFM)*			
205.		*Rheotanytarsus trivittatus*			
206.		*Rheotanytarsus underwoodi*			
207.	48096	*Rhipidura albiscapa (Grey Fantail)*			
208.	25614	*Rhipidura leucophrys (Willie Wagtail)*			
209.		*Richardsonianidae sp.*			
210.		*Riekoperla occidentalis*			
211.		*Riethia v4*			
212.		*Sciomyzidae sp.*			
213.		*Scirtidae sp.*			
214.		*Scolopendra laeta*			
215.	25534	*Sericornis frontalis (White-browed Scrubwren)*			
216.		*Servaea spinibarbis*			
217.		*Simulidae sp.*			
218.		*Skusella/"V12 ex-WA" (Cranston)*			
219.		*Sphaeriidae sp.*			
220.		*Spinicrus minimus*			
221.	24645	*Stagonopleura oculata (Red-eared Firetail)*			
222.		*Staphylinidae sp.*			
223.		*Sternopriscus sp.*			
224.	25655	*Stipiturus malachurus (Southern Emu-wren)*			
225.	25597	*Strepera versicolor (Grey Currawong)*			
226.		*Styloniscidae sp.*			
227.		*Synthemistidae sp.*			
228.		*Tabanidae sp.*			
229.	25705	*Tachybaptus novaehollandiae (Australasian Grebe, Black-throated Grebe)*			
230.	24331	*Tadorna tadornoides (Australian Shelduck, Mountain Duck)*			
231.		*Tanypodinae sp.*			
232.		*Tanytarsus aff manleyensis*			
233.		*Tanytarsus nr K5*			
234.		*Tanytarsus palmatus*			
235.		*Tasmanocoenis tillyardi*			
236.		*Telephlebiidae sp.*			
237.		*Temnocephalidea sp.*			
238.		*Thienemanniella sp. (V19) (SAP)*			
239.	24845	*Threskiornis spinicollis (Straw-necked Ibis)*			
240.		*Tipulidae sp.*			
241.	25723	*Trichoglossus haematodus (Rainbow Lorikeet)*			
242.	25521	*Trichosurus vulpecula (Common Brushtail Possum)*			

NatureMap
Mapping Western Australia's biodiversity

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
243.	24158	*Trichosurus vulpecula subsp. vulpecula (Common Brushtail Possum)*			
244.		*Triplectides sp. AV1 (SFM)*			
245.		*Triplectides sp. AV21 (SFM)*			
246.		*Urodacus novaehollandiae*			
247.		*Velildae sp.*			
248.	24206	*Vespadelus regulus (Southern Forest Bat)*			
249.	25765	*Zosterops lateralis (Grey-breasted White-eye, Silvereye)*			

Conservation Codes
T - Rare or likely to become extinct
X - Presumed extinct
IA - Protected under international agreement
S - Other specially protected fauna
1 - Priority 1
2 - Priority 2
3 - Priority 3
4 - Priority 4
5 - Priority 5

[1] For NatureMap's purposes, species flagged as endemic are those whose records are wholely contained within the search area. Note that only those records complying with the search criterion are included in the calculation. For example, if you limit records to those from a specific datasource, only records from that datasource are used to determine if a species is restricted to the query area.

Appendix B Protected Matters Search Tool Extract

Australian Government
Department of Agriculture, Water and the Environment

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected. Please see the caveat for interpretation of information provided here.

Report created: 14-Mar-2022

Summary
Details
- Matters of NES
- Other Matters Protected by the EPBC Act
- Extra Information

Caveat
Acknowledgements

Summary

Matters of National Environment Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance (Ramsar	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	2
Listed Threatened Species:	42
Listed Migratory Species:	20

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Lands:	5
Commonwealth Heritage Places:	None
Listed Marine Species:	25
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None
Habitat Critical to the Survival of Marine Turtles:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have

State and Territory Reserves:	17
Regional Forest Agreements:	1
Nationally Important Wetlands:	None
EPBC Act Referrals:	13
Key Ecological Features (Marine):	None
Biologically Important Areas:	None
Bioregional Assessments:	None
Geological and Bioregional Assessments:	None

Details

Matters of National Environmental Significance

Listed Threatened Ecological Communities [Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.
Status of Vulnerable, Disallowed and Ineligible are not MNES under the EPBC Act.

Community Name	Threatened Category	Presence Text	Buffer Status
Banksia Woodlands of the Swan Coastal Plain ecological community	Endangered	Community likely to occur within area	In buffer area only
Tuart (Eucalyptus gomphocephala) Woodlands and Forests of the Swan Coastal Plain ecological community	Critically Endangered	Community may occur within area	In buffer area only

Listed Threatened Species [Resource Information]

Status of Conservation Dependent and Extinct are not MNES under the EPBC Act.
Number is the current name ID.

Scientific Name	Threatened Category	Presence Text	Buffer Status
BIRD			
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat may occur within area	In feature area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area	In buffer area only
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat likely to occur within area	In feature area
Calyptorhynchus banksii naso Forest Red-tailed Black-Cockatoo, Karrak [67034]	Vulnerable	Species or species habitat known to occur within area	In feature area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area	In buffer area only
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Limosa lapponica menzbieri Northern Siberian Bar-tailed Godwit, Russkoye Bar-tailed Godwit [86432]	Critically Endangered	Species or species habitat may occur within area	In buffer area only
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area	In feature area
Pachyptila turtur subantarctica Fairy Prion (southern) [64445]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Species or species habitat may occur within area	In feature area
Thalassarche cauta Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area	In buffer area only
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In buffer area only
Zanda baudinii listed as Calyptorhynchus baudinii Baudin's Black-Cockatoo, Long-billed Black-cockatoo [87736]	Endangered	Breeding known to occur within area	In feature area
Zanda latirostris listed as Calyptorhynchus latirostris Carnaby's Black Cockatoo, Short-billed Black-cockatoo [87737]	Endangered	Species or species habitat known to occur within area	In feature area
CRUSTACEAN			
Cherax tenuimanus Hairy Marron, Margaret River Hairy Marron, Margaret River Marron [78931]	Critically Endangered	Species or species habitat may occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Engaewa pseudoreducta Margaret River Burrowing Crayfish [82674]	Critically Endangered	Species or species habitat known to occur within area	In buffer area only
Engaewa reducta Dunsborough Burrowing Crayfish [82675]	Critically Endangered	Species or species habitat known to occur within area	In feature area
FISH			
Nannatherina balstoni Balston's Pygmy Perch [66698]	Vulnerable	Species or species habitat known to occur within area	In buffer area only
FROG			
Geocrinia alba White-bellied Frog, Creek Frog [26181]	Critically Endangered	Species or species habitat may occur within area	In buffer area only
MAMMAL			
Bettongia penicillata ogilbyi Woylie [66844]	Endangered	Species or species habitat known to occur within area	In feature area
Dasyurus geoffroii Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat known to occur within area	In feature area
Pseudocheirus occidentalis Western Ringtail Possum, Ngwayir, Womp, Woder, Ngoor, Ngoolangit [25911]	Critically Endangered	Foraging, feeding or related behaviour likely to occur within area	In feature area
Setonix brachyurus Quokka [229]	Vulnerable	Species or species habitat may occur within area	In buffer area only
OTHER			
Westralunio carteri Carter's Freshwater Mussel, Freshwater Mussel [86266]	Vulnerable	Species or species habitat known to occur within area	In feature area
PLANT			
Banksia nivea subsp. uliginosa Swamp Honeypot [82766]	Endangered	Species or species habitat known to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Banksia squarrosa subsp. argillacea Whicher Range Dryandra [82769]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
Caladenia excelsa Giant Spider-orchid [56717]	Endangered	Species or species habitat likely to occur within area	In buffer area only
Caladenia hoffmanii Hoffman's Spider-orchid [56719]	Endangered	Species or species habitat likely to occur within area	In buffer area only
Caladenia huegelii King Spider-orchid, Grand Spider-orchid, Rusty Spider-orchid [7309]	Endangered	Species or species habitat may occur within area	In feature area
Caladenia lodgeana Lodge's Spider-orchid [68664]	Critically Endangered	Species or species habitat known to occur within area	In buffer area only
Daviesia elongata subsp. elongata Long-leaved Daviesia [64883]	Vulnerable	Species or species habitat known to occur within area	In buffer area only
Diuris micrantha Dwarf Bee-orchid [55082]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Drakaea micrantha Dwarf Hammer-orchid [56755]	Vulnerable	Species or species habitat known to occur within area	In feature area
Eucalyptus x phylacis Meelup Mallee [87817]	Endangered	Species or species habitat may occur within area	In buffer area only
Gastrolobium papilio Butterfly-leaved Gastrolobium [78415]	Endangered	Species or species habitat may occur within area	In feature area
Grevillea brachystylis subsp. grandis Large-flowered Short-styled Grevillea [85001]	Critically Endangered	Species or species habitat likely to occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Lambertia echinata subsp. occidentalis Western Prickly Honeysuckle [64528]	Endangered	Species or species habitat may occur within area	In buffer area only
REPTILE			
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding likely to occur within area	In buffer area only
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area	In buffer area only
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding likely to occur within area	In buffer area only

Listed Migratory Species		[Resource Information]	
Scientific Name	Threatened Category	Presence Text	Buffer Status
Migratory Marine Birds			
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area	In feature area
Ardenna carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Species or species habitat likely to occur within area	In buffer area only
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In buffer area only
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area	In buffer area only
Thalassarche cauta Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Thalassarche steadi			
White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In buffer area only
Migratory Marine Species			
Caretta caretta			
Loggerhead Turtle [1763]	Endangered	Breeding likely to occur within area	In buffer area only
Chelonia mydas			
Green Turtle [1765]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Dermochelys coriacea			
Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area	In buffer area only
Natator depressus			
Flatback Turtle [59257]	Vulnerable	Breeding likely to occur within area	In buffer area only
Migratory Terrestrial Species			
Motacilla cinerea			
Grey Wagtail [642]		Species or species habitat may occur within area	In feature area
Migratory Wetlands Species			
Actitis hypoleucos			
Common Sandpiper [59309]		Species or species habitat known to occur within area	In feature area
Calidris acuminata			
Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area	In feature area
Calidris canutus			
Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area	In buffer area only
Calidris ferruginea			
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat likely to occur within area	In feature area
Calidris melanotos			
Pectoral Sandpiper [858]		Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat may occur within area	In buffer area only
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area	In feature area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area	In buffer area only
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area	In buffer area only

Other Matters Protected by the EPBC Act

Commonwealth Lands [Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Commonwealth Land Name	State	Buffer Status
Unknown		
Commonwealth Land - [50382]	WA	In buffer area only
Commonwealth Land - [51992]	WA	In buffer area only
Commonwealth Land - [51103]	WA	In buffer area only
Commonwealth Land - [51990]	WA	In buffer area only
Commonwealth Land - [50383]	WA	In buffer area only

Listed Marine Species [Resource Information]

Scientific Name	Threatened Category	Presence Text	Buffer Status
Bird			
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area overfly marine area	In feature area
Ardenna carneipes as Puffinus carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Species or species habitat likely to occur within area	In buffer area only
Bubulcus ibis as Ardea ibis Cattle Egret [66521]		Species or species habitat may occur within area overfly marine area	In feature area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area	In feature area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area overfly marine area	In buffer area only
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat likely to occur within area overfly marine area	In feature area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area overfly marine area	In feature area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In buffer area only
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area	In buffer area only
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat may occur within area	In buffer area only
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area overfly marine area	In feature area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area overfly marine area	In feature area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area	In feature area
Pachyptila turtur Fairy Prion [1066]		Species or species habitat likely to occur within area	In buffer area only
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area	In buffer area only
Thalassarche cauta Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area	In buffer area only
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In buffer area only
Thinornis cucullatus as Thinornis rubricollis Hooded Dotterel, Hooded Plover [87735]		Species or species habitat known to occur within area overfly marine area	In buffer area only
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area overfly marine area	In buffer area only
Reptile			

Scientific Name	Threatened Category	Presence Text	Buffer Status
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding likely to occur within area	In buffer area only
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area	In buffer area only
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding likely to occur within area	In buffer area only

Extra Information

State and Territory Reserves			[Resource Information]
Protected Area Name	Reserve Type	State	Buffer Status
Bramley	National Park	WA	In buffer area only
Leeuwin-Naturaliste	National Park	WA	In buffer area only
NTWA Bushland covenant (0003)	Conservation Covenant	WA	In buffer area only
NTWA Bushland covenant (0037)	Conservation Covenant	WA	In buffer area only
NTWA Bushland covenant (0044A)	Conservation Covenant	WA	In buffer area only
NTWA Bushland covenant (0044B)	Conservation Covenant	WA	In buffer area only
NTWA Bushland covenant (0044C)	Conservation Covenant	WA	In buffer area only
NTWA Bushland covenant (0065A)	Conservation Covenant	WA	In buffer area only
NTWA Bushland covenant (0065B)	Conservation Covenant	WA	In buffer area only
NTWA Bushland covenant (0130)	Conservation Covenant	WA	In buffer area only
NTWA Bushland covenant (0148)	Conservation Covenant	WA	In buffer area only
NTWA Bushland covenant (0149)	Conservation Covenant	WA	In buffer area only
NTWA Bushland covenant (0152)	Conservation Covenant	WA	In buffer area only
NTWA Bushland covenant (0164)	Conservation Covenant	WA	In buffer area only
NTWA Bushland covenant (0168)	Conservation Covenant	WA	In buffer area only
Walburra	Nature Reserve	WA	In buffer area only

Protected Area Name	Reserve Type	State	Buffer Status
Yelverton	National Park	WA	In buffer area only

Regional Forest Agreements

[Resource Information]

Note that all areas with completed RFAs have been included.

RFA Name	State	Buffer Status
South West WA RFA	Western Australia	In feature area

EPBC Act Referrals

[Resource Information]

Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Controlled action				
Lot 32 Tom Cullity Drive, Wilyabrup	2020/8866	Controlled Action	Proposed Decision Comment	In buffer area only
Not controlled action				
Bussell Highway (Bramley Section) SLK Upgrade	2012/6511	Not Controlled Action	Completed	In buffer area only
Busselton to Flinders Bay Rails to Trails Project, WA	2013/6835	Not Controlled Action	Completed	In buffer area only
Busselton to Margaret River Transmission Line	2008/3964	Not Controlled Action	Completed	In buffer area only
Construction of the Margaret River bypass road	2012/6677	Not Controlled Action	Completed	In buffer area only
Geo-science Investigations	2005/2069	Not Controlled Action	Completed	In buffer area only
Gloucester Park Precinct-expansion of ovals and community facilities, Margaret River, WA	2017/7985	Not Controlled Action	Completed	In buffer area only
Improving rabbit biocontrol: releasing another strain of RHDV, sthrn two thirds of Australia	2015/7522	Not Controlled Action	Completed	In feature area
INDIGO Central Submarine Telecommunications Cable	2017/8127	Not Controlled Action	Completed	In feature area
Residential Development Riverslea Estate Stage 8, Margaret River, WA	2014/7227	Not Controlled Action	Completed	In buffer area only
West's gravel pit development, Cowaramup, WA	2015/7586	Not Controlled Action	Completed	In buffer area only
Not controlled action (particular manner)				
Clearing of understorey vegetation for fire management purposes	2010/5788	Not Controlled Action (Particular Manner)	Post-Approval	In buffer area only

Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Not controlled action (particular manner)				
INDIGO Marine Cable Route Survey (INDIGO)	2017/7996	Not Controlled Action (Particular Manner)	Post-Approval	In feature area

Caveat

1 PURPOSE

This report is designed to assist in identifying the location of matters of national environmental significance (MNES) and other matters protected by the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) which may be relevant in determining obligations and requirements under the EPBC Act.

The report contains the mapped locations of:

- World and National Heritage properties;
- Wetlands of International and National Importance;
- Commonwealth and State/Territory reserves;
- distribution of listed threatened, migratory and marine species;
- listed threatened ecological communities; and
- other information that may be useful as an indicator of potential habitat value.

2 DISCLAIMER

This report is not intended to be exhaustive and should only be relied upon as a general guide as mapped data is not available for all species or ecological communities listed under the EPBC Act (see below). Persons seeking to use the information contained in this report to inform the referral of a proposed action under the EPBC Act should consider the limitations noted below and whether additional information is required to determine the existence and location of MNES and other protected matters.

Where data are available to inform the mapping of protected species, the presence type (e.g. known, likely or may occur) that can be determined from the data is indicated in general terms. It is the responsibility of any person using or relying on the information in this report to ensure that it is suitable for the circumstances of any proposed use. The Commonwealth cannot accept responsibility for the consequences of any use of the report or any part thereof. To the maximum extent allowed under governing law, the Commonwealth will not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance

3 DATA SOURCES

Threatened ecological communities

For threatened ecological communities where the distribution is well known, maps are generated based on information contained in recovery plans, State vegetation maps and remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species

Threatened, migratory and marine species distributions have been discerned through a variety of methods. Where distributions are well known and if time permits, distributions are inferred from either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc.) together with point locations and described habitat; or modelled (MAXENT or BIOCLIM habitat modelling) using

Where little information is available for a species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc.).

In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More detailed distribution mapping methods are used to update these distributions

4 LIMITATIONS

The following species and ecological communities have not been mapped and do not appear in this report:

- threatened species listed as extinct or considered vagrants;
- some recently listed species and ecological communities;
- some listed migratory and listed marine species, which are not listed as threatened species; and
- migratory species that are very widespread, vagrant, or only occur in Australia in small numbers.

The following groups have been mapped, but may not cover the complete distribution of the species:

- listed migratory and/or listed marine seabirds, which are not listed as threatened, have only been mapped for recorded
- seals which have only been mapped for breeding sites near the Australian continent

The breeding sites may be important for the protection of the Commonwealth Marine environment.

Refer to the metadata for the feature group (using the Resource Information link) for the currency of the information.

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

© Commonwealth of Australia
Department of Agriculture Water and the Environment
GPO Box 858
Canberra City ACT 2601 Australia
+61 2 6274 1111

Appendix C Conservation Codes for WA Flora and Fauna

CONSERVATION CODE	CATEGORY
Threatened species (T)	Listed by order of the Minister as Threatened in the category of critically endangered, endangered or vulnerable under Section 19(1), or is a rediscovered species to be regarded as threatened species under section 26(2) of the *Biodiversity Conservation Act 2016* (BC Act). ***Threated fauna*** is that subset of 'Specially Protected Fauna' listed under Schedules 1 to 3 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for Threatened Fauna. ***Threatened flora*** is that subset of 'Rare Flora' listed under schedules 1 to 3 of the *Wildlife Conservation (Rare Flora) Notice 2018* for Threated Flora. The Assessment of the conservation status of these species is based on their national extent and ranked according to their level of threat using IUCN Red List categories and criteria as detailed below
Critically endangered species (CR)	Threatened species considered to be *"facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the criteria set out in the ministerial guidelines"*. Listed as critically endangered under section 19(1)(a) of the BC Act in accordance with the criteria set out in section 20 and the ministerial guidelines. Published under schedule 1 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for critically endangered fauna or the *Wildlife Conservation (Rare Flora) Notice 2018* for critically endangered flora.
Endangered species (EN)	Threatened species considered to be *"facing a very high risk of extinction in the wild in the near future, as determined in accordance with criteria set out in the ministerial guidelines"*. Listed as endangered under Section 19(1)(b) of the BC Act in accordance with the criteria set out in section 21 and the ministerial guidelines. Published under schedule 2 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for endangered fauna or the *Wildlife Conservation (Rare Flora) Notice 2018* for endangered flora.

CONSERVATION CODE	CATEGORY
Vulnerable species (VU)	Threatened species considered to *be "facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with criteria set out in the ministerial guidelines".* Listed as endangered under section 19(1)(c) of the BC Act in accordance with the criteria set out in section 22 and the ministerial guidelines. Published under schedule 3 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for vulnerable fauna or the *Wildlife Conservation (Rare Flora) Notice 2018* for vulnerable flora.
Extinct species (EX)	Species where *"there is no reasonable doubt that the last member of the species has died",* and listing is otherwise in accordance with the ministerial guidelines (section 24 of the BC Act). Published as presumed extinct under schedule 4 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for extinct fauna or the *Wildlife Conservation (Rare Flora) Notice 2018* for extinct flora.
Extinct in the wild species (EW)	Species that *"is known only to survive in cultivation, captivity or as a naturalised population well outside its part range; and it has not been recorded in its known habitat or expected habitat, at appropriate seasons, anywhere in its past range, despite surveys over a time frame appropriate to its life cycle and form",* and listing is otherwise in accordance with the ministerial guidelines (section 25 of the BC Act). Currently there are no threated fauna or flora species listed as extinct in the wild. If listing of a species as extinct in the wild occurs, then a schedule will be added to the applicable notice.
Specially protected species	Listed by order of the Minister as specially protected under section 13(1) of the BC Act. Meeting one or more of the following categories: species of special conservation interest; migratory species; cetaceans; species subject to international agreement; or species otherwise in need of special protection. Species that are listed as threatened species (critically endangered, endangered or vulnerable) or extinct species under the BC Act cannot also be listed as Specially Protected species.

CONSERVATION CODE	CATEGORY
Migratory species (MI)	Fauna that periodically or occasionally visit Australia or an external Territory or the exclusive economic zone; or the species is subject of an international agreement that relates to the protection of migratory species and that binds the Commonwealth; and listing is otherwise in accordance with the ministerial guidelines (Section 15 of the BC Act). Includes birds that are subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and the Republic of Korea (ROKAMBA), and fauna subject to the *Convention on the Conservation of Migratory Species of Wild Animals* (Bonn Convention), an environmental treaty under the United Nations Environment Program. Migratory species listed under the BC Act are a subset of the migratory animals, that are known to visit Western Australia, protected under the international agreements of treaties, excluding species that are listed as Threated species. Published as migratory birds protected under an international agreement under schedule 5 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018*.
Species of special conservation interest (conservation dependent fauna) (CD)	Fauna of special conservation need being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened, and listing is otherwise in accordance with the ministerial guidelines (section 14 of the BC Act). Published as conservation dependent fauna under schedule 6 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018*.
Other specially protected species (S)	Fauna otherwise in need of special protection to ensure their conservation, and listing is otherwise in accordance with the ministerial guidelines (section 18 of the BC Act). Published as other specially protected fauna under schedule 7 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018*.

CONSERVATION CODE	CATEGORY
Priority species (P)	Possibly threatened species that do not meet survey criteria, or are otherwise data deficient, are added to the Priority Fauna or Priority Flora Lists under Priorities 1, 2 or 3. These three categories are ranked in order of priority for survey and evaluation of conservation status so that consideration can be given to their declaration as threatened fauna or flora. Species that are adequately known, are rare but not threatened, or meet criteria for near threatened, or that have been recently removed from the threatened species or other specially protected fauna lists for other than taxonomic reasons, are placed in Priority 4. These species require regular monitoring. Assessment of Priority codes in based on the Western Australian distribution of the species, unless the distribution in WA is part of a contiguous population extending into adjacent States, as defined by the known spread of locations.
Priority 1 (P1) – Poorly-known species	Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g., agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases, or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.
Priority 2 (P2) – Poorly-known species	Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g., national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.

CONSERVATION CODE	CATEGORY
Priority 3 (P3) – Poorly-known species	Species that are known from several locations, and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.
Priority 4 (P4) – Rare, Near Threatened and other species in need of monitoring	(a) Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection but could be if present circumstances change. These species are usually represented on conservation lands. (b) Near Threatened. Species that are considered to have been adequately surveyed and that are close to qualifying for vulnerable but are not listed as Conservation Dependent. (c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.

Appendix D Relevé Field Sheet

STRUCTURAL VEGETATION, FLORA – Relevé			SITE_ID: R01
Date: 09/03/2022	**GPS Location**	**E**	
		N	
Recorder: KL	**Structural Community Type**	**Marri – Jarrah Open Forest over Marri – Jarrah Low Open Woodland over Woody Pear – Bull Banksia scattered tall shrubs over Woody Pear, *Apple of Sodom and Marri Scattered Low Shrubs over scattered herbs and grasses**	
Location: Lot 500 Wirring Road, west of Villiers Street, Cowaramup			

Condition: Degraded	
Aspect: NW	**Slope:** Gentle
Geology: Laterite/rock	**Rock:** <2%
Soil Colour: Grey/Brown	**Soil Type:** Sandy Loam + gravel
Litter (% cover & depth): 95%, 3cm, dried grass + leaves	**Bare Ground (% cover):** <2%
Hydrology: Good drainage	**Topographic position:** Flat

Layer	Height (m)	Cover	Plant Species (Dominant 3 first)
Tree (T2)	10-30	30-70%	*Corymbia calophylla, Eucalyptus marginata*
Tree (T3)	< 10	2-10%	*Corymbia calophylla, Eucalyptus marginata*
Shrub (S1)	> 2	<2%	*Xylomelum occidentale, Banksia grandis*
Shrub (S2)	1-2	N/A	N/A
Shrub (S3)	0-1	<2%	*Xylomelum occidentale, *Solanum linnaeanum, Corymbia calophylla*
Sedge/Rush (VR)		N/A	N/A
Herb (H)		<2%	**Sonchus asper*
Grass (G)		2-10%	**Kikuyu*
Other (climbers) (C)		N/A	N/A

Cover Codes: D >70% M 30-70% S 10-30% V 2-10% VV <2% E <5% Emergent * = Introduced

Surrounding Plants: High density (>70%) of dead annual grasses (e.g., **Avena* sp., **Briza maxima*)

Appendix E Identified Trees (>50cm DBH)

ID No.	DBH (cm)	Species	Height (m)	Hollows/s	Easting	Northing
1000	>50	Marri	16	No Hollow	325326	6251996
1001	>50	Marri	20	No Hollow	325320	6252003
1002	71	Marri	16	Potential Hollow	325316	6252004
1003	>50	Marri	16	No Hollow	325315	6252006
1004	>50	Marri	18	No Hollow	325313	6252009
1005	>50	Marri	5	Hollow	325310	6252011
1006	>50	Marri	18	Potential Hollow	325308	6252013
1007	>50	Marri	10	No Hollow	325305	6252015
1008	56	Marri - Dead	10	Potential Hollow	325301	6252023
1009	>50	Marri	14	No Hollow	325296	6252030
1010	>50	Karri	12	No Hollow	325256	6252057
1011	>50	Karri	20	No Hollow	325257	6252060
1012	>50	Karri	15	No Hollow	325253	6252060
1013	>50	Karri	18	No Hollow	325252	6252062
1014	>50	Karri	18	No Hollow	325247	6252064
1015	>50	Karri	18	No Hollow	325244	6252067
1016	>50	Karri	20	No Hollow	325253	6252068
1017	159	Karri	22	Hollows x 2	325208	6252061
1018	145	Karri	20	Hollow	325205	6252056
1019	161	Karri	20	Hollow	325207	6252078
1020	>50	Marri	20	No Hollow	325171	6252044
1021	>50	Marri	18	No Hollow	325173	6252050
1022	>50	Marri	18	No Hollow	325175	6252051
1023	>50	Marri	16	No Hollow	325168	6252060
1024	>50	Marri	12	No Hollow	325153	6252080
1025	>50	Marri	14	No Hollow	325149	6252081
1026	>50	Marri	12	No Hollow	325147	6252079
1027	>50	Marri	14	No Hollow	325145	6252082
1028	>50	Marri	14	No Hollow	325143	6252085
1029	91	Marri	10	Hollow	325140	6252083
1030	>50	Marri	12	No Hollow	325138	6252092
1031	>50	Marri	20	No Hollow	325120	6252104
1032	77	Marri	14	Hollow	325112	6252110
1033	>50	Marri	16	No Hollow	325111	6252113
1034	55	Marri	10	Hollow	325107	6252115
1035	>50	Marri	14	No Hollow	325104	6252117
1036	>50	Marri	12	No Hollow	325104	6252117
1037	>50	Marri	14	No Hollow	325106	6252122
1038	>50	Marri	18	No Hollow	325104	6252127
1039	>50	Marri	18	No Hollow	325097	6252126

ID No.	DBH (cm)	Species	Height (m)	Hollows/s	Easting	Northing
1040	>50	Marri	18	No Hollow	325092	6252129
1041	>50	Marri	18	No Hollow	325087	6252128
1042	>50	Marri	18	No Hollow	325085	6252139
1043	>50	Marri	16	No Hollow	325085	6252138
1044	>50	Marri	16	No Hollow	325050	6252169
1045	90	Karri	16	Potential Hollow	325050	6252172
1046	>50	Marri	12	No Hollow	325047	6252171
1047	>50	Marri	16	No Hollow	325001	6252218
1048	92	Marri	18	Hollow	324999	6252222
1049	>50	Marri	14	No Hollow	324991	6252219
1050	>50	Marri	8	No Hollow	325054	6252354
1051	>50	Marri	14	No Hollow	325055	6252356
1052	>50	Marri	14	No Hollow	325055	6252355
1053	>50	Marri	14	No Hollow	325059	6252356
1054	>50	Marri	12	No Hollow	325060	6252359
1055	>50	Marri	10	No Hollow	325067	6252365
1056	>50	Marri	10	No Hollow	325069	6252363
1057	>50	Marri	12	No Hollow	325071	6252364
1058	>50	Marri	14	No Hollow	325076	6252370
1059	>50	Marri	16	No Hollow	325076	6252372
1060	>50	Marri	10	No Hollow	325073	6252374
1061	>50	Marri	14	No Hollow	325079	6252383
1062	>50	Marri	14	No Hollow	325078	6252385
1063	>50	Marri	14	No Hollow	325080	6252385
1064	>50	Marri	12	No Hollow	325092	6252387
1067	87	Marri	10	Hollow	325110	6252407
1068	>50	Marri	12	No Hollow	325109	6252405
1069	>50	Marri	10	No Hollow	325110	6252411
1070	>50	Jarrah	12	No Hollow	325102	6252409
1071	>50	Marri	14	No Hollow	325122	6252422
1072	>50	Marri	14	No Hollow	325124	6252423
1073	>50	Jarrah	12	No Hollow	325141	6252441
1074	>50	Marri	12	No Hollow	325142	6252445
907	>50	Marri	18	No Hollow	325350	6276990
908	>50	Marri	18	No Hollow	325350	6276990
909	>50	Marri	18	No Hollow	325350	6276990
910	>50	Marri	18	No Hollow	325350	6276990
911	>50	Marri	16	No Hollow	325350	6276990
912	>50	Marri	15	No Hollow	324462	6252024
913	>50	Marri	14	No Hollow	324469	6252007
914	>50	Marri	10	No Hollow	324475	6252037
915	>50	Marri	12	No Hollow	324478	6252038

ID No.	DBH (cm)	Species	Height (m)	Hollows/s	Easting	Northing
916	>50	Marri	14	No Hollow	324480	6252037
917	>50	Marri	14	No Hollow	324481	6252035
918	>50	Marri	16	No Hollow	324491	6252020
919	>50	Marri	15	No Hollow	324715	6251955
920	96	Marri	16	Potential Hollow	324655	6252010
921	>50	Marri	15	No Hollow	324603	6252265
922	>50	Marri	8	No Hollow	324598	6252270
923	>50	Marri	10	No Hollow	324600	6252268
924	>50	Marri	14	No Hollow	324608	6252264
925	>50	Marri	12	No Hollow	324612	6252270
926	>50	Marri	14	No Hollow	324610	6252276
927	>50	Marri	16	No Hollow	324610	6252284
928	78	Jarrah	6	Potential Hollow	324608	6252289
929	>50	Marri	12	No Hollow	324609	6252288
930	>50	Marri	10	No Hollow	324611	6252289
931	>50	Marri	18	No Hollow	324621	6252290
932	69	Marri	7	Hollow	324627	6252297
933	>50	Marri	16	No Hollow	324629	6252293
934	>50	Marri	12	No Hollow	324629	6252293
935	>50	Marri	14	No Hollow	324631	6252290
936	>50	Marri	14	No Hollow	324633	6252287
937	>50	Marri	14	No Hollow	324622	6252276
938	58	Marri	12	Potential Hollow	324620	6252269
939	>50	Marri	12	No Hollow	324630	6252275
940	>50	Marri	16	No Hollow	324637	6252289
941	>50	Marri	16	No Hollow	324637	6252288
942	>50	Marri	12	No Hollow	324633	6252276
943	>50	Marri	10	No Hollow	324634	6252262
944	>50	Marri	12	No Hollow	324633	6252265
945	>50	Marri	14	No Hollow	324639	6252276
946	>50	Marri	15	No Hollow	324642	6252272
947	>50	Marri	12	No Hollow	324643	6252268
948	>50	Marri	16	No Hollow	324650	6252274
949	>50	Marri	16	No Hollow	324656	6252269
950	>50	Jarrah	14	No Hollow	324725	6252211
951	>50	Marri	14	No Hollow	324645	6252304
952	>50	Marri	12	No Hollow	324647	6252307
953	>50	Marri	14	No Hollow	324633	6252290
954	>50	Marri	15	No Hollow	324649	6252301
955	>50	Marri	18	No Hollow	324650	6252289
956	>50	Marri	10	No Hollow	324650	6252286
957	>50	Marri	12	No Hollow	324654	6252286

ID No.	DBH (cm)	Species	Height (m)	Hollows/s	Easting	Northing
958	>50	Marri	14	No Hollow	324662	6252297
959	87	Marri	10	Chimney Hollow	324664	6252301
960	>50	Marri	12	No Hollow	324676	6252322
961	>50	Marri	12	No Hollow	324683	6252324
962	>50	Marri	14	No Hollow	324689	6252316
963	>50	Marri	14	No Hollow	324690	6252315
964	>50	Marri	12	No Hollow	324685	6252307
965	>50	Marri	14	No Hollow	324682	6252297
966	>50	Marri	14	No Hollow	324688	6252301
968	>50	Marri	12	No Hollow	324664	6252275
969	>50	Marri	14	No Hollow	324666	6252277
970	>50	Marri	14	No Hollow	324679	6252290
971	>50	Marri	18	No Hollow	324686	6252284
972	>50	Marri	12	No Hollow	324683	6252281
973	73	Marri	10	Hollows x 2	324679	6252267
974	>50	Marri	18	No Hollow	324692	6252275
975	>50	Marri	12	No Hollow	324699	6252280
976	>50	Marri	12	No Hollow	324703	6252287
977	>50	Marri	12	No Hollow	324704	6252277
978	>50	Marri	12	No Hollow	324698	6252270
979	>50	Marri	10	No Hollow	324711	6252280
980	>50	Marri	14	No Hollow	324711	6252281
981	>50	Marri	14	No Hollow	324711	6252285
982	>50	Marri	10	No Hollow	324715	6252289
983	>50	Marri	8	No Hollow	324718	6252286
984	>50	Marri	8	No Hollow	324722	6252275
985	>50	Marri	12	No Hollow	324716	6252265
986	>50	Marri	12	No Hollow	324716	6252268
987	>50	Marri	12	No Hollow	324711	6252258
988	>50	Marri	14	No Hollow	324709	6252257
989	>50	Marri	12	No Hollow	325143	6252017
990	84	Marri	12	Potential Hollow	325140	6252011
991	>50	Marri	10	No Hollow	325138	6252010
992	86	Marri	12	Potential Hollow	325130	6252004
993	>50	Marri	10	No Hollow	325130	6251997
994	62	Marri	10	Potential Hollow	325164	6252039
995	>50	Marri	10	No Hollow	325163	6252037
996	78	Marri	12	Hollow	325168	6252040
997	120	Marri	18	Potential Hollow	325332	6251997
998	>50	Marri	18	No Hollow	325328	6252000
999	>50	Marri	18	No Hollow	325327	6251997

This page has been left blank intentionally.

ATTACHMENT 5

LOCAL WATER MANAGEMENT PLAN



MAKING COMPLEX EASY

A TETRA TECH COMPANY

LOCAL WATER MANAGEMENT STRATEGY

Lot 500 Wirring Road, Cowaramup

AU213002398.001
Rev 1
23 June 2023

rpsgroup.com

Document status

Version	Purpose of document	Authored by	Reviewed by	Approved by	Review date
Draft A	Draft for client review	AngFil/JoySie	ShaMcS	NA	04/07/2022
Rev 0	Final for issue	AngFil/JoySie	AmiHed	SteRol	28/07/2022
Rev 1	Final for issue	JoySie	DavSim	SteRol	23/06/2023

Approval for issue

S. Rolls 23 June 2023

This report was prepared by RPS within the terms of RPS' engagement with its client and in direct response to a scope of services. This report is supplied for the sole and specific purpose for use by RPS' client. The report does not account for any changes relating the subject matter of the report, or any legislative or regulatory changes that have occurred since the report was produced and that may affect the report. RPS does not accept any responsibility or liability for loss whatsoever to any third party caused by, related to or arising out of any use or reliance on the report.

Prepared by:

RPS

Joycelyn Siew
Senior Hydrologist

Level 3, 500 Hay Street
Subiaco, WA 6008

T +61 8 9211 1111
E water@rpsgroup.com.au

Prepared for:

Rod Duggan

Rod Duggan

c/o PGPM Pty Ltd
PO Box 369, Margaret River WA 6285

T 0419 919 459
E pgleed@bigpond.net.au

Contents

NOTE REGARDING DESIGN STORM TERMINOLOGY **1**

EXECUTIVE SUMMARY **2**

1 INTRODUCTION **4**
1.1 Background 4
1.2 Planning background 4
1.2.1 Shire of Augusta-Margaret River Local Planning Strategy 4
1.3 Design objectives 5
1.4 Previous studies 6

2 EXISTING ENVIRONMENT **7**
2.1 Topography 7
2.2 Geology 7
2.2.1 Geotechnical Investigation 7
2.2.2 Acid sulfate soils 8
2.3 Hydrology 8
2.3.1 Surface water drainage 8
2.3.2 Pre-development drainage modelling 9
2.3.3 Groundwater 11
2.4 Wetlands 14
2.5 Significant flora and fauna 14
2.6 Bushfire risk 14
2.7 Contamination 14
2.8 Vegetation and heritage 14

3 WATER CONSERVATION STRATEGY **15**
3.1 Landscaping and irrigation requirements 15
3.2 Potable water 15
3.2.1 Potable water supply 15
3.2.2 Education and information packages 15
3.2.3 Reticulated main sewer 16

4 STORMWATER MANAGEMENT **17**
4.1 Stormwater drainage design 17
4.2 Small rainfall event drainage system 17
4.2.1 Lot scale 17
4.3 Minor and major event drainage system 17
4.3.1 Rural run-off management 17
4.3.2 Subdivision drainage management 18
4.3.3 Impacts on surface water ecosystems 18
4.4 Key structural controls 19
4.4.1 Bund in landscape buffer 19
4.4.2 Basins/swales and outlet configurations 19
4.5 Surface water modelling 19
4.5.1 Modelling parameters 19
4.5.2 Modelling results 20
4.5.3 Rainwater tank risk analysis 21
4.6 Pre- and post-development flows 22
4.7 Non-structural controls 23
4.7.1 Landscaping and fertiliser applications 23
4.7.2 Vegetation 23

5 GROUNDWATER MANAGEMENT **24**
5.1 Groundwater quality 24

6 MONITORING AND REPORTING 25
6.1 Pre-development 25
6.2 Post-development 25
7 IMPLEMENTATION 26
8 REFERENCE 27

Tables
(contained within report text)

Table 1: Design storm terminology 1
Table 2: Summary of existing site conditions and key design strategies 2
Table 3: Pre-development flows 10
Table 4: Pre-development average groundwater quality April, July, and October 2021 13
Table 5: Basin/swale details 19
Table 6: Infiltration loss parameters 20
Table 7: Modelled land use areas (hectares) 20
Table 8: Drainage basin modelling results 21
Table 9: Drainage impact of 10% non-compliance in rainwater tanks 22
Table 10: Post-development catchment flows 23
Table 11: Roles and responsibilities 26

Figures
(contained within report text)

Figure 1: Site location 4
Figure 2: Topography and geology 7
Figure 3: ASS risk map 8
Figure 4: Regional surface water drainage 9
Figure 5: Pre-development surface water catchments and flow directions 10
Figure 6: Groundwater monitoring bore locations 11
Figure 7: Extent of remnant native vegetation and local European heritage 14

(compiled at rear of report)

Figure A: Post-development stormwater management

Appendices

Appendix A : Structure plan and staging
Appendix B : Geotechnical report
Appendix C : Roy Earl drainage
Appendix D : Waverley Road drainage
Appendix E : Groundwater level data
Appendix F : DWER/Shire correspondence
Appendix G : Groundwater quality
Appendix H : Landscape Masterplan
Appendix I : Engineering service report

NOTE REGARDING DESIGN STORM TERMINOLOGY

In accordance with the most recent edition of Australian Rainfall and Runoff (ARR), the terminology used to describe the design level (frequency of occurrence) of a rainfall or storm event has recently been revised. This report refers to both the new and old terminology for clarity, Table 1 describes how the new terminology "EY – exceedances per year" and "AEP – annual exceedance probability" relate to the previous terminology "ARI – average recurrence interval"

Table 1: Design storm terminology

Relative Frequency	ARI years (previously used terminology)	AEP %	AEP (1 in x)	EY (exceedances per year)	Currently used adopted terminology
Most frequent	1	63.21	1.58	1	1EY
	4.48	20	5	0.22	20% AEP
	5	18.13	5.52	0.2	20% AEP
Less frequent	100	1	100	0.01	1% AEP

The new (post-2016) design rainfall datasets provide intensity-frequency-duration (IFD) data for a design level of 20% AEP, which equates to 4.48 years ARI. Conversely, the previous (pre-2016) design rainfall dataset provided IFD data for a design level of 5 years' ARI, which equates to 18.13% AEP. For simplicity, this report adopts "20% AEP" as the equivalent to the previously used "5-year ARI" design level, with the two terms considered interchangeable.

EXECUTIVE SUMMARY

This Local Water Management Strategy (LWMS) has been prepared to support the Local Structure Plan (LSP) by demonstrating that the site can support urban development and will achieve sustainable urban water management outcomes. The landowner (Rod Duggan c/o PGPM Pty Ltd) is proposing to develop Lot 500 Wirring Road, Cowaramup (referred herein as "the site"). The site is located approximately 260 kilometres (km) south-south-west of Perth and 12 km north of Margaret River.

The LWMS details the integrated water management strategies to facilitate future urban water management planning. A summary of the site conditions governing the design and key design strategies are presented in Table 2.

Table 2: Summary of existing site conditions and key design strategies

Item	Summary
Existing site characteristics	
Topography Section 2.1	• Site elevations range from approximately 140 metres Australian Height Datum (m AHD) in the south-east to 134 m AHD in the north-west
Geology and soils Section 2.2	• Across the site, there is generally sand/clayey sand to depths of 0.3 m overlying sandy clay/ gravelly clay and shallow basement rock.
Acid sulfate soils Section 2.2.2	• Regional acid sulfate soils (ASS) mapping indicates a small portion of the west border is classified as a moderate to low risk of ASS occurring within 3 m of the natural surface.
Wetlands Section 2.4	• No Geomorphic wetlands are mapped within the site.
Surface water hydrology Section 2.3	• No surface water features are located within the site. • Surface water drainage from the northern portion of the site naturally drains through the existing Lakeview Estate development and into the dam (on Wilyabrup Brook) located in Symphony Waters Estate.
Groundwater hydrology Section 2.3.3	• Groundwater monitoring bores present at the site and in the surrounding area typically indicate that the static water level is around 1.9 m to 2.3 m below the ground level. • Pre-development groundwater quality monitoring shows evidence of elevated nutrients, and total metals (Cu, Cr, Pb, and Zn).
Water conservation	
Water efficiency initiatives Section 3	• 4-star WELS water efficient fixtures and fittings to be installed in all new buildings • Mandatory requirement to install rainwater tanks (required spare capacity will be specified in the land sale contract). Either 2,500 L or 5,000 L will be required. An S70A Notification will be imposed on titles regarding the need to comply with the rainwater tank requirement.
Landscaping and irrigation Section 3.1	• The landscape master plan aims to retain existing native vegetation where possible and provide amenity in public open space areas in conjunction with the retained vegetation. The POS locations (three in total) have generally aimed to respond and capture the existing vegetation on site and provide a drainage function in most cases. A small amount of turf is proposed within each POS for active recreation. • The development's POS areas will have a likely irrigation demand of between 15,000 and 20,000 kL/yr. • Groundwater is limited underlying the site and local area. • The irrigation source is proposed to be the constructed dam to the north where non-potable water is currently sourced for irrigation of Cowaramup.
Stormwater management	
Small event (15 mm) Section 4.2	• The site will aim to retain run-off from the small (15 mm) storm event through the use of on-lot rainwater tanks, basins and swales.
Minor event (20% AEP) Section 4.2	• Flows will be conveyed via piped drainage system or via overland flow into detention basins. • Rural run-off from external rural catchments will be managed through structural controls (i.e. bunds at the rear of lots) to manage flow to detention basins prior to discharge (at pre-development flow rates) through existing stormwater infrastructure.

Item	Summary
Major event (1% AEP) Section 4.3	• Stormwater flows will be detained in drainage basins or swales and through existing infrastructure capacity to maintain pre-development flow rates. • Flows will be discharged to basins and swales prior to discharge into the three points of discharge at Wirring Road, Roy Earl Drive and Waverley Road. • Minimum habitable floor levels to provide a minimum separation of – 0.3 m above the 1% AEP water level in local stormwater storages
Water quality Section 4	• Stormwater which may infiltrate into the ground will still receive some form of treatment via the strong ability of the clayey soil to adsorb phosphorus. • Non-structural controls such as minimising fertiliser and pesticide application and maintaining well-established vegetation in drainage areas will also assist in groundwater quality protection
Groundwater levels Section 5	• Inter-allotment drainage will be provided for all lots to ensure excess roof run-off can connect to a free-flowing outlet to reduce perched groundwater recharge. • Subsoil drainage located within road reserves and along some lot boundaries to control potential groundwater rise.
Groundwater quality Section 5.1	• Subsoil drainage from the subdivision will be discharged into the vegetated detention basin/s, prior to discharge offsite. • High PRI (>10) soil media will be used in the vegetated treatment areas to provide phosphorus treatment • Vegetation will be selected based on their nutrient uptake ability
Monitoring	
Post-development monitoring Section 6	• No post-development monitoring is proposed.
Roles and responsibilities	
Roles and responsibilities Section 7	• Outlined in Table 9

1 INTRODUCTION

1.1 Background

The landowner (Rod Duggan c/o PGPM Pty Ltd) is proposing to develop Lot 500 Wirring Road, Cowaramup (referred herein as "the site"). The site is located approximately 260 kilometres (km) south-south-west of Perth and 12 km north of Margaret River (Figure 1).

The site is currently cleared and undeveloped, with some access tracks across the site. Some mature trees are present, particularly at a cluster at the north of the site. Land to the east and south of the site are zoned 'Priority Agriculture' under Local Planning Scheme (LPS) 1, and land to the north and the west of the site is zoned 'Residential' and 'Future Residential'. The site is bordered by the existing developments of Lakeview Estate to the northeast and Country Vines Estate to the west.

The structure plan for the site is included in Appendix A, as well as an indicative staging plan for the development.



Figure 1: Site location

1.2 Planning background

Rowe Group on behalf of the owner has submitted a Town Planning Scheme Amendment to initiate the rezoning of the site from "General Agriculture" to "Future Development" under the Shire of Augusta Margaret River Local Planning Scheme No. 1.

1.2.1 Shire of Augusta-Margaret River Local Planning Strategy

The Shire of Augusta-Margaret River Local Planning Strategy was prepared by the Shire and endorsed by the Western Australian Planning Commission on 18 January 2022, setting out the strategic framework for development within the Shire municipality to 2036.

The site is identified within the Strategy as Future Urban Growth Area and contained within Planning Precinct C5. The Strategy sets out a target lot yield of 300 lots at residential densities between R10–R30, in addition to the required public open space reserves.

The Strategy sets out the following key planning matters to be addressed:

- Opportunity to create road linkages with existing network
- Stands of remnant vegetation located on site shall be retained
- Need to provide attractive entrance to Cowaramup from the south and buffers to adjoining agricultural land
- Sufficient buffers to surrounding agricultural properties such that their operations are not prejudiced.

These key considerations have been the drivers of the design of the future Structure Plan (Appendix A at rear of report) for the site, which proposes the following:

- 372 single residential lots (ranging from R10 to R30)
- A retirement village
- Five public open space/drainage reserves (total 5.12 ha)
- Associated access roads.

This Local Water Management Strategy (LWMS) has been prepared to support the Local Structure Plan (LSP) by demonstrating that the site is capable of supporting urban development and will achieve sustainable urban water management outcomes.

1.3 Design objectives

The LWMS is in accordance with State Planning Policy 2.9: Water Resources (Government of WA 2007) and has been developed with reference to the following guidance documents:

- General Requirements for Stormwater Drainage Disposal (AMRS 2012)
- Standards and Specifications for Subdivisions and Developments (AMRS 2006).
- Better Urban Water Management (Western Australian Planning Commission 2008)
- Interim: Developing a Local Water Management Strategy (Department of Water 2008)
- Western Australian State Water Plan (Government of Western Australia 2007)
- Stormwater Management Manual for Western Australia (Department of Water 2004–2007)
- Liveable Neighbourhoods (Western Australian Planning Commission 2007).

The LWMS will detail the integrated water management strategies for the LSP to facilitate future urban water management planning. The LWMS will achieve integrated water management through the following design objectives:

- Minimise irrigation requirements for public open space and other landscaping components.
- Effectively manage the risk to human life, property damage and environmental degradation from water contamination and stormwater flooding.
- Maintain and if possible, improve water quality within the development in relation to pre-development water quality.
- Implement best management practices in regard to stormwater management.
- Incorporate where possible, low maintenance, cost-effective landscaping and stormwater treatment systems.

1.4 Previous studies

- Geotechnical Study – Proposed residential subdivision, part of Lot 304 & 51 Wirring Road, Cowaramup (Galt Geotechnics 2021)
- Ecosystem solutions. (2022a). Bushfire Management Plan, Lot 500 Wirring Road, Cowaramup
- Ecosystem solutions. (2022b). Environmental Assessment Report, Lot 500 Wirring Road, Cowaramup. 09 June 2022.

2 EXISTING ENVIRONMENT

2.1 Topography

The site is gently undulating. Elevations range from approximately 140 metres Australian Height Datum (m AHD) in the south-east to 134 m AHD in the north-west (Figure 2).

2.2 Geology

The Busselton sheet of the 1:50,000 scale Environmental Geology series map indicates that the area is underlain by laterite and associated quartz sand (undifferentiated) (Figure 2).



Figure 2: Topography and geology

2.2.1 Geotechnical Investigation

A Geotechnical Investigation was undertaken by Galt Geotechnics at the site in December 2021. The investigation results, pertaining to subsurface geology and soil permeability/infiltration are summarised below. A summary of the groundwater findings from this investigation can be found in Section 2.3.3.

The subsurface conditions generally comprise:

- Sand/Clayey Sand– typical thickness of 0.5 m to 1 m, with variable fines and gravel content overlying
- Clayey SAND/Sandy CLAY/Gravelly CLAY – fines typically low to medium plasticity, with some high plasticity areas, variable gravel content, present to the maximum investigated depth of 3 m
- Shallow rock (laterised /conglomerate rock) may be present as either relatively shallow rock or large boulders. This is based on irregular refusal of test pits/boreholes on inferred very hard rock layers. This was encountered at depths as shallow as 0.3 m (though, typical encountered depth of ~ 1 m)
- The natural soils have a very low permeability based on the results of the field and laboratory testing. There are no soils at the site that we would consider to be consistently “free draining”.

The Geotechnical report is provided in Appendix B.

2.2.2 Acid sulfate soils

According to the Acid Sulfate Soil (ASS) Risk Map – Swan Coastal Plain (DWER-055), most of the site is not classed within a potential ASS risk area. However, there is a small area of "moderate to low" risk of encountering ASS within three metres of the natural soil surface, but "high to moderate" risk of ASS beyond three metres along Roy Earl Drive, which intersects the north-west boundary of the site. The site is closely surrounded by "moderate to low" ASS risk areas on all boundaries, which are associated with the natural drainage depressions in these areas (Figure 3)

In accordance with relevant guidelines, any dewatering or soil disturbance, compaction or lateral displacement in the ASS risk areas will require a Preliminary Site Investigation to determine whether or not ASS is present. Consequently, ASS investigations prior to any soil or groundwater disturbance may be required in future stages of planning if disturbance to the soil or dewatering in the immediate area of the "moderate to low" risk soils is required.

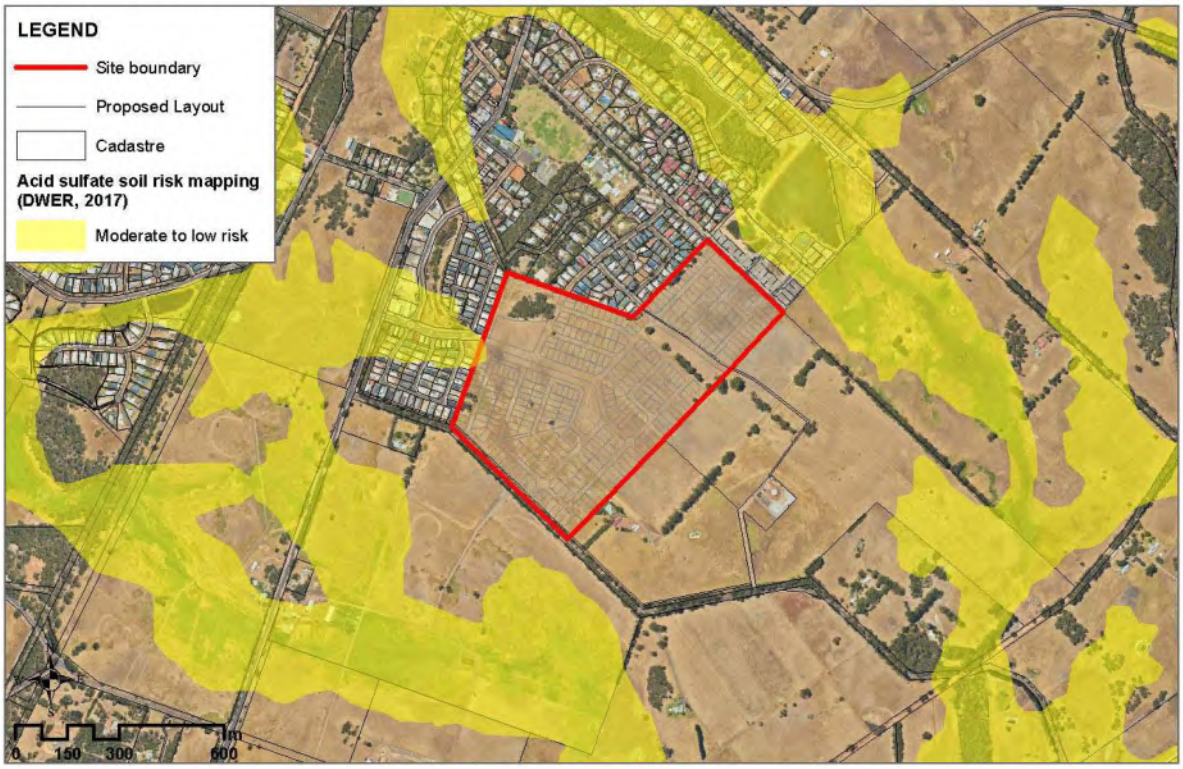


Figure 3: ASS risk map

2.3 Hydrology

2.3.1 Surface water drainage

The site is located in the Wilyabrup Brook catchment, which covers an area of 89.2 km^2. The brook is almost 20 km in length. It runs through both the Shire of Busselton and the Shire of Augusta-Margaret River. The main branch of the Wilyabrup Brook starts east of the Cowaramup town site and flows in a north-westerly direction. The north branch and the main branch meet east of Caves Road. The brook then flows westward to the Indian Ocean (DoW 2007).

There are no surface water features within the site. Review of the National Map (as of 13 June 2022) indicated there are no Geomorphic Wetlands or Significant Wetlands within or in immediate vicinity of the site.

Surface water drainage from the northern portion of the site naturally drains through the existing Lakeview Estate development and into the dam (Wilyabrup Brook) located in Symphony Waters Estate. For the remainder of the site, a portion of the drainage travels west through the swale located in the existing Country Vines Estate, or down to the south into the drainage line to the southwest of the site (Figure 4). All receiving waterways are tributaries of Wilyabrup Brook.

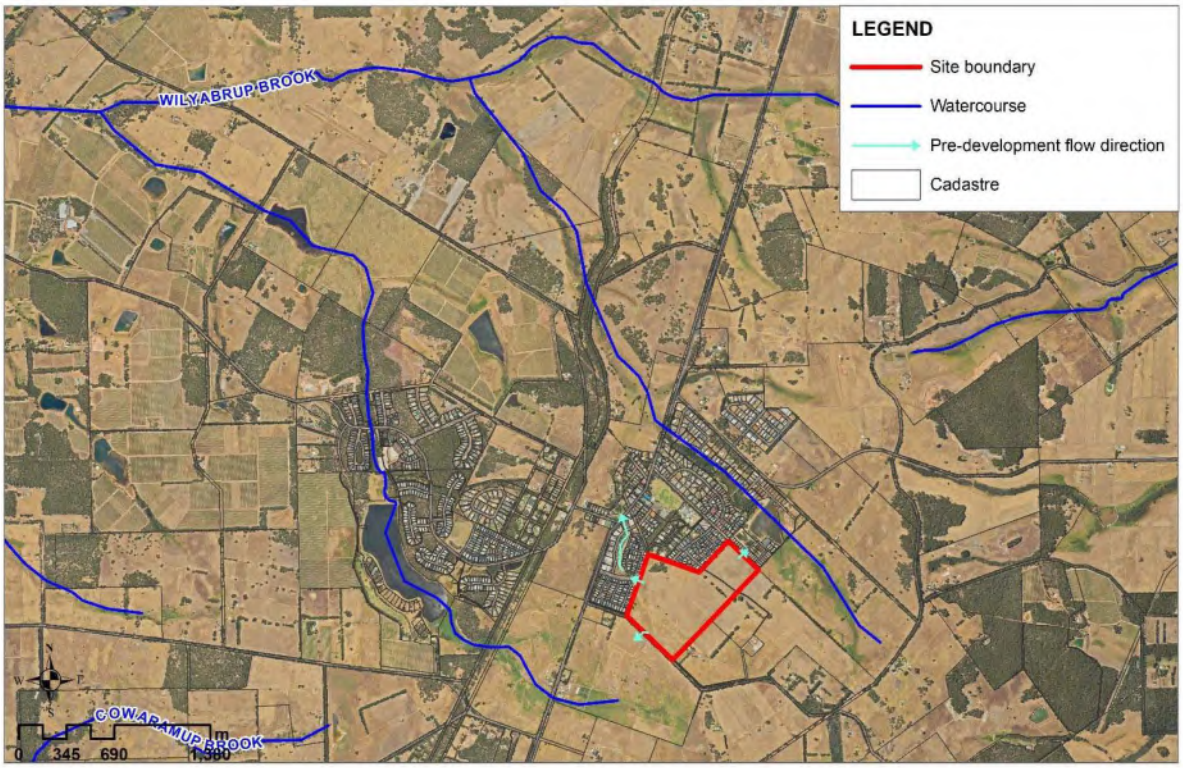


Figure 4: Regional surface water drainage

2.3.2 Pre-development drainage modelling

RPS has developed a hydrological model in XP-SWMM for the external rural catchments to assess pre-development drainage catchments, flow directions, and pre-development flow rates. The XP-SWMM modelling has been used to simulate the 20% and 1% AEP external catchment inflows to the site and from the site. RPS' model used the detailed on-site feature survey and external contour information to develop an accurate pre-development model. Previous assessments and studies were also used to inform existing development outcomes based their analysis on coarse topography data. In summary, the pre-development catchments have been slightly revised based on on-site feature survey and remodelled. There were some modest changes compared to the previous assessments. The pre-development drainage catchments, flow direction and existing drainage infrastructure are illustrated in Figure 5.

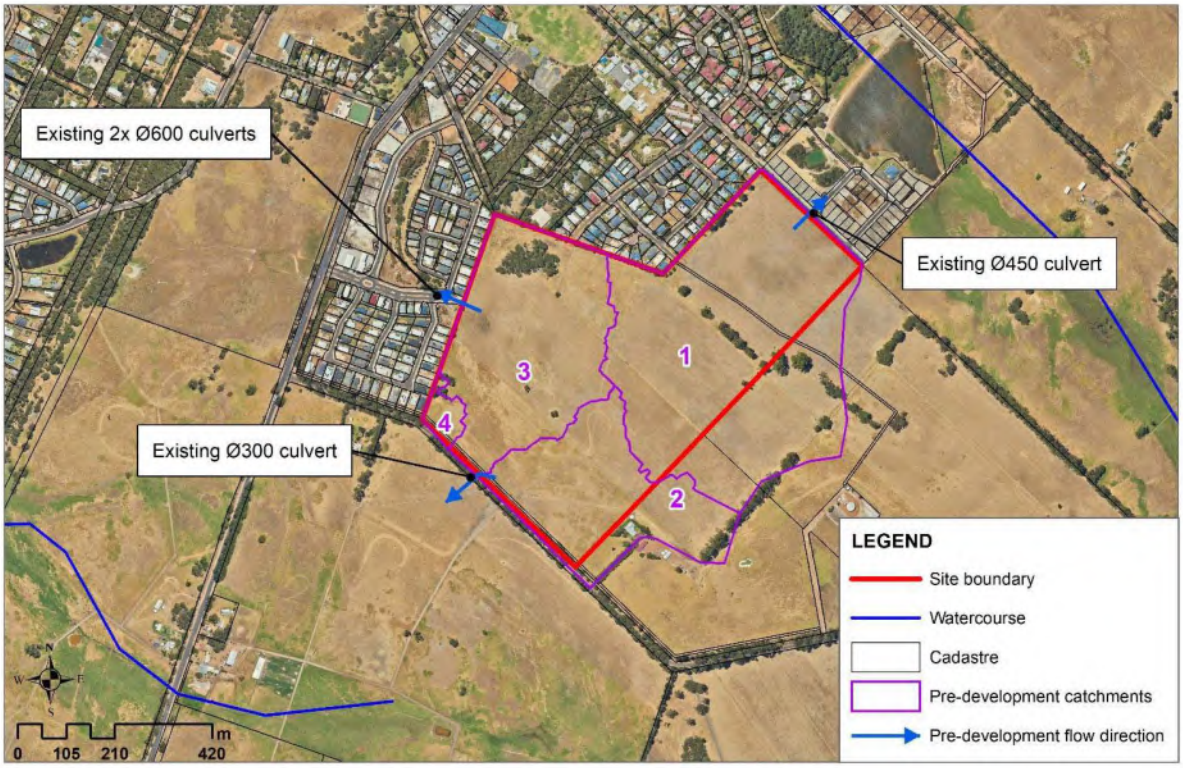


Figure 5: Pre-development surface water catchments and flow directions

The pre-development flow rates, drainage infrastructure details and catchment information are presented in Table 3. The catchments in Table 3 correspond with catchment numbers illustrated in Figure 5 above.

Table 3: Pre-development flows

Catchment	1	2	3	4
Discharge point	Waverley Rd	Wirring Rd	Roy Earl Dr	-
Revised catchment area (ha)	27.33	11.08	14.37	0.82
Catchment area to discharge point in previous studies (ha)	15.51*	0	28.71#	0
Revised pre-development flow rates				
20% AEP critical duration (hours)	0.75	4.5	4.5	No discharge from site
20% AEP peak flow (m^3/s)	0.51	0.12	0.21	No discharge from site
1% AEP critical duration (hours)	3	3	2	No discharge from site
1% AEP peak flow (m^3/s)	0.99	0.54	0.75	No discharge from site
Flow rates allowed by downstream infrastructure				
20% AEP peak flow (m^3/s)	0.20 m^3/s at existing Ø450 culvert (Additional 0.02 m^3/s capacity via pit B2 further east*)	0.12	Controlled by 2x Ø600 culverts (~1.6 m^3/s)#	-
1% AEP peak flow (m^3/s)	Overland flow	Overland flow	Controlled by 2x Ø600 culverts (~1.6 m^3/s)#	-

* Refer to Waverley Rd drainage details in Appendix C # Refer to Roy Earl Dr drainage details in Appendix D

Further details and supporting information relating to previously assumed catchments and constructed downstream infrastructure at Roy Earl Drive and Waverley Road are provided in Appendices C and D, respectively.

2.3.3 Groundwater

2.3.3.1 Groundwater levels

RPS has undertaken monthly groundwater level monitoring at six bores on the site (MW13 to MW18) from May to November 2021. The groundwater bore locations are presented in Figure 6. This monitoring program has captured the 2021 winter peak, with the data indicating that the site is frequently boggy in winter with a perched water table. The monitoring results are consistent with the groundwater findings from the Geotechnical report (summarised below) and in combination have been used to better understand the localised groundwater conditions.

As previously discussed, Galt Geotechnics undertook a site investigation in December 2021. A summary of the groundwater conditions is provided as follows:

- The critical water levels at the site are likely to be governed by perched water overlying impermeable layers. Noting the presence of relatively shallow farm soaks in the vicinity of the site that would confirm this.
- Registered bores present at the site and in the surrounding area typically indicate that the static water level is around 1.9 m to 2.3 m below the ground level.
- The groundwater level should be assumed to be at the top of any impermeable clay layer to allow for seasonal perched water.

The Geotechnical Report (Appendix B) and groundwater level monitoring data (Appendix E) have been presented to the Department of Water and Environmental Regulation (DWER) and the Shire of Augusta Margaret River (AMRS). The DWER and AMRS have confirmed that they are satisfied with the above investigations to enable an informed decision on groundwater management at the site. As such, no further pre-development groundwater level monitoring is required. DWER/AMRS correspondence is provided in Appendix F.



Figure 6: Groundwater monitoring bore locations

2.3.3.2 Groundwater quality

RPS has undertaken quarterly groundwater quality monitoring (April, July and October 2021) from the network of six bores on the site. Water was sampled for a standard suite of nutrients, metals and field parameters. Water quality was compared with the ANZECC (2000) freshwater guidelines (FWG) for lowland rivers in south-west Australia.

Table 4 provides average nutrient and metal concentrations from groundwater over the three-month period. Appendix G provides the water quality results and laboratory certificates.

The ANZECC FWG guideline was exceeded for total nitrogen and total phosphorus in all bores. Nitrogen was predominantly in the form of dissolved inorganic NOx-N. Dissolved inorganic phosphorus concentrations were however low. The elevated nitrogen concentrations observed at the site is expected to be due to the semi-rural/agricultural land use in the catchment.

The ANZECC FWG guideline was exceeded for dissolved copper at MW14, MW16 and MW17. All dissolved copper exceedances occurred during a single monitoring round (20 July 2021); concentrations during the other two monitoring rounds were below detection limit.

Table 4: Pre-development average groundwater quality April, July, and October 2021

Sample ID	Date	Trigger	Dissolved Metals								Nutrients					
			Arsenic	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc	Total Nitrogen	Total Kjeldahl Nitrogen	NOx as N	Ammonia as N	Total Phosphorus	Phosphate
			mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
		FWG	0.013	0.0002	0.001^	0.0014	0.00034	0.00006	0.011	0.008	0.75	-	0.045	0.04	0.03	0.03
		LOR	0.001	0.0001	0.001	0.001	0.001	0.00005	0.001	0.001	0.1	0.1	0.005	0.005	0.05	0.005
MW13																
	Average		0.001	0.0001	0.001	0.001	0.001	0.00005	0.001	0.002	0.6	0.2	0.39	0.012	0.05	0.005
MW14																
	Average		0.001	0.000	0.001	0.002	0.001	0.00005	0.001	0.001	0.800	0.167	0.600	0.006	0.050	0.005
MW15																
	Average		0.001	0.0001	0.001	0.001	0.001	0.00005	0.001	0.002	2.3	0.35	1.98	0.053	0.055	0.005
MW16																
	Average		0.001	0.0001	0.001	0.002	0.001	0.00005	0.001	0.005	3.80	1.10	2.69	0.11	0.16	0.005
MW17																
	Average		0.001	0.0001	0.001	0.002	0.001	0.00005	0.001	0.003	1.13	0.37	0.76	0.15	0.05	0.005
MW18																
	Average		0.001	0.0001	0.001	0.001	0.001	0.00005	0.001	0.003	2.3	0.7	1.61	0.016	0.08	0.005

*LOR (Limits of Reporting), FWG (Freshwater Guidelines for south-west WA lowland river ecosystems)

2.4 Wetlands

A search of DWER online database indicated that there are no geomorphic wetlands within the site. There are two unreviewed geomorphic wetlands Leeuwin Naturaliste Ridge and Donnybrook to Nannup (DBCA-043) located immediately north-east of the site and about 500 m south-west of the site.

2.5 Significant flora and fauna

The site was surveyed by Ecosystem Solutions for fauna over two days (24 March 2022 to 27 March 2022). The survey results indicated no observation of animals, black cockatoos and western ringtail possum. There were no Threatened flora or conservation significant flora identified within the site (Ecosystem Solutions 2022b).

2.6 Bushfire risk

The site is identified as 'Bushfire Prone Area' by the Department of Fire and emergency services ('DFES') Map of Bushfire Prone Areas. The Bushire Management Plan (BMP) has been prepared by Ecosystem Solutions and has confirmed the risk of bushfire onsite is capable of being mitigated to comply with associated guidelines for planning in Bushing Prone areas (Ecosystem solutions 2022a).

2.7 Contamination

DWER's Contaminated Sites database did not identify any registered contaminated sites within the site (DWER 2022). The nearest contaminated site (ID no: 74121) is located about 1 km north of the site classified as remediated for restricted use due to presence of hydrocarbons in groundwater because of agriculture depot land use.

2.8 Vegetation and heritage

Pre-European settlement, vegetation in this area mainly consisted of jarrah and marri, however the site has previously been cleared for agricultural use. A cluster of native remnant vegetation (mostly mature trees) is present in the north of the site, which will be retained in public open space (Figure 7).

There are no Aboriginal Heritage or local European heritage sites identified within the site (Department of Planning Lands and Heritage – Aboriginal Heritage Inquiry System and Local Heritage Survey 2022).

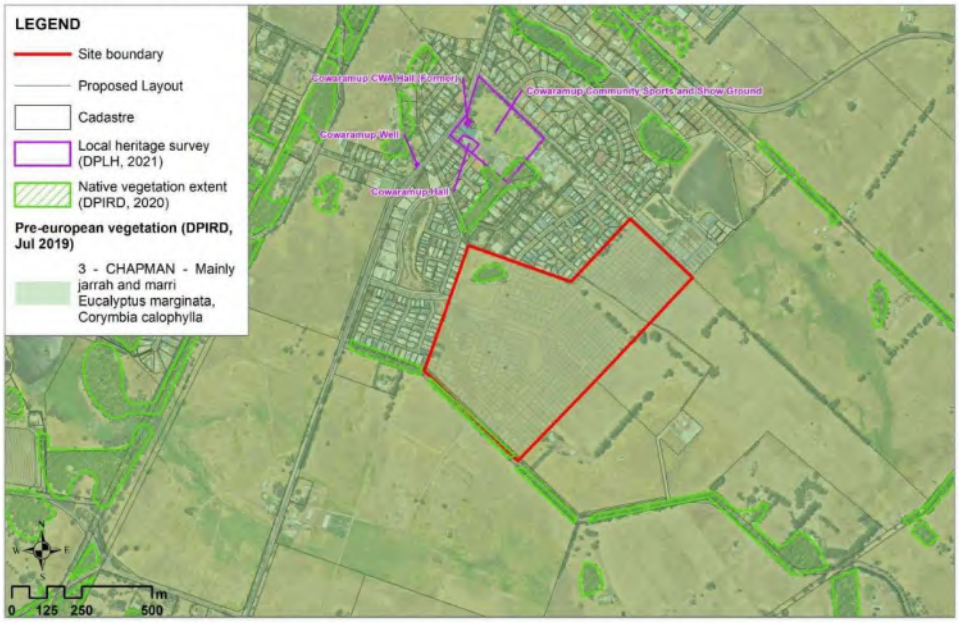


Figure 7: Extent of remnant native vegetation and local European heritage

3 WATER CONSERVATION STRATEGY

3.1 Landscaping and irrigation requirements

The landscape master plan aims to retain existing native vegetation where possible and provide amenity in public open space areas in conjunction with the retained vegetation. The POS locations have generally aimed to respond and capture the existing vegetation on site and provide a drainage function in most cases. A small amount of turf is proposed within each POS for active recreation. The development connects to the existing residential areas of Cowaramup by the footpath network, tying the development into the fabric of the town.

The landscape masterplan has been developed by SW Landscape Collective and is provided in Appendix H.

The street tree vegetation will be an extension of the existing Country Vines estate to the west and comprise a mixture of the following species:

- *Fraxinus raywoodii* – claret ash
- *Agonis Flexuosa* – WA peppermint
- *Corymbia calophylla* – grafted varieties
- *Lagerstroemia indica 'Natchez* – crepe myrtle.

The current landscape master plan (Appendix H) including the turf areas is likely to have a total irrigation demand of between 15,000 and 20,000 kL/yr.

Groundwater is limited beneath the site and the underlying hydrogeology consists of shallow surficial deposits overlaying granite basement rock. The deeper, higher yielding sedimentary Leederville and Yarragadee aquifers are not located beneath the site and are situated further east overlaying the Vasse Shelf and Bunbury Trough. Based on the geotechnical investigation and the groundwater drilling undertaken to support the installation of groundwater monitoring bores, it was established that there is a shallow perched groundwater system beneath the site but that this is likely to largely dry out or not have sufficient aquifer yields to support an irrigation bore(s) water supply for irrigation of POS throughout the year.

Given the unavailability of groundwater, the proposed irrigation water source is surface water and specifically the proposed source is the dam immediately to the north on the Wilyabrup watercourse. The dam was constructed in 2006, with the intention that it could be used as a secure, long-term water supply to meet irrigation requirements for the existing Cowaramup townsite and future development of public open space (DWER, pers. comm. 2022).

3.2 Potable water

3.2.1 Potable water supply

The development will be provided with a reticulated potable water supply. There are two existing water mains terminating at the site boundary in Roy Earl Drive and Duggan Drive. There are two existing DN 250 water distribution mains that traverse the site to the south-west border and to the north-east portion of the site (in proximity to the north-east POS).

It is understood that the water distribution mains on site will remain in place within the appropriate easements and proposed road reserves.

3.2.2 Education and information packages

The objective of the water supply for the development is to minimise the use of potable water, where potable water use is not essential. To achieve this objective, the proponent will provide education and information packages to each dwelling within the development that outline the importance of water efficiency and encourage the implementation of water saving initiatives. Emphasis will be placed on the mandatory requirement for all houses to have an under-eave rainwater tank (with slow-release outlets) to be plumbed into the home.

Packages will also include initiatives to minimise the use of fertilisers and promote the use of native plants in the garden to protect the water quality and conservation values of nearby waterways.

The sales office will be supplied with the above information packages to distribute to new and potential homebuyers.

3.2.3 Reticulated main sewer

Water Corporation operates a gravity sewerage network in the surrounding area of the site. The existing gravity sewerage network is located to the north-north-east, and west of the site. There is no existing sewerage pipe connection to the south and east of the site.

It should be noted that sewer stub lines have previously been extended across the site and there are three potential connection locations, i.e. two to the north-east border of the site (one is in proximity to Lions Drive) and to the west border of the site and in proximity to the Roy Earl Drive.

The existing reticulated potable water and gravity sewerage network locations is provided in the engineering services report in Appendix I.

4 STORMWATER MANAGEMENT

4.1 Stormwater drainage design

The stormwater drainage concepts have been completed by Stantec Engineers and RPS, respectively. The proposed post-development stormwater management concept is provided in Figure A at the rear of this report.

4.2 Small rainfall event drainage system

The stormwater drainage design endeavours to provide treatment of the small (15 mm) rainfall events as close to source as possible and at vegetated detention basins within POS areas. It should be noted that infiltration at source is not being actively pursued at this site due to the shallow perched nature of the groundwater system and the risk that presents to properties. The opportunity for stormwater treatment is limited by the level constraints and existing outlet infrastructure. Water quality treatment will be promoted via a vegetated conveyance swale along Wirring Road as well as the vegetated detention basins at Wirring Road, Roy Earl Drive and Waverley Road (Figure A), which will discharge offsite to rural land, existing drainage infrastructure and existing infrastructure including Duggan's Dam respectively.

4.2.1 Lot scale

Due to the likely clayey soils at the site, soak wells will not be used, and at-source infiltration will not be pursued. Instead, it will be a mandatory requirement for all homebuyers to install an under-eave rainwater tank with a storage capacity of at least 2,500 litres between the overflow and the slow-release pipe, to be plumbed into the home. On the larger lot product (R10) adjacent to Wirring Road and adjoining the rural landholding to the east (Figure A), these properties will be required to install rainwater tanks with minimum 5,000 L of storage available between the overflow and the slow-release pipe. All rainwater tanks will have a slow-release outlet to allow for the tank to drain out to allow capacity for the next rain event as described above. A S70A Notification will be imposed on titles regarding the need to comply with the rainwater tank requirement. Additionally, the developer will offer a rebate to lot purchasers for the purchase of rainwater tanks to further encourage compliance.

4.3 Minor and major event drainage system

4.3.1 Rural run-off management

Stormwater flows for the minor 20% and major 1% AEP events from the external rural catchment will be managed by creating a bund and preferential flow path at the rear of the lots on the site's eastern boundary. The rear of these easternmost lots will have a landscape buffer to the rural area and the bund and flow path will be within this landscape buffer. Run-off from the rural catchments (XA1 in Figure A) will flow north along the preferential flow path directly to the existing creek line and dam to the north, bypassing the existing and proposed developments. Run-off from the rural catchments XA2 (Figure A) will flow north along the preferential flow path and be captured and detained in the drainage basin within a POS reserve. Run-off detained in this drainage area will subsequently be piped to a drainage basin in the POS adjoining the Waverley Road drainage infrastructure and eventually into Duggan's Dam at pre-development flow rates (See Section 2.3.2). Run-off from rural catchment XC (Figure A) will be directed south along the constructed bund and preferential flow path to another detention basin within urban catchment C1. The run-off will subsequently be piped to the drainage basin in C2 and then discharge to the extended roadside swale and ultimately discharge to the rural property to the south of Wirring Road via an existing culvert under Wirring Road.

Catchment D will remaining relatively consistent with its existing vegetated condition with the retention of the large stand of trees. Run-off from this vegetated area will not be managed and will remain in its pre-development condition with some overland flow predicted to be travel in a north-westerly direction with the natural grade.

4.3.2 Subdivision drainage management

The proposed Structure Plan area has been divided into three main catchments that align with three proposed stormwater discharge locations. The proposed post-development catchments have been informed by a detailed feature survey, urban design, preliminary earthworks design, and the pre-development hydrological assessment including surface water modelling as described in Section 2.3.2. The proposed post-development catchments and sub-catchments are illustrated in Figure A at the rear of this report and relate to the existing infrastructure illustrated in Figure A.

Each catchment relates to a proposed discharge location as follows:

- **Catchment A**: relates to stormwater that has a discharge point into the existing Waverley Road and adjoining subdivision (Lakeview Estate). Lakeview Estate contains a DN450 stormwater pipe that has capacity to accept 0.20 m^3/s of flow from the site in the 20% AEP event (drainage details in Appendix C). Catchment A has been split into two sub-catchments with the aim to attenuate flows within the POS/drainage reserve in each of the sub-catchments. It is intended for water quality treatment to be provided within Basin A1; this allows flexibility in the landscape treatment of Basin A2 to meet landscape and amenity objectives. This catchment ultimately drains to the existing dam to the east of the site.
- **Catchment B**: relates to stormwater that will discharge to an existing basin in the POS and then through the 2 x DN600 culverts under Roy Earl Drive and into the existing swale through the existing Cowaramup town site (drainage details in Appendix D). The existing basin is proposed to be enlarged to provide a single consolidated basin with sufficient detention volume for the site. Discharge rates will be controlled via the existing culverts. Sub-catchment B1, B2, and B3 will all be graded to the Roy Earl drainage basin. There is opportunity for flows from these sub-catchments to be conveyed via a living stream in the POS to reduce pipe infrastructure; this will be investigated at the Urban Water Management Plan (UWMP) stage.
- **Catchment C**: relates to stormwater that will discharge through the existing DN300 culvert under Wirring Road. Catchment C is a heavily constrained catchment due to the natural grade of the site and the minimal existing infrastructure to allow for post-development stormwater management. Sub-catchment C1 will drain to an internal basin for attenuation before entering the piped street drainage and discharge into a basin in sub-catchment C2. Due to the natural grade of sub-catchment C3, runoff will flow overland into a roadside swale along Wirring Road. This roadside swale will take detained stormwater from catchment C1, C2 and C3 and detain and convey the stormwater to the existing DN300 culvert under Wirring Road.
- **Catchment D** is being retained as POS with no significant hardstand areas being proposed and will therefore maintain current pre-development flow conditions.

Figure A presents the preliminary design for these stormwater catchments. Post-development surface water modelling has been used to verify the preliminary earthworks, swale and basin design function appropriately and can achieve the detention of flows to pre-development flow rates and ensure appropriate protection of properties and infrastructure.

Assessment of the proposed stormwater management concepts have been undertaken using an XP-SWMM hydrological model. Details of this model is presented in Section 4.4 below.

4.3.3 Impacts on surface water ecosystems

There are no major surface water ecosystems within the site, however as discussed previously stormwater from the site will flow into neighbouring waterways and ultimately the Wilyabrup Brook. Based on the Stormwater Management Strategy, which adopts Water-Sensitive Urban Design (WSUD) principles and Best Management Practices (BMPs), including vegetating the drainage basins/swales and minimising export of stormwater off site during the common, more stormwater events, it is not envisaged that the development of the site will impact the water quality of these downstream waterways.

4.4 Key structural controls

4.4.1 Bund in landscape buffer

A low bund (less than 0.5 m high) built within the 10 m wide landscape buffer at the back of the eastern lots (shown in Appendix G) will ensure flows from external catchments XA1, XA2, and XC (Figure A) are directed either north to the dam or south to Wirring Road without flowing through the subdivision's residential lots and roads.

4.4.2 Basins/swales and outlet configurations

Basins and swales will provide attenuation of stormwater before it is discharged from site, to ensure flows are being controlled to pre-development flow rates and to protect downstream infrastructure from flooding. Table 5 summarises the key design concepts for each basin and swale (locations are shown in Figure A).

Table 5: Basin/swale details

Basin/swale	Design concept	Outlet configuration
Basin A1	Detain up to the 1% AEP event. Vegetated to provide treatment for the small rainfall event.	Outlet set at basin invert, with an overflow grate set at the 20% AEP top water level for overflow of events greater than the 20% AEP. To connect into existing DN450 pipe in Waverley Road.
Basin A2	Main basin detains up to the 20% AEP event. Larger events up to the 1% AEP will spill out across a larger tier. Treatment for the small rainfall event is intended to be provided in the downstream Basin A1.	Pipe outlet set at basin invert
Basin B4 (Roy Earl Dr basin)	Existing Roy Earl Dr basin to be enlarged to provide sufficient volume to detain up to the 1% AEP event. Vegetated to provide treatment for the small rainfall event.	Existing 2 × DN600 culverts
Basin C1	Detain up to the 1% AEP event. Vegetated to provide treatment for the small rainfall event.	Pipe outlet set at basin invert
Basin C2	Detain up to the 1% AEP event. Vegetated to provide treatment for the small rainfall event.	Piped outlet set at basin invert, with a spillway into the Wirring Rd swale for the 1% AEP event.
Wirring Rd swale	To convey and detain up to the 20% AEP event. Will provide some detention for the 1% AEP event, however, has been designed to overtop Wirring Rd as in pre-development conditions. Proposed to have 2 m base width and 1:4 side slopes.	Existing DN300 culvert for the 20% AEP event. Will overtop Wirring Road in the 1% AEP event.

4.5 Surface water modelling

RPS has developed a hydrological model in XP-SWMM for the external rural catchments and the proposed subdivision. The XP-SWMM modelling has been used to simulate the 20% and 1% AEP external catchment inflows to ensure that the proposed drainage infrastructure is appropriately designed to accommodate these major events, as well as assess the on-site drainage design and the requirement to manage post-development flow rates to be within the pre-development flow rates and ensure the risk to infrastructure and downstream properties is not increased.

4.5.1 Modelling parameters

The infiltration loss parameters adopted in the model have been summarised in Table 6.

Table 6: Infiltration loss parameters

Parameters	Adopted value	Notes
Rural	IL – 20 mm CL – 4.9 mm Manning's n – 0.073	Initial and continuing loss rates from ARR 2016 Data Hub (reduced to account for storm pre-bursts not being included).
Lot roofs	IL – 7.4 mm CL – 0 mm Manning's n – 0.015	Assumed to be 50% of all non-R10 lot area. All lots to have rainwater tanks with 2,500 L of storage between the overflow and slow-release pipe.
R10 lot roofs	IL – 11.5 mm CL – 0 mm Manning's n – 0.015	Assumed to be 40% of R10 lots. R10 lots to have rainwater tanks with 5,000L of storage between the overflow and slow-release pipe.
Lot yards	IL – 0 mm CL – 40% Manning's n – 0.5	Assumed to be 50% to 60% of lot area.
Road reserve	IL – 1 mm CL – 1.9 mm Manning's n – 0.02	Continuing loss is based on a 40% pervious area and 0.08 m/day permeability.
Public Open Space (POS) & Public Access Walkway (PAW)	IL – 20 mm CL – 4.9 mm Manning's n – 0.03	Initial (excluding pre-burst) and continuing loss rates from ARR 2016 Data Hub.
Drainage basins	IL – 2.8 mm CL – 0 mm Manning's n – 0.012	A standardised loss factor of 0.14 has been applied to an IL of 20 mm to estimate the reduced IL in the wettest catchment condition (ARR 2016).

* IL: Initial loss, CL: Continuing loss

The post-development land use areas assumed in the model are shown in Figure A at the rear of the report and catchment areas are summarised in Table 7.

Table 7: Modelled land use areas (hectares)

Sub-catchment	Lots	R10 lots	Road	POS & PAW	Drainage	Rural	Total
A1	4.398	1.264	1.921	-	0.415	-	7.999
A2	4.208	1.411	1.672	1.262	-	-	8.553
B1	1.634	0.305	1.091	0.681	-	-	3.710
B2	4.139	-	2.044	0.594	0.000	-	6.778
B3	3.811	0.726	1.217	0.178	-	-	5.932
B4	1.620	-	0.295	-	0.206	-	2.121
C1	0.001	0.911	0.290	-	0.149	-	1.352
C2	1.273	0.000	0.499	-	0.131	-	1.903
C3	-	0.856	-	-	-	-	0.856
D	-	-	-	1.636	-	-	1.636
External catchments							
XA1						4.994	4.994
XA2						3.508	3.516
XC						3.709	3.710

4.5.2 Modelling results

The post-development drainage basin modelling results are presented in Table 8 and are associated with the post-development catchments illustrated on Figure A.

Table 8: Drainage basin modelling results

Catchment	A1	A2	B	C1	C2
Basin details					
Base invert (mAHD)	131.20	136.20	131.87	135.60	134.84
Base area (m^2)	1100	1200	1400	420	434
Flood tier invert (mAHD)	-	136.90	-	-	-
Flood tier area (m^2)	-	3840	-	-	-
Side slopes	1:6	1:6	1:6	1:6	1:6
Outlet invert (mAHD)	131.20	136.20	131.87	135.60	134.84
Outlet size (mm)	Ø380 orifice plate	Ø300	2x Ø600	Ø375*	300 x 300 box culvert
1% AEP spillway/overflow invert (mAHD)	132.00	-	-	-	135.24
15 mm (~1 EY 25 min)					
Max depth (m)	0.31	0.22	0.35	0.11	0.18
Top water level elevation (mAHD)	131.51	136.42	132.22	135.71	135.02
Inundation area (m^2)	1553	1500	1728	483	539
Storage volume (m^3)	404	294	544	49	90
20% AEP					
Critical duration (hours)	4.5	3	0.5	4.5	1.5
Max depth (m)	0.79	0.60	0.54	0.25	0.34
Top water level elevation (mAHD)	131.99	136.80	132.41	135.85	135.18
Inundation area (m^2)	2324	2054	1928	570	636
Storage volume (m^3)	1338	967	903	123	182
Peak outflow (m^3/s)	0.20	0.15	0.96	0.09	0.12
1% AEP					
Critical duration (hours)	4.5	3	0.75	3	1.5
Max depth (m)	1.20	1.01	1.05	0.97	0.53
Top water level elevation (mAHD)	132.40	137.21	132.92	136.57	135.37
Inundation area (m^2)	3027	4945	2469	1106	760
Storage volume (m^3)	2426	2773	2017	722	311
Peak outflow (m^3/s)	0.38	0.21	1.54	0.15	0.36

4.5.3 Rainwater tank risk analysis

The stormwater management strategy includes the use of rainwater tanks on all residential lots to assist in managing rainfall events at-source. Rainwater tanks are to be fitted with a slow-release outlet to allow water to drain out to free up capacity to capture the next rain event. An overflow pipe will allow flows exceeding the capacity of the rainwater tank to enter the street drainage system.

A risk analysis was undertaken to assess the impacts on the subdivision's drainage system if rainwater tanks on private lots were not installed or non-compliant (i.e. if the slow-release outlet that ensures the tank empties for the next rain event were removed or blocked).

The following scenario was modelled:

- 90% of R10 lots will have rainwater tanks with a slow-release outlet which will allow a minimum capacity of 5,000 L to empty after a rain event (compliant)
- 90% of non-R10 lots will have rainwater tanks with a slow-release outlet which will allow a minimum capacity of 2,500 L to empty after a rain event (compliant)

- 10% of all lots assumed to have only 600 L capacity in rainwater tanks for capturing rainfall (non-compliant). This is based on the slow-release outlet being removed or blocked, and an estimated daily household water consumption of 0.6 m^3/day.

The impact of a 10% non-compliance in rainwater tank requirements is summarised in Table 9. There is generally minimal impact on the drainage basins. Maximum water depths only increased by 1 cm and there is generally no change in the peak discharge rates. The greatest impact to storage volumes was for the small 15 mm event (a maximum 5% increase), which does not pose a risk to the development. Storage volumes in the 20% and 1% AEP events only increased by a maximum of 2%.

Table 9: Drainage impact of 10% non-compliance in rainwater tanks

Basin	A1	A2	B	C1	C2
15 mm (~1 EY 25 min)					
Change in depth (Δm)	0.01	0.01	0.01	0	0
Change in storage volume (Δm^3)	16	14	16	2	0
Change in storage volume (%)	4%	5%	3%	4%	0%
20% AEP					
Change in depth (Δm)	0.01	0	0.01	0	0
Change in storage volume (Δm^3)	10	6	18	1	2
Change in storage volume (%)	1%	1%	2%	1%	1%
Change in peak outflow (m^3/s)	0	0	0.01	0	0
1% AEP					
Change in depth (Δm)	0	0	0.01	0	0
Change in storage volume (Δm^3)	8	9	19	-1	1
Change in storage volume (%)	0%	0%	1%	0%	0%
Change in peak outflow (m^3/s)	0	0	0	0	0

4.6 Pre- and post-development flows

Revised pre-development flows are presented in Section 2.3.2. As a detailed feature survey was not available when the downstream developments were built, design of the downstream drainage infrastructure was based on coarse topographical data available at the time. There are some modest changes in the revised pre-development flow rates compared to previous assessments. Discharge from the site is therefore constrained by the existing infrastructure. Flow rates from the site allowed by the downstream infrastructure are summarised in Table 3 in Section 2.3.2.

Due to these constraints, discharge rates have been rebalanced across the site, with some catchments discharging less and others discharging more compared to predevelopment flow rates. Post-development 1% AEP peak flow rates are less than pre-development 1% AEP peak flow rates at the discharge points at Waverley Road (0.70 m^3/s vs 0.99 m^3/s respectively) and Wirring Road (0.36 m^3/s vs 0.54 m^3/s respectively. The 1% AEP peak flow rate at Roy Earl Drive is higher in the post-development scenario (1.57 m^3/s) than in the pre-development scenario (0.75 m^3/s), however this includes flow diverted from the site's other constrained catchments and external flow from the existing Country Vines estate to the west (0.29 m^3/s). Additionally, the existing Roy Earl Drive basin outlet was designed and sized as part of the Country Vines development which also provides further attenuation downstream via a swale and detention basin prior to discharge under Bussell Highway.

The post-development modelled flow rates at each discharge point are provided in Table 10 below.

Table 10: Post-development catchment flows

Catchments Discharge point	A Waverley Road	XA1^ Duggan's Dam	B Roy Earl Drive	C Wirring Road
20% AEP critical duration (hours)	3	3	0.5	1.5
20% AEP peak flow (m^3/s)	0.20	0.09	0.96#	0.12
1% AEP critical duration (hours)	2	2	1	1.5
1% AEP peak flow (m^3/s)	0.38^	0.32^	1.54#	0.36*

^ Catchment XA1 is an external catchment with an off-site discharge point. It has been included to allow comparison to the pre-development flow rates. The combined 1% AEP discharge from Catchments A and XA1 is 0.70 m^3/s, less than the equivalent pre-development Catchment 1 flow rate of 0.99 m^3/s.

Includes flow from an external catchment downstream of the site

* 0.15 m^3/s through existing culvert under Wirring Rd and 0.21 m^3/s will overtop Wirring Rd

4.7 Non-structural controls

4.7.1 Landscaping and fertiliser applications

Educational material will be distributed to all new homeowners to emphasise the importance of appropriate fertiliser application and encourage current best practice to minimise stormwater run-off pollutants at the lot scale.

The landscaping vision for the development is to retain and blend the site into the natural vegetated surroundings. As such, landscaped areas predominantly comprise of native endemic plant species and minimal turf. Minimal to no fertiliser application at the precinct scale will therefore be required. Any fertiliser application will utilise phosphate free products and be applied by manual methods to increase control and prevent overapplication.

4.7.2 Vegetation

The conveyance swale on Wirring Road and detention basins will incorporate native rushes and sedges to help prevent erosion, restrict flows and remove pollutants, particularly nutrients.

A list of species and proposed planting densities to be used in the drainage areas will be provided within a subsequent UWMP and landscape plans. Consultation with the AMRS regarding site specific species and landscape designs will be undertaken by a suitably qualified landscape architect concurrent with the UWMP assessment.

5 GROUNDWATER MANAGEMENT

Site specific groundwater level data combined with the geotechnical investigation indicates that there is localised groundwater perching across the site. The groundwater level is therefore assumed to be at the top of any impermeable clay layer, with levels rapidly rising in response to winter rainfall, making some areas of the site susceptible to groundwater inundation.

A combination of the following design mechanisms is proposed to eliminate the risk of potential groundwater inundation and protect the structural integrity of infrastructure:

- Inter-allotment drainage for all lots is to be provided, which will enable excess roof run-off to connect into a free-flowing outlet and reduce point recharge of the upper granular soil layer and water table within lots.
- Subsoil drainage will be installed within road reserves and along some lot boundaries to control any groundwater level rise to the perched aquifer recharging in response to rainfall. Subsoils will discharge into the drainage basins prior to discharge to the environment.

Further assessments will be conducted as part of the detailed design phase to ascertain which areas of the site may require the installation of subsoil drainage to ensure the timely removal of groundwater from this perched layer.

5.1 Groundwater quality

The dominant hydrological regime at the site is characterised by overland flow. Rainfall run-off will be captured in vegetated detention basins and swales and is likely to infiltrate into the surficial soils above the clay. Infiltrated stormwater will receive some form of treatment via the strong ability of the clayey soil to adsorb phosphorus both in the basins and in the underlying soils and sediments.

Non-structural controls such as minimising fertiliser and pesticide application and maintaining well-established vegetation in drainage areas will also assist in groundwater quality protection.

Considering the above factors, the development does not pose a risk to groundwater quality underlying the site. Therefore, no post-development groundwater quality monitoring is proposed for this site.

6 MONITORING AND REPORTING

6.1 Pre-development

As previously discussed in Section 2.3.3.1 DWER and the AMRS have confirmed that they are satisfied with the groundwater/geotechnical investigations to enable an informed decision regarding groundwater management at the site. Consequently, no further pre-development groundwater level monitoring is required.

6.2 Post-development

As has been previously documented, the pre-development bores are to be removed by the current landowner and the Shire and DWER have indicated their support for this. The perched nature of the groundwater beneath the site indicates that it is not a groundwater resource that has nearby users from a water supply perspective and there are no local Groundwater Dependent Ecosystems that will be impacted by changes in perched groundwater quality aside from the springs and dam to the north adjacent to the Waverley subdivision that is already subject to post-development monitoring. Therefore, no post-development groundwater quality monitoring is proposed for this site.

The stormwater drainage system encourages the collection of stormwater at source and incorporates a series of vegetated drainage basins/swales that will allow for adequate sediment control and water quality treatment prior to water leaving the site, therefore post-development surface water monitoring is also not deemed necessary.

Visual inspection of the drainage basins/swales and designated discharge points will be carried out on a routine basis during both summer and winter months to ensure that the drainage system is functioning as per the design.

7 IMPLEMENTATION

The effectiveness of this LWMS will rely on the system's regular maintenance. The operation and maintenance program is proposed in Table 11 below.

Table 11: Roles and responsibilities

Principles	Role	Responsibility	Time-scale
Subdivision management	UWMP preparation	The proponent	Following subdivision application. DWER has recommended that the UWMP covers the entire structure plan area.
	Construction and site works management	The proponent	As required during construction until hand over to the AMRS.
	Waste and pollution management	The proponent	As required during construction until hand over to the AMRS.
	Erosion control	The proponent	As required during construction
POS and landscaped community areas	Maintenance of drainage infrastructure	The proponent	As specified within the POS design documentation until hand over to the AMRS.
	Fertiliser application	The proponent	As specified within the POS design documentation until hand over to the AMRS.
	Irrigation systems	The proponent	As specified within the POS design documentation until hand over to the AMRS.
Subsoil drainage system	Maintenance of subsoil drainage in road reserves	The proponent	Subsoil drainage system will be inspected prior to handover to the AMRS and flushed as required. To be maintained by AMRS thereafter.
	Maintenance of subsoil drainage on private property	Land owner	On purchase of lot.

8 REFERENCE

Department of Biodiversity, Conservation and Attractions (2022). Acid Sulfate Soil risk mapping.

Department of Planning and Infrastructure (2008). Better Urban Water Management.

~~Department of Water and Environmental Regulation. (2022). Contaminated Sites Database. Accessed June 2022.~~

Department of Water. (2004–2007). Stormwater Management Manual for Western Australia. Government of Western Australia.

Department of Water and Environmental Regulation. (2022). Contaminated Sites Database. Accessed June 2022.

DPLH (2022). Department of Planning, Lands and Heritage and Western Australian Planning Commission.

Ecosystem Solutions. (2022a). Bushfire Management Plan, Lot 500 Wirring Road, Cowaramup.

Ecosystem Solutions. (2022b). Environmental Assessment Report, Lot 500 Wirring Road, Cowaramup. 09 June 2022.

Galt Geotechnics. (2021). Geotechnical Study Proposed Residential Subdivision Part of Lot 204 & 51 Wirring Road, Cowaramup.

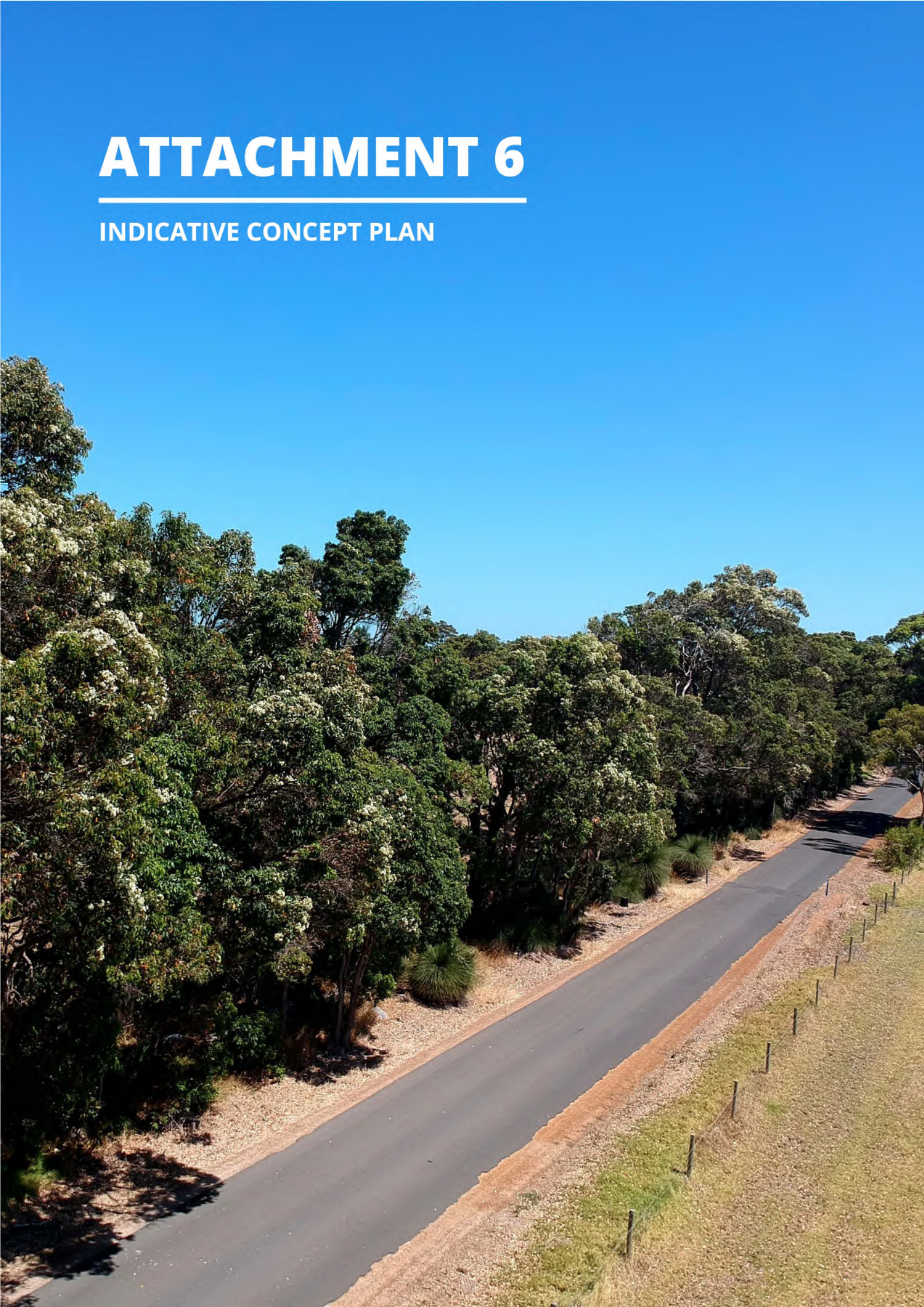
RPS. (2015). Urban Water Management Plan, Lot 9501 Bussell Highway and Lot 9500 Waverley Road Cowaramup.

Stantec. (2022). Lot 500 Wirring Road, Cowaramup. Civil, Electrical and Communications Engineering Servicing Report.

This page has been left blank intentionally.

ATTACHMENT 6

INDICATIVE CONCEPT PLAN





INDICATIVE CONCEPT PLAN

LOT 500 WIRRING ROAD
COWARAMUP

N

0 100 m
SCALE @ A3: 1:4000

9449-CON-05-B

DRAWN: VR
DATE CREATED: 2022.07.28
PROJECTION: MGA50 GDA94
CADASTRE: LANDGATE
SURVEY: SURVEY SOUTH - 28/03/2022
AERIAL: 15/10/2021

This document may not be reproduced without the written consent of Rowe Group. All areas and dimensions are subject to survey.

ROWE GROUP DESIGN

This page has been left blank intentionally.

ATTACHMENT 7

LANDSCAPE MASTER PLAN





LEGEND

01 POS 1 - 1.81Ha PASSIVE OPEN SPACE CENTRED AROUND RETENTION OF LARGE STAND OF EXISTING MATURE TREES AND PROVIDING DIRECT ACCESS TO RECREATIONAL SPACE FOR THE PROPOSED LIFESTYLE VILLAGE / R60 LOT. IT ALSO PROVIDES KEY CONNECTION THROUGH TO THE EXISTING COWARAMUP TOWNSITE - REFER DETAIL PLAN.

02 POS 2 - 1.24Ha LINEAR POS PROVIDING GREEN LINK THROUGH THE PROPOSED NEW SUBDIVISION AND A FOCAL POINT FOR KEY PEDESTRIAN MOVEMENTS. LIVING STREAM ALONG ENTRY ROAD PROVIDES NATURAL VISUAL AESTHETIC AND DRAINAGE FUNCTION IN ACCORDANCE WITH LWMS. FOOTPATHS AND SEATING AREAS CONNECT THROUGH TO MAIN ACTIVE OPEN SPACE WITH LARGE TURF KICK-ABOUT SPACE, PLAYGROUND AND PICNIC SHELTER / SEATING AREA AT SOUTHERN END - REFER DETAIL PLAN

03 POS 3 - .1.23Ha PASSIVE OPEN SPACE WITH RETENTION OF LARGE EXISTING TREES ALONG THE SOUTHERN / WESTERN BOUNDARY TO BE RETAINED AND PROTECTED. LIVING STREAM ALONG THE NORTHERN BOUNDARY PROVIDES NATURAL VISUAL AESTHETIC AND DRAINAGE FUNCTION IN ACCORDANCE WITH LWMS. FOOTPATHS AND SEATING AREAS CONNECT TO AN OPEN INFORMAL TURF AREA AT THE WESTERN END FOR INFORMAL ACTIVE RECREATION AND POSSIBLE DOG OF LEASH AREA - REFER DETAIL PLAN

04 DRAINAGE RESERVES - FOUR SEPARATE RESERVES ARE NOMINATED FOR DRAINAGE TO PROVIDE STORMWATER RETENTION AND TREATMENT OF THE PROPOSED PIT AND PIPE DRAINAGE SYSTEM WITHIN THE STREETSCAPES. PLANTED WITH NATIVE RUSHES AND SEDGES LESS THAN 1.0m IN HEIGHT AND CLUSTERS OF MELALEUCA AND WA PEPPERMINT TREES TO PROVIDE A NATURAL WETLAND WETLAND AESTHETIC BUT TO BE MANAGED IN ACCORDANCE WITH BUSHFIRE MANAGEMENT AND LWMS REQUIREMENTS.

05 10m WIDE LANDSCAPE BUFFER TO SOUTH-EAST BOUNDARY - VISUAL LANDSCAPE BUFFER TO PROVIDE SCREEN AND VISUAL SEPARATION BETWEEN RURAL AND DEVELOPED LAND AREAS. CONSISTING OF NATIVE TREE AND SHRUB PLANTING BY THE DEVELOPER IN THE REAR OF PRIVATE LOTS BUT TO BE MAINTAINED BY THE LOT OWNERS IN ACCORDANCE WITH THE BUSHFIRE MANAGEMENT PLAN REQUIREMENTS. THIS BUFFER INCLUDES A 0.5m HIGH EARTH MOUND AS A PHYSICAL DRAINAGE BARRIER BETWEEN THE RURAL AND RESIDENTIAL LAND AREAS.

06 10m WIDE LANDSCAPE BUFFER TO SOUTH-WEST BOUNDARY - VISUAL LANDSCAPE BUFFER TO PROVIDE SCREEN AND VISUAL SEPARATION FROM WIRRING ROAD TO THE NEW DEVELOPED LAND AREAS. CONSISTING OF NATIVE TREE AND SHRUB PLANTING BY THE DEVELOPER IN THE REAR OF PRIVATE LOTS BUT TO BE MAINTAINED BY THE LOT OWNERS IN ACCORDANCE WITH THE BUSHFIRE MANAGEMENT PLAN REQUIREMENTS.

- EXTENT OF PROJECT SITE
- REFER DETAIL PLAN
- CONNECTION TO EXISTING ROAD NETWORK
- POSSIBLE ROAD CONNECTION FOR FUTURE SUBDIVISION
- PEDESTRIAN PATHWAY CONNECTION
- PROPOSED PLAYGROUND
- PROPOSED PICNIC SETTING
- PROPOSED SHADE STRUCTURE / SHELTER
- PROPOSED SEATING NODE / BENCH SEAT
- MIN. 2.0m WIDE CONCRETE PATH
- FEATURE EXPOSED AGGREGATE PAVING NODE
- PROPOSED SHADE STRUCTURE / SHELTER
- PROPOSED SHADE SAILS OVER PLAYGROUND
- PLAYGROUND MULCH SOFTFALL
- IRRIGATED TURF
- 10m WIDE LANDSCAPE BUFFER PLANTING
- MIXED NATIVE POS PLANTING
- LOW FUEL / FIRE RESISTANT PLANTING
- DRAINAGE BASIN BATTER PLANTING
- DRAINAGE BASIN AND SWALE INVERT PLANTING
- FEATURE GRANITE BOULDERS AND RIFFLES

STREET TREE LEGEND

- EXISTING TREES TO BE RETAINED AND PROTECTED
- FRAXINUS RAYWOODII - Claret Ash
- LAGERSTROEMIA INDICA - Crepete Myrtle
- AGONIS FLEXUOSA - WA Peppermint
- CORYMBIA CALOPHYLLA - Grafted Cultivar Varieties
- POS TREE PLANTING - Mixed Species

NOTE: ALL STREET TREE PLANTING IS SUBJECT TO RESOLUTION OF CIVIL ENGINEERS SERVICING LAYOUT. ALL STREET PLANTING WILL REQUIRE INSTALLATION OF SUITABLE ROOT CONTROL BARRIERS.

LOT 500 WIRRING ROAD, COWARAMUP

LANDSCAPE MASTERPLAN

CLIENT: RW Duggan C/- PGPM Pty Ltd

DATE: 20 July 2022
REVISION: A

SCALE: 1:750 @ A1

SW LANDSCAPE COLLECTIVE



LEGEND

01 EXISTING STAND OF DEGRADED JARRAH AND MARRI WOODLAND TO BE RETAINED AND PROTECTED. UNDERSTOREY TO BE RE-ESTABLISHED WITH LOW GROUND COVERS AND SHRUBS AND MAINTAINED AS LOW FUEL STATE WITH CANOPY PRUNING TO ACHIEVE MINIMUM 2.0m SEPARATION FROM GROUND LEVEL OR UNDERSTOREY

02 MIXED NATIVE POS PLANTING AREAS TO REPLACE DEGRADED PADDOCK GRASSLAND WITH MIX OF LOCAL NATIVE LANDSCAPE SPECIES. TREE PLANTING TO OCCUR IN CLUMPS WITH MINIMUM 5.0m BETWEEN CANOPIES AT MATURITY. PLANTING AREAS TO BE MULCHED AND MAINTAINED TO CONTROL WEEDS AND ACHIEVE A NATURAL LANDSCAPE APPEARANCE

03 LOW FUEL PLANTING AREAS TO OUTER SURROUNDS OF POS AND BACKING ONTO EXISTING AND PROPOSED NEW LOTS. MIXTURE OF LOW NATIVE GROUNDCOVER AND FIRE RESISTANT PLANT SPECIES PLANTED IN CLUMPS WITH OPEN MULCH ONLY AREAS BETWEEN. TREE PLANTING TO OCCUR IN CLUMPS WITH MINIMUM 20.0m SEPARATION BETWEEN CANOPIES AT MATURITY ALSO TO ALLOW VIEWS FOR EXISTING DWELLINGS INTO THE POS

04 INFORMAL OPEN TURF AREA FOR ACTIVE RECREATION OPPORTUNITIES AND KICK-ABOUT SPACE. DIRECT ACCESS FROM PROPOSED LIFESTYLE VILLAGE / R60 LOT ENABLES BREAK-OUT ACTIVITY SPACE AND CONNECTION TO CIRCUIT WALKING PATHS AROUND THE EXISTING RETAINED VEGETATION.

EXTENT OF PROJECT SITE

PROPOSED SEATING NODE / BENCH SEATING AT POINT OF INTEREST AND WITH NATURAL SHADE

MIN. 2.0m WIDE CONCRETE PATH MEANDERING THROUGH POS PROVIDING CONNECTION BETWEEN KEY ACCESS POINTS AND WALKING CIRCUITS FOR EXERCISE ROUTES

IRRIGATED TURF (Subject ot Availability of Water Source)

MIXED NATIVE POS PLANTING AREAS

LOW FUEL / FIRE RESISTANT PLANTING AREAS

POS TREE PLANTING UTILISING A MIX OF LOCAL ENDEMIC AND NON-ENDEMIC SPECIES FOR SHADE, SHELTER, HABITAT AND AESTHETICS

STREET TREE LEGEND

EXISTING TREES TO BE RETAINED AND PROTECTED

FRAXINUS RAYWOODII - Claret Ash

LAGERSTROEMIA INDICA - Crepete Myrtle

AGONIS FLEXUOSA - WA Peppermint

CORYMBIA CALOPHYLLA - Grafted Cultivar Varieties

EXISTING STAND OF JARRAH / MARRI WOODLAND TO BE RETAINED AND PROTECTED AS CENTRAL FEATURE OF POS



EXISTING FOOTPATH CONNECTION TO COWARAMUP TOWNSITE IN NORTH WEST CORNER OF POS

LOT 500 WIRRING ROAD, COWARAMUP

LANDSCAPE CONCEPT PLAN - POS 1

CLIENT: RW Duggan C/- PGPM Pty Ltd

DATE: 20 July 2022
REVISION: A

SCALE: 1:200 @ A1

SW LANDSCAPE COLLECTIVE



LEGEND

01 LIVING STREAM TO BE CONSTRUCTED AS AN OPEN DRAINAGE SWALE CAPTURING ROAD RUN OFF FROM THE EXTENSION OF ROY EARL DRIVE AND ANY PIT AND PIPE STORMWATER WHERE REQUIRED. PLANTED WITH RUSHES AND SEDGES LESS THAN 1.0m in HEIGHT AND CONSTRUCTED POOLS AND ROCK RIFFLES TO ASSIST WITH WATER FLOW, EROSION CONTROL, INFILTRATION AND NUTRIENT STRIPPING. THIS IS ALSO KEY VISUAL LANDSCAPE FEATURE ALONG THE MAIN ENTRANCE ROAD

02 ACTIVITY NODE CONTAINING SHADE SHELTER AND PICNIC FACILITIES ADJACENT TO THE PROPOSED PLAYGROUND AND ACTIVE TURF AREA. EXPOSED AGGREGATE CONCRETE DEFINES THE NODE WITH PICNIC SETTINGS, DRINK FOUNTAIN AND OTHER FACILITIES TO BE PROVIDED IN DISCUSSION WITH THE SHIRE OF AUGUSTA-MARGARET RIVER

03 PLAYGROUND FACILITIES BENEATH SHADE SAILS AND INCLUDING MULCH PLAYGROUND SOFTFALL. EQUIPMENT TO PROVIDE FOR ALL ABILITIES AND AGES BUT WITH FOCUS ON YOUNGER AGE GROUPS NOTING CLOSE PROXIMITY TO COWARAMUP DISTRICT OVAL FACILITIES, SKATE PARK AND BMX

04 INFORMAL OPEN TURF AREA FOR ACTIVE RECREATION OPPORTUNITIES AND KICK-ABOUT SPACE. FACILTIES SUCH AS GOAL POSTS, SOCCER GOALS AND EXERCISE EQUIPMENT TO BE CONSIDERED IN DISCUSSION WITH THE SHIRE OF AUGUSTA-MARGARET RIVER

EXTENT OF PROJECT SITE

PROPOSED SHADE STRUCTURE / SHELTER

PROPOSED PLAYGROUND

PROPOSED PICNIC SETTING / FACILITIES

PROPOSED SEATING NODE / BENCH SEATING AT POINT OF INTEREST AND WITH NATURAL SHADE

MIN. 2.0m WIDE CONCRETE PATH MEANDERING THROUGH POS PROVIDING CONNECTION BETWEEN KEY ACCESS POINTS AND WALKING CIRCUITS FOR EXERCISE ROUTES

FEATURE EXPOSED AGGREGATE TO DEFINE KEY ACTIVITY NODES AND SEATING AREAS

PROPOSED SHADE STRUCTURE / SHELTER, PREFERABLY CUSTOM MADE OF LOCAL MATERIALS SUCH AS HARD AND ALUMINIUM TO MAINTAIN LOCAL CHARACTER

PROPOSED PLAYGROUND WITH SHADE SAILS OVER FOR SHADE AND SHELTER

PLAYGROUND MULCH SOFTFALL

FEATURE GRANITE BOULDERS AND RIFFLES TO LIVING STREAM FOR STRUCTURAL AND AESTHETIC FUNCTION

IRRIGATED TURF (Subject ot Availability of Water Source)

MIXED NATIVE POS PLANTING AREAS

LOW FUEL / FIRE RESISTANT PLANTING AREAS

DRAINAGE BASIN BATTER PLANTING

DRAINAGE BASIN AND SWALE INVERT PLANTING

POS TREE PLANTING UTILISING A MIX OF LOCAL ENDEMIC AND NON-ENDEMIC SPECIES FOR SHADE, SHELTER, HABITAT AND AESTHETICS

LOT 500 WIRRING ROAD, COWARAMUP

LANDSCAPE CONCEPT PLAN - POS 2

CLIENT: RW Duggan C/- PGPM Pty Ltd

DATE: 20 July 2022
REVISION: A

SCALE: 1:200 @ A1

SW LANDSCAPE COLLECTIVE



LEGEND

01 EXISTING LINE OF MATURE EXISTING TREES TO BE RETAINED AND PROTECTED. UNDERSTOREY TO BE RE-ESTABLISHED WITH LOW GROUND COVERS AND SHRUBS AND MAINTAINED AS LOW FUEL STATE WITH CANOPY PRUNING TO ACHIEVE MINIMUM 2.0m SEPARATION FROM GROUND LEVEL OR UNDERSTOREY

02 MIXED NATIVE POS PLANTING AREAS TO REPLACE DEGRADED PADDOCK GRASSLAND WITH MIX OF LOCAL NATIVE LANDSCAPE SPECIES. TREE PLANTING TO OCCUR IN CLUMPS WITH MINIMUM 5.0m BETWEEN CANOPIES AT MATURITY. PLANTING AREAS TO BE MULCHED AND MAINTAINED TO CONTROL WEEDS AND ACHIEVE A NATURAL LANDSCAPE APPEARANCE

03 LOW FUEL PLANTING AREAS TO OUTER SURROUNDS OF POS AND BACKING ONTO EXISTING AND PROPOSED NEW LOTS. MIXTURE OF LOW NATIVE GROUNDCOVER AND FIRE RESISTANT PLANT SPECIES PLANTED IN CLUMPS WITH OPEN MULCH ONLY AREAS BETWEEN. TREE PLANTING TO OCCUR IN CLUMPS WITH MINIMUM 20.0m SEPARATION BETWEEN CANOPIES AT MATURITY ALSO TO ALLOW VIEWS FOR EXISTING DWELLINGS INTO THE POS

04 INFORMAL OPEN TURF AREA FOR ACTIVE RECREATION OPPORTUNITIES AND KICK-ABOUT SPACE. ALTERNATE USES TO POS 2 PROPOSED INCLUDING POSSIBLE DOG OFF LEASH AREA TO BE CONSIDERED IN DISCUSSION WITH SHIRE OF AUGUSTA-MARGARET RIVER

05 LIVING STREAM TO BE CONSTRUCTED AS AN OPEN DRAINAGE SWALE CAPTURING ROAD RUN OFF FROM THE EXTENSION OF ROY EARL DRIVE AND ANY PIT AND PIPE STORMWATER WHERE REQUIRED. PLANTED WITH RUSHES AND SEDGES LESS THAN 1.0m In HEIGHT AND CONSTRUCTED POOLS AND ROCK RIFFLES TO ASSIST WITH WATER FLOW, EROSION CONTROL, INFILTRATION AND NUTRIENT STRIPPING. THIS IS ALSO KEY VISUAL LANDSCAPE FEATURE ALONG THE MAIN ENTRANCE ROAD

EXTENT OF PROJECT SITE

PROPOSED SHADE STRUCTURE / SHELTER

PROPOSED PICNIC SETTING / FACILITIES

PROPOSED PLAYGROUND

PROPOSED SEATING NODE / BENCH SEATING AT POINT OF INTEREST AND WITH NATURAL SHADE

MIN. 2.0m WIDE CONCRETE PATH MEANDERING THROUGH POS PROVIDING CONNECTION BETWEEN KEY ACCESS POINTS AND WALKING CIRCUITS FOR EXERCISE ROUTES

FEATURE EXPOSED AGGREGATE TO DEFINE KEY ACTIVITY NODES AND SEATING AREAS

PROPOSED SHADE STRUCTURE / SHELTER, PREFERABLY CUSTOM MADE OF LOCAL MATERIALS SUCH AS HARD AND ALUMINIUM TO MAINTAIN LOCAL CHARACTER

FEATURE GRANITE BOULDERS AND RIFFLES TO LIVING STREAM FOR STRUCTURAL AND AESTHETIC FUNCTION

IRRIGATED TURF (Subject ot Availability of Water Source)

MIXED NATIVE POS PLANTING AREAS

LOW FUEL / FIRE RESISTANT PLANTING AREAS

DRAINAGE BASIN BATTER PLANTING

DRAINAGE BASIN AND SWALE INVERT PLANTING

POS TREE PLANTING UTILISING A MIX OF LOCAL ENDEMIC AND NON-ENDEMIC SPECIES FOR SHADE, SHELTER, HABITAT AND AESTHETICS



EXISTING MATURE TREES TO BE RETAINED ALONG SOUTHERN BOUNDARY OF POS

LOT 500 WIRRING ROAD, COWARAMUP

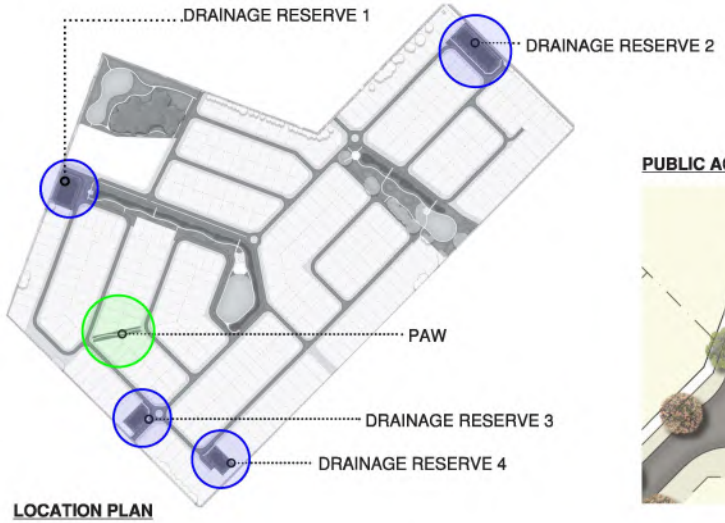
LANDSCAPE CONCEPT PLAN - POS 3

CLIENT: RW Duggan C/- PGPM Pty Ltd

DATE: 20 July 2022
REVISION: A

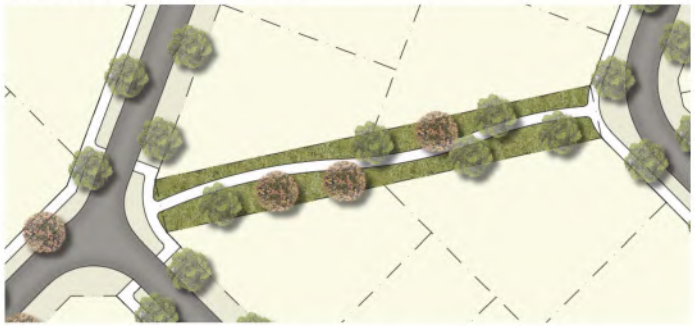
SCALE: 1:200 @ A1

SW LANDSCAPE COLLECTIVE



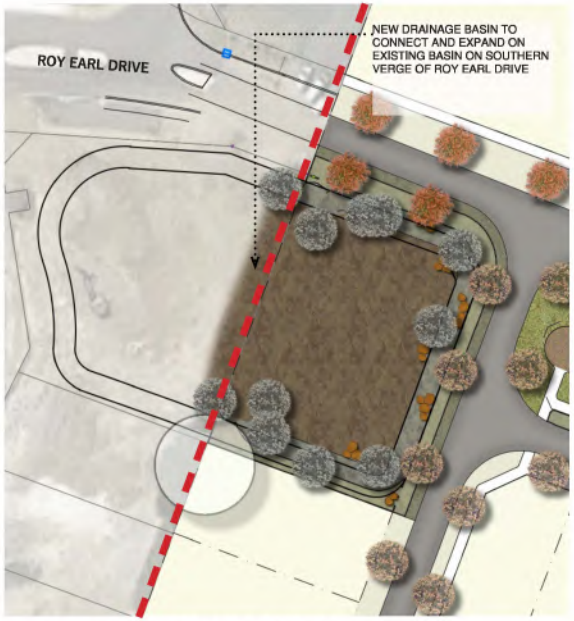
LOCATION PLAN

PUBLIC ACCESS WAY - DETAIL PLAN

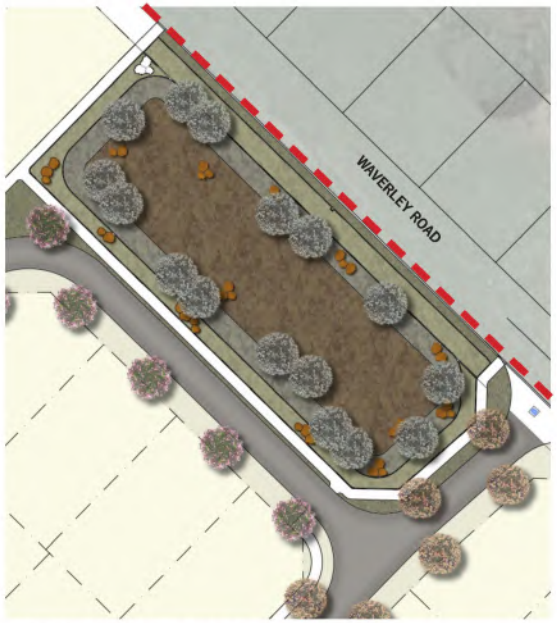


LEGEND

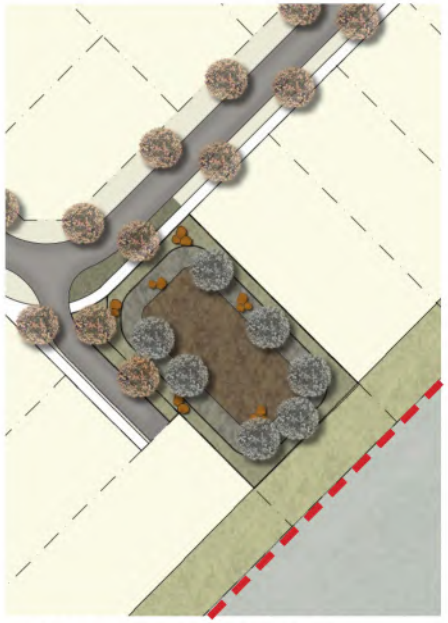
- MIN. 2.0m WIDE CONCRETE PATH
- IRRIGATED TURF (Subject ot Availability of Water Source)
- MIXED NATIVE POS PLANTING AREAS
- LOW FUEL / FIRE RESISTANT PLANTING AREAS
- DRAINAGE BASIN BATTER PLANTING
- DRAINAGE BASIN AND SWALE INVERT PLANTING
- POS TREE PLANTING UTILISING A MIX OF LOCAL ENDEMIC AND NON-ENDEMIC SPECIES FOR SHADE, SHELTER, HABITAT AND AESTHETICS
- FEATURE GRANITE BOULDERS AND RIFFLES TO LIVING STREAM FOR STRUCTURAL AND AESTHETIC FUNCTION
- EXISTING TREES TO BE RETAINED AND PROTECTED
- LAGERSTROEMIA INDICA - Crepete Myrtle
- CORYMBIA CALOPHYLLA - Grafted Cultivar Varieties
- FRAXINUS RAYWOODII - Claret Ash
- AGONIS FLEXUOSA - WA Peppermint
- MELALEUCA RAPHIOPHYLLA - Swamp Paperbark



DRAINAGE RESERVE 1 - DETAIL PLAN



DRAINAGE RESERVE 2 - DETAIL PLAN



DRAINAGE RESERVE 3 - DETAIL PLAN



DRAINAGE RESERVE 4 - DETAIL PLAN

0 2 4 6 8 10 m

LOT 500 WIRRING ROAD, COWARAMUP

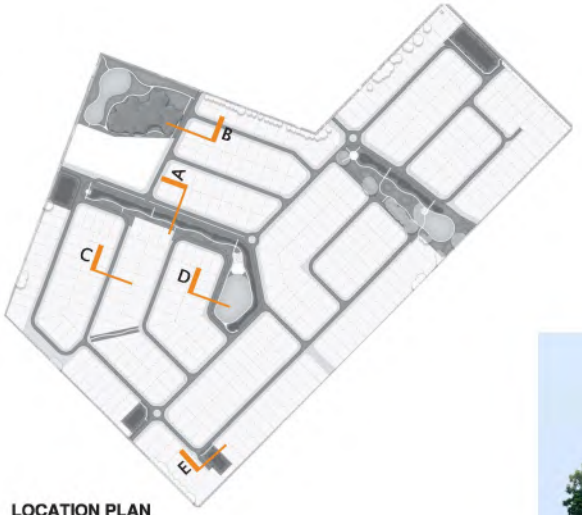
LANDSCAPE CONCEPT PLAN - DRAINAGE RESERVES AND PUBLIC ACCESS WAY

CLIENT: RW Duggan C/- PGPM Pty Ltd

DATE: 20 July 2022
REVISION: A

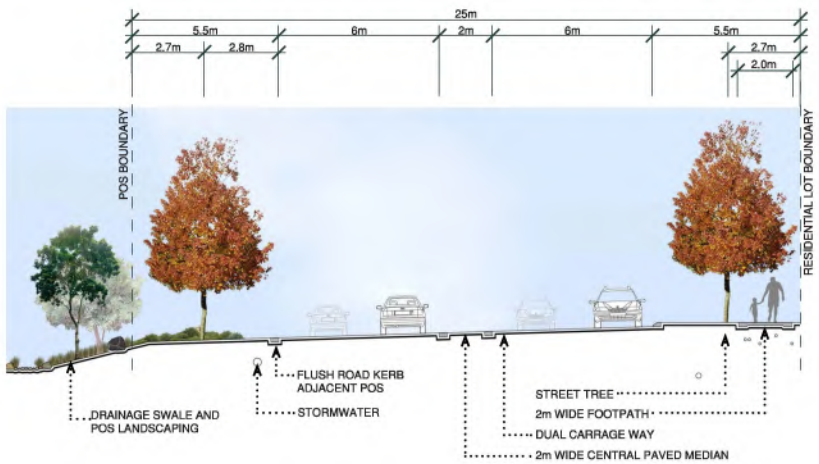
SCALE: 1:200 @ A1

SW LANDSCAPE COLLECTIVE

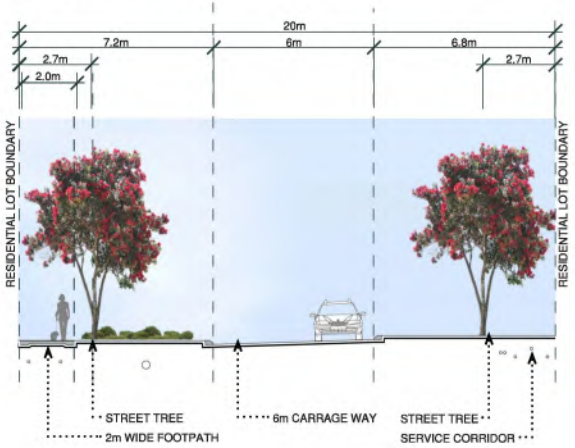


LOCATION PLAN

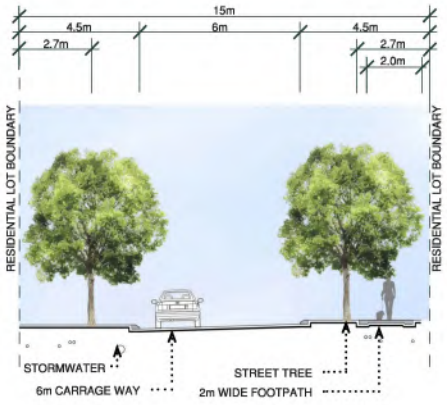
A) 25m ROAD RESERVE



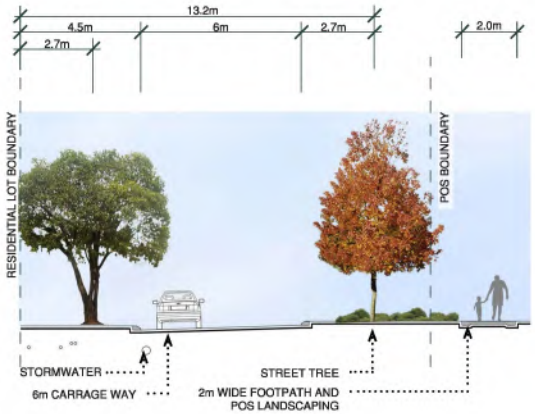
B) 20m ROAD RESERVE



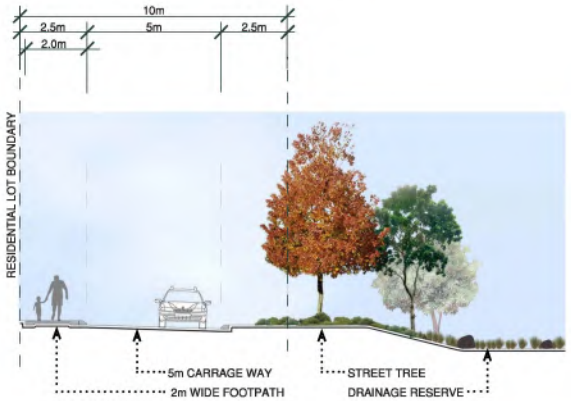
C) 15m ROAD RESERVE



D) 13.2m ROAD RESERVE



E) 10m ROAD RESERVE - BATTLEAXE





LOT 500 WIRRING ROAD, COWARAMUP

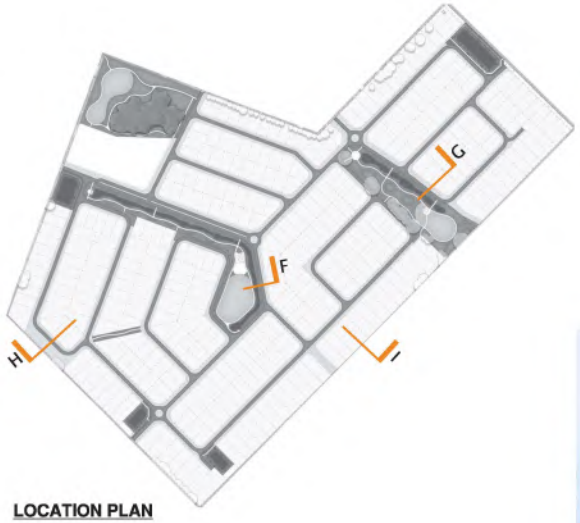
LANDSCAPE CONCEPT PLAN - TYPICAL ROAD SECTIONS

CLIENT: RW Duggan C/- PGPM Pty Ltd

DATE: 20 July 2022
REVISION: A

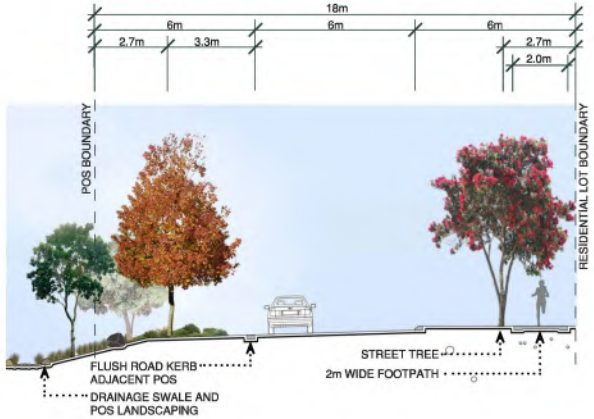
SCALE: 1:100 @ A1

SW LANDSCAPE COLLECTIVE

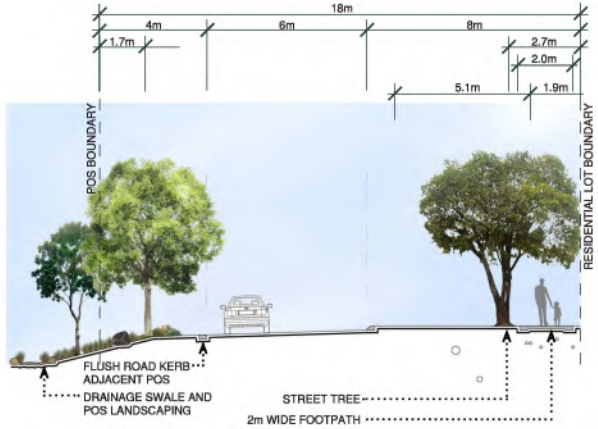


LOCATION PLAN

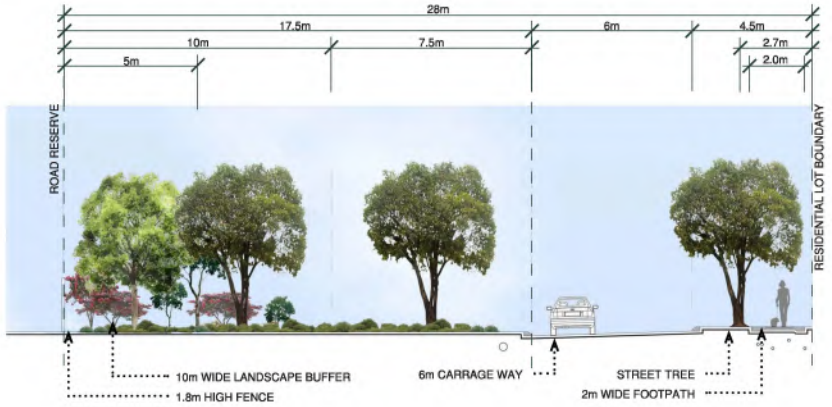
F) 18m ROAD RESERVE (A)



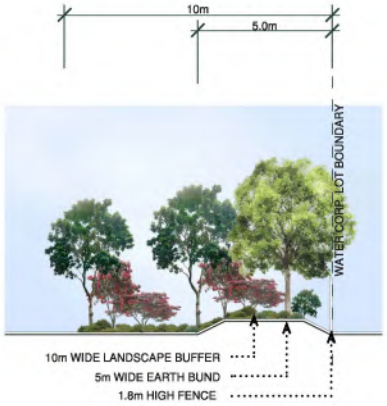
G) 18m ROAD RESERVE (B)



H) 28m ROAD RESERVE



I) 10m BUFFER PLANTING



LOT 500 WIRRING ROAD, COWARAMUP

LANDSCAPE CONCEPT PLAN - TYPICAL ROAD SECTIONS

CLIENT: RW Duggan C/- PGPM Pty Ltd

DATE: 20 July 2022
REVISION: A

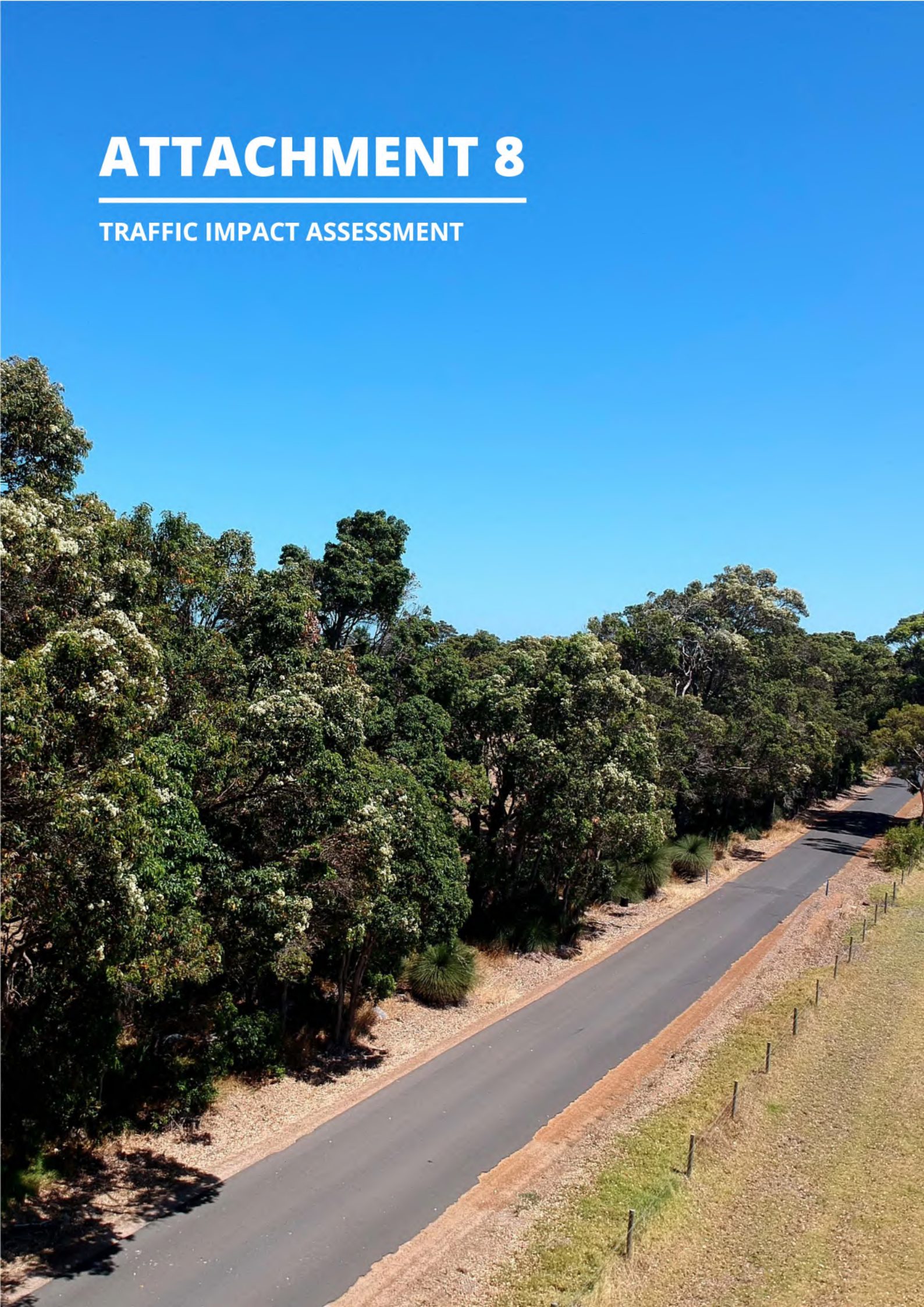
SCALE: 1:100 @ A1

SW LANDSCAPE COLLECTIVE

This page has been left blank intentionally.

ATTACHMENT 8

TRAFFIC IMPACT ASSESSMENT



Transport Impact Assessment

Proposed Structure Plan, Lot 500 Wirring Road, Cowaramup

CW1200069



Prepared for

R. W. Duggan

20 July 2022

Cardno

now

Stantec

Contact Information

Cardno (WA) Pty Ltd
ABN 77 009 119 000

11 Harvest Terrace
West Perth WA 6005
PO Box 447

www.cardno.com
Phone +61 8 9273 3888
Fax +61 8 9486 8664

Document Information

Prepared for	R. W. Duggan
Project Name	Proposed Structure Plan, Lot 500 Wirring Road, Cowaramup
File Reference	CW1200069-TR-R001-A-Cowaramup TIA
Job Reference	CW1200069
Date	20 July 2022
Version Number	B

Author(s):

Edmond Hoang
Traffic Engineer

Effective Date 20/07/2022

Approved By:

Ray Cook
Business Leader – Traffic and Transport Planning

Date Approved 20/07/2022

Document History

Version	Effective Date	Description of Revision	Prepared by	Reviewed by
A	24/05/2022	For Issue	EH	AW
B	20/07/2022	For Issue	EH	AW

Table of Contents

1	Introduction		1
	1.1	Background	1
	1.2	Site Context	1
2	Existing Situation		2
	2.1	Surrounding Land Uses	2
	2.2	Existing External Road Network	4
	2.3	Existing Traffic Volumes	7
	2.4	Existing Public Transport Facilities	7
	2.5	Existing Pedestrian/Cycle Network Facilities	7
	2.6	Existing Crash Data	7
3	Proposed Development		9
	3.1	Proposed Development	9
	3.2	Access Arrangements	9
	3.3	Road Network	11
4	Changes to Surrounding Transport Network		12
	4.1	Road Network	12
	4.2	Pedestrian/Cycle Networks	12
	4.3	Public Transport Networks	13
5	Integration with Surrounding Area		14
	5.1	Major Attractors/Generators	14
6	Analysis of Transport Network		15
	6.1	Assessment Years and Time Period	15
	6.2	Key Assumptions	15
	6.3	Development Trip Generation	15
	6.4	Development Trip Distribution	16
	6.5	Intersection Performance	18
	6.6	SIDRA Analysis Results	19
	6.7	Analysis Summary	23
7	Site-Specific Issues		24
	7.1	Intersection Warrant Assessment	24
8	Conclusions and Summary		27

Appendices

Appendix A WAPC Checklist

Appendix B Site Plans

Tables

Table 2-1	Existing Road Network Classification	4
Table 2-2	Traffic Volumes	7
Table 2-3	Bussell Highway / Wirring Road Intersection Crashes	8
Table 2-4	Bussell Highway Midblock Crashes	8
Table 3-1	Road Reserve Widths	11
Table 6-1	Trip Generation Rates	15
Table 6-2	Directional Distribution	15
Table 6-3	Total Trip Generation	16
Table 6-4	Level of Service (LoS) Performance Criteria	18
Table 6-5	Bussell Highway/Waverley Road Intersection – Scenario 1	19
Table 6-6	Bussell Highway/Roy Earl Drive Intersection – Scenario 1	20
Table 6-7	Bussell Highway/Wirring Road Intersection – Scenario 1	21
Table 6-8	Bussell Highway/Waverley Road Intersection – Scenario 3	22
Table 6-9	Bussell Highway/Roy Earl Drive Intersection – Scenario 3	22
Table 6-10	Bussell Highway/Wirring Road Intersection – Scenario 3	23

Figures

Figure 1-1	Aerial Image of Site Area	1
Figure 2-1	Shire of Augusta-Margaret River Zoning	2
Figure 2-2	Road Hierarchy	5
Figure 2-3	Posted Speed Limits	6
Figure 2-4	Crash Map	8
Figure 3-1	Indicative Concept Plan	9
Figure 3-2	Site Access Location	10
Figure 3-3	Local Road Network Classification	11
Figure 4-1	Inter-regional Cycling Connections Map	13
Figure 5-1	Key Attractors/Generators within the Surrounding Area	14
Figure 6-1	Development Trip Distribution Inbound	16
Figure 6-2	Development Trip Distribution Outbound	17
Figure 6-3	SIDRA Layout for Bussell Highway/Waverley Road Intersection	19
Figure 6-4	SIDRA Layout for Bussell Highway/Roy Earl Drive Intersection	20
Figure 6-5	SIDRA Layout for Bussell Highway/Wirring Road Intersection	21
Figure 7-1	Scenario 1 Bussell Highway/Wirring Road Intersection Warrant Assessment – AM	25
Figure 7-2	Scenario 1 Bussell Highway/Wirring Road Intersection Warrant Assessment – PM	25
Figure 7-3	Scenario 2 Bussell Highway/Wirring Road Intersection Warrant Assessment – AM	26
Figure 7-4	Scenario 2 Bussell Highway/Wirring Road Intersection Warrant Assessment – PM	26

1 Introduction

1.1 Background

Cardno has been commissioned by R. W. Duggan ('the Client') to prepare a Transport Impact Assessment (TIA) in support of a proposal Local Structure Plan (LSP) located at Lot 500 Wirring Road, Cowaramup, within the Shire of Augusta-Margaret River (the "Site").

This report assesses the impacts of the proposed development upon the adjacent transport network, with a focus on traffic operations, internal road connections and intersection warrants. The Structure Plan proposes predominantly residential development between R10 and R60 (including a Retirement Village), and the associated movement network and public open space reserves.

This report has been prepared in accordance with the *Western Australian Planning Commission (WAPC) Transport Impact Assessment Guidelines for Developments: Volume 2 – Planning Schemes, Structure Plans and Activity Centre Plans (2016)* and the checklist is included in **Appendix A.**

1.2 Site Context

The Site is located at Lot 500 Wirring Road, Cowaramup and is currently vacant land. The Site is located in the Shire of Augusta-Margaret River. **Figure 1-1** shows an aerial image of the Site area.

Figure 1-1 Aerial Image of Site Area



Source: MetroMap

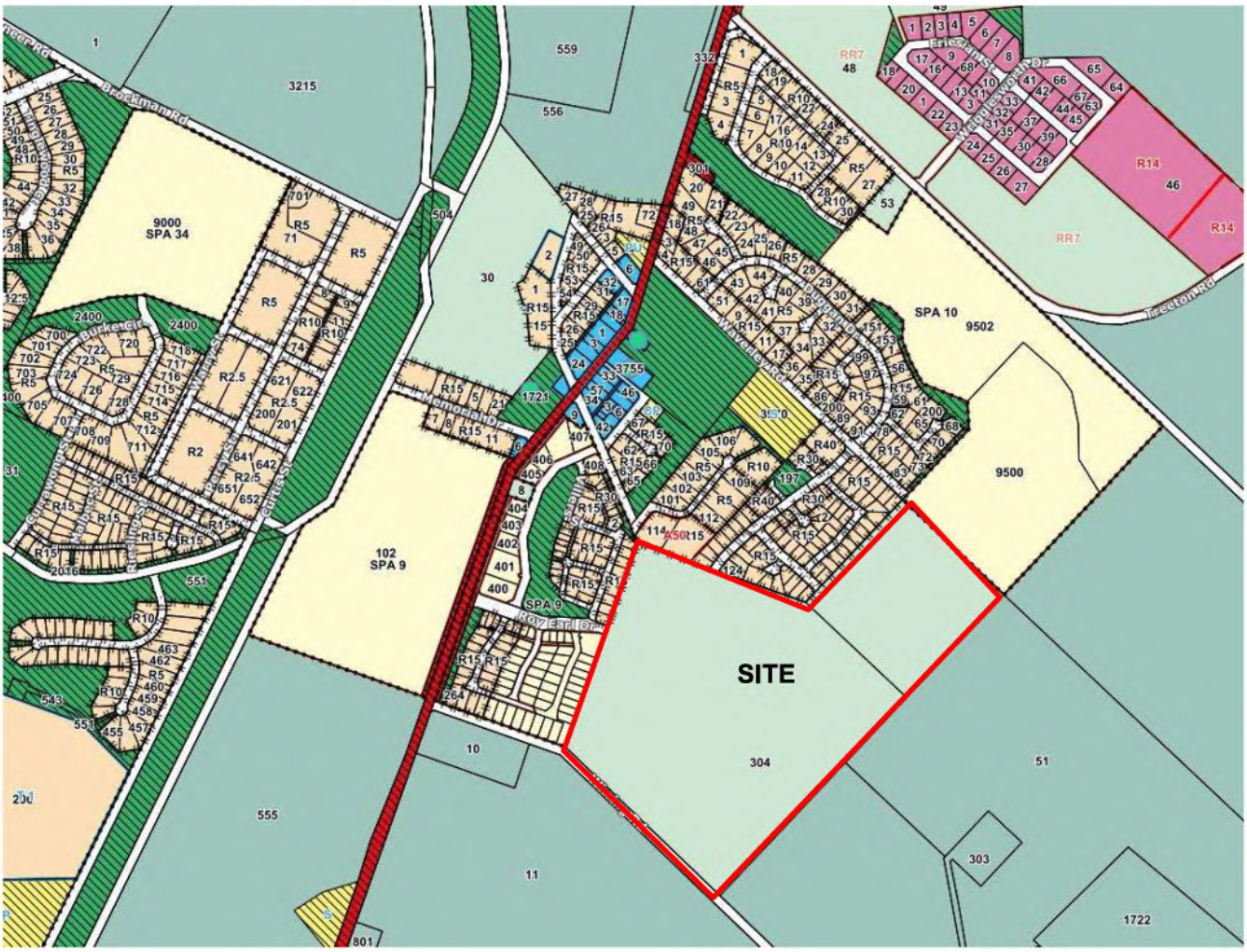
2 Existing Situation

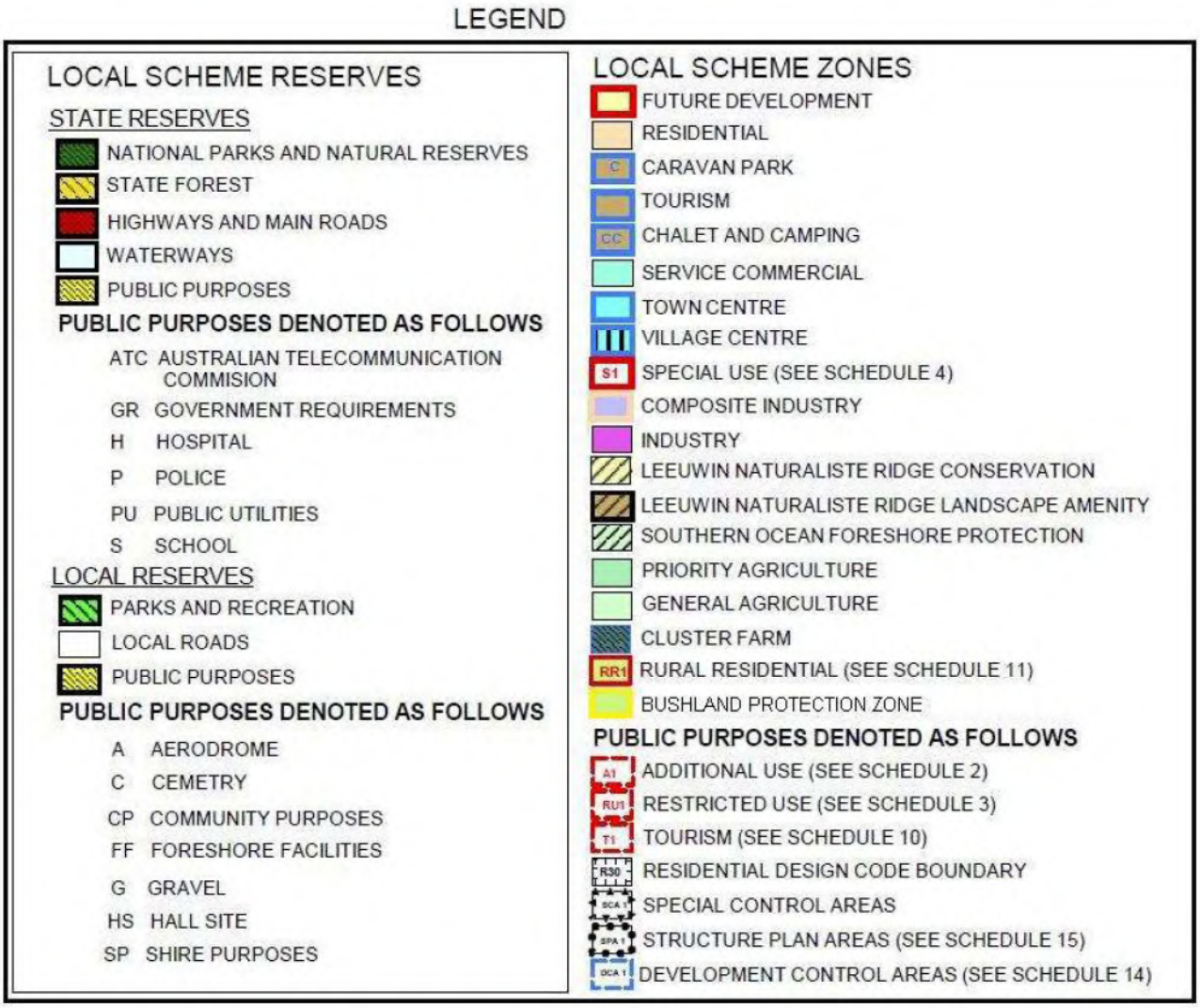
2.1 Surrounding Land Uses

Pursuant to the provision of the *Shire of Augusta-Margaret River Local Planning Scheme No. 1*, the Site is zoned *'General Agriculture'*, as shown in **Figure 2-1**. A Request to Amend LPS 1 (Amendment 76) was lodged in June 2022, seeking to rezone the land to 'Future Development'.

Within the immediate surrounding area, the land uses consist of Priority Agriculture to the east and south of the site and residential dwellings to the north and west of the site.

Figure 2-1 Shire of Augusta-Margaret River Zoning





Source: Shire of Augusta-Margaret River Local Planning Scheme No. 1

2.2 Existing External Road Network

Road classifications are defined in the Main Roads Functional Hierarchy as follows:

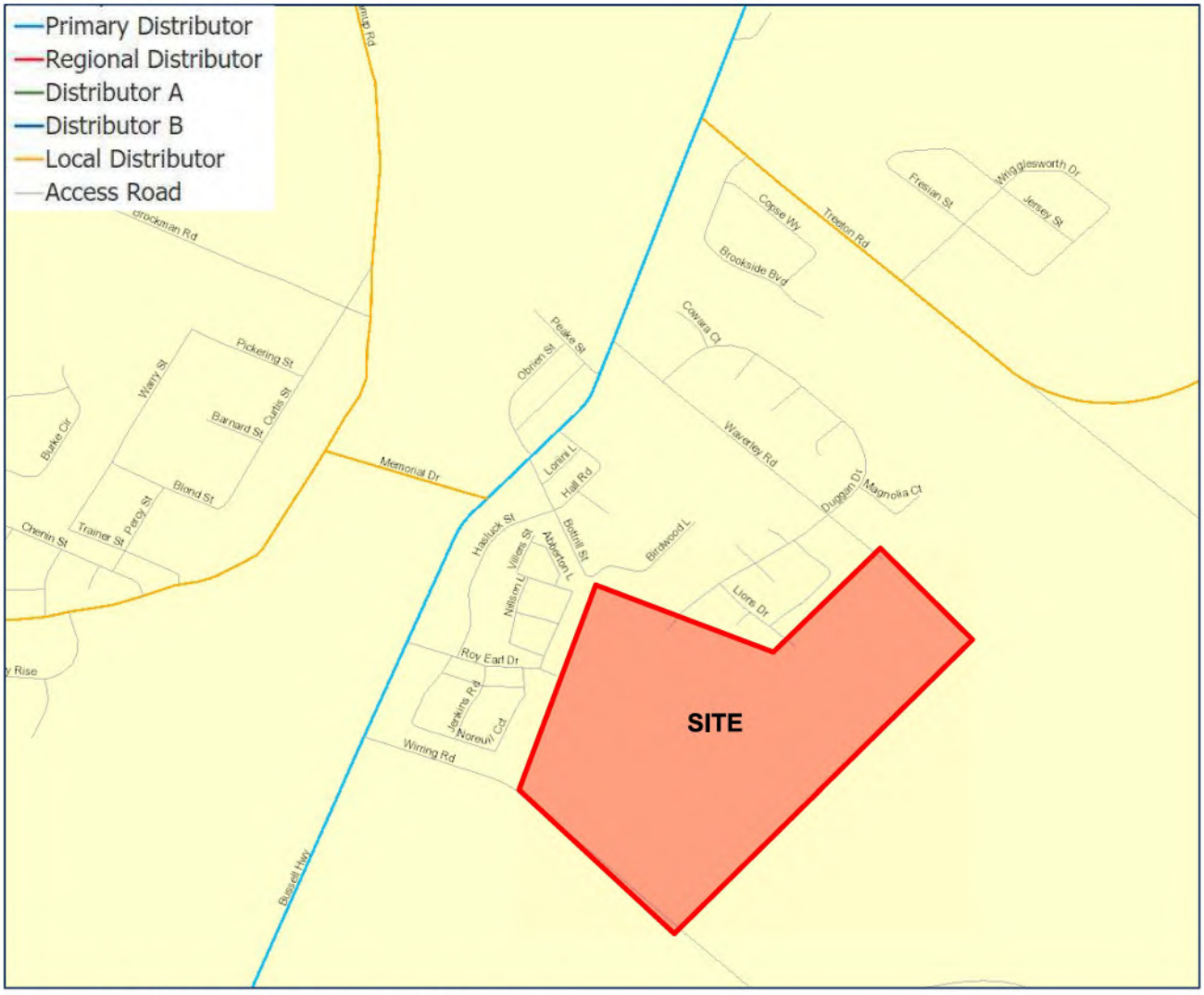
- **Primary Distributors (light blue):** Form the regional and inter-regional grid of MRWA traffic routes and carry large volumes of fast-moving traffic. Some are strategic freight routes, and all are National or State roads. They are managed by Main Roads.
- **Regional Distributors (red):** Roads that are not Primary Distributors, but which link significant destinations and are designed for efficient movement of people and goods within and beyond regional areas. They are managed by Local Government.
- **District Distributor A (green):** These carry traffic between industrial, commercial and residential areas and connect to Primary Distributors. These are likely to be truck routes and provide only limited access to adjoining property. They are managed by Local Government.
- **District Distributor B (dark blue):** Perform a similar function to District Distributor A but with reduced capacity due to flow restrictions from access to and roadside parking alongside adjoining property. These are often older roads with traffic demand in excess of that originally intended. District Distributor A and B roads run between land-use cells and not through them, forming a grid that would ideally be around 1.5 kilometres apart. They are managed by Local Government.
- **Local Distributors (orange):** Carry traffic within a cell and link District Distributors at the boundary to access roads. The route of the Local Distributor discourages through traffic so that the cell formed by the grid of District Distributors only carries traffic belonging to or serving the area. These roads should accommodate buses but discourage trucks. They are managed by Local government.
- **Access Roads (grey):** Provide access to abutting properties with amenity, safety and aesthetic aspects having priority over the vehicle movement function. These roads are bicycle and pedestrian friendly. They are managed by Local government.

The Site is bounded by residential development established to the north and west (comprising the Cowaramup Country and Symphony Waters Estates), Wirring Road to the south and vacant agricultural land to the east. The surrounding road network is further described in **Table 2-1** and shows the hierarchy as per the Main Roads WA Road Information Mapping System, whilst **Figure 2-2** shows the existing road hierarchy and **Figure 2-3** shows the posted speed limits on the roads adjacent to the Site.

Table 2-1 Existing Road Network Classification

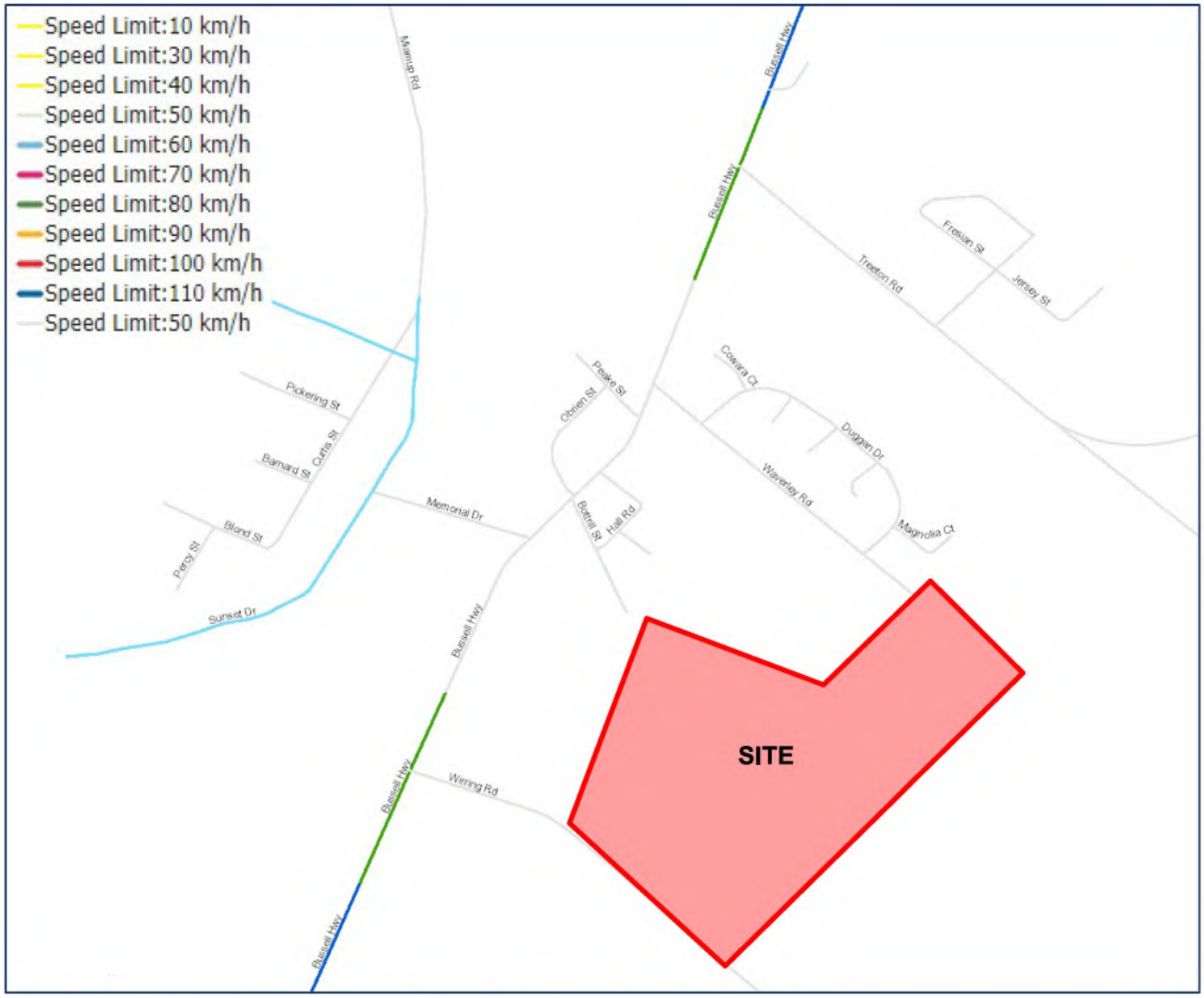
Road Name	Road Hierarchy	Jurisdiction	No. of Lanes	No. of Footpaths	Road (Pavement) Width (m)	Posted Speed (km/h)
Roy Earl Drive	Access Road	Local Government	2	2	15.0 (including 4.0m central median)	50
Bussell Highway	Primary Distributor	Main Roads WA	2	0	9.5	50-110
Waverley Road	Access Road	Local Government	2	1	6.6	50
Wirring Road	Access Road	Local Government	2	0	7.5	50

Figure 2-2 Road Hierarchy



Source: Main Roads WA – Road Information Mapping System

Figure 2-3 Posted Speed Limits



Source: Main Roads WA – Road Information Mapping System

2.3 Existing Traffic Volumes

The most recent traffic volumes for the roads in the vicinity of the Site were obtained from the Main Roads Traffic Map, the Shire of Augusta Margaret River and through traffic surveys (for Roy Earl Drive) and are summarised in **Table 2-2**. Note that the traffic surveys were conducted during school holidays which represented the peak period, as requested by the Shire of Augusta-Margaret River.

Table 2-2 Traffic Volumes

Road Name	Date	Average Two-way Daily Traffic Volume	Average Two-way AM Peak Traffic Volume (Weekday)	Average Two-way PM Peak Traffic Volume (Weekday)	Heavy Vehicles (%)
Bussell Highway	2018/19	7,654	626	682	12.8
Waverley Road	2017/18	1,116	168	165	7.3
Wirring Road	2016	302	25	36	6.9
Roy Earl Drive	2022	N/A*	126	130	2.0

Source: Shire of Augusta-Margaret River, Main Roads Traffic Map and Traffic Surveys

** Intersection survey was only conducted during the morning and afternoon peak periods*

2.4 Existing Public Transport Facilities

There are currently no public transport services which operate within the vicinity of the Site.

2.5 Existing Pedestrian/Cycle Network Facilities

The pedestrian path network within the surrounding area is limited.

2.6 Existing Crash Data

A search of the *Main Roads WA Reporting Centre* for crash data was undertaken for all recorded traffic accidents between 1 January 2017 and 31 December 2021 within the surrounding area of the subject Site for the following roads and intersections:

> Bussell Highway/ Roy Earl Road intersection (no crashes)

> Bussell Highway/ Waverley Road intersection (no crashes)

> Bussell Highway/ Wirring Road intersection (refer to **Table 2-3**)

> Bussell Highway mid-block (refer to **Table 2-4**)

> Roy Earl Road midblock (no crashes)

> Wirring Road midblock (no crashes)

Overall, very few crashes have been recorded to occur on the roads and at the intersections adjacent to the Study Area.

Figure 2-4 Crash Map



Source: Main Road WA Crash Map

Table 2-3 Bussell Highway / Wirring Road Intersection Crashes

Type of Crash	Fatal	Hospital	Medical	Major Property Damage	Minor Property Damage	Total Crashes
Right Angle	-	-	-	1	-	1
Total	**0**	**0**	**0**	**1**	**0**	**1**

Table 2-4 Bussell Highway Midblock Crashes

Type of Crash	Fatal	Hospital	Medical	Major Property Damage	Minor Property Damage	Total Crashes
Rear End	-	-	1	-	1	2
Sideswipe Same Direction	-	-	-	2	-	2
Hit Pedestrian	-	-	-	-	1	1
Right Angle	-	-	-	1	-	1
Other	-	-	-	1	-	1
Total	**0**	**0**	**1**	**4**	**2**	**7**

Additionally, a right angle crash was also recorded along Duggan Drive resulting in minor property damage.

3 Proposed Development

3.1 Proposed Development

The proposed local structure plan comprises the following land uses:

> Approximately 350 residential lots with densities between R10 and R25

> A retirement village development site (R60); and

> Roads and public open space

Figure 3-1 shows the indicative Concept Plan.

Figure 3-1 Indicative Concept Plan



Source: Rowe Group Design

3.2 Access Arrangements

The proposed Site access arrangement is shown in **Figure 3-2** and summarised below:

> Access 1 – Roy Earl Drive

> Access 2 – Duggan Drive

> Access 3 – Lions Drive

> Access 4 – Waverley Road

> Access 5 – Wirring Road

> Access 6 & 7 – Potential future road connections

Figure 3-2 Site Access Location



Source: Rowe Group Design

3.3 Road Network

The Site will contain approximately 9 ha of road reserve space forming the local road network within the Site. The internal road network will consist of access streets to facilitate travel to and from the residential dwellings with the Roy Earl Drive extension serving as the main road link providing access to Bussell Highway. **Figure 3-3** shows the classification of the access streets within the Site based on the indicative road reserve widths specified in *Draft Liveable Neighbourhoods 2015*.

Figure 3-3 Local Road Network Classification



Source: Rowe Group Design

Table 3-1 provides a summary of the road reserve widths for each road class.

Table 3-1 Road Reserve Widths

Road Type	Road Reserve Width
Access Street A	25m
Access Street C	18m
Access Street D	10-15m

4 Changes to Surrounding Transport Network

4.1 Road Network

Based on the information provided on the Main Roads WA and Shire of Augusta-Margaret River websites, there does not appear to be any future road network changes or upgrades within the vicinity of the Site.

4.2 Pedestrian/Cycle Networks

4.2.1 Leeuwin-Naturaliste 2050 Cycling Strategy

The Leeuwin-Naturaliste 2050 Cycling Strategy details the future cycling plans within the region focused on connecting, enhancing and extending the region's cycling infrastructure through the development of an interconnected network of off-road shared paths and trails, protected on-road bike lanes and low-stress residential streets.

Within the Cowaramup area, the keys cycling link proposed are as follows:

> a primary route linking Gracetown to the Wadandi Track along Cowaramup Bay Road - performing a similar function to the Margaret River-Prevelly Shared Path.

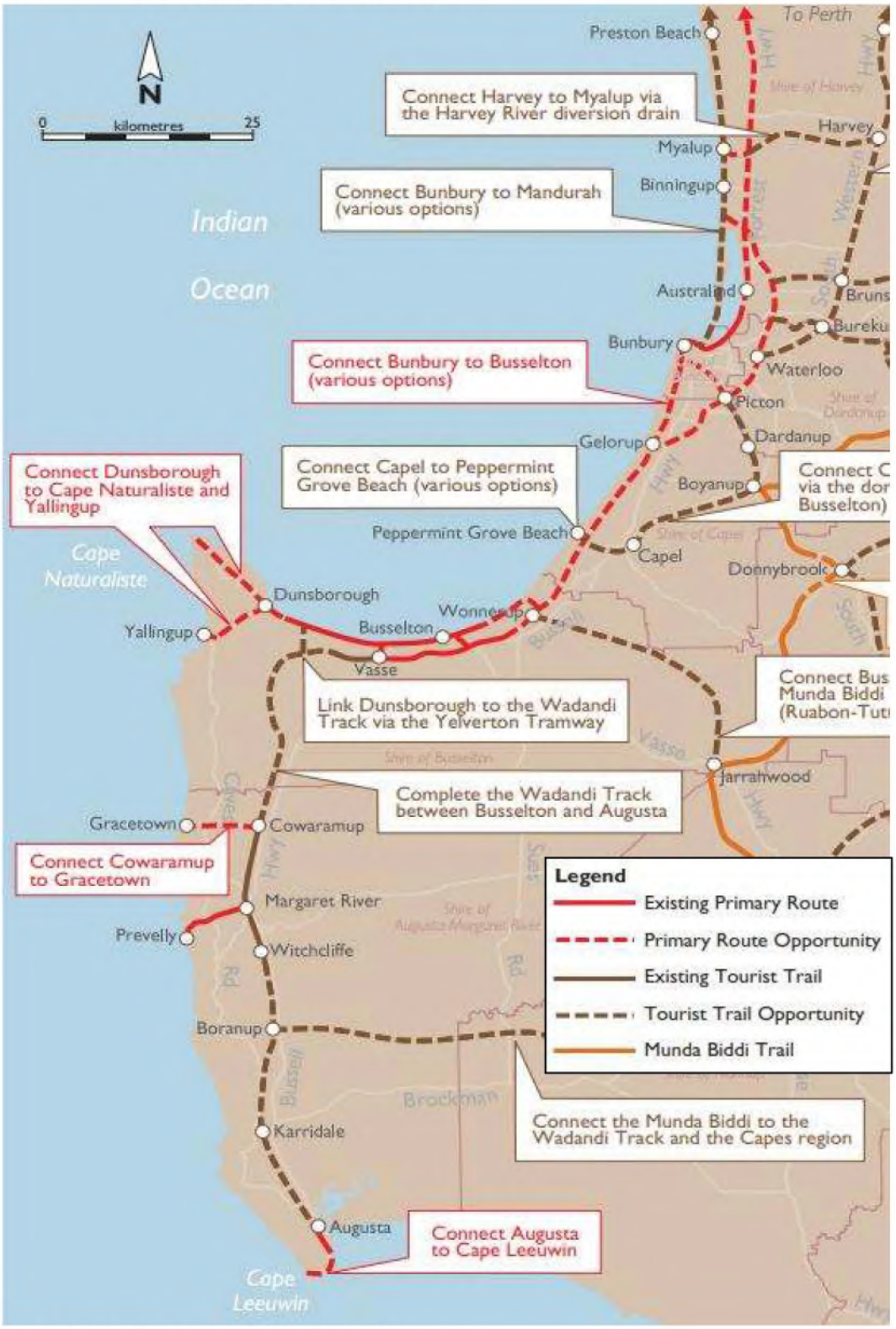
> a secondary route along the main street of Cowaramup (extending from Waverley Road to Roy Earl Drive) providing people with access to Cowaramup's shops and community facilities.

> a secondary route along Memorial Drive providing a safe link between the Cowaramup town centre and the town's western residential area.

> two local route loops providing residents of east and west Cowaramup with access to higher-order cycling facilities.

Figure 4-1 shows the inter-regional cycling connections proposed near Cowaramup.

Figure 4-1 Inter-regional Cycling Connections Map



Source: Leewin-Naturaliste 2050 Cycling Strategy

4.3 Public Transport Networks

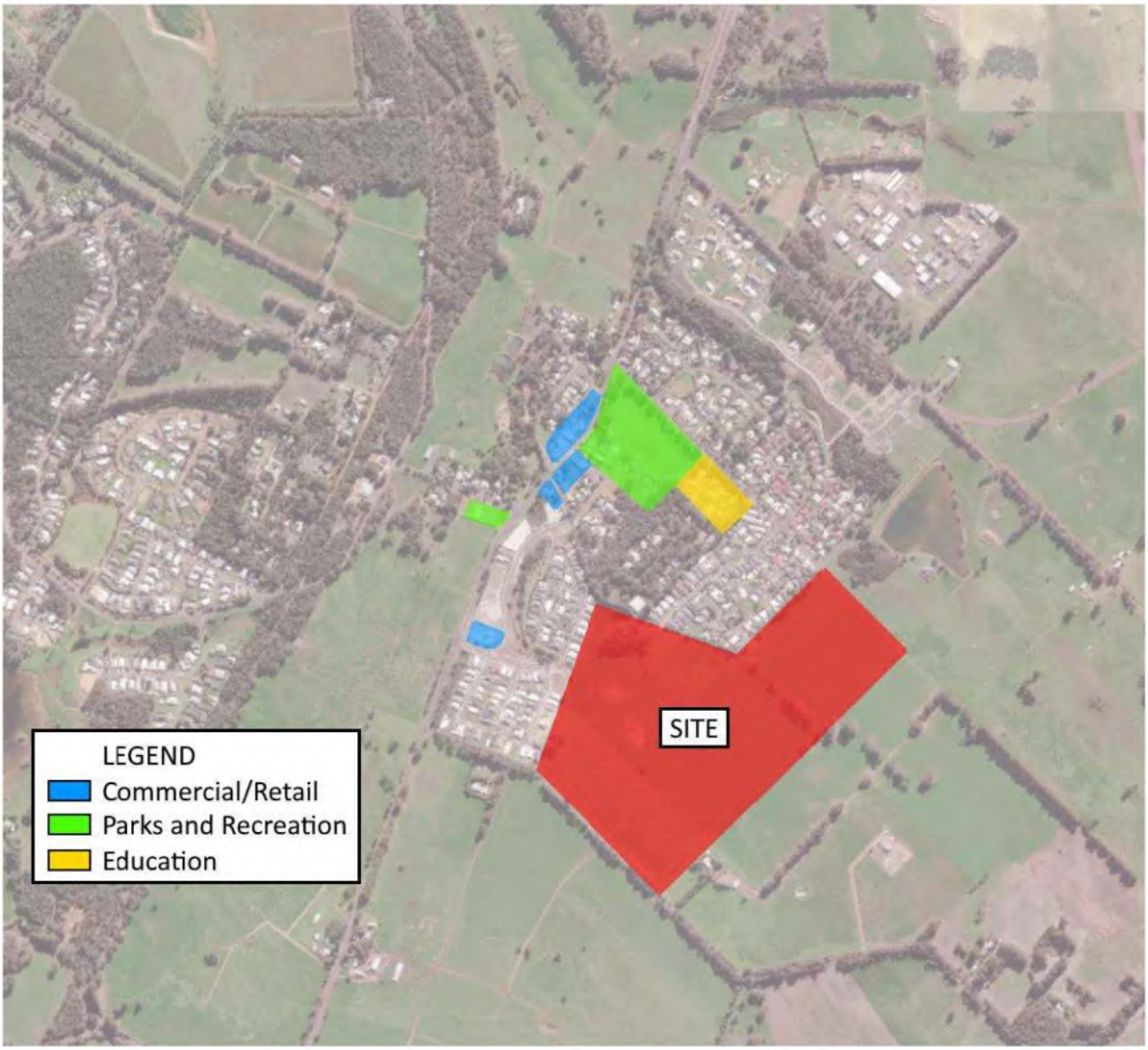
TransRegional were contacted with regards to future public transport services within the surrounding area of the Site. TransRegional advised that there were no new services planned for the area surrounding the Site.

5 Integration with Surrounding Area

5.1 Major Attractors/Generators

The surrounding attractors/generators within close proximity to the Site are shown below in **Figure 5-1**.

Figure 5-1 Key Attractors/Generators within the Surrounding Area



Source: Metromap (2021)

6 Analysis of Transport Network

6.1 Assessment Years and Time Period

Peak times selected are 8:00 AM to 9:00 AM and 4:00 PM to 5:00 PM respectively for the morning and afternoon peak periods on weekdays, based on mid-block traffic volume data from the Main Roads WA TrafficMap website.

In accordance with the WAPC Transport Assessment Guidelines for Structure Plans, the following model scenarios have been analysed as part of this assessment:

> Scenario 1 – 2022 Existing Traffic without Development (AM and PM)

> Scenario 2 – 2034 Traffic with Full Development (AM and PM)

6.2 Key Assumptions

The following provides a list of assumptions use in the assessment.

> Heavy vehicle volumes are based on the traffic data obtained from the Main Roads WA Traffic Map.

> A background growth rate of 1.67% was adopted for Bussell Highway for the future assessment scenarios. This growth rate was estimated from the traffic data for Bussell Highway (north of Gardiner Road, site number 15082) for the period 2016 to 2021.

- For the side roads (Waverley Road, Roy Earl Drive and Wirrling Road) a growth rate of 1.0% was adopted as most of the "new" traffic on these roads likely will be generated by the proposed local structure plan and therefore not considered background traffic.

> The following assumptions were made with regards to the proposed retirement village:

- To gain a better understanding on the various components of the retirement village, several other retirement villages were within the surrounding area were used as comparison (mostly those located within Margaret River). Based on the review, the surrounding area retirement villages comprises of attached living dwellings and usually contains a communal building for social activities. The size of the lots usually ranges between 250-300 m^2.
- Therefore, it is assumed that the individual dwellings are approximately 250 m^2 in size. For a 1.1 Ha site, this equates to approximately 44 dwellings. For the purpose of a conservative assessment, the community facilities as well as internal road and landscaping elements have been disregarded to maximise the trip generating component.

6.3 Development Trip Generation

Trip generation has been calculated for the proposed development utilising trip generation rates from the *Institute of Transportation Engineers (ITE) "Trip Generation" 10th Ed* and *RTA Guide to Traffic Generating Developments*. **Table 6-1** provides the trip generation rate during the Weekday AM and Weekday PM, **Table 6-2** outlines the directional distribution acquired from ITE for the proposed development and **Table 6-3** summarises the total trip generation for the proposed development.

Table 6-1 Trip Generation Rates

Land Use	Source	Weekday AM Peak	Weekday PM Peak	Daily
Residential	ITE 210	0.76 per dwelling	1.00 per dwelling	9.44 per dwelling
Retirement Village	ITE 252	0.20 per dwelling*	0.26 per dwelling*	3.70 per dwelling

* Note: peak hour of road network

Table 6-2 Directional Distribution

Land Use	Weekday AM Peak		Weekday PM Peak		Daily	
	In	Out	In	Out	In	Out
Residential	26%	74%	64%	36%	50%	50%
Retirement Village	35%	65%	55%	45%	50%	50%

Table 6-3 Total Trip Generation

Land Use	Weekday AM Peak		Weekday PM Peak		Daily	
	In	Out	In	Out	In	Out
Residential	69	197	224	126	1,648	1,648
Retirement Village	4	6	7	6	82	82
Total	**76**	**205**	**231**	**133**	**1,730**	**1,730**
	276		**363**		**3,460**	

Upon full development of the structure plan area, it is estimated that the development-generated traffic will be 276 vehicles during the weekday AM peak hour and 363 vehicles during the weekday PM peak hour.

6.4 Development Trip Distribution

The overall trip distribution used for the development traffic are detailed in **Figure 6-1** and **Figure 6-2**, for inbound and outbound trips respectively. The development distribution considers the following:

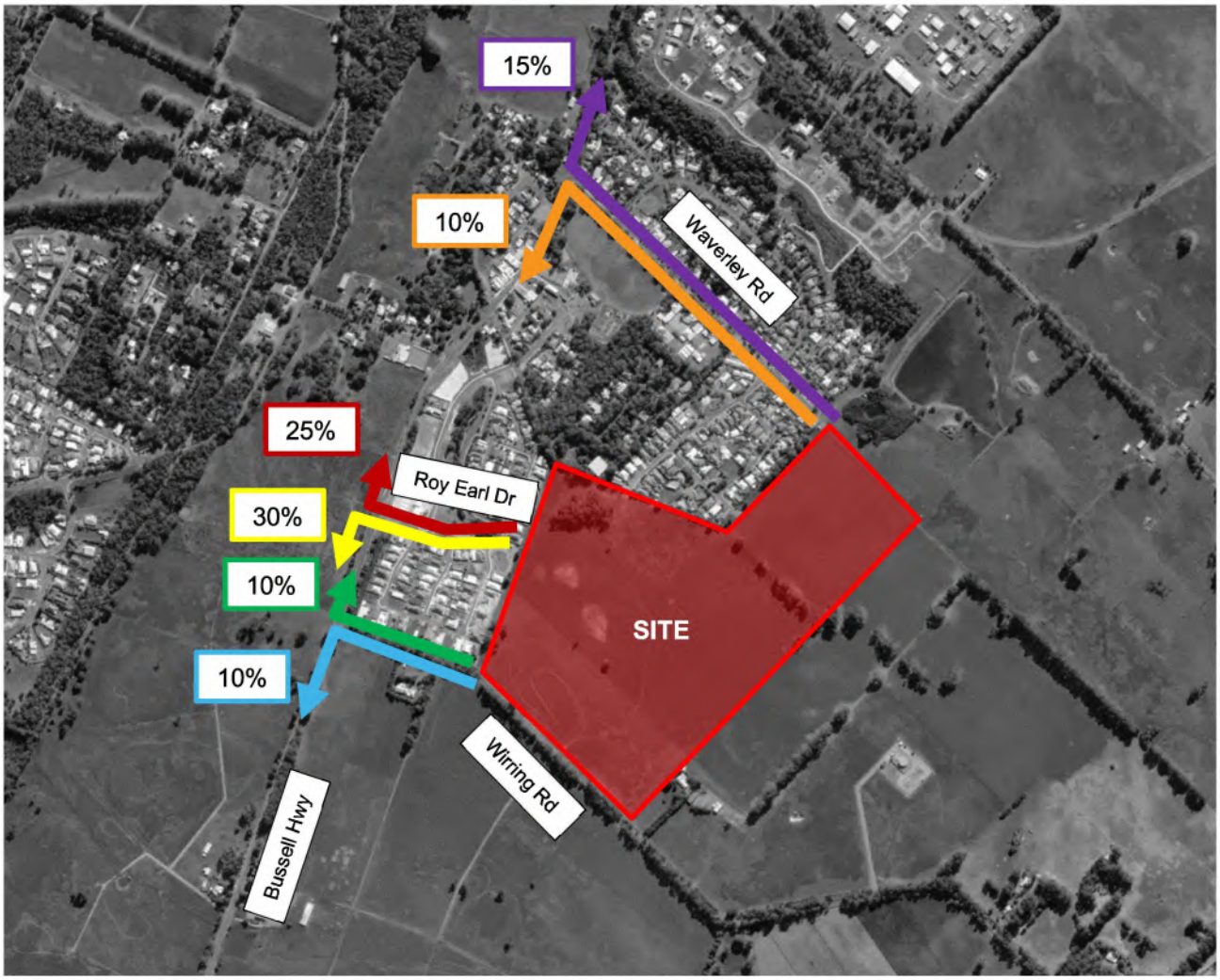
> Location of the development and access roads relative to the surrounding area.

> Driver behaviour based on the local and arterial road network.

Figure 6-1 Development Trip Distribution Inbound



Figure 6-2 Development Trip Distribution Outbound



6.5 Intersection Performance

Analysis of the traffic impacts of the proposed development has been carried out for the following intersections:

> Bussell Highway/Wirring Road Intersection

> Bussell Highway/Roy Earl Drive Intersection

> Bussell Highway/Waverley Road Intersection

The identified intersections have been analysed using the SIDRA analysis program. This program calculates the performance of intersections based on input parameters, including geometry and traffic volumes. As an output SIDRA provides values for the Degree of Saturation (DOS), queue lengths, delays, level of service, and 95th Percentile Queue. These parameters are defined as follows:

> Degree of Saturation (DOS): is the ratio of the arrival traffic flow to the capacity of the approach during the same period. The theoretical intersection capacity is exceeded for an un-signalized intersection where DOS > 0.80;

> 95% Queue: is the statistical estimate of the queue length up to or below which 95% of all observed queues would be expected;

> Average Delay: is the average of all travel time delays for vehicles through the intersection. An unsignalised intersection can be considered to be operating at capacity where the average delay exceeds 40 seconds for any movement; and

> Level of Service (LOS): is the qualitative measure describing operational conditions within a traffic stream and the perception by motorists and/or passengers. The different levels of service can generally be described as shown in **Table 6-4**.

Table 6-4 Level of Service (LoS) Performance Criteria

LOS	Description	Signalised Intersection	Unsignalised Intersection
A	No or minimal delays (best condition). Queues are rarely more than one vehicle	≤10 sec	≤10 sec
B	Short traffic delays. Occasionally more than one queued vehicle.	10-20 sec	10-15 sec
C	Average traffic delays. Often more than one queued.	20-35 sec	15-25 sec
D	Long traffic delays. Regularly more than one queued vehicle.	35-55 sec	25-35 sec
E	Very long traffic delays. Traffic demand is near or equal to the practical capacity of the intersection. Almost always more than one queued vehicle.	55-80 sec	35-50 sec
F	Forced flow conditions with extensive delays caused by geometric and/or operational constraints external to the intersection.	≥80 sec	≥50 sec

6.6 SIDRA Analysis Results

6.6.1 Scenario 1 – 2022

6.6.1.1 Bussell Highway/Waverley Road

Figure 6-3 shows SIDRA layout of the Bussell Highway/Waverley Road intersection and **Table 6-5** provides a summary of the SIDRA results.

Figure 6-3 SIDRA Layout for Bussell Highway/Waverley Road Intersection

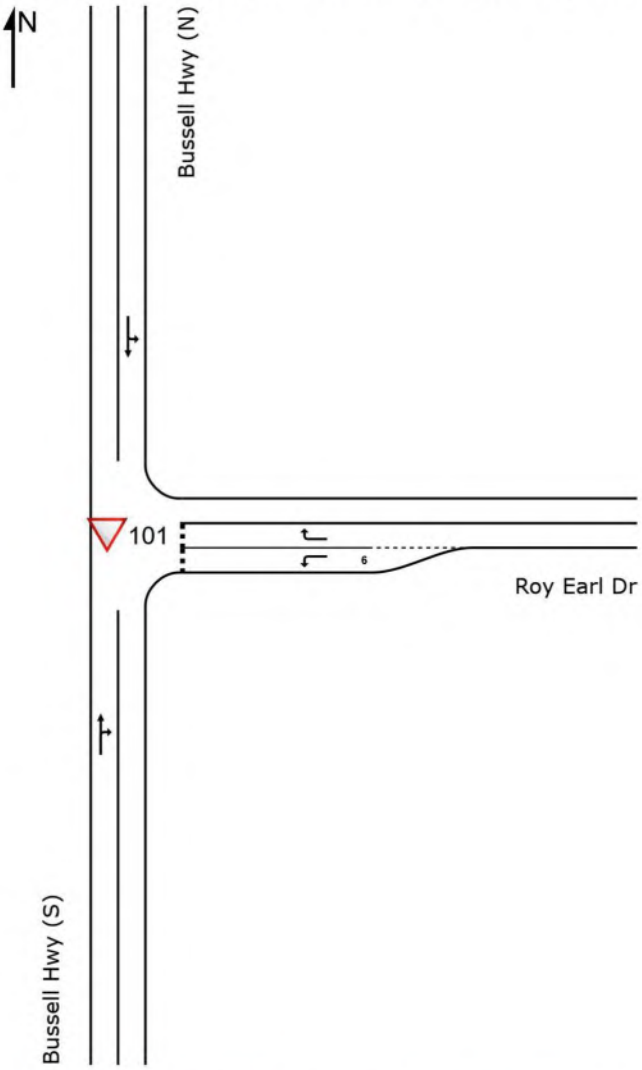


Table 6-5 Bussell Highway/Waverley Road Intersection – Scenario 1

Intersection Approach		AM Peak				PM Peak			
		DOS	Delay (s)	LOS	95th Percentile Back of Queue (m)	DOS	Delay (s)	LOS	95th Percentile Back of Queue (m)
Bussell Hwy (S)	T	0.20	0	A	3	0.21	1	A	4
	R	0.20	6	A	3	0.21	7	A	4
Waverley Rd (E)	L	0.04	5	A	1	0.02	6	A	1
	R	0.07	8	A	2	0.03	8	A	1
Bussell Hwy (N)	L	0.15	5	A	0	0.21	5	A	0
	T	0.15	0	A	0	0.21	0	A	0
All vehicles		0.20	-	-	-	0.21	-	-	-

6.6.1.2 *Bussell Highway/Roy Earl Drive*

Figure 6-4 shows SIDRA layout of the Bussell Highway/Roy Earl Drive intersection and **Table 6-6** provides a summary of the SIDRA results.

Figure 6-4 SIDRA Layout for Bussell Highway/Roy Earl Drive Intersection

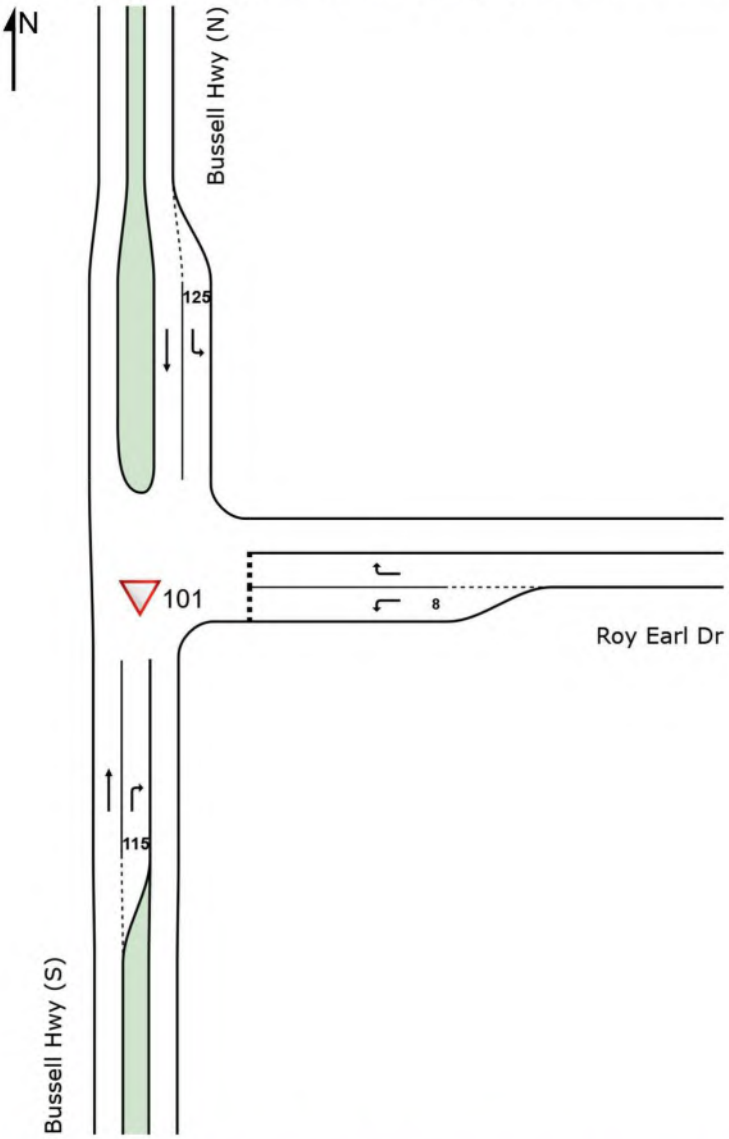


Table 6-6 Bussell Highway/Roy Earl Drive Intersection – Scenario 1

Intersection Approach		AM Peak				PM Peak			
		DOS	Delay (s)	LOS	95th Percentile Back of Queue (m)	DOS	Delay (s)	LOS	95th Percentile Back of Queue (m)
Bussell Hwy (S)	T	0.2	3	A	0	0.23	3	A	0
	R	0.04	9	A	2	0.03	9	A	2
Roy Earl Dr (E)	L	0.07	7	A	2	0.06	7	A	2
	R	0.12	16	C	3	0.13	19	C	3
Bussell Hwy (N)	L	0.01	5	A	0	0.01	5	A	0
	T	0.21	0	A	0	0.26	0	A	0
All vehicles		0.23	-	-	-	0.26	-	-	-

6.6.1.3 *Bussell Highway/Wirring Road*

Figure 6-5 shows SIDRA layout of the Bussell Highway/Wirring Road intersection and **Table 6-7** provides a summary of the SIDRA results.

Figure 6-5 SIDRA Layout for Bussell Highway/Wirring Road Intersection

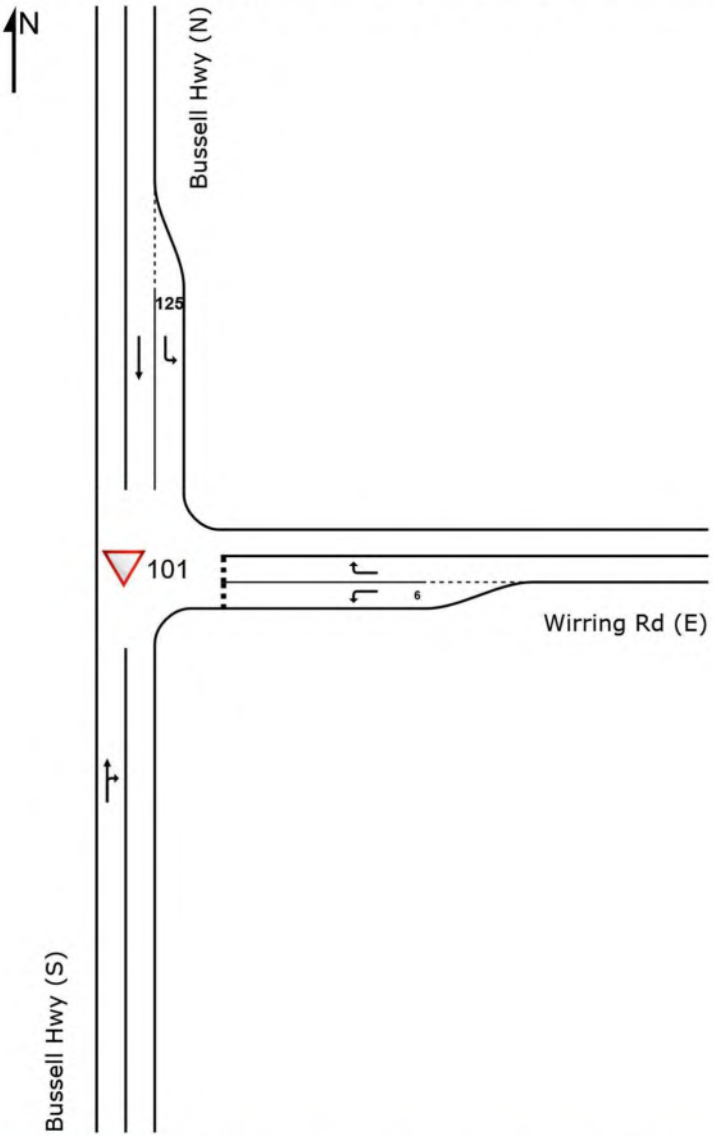


Table 6-7 Bussell Highway/Wirring Road Intersection – Scenario 1

Intersection Approach		AM Peak				PM Peak			
		DOS	Delay (s)	LOS	95th Percentile Back of Queue (m)	DOS	Delay (s)	LOS	95th Percentile Back of Queue (m)
Bussell Hwy (S)	T	0.26	0.1	A	1	0.26	0	A	2
	R	0.26	9.8	A	1	0.26	11	B	2
Wirring Rd (E)	L	0.01	6.1	A	0	0.01	7	A	0
	R	0.02	13.5	B	1	0.03	17	C	1
Bussell Hwy (N)	L	0.00	7.0	A	0	0.01	7	A	0
	T	0.23	0.0	A	0	0.31	0	A	0
All vehicles		0.26	-	-	-	0.31	-	-	-

6.6.2 Scenario 2 – 2034 (Full Development)

6.6.2.1 Bussell Highway/Waverley Road

Table 6-8 provides a summary of the SIDRA results Bussell Highway/Waverley Road intersection.

Table 6-8 Bussell Highway/Waverley Road Intersection – Scenario 3

Intersection Approach		AM Peak				PM Peak			
		DOS	Delay (s)	LOS	95th Percentile Back of Queue (m)	DOS	Delay (s)	LOS	95th Percentile Back of Queue (m)
Bussell Hwy (S)	T	0.29	0	A	6	0.32	2	A	11
	R	0.29	7	A	6	0.32	9	A	11
Waverley Rd (E)	L	0.07	6	A	2	0.04	7	A	1
	R	0.17	10	B	4	0.11	12	B	3
Bussell Hwy (N)	L	0.21	5	A	0	0.33	5	A	0
	T	0.21	0	A	0	0.33	0	A	0
All vehicles		0.29	-	-	-	0.33	-	-	-

6.6.2.2 Bussell Highway/Roy Earl Drive

Table 6-9 provides a summary of the SIDRA results for Bussell Highway/Roy Earl Drive intersection.

Table 6-9 Bussell Highway/Roy Earl Drive Intersection – Scenario 3

Intersection Approach		AM Peak				PM Peak			
		DOS	Delay (s)	LOS	95th Percentile Back of Queue (m)	DOS	Delay (s)	LOS	95th Percentile Back of Queue (m)
Bussell Hwy (S)	T	0.30	3	A	0	0.29	3	A	0
	R	0.10	11	B	3	0.20	12	B	6
Roy Earl Dr (E)	L	0.18	8	A	5	0.15	9	A	4
	R	0.51	34	D	17	0.60	56	F	18
Bussell Hwy (N)	L	0.02	5	A	0	0.05	5	A	0
	T	0.26	0	A	0	0.33	0	A	0
All vehicles		0.51	-	-	-	0.60	-	-	-

6.6.2.3 *Bussell Highway/Wirring Road*

Table 6-10 provides a summary of the SIDRA results for Bussell Highway/Wirring Road intersection.

Table 6-10 Bussell Highway/Wirring Road Intersection – Scenario 3

Intersection Approach		AM Peak				PM Peak			
		DOS	Delay (s)	LOS	95th Percentile Back of Queue (m)	DOS	Delay (s)	LOS	95th Percentile Back of Queue (m)
Bussell Hwy (S)	T	0.34	0	A	4	0.42	2	A	12
	R	0.34	13	B	4	0.42	16	C	12
Wirring Rd (E)	L	0.04	7	A	1	0.04	9	A	1
	R	0.15	23	C	4	0.21	38	E	5
Bussell Hwy (N)	L	0.01	7	A	0	0.02	7	A	0
	T	0.33	0	A	0	0.41	0	A	0
All vehicles		0.34	-	-	-	0.42	-	-	-

6.7 Analysis Summary

A summary of the SIDRA results are as follows:

> The Bussell Highway/Wirring Road intersection operates at an acceptable level of service for all scenarios.

> The Bussell Highway/Roy Earl Drive intersection operates at an acceptable level of service for all scenarios. The level of service for the right turn out of Roy Earl Drive reaches LoS F for the PM peak period for Scenario 3. However, the queues and delays associated with this movement is not considered to be excessive (the threshold for LoS F is 50 seconds).

- However, it is noted that the traffic surveys were conducted during school holidays which represented the peak period, as requested by the Shire of Augusta-Margaret River. In this regard, the results are considered inflated in terms of average weekday traffic volumes and that for the majority of the year, the LoS at this intersection will likely be LoS E or better.

> The Bussell Highway/Waverley Road intersection operates at an acceptable level of service for all scenarios.

In conclusion, the proposed road network is able to satisfactorily accommodate the estimated traffic generated by the proposed structure plan.

7 Site-Specific Issues

7.1 Intersection Warrant Assessment

As Bussell Highway is a Primary Distributor managed by Main Roads WA, an intersection warrant assessment was conducted at the Bussell Highway/Wirring Road intersection to determine if intersection modifications are warranted.

The Bussell Highway/Roy Earl Drive intersection was not assessed as the left turn and right turn pockets are already channelised.

The volumes from the following periods were used for assessment:

> Scenario 1 – 2022 Existing Traffic without Development (AM and PM)

> Scenario 2 – 2034 Traffic with Development (AM and PM)

The parameters are defined as follows:

> Q_{T1} and Q_{T2} = Through traffic volumes

> Q_R = Right turn volumes

> Q_L = Left turn volumes

> HV% = heavy vehicle percentage

> Q_M = Major road traffic volume (based on table in the figure below)

> x = Parameter which determines turning warrants, for 70 km/h ≤ Design Speeds < 100 km/h

- If x < 1.5, only a BAR / BAL treatment is warranted
- If 1.5 ≤ x < 3.3, an AUR / AUL(S) treatment is warranted
- If x ≥ 3.3, a CHR / (AUL or CHL) treatment is warranted

Figure 7-1 Scenario 1 Bussell Highway/Wirring Road Intersection Warrant Assessment – AM

INTERSECTION WARRANTS

Main Roads WA Supplement to Austroads Guide to Road Design - Part 4 A.8

DESIGN SPEED =	80km/h
SPLITTER ISLAND YES / NO =	No
DUAL CARRIAGEWAY YES / NO =	No

MOVEMENT	COUNT (v/h)	HV (%)
Q_{T1} =	409	10
Q_R =	9	4
Q_{T2} =	380	12
Q_L =	6	4

RIGHT TURN ASSESSMENT

Q_m =	795
% HV =	10.911
x =	2.48
TREATMENT =	AUR

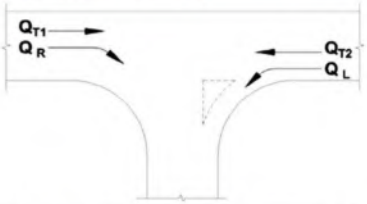
LEFT TURN ASSESSMENT

Q_m =	380
% HV =	12.000
x =	1.08
TREATMENT =	BAL

Source: Austroads GTM Part 6 - 2017

Guide to Traffic Management Part 6: Intersections, Interchanges and Crossings

Figure 2.27: Calculation of the major road traffic volume Q_M



Road type	Turn type	Splitter island	Q_M (veh/h)
Two-lane two-way	Right	No	= $Q_{T1} + Q_{T2} + Q_L$
		Yes	= $Q_{T1} + Q_{T2}$
	Left	Yes or no	= Q_{T2}
Four-lane two-way	Right	No	= 50% x $Q_{T1} + Q_{T2} + Q_L$
		Yes	= 50% x $Q_{T1} + Q_{T2}$
	Left	Yes or no	= 50% x Q_{T2}
Six-lane two-way	Right	No	= 33% x $Q_{T1} + Q_{T2} + Q_L$
		Yes	= 33% x $Q_{T1} + Q_{T2}$
	Left	Yes or no	= 33% x Q_{T2}

Source: TMR (2016a).

Figure 7-2 Scenario 1 Bussell Highway/Wirring Road Intersection Warrant Assessment – PM

INTERSECTION WARRANTS

Main Roads WA Supplement to Austroads Guide to Road Design - Part 4 A.8

DESIGN SPEED =	80km/h
SPLITTER ISLAND YES / NO =	No
DUAL CARRIAGEWAY YES / NO =	No

MOVEMENT	COUNT (v/h)	HV (%)
Q_{T1} =	414	9
Q_R =	11	4
Q_{T2} =	474	8
Q_L =	8	4

RIGHT TURN ASSESSMENT

Q_m =	896
% HV =	8.426
x =	2.94
TREATMENT =	AUR

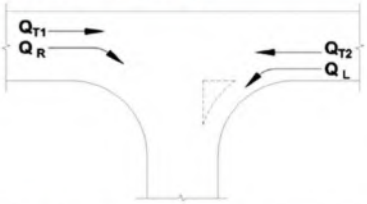
LEFT TURN ASSESSMENT

Q_m =	474
% HV =	8.000
x =	1.44
TREATMENT =	BAL

Source: Austroads GTM Part 6 - 2017

Guide to Traffic Management Part 6: Intersections, Interchanges and Crossings

Figure 2.27: Calculation of the major road traffic volume Q_M



Road type	Turn type	Splitter island	Q_M (veh/h)
Two-lane two-way	Right	No	= $Q_{T1} + Q_{T2} + Q_L$
		Yes	= $Q_{T1} + Q_{T2}$
	Left	Yes or no	= Q_{T2}
Four-lane two-way	Right	No	= 50% x $Q_{T1} + Q_{T2} + Q_L$
		Yes	= 50% x $Q_{T1} + Q_{T2}$
	Left	Yes or no	= 50% x Q_{T2}
Six-lane two-way	Right	No	= 33% x $Q_{T1} + Q_{T2} + Q_L$
		Yes	= 33% x $Q_{T1} + Q_{T2}$
	Left	Yes or no	= 33% x Q_{T2}

Source: TMR (2016a).

Figure 7-3 Scenario 2 Bussell Highway/Wirring Road Intersection Warrant Assessment – AM

INTERSECTION WARRANTS

Main Roads WA Supplement to Austroads Guide to Road Design - Part 4 A.8

DESIGN SPEED =	80km/h
SPLITTER ISLAND YES / NO =	No
DUAL CARRIAGEWAY YES / NO =	No

MOVEMENT	COUNT (v/h)	HV (%)
Q_{T1} =	537	10
Q_R =	19	4
Q_{T2} =	553	12
Q_L =	15	4

RIGHT TURN ASSESSMENT

Q_m =	1105
% HV =	10.919
x =	4.53
TREATMENT =	CHR

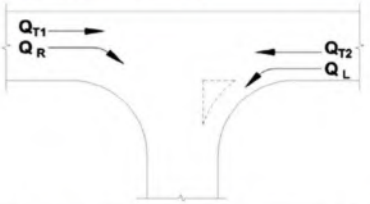
LEFT TURN ASSESSMENT

Q_m =	553
% HV =	12.000
x =	2.20
TREATMENT =	AUL(S)

Source: Austroads GTM Part 6 - 2017

Guide to Traffic Management Part 6: Intersections, Interchanges and Crossings

Figure 2.27: Calculation of the major road traffic volume Q_M



Road type	Turn type	Splitter island	Q_M (veh/h)
Two-lane two-way	Right	No	= $Q_{T1} + Q_{T2} + Q_L$
		Yes	= $Q_{T1} + Q_{T2}$
	Left	Yes or no	= Q_{T2}
Four-lane two-way	Right	No	= 50% x $Q_{T1} + Q_{T2} + Q_L$
		Yes	= 50% x $Q_{T1} + Q_{T2}$
	Left	Yes or no	= 50% x Q_{T2}
Six-lane two-way	Right	No	= 33% x $Q_{T1} + Q_{T2} + Q_L$
		Yes	= 33% x $Q_{T1} + Q_{T2}$
	Left	Yes or no	= 33% x Q_{T2}

Source: TMR (2016a).

Figure 7-4 Scenario 2 Bussell Highway/Wirring Road Intersection Warrant Assessment – PM

INTERSECTION WARRANTS

Main Roads WA Supplement to Austroads Guide to Road Design - Part 4 A.8

DESIGN SPEED =	80km/h
SPLITTER ISLAND YES / NO =	No
DUAL CARRIAGEWAY YES / NO =	No

MOVEMENT	COUNT (v/h)	HV (%)
Q_{T1} =	606	9
Q_R =	37	4
Q_{T2} =	641	8
Q_L =	33	4

RIGHT TURN ASSESSMENT

Q_m =	1280
% HV =	8.370
x =	6.67
TREATMENT =	CHR

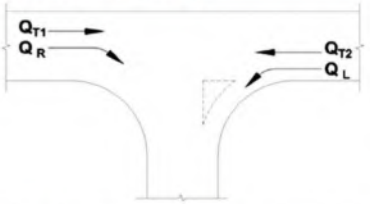
LEFT TURN ASSESSMENT

Q_m =	641
% HV =	8.000
x =	3.38
TREATMENT =	AUL or CHL

Source: Austroads GTM Part 6 - 2017

Guide to Traffic Management Part 6: Intersections, Interchanges and Crossings

Figure 2.27: Calculation of the major road traffic volume Q_M



Road type	Turn type	Splitter island	Q_M (veh/h)
Two-lane two-way	Right	No	= $Q_{T1} + Q_{T2} + Q_L$
		Yes	= $Q_{T1} + Q_{T2}$
	Left	Yes or no	= Q_{T2}
Four-lane two-way	Right	No	= 50% x $Q_{T1} + Q_{T2} + Q_L$
		Yes	= 50% x $Q_{T1} + Q_{T2}$
	Left	Yes or no	= 50% x Q_{T2}
Six-lane two-way	Right	No	= 33% x $Q_{T1} + Q_{T2} + Q_L$
		Yes	= 33% x $Q_{T1} + Q_{T2}$
	Left	Yes or no	= 33% x Q_{T2}

Source: TMR (2016a).

Based on the existing traffic volumes, an AUR treatment (auxiliary right turn) is required for the right turn and a BAL (basic left turn) is required for the left turn at the Bussell Highway/Wirring Road intersection. The current intersection arrangement already includes an AUL, therefore the only warranted upgrade would be the AUR.

With the proposed development and future assessment, the desktop assessment shows that a CHR (channelised right turn) will be required for scenarios both with and without the development-generated traffic.

As the proposed connection between the proposed structure plan area and Wirring Road will increase the volume of traffic turning left and right at this intersection, it is recommended that the timing of the CHR modifications to this intersection coincide with the construction of the Wirring Road connection.

8 Conclusions and Summary

This Transport Impact Assessment outlines the transport aspects of the proposed Site focusing on traffic operations, integration with the surrounding network, and local (structure plan) road requirements.

This assessment has been prepared in accordance with the *WAPC Transport Impact Assessment Guidelines for Developments: Volume 2 – Planning Schemes, Structure Plans and Activity Centre Plans (2016).*

The following are conclusions about the proposed development:

> The proposed structure plan will provide for generally single residential development (approximately 350 lots), a retirement village development site, public open space and a movement network.

> Pedestrian and cycling infrastructure within the surrounding area is limited due to the rural nature of the surrounding development.

> The two-way trip generation associated with the full development of the proposed structure plan is estimated to be 276 vehicles during the weekday AM peak hour and 363 vehicles during the weekday PM peak hour.

> The Bussell Highway/Wirring Road intersection operates at an acceptable level of service for all scenarios.

> The Bussell Highway/Roy Earl Drive intersection operates at an acceptable level of service for all scenarios.

- The level of service for the right turn out of Roy Earl Drive reaches LoS F for the PM peak period for Scenario 3. However, as the DoS is less than 0.80, the queues and delays associated with this movement is not considered to be excessive (the threshold for LoS F is 50 seconds). It is also noted that the traffic surveys were conducted during school holidays which represented the peak period, as requested by the Shire of Augusta-Margaret River. In this regard, the results are considered inflated in terms of average weekday traffic volumes and that for the majority of the year, the LoS at this intersection will likely be LoS E or better.

> A review of the crash data shows that the number of recorded crashes within the surrounding area is low and is unlikely to result in any material impacts on the road network.

> A turning warrant assessment was conducted to determine if intersection upgrades are warranted in the future. The intersection of Bussell Highway/Wirring Road was found to warrant a channelised right turn (CHR) treatment for scenarios both with and without the development-generated traffic.

- As the proposed connection between the proposed structure plan area and Wirring Road will increase the volume of traffic turning at this intersection, it is recommended that the timing of the CHR modifications to this intersection coincide with the construction of the Wirring Road connection.

APPENDIX A

WAPC CHECKLIST

ITEM	PROVIDED	COMMENTS
Summary		
Introduction/Background	Section 1	
Subdivision proposal		
regional context	Section 2	
proposed land uses	Section 3	
table of land uses and quantities	Section 3	
major attractors/generators	Section 5	
specific issues	N/A	
Existing situation		
existing land uses within structure plan	Section 2	
existing land uses within 800 metres of subdivision	Section 2	
existing road network within subdivision	Section 2	
existing pedestrian/cycle networks within subdivision	Section 2	
existing public transport services within structure plan area	Section 2	
existing road network within 2 (or 5) km of subdivision	Section 2	
traffic flows on roads within subdivision area (PM and/or AM peak hours)	Section 2	
traffic flows on roads within 2 (or 5) km of within subdivision area (AM and/ or PM peak hours)	Section 2	
existing pedestrian/cycle networks within 800m of subdivision	Section 2	
existing public transport services within 800m of subdivision area	Section 2	
Proposed internal transport networks		
changes/additions to existing road network or proposed new road network	Section 3	
road reservation widths	Section 3	
road cross-sections & speed limits	Section 3	
intersection controls	Section 3	
pedestrian/cycle networks and crossing facilities	N/A	
public transport routes	N/A	
Changes to external transport networks		
road network	Section 4	
intersection controls	N/A	
pedestrian/cycle networks and crossing facilities	Section 4	
public transport services	Section 4	
Integration with surrounding area		
trip attractors/generators within 800 metres	Section 5	
proposed changes to land uses within 800 metres	N/A	
travel desire lines from structure plan to these attractors/generators	N/A	

ITEM	PROVIDED	COMMENTS
adequacy of external transport networks	N/A	
deficiencies in external transport networks	N/A	
remedial measures to address deficiencies	N/A	
Analysis of internal transport networks		
assessment year(s) and time period(s)	Section 6	
subdivision generated traffic	Section 6	
extraneous (through) traffic	Section 6	
design traffic flows (that is, total traffic)	Section 6	
road cross-sections	Section 6	
intersection sight distances	N/A	
intersection operation and method of control	N/A	
frontage access strategy	N/A	
pedestrian/cycle networks	N/A	
safe walk/cycle to school assessment (residential subdivisions only)	N/A	
pedestrian permeability & efficiency	N/A	
access to public transport	N/A	
Analysis of external transport networks		
base flows for assessment year(s)	Section 6	
total traffic flows	Section 6	
road cross-sections	N/A	
intersection layouts & controls	Section 6	
pedestrian/cycle networks	N/A	
Safety issues		
Identify issues	N/A	
Remedial measures	N/A	
Conclusions	Section 8	

APPENDIX

B

SITE PLANS



INDICATIVE CONCEPT PLAN

LOT 500 WIRRING ROAD
COWARAMUP

N

0 100 m

SCALE @ A3: 1:4000

9449-CON-05-A

DRAWN: VR
DATE CREATED: 2022.06.09
PROJECTION: MGA50 GDA94
CADASTRE: LANDGATE
SURVEY: SURVEY SOUTH - 28/03/2022
AERIAL: 15/10/2021

This document may not be reproduced without the written consent of Rowe Group. All areas and dimensions are subject to survey.

ROWE GROUP DESIGN

This page has been left blank intentionally.

ATTACHMENT 9

ENGINEERING SERVICING REPORT



Lot 500 Wirring Road, Cowaramup

Civil, Electrical and Communications

Engineering Servicing Report

Revision 002 – 20 July 2022

Ref: 301270419

PREPARED FOR:

RW Duggan
c/- PGPM Pty Ltd Attn: Peter Gleed

PREPARED BY:

Richard Martin / Rhys Fowler

Stantec

Revision

Revision	Date	Comment	Prepared By	Approved By
001	09 June 2022	Original issue	R. Fowler	R. Martin
002	20 July 2022	Water Corporation Advice Added Concept Plan Updated	R. Fowler	R. Martin

Contents

Executive Summary 1

1. General 2

1.1 Introduction 2
1.2 Site Description 2

2. Sewerage 4

2.1 Existing Infrastructure 4
2.2 Proposed Development Servicing 5

3. Potable Water 6

3.1 Existing Infrastructure 6
3.2 Proposed Development Servicing 6

4. Underground Power 7

4.1 Existing Infrastructure 7
4.2 Infrastructure Capacity / Proposed Upgrades 7

5. Communications 8

6. Gas 9

Appendix A Concept Development Layout

Appendix B Water Corporation Correspondence

Executive Summary

Stantec Australia Pty Ltd (Stantec) has been commissioned to prepare a desktop engineering servicing report for Lot 500 Wirring Road, Cowaramup (the Site) within the Shire of Augusta-Margaret River.

A concept subdivision layout has been prepared by Rowe Group and is included as *Appendix A*.

The information presented in this report is based on the concept subdivision layout, preliminary advice from the relevant service providers/authorities, and their available strategic planning information.

The desktop review has identified that infrastructure exists within close proximity to the Site and can be extended to provide the proposed development with the services discussed within this report.

1. General

1.1 Introduction

Stantec Australia Pty Ltd (Stantec) has been commissioned to prepare a desktop engineering servicing report for Lot 500 Wirring Road, Cowaramup (the Site) within the Shire of Augusta-Margaret River.

A concept subdivision layout has been prepared by Rowe Group and is included as *Appendix A*. The information presented in this report is based on the concept subdivision layout, preliminary advice from the relevant service providers/authorities, and their available strategic planning information.

1.2 Site Description

1.2.1 Site Location, Topography, and Existing Features

The Site is located on Wirring Road, Cowaramup within the Shire of Augusta-Margret River, approximately 11km north of Margaret River.



Figure 1: Site Location

Figure 2 on the following page indicates the majority of the Site is clear of vegetation, with several small pockets of trees remaining. Ground levels across the Site range between approximately 140.20mAHD to 133.00mAHD. A ridge running approximately north-south splits the Site, with the ground then generally falling to the north-west and north-east. The Site adjoins existing development to the north, and farmland to the south.

Acid Sulfate Soil (ASS) risk mapping published by the Department of Water and Environmental Regulation, as presented in *Figure 3*, indicates most of the Site sits within an area of 'no known risk of ASS occurring within 3m of natural soil surface '. A very small area in the west is identified as having 'moderate to low risk of ASS occurring within 3m of natural soil surface…'.



Figure 2: Site Overview (Imagery: Nearmap, dated 28/02/2022)

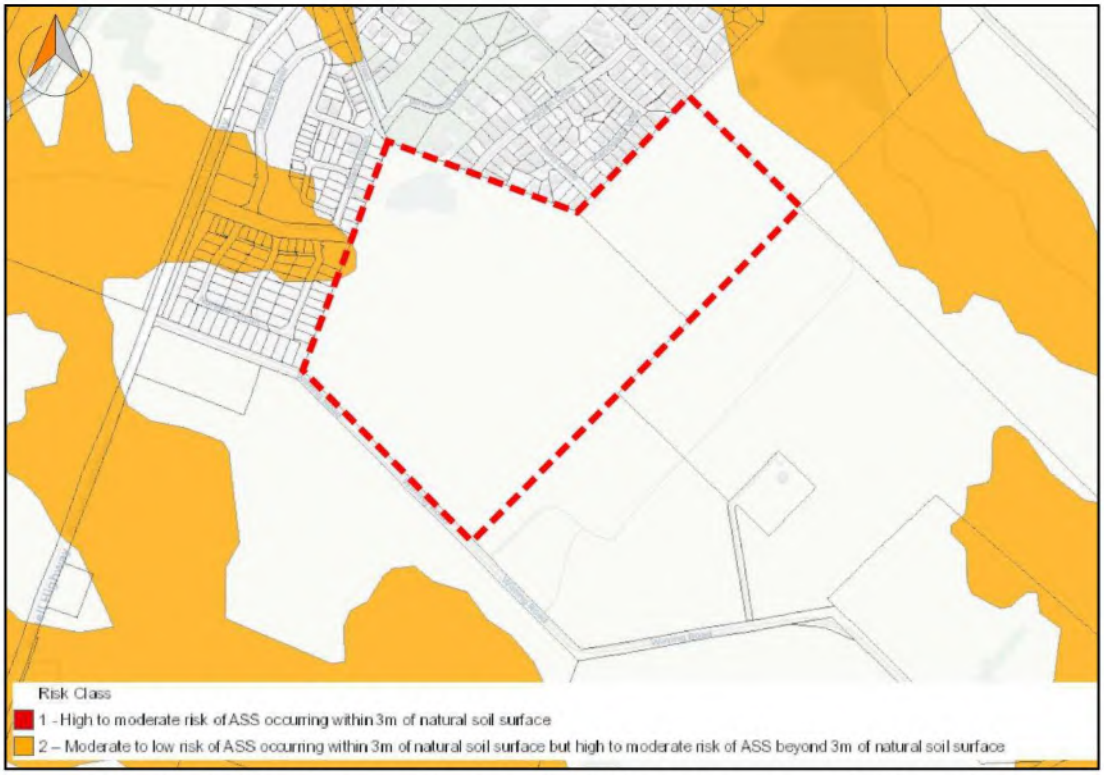


Figure 3: ASS Risk Mapping (Department of Water and Environmental Regulation)

2. Sewerage

2.1 Existing Infrastructure

Water Corporation operates a gravity sewerage network in the area surrounding the Site, with the locations of their existing infrastructure depicted in *Figure 4*.

The existing gravity sewerage network is located to the north and west of the Site, with no existing sewerage infrastructure located south-east of the Site.

There are three potential connection locations to the existing sewerage network where sewer stub lines have previously been extended into the Site; these are indicated in *Figure 4* along with their approximate depths as calculated from as-constructed data on Water Corporation's ESInet system.

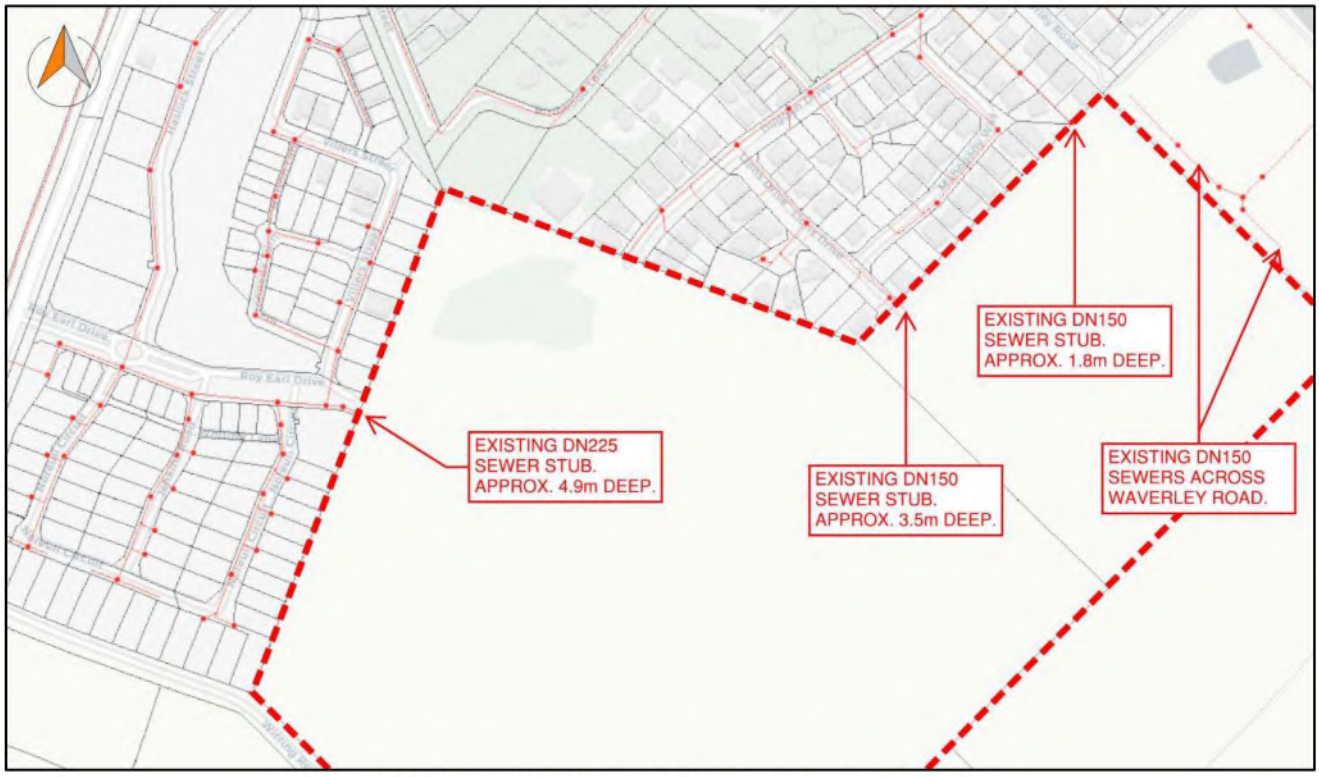


Figure 4: Existing Water Corporation Sewerage Infrastructure

2.2 Proposed Development Servicing

The Site is located within Water Corporation's SD242 Cowaramup Long Term Sewer Planning (SD242) scheme boundary, meaning that allowance has been made within Water Corporation's planning and infrastructure to service the Site with reticulated gravity sewerage. An extract from Water Corporation's SD242 document is included as *Figure 5*, with the Site shaded red.

Water Corporation's SD242 indicates the Site will be serviced via extension of DN150 gravity sewers from the existing sewer stub locations, and that the Site is split across two existing wastewater pump station (WWPS) catchments. The western portion of the Site falls within the catchment of Cowaramup TPS1, and the eastern portion of the Site falls within the catchment of Cowaramup PS1.

Sewerage infrastructure also exists to the north-east of the Site on the other side of Waverley Road as indicated in *Figure 4*. These sewers, subject to discussions with Water Corporation, could also potentially be extended across Waverley Road to service the Site.

Water Corporation was contacted and they confirmed that their existing assets are capable of servicing the proposed development.

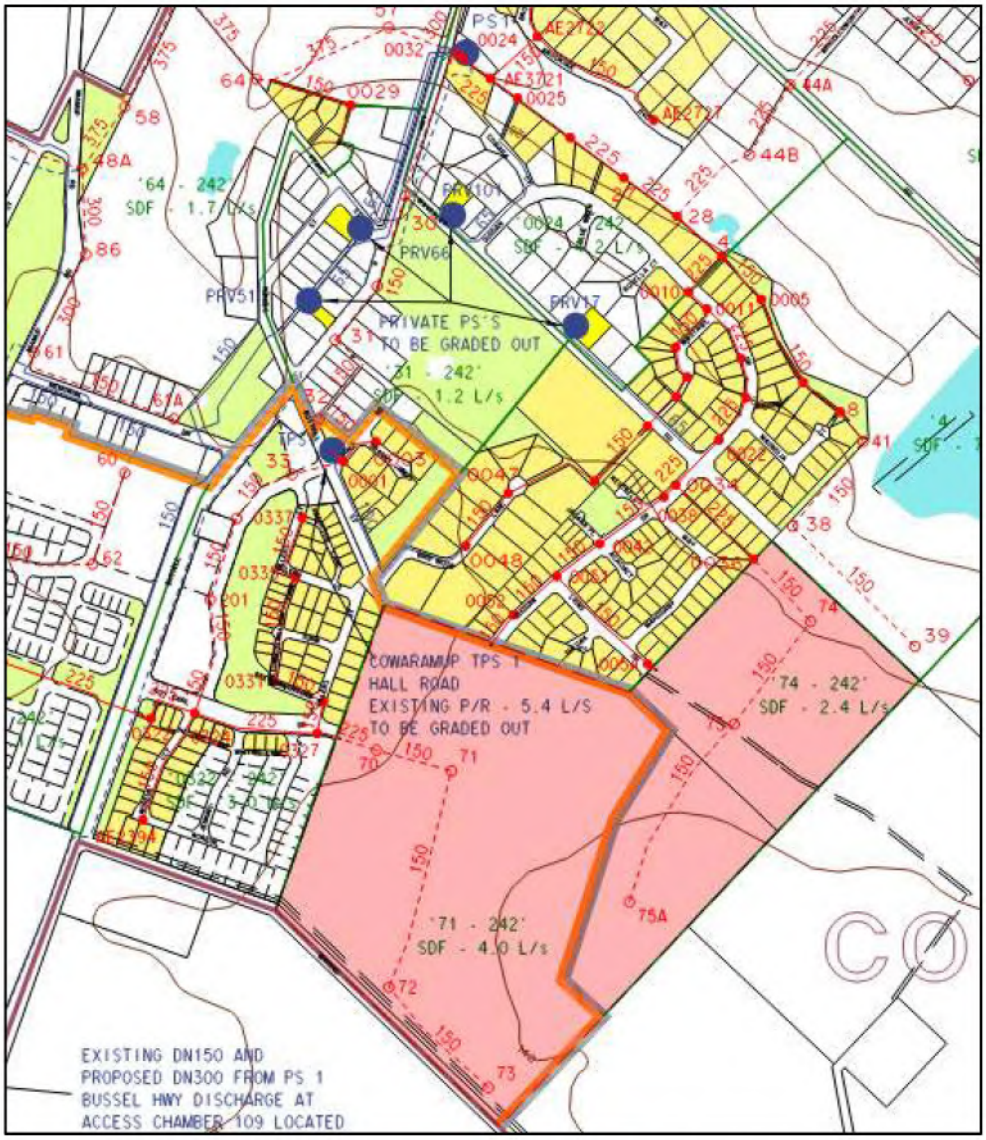


Figure 5: Extract from Water Corporation's SD242

3. Potable Water

3.1 Existing Infrastructure

Water Corporation operates a reticulated potable water network in the area surrounding the Site, with *Figure 6* indicating the locations of their existing infrastructure.

There are existing water mains terminating at the Site boundary in Roy Earl Drive and Duggan Drive.

Additionally, there are two existing DN250 water distribution mains that traverse the Site – one following the south-west boundary and one in the north-east portion of the Site. It is understood the intention is for these mains to remain in place within appropriate easements and proposed road reserves. Detailed design will need to consider these existing mains and any requirements Water Corporation may have regarding construction works being undertaken around them.

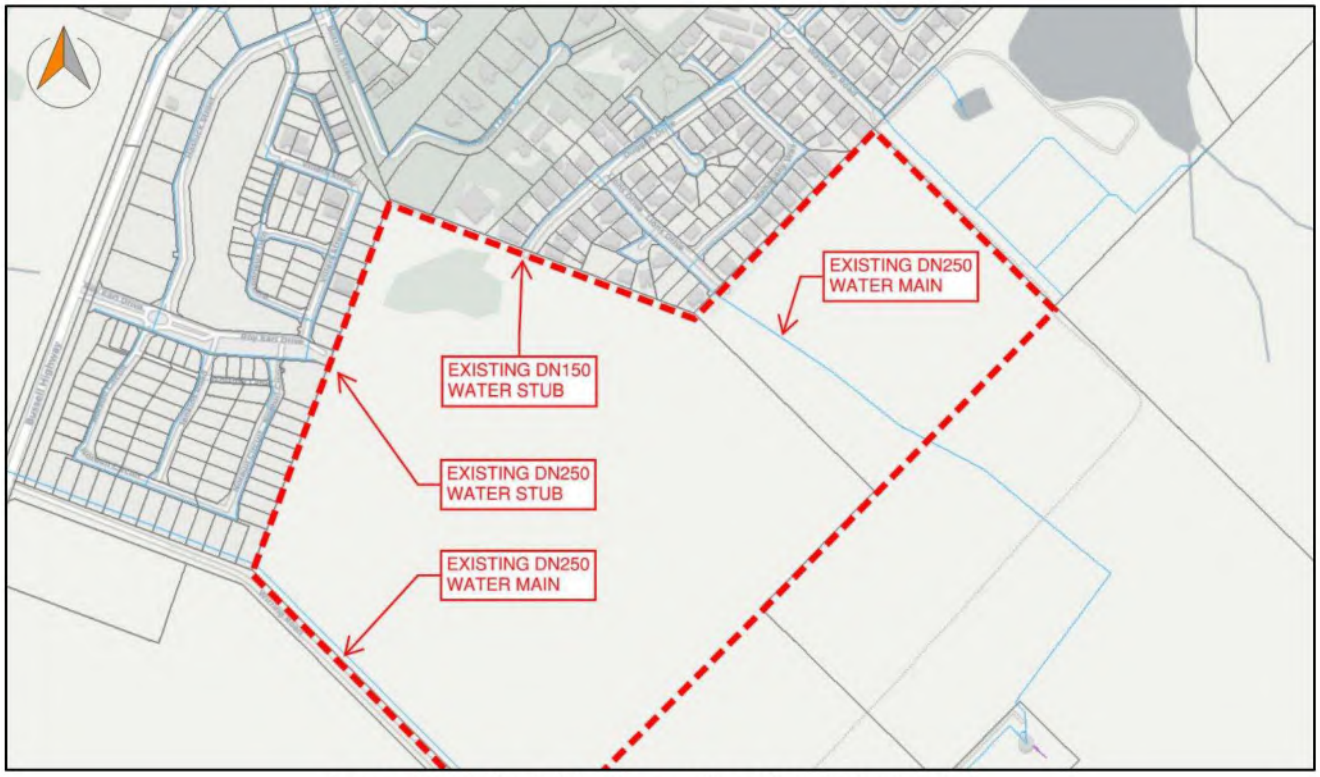


Figure 6: Existing Water Corporation Water Infrastructure

3.2 Proposed Development Servicing

Water Corporation was contacted to provide advice on servicing the proposed development of the Site with potable water and to confirm whether the existing network has capacity to do so. Water Corporation advised that their existing assets can accommodate the proposed development.

Correspondence from Water Corporation is included as *Appendix B*.

4. Underground Power

4.1 Existing Infrastructure

An analysis of Western Power's (WP) DFIS system has been conducted to determine the existing power supply configuration surrounding the development. The existing Western Power network surrounding the site consists of the following:

- High Voltage (HV) Ring Main Unit (RMU) installed at the south-eastern end of Lions Drive. This RMU will in all likelihood be utilised to provide an HV take off point for the proposed subdivision.
- HV underground cable from the western side of Bussell Hwy installed on the Northern side of Wirring Rd. It is likely that WP will require that this cable be used to interconnect the hv network that will be installed to service the proposed subdivision.
- HV Ring Main unit installed in Stewart Smith Loop (adj Lot 7) on the Eastern side of Waverley Rd as part of a recent subdivision. This RMU will in all likelihood be utilized to provide a 2nd hv take off point for the proposed subdivision.

4.2 Infrastructure Capacity / Proposed Upgrades

Based on the proposed development, it is likely that the site power demand will be in the vicinity of 1.65 MVA. This is based on the standard Western Power load allocation of 4.7kVA per residential.

The Western Power Network Capacity Mapping Tool indicates that the forecasted remaining capacity for this area for 2021 is in the order of 20-25MVA (18/5/2022). This figure indicates that capacity is available at the zone substation, however we are unable to confirm whether any off-site feeder upgrades may be required to service the development. This can only be confirmed via a formal WP Feasibility or Design Information Package application.

In order to service the proposed subdivision, a new HV ring main will be established using take off points from the 2 x existing RMU's near the site. The hv ring main will a total of 4 transformers within the subdivision. Transformer will be installed within public open spaces where possible as they have fire exclusion zones that significantly reduce usable space within residential lots.

It should be noted that due to the dynamic nature of Western Power's network, infrastructure requirements and connection points referred above may differ when applications are placed in the future. It is recommended that a planning study be undertaken closer to the date of proposed load uptake to determine if the existing network has the capacity to service the proposed development.

5. Communications

The proposed development will require a fibre ready pit and conduit network to be installed at the Developer's cost.

The pit and conduit will be designed in accordance with NBN standards and will be installed in the telecommunications alignment within the internal road reserves. Once installed and inspected, ownership of the pit and conduit network will be transferred to NBN.

An analysis of NBN's DBYD has been conducted in order to determine the location of the existing NBN network that would supply the proposed pit and conduit network. The nearest existing NBN networks are located within the road reserve on the northern side of Waverley Road with additional interconnection points at Duggan Drive, Lions Drive and Roy Earl Drive. Based on the proposed development, it is likely that the connection will initially originate from existing pits along Waverley Road or Roy Earl Drive. Minor works (relocations) may be required in this vicinity to accommodate the new connection to the subdivision.

It should be noted that due to the dynamic nature of NBN's network, infrastructure requirements and connection points referred above may differ when applications are placed in the future.

In addition to the new pit and conduit network, the developer will be required to remove all existing telecommunications infrastructure that may be located within the proposed new lots.

6. Gas

There is no reticulated gas network in the Cowaramup area.

It is understood that some developments in the Margaret River region utilise internal reticulated liquified petroleum gas (LPG) networks internally fed from a storage vessel on site and operated by a retailer such as Kleenheat. This is an option the development could consider as an alternative to bottled gas.

Appendix A
Concept Development Layout



LEGEND

- SUBJECT SITE
- CONTOURS
- EXISTING BOUNDARIES
- EXISTING LOT NUMBERS
- PROPOSED BOUNDARIES
- RESIDENTIAL - R10
- RESIDENTIAL - R15-20
- RESIDENTIAL - R25
- RESIDENTIAL - R60
- PUBLIC OPEN SPACE
- DRAINAGE
- 10m WIDE LANDSCAPE BUFFER
- WATER SUPPLY EASEMENT
- VEGETATION TO BE RETAINED

LOT SUMMARY

ORIGINAL AREAS:	1
LOT 500	40.93ha
PUBLIC OPEN SPACE & DRAINAGE	
PUBLIC OPEN SPACE:	4.28ha (10.5%)
DRAINAGE:	7,680m²
R10	
PROPOSED LOTS:	51
MINIMUM LOT AREA	990m²
AVERAGE LOT AREA	1061m²
MAXIMUM LOT AREA	1949m²
TOTAL AREA	5.41ha
R15-20	
PROPOSED LOTS:	215
MINIMUM LOT AREA	541m²
AVERAGE LOT AREA	704m²
MAXIMUM LOT AREA	1218m²
TOTAL AREA	15.1ha
R25	
PROPOSED LOTS:	86
MINIMUM LOT AREA	469m²
AVERAGE LOT AREA	597m²
MAXIMUM LOT AREA	835m²
TOTAL AREA	5.14ha
TOTAL	
PROPOSED LOTS:	352
MINIMUM LOT AREA	469m²
AVERAGE LOT AREA	730m²
MAXIMUM LOT AREA	1949m²
TOTAL AREA	25.7ha

LAND USE SUMMARY	LOT 500
SITE AREA (ha)	40.9
PUBLIC OPEN SPACE (ha)	4.3
DRAINAGE (ha)	0.8
ROAD RESERVES (ha)	9.0
RETIREMENT VILLAGE (ha)	1.2
R10 RESIDENTIAL AREA (ha)	5.4
R15-20 RESIDENTIAL AREA (ha)	15.1
R25 RESIDENTIAL AREA (ha)	5.1

INDICATIVE CONCEPT PLAN

LOT 500 WIRRING ROAD
COWARAMUP

DRAFT

N

0 100 m
SCALE @ A3: 1:4000

9449-CON-05-A

DRAWN: VR
DATE CREATED: 2022.06.09
PROJECTION: MGA50 GDA94
CADASTRE: LANDGATE
SURVEY: SURVEY SOUTH - 28/03/22
AERIAL: 15/10/2021

This document may not be reproduced without the written consent of Rowe Group. All areas and dimensions are subject to survey.

ROWE GROUP DESIGN

Appendix B
Water Corporation Correspondence

Fowler, Rhys

From: Rob Pettersson <Rob.Pettersson@watercorporation.com.au>
Sent: Monday, 27 June 2022 10:25 AM
To: Fowler, Rhys
Subject: RE: 500, 0, Wirring Road, Cowaramup SF0009374

Categories: Filed by Newforma

Hi Rhys,

The response is that Water and Wastewater assets can accommodate the proposed development.

Rob Pettersson
Adv - Network Expansion
Development Services

E Rob.Pettersson@watercorporation.com.au
T (08) 9420 3970

watercorporation.com.au

From: Fowler, Rhys <rhys.fowler@stantec.com>
Sent: Wednesday, 22 June 2022 12:11 PM
To: Rob Pettersson <Rob.Pettersson@watercorporation.com.au>
Cc: Martin, Richard <richard.martin2@stantec.com>
Subject: RE: 500, 0, Wirring Road, Cowaramup SF0009374

Hi Rob,

Are you please able to provide an update on the below?

Thanks,

Rhys Fowler
Civil Engineer

Direct: +61 8 9717 6103
rhys.fowler@stantec.com

Stantec Australia Pty Ltd

Better Together, Even If We're Apart. Read more about Stantec's COVID-19 response, including remote working and business continuity measures.

From: Fowler, Rhys
Sent: Tuesday, 14 June 2022 11:06 AM
To: Rob Pettersson <Rob.Pettersson@watercorporation.com.au>
Cc: Martin, Richard <richard.martin2@stantec.com>
Subject: RE: 500, 0, Wirring Road, Cowaramup SF0009374

Hi Rob,

Just following up on the below discussed servicing advice for Lot 500 Wirring Rd, Cowaramup.

Have the investigations now been undertaken and is further advice available?

Thankyou,

Rhys Fowler
Civil Engineer

Direct: +61 8 9717 6103
rhys.fowler@stantec.com

Stantec Australia Pty Ltd

Better Together, Even If We're Apart. Read more about Stantec's COVID-19 response, including remote working and business continuity measures.

From: Fowler, Rhys
Sent: Wednesday, 8 June 2022 2:03 PM
To: Rob Pettersson <Rob.Pettersson@watercorporation.com.au>
Cc: Martin, Richard <richard.martin2@stantec.com>
Subject: RE: 500, 0, Wirring Road, Cowaramup SF0009374

Thanks Rob, we will await the findings.

Regards,

Rhys Fowler
Civil Engineer

Direct: +61 8 9717 6103
rhys.fowler@stantec.com

Stantec Australia Pty Ltd

Better Together, Even If We're Apart. Read more about Stantec's COVID-19 response, including remote working and business continuity measures.

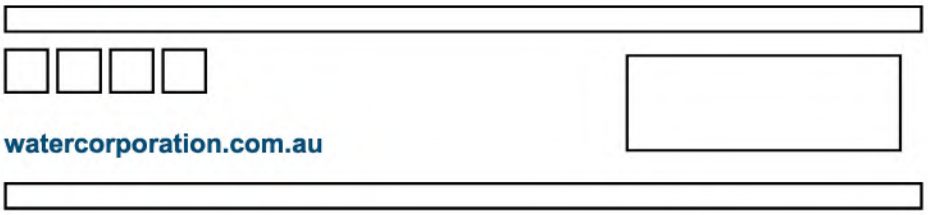
Hi Rhys,

There appears to be a number of issues with water supply in this area as our Region Ops Group have been asked to clarify. Unfortunately we are looking at 2 weeks investigation, report and findings.

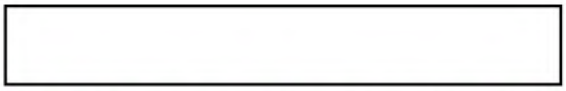
Sorry for this delay, Rhys I'll continue to keep you informed.

Rob Pettersson
Adv - Network Expansion
Development Services

E Rob.Pettersson@watercorporation.com.au
T (08) 9420 3970



watercorporation.com.au



Please consider the environment before printing this email.

Water Corporation E-mail – Report any suspicious emails to the WC Cyber Team using our "Report Phishing" button in outlook.

The Water Corporation respects individuals' privacy. Please see our privacy notice at What about my privacy

This Electronic Mail Message and its attachments are confidential. If you are not the intended recipient, you may not disclose or use the information contained in it. If you have received this Electronic Mail Message in error, please advise the sender immediately by replying to this email and delete the message and any associated attachments. While every care is taken, it is recommended that you scan the attachments for viruses. This message has been scanned for malware by Websense. www.websense.com

w

PO Box 1276
10 / 44 - 48 Queen Street
Busselton WA 6280
Tel +61 8 9754 4244

Stantec

Connect with us

stantec.com/australia