ROWE GROUP DESIGN

STRUCTURE PLAN

PART LOT 11, PART LOT 74 & LOT 9046 BEENYUP ROAD, BANJUP SPN

OUR REF: 4080 19/05/2020

DOCUMENT CONTROL

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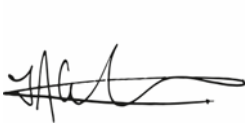
2	4080_20apr02R_rt.docx	Rebecca Thompson	Forbes Chesterman	19/05/2020

This report has been authorised by;



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RECORD OF ENDORSEMENT

This structure plan is prepared under the provisions of the City of Cockburn Local Planning Scheme No. 3.

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

..... Date

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

.....

an officer of the Commission duly authorised by the Commission pursuant to section 16 of the Planning and Development Act 2005 for that purpose, in the presence of:

..... Witness

..... Date

..... Date of Expiry

TABLE OF AMENDMENTS

AMENDMENT NO.	SUMMARY OF THE AMENDMENT	AMENDMENT TYPE	DATE APPROVED BY WAPC
0	*[Original Structure Plan]*	-	

TABLE OF DENSITY PLANS

DENSITY PLAN NO.	AREA OF DENSITY PLAN APPLICATION	DATE ENDORSED BY WAPC

EXECUTIVE SUMMARY

This Structure Plan applies to Part Lot 11 (No. 252), Part Lot 74 (No. 268) and Lot 9046 Beenyup Road, Banjup (the subject site), comprising approximately 7.28 hectares of land adjacent to existing residential development. The land is primarily contained within the 'Development' zone under the City of Cockburn's Local Planning Scheme No. 3 (LPS 3) and is currently zoned 'Urban Deferred' under the Metropolitan Region Scheme. A request to lift the Urban Deferment over the subject site has been lodged concurrently with this Structure Plan.

The Structure Plan Area is located approximately 3.4 km to the south east of Cockburn Central and 20 km south west of the Perth CBD.

The objective of this Structure Plan is to facilitate the development of the Structure Plan area for residential purposes. The Structure Plan is therefore prepared to satisfy the requirements of LPS 3 and *Planning and Development (Local Planning Schemes) Regulations 2015* to facilitate subdivision and development of the Structure Plan Area.

The Structure Plan Area adjoins the approved Structure Plan for Lot 204 Lyon Road, Aubin Grove to the west and the approved Harvest Lakes Structure Plan, Atwell to the north.

STRUCTURE PLAN SUMMARY

ITEM	DATA	SECTION NUMBER REFERENCED IN PART 2 OF REPORT
Total area covered by the Structure Plan	7.28 hectares	1.4
Area of each land use proposed: *Residential*	 3.63 hectares	3.3
Total estimated lot yield	111 lots	3.3
Estimated number of dwellings	111 dwellings	3.3
Estimated residential site density	30 dwellings per residential site hectare 15 dwellings per gross urban hectare	3.3
Estimated population	299 people (based on 2.7 ppl/household)	3.3
Number of high schools	n/a	3.6
Number of primary schools	n/a	3.6
Estimated commercial floor space	nil	3.7
Estimated area and percentage of public open space	0.7 hectares, 2 local parks (10.31% of gross subdivisible area)	3.2
Estimate percentage of natural area	0.9 hectares – ecological link and wetland buffer (12.9% of Structure Plan area)	3.2

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

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TECHNICAL APPENDICES

APPENDIX NUMBER	DOCUMENT TITLE	NATURE OF DOCUMENT	REFERRAL/APPROVAL AGENCY	APPROVAL STATUS AND MODIFICATIONS
1	Certificates of Title	Supporting	-	-
2	Bushfire Management Plan	Requires Approval	Dept of Fire and Emergency Services	
3	Environmental Assessment Report	Supporting	-	-
4	Landscape Master Plan	Supporting	-	-
5	Traffic Assessment	Supporting	-	-
6	Local Water Management Strategy	Requires Approval	Department of Water and City of Cockburn	
7	Engineering Services Report	Supporting	-	-

PART ONE

IMPLEMENTATION

ROWE GROUP DESIGN

1. STRUCTURE PLAN AREA

This Structure Plan applies to Part Lot 11 (No. 252), Part Lot 74 (No. 268) and Lot 9046 Beenyup Road, Banjup, 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

In accordance with Schedule 2, Part 4 of the *Planning and Development (Local Planning Schemes) Regulations 2015*, this Structure Plan shall come into operation when it is approved by the Western Australian Planning Commission (WAPC) pursuant to Schedule 2, Part 4, Clause 22 of the Regulations.

3. STAGING

No staging of development within the Structure Plan area is proposed.

4. SUBDIVISION & DEVELOPMENT REQUIREMENTS

4.1 LAND USE AND ZONES

The Structure Plan Map (Plan 1) outlines land uses, zones and reserves applicable within the Structure Plan area. Land use permissibility within the Structure Plan area shall be in accordance with the corresponding zone or reserve under the City of Cockburn Local Planning Scheme No. 3.

4.2 PUBLIC OPEN SPACE

The Structure Plan is to provide a minimum 10% public open space, in accordance with the WAPC's Liveable Neighbourhood's requirements.

Public open space is to be provided generally in accordance with the Structure Plan Map (Plan 1), and as indicatively shown at Figures 6 and 7.

4.3 ENVIRONMENTAL FEATURES

4.3.1 CONSERVATION CATEGORY WETLAND

Lots 11 and 74 comprise an existing mapped Conservation Category Wetland, situated outside the Structure Plan boundary. The mapped wetland and associated 50 metre buffer are to be retained under the Local Structure Plan. A Wetland Management Plan will be required as a condition of subdivision approval.

4.3.2 BUSH FOREVER

The Jandakot Reserve (Bush Forever Site No. 492) adjoins the Structure Plan area on its southern and western boundaries. Subdivision and development of the Structure Plan area shall have due consideration for the appropriate management of the interface with this Reserve, with regard to fire management, environmental management and water management.

4.4 FIRE MANAGEMENT

This Structure Plan is supported by a Bushfire Management Plan. Any development on land situated within 100 metres of a bushfire hazard identified in the Bushfire Management Plan shall comply with the requirements of Australian Standard 3959 under the Building Code of Australia.

4.5 INTERFACE WITH ADJOINING LAND

Subdivision and development of the Structure Plan area shall have due regard to the existing residential development to the west and north.

Subdivision and development of the Structure Plan area shall also have due regard to environmental features adjoining the site to the south, east and west.

4.6 RESIDENTIAL DENSITY TARGETS

The residential density codes applicable to the Structure Plan shall be in accordance with those shown on the Structure Plan Map (Plan 1).

In accordance with Liveable Neighbourhoods and Directions 2031 targets, the Structure Plan area shall provide for an minimum average of 22 dwellings per residential site hectare and 15 dwellings per gross urban hectare.

5. LOCAL DEVELOPMENT PLANS

Local Development Plans may be prepared in accordance with Part 6 of Schedule 2 of the *Planning and Development (Local Planning Schemes) Regulations (2015)* for any lots within a subdivision area comprising one or more of the following site attributes:

a) Has an area of 260m^2 or less;

b) Irregular shaped lots;

c) Lots where specific vehicle access and egress control is required;

d) Lots abutting and/or fronting public open space;

e) Lots subject of a Notification on Title;

f) Lots with a BAL Rating of 12.5 or greater; and/or

g) Requires special conditions to be set; or where otherwise deemed appropriate to the satisfaction of the City of Cockburn.

6. OTHER REQUIREMENTS

6.1 INFRASTRUCTURE CORRIDORS AND UPGRADES

The internal road infrastructure shall have due regard to the existing design, service alignments and connection points to the immediate surrounding development, including connection to the existing road network at Prosperity Loop to the west of the Structure Plan area and Gibbs Road to the north of the Structure Plan area.

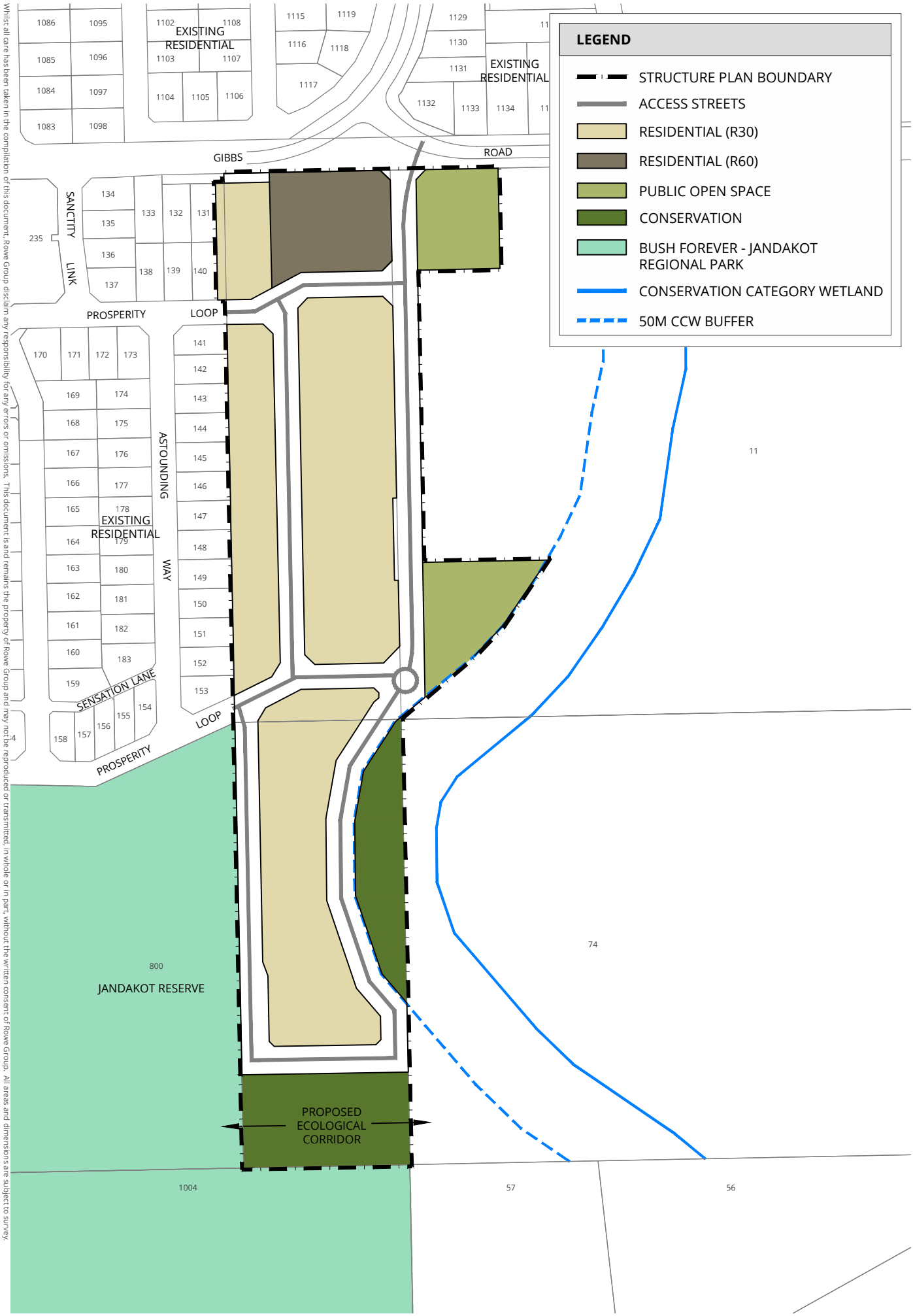
6.2 DEVELOPER CONTRIBUTION ARRANGEMENTS

In accordance with the Schedule 12 of Local Planning Scheme No. 3, the Structure Plan area is subject Development Contribution Area 13. Contributions are to be paid in accordance with the requirements of the Scheme.

7. ADDITIONAL INFORMATION

The following additional information shall be required.

ADDITIONAL INFORMATION	APPROVAL STAGE	CONSULTATION REQUIRED
Urban Water Management Plan	Subdivision Clearance	City of Cockburn / DWER
Landscape Management Plan	Subdivision Clearance	City of Cockburn
Wetland Management Plan	Subdivision Clearance	City of Cockburn
Midge and Mosquito Management Plan	Subdivision Clearance	City of Cockburn



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N:\TOWN PLANNING\4000-4999\4080\DRAFTING\A-CAD - WILLIAM CLEMENTS - 2020.05.05

4080_FIG20C_20200505 Banjup (LSP Zoning no resource) · DRAWN: A. GLASKIN · DATE CREATED: 2020.05.05 · PROJECTION: MGA50 GDA94 · CADASTRE: LANDGATE ·

0 75 m

SCALE @ A4: 1:3000

NORTH

PLAN 1

LOCAL STRUCTURE PLAN

PART TWO

EXPLANATORY SECTION

ROWE GROUP DESIGN

1. PLANNING BACKGROUND

1.1 INTRODUCTION AND PURPOSE

This Structure Plan has been prepared on behalf of Elite Developments (WA) Pty Ltd, Omega Management Services Pty Ltd, Anthony Poli, Bellridge Corporation Pty Ltd, and ARD No. 7 Pty Ltd, the owners of the subject land.

The purpose of this Structure Plan is to facilitate the subdivision and development of the subject land, being Part Lot 11, Part Lot 74 and Lot 9046 Beenyup Road, Banjup, for residential purposes. The Structure Plan has been prepared in accordance with the City of Rockingham Local Planning Scheme No. 3 (LPS 3), the *Planning and Development (Local Planning Schemes) Regulations 2015* (the Regulations) and the Western Australian Planning Commission's (WAPC) *Liveable Neighbourhoods*.

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;
- Retain the general landform and natural features of the site, as far as practicable, through the designation of appropriate land uses, the design of the road network and consideration of the future built form;
- Preserve and enhance the Conservation Category Wetland and its ecosystem;
- Provide a range of lot products and sizes to facilitate the creation of a mix of housing typologies and range of affordability to cater for a varied demographic; and
- Encourage the use of pedestrian and cyclist networks.

1.2 STRUCTURE PLAN AREA

For the purposes of reporting, the public open space (including drainage) areas and the eastern road reserve proposed outside of the 'Development' zone, to which a Structure Plan under LPS 3 is required, are considered to be included within the Structure Plan boundary.

In regard to the above, Clause 15 (c) of Schedule 2 of the *Planning and Development Act (Local Planning Schemes) Regulations 2015* allows for the WAPC to approve a Structure Plan outside the requirements for a structure plan, as set out under LPS 3. Thus, it is permissible to include the eastern subdivisional road and public open space areas within the Structure Plan area.

1.3 LIFTING OF URBAN DEFERMENT

Whilst already appropriately zoned 'Development' under LPS 3, the land comprising the Structure Plan is currently zoned Urban Deferred under the Metropolitan Region Scheme (MRS). An Urban Deferred lifting request has therefore been lodged concurrently with this Structure Plan.

1.4 LAND DESCRIPTION

1.4.1 LOCATION

The subject land is located approximately 20 kilometres south of the Perth central area, to the east of the Kwinana Freeway.

The Structure Plan area has frontage to Gibbs Road to the north and Prosperity Loop to the west, which was created as part of the subdivision of the adjoining land.

Refer **Figure 1** – Regional Location.

Refer **Figure 2** – Local Location.

1.4.2 AREA AND LAND USE

The Structure Plan area comprises three separate landholdings, being Part Lot 11, Part Lot 74 and Lot 9046 Beenyup Road, Banjup. Lot 11 has a total area of approximately 22.7 hectares, of which approximately 4.52 hectares is situated within the Structure Plan boundary. Lot 74 has an approximate total area of 18.7 hectares, of which approximately 2.73 hectares is situated within the Structure Plan boundary. Lot 9046 has a total area of approximately 371m^2, all of which is contained within the Structure Plan.

The Structure Plan area has an approximate total area of 7.28 hectares.

The Structure Plan area is generally vacant, comprising remnant vegetation across the site and an existing single dwelling (with associated structures) in the southwest corner of Lot 11.

Lot 9046 abuts the existing residential development along the western boundary of the Structure Plan Area. Lot 9046 contains an existing access easement (benefiting the City) for emergency access purposes. The easement for emergency access is proposed to be removed in due course, given the Structure Plan will create a new road network suitable for access for emergency vehicles.

Refer **Figure 3** – Site Plan.

1.4.3 LEGAL DESCRIPTION AND OWNERSHIP

The Structure Plan area comprises three land parcels, legally described as follows:

LOT NO.	DEPOSITED PLAN	VOLUME / FOLIO	PROPRIETOR/S
Part Lot 11	D59740	1576 / 356	ARD No. 7 Pty Ltd
Part Lot 74	P55156	2680 / 800	Bellridge Corporation Pty Ltd
Lot 9046	DP75193	2808 / 590	Elite Developments (WA) Pty Ltd; Omega Management Services Pty Ltd; Anthony Poli

All lots comprising the proposed Structure Plan are under the management of our Client, Aigle Royal Developments.

The Structure Plan area comprises a total of approximately 7.28 hectares.

Refer **Appendix 1** – Certificates of Title.

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4080_FIG06B_20200420 Banjup (LSP - Regional Location) - DRAWN:ADAM GLASKIN - DATE CREATED: 2020.04.20 - PROJECTION: MGA50 GDA94 -

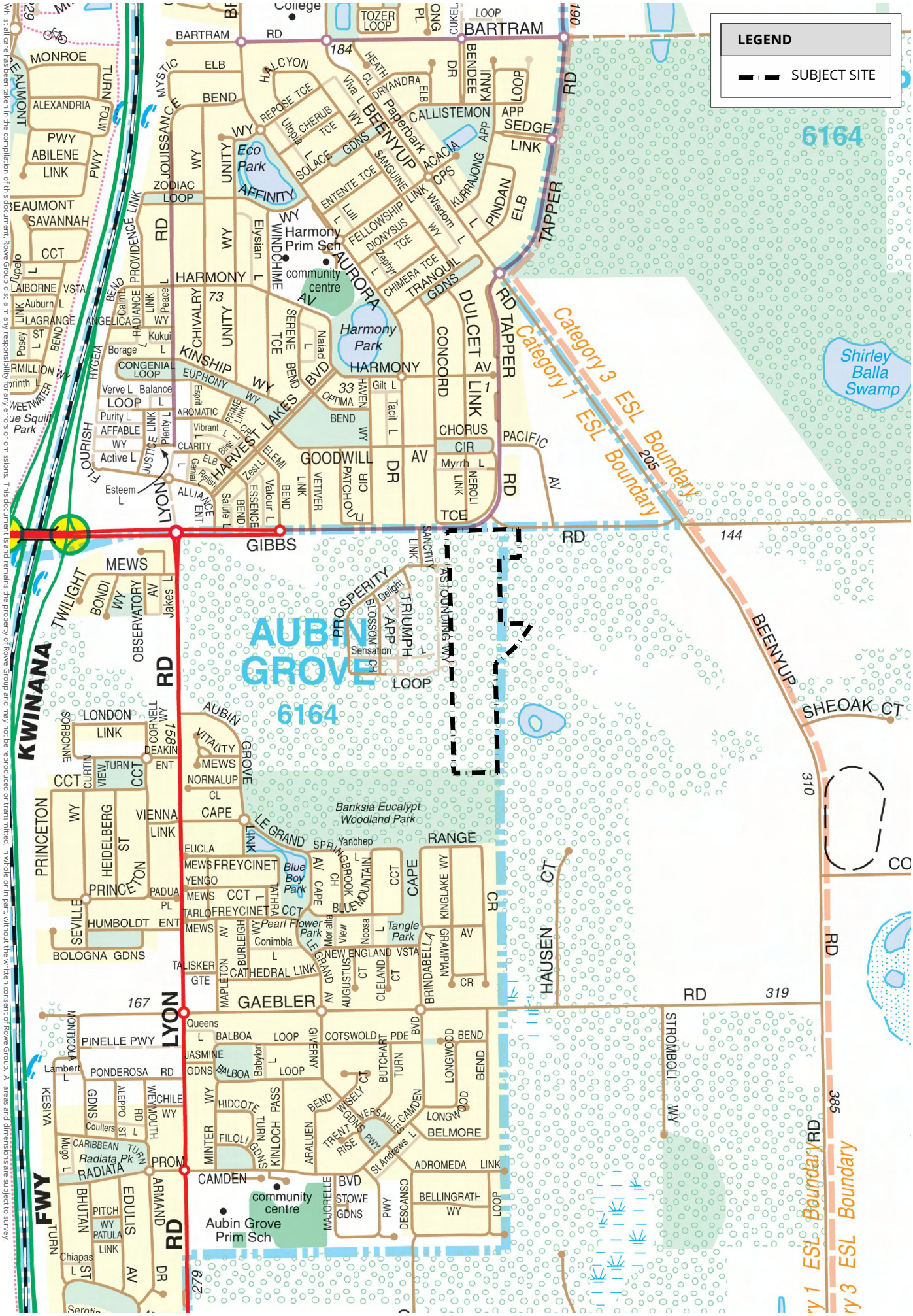
0 1250 m

SCALE @ A4: 1:50,000

N

FIGURE 1

REGIONAL LOCATION



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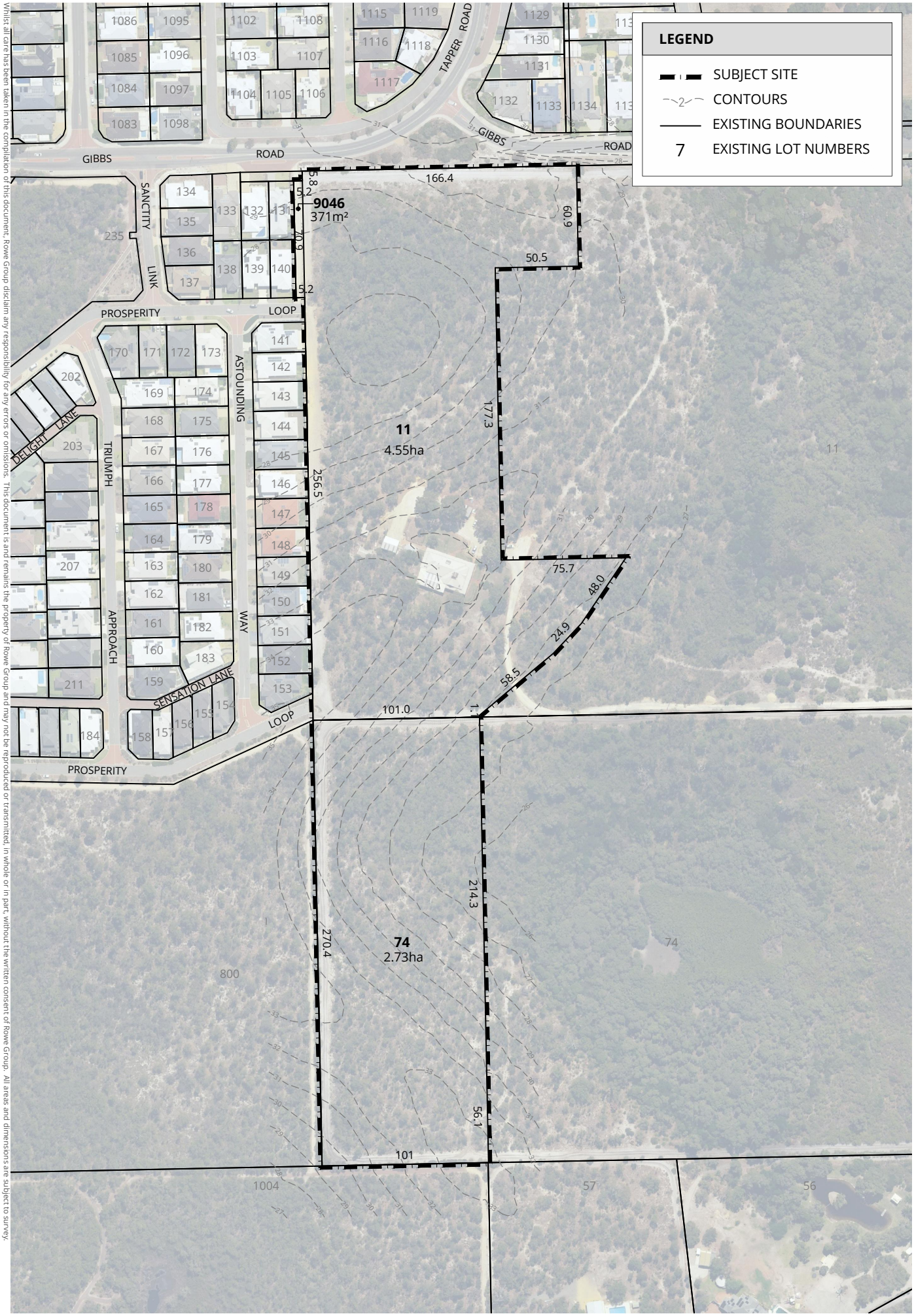
4080_FIG07B_20200417 Banjup (LSP - Local Location) · DRAWN: A. GLASKIN · DATE CREATED: 2020.04.17 · PROJECTION: MGA50 GDA94 · CADASTRE: LANDGATE · MAP DATA: STREETSMART

0 312.5 m

SCALE @ A4: 1:12,500

FIGURE 2

LOCAL LOCATION



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N:\TOWN PLANNING\4000-4999\4080\DRAFTING\A-CAD · ADAM GLASKIN · 2020.05.01

4080_FIG08B_20200501 Banjup (LSP - Site Plan) · DRAWN: A. GLASKIN · DATE CREATED: 2020.05.01 · PROJECTION: MGA50 GDA94 · CADASTRE: LANDGATE · AERIAL: MNG

0 75 m

SCALE @ A4: 1:3000

FIGURE 3

SITE PLAN

1.5 PLANNING FRAMEWORK

1.5.1 ZONING AND RESERVATIONS

1.5.1.1 METROPOLITAN REGION SCHEME

The subject site is currently zoned '*Urban Deferred*' under the Metropolitan Region Scheme (MRS).

A request to lift the Urban Deferment over the land has been lodged with the WAPC concurrently with this Structure Plan.

Land to the immediate east of the site is zoned '*Rural – Water Protection*' under the MRS. The Structure Plan proposes some public open space, drainage and road reserve within this land, with those relevant areas included within the Structure Plan boundary.

Refer **Figure 4** – Metropolitan Region Scheme Zoning.

1.5.1.2 CITY OF COCKBURN LOCAL PLANNING SCHEME NO. 3

The subject land is currently zoned '*Development*' under the City of Cockburn Local Planning Scheme No.3 (LPS 3) and is contained within '*Development Area 11 (Lyon Road)*'. The objective of the Development zone, as stated under LPS 3, is as follows:

> *"To provide for future residential, industrial or commercial development in accordance with a comprehensive Structure Plan prepared under the Scheme."*

The subdivision, use and development of land within the 'Development zone is to be generally in accordance with a Structure Plan that has been prepared and approved by the WAPC. This Structure Plan is therefore considered to satisfy this requirement.

Further, the subject land is contained within 'Development Contribution Area 13' (DCA13) of LPS 3. Contributions for the provision infrastructure within the region will be required to be made in accordance with DCA13 under LPS 3.

Refer **Figure 5** – City of Cockburn Local Planning Scheme No. 3 Zoning.

1.5.2 DISTRICT STRUCTURE PLAN

The *Southern Suburbs District Structure Plan Stage 2 Banjup* (DSP) was adopted in 2003, and in accordance with the Planning Regulations, shall be given due regard in the preparation, assessment and determination of any subsequent planning proposals. Notwithstanding, since adoption of the DSP in 2003, planning and development in the locality has significantly advanced and thus the document is considered to be somewhat 'dated'.

The DSP identifies the subject land primarily for Residential development, consistent with the zoning for the site and as reflected in the proposed Structure Plan.

The DSP also identifies the southern portion of the site for potential 'Bush Forever', as an extension to the existing adjoining Bush Forever site 492. However, the WAPC *Bush Forever Policy* (Volumes 1 and 2) (2000) does not identify the Structure Plan area for any existing or proposed Bush Forever sites, nor does the *South Metropolitan Peel Sub-Regional Planning Framework* or the *Metropolitan Region Scheme*. Given the Structure Plan area has not been identified in any

overarching State strategic planning frameworks for Bush Forever, nor has it been acquired for such purposes, the DSP is considered to be irrelevant on this regard.

On that basis, the Structure Plan does not propose any Bush Forever, however does allocate land for an ecological link in the south of the site, connecting the existing Bush Forever site to the south and west with the Conservation Category Wetland to the east, providing for important vegetation retention and fauna movements.

1.5.3 LOCAL STRUCTURE PLANS

The subject site adjoins the approved Structure Plan for Lot 204 Lyon Road, Aubin Grove to the west and the approved Harvest Lakes Structure Plan, Atwell to the north.

The proposed Structure Plan will complement the existing development and provide additional vehicular and pedestrian connections between the already established residential areas.

1.5.4 PLANNING STRATEGIES

1.5.4.1 DIRECTIONS 2031

Directions 2031 is a high level spatial and strategic planning framework that establishes a vision for future growth of the Perth Metropolitan and Peel region. It provides a detailed framework guiding the planning and delivery of housing, infrastructure and services required to accommodate a range of growth scenarios.

Directions 2031 seeks a 50% increase to the existing average residential density of 10 dwellings per gross urban zoned hectare, setting the target of 15 dwellings per gross urban zoned hectare for land in new development areas. Based on a total land area of approximately 7.28 hectares, the Structure Plan area is required to achieve a minimum total of 109 dwellings. Based on preliminary concept planning for the site, an indicative yield of approximately 111 dwellings is anticipated, therefore achieving Directions 2031 targets.

1.5.4.2 PERTH AND PEEL @ 3.5 MILLION

The *Perth and Peel @ 3.5 Million* (March 2018) suite of documents provide a framework for the development of the Perth and Peel regions as the population reaches an estimated 3.5 million by 2050. The documents seek to meet the targets identified under Directions 2031 and the State Planning Strategy 2050. The suite of documents includes four sub-regional planning frameworks for the Central, North-West, North-East and South Metropolitan Peel sub-regions. The four sub-regional planning frameworks detail where future homes and employment should be located, and where important environmental assets should be avoided and protected.

The subject site is included within the South Metropolitan Peel Sub-Regional Planning Framework and is identified as 'Urban Deferred', consistent with the current MRS zoning.

1.5.4.3 SOUTH METROPOLITAN PEEL SUB-REGIONAL PLANNING FRAMEWORK

The *South Metropolitan Peel Sub-Regional Planning Framework* (the 'Framework') represents a whole of State Government approach to managing the future urban form within the sub-region and identifies sufficient land to meet the increased demand for residential dwellings. The South Metropolitan Peel sub-region is proposed to accommodate more than 1.26 million people, over

507,000 homes and approximately 430,000 jobs, with a projected additional dwelling target of 30,120 (66,960 people) within the City of Cockburn.

The proposed Structure Plan provides for an indicative yield of 111 residential lots (based on preliminary concept planning), equating to a population of approximately 310 people (based on 2.8 people per household). The development of the site, as proposed, will therefore assist in achieving dwelling and population targets identified under the draft Framework.

The Framework requires new urban development meet a residential density target of 15 dwellings per gross hectare. Based on preliminary concept planning, the proposed Structure Plan provides for an approximate residential density of 15.3 dwellings per gross urban hectare (subject to detailed design).

The subdivision and development of the Structure Plan area for residential purposes is therefore consistent with the Planning Framework, providing for a consolidation of an existing urban area which has ready access to existing services and facilities.

1.5.4.4 LIVEABLE NEIGHBOURHOODS

Liveable Neighbourhoods is a WAPC operational policy for the design and assessment of structure plans and subdivision for new urban areas. It seeks to create more vibrant, self sufficient and interactive communities that provide a wide range of residential, employment, recreational and business opportunities within a reasonable catchment.

The aims of Liveable Neighbourhoods can be summarised as follows:

- To promote an environment for safe, efficient and pleasant walking, cycling and driving.
- To facilitate mixed use urban development which provide a wider range of living, employment and leisure opportunities.
- To provide for a flexible neighbourhood structure capable of adapting over time as a community changes.
- To provide for a variety of lot sizes for housing choice and diversity.
- To provide a comprehensive approach to the design of open space and water management.

Liveable Neighbourhoods also requires a minimum average of 22 dwellings per site hectare across new residential areas. Based on preliminary concept planning, the Structure Plan provides for approximately 31 dwellings per residential site hectare, therefore achieving the Liveable Neighbourhoods targets.

The Structure Plan has been prepared in accordance with the provisions of Liveable Neighbourhoods.

1.5.5 STATE PLANNING POLICIES

1.5.5.1 SPP 2.8: BUSHLAND POLICY FOR THE PERTH METROPOLITAN REGION

State Planning Policy 2.8: Bushland Policy for the Perth Metropolitan Region (SPP 2.8) applies to land identified as Bush Forever and areas of bushland outside of Bush Forever sites within the Perth Metropolitan Region.

The subject land is not identified as Bush Forever but contains some native vegetation and abuts Bush Forever Site 492. An assessment of vegetation, along with areas of vegetation proposed to be retained, is detailed within Section 2.1.1 of this report.

1.5.5.2 SPP 3: URBAN GROWTH AND SETTLEMENT

Statement of Planning Policy 3 - Urban Growth and Settlement (SPP3) sets out the principles and considerations which apply to planning for urban growth and settlement.

SPP 3 refers to the requirement for urban areas to be identified in Regional and Local Planning Strategies and development of identified urban areas to be facilitated by Structure Plans. The Structure Plan area is zoned 'Development' under LPS 3 and the proposed Structure Plan will ensure orderly and proper planning is achieved consistent with the requirements of the 'Development' zone and the Planning Regulations.

The development of the land takes advantage of existing service and community infrastructure to the west of the subject site. The site is also located within 1.2 kilometres of the new Aubin Grove railway station. As such, future residents will have access to the station for commuting purposes.

1.5.5.3 SPP 2.3: JANDAKOT GROUNDWATER PROTECTION POLICY

The subject land is situated within the Jandakot Underground Water Pollution Control Area (UWPCA), and therefore subject to the provisions of *Statement of Planning Policy 2.3: Jandakot Groundwater Protection Policy* (SPP 2.3).

The objectives of SPP 2.3 are:

- *To ensure that all development and changes to land use within the policy area are compatible with maximising the long-term protection and management of groundwater, in particular for public drinking water supply;*
- *To protect groundwater quality and quantity in the policy area in order to maintain the ecological integrity of important wetlands that are hydraulically connected to that groundwater, including wetlands outside the policy area;*
- *To prevent, minimise, and manage in defined locations development and land uses that may result in contamination of groundwater; and*
- *To maintain or increase natural vegetation cover over the policy area.*

In the most part, the Structure Plan area is classified as a Priority 3 area, in which residential development is a compatible and permissible use.

The eastern subdivisional road and public open space (including drainage) are located within the 'Rural-Water Protection' zone under the MRS. The Rural Water Protection zone under the MRS

relates to the Priority 2 area of the Jandakot Groundwater Protection Area. Guidance on the acceptability of land uses and activities within Priority 2 areas is provided for in the *Water Quality Protection Note 25: Land Use Compatibility Tables for Public Drinking Water Source Areas* (WQPN). In accordance with the WQPN, stormwater drainage infrastructure and roads are compatible uses within a P2 area.

1.5.5.4 SPP 3.7: PLANNING IN BUSHFIRE PRONE AREAS

In accordance with the Department of Fire and Emergency Services mapping, the subject site is identified as being 'fire prone'. Therefore, the requirements of *State Planning Policy 3.7: Planning in Bushfire Prone Areas* (SPP 3.7) apply to the proposed Structure Plan.

The objectives of SPP 3.7 are:

> *5.1 Avoid any increase in the threat of bushfire to people, property and infrastructure. The preservation of life and the management of bushfire impact are paramount.*
>
> *5.2 Reduce vulnerability to bushfire through the identification and consideration of bushfire risks in decision-making at all stages of the planning and development process.*
>
> *5.3 Ensure that higher order strategic planning documents, strategic planning proposals, subdivision and development applications take into account bushfire protection requirements and include specified bushfire protection measures.*
>
> *5.4 Achieve an appropriate balance between bushfire risk management measures and, biodiversity conservation values, environmental protection and biodiversity management and landscape amenity, with consideration of the potential impacts of climate change.*

In accordance with SPP 3.7, this Structure Plan is supported by a Bushfire Management Plan. The outcomes of the Bushfire Management Plan indicate the proposed residential development is capable of achieving a Bushfire Attack Level Ratings of 29 or below.

Refer **Appendix 2** – Bushfire Management Plan.

1.5.6 LOCAL PLANNING POLICIES

The following Local Planning Policies (LPPs) were considered in the preparation of this Structure Plan:

- LPP 1.11: Residential Rezoning and Subdivision Adjoining Midge Infested Lakes and Wetlands;
- LPP 5.1: Public Open Space;
- LPP 5.2: Incorporating Natural Areas in Public Open Space and/or Drainage Areas; and
- LPP 5.3: Control Measures for Protecting Water Resources in Receiving Environments.

In addition to the above, development within the Structure Plan area shall be in accordance with the following Local Planning Policies, except where otherwise varied by the Structure Plan, an approved Local Development Plan (LDP), or by the City.

- LPP 1.2: Residential Design Guidelines;
- LPP 1.16: Single House Standards for Medium Density Housing in the Development Zone;
- LPP 5.3: Control Measures for Protection Water Resources in Receiving Environments;
- LPP 5.5: Local Development Plans;
- LPP 5.7: Uniform Fencing;
- LPP 5.11: Filling of Land;
- LPP 5.12: Retaining Walls;
- LPP 5.15: Access Street – Road Reserve and Pavement Standards; and
- LPP 5.18: Subdivision and Development – Street Trees.

1.5.6.1 LPP 1.11: RESIDENTIAL REZONING AND SUBDIVISION ADJOINING MIDGE INFESTED LAKES AND WETLANDS

Given the site's proximity to the Conservation Category Wetland to the east, there is a risk of nuisance caused by midge and mosquitoes. A Midge and Mosquito Management Plan will therefore likely be required as a condition of subdivision approval, as well as a Notification on Title advising future residents of the potential risk.

1.5.6.2 LPP 5.1: PUBLIC OPEN SPACE

The purpose of this policy is to specify land features which will not be accepted by the City as part of the 10% POS requirement. The City will not accept land that is considered to be 'contaminated' or 'possibly contaminated'. It is noted the Structure Plan Area is understood to not be contaminated, and is therefore compliant with LPP 5.1.

1.5.6.3 LPP 5.2: INCORPORATING NATURAL AREAS IN PUBLIC OPEN SPACE AND/OR DRAINAGE AREAS

LPP 5.2: Incorporating Natural Areas in Public Open Space and/or Drainage Areas provides guidance for the retention of natural areas in public open space or drainage areas.

The Structure Plan integrates public open space and drainage areas adjacent to the 50 metre buffer of an existing Conservation Category Wetland, situated to the west of the site.

1.5.6.4 LPP 5.3: CONTROL MEASURES FOR PROTECTING WATER RESOURCES IN RECEIVING ENVIRONMENTS

The purpose of *LPP 5.3: Control Measures for Protecting Water Resources in Receiving Environments* (LPP 5.3) is to ensure drainage generated from development can be controlled through best practices water sensitive urban design to protect water resources in receiving environments.

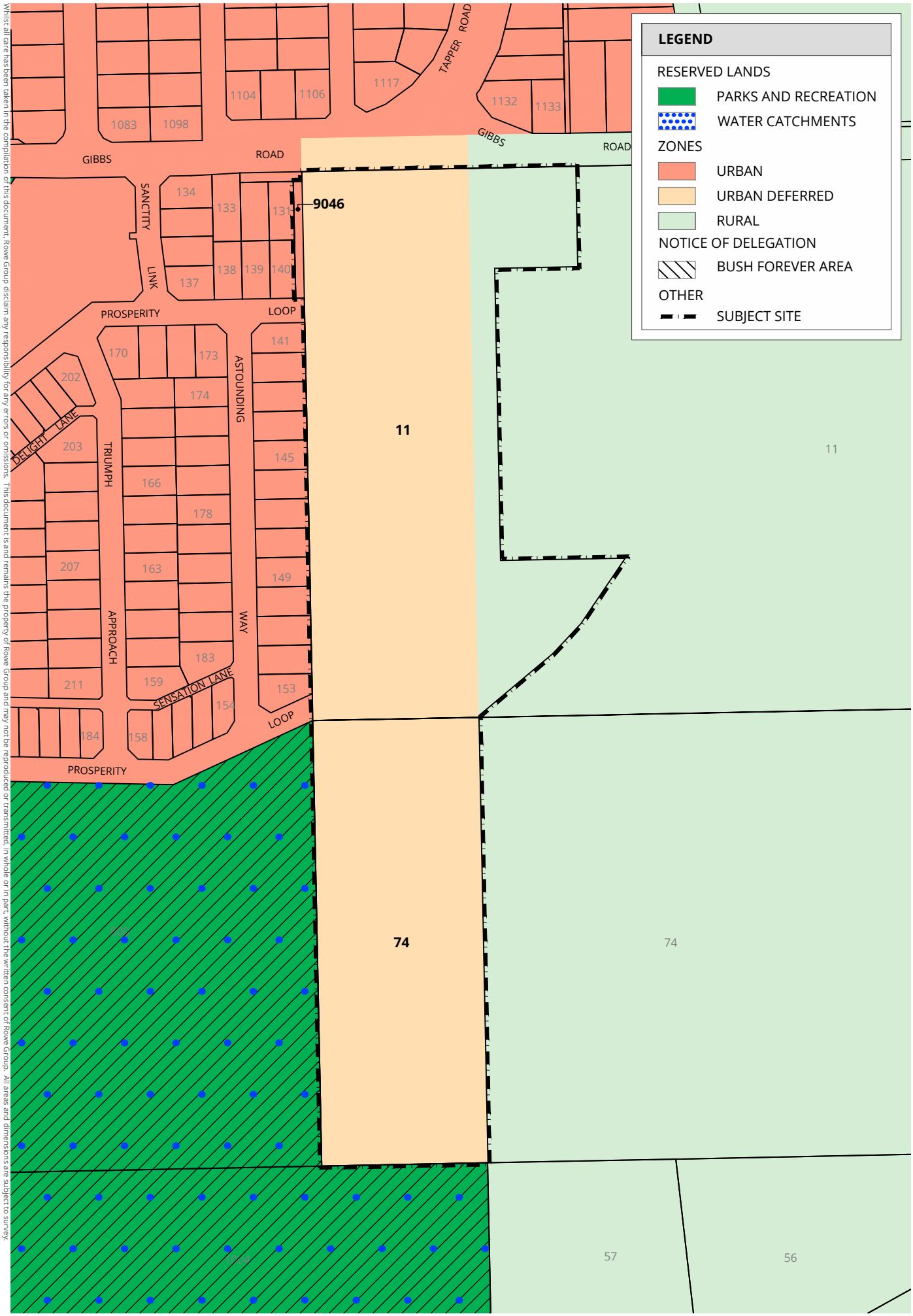
A Local Water Management Strategy (LWMS) has been prepared to support the proposed Structure Plan. The LWMS has been prepared in accordance with *Better Urban Water Management* and the *Stormwater Management Manual of Western Australia,* and sets out current best practice management principles in relation to stormwater management within the Structure Plan area.

1.5.7 PRE-LODGEMENT CONSULTATION

An MRS Amendment Request was lodged for Lots 11 and 74 Beenyup Road in 2017, seeking to rezone the portion of land zoned 'Rural-Water Protection' to 'Urban'. Concurrently with the MRS Amendment Request, an Urban Deferred Lifting Request and associated Local Structure Plan were lodged for the site.

The previously lodged Urban Deferred Lifting and Structure Plan proposals were subsequently put 'on hold', pending resolution of the MRS Amendment Request. However, the MRS Amendment Request has since been withdrawn and the Structure Plan proposal redesigned to exclude that land.

Given the time lapsed since lodgement of the initial proposals, an updated Structure Plan has been prepared. Prior to preparing this updated Structure Plan request, the landowner has been in regular contact with the City of Cockburn and sought comment on the previously lodged version of the Structure Plan. The revised Structure Plan, the subject of this proposal, has been updated with due consideration to the preliminary comments received from the City and in accordance with previous discussions undertaken in regard to the plan and reporting requirements.

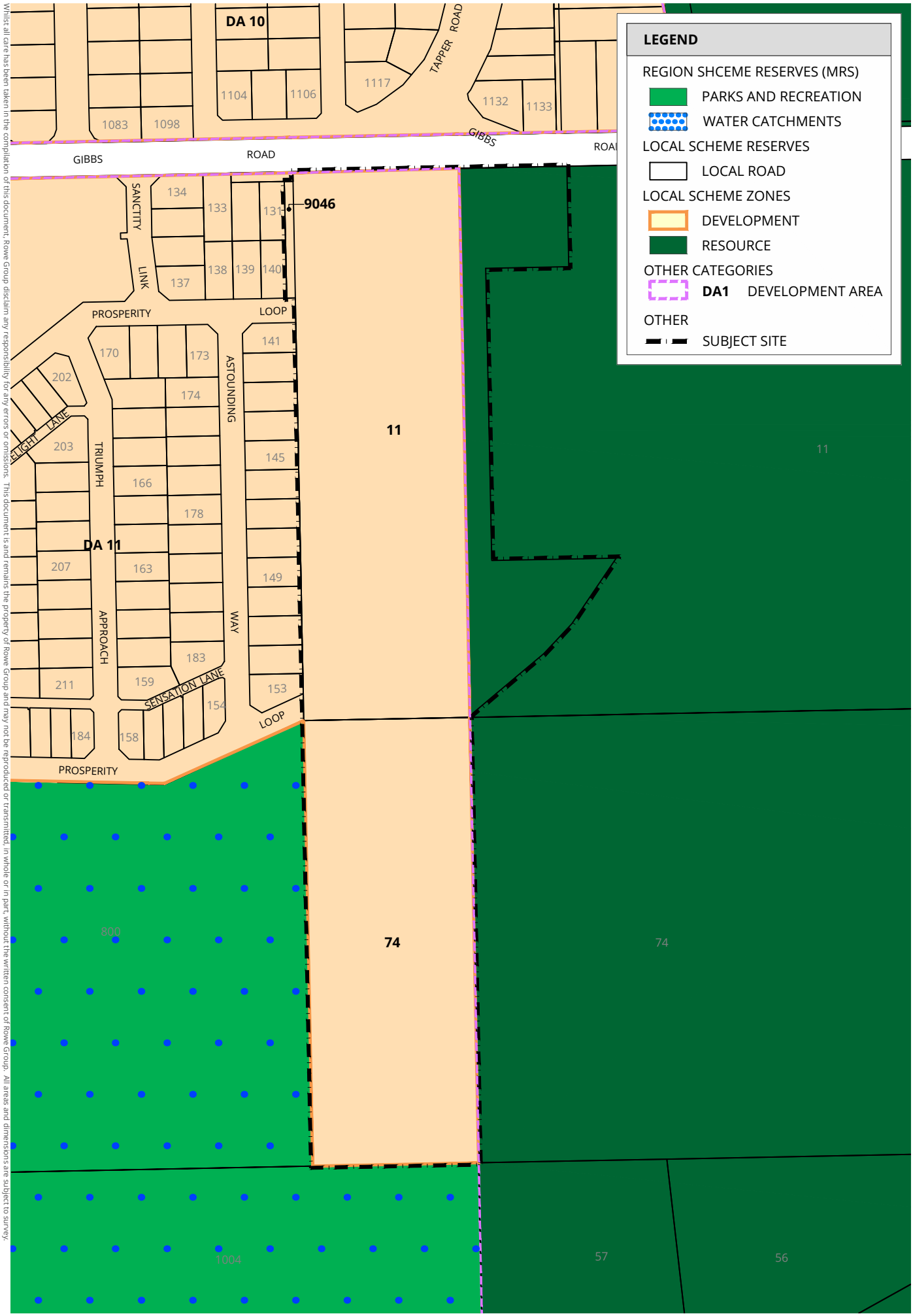


0 75 m

SCALE @ A4: 1:3000

FIGURE 4

METROPOLITAN REGION SCHEME ZONING



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4080_FIG10B_20200501 Banjup (LSP - TPS) · DRAWN: A. GLASKIN · DATE CREATED: 2020.05.01 · PROJECTION: MGA50 GDA94 · CADASTRE: LANDGATE · MAP DATA: DPLH

0 75 m

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FIGURE 5

CITY OF COCKBURN TOWN PLANNING SCHEME No. 3 ZONING

2. SITE CONDITIONS AND CONSTRAINTS

2.1 BIODIVERSITY AND NATURAL AREA ASSETS

This Structure Plan is supported by an Environmental Assessment Report, included at **Appendix 3**. The outcomes of the Environmental Assessment Report are summarised below.

2.1.1 FLORA AND VEGETATION

The subject site contains remnant vegetation.

360 Environmental undertook a *Detailed (Level 2) Flora and Vegetation Survey* across the site in September 2015. A subsequent *Targeted Flora Survey* was undertaken in October 2017 by a Senior Botanist to identify the presence of any conservation significant flora species identified as likely to occur within the 2015 survey and perennial orchids that are difficult to detect (*Caladenia hueglii* and *Drakaea micrantha*). From the 2017 survey, the vegetation condition within the site was reassessed and the condition rescored from the original survey in 2015.

Five vegetation types were recorded across the site:

- Low Woodland of *Banksia attenuata*, *Banksia menziesii*, *Allocasuarina fraseriana*, *Eucalyptus marginata* over *Kunzea glabrescens*, *Acacia pulchella*, *Hibbertia hypericoides*, *Xanthorrhoea preissii*, *Bossiaea eriocarpa* and *Conostylis aculeata*.
- Low Woodland of *Banksia attenuata*, *Banksia menziesii*, *Allocasuarina fraseriana* over *Kunzea glabrescens*, *Dasypogon bromeliifolius*, *Hibbertia subvaginata*, *Calytrix fraseri* and *Bossiaea eriocarpa*.
- Open Woodland of *Allocasuarina fraseriana*, *Eucalyptus marginata* and *Banksia ilicifolia* over *Xanthorrhoea preissii*, *Dasypogon bromeliifolius*, *Bossiaea eriocarpa*, *Gompholobium tomentosum* and *Phlebocarya ciliata*.
- Woodland of *Banksia ilicifolia* and *Banksia attenuata* over *Kunzea glabrescens*, *Xanthorrhoea preissii*, *Dasypogon bromeliifolius* and *Desmocladus flexuosus*.
- Ecotone of *Banksia ilicifolia* and *Banksia menziesii* over Kunzea glabrescens, *Dasypogon bromeliifolius* and *Phlebocarya ciliata*.

Vegetation across the site ranges from 'Completely Degraded' to 'Excellent'. Historical vegetation clearing, weeds, housing, a nursery and the presence of tracks over the site were the most frequently observed impacts on native vegetation. A large portion of the site (30%) was mapped to be in 'Good' condition, with 19% mapped as 'Degraded' to 'Completely Degraded'.

The proposed development will involve the clearing of approximately 4.71 hectares of remnant vegetation across the site and the retention of approximately 1.27 hectares (0.93 hectares of Banksia Woodland and 0.34 hectares of Eucalypt Woodland) within the wetland buffer and proposed ecological link.

2.1.1.1 THREATENED ECOLOGICAL COMMUNITY (BANKSIA WOODLAND)

Based on survey results and statistical analysis, approximately 5.84 hectares of the Banksia Woodland threatened ecological community (TEC) is identified on site. The spatial extent of the Banksia Woodland TEC is shown within the attached Environmental Assessment Report. Approximately 3.71 hectares of Banksia Woodland within the Structure Plan area is proposed to be cleared to facilitate future development, with approximately 0.74 hectares proposed to be retained within the proposed ecological link in the south of the Structure Plan area.

2.1.1.2 THREATENED AND PRIORITY FLORA

A two-kilometre radial DBCA *NatureMap* and DAWE *Protected Matters Search Tool* (PMST) search was undertaken for the site. The *NatureMap* and PMST databases identified 13 conservation significant flora species as potentially occurring in the vicinity of the site. Of these, eight are classified as Threatened, one as Priority 3 and four as Priority 4.

The likelihood of occurrence of conservation significant flora species was determined by comparing the plant species' requirements to the vegetation descriptions obtained from a Level 2 Flora and Vegetation Survey of the site. The likelihood assessment determined that of the 13 Conservation significant species listed under the *EPBC Act* and the *BC Act 2016* as potentially occurring in the vicinity of the site, eight were considered likely or possible to occur on the site.

The 2016 *Detailed (Level 2) Flora and Vegetation Survey* did not identify any Priority species as listed by DBCA or Threatened Species as listed under the EPBC Act or BC Act (previously known as the Wildlife Conservation Act 1950). In addition, the DBCA database did not identify any conservation significant flora species within the site.

360 Environmental undertook a Targeted Flora Survey for the King Spider-orchid (*Caladenia huegelii*), the Dwarf Hammer-orchid (*Drakaea micrantha*) and other conservation significant flora species identified as likely to occur within the site. The targeted flora survey was undertaken on 11 October 2017 during the optimal flowering period for these species (September and October).

The site was sufficiently surveyed by an experienced Principal Botanist. No Threatened species pursuant to the EPBC Act or BC Act or Priority listed species were recorded during the targeted survey.

2.1.1.3 ENVIRONMENTALLY SENSITIVE AREAS

The site is mapped as an 'Environmentally Sensitive Area' (ESA), which relates to the Gibbs Road Swamp System and its associated buffers. ESA's are protected by legislation and areas within the extent of an ESA are not subject to native vegetation clearing exemptions (such as exemptions associated with subdivision approval).

2.1.1.4 BUSH FOREVER

There are no Bush Forever sites mapped within the Structure Plan area.

There is an existing mapped Bush Forever site (No. 492), known as the Jandakot Regional Park, adjoining the site on its south and south-western boundaries. Further, Bush Forever Sites 263 and 344 are situated approximately 650 metres to the north and 1.17 kilometres to the east of the site. There are also extensive areas of Bush Forever (sites 392 and 391) surrounding the site

associated with the Forrestdale Lake Nature Reserve and Beeliar Regional Park (including Thompsons Lake Nature Reserve).

The City of Cockburn *Southern Suburbs District Structure Plan* (2002) identified the southern portion of the Structure Plan area for potential Bush Forever, as an extension to the existing adjoining site 492. However, the *WAPC Bush Forever* policy (Volumes 1 and 2) (2000) does not identify the Structure Plan area for any existing or proposed Bush Forever sites, nor does the *South Metropolitan Peel Sub-Regional Planning Framewo*rk or the *Metropolitan Region Scheme*. Given the Structure Plan area has not been identified in any overarching State strategic planning frameworks for Bush Forever, nor has it been acquired for such purposes, the District Structure Plan is considered irrelevant in this regard.

Notwithstanding the above, the Structure Plan proposes an ecological corridor in the south of the site, providing a connection between the existing Bush Forever site to the south/west and the wetland to the east, thereby addressing some of the key environmental considerations under the District Structure Plan.

2.1.2 FAUNA

A review of the DBCA *NatureMap* and DAWE *Protected Matters Search Tool* was undertaken within a two-kilometre radius of the site. The results of that search identified the site predominantly consists of terrestrial habitat associated with Banksia Woodlands.

A likelihood assessment was undertaken by 360 Environmental, and found the subject site is likely to offer suitable habitat for:

- Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksi naso*)
- Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*)
- Chuditch (*Dasyurus geoffroii*)
- Southern Brown Bandicoot (Quenda) (*Isoodon obesulus spp. fusciventer*)
- Perth Slider, Lined Skink (*Lerista lineata*)

A Black Cockatoo Habitat Assessment was undertaken on 9 February 2017, with a follow up site visit undertaken on 11 October 2017 to confirm the presence and size of tree hollows. The initial assessment identified the site primarily comprises of Eucalypt Woodlands and Banksia Woodlands, which are known habitats of three species of the Black Cockatoo. Survey results indicated the site is not currently utilised by black cockatoos for breeding. The primary value of the area is a foraging resource for the Carnaby's Cockatoo.

The site comprises approximately 6.01 hectares of Black Cockatoo foraging habitat, consisting of the following:

- 4.45 hectares of Banksia Woodland; and
- 1.56 hectares of Eucalyptus Woodland.

Further, the Black Cockatoo habitat assessment and follow up site visit identified five potential breeding trees. Two of the five trees were stags, one of which contained hollows not utilised by

the Carnaby's Cockatoo. 360 Environmental reports breeding of the Carnaby's Cockatoo is unlikely to occur within the site.

The development of the Structure Plan area will result in clearing of approximately 4.93 hectares of Black Cockatoo habitat, and removal of five potential breeding trees, with approximately 1.09 hectares of foraging habitat to be retained in wetland buffer and proposed ecological link. Subject to engineering [cut and fill] specifications and assessment against AS 4970-2009, further habitat may be viable for retention within the proposed Structure Plan, within areas of public open space and road reserves.

The proposed ecological link provides for a connection from the adjacent Bush Forever Site No. 492 (Jandakot Regional Park) through to adjacent bushland proposed within the wetland buffer (restricted open space). The width of the proposed ecological link is approximately 50 metres, and will allow continued movement of fauna species through the landscape, particularly to the wetland as a potential water source.

The wetland buffer area captures a variety of fauna habitats, such as transition zones from low lying to uplands to Banksia woodlands.

Additional mitigation and management measures will be implemented through management plans at subsequent stages of planning, including but not limited to a *Fauna Management and Relocation Plan* being required as a condition of subdivision approval.

2.1.3 ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999 REFERRAL

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is the central piece of environmental legislation protecting *Matters of National Environmental Significance* (MNES) and broadly, to conserve Australia's biodiversity. If a proposed action is likely to have a significant impact on any MNES, a referral to the Commonwealth Department of Agriculture Water and Environment (DAWE) (formally known as the Department of Environment and Energy – DEE) may be warranted.

A proposed action for the development of the subject site was referred under the EPBC Act (ref 2017/7923) for DAWE assessment in 2017, which was deemed a 'Controlled Action' and required assessment by Preliminary Documentation, including an offset strategy. It was determined the proposed action is likely to, or may, have a significant impact on the following MNES:

- Banksia Woodlands of the Swan Coastal Plain Threatened Ecological Community (TEC) – Endangered
- Carnaby's Cockatoo (*Calyptorhynchus latirostris*) – Endangered
- King Spider-orchid (*Caladenia huegelii*) - Endangered
- Dwarf Hammer-orchid (*Drakaea micrantha*) - Vulnerable.

The public comment period for the Preliminary Documentation closed on the 24 March 2020.

Aigle Royal Group is currently in negotiation with the Department of Biodiversity, Conservation and Attractions (DBCA) to secure a parcel of land adjoining the Moore River National Park as an

offset opportunity. Securing the land, and its incorporation in to the Moore River National Park, will produce significant environmental dividends. Realisation of this opportunity will far outweigh any potential environmental impacts from developing the subject land as envisaged by the proposed Structure Plan.

2.2 LANDFORM AND SOILS

The topography of the subject land slopes from 34 metres AHD in the south-east, to 32 metres AHD in the general central portion of the site, and down to 27 metres AHD in the north.

The geology of the site is typically defined as *Bassendean sand: basal conglomerate overlain by dune quartz sand with heavy mineral concentrations, Aeolian coastal sediment*.

The site falls within the Bassendean System, of which the relevant subsystems are described as follows:

- *Bassendean B2 Phase* – Deep bleached grey sands with a pale yellow B horizon or a weak iron-organic hardpan 1-2 metres; and
- *Bassendean B3 Phase* – Moderately deep, bleached sands with an iron-organic pan, or clay subsoil. Surfaces are dark grey sand or sandy loam.

2.2.1 ACID SUPLHATE SOILS

The Department of Water and Environmental Regulation (DWER) regional mapping indicates the site is mapped as having a moderate to low risk of Acid Sulphate Soils (ASS) occurring within three metres of natural soil surface.

2.2.2 POTENTIAL CONTAMINATION

A search of the Department of Water and Environmental Regulation (DWER) Contaminated Sites Database identified no registered contaminated sites within or immediately adjacent to the Structure Plan area.

2.3 GROUNDWATER

Ground water monitoring indicates that Average Annual Maximum Groundwater Levels (AAMGL) range across the site from 26 to 23.92 metres AHD.

The site is situated within the boundary of the *Russell Road Arterial Drain Scheme* (DWA, 2003) and has Control Groundwater Levels (CGL) between 25.0 metres AHD and 25.25 metres AHD. Data collected between September 2011 and September 2014 from three groundwater monitoring bores installed at the site are comparable to the CGL's from the Russell Road Arterial Drain Scheme.

The Structure Plan area is classified as a Priority 3 area, with the eastern subdivisional road and proposed areas of public open space/ drainage classified as a Priority 2 Area under the Jandakot Underground Water Pollution Control Area (UWPCA). No wellhead zones exist in proximity to the Structure Plan area.

2.4 WETLANDS

The subject site is mapped as being situated within the Gibbs Road Swamp System, listed under the Directory of Nationally Important Wetlands. The Gibbs Road system wetland mapping covers a total area of approximately 70 hectares, including large areas of residential development, small rural landholdings and conservation areas. The Directory of Nationally Important Wetlands is not protected by any legislative mechanism; however, it is acknowledged and considered for future planning and development.

There are no Department of Biodiversity Conservation and Attractions (DBCA) geomorphic wetlands within the site. There is a mapped Conservation Category Wetland (CCW) (UFI 12984) and Multiple Use Wetland (MUW (UFI 6657) located adjacent to the Structure Plan area to the east. There is a 50 metre buffer applicable to the CCW, which is partially located within the Structure Plan area.

The following management measures are proposed for the CCW:

- A 50 metre buffer will be applied to the CCW to protect the wetland from the proposed residential development;
- The wetland buffer will be revegetated with low fuel native vegetation to support, compliment and protect the CCW, as well as providing adequate bushfire protection for the proposed development;
- The CCW, buffer and retained Black Cockatoo habitat will be rehabilitated where required, including revegetation and weed control measures to preserve the ecological attributes and functions of the wetland's conservation category;
- Monitoring for Dieback infestation and early management of new infestations;
- The restricted public open space and CCW will be fenced from the development to prevent unauthorised access and control access to feral and domestic animals from entering areas reserved for conservation;
- Prior to clearing, significant trees to be cleared or retained will be clearly demarcated and all site personnel will be inducted on the clearing areas;
- Structural and non-structural best management practices will be used to improve water quality in the CCW, by reducing exposure to pollutants in line with an approved LWMS and UWMP;
- Controlled access to the wetland and buffer for maintenance and fire access;
- Revegetation, monitoring and annual reporting for two years post construction to the City of Cockburn's requirements;
- The portion of CCW buffer situated within the Structure Plan boundary will be ceded for conservation and management at the subdivision stage; and
- Ceding of the portion of CCW buffer and ecological link to the City of Cockburn for long term conservation and management. This area will be part of the local reserve 'Banksia Eucalypt Woodland Park', and potentially part of the Jandakot Regional Park.

A Wetland Buffer Management Plan will also be required as a condition of subdivision approval.

2.5 BUSHFIRE MANAGEMENT

In accordance with the Department of Fire and Emergency Services mapping, the subject site is identified as being fire prone. Therefore, this Structure Plan is supported by a Bushfire Management Plan, prepared by Strategen JBS&G. A copy of the Bushfire Management Plan is included at **Appendix 2**. The Bushfire Management Plan has been prepared to address the requirements under *State Planning Policy 3.7: Planning in Bushfire Prone Areas* (SPP 3.7) and the WAPC *Guidelines for Planning in Bushfire Prone Areas* (Guidelines).

In preparing the Bushfire Management Plan, Strategen JBS&G assessed classified vegetation and exclusions within 150 metres of the site through on-ground verification on 6 March 2020. As a result, post-development vegetation is expected to include:

- **Class B woodland** occurring as banksia woodland throughout the site and adjacent areas. The vegetation presents predominantly as a Class D scrub structure, which at times is quite dense, and in other areas it becomes sparser and patchier. The Class B woodland classification has been assigned due to the predominance of banksia throughout the vegetation. On site retention of vegetation is expected to occur within the proposed ecological corridor along the southern boundary and the small section of CCW buffer extending into the south-eastern boundary;
- **Class A forest** vegetation occurs to the south-east within the CCW, and is dominated by banksia with a shrubby understorey and eucalypt overstorey;
- **Class D scrub** associated with an existing drainage basin to the north-west of the site; and
- **Class G grassland** within rural residential lots to the north-east of the site, which is not required to be managed in perpetuity under the City of Cockburn's firebreak notice.

Exclusions identified within the site and adjacent 150 metre assessment area include the following:

- Small isolated plots less than 0.25 hectares, that are further than 20 metres from any other classified vegetation or proposed habitable development. This exclusion is expected to be applied to future unmanaged drainage basins;
- Non-vegetated areas (i.e. buildings, roads, mulched road verges, mineral earth firebreaks, driveways, carparks); and
- Low threat vegetation (i.e. manicured lawns, managed gardens, slashed road verges).

Post-development vegetation classifications and exclusions will be achieved through clearing within the Structure Plan area (with the exception of the proposed ecological link and CCW buffer), which will replace on-site woodland vegetation with residential development and roads to achieve exclusion as non-vegetated or low threat vegetation.

Based on post-development vegetation classifications and exclusions, Strategen JBS&G has undertaken a Bushfire Attack Level (BAL) Contour assessment for the Structure Plan area, based on an indicative subdivision concept. The BAL rating gives an indication of the level of bushfire attack (i.e. the radiant heat flux) that may be received by proposed future development and subsequently informs the standard of building construction and/or setbacks required for proposed habitable development to potentially withstand such impacts.

The BAL contour mapping identifies all proposed lots within the Structure Plan area as being capable of achieving a BAL rating of 29 or below. In accordance with AS3959, a BAL rating of 29 is the maximum permitted to enable habitable residential development.

Whilst final lot and building locations will be determined at the subdivision stage, based on the Structure Plan layout, the BMP advises that sufficient separation distance (to achieve the require BAL rating of 29 or below) can be achieved between the classified vegetation and the proposed development in the form of an indicative Asset Protection Zone (APZ). This APZ consists of public roads and managed verges along the eastern, southern, western and northern boundaries.

In addition to the BAL contour map, a range of bushfire management measures have been identified that will enable the subject site to be developed in compliance with the Guidelines and AS 3959.

Having regard to the above, and information provided in the Bushfire Management Plan, Strategen-JBS&G considers the bushfire hazards within and adjacent to Structure Plan area and the associated bushfire risks are readily manageable through the standard management responses outlined in the Guidelines and AS 3959. These responses have been factored in to proposed development as early as possible, at all stages of the planning process, to ensure a suitable, compliant and effective bushfire management outcome is achieved for protection of future life, property and environmental assets.

Refer **Appendix 3** – Bushfire Management Plan.

2.6 HERITAGE

A review of the Department of Aboriginal Affairs (DAA) Aboriginal Inquiry System did not identify any sites of aboriginal heritage affecting the Structure Plan area.

A review of the Heritage Council's inherit online database indicates that there are no sites of European heritage value affecting the Structure Plan area.

3. LAND USE AND SUBDIVISION REQUIREMENTS

3.1 LAND USE

The Structure Plan proposes residential development with density codes ranging between R30 and R60. The Structure Plan has been designed to seamlessly fit with the existing approved residential area to the immediate west, in terms of road and service connections, as well as lot typologies.

Areas of public open space are proposed along the eastern boundary of the Structure Plan area.

3.2 PUBLIC OPEN SPACE

The proposed Structure Plan provides two areas of public open space, equating to approximately 6,538m^2 of land (subject to survey) and 10.31% of the gross subdivisible area, in accordance with Liveable Neighbourhoods requirements. These areas are classified as local parks, and will provide for both active and passive recreation, as well as accommodating stormwater drainage. Preliminary Landscape Concepts have been prepared for these public open space areas, provided at Appendix 4.

In addition, the Structure Plan also provides for an ecological link in the south of the site and a portion of the buffer applicable to the mapped Conservation Category Wetland situated to the east of the site. Both the ecological link and the wetland buffer will be ceded to the Crown free of cost, and are not included as creditable public open space. Notwithstanding the exclusion of these areas from credited public open space, it is anticipated pedestrian paths will be provided around the perimeter of the wetland buffer and ecological link to provide for passive recreation, consistent with the conservation nature of the vegetation being retained in these locations. This is to be further explored as part of the detailed landscape design at subdivision stage.

Refer below Public Open Space Schedule.

Public Open Space Schedule			
Site Area (Structure Plan boundary)			7.28 ha
Less			
Ecological Corridor	0.57		
CCW Buffer	0.37		
Total		**0.94 ha**	
Net Site Area			6.34 ha
Gross Subdivisible Area			**6.34 ha**
POS @10%			0.63 ha
Public Open Space Contribution			
May comprise: Min 80% unrestricted POS Min 20% restricted use POS		 0.51 ha 0.13 ha	
Total Required POS			**0.63 ha**
POS Reference Number		**Unrestricted Urban POS sites (m^2)**	**Restricted Urban POS sites (m^2)**
1 _Local Park		2,846.9	180
2_ Local Park		2,875.2	636
Total		**5,722.2 m^2**	**816 m^2**
		(0.6 ha)	**(0.1 ha)**
Percentage of Gross Subdivisible Area		**9.02 %**	**1.29 %**

Public Open Space Schedule based on Rowe Group Plan Reference 4080 LSP 04 E
Correct as at 19/05/2020

Refer **Figure 6** – Public Open Space Plan.

Refer **Appendix 4** – Landscape Master Plan.

3.2.1 ECOLOGICAL LINK

A 50 metre wide ecological link is proposed within the south of the site, providing for a continuous connection from the Jandakot Regional Park (Bush Forever Site 492) to the CCW within Lot 74. The ecological link is proposed to be ceded to the Crown free of cost for conservation purposes, and is not included as creditable open space.

The only area of vegetation surveyed as being in 'Excellent' condition within the Structure Plan is in the southern portion of the site, generally corresponding to the proposed ecological link. Whilst a portion of the surveyed 'Excellent' vegetation will be cleared for development, a significant portion is proposed to be retained within an ecological link. This area will be set aside for conservation purposes, with access restricted.

As stipulated in the Environmental Assessment Report, based on previous studies, linear corridors of native vegetation need to be a minimum of 25 to 50 metres wide to function effectively as a linkage for a range of bird species. A width of 50m is considered to be the minimum required for maintaining long term viability. The width determination of urban ecological corridors varies and is dependent on the influencing factors that may impact on the ecological processes of the area. The ecological link is proposed to be fenced, thereby limiting degradation processes such as weed encroachment and uncontrolled access. This, in conjunction with the link's siting adjacent to existing reserves on its southern and western boundaries, supports the proposed 50 metre width.

3.2.2 WETLAND BUFFER

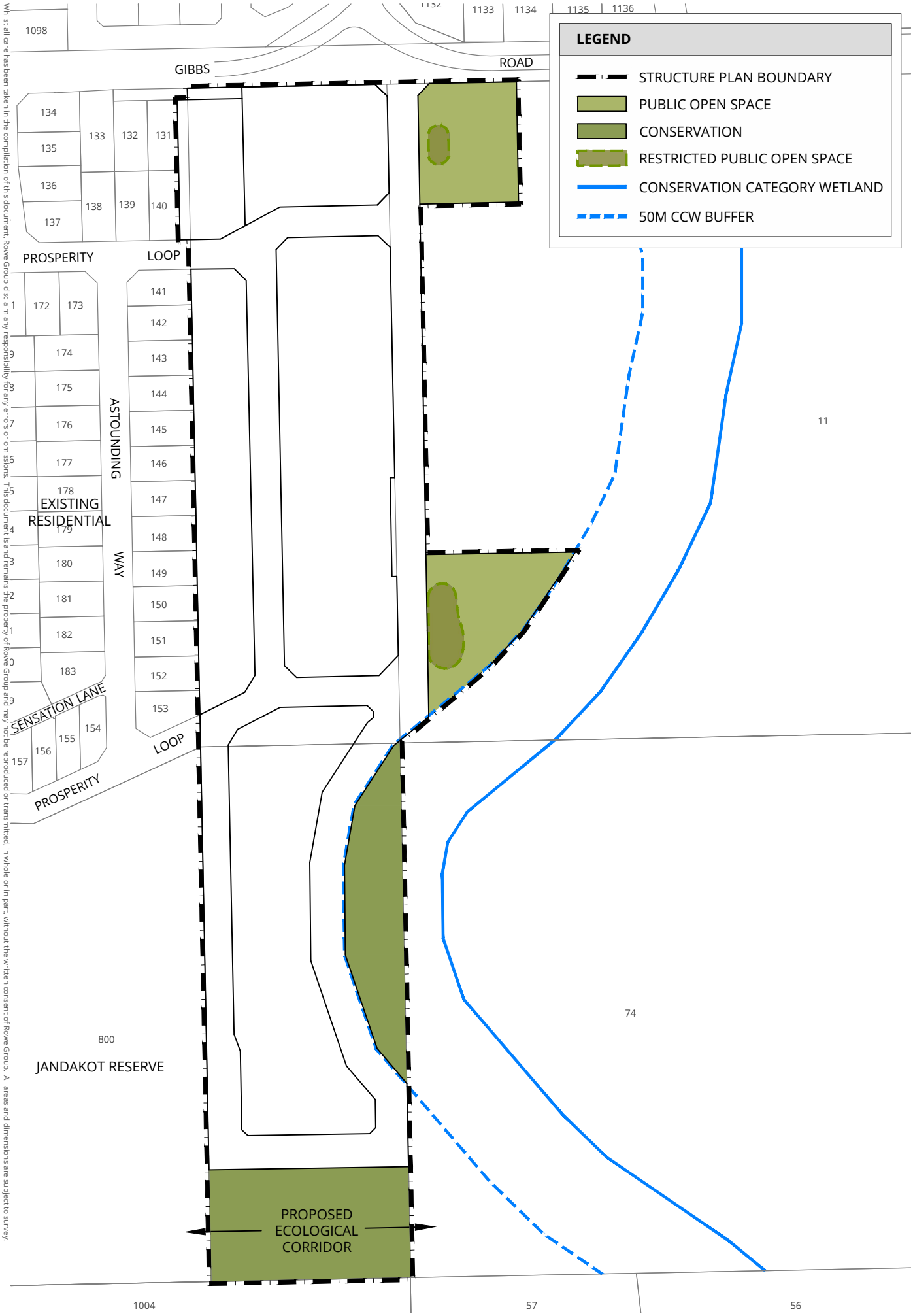
There is a mapped Conservation Category Wetland (CCW) situated within the balance of the Lots 74 and 11, outside the Structure Plan boundary. There is a 50 metre buffer applicable to the CCW, in which approximately 3733m^2 encroaches in to the Structure Plan area. This is proposed to be retained as part of the Structure Plan for conservation purposes.

Vegetation within the buffer is intended to be retained and managed, with access restricted through the use of conservation style fencing.

3.2.3 BUSH FOREVER INTERFACE

The Structure Plan adjoins the existing Jandakot Regional Reserve (Bush Forever Site No. 492) on its southern and south-western boundaries. The proposed ecological link will directly abut this reserve. To protect the interface of these areas from the proposed urban development, the Structure Plan proposes a periphery road, providing for a hard, manageable edge. This road will also provide suitable separation for fire management purposes.

Conservation style fencing (in accordance with City of Cockburn LPP 5.7 specifications) is also proposed for this interface. The fencing will limit uncontrolled access to the existing reserve and proposed ecological link.



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N:\TOWN PLANNING\4000-4999\4080\DRAFTING\A-CAD - ADAM GLASKIN - 2020.05.01

4080_FIG21A_20200501 Banjup (POS Plan) - DRAWN: A. GLASKIN - DATE CREATED: 2020.05.01 - PROJECTION: MGA50 GDA94 - CADASTRE: LANDGATE -

0 62.5 m

SCALE @ A4: 1:2500

NORTH

FIGURE 6

PUBLIC OPEN SPACE PLAN

3.3 RESIDENTIAL

The Structure Plan proposes a base density code of R30, with a small node (approximately 4,514m^2) of R60 in an area of greater amenity and access, along the Gibbs Road frontage and fronting public open space (refer to Plan 1). The Gibbs Road reserve also diverts at this location, providing for a higher amenity landscaped verge area.

The proposed residential density codes allow for an efficient configuration of lot sizes, with lot dimensions that are consistent with the market standard for project home builders and supply a diversity of lot product therefore, providing lots that are easier and more affordable to develop.

The area of higher density, R60, is proposed along Gibbs Road and adjacent to an area of public open space along the eastern boundary. This area of higher density is proposed to provide an opportunity for diversified housing.

Based on the identified density codes, the Structure Plan is capable of achieving a maximum density of approximately 37 dwellings per residential site hectare and 18 dwellings per gross urban hectare. However, based on preliminary subdivision design, consistent with the current market realities of the site, the proposed Structure Plan is more likely to achieve a density of 30 dwellings per residential site hectare and 15 dwellings per gross urban hectare, in accordance with the targets specified under Directions 2031 and Liveable Neighbourhoods, being 15 dwellings per gross urban hectare and 22 dwellings per residential site hectare, respectively.

Based on an indicative dwelling yield of 111 dwellings (based on preliminary concept planning), the Structure Plan area is likely to accommodate a residential population of approximately 299 persons, based upon 2.7 persons per household (2016 Census).

3.3.1 LOCAL DEVELOPMENT PLANS

A Local Development Plan may be required, as a condition of subdivision approval, in the following circumstances:

- Lots with an area of 260m^2 or less;
- Irregular shaped lots;
- Lots where specific vehicle access and egress control is required;
- Lots abutting and/or fronting public open space;
- Lots subject of a Notification on Title;
- Lots with a BAL Rating of 12.5 or greater; and
- Lots requiring special conditions to be set, or where otherwise deemed appropriate to the satisfaction of the City of Cockburn.

Local Development Plans are to address, as a minimum, the following:

- Dwelling orientation;
- Type of fencing;
- Location of carports/ garages and vehicular access;

- Surveillance;
- Setback variations;
- Solar orientation; and
- Requirements for dwelling construction compliant with an approved Bushfire Management Plan and Noise Management Plan.

In preparing Local Development Plans, the design responses and interface treatments between the subject site and the adjoining residential development to the west will need to be considered to ensure an effortless transition between the two developments, however noting the different design objectives of the two estates to create individual character and sense of place.

3.4 MOVEMENT NETWORKS

3.4.1 EXISTING ROAD NETWORK

Gibbs Road

Gibbs Road runs along the northern boundary of the subject site and provides a direct connection to the Kwinana Freeway to the east, as well as a connection to Armadale and Nicholson Roads to the west (via Taylor Road).

Gibbs Road is classified as an 'Access Road' under the Main Roads WA Functional Road Hierarchy.

Traffic counts undertaken by the City of Cockburn in 2009 indicated approximately 900 vehicle movements per day on Gibbs Road.

Prosperity Loop

Prosperity provides for two connection points to the Structure Plan area from the existing residential subdivision to the west.

Prosperity Loop is classified as an 'Access Road' under the Main Roads WA Functional Road Hierarchy.

There are no existing traffic counts available for Prosperity Loop, however are expected to be less than 1,000 vehicle movements per day.

3.4.2 PROPOSED ROAD NETWORK

The proposed movement network has been designed to connect seamlessly with the adjoining residential development to the west and Gibbs Road to the north. This includes an extension of Prosperity Loop through the Structure Plan area.

The proposed road network provides for simple and efficient vehicle movements through the site. The street block lengths are consistent with the requirements of Liveable Neighbourhoods, providing for connectivity and permeability through the site, for both pedestrians and vehicles.

The road network primarily comprises Access Street C roads, with reserves of 15 metres. Wider road reserves are proposed around the periphery of the site where adjoining areas of natural bushland, to provide for adequate separation for fire management purposes.

3.4.3 TRAFFIC GENERATION AND INTERSECTION ANALYSIS

A Traffic Assessment was undertaken by Shawmac Consulting in support of the original Structure Plan proposal for the site, lodged in 2017. Whilst some time has passed and modifications to the Structure Plan have been undertaken, the proposed road network between the previous and current Structure Plan proposals remains relatively unchanged and, as such, the previous Traffic Assessment remains relevant.

Refer **Appendix 5** – Traffic Assessment (Traffic Note).

Shawmac conclude the additional traffic generated by the proposed Structure Plan can be accommodated within the existing road network. Shawmac estimate the proposal will generate approximately 1,200 vehicle trips per day.

Traffic distribution from the development will be via Gibbs Road and Prosperity Loop (two connection points). With the additional traffic, Gibbs and Prosperity Loop are predicted to operate within their capacity.

A new intersection with Gibbs Road is proposed as part of the development. As part of their assessment, Shawmac reviewed the intersection and have undertaken a SIDRA analysis of peak hour operation. The SIDRA analysis indicates the intersection will operate safely with minimal queuing. The results of the SIDRA assessment are contained within figure 4 of the Traffic Assessment.

3.4.4 PEDESTRIANS AND CYCLISTS

In accordance with Liveable Neighbourhoods, footpaths will be provided on at least one side of all streets.

Footpaths will provide connections to the adjoining residential development to the west and proposed areas of public open space along the eastern boundary.

All cycling within the Structure Plan area is proposed to be either on-road or on proposed footpaths. Internal traffic volumes are expected to be low enough such that on-road cycling will not pose a high risk to cyclists

3.4.5 PUBLIC TRANSPORT

The Structure Plan area is serviced by existing Transperth Bus Route 527, which runs to and from Wandi and Cockburn Central. The bus service operates frequently and more so during peak periods. The closest bus stop is located approximately 500 metres north west of the Structure Plan area. No new bus routes are anticipated as a result of the proposed development.

The Structure Plan area is also situated within approximately 1.2 kilometres of the Aubin Grove Railway Station. Future residents are expected to utilise the Aubin Grove Station for commuting to the Perth CBD.

3.5 WATER MANAGEMENT

A Local Water Management Strategy (LWMS) has been prepared in support of the proposed Structure Plan, and is provided at **Appendix 6**. The LWMS has been prepared in accordance with the design objectives outlined in *Better Urban Water Management* (2008), as well as the requirements of the Department of Water and the City of Cockburn.

3.5.1 STORMWATER MANAGEMENT STRATEGY

The proposed stormwater management design criteria are:

- Retain catchment runoff up to the 1 in 100 year ARI rainfall event within the site;
- Convey the 1 in 5 year ARI rainfall event within the pipe network;
- Contain flows within individual lots within property soakwells sized for storage and infiltration of the 1 in 20 year (5 minute) ARI rainfall event;
- Ensure the 1 in 100 year ARI rainfall event can be conveyed and contained within road reserves;
- The floor levels of all habitable buildings are a minimum of 300mm above the 1 in 100 year ARI rainfall event flood level within road reserves; and
- The floor levels of all habitable buildings are a minimum of 500mm above the 1 in 100 year ARI rainfall event flood levels within storage areas (basin).

Based on the above criteria, the below provides a summary of the stormwater management for the Structure Plan area:

- **1 in 1 year ARI event**

  The drainage plan has been designed to cater for minor event runoff without exporting pollutants in surface water from the site. The 1 in 1 year ARI will be retained as high in the catchment as practical. This will be achieved through a combination of the following

  - Roof and lot runoff from each property will be detained in the property soakwells.
  - Public open space drainage basins are designed to ensure the 1 in 1 year ARI event maximum water depth does not exceed 0.5 metres.
  - Use of amended soils with PRI >10 in basins.

- **1 in 5 year ARI event**

  The pipe drainage system and infiltration basin in the POS are designed to cater for the 1 in 5 year ARI event from the road reserve catchment fully within the system. The stormwater runoff within the area will enter the pipe system through side entry pits; to be conveyed to the public open space infiltration basin, via the Gross Pollutant Trap and the Bubble-up pit.

  Public open space drainage basins are to be sized to store a 1 in 5 year ARI event, and to empty via infiltration within 72 hours.

- **1 in 20 year ARI event**

  Individual lots will contain flows within property soakwells sized for storage and infiltration of the 1 in 20 year ARI (5 minute duration) event. During larger events, lot runoff will be directed in to the road reserve for conveyance via overland flows in the road carriageway to the public open space major flood area.

- **1 in 100 year ARI event**

  For events exceeding the 1 in 5 year ARI event from the road reserve catchment and exceeding the 1 in 20 year ARI event from lot runoff, stormwater will be conveyed through both the pipe system and overland flows within the road pavement carriageway in to the infiltration basin and public open space area.

3.5.2 GROUNDWATER MANAGEMENT STRATEGY

The design objectives for groundwater management are:

- Minimise changes to the underlying groundwater level as a result of development;
- Maintain a two metre separation between lot levels and CGL;
- Minimise the risk of nutrient enrichment of downstream receiving surface water bodies from groundwater sources;
- Implement strategies to reduce the nutrient transport in to the groundwater; and
- Protect wetlands that are dependent on the underlying groundwater.

To achieve the above objectives, the design philosophy for the Structure Plan area is as follows:

- Provide for a minimum of 2.0 metre clearance from finished lot levels to the CGL.
- Detention basins are not permitted to intersect groundwater and emptying of the basins within 72 hours is likely.
- Infiltration both at source and from the public open space/drainage areas will ensure groundwater levels should be maintained close to pre-development levels.
- Sediment and gross pollutant control systems have been included in the design, this preventing pollutants from entering the aquifers, and therefore improving the quality of the stormwater before infiltration at the detention basin takes place.
- Detention basins will be vegetated with local species to encourage stripping of nutrients before being infiltrated, thus increasing water quality before being recharged in to the ground.

3.5.3 MONITORING

3.5.3.1 PRE-DEVELOPMENT MONITORING

Bioscience have set up three monitoring bores for pre-development monitoring within the subject land. Pre-development groundwater quality monitoring of following parameters will be undertaken prior to the next phase of development:

- In-situ pH, electrical conductivity, turbidity, dissolved oxygen, and oxidation reduction potential;
- Laboratory
    - Heavy metals: aluminium, arsenic, cadmium, chromium, copper, iron, lead mercury, nickel, zinc
    - Total suspended solids
    - Nutrients: ammonia, nitrate and nitrite, total nitrogen and total phosphorous
    - Total titratable acidity, and total alkalinity
    - Major cations (calcium, magnesium, sodium, and potassium) and anions (chloride and sulphate); and
- Potential ASS effects and contaminants to the subsoil drainage system and groundwater conveyance.

The design and requirements of the final UWMP will be prepared based on the results of the pre-development monitoring programme.

3.5.3.2 POST-DEVELOPMENT MONITORING

Upon completion of the detailed design and confirmation of final development layout, the location of the monitoring bores with respect to the lots will be assessed and detailed in the UWMP. Should additonal bores be required for the post development monitoring, these will be implemented and clarified in the UWMP at subdivision stage.

The implementation, funding and reporting of the post development monitoring programme is the responsibility of the developer for a period of 36 months post construction of the subdivision.

A post development monitoring program will be implemented with activities pertaining to the following:

- biannual water quality monitoring for nutrients, total suspended solids and other physical parameters at the outlet of the stormwater treatment swale. This will be opportunistic based on flow; and
- Nutrients should be measured on a quarterly basis with some initial first flush monitoring for heavy metals and pesticides. Groundwater levels and field parameters should be measured every two months.
- Groundwater level measurements will continue for 36 months after completion of the development, and should be undertaken on a quarterly basis.
- Surface water flows should be monitored at drainage controls (basin inlets) on a quarterly basis and on the first flush.

Monitoring will continue at the same borehole locations used for pre-development monitoring to allow for consistent and direct comparison of pre to post development.

3.5.4 IMPLEMENTATION

An Urban Water Management Plan (UWMP), containing more detailed water management plans, will be required as a condition of subdivision approval. The UWMP will be required to include the following:

- Completion of Geotechnical Investigation;
- Design of a water management strategy which demonstrate compliance with the City of Cockburn and Department of Water design criteria and this document;
- Detailed methodology for implementation of water conservation strategies;
- A further detailed study which includes:
  - A Hydrogeological Investigation to determine depth of groundwater and infiltration capacity of the soil;
  - Detailed earthworks design and stormwater drainage management design, including and calculation and modelling to determine drainage strategy and flood storage requirements; and
  - Detailed monitoring of surface and groundwater targets for water quality, flows, and levels that are to be maintained at post development;
- A landscape concept ensuring the concept promotes the water conservation strategy and stormwater management;
- Completion of a Contaminated Site Investigation;
- Construction management of subdivisional works to ensure minimum disturbance to the environment;
- A maintenance strategy including roles and responsibilities of each stakeholder; and
- Implementation of the UWMP, including roles, responsibilities, funding, and maintenance arrangements.

The following table summarises the commitments, roles and responsibilities for the implementation of the LWMS:

ORGANISATION	ROLE/ RESPONSIBILITY	FUNDING
City of Cockburn	Approval of this document and provide guidance during development of an UWMP	Rates
Water Corporation	Assumes responsibility for the potable and non-potable water supply and sewerage infrastructure constructed, including ongoing operations and maintenance.	Rates
Developer	- Satisfy WAPC Conditions including preparation of LWMS and implement a UWMP in consultation with DoW and City of Cockburn - Demonstrated that UWMP for subdivision proposal comply with LWMS and achieve water quantity and quality	Developer

	objectives and criteria set by this document. - Design and construct water supply and sewerage infrastructure to Water Corporation standards. - Apply for water use license. - Contribute for sampling and analysis of post development monitoring activities for submission to the regulatory authorities.	
Lot Owner	Construction and management, consistent with City of Cockburn requirements	Lot Owner

3.6 EDUCATION FACILITIES

No educational facilities are proposed within the Structure Plan area.

There are two primary schools located within 1 kilometre of the Structure Plan area. Harmony Primary School is situated approximately 600 metres to the north east of the Structure Plan area, and Aubin Grove Primary School is situated approximately 900 metres to the south west.

Lakelands Senior High School is situated approximately 5 kilometres north west of the Structure Plan area, with other High Schools also located in neighbouring suburbs.

Murdoch University is the closest tertiary institution to the site, and is easily accessible utilising existing public transport services.

Having regard to the above, it is considered that the Structure Plan area is well served by educational facilities.

3.7 ACTIVITY CENTRES AND EMPLOYMENT

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

The Cockburn Central Activity Centre is situated approximately 3 kilometres to the north west of the Structure Plan area.

Under *State Planning Policy 4.2: Activity Centres for Perth and Peel* (SPP4.2), Cockburn Central is classified as a Secondary Centre, which has an indicative service population of up to 150,000 persons.

As the Structure Plan area is within approximately 3.4 kilometres of the Cockburn Centre Activity Centre, it is expected that residents will utilise the centre, and thus bolster its economic sustainability.

3.8 INFRASTRUCTURE COORDINATION, SERVICING AND STAGING

An *Engineering Servicing Report* has been prepared for the Structure Plan area and is contained within **Appendix 7**. The findings of the Engineering Report are summarised below.

3.8.1 POWER

There is an existing power service, both HV and LV, located to the west of the Structure Plan area, as well as existing HV overhead infrastructure servicing the existing dwelling on Lot 11. These services would provide a suitable connection point for the Structure Plan area.

3.8.2 WATER

The Water Corporation has advised there is no detailed water reticulation plan for the Structure Plan area. Water services are likely to be extended from the existing network within the residential development to the west of the Structure Plan area.

A single feed 150P main is located in Sanctity Loop, but may not have the capacity to service the Structure Plan area. As such, a 150P feed may need to be extended from an existing service within Gibbs Road.

3.8.3 RETICULATED SEWER

The Structure Plan area is situated within the Water Corporation's Thomson's Lake Sewer District catchment boundary.

Sewer connections are available from two locations, being an existing 150mm diameter sewer located on Prosperity Loop and from a 150mm diameter stud located on Gibbs Road.

Given the above, reticulated sewer services can be provided to the Structure Plan area.

3.8.4 RETICULATED GAS

There is an existing high pressure gas pipeline within Prosperity Loop. A request to connect to this service to serve the Structure Plan area will need to be sought from ATCO Gas.

3.8.5 TELECOMMUNICATIONS

NBN Co has advised there are underground facilities in the vicinity of the Structure Plan area. The most likely connection will be from the existing residential development to the west of the Structure Plan area.

3.8.6 BULK EARTHWORKS AND ROAD CONSTRUCTION

As the Structure Plan area remains generally undeveloped, the following works will be required:

- Demolition of existing structures.
- Stripping and clearing of areas (clear existing vegetation).
- Removing topsoil and storing for future use.
- Cut to fill earthworks to form flat building pads.
- Installation of retaining walls.

The internal road network will be designed and constructed to meet the requirements of the City, including a shared path network. Final design of the road and path network will occur at the subdivision stage.

3.9 DEVELOPER CONTRIBUTION ARRANGEMENTS

The Structure Plan area is situated within Development Contribution Area 13 (DCA13), as identified in Schedule 12 of the LPS 3. Under LPS 3, a Development Contribution Plan applies to the site, and should be read in conjunction with *State Planning Policy 3.6: Developer Contributions for Infrastructure* (SPP3.6).

The landowner is to contribute towards key service and community infrastructure within the latest Development Contribution Plan for DCA13, by way of a cost contribution payment. Contributions shall be calculated on the basis of the number of new lots and/or dwellings created.

APPENDIX 1

CERTIFICATES OF TITLE

ROWE GROUP DESIGN

WESTERN AUSTRALIA

REGISTER NUMBER	
11/D59740	
DUPLICATE EDITION	DATE DUPLICATE ISSUED
4	4/7/2016

VOLUME 1576 FOLIO 356

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.

REGISTRAR OF TITLES

LAND DESCRIPTION:

LOT 11 ON DIAGRAM 59740

REGISTERED PROPRIETOR:
(FIRST SCHEDULE)

ARD NO. 7 PTY LTD OF LEVEL 8 225 ST GEORGES TERRACE PERTH WA 6000
(T N371517) REGISTERED 30/6/2016

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

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:	1576-356 (11/D59740)
PREVIOUS TITLE:	1316-983
PROPERTY STREET ADDRESS:	252 BEENYUP RD, BANJUP.
LOCAL GOVERNMENT AUTHORITY:	CITY OF COCKBURN

LANDGATE COPY OF ORIGINAL NOT TO SCALE 29/04/2020 08:33 AM Request number: 60538067

Landgate
www.landgate.wa.gov.au

WESTERN AUSTRALIA

REGISTER NUMBER	
74/DP55156	
DUPLICATE EDITION	DATE DUPLICATE ISSUED
2	24/3/2010

VOLUME 2680 FOLIO 800

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.

REGISTRAR OF TITLES

REGISTRAR OF TITLES WESTERN AUSTRALIA

LAND DESCRIPTION:

LOT 74 ON DEPOSITED PLAN 55156

REGISTERED PROPRIETOR:
(FIRST SCHEDULE)

BELLRIDGE CORPORATION PTY LTD OF PO BOX 1038, SOUTH PERTH

(TP L253774) REGISTERED 10/3/2010

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

1. K473644 RESTRICTIVE COVENANT TO CITY OF COCKBURN - SEE DEPOSITED PLAN 55156 REGISTERED 14/1/2008.

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:	DP55156
PREVIOUS TITLE:	1674-425
PROPERTY STREET ADDRESS:	268 BEENYUP RD, BANJUP.
LOCAL GOVERNMENT AUTHORITY:	CITY OF COCKBURN

LANDGATE COPY OF ORIGINAL NOT TO SCALE 29/04/2020 08:33 AM Request number: 60538067

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WESTERN AUSTRALIA

REGISTER NUMBER	
9046/DP75193	
DUPLICATE EDITION **2**	DATE DUPLICATE ISSUED **13/5/2013**

VOLUME **2808** FOLIO **590**

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.

REGISTRAR OF TITLES

REGISTRAR OF TITLES WESTERN AUSTRALIA

LAND DESCRIPTION:

LOT 9046 ON DEPOSITED PLAN 75193

REGISTERED PROPRIETOR:
(FIRST SCHEDULE)

ANTHONY POLI
IN 1/100 SHARE
OMEGA MANAGEMENT SERVICES PTY LTD
IN 4/100 SHARE
ELITE DEVELOPMENTS (WA) PTY LTD
IN 95/100 SHARE
ALL OF PO BOX 1038, SOUTH PERTH
AS TENANTS IN COMMON

(T M248063) REGISTERED 22/4/2013

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

1. M213556 EASEMENT TO CITY OF COCKBURN FOR PUBLIC ACCESS PURPOSES SEE DEPOSITED PLAN 75193 REGISTERED 18/3/2013.

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:	DP75193
PREVIOUS TITLE:	2803-280
PROPERTY STREET ADDRESS:	NO STREET ADDRESS INFORMATION AVAILABLE.
LOCAL GOVERNMENT AUTHORITY:	CITY OF COCKBURN

LANDGATE COPY OF ORIGINAL NOT TO SCALE 29/04/2020 08:33 AM Request number: 60538067

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APPENDIX 2

BUSHFIRE MANAGEMENT PLAN

ROWE GROUP DESIGN

Bushfire management plan/Statement addressing the Bushfire Protection Criteria coversheet

Site address: Lots 11 and 74, Beenyup Road, Banjup

Site visit: Yes ☑ No ☐

Date of site visit (if applicable): Day 6 Month March Year 2020

Report author or reviewer: Linden Wears

WA BPAD accreditation level (please circle):

Not accredited ☐ Level 1 BAL assessor ☐ Level 2 practitioner ☐ Level 3 practitioner ☑

If accredited please provide the following.

BPAD accreditation number: 19809 Accreditation expiry: Month June Year 2020

Bushfire management plan version number: Rev 0

Bushfire management plan date: Day 24 Month April Year 2020

Client/business name: Aigle Royal

	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 bushfire protection criteria elements)?		✔

Is the proposal any of the following (see SPP 3.7 for definitions)?	Yes	No
Unavoidable development (in BAL-40 or BAL-FZ)		✔
Strategic planning proposal (including rezoning applications)	✔	
High risk land-use		✔
Vulnerable land-use		✔

None of the above ☐

Note: Only if one (or more) of the above answers in the tables is yes should the decision maker (e.g. local government or the WAPC) refer the proposal to DFES for comment.

Why has it been given one of the above listed classifications (E.g. Considered vulnerable land-use as the development is for accommodation of the elderly, etc.)?

Strategic planning proposal

The information provided within this bushfire management plan to the best of my knowledge is true and correct:

Signature of report author or reviewer

Date 24 April 2020

Aigle Royal Developments

Bushfire Management Plan (Subdivision Application)

Lots 11 and 74, Beenyup Road, Banjup

24 April 2020

58534/128,132 (Rev 0)

JBS&G Australia Pty Ltd T/A Strategen-JBS&G

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Appendix C Vehicular access technical standards of the Guidelines
Appendix D Water technical standards of the Guidelines
Appendix E City of Cockburn Firebreak Notice 2019/2020

1. Proposal details

1.1 Background

Aigle Royal Developments are proposing to submit a local structure plan for the proposed development of Lots 11 and 74, Beenyup Road, Banjup (the project area) which is located in the City of Cockburn (the City).

The Structure Plan (depicted in Figure 1) identifies:

- residential lots
- restricted and unrestricted public open space (POS)
- an ecological linkage along the southern boundary and;
- internal road layout

1.2 Site description

The project area is bound by the following:

- existing residential dwellings and the existing Jandakot Regional Park, Bush Forever site 492) to the west
- undeveloped parts of Lots 11 & 74 Beenyup Road and the Conservation Category Wetland (CCW) area to the east
- Gibbs Road East and Tapper Road to the north, with existing residential dwelling north of the roads
- an ecological corridor (connecting the CCW to Jandakot Regional Park) of retained native vegetation within Lot 74 Beenyup Road, to the south.

The project area is designated as bushfire prone on the *Map of Bush Fire Prone Areas* (DFES 2020; see Plate 1).

1.3 Purpose

This Bushfire Management Plan (BMP) has been prepared to address requirements under *Policy Measure 6.3 of State Planning Policy 3.7 Planning in Bushfire-Prone Areas* (SPP 3.7; WAPC 2015) and *Guidelines for Planning in Bushfire-Prone Areas* (the Guidelines; WAPC 2017).

1.4 Other plans/reports

Other reports that have been prepared for the project area include:

- Local Structure Plan: Environmental Assessment Report (dated April 2020) prepared by 360 Environmental

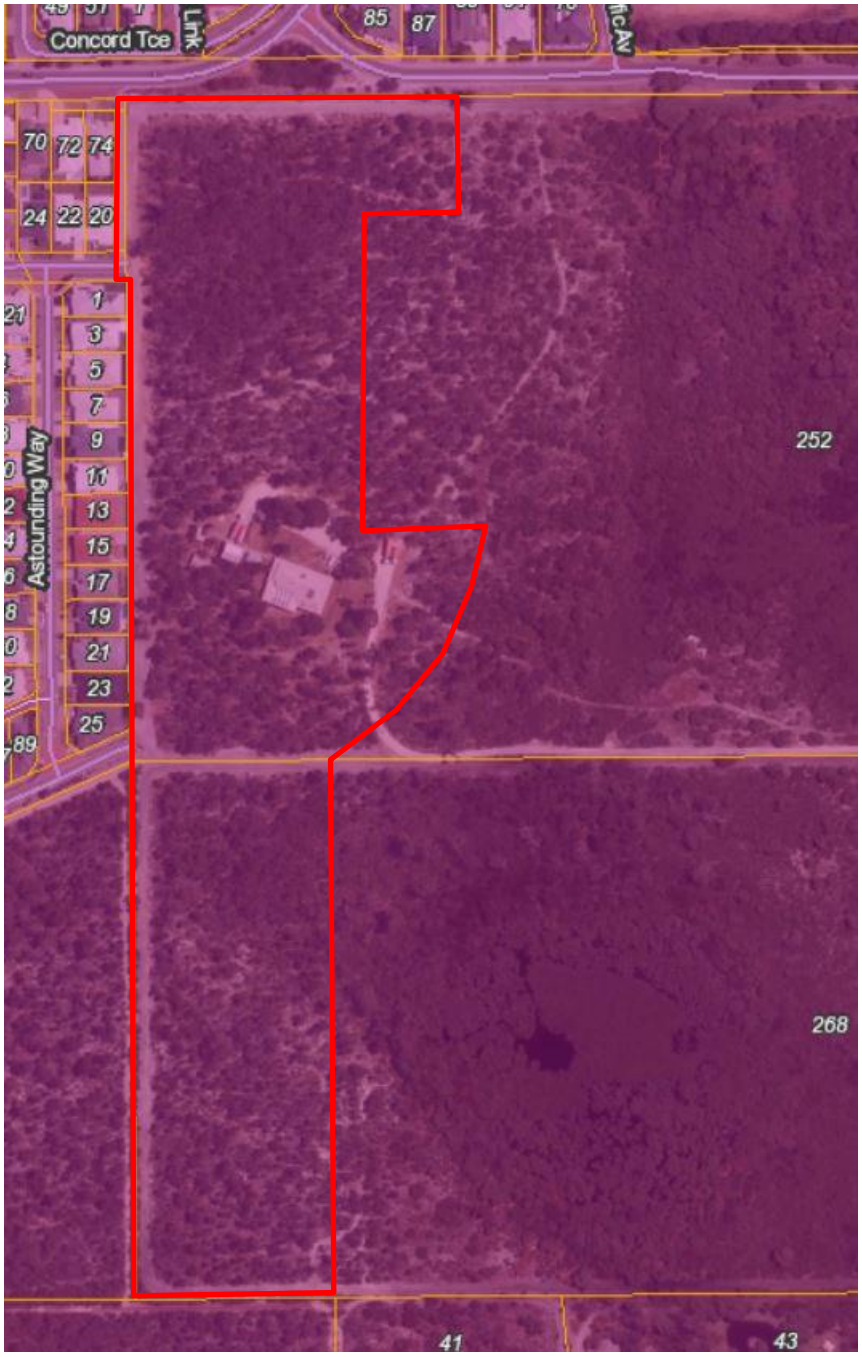
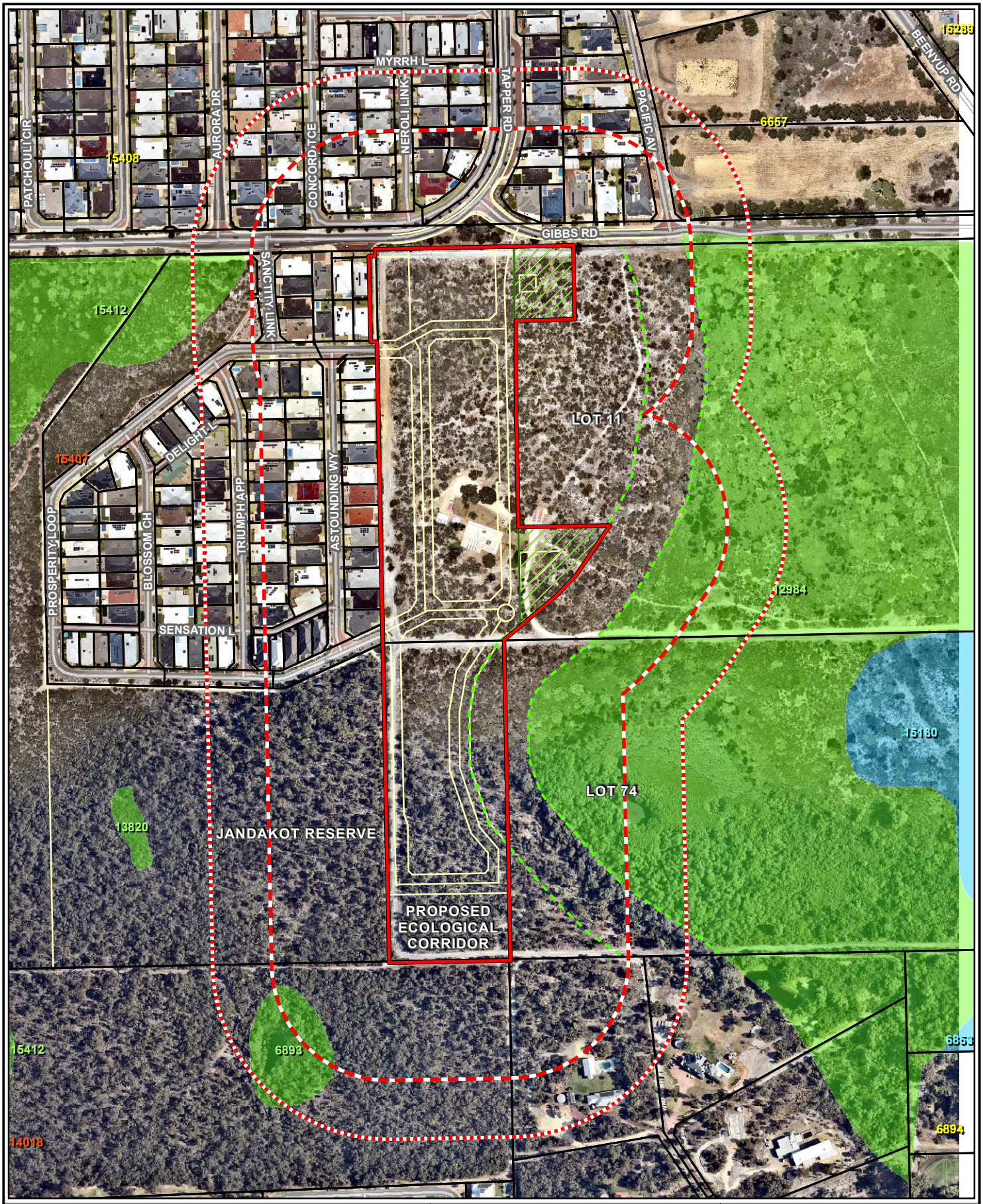


Plate 1: Map of Bush Fire Prone Areas (DFES 2020)

Figure 1: Local Structure Plan



Legend:

- Project area
- 100m assessment area
- 150m assessment area
- Cadastral boundary
- POS
- Geomorphic Wetlands (DBCA)
  - Conservation
  - Resource Enhancement
- Proposed development
- 50m buffer CCW boundary
- Roads (MRWA)

Scale 1:4,250 at A4 (0 50 100 metres)	**Lot 11 and 74, Gibbs Rd Banjup, WA**
Coord. Sys. GDA 1994 MGA Zone 50	**SITE OVERVIEW**
Job No: 58534	
Client: Aigle Royal	**FIGURE 2**
Version: A — Date: 24-Apr-2020	strategen JBS&G
Drawn By: hsullivan — Checked By: LW	

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Image Reference: www.nearmap.com© - Imagery Date: 09. December 2019.

2. Environmental considerations

2.1 Native vegetation - modification and clearing

The majority of the project area contains remnant vegetation, which will be cleared as part of the proposal. Table 1 provides a summary of a search of publicly available environmental data.

Table 1: Summary of environmental values

Environmental value	Not mapped as occurring within or adjacent to the project area	Mapped as occurring within or adjacent to the project area		Description
		Within	Adjacent	
Environmentally Sensitive Area		✓	✓	An Environmentally Sensitive Area occurs within and adjacent to the project area.
Swan Bioplan Regionally Significant Natural Area	✓			
Ecological linkages		✓	✓	The majority of the northern portion of the project area is mapped as containing a Perth Regional Ecological Linkage, in addition to land to the west, north and east.
Wetlands		✓	✓	A Conservation Category Wetland (CCW; 12984) extends along the eastern project area boundary, with the 50 m buffer extending into south-eastern portion of the project area. Other small CCWs also exist to the north-west (15412), west (13820) and south-west (6893) of the project area. Adjacent areas also contain Resource Enhancement Category Wetlands and Multiple Use Category Wetlands. No Ramsar sites are mapped as occurring.
Waterways		✓	✓	A Conservation Category wetland intersects the assessment area with the 50 m buffer extending into the south-western part of the project area.
Threatened Ecological Communities listed under the EPBC Act		✓	✓	Endangered Banksia Woodlands of the Swan Coastal Plain TEC is mapped as being likely to occur within project area. No Tuart Woodlands are mapped as occurring.
Threatened and priority flora	✓			
Fauna habitat listed under the EPBC Act		✓	✓	Potential Quenda habitat is mapped as occurring within and adjacent to the project area. With respect to Carnaby's Black Cockatoo, the project area is mapped as containing confirmed roosting areas and potential feeding areas.
Threatened and priority fauna		✓	✓	The buffer zone for a Priority Fauna species occurs on the western edge of the project area. Two Threatened Fauna species occur 330 m to the south of the project area.
Bush Forever Site			✓	Bush Forever site 492 occurs immediately to the west of the project area.

Environmental value	Not mapped as occurring within or adjacent to the project area	Mapped as occurring within or adjacent to the project area		Description
		Within	Adjacent	
DBCA managed lands and waters (includes legislated lands and waters and lands of interest)	✓			
Conservation covenants	✓			N/A

Regional vegetation surveys and mapping of the Swan Coastal Plain indicates the project area and adjacent land is contained within the Bassendean Complex – Central and South. This vegetation complex is described as:

- Vegetation ranges from woodland of *E. marginata – A. fraseriana – Banksia* spp. to low woodland of *Melaleuca* spp. and sedgelands on the moister sites. This area includes the transition of *E. marginata* to *E. todtiana* in the vicinity of Perth.

In addition to the publicly available environmental data outlined above, the project Environmental Assessment Report (360 Environmental, 2020) also identifies the following key environmental values:

- **Wetlands**
  - Entire site is mapped as within the Gibbs Road Swamp System wetland listed under the Directory of Nationally Important Wetlands
- **Jandakot Underground Water Pollution Control Area**
  - The site forms part of the Jandakot Underground Water Pollution Control Area and is classified as Priority 3.
- **Remnant Vegetation**
  - The site contains 5.98 ha of remnant vegetation which consists of Floristic Community Type (FCT) representative of the Threatened Ecological Community: Banksia Woodlands of the Swan Coastal Plain.
  - The proposed development will involve the clearing of 4.71 ha and the retention of 1.27 ha within the CCW buffer and ecological linkage.
  - It is proposed that the ecological linkage which contains Banksia Woodlands TEC in 'Excellent' condition will be within restricted POS.
- **Black Cockatoo Habitat**
  - The site contains 6.02 ha of Black Cockatoo foraging habitat and four potential breeding trees.
  - The project will involve the clearing of 4.93 ha of foraging habitat and five potential breeding trees.
  - 1.09 ha of foraging habitat will be retained in CCW buffer and proposed ecological linkage. Further foraging habitat may be viable for retention within proposed POS and road reserves (depending on engineering requirements)
  - The maintenance of this ecological corridor will allow continued movement of fauna species through the landscape, particularly to the CCW as a potential watering source.

- **Environmentally Sensitive Areas**
    - The site is mapped as an Environmentally Sensitive Area (ESA) which relates to the Gibbs Road Swamp System and its associated buffers.
    - ESA's are protected by legislation and areas within the extent of an ESA are not subject to native vegetation clearing exemptions (such as exemptions associated with subdivision approval)
- **Hydrology and Water Quality**
    - A Local Water Management Strategy (LWMS) has been developed to support the LSP processes.
    - The LWMS provides management strategies to ensure hydrological flows and regimes reflect predevelopment flows of the site and prevent water quality degradation from the development.

In response to identification of the above environmental values, the project Environmental Assessment Report identifies the following key environmental outcomes associated with the proposed development:

- Provision of an ecological linkages in the south of the project area, which provides a continues linkage from the adjacent Bush Forever Site/Jandakot Regional Park and remnant vegetation and CCW located east of the site.
- The development will be fenced from the restricted POS to provide protection of fauna and fauna habitat (i.e. black cockatoo) from future urban development.
- The CCW will have long term protection through reservation as Parks and Recreation under the MRS.
    - The CCW will be revegetated where required to meet the objective of preserving the wetland's natural ecological attributes and functions
- Incorporation of a 50m buffer to the adjacent CCW.
- Development and implementation of environmental management plans will ensure the long-term management and viability of the proposed conservation areas.
- Application of water management initiatives and a framework to the guide future development of the site to ensure water sensitive urban design is achieved.

From a bushfire compliance perspective, in addition to the retention of key vegetation and habitat, the construction of proposed dwellings to BAL-29 will minimise environmental impacts from Asset Protection Zones (APZs) required to achieve a compliant outcome.

Environmental impacts resulting from implementation of the proposal will need to be addressed under standard State and Federal environmental assessment and referral requirements under the Environmental Protection Act 1986 and Environment Protection and Biodiversity Conservation Act 1999.

2.2 Revegetation / Landscape Plans

Existing vegetation within the proposed ecological corridor and CCW buffer within the southern part of the project area, is to be retained as part of the proposed development.

No significant revegetation is proposed as part of the proposal. It is expected that the creation of the two POS areas along the eastern boundary will likely require revegetation with nutrient stripping vegetation, however it is proposed that these two drainage basins can be configured to be small isolated plots of low threat vegetation, excludable in accordance with AS 3959 Clause 2.2.3.2 (c). If

this is not achievable, this drainage vegetation will need to be classified and sufficient separation provided to ensure a compliant BAL outcome on adjacent habitable development.

Any onsite landscaping proposed will consist of low threat and managed gardens and street scaping in accordance with AS 3959 Clause 2.2.3.2 (f) and Schedule 1 of the Guidelines (refer to Appendix B).

3. Bushfire assessment results

3.1 Assessment inputs

3.1.1 Vegetation classification

Strategen-JBS&G assessed classified vegetation and exclusions within the 150 m assessment area through on-ground verification on 6 March 2020 in accordance with *AS 3959-2018 Construction of Buildings in Bushfire-Prone Areas* (AS 3959; SA 2018) and the *Visual Guide for Bushfire Risk Assessment in Western Australia* (DoP 2016). Georeferenced site photos and a description of the vegetation classifications and exclusions are contained in Table 2 and depicted in Figure 3.

Post development vegetation is expected to include:

- Class B woodland occurring as banksia woodland throughout the project area and adjacent areas. The vegetation presents predominantly as a Class D scrub structure which at times is quite dense, and in other areas it becomes sparser and patchier. The Class B woodland classification has been assigned due to the predominance of banksia throughout the vegetation. Onsite retention of vegetation within the project area is expected to occur within the proposed ecological corridor along the southern boundary and the small section of CCW buffer that extends into the south-eastern boundary.
- Class A forest vegetation occurs to the southeast within the CCW, and is dominated by banksia with a shrubby understorey and eucalypt overstorey
- Class D scrub associated with an existing drainage basin to the north-west of the project area
- Class G grassland within rural residential lots to the north-east of the project area, which is not required to be managed in perpetuity under the Shire's firebreak notice.

Exclusions identified within the project area and adjacent 150 m assessment area include the following:

- Clause 2.2.3.2 (c): small isolated plots less than 0.25 ha, that are further than 20 m from any other classified vegetation or proposed habitable development. This exclusion is expected to be applied to future unmanaged drainage basins
- Clause 2.2.3.2 (e): non-vegetated areas (i.e. buildings, roads, mulched road verges, mineral earth firebreaks, driveways, carparks)
- Clause 2.2.3.2 (f): low threat vegetation (i.e. manicured lawns, managed gardens, slashed road verges).

Post-development vegetation classifications and exclusions depicted in Figure 3 will be achieved through clearing within the project area (other than the proposed ecological linkage and CCW buffer), which will replace on-site woodland vegetation with residential development and roads to achieve exclusion as non-vegetated or low threat vegetation (i.e. excluded under Clauses 2.2.3.2 (e) and (f)).

Two POS areas including drainage basins are to be created as part of the development, with the vegetation in the POS area will be largely managed and therefore excluded as low threat vegetation. Should there be any classified vegetation associated with the drainage basin post-development, it is expected to be excluded on the basis that is less than 0.25 ha and will be further than 20 m from other classified vegetation or proposed habitable development (Clause 2.2.3.2 (c) of AS 3959). Should this not be achievable, the drainage basin would require classification and sufficient setbacks employed to achieve a compliant BAL outcome on adjacent habitable development.

3.1.2 Effective slope

Strategen-JBS&G assessed effective slope under classified vegetation within the 150 m assessment area through on-ground verification on 6 March 2020 in accordance with AS 3959. Results were cross-referenced with DPIRD 2m contour data and are depicted in Figure 3.

The project area is predominately sloping from west to east with land flattening to the east of the assessment area. The effective slope beneath the classified vegetation is downslope (0° - 5°) with some land to the west of the project area assessed as flat/upslope (0°).

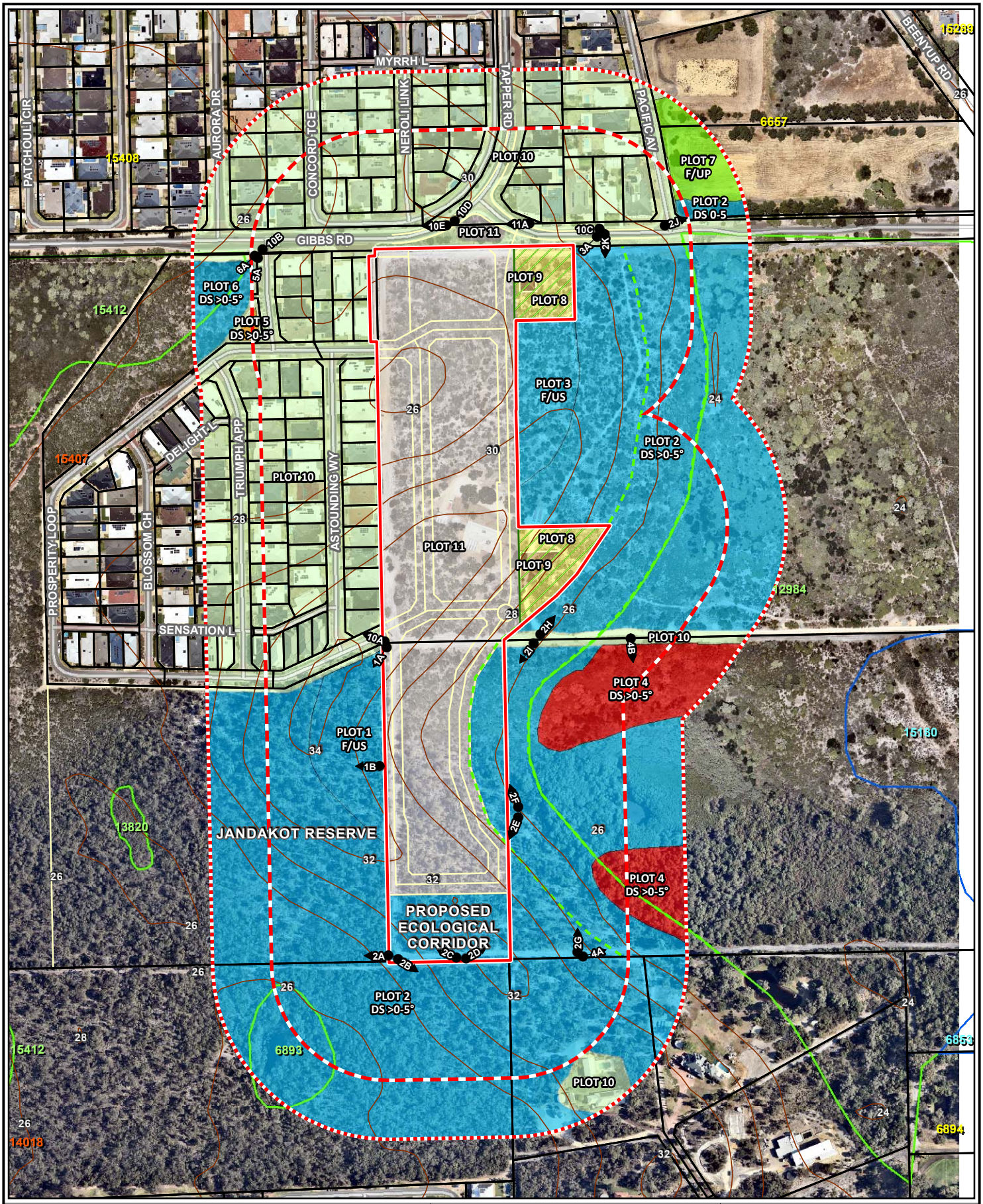
3.1.3 Summary of inputs

Figure 3 illustrates the anticipated post-development vegetation classifications and exclusions following completion of subdivision works and implementation of low threat landscaping throughout the project area and adjacent 150 m. The post-development vegetation classifications/exclusions and effective slope are summarised in Table 2.

The post-development vegetation classifications for all land external to the project area are expected to remain the same as for the pre-development classifications, other than the management of vegetation to a low threat state at the main entrance from Gibbs Road. If external vegetation other than the Gibbs Road reserve is altered prior to future planning stages, the change in vegetation condition is to be captured through a future BHL assessment or BAL contour map assessment.

Table 2: Summary of post-development vegetation classifications, exclusions and effective slope

Vegetation plot	Vegetation classification	Effective slope	Comments
1	Class B Woodland	Flat/upslope (0°)	Banksia woodland vegetation within Jandakot Reserve that presents as scrub profile but is dominated by banksia
2	Class B Woodland	Downslope >0–5°	Banksia woodland vegetation with melaleuca dominated vegetation in parts of the CCW
3	Class B Woodland	Flat/upslope (0°)	Banksia woodland
4	Class A Forest	Downslope >0–5°	Eucalyptus dominated forest vegetation within the CCW.
5	Class D Scrub	Downslope >0–5°	Scrub vegetation within small drainage basin
6	Class B Woodland	Downslope >0–5°	Banksia woodland
7	Class G Grassland	Flat/upslope (0°)	Unmanaged grassland
8	Excluded – Low threat (Clause 2.2.3.2 [f])	N/A	Managed low threat vegetation within proposed POS
9	Excluded – Clause 2.2.3.2 [c]	N/A	Isolated small plots of unmanaged vegetation within proposed drainage basins
10	Excluded – Non-vegetated and Low threat (Clause 2.2.3.2 [e] and [f])	N/A	Existing non-vegetated and low threat vegetation
11	Excluded – Non-vegetated and Low threat (Clause 2.2.3.2 [e] and [f])	N/A	Existing unmanaged vegetation to be modified to a non-vegetated or low threat state



Project area
100m assessment area
150m assessment area
Cadastral boundary
POS
Geomorphic Wetlands (DBCA)
Conservation
Resource Enhancement
Proposed development
50m buffer CCW boundary
Topographic contours (mAHD)
Photo point and direction
Roads (MRWA)

Vegetation classification
Class A Forest
Class B Woodland
Class C Shrubland
Class G Grassland
Clause 2.2.3.2 (c)
Clause 2.2.3.2 (e) & (f)
Clause 2.2.3.2 (f)
Area to be modified to non-vegetated and low threat state

Scale 1:4,250 at A4 (0 50 100 metres)

Coord. Sys. GDA 1994 MGA Zone 50

Job No: 58534

Client: Aigle Royal

Version: A | Date: 24-Apr-2020

Drawn By: hsullivan | Checked By: LW

Lot 11 and 74, Gibbs Rd Banjup, WA

VEGETATION CLASSIFICATION AND EFFECTIVE SLOPE

FIGURE 3

strategen JBS&G

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3.2 Assessment outputs

3.2.1 Bushfire Hazard Level (BHL) assessment

Post-development vegetation extents have been assigned a bushfire hazard level in accordance with the methodology detailed in Appendix Two of the Guidelines as outlined in Table 3.

Table 3: Bushfire hazard levels and characteristics

Bushfire hazard level	Characteristics*
Extreme	• Class A Forest • Class B Woodland (05) • Class D Scrub • Any classified vegetation with a greater than 10° slope.
Moderate	• Class B Low woodland (07) • Class C Shrubland • Class E Mallee/Mulga • Class G Grassland, including sown pasture and crops • Class G Grassland: Open woodland (06), Low open woodland (08), Open shrubland (09) • Vegetation that has a low hazard level but is within 100 metres of vegetation classified as a moderate or extreme hazard, is to adopt a moderate hazard level.
Low	• Low threat vegetation may include areas of maintained lawns, golf courses, public recreation reserves and parklands, vineyards, orchards, cultivated gardens, commercial nurseries, nature strips and windbreaks • Managed grassland in a minimal fuel condition (insufficient fuel is available to significantly increase the severity of the bushfire attack). For example, short-cropped grass to a nominal height of 100 millimetre • Non-vegetated areas including waterways, roads, footpaths, buildings and rock outcrops.
*Vegetation classifications from AS 3959-2018 Table 2.3.	

3.2.1.1 Post-development

Strategen-JBS&G has mapped the potential post-development bushfire hazard levels to demonstrate that the future bushfire hazard levels will be acceptable for future development to occur within the project area. The bushfire hazard levels have been assigned on the basis of the vegetation discussed in Section 3.1 and the future expected vegetation extent within and surrounding the project area.

The post-development BHL assessment (refer to Figure 4) demonstrates that all future habitable development will be located on land with either a Low or Moderate bushfire hazard level.

3.2.2 Bushfire Attack Level (BAL) contour assessment

Strategen-JBS&G has undertaken a BAL contour assessment in accordance with Method 1 of AS 3959 for the project area to provide greater clarity on the anticipated BAL ratings expected on future habitable development. The Method 1 procedure incorporates the following factors:

- state-adopted FDI 80 rating
- vegetation classification
- effective slope
- distance maintained between proposed development areas and the classified vegetation.

The BAL rating gives an indication of the level of bushfire attack (i.e. the radiant heat flux) that may be received by proposed future development and subsequently informs the standard of building construction and/or setbacks required for proposed habitable development to potentially withstand such impacts.

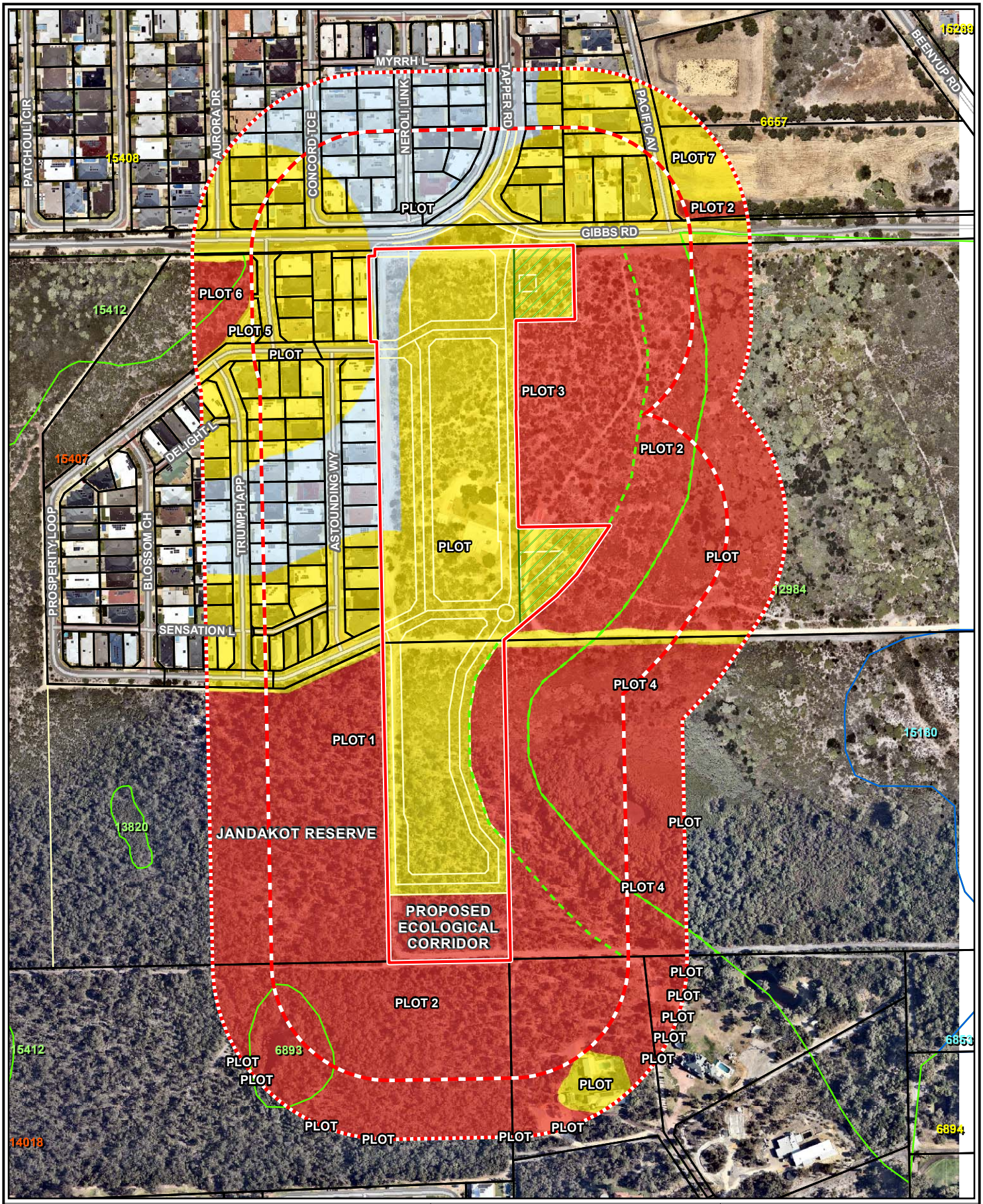
The BAL contours are based on:

- the post-development vegetation classifications and effective slope observed at the time of inspection as well as consideration of the proposed on-site clearing extent, resultant vegetation exclusions and separation distances achieved in line with the proposed Local Structure Plan.

The results of the BAL contour assessment are detailed in Table 4 and illustrated in Figure 5. The highest BAL applicable to the external boundary of the proposed lots is BAL–29 or lower. Implementation of building setbacks at the building stage may result in further BAL reductions for various lots.

Table 4: BAL contour assessment results

Method 1 BAL determination					
Plot	**Vegetation classification**	**Effective slope**	**Minimum Separation distance**	**Highest BAL (to lot boundary)**	**Modified BAL (with building setbacks)**
1	Class B Woodland	Flat/upslope (0°)	14 m	BAL–29	BAL–Low
2	Class B Woodland	Downslope >0–5°	15 m	BAL–29	BAL–Low
3	Class B Woodland	Flat/upslope (0°)	15 m	BAL–29	BAL–Low
4	Class A Forest	Downslope >0–5°	74 m	BAL–12.5	BAL–Low
5	Class D Scrub	Downslope >0–5°	95 m	BAL–12.5	BAL–Low
6	Class B Woodland	Downslope >0–5°	97 m	BAL–12.5	BAL–Low
7	Class G Grassland	Flat/upslope (0°)	>50 m	BAL–Low	BAL–Low
8	Excluded – Low threat (Clause 2.2.3.2 [f])	N/A	N/A	BAL–Low	BAL–Low
9	Excluded – Clause 2.2.3.2 [c]	N/A	N/A	BAL–Low	BAL–Low
10	Excluded – Non-vegetated and Low threat (Clause 2.2.3.2 [e] and [f])	N/A	N/A	BAL–Low	BAL–Low
11	Excluded – Non-vegetated and Low threat (Clause 2.2.3.2 [e] and [f])	N/A	N/A	BAL–Low	BAL–Low



Legend:

- Project area
- 100m assessment area
- 150m assessment area
- Cadastral boundary
- POS
- Geomorphic Wetlands (DBCA)
  - Conservation
  - Resource Enhancement

BHL
- Extreme
- Moderate
- Low
- Proposed development
- 50m buffer CCW boundary
- Roads (MRWA)

Scale 1:4,250 at A4 (0 50 100 metres)		**Lot 11 and 74, Gibbs Rd Banjup, WA**
Coord. Sys. GDA 1994 MGA Zone 50		**BUSHFIRE HAZARD LEVEL ASSESSMENT**
Job No: 58534		
Client: Aigle Royal		**FIGURE 4**
Version: A	Date: 24-Apr-2020	strategen JBS&G
Drawn By: hsullivan	Checked By: CT	

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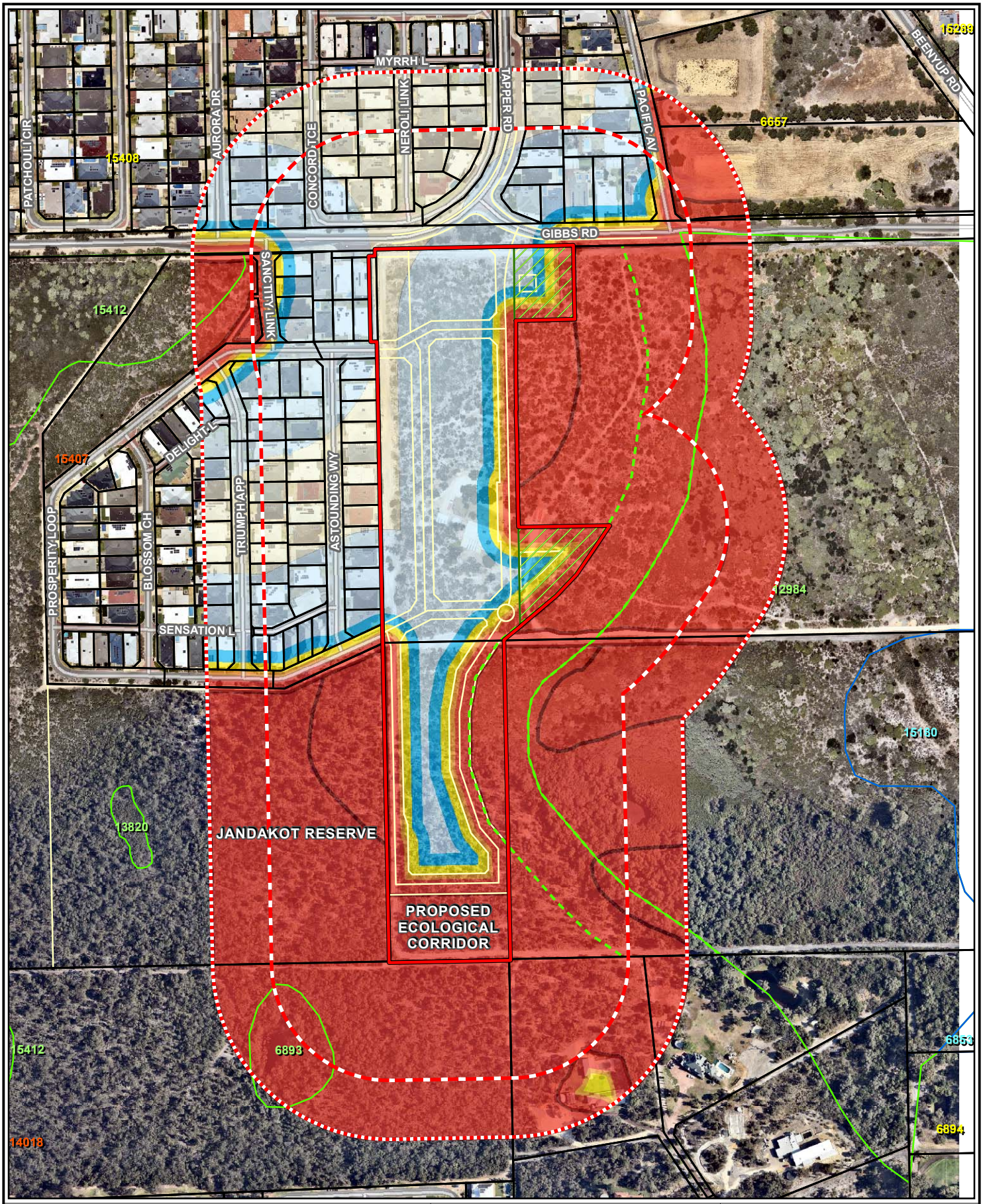

Legend:

- Project area
- 100m assessment area
- 150m assessment area
- Cadastral boundary
- POS
- Classified vegetation

Geomorphic Wetlands (DBCA)

- Conservation
- Resource Enhancement

BAL contours

- BAL FZ
- BAL 40
- BAL 29
- BAL 19
- BAL 12.5
- BAL LOW

- Proposed development
- 50m buffer CCW boundary
- Roads (MRWA)

Scale 1:4,250 at A4 (0 50 100 metres)		**Lot 11 and 74, Gibbs Rd Banjup, WA**
Coord. Sys. GDA 1994 MGA Zone 50		**BAL CONTOURS**
Job No: 58534		
Client: Aigle Royal		**FIGURE 5**
Version: A	Date: 24-Apr-2020	strategen JBS&G
Drawn By: hsullivan	Checked By: CT	

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4. Identification of bushfire hazard issues

4.1 Bushfire context

The main bushfire risk to the proposed development is from a fire travelling east, west or north-west, predominantly through banksia woodland vegetation located to the west, east and south of the project area. This woodland vegetation will be retained as part of the Conservation Category Wetland located to the south-east of the project area, an ecological linkage to the south and a Bush Forever site to the west. Maximum potential fire runs through this woodland vegetation could be up to 700 m, however future urban development in this area may lead to fragmentation of the fire run.

Given the adjacent vegetation is to be retained in perpetuity, Strategen-JBSG considers this bushfire scenario to pose the principal bushfire risk to future assets of the project area, particularly should a bushfire occur in this area under standard morning conditions in summer associated with prevailing winds from the east, which has the potential to result in moderate to elevated levels of radiant heat and ember attack at the bushland interface. Therefore, bushfire management for the project area should focus on providing adequate hazard separation, in the form of APZs, increased building construction standards for individual lots where required in accordance with AS 3959, and vehicle access at the eastern, southern and western interfaces for resident/public egress and firefighter access.

It is acknowledged that the bushfire risk to the proposed development posed by these hazards can be managed through standard application of acceptable solutions under the Guidelines, as well as through a direct bushfire suppression response if required. Bushfire mitigation strategies applicable to the proposed development are addressed in Section 5 of this BMP.

4.2 Bushfire hazard issues

Examination of strategic development design in accordance with the Structure Plan and post-development bushfire hazard levels has identified the following bushfire hazard issues to be considered at future planning stages:

- A direct vegetation interface exists between proposed development around much of the perimeter of the project area, with key interfaces in the south-west, south and east with Class B woodland vegetation retained in the conservation areas. Future stages of planning are to ensure that sufficient separation exists for future habitable development to achieve BAL-29 or lower.
- Ensuring any POS and drainage areas to the east of the proposed urban development are created and maintained in a low threat state, or otherwise excludable under AS3959 Clause 2.2.3.2, to ensure sufficient APZ setbacks provided to achieve BAL-29. Setback distances will be determined at future planning stages (i.e. subdivision) through the development of a Landscaping Plan.
- Given the potential bushfire risk to the site, appropriate vehicular access is required for both egress by residents and public but also for firefighter access to, and around, the project area.
    - The internal vehicular access network will comply with the requirements of the Guidelines, with a focus on preventing trapping of the public or firefighters in a bushfire scenario.
    - Ensuring perimeter public roads are created at the main bushfire hazard interfaces to proposed habitable development to facilitate firefighter access to and around the development and to undertake bushfire fighting operations at these interfaces.

- Creation of an additional public road connection to Gibbs Road addresses a legacy non-compliance for the existing residential development to the west, by creating another vehicular access route from the area.

- Water supply for bushfire fighting operations will be critical to protection of development from bushfire impact.
  - A compliant reticulated water supply, complete with street hydrants, is proposed for the development.

- Given the location of the proposed development, resident bushfire awareness and preparation will be critical to ensuring appropriate response in a bushfire emergency, thereby reducing the burden on fire and emergency services.
  - A section on bushfire is to be included in the resident information package issued to all landowners upon purchase of their lot. This will include information on bushfire behaviour, building construction and APZ specifications, vehicular access, firebreak requirements and ongoing maintenance and housekeeping requirements for buildings and APZs. Additionally, information will also be provided on developing a bushfire survival plan for the residence including evacuation planning, and where to access information on bushfire status.

Based on the above, Strategen-JBS&G considers the bushfire hazards within and adjacent to project area and the associated bushfire risks are readily manageable through standard management responses outlined in the Guidelines and AS 3959. These responses have been factored in to proposed development as early as possible at all stages of the planning process to ensure a suitable, compliant and effective bushfire management outcome is achieved for protection of future life, property and environmental assets.

5. Assessment against bushfire protection criteria

5.1 Compliance table

An acceptable solutions assessment against the bushfire protection criteria is provided in Table 5.

Table 5: Compliance with the bushfire protection criteria of the Guidelines

Bushfire protection criteria	Method of compliance Acceptable solutions	Proposed bushfire management strategies
Element 1: Location	A1.1 Development location	The post-development BHL assessment (Figure 4) identifies that on completion of development, all developable land will comprise either a Low or Moderate bushfire hazard level. A preliminary BAL contour assessment (depicted on Figure 5) has also been produced to assess the BAL impact across the proposed development and to review the anticipated level of compliance at future planning stages. The BAL contour assessment demonstrates that sufficient separation between unmanaged vegetation and all proposed lots can implemented to achieve a rating of BAL-29 or lower which complies with Acceptable Solution A1.1.
Element 2: Siting and design	A2.1 Asset Protection Zone	APZs sufficient to achieve BAL—29 are to be implemented for all lots subject to a BAL above BAL-LOW. The required APZs are to be identified at future planning stages based on future subdivision/development design and following a BAL contour assessment. As outlined above, a preliminary BAL contour assessment identifies all proposed lots are already located in BAL-29 or lower and have the capacity to achieve compliant APZs within the project area boundary including surrounding permanent low fuel roads and POS areas. APZs are to be implemented and maintained in accordance with Schedule 1 of the Guidelines (Appendix B) and the City's Firebreak and Fuel Hazard Reduction Notice (see Appendix E).
Element 3: Vehicular access	A3.1 Two access routes	A combination of existing public roads and the proposed internal vehicle access network will provide all occupants with the option of travelling to more than two different destinations: • connection to Gibbs Road along the northern project area boundary providing the option of travelling east to Liddlelow Road, west towards Kwinana Freeway or north on Tapper Road into a residential built-up area • connection to Prosperity Loop at two points to the west of the development providing the option of travelling north to Gibbs Road, where travel is available west, north or east. In this regard, the proposed development is provided with at least two access routes which meets the requirements of Acceptable Solution A3.1. Additionally, no less than two access routes are to be provided during staging of development.
	A3.2 Public road	All public roads will be constructed to the relevant technical requirements of the Guidelines (see Appendix C).

Bushfire protection criteria	Method of compliance Acceptable solutions	Proposed bushfire management strategies
	A3.3 Cul-de-sac (including a dead-end-road)	No cul-de-sacs are proposed as part of the subdivision and the project area is not serviced by an existing cul-de-sac. The existing residential development to the west of this proposal is currently only served by a single connection to Gibbs Road, with a second to be provided following completion of this development, rectifying this legacy non-compliance. Currently no permanent cul-de-sacs are proposed; however if development and vehicular access construction is to be staged, any proposed temporary cul-de-sacs or any introduced into the subdivision design, are to be less than 200 m in length and constructed in accordance with the relevant technical requirements of the Guidelines (see Appendix C).
	A3.4 Battle-axe	No battle-axes are currently proposed as part of the subdivision and the project area is not serviced by an existing battle-axe. Should any battle-axes be proposed as part of future planning stages, they will be less than 600 m in length and will be constructed to relevant technical requirements under the Guidelines (see Appendix C), including passing bays at 200 m intervals and turn-around areas for fire appliances where battle-axes are longer than 500 m.
	A3.5 Private driveway longer than 50 m	The proposed lots are of size where all future habitable development will be located within 50 m of a public road. Should any private driveways exceed 50 m in length, they are to be constructed to the relevant technical requirements of the Guidelines (see Appendix C), including turn-around areas within 50 m of each building, passing bays if driveways are longer than 200 m and additional turn-around areas for fire appliances every 500 m.
	A3.6 Emergency access way	The proposed subdivision design does not require Emergency Access Ways (EAWs) to provide through access to a public road. Whilst no permanent emergency access ways (EAW) are proposed; if development and vehicular access construction is to be staged, any proposed temporary EAW is to be constructed to the relevant technical requirements of the Guidelines (see Appendix C).
	A3.7 Fire service access routes (perimeter roads)	The proposed subdivision design does not require fire service access routes (FSARs) to achieve access within and around the perimeter of the project area. Although no permanent fire service access routes (FSARs) are proposed; if development and construction of vehicular access is to be staged, any proposed temporary FSAR is to be constructed to the relevant technical requirements of the Guidelines (see Appendix C).
	A3.8 Firebreak width	N/A – given that all lots will be cleared and developed, lot boundary firebreaks will not be required around the proposed residential lots.
Element 4: Water	A4.1 Reticulated areas	The proposed development will be connected to reticulated water supply via surrounding development in accordance with Water Corporations Design Standard 63 requirements, complete with compliant street hydrants (refer to Appendix D).
	A4.2 Non-reticulated areas	Although the proposed development is to be provided with a compliant reticulated water supply, should this not be achievable, a non-reticulated water supply will need to be provided in accordance with the Guidelines.

Bushfire protection criteria	Method of compliance Acceptable solutions	Proposed bushfire management strategies
	A4.3 Individual lots within non-reticulated areas (Only for use if creating 1 additional lot and cannot be applied cumulatively)	N/A

5.2 Additional management strategies

Strategen-JBS&G makes the following additional bushfire management recommendations to inform ongoing planning stages of the development and increase the level of bushfire risk mitigation across the site.

5.2.1 On-site staging buffers

If future development (and therefore clearing) is to occur on a staged basis, clearing in advance of adjacent areas may need to occur to ensure building construction is not inhibited by a temporary vegetation extent located within adjacent development stages yet to be cleared. This can be achieved by ensuring that each approved stage subject to construction is surrounded by a 100-m wide (or other width confirmed by an accredited bushfire practitioner), on-site cleared or low threat buffer prior to development (not including vegetation proposed to be retained). Once the buffers are created, they will need to be maintained on a regular and ongoing basis in accordance with AS 3959 Clause 2.2.3.2 (f) (including the management of grassland at 100 mm or lower) to achieve a low threat minimal fuel condition all year round until such time that the buffer area is developed as part of the next development stage. This will assist in managing the current on-site temporary vegetation hazards.

5.2.2 Staging of access

If development (and therefore construction of vehicular access) is to occur on a staged basis, vehicular access arrangements will need to ensure that all occupiers and visitors are provided with at least two access routes at all stages. This can be achieved via construction of access in advance of stages or through provision of temporary emergency access ways until two formal access roads are available.

5.2.3 Fuel management within cleared vacant lots

Cleared vacant lots are to be managed on a regular and ongoing basis by the developer until sale of lots after which time landowners will be responsible for ongoing management. Maintenance is to be in accordance with Clause 2.2.3.2 (f) of AS 3959 and Schedule 1 of the Guidelines (refer to Appendix B) and will involve slashing/mowing of grassland and weeds to height of less than 100 mm.

5.2.4 Road verge fuel management

Existing and proposed road verges that have been excluded as low threat are to be managed to ensure the understorey and surface fuels remain in a low threat, minimal fuel condition in accordance with Clause 2.2.3.2 (f) of AS 3959. Management of proposed road verges is expected to be by the Developer initially, and the City following handover, while ongoing management of existing road verges management is the responsibility of the City.

5.2.5 Notification on title

Notification is to be placed on the Title of proposed lots subject to BAL-12.5 or higher (either through condition of subdivision or other head of power) to ensure landowners/proponents and prospective purchasers are aware that their lot is subject to an approved BMP and BAL assessment; however, since the lot is situated within a designated bushfire prone area (at creation of title), the BAL for proposed buildings may, at the discretion of the City of Cockburn, need to be confirmed at the development application or building permit stage.

5.2.6 Building construction standards

Future Class 1, 2, 3 and associated 10a buildings in areas subject to BAL-12.5 or higher are required to comply with the bushfire specific building construction requirements of AS 3959.

5.2.7 BMP compliance and/or individual lot BAL assessment at future stages

A BMP compliance report will be prepared following completion of subdivisional works and prior to issue of title, to confirm the accuracy of BAL contour assessments and to validate that relevant management measures of this BMP have been implemented appropriately to achieve the intended bushfire management outcomes and compliance with bushfire protection criteria.

5.2.8 Landscaping Plan

The BAL contour assessment depicted is reliant on all onsite landscaping, POS and drainage being excludable as low threat vegetation. A detailed landscaping design, in particular with regard to proposed POS and drainage areas, will be required at future planning stages to demonstrate how proposed vegetation will achieve this exclusion, or if any vegetation is required to be classified, how sufficient separation will be provided to achieve a compliant BAL outcome.

5.2.9 Compliance with annual firebreak notice

The developer/land manager and prospective land purchasers are to comply with the current City of Cockburn annual firebreak notice as amended (refer to Appendix E).

5.2.10 Resident bushfire information

Include a section relating to bushfire in the resident information package issued to all landowners upon purchase of their lot. This is to include information on bushfire behaviour, building construction and APZ specifications, vehicular access, firebreak requirements, ongoing maintenance and housekeeping requirements for buildings and APZs. Information on how to develop a bushfire survival plan should also be provided including evacuation planning, and where to access information on bushfire status.

6. Responsibilities for implementation and management of the bushfire measures

This BMP has been prepared as a strategic guide to demonstrate how development compliance will be delivered at future planning stages in accordance with the Guidelines. Aside from the preparation of future BMPs to accompany future subdivision and development applications where appropriate, there are no further items to implement, enforce or review at this strategic stage of the planning process.

Future BMPs prepared for subsequent subdivision and development applications are to meet the relevant commitments outlined in this strategic level BMP, address the relevant requirements of SPP 3.7 (i.e. Policy Measures 6.4 and 6.5 respectively) and demonstrate in detail how the proposed development will incorporate the relevant acceptable solutions or meet the performance requirements of the Guidelines. Future BMPs are to include the following detailed information:

- proposed lot layout, including any public open space (POS) and drainage areas
- detailed landscaping design/plans in regard to POS and drainage areas, consistent with the provisions of this BMP
- post development classified vegetation extent and effective slope
- BAL contour map demonstrating that proposed development areas will achieve BAL–29 or lower (may require designation of building envelopes)
- width and alignment of compliant APZs/setbacks
- confirmation of how bushfire management will be addressed during development staging
- proposed approach to fuel management or AS 3959 application in response to on-site POS
- vehicular access provisions, including demonstration that a minimum of two access routes will be achieved for each stage of development in accordance with Acceptable Solution A3.1
- water supply provisions with regards to reticulated water
- future requirements for any future vulnerable land uses, such as provision of a Bushfire Emergency Evacuation Plan (if relevant)
- future requirements for any future high-risk land uses, such as provision of a Bushfire Risk Management Plan (if relevant)
- provisions for notification on Title for any future lots with a rating of BAL–12.5 or greater as a condition of subdivision
- compliance requirements with the current City's annual firebreak notice as amended
- construction of Class 1, 2, 3 or associated 10a buildings in accordance with AS 3959 to the assessed BAL rating
- requirements for BMP/BAL compliance reports as conditions of subdivision
- compliance with performance principles of the bushfire protection criteria (where required)
- proposed implementation and audit program outlining all measures requiring implementation and the appropriate timing and responsibilities for implementation.

On the basis of the information contained in this BMP, Strategen-JBS&G considers the bushfire hazards both within and adjacent to the project area and the associated bushfire risks are readily manageable through standard management responses outlined in the Guidelines and AS 3959. Strategen-JBS&G considers that on implementation of the proposed management measures, the

project area will be able to be developed with a manageable level of bushfire risk whilst maintaining full compliance with the Guidelines and AS 3959.

7. References

360 Environmental 2020, *Local Structure Plan: Environmental Assessment Report*, 360 Environmental, Leederville, Perth

Department of Fire and Emergency Services (DFES) 2020*, Map of Bush Fire Prone Areas*, [Online], Government of Western Australia, available from: http://www.dfes.wa.gov.au/regulationandcompliance/bushfireproneareas/Pages/default.aspx.

Department of Planning (DoP) 2016, *Visual guide for bushfire risk assessment in Western Australia*, Department of Planning, Perth, WA.

Standards Australia (SA) 2018, *Australian Standard AS 3959–2018 Construction of Buildings in Bushfire-prone Areas*, Standards Australia, Sydney.

Western Australian Planning Commission (WAPC) 2015, *State Planning Policy 3.7 Planning in Bushfire-Prone Areas*, Western Australian Planning Commission, Perth.

Western Australian Planning Commission (WAPC) 2017*, Guidelines for Planning in Bushfire-Prone Areas*, Western Australian Planning Commission, Perth.

8. Limitations

Scope of services

This report ("the report") has been prepared by Strategen-JBS&G in accordance with the scope of services set out in the contract, or as otherwise agreed, between the Client and Strategen-JBS&G. In some circumstances, a range of factors such as time, budget, access and/or site disturbance constraints may have limited the scope of services. This report is strictly limited to the matters stated in it and is not to be read as extending, by implication, to any other matter in connection with the matters addressed in it.

Reliance on data

In preparing the report, Strategen-JBS&G has relied upon data and other information provided by the Client and other individuals and organisations, most of which are referred to in the report ("the data"). Except as otherwise expressly stated in the report, Strategen-JBS&G has not verified the accuracy or completeness of the data. To the extent that the statements, opinions, facts, information, conclusions and/or recommendations in the report ("conclusions") are based in whole or part on the data, those conclusions are contingent upon the accuracy and completeness of the data. Strategen-JBS&G has also not attempted to determine whether any material matter has been omitted from the data. Strategen-JBS&G will not be liable in relation to incorrect conclusions should any data, information or condition be incorrect or have been concealed, withheld, misrepresented or otherwise not fully disclosed to Strategen-JBS&G. The making of any assumption does not imply that Strategen-JBS&G has made any enquiry to verify the correctness of that assumption.

The report is based on conditions encountered and information received at the time of preparation of this report or the time that site investigations were carried out. Strategen-JBS&G disclaims responsibility for any changes that may have occurred after this time. This report and any legal issues arising from it are governed by and construed in accordance with the law of Western Australia as at the date of this report.

Environmental conclusions

Within the limitations imposed by the scope of services, the preparation of this report has been undertaken and performed in a professional manner, in accordance with generally accepted environmental consulting practices. No other warranty, whether express or implied, is made.

The advice herein relates only to this project and all results conclusions and recommendations made should be reviewed by a competent person with experience in environmental investigations, before being used for any other purpose.

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Appendix A Site Photographs

Photo ID: 1a

Photo ID: 1b

Plot number		Plot 1
Vegetation classification	**Pre-development**	Class B Woodland
	Post-development	Class B Woodland
Description / justification		Banksia woodland with vegetation height less than 6 m height

Photo ID: 2a

Photo ID: 2b

Photo ID: 2c

Photo ID: 2d

Photo ID: 2e

Photo ID: 2f

Plot number		Plot 2
Vegetation classification	**Pre-development**	Class B Woodland
	Post-development	Class B Woodland
Description / justification		Banksia woodland with vegetation height less than 6 m height

Photo ID: 2g

Photo ID: 2h

Photo ID: 2i

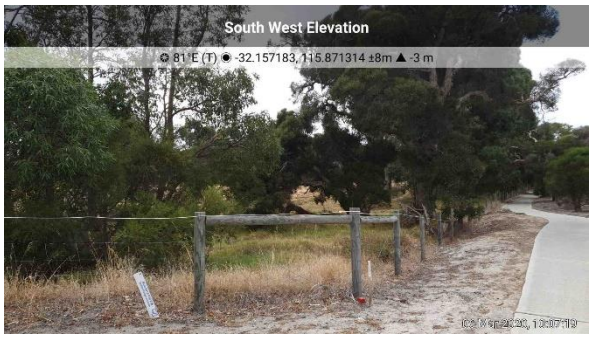


Photo ID: 2j

Photo ID: 2k

Plot number		Plot 2
Vegetation classification	Class B Woodland	Class B Woodland
	Class B Woodland	Class B Woodland
Description / justification		Banksia woodland with vegetation height less than 6 m height

Photo ID: 3a

Plot number		Plot 3
Vegetation classification	**Pre-development**	Class B Woodland
	Post-development	Class B Woodland
Description / justification		Banksia woodland with vegetation height less than 6 m height

Photo ID: 4a

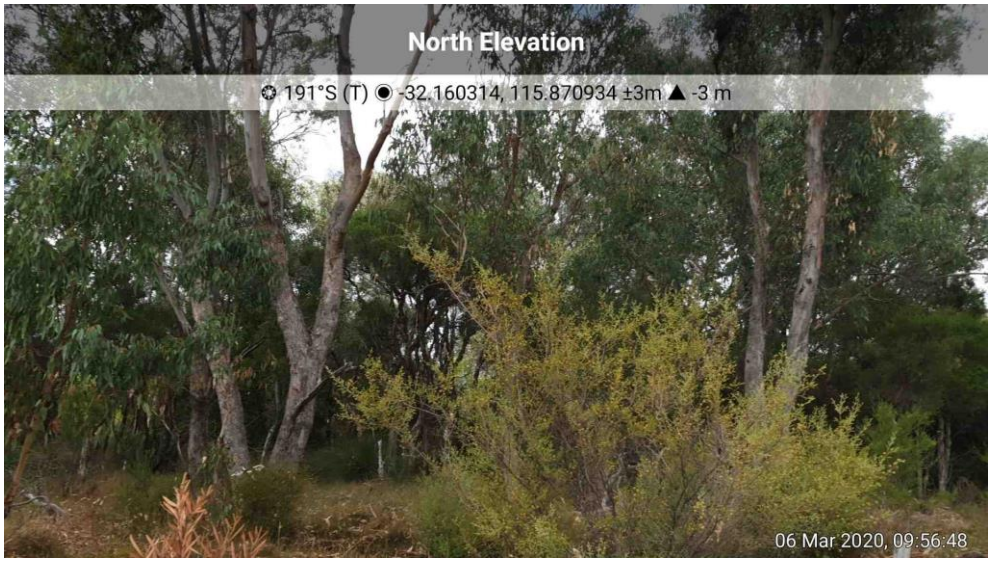


Photo ID: 4b

Plot number		Plot 4
Vegetation classification	**Pre-development**	Class A Forest
	Post-development	Class A Forest
Description / justification		Forest vegetation dominated by banksia with a multi-tiered fuel structure including a shrubby understorey, scrub mid-storey and eucalypt overstorey.

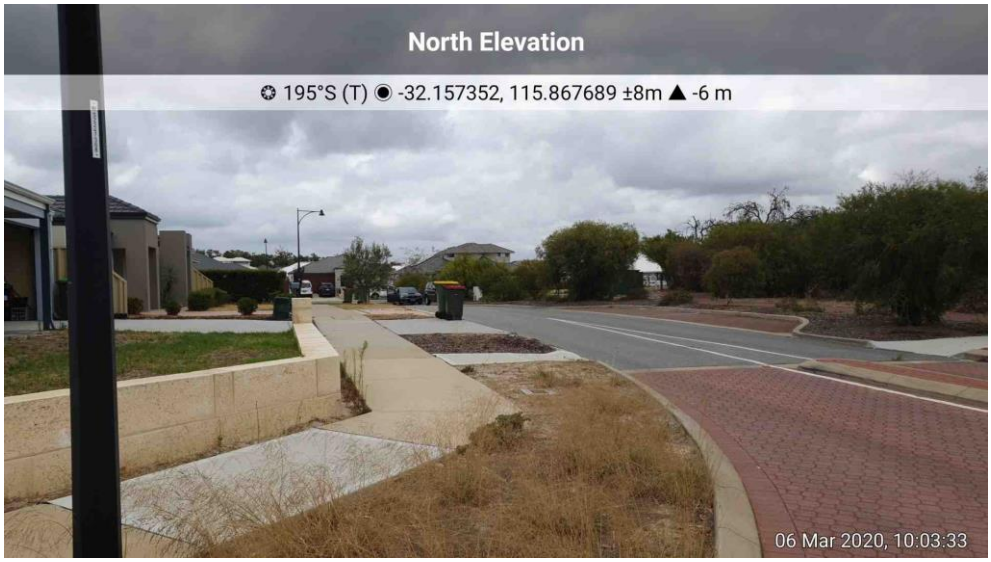


Photo ID: 5a

Plot number		Plot 5
Vegetation classification	**Pre-development**	Class D Scrub
	Post-development	Class D Scrub
Description / justification		Scrub vegetation in small drainage basin

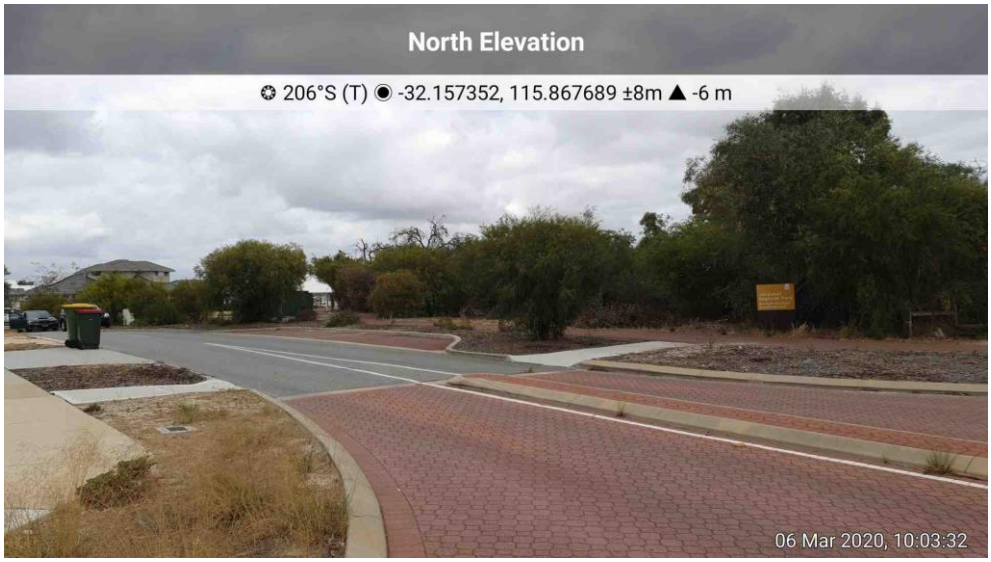


Photo ID: 6a

Plot number		Plot 6
Vegetation classification	**Pre-development**	Class B Woodland
	Post-development	Class B Woodland
Description / justification		Banksia woodland

Photo ID: 10a

Photo ID: 10b

Photo ID: 10c

Photo ID: 10d

Photo ID: 10e

Plot number		Plot 10
Vegetation classification	**Pre-development**	Excluded – Non-vegetated and Low threat (Clause 2.2.3.2 [e] and [f])
	Post-development	Excluded – Non-vegetated and Low threat (Clause 2.2.3.2 [e] and [f])
Description / justification		Non-vegetated areas (i.e. buildings, roads, mulched road verges, mineral earth firebreaks, driveways, carparks) and low threat vegetation (i.e. manicured lawns, managed gardens, slashed road verges).

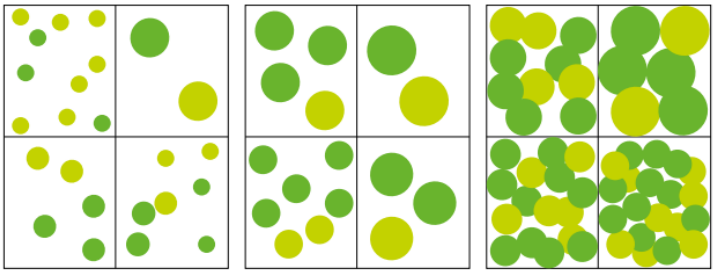
Photo ID: 11a

Plot number		Plot 11
Vegetation classification	**Pre-development**	Class D Scrub
	Post-development	Modified to non-vegetated (exclusion 2.2.3.2 [e]) and/or low threat (exclusion 2.2.3.2 [f]) state
Description / justification		Area to be modified to a low threat state.

Appendix B APZ standards (Schedule 1 of the Guidelines)

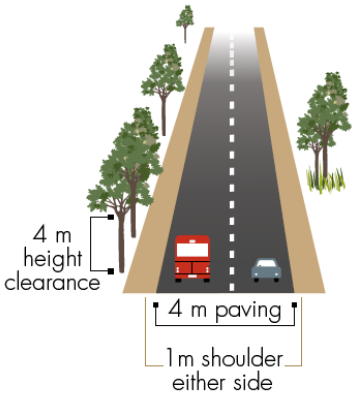
Schedule 1: Standards for Asset Protection Zones

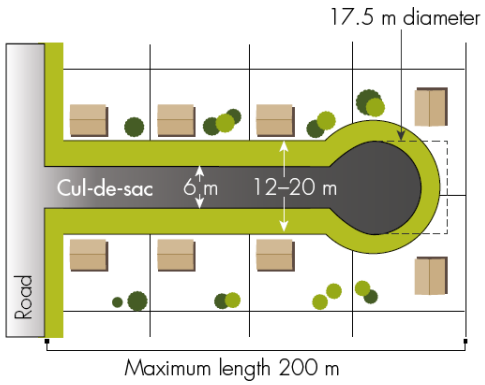
- **Fences:** within the APZ are constructed from non-combustible materials (e.g. iron, brick, limestone, metal post and wire). It is recommended that solid or slatted non-combustible perimeter fences are used.
- **Objects:** within 10 metres of a building, combustible objects must not be located close to the vulnerable parts of the building i.e. windows and doors.
- **Fine Fuel load:** combustible dead vegetation matter less than 6 millimetres in thickness reduced to and maintained at an average of two tonnes per hectare.
- **Trees (> 5 metres in height):** trunks at maturity should be a minimum distance of 6 metres from all elevations of the building, branches at maturity should not touch or overhang the building, lower branches should be removed to a height of 2 metres above the ground and or surface vegetation, canopy cover should be less than 15% with tree canopies at maturity well spread to at least 5 metres apart as to not form a continuous canopy.

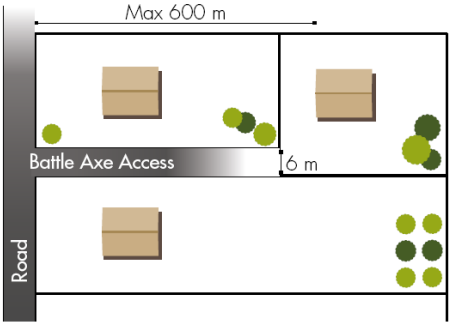


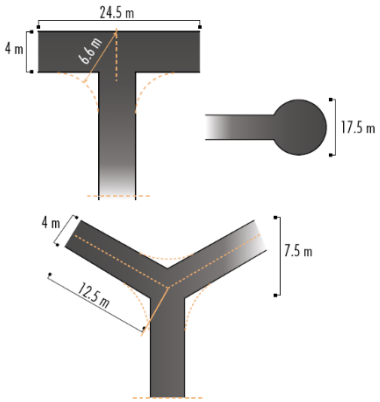
- **Shrubs (0.5 metres to 5 metres in height):** should not be located under trees or within 3 metres of buildings, should not be planted in clumps greater than 5m2 in area, clumps of shrubs should be separated from each other and any exposed window or door by at least 10 metres. Shrubs greater than 5 metres in height are to be treated as trees.
- **Ground covers (<0.5 metres in height):** can be planted under trees but must be properly maintained to remove dead plant material and any parts within 2 metres of a structure, but 3 metres from windows or doors if greater than 100 millimetres in height. Ground covers greater than 0.5 metres in height are to be treated as shrubs.
- **Grass:** should be managed to maintain a height of 100 millimetres or less.

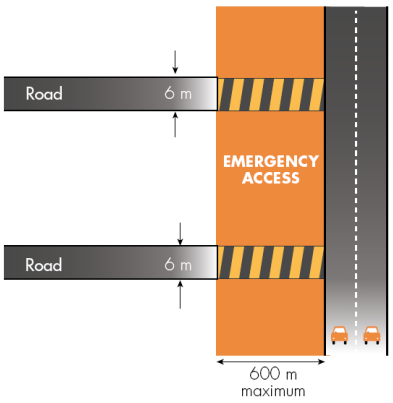
Appendix C Vehicular access technical standards of the Guidelines

Public roads	
Acceptable solution A3.2	A public road is to meet the requirements in Table 1, Column 1.
Explanatory note E3.2	Trafficable surface: Widths quoted for access routes refer to the width of the trafficable surface. A six metre trafficable surface does not necessarily mean paving width. It could, for example, include four metre wide paving one metre wide constructed road shoulders. In special circumstances, where eight lots or less are being serviced, a public road with a minimum trafficable surface of four metres for a maximum distance of 90 metres may be provided subject to the approval of both the local government and Department of Fire and Emergency Services. Public road design: All roads should allow for two-way traffic to allow conventional two-wheel drive vehicles and fire appliances to travel safely on them. 

Cul-de-sac (including a dead-end road)	
Acceptable solution A3.3	A cul-de-sac and/ or a dead end road should be avoided in bushfire prone areas. Where no alternative exists (i.e. the lot layout already exists and/ or will need to be demonstrated by the proponent), the following requirements are to be achieved: • Requirements in Table 1, Column 2 • Maximum length: 200 metres (if public emergency access is provided between cul-de-sac heads maximum length can be increased to 600 metres provided no more than eight lots are serviced and the emergency access way is no more than 600 metres) • Turn-around area requirements, including a minimum 17.5 metre diameter head.
Explanatory note E3.3	In bushfire prone areas, a cul-de-sac subdivision layout is not favoured because they do not provide access in different directions for residents. In some instances it may be possible to provide an emergency access way between cul-de-sac heads to a maximum distance of 600 metres, so as to achieve two-way access. Such links must be provided as right of ways or public access easements in gross to ensure accessibility to the public and fire services during an emergency. A cul-de-sac in a bushfire prone area is to connect to a public road that allows for travel in two directions in order to address Acceptable Solution A3.1. 

Battle-axe	
Acceptable solution A3.4	Battle-axe access leg should be avoided in bushfire prone areas. Where no alternative exists, (this will need to be demonstrated by the proponent) all of the following requirements are to be achieved: • Requirements in Table 1, Column 3 • Maximum length: 600 metres • Minimum width: six metres.
Explanatory note E3.4	In bushfire prone areas, lots with battle-axe access legs should be avoided because they often do not provide two-way access and egress for residents and may be easily blocked by falling trees or debris. In some instances, however; it may be appropriate for battle-axe access to be used to overcome specific site constraints. Where used, they should comply with the minimum standards for private driveways. Passing bays should be provided at 200 metre intervals along battle-axe access legs to allow two-way traffic. The passing bays should be a minimum length of 20 metres, with the combined width of the passing bay and the access being a minimum of six metres. Turn-around areas should allow type 3.4 fire appliances to turn around safely (i.e. kerb to kerb 17.5 metres) and should be available at house sites and at 500 metre intervals along the access leg. 

Private driveway longer than 50 metres	
Acceptable solution A3.5	A private driveway is to meet all of the following requirements: • Requirements in Table 1, Column 3 • Required where a house site is more than 50 metres from a public road • Passing bays: every 200 metres with a minimum length of 20 metres and a minimum width of two metres (i.e. the combined width of the passing bay and constructed private driveway to be a minimum six metres) • Turn-around areas designed to accommodate type 3.4 fire appliances and to enable them to turn around safely every 500 metres (i.e. kerb to kerb 17.5 metres) and within 50 metres of a house • Any bridges or culverts are able to support a minimum weight capacity of 15 tonnes • All-weather surface (i.e. compacted gravel, limestone or sealed).
Explanatory note E3.5	For a driveway shorter than 50 metres, fire appliances typically operate from the street frontage however where the distance exceeds 50 metres, then fire appliances will need to gain access along the driveway in order to defend the property during a bushfire. Where house sites are more than 50 metres from a public road, access to individual houses and 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 50 metres of a house. Passing bays should be available where driveways are longer than 200 metres and turn-around areas in driveways that are longer than 500 metres. Circular and loop driveway designs may also be considered. These criteria should be addressed through subdivision design. Passing bays should be provided at 200 metre intervals along private driveways to allow two-way traffic. The passing bays should be a minimum length of 20 metres, with the combined width of the passing bay and the access being a minimum of six metres. Turn-around areas should allow type 3.4 fire appliances to turn around safely (i.e. kerb to kerb 17.5 metres) and should be available at the house sites and at 500 metre intervals along the driveway. 

Emergency access way	
Acceptable solution A3.6	An access way that does not provide through access to a public road is to be avoided in bushfire prone areas. Where no alternative exists (this will need to be demonstrated by the proponent), an emergency access way is to be provided as an alternative link to a public road during emergencies. An emergency access way is to meet all of the following requirements: • Requirements in Table 1, Column 4 • No further than 600 metres from a public road • Provided as right of way or public access easement in gross to ensure accessibility to the public and fire services during an emergency • Must be signposted.
Explanatory note E3.6	An emergency access way is not a preferred option however may be used to link up with roads to allow alternative access and egress during emergencies where traffic flow designs do not allow for two-way access. Such access should be provided as a right-of-way or easement in gross to ensure accessibility to the public and fire emergency services during an emergency. The access should comply with minimum standards for a public road and should be signposted. Where gates are used to control traffic flow during non-emergency periods, these must not be locked. Emergency access ways are to be no longer than 600 metres and must be adequately signposted where they adjoin public roads. Where an emergency access way is constructed on private land, a right of way or easement in gross is to be established. 

Fire service access routes (perimeter roads)	
Acceptable solution A3.7	Fire service access routes are to be established to provide access within and around the edge of the subdivision and related development to provide direct access to bushfire prone areas for fire fighters and link between public road networks for firefighting purposes. Fire service access routes are to meet the following requirements: • Requirements in Table 1, Column 5 • Provided as right of ways or public access easements in gross to ensure accessibility to the public and fire services during an emergency • Surface: all-weather (i.e. compacted gravel, limestone or sealed) • Dead end roads are not permitted • Turn-around areas designed to accommodate type 3.4 appliances and to enable them to turn around safely every 500 metres (i.e. kerb to kerb 17.5 metres) • No further than 600 metres from a public road • Allow for two-way traffic • Must be signposted.
Explanatory note E3.7	Fire service access routes should be established to separate bushfire prone areas from developed areas, and to provide access within and around the edge of subdivisions and related development. Fire service access is used during bushfire suppression operations but can also be used for fire prevention work. Fire service access routes should: • Link up with the road network at regular intervals - the development and road network forms part of the fire service access system • Be adequately signposted • Allow for two-way traffic - that is, two fire appliances must be able to safely pass each other • Have an all-weather surface (i.e. compacted gravel, limestone or sealed) • Have erosion control measures in place. Driveways may be used as part of the designated fire service access system, provided they meet the minimum standard for fire service access routes. It is beneficial to link the fire service access routes with individual driveways to allow quick access to properties and houses during fire emergencies. Where gates are used, these should be wide enough to accommodate type 3.4 fire appliances (minimum width of 3.6m) with the design and construction to be approved by the relevant local government. Gates on fire service access routes may be locked to restrict access provided that a common key system is used and such keys are made available for fire appliances and designated fire officers within the local government area and/or surrounding district. Gates should be installed where fences cross fire service access routes. Management and access arrangements should be in place to ensure that the maintenance of fire service access routes will occur in the long term after an area has been subdivided. A number of options can be used to achieve this, including but not limited to: • Individual property owners being responsible for maintaining fire service access routes where these fall on their property • Providing such access as a right-of-way or easement in gross to ensure accessibility to fire services during an emergency; and/or • A levy system administered by local government to cover the cost of maintaining fire service access routes. Such arrangements should be documented in the relevant planning application (such as a structure plan, subdivision plan or development plan) and should be agreed to by local government.

Technical requirement	1	2	3	4	5
	Public road	Cul-de-sac	Private driveway longer than 50 m	Emergency access way	Fire service access routes
Minimum trafficable surface (m)	6*	6	4	6*	6*
Horizontal distance (m)	6	6	6	6	6
Vertical clearance (m)	4.5	N/A	4.5	4.5	4.5
Maximum grade <50 m	1 in 10	1 in 10	1 in 10	1 in 10	1 in 10
Minimum weight capacity (t)	15	15	15	15	15
Maximum crossfall	1 in 33	1 in 33	1 in 33	1 in 33	1 in 33
Curves minimum inner radius	8.5	8.5	8.5	8.5	8.5
* Refer to E3.2 Public roads: Trafficable surface					

Appendix D Water technical standards of the Guidelines

Reticulated areas	
Acceptable solution A4.1	The subdivision, development or land use is provided with a reticulated water supply in accordance with the specifications of the relevant water supply authority and Department of Fire and Emergency Services.
Explanatory note E4.1	Water supply authorities in Western Australia include the Water Corporation, Aqwest and the Busselton Water Board. The Water Corporation's 'No. 63 Water Reticulation Standard' is deemed to be the baseline criterion for developments and should be applied unless local water supply authorities' conditions apply.

Non-reticulated areas	
Acceptable solution A4.2	Water tanks for firefighting purposes with a hydrant or standpipe are provided and meet the following requirements: • Volume: minimum 50,000 litres per tank • Ratio of tanks to lots: minimum one tank per 25 lots (or part thereof) • Tank location: no more than two kilometres to the further most house site within the residential development to allow a 2.4 fire appliance to achieve a 20 minute turnaround time at legal road speeds • Hardstand and turn-around areas suitable for a type 3.4 fire appliance (i.e. kerb to kerb 17.5 metres) are provided within three metres of each water tank • Water tanks and associated facilities are vested in the relevant local government.
Explanatory note E4.2	A procedure must be in place to ensure that water tanks are maintained at or above the designated capacity, including home tanks on single lots, at all times. This could be in the form of an agreement with the local government and the fire service.

Appendix E City of Cockburn Firebreak Notice 2019/2020

Aboriginal and Torres Strait Islander people are warned that this website may contain images and voices of deceased persons.

Fire Control Order

Find on this page

- » Definitions
- » All property (vacant or developed) –less than 4,047m2
- » All property (vacant or developed) – 4,047m2 or greater
- » Firebreak Specifications
- » Additional Works
- » Fire Control Order Variations
- » Burning
- » Penalties
- » More Information and contact

City of Cockburn Fire Control Order - Effective from 10 May 2018

First and Final Notice

Pursuant to *Section 33* of the *Bush Fires Act 1954* owners or occupiers of land situated within the City of Cockburn are required by law to comply with the prescribed Fire Control Order here within.

All Property (vacant or developed) - less than 4,047m2

To reduce the fire hazard on your land and to comply with the requirements of this Fire Control Order you are required to:

1. Have all flammable materials such as dry grass and weeds slashed, mown or trimmed down by other means to a maximum height of 50mm across the entire property for the duration of this firebreak time; and
2. Remove all dead vegetation.

All property (vacant or developed) - 4,047m2 or greater

To reduce the fire hazard on your land and to comply with the requirements of this Fire Control Order you are required to:

1. Construct a firebreak (as defined within section 3 of this order) immediately inside all external property boundaries, this includes those adjacent to roads, drains, rail reserves and any public open space reserves
2. Remove all dead vegetation surrounding and over all habitable structures to a radius of 3 metres except living trees, shrubs, maintained grass and gardens under cultivation.

Firebreak Specifications

A firebreak is an area of land cleared of flammable material, installed to minimise the spread or extension of a fire and to provide suitable access for fire fighting vehicles. The standards of a compliant firebreak are as follows:

1. A firebreak must be constructed of bare earth, stone, or sealed surfaces and be clear of all flammable materials to create a 3 metre wide trafficable surface
2. Maintained grass may occupy a firebreak
3. Overhanging branches must be pruned to provide a 4 metre vertical clearance above the full width of the 3 metre firebreak surface
4. A firebreak must be a continuous trafficable surface for a fire fighting vehicle, clear of any obstructions and must not terminate in a cul-de-sac (dead end).

Additional Works

Regardless of land size and location, the City of Cockburn or its Authorised Officer(s) may require you to undertake additional work(s) on your property to improve access and/or undertake further works where in the opinion of that Authorised Officer(s), these works would be conducive to preventing the outbreak and/or the spread or extension of a fire.

Fire Control Order Variations

A variation will be considered where the owner and/or occupiers believe it is impractical to meet the compliance requirements of this Fire Control Order.

Approved structure's occupying a firebreak will not require a variation approval. However, a firebreak will be required to be installed as close as practical around the approved structure.

If approved, variations will be valid in perpetuity, unless a new variation has been approved or the property changes ownership.

The City of Cockburn reserves the right to review, amend or revoke an existing variation in writing at any time. Should a request to vary the Fire Control Order requirements on your property not be approved in writing, this Fire Control Order must be complied with as applicable in its entirety.

If you cannot comply with the above requirements you can complete the online firebreak variation application form.

Firebreak Variation Application Form

Approved: You must comply with the conditions of the approved variation.
Not approved: You must comply with the requirements of the Fire Control Order.

Burning

During the declared prohibited burning time, owners and/or occupiers must not undertake any bush or garden refuse burning activities.

During the declared restricted burning time only, owners and/or occupiers may:

1. Apply for a permit to burn the bush for bush fire risk mitigation purposes, by following the conditions imposed on a permit to burn as issued by an Authorised Officer.

2. In areas zoned rural by the Metropolitan Region Scheme you may undertake burning of leaves, tree branches, and other dry vegetation in piles no larger than $1m^3$ in size, without a permit to burn, subject to the following conditions:

3. No flammable material (other than that being burned) is to be within 5 metres of the fire at any time while the fire is burning

4. The fire is lit between 6pm and 11pm and is completely extinguished before midnight on the same day

5. At least one person is present at the site of the fire at all times until it is completely extinguished

6. When the fire is no longer required, the person ensures that the fire is completely extinguished by the application of water or earth.

During the unrestricted burning time, owners and/or occupiers in areas zoned rural under the Metropolitan Region Scheme may burn garden refuse and set fire to bush on their land without a permit 'To Set Fire To The Bush'. Burning of the bush must be in accordance with all relevant State legislative requirements.

Burning of garden refuse in areas not zoned rural should not be undertaken within the City of Cockburn, unless approved by an Authorised Officer. Burning of household waste is prohibited in all areas of the City of Cockburn.

Penalties

Failing to comply with this Fire Control Order will result in a penalty of up to $5,000. A person in default is also liable whether prosecuted or not to pay the costs of performing the work directed by a City's Authorised Officer.

Any owner and/or occupier who engages a contractor to undertake works on their behalf is responsible to ensure that the works completed meet the requirements of this Fire Control Order.

Definitions

Authorised Officer	A person appointed by the City of Cockburn Chief Executive Officer as an authorised person/officer to exercise the powers and duties set out in the Local Government Act 1995, Bush Fires Act 1954 and Local Law(s).

Definitions	
Flammable Material	Any dead or dry grass, vegetation, substance, object, thing or material (except living flora including live and/ or habitat standing trees) that may or is likely to catch fire and burn or any other thing deemed by an Authorised Officer to be capable of combustion.
Maintained Grass	Soil covered land, planted with grasses or other durable plants, maintained green and less than 50mm in height.
Prohibited Burning Time	The time of each year where it is unlawful to set fire to the bush at any time. This time is normally from 1 December of each year until and including 31 March of the following year. This time may be amended, subject to prevailing seasonal conditions.
Restricted Burning Time	The time of each year where it is unlawful to set fire to the bush without a valid Permit to Set Fire To The Bush issued by an Authorised Officer. This period is normally from 1 April until and including 31 May and from 1 October until and including 30 November of any year. This time may be amended, subject to the prevailing seasonal conditions.
Unrestricted Burning Time	The time of each year where it is lawful to set fire to the bush at any time, in areas zoned rural under the Metropolitan Region Scheme. This time is normally from 1 June until and including 30 September. This time may be amended, subject to the prevailing seasonal conditions.
Firebreak Time	The time of each year where fire hazard reduction works must be maintained as specified in this Fire Control Order. This time is 1 November of each year until and including 15 April of the following year.
Structure	A building, as defined in the Building Codes of Australia (BCA) may be made up of a number of classes if it has a mixed use.

Any Fire Control Order previously published by the City of Cockburn in the Government Gazette or in any Western Australian newsprint is hereby revoked.

By Order of Council

More information and contact

Please contact the City's Fire and Emergency Services for more information on firebreaks and burning permits on 08 9411 3444 or at customer@cockburn.wa.gov.au

Related Pages

- Fire and Emergency Management
- Fire Pits
- Prepare your home for Fire Season
- Proposed Prescribed Burning Areas
- Water Suppliers for Fire Fighters
- Cockburn Emergency Management Plans
- Home Emergency Plan

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Final Report	**Rev 0**	**For approval**	**Linden Wears (BPAD 19809, Level 3)**	**Linden Wears (BPAD 19809, Level 3)**	**24 April 2020**

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APPENDIX 3

ENVIRONMENTAL ASSESSMENT REPORT

ROWE GROUP DESIGN

360 environmental

Part Lots 11 and 74 Gibbs Road Banjup

Local Structure Plan: Environmental Assessment Report

Prepared for

Aigle Royal Development

April 2020

people • planet • professional

Document Reference	Revision	Prepared by	Reviewed by	Admin Review	Submitted to Client	
					Copies	Date
1350AN_Rev0	Internal Draft	KAC	TS	-	1 x electronic	
1350AN_Rev1	Client Draft	KAC	-	NL	1 x electronic	17/03/2020
1350AN_Rev2	LSP Design and text update	KAC	-	NL	1 x electronic	08/04/2020
1350AN_Rev3	Text update	KAC		SH	1 x electronic	22/04/2020

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Executive Summary

360 Environmental Pty Ltd has been engaged by Aigle Royal Developments (the proponent) to prepare an Environmental Assessment Report (EAR) to support urban development within part Lots 11 and 74 Gibbs Road, Banjup (approximately 7.27 ha) ('the site') (Figure 1). The site is located in City of Cockburn, approximately 24 km south of Perth.

The site is currently zoned 'Urban Deferment' and 'Rural- Water Protection' under the Metropolitan Region Scheme (MRS) and 'Development Zone' and 'Resource Zone' under the City Local Planning Scheme (LPS) No. 3 (Figure 2).

The Lifting of 'Urban Deferment' under the MRS Amendment will be initiated to facilitate development on site in accordance with the proposed Local Structure Plan (LSP). Under the City's LPS the current zoning 'Development Zone' permits the proposed land use (Figure 2). It is understood that road reserves and Public Open Space (POS) are applicable land uses under the Rural (MRS) and Resources (LPS) zonings.

The proposed Local Structure Plan (LSP) has been developed for the site and includes the following:

- Residential lots (traditional and laneway product)
- Active and restricted Public Open Space (includes drainage)
- Ecological Corridor.

Key Environmental Aspects

Wetlands

The entire site is mapped as within the Gibbs Road Swamp System wetland listed under the Directory of Nationally Important Wetlands (DoE 2008). The Gibbs Road system wetland mapping covers a total area of 70 ha which includes large areas of residential developments, small rural landholdings and conservation areas. The Directory of Nationally Important Wetlands is not protected by any legislative mechanism; however, it is acknowledged and considered for future planning and development. There are no Department of Biodiversity Conservation and Attractions (DBCA) geomorphic wetland within the site. A Conservation Category Wetland (CCW) (UFI 12984) and Multiple Use Wetland (MUW (UFI 6657) located adjacent to the LSP area.

The 50m CCW buffer impinges the southern section of the site.

Jandakot Underground Water Pollution Control Area

The site forms part of the Jandakot Underground Water Pollution Control Area (UWPCA) and is classified as Priority 3. The identified LSP land uses and their compatibility within a P3 area are Residential Area: acceptable (connected to deep sewerage) and Public Open Space (POS) (unrestricted): compatible with conditions.

A LWMS has been prepared and addresses the water management requirements for future development.

Remnant Vegetation

The site contains 5.98 ha of remnant vegetation which consists of Floristic Community Type (FCT) representative of the Threatened Ecological Community: Banksia Woodlands of the Swan Coastal Plain. The proposed development will involve the clearing of 4.71 ha and the retention of 1.27 ha within the CCW buffer and ecological linkage. It is proposed that the ecological linkage which contains Banksia Woodlands TEC in 'Excellent' condition will be retained on site.

Additional management measures will be implemented through management plans and at subsequent stages of planning.

Black Cockatoo Habitat

The site contains 6.02 ha of Black Cockatoo foraging habitat and four potential breeding trees. The project will involve the clearing of 4.93 ha of foraging habitat and five potential breeding trees. However, 1.09 ha of foraging habitat will be retained in CCW buffer and proposed ecological linkage. Subject to engineering [cut and fill] specifications and assessment against AS 4970-2009, further black cockatoo foraging habitat may be viable for retention within the proposed LSP POS and road reserves.

The maintenance of this ecological corridor will allow continued movement of fauna species through the landscape, particularly to the CCW as a potential watering source.

Additional mitigation and management measures will be implemented through management plans and at subsequent stages of planning.

Environmentally Sensitive Areas

The site is mapped as an Environmentally Sensitive Area (ESA) which relates to the Gibbs Road Swamp System and its associated buffers. ESA's are protected by legislation and areas within the extent of an ESA are not subject to native vegetation clearing exemptions (such as exemptions associated with subdivision approval).

Hydrology and Water Quality

A Local Water Management Strategy (LWMS) has been developed by Ochre West to support the LSP processes. The LWMS provides management strategies to ensure hydrological flows and regimes reflect predevelopment flows of the site and prevent water quality degradation from the development.

Environmental Outcomes

Future residential development through the implementation of the LSP will deliver the following key environmental outcomes:

- Provision of an ecological linkages in the southern section of the site which provides a continues linkage from the adjacent Bush Forever Site/Jandakot Regional Park and

remnant vegetation and CCW located east of the site. The interface with the linkage and development area will be fenced

- The development will be fenced along the interface with the adjacent Bush Forever site to provide protection of fauna and fauna habitat (i.e. black cockatoo)
- Incorporation of a 50m buffer to the adjacent CCW
- Development and implementation of environmental management plans (i.e. Fauna Management and Relocation Plan and Vegetation and Wetland Buffer Management Plan) will ensure the long-term management and viability of the proposed conservation areas
- Application of water management initiatives and a framework to the guide future development of the site to ensure water sensitive urban design is achieved. This will be done through a combined DLWMS and an Urban Water Management Plan (UWMP).

Other environmental issues (such as acid sulfate soils, potential contamination, etc.) are capable of being resolved (i.e. avoided or managed) through site-specific investigations and detailed engineering drainage design.

A significant environmental outcome of the proposed LSP is maintaining the ecological corridor between the adjacent Bush Forever Site 492 and CCW.

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1 Introduction

1.1 Background

360 Environmental Pty Ltd has been engaged by Aigle Royal Developments (the proponent) to prepare an Environmental Assessment Report (EAR) to support urban development within part Lots 11 and 74 Gibbs Road, Banjup (approximately 7.27 ha) ('the site') (Figure 1). The site is located within City of Cockburn, approximately 24 km south of Perth

The site is currently zoned 'Urban Deferment' and 'Rural- Water Protection' under the Metropolitan Region Scheme (MRS) and 'Development Zone' and 'Resource Zone' under the City Local Planning Scheme (LPS) No. 3 (Figure 2).

The Lifting of 'Urban Deferment' under the MRS Amendment will be initiated to facilitate development on site in accordance with the proposed Local Structure Plan (LSP). Under the City's LPS the current zoning 'Development Zone' permits the proposed land use (Figure 2). It is understood that road reserves and Public Open Space (POS) are applicable land uses under the Rural (MRS) and Resources (LPS) zonings.

1.2 Environmental Assessment Objectives

The objective of this EAR is to provide an overview of the general environmental features of the site, identify the key environmental issues and the potential impacts associated with the proposed development and the measures proposed to manage these impacts.

1.3 Proposed Local Structure Plan

An Indicative Concept Plan, has been developed for the site and includes the following:

- Residential lots (traditional and laneway product)
- Active and restricted Public Open Space (includes drainage)
- Ecological Corridor.

1.4 Other Documentation

A Bushfire Management Plan (BMP) and Local Water Management Strategy (LWMS) has been developed to support the LSP. These documents should be read in conjunction with this EAR.

2 Key Legislation and Policies

2.1 Federal

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is the central piece of environmental legislation which protects Matters of National Environmental Significant (MNES) and broadly, to conserve Australia's biodiversity. If a proposed action is likely to have a significant impact on any MNES, a referral to the Commonwealth Department of Agriculture Water and Environment (DAWE) (formally known as the Department of Environment and Energy -DEE) may be warranted.

A proposed action which included the development of the site was referred under the EPBC Act (ref 2017/7923) for DAWE assessment, which was deemed a 'Controlled Action' and assessment by Preliminary Documentation (PD) which includes an offset strategy (Appendix A). It was determined that the proposed action is likely to, or may, have a significant impact on the following MNES:

- Banksia Woodlands of the Swan Coastal Plain (SCP) Threatened Ecological Community (TEC) – Endangered
- Carnaby's Cockatoo (*Calyptorhynchus latirostris*) – Endangered
- King Spider-orchid (*Caladenia huegelii) - Endangered*
- Dwarf Hammer-orchid (*Drakaea micrantha*) - Vulnerable.

The public comment period for the PD closed on the 24 March 2020. The PD approvals process is continuing with the DAWE.

2.2 State

The *Environmental Protection Act 1986* (EP Act) is the key legislative tool for environmental protection in Western Australia. Under Part IV of the EP Act, the Environmental Protection Authority (EPA) EPA undertakes environmental impact assessment of proposals and schemes to provide advice on environmental acceptability of developments. The lifting of 'Urban Deferment' is typically not referred to the EPA for assessment. The Western Australian Planning Commission (WAPC) may seek comment from the EPA during the lifting processes under the *Planning and Development Act 2005*.

All future development will be required to comply with the requirements of other relevant state legislation and regulations. Table 1 provides a summary of the key state legislation and regulations relevant to the proposed residential development.

Table 1: Legislation

Key Legislation	Responsible Government Agency	Aspect
Aboriginal Heritage Act 1972	Department of Planning, Lands and Heritage	Archaeological and ethnographic heritage

Key Legislation	Responsible Government Agency	Aspect
Biodiversity Conservation Act 2016 (BC Act)	Department of Biodiversity Conservation and Attractions	Listing of and protection of native species, threatened species, ecological communities, fauna, critical habitat and threatening processes
Biosecurity and Agriculture Management Act 2007 (BAM Act)	Department of Primary Industries and Regional Development	Weeds / pests / diseases
Bush Fires Act 1954	Department of Fires and Emergency Services	Bush fire control
Environmental Protection Act 1986 (EP Act)	Environmental Protection Authority Department of Water and Environmental Regulation	Part IV – Environmental Impact Assessment Part V – Works Approvals and Licences, Clearing Permits
Environmental Protection (Clearing of Native Vegetation) Regulations 2004	Department of Water and Environmental Regulation	Clearing of native vegetation
Contaminated Sites Act 2003	Department of Water and Environmental Regulation	Management of contaminated soils and water
Conservation and Land Management Act 1984	Department of Biodiversity Conservation and Attractions Department of Agriculture	Flora and fauna / habitat / weeds / pests / diseases

The following table details the key standards, guidelines and State Planning Policies relevant to the site.

Table 2: Relevant Policies and Guidelines

Document	Description
EPA Policies and Guidance	
Statement of Environmental Principles, Factors and Objectives (EPA 2016a)	This statement communicates the EPA considers the object and principles of the EP Act, uses environmental factors and objectives to organise and systemise environmental impact assessment, taking a holistic view of the environment and considering significance of a proposal.
Environmental Factor Guideline – Flora and Vegetation (EPA 2016b)	Provides guidance to protect flora and vegetation so that biological diversity and ecological integrity are maintained.
Environmental Factor Guideline – Terrestrial Environmental Quality (EPA 2016c)	Provides guidance with the objective to maintain the quality of land and soils so that environmental values are protected.
Environmental Factor Guideline – Terrestrial Fauna (EPA 2016d)	Provides guidance with the objective to protect terrestrial fauna so that biological diversity and ecological integrity at maintained.
Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment (EPA 2016e)	Provides technical guidance to ensure adequate flora and vegetation data of an appropriate standard are obtained and used in environmental impact assessment.
Technical Guidance – Terrestrial Fauna Surveys (EPA 2016)	Provides technical on the direction and information on general standards and protocols for terrestrial fauna surveys for environmental impact assessment.

Document	Description
Guidance Statement No. 33: *Environmental Guidance for Planning and Development* (EPA 2008)	Provides information and advice to assist land use planning and development processes to protect, conserve and enhance the environment. Describes the processes the EPA may apply under the EP Act to land use planning and development in Western Australia, and the environmental impact assessment process applied by the EPA to schemes.
WA Environmental Offsets Policy (EPA 2011)	Seeks to protect and conserve environmental and biodiversity values for present and future generations. The policy ensures that economic and social development may occur while supporting long term environmental and conservation values.
EPA Bulletins	
Environmental Protection Bulletin No. 1: *Environmental Offsets* (EPA, 2011)	Clarifies how the EPA will consider offsets through the environmental impact assessment process.
State Planning Policies	
State Planning Policy 2.3: Jandakot Groundwater Protection Policy (WAPC 2003)	Provides policy framework to ensure protection of the Jandakot Groundwater Protection areas from development and land uses that may have a detrimental impact on the water resource.
State Planning Policy 2.7: Public Drinking Water Source	Addresses land use and development in public drinking water supply areas (PDWSA).
State Planning Policy 2.8: *Bushland Policy for the Perth Metropolitan Region* (WAPC 2010)	Provide policy and implementation framework that will ensure bushland protection and management issues in the Perth Metropolitan Region are appropriately addressed and integrated with broader land use planning and decision making. Ensure the long-term protection of biodiversity and associated environmental values.
State Planning Policy 2.9: Water Resources (WAPC 2006)	Provides clarification and additional guidance to planning decision-makers for consideration of water resources identified as having significant economic, social, cultural or environmental values.
State Planning Policy 3.7: *Planning in Bushfire Prone Areas* (WAPC 2015)	Provides guidance on the implementation of effective risk-based land use planning and development to preserve life and reduce the impact of bushfire on property and infrastructure.

2.3 Local

The City of Cockburn has Local Planning Policies (LPP) which are guidelines used to assist Council in making decisions under the City's LPS. Due regard to the LPPs and their application should be considered for the LSP.

2.3.1 Public Open Space-LLP 5.1

This policy applies to the assessment of structure plan proposals in relation to POS reserves within the City of Cockburn (2019). This Policy identifies such land features which will not be accepted by the City as part of the POS requirement, including separate matters pertaining to bushfire risk matters.

This policy states that the City will not accept bushfire protection areas within areas of natural bushland that are existing or proposed to be revegetated through rehabilitation as part of undertaking subdivision and development on the land.

The City discusses that land where public access is incapable, restricted or denied will not be accepted by the City as part of any public open space.

The application of the policy may be applicable for the CCW Buffer (50m) which partly impinges the south eastern section of the site.

2.3.2 Incorporating Natural Areas in Public Open Space and/or Drainage Areas- LLP 5.2

Natural Areas which include wetlands and their buffers and bushland and are commonly located within in POS and/or drainage reserves are managed and maintained by the City after handover from developer/landowner (City of Cockburn 2019a).

One of the LLP objectives is to require that development adjacent to wetlands be suitably set back from the wetland boundary to allow for the retention of the wetland dependent vegetation and to maintain its environmental values and functions.

It is noted by the City that where development includes or is adjacent to a wetland, buffers are provided and managed to protect and maintain wetland values. The City will apply buffer distances as outlined in Department of Environment and Department of Planning wetland buffer guidelines. A 50m buffer is generally required (City of Cockburn, 2019a).

There is a CCW located west of the site, as part of the LSP design a 50 m wetland buffer has been provided to maintain the wetlands values and function. The 50 m buffer intrudes the site and will be fenced to reduced uncontrolled access. For further information refer to Section 4.

2.3.3 Control Measures for Protecting Water Resources in Receiving Environments- LLP 5.3

The purpose of this policy is to ensure drainage generated from subdivision can be controlled through best practice water sensitive urban design to protect of water resources in receiving environments (City of Cockburn, 2019b).

A LWMS has been developed in accordance with the Stormwater Management Manual of Western Australia (Department of Water), the LWMS sets out current best management principles and practices in relation to stormwater management for the LSP.

2.3.4 Uniform Fencing- LLP 5.7

Uniform fencing is generally required where development of land abuts the public domain including roads and public open space. Uniform Fencing abutting POS should consist of the following:

1. Uniform fencing abutting POS shall provide visually permeable infill panels to promote passive surveillance.

2. Minor portions of solid uniform fencing may be permitted to screen some areas of residential land including drying areas.

3. Pedestrian access gates (and stairs if required) are encouraged to be constructed as part of the uniform fencing between residential lots and POS to encourage use of the POS by the adjoining residents.

Due regard to the above specification will be given within subsequent vegetation and wetland and buffer management plans for the site.

3 Existing Environment

3.1 Topography and Geology

The topography of the site sits at an elevation of between 32 m Australian Height Datum (AHD) in the central portion of the site, to 27 m AHD in the northern and south eastern portion of the site to 34 m (DoW 2012) (Figure 3).

Surfacing geology profile mapping at 1:250 000 indicates the geology of the project area is typically defined as Bassendean sand: basal conglomerate overlain by dune quartz sand with heavy mineral concentrations, Aeolian coastal sediment(Department of Agriculture and Food WA (DWFWA), 2012).

The site is within the Bassendean Land System (DAFWA 2012):

- Bassendean System: Sand dunes and sandplains with pale deep sand, semi-wet and wet soil. Banksia-paperbark woodlands and mixed heaths.

The Department of Agriculture and Food WA (DAFWA) Soil Subsystems mapping indicates that the site falls within the Bassendean System and within five soil subsystems (DAFWA 2006). These subsystems are described below and displayed in Figure 3.

- Bassendean B2 Phase - Deep bleached grey sands with a pale yellow B horizon or a weak iron-organic hardpan 1-2 m
- Bassendean B3 Phase - Moderately deep, bleached sands with an iron-organic pan, or clay subsoil. Surfaces are dark grey sand or sandy loam.

3.2 Acid Sulphate Soils

Department of Water and Environmental Regulation (DWER) regional mapping indicates that the site is mapped as moderate to low risk of Acid Sulphate Soils (ASS) disturbance within <3m below the natural ground surface (Figure 4).

3.3 Hydrology

3.3.1 Groundwater

Pre-development groundwater monitoring was undertaken by Bioscience between September 2011 and September 2014. Results from the groundwater monitoring program found that the Average Annual Maximum Groundwater Level (AAMGL) ranges from 25.2 m AHD in the southern central portion of the site to 25.85 m AHD in the north-western portion of the site (Figure 5) (Ochre West 2017).

Based on existing topography and DWER maximum regional groundwater contours AAMGL groundwater contours, the depth to groundwater within the site ranges from approximately from 4.8 metres below ground level (mbgl) in the northern part of the site, 8 mbgl in the centre of the site and approximately 2.8 mbgl in the eastern section of Lot 74 (within the wetland buffer) (Department of Water and Environmental Regulation, 2019).

Information sourced from DWER identify aquifers underlying the site; each assigned the name of the major geological unit in which the aquifer occurs (Department of Water and Environmental Regulation, 2019b). In descending order of depth from natural surface they are:

- Perth Superficial Swan (Banjup): Allocation Available
- Perth Yarragadee North Aquifer (Jandakot confined): Limited Information.

There is current one licence to take groundwater within the site. Details of the licence are provided in Table 3.

Table 3: Groundwater Licences

Licence No.	Location	Allocation	Expiry
163844 Elite Developments (WA) Pty Ltd	11, BEENYUP RD, BANJUP	23,400 KL	14/08/2027

3.3.2 Public Drinking Water Source Areas

The site is within Priority 3 (P3) Public Drinking Water Source Area (PDWSA) of the Jandakot Underground Water Pollution Control Area (UWPCA) (Department of Water, 2016b) and is therefore subject to the provisions of the Statement of Planning Policy No. 2.3- *Jandakot Groundwater Protection Policy and Department of Water (DoW) Water Quality Protection Note No. 25*. P3 areas are defined and managed to maintain the quality of the drinking water source for as long as possible with the objective of risk management. P3 areas occur within PDWSAs where the land is zoned for urban and commercial or light industrial uses (Department of Water, 2016a).

Department of Water (2016) sets out 'protection zones' that are defined in the immediate vicinity of drinking water extraction points, as these areas are the most vulnerable to contamination (DoW 2016). Protection zones can be located within P1, P2 or P3 areas. There are two types of protection zones: wellhead protection zones (WPZs) defined for groundwater sources; and reservoir protection zones (RPZs) defined for surface water sources (DoW 2016).

No WPZs or RPZs exist in the vicinity of the site that requires a 'buffer' from urban development (DoP 2017).

3.3.3 Surface Water and Wetlands

There are no mapped open water bodies or drainage lines within the site. There are no mapped geomorphic wetlands within the site. There is a Conservation Category Wetland (CCW) (UFI 12984) and Multiple Use Wetland (MUW (UFI 6657) located adjacent to the LSP area.

Wetland categories and their management objectives are described within Table 4 below:

Table 4: Wetland Categories and Management Objectives (Western Australian Planning Commission, 2005)

Category	Category Description	Management Objective
Conservation Category	High conservation and ecological value	To preserve the wetlands (natural) attributes and functions
Multiple Use	Little remaining important wetland attributes, functions and ecological value	To use, develop and manage wetlands in the context of water, town and environmental planning

The EPA recommends a minimum 50 m wetland buffer to CCWs. While it is noted that generic 50 m buffer is generally applicable to CCW to protect the wetlands ecosystem, a site buffer assessment can be undertaken to determine the buffer widths (Environmental Protection Authority, 2008).

The wetlands (CCW [UFI 12984] and MUW [UFI 6657] are not listed as Ramsar sites. The entire site and the wider surrounding environment are mapped as the Gibbs Road Swamp System under the Directory of Nationally Important Wetlands (Australian Government, 2010).

3.4 Flora and Vegetation

3.4.1 Overview

The site is located within the Swan Coastal Plain (SCP) bioregion of the Interim Biogeographic Regionalisation of Australia (IBRA) of the Southwest botanical district. The Swan Coastal Plain 2 (SWA02) sub-region is an area composed of colluvial and Aeolian sands, alluvial river flats, coastal limestone. Heath and Tuart woodlands on limestone, Banksia and Jarrah-Banksia woodlands on Quaternary marine dunes of various ages, Marri on colluvial and alluvial and includes a complex series of seasonal wetlands (Mitchell, Williams, & Desmond, 2002).

There is one vegetation association mapped across the site which includes, 1001 (e2Mb cbLi) – Bassendean; Medium very sparse woodland; *E. marginata* with low woodland, Banksia sp. and Casuarina sp. Its representation within the site, subregion and state is shown in Table 5.

Table 5: Broad Vegetation Type within the Site and its State and Regional Representation (Government of Western Australia, 2019)

	Pre-European Area (Ha)	Current Extent (Ha)	Remaining (%)	Current Extent in DBCA Reserves (%)
Statewide				
1001	57,410.23	12,660.76	22.05	14.19
IBRA Region Swan Coastal Plain				
1001	57,410.23	12,660.76	22.05	14.19
Local Government Authority – City of Cockburn				
1001	7,328.39	2,002.93	27.33	14.92

Vegetation complexes of the SCP have been mapped by Heddle et al. (1980). The site contains one vegetation complex which relates to the underlying soil profile, its representation is provided in Table 6:

- 'Bassendean Complex - Central and South': vegetation ranging from woodland of *Eucalyptus marginata - Allocasuarina fraseriana* - Banksia spp. to low woodland of Melaleuca spp. and sedgelands on the moister sites. This area includes the transition of *Eucalyptus marginata* to *Eucalyptus todtiana* in the vicinity of Perth.

Table 6: Broad Vegetation Complex within the Site and its State and Regional Representation (Government of Western Australia, 2019)

	Pre-European Area (Ha)	Current Extent (Ha)	Remaining (%)	Current Extent in DBCA Reserves (%)
Swan Coastal Plain				
Bassendean Complex - Central and South'	87,476.25	23,508.66	26.87	2.15
Perth Metropolitan Region				
Bassendean Complex - Central and South'	46,278.61	10,175.29	21.99	3.54

Within constrained areas on the SCP (i.e. PMR), the EPA Guidance Statement 33: Environmental Guidance for Planning and Development has set a threshold for retention of 10% of the pre-existing extent of native vegetation (EPA, 2008). Based on the Government of Western Australia (2019) data presented in Table 5 and Table 6 the current vegetation extents are greater than the above-mentioned 10% threshold.

3.4.2 Site Survey

360 Environmental undertook a Detailed (Level 2) Flora and Vegetation Survey of the site on the in September 2015. The complete Flora and Vegetation report can be found in Appendix B. The flora survey was undertaken within the recommended season and flowering period for the south west botanical province.

A subsequent Targeted Flora survey was undertaken in October 2017 by a Senior Botanist to identify the presence of any conservation significant flora species identified as Likely to occur within the 2015 survey and perennial orchids that are difficult to detect (*Caladenia huegelii* and *Drakaea micrantha*). From the 2017 survey, the vegetation condition within the site was re-assessed and the condition rescored from the original survey in 2015 (Appendix C).

3.4.3 Threatened and Priority Flora

A 2 km radial DBCA NatureMap and DAWE Protected Matters Search Tool (PMST) was undertaken. The NatureMap and PMST databases identified 13 conservation significant flora species as potentially occurring in the vicinity of the site. Of these eight are classed as Threatened, one as Priority 3 and four as Priority 4 (Appendix D).

The likelihood of occurrence of conservation significant flora species was determined by comparing the plant species requirements to the vegetation descriptions obtained from a Level 2 Flora and Vegetation Survey of the site. The likelihood assessment determined that of the 13 Conservation significant species (listed under the EPBC Act and the BC Act 2016) flora as potentially occurring in the vicinity of the site. Of this, there are eight considered likely or possible to occur on the site (Table 7) (360 Environmental 2016).

Table 7: Conservation Significant Flora Potentially Occurring within 2 km of the Site

Species	EPBC Act Listing	BC Act Listing	Likelihood
Caladenia huegelii	Threatened	Threatened	Likely
Diuris purdiei	Endangered	Threatened	Possible
Diuris drummondii	Vulnerable	Threatened	Possible
Drakaea elastica	Endangered	Threatened	Possible
Drakaea micrantha	Vulnerable	Threatened	Possible
Lepidosperma rostratum	Endangered	Threatened	Possible
Jacksonia gracillima	-	Priority 3	Likely
Verticordia lindleyi subsp. lindleyi	-	Priority 4	Possible

The 2016, Detailed (Level 2) Flora and Vegetation Survey did not identify any Priority species as listed by DBCA or Threatened Species as listed under the EPBC Act or BC Act (previously known as the *Wildlife Conservation Act 1950*). In addition, the DBCA database did not identify any conservation significant flora species within the site (360 Environmental 2016) (Appendix B).

360 Environmental conducted a Targeted Flora Survey for the King Spider-orchid (*Caladenia huegelii*), the Dwarf Hammer-orchid (*Drakaea micrantha*) and other conservation significant flora species identified as likely to occur within the site. The targeted flora survey was undertaken on 11 October 2017 during the optimal flowering period for these species (September and October) (360 Environmental 2018).

The site was sufficiently surveyed by an experienced Principal Botanist. No Threatened species pursuant to the EPBC Act or BC Act or Priority listed species were recorded during the targeted survey (Appendix C).

3.4.4 Vegetation Types

Five vegetation types were recorded on the site; their extents and descriptions are provided in Table 8 and represented in Figure 6.

Table 8: Vegetation Types (360 Environmental, 2016)

Vegetation Type	Description	Area (ha)
BaBm(a)*	Low Woodland of *Banksia attenuata, Banksia menziesii, Allocasuarina fraseriana, Eucalyptus marginata* over *Kunzea glabrescens, Acacia pulchella, Hibbertia hypericoides, Xanthorrhoea preissii, Bossiaea eriocarpa and Conostylis aculeata.*	1.67
BaBm(b)*	Low Woodland of *Banksia attenuata, Banksia menziesii, Allocasuarina fraseriana* over *Kunzea glabrescens, Dasypogon bromeliifolius, Hibbertia subvaginata, Calytrix fraseri* and *Bossiaea eriocarpa*.	1.92
AfEmBi*	Open Woodland of *Allocasuarina fraseriana*, *Eucalyptus marginata* and *Banksia ilicifolia* over *Xanthorrhoea preissii*, *Dasypogon bromeliifolius, Bossiaea eriocarpa, Gompholobium tomentosum* and *Phlebocarya ciliata.*	0.70
BiKg*[1]	Woodland of *Banksia ilicifolia* and *Banksia attenuata* over *Kunzea glabrescens*, *Xanthorrhoea preissii*, *Dasypogon bromeliifolius* and *Desmocladus flexuosus*.	1.12

[1] *Vegetation types which represent Banksia Woodland SCP TEC, refer to Section 2.4.5 for further information.

Vegetation Type	Description	Area (ha)
Ec*	Ecotone of *Banksia ilicifolia* and *Banksia menziesii* over *Kunzea glabrescens, Dasypogon bromeliifolius* and *Phlebocarya ciliata.*	0.57
C	Cleared.	0.72
G/O	Garden and Orchard	0.57
TOTAL		**7.27**

3.4.5 Vegetation Condition

Vegetation condition within the site ranged from 'Completely Degraded' to 'Excellent' (360 Environmental 2016) (Figure 7). Historical vegetation clearing, weeds, housing, a nursery and the presence of tracks in the site were the most frequently observed impacts on native vegetation. A major portion of the site (30%) was mapped to be in 'Good' condition, with 19% mapped as 'Degraded' to 'Completely Degraded' (Table 9).

Table 9: Vegetation Condition (360 Environmental, 2016)

Vegetation Condition	Area (ha)
Excellent	1.05
Excellent - Very Good	0.84
Very Good - Good	1.73
Good	2.21
Degraded	0.15
Completely Degraded	1.29
Total	**7.27**

3.4.6 Threatened and Priority Ecological Communities

The results from the Detailed (Level 2) Flora and Vegetation Survey (2015) was used to identify if any Threatened Ecological Communities (TECs) occur on the site (Appendix C) (360 Environmental 2018).

The statistical analysis identified vegetation associations; BaBm(a), AfEmBi, BiKg, BaBm(b) as having the most affiliation to the following Floristic Community Types (FCT):

- SCP 21a: Central *Banksia attenuata-Eucalyptus marginata* woodlands
- SCP21c: Low lying *Banksia attenuata* woodlands or shrublands
- SCP 23s: Central *Banksia attenuata-Banksia menziesii* woodlands.

These FCTs are listed as sub-communities of the Banksia Woodland SCP TEC (DotEE 2016). The site contains approximately 5.84 ha of TEC, which are all of the mapped vegetation types (refer to Table 8).

3.4.7 Weeds

A total of 27 introduced species were recorded during the Detailed (Level 2) Flora and Vegetation Survey undertaken in 2015. Two species **Asparagus asparagoides* (Bridal Creeper) and **Zantedeschia* aethiopica (Arum Lily) are listed as Declared under the *Biosecurity and Agriculture Management Act 2007* (BAM Act). One species, **Asparagus asparagoides* (Bridal Creeper) is listed as a Weed of National Significance (WONS) (360 Environmental, 2016).

Table 10: Weed Species Identified within the Site and Their Status (360 Environmental 2016)

Species	Common Name	WONS	BAM Act
**Acacia iteaphylla*	Flinders Ranges Wattle	-	s11 permitted
**Acacia longifolia*	Sydney Golden Wattle	-	s11 permitted
**Arctotheca calendula*	Cape Weed	-	s11 permitted
**Avena barbata*	Bearded Oat	-	s11 permitted
**Asparagus asparagoides*	Bridal Creeper	Yes	s22(2) (C3)
**Briza maxima*	Blowfly Grass	-	s11 permitted
**Carpobrotus edulis*	Pigface	-	s11 permitted
**Cotula coronopifolia*	Waterbuttons	-	s11 permitted
**Crassula natans var. minus*	-	-	-
**Cyperus tenellus*	Tiny Flat-Sedge	-	s11 permitted
**Ehrharta calycina*	Perennial Veld Grass	-	s11 permitted
**Ehrharta longiflora*	Annual Veld Grass	-	s11 permitted
**Eragrostis curvula*	African Lovegrass	-	s11 permitted
**Euphorbia terracina*	Geraldton Carnation Weed	-	s11 permitted
**Fumaria capreolata*	Whiteflower Fumitory	-	s11 permitted
**Galium murale*	Small Bedstraw	-	s11 permitted
**Gladiolus caryophyllaceus*	Wild Gladiolus	-	s11 permitted
**Hypochaeris glabra*	Smooth Cats ear	-	s11 permitted
**Juncus capitatus*	-	-	s11 permitted
**Lysimachia arvensis*	Pimpernel	-	s11 permitted
**Pelargonium capitatum*	Rose Pelargonium	-	s11 permitted
**Romulea rosea var. australis*	Guildford Grass	-	s11 permitted
**Sonchus oleraceus*	Common Sowthistle	-	s11 permitted
**Trifolium sp.*	Hop Clover	-	s11 permitted

Species	Common Name	WONS	BAM Act
**Ursinia anthemoides*	Ursinia	-	s11 permitted
**Vulpia bromoides*	Squirrels Tail Fescue	-	s11 permitted
**Zantedeschia aethiopica*	Arum Lily	-	s22(2) (C3)

3.5 Fauna and Habitats

3.5.1 Overview

DBCA NatureMap and DAWE Protected Matters Search Tool (PMST) was undertaken with a 2 km buffer (Appendix D). As there are no open water bodies/ wetland on the site marine and migratory birds have not been further discussed due to the absence of suitable habitat on site. The site mainly consists of terrestrial habitat associated with Banksia woodlands.

Table 11: Conservation Significant Fauna Species Likelihood Assessment

Species	State Status	EPBC Act Status	Likelihood	Likelihood justification*
Botaurus poiciloptilus (Australasian Bittern)	Endangered	Endangered	Unlikely	Not found within a 5km NatureMap Search.
Calyptorhynchus banksii subsp. *naso* (Forest Red-tailed Black Cockatoo)	Vulnerable	Vulnerable	Likely	Not found within 2km NatureMap Search; however suitable habitat present (Eucalypt woodland) and in species known distribution.
Calyptorhynchus latirostris (Carnaby's Cockatoo)	Endangered	Endangered	Likely	Found within a 2km NatureMap Search. Suitable habitat present (Banksia and Eucalypt woodland) and in species known distribution.
Dasyurus geoffroii (Chuditch)	Vulnerable	Vulnerable	Possible	Not found within 2km NatureMap Search, however suitable habitat on-site (Eucalypt woodland).
Leipoa ocellata (Malleefowl)	Vulnerable	Vulnerable	Unlikely	Not found within 5 km NatureMap Search.
Rostratula australis (Australian Painted Snipe)	Endangered	Endangered	Unlikely	Not found within 5km NatureMap Search.
Isoodon obesulus spp. fusciventer	Priority 4	-	Likely	Found within a 2km NatureMap Search. Suitable

Species	State Status	EPBC Act Status	Likelihood	Likelihood justification*
(Southern Brown Bandicoot; Quenda)				woodland habitat with sandy soils on site. The WALGA (2019) Environmental Planning tool maps the site as potential Quenda habitat.
Lerista lineata (Perth Slider, Lined Skink)	Priority 3	-	Likely	Found within the Jandakot area. Suitable woodland habitat with sandy soils on site.

3.5.2 Black Cockatoos

A Black Cockatoo Habitat Assessment was undertaken on 9 February 2017 and a follow up site visit was undertaken on 11 October 2017 to confirm the presence and size of tree hollows (Appendix E). The initial assessment identified that the site is mainly composed of Eucalypt Woodlands and Banksia Woodlands which are known habitats of three species of the Black Cockatoo (Figure 8). The site is not currently utilised by black cockatoos for breeding. The primary value of the area is a foraging resource for the Carnaby's cockatoo (360 Environmental 2017).

3.5.2.1 Foraging Habitat

Carnaby's Cockatoos feed on a variety of seeds, nuts and flowers from a range of native and exotic plants. Food plants include a number of Banksia species, Pine trees, Marri, Jarrah and Allocasuarina (Shah, 2006; Johnstone & Storr, 1998). The Forest Red-tailed Black Cockatoo (FRTBC) feeds primarily on Marri and Jarrah Fruit which makes up 90% of the diet (Johnstone & Kirkby 1999; Cooper et al., 2002). Baudin's Black Cockatoo forages primarily in Eucalypt forest, where it feeds on Marri seeds, flowers, nectar and buds. They also feed on a wide range of seeds from other Eucalypt and Banksia species and Pines (Johnstone & Storr 1998).

Approximately 6.01 ha of black cockatoo foraging habitat is within the site and consists of the following:

- 4.45 ha: Banksia Woodland
- 1.56 ha: Eucalyptus Woodland.

3.5.2.2 Potential Breeding Habitat

Black Cockatoos breed in large hollow-bearing trees, generally within woodlands or forests (Johnstone et al. 2013). The size of the tree can be a useful indication of the hollow-bearing potential of the tree. Trees of suitable DBH (>500mm diameter breast height [DBH] are potentially important for maintaining breeding in the long-term, through maintaining the integrity of the habitat and allowing trees to provide future nest hollows. The potential breeding trees have been placed in one of the following size categories:

- A = 500 – 1000 mm DBH or
- B = 1000 – 2000 mm DBH.

The black cockatoo habitat assessment and follow-up site visit identified five potential black cockatoo breeding trees (360 Environmental 2017). Two of the five trees were stags one of which contained hollows not utilized by Carnaby's cockatoo (Appendix E). 360 Environmental (2020) reports that breeding of the Carnaby's cockatoo is unlikely to occur within the site.

Table 12: Potential Black Cockatoo Habitat Trees

	Species	DBH*	Height (M)	Easting	Northing	Comments
1	Jarrah	B	12	0393358	6441096	No hollows, stag, lots of fallen branches, beehive present
2	Jarrah	A	12	0393384	6441087	Hollows, stag, red cap parrot on ends of branches during site
8	Jarrah	A	14	0393367	6441084	No hollows, splits at 4m height
18	Jarrah	A	8	0393055	6441295	No hollows
20	Jarrah	A	8	0393384	6441081	Burnt, 1 hollow with beehive

3.6 Conservation Areas

3.6.1 Environmentally Sensitive Areas

Environmentally Sensitive Areas (ESAs) are areas that have been identified for protection due to their environmental significance as outlined in the Western Australian *Environmental Protection (Environmentally Sensitive Areas) Notice 2005* under Section 51B of the EP Act. ESAs include the following:

- World Heritage areas
- areas included on the National Estate Register
- defined conservation wetlands and associated buffers
- vegetation within 50 m of a listed rare flora or TEC
- Bush Forever Site.

ESA mapping (which includes a buffer) indicates that the entire site and surround is mapped as an ESA (Figure 9). The boundary of the ESA correlates to the Gibbs Road Swamp System and associated buffers according to the Directory of Important Wetlands and Bush Forever Site.

3.6.2 Regional Park and Bush Forever

It is noted that the City of Cockburn (2002) Southern Suburbs District Structure Plan presented the southern portion of the site as a possible addition to the Bush Forever site. The WAPC (2000)

Bush Forever (Volumes 1 and 2) did not identify the southern portion of the site as a bush forever site or as a strategic negotiated planning solution or an urban/urban deferred/industrial negotiated planning solution (agreement proposed or to be determined). The current Bush Forever mapping is provided in Figure 9.

The current mapping confirms that the southern portion of the site is not identified as or proposed to be an extension to the adjoining Bush Forever site. In relation to this matter the district structure plan is redundant and of no relevance to the assessment of the proposed structure plan.

Jandakot Regional Park and Bush Forever Site (492) adjoins the western and southern part of Lot 74 (Figure 9). There are no mapped Bush Forever Sites within the site.

Bush Forever Site (263, 344) within the Jandakot Regional Park exists approximately 650 m to the north and 1.17 km to the east of the site. There are extensive areas of Bush Forever Sites (392, 391) surrounding the site associated with Forrestdale Lake Nature Reserve and Beeliar Regional Park (including Thompsons Lake Nature Reserve) (Department of Planning, 2014) .

3.6.3 Ecological Linkages

According to Del Marco et al. (2004) the importance of ecological linkage is to connect natural areas, preferably with continuous corridors of native vegetation, which assists in fauna movement between the areas and to access resources and habitats. The protection, management and buffering of existing natural areas within an ecological linkage is a higher priority than revegetation of cleared portions of the link.

Perth Regional Ecological Linkage (ID 52) runs through the northern portion of the site (Western Australian Local Government Authority, 2014) (Figure 9).

3.7 Heritage

3.7.1 Aboriginal Heritage

In Western Australia, the *Aboriginal Heritage Act 1972* protects places and objects customarily used by or traditional to the original habitants of Australia. A register of such places and objects is maintained under the Act, however all sites are protected under the Act whether they are registered or not. A search of the Department of Planning, Lands and Heritage's (DPLH) Aboriginal Heritage Inquiry System did not identify any 'Registered Aboriginal Sites' or 'Other Heritage Places' within the site (DPLH, 2018).

There are three registered sites within the vicinity of the site which include Mather Reserve (3447) (1.28 km), Thompsons Lake 01 (15934) 1.36 km and Kraemer Reserve (21811) 2.32 km.

3.7.2 European heritage

A search of the Heritage Council of Western Australia database of culturally significant sites in Western Australia was undertaken for the site. No State Heritage Places exist within or nearby the site (SHO 2018).

3.8 Potential Contamination

Under the *Contaminated Sites Act 2003*, contaminated sites must be reported to the Department of Water and Environmental Regulation (DWER), investigated and, if necessary, remediated. The DWER Contaminated Sites database was searched are there are no registered site within or immediately adjacent to the site. The database identified a contaminated site across several Lots within Aubin Grove and within 1 km of the site. The contamination is described in Table 13.

Table 13: Contaminated Sites within 1 km radius of the site (DWER 2018)

Site Number	Lot Number	Nature of Contamination	Status	Approx Distance to Site
15634	Lot 8001 on Plan 53298 Aubin Grove containing 85 Parcels.	Microbiological indicators of possible pathogens (Thermo tolerant coliforms, Enterococci /Faecal Streptococci and E.coli) are present in groundwater across the Site.	Remediated for restricted use	800 m

3.9 Bushfire Risk

The site is situated within a designated bushfire prone area as outlined by the WA Map of Bush Fire Prone Areas (Western Australian Planning Commission, 2015). As a result of the bushfire prone status of the site, a BMP has been developed to address the requirements of State Planning Policy 3.7 Planning in Bushfire Prone Areas (SPP 3.7) in support of the LSP.

4 Potential Impacts, Management Measures and Local Structure Plan Response

The potential impacts that may result from implementation of the proposed development based on the LSP design (Figure 10) and the site's key environmental features are discussed in this section. Management measures based on key legislation, guidelines and policies are also outlined with the intent to mitigate the potential impacts.

4.1 Acid Sulphate Soils

4.1.1 Overview

As discussed in Section 3.2, while ASS is not considered to be a limited factor to the development potential of the site. The site is within a moderate to low ASS disturbance risk (<3 m from surface) (Class II) (Figure 4) which may require an ASS investigation subject to the following being undertaken at the site:

- Works involving lowering of watertable (temporary or permanent)
- Earthworks extending to beyond 3 metres below natural ground surface
- Works within 500m of wetlands (Department of Environment Regulation, 2015).

4.1.2 Further Environmental Considerations

Subject to engineering specifications, earthworks (cut and fill) of the site may be required and can be determined during subsequent planning phase i.e. Subdivision. The WAPC's ASS Self-Assessment form can be filled out to identify the need of an ASS investigation. If required, prior to ground disturbing activities an ASS and Dewatering Management Plan (ASSDMP) can be developed to manage the ASS risk within the site and adjacent CCW and its buffer.

4.2 Groundwater and Surface Water

4.2.1 Overview

Potential impacts to hydrological processes from the implementation of the LSP include:

- Groundwater level changes from changes in land use and clearing. Residential development has the potential to increase recharge of rainfall into groundwater through increased surface area of residential roofs, driveways, carparks and roads
- Increased runoff from hard urban surfaces into surrounding retained environments
- Diminished water quality (nutrients, organic compounds, suspended solids, toxic compounds and salinity).

A LWMS has been developed by Orche West to support both the lifting of 'Urban Deferment' and LSP. The LWMS guides the key requirements for water sensitive urban design based on Better Urban Water Management (WAPC 2008) guidance. Potential environmental impacts to inland waters environmental quality will be addressed through the implementation of the

following measures at subsequent planning stages to ensure the site's hydrology is not altered during or post development:

- Urban development of the land will require the establishment of an improved drainage system and incorporating urban water management design principles
- Bio-retention areas will be provided to ensure water from the low ARI rainfall events will be contained and maximise the usability of the POS areas
- The site will be filled to a minimum of 2 m separation to Controlled Groundwater Levels, the drainage system will utilise generally high site infiltration
- Encouraging on-source surface water recharge wherever possible
- Retention of native trees within POS to reduce the demand for water, minimise irrigation and fertiliser demands.

4.2.2 LSP Mitigation and Management Measures

The stormwater catchments on site are directed to two drainage basins within the POS located in the north eastern section of the site (refer to Figure 10). The LSP incorporates a 50m buffer to the adjacent CCW (UFI 12984) (Figure 5 and Figure 10). No drainage treatment or discharge is currently proposed within the CCW buffer.

The DWER standard irrigations rates for POS (ovals) is typically 7,500KL/ha for POS. The LPS proposes passive POS (approximately 0.35 ha). The minimum water requirement for the POS would be approximately 2,625 KL /year which is 11% of the current groundwater allocation (est. 23,400 KL of existing license within the site).

For further detailed information, refer to the site's LWMS.

4.2.3 Further Environmental Considerations

An Urban Water Management Plan (UWMP) will be prepared and implemented at subdivision stage to the requirements of the Local Government authority. The proposed development of the site to urban will influence the total water cycle as a result of clearing native vegetation, increased impervious areas and changes to surface and stormwater runoff. The UWMP will be prepared in accordance with, but not limited to, the following documents in consultation with the City of Cockburn to ensure pre-development hydrological conditions are maintained during and post construction:

- Better Urban Water Management (WAPC 2008)
- State Planning Policy 2.9 (SPP 2.9) Water Resources
- Local Planning Policy 5.3 (LPP 5.3) Control Measures for Protecting Water Resources in Receiving Environments.

The UWMP will include measures for stormwater management, stormwater modelling, water quality protection, serviceability requirements, flood protection, groundwater management and the protection of receiving environments.

In particular, the water and drainage management measures will ensure the following are met in line with LPP 5.3 (City of Cockburn 2019):

- Water quality and quantity is tied to long term community needs
- The ecological integrity of the receiving environment and the quality of water is preserved and enhanced
- Provision is made for local groundwater recharge.

4.3 Public Drinking Water Source Areas

As discussed in Section 3.3.2, the site is located within the Priority 3 PDWSA. The identified LSP land uses and their compatibility within a P3 area are as follows:

- Residential Area: acceptable (connected to deep sewerage)
- POS (unrestricted): compatible with conditions.

4.3.1 LSP Mitigation and Management Measures

The LSP proposes POS and urban development (sewered) within the P3 area, these are compatible land uses in accordance with DoW (2016) guidelines.

4.4 Flora and Vegetation

4.4.1 Overview

The key potential impacts on terrestrial flora and vegetation from future development of the site include:

- Clearing of 4.71 ha of remnant vegetation. Refer to Table 14
- Ecological linkage fragmentation
- Associated urban degradation and disturbances, including rubbish dumping, uncontrolled access and flower/seed harvesting
- Edge effects due to the proposed development caused by the interaction of native vegetation with surrounding urban land uses, leading to inhibition or promotion of certain species from establishing populations along edges and imitating a decline in vegetation condition
- Potential introduction of Dieback disease
- Introduction and spread of invasive weed species
- Hydrological changes.

Table 14: Remnant Vegetation Proposed Areas to be Cleared and Retained

Vegetation Unit	Area(ha)	Areas to be Cleared (ha)	Areas to be Retained (ha)
BaBm(a)*	1.67	0.91	0.76
BaBm(b)*	1.92	1.92	0
AfEmBi*	0.70	0.53	0.17
BiKg*[2]	1.12	1.12	0
Ec*	0.57	0.23	0.34
Subtotal Vegetation Unit	-	**4.71**	**1.27**
Cleared	0.72	0.66	0
G/O	0.57	0.57	0
Total	7.27	5.94	1.27

4.4.2 LSP Mitigation and Management Measures

The LSP proposes to retain 1.27 ha (0.93ha of Banksia Woodland [and 0.34 ha of Eucalypt woodland within the CCW buffer and/or proposed ecological corridor (Figure 10).

An ecological linkage (50m wide) is proposed within the southern section of the site which provides for a continuous connection from Jandakot Regional Park (Bush Forever Site 492) to the CCW area within Lot 74. Vegetation within the proposed ecological linkage is recorded to be in 'Excellent' condition. The only location of vegetation on site in 'Excellent' condition is the southern section of the site. A significant portion of this is proposed to be retained within an ecological linkage (Figure 10).

Del Marco *et al.* (2004) discusses that several studies have found that linear corridors of native vegetation need to be at least 25 to 50m wide to function effectively as linkage for a range of bird species. A width of 50m is considered to be the minimum required for maintaining long term viability. The width determination of urban ecological corridors varies and are dependent on the influencing factors that may impact on the ecological processes of the area (Peng et al. 2016). As the ecological linkage will be fenced, there will be limited access hence, degradation processes such as weed encroachment and uncontrolled access will be minimal. Therefore, supporting the requirement width of 50 m for the ecological corridor.

Regarding the interface of the proposed development and Bush Forever Site No. 492 and Jandakot Regional Park, the LPS includes a road reserve around the periphery of the site, which provides a hard edge and conservation style fencing (subject to City of Cockburn LLP 5.7 specifications). The fencing will limit uncontrolled access to the Bush Forever Site 492/ Jandakot

[2] *Vegetation types which represent Banksia Woodland SCP TEC, refer to Section 2.4.5 for further information.

Regional Park. The restricted access within the CCW buffer will be addressed within a Vegetation and Wetland Buffer Management Plan (refer to Section 4.4.3).

For tree retention outside the CCW buffer, as part of future subdivision design it is recommended that remnant trees within POS and road reserves are surveyed and assessed by an arborist, in accordance with AS 4970-2009 Protection of Trees on Site. The assessment will identify other significant trees, whether the tree(s) are viable for retention and determine tree protection zones. This will guide potential tree retention within these areas.

4.4.3 Further Environmental Considerations

Prior to subdivision a Vegetation and Wetland Buffer Management Plan (or equivalent) will be prepared to mitigate potential impact to the CCW and its buffer and management measures. The plan will also include EPBC referral commitments (360 Environmental 2020) and the following:

- A buffer distance of 50 m from the CCW (UFI 12984) will be implemented to ensure the CCW is protected from the proposed residential development. Refer to LSP design in Figure 10
- The wetland buffer will be revegetated with low fuel native vegetation to support, compliment and protect the CCW as well as providing adequate bushfire protection for the proposed development. Due regard will be given to the City of Cockburn's revegetation criteria presented in LLP 5.2
- The CCW, buffer, and retained Black Cockatoo habitat will be rehabilitated where required, including revegetation and weed control measures to preserve the ecological attributes and functions of the wetland's Conservation Category
- Monitoring for *Phytophthora cinnamomi* (Dieback) infestation and early management of new infestations
- The CCW buffer will be fenced from the development to prevent unauthorised access and control access by feral and domestic animals from entering areas reserved for conservation. This will be undertaken in line with the City of Cockburns LPP 5.7 – Uniform Fencing
- Prior to clearing, significant trees to be cleared or retained will be clearly demarcated and all site personnel will be inducted on the clearing areas
- Structural and non-structural best management practices will be used to improve water quality within the CCW by reducing exposure to pollutants in line with the UWMP and LWMS
- Controlled access to the wetland and buffer for maintenance and fire access
- Revegetation, monitoring and annual reporting for two years post construction to the City of Cockburn's requirements.

4.5 Fauna and Habitat

4.5.1 Overview

The potential environmental impacts on terrestrial fauna from the implementation of the LSP and subsequent future development of the site include:

- Animal deaths during the clearing process
- Habitat removal and modification
- Clearing of 4.93 ha of black cockatoo habitat (Table 15)
- Removal of five potential black cockatoo breeding trees
- Habitat fragmentation
- An increased abundance of introduced species
- Inappropriate recreational use.

Table 15: Potential Black Cockatoo Foraging Habitat Proposed to be Cleared and Retained

Habitat	Area (ha)	Areas to be Cleared (ha)	Areas to be Retained (ha)
Banksia Woodland	4.45	3.71	0.74
Eucalyptus Woodland	1.57	1.22	0.34
Total	**6.02**	**4.93**	**1.09**

4.5.2 LSP Mitigation and Management Measures

The LSP proposes to retain approximately 1.09 ha of black cockatoo foraging habitat within the proposed CCW buffer and ecological linkage on site.

Subject to engineering specifications and assessment against AS 4970-2009, further black cockatoo foraging habitat may be viable for retention within the proposed LSP POS and road reserves.

The ecological linkage proposed allows for connection from adjacent Bush Forever Site No. 492 (Jandakot Regional Parks) . The width of the ecological linkage is approximately 50m. This will assist fauna movement across the site.

The wetland buffer area captures a variety of fauna habitats such as, transition zones from low lying to uplands to Banksia woodlands.

4.5.3 Further Environmental Considerations

Before the commencement of subdivision, a Fauna Management and Relocation Plan will be developed and will include the following management measures in detail:

- Development and implementation of clearing and site disturbance protocols
- All site personnel will be inducted on the purpose, content and processes of the Fauna Management and Relocation Plan

- Prior to clearing, all trees (including stags) and hollows will be inspected for the presence of fauna occupying them. Any fauna present, with the exception of black cockatoos and other birds, will be removed and relocated by authorised personnel
- Development of a trapping program and methods, relocation process and identifying the indicators to successful trapping prior to clearing
- Fauna handling and rescue measures, including stopping works in the immediate vicinity of small and large animals that are injured, shocked or uninjured
- Inclusion and implementation of a feral species control program which includes targeted surveys, if required, threat prevention and elimination, threat management techniques
- All areas to be cleared or retained will be clearly demarcated
- Clearing will be undertaken outside of the breeding period for the Carnaby's cockatoos, where practicable
- Clearing will occur in a staged process from the north towards the CCW and retained vegetated areas to the south to allow fauna to escape to adjacent vegetated areas
- Monitoring during clearing and construction activities will occur to ensure Black Cockatoo habitat to be retained is not impacted and to ensure any fauna identified within clearing areas are managed through relocation
- Wildlife protection during construction activities and post development to ensure the management of foxes, cats and domestic animals.

5 Conclusion

The implementation of the LSP will result in clearing approximately 4.71 ha of remnant vegetation with the retention of 1.09 ha within CCW buffer and ecological linkage. Subject to engineering specifications and assessment against AS 4970-2009, further remnant vegetation/black cockatoo foraging habitat may be viable for retention within the proposed LSP POS and road reserves. Four potential black cockatoo breeding trees will also be cleared.

Future residential development will deliver the following key environmental outcomes:

- Provision of an ecological linkages in the southern section of the site which provides a continues linkage from the adjacent Bush Forever Site/Jandakot Regional Park and remnant vegetation and CCW located east of the site.
- The development will be fenced to provide protection of fauna and fauna habitat (i.e. black cockatoo) from future urban development.
- Incorporation of a 50m buffer to the adjacent CCW.
- Development and implementation of environmental management plans (i.e. Fauna Management and Relocation Plan and Vegetation and Wetland Buffer Management Plan) will ensure the long-term management and viability of the proposed conservation areas.
- Application of water management initiatives and a framework to the guide future development of the site to ensure water sensitive urban design is achieved. This will be done through a combined DLWMS and an Urban Water Management Plan (UWMP).

Other environmental issues (such as acid sulfate soils, potential contamination, etc.) are capable of being resolved (i.e. avoided or managed) through site-specific investigations and detailed engineering drainage design.

A significant environmental outcome of the proposed LSP is maintaining the ecological corridor between the adjacent Bush Forever Site 492 and CCW.

6 Limitations

This report is produced strictly in accordance with the scope of services set out in the contract or otherwise agreed in accordance with the contract. 360 Environmental makes no representations or warranties in relation to the nature and quality of soil and water other than the visual observation and analytical data in this report.

In the preparation of this report, 360 Environmental has relied upon documents, information, data and analyses ("client's information") provided by the client and other individuals and entities. In most cases where client's information has been relied upon, such reliance has been indicated in this report. Unless expressly set out in this report, 360 Environmental has not verified that the client's information is accurate, exhaustive or current and the validity and accuracy of any aspect of the report including, or based upon, any part of the client's information is contingent upon the accuracy, exhaustiveness and currency of the client's information. 360 Environmental shall not be liable to the client or any other person in connection with any invalid or inaccurate aspect of this report where that invalidity or inaccuracy arose because the client's information was not accurate, exhaustive and current or arose because of any information or condition that was concealed, withheld, misrepresented, or otherwise not fully disclosed or available to 360 Environmental.

Aspects of this report, including the opinions, conclusions and recommendations it contains, are based on the results of the investigation, sampling and testing set out in the contract and otherwise in accordance with normal practices and standards. The investigation, sampling and testing are designed to produce results that represent a reasonable interpretation of the general conditions of the site that is the subject of this report. However, due to the characteristics of the site, including natural variations in site conditions, the results of the investigation, sampling and testing may not accurately represent the actual state of the whole site at all points.

It is important to recognise that site conditions, including the extent and concentration of contaminants, can change with time. This is particularly relevant if this report, including the data, opinions, conclusions and recommendations it contains, are to be used a considerable time after it was prepared. In these circumstances, further investigation of the site may be necessary.

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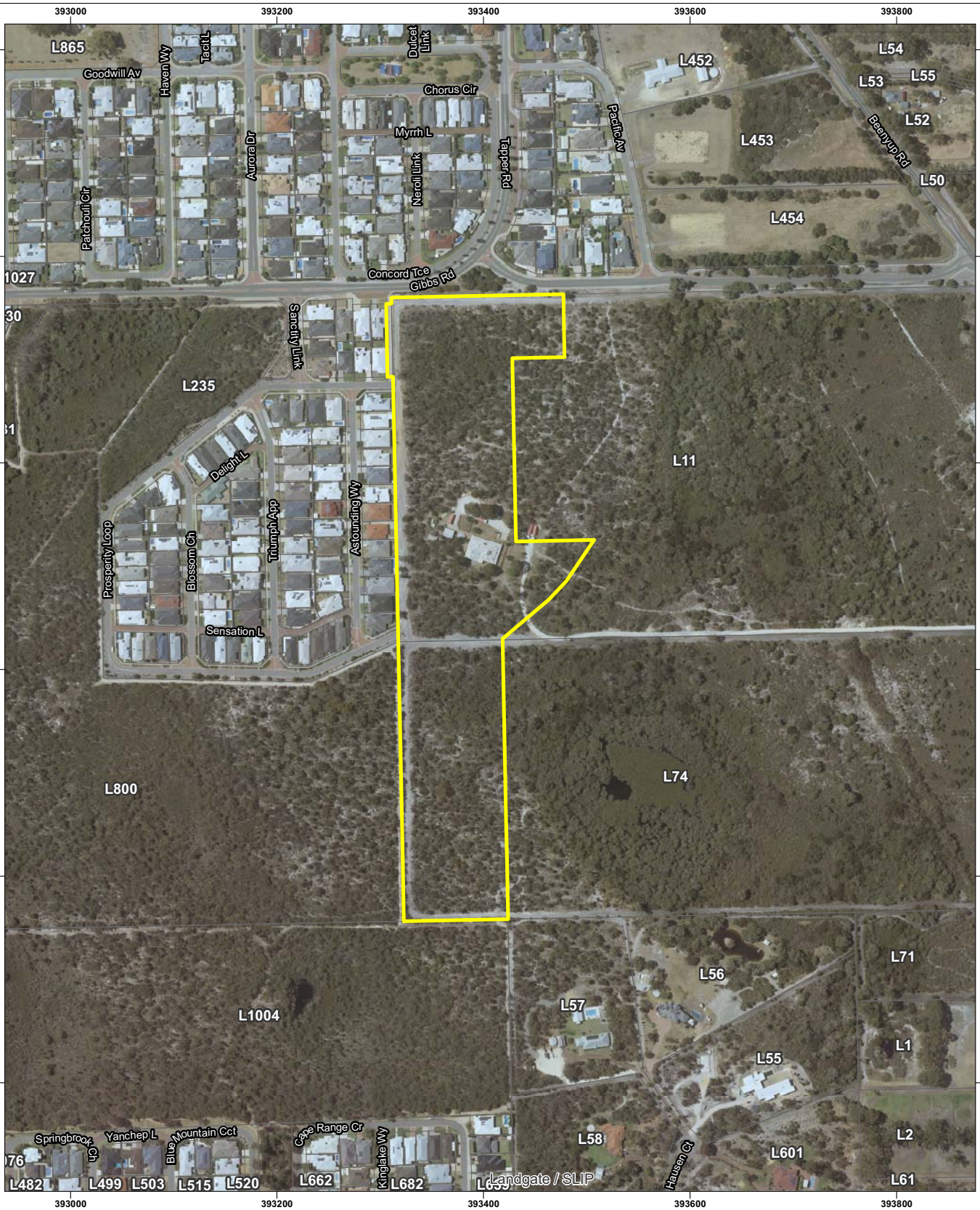
Figures



Legend

- Site Boundary (7.27 ha)
- Lot Boundaries

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Meters

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- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS

LOCALITY MAP

AIGLE ROYAL

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Aigle Royal Developments
Part Lot 11 and 71 Gibbs Road Banjup

Environmental Assessment Report: Local Structure Plan

Figure 1
Site Location

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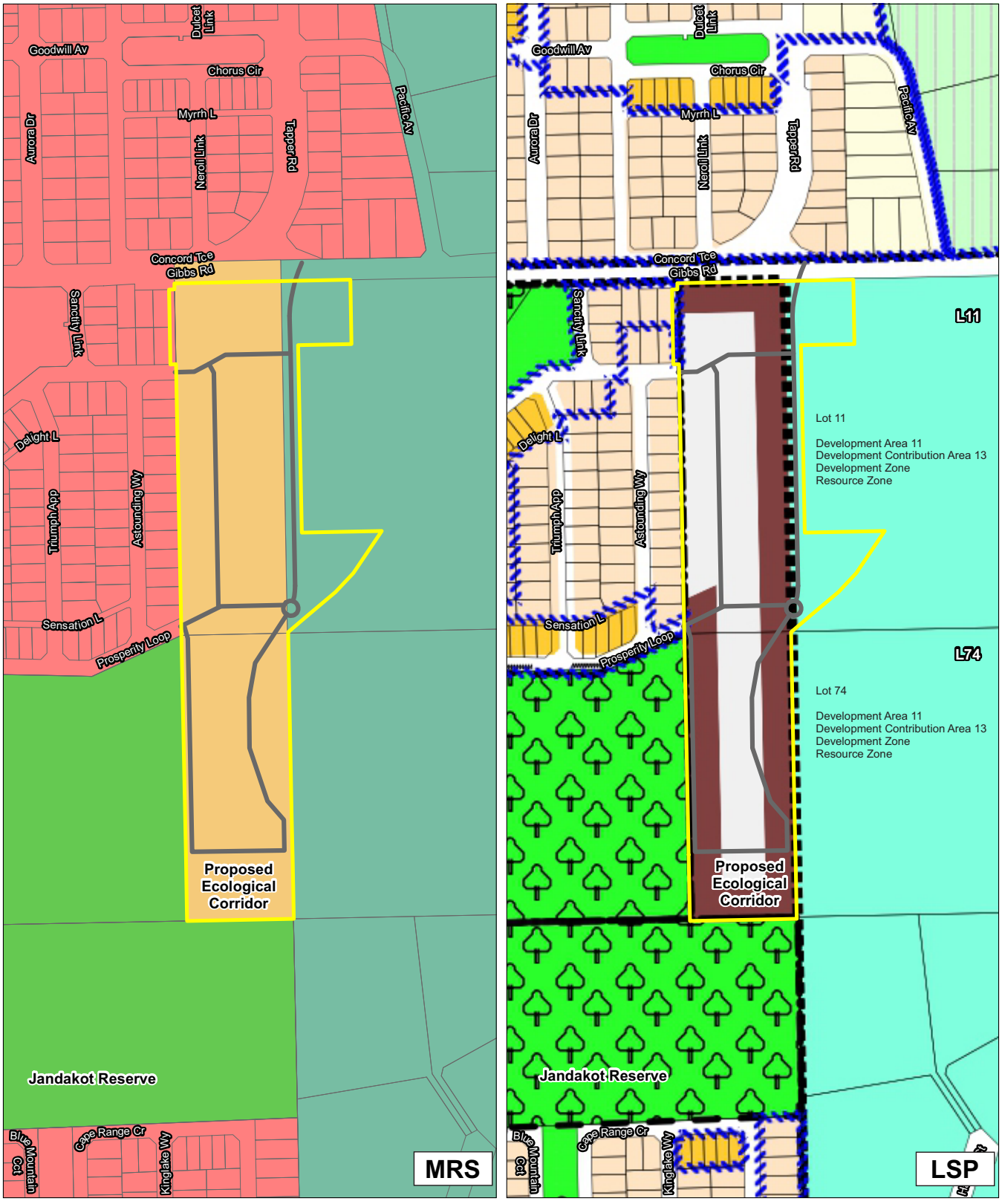

Legend

- Site Boundary (7.27 ha)
- Lot Boundaries

Regional Scheme Zones and Reserves

- Parks and Recreation
- Rural - Water Protection
- Urban
- Urban Deferred

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Environmental Assessment Report: Local Structure Plan

Figure 2
Zoning and Local Structure Plan

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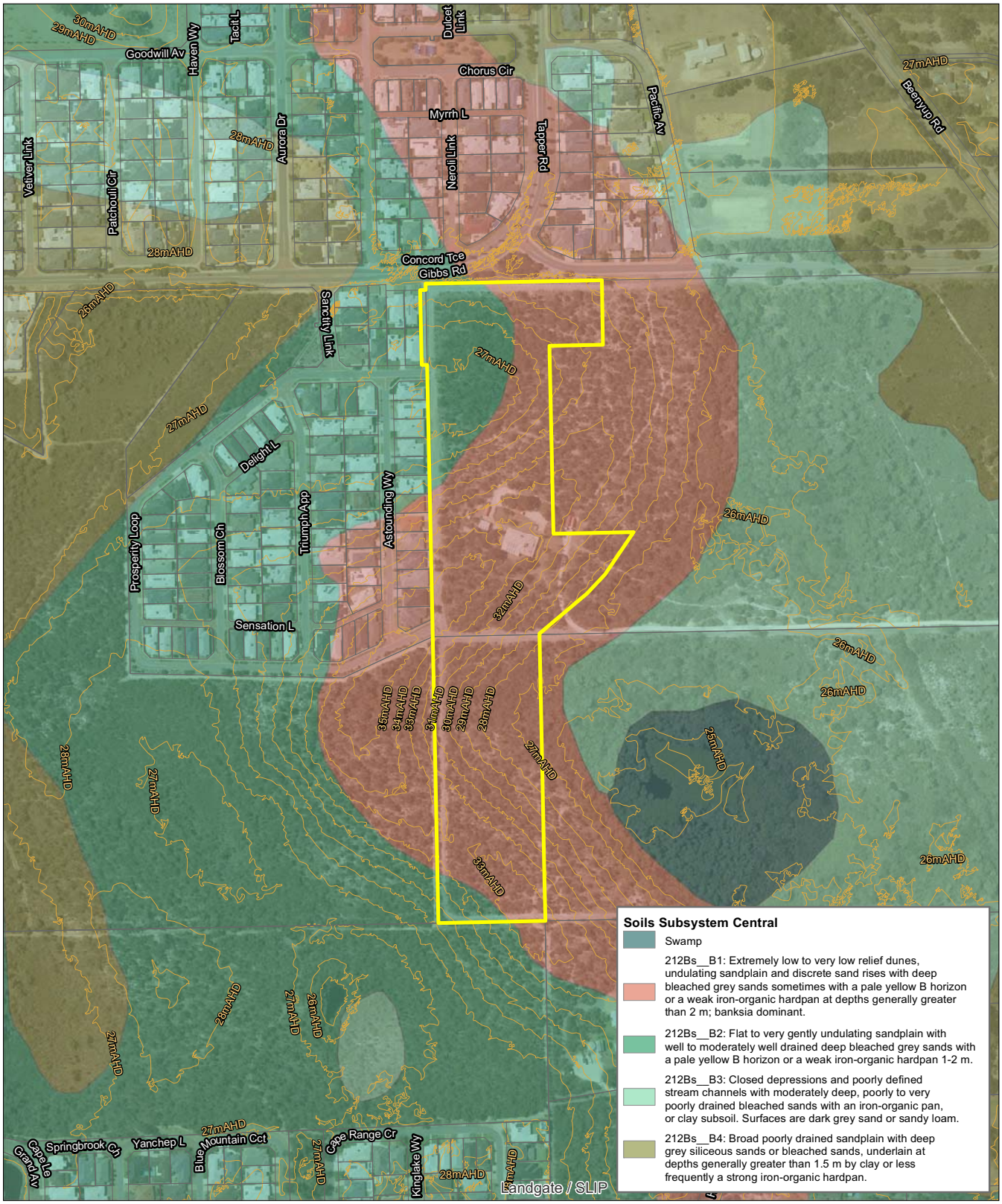

Legend

- Site Boundary (7.27 ha)
- Lot Boundaries
- Contours 1m Interval

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Aigle Royal Developments
Part Lot 11 and 71 Gibbs Road Banjup

Environmental Assessment Report: Local Structure Plan

Figure 3
Topography and Geology

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Legend

- Site Boundary (7.27 ha)
- Lot Boundaries

Acid Sulfate Soils Risk

- High to moderate risk
- Moderate to low risk

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Environmental Assessment Report: Local Structure Plan

Figure 4
Acid Sulphate Soils

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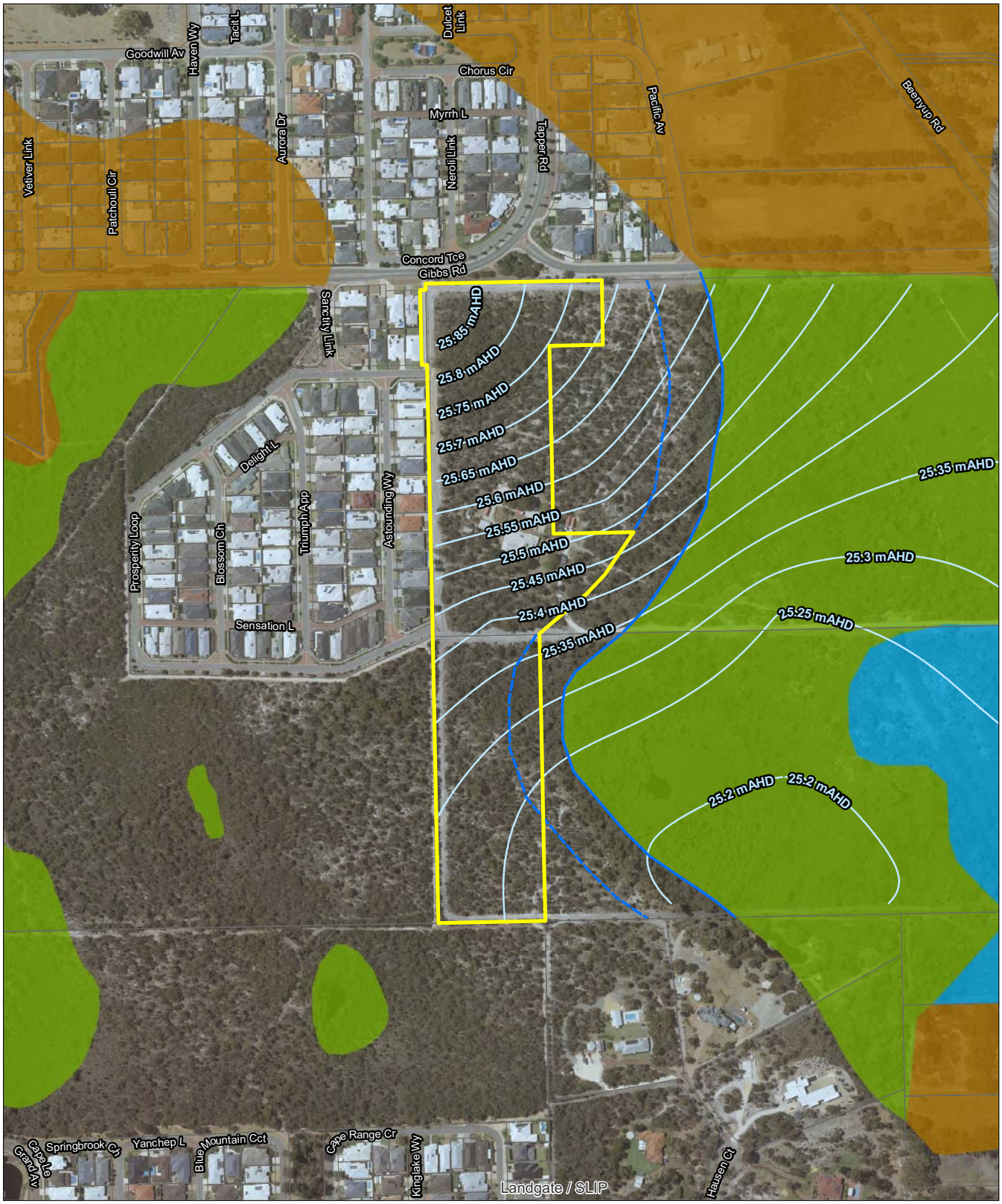

Legend

- Site Boundary (7.27 ha)
- Lot Boundaries
- Conservation Category Wetland (CCW)
- 50m CCW Buffer
- Groundwater Contours (mAHD; AAMGL)

Geomorphic Wetlands

- Conservation Category
- Resource Enhancement Category
- Multiple Use Category

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PROJECT ID	DATE
1350	02/04/2020

HORIZONTAL DATUM AND PROJECTION
GDA 1994 MGA Zone 50

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LF	KC	KC	0

Aigle Royal Developments
Part Lot 11 and 71 Gibbs Road Banjup

Environmental Assessment Report: Local Structure Plan

Figure 5
Hydrology

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Legend

- Site Boundary (7.27 ha)
- Proposed Road Network

Vegetation Associations

- AfEmBi (0.70 ha)
- BaBm (A) (1.67 ha)
- BaBm (B) (1.92 ha)
- BiKg (1.12 ha)
- Ec (0.57 ha)
- Garden or Orchard (0.57 ha)
- Cleared (0.72 ha)

AIGLE ROYAL

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Figure 6
Vegetation Type

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Legend

- Site Boundary (7.27 ha)
- Proposed Road Network

Vegetation Condition

- Excellent (1.05 ha)
- Excellent - Very Good (0.84 ha)
- Very Good - Good (1.73 ha)
- Good (2.21 ha)
- Degraded (0.15 ha)
- Completely Degraded (1.29 ha)

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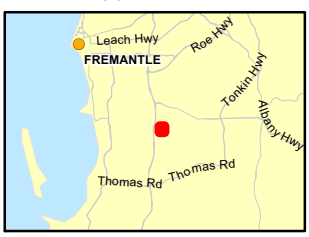

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Figure 7
Vegetation Condition

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Legend

- Site Boundary (7.27 ha)
- Proposed Road Network

Potential Breeding Trees

- Jarrah

Black Cockatoo Foraging Habitat

- Banksia Woodland (3.71 ha)
- Eucalypt Woodland (1.22 ha)
- Banksia Woodland, Remaining (0.74 ha)
- Eucalypt Woodland, Remaining (0.34)

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Figure 8
Black Cockatoo Foraging Habitat

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Legend

- Site Boundary (7.27 ha)
- Lot Boundaries
- Bush Forever Sites
- Regional Ecological Linkage
- Environmentally Sensitive Areas
- Regional Parks

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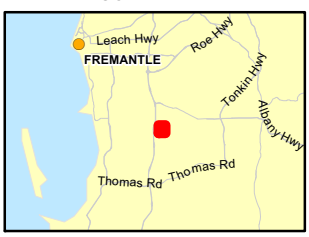

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Environmental Assessment Report: Local Structure Plan

Figure 9
Environmental Conservation Areas

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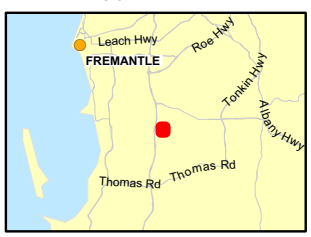

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Aigle Royal Developments
Part Lot 11 and 71 Gibbs Road Banjup

Environmental Assessment Report: Local Structure Plan

Figure 10
Proposed Local Structure Plan

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Appendices

Appendix A
EPBC Referral (2017/7923)

Notification of
REFERRAL DECISION AND DESIGNATED PROPONENT – controlled action
Residential Development on Lot 11 and 74 Beenyup Road, Banjup, WA (EPBC 2017/7923)

This decision is made under section 75 and section 87 of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

proposed action	To clear vegetation to develop Lot 11 and 74 Beenyup Road, Banjup, Western Australia, for residential housing [See EPBC Act Referral 2017/7923].
decision on proposed action	The proposed action is a controlled action. The project will require assessment and approval under the EPBC Act before it can proceed.
relevant controlling provisions	• Listed threatened species and communities (sections 18 & 18A)
designated proponent	The trustee for The Bellridge Trust ABN: 12 585 998 898
assessment approach	The project will be assessed by preliminary documentation.

Decision-maker

Name and position	Gregory Manning Assistant Secretary Assessments (WA, SA, NT) and Air Branch
Signature	
date of decision	20 July 2017

Appendix B
360 Environmental (2016) Flora and Vegetation Report

360 environmental

Beenyup Road

Level 2 Flora and Vegetation Survey

Prepared for:
Aigle Royal Developments

February 2016

people • planet • professional

Document Reference	Revision	Prepared by	Reviewed by	Submitted to Client	
				Copies	Date
1269 AB	A INTERNAL DRAFT	NW	RF	1 Electronic (email)	17/12/15
1269 AB	B CLIENT DRAFT	NW	KK	1 Electronic (email)	22/01/16
1269 AB	C FINAL	NW	TS	1 Electronic (email)	02/02/16

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Executive Summary

360 Environmental was commissioned by Aigle Royal Developments (ARD) to conduct a Level 2 flora and vegetation survey at Lots 11 and 74 Beenyup Road in Banjup (Survey Area). The Survey Area is approximately 41.1 ha in size and is located approximately 22 km south of Perth Central Business District (CBD), in the Swan Coastal Plain (SCP) biogeographic region of WA.

A total of 145 taxa (including species, subspecies, varieties and forms) from 101 genera and 45 families were recorded in the Survey Area. The commonly occurring families were; Myrtaceae (18 taxa), Fabaceae (15 taxa) and Orchidaceae (13 taxa).

Portions of the Survey Area have been completely cleared for residential and a nursery, while other areas have been allowed to regenerate naturally and some sections have had endemic and non-endemic species planted. There is also a large proportion of the site that is original native vegetation.

A total of 27 introduced species were recorded during the survey (Table 6). Two species, **Asparagus asparagoides* and **Zantedeschia aethiopica*, are listed as Declared under the BAM Act. One species **Asparagus asparagoides* is listed as a Weed of National Significance (WONS).

The database searches identified 24 conservation significant flora as potentially occurring in the vicinity of the Survey Area. Of these, nine are classed as Threatened, one as Priority 1, eight as Priority 3 and six as Priority 4.

No Threatened flora species listed under the *Environment Protection and Biodiversity Conservation Act 1999* or gazetted as Declared Rare Flora (Threatened) pursuant to the Wildlife Conservation Act were recorded during the survey. No Priority species were found during the survey.

Vegetation condition ranged from Completely Degraded to Excellent. Historical vegetation clearing, weeds, housing, a nursery and the presence of tracks in the Survey Area were the most frequently observed impacts on native vegetation.

Two Priority 3 vegetation communities, SCP21c - Low lying *Banksia attenuata* woodlands or shrublands and SCP22 – *Banksia ilicifolia* woodlands, are known to occur in close proximity to the Survey Area with their buffers encroaching into the north east corner of the Survey Areas boundary.

One listed Priority 3 vegetation community from the database search was identified as occurring in the Survey Area. Vegetation associations BaBm (b) and BiKg are thought to represent FCT SCP 21c – Low lying *Banksia attenuata* woodlands or shrublands.

The vegetation association BaBm (a), has been identified as FCT SCP23a - Central *Banksia attenuata – B. menziesii* woodlands. Although the database search did not identify SCP23a, it is included in the PEC "Banksia dominated woodlands of the Swan Coastal Plain IBRA region", which is now listed as a Priority 3.

The entire Survey Area is identified as an Environmentally Sensitive area (ESA). Although there is no publicly available information detailing the reasoning behind the ESA mapping, the boundaries are found to correlate with the Gibbs Road Swamp System according to the Directory of Important Wetlands.

The DPaW Geomorphic Wetlands Dataset identifies one Conservation Category Wetland (CCW) and one Resource Enhancement Wetland (REW) as occurring in the Survey Area. CCWs and their associated buffers are considered ESAs.

Environmentally Sensitive Areas are declared to prevent degradation of important environmental values such as T/DRF, TECs or significant wetlands. Exemptions contained in the Environmental Protection (Clearing of Native vegetation) Regulations 2004 for low impact land clearing do not apply in ESAs and a clearing permit is required.

Permits

This flora survey was conducted under the following licences issued by DPaW; Licence to take flora for scientific or other prescribed purposes SL011541 and Permit to take Declared Rare Flora 44-1516 issued to Narelle Whittington.

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1 Introduction

1.1 The Project

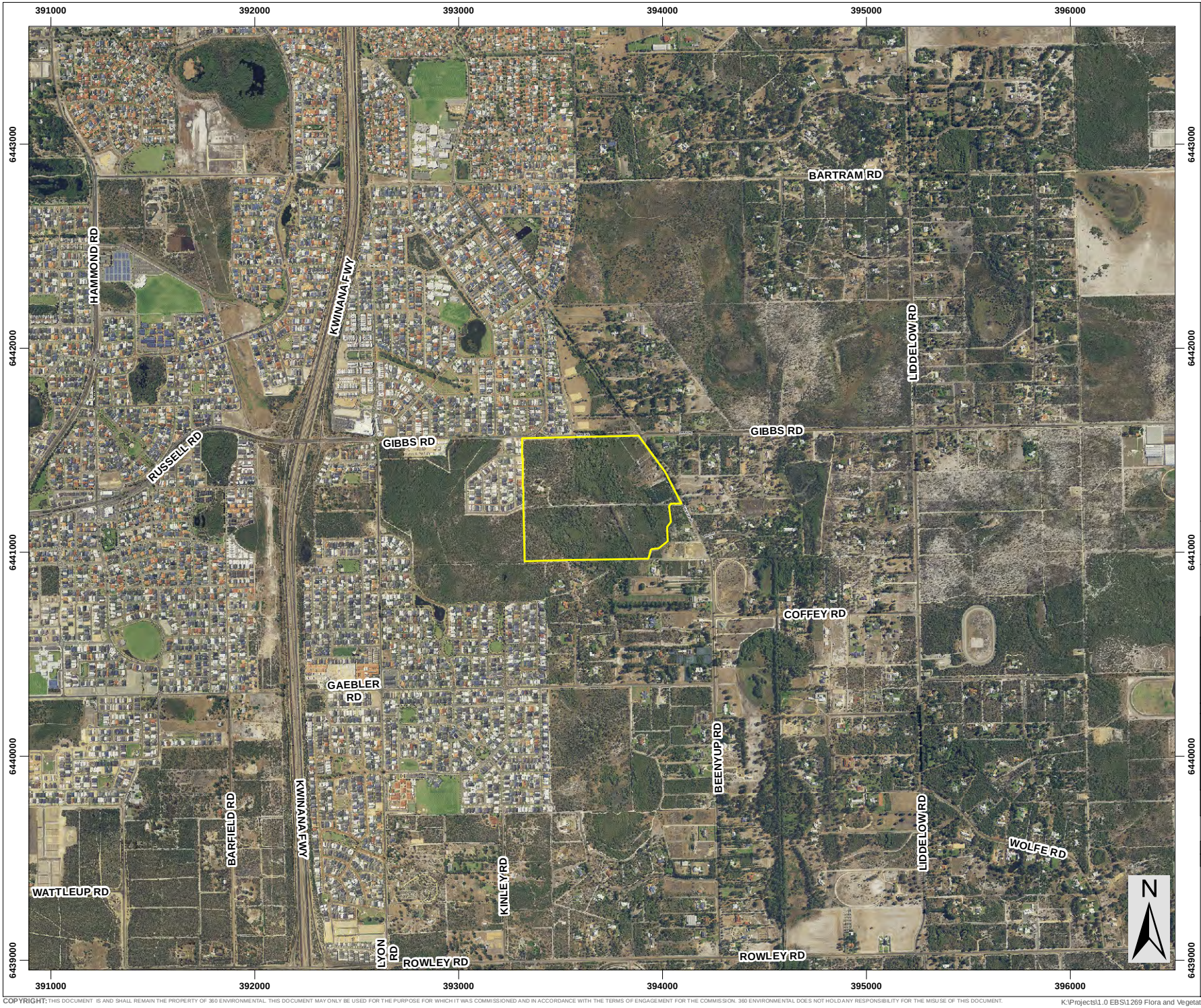
360 Environmental was commissioned by Aigle Royal Developments (ARD) to conduct a Level 2 flora and vegetation survey at Lots 11 and 74 Beenyup Road in Banjup (Survey Area). The Survey Area is approximately 41.1 ha in size and is located about 22 km south of Perth CBD, in the Swan Coastal Plain (SCP) biogeographic region of Western Australia (WA) (Figure 1).

360 Environmental understands from communications with ARD that a flora assessment was previously undertaken in the Survey Area and that this data is not accessible, as such a new survey is required. This flora and vegetation survey is required to support a local structure plan and to undertake wetland assessments and possible boundary changes.

1.1.1 Objectives

The objectives of the flora and vegetation assessment were to:

- Conduct a desktop assessment of databases and spatial datasets to determine the environmental values and any potential issues, such as Threatened/Rare and significant species, Threatened Ecological Communities (TECs) and Priority Ecological Communities (PECs), that may be present in the Survey Area and the surrounding areas;
- Produce a list of plant species (including weed species);
- Document and map the location of any Threatened/Declared Rare Flora (T/DRF), Priority flora and any other flora of local or taxonomic significance;
- Identify, map and discuss the significance of any TECs, PECs and any other areas of ecological importance (e.g. National Parks, wetlands and Environmentally Sensitive Areas [ESAs] etc.);
- Assess, map and photograph vegetation condition; and
- Document, describe and map the vegetation associations present.



Legend

- Survey Area
- Roads

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LOCALITY MAP

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Level 2 Flora and Vegetation Survey

Figure 1 -
Vegetation Condition

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1.2 Background to the Protection of Flora and Vegetation

WA flora is protected formally and informally by various legislative and non-legislative measures, which are as follows:

Legislative measures:

- *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act);
- *Wildlife Conservation Act 1950* (WC Act);
- *Environmental Protection Act 1986* (EP Act); and
- *Biosecurity and Agriculture Management Act 2007* (BAM Act).

Non-legislative measures:

- WA Department of Parks and Wildlife (DPaW) Priority lists for flora and ecological communities;
- Weeds of National Significance (WONS); and
- Recognition of locally significant populations by the DPaW.

A short description of each is given below. Other definitions, including species conservation categories, are provided in Appendix A. Conservation categories for ecological communities are provided in Appendix B.

1.2.1 EPBC Act

The EPBC Act aims to protect matters of national environmental significance (MNES). Under the EPBC Act, the Commonwealth Department of the Environment (DoE) lists threatened species and communities in categories determined by criteria set out in the Act (Appendix A and B).

Projects likely to cause a significant impact on MNES should be referred to the DoE for assessment under the EPBC Act.

1.2.2 WC Act

The WA DPaW lists flora under the provisions of the WC Act as protected according to their need for protection (Appendix A).

Flora is given Declared Rare status when populations are geographically restricted or are threatened by local processes. In addition, under the WC Act, by Notice in the WA Government Gazette of 9 October 1987, all native flora are protected throughout the State.

1.2.3 EP Act

T/DRF and TECs are given special consideration in environmental impact assessments, and have special status as ESAs under the EP Act and the *Environmental Protection*

(Clearing of Native Vegetation) Regulations 2004. Exemptions for a clearing permit do not apply in an ESA.

1.2.4 BAM Act

Plants may be 'Declared' by the Agriculture Protection Board (APB) under the BAM Act 2007 (WA). Declared Plants are gazetted under three categories (C1-C3), which define the action required. Details of the definitions of these categories are provided in Appendix C. A declaration may apply to the whole State, to districts, individual properties or even to single paddocks. If a plant is 'Declared', landholders are obliged to control that plant on their properties (Department of Agriculture and Food WA [DAFWA] 2014).

1.2.5 DPaW Weed Prioritisation Process

The DPaW Weed Prioritisation Process (WPP) was developed to progress the Environmental Weed Strategy of WA. The Weed Prioritisation Process for DPaW (DPaW 2013) prioritises weeds in each of the DPaW Regions, with the aim being to establish both a species-led and an asset-protection-based approach to weed management.

The species-led process assesses weed species for their invasiveness, ecological impacts, potential and current distribution and feasibility of control. The resulting priorities focus on infestations of species which are considered to be high impact, rapidly invasive and still at a population size which is feasible to eradicate or contain to a manageable size. Weed species which are already widespread do not rank as a high priority through this part of the process.

The next stage of the process investigates the use of an asset-protection-based approach to guide the management of widespread weeds. This approach focuses on identifying high value biodiversity assets, the weeds that pose a threat to these assets and the sites where control will have the greatest biodiversity benefit and cost effectiveness. Social, cultural and economic assets as well as good neighbour issues are considered at a later stage of the process.

1.2.6 Weeds of National Significance

The Australian Government along with the State and Territory governments has endorsed 32 WONS. Four major criteria were used in determining WONS:

- The invasiveness of a weed species;
- A weed's impacts;
- The potential for spread of a weed; and
- Socio-economic and environmental values.

Each WONS has a national strategy and a national coordinator, responsible for implementing the strategy. WONS are regarded as the worst weeds in Australia because of their invasiveness, potential for spread, economic and environmental impacts (Thorp & Lynch 2000).

1.2.7 DPAW Priority Lists

The DPaW lists 'Priority' flora that have not been assigned statutory protection as Declared Rare or 'Scheduled' under the WC Act, but which are under consideration for declaration as DRF. Flora assessed as Priority 1-3 are considered to be in urgent need of further survey. Priority 4 flora requires monitoring every 5-10 years and Priority 5 flora is subject to a specific conservation programme (Appendix A).

The DPaW maintains a list of PECs which identifies ecologically valuable communities that need further investigation before possible nomination for TEC status. Once listed, a community is a PEC, and when endorsed by the WA Minister of Environment becomes a TEC, and protected as an ESA under *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* (Appendix B).

1.2.8 Informal Recognition of Flora

Certain populations or communities of flora may be of local significance or interest because of their patterns of distribution and abundance. For example, specific locations of flora may be locally significant because they are range extensions to the previously known distribution, or are newly discovered taxa (and have the potential to be of more than local significance). In addition, many species are in decline as a result of threatening processes (land clearing, grazing, changed fire regimes), and relict populations of such species assume local importance for the DPaW. It is not uncommon for the DPaW to make comment on these species of interest.

2 Biophysical Environment

2.1 Climate

The closest long term official Bureau of Meteorology (BoM) weather station currently operating near the Survey Area, is Jandakot Airport (Station number 009172), approximately 7 km north of the Survey Area. The climate for the area is described as warm Mediterranean (Mitchell *et al*. 2002), with mean minima of 11.5 °C, a maxima of 24.5 °C and an average of 820.1 mm of rainfall per annum (BoM 2015).

Jandakot Airport recorded 530.8 mm of rain prior to the survey (January 2015 – August 2015). This is 121.4 mm below the long term average rainfall of 652.2 mm for the same period (BoM 2015). For the three months prior to the survey (June 2015 – August 2015), Jandakot Airport recorded 351.6 mm of rainfall, 23% below the 456.4 mm long term average rainfall for the same period (BoM 2015).

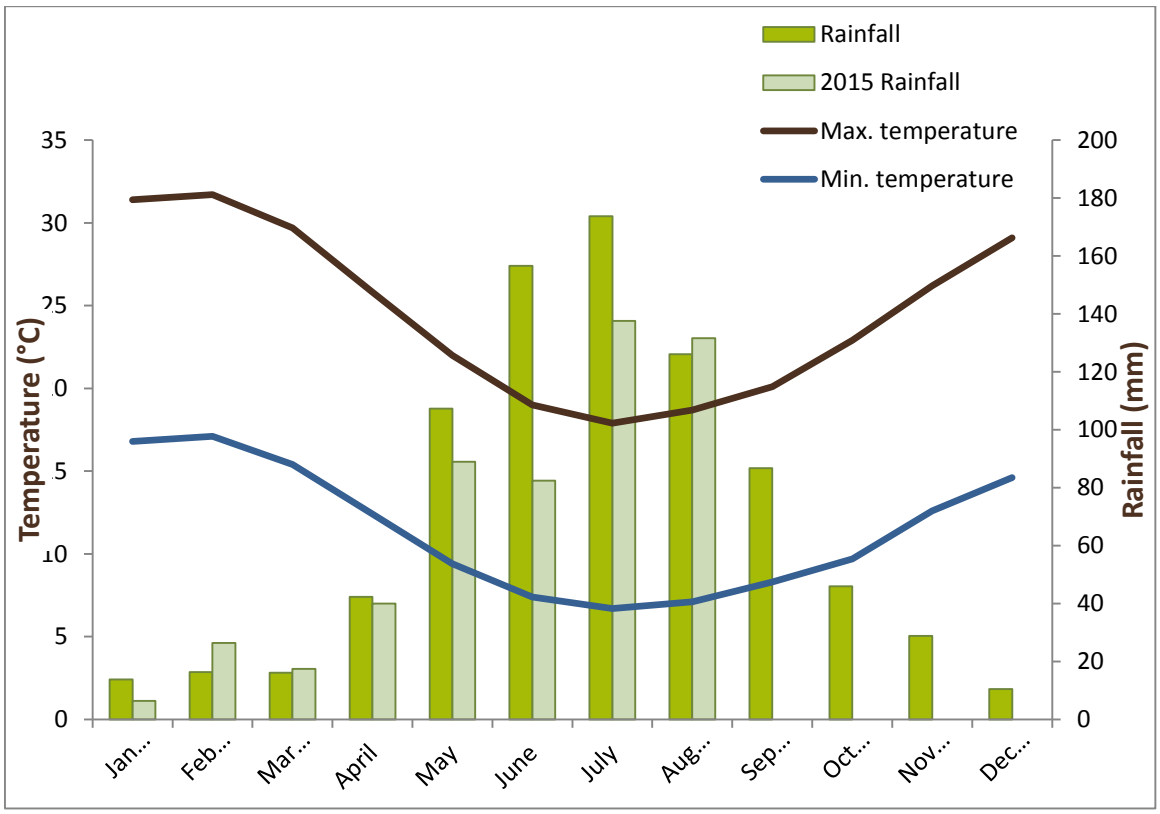

Figure 2: Mean Rainfall (from 1944 to 2015) and Temperature Data (from 1944 to 2015) for Jandakot Airport Weather Station (009172) (BoM 2015).

2.2 Geology and Soils

Soil-landscape mapping of South West WA has been captured at scales ranging from 1:20 000 to 1:250 000 (DAFWA 2012). Soil-landscape mapping describes broad soil and landscape characteristics from regional to local scales.

The Survey Area contains the following geological units and soil types:

- 212Bs – Swan Coastal Plain from Busselton to Jurian. Sand Dunes and sandplains with pale deep sand, semi-wet and wet soil. Banksia-paperbark woodlands and mixed heaths.

2.3 Hydrology

The Geomorphic Wetlands dataset is identified and utilised by the Environmental Protection Authority (EPA), Department of Environment Regulation (DER) and the Department of Planning as a basis for planning and decision making. The wetland management categories as set out by Hill *et al.* (1996) along with the management objectives utilised by the EPA and the DPaW for wetlands are displayed in Table 1.

The DPaW Geomorphic Wetlands Dataset identifies two wetlands as occurring in the Survey Area (DPAW 2015a) (Figure 3).

The DPaW Geomorphic Wetlands Dataset identifies one Conservation Category Wetland (CCW) and one Resource Enhancement Wetland (REW) as occurring in the Survey Area. The unique identification numbers (UFI) and management category of these wetlands are provided in Table 1.

Table 1: Geomorphic Wetlands in the Survey Area

MANAGEMENT CATEGORY	WETLAND UFI
Resource Enhancement Wetland	15180
Conservation Wetland	12984

2.4 Bush Forever

Bush Forever is a State Government Policy and programme that identifies 51,200 ha of regionally significant vegetation for protection, covering 26 vegetation complexes. This amounts to approximately 18% of the original vegetation on the SCP biogeographic region of the Perth metropolitan area.

Regionally significant vegetation has been identified based on criteria relating to its conservation value. Important criteria in the identification process include the achievement, where possible, of a comprehensive representation of all the ecological communities originally occurring in the region, principally through protecting a target of at least 10% of each vegetation complex in the Bush Forever project boundary (Government of WA 2000).

No Bush Forever Sites are in the Survey Area; however, there is one Bush Forever site adjacent to the site on the south west corner (Figure 3):

- BF 492 – Lyon Road Bushland, Banjup.

There is also another Bush Forever Site, 263 – Banjup Bushland, Banjup which, is approximately 250 m to the east.

2.5 Ecological Linkages

The Survey Area forms part of the Perth Biodiversity Project's (PBP) Draft Regional Ecological Linkage Network presented in Figure 3. The purpose of the Regional Ecological Linkages identified by the PBP was to link protected natural areas with other areas of mapped native vegetation. Priority was given to identifying linkages through those areas having the greatest assumed protection and to those areas that maximised opportunities to form continuous corridors of native vegetation. The Survey Area is intersected by ecological linkage 52 which includes approximately 50% of the Survey Area and joins ecological linkage 46 that runs in a northern direction.

2.6 Environmentally Sensitive Areas

The entire Survey Area is mapped as an ESA (Figure 4).

2.7 Biogeographic Regionalisation for Australia

The Biogeographic Regionalisation of Australia (IBRA7) divides Australia into 89 bioregions based on major biological and geographical/geological attributes. These bioregions are subdivided into 419 subregions, as part of a refinement of the IBRA framework (DoE 2014a). The Survey Area lies within the Swan Coastal Plain Bioregion and Perth subregion (SWA2) of WA.

2.8 Broad Vegetation Types

Mapping of the vegetation of the Perth region of WA was completed on a broad scale (1:250,000) by Beard (1981). These vegetation units were re-assessed by Shepherd *et al*. (2001) to account for clearing in the intensive land use zone, dividing some larger vegetation units into smaller units.

There is one Beard / Shepherd vegetation unit in the Survey Area. The Shepherd *et al.* (2001) vegetation types (along with the corresponding Beard [1981] type in brackets), is described below, and its representation within the Survey Area, subregion, region and state is shown in Table 2.

- **1001** (e2Mb cbLi) – **Bassendean;** Medium very sparse woodland; *E. marginata* with low woodland, *Banksia* sp. and *Casuarina* sp.

Table 2: Broad Vegetation Types within the Survey Area and its State and Regional Representation (Government of WA 2013).

	Pre-European area (ha)	Current extent (ha) 1	Remaining (%)	Current extent % in IUCN Class I-IV Reserves1
Vegetation Types (Beard 1981/ Shepherd *et al*. 2001) in the state				
1001	57,410.23	13,240.22	23.06	1.14
Vegetation Types (Beard 1981/ Shepherd *et al*. 2001) in the Swan Coastal Bioregion				
1001	57,410.23	13,240.22	23.06	1.14
Vegetation Types (Beard 1981/ Shepherd *et al*. 2001) in the Perth Subregion				
1001	57,410.23	13,240.22	23.06	1.14

Mapping by Heddle *et al.* (1980) is based on the relationship to the landform-soil units determined by Churchward & McArthur (1980). This mapping identified one vegetation complex occurring in the Survey Area and this is summarised in Table 3. The delineation of vegetation complexes is based on the concept of series of plant communities forming regularly repeating complexes associated with a particular soil unit. The Heddle *et al.* (1980) vegetation complex that occurs across the Survey Area is described below:

- **Bassendean Complex – Central and South** Woodland to low woodland and sedgelands;

Table 3: Vegetation Complex within the Survey Area and their State and Regional Representation.

	Pre-European area (ha)	Current extent (ha)	Remaining (%)	Current extent Secure Tenure Reserves (%)
Vegetation Complex (Heddle *et al.* 1980) in the System 6/part System 1 area (EPA 2006)				
Bassendean Complex–Central and South	87,477	23,624	27.0	0.7
Vegetation (Heddle *et al.* 1980) in the Swan Coastal Bioregion (PBP 2013)				
Bassendean Complex–Central and South	87,392.73	24,206.24	27.70	2.57

3 Methods

3.1 Background

The flora survey was consistent with a single season Level 2 survey as per the EPA requirements for environmental surveying and reporting for flora and vegetation in WA where practical and relevant, as set out in the following documents:

- EPA Guidance for the Assessment of Environmental Factors: Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in WA No. 51 (EPA 2004); and
- EPA Guidance for the Level of Assessment for Proposals affecting Natural Areas within the System 6 Region and Swan Coastal Plain Portion of the System 1 region. Guidance Statement No. 10 (EPA 2006).

3.2 Flora and Vegetation Survey Methods

3.2.1 Flora and Vegetation Database Review

The desktop study provided background information on the flora and vegetation of the Survey Area. This involved a search of the following sources:

- DPaW Threatened and Priority Flora database (DPaW 2015b);
- DPaW Threatened and Priority Ecological Communities database (DPaW 2015c); and
- DoE Protected Matters Search Tool (DoE 2015b).

A request for a database search was submitted to the DPaW on the 8th September 2015 (5 km buffer search around the Survey Area) to obtain a list of Declared Rare Flora/Threatened or Priority flora, and TECs and PECs in and near the Survey Area. These sources were used to compile a list of expected DRF or Priority species and TECs and PECs that may occur based on the landforms in the Survey Area.

3.2.2 Flora and Vegetation Field Survey

The field survey was conducted by two botanists, on the 15th and 16th September 2015.

The survey included the assessment of 15 quadrats and seven relevés and vegetation mapping notes. Quadrats are vegetation survey plots which are accurately measured out as 10 x 10 m (or an area equivalent to 100 m2) and marked at the NW corner using a handheld Garmin GPS unit. Relevés are unbounded vegetation survey plots with information recorded including landscape features, surface soil colour and texture, bare ground, litter cover, disturbance, fire age, aspect and vegetation condition. Each species

of dominant plant at each relevé was recorded, including information on height and percentage cover.

3.2.3 Taxonomy and Nomenclature

Where field identification of plant taxa was not possible, specimens were collected systematically for later identification utilising resources of the Western Australian Herbarium (WAH).

The species list was checked against FloraBase (WAH 2014) to determine the species conservation status. Threatened and Priority Flora were verified against the EPBC Act listing of threatened species to determine Commonwealth listing.

Introduced species were checked against the DPaW Weed Prioritisation Process (WPP) (DPaW 2013), to determine their ranking in terms of environmental impact. The BAM Act Declared Plants list was consulted to determine if any are Declared Plants, and the WONS list to determine the presence of any WONS (Thorp & Lynch 2000).

3.2.4 Vegetation Mapping

The vegetation mapping units were described based on their structure and species composition, as defined by quadrat data and field observations. Vegetation was mapped in the field using handheld GPS (Garmin) units and high-resolution aerial photographs (1:2,000 scale), which in the office were digitised using GIS software.

Vegetation condition was mapped in the field using handheld GPS (Garmin) units and high-resolution aerial photographs (1:2,000 scale), which in the office were digitised using GIS software. Vegetation condition was assessed based on Bush Forever (Government of WA 2000) (Appendix D).

4 Results

4.1 Flora and Vegetation Survey Limitations and Constraints

Survey constraints are often difficult to predict, as is the extent to which they influence survey effort. Survey limitations and constraints of the flora and vegetation survey are detailed in Table 4.

Table 4: Limitations and Constraints Associated with the Survey.

VARIABLE	IMPACT ON SURVEY OUTCOMES
Access	The whole Survey Area was accessed and traversed. Particular focus was given to areas expected to be impacted and or that may have species of conservation significance.
Experience	The personnel who executed these surveys were practitioners suitably qualified in their respective fields: ● Coordinating Principal Botanist: Narelle Whittington; ● Field Staff: Narelle Whittington and Hayden Ajduk; ● Data Interpretation and Reporting: Narelle Whittington and Hayden Adjuk ● Report Review: Dr Ron Firth.
Timing, weather, season	The survey was conducted during spring after three months of below average rainfall (refer to section 2.1). The climate for the area is described as warm Mediterranean (Mitchell *et al.* 2002), with mean minima of 11.5 °C, a maxima of 24.5 °C and an average of 820.1 mm of rainfall per annum (BoM 2015). Flora composition changes with time, particularly seasonally as a result of seasonal conditions. Therefore, botanical surveys completed at different times will have varying results.
Scope: Life forms sampled	The scope of this project included the detailed surveying of flora and vegetation and searching for conservation significant species or communities.
Sources of information	Relevant DPaW searches were undertaken for the Survey Area and are listed in section 3.2. The desktop analysis used several sources to produce a list

	of flora species previously recorded in the vicinity of the Survey Area. This includes records from the EPBC Protected Matters Search Tool (DoE 2015b), NatureMap (DoE 2015c), DPaW Threatened & Priority Flora Search (DPaW 2015b) and DPaW Threatened & Priority Ecological Communities Search (DPaW 2015c), as well as field guides and other scientific literature.
Completeness	The entire Survey Area was accessible; the time spent conducting the survey was considered adequate for the size and complexity of the site. All vegetation associations were sufficiently surveyed; with 15 quadrats and seven relevés and additional vegetation mapping notes recorded.
Disturbances	The disturbance of the Survey Area varies. Portions of the Survey Area have been completely cleared for housing and the nursery. Some areas have been allowed to regenerate naturally and others have had endemic and non-endemic species planted. A large proportion of the site has not been cleared and remains intact.

4.2 Flora Results

4.2.1 Database Results

The database searches identified 24 conservation significant flora species as potentially occurring in the vicinity of the Survey Area. Of these, nine are classed as Threatened, one as Priority 1, eight as Priority 3 and six as Priority 4.

The likelihood of these 24 conservation significant flora occurring in the Survey Area is shown in Table 5 (refer also to Figure 5).

No TECs listed by the State or under the EPBC Act were present in the databases within a 5 km radius of the Survey Area. However, three State PECs were identified as occurring within 5 km of the Survey Area:

- SCP21c – Low lying *Banksia attenuata* woodlands or shrublands (Priority 3 (DPaW);
- SCP22 – *Banksia ilicifolia* woodlands (Priority 3 (DPaW)); and
- SCP24 – Northern *Spearwood shrublands and woodlands* (Priority 3 (DPaW));

Table 5: Assessment of the Likelihood of Occurrence of Significant Flora in the Survey Area.

[1]Closest record to Survey Area based on DPaW 2014.
Likely = Suitable habitat present and records less than 2 km from the Survey Area, Possible = Suitable habitat present and records between 2 km and 5 km from the Survey Area, Unlikely = No suitable habitat present and/or records greater than 5 km from the Survey Area, EN = Endangered, CR = Critically Endangered, VU = Vulnerable and T=Threatened.

Conservation Status		Species	Habitat Information (WAH 2014)	Suitable Habitat	Closest Record[1]	Likelihood
EPBC	DPaW					
EN	T	*Andersonia gracilis*	White/grey sand, sandy clay, gravelly loam. Winter-wet areas, near swamps.	Yes	16.0 km	Unlikely
CR	T	*Caladenia huegelii*	Grey or brown sand, clay loam.	Yes	1 km	Likely
CR	T	*Darwinia foetida*	Information unavailable	Unknown	56.1 km	Unlikely
VU	T	*Diuris micrantha*	Brown loamy clay. Winter-wet swamps, in shallow water.	Yes	6.3 km	Unlikely
EN	T	*Diuris purdiei*	Grey-black moist sand. Winter-wet swamps.	Yes	4.2 km	Possible
EN	T	*Drakaea elastica*	White or grey sand. Low-lying situations adjoining winter-wet swamps.	Yes	3.1 km	Possible
EN	T	*Drakaea micrantha*	White-grey sand.	Yes	3.6 km	Possible
EN	T	*Lepidosperma rostratum*	Peaty sand, clay.	Yes	7.3 km	Unlikely
EN	T	*Thelymitra dedmaniarum*	Granite	No	41.1 km	Unlikely
-	P1	*Acacia lasiocarpa* var. *bracteolata* long peduncle variant	Grey or Black sand over clay. Swampy areas, winter wet lowlands	Yes	Not available	Possible

Conservation Status		Species	Habitat Information (WAH 2014)	Suitable Habitat	Closest Record[1]	Likelihood
EPBC	DPaW					
-	P3	*Byblis gigantea*	Sandy-peat swamps. Seasonally wet areas.	Yes	6.3 km	Unlikely
-	P3	*Cyathochaeta teretifolia*	Grey sand, sandy clay. Swamps, creek edges.	Yes	2.7 km	Possible
-	P3	*Eryngium pinnatifidum* subsp. *palustre*	No information available	Unknown	Not available	Unknown
-	P3	*Jacksonia gracillima*	No information available	Yes	500 m	Likely
-	P3	*Pimelea calcicola*	Coastal limestone ridges	No	3.4 km	Unlikely
-	P3	*Stylidium longitubum*	Sandy clay, clay. Seasonal wetlands.	Yes	5.8 km	Possible
-	P3	*Stylidium paludicola*	Peaty sand over clay. Winter-wet areas. Marri and *Melaleuca* woodland, *Melaleuca* shrubland.	Yes	3.2 km	Possible
-	P4	*Dodonaea hackettiana*	Sand. Outcropping limestone.	No	3.6 km	Unlikely
-	P4	*Microtis quadrata*	No information available	Unknown	6.0 km	Unknown
-	P4	*Ornduffia submersa*	No information available	Unknown	6.9 km	Unknown
-	P4	*Thysanotus glaucus*	White, grey or yellow sand, sandy gravel	Yes	9.3 km	Unlikely
-	P4	*Tripterococcus* sp. *Brachylobus*	No information available	Unknown	1.2 km	Unknown

Conservation Status		Species	Habitat Information (WAH 2014)	Suitable Habitat	Closest Record[1]	Likelihood
EPBC	DPaW					
-	P4	*Verticordia lindleyi* subsp. *lindleyi*	Sand, sandy clay. Winter-wet depressions.	Yes	1.5 km	Likely

4.2.2 Overview of Flora

A total of 145 taxa (including species, subspecies, varieties and forms) from 101 genera and 45 families were recorded in the Survey Area. The commonly occurring families were; Myrtaceae (18 taxa), Fabaceae (15 taxa) and Orchidaceae (13 taxa.)

Of the 146 taxa, 27 are introduced species. Portions of the Survey Area have been completely cleared for residential and nursery purposes, some areas have been allowed to regenerate naturally and others have had endemic and non-endemic species planted (Figure 6). There is also a large proportion of the site that is original native vegetation.

The flora inventory is provided in Appendix E and the Survey Area data sheets in Appendix F.

4.2.3 Flora of Conservation Significance

A targeted search for conservation significant flora species resulted in:

- No Priority species as listed by DPaW were recorded during the survey; and
- No Threatened species listed under the EPBC Act or gazetted as Declared Rare Flora (Threatened) pursuant to the WC Act were recorded during the survey.

4.2.4 Introduced Flora

A total of 27 introduced species were recorded during the survey (Table 6). Two species, **Asparagus asparagoides* and **Zantedeschia aethiopica*, are listed as Declared under the BAM Act. One species **Asparagus asparagoides* is listed as a WONS.

Table 6: Introduced Flora Recorded in the Survey Area and Their Ranking under the DPaW Weed Prioritisation Process (DPaW 2013).

Taxon	Common Name	DPaW WPP ranking	Declared BAM Act	WONS
**Acacia iteaphylla*	Flinders Range Wattle	High	No	No
**Acacia longifolia*	Sydney Golden Wattle	High	No	No
**Arctotheca calendula*	Cape Weed	Low	No	No
**Avena barbata*	Bearded Oat	Low	No	No
**Asparagus asparagoides*	Bridal Creeper	Low	Yes	Yes
**Briza maxima*	Blowfly Grass	Low	No	No
**Carpobrotus edulis*	Pigface	Under review	No	No
**Cotula coronopifolia*	Waterbuttons	Under review	No	No
**Crassula natans* var. *minus*	-	Under review	No	No

**Cyperus tenellus*	Tiny Flat-Sedge	Under review	No	No
**Ehrharta calycina*	Perennial Veld Grass	Low	No	No
**Ehrharta longiflora*	Annual Veld Grass	Low	No	No
**Eragrostis curvula*	African Lovegrass	Low	No	No
**Euphorbia terracina*	Geraldton Carnation Weed	Moderate	No	No
**Fumaria capreolata*	Whiteflower Fumitory	Low	No	No
**Galium murale*	Small Bedstraw	Under review	No	No
**Gladiolus caryophyllaceus*	Wild Gladiolus	Moderate	No	No
**Hypochaeris glabra*	Smooth Catsear	Low	No	No
**Juncus capitatus*	-	Under review	No	No
**Lysimachia arvensis*	Pimpernel	Under review	No	No
**Pelargonium capitatum*	Rose Pelargonium	Low	No	No
**Romulea rosea* var. *australis*	Guildford Grass	Negligible	No	No
**Sonchus oleraceus*	Common Sowthistle	Negligible	No	No
**Trifolium* sp.	Hop Clover	information unavailable	No	No
**Ursinia anthemoides*	Ursinia	Negligible	No	No
**Vulpia bromoides*	Squirrels Tail Fescue	Under review	No	No
**Zantedeschia aethiopica*	Arum Lily	Moderate	Yes	No

4.2.5 Vegetation Associations

Thirteen natural vegetation associations were recorded in the Survey Area, there are also five other mapping units. Descriptions of these are provided in Table 7 and 8 and Figure 6.

Table 7: Vegetation Association Descriptions and their Extent in the Survey Area.

Vegetation Association Code	Description	Area (ha)
BaBm(a)	Low Woodland of *Banksia attenuata*, *Banksia menziesii*, *Allocasuarina fraseriana*, *Eucalyptus marginata* over *Kunzea glabrescens*, *Acacia pulchella*, *Hibbertia hypericoides*, *Xanthorrhoea preissii*, *Bossiaea eriocarpa* and *Conostylis aculeata*.	2.64
BaBm(b)	Low Woodland of *Banksia attenuata*, *Banksia menziesii*, *Allocasuarina fraseriana* over *Kunzea glabrescens*, *Dasypogon bromeliifolius*, *Hibbertia subvaginata*, *Calytrix fraseri* and *Bossiaea eriocarpa*.	4.67
AfEmBi	Open Woodland of *Allocasuarina fraseriana*, *Eucalyptus marginata* and *Banksia ilicifolia* over *Xanthorrhoea preissii*, *Dasypogon bromeliifolius*, *Bossiaea eriocarpa*, *Gompholobium tomentosum* and *Phlebocarya ciliata*.	1.53
BiKg	Woodland of *Banksia ilicifolia* and *Banksia attenuata* over *Kunzea glabrescens*, *Xanthorrhoea preissii*, *Dasypogon bromeliifolius* and *Desmocladus flexuosus*.	1.12
ErMp	Woodland of *Eucalyptus rudis* and *Melaleuca preissiana* over *Kunzea glabrescens*, *Xanthorrhoea preissii*, *Adenanthos cygnorum* and *Hypocalymma angustifolium*.	1.14
KgHa	Low Open Woodland of *Melaleuca preissiana* and *Melaleuca rhaphiophylla* over *Kunzea glabrescens*, *Hypocalymma angustifolium*, *Astartea scoparia*, *Melaleuca teretifolia*, *Meeboldina scariosa* and *Lepidosperma longitudinale*.	3.38
MpKg	Low Open Woodland of *Melaleuca preissiana* over *Kunzea glabrescens*, *Hakea varia*, *Acacia pulchella* var. *glaberrima*, *Calothamnus lateralis* var. *lateralis* and *Meeboldina coangustata*.	2.89
MrBa	Low Closed Forest of *Melaleuca rhaphiophylla* over *Baumea articulata*.	2.83

MtMr	*Closed Tall Scrub of Melaleuca teretifolia, Melaleuca rhaphiophylla, Meeboldina coangustata and Juncus capitatus.*	1.24
MrMl	*Low Woodland of Melaleuca rhaphiophylla over Melaleuca lateritia, Astartea scoparia, Meeboldina coangustata, Lepidosperma longitudinale and Juncus pallidus.*	3.65
Ec	Ecotone of *Banksia ilicifolia* and *Banksia menziesii* over *Kunzea glabrescens, Dasypogon bromeliifolius* and *Phlebocarya ciliata.*	0.8
Ha	Closed Heath of *Hypocalymma angustifolium, Kunzea glabrescens, Dielsia stenostachya, Dasypogon bromeliifolius* and *Boronia crenulata* var. *crenulata.*	7.87
Mr	Monoculture of young *Melaleuca rhaphiophylla* over water.	0.47

Table 8: Other Mapping Unit Descriptions and their Extent in the Survey Area

VEGETATION ASSOCIATION CODE	DESCRIPTION	AREA (HA)
NE	Non-endemic Eucalypt species.	0.49
G/O	Garden and Orchard.	3.96
Cleared	Cleared.	1.95
P	Planted non-endemic and endemic species.	0.73
OW	Open Water	0.04

4.2.6 Vegetation Condition

Vegetation condition ranged from Completely Degraded to Excellent (Figure 7). Historical vegetation clearing, weeds, housing, a nursery and the presence of tracks in the survey area were the most frequently observed impacts on native vegetation.

As evident from historical photographs clearing of the eastern side of the Survey Area was undertaken around 1983 for residential and agriculture use (Figure 8). This has had a direct effect on vegetation association 'Ha' and 'P' which have regrown and now has very low diversity. Vegetation 'P' has had supplementary planting undertaken and is now interspersed with non-endemic species along with naturally occurring vegetation. Additional tracks and clearing have been undertaken since then, including another residence on the western side.

The CCW in the middle of the Survey Area has remained relatively intact and the majority is considered to be in Very Good to Excellent condition with a couple of areas of vegetation in Good condition along with the tracks and a couple of small pockets considered to be in Degraded to Completely Degraded condition. The extent of each vegetation condition is presented in Tables 9.

Table 9: Vegetation Condition and Extent in the Survey Area.

CONDITION	EXTENT (HA)
Excellent	1.29
Excellent – Very Good	11.71
Very Good	9.52
Very Good - Good	1.25
Good	9.70
Good - Degraded	1.29
Degraded	0.28
Completely Degraded	3.36

4.2.7 Floristic Community Types

Statistical analysis (multivariate analysis) and data interpretation, as shown in Table 10 was undertaken to help determine the FCTs represented by the vegetation in the project area. This involves reviewing site data for other factors that are diagnostic for FCTs, including the presence of indicator species, soil types and landform position. The quadrat data was tested for similarity against each of the 509 Gibson *et al.* quadrats that were established as part of a regional study to describe the vegetation types present on the Swan Coastal Plain in 1994. Results from the statistical analysis and the site information, identified six FCTs as occurring in the Survey Area

Table 10: Floristic Community Type Analysis

VEGETATION ASSOCIATION	GIBSON *ET AL.* QUADRAT & FCT	SIMILARITY BASED ON STATISTICAL ANALYSIS	COMMENTS	INFERRED FLORISTIC COMMUNITY TYPE
BJQ1 (BaBm[a])	CRES01 (FCT SCP 23a)	55.0	The top three results in the analysis were SCP23a. This result seems appropriate given the species present and the location of the	**FCT SCP23a** – Central *Banksia attenuata* – *B. menziesii* woodlands
	BANK-3 (FCT SCP 23a)	54.7		
	YULE-2 (FCT	53.7		

Vegetation Association	Gibson *et al.* Quadrat & FCT	Similarity Based on Statistical analysis	Comments	Inferred Floristic Community Type
	SCP 23a)		community on the higher dunes of the Survey Area.	
BJQ2 (MrBa)	Chid06 (FCT SCP s17)	50	This quadrat was characterised by large mature *Melaleuca preissiana* over either sedges or exposed soil which had evidence of inundation.	FCT SCP13 – Deeper wetlands on heavy soils
	White04 (FCT SCP s17)	35.2		
	WN020 (FCT SCP s19)	30.7		
BJQ3 (MrBa)	HYMUS05 (FCT SCP 11)	28.5	The association had both *Melaleuca preissiana* and *M. rhaphiophylla* with an open understorey which showed signs of being inundated.	FCT SCP13 – Deeper wetlands on heavy soils
	HYMUS01 (FCT SCP 11)	25.8		
	CAVS06 (FCT SCP s07)	25.8		
BJQ4 (Mr)	MTB-5 (FCT SCP 17)	25	This quadrat was established in the core of the wetland and was still inundated with water to approximately 30 cm, consisting of only *Melaleuca preissiana*.	FCT SCP13 – Deeper wetlands on heavy soils
	CHID06 (FCT SCP 17)	22.2		
	WATER-2 (FCT SCP 13)	20		
BJQ5 (KgHa)	CHID06 (FCT SCP 17)	36.3	This association was characterised by high density wetland shrubs with scattered *Melaleuca preissiana* and *M. rhaphiophylla*. It is more analogous to SCP5 rather than	FCT SCP5 – Mixed shrub damplands
	PINJ02 (FCT SCP s03)	32.2		
	GOSN05 (FCT SCP s03)	29.6		

Vegetation Association	Gibson *et al.* Quadrat & FCT	Similarity Based on Statistical analysis	Comments	Inferred Floristic Community Type
			SCP4. This is based on the low diversity of the dense shrub layer.	
BJQ6 (MtMr)	McLART-1 (FCT SCP 13)	35.7	This quadrat consisted of dense wetland shrubs and sedges with scattered *Melaleuca rhaphiophylla*.	FCT SCP5 – Mixed shrub damplands
	ELLIS-1(FCT SCP 17)	29.6		
	CAPEL-9 (FCT SCP 12)	28.5		
BJQ7 (AfEmBi)	ELE33 (FCT SCP 4)	48.1	Regardless of the analysis results that indicate a higher similarity with SCP4, because of the presence of more dry land species and the dominance of *Allocasuarina fraseriana* and *Eucalyptus marginata* it is thought to be more similar with SCP21a.	FCT SCP21a – Central *Banksia attenuata* – *E. marginata* woodlands
	MODO-2 (FCT SCP 21c)	44.8		
	ELE04 (FCT SCP 21a)	42.1		
BJQ8 (Ha)	TWIN-1 (FCT SCP 6)	34.4	This association had been historically cleared and is now natural regrowth with very low diversity. Due to the lack of upper- storey species, it is most analogous to SCP5.	FCT SCP5 – Mixed shrub damplands
	PINJ13 (FCT SCP s17)	33.3		
	AUSTB-4 (FCT SCP 5)	30		
BJQ9	McLART-1 (FCT	31.25	Due to the	FCT SCP4 -

Vegetation Association	Gibson *et al.* Quadrat & FCT	Similarity Based on Statistical analysis	Comments	Inferred Floristic Community Type
(MrMl)	SCP 13)		dominance of *Melaleuca preissiana* and *M. rhaphiophylla* along with the typical understorey species it is thought that this association is more similar to SCP4. The area also did not appear to be subject to deep inundation in the winter months due to the species and ground litter present.	Melaleuca preissiana damplands
	LESCH-6 (FCT SCP 17)	27.7		
	BEEL03 (FCT SCP 11)	27.5		
BJQ10 (BiKg)	LOW07 (FCT SCP 21c)	52.1	The analysis indicated that BJQ10 is most similar to SCP21c, given the species present, and the location of the association in the landscape SCP21c.	**FCT SCP21c** – Low Lying *Banksia attenuata* woodlands or shrublands
	MODO-2 (FCT SCP 21c)	48.3		
	GOSN13 (FCT SCP 23a)	46.6		
BJQ11 (MrMl)	WHITE08 (FCT SCP 21a)	33.3	Due to the dominance of *Melaleuca preissiana* and *M. rhaphiophylla* along with the typical understorey species it is thought that the association is more analogous to SCP4. The area also did not appear to be subject to deep inundation in the winter months.	**FCT SCP4** - Melaleuca preissiana damplands
	GOSN05 (FCT SCP s03)	28.5		
	McLART-1(FCT SCP 13)	28.5		

Vegetation Association	Gibson *et al.* Quadrat & FCT	Similarity Based on Statistical analysis	Comments	Inferred Floristic Community Type
BJQ12 (BaBm[b])	FL-5 (FCT SCP 21c)	55	The analysis showed that BJQ10 is most similar to SCP21c. This is due to the species present and the location of the association in the landscape. .	FCT SCP21c – Low Lying *Banksia attenuata* woodlands or shrublands
	ELE02 (FCT SCP 21c)	49.3		
	HURST03 (FCT SCP 23a)	49.0		
BJQ13 (MpKg)	McLART-1 (FCT SCP 13)	36.3	Due to the dominance of *Melaleuca preissiana* along with the typical understorey species it is thought that the association is more similar to SCP4. The association is not part of the core wetland and did not appear to be subject to deep inundation in the winter months due to the species and ground litter present.	FCT SCP4 - *Melaleuca preissiana* damplands
	WHITE08 (FCT SCP s17)	34.0		
	GOS05 (FCT SCP s03)	30.3		
BJQ14 (Ha)	PERTH10 (FCT SCP 4)	44.0	The location of this association had been historically disturbed and consequently has low diversity. Due to the lack of upper- storey species and in its present state it is most analogous with SCP5.	FCT SCP5 – Mixed shrub damplands
	GUTHR-4 (FCT SCP 5)	36.6		
	GOSN01 (FCT SCP 4)	34.9		

Vegetation Association	Gibson *et al.* Quadrat & FCT	Similarity Based on Statistical Analysis	Comments	Inferred Floristic Community Type
BJQ15 (BaBm[a])	HURST03 (FCT SCP 23a)	50.9	The top two results in the analysis were for SCP23a, this result seems appropriate given the species present and the location of the community on the higher dunes of the Survey Area.	FCT SCP23a – Central Banksia attenuata – B. menziesii woodlands
	CRESW01 (FCT SCP 23a)	49.4		
	CAVS11 (FCT SCP 21a)	49.4		

Table 11: Referred Floristic Community Types

Vegetation Association	Comments	Inferred Floristic Community Type
ErMp (BJR4)	This community had an over storey of species found in wetland areas (*Eucalyptus rudis* and *Melaleuca preissiana*), however, it also had upland species present such as *Xanthorrhoea preissii* and *Adenanthos cygnorum*. This characteristic as well as nearby occurrences makes it simular to SCP5,	FCT SCP5 - Mixed shrub damplands
Ec	This community is an ecotone between the drier BaBm association and the wetland. Due to the mix of both dry land and wetland species a FCT couldn't be determined.	-

4.2.8 Threatened and Priority Ecological Communities

A search of the DPaW TEC and PEC database identified no TECs listed by the State or under the EPBC Act within a 5 km radius of the Survey Area. Three PECs were identified as occurring within 5 km of the Survey Area:

Two Priority 3 vegetation communities, SCP21c - Low lying *Banksia attenuata* woodlands or shrublands and SCP22 – *Banksia ilicifolia* woodlands, are known to occur in close proximity to the Survey Area with their buffers encroaching into the north east corner of the Survey Areas boundary.

One listed Priority 3 vegetation community was identified as occurring in the Survey Area. Vegetation associations BaBm (b) and BiKg are thought to represent FCT SCP 21c – Low lying *Banksia attenuata* woodlands or shrublands.

Although the database search did not identify "Banksia dominated woodlands of the Swan Coastal Plain IBRA region", all vegetation that has an over storey dominated by *Banksia* are all listed as Priority 3 ecological communities and have been nominated to become a federally listed TEC under the EPBC Act. The nomination is currently being assessed by the DoE and the corresponding threatened species scientific committee. The key feature of these *Banksia* woodlands is the presence of *Banksia attenuata* and/or *B. menziesii* occurring on deep sands. The vegetation association BaBm (a), which has been identified as FCT SCP23a - Central *Banksia attenuata – B. menziesii* woodlands, may also be considered the Priority 3 ecological community. With this taken into consideration vegetation association BaBm (a) is considered Priority 3.

4.2.9 Regional Representation

Vegetation mapping units described in the Survey Area were correlated with the Beard (1981) and Shepherd *et al*. (2001) broad vegetation types as much as possible by examining similarities in vegetation descriptions (Table 11). Differences exist with the terminology used in the descriptions as they are based on different methods of categorising and characterising vegetation types, and the different spatial scale of the analysis (i.e. region vs. local scale). Due to the altered state of some of the vegetation and the majority of the vegetation being wetland dependant many of the vegetation associations could not be correlated.

Table 12: Representation of broad vegetation types and corresponding vegetation associations.

Vegetation Type and Description (Shepherd *et al.* 2001 / Beard 1981)	Corresponding Vegetation Association (Current Survey)	Vegetation Association Extent in Survey Area (ha)
1001 (e2Mb cbLi)	BaBm, AfEmBt, Ec	9.64

5 Discussion

5.1 Flora Context

A total of 145 taxa (including species, subspecies, varieties and forms) from 101 genera and 45 families were recorded in the Survey Area.

Of the 145 taxa, 27 are introduced species. Portions of the Survey Area have been completely cleared for residential and a nursery, some areas have been allowed to regenerate naturally and others have had endemic and non-endemic species planted. There is also a large proportion of the site that is original native vegetation.

5.2 Flora of Conservation Significance

No Threatened species listed under the EPBC Act or gazetted as Declared Rare Flora (Threatened) pursuant to the WC Act were recorded during the survey. No Priority Flora were recorded during the survey.

The review of the database searches identified nine T/DRF flora species potentially occurring in the vicinity of the Survey Area. Of these species, five are unlikely, three are possible and one is likely. Two of these possible species are perennial, so would have been detectable at the time of the survey if they occurred in the Survey Area. Five species, *Caladenia huegelii*, *Diuris micrantha, Diuris purdiei, Drakaea elastica* and *Drakaea micrantha,* are perennial (tuberous) short-lived herbs (orchids) that need various conditions to flower and exhibit different flowering patterns. Regardless of these attributes, the survey was undertaken during the optimum time for the flowering of these species and targeted searches were undertaken in their preferred habitats and none were found.

A further 14 priority flora taxa were identified as potentially occurring in the Survey Area based on database searches. Of these species, four do not have information available to determine whether it could occur in the Survey Area, two are considered likely to occur, four are considered possible and four are considered unlikely. Five of the potential species are perennial so would have been able to be located at the time of the survey. The remaining two species are annual; *Stylidium longitudinale* would have been able to be detected during the survey based on the species flowering period.

5.3 Vegetation of Conservation Significance

A search of the DPaW TEC and PEC database identified three PEC occurring within 5 km of the Survey Area (DPaW 2013c). Two PECs are considered likely to occur in the Survey Area.

Results from the statistical analysis (multivariate analysis) and data interpretation indicate that there are two Priority 3 ecological communities in the Survey Area. Vegetation associations BaBm (b) and BiKg are thought to represent FCT SCP 21c – Low lying *Banksia attenuata* woodlands or shrublands. These two associations equate to 5.79 ha of the survey area. The majority of this FCT is considered to be in good condition. On the northern boundary there is a small area that is very weed infested and has some *Banksia* death, therefore this area has been given a condition rating of Good to Degraded. There are a few localised patches of weeds in the north west corner, however, these haven't effected the overall condition of the vegetation, therefore, its considered to be in Excellent condition.

The vegetation association BaBm(a), has been identified as FCT SCP23a - Central *Banksia attenuata – B. menziesii* woodlands. Although the database search did not identify SCP23a, it is included in the PEC "*Banksia* dominated woodlands of the Swan Coastal Plain IBRA region", which is now listed as a Priority 3 and is being currently assessed to become a federally listed TEC. With this taken into consideration vegetation association BaBm(a) is considered Priority 3 and equates to 2.64 ha of the Survey Area. This FCT is considered to be in a Good to Excellent condition.

Two Priority 3 vegetation communities, SCP21c - Low lying *Banksia attenuata* woodlands or shrublands and SCP22 – *Banksia ilicifolia* woodlands, are known to occur in close proximity to the Survey Area with their buffers encroaching into the north east corner of the Survey Areas boundary.

PECs are known as ecologically valuable communities that need further investigation before possible nomination for TEC status. Priority communities listed by DPaW have no formal protection. There is no written policy on how to respond to the presence of PECs within proposed development sites and the presence of these communities is dealt with by DPaW on a case by case basis.

5.4 ESAs

There are no TECs or DRF present in the Survey Area, however, the entire Survey Area is identified as an ESA. Although there is no publicly available information detailing the reasoning behind the ESA mapping, the boundaries are found to correlate with the Gibbs Road Swamp System according to the Directory of Important Wetlands (2008).

Under the EP Act, any clearing of native vegetation requires a permit unless done for an exempt purpose. ESAs are declared to prevent degradation of important environmental values such as T/DRF, TECs or significant wetlands. Exemptions contained in the Environmental Protection (Clearing of Native vegetation) Regulations 2004 for low impact land clearing do not apply in ESAs and a native vegetation clearing permit is required. A specific permit must therefore be obtained prior to any clearing in an ESA.

5.5 Vegetation Condition and Introduced Flora

Vegetation condition ranged from Completely Degraded to Excellent (Figure 7). Historical vegetation clearing, weeds, housing, a nursery and the presence of tracks in the survey area were the most frequently observed impacts on native vegetation.

Historical and present land use has altered areas of the vegetation, which is reflected in the low diversity and non-endemic species that have been planted to supplement the regrowth of the natural vegetation. This has mainly affected the eastern side of the CCW.

The CCW in the middle of the Survey Area has remained relatively intact and is considered to be in Very Good to Excellent condition with a couple of areas of vegetation in Good condition along with the tracks that are cleared.

The upland vegetation on the Western side of the Survey Area varies greatly in condition from Excellent to Good to Degraded. There are areas considered high in diversity, however, there are pockets where the understory is low in both diversity and density and is weed infested.

A total of 27 introduced species were recorded during the survey. Two species, **Asparagus asparagoides* and **Zantedeschia aethiopica*, are listed as Declared under the BAM Act. One species **Asparagus asparagoides* is listed as a WONS.

5.6 Regional Representation

The PBP has mapped native vegetation extent by vegetation complex on the Swan Coastal Plain. It is estimated that Bassendean Complex – Central and South has 27.7% native vegetation remaining based on the pre-European extent.

The EPA recognises vegetation complexes that are not well represented as being significant. Vegetation complexes which have 10%-30% remaining may be considered regionally significant. Proposals that would affect a vegetation complex with 10% or less remaining are likely to be formally assessed by the EPA (EPA 2006).

5.7 Geomorphic Wetlands

The DPaW Geomorphic Wetlands Dataset identifies two wetlands as occurring within the Survey Area including one CCW and one REW. CCWs and their associated buffers are considered ESAs and as such exemptions offered for clearing under Regulation 5 of the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* do not apply.

5.8 Ecological Linkages

The Survey Area forms part of the PBPs Draft Regional Ecological linkage network. The Survey Area is intersected by ecological linkage 52 which includes approximately 50% of the Survey Area and joins ecological linkage 46 that runs in a northern direction (Figure 3). The linkage portion of the Survey Area is fully vegetated and could be considered to be important in providing vegetated habitat in a non-continuous linkage across the landscape.

Recognised by the EPA, DPaW and local government, the retention of native vegetation and fauna habitat within the Regional Ecological Linkages aims to reduce the loss of biodiversity and key ecological functions across the South West. The EPA expects that in preparing plans and proposals for development, consideration will be given to both the site-specific biodiversity conservation values of patches of native vegetation, as well as the landscape function and core linkage significance of a patch in supporting the maintenance of an ecological linkage.

6 Conclusions

The targeted flora survey was undertaken within the recommended season and flowering period for the south west botanical province. The Survey Area was sufficiently surveyed and as such the following conclusions can be drawn:

- The condition varies greatly across the site, this being influenced by historical clearing and land use;
- Results from the statistical analysis (multivariate analysis) and data interpretation indicate that there are two Priority 3 ecological communities in the Survey Area;
- Vegetation associations BaBm (b) and BiKg are thought to represent FCT SCP 21c – Low lying *Banksia attenuata* woodlands or shrublands;
- The vegetation association BaBm (a), has been identified as FCT SCP23a - Central *Banksia attenuata – B. menziesii* woodlands. Although the database search did not identify SCP23a, it is included in the PEC "*Banksia* dominated woodlands of the Swan Coastal Plain IBRA region", which is now listed as a Priority 3;
- No Threatened species listed under the EPBC Act and/or gazetted as Declared Rare Flora (Threatened) pursuant to the WC Act were recorded during the survey;
- No Priority flora were recorded during the survey;
- No Bush Forever sites occur in the Survey Area, however, there is one adjacent to the boundary in the south west corner;
- The DPaW Geomorphic Wetlands Dataset identifies one CCW and one REW as occurring in the Survey Area; and
- The Survey Area is identified as part of a larger ESA, and part of the PBP's Draft Regional Ecological linkage network.

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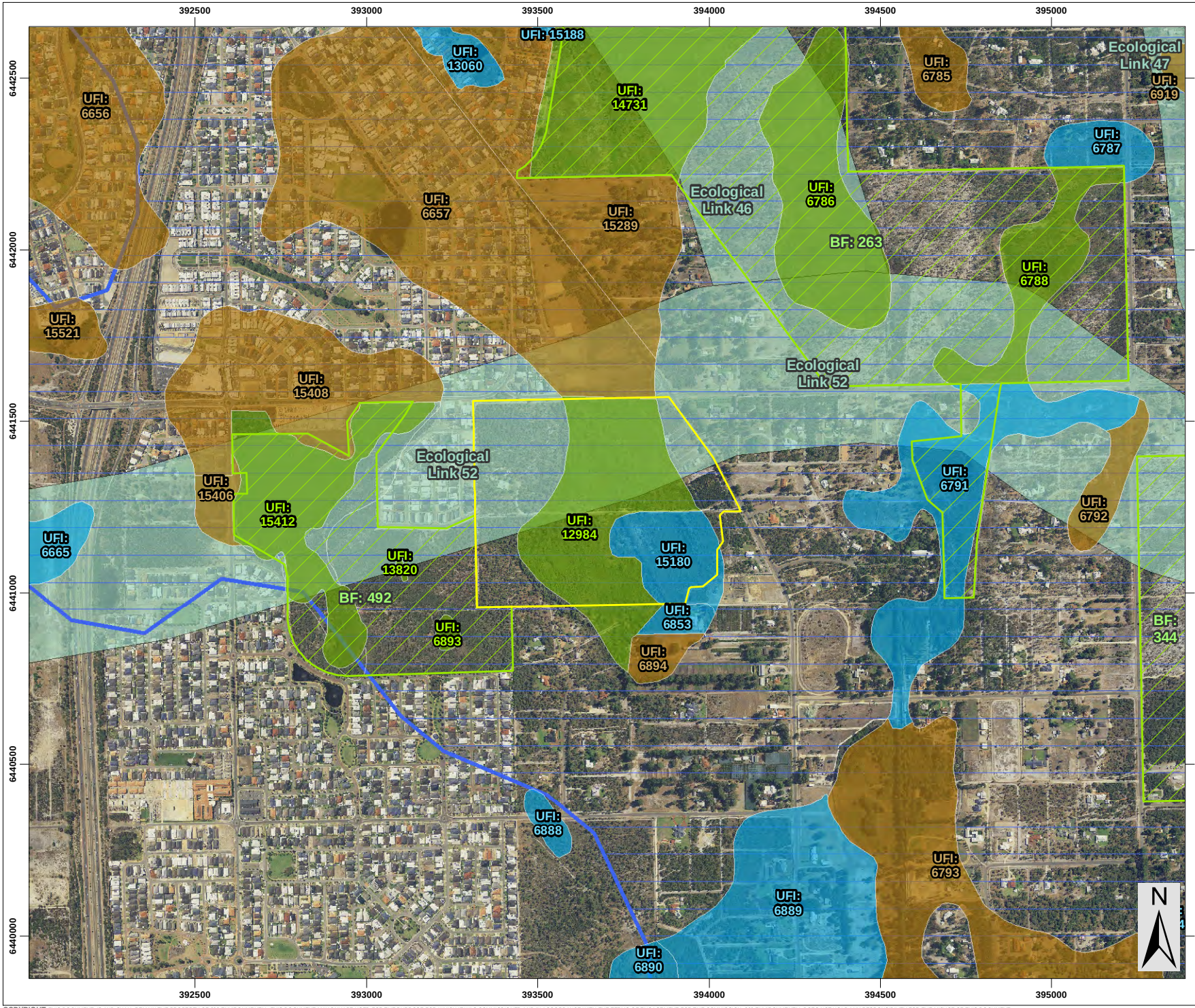
FIGURES



Legend

- Survey Area
- Bush Forever Sites
- DPaW Managed Lands
- Perth Regional Ecological Linkages
- Directory of Important Wetlands DIWA Australia

Geomorphic Wetlands

- Conservation
- Resource Enhancement
- Multiple Use
- Not Assessed

- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS
- WETLANDS SOURCED DPAW 2015
- ECOLOGICAL LINKAGES SOURCED WALGA 2014
- BUSH FOREVER SOURCED DOP 2014
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LOCALITY MAP

PROJECT ID	DATE
1269	14/12/2015

HORIZONTAL DATUM AND PROJECTION
GDA 1994 MGA Zone 50

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Level 2 Flora and Vegetation Survey

Figure 3 -
Conservation Areas

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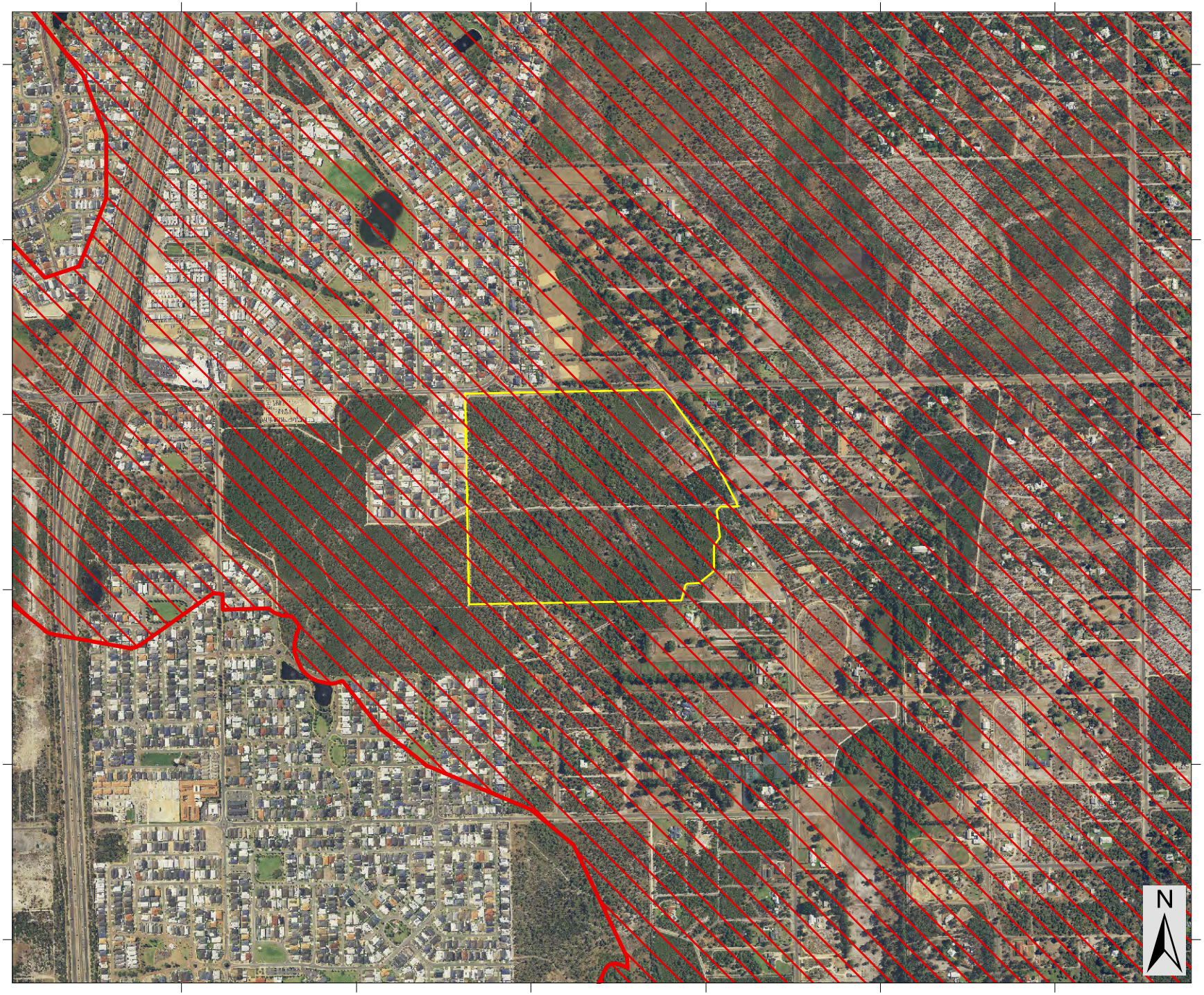

Legend

- Survey Area
- Environmentally Sensitive Areas

- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS
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Figure 4 -
Environmentally Sensitive Areas

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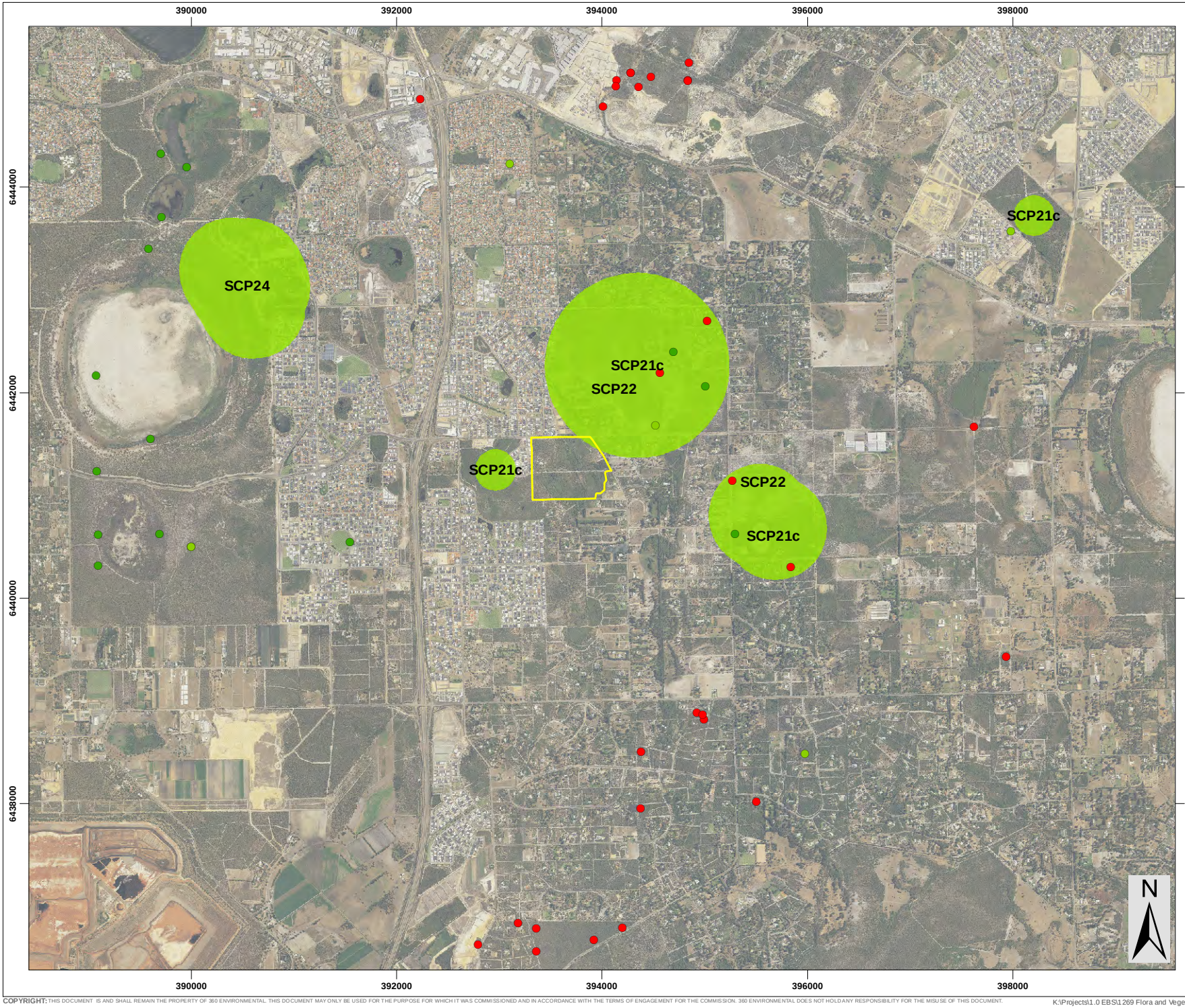

Legend

Survey Area

Rare and Priority Flora

- Priority 4
- Priority 3
- Priority 2
- Priority 1
- Declared Rare

TECs/PECs

- Priority 4
- Priority 3
- Priority 2
- Priority 1
- Vulnerable
- Endangered
- Critically Endangered

- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS
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Level 2 Flora and Vegetation Survey

Figure 5 -
DPAW Results

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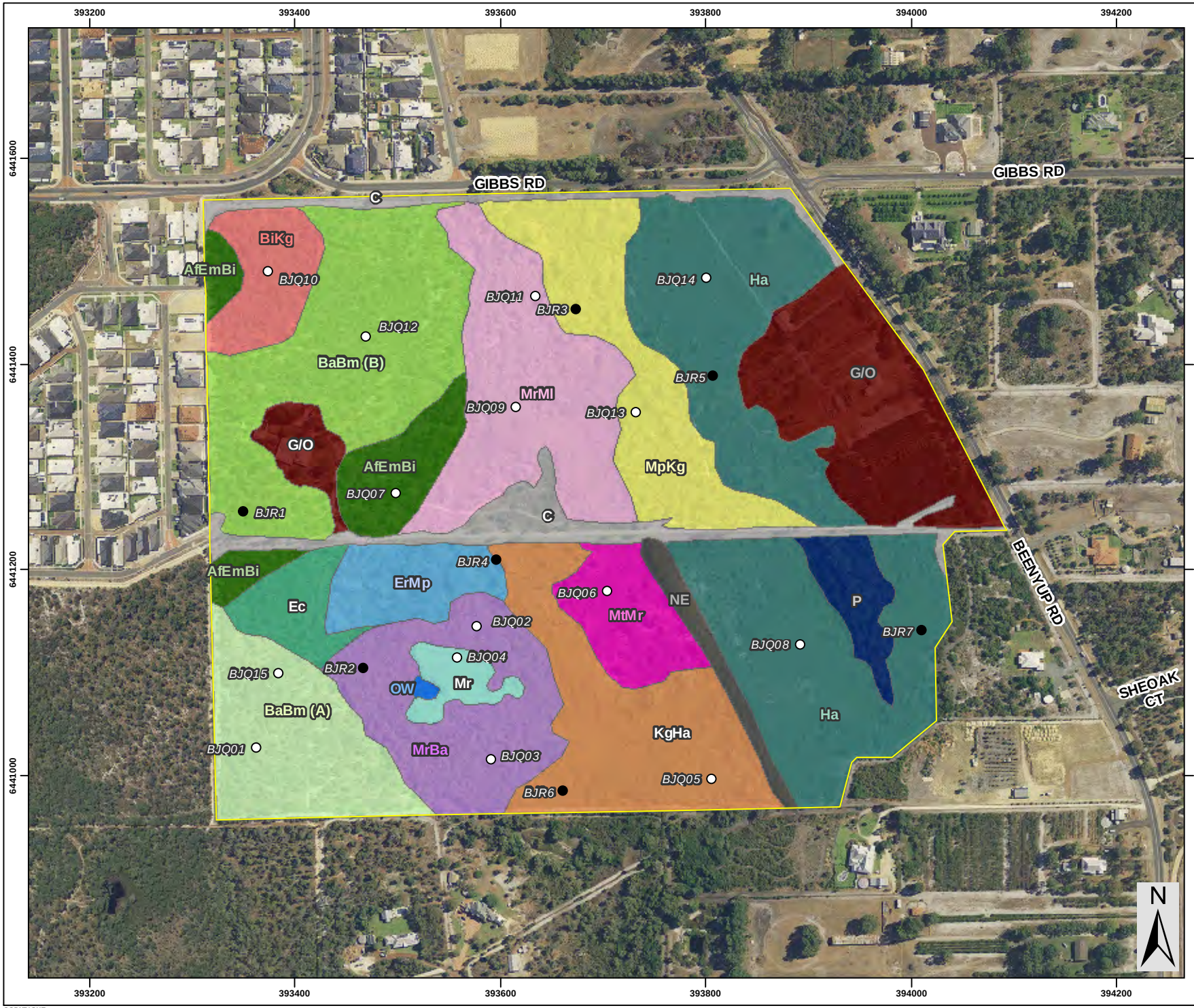

Legend

- Survey Area (41.4 ha)

Vegetation Association

- BaBm (A)
- BaBm (B)
- AfEmBi
- BiKg
- Ec
- ErMp
- Ha
- KgHa
- MpKg
- Mr
- MrBa
- MrMl
- MtMr
- Non Endemic Eucalypt species
- Open Water
- Planted non endemic and endemic species
- Cleared
- Garden/Orchard

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Figure 6 -
Vegetation Associations

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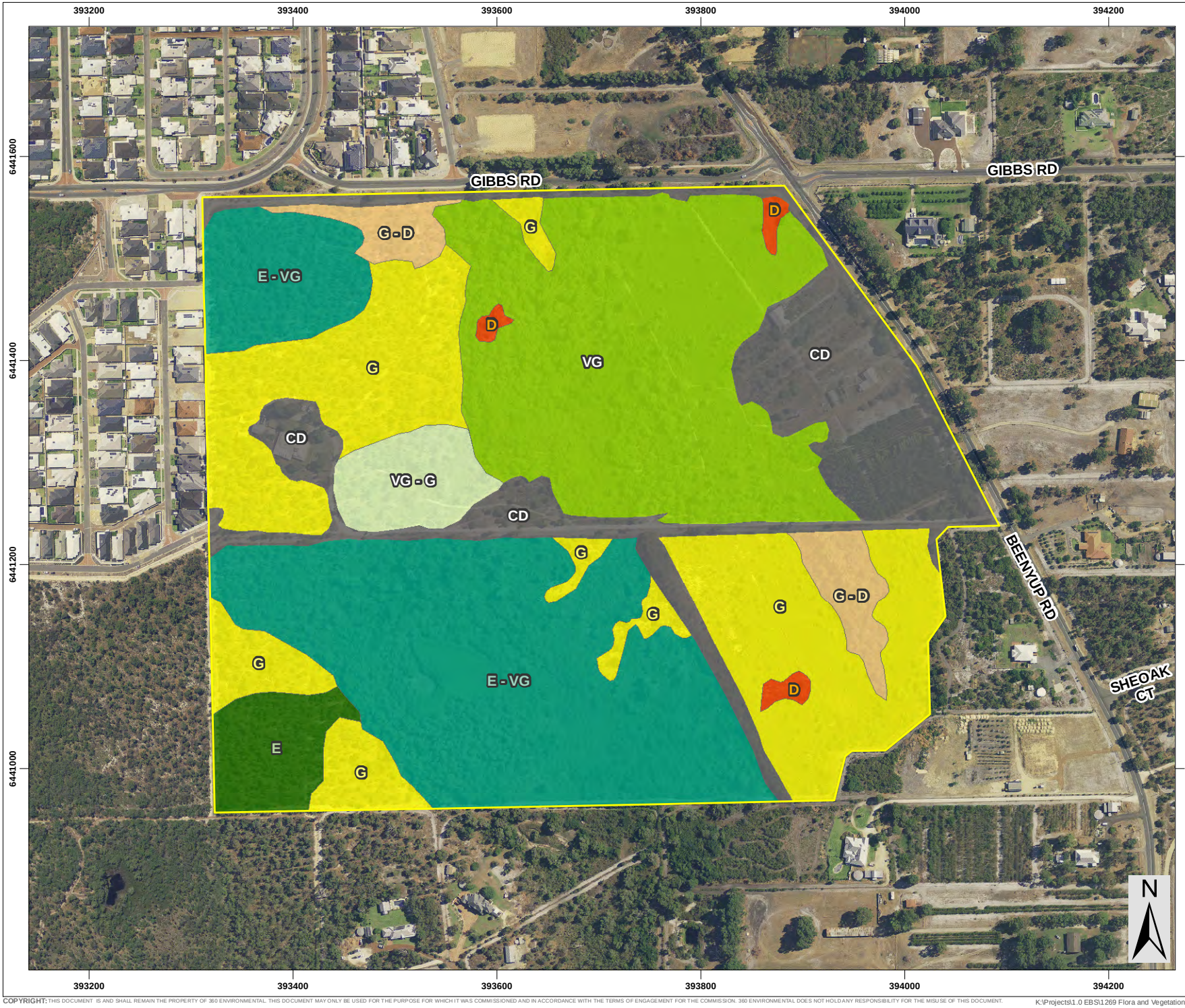

Legend

Survey Area

Vegetation Condition

- Excellent (1.29 ha)
- Excellent - Very Good (11.71 ha)
- Very Good (9.52 ha)
- Very Good - Good (1.25 ha)
- Good (9.70 ha)
- Good - Degraded (1.29 ha)
- Degraded (0.28 ha)
- Completely Degraded (6.36 ha)

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0 50 100 150 200
Meters
1:5,000 @ A4

LOCALITY MAP

PROJECT ID	DATE
1269	14/12/2015

HORIZONTAL DATUM AND PROJECTION
GDA 1994 MGA Zone 50

CREATED	CHECKED	APPROVED	REVISION
CS	NW	TS	0

Aigle Royal Developments
Beenyup Road, Banjup

Level 2 Flora and Vegetation Survey

Figure 7 -
Vegetation Condition Mapping

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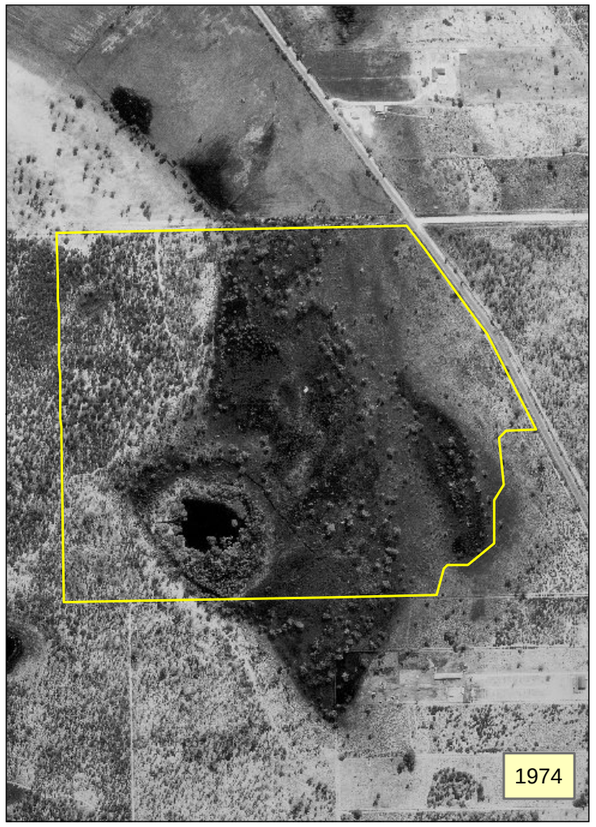
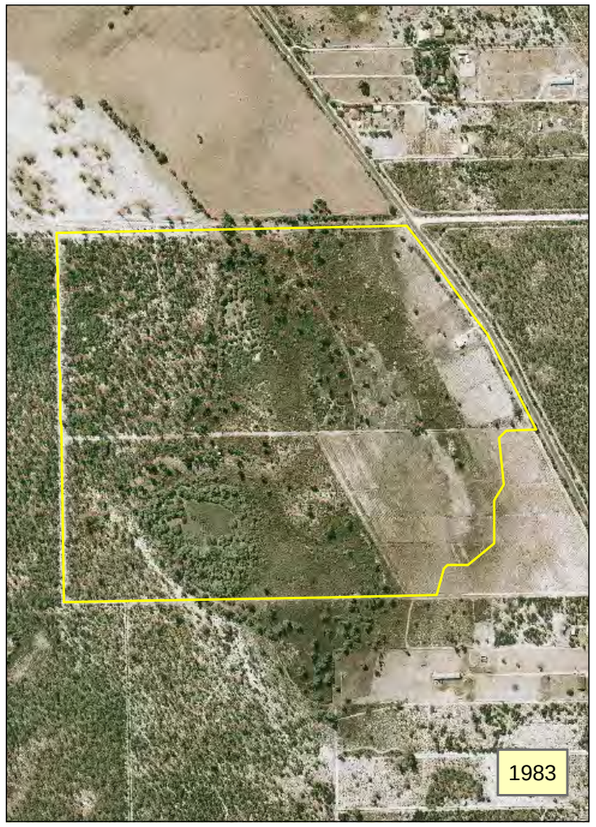
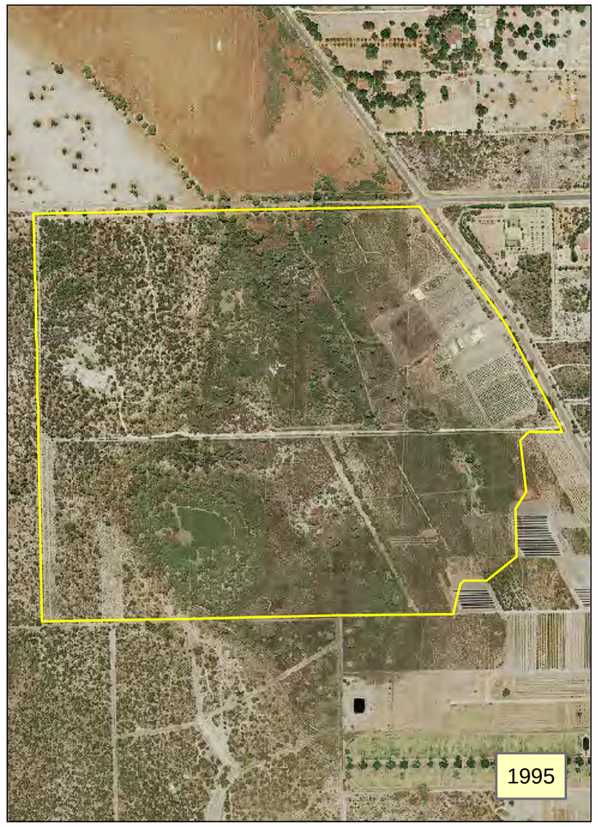
K:\Projects\1.0 EBS\1269 Flora and Vegetation Banjup\Figures\L2 Flora and Veg Report\1269 L2 FX Vegetation Condition.mxd







Legend

Site Location

- CADASTRAL BOUNDARY SOURCED LANDGATE 2009
- LOCALITY MAP SOURCED LANDGATE 2006
- CADASTRE SOURCED SLIP SERVICES 15 JAN 2015
- AERIAL PHOTOGRAPHY SOURCED LANDGATE 2014
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- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS

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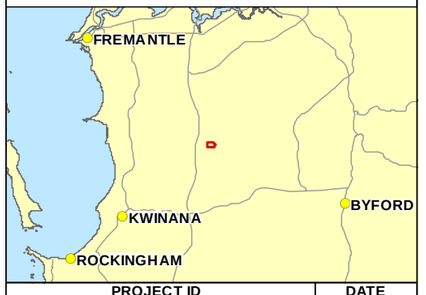
0 50 100 200 300 400 500
Meters
@ A3

LOCALITY MAP



PROJECT ID	DATE
950	17-Dec-15

HORIZONTAL DATUM AND PROJECTION
GDA 1994 MGA Zone 50

CREATED	CHECKED	APPROVED	REVISION
CS	RHa	LR	0

Aigle Royal Developments
Beenyup Road, Banjup

Level 2 Flora and Vegetation Survey

Figure 8 -
Historical Aerial Imagery

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APPENDIX A

Definition of Declared Rare / Priority / Threatened Flora and Fauna Species

Categories of Declared Rare Flora (WC act) and Priority listings (DPaW)

Conservation Code	Description
X	**Presumed Extinct Flora (Declared Rare Flora – Extinct)** "Taxa which have been adequately searched for and there is no reasonable doubt that the last individual has died, and have been gazetted as such (Schedule 2 under the *Wildlife Conservation Act 1950*)."
T	**Threatened Flora (Declared Rare Flora – Extant)** "Taxa which have been adequately searched for and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection, and have been gazetted as such (Schedule 1 under the *Wildlife Conservation Act 1950*)." "Threatened Flora (Schedule 1) are further ranked by the Department according to their level of threat using IUCN Red List criteria: CR: Critically Endangered – considered to be facing an extremely high risk of extinction in the wild; EN: Endangered – considered to be facing a very high risk of extinction in the wild; VU: Vulnerable – considered to be facing a high risk of extinction in the wild."
P1	**Priority One: Poorly-known taxa** "Taxa which are known from one or a few collections or sight records (generally less than five), all on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, Shire, Westrail and Main Roads WA road, gravel and soil reserves, and active mineral leases and under threat of habitat destruction or degradation. Taxa may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes."
P2	**Priority Two: Poorly-known taxa** "Taxa which are known from one or a few collections or sight records, some of which are on lands not under imminent threat of habitat destruction or degradation, e.g. national parks, conservation parks, nature reserves, State forest, vacant Crown Land, water reserves, etc. Taxa may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes."
P3	**Priority Three: Poorly-known taxa** "Taxa which are known from collections or sight records from several localities not under imminent threat, or few but widespread localities with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Taxa may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and known threatening

	processes exist that could affect them."
P4	**Priority Four: Rare, Near Threatened and other taxa in need of monitoring** a. Rare. "Taxa which 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 taxa are usually represented on conservation lands." b. Near Threatened. "Taxa that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable." c. "Taxa that have been removed from the list of threatened species during the past five years for reasons other than taxonomy."
P5	**Priority Five: Conservation Dependent taxa** "Taxa that are not threatened but are subject to a specific conservation program, the cessation of which would result in the taxon becoming threatened within five years."

Source: Department of Parks and Wildlife (2013). Online: http://florabase.dpaw.wa.gov.au.

Western Australian Threatened Fauna Categories Wildlife Conservation Act 1950 (WA)

CATEGORY	CODE	DESCRIPTION
Schedule 1	S1	Rare or likely to become extinct.
Schedule 2	S2	Presumed extinct.
Schedule 3	S3	Birds subject to an agreement between the governments of Australia and Japan, the People's Republic of China & the Republic of Korea relating to the protection of migratory birds and birds in danger of extinction.
Schedule 4	S4	Other specially protected fauna.

Department of Environment and Conservation Fauna Priority Codes

CATEGORY	CODE	DESCRIPTION
Priority 1	P1	Taxa with few, poorly known populations on threatened lands.
Priority 2	P2	Taxa with few, poorly known populations on conservation lands.
Priority 3	P3	Taxa with several, poorly known populations, some on conservation lands.
Priority 4	P4	Taxa in need of monitoring: not currently threatened or in need of special protection, but could become so. Usually represented on conservation lands.
Priority 5	P5	Taxa in need of monitoring: not considered threatened, but the subject of a specific conservation program, the cessation of which would result in the species becoming threatened within five years.

Categories of Threatened Flora and Fauna Species under the EPBC Act

CONSERVATION CODE	DESCRIPTION
Ex	**Extinct** Taxa which at a particular time if, at the time, there is no reasonable doubt that the last member of the species has died.
ExW	**Extinct in the Wild** Taxa which is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or it has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
CE	**Critically Endangered** Taxa which at a particular time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
E	**Endangered** Taxa which is not critically endangered and it is facing a very high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.
V	**Vulnerable** Taxa which is not critically endangered or endangered and is facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.
CD	**Conservation Dependent** Taxa which at a particular time if, at that time, the species is the focus of a specific conservation program, the cessation of which would result in the species becoming vulnerable, endangered or critically endangered within a period of 5 years.

Source: *Environment Protection and Biodiversity Conservation Act 1999*

APPENDIX B

Definition of Threatened and Priority Ecological Communities

Definitions of Threatened Ecological Communities as Endorsed by the Western Australian Minister for the Environment

Presumed Totally Destroyed (PD)

An ecological community will be listed as presumed totally destroyed if there are no recent records of the community being extant and either of the following applies (A or B);

A) Records within the last 50 years have not been confirmed despite thorough searches or known or likely habitats or

B) All occurrences recorded within the last 50 years have since been destroyed.

Critically Endangered (CR)

An ecological community will be listed as Critically Endangered when it has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future. This will be determined on the basis of the best available information, by it meeting any one or more of the following criteria (A, B or C):

A) The estimated geographic range, and/or total area occupied, and/or number of discrete occurrences since European settlement have been reduced by at least 90% and either or both of the following apply (i or ii)

i) geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is imminent (within approximately 5 years)

ii) modification throughout its range is continuing such that in the immediate future (within approximately 5 years) the community is unlikely to be capable of being substantially rehabilitated.

B) Current distribution is limited, and one or more of the following apply (i, ii or iii):

i) geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the immediate future (within approximately 5 years)

ii) there are very few occurrences, each of which is small and/or isolated and extremely vulnerable to known threatening processes

iii) there may be many occurrences but total area is very small and each occurrence is small and/or isolated and extremely vulnerable to known threatening processes

C) The ecological community exists only as highly modified occurrences which may be capable of being rehabilitated if such work begins in the immediate future (within approximately 5 years)

Endangered (EN)

An ecological community will be listed as Endangered when it has been adequately surveyed and is not Critically Endangered but is facing a very high risk of total destruction in the near future. This will be determined on the basis of the best available information, by it meeting any one or more of the following criteria (A, B or C):

A) The estimated geographic range, and/or total area occupied, and/or number of discrete occurrences since European settlement have been reduced by at least 70% and either or both of the following apply (i or ii)

i) geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is likely in the short term (within approximately 10 years)

ii) modification throughout its range is continuing such that in the short term future (within approximately 10 years) the community is unlikely to be capable of being substantially restored or rehabilitated.

B) Current distribution is limited, and one or more of the following apply (i, ii or iii):

i) geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the short term future (within approximately 10 years)

ii) there are very few occurrences, each of which is small and/or isolated and extremely vulnerable to known threatening processes

iii) there may be many occurrences but total area is very small and each occurrence is small and/or isolated and extremely vulnerable to known threatening processes

C) The ecological community exists only as highly modified occurrences which may be capable of being rehabilitated if such work begins in the short term future (within approximately 10 years).

Vulnerable (VU)

An ecological community will be listed as Vulnerable when it has been adequately surveyed and is not Critically Endangered or Endangered but is facing a high risk of total destruction in the medium to long term future. This will be determined on the basis of the best available information, by it meeting any one or more of the following criteria (A, B or C):

A) The ecological community exists largely as modified occurrences which are likely to be capable of being substantially restored or rehabilitated.

B) The ecological community can be modified or destroyed and would be vulnerable to threatening processes, is restricted in area and/or range and/or is only found at a few locations.

C) The ecological community may still be widespread but is believed likely to move into a category of higher threat in the medium to long term future because of existing or impending threatening processes.

Source: Department of Environment and Conservation (2010). Definitions, Categories and Criteria for Threatened and Priority Ecological Communities. Department of Environment and Conservation, Perth, WA. Online: www.naturebase.net/

Definitions of Priority Ecological Communities as listed DPaW

Possible threatened ecological communities that do not meet survey criteria or that are not adequately defined are added to the Priority Ecological Community Lists under Priorities 1, 2 and 3. These three categories are ranked in order of priority for survey and/or definition of the community, and evaluation of conservation status, so that consideration can be given to their declaration as threatened ecological communities. Ecological Communities that are adequately known, and are rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list, are placed in Priority 4. These ecological communities require regular monitoring. Conservation Dependent ecological communities are placed in Priority 5.

Priority One: Poorly known ecological communities

Ecological communities with apparently few, small occurrences, all or most not actively managed for conservation (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) and for which current threats exist. Communities may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under immediate threat from known threatening processes across their range.

Priority Two: Poorly known ecological communities

Communities that are known from few small occurrences, all or most of which are actively managed for conservation (e.g. within national parks, conservation parks, nature reserves, State forest, unallocated Crown land, water reserves, etc.) and not under imminent threat of destruction or degradation.

Communities may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under threat from known threatening processes.

Priority Three: Poorly known ecological communities

(i) Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation or:

(ii) Communities known from a few widespread occurrences, which are either large or within significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat, or;

(iii) Communities made up of large, and/or widespread occurrences that may or not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, and inappropriate fire regimes.

Communities may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and/or are not well defined, and known threatening processes exist that could affect them.

Priority Four: Ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened or that have been recently removed from the threatened list.

These communities require regular monitoring.

(a) Rare. Ecological communities known from few occurrences 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 communities are usually represented on conservation lands.

(b) Near Threatened. Ecological communities that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable.

(c) Ecological communities that have been removed from the list of threatened communities during the past five years.

Priority Five: Conservation Dependent ecological communities.

Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.

Source: Department of Parks and Wildlife (2013). Definitions, Categories and Criteria for Threatened and Priority Ecological Communities. Department of Environment and Conservation, Perth, WA. Online: www.naturebase.net/

APPENDIX C

Environmental Weeds and Declared Plant Categories

Criteria used for Ranking Environmental Weeds

The Weed Prioritisation Process for DPaW contains criteria for the assessment and ranking of weeds in terms of their environmental impact on biodiversity. These criteria are as follows:

- **Potential Distribution** – Area of potential habitat in the Region that could be occupied or the area at risk of invasion by the weed.
- **Current Distribution** - Area of habitat in the Region currently occupied by the weed, in relation to the habitat that it could invade.
- **Ecological Impact** - Impact of species within the Region, from low impact (causes minimal disruption to ecological processes or loss of biodiversity) to high (causes acute disruption of ecological processes, dominates and/or significantly alters vegetation structure, composition and function of ecosystems).
- **Invasiveness** – rate of spread of a weed in native vegetative, encompassing factors of establishment, reproduction and long distance dispersal (>100m).
- **Feasibility of Control** - The longer a coordinated control program takes to achieve its desired goal, the more expensive and less feasible it becomes. Is it feasible to eradicate or at least contain the infestation?

Source: DPaW (2013). Weed Prioritisation Process for DPaW (formerly DEC) – "An integrated approach to Weed Management on DPaW-managed lands in WA"

Standard Meanings of Declared Plant Categories

Under the Biosecurity and Agriculture Management Act 2007 (the BAM Act), all declared pests are placed in one of three categories, namely C1 (exclusion), C2 (eradication) or C3 (management).

C1 category (Exclusion) - Pests will be assigned to this category if they are not established in WA and control measures are to be taken, including border checks, in order to prevent them entering and establishing in the State.

C2 category (Eradication) – Pests will be assigned to this category if they are present in WA in low enough numbers or in sufficiently limited areas that their eradication is still a possibility.

C3 category (Management) – Pests will be assigned to this category if they are established in WA but it is feasible, or desirable, to manage them in order to limit their damage. Control measures can prevent a C3 pest from increasing in population size or density or moving from an area in which it is established into an area which currently is free of that pest.

Source: Department of Agriculture and Food, WA. Online: http://www.biosecurity.wa.gov.au/western-australian-organism-list-waol

APPENDIX D

Vegetation Condition Scale

Condition Scale Code	Condition Scale
P	**Pristine (1)** Pristine or nearly so, no obvious signs of disturbance
E	**Excellent (2)** Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.
VG	**Very Good (3)** Vegetation structure altered 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.
G	**Good (4)** Vegetation structure significantly altered by very obvious signs of multiple disturbance. Retains basic vegetation structure or ability to regenerate 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.
D	**Degraded (5)** 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.
CD	**Completely Degraded (6)** The structure of the vegetation is 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 comprising weed or crop species with isolated native trees or shrubs.

Source: Bush Forever Vegetation Condition Scale as developed by Keighery (1994) and summarized in Bush Forever (Government of WA (2000b)

APPENDIX E

Flora Inventory

Family	Name
Aizoaceae	**Carpobrotus edulis*
Anarthriaceae	*Lyginia barbata*
	Lyginia imberbis
Apiaceae	*Actinotus glomeratus*
Araceae	**Zantedeschia aethiopica*
Araliaceae	*Trachymene pilosa*
Asparagaceae	**Asparagus asparagoides*
	Chamaescilla corymbosa
	Laxmannia squarrosa
	Lomandra caespitosa
	Lomandra hermaphrodita
	Lomandra micrantha subsp. *micrantha*
	Lomandra suaveolens
	Thysanotus manglesianus
	Thysanotus patersonii
Asteraceae	**Arctotheca calendula*
	**Cotula coronopifolia*
	**Hypochaeris glabra*
	Lagenifera huegelii
	Quinetia urvillei
	Siloxerus humifusus
	**Sonchus oleraceus*
	**Ursinia anthemoides*
	Waitzia suaveolens var. *suaveolens*
	Asteraceae sp.
Campanulaceae	*Lobelia alata*
	Lobelia anceps
	Wahlenbergia sp.
Casuarinaceae	*Allocasuarina fraseriana*
Colchicaceae	*Burchardia congesta*
Crassulaceae	*Crassula closiana*
	Crassula colorata var. *colorata*
	**Crassula natans* var. *minus*
Cupressaceae	*Callitris preissii*
Cyperaceae	*Baumea articulata*
	Cyathochaeta avenacea
	**Cyperus tenellus*
	Lepidosperma ? longitudinale
	Lepidosperma longitudinale
	Lepidosperma sp.
	Lepidosperma squamatum

Family	Name
	Lepidosperma squamatum
	Schoenus efoliatus
Dasypogonaceae	*Dasypogon bromeliifolius*
Dilleniaceae	*Hibbertia hypericoides*
	Hibbertia racemosa
	Hibbertia subvaginata
Droseraceae	*Drosera erythrorhiza*
	Drosera macrantha subsp. *macrantha*
	Drosera pulchella
	Drosera glanduligera
Ericaceae	*Leucopogon* aff. *conostephioides*
	Leucopogon conostephioides
Euphorbiaceae	**Euphorbia terracina*
Fabaceae	**Acacia iteaphylla*
	**Acacia longifolia*
	Acacia pulchella var. *glaberrima*
	Acacia stenoptera
	Aotus sp.
	Bossiaea eriocarpa
	Daviesia triflora
	Eutaxia virgata
	Gompholobium tomentosum
	Hovea pungens
	Jacksonia furcellata
	Kennedia prostrata
	Pultenaea ochreata
	Pultenaea reticulata
	**Trifolium* sp.
Geraniaceae	**Pelargonium capitatum*
Goodeniaceae	*Dampiera linearis*
Haemodoraceae	*Anigozanthos humilis*
	Anigozanthos manglesii
	Conostylis aculeata subsp. *aculeata*
	Conostylis juncea
	Phlebocarya ciliata
Haloragaceae	*Glischrocaryon angustifolium*
Iridaceae	**Gladiolus caryophyllaceus*
	Patersonia occidentalis var. *occidentalis*
	**Romulea rosea* var. *australis*
Juncaceae	**Juncus capitatus*
	Juncus pallidus

Family	Name
	Juncus planifolius
Lamiaceae	*Hemiandra pungens*
Lauraceae	*Cassytha racemosa*
	Cassytha sp.
Loganiaceae	*Phyllangium divergens*
Loranthaceae	*Nuytsia floribunda*
Menyanthaceae	*Liparophyllum* sp.
Molluginaceae	*Macarthuria australis*
Myrtaceae	*Astartea scoparia*
	Calothamnus lateralis var. *lateralis*
	Calytrix fraseri
	Chamelaucium uncinatum
	Eucalyptus camaldulensis
	Eucalyptus marginata
	Eucalyptus rudis
	Eucalyptus todtiana
	Hypocalymma angustifolium
	Hypocalymma robustum
	Kunzea glabrescens
	Melaleuca lateritia
	Melaleuca preissiana
	Melaleuca rhaphiophylla
	Melaleuca teretifolia
	Melaleuca thymoides
	Pericalymma ellipticum var. *ellipticum*
	Scholtzia involucrata
Orchidaceae	*Caladenia discoidea*
	Caladenia flava subsp. *flava*
	Caladenia latifolia
	Diuris corymbosa
	Diuris laxiflora
	Diuris sp.
	Pterostylis recurva
	Pterostylis sanguinea
	Pterostylis sp. crinkled leaf (G.J. Keighery 13426)
	Pterostylis sp. short sepals (W. Jackson BJ259)
	Pterostylis vittata
	Thelymitra sp.
	Orchidaceae sp.
Papaveraceae	**Fumaria capreolata*
Phyllanthaceae	*Poranthera microphylla*

Family	Name
Poaceae	*Amphipogon turbinatus*
	**Avena barbata*
	**Briza maxima*
	**Ehrharta calycina*
	**Ehrharta longiflora*
	**Eragrostis curvula*
	Neurachne alopecuroidea
	**Vulpia bromoides*
	Poaceae sp.
Primulaceae	**Lysimachia arvensis*
Proteaceae	*Adenanthos cygnorum* subsp. *cygnorum*
	Banksia attenuata
	Banksia ilicifolia
	Banksia menziesii
	Banksia prionotes
	Hakea varia
	Persoonia saccata
	Petrophile linearis
	Stirlingia latifolia
	Xylomelum occidentale
Restionaceae	*Desmocladus flexuosus*
	Dielsia stenostachya
	Hypolaena exsulca
	Meeboldina coangustata
	Meeboldina scariosa
Rubiaceae	**Galium murale*
	Opercularia vaginata
Rutaceae	*Boronia crenulata*
	Philotheca spicata
Santalaceae	*Leptomeria pauciflora*
Stylidiaceae	*Stylidium brunonianum*
	Stylidium piliferum
	Stylidium repens
Violaceae	*Hybanthus calycinus*
Xanthorrhoeaceae	*Xanthorrhoea preissii*
Zamiaceae	*Macrozamia riedlei*

APPENDIX F

Flora Survey Area Data Sheets

Site BJQ01

Described by HA
Date 16/09/2015
Type Quadrat 10 X 10m
MGA Zone 50 393363 **mE** 6441026 **mN**
Habitat Top dune
Soil Grey sands
Vegetation Low woodland of Banksia attenuata, Banksia menziesii, Allocasuarina fraseriana and Eucalyptus marginata over mixed low shrubs over Conostylis aculeata subsp. aculeata and Dasypogon bromeliifolius with Desmocladus flexuosus with Stylidium repens.
Veg Condition Excellent - Very Good
Fire Age Old (8-12)
Notes Aspect: North
Disturbance: Weeds, Clearing
Ground Cover: 2% Bareground, 1% Logs, 1% Twigs, 45% Leaves

SPECIES LIST:

Name	Cover	Height	Specimen Notes
Acacia pulchella var. glaberrima	1.5	50	BJ01-02
Acacia stenoptera	+	30	BJ01-23
Allocasuarina fraseriana	4	400	nc
Amphipogon turbinatus	+	15	BJ01-11
Anigozanthos manglesii	+	50	nc
Banksia attenuata	17	600	nc
Banksia menziesii	4	500	nc
Bossiaea eriocarpa	1	40	BJ01-06
Briza maxima	+	10	nc
Burchardia congesta	+	50	nc
Caladenia discoidea	+	20	BJHA02
Caladenia flava subsp. flava	+	20	nc
Chamaescilla corymbosa	+	20	BJ01-X1
Conostylis aculeata subsp. aculeata	3	30	BJ01-10
Conostylis juncea	1	50	BJ01-04
Dampiera linearis	+	20	BJ01-09
Dasypogon bromeliifolius	2	40	nc
Desmocladus flexuosus	8	20	BJ01-07
Drosera erythrorhiza	+	1	nc
Drosera macrantha subsp. macrantha	+	<1	BJ01-28
Ehrharta calycina	+	40	nc
Eucalyptus marginata	3	350	nc
Gladiolus caryophyllaceus	+	50	nc
Gompholobium tomentosum	+	40	BJ01-08
Hibbertia hypericoides	2	50	nc
Hibbertia racemosa	1.5	30	BJ01-19
Hypocalymma robustum	3	50	BJ01-03
Hypochaeris glabra	+	1	nc
Kennedia prostrata	+		nc
Kunzea glabrescens	2	50-200	BJ01-01
Lagenifera huegelii	+	40	BJ01-14
Laxmannia squarrosa	+	20	BJ01-24
Lepidosperma squamatum	+	50	BJ01-13
Leucopogon conostephioides	1	20	BJ01-16
Lomandra hermaphrodita	+	20	BJ01-22
Lomandra micrantha subsp. micrantha	+	30	BJ01-27
Lomandra suaveolens	+	10	BJ01-25
Lyginia barbata	1	50	BJ01-17
Macrozamia riedlei	+	50	nc
Opercularia vaginata	+	20	BJ01-12
Patersonia occidentalis var. occidentalis	1	30	nc
Petrophile linearis	+	30	nc
Philotheca spicata	1	60	BJ01-05
Pterostylis sanguinea	+	20	BJ01-26
Stirlingia latifolia	+	70	nc
Stylidium brunonianum	+	20	BJ01-21
Stylidium piliferum	+	30	BJ01-15
Stylidium repens	3	10	nc
Thysanotus patersonii	+	<1	BJ01-18
Trachymene pilosa	+	10	BJ01-20
Ursinia anthemoides	+	10	nc

Site BJQ02

Described by NW
Date 15/09/2015
Type Q 10 x 10m
MGA Zone 50 393578 **mE** 6441144 **mN**
Habitat Wetland
Soil Brown loam peat
Vegetation Closed woodland of *Melaleuca rhaphiophylla* over *Baumea articulata*
Veg Condition Excellent
Fire Age Very Old (>12)
Notes Aspect: N/A
Disturbance: -
Ground Cover: 41% Bareground, 4% Logs, 8% Twigs, 85% Leaves

SPECIES LIST:

Name	Cover	Height	Specimen Notes
Acacia longifolia	1.5	200	nc
Baumea articulata	70	150	nc
Lepidosperma longitudinale	2	45	nc
Melaleuca rhaphiophylla	85	800	nc
Pterostylis sp. short sepals (W. Jackson BJ259)	+	10	BJQ2-1

Site BJQ03

Described by HA
Date 15/09/2015
Type Q 10 x 10m
MGA Zone 50 393591 **mE** 6441015 **mN**
Habitat Wetland
Soil dark brown peaty soils
Vegetation *Melaleuca rhaphiophylla* low forest with very open tussock grassland of **Ehrharta longiflora* with very open herbland of **Cotula coronopifolia*
Veg Condition Very Good - Good
Fire Age Old (8-12)
Notes Aspect: North
Disturbance: Weeds, Clearing
Ground Cover: 5% Bareground, 2% Logs, 3% Twigs, 85% Leaves

SPECIES LIST:

Name	Cover	Height	Specimen Notes
Acacia longifolia	+	40	nc
Carpobrotus edulis	1	Pr	nc
Cotula coronopifolia	4	10	BJ03-01
Crassula natans var. *minus*	+	1	BJ03-05
Ehrharta longiflora	3	30	nc
Fumaria capreolata	+		nc
Hypochaeris glabra	+	1	nc
Juncus planifolius	+	100	BJ03-03
Melaleuca rhaphiophylla	65	350-700	nc
Sonchus oleraceus	+	10	nc
Trifolium sp.	+	5	BJ03-04
Vulpia bromoides	+	10	BJ03-02
Zantedeschia aethiopica	+	30	nc

Site BJQ04

Described by NW
Date 15/09/2015
Type Q 10x10m
MGA Zone 50 393559 **mE** 6441114 **mN**
Habitat Wetland
Soil peat
Vegetation Surface water, dense saplings of *Melaleuca rhaphiophylla*
Veg Condition Excellent
Fire Age Old (8-12)
Notes Aspect: N/A
Disturbance:
Ground Cover: -% Bareground, -% Logs, -% Twigs, -% Leaves

SPECIES LIST:

Name	Cover	Height	Specimen Notes
Melaleuca rhaphiophylla	95	400	nc

Site BJQ05

Described by HA
Date 15/09/2015
Type Q 10 x 10m
MGA Zone 50 393806 **mE** 6440996 **mN**
Habitat Wetland/Dampland
Soil dark brown peat and grey sands
Vegetation Low scattered trees of *Melaleuca preissiana* and Melaleuca rhaphiophylla over tall open scrub of *Kunzea glabrescens* and *Astartea scoparia* over *Hypocalymma angustifolium* and *Acacia pulchella* var. *glaberrima* shrubland with scattered sedges of *Lepidosperma longitudinale*
Veg Condition Excellent - Very Good
Fire Age Old (>12)
Notes Aspect: North
Disturbance: Weeds, Clearing
Ground Cover: 90% Bareground, <1% Logs, 1% Twigs, 7% Leaves

SPECIES LIST:

Name	Cover	Height	Specimen Notes
Acacia longifolia	+	150	nc
Acacia pulchella var. *glaberrima*	5	180-200	BJ05-08
Aotus sp.	+	100	BJ05-03
Astartea scoparia	25	200-250	BJ05-04
Cassytha racemosa	+	<1	BJ05-05
Hypocalymma angustifolium	15	180	BJ05-01
Hypochaeris glabra	+	1	nc
Kunzea glabrescens	25	300	nc
Lepidosperma longitudinale	1	100	BJ05-10
Meeboldina scariosa	+	180	BJ05-02
Melaleuca lateritia	+	100	BJ05-07
Melaleuca preissiana	0.5	600	nc
Melaleuca rhaphiophylla	0.5	600	nc
Melaleuca teretifolia	+	150	BJ05-06
Orchidaceae sp.	+	2	BJ05-11
Pterostylis recurva	+	40	BJ05-09
Pterostylis sp. crinkled leaf (G.J. Keighery 13426)	+	20	BJHA-08

Site BJQ06

Described by NW
Date 15/09/2015
Type Q 10x10m
MGA Zone 50 393704 **mE** 6441178 **mN**
Habitat Flat
Soil grey/black loamy sand
Vegetation Dense shrubland of *Melaleuca teretifolia* and *Melaleuca rhaphiophylla* over sedges
Veg Condition Excellent
Fire Age Old (8-12)
Notes Aspect: North
Disturbance: Weeds, Clearing
Ground Cover: 4% Bareground, 0% Logs, 2% Twigs, 3% Leaves

SPECIES LIST:

Name	Cover	Height	Specimen Notes
Acacia longifolia	2	240	nc
Acacia pulchella var. *glaberrima*	1	130	nc
Briza maxima	2	35	nc
Cassytha racemosa	35	+	BJQ6-4
Crassula closiana	+	1	BJQ6-7
Galium murale	+	3	BJQ6-6
Galium murale	+	3	BJQ6-5
Hypochaeris glabra	5	1	nc
Juncus capitatus	+	2	BJQ6-8
Juncus pallidus	+	120	nc
Lepidosperma longitudinale	25	60	nc
Lysimachia arvensis	+	5	nc
Meeboldina coangustata	4	10	BJQ6-3
Melaleuca rhaphiophylla	55	170	BJQ6-2
Melaleuca teretifolia	8	90	BJQ6-1
Zantedeschia aethiopica	+	15	nc

Site BJQ07

Described by HA
Date 15/09/2015
Type Q 10 x 10m
MGA Zone 50 393499 **mE** 6441274 **mN**
Habitat Lower slope above wetland
Soil Grey sands
Vegetation *Allocasuarina fraseriana* and *Eucalyptus marginata* and *Banksia ilicifolia* over *Xanthorrhoea preissii* open heath over *Dasypogon bromeliifolius*, *Phlebocarya ciliata* and *Gompholobium tomentosum* over very open herbland of *Stylidium repens* and *Ursinia anthemoides*
Veg Condition Very Good
Fire Age Very Old (>12)
Notes Aspect: NA
Disturbance: Some tracks, weeds, historic clearing
Ground Cover: 1% Bareground, <1% Logs, <1% Twigs, 60% Leaves

SPECIES LIST:

Name	Cover	C Class	Height	Specimen Notes
Allocasuarina fraseriana	8		1000	nc
Banksia ilicifolia	2		600	nc
Bossiaea eriocarpa	+		30	BJ01-06
Briza maxima	+		20	nc
Chamaescilla corymbosa	+		10	BJ01-X1
Conostylis juncea	+		20	BJ07-04
Crassula colorata var. *colorata*	+		1	BJ07-07
Dasypogon bromeliifolius	15		30	nc
Drosera erythrorhiza	+		1	nc
Ehrharta longiflora	+		30	nc
Eucalyptus marginata	4		1000	nc
Gladiolus caryophyllaceus	+		20	nc
Gompholobium tomentosum	1		30	BJ01-08
Hypochaeris glabra	+		1	nc
Hypolaena exsulca	+		30	BJ07-06
Jacksonia furcellata	+		120	nc
Laxmannia squarrosa	+		20	BJ01-24
Lepidosperma sp.	+		30	BJ07-05
Phlebocarya ciliata	3		30	BJ07-03
Phyllangium divergens	+		10	BJ07-01
Pterostylis sanguinea	+		20	BJ01-26
Stylidium piliferum	+		10	BJ01-15
Stylidium repens	1		5	nc
Trachymene pilosa	+		10	BJ01-20
Ursinia anthemoides	1		10	nc
Wahlenbergia sp.	+		10	BJ07-02
Xanthorrhoea preissii	38		120	nc

Site BJQ08

Described by NW
Date 15/09/2015
Type Q 10x10m
MGA Zone 50 393892 **mE** 6441127 **mN**
Habitat flat wetland plain
Soil blank sand with a little silt
Vegetation Heath of *Hypocalymma angustifolium*
Veg Condition Excellent
Fire Age Old (8-12)
Notes Aspect: NA
Disturbance: ? historic clearing
Ground Cover: 7% Bareground, 0% Logs, 1% Twigs, 1% Leaves

SPECIES LIST:

Name	Cover	C Class	Height	Specimen Notes
Acacia pulchella var. *glaberrima*	1		120	nc
Caladenia flava subsp. *flava*	+		15	nc
Cassytha racemosa	4		+	BJQ6.04
Dielsia stenostachya	7		20	BJR04.02
Gladiolus caryophyllaceus	+		60	nc
Hypocalymma angustifolium	90		110	nc
Hypochaeris glabra	+		1	nc
Kunzea glabrescens	1		170	nc
Siloxerus humifusus	+		2	nc
Trachymene pilosa	+		3	nc
Ursinia anthemoides	+		10	nc

Site BJQ09

Described by HA
Date 15/09/2015
Type Q 10x10m
MGA Zone 50 393615 **mE** 6441358 **mN**
Habitat Wetland
Soil dark grey sands and peat
Vegetation *Melaleuca rhaphiophylla* tall open shrubland over *Acacia longifolia* over scattered shrubs of *Melaleuca lateritia* over *Lepidosperma longitudinale*, *Meeboldina coangustata* and *Juncus pallidus* sedgeland over open herbland of *Zantedeschia aethiopica* over scattered grasses of *Ehrharta longiflora*
Veg Condition Very Good
Fire Age Very Old (>12)
Notes Aspect: NA
Disturbance: Some tracks, weeds, historic clearing
Ground Cover: 20% Bareground, 1% Logs, 5% Twigs, 45% Leaves

SPECIES LIST:

Name	Cover	C Class	Height	Specimen Notes
Acacia longifolia	10		400	nc
Asparagus asparagoides	+		C1	nc
Astartea scoparia	+		180	BJ05.04
Briza maxima	+		20	nc
Cassytha sp.	+		C1	nc
Chamaescilla corymbosa	+		10	BJ01.X1
Ehrharta longiflora	1		30	nc
Galium murale	+		2	BJ09.05
Gladiolus caryophyllaceus	+		60	nc
Hypochaeris glabra	+		1	nc
Juncus pallidus	1		100	BJ03.03
Lepidosperma longitudinale	25		100	BJ09.03
Liparophyllum sp.	+		10	BJ09.07
Lobelia alata	+		10	BJ09.06
Meeboldina coangustata	8		100	BJ09.02
Melaleuca lateritia	1		120	BJ05.07
Melaleuca rhaphiophylla	1		500	nc
Melaleuca rhaphiophylla	20		300	BJ09.01
Pelargonium capitatum	+		30	BJ09.04
Sonchus oleraceus	+		10	nc
Trachymene pilosa	+		10	BJ01.20
Trifolium sp.	+		10	BJ03.04
Zantedeschia aethiopica	3		50	nc

Site BJQ10

Described by NW
Date 15/09/2015
Type Q 10x10m
MGA Zone 50 393374 **mE** 6441490 **mN**
Habitat Plain
Soil grey sand - some loam
Vegetation Woodland of *Banksia ilicifolia*, *Banksia attenuata* over *Kunzea glabrescens*, *Xanthorrhoea preissii*, *Dasypogon bromeliifolius*
Veg Condition Very Good to Excellent
Fire Age Old (8-12)
Notes Aspect: NA
Disturbance: Some weeds
Ground Cover: 2% Bareground, 0% Logs, 4% Twigs, 15% Leaves

SPECIES LIST:

Name	Cover	Height	Specimen Notes
Acacia longifolia	+	120	nc
Allocasuarina fraseriana	+	35	nc
Banksia attenuata	5	700	nc
Banksia ilicifolia	12	1100	nc
Bossiaea eriocarpa	+	40	nc
Briza maxima	4	15	nc
Burchardia congesta	+	50	nc
Caladenia flava subsp. *flava*	+	15	nc
Chamaescilla corymbosa	+	1	nc
Conostylis juncea	+	15	nc
Dasypogon bromeliifolius	15	40	nc
Desmocladus flexuosus	50	25	BJQ10.01
Drosera erythrorhiza	1	1	nc
Gompholobium tomentosum	1.5	40	nc
Hemiandra pungens	+	15	BJQ10.05
Hibbertia subvaginata	+	20	nc
Hypolaena exsulca	+	30	BJQ10.03
Kunzea glabrescens	55	600	nc
Leucopogon aff. *conostephioides*	+	35	BJQ10.04
Philotheca spicata	+	15	nc
Phlebocarya ciliata	1	30	nc
Pterostylis recurva	+	70	BJQ10.02
Stylidium brunonianum	+	45	nc
Stylidium piliferum	+	15	nc
Stylidium repens	+	3	nc
Thelymitra sp.	+	25	nc
Thysanotus manglesianus	+	C	nc
Xanthorrhoea preissii	4	110	nc
Zantedeschia aethiopica	1	45	nc

Site BJQ11

Described by HA
Date 16/09/2015
Type Q 10x10m
MGA Zone 50 393635 **mE** 6441466 **mN**
Habitat wetland
Soil dark grey sands and peat
Vegetation Low open forest of *Melaleuca rhaphiophylla* and *Acacia longifolia* over scattered shrubs of *Astartea scoparia* over *Lepidosperma ? longitudinale* and *Meeboldina coangustata* sedgeland over open herbland of *Zantedeschia aethiopica*
Veg Condition Very Good
Fire Age Very Old (>12)
Notes Aspect: NA
Disturbance: Some tracks, weeds, historic clearing
Ground Cover: 1% Bareground, <1% Logs, <1% Twigs, 30% Leaves

SPECIES LIST:

Name	Cover	Height	Specimen Notes
Acacia longifolia	5	300	nc
Acacia pulchella var. *glaberrima*	+	70	BJ05.08
Asparagus asparagoides	ASS		nc
Astartea scoparia	2	180	BJ05.04
Briza maxima	+	10	nc
Cassytha racemosa	+	C1	BJ11.03
Eutaxia virgata	+	50	BJ11.05
Galium murale	+	10	BJ11.07
Hypocalymma angustifolium	+	80	BJ05.01
Hypochaeris glabra	+	1	nc
Lepidosperma ? longitudinale	40	120	BJ11.02
Lobelia anceps	+	10	BJ11.04
Lysimachia arvensis	+	30	BJ11.06
Meeboldina coangustata	20	120	BJ11.01
Melaleuca lateritia	+	60	BJ05.07
Melaleuca preissiana	ASS		nc
Melaleuca rhaphiophylla	20	300	nc
Melaleuca rhaphiophylla	25	250	BJ09.01
Zantedeschia aethiopica	3	50	nc

Site BJQ12

Described by NW
Date 15/09/2015
Type Q 10x10
MGA Zone 50 393470 **mE** 6441426 **mN**
Habitat Mid slope
Soil grey sand
Vegetation Woodland of *Banksia menziesii*, *Banksia attenuata*, *Nuytsia floribunda* over *Stirlingia latifolia*, *Calytrix fraseri*, *Jacksonia furcellata*, *Adenanthos cygnorum* subsp. *cygnorum* & grass weeds
Veg Condition Good
Fire Age Moderate (4-8)
Notes Aspect: NA
Disturbance: Weeds, Banksia death
Ground Cover: 6% Bareground, 1.5% Logs, 4% Twigs, 3% Leaves

SPECIES LIST:

Name	Cover	Height	Specimen Notes
Adenanthos cygnorum subsp. *cygnorum*	6	400	nc
Allocasuarina fraseriana	1.5	400	nc
Anigozanthos manglesii	1	80	nc
Banksia attenuata	5	700	nc
Banksia menziesii	6	500	nc
Bossiaea eriocarpa	40	+	nc
Briza maxima	3	20	nc
Burchardia congesta	+	40	nc
Caladenia flava subsp. *flava*	+	15	nc
Calytrix fraseri	8	150	nc
Conostylis aculeata subsp. aculeata	+	30	nc
Crassula colorata var. colorata	+	2	BJQ12.03
Dasypogon bromeliifolius	2	45	nc
Desmocladus flexuosus	3	15	BJQ10.01
Diuris corymbosa	+	30	OPPNW01
Drosera erythrorhiza	+	1	nc
Ehrharta calycina	20	80	nc
Gladiolus caryophyllaceus	+	60	nc
Gompholobium tomentosum	1	45	nc
Hibbertia subvaginata	1	30	nc
Hypochaeris glabra	4	1	nc
Hypolaena exsulca	+	35	nc
Jacksonia furcellata	1	130	nc
Kunzea glabrescens	2	300	nc
Lomandra caespitosa	+	25	BJQ12.04
Lyginia imberbis	1	40	nc
Neurachne alopecuroidea	+	25	nc
Nuytsia floribunda	6	600	nc
Pterostylis vittata	+	35	BJQ12.05
Quinetia urvillei	+	4	BJQ12.01
Scholtzia involucrata	1	30	nc
Sonchus oleraceus	+	25	nc
Stirlingia latifolia	4	120	nc
Stylidium brunonianum	+	30	nc
Thysanotus manglesianus	+	C	nc
Trachymene pilosa	+	3	nc
Ursinia anthemoides	+	10	nc
Vulpia bromoides	+	3	BJQ12.02
Zantedeschia aethiopica	1.5	80	nc

Site BJQ13

Described by HA
Date 16/09/2015
Type Q 10x10m
MGA Zone 50 393733 **mE** 6441353 **mN**
Habitat dampland/wetland
Soil dark grey sands with peat
Vegetation Low woodland of *Melaleuca preissiana* over *Kunzea glabrescens*, *Acacia longifolia* and *Hakea varia* tall scrub over mixed shrubs over *Meeboldina coangustata* sedgeland
Veg Condition Very Good to Excellent
Fire Age Very Old (>12)
Notes Aspect: NA
Disturbance: Weeds
Ground Cover: 3% Bareground, <1% Logs, 5% Twigs, 40% Leaves

SPECIES LIST:

Name	Cover	Height	Specimen Notes
Acacia longifolia	12	350	nc
Acacia pulchella var. *glaberrima*	1	120	BJ05.08
Astartea scoparia	2	150	BJ05.04
Briza maxima	+	20	nc
Caladenia flava subsp. *flava*	+	10	nc
Calothamnus lateralis var. *lateralis*	2	210	BJ13.01
Cassytha racemosa	+	C1	BJ11.03
Ehrharta calycina	+	100	nc
Hakea varia	3	310	BJ13.02
Hypochaeris glabra	+	1	nc
Kunzea glabrescens	12	350	nc
Lepidosperma longitudinale	2	90	BJ11.02
Liparophyllum sp.	+	10	BJ09.07
Meeboldina coangustata	40	130	BJ11.01
Melaleuca lateritia	+	120	BJ05.07
Melaleuca preissiana	10	800-600	nc
Melaleuca rhaphiophylla	+	190	BJ09.01
Melaleuca teretifolia	+	180	BJ13.05
Pericalymma ellipticum var. *ellipticum*	2	120	BJ13.03
Poaceae sp.	+	10	BJ13.04
Trachymene pilosa	+	1	BJ01.20
Zantedeschia aethiopica	+	10	nc

Site BJQ14

Described by HA
Date 16/09/2015
Type Q 10x10m
MGA Zone 50 393801 **mE** 6441483 **mN**
Habitat dampland
Soil grey sands and some peat
Vegetation Low scattered trees of *Melaleuca preissiana* over scattered *Kunzea glabrescens* over low open health of *Hypocalymma angustifolium* and *Boronia crenulata* over *Dielsia stenostachya, Schoenus efoliatus* and *Dasypogon bromeliifolius* sedgeland or scattered *Hypochaeris glabra* & *Ursinia anthemoides* herbs

Veg Condition Excellent (Very Good in surrounding area)
Fire Age Old (8-12)
Notes Aspect: NA
Disturbance: Minor weeds, historic clearing
Ground Cover: 3% Bareground,<1% Logs, +% Twigs, 2% Leaves

SPECIES LIST:

Name	Cover	Height	Specimen Notes
Acacia pulchella var. *glaberrima*	+	60	nc
Actinotus glomeratus	0.5	15	BJ15.02
Asteraceae sp.	+	1	BJ15.06
Boronia crenulata	7	70	BJ15.01
Briza maxima	+	20	nc
Carpobrotus edulis	+	10	nc
Cassytha racemosa	+	Cl	BJ15.10
Crassula colorata var. *colorata*	+	1	BJ15.05
Cyperus tenellus	+	10	BJ15.07
Dasypogon bromeliifolius	2	40	nc
Dielsia stenostachya	28	30	BJR5.01
Drosera pulchella	+	1	BJ15.03
Ehrharta calycina	+	30	nc
Gladiolus caryophyllaceus	+	60	nc
Hypocalymma angustifolium	45	70	BJ05.01
Hypochaeris glabra	0.5	1	nc
Kunzea glabrescens	2	180	nc
Melaleuca preissiana	1.5	300	nc
Phyllangium divergens	+	8	BJ15.09
Poranthera microphylla	+	10	BJ15.11
Pultenaea reticulata	+	60	BJ15.08
Schoenus efoliatus	3	3	BJR3.01
Stylidium brunonianum	+	20	BJ15.04
Stylidium repens	+	10	nc
Ursinia anthemoides	0.5	20	nc
Xanthorrhoea preissii	1	100	nc

Site BJQ15

Described by HA
Date 16/09/2015
Type Q 10x10m
MGA Zone 50 393384 **mE** 6441099 **mN**
Habitat lower slope above wetland
Soil grey sands
Vegetation Low woodland of *Banksia ilicifolia* and *Eucalyptus marginata* over tall shrubland of *Kunzea glabrescens* over scattered *Leucopogon conostephioides* and *Scholtzia involucrata* over *Desmocladus flexuosus*, *Conostylis aculeata* subsp. *aculeata*, *Dasypogon bromeliifolius* and *Phlebocarya ciliata* over very open herb land of *Carpobrotus edulis* and *Stylidium repens* over *Briza maxima* and *Ehrharta calycina* grasses

Veg Condition Good

Fire Age Old (8-12)

Notes Aspect: East
Disturbance: Some tracks, weeds, historic clearing
Ground Cover: 5% Bareground, <1% Logs, 1% Twigs, 70% Leaves

SPECIES LIST:

Name	Cover	C Class	Height	Specimen Notes
Allocasuarina fraseriana	+		120	nc
Anigozanthos humilis	+		100	nc
Banksia ilicifolia	8		700	nc
Banksia menziesii	+		100	nc
Bossiaea eriocarpa	+		30	BJ01.06
Briza maxima	3		20	nc
Burchardia congesta	+		50	nc
Caladenia flava subsp. *flava*	+		20	nc
Carpobrotus edulis	2		Pr	nc
Conostylis aculeata subsp. *aculeata*	2		30	BJ01.10
Conostylis juncea	+		20	BJR01.03
Crassula colorata var. *colorata*	+		1	BJ17.06
Dampiera linearis	+		10	BJ01.09
Dasypogon bromeliifolius	1		30	nc
Desmocladus flexuosus	20		10	BJ01.07
Drosera erythrorhiza	+		1	nc
Ehrharta calycina	1		100	nc
Eucalyptus marginata	2		500	nc
Gladiolus caryophyllaceus	+		50	nc
Gompholobium tomentosum	+		100	BJ01.08
Hovea pungens	ASS			BJ17.X1
Hypochaeris glabra	+		1	nc
Jacksonia furcellata	1		180	nc
Kennedia prostrata	+		Pr	nc
Kunzea glabrescens	28		300	BJ01.01
Lepidosperma sp.	+		10	BJ17.04
Lepidosperma squamatum	+		30	BJ17.02
Lepidosperma squamatum	+		30	BJ17.03
Leucopogon conostephioides	1		30	BJ17.05
Lyginia imberbis	+		30	nc
Melaleuca thymoides	+		180	BJ07.X1
Nuytsia floribunda	ASS			nc
Philotheca spicata	+		40	BJ01.01
Phlebocarya ciliata	3		30	BJ17.01
Scholtzia involucrata	1		30	nc
Stylidium repens	2		20	nc
Thysanotus patersonii	+		Cl	BJ01.01
Trachymene pilosa	+		10	BJ01.20
Ursinia anthemoides	+		30	nc
Xanthorrhoea preissii	ASS			nc

Site BJR1

Described by HA
Date 15/09/2015
Type R
MGA Zone 50 393350 **mE** 6441256 **mN**
Habitat Hill top / sand dune-
Soil Grey sands
Vegetation Low woodland of *Banksia menziesii*, *B. attenuata* & *Allocasuarina fraseriana* over tall open shrubland of *Adenanthos cygnorum* subsp. *cygnorum* over low open shrubland of *Leucopogon conostephioides* and *Stirlingia latifolia* over *Briza maxima*

Veg Condition Good

Fire Age 8-12

Notes Disturbance: Weeds
Ground Cover: 4% Bareground, 1% Logs, 2% Twigs, 70% Leaves

SPECIES LIST:

Name	Cover	Height	Specimen Notes
Adenanthos cygnorum subsp. *cygnorum*	3	210	nc
Allocasuarina fraseriana	4	800	nc
Anigozanthos manglesii	+	100	nc
Banksia attenuata	5	600	nc
Banksia menziesii	18	800	nc
Bossiaea eriocarpa	+	30	Q1-6
Briza maxima	9	20	nc
Burchardia congesta	+	50	nc
Caladenia flava subsp. *flava*	+	10	nc
Conostylis aculeata subsp. *aculeata*	1.0	30	21-10
Conostylis juncea	+	20	R1-3
Dasypogon bromeliifolius	2	30	nc
Drosera erythrorhiza	1	1	nc
Ehrharta longiflora	+	30	nc
Gompholobium tomentosum	+	50	21-8
Hibbertia hypericoides	+	50	nc
Hypochaeris glabra	+	1	nc
Kunzea glabrescens	+	Cl	R1-1
Kunzea glabrescens	1	180	nc
Leucopogon conostephioides	2	30	R1-2
Petrophile linearis	+	30	nc
Stirlingia latifolia	2	50	nc
Stylidium brunonianum	+	30	Q1-21
Stylidium repens	+	20	nc
Thysanotus patersonii	+	Cl	BJR01.07
Ursinia anthemoides	2	30	nc
Zantedeschia aethiopica	+	30	nc

Site BJR2

Described by NW
Date 15/09/2015
Type R
MGA Zone 50 393467 **mE** 6441104 **mN**
Habitat Wetland - with water
Soil Brown Loam
Vegetation Low closed forest of *Melaleuca rhaphiophylla* over water
Veg Condition Excellent
Fire Age Very Old (>12)
Notes Disturbance:
Ground Cover: 3% Bareground, 4% Logs, 6% Twigs, 85% Leaves

SPECIES LIST:

Name	Cover	Height	Specimen Notes
Acacia longifolia	1.5	450	
Baumea articulata	3	200	
Hypochaeris glabra	+	1	
Lepidosperma longitudinale	3	60	
Melaleuca rhaphiophylla	90	600	

Site BJR3

Described by HA
Date 16/09/2015
Type R
MGA Zone 50 393674 **mE** 6441453 **mN**
Habitat Dampland
Soil
Vegetation Low open woodland of *Melaleuca preissiana* over tall open shrubland of *Kunzea glabrescens* over low open heath of *Hypocalymma angustifolium* and *Acacia pulchella* var. *glaberrima* over *Hypolaena exsulca* and *Schoenus efoliatus*
Veg Condition Good
Fire Age >12
Notes Disturbance: Weeds, Clearing
Ground Cover: 30%Bareground, 1% Logs, 2% Twigs, 20% Leaves

SPECIES LIST:

Name	Cover	Height	Specimen Notes
Acacia longifolia	+	200-300	nc
Acacia pulchella var. *glaberrima*	2	50	BJQ05-8
Briza maxima	+	10	nc
Caladenia flava subsp. *flava*	+	10	nc
Dampiera linearis	+	10	BJR03.03
Ehrharta calycina	1	30	nc
Hypocalymma angustifolium	35	60	BJQ5-1
Hypochaeris glabra	1	1	nc
Hypolaena exsulca	10	20	BJR3-2
Kunzea glabrescens	4	200	BJQ1-1
Melaleuca preissiana	5	300-1000	nc
Schoenus efoliatus	1	30	BJR3-1
Ursinia anthemoides	3	20	nc
Xanthorrhoea preissii	+	100	nc

Site BJR4

Described by NW
Date 15/09/2015
Type R
MGA Zone 50 393596 **mE** 6441209 **mN**
Habitat Lower slope however higher edge of wetland
Soil Grey sands
Vegetation Open woodland of *Melaleuca preissiana* and *Eucalyptus rudis* over dense understorey of *Hypocalymma angustifolium*, *Xanthorrhoea preissii* and sedges
Veg Condition Excellent
Fire Age Old (8-12)
Notes Disturbance: Some weeds
Ground Cover: 0% Bareground, 0% Logs, 6% Twigs, 30% Leaves

SPECIES LIST:

Name	Cover	Height	Specimen Notes
Acacia pulchella var. glaberrima	1	120	nc
Avena barbata	6	40	nc
Caladenia latifolia	+	30	nc
Carpobrotus edulis	1.5	15	nc
Chamaescilla corymbosa	3	5	nc
Cyathochaeta avenacea	3	100	BJR4-1
Dielsia stenostachya	5	25	BJR4-2
Eucalyptus rudis	5	1200	nc
Hypocalymma angustifolium	20	140	nc
Kunzea glabrescens	2	140	nc
Lepidosperma longitudinale	2	50	nc
Lepidosperma sp.	8	80	BJR4-3
Melaleuca preissiana	10	1100	nc
Xanthorrhoea preissii	8	130	nc

Site BJR5

Described by HA
Date 16/09/2015
Type R
MGA Zone 50 393808 **mE** 6441388 **mN**
Habitat Dampland
Soil Grey sands and peat
Vegetation Low open woodland of *Melaleuca preissiana* over tall shrubland of *Kunzea glabrescens* and *Acacia longifolia* over *Hypocalymma angustifolium* heath over *Dielsia stenostachya* sedgeland
Veg Condition Very Good
Fire Age Old (8-12)
Notes Disturbance: Some weeds
Ground Cover: 1% Bareground,<1% Logs, <1% Twigs, 5% Leaves

SPECIES LIST:

Name	Cover	Height	Specimen Notes
Acacia longifolia	0.5	300	nc
Acacia pulchella var. *glaberrima*	+	60	BJQ05.08
Astartea scoparia	+	180	BJQ05.04
Briza maxima	+	20	nc
Cassytha racemosa	+	Cl	BJQ11.03
Dielsia stenostachya	30	30	BJR05.01
Drosera pulchella	+	1	BJQ15.03
Glischrocaryon angustifolium	+	50	BJR05.03
Hypocalymma angustifolium	60	50	BJQ05.01
Kunzea glabrescens	12	150-250	nc
Melaleuca preissiana	5	300-800	nc
Ursinia anthemoides	+	20	nc
Xanthorrhoea preissii	1	100	nc

Site BJR6

Described by HA
Date 16/09/2015
Type R
MGA Zone 50 393661 **mE** 6440984 **mN**
Habitat Dampland / Wetland
Soil Grey sands and peat
Vegetation Scattered *Melaleuca preissiana* trees over *Kunzea glabrescens* and *Melaleuca rhaphiophylla* and *Acacia longifolia* tall shrubland over *Lepidosperma longitudinale* and *Meeboldina coangustata* sedgeland
Veg Condition Very Good
Fire Age Very Old (>12)
Notes Disturbance: Some weeds
Ground Cover: 5% Bareground, <1% Logs, <1% Twigs, 12% Leaves

SPECIES LIST:

Name	Cover	Height	Specimen Notes
Acacia longifolia	3	300	nc
Astartea scoparia	+	150	BJQ05.04
Carpobrotus edulis	+	Cr	nc
Cassytha racemosa	+	Cl	BJQ11.03
Hypocalymma angustifolium	5	90	BJQ05.01
Hypochaeris glabra	+	1	nc
Kunzea glabrescens	10	300	BJQ01.01
Lepidosperma longitudinale	38	100	BJQ11.02
Meeboldina coangustata	15	100	BJQ11.01
Melaleuca lateritia	+	100	BJQ05.07
Melaleuca preissiana	1	600	nc
Melaleuca rhaphiophylla	15	250	BJQ09.01
Pericalymma ellipticum var. *ellipticum*	+	120	BJQ13.03
Ursinia anthemoides	+	30	nc
Zantedeschia aethiopica	+	30	nc

Site BJR7

Described by HA
Date 16/09/2015
Type R
MGA Zone 50 394011 **mE** 6441140 **mN**
Habitat Dampland
Soil Grey sand and peat
Vegetation Scattered low trees of *Melaleuca preissiana* over scattered tall shrubs of *Acacia longifolia* and *Kunzea glabrescens* over *Hypocalymma angustifolium* low heath over *Dielsia stenostachya* and *Schoenus efoliatus* open sedgeland.
Veg Condition Very Good
Fire Age Old (8-12)
Notes Disturbance: Some weeds
Ground Cover: 5% Bareground, <1% Logs, <1% Twigs, 12% Leaves

SPECIES LIST:

Name	Cover	Height	Specimen Notes
Acacia longifolia	1	300	nc
Astartea scoparia	1	150	BJQ05.04
Briza maxima	+	20	nc
Dampiera linearis	+	10	BJR03.03
Dielsia stenostachya	10	30	BJR05.01
Glischrocaryon angustifolium	+	50	BJR05.03
Hypocalymma angustifolium	80	60	BJQ05.01
Hypochaeris glabra	+	1	nc
Kunzea glabrescens	1	250	BJQ01.01
Melaleuca preissiana	+	300	nc
Schoenus efoliatus	1	30	BJR03.01
Stylidium brunonianum	+		BJQ15.04

Banjup Beenyup Rd | Site BJOPPCOLL

Described by | Date | Type O

Season | Uniformity

Location

MGA Zone | mE | mN | E | S

Habitat

Soil

Rock Type

Vegetation

Veg Condition

Fire Age

Notes

SPECIES LIST:

Name	Cover	C Class	Height	Specimen	Notes
Acacia iteaphylla	-			nc	Acacia lteaphylla
Adenanthos cygnorum subsp. cygnorum	-			nc	adenanthos cyg
Arctotheca calendula	-			nc	Arcotheca cal
Banksia prionotes	-			nc	Banksia prionotes
Caladenia discoidea	-			BJHA02	orchid
Caladenia flava subsp. flava	-			nc	Caladenia flava
Caladenia flava subsp. flava	-			nc	Caladenia flava
Caladenia latifolia	-			nc	Calandenia lati
Caladenia latifolia	-			nc	Caladenia lat
Callitris preissii	-			BJHA15	? Callitris
Chamelaucium uncinatum	-			BJHA16	Geraldton wax
Daviesia triflora	-			BJHA07	Daviesa physoides
Diuris corymbosa	-			OPPNW01	pale donkey orchid
Diuris corymbosa	-			BJHA21	Diuris large
Diuris corymbosa	-			OPPNW01	Pale donkey orchid
Diuris laxiflora	-			BJHA19	Diuris
Diuris sp.	-			BJHA01	diuris
Drosera glanduligera	-			BJHA11a	
Eragrostis curvula	-			nc	Eragrostis
Eucalyptus camaldulensis	-			BJHA14	Euc camlad
Eucalyptus todtiana	-			nc	Euc tod
Euphorbia terracina	-			BJHA12	Euphorbia terra
Hemiandra pungens	-			BJHA06	Hemiandra creeper
Hovea pungens	-			BJHA05	Hovea
Hybanthus calycinus	-			BJHA09	Hybanthus blue
Lepidosperma longitudinale	-			BJHA13	Lepidosperma longi
Leptomeria pauciflora	-			OPPNW03	Strange white flw stick
Macarthuria australis	-			BJHA03	Macarthuria aust
Persoonia saccata	-			BJHA04	Dunno
Pterostylis sp. crinkled leaf (G.J. Keighery 13426)	-			BJHA08	Snail orhicd
Pultenaea ochreata	-			BJHA11a	Pea wetland
Pultenaea reticulata	-			BJHA18	Pea
Romulea rosea var. australis	-			BJHA17	Romulea rosea
Trachymene pilosa	-			BJHA10	Trachymene oprnata
Waitzia suaveolens var. suaveolens	-			BJHA20	Waitzia
Xylomelum occidentale	-			nc	Xylomelum occi
Zantedeschia aethiopica	-			nc	Arum lily
Zantedeschia aethiopica	-			nc	Arum lily
Zantedeschia aethiopica	-			nc	Arum lily

APPENDIX G

Desktop Searches

Australian Government

Department of 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.

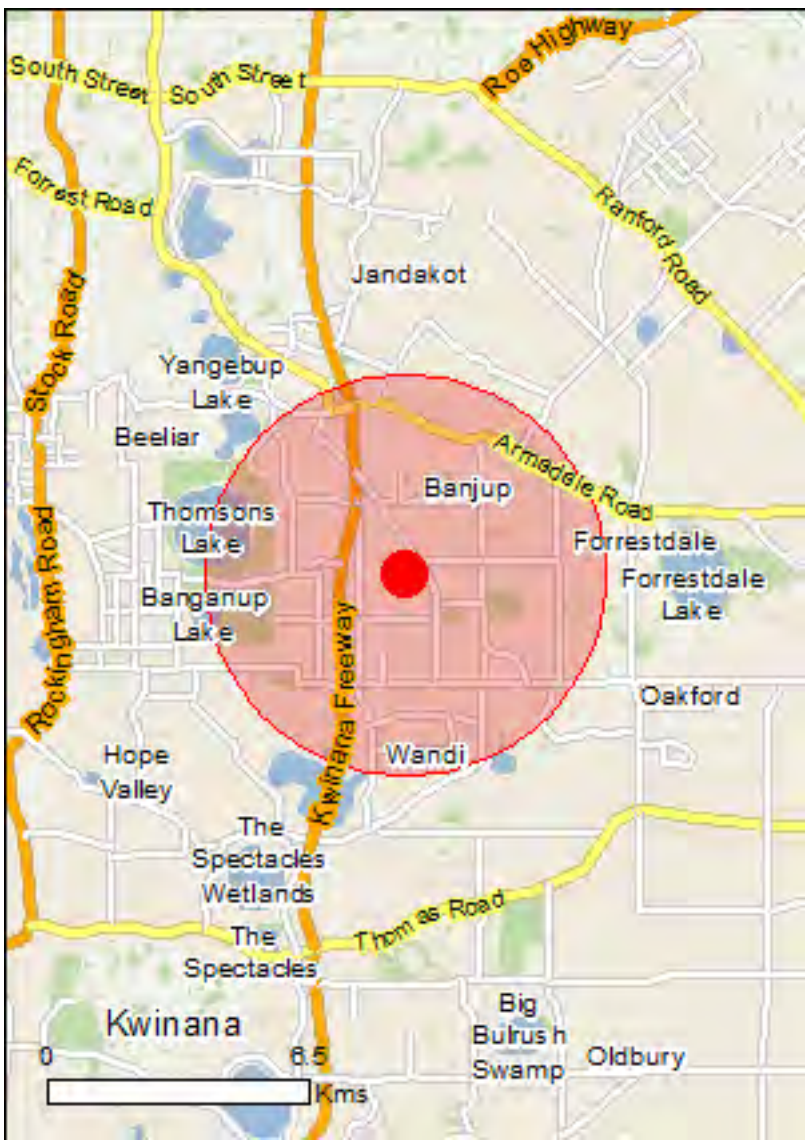
Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 14/12/15 12:44:39

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

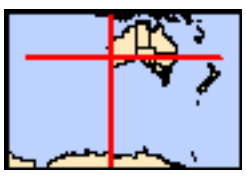
Caveat
Acknowledgements



This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2010

Coordinates

Buffer: 5.0Km



Summary

Matters of National Environmental 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:	2
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	19
Listed Migratory Species:	18

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 environment anywhere.

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 Land:	1
Commonwealth Heritage Places:	None
Listed Marine Species:	24
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Commonwealth Reserves Marine:	None

Extra Information

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

State and Territory Reserves:	6
Regional Forest Agreements:	None
Invasive Species:	44
Nationally Important Wetlands:	2
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar)	[Resource Information]
Name	Proximity
Forrestdale and thomsons lakes	Within Ramsar site
Peel-yalgorup system	30 - 40km upstream

Listed Threatened Species		[Resource Information]
Name	Status	Type of Presence
Birds		
Botaurus poiciloptilus		
Australasian Bittern [1001]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calyptorhynchus banksii naso		
Forest Red-tailed Black-Cockatoo, Karrak [67034]	Vulnerable	Species or species habitat may occur within area
Calyptorhynchus baudinii		
Baudin's Black-Cockatoo, Long-billed Black-Cockatoo [769]	Vulnerable	Species or species habitat likely to occur within area
Calyptorhynchus latirostris		
Carnaby's Black-Cockatoo, Short-billed Black-Cockatoo [59523]	Endangered	Species or species habitat likely to occur within area
Leipoa ocellata		
Malleefowl [934]	Vulnerable	Species or species habitat likely to occur within area
Rostratula australis		
Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area
Insects		
Neopasiphae simplicior		
A native bee [66821]	Critically Endangered	Species or species habitat may occur within area
Mammals		
Dasyurus geoffroii		
Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat known to occur within area
Pseudocheirus occidentalis		
Western Ringtail Possum, Ngwayir [25911]	Vulnerable	Species or species habitat likely to occur within area
Plants		
Andersonia gracilis		
Slender Andersonia [14470]	Endangered	Species or species habitat may occur within area

Name	Status	Type of Presence
Caladenia huegelii King Spider-orchid, Grand Spider-orchid, Rusty Spider-orchid [7309]	Endangered	Species or species habitat known to occur within area
Darwinia foetida Muchea Bell [83190]	Critically Endangered	Species or species habitat likely to occur within area
Diuris micrantha Dwarf Bee-orchid [55082]	Vulnerable	Species or species habitat known to occur within area
Diuris purdiei Purdie's Donkey-orchid [12950]	Endangered	Species or species habitat likely to occur within area
Drakaea elastica Glossy-leafed Hammer-orchid, Praying Virgin [16753]	Endangered	Species or species habitat likely to occur within area
Drakaea micrantha Dwarf Hammer-orchid [56755]	Vulnerable	Species or species habitat known to occur within area
Lepidosperma rostratum Beaked Lepidosperma [14152]	Endangered	Species or species habitat likely to occur within area
Thelymitra dedmaniarum Cinnamon Sun Orchid [65105]	Endangered	Species or species habitat may occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Migratory Wetlands Species		
Ardea alba Great Egret, White Egret [59541]		Breeding known to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]		Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species

Name	Threatened	Type of Presence
		habitat known to occur within area
[Calidris ruficollis](#) Red-necked Stint [860]		Species or species habitat known to occur within area
[Calidris subminuta](#) Long-toed Stint [861]		Species or species habitat known to occur within area
[Charadrius dubius](#) Little Ringed Plover [896]		Species or species habitat known to occur within area
[Limosa limosa](#) Black-tailed Godwit [845]		Species or species habitat known to occur within area
[Pandion haliaetus](#) Osprey [952]		Species or species habitat likely to occur within area
[Philomachus pugnax](#) Ruff (Reeve) [850]		Species or species habitat known to occur within area
[Tringa glareola](#) Wood Sandpiper [829]		Species or species habitat known to occur within area
[Tringa nebularia](#) Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
[Tringa stagnatilis](#) Marsh Sandpiper, Little Greenshank [833]		Species or species habitat known to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land [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.

Name
Commonwealth Land -

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
[Apus pacificus](#) Fork-tailed Swift [678]		Species or species habitat likely to occur within area
[Ardea alba](#) Great Egret, White Egret [59541]		Breeding known to occur within area
[Ardea ibis](#) Cattle Egret [59542]		Species or species habitat may occur within area
[Calidris acuminata](#) Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Calidris canutus Red Knot, Knot [855]		Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat known to occur within area
Calidris ruficollis Red-necked Stint [860]		Species or species habitat known to occur within area
Calidris subminuta Long-toed Stint [861]		Species or species habitat known to occur within area
Charadrius dubius Little Ringed Plover [896]		Species or species habitat known to occur within area
Charadrius ruficapillus Red-capped Plover [881]		Species or species habitat known to occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Himantopus himantopus Black-winged Stilt [870]		Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]		Species or species habitat known to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat likely to occur within area
Philomachus pugnax Ruff (Reeve) [850]		Species or species habitat known to occur within area
Recurvirostra novaehollandiae Red-necked Avocet [871]		Species or species habitat known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat may occur within area
Thinornis rubricollis Hooded Plover [59510]		Species or species habitat known to occur within area
Tringa glareola Wood Sandpiper [829]		Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Tringa nebularia		
Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
Tringa stagnatilis		
Marsh Sandpiper, Little Greenshank [833]		Species or species habitat known to occur within area

Extra Information

State and Territory Reserves [Resource Information]

Name	State
Gibbs Road	WA
Harry Waring Marsupial Reserve	WA
Thomsons Lake	WA
Unnamed WA48291	WA
Unnamed WA49561	WA
Wandi	WA

Invasive Species [Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Acridotheres tristis		
Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Anas platyrhynchos		
Mallard [974]		Species or species habitat likely to occur within area
Carduelis carduelis		
European Goldfinch [403]		Species or species habitat likely to occur within area
Columba livia		
Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Passer domesticus		
House Sparrow [405]		Species or species habitat likely to occur within area
Passer montanus		
Eurasian Tree Sparrow [406]		Species or species habitat likely to occur within area
Streptopelia chinensis		
Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Streptopelia senegalensis		
Laughing Turtle-dove, Laughing Dove [781]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Turdus merula Common Blackbird, Eurasian Blackbird [596]		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Funambulus pennantii Northern Palm Squirrel, Five-striped Palm Squirrel [129]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus norvegicus Brown Rat, Norway Rat [83]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Anredera cordifolia Madeira Vine, Jalap, Lamb's-tail, Mignonette Vine, Anredera, Gulf Madeiravine, Heartleaf Madeiravine, Potato Vine [2643]		Species or species habitat likely to occur within area
Asparagus aethiopicus Asparagus Fern, Ground Asparagus, Basket Fern, Sprengi's Fern, Bushy Asparagus, Emerald Asparagus [62425]		Species or species habitat likely to occur within area
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Asparagus plumosus Climbing Asparagus-fern [48993]		Species or species habitat likely to occur within area
Brachiaria mutica Para Grass [5879]		Species or species habitat may occur within area
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat may occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat may occur within

Name	Status	Type of Presence
		area
Chrysanthemoides monilifera subsp. monilifera Boneseed [16905]		Species or species habitat likely to occur within area
Genista linifolia Flax-leaved Broom, Mediterranean Broom, Flax Broom [2800]		Species or species habitat likely to occur within area
Genista monspessulana Montpellier Broom, Cape Broom, Canary Broom, Common Broom, French Broom, Soft Broom [20126]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Olea europaea Olive, Common Olive [9160]		Species or species habitat may occur within area
Opuntia spp. Prickly Pears [82753]		Species or species habitat likely to occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Protasparagus densiflorus Asparagus Fern, Plume Asparagus [5015]		Species or species habitat likely to occur within area
Protasparagus plumosus Climbing Asparagus-fern, Ferny Asparagus [11747]		Species or species habitat likely to occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Sagittaria platyphylla Delta Arrowhead, Arrowhead, Slender Arrowhead [68483]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
Solanum elaeagnifolium Silver Nightshade, Silver-leaved Nightshade, White Horse Nettle, Silver-leaf Nightshade, Tomato Weed, White Nightshade, Bull-nettle, Prairie-berry, Satansbos, Silver-leaf Bitter-apple, Silverleaf-nettle, Trompillo [12323]		Species or species habitat likely to occur within area
Tamarix aphylla Athel Pine, Athel Tree, Tamarisk, Athel Tamarisk, Athel Tamarix, Desert Tamarisk, Flowering Cypress, Salt Cedar [16018]		Species or species habitat likely to occur within area
Reptiles		

Name	Status	Type of Presence
Hemidactylus frenatus Asian House Gecko [1708]		Species or species habitat likely to occur within area

Nationally Important Wetlands [Resource Information]

Name	State
Gibbs Road Swamp System	WA
Thomsons Lake	WA

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

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.

For species where the distributions are well known, maps are digitised from sources such as recovery plans and detailed habitat studies. Where appropriate, core breeding, foraging and roosting areas are indicated under 'type of presence'. For species whose distributions are less well known, point locations are collated from government wildlife authorities, museums, and non-government organisations; bioclimatic distribution models are generated and these validated by experts. In some cases, the distribution maps are based solely on expert knowledge.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

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

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

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

Coordinates

-32.15964 115.87145

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
-Parks and Wildlife Commission NT, Northern Territory Government
-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, Atherton and Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-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.

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NatureMap
Mapping Western Australia's biodiversity

NatureMap Species Report

Created By Guest user on 13/12/2015

Current Names Only	Yes
Core Datasets Only	Yes
Method	'By Circle'
Centre	115°52' 19" E,32°09' 35" S
Buffer	5km
Group By	Conservation Status

Conservation Status	Species	Records
Non-conservation taxon	625	8384
Other specially protected fauna	1	6
Priority 1	1	3
Priority 3	7	139
Priority 4	7	35
Priority 5	3	83
Protected under international agreement	11	228
Rare or likely to become extinct	12	121
TOTAL	**667**	**8999**

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
Rare or likely to become extinct					
1.	1596	*Caladenia huegelii (Grand Spider Orchid)*		T	
2.	24784	*Calidris ferruginea (Curlew Sandpiper)*		T	
3.	24731	*Calyptorhynchus banksii subsp. naso (Forest Red-tailed Black-Cockatoo)*		T	
4.	24734	*Calyptorhynchus latirostris (Carnaby's Cockatoo (short-billed black-cockatoo), Carnaby's Cockatoo)*		T	
5.	24092	*Dasyurus geoffroii (Chuditch, Western Quoll)*		T	
6.	1637	*Diuris purdiei (Purdie's Donkey Orchid)*		T	
7.	1639	*Drakaea elastica (Glossy-leaved Hammer Orchid)*		T	
8.	13635	*Drakaea micrantha*		T	
9.	24146	*Myrmecobius fasciatus (Numbat, Walpurti)*		T	
Protected under international agreement					
10.	41324	*Ardea modesta (Eastern Great Egret)*		IA	
11.	24779	*Calidris acuminata (Sharp-tailed Sandpiper)*		IA	
12.	24786	*Calidris melanotos (Pectoral Sandpiper)*		IA	
13.	24788	*Calidris ruficollis (Red-necked Stint)*		IA	
14.	24789	*Calidris subminuta (Long-toed Stint)*		IA	
15.	24293	*Haliaeetus leucogaster (White-bellied Sea-Eagle)*		IA	
16.	25741	*Limosa limosa (Black-tailed Godwit)*		IA	
17.	24598	*Merops ornatus (Rainbow Bee-eater)*		IA	
18.	24843	*Plegadis falcinellus (Glossy Ibis)*		IA	
19.	24806	*Tringa glareola (Wood Sandpiper)*		IA	
20.	24808	*Tringa nebularia (Common Greenshank)*		IA	
Other specially protected fauna					
21.	25624	*Falco peregrinus (Peregrine Falcon)*		S	
Priority 1					
22.	33994	*Throscodectes xiphos (cricket)*		P1	
Priority 3					
23.	16245	*Cyathochaeta teretifolia*		P3	
24.	20462	*Jacksonia gracillima*		P3	
25.	25147	*Lerista lineata (Perth Slider, Lined Skink)*		P3	
26.	25249	*Neelaps calonotos (Black-striped Snake)*		P3	
27.	5237	*Pimelea calcicola*		P3	
28.	8163	*Pithocarpa corymbulosa (Corymbose Pithocarpa)*		P3	
29.	25800	*Stylidium paludicola*		P3	
Priority 4					
30.	4763	*Dodonaea hackettiana (Hackett's Hopbush)*		P4	
31.	24189	*Falsistrellus mackenziei (Western False Pipistrelle)*		P4	

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
32.	24328	*Oxyura australis (Blue-billed Duck)*		P4	
33.	24663	*Phaethon rubricauda (Red-tailed Tropicbird)*		P4	
34.	33992	*Synemon gratiosa (Graceful Sunmoth)*		P4	
35.	44444	*Tripterococcus sp. Brachylobus (A.S. George 14234)*		P4	
36.	14714	*Verticordia lindleyi subsp. lindleyi*		P4	
Priority 5					
37.	25478	*Isoodon obesulus (Southern Brown Bandicoot)*		P5	
38.	24153	*Isoodon obesulus subsp. fusciventer (Quenda, Southern Brown Bandicoot)*		P5	
39.	24131	*Macropus eugenii subsp. derbianus (Tammar Wallaby (WA subsp))*		P5	
Non-conservation taxon					
40.	11731	*Acacia browniana var. browniana*			
41.	3262	*Acacia cochlearis (Rigid Wattle)*			
42.	3282	*Acacia cyclops (Coastal Wattle)*			
43.	3374	*Acacia huegelii*			
44.	3502	*Acacia pulchella (Prickly Moses)*			
45.	15481	*Acacia pulchella var. glaberrima*			
46.	30032	*Acacia saligna subsp. saligna*			
47.	3557	*Acacia stenoptera (Narrow Winged Wattle)*			
48.	24260	*Acanthiza apicalis (Broad-tailed Thornbill, Inland Thornbill)*			
49.	24261	*Acanthiza chrysorrhoa (Yellow-rumped Thornbill)*			
50.	24262	*Acanthiza inornata (Western Thornbill)*			
51.		*Acantholophus hypoleucus*			
52.	24560	*Acanthorhynchus superciliosus (Western Spinebill)*			
53.	25535	*Accipiter cirrocephalus (Collared Sparrowhawk)*			
54.	25536	*Accipiter fasciatus (Brown Goshawk)*			
55.	42368	*Acritoscincus trilineatus (Western Three-lined Skink)*			
56.	25755	*Acrocephalus australis (Australian Reed Warbler)*			
57.	1775	*Adenanthos cygnorum (Common Woollybush)*			
58.	11837	*Adenanthos cygnorum subsp. cygnorum (Common Woollybush)*			
59.	1791	*Adenanthos obovatus (Basket Flower)*			
60.	17202	*Agonis flexuosa var. flexuosa*			
61.	184	*Aira caryophyllea (Silvery Hairgrass)*	Y		
62.	185	*Aira cupaniana (Silvery Hairgrass)*	Y		
63.	1728	*Allocasuarina fraseriana (Sheoak, Kondil)*			
64.	1732	*Allocasuarina humilis (Dwarf Sheoak)*			
65.	198	*Amphipogon laguroides*			
66.	200	*Amphipogon turbinatus*			
67.	13267	*Amyema linophylla subsp. linophylla*			
68.	24310	*Anas castanea (Chestnut Teal)*			
69.	24312	*Anas gracilis (Grey Teal)*			
70.	24313	*Anas platyrhynchos (Mallard)*			
71.	24315	*Anas rhynchotis (Australasian Shoveler)*			
72.	24316	*Anas superciliosa (Pacific Black Duck)*			
73.	7833	*Angianthus preissianus*			
74.	25553	*Anhinga melanogaster (Darter)*			
75.		*Anhinga novaehollandiae*			
76.	11434	*Anigozanthos humilis subsp. humilis*			
77.	1411	*Anigozanthos manglesii (Mangles Kangaroo Paw, Kurulbrang)*			
78.	11566	*Anigozanthos viridis subsp. viridis*			
79.	44629	*Anilios australis*			
80.		*Anser sp.*			
81.	24561	*Anthochaera carunculata (Red Wattlebird)*			
82.	24562	*Anthochaera lunulata (Western Little Wattlebird)*			
83.	3688	*Aotus gracillima*			
84.	3692	*Aotus procumbens*			
85.	24991	*Aprasia repens (Sand-plain Worm-lizard)*			
86.	24285	*Aquila audax (Wedge-tailed Eagle)*			
87.		*Archiargiolestes parvulus*			
88.		*Archiargiolestes pusillus*			
89.		*Arcuatula glaberrima*			
90.	38968	*Arcyria insignis*			
91.	24340	*Ardea novaehollandiae (White-faced Heron)*			
92.	24341	*Ardea pacifica (White-necked Heron)*			
93.	1264	*Arnocrinum preissii*			
94.	25566	*Artamus cinereus (Black-faced Woodswallow)*			
95.	24353	*Artamus cyanopterus (Dusky Woodswallow)*			
96.	8779	*Asparagus asparagoides (Bridal Creeper)*	Y		
97.	20283	*Astartea scoparia*			
98.	7851	*Asteridea pulverulenta (Common Bristle Daisy)*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
99.	6334	*Astroloma pallidum (Kick Bush)*			
100.	2471	*Atriplex prostrata (Hastate Orache)*	Y		
101.	17234	*Austrostipa compressa*			
102.	17240	*Austrostipa flavescens*			
103.	17245	*Austrostipa mollis*			
104.	17257	*Austrostipa variabilis*			
105.		*Aythya (Nyroca) australis*			
106.	24318	*Aythya australis (Hardhead)*			
107.	17737	*Azolla pinnata*			
108.	36441	*Babingtonia camphorosmae (Camphor Myrtle)*			
109.	1800	*Banksia attenuata (Slender Banksia, Piara)*			
110.	32580	*Banksia dallanneyi var. dallanneyi*			
111.	1822	*Banksia ilicifolia (Holly-leaved Banksia)*			
112.	1830	*Banksia littoralis (Swamp Banksia, Pungura)*			
113.	1834	*Banksia menziesii (Firewood Banksia)*			
114.	32077	*Banksia sessilis var. cygnorum*			
115.	1852	*Banksia telmatiaea (Swamp Fox Banksia)*			
116.		*Barnardius zonarius*			
117.	741	*Baumea articulata (Jointed Rush)*			
118.	743	*Baumea juncea (Bare Twigrush)*			
119.	744	*Baumea laxa*			
120.	5382	*Beaufortia elegans*			
121.	24319	*Biziura lobata (Musk Duck)*			
122.	1417	*Blancoa canescens (Winter Bell)*			
123.	749	*Bolboschoenus caldwellii (Marsh Club-rush)*			
124.	4413	*Boronia crenulata (Aniseed Boronia)*			
125.	16636	*Boronia crenulata subsp. viminea*			
126.	11503	*Boronia crenulata var. crenulata*			
127.	4417	*Boronia dichotoma*			
128.	11381	*Boronia ramosa subsp. anethifolia*			
129.	3710	*Bossiaea eriocarpa (Common Brown Pea)*			
130.	6341	*Brachyloma preissii (Globe Heath)*			
131.	30142	*Brachyloma preissii subsp. obtusifolium*			
132.	30136	*Brachyloma preissii subsp. preissii*			
133.	8661	*Brachypodium distachyon (False Brome)*	Y		
134.	42381	*Brachyurophis semifasciatus (Southern Shovel-nosed Snake)*			
135.	244	*Briza maxima (Blowfly Grass)*	Y		
136.	245	*Briza minor (Shivery Grass)*	Y		
137.	249	*Bromus diandrus (Great Brome)*	Y		
138.	12770	*Burchardia congesta*			
139.	25714	*Cacatua pastinator (Western Long-billed Corella)*			
140.	25716	*Cacatua sanguinea (Little Corella)*			
141.		*Cacatua sp.*			
142.	24729	*Cacatua tenuirostris (Eastern Long-billed Corella)*	Y		
143.	25598	*Cacomantis flabelliformis (Fan-tailed Cuckoo)*			
144.	42307	*Cacomantis pallidus (Pallid Cuckoo)*			
145.	1277	*Caesia occidentalis*			
146.	1586	*Caladenia discoidea (Dancing Orchid)*			
147.	1592	*Caladenia flava (Cowslip Orchid)*			
148.	15352	*Caladenia georgei*			
149.	1599	*Caladenia latifolia (Pink Fairy Orchid)*			
150.	15361	*Caladenia longicauda subsp. calcigena*			
151.	1605	*Caladenia marginata (White Fairy Orchid)*			
152.	2848	*Calandrinia corrigioloides (Strap Purslane)*			
153.	2856	*Calandrinia liniflora (Parakeelya)*			
154.	19309	*Calectasia narragara*			
155.	34942	*Callitriche brutia subsp. brutia*	Y		
156.	36600	*Callitris pyramidalis (Swamp Cypress)*			
157.	5411	*Calothamnus hirsutus*			
158.	5415	*Calothamnus lateralis*			
159.	25717	*Calyptorhynchus banksii (Red-tailed Black-Cockatoo)*			
160.		*Calyptorhynchus sp.*			
161.	5439	*Calytrix angulata (Yellow Starflower)*			
162.	5458	*Calytrix flavescens (Summer Starflower)*			
163.	5460	*Calytrix fraseri (Pink Summer Calytrix)*			
164.		*Calytrix sp.*			
165.	2794	*Carpobrotus aequilaterus (Angular Pigface)*	Y		
166.	2795	*Carpobrotus edulis (Hottentot Fig)*	Y		
167.	1162	*Cartonema philydroides*			
168.	2951	*Cassytha flava (Dodder Laurel)*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
169.	2957	*Cassytha racemosa (Dodder Laurel)*			
170.		*Castiarina anchoralis*			
171.	1742	*Casuarina obesa (Swamp Sheoak, Kuli)*			
172.	41568	*Cenchrus setaceus (Fountain Grass)*	Y		
173.	6542	*Centaurium tenuiflorum*	Y		
174.	6214	*Centella asiatica*			
175.	1125	*Centrolepis drummondiana*			
176.	1134	*Centrolepis polygyna (Wiry Centrolepis)*			
177.	2889	*Cerastium glomeratum (Mouse Ear Chickweed)*	Y		
178.	24186	*Chalinolobus gouldii (Gould's Wattled Bat)*			
179.	18156	*Chamaecytisus palmensis (Tagasaste)*	Y		
180.	1280	*Chamaescilla corymbosa (Blue Squill)*			
181.	24373	*Charadrius melanops (Black-fronted Dotterel)*			
182.	24377	*Charadrius ruficapillus (Red-capped Plover)*			
183.	43380	*Chelodina colliei (Oblong Turtle)*			
184.	24321	*Chenonetta jubata (Australian Wood Duck, Wood Duck)*			
185.	2490	*Chenopodium glaucum (Glaucous Goosefoot)*	Y		
186.	24980	*Christinus marmoratus (Marbled Gecko)*			
187.		*Chroicocephalus novaehollandiae*			
188.	24288	*Circus approximans (Swamp Harrier)*			
189.	7937	*Cirsium vulgare (Spear Thistle)*	Y		
190.	24774	*Cladorhynchus leucocephalus (Banded Stilt)*			
191.	38983	*Clastoderma debaryanum*			
192.	25675	*Colluricincla harmonica (Grey Shrike-thrush)*			
193.	24399	*Columba livia (Domestic Pigeon)*	Y		
194.	38990	*Comatricha nigra*			
195.	4550	*Comesperma calymega (Blue-spike Milkwort)*			
196.	1858	*Conospermum amoenum (Blue Smokebush)*			
197.	15611	*Conospermum stoechadis subsp. stoechadis (Common Smokebush)*			
198.	6348	*Conostephium pendulum (Pearl Flower)*			
199.	6349	*Conostephium preissii*			
200.	1418	*Conostylis aculeata (Prickly Conostylis)*			
201.	11826	*Conostylis aculeata subsp. aculeata*			
202.	1436	*Conostylis juncea*			
203.	1454	*Conostylis setigera (Bristly Cottonhead)*			
204.	11597	*Conostylis setigera subsp. setigera*			
205.	20074	*Conyza sumatrensis*	Y		
206.	25568	*Coracina novaehollandiae (Black-faced Cuckoo-shrike)*			
207.	277	*Cortaderia selloana (Pampas Grass)*	Y		
208.	25592	*Corvus coronoides (Australian Raven)*			
209.	1285	*Corynotheca micrantha (Sand Lily)*			
210.	7945	*Cotula coronopifolia (Waterbuttons)*	Y		
211.	24671	*Coturnix pectoralis (Stubble Quail)*			
212.	25701	*Coturnix ypsilophora (Brown Quail)*			
213.	24420	*Cracticus nigrogularis (Pied Butcherbird)*			
214.	25595	*Cracticus tibicen (Australian Magpie)*			
215.	25596	*Cracticus torquatus (Grey Butcherbird)*			
216.	3137	*Crassula colorata (Dense Stonecrop)*			
217.	3139	*Crassula exserta*			
218.	3140	*Crassula glomerata*	Y		
219.	25399	*Crinia glauerti (Clicking Frog)*			
220.	25400	*Crinia insignifera (Squelching Froglet)*			
221.	30893	*Cryptoblepharus buchananii*			
222.	30899	*Ctenophorus adelaidensis (Southern Heath Dragon, Western Heath Dragon)*			
223.	25027	*Ctenotus australis*			
224.	25040	*Ctenotus gemmula (Jewelled South-west Ctenotus (Swan Coastal Plain pop P3), skink)*			
225.		*Cubicorhynchus crenicollis*			
226.	40660	*Cycnogeton huegelii*			
227.	24322	*Cygnus atratus (Black Swan)*			
228.	19625	*Cymbalaria muralis subsp. muralis*	Y		
229.	816	*Cyperus tenuiflorus (Scaly Sedge)*	Y		
230.	30901	*Dacelo novaeguineae (Laughing Kookaburra)*	Y		
231.	7454	*Dampiera linearis (Common Dampiera)*			
232.	7462	*Dampiera pedunculata*			
233.	25673	*Daphoenositta chrysoptera (Varied Sittella)*			
234.	5508	*Darwinia citriodora (Lemon-scented Darwinia)*			
235.	35618	*Darwinia sp. Karonie (K. Newbey 8503)*			
236.	1218	*Dasypogon bromeliifolius (Pineapple Bush)*			
237.	3832	*Daviesia physodes*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
238.	3845	*Daviesia triflora*			
239.	25766	*Delma fraseri (Fraser's Legless Lizard)*			
240.	24999	*Delma grayii*			
241.	25296	*Demansia psammophis subsp. reticulata (Yellow-faced Whipsnake)*			
242.		*Descolea maculata*			
243.	16595	*Desmocladus flexuosus*			
244.	299	*Deyeuxia quadriseta (Reed Bentgrass)*			
245.	1259	*Dianella revoluta (Blueberry Lily)*			
246.	25607	*Dicaeum hirundinaceum (Mistletoebird)*			
247.	1287	*Dichopogon capillipes*			
248.	17838	*Dielsia stenostachya*			
249.	1634	*Diuris laxiflora (Bee Orchid)*			
250.	1636	*Diuris pauciflora*			
251.	1640	*Drakaea glyptodon (King-in-his-carriage)*			
252.	3095	*Drosera erythrorhiza (Red Ink Sundew)*			
253.	3098	*Drosera glanduligera (Pimpernel Sundew)*			
254.	3106	*Drosera macrantha (Bridal Rainbow)*			
255.	14298	*Drosera macrantha subsp. macrantha*			
256.	3109	*Drosera menziesii (Pink Rainbow)*			
257.	13216	*Drosera menziesii subsp. penicillaris*			
258.	3117	*Drosera paleacea (Dwarf Sundew)*			
259.	13188	*Drosera paleacea subsp. paleacea*			
260.	3135	*Drosera zonaria (Painted Sundew)*			
261.	11105	*Echinochloa crus-galli*	Y		
262.		*Ecnomus pansus*			
263.	25100	*Egernia napoleonis*			
264.		*Egretta garzetta*			
265.		*Egretta novaehollandiae*			
266.	347	*Ehrharta calycina (Perennial Veldt Grass)*	Y		
267.	349	*Ehrharta longiflora (Annual Veldt Grass)*	Y		
268.		*Elanus axillaris*			
269.	25250	*Elapognathus coronatus (Crowned Snake)*			
270.		*Elseyornis melanops*			
271.		*Eolophus roseicapillus*			
272.	1645	*Epiblema grandiflorum (Babe-in-a-cradle)*			
273.	6133	*Epilobium hirtigerum (Hairy Willow Herb)*			
274.	24567	*Epthianura albifrons (White-fronted Chat)*			
275.	13950	*Eremaea asterocarpa subsp. asterocarpa*			
276.	5541	*Eremaea pauciflora*			
277.	14104	*Eremaea pauciflora var. pauciflora*			
278.		*Eremaea sp.*			
279.	1647	*Eriochilus scaber (Pink Bunny Orchid)*			
280.	15446	*Eryngium pinnatifidum subsp. pinnatifidum*			
281.	24379	*Erythrogonys cinctus (Red-kneed Dotterel)*			
282.	5615	*Eucalyptus decipiens (Limestone Marlock, Moit)*			
283.	5708	*Eucalyptus marginata (Jarrah, Djara)*			
284.	13547	*Eucalyptus marginata subsp. marginata (Jarrah)*			
285.	5763	*Eucalyptus rudis (Flooded Gum, Kulurda)*			
286.	13511	*Eucalyptus rudis subsp. rudis*			
287.	5790	*Eucalyptus todtiana (Coastal Blackbutt)*			
288.	3872	*Euchilopsis linearis (Swamp Pea)*			
289.	20014	*Euphorbia hyssopifolia*	Y		
290.	4648	*Euphorbia terracina (Geraldton Carnation Weed)*	Y		
291.	3880	*Eutaxia virgata*			
292.	25621	*Falco berigora (Brown Falcon)*			
293.	25622	*Falco cenchroides (Australian Kestrel)*			
294.	25623	*Falco longipennis (Australian Hobby)*			
295.	24041	*Felis catus (Cat)*	Y		
296.	1747	*Ficus carica (Common Fig)*	Y		
297.	25727	*Fulica atra (Eurasian Coot)*			
298.	24761	*Fulica atra subsp. australis (Eurasian Coot)*			
299.	2969	*Fumaria capreolata (Whiteflower Fumitory)*	Y		
300.	25729	*Gallinula tenebrosa (Dusky Moorhen)*			
301.	24763	*Gallinula tenebrosa subsp. tenebrosa (Dusky Moorhen)*			
302.	24764	*Gallinula ventralis (Black-tailed Native-hen)*			
303.	25730	*Gallirallus philippensis (Buff-banded Rail)*			
304.	20475	*Gastrolobium capitatum*			
305.	20483	*Gastrolobium linearifolium*			
306.	3921	*Gastrolobium reticulatum*			
307.	24959	*Gehyra variegata*			

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308.		*Gelochelidon nilotica*			
309.	25530	*Gerygone fusca (Western Gerygone)*			
310.	1520	*Gladiolus caryophyllaceus (Wild Gladiolus)*	Y		
311.	24735	*Glossopsitta porphyrocephala (Purple-crowned Lorikeet)*			
312.	12624	*Gnephosis angianthoides*			
313.	6587	*Gomphocarpus fruticosus (Narrowleaf Cottonbush)*	Y		
314.	3957	*Gompholobium tomentosum (Hairy Yellow Pea)*			
315.	6161	*Gonocarpus pithyoides*			
316.	24443	*Grallina cyanoleuca (Magpie-lark)*			
317.	14282	*Gratiola pubescens*			
318.	2032	*Grevillea leucopteris (White Plume Grevillea)*			
319.	1475	*Haemodorum spicatum (Mardja)*			
320.	2197	*Hakea prostrata (Harsh Hakea)*			
321.	2216	*Hakea varia (Variable-leaved Hakea)*			
322.	24295	*Haliastur sphenurus (Whistling Kite)*			
323.	3961	*Hardenbergia comptoniana (Native Wisteria)*			
324.	25410	*Heleioporus eyrei (Moaning Frog)*			
325.		*Heleioporus sp.*			
326.	29594	*Helichrysum luteoalbum (Jersey Cudweed)*			
327.	6710	*Heliotropium europaeum (Common Heliotrope)*	Y		
328.	6839	*Hemiandra pungens (Snakebush)*			
329.		*Hemiandra sp.*			
330.	38320	*Hemiandra sp. Jurien (B.J. Conn & M.E. Tozer BJC 3885)*			
331.		*Hemiandra sp. Jurien (B.J.Conn 3885 & M.E.Tozer)*			
332.	25119	*Hemiergis quadrilineata*			
333.	1293	*Hensmania turbinata*			
334.	27778	*Heterodermia speciosa*			
335.		*Heurodes turritus*			
336.	5134	*Hibbertia huegelii*			
337.	5135	*Hibbertia hypericoides (Yellow Buttercups)*			
338.	5162	*Hibbertia racemosa (Stalked Guinea Flower)*			
339.	43280	*Hibbertia sericosepala*			
340.	5173	*Hibbertia subvaginata*			
341.	5176	*Hibbertia vaginata*			
342.	25734	*Himantopus himantopus (Black-winged Stilt)*			
343.	24491	*Hirundo neoxena (Welcome Swallow)*			
344.	444	*Holcus lanatus (Yorkshire Fog)*	Y		
345.	6222	*Homalosciadium homalocarpum*			
346.	12859	*Hovea trisperma var. trisperma*			
347.	12741	*Hyalosperma cotula*			
348.	5216	*Hybanthus calycinus (Wild Violet)*			
349.	5817	*Hypocalymma angustifolium (White Myrtle, Kudjid)*			
350.	35070	*Hypocalymma angustifolium subsp. Swan Coastal Plain (G.J. Keighery 16777)*			
351.	5825	*Hypocalymma robustum (Swan River Myrtle)*			
352.	8086	*Hypochaeris glabra (Smooth Catsear)*	Y		
353.	9352	*Hypochaeris radicata (Flat Weed)*	Y		
354.	1070	*Hypolaena exsulca*			
355.	17841	*Hypolaena pubescens*			
356.		*Idiommata blackwalli*			
357.		*Iridomyrmex conifer*			
358.	20200	*Isolepis cernua var. setiformis*			
359.	917	*Isolepis marginata (Coarse Club-rush)*			
360.	921	*Isolepis producta*			
361.		*Ixobrychus dubius*			
362.	4012	*Jacksonia furcellata (Grey Stinkwood)*			
363.	4029	*Jacksonia sternbergiana (Stinkwood, Kapur)*			
364.	1178	*Juncus bufonius (Toad Rush)*	Y		
365.	1186	*Juncus microcephalus*	Y		
366.	1188	*Juncus pallidus (Pale Rush)*			
367.	1190	*Juncus planifolius (Broadleaf Rush)*			
368.	4044	*Kennedia prostrata (Scarlet Runner)*			
369.	5832	*Kunzea ericifolia (Spearwood, Pondil)*			
370.	15498	*Kunzea glabrescens (Spearwood)*			
371.	20019	*Lachnagrostis filiformis*			
372.	6777	*Lachnostachys albicans*			
373.	18585	*Lagenophora huegelii*			
374.		*Latrodectus hasseltii*			
375.	1307	*Laxmannia ramosa (Branching Lily)*			
376.	11911	*Laxmannia ramosa subsp. ramosa*			
377.	11464	*Laxmannia sessiliflora subsp. australis*			

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378.	1309	*Laxmannia squarrosa*			
379.	7572	*Lechenaultia expansa*			
380.	7574	*Lechenaultia floribunda (Free-flowering Leschenaultia)*			
381.		*Lechenaultia sp.*			
382.	8099	*Leontodon saxatilis (Hairy Hawkbit)*	Y		
383.	925	*Lepidosperma angustatum*			
384.	937	*Lepidosperma longitudinale (Pithy Sword-sedge)*			
385.	940	*Lepidosperma pubisquameum*			
386.	41649	*Lepidosperma rigidulum*			
387.		*Lepidosperma sp.*			
388.	945	*Lepidosperma squamatum*			
389.	19833	*Leptocarpus laxus*			
390.	2342	*Leptomeria cunninghamii*			
391.	2344	*Leptomeria empetriformis*			
392.	2350	*Leptomeria pauciflora (Sparse-flowered Currant Bush)*			
393.	5850	*Leptospermum laevigatum (Coast Teatree)*	Y		
394.	25131	*Lerista distinguenda*			
395.	25133	*Lerista elegans*			
396.	6360	*Leucopogon australis (Spiked Beard-heath)*			
397.	6374	*Leucopogon conostephioides*			
398.	6425	*Leucopogon oxycedrus*			
399.	6434	*Leucopogon polymorphus*			
400.	6436	*Leucopogon propinquus*			
401.	7676	*Levenhookia pusilla (Midget Stylewort)*			
402.	7677	*Levenhookia stipitata (Common Stylewort)*			
403.	25005	*Lialis burtonis*			
404.	31280	*Lichenomphalia chromacea*			
405.	25661	*Lichmera indistincta (Brown Honeyeater)*			
406.	25415	*Limnodynastes dorsalis (Western Banjo Frog)*			
407.	25378	*Litoria adelaidensis (Slender Tree Frog)*			
408.	25388	*Litoria moorei (Motorbike Frog)*			
409.	9289	*Lobelia anceps (Angled Lobelia)*			
410.	7408	*Lobelia tenuior (Slender Lobelia)*			
411.	6515	*Logania vaginalis (White Spray)*			
412.	478	*Lolium rigidum (Wimmera Ryegrass)*	Y		
413.	1223	*Lomandra caespitosa (Tufted Mat Rush)*			
414.	1228	*Lomandra hermaphrodita*			
415.	1234	*Lomandra nigricans*			
416.	1239	*Lomandra preissii*			
417.	1243	*Lomandra sericea (Silky Mat Rush)*			
418.	1246	*Lomandra suaveolens*			
419.	25683	*Lonchura castaneothorax (Chestnut-breasted Mannikin)*			
420.		*Lophoictinia isura*			
421.	8564	*Lotus subbiflorus*	Y		
422.	4065	*Lupinus angustifolius (Narrowleaf Lupin)*	Y		
423.	1097	*Lyginia barbata*			
424.	18049	*Lyginia imberbis*			
425.	6456	*Lysinema ciliatum (Curry Flower)*			
426.	6458	*Lysinema elegans*			
427.	34736	*Lysinema pentapetalum*			
428.	5281	*Lythrum hyssopifolia (Lesser Loosestrife)*	Y		
429.	2839	*Macarthuria australis*			
430.	85	*Macrozamia riedlei (Zamia, Djiridji)*			
431.	24326	*Malacorhynchus membranaceus (Pink-eared Duck)*			
432.	25651	*Malurus lamberti (Variegated Fairy-wren)*			
433.	25654	*Malurus splendens (Splendid Fairy-wren)*			
434.	4079	*Medicago polymorpha (Burr Medic)*	Y		
435.	17683	*Meeboldina cana*			
436.		*Meeboldina roycei MS*			
437.	25758	*Megalurus gramineus (Little Grassbird)*			
438.	34676	*Meionectes brownii (Swamp Raspwort)*			
439.	5900	*Melaleuca cuticularis (Saltwater Paperbark)*			
440.	5917	*Melaleuca hamulosa*			
441.	13271	*Melaleuca huegelii subsp. huegelii*			
442.	13273	*Melaleuca incana subsp. incana*			
443.	5926	*Melaleuca lateritia (Robin Redbreast Bush)*			
444.	5946	*Melaleuca pauciflora*			
445.	5952	*Melaleuca preissiana (Moonah)*			
446.	5959	*Melaleuca rhaphiophylla (Swamp Paperbark)*			
447.	18598	*Melaleuca systena*			

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448.	5978	*Melaleuca teretifolia (Banbar)*			
449.	5980	*Melaleuca thymoides*			
450.	5987	*Melaleuca viminea (Mohan)*			
451.	4085	*Melilotus indicus*	Y		
452.	25663	*Melithreptus brevirostris (Brown-headed Honeyeater)*			
453.	25184	*Menetia greyii*			
454.	955	*Mesomelaena pseudostygia*			
455.	957	*Mesomelaena tetragona (Semaphore Sedge)*			
456.		*Metaballus litus*			
457.		*Microcarbo melanoleucos*			
458.	485	*Microlaena stipoides (Weeping Grass)*			
459.	15419	*Microtis media subsp. media*			
460.		*Microtis sp.*			
461.	25191	*Morethia lineoocellata*			
462.	25192	*Morethia obscura*			
463.	24223	*Mus musculus (House Mouse)*	Y		
464.	25420	*Myobatrachus gouldii (Turtle Frog)*			
465.	6189	*Myriophyllum crispatum*			
466.	6199	*Myriophyllum tillaeoides*			
467.		*Nassarius sp.*			
468.	25248	*Neelaps bimaculatus (Black-naped Snake)*			
469.	24738	*Neophema elegans (Elegant Parrot)*			
470.	6974	*Nicotiana glauca (Tree Tobacco)*	Y		
471.		*Nidula emodensis*			
472.	25748	*Ninox novaeseelandiae (Boobook Owl)*			
473.	25252	*Notechis scutatus (Tiger Snake)*			
474.	25564	*Nycticorax caledonicus (Rufous Night Heron)*			
475.	24194	*Nyctophilus geoffroyi (Lesser Long-eared Bat)*			
476.	24407	*Ocyphaps lophotes (Crested Pigeon)*			
477.		*Oecetis pechana*			
478.	14293	*Oenothera indecora subsp. bonariensis*	Y		
479.	16347	*Oenothera laciniata*	Y		
480.	6140	*Oenothera mollissima*	Y		
481.	36177	*Ornduffia albiflora*			
482.	4113	*Ornithopus compressus (Yellow Serradella)*	Y		
483.	24085	*Oryctolagus cuniculus (Rabbit)*	Y		
484.	25679	*Pachycephala pectoralis (Golden Whistler)*			
485.	25680	*Pachycephala rufiventris (Rufous Whistler)*			
486.		*Paramphisopus sp.*			
487.	25253	*Parasuta gouldii*			
488.	25681	*Pardalotus punctatus (Spotted Pardalote)*			
489.	25682	*Pardalotus striatus (Striated Pardalote)*			
490.	7090	*Parentucellia viscosa (Sticky Bartsia)*	Y		
491.	527	*Paspalum dilatatum*	Y		
492.	1550	*Patersonia occidentalis (Purple Flag, Koma)*			
493.	30471	*Patersonia occidentalis var. angustifolia*			
494.	30472	*Patersonia occidentalis var. occidentalis*			
495.	4343	*Pelargonium capitatum (Rose Pelargonium)*	Y		
496.	24648	*Pelecanus conspicillatus (Australian Pelican)*			
497.	6006	*Pericalymma ellipticum (Swamp Teatree)*			
498.	16477	*Pericalymma ellipticum var. ellipticum*			
499.	2273	*Persoonia saccata (Snottygobble)*			
500.	24659	*Petroica goodenovii (Red-capped Robin)*			
501.	2299	*Petrophile linearis (Pixie Mops)*			
502.	2301	*Petrophile macrostachya*			
503.	2312	*Petrophile striata*			
504.	19825	*Petrorhagia dubia*	Y		
505.	25697	*Phalacrocorax carbo (Great Cormorant)*			
506.	25698	*Phalacrocorax melanoleucos (Little Pied Cormorant)*			
507.	24667	*Phalacrocorax sulcirostris (Little Black Cormorant)*			
508.	25699	*Phalacrocorax varius (Pied Cormorant)*			
509.	24409	*Phaps chalcoptera (Common Bronzewing)*			
510.	20460	*Pheladenia deformis*			
511.	1478	*Phlebocarya ciliata*			
512.	1479	*Phlebocarya filifolia*			
513.	24596	*Phylidonyris novaehollandiae (New Holland Honeyeater)*			
514.	16177	*Phyllangium paradoxum*			
515.	4675	*Phyllanthus calycinus (False Boronia)*			
516.	4141	*Phyllota gracilis*			
517.	2793	*Phytolacca octandra (Red Ink Plant)*	Y		

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518.		*Phytophthora cinnamomi*			
519.	18117	*Pimelea rosea subsp. rosea*			
520.		*Piona murleyi*			
521.	24841	*Platalea flavipes (Yellow-billed Spoonbill)*			
522.	25720	*Platycercus icterotis (Western Rosella)*			
523.	6249	*Platysace compressa (Tapeworm Plant)*			
524.	6253	*Platysace filiformis*			
525.	4524	*Platytheca galioides*			
526.	25509	*Pletholax gracilis (Keeled Legless Lizard)*			
527.	25007	*Pletholax gracilis subsp. gracilis (Keeled Legless Lizard)*			
528.	25703	*Podargus strigoides (Tawny Frogmouth)*			
529.	25704	*Podiceps cristatus (Great Crested Grebe)*			
530.	8175	*Podolepis gracilis (Slender Podolepis)*			
531.	8182	*Podotheca angustifolia (Sticky Longheads)*			
532.	8183	*Podotheca chrysantha (Yellow Podotheca)*			
533.	8184	*Podotheca gnaphalioides (Golden Long-heads)*			
534.	25510	*Pogona minor (Dwarf Bearded Dragon)*			
535.	24907	*Pogona minor subsp. minor (Dwarf Bearded Dragon)*			
536.	24681	*Poliocephalus poliocephalus (Hoary-headed Grebe)*			
537.	582	*Polypogon monspeliensis (Annual Beardgrass)*	Y		
538.	25722	*Polytelis anthopeplus (Regent Parrot)*			
539.	4691	*Poranthera microphylla (Small Poranthera)*			
540.	25731	*Porphyrio porphyrio (Purple Swamphen)*			
541.	24767	*Porphyrio porphyrio subsp. bellus (Purple Swamphen)*			
542.	24769	*Porzana fluminea (Australian Spotted Crake)*			
543.	25732	*Porzana pusilla (Baillon's Crake)*			
544.	24771	*Porzana tabuensis (Spotless Crake)*			
545.	1670	*Prasophyllum drummondii (Swamp Leek Orchid)*			
546.	1672	*Prasophyllum fimbria (Fringed Leek Orchid)*			
547.	1673	*Prasophyllum gibbosum (Humped Leek Orchid)*			
548.	1680	*Prasophyllum parvifolium (Autumn Leek Orchid)*			
549.	10853	*Prasophyllum plumiforme*			
550.	25511	*Pseudonaja affinis (Dugite)*			
551.	25259	*Pseudonaja affinis subsp. affinis (Dugite)*			
552.	25433	*Pseudophryne guentheri (Crawling Toadlet)*			
553.		*Pterostylis sp.*			
554.	4177	*Pultenaea ochreata*			
555.	4181	*Pultenaea reticulata*			
556.		*Purpureicephalus spurius*			
557.		*Pycnoporus coccineus*			
558.	25008	*Pygopus lepidopodus (Common Scaly Foot)*			
559.	8195	*Quinetia urvillei*			
560.	24243	*Rattus fuscipes (Western Bush Rat)*			
561.	24245	*Rattus rattus (Black Rat)*	Y		
562.	24776	*Recurvirostra novaehollandiae (Red-necked Avocet)*			
563.	6012	*Regelia ciliata*			
564.	3083	*Reseda alba (White Mingnonette)*	Y		
565.	4822	*Rhamnus alaternus (Buckthorn)*	Y		
566.	25614	*Rhipidura leucophrys (Willie Wagtail)*			
567.	13300	*Rhodanthe citrina*			
568.		*Rimelia sp.*			
569.	14485	*Romulea flava var. minor*	Y		
570.	1556	*Romulea rosea (Guildford Grass)*	Y		
571.	14924	*Romulea rosea var. communis*	Y		
572.	40426	*Rytidosperma occidentale*			
573.	11647	*Samolus repens var. repens*			
574.	978	*Schoenus brevisetis*			
575.	982	*Schoenus clandestinus*			
576.	984	*Schoenus curvifolius*			
577.	986	*Schoenus efoliatus*			
578.	992	*Schoenus grandiflorus (Large Flowered Bogrush)*			
579.	1011	*Schoenus rigens*			
580.	1017	*Schoenus subbulbosus*			
581.	6033	*Scholtzia involucrata (Spiked Scholtzia)*			
582.		*Sclerorrhinella crawshawi*			
583.	6	*Selaginella gracillima (Tiny Clubmoss)*			
584.	25534	*Sericornis frontalis (White-browed Scrubwren)*			
585.	8225	*Siloxerus humifusus (Procumbent Siloxerus)*			
586.	25266	*Simoselaps bertholdi (Jan's Banded Snake)*			
587.	30948	*Smicrornis brevirostris (Weebill)*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
588.	7020	*Solanum linnaeanum (Apple of Sodom)*	Y		
589.	8231	*Sonchus oleraceus (Common Sowthistle)*	Y		
590.	1312	*Sowerbaea laxiflora (Purple Tassels)*			
591.	4211	*Sphaerolobium vimineum (Leafless Globe Pea)*			
592.		*Stackhousia sp.*			
593.	2918	*Stellaria media (Chickweed)*	Y		
594.	24329	*Stictonetta naevosa (Freckled Duck)*			
595.	2316	*Stirlingia latifolia (Blueboy)*			
596.	25597	*Strepera versicolor (Grey Currawong)*			
597.	25589	*Streptopelia chinensis (Spotted Turtle-Dove)*	Y		
598.	25590	*Streptopelia senegalensis (Laughing Turtle-Dove)*	Y		
599.	25831	*Stylidium araeophyllum (Stilt Walker)*			
600.	7693	*Stylidium brunonianum (Pink Fountain Triggerplant)*			
601.	7696	*Stylidium calcaratum (Book Triggerplant)*			
602.	7745	*Stylidium junceum (Reed Triggerplant)*			
603.	25829	*Stylidium neurophyllum (Coastal Plain Triggerplant)*			
604.	7774	*Stylidium piliferum (Common Butterfly Triggerplant)*			
605.	7785	*Stylidium repens (Matted Triggerplant)*			
606.	25806	*Stylidium scariosum*			
607.	7798	*Stylidium schoenoides (Cow Kicks)*			
608.	23511	*Stylidium thesioides (Delicate Triggerplant)*			
609.	1260	*Stypandra glauca (Blind Grass)*			
610.	15532	*Synaphea spinulosa subsp. spinulosa*			
611.	25705	*Tachybaptus novaehollandiae (Australasian Grebe, Black-throated Grebe)*			
612.	24682	*Tachybaptus novaehollandiae subsp. novaehollandiae (Australasian Grebe, Black-throated Grebe)*			
613.	24331	*Tadorna tadornoides (Australian Shelduck, Mountain Duck)*			
614.		*Talaurinus carbonarius*			
615.		*Talaurinus sp.*			
616.	24167	*Tarsipes rostratus (Honey Possum, Noolbenger)*			
617.		*Tellina sp.*			
618.		*Thalotia conica*			
619.	1716	*Thelymitra tigrina (Tiger Orchid)*			
620.		*Thinornis rubricollis*			
621.	24844	*Threskiornis molucca (Australian White Ibis)*			
622.	24845	*Threskiornis spinicollis (Straw-necked Ibis)*			
623.	1318	*Thysanotus arbuscula*			
624.	1338	*Thysanotus manglesianus (Fringed Lily)*			
625.	1339	*Thysanotus multiflorus (Many-flowered Fringe Lily)*			
626.	1343	*Thysanotus patersonii*			
627.	1351	*Thysanotus sparteus*			
628.	1357	*Thysanotus thyrsoideus*			
629.	1358	*Thysanotus triandrus*			
630.	25519	*Tiliqua rugosa*			
631.	25204	*Tiliqua rugosa subsp. aspera*			
632.	25207	*Tiliqua rugosa subsp. rugosa*			
633.	25549	*Todiramphus sanctus (Sacred Kingfisher)*			
634.	6280	*Trachymene pilosa (Native Parsnip)*			
635.		*Tribonyx ventralis*			
636.	4383	*Tribulus terrestris (Caltrop)*	Y		
637.	25723	*Trichoglossus haematodus (Rainbow Lorikeet)*			
638.	25521	*Trichosurus vulpecula (Common Brushtail Possum)*			
639.	1361	*Tricoryne elatior (Yellow Autumn Lily)*			
640.	1363	*Tricoryne tenella*			
641.	1038	*Tricostularia neesii*			
642.	17145	*Trifolium angustifolium var. angustifolium*	Y		
643.	14738	*Trifolium resupinatum var. resupinatum*	Y		
644.	150	*Triglochin stowardii*			
645.	4360	*Tropaeolum majus (Garden Nasturtium)*	Y		
646.	98	*Typha domingensis (Bulrush, Djandjid)*			
647.		*Urodacus novaehollandiae*			
648.	8255	*Ursinia anthemoides (Ursinia)*	Y		
649.	38388	*Ursinia anthemoides subsp. anthemoides*	Y		
650.	24386	*Vanellus tricolor (Banded Lapwing)*			
651.		*Venator immansueta*			
652.	15432	*Verticordia densiflora var. densiflora*			
653.	4320	*Vicia hirsuta (Hairy Vetch)*	Y		
654.	11474	*Vicia sativa subsp. nigra*	Y		
655.	4325	*Viminaria juncea (Swishbush, Koweda)*			
656.	722	*Vulpia bromoides (Squirrel Tail Fescue)*	Y		

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
657.	7384	*Wahlenbergia capensis (Cape Bluebell)*	Y		
658.	7389	*Wahlenbergia preissii*			
659.	8282	*Waitzia suaveolens (Fragrant Waitzia)*			
660.	1256	*Xanthorrhoea preissii (Grass tree, Palga)*			
661.	6289	*Xanthosia huegelii*			
662.	1049	*Zantedeschia aethiopica (Arum Lily)*	Y		
663.		*Zoila friendii*			
664.	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.

FID_	Sheet	NameID	Taxon	Cons_Code	Plant_Desc	Site_Descr	Vegetation	Frequency	Other_Note	Locality	Latitude	Longitude	Geocode_T	Accuracy	Date
	4421213	1596	Caladenia huegelii	T	Up to 60 cm high.	Coastal plain. Grey sand.	Closed Banksia woodland. Banksia sp., Stirlingia latifolia, Hibbertia spp., Hypocalymma robustum, Conostephium pendulum		Abundance: 23 plants flowering. Plants found only in 'depression' ca 50 m x 75 m.	300 m E (right) on sand track, 300 m N up Fraser Road from Forrest Road, Banjup	-32.1254	115.8793	GPS	1	20/09/1996
	4421205	1596	Caladenia huegelii	T	Up to 60 cm high.	Coastal plain. Grey sand.	Closed Banksia woodland. Banksia sp., Stirlingia latifolia, Hibbertia spp., Hypocalymma robustum, Conostephium pendulum		Abundance: 23 plants flowering. Plants found only in 'depression' ca 50 m x 75 m.	300 m E (right) on sand track, 300 m N up Fraser Road from Forrest Road, Banjup	-32.1254	115.8793	GPS	1	20/09/1996
	6752624	1596	Caladenia huegelii	T	Ca 30 cm tall. Linear hairy leaf 15 cm x 1 cm.	Grey sand.	Low open woodland of Melaleuca preissiana over Low Open Shrubland of Melaleuca thymoides over Dasypogon sp. and Desmocladus sp. herbland on lower slopes.	2 mature plants, one dead over 2 sq m.	Condition of population: healthy.	Bush Forever Site 390, Fraser Road Bushland, Banjup	-32.1262	115.8851	GPS	1	30/10/2003
	7439938	1596	Caladenia huegelii	T		Private land. Flat. White / grey sand.		452 mature plants.	Healthy population but at risk from disturbance given location and proximity to sand.	Lot 4, 131, 135 and 136, Fraser road. Fro, Armadale road head E onto Fraser road, Banjup	-32.1267	115.88	GPS	1	21/10/2004
	6534163	16245	Cyathochaeta teretifolia		3					In or adjacent to Emma Treeby Reserve, S Armadale Road, Banjup	-32.1333	115.8667	MAN	3	10/12/1995
	4260171	4763	Dodonaea hackettiana		4					Russell Road (S side of Reserve) between Thomsons Lake and Marsupial Reserves, Wattleup	-32.1664	115.8497	AUTO	2	28/11/1993
	1157655	4763	Dodonaea hackettiana		4				2159/62/2.	Thomson's Lake Reserve, Jandakot	-32.1333	115.8333	MAN	3	/09/1962
	231282	1639	Drakaea elastica	T		In deep grey sand on gradual slopes in undulating plain.	Low woodland of Banksia attenuata, B. menziesii, B. ilicifolia, and Jarrah over scrub of Adenanthos cygnorum and Kunzea over herbs.	ca 60 plants.	Abundance: ca 60 plants.	Mandogalup, S of Perth, 0.8 km S of Hope Valley Road, along Treeby Road	-32.2	115.8667	MAN	3	28/10/1982
	8415331	20462	Jacksonia gracillima		3 Decumbent perennial to 0.3 m high x 1.4 m diam.	Flat, well-drained but adjacent to winter-wet swamp; pale grey sand.	Banksia woodland.	infrequent.		Bushland near Shirley Balla Swamp, north of Gibbs Rd, Banjup	-32.1564	115.8814	GPS	1	14/11/2010
	6836445	20462	Jacksonia gracillima		3 Low spreading shrub to 30 cm x 120 cm. Standard yellow-orange with red band close to base and yellow eye; wings yellow-orange in distal half, red basally, keel red.	Coastal plain, low flat. Dry, but in area of high water table. Grey sand.	Open heath over dense herbs. Kunzea glabrescens, Melaleuca thymoides, Dasypogon bromelilifolius, Phlebocarya ciliata.	occasional.		Piara Nature Reserve, Forrestdale, off N-S track ca 300 m from powerline access track	-32.1397	115.9183	GPS	1	12/11/2003
	5592224	5237	Pimelea calcicola		3 Erect, perennial, dwarf shrub.	Brown sand and protruding limestone.	Melaleuca/Acacia rostellifera patches. Associated vegetation: Dryandra sessilis, Phyllanthus calycinus, Hibbertia hypericoides, Ehrharta calycina.			ca 75 m N of Retta Street on E side of Cockburn Road, Mount Brown (Beeliar) Regional Park,	-32.1667	115.8333	MAN	0	10/11/1997
	2857685	25800	Stylidium paludicola		3 0.5 m tall, flowers pink.	Near edge of swamp.	Amongst Juncus.			Jandakot Marsupial Breeding Station at Banganup Lake	-32.1667	115.8333	MAN	0	4/12/1974
	7279906	25800	Stylidium paludicola		3 Herb to 0.4 m high. Flowers pink/red.	Gentle slope, south aspect, surface soil is dark grey loamy sand and sub surface soil is very dark grey brown sandy loam, drainage is poor and wet during winter and spring only.	Melaleuca preissiana, Kunzea glabrescens low open forest over Astartea scoparia, Hypocalymma angustifolium open shrubland over Lepidosperma longitudinale open sedgeland. Vegetation is in a pristine to excellent condition with some rabbit diggings and pot	scattered.		Robinson Road, Wandi	-32.1853	115.8965	GPS	1	22/11/2005
	2521296	44444	Tripterococcus sp. Brachylobus (A.S. George 14234)		4 Slender erect multi-stemmed shrub to 40 cm. Flowers orange-yellow, in full flower.	Winter wet flats, peaty sand over clay.	Hypocalymma angustifolium low heath.	scattered groups of 5-15 plants.		Gazetted Reserve 418 [Reserve No. 41438], Bartrum Road swamp, Jandakot	-32.15	115.8833	MAN	3	21/02/1992

Taxon	Status	Rank	IUCNCriteria	EPBC	DPaWRegion	DPaWDistrict	Distribution	FloweringPeriod	RecoveryPlan
Acacia lasiocarpa var. bracteolata long peduncle variant (G.J. Keighery 5026)		1			SWAN	PERTH HILLS,SWAN COASTAL	North Dandalup, Mundijong, Gosnells, Jandakot, Serpentine, Mundijong	My,Aug	
Amanita drummondii		3			SCST,SWAN,WARR	ALBANY,DONNELLY,FRANKLAND,SWAN COASTAL	Jandakot, Yunderup, Perup, Mount Roe N.P., Denmark, Albany		
Byblis gigantea		3			MWST,SWAN	MOORA,PERTH HILLS,SWAN COASTAL	Yule Brook, Cannington, Jandakot, Brookton Highway, Cervantes	Sep-Jan	
Dodonaea hackettiana		4			SWAN	SWAN COASTAL	Wattleup, Thompson Lake, Kings Park, Jandakot, Bibra Lake-The Spectacles, Gingin, Peron, Baldivis, Beeliar, Baldivis, Harry Waring Marsupial Reserve	Jul-Oct	
Eryngium pinnatifidum subsp. Palustre (G.J. Keighery 13459)		3			SWAN	SWAN COASTAL	Serpentine, Kenwick, Upper Swan, Gingin, Forrestdale, Bullsbrook, Mandurah, Arrowsmith, Capel	-	
Jacksonia gracillima		3			SWAN,SWST	BLACKWOOD,SWAN COASTAL	Mundijong, Forrestdale, Capel, Elgin, Modong N.R., Forrestfield, Ambergate	Oct-Nov	
Lepidosperma rostratum	T	EN	B1ab(iii)+2ab(iii)	EN	SWAN	SWAN COASTAL	Cannington, Kenwick, Forrestdale Lake NR	Aug	
Microtis quadrata		4			SCST,SWAN,WARR,WHTB	ALBANY,FRANKLAND,SWAN COASTAL,GREAT SOUTHERN	Pinjarra, Jandakot, Albany, Lake Barker, Denamrk , Baufort Inlet	Dec-Jan	
Ornduffia submersa		4			SCST,SWAN,SWST,WARR	ALBANY,DONNELLY,FRANKLAND,PERTH HILLS,SWAN COASTAL,WELLINGTON	Gunapin, Boyanup, Lake Muir, Denmark, Forrestdale, Kenwick, Frankland River, Lane Poole	Sep-Oct	
Stylidium longitubum		3			SWAN,SWST,WHTB	BLACKWOOD,SWAN COASTAL,WELLINGTON,GREAT SOUTHERN	Upper Swan, Bullsbrook, Bunbury, Midland, Busselton, Arthur River, Jandakot, Mundijong, Karnup	Nov	
Stylidium paludicola		3			SWAN,SWST	BLACKWOOD,SWAN COASTAL,WELLINGTON	Bullsbrook, Ruabon, Mandogalup, Lake Clifton, Cookernup, Capel, Dardanup		
Thysanotus glaucus		4			MWST,SCST,SWAN,SWST,WHTB	BLACKWOOD,ALBANY,ESPERANCE,MOORA,PERTH HILLS,SWAN COASTAL,GREAT SOUTHERN	Regans Ford, Forrestdale, Busselton, Lake King, West Mt Barren, Lesueur NPk	Nov-Feb	
Verticordia lindleyi subsp. lindleyi		4			MWST,SWAN	MOORA,PERTH HILLS,SWAN COASTAL	Gillingarra-Forrestdale, Cannington, Guildford, Muchea, Gingin, Murray River, Moore River, Serpentine	Nov-Jan	

FID_	PopId	Nameid	Taxon	ConsStatus	WARank	PopNumbe	SubPopCoc	Gda94Lat	Gda94Long	PopStatus	Location	District	Vesting	Purpose1	Purpose2	CountDate	Method	MatureCou	JuvenileCo	SeedlingCo	LiveTotal	PlantTypeC	AreaOccup	inFlower	Population
	84932	1596	Caladenia h	T	CR	12		-32.1771	115.9174	X	*Extinct?*	SWAN COA	PRI			15/10/1997 0:00	ACT_IND	0			0			N	
	84944	1596	Caladenia h	T	CR	41		-32.1276	115.8575	X	EXTINCT - A	SWAN COA	MRD	VER		23/10/2006 0:00		0			0			N	
	97288	1596	Caladenia h	T	CR	42	A	-32.1258	115.8813		Lot 820 (pr	SWAN COA	SPC	GVT		23/09/2011 0:00	ACT_IND	447			0	PLANTS	112380	Y	HEALTHY
	97289	1596	Caladenia h	T	CR	42	B	-32.1261	115.8778		Lot 9004 (L	SWAN COA	PRI			14/10/2005 0:00	ACT_IND	0			0			Y	MODERATE
	97290	1596	Caladenia h	T	CR	42	C	-32.1246	115.8853		Lot 131 Fra	SWAN COA	PRI			9/10/2004 0:00		5			5			Y	
	97291	1596	Caladenia h	T	CR	42	D	-32.1266	115.8777		Fraser Roa	SWAN COA	LGA	VER		23/09/2011 0:00		0			0			N	
	106241	1596	Caladenia h	T	CR	42	E	-32.1284	115.8763		Lot 821 (pr	SWAN COA	PRI			14/10/2005 0:00	ACT_IND	0			0			Y	MODERATE
	106242	1596	Caladenia h	T	CR	42	F	-32.1262	115.8851		Private Pro	SWAN COA	PRI			14/10/2005 0:00	ACT_IND	0			0			Y	MODERATE
	97306	1596	Caladenia h	T	CR	59	A	-32.2004	115.8686		The north v	SWAN COA	CC	CFF		21/09/2004 0:00		1			1			N	
	97308	1596	Caladenia h	T	CR	59	C	-32.2024	115.8686		Western bc	SWAN COA	CC	CFF		4/10/2010 0:00	ACT_IND	0			0			N	
	97309	1596	Caladenia h	T	CR	59	D	-32.2016	115.8745		The southe	SWAN COA	CC	CFF		4/10/2010 0:00	ACT_IND	1		1	1			Y	
	97310	1596	Caladenia h	T	CR	59	E	-32.2005	115.8775		Approx 15(	SWAN COA	CC	CFF		4/10/2010 0:00	ACT_IND	26		14	26			Y	
	97312	1596	Caladenia h	T	CR	60	A	-32.1822	115.8861		Private Pro	SWAN COA	PRI			11/10/2005 0:00	ACT_IND	6			6			Y	
	97313	1596	Caladenia h	T	CR	60	B	-32.1817	115.8854		Private Pro	SWAN COA	PRI			11/10/2005 0:00	ACT_IND	11			0			Y	
	97314	1596	Caladenia h	T	CR	60	C	-32.185	115.8796		Private Pro	SWAN COA	PRI			16/10/2005 0:00	ACT_IND	3			3			Y	
	106221	1596	Caladenia h	T	CR	60	D	-32.1818	115.886		Private Pro	SWAN COA	PRI			10/10/2005 0:00	ACT_IND	5			0			Y	
	84954	1596	Caladenia h	T	CR	61		-32.1473	115.8869		Private Pro	SWAN COA	PRI			5/10/2005 0:00		1			1			Y	
	84955	1596	Caladenia h	T	CR	62		-32.1614	115.8893		Western ec	SWAN COA	LGA	REC		3/10/2005 0:00	ACT_IND	18			18			N	
	84960	1596	Caladenia h	T	CR	67		-32.1518	115.8819		Unvested R	SWAN COA	NON	GVT		8/10/2006 0:00	ACT_IND	4			4			Y	
	84964	1596	Caladenia h	T	CR	72		-32.1689	115.8953		Private Pro	SWAN COA	PRI			19/09/2007 0:00	ACT_IND	1			1			Y	
	84968	1596	Caladenia h	T	CR	76		-32.1895	115.8914		Private pro	SWAN COA	PRI			1/10/2009 0:00	ACT_IND	1		0	1			Y	
	106981	1596	Caladenia h	T	CR	78	A	-32.2018	115.8625		Private Pro	SWAN COA	PRI			25/09/2012 0:00	ACT_IND	1	1		0	PLANTS	1	Y	HEALTHY
	99183	4763	Dodonaea	4		4	A	-32.1321	115.8307		Along the N	SWAN COA	PRI			15/10/1980 0:00		0			0			N	
	99184	4763	Dodonaea	4		4	B	-32.1377	115.8307		N verge of	SWAN COA	LGA	VER		15/10/1980 0:00		0			0			N	
	99185	4763	Dodonaea	4		4	C	-32.1404	115.8293		N edge of T	SWAN COA	NON	OTH		15/10/1980 0:00		0			0			N	
	99189	4763	Dodonaea	4		5	A	-32.1599	115.8237		Russell Rd,	SWAN COA	LGA	VER		15/10/1980 0:00	ACT_IND	27			27			N	
	99190	4763	Dodonaea	4		5	B	-32.1516	115.8237		S side of Ru	SWAN COA	CC	CFF	OTH	15/10/1980 0:00	ACT_IND	13			13			N	
	99191	4763	Dodonaea	4		5	C	-32.1571	115.8293		S edge of T	SWAN COA	LGA	NRE	CFA	15/10/1980 0:00		0			0			N	
	99192	4763	Dodonaea	4		5	D	-32.1655	115.8237		Harry Wari	SWAN COA	CC	CFF	OTH	15/10/1980 0:00	ESTMT	700			1750			N	
	99193	4763	Dodonaea	4		5	E	-32.1655	115.8301		Harry Wari	SWAN COA	CC	CFF	OTH	15/10/1980 0:00	ESTMT	15			23			N	
	99194	4763	Dodonaea	4		5	F	-32.1682	115.8237		WSW edge	SWAN COA	PRI			15/10/1980 0:00		0			0			N	
	85074	1639	Drakaea ela	T	CR	31		-32.19	115.8795		Private Pro	SWAN COA	PRI			17/08/2010 0:00		0			0			N	
	91320	13635	Drakaea mi	T	EN	15		-32.1568	115.9143		PP (Loc 33,	SWAN COA	PRI			14/11/2002 0:00		0			0			N	
	93725	16998	Tripterococ	4		6		-32.153	115.8866		Reserve 41	SWAN COA	NON	GVT		21/02/1992 0:00	ESTMT	10			10			N	
	92664	14714	Verticordia	4		22		-32.166	115.8895		Denis De Y	SWAN COA	LGA	REC		15/06/1991 0:00		0			0			N	

Appendix C
360 Enviromental (2017) Targeted Flora Survey

Our Ref: 2493AB

16 May 2018

Kris Kennedy
Manager-Planning
Aigle Royal Developments
Via Email: kkennedy@aigleroyal.com.au

Dear Kris

Targeted Flora Survey – Lots 11 and 74 Beenyup Road, Banjup

1. Background

DRAFT

360 Environmental Pty Ltd (360 Environmental) was commissioned by Aigle Royal Developments to address the additional information request by Department of Environment and Energy (DEE) in regards to the assessment of the proposed redevelopment of Lots 11 and 74 Beenyup Road, Banjup under the Environmental Protection and Biodiversity Conservation (EPBC) Act 1999 (Figure 1).

360 Environmental (2015) undertook a Level 2 Flora and Vegetation Survey for the proposed development on 15 and 16 September 2015, which involved a database and desktop study. No Threatened species pursuant to the EPBC Act 1999 and/or gazetted as Declared Rare Flora (DRF) pursuant to the Wildlife Conservation (WC) Act 1950 or Priority species were recorded during the 2015 survey.

From the 2015 report, 24 species listed as Threatened by the EPBC Act, listed under the WC Act, or considered Priority flora, were identified as potentially occurring in the Survey Area. Two of these species, *Caladenia huegelii and Drakaea micrantha* have been identified as having the potential to occur in the Survey Area due to the presence of suitable habitat and the close proximity to the site of previous records. *The 2015 survey was undertaken at the optimum time for these species; however, due to their growth habits and therefore the difficulty in locating them, the DEE raised their concerns of these orchids being present and requested a second survey to be undertaken (DEE letter 22 September, Comment 10).*

2. Methods

The targeted search was undertaken on 11 October 2017. The survey involved traversing the Survey Area on foot to search for species of conservation significance, particularly *Drakaea micrantha*, *Caladenia huegelii* and other species identified during the 2015 desktop assessment.

For each population of suspected significant flora located in the Survey Area the following was recorded:

- Co-ordinate locations (using handheld GPS units);
- Photograph; and
- Estimation of population size.

3. Results

3.1. Vegetation Description

Thirteen vegetation associations were described for the Survey Area:

- Low Woodland of *Banksia attenuata*, *Banksia menziesii*, *Allocasuarina fraseriana*, *Eucalyptus marginata* over *Kunzea glabrescens*, *Acacia pulchella*, *Hibbertia hypericoides*, *Xanthorrhoea preissii*, *Bossiaea eriocarpa* and Conostylis aculeata;
- Low Woodland of *Banksia attenuata*, *Banksia menziesii*, *Allocasuarina fraseriana* over *Kunzea glabrescens*, *Dasypogon bromeliifolius*, *Hibbertia subvaginata*, *Calytrix fraseri* and *Bossiaea eriocarpa*;
- Open Woodland of *Allocasuarina fraseriana*, *Eucalyptus marginata* and *Banksia ilicifolia* over *Xanthorrhoea preissii*, *Dasypogon bromeliifolius*, *Bossiaea eriocarpa*, *Gompholobium tomentosum* and *Phlebocarya ciliata*;
- Woodland of *Banksia ilicifolia* and *Banksia attenuata* over *Kunzea glabrescens*, *Xanthorrhoea preissii*, *Dasypogon bromeliifolius* and *Desmocladus flexuosus*;
- Woodland of *Eucalyptus rudis* and *Melaleuca preissiana* over *Kunzea glabrescens*, *Xanthorrhoea preissii*, *Adenanthos cygnorum* and *Hypocalymma angustifolium*;
- Low Open Woodland of *Melaleuca preissiana* and *Melaleuca rhaphiophylla* over *Kunzea glabrescens*, *Hypocalymma angustifolium*, *Astartea scoparia*, *Melaleuca teretifolia*, *Meeboldina scariosa* and *Lepidosperma longitudinale*;

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- Low Open Woodland of *Melaleuca preissiana* over *Kunzea glabrescens, Hakea varia, Acacia pulchella* var. *glaberrima, Calothamnus lateralis* var. *lateralis* and *Meeboldina coangustata*;
- Low Closed Forest of *Melaleuca rhaphiophylla* over *Baumea articulata*;
- Closed Tall Scrub of *Melaleuca teretifolia, Melaleuca rhaphiophylla*, *Meeboldina coangustata* and *Juncus capitatus*;
- Low Woodland of *Melaleuca rhaphiophylla* over *Melaleuca lateritia, Astartea scoparia, Meeboldina coangustata*, *Lepidosperma longitudinale* and *Juncus pallidus*;
- Ecotone of *Banksia ilicifolia* and *Banksia menziesii* over *Kunzea glabrescens*, *Dasypogon bromeliifolius* and *Phlebocarya ciliata*;
- Closed Heath of *Hypocalymma angustifolium, Kunzea glabrescens, Dielsia stenostachya, Dasypogon bromeliifolius* and *Boronia crenulata* var. *crenulata*; and
- Monoculture of young *Melaleuca rhaphiophylla* over water.

3.2. Vegetation Condition

The vegetation condition within the site ranged from Excellent to Completely Degraded. Historical vegetation clearing, weeds, housing, a nursery and the presence of tracks within the Survey Area were the most frequently observed impacts on native vegetation.

Clearing of the eastern side of the Survey Area was undertaken around 1983 for residential and agriculture use. Additional tracks and clearing have been undertaken since then, including the construction of an additional residence on the western side.

The vegetation condition mapping undertaken in 2015 was reassessed and re-scored to reflect the current vegetation condition. This resulted in vegetation in the northern portion of the Survey Area to be re-scored from Good to Degraded condition to Degraded condition (Figure 2).

The Conservation Category Wetland (CCW) in the middle of the Survey Area has remained relatively intact and the majority is considered to be in Very Good to Excellent condition. There are a couple of areas within the wetland in Good condition along with tracks and a couple of small pockets considered to be in Degraded to Completely Degraded condition.

The upland vegetation ranges from Excellent to Degraded condition, with the majority considered to be in Good condition.

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3.3. Flora of Conservation Significance

The aim of this survey was to undertake a targeted search for *Drakaea micrantha* and *Caladenia huegelii*; however, no specimens of these species were recorded during the survey.

4. Discussion

No threatened species pursuant to the EPBC Act or to the WC Act or priority species were recorded in the project area during the field survey. *Caladenia huegelii* is a tuberous, perennial orchid that grows to 0.6 m high that is easily recognizable during its flowering period from September to October (WAH 2017). Outside of this period *C. huegelii* remains as an underground tuber and is difficult to detect in the field. Soil preferable for the species is usually deep grey-white sand associated with the Bassendean sand-dune system. However, specimens have been known to extend into the Spearwood system in some areas. The species grows in well-drained, deep sandy soils in low mixed woodlands of *Banksia attenuata*, *Banksia menziesii*, *Banksia ilicifolia*, *Allocasuarina fraseriana* and *Eucalyptus marginata*. It tends to favour areas of lush undergrowth (Brown et al. 1998; Hoffman & Brown 1998; Kelly et al. 1993). Therefore, there is vegetation in the Survey Area that is favourable habitat for *Caladenia huegelii*. As the Survey Area was extensively searched for a second time at the optimal time for this species, it can be concluded that *Caladenia huegelii* is not present.

Drakaea micrantha is a tuberous, terrestrial herb which has a diminutive flower and a heart shaped leaf which is silvery grey with prominent green veins. The species flowers from September to October and is usually found on cleared firebreaks or open sandy patches that have been disturbed, where competition from other plants has been removed (Brown et al. 1998; Hearn et al. 2006). It occurs in infertile grey sands, in *Eucalyptus marginata* and *Allocasuarina fraseriana* woodland or forest associated with *Banksia* species. It is often found under thickets of Spearwood *Kunzea glabrescens* with the Flying Duck-orchid (Paracaleana nigrita) and other Drakaea species (Brown et al. 1998; Hoffman & Brown 1992; Robinson & Coates 1995). Regardless of the Survey Area containing suitable habitat for the species, the Survey Area was extensively searched and no specimens were found.

The 2017 targeted flora survey was completed within the recommended season and optimum flowering period for the south west botanical province and the targeted conservation significant species *Caladenia huegelii* and *Drakaea micrantha*. The project area was sufficiently surveyed and as such the following conclusions can be drawn:

- No Threatened species are present in the Survey Area

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We trust this meets your requirements at this time. Should you have any questions or require further action please do not hesitate to contact Narelle Whittington on (08) 9388 8360.

For and on behalf of

360 Environmental Pty Ltd

Narelle Whittington - Principal Botanist

Enc:
Attachment 1.0 – Figure 1: Site Location
Attachment 2.0 – Figure 2: Updated Vegetation Condition

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5. References

Brown, A., Thomson-Dans, C. and Marchant, N. (Eds). (1998) Western Australia's Threatened Flora;

Florabase - Information on the Western Australian Flora. Accessed from http://florabase.dpaw.wa.gov.au;

Hearn, R.W., R. Meissner, A.P. Brown, T.D. Macfarlane and T.R. Annels (2006). Declared rare and poorly known flora in the Warren Region, Western Australian Wildlife Management Program No 40. Western Australian Department of Conservation and Land Management. Available from: http://www.dpaw.wa.gov.au/plants-and-animals/threatened-species-and-communities/threatened-plants;

Hoffman, N. and Brown A. (1998) Orchids of South West Australia, Revised Second Edition with supplement, UWA Press, Western Australia;

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Robinson, C.J. and D.J. Coates (1995). Declared Rare & Poorly Known Flora in the Albany District. Western Australian wildlife management program no. 20. Como, Western Australia: Australian Nature Conservation Agency, Department of Conservation and Land Management. Available from: http://www.dpaw.wa.gov.au/plants-and-animals/threatened-species-and-communities/threatened-plants; and

Western Australian Herbarium [WAH]. (2017). Florabase - Information on the Western Australian Flora. Accessed from http://florabase.dpaw.wa.gov.au

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FIGURE

Legend

Survey Area

- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS
- LOCALITY MAP SOURCED LANDGATE 2016
- AERIAL PHOTOGRAPHY SOURCED LANDGATE 2018
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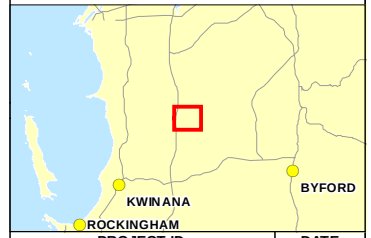
LOCALITY MAP



PROJECT ID	DATE
2493	16/05/2018

HORIZONTAL DATUM AND PROJECTION
GDA 1994 MGA Zone 50

CREATED	CHECKED	APPROVED	REVISION
SL	NW	NW	0

Aigle Royal Developments
Beenup Road, Banjup

Targeted Flora Survey

Figure 1
Site Location

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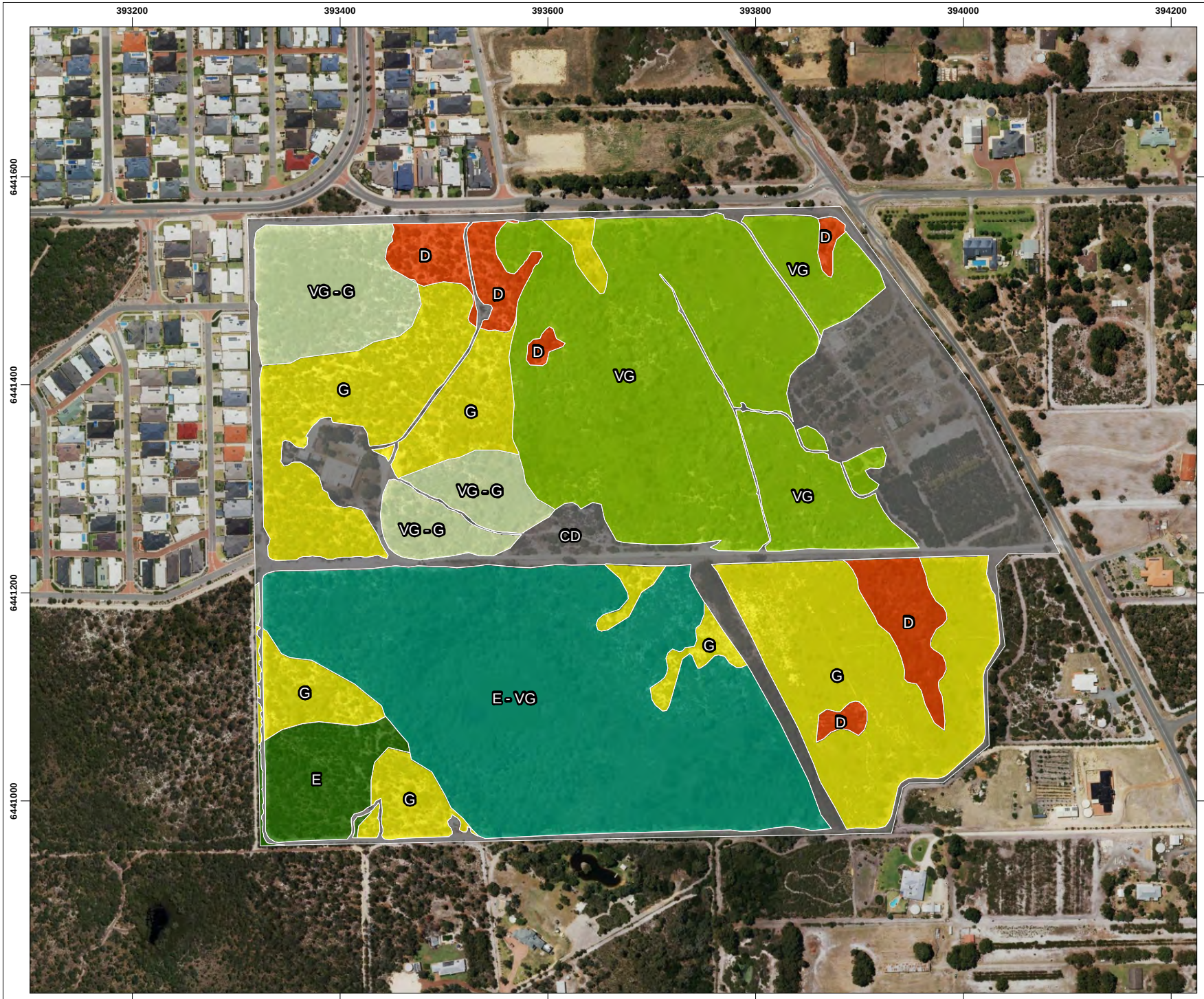
K:\Projects\1.0 EBS\2493 Aigle Royal Developments\Figures\Figure 1 Site Location.mxd



Legend

Vegetation Conditions

- Excellent
- Excellent - Very Good
- Very Good
- Very Good - Good
- Good
- Degraded
- Completely Degraded

- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS
- LOCALITY MAP SOURCED LANDGATE 2016
- AERIAL PHOTOGRAPHY SOURCED LANDGATE 2018
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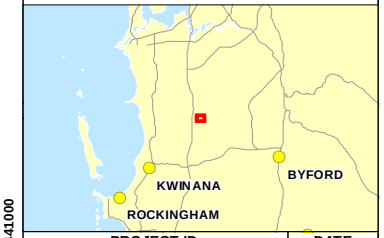
LOCALITY MAP



PROJECT ID	DATE
2493	16/05/2018

HORIZONTAL DATUM AND PROJECTION
GDA 1994 MGA Zone 50

CREATED	CHECKED	APPROVED	REVISION
SL	NW	NW	0

Aigle Royal Developments
Beenup Road, Banjup

Targeted Flora Survey

Figure 2
Vegetation Condition

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Appendix D
DBCA NatureMap and DAWE PMST Database Searches

Australian Government
Department of the Environment and Energy

EPBC Act Protected Matters Report

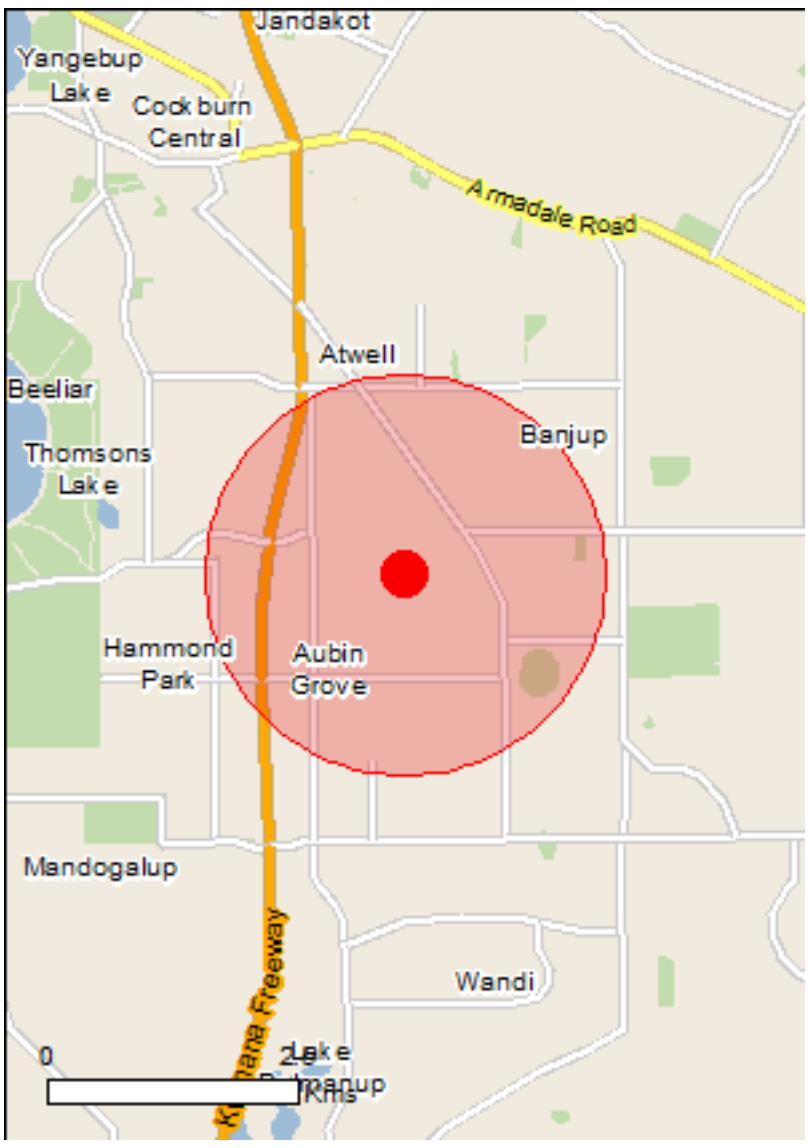
This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 11/03/20 16:17:36

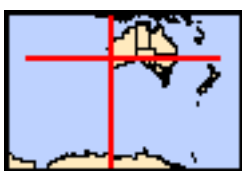
Summary
Details
Matters of NES
Other Matters Protected by the EPBC Act
Extra Information
Caveat
Acknowledgements



This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2010

Coordinates

Buffer: 2.0Km



Summary

Matters of National Environmental 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:	1
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	2
Listed Threatened Species:	20
Listed Migratory Species:	10

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 environment anywhere.

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 Land:	1
Commonwealth Heritage Places:	None
Listed Marine Species:	15
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

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

State and Territory Reserves:	None
Regional Forest Agreements:	None
Invasive Species:	40
Nationally Important Wetlands:	1
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar) [Resource Information]

Name	Proximity
Forrestdale and thomsons lakes	Within 10km of Ramsar

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.

Name	Status	Type of Presence
Banksia Woodlands of the Swan Coastal Plain ecological community	Endangered	Community likely to occur within area
Tuart (Eucalyptus gomphocephala) Woodlands and Forests of the Swan Coastal Plain ecological community	Critically Endangered	Community likely to occur within area

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat may occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calyptorhynchus banksii naso Forest Red-tailed Black-Cockatoo, Karrak [67034]	Vulnerable	Species or species habitat known to occur within area
Calyptorhynchus baudinii Baudin's Cockatoo, Long-billed Black-Cockatoo [769]	Endangered	Species or species habitat likely to occur within area
Calyptorhynchus latirostris Carnaby's Cockatoo, Short-billed Black-Cockatoo [59523]	Endangered	Species or species habitat known to occur within area
Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species habitat likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area

Name	Status	Type of Presence
Sternula nereis nereis		
Australian Fairy Tern [82950]	Vulnerable	Species or species habitat may occur within area
Mammals		
Dasyurus geoffroii		
Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat likely to occur within area
Pseudocheirus occidentalis		
Western Ringtail Possum, Ngwayir, Womp, Woder, Ngoor, Ngoolangit [25911]	Critically Endangered	Species or species habitat may occur within area
Plants		
Andersonia gracilis		
Slender Andersonia [14470]	Endangered	Species or species habitat may occur within area
Caladenia huegelii		
King Spider-orchid, Grand Spider-orchid, Rusty Spider-orchid [7309]	Endangered	Species or species habitat known to occur within area
Diuris drummondii		
Tall Donkey Orchid [4365]	Vulnerable	Species or species habitat may occur within area
Diuris micrantha		
Dwarf Bee-orchid [55082]	Vulnerable	Species or species habitat known to occur within area
Diuris purdiei		
Purdie's Donkey-orchid [12950]	Endangered	Species or species habitat likely to occur within area
Drakaea elastica		
Glossy-leafed Hammer Orchid, Glossy-leaved Hammer Orchid, Warty Hammer Orchid [16753]	Endangered	Species or species habitat likely to occur within area
Drakaea micrantha		
Dwarf Hammer-orchid [56755]	Vulnerable	Species or species habitat likely to occur within area
Lepidosperma rostratum		
Beaked Lepidosperma [14152]	Endangered	Species or species habitat likely to occur within area

Listed Migratory Species [Resource Information]		
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Motacilla cinerea		
Grey Wagtail [642]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos		
Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata		
Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris canutus		
Red Knot, Knot [855]	Endangered	Species or species habitat may occur within

Name	Threatened	Type of Presence
		area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land [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.

Name
Commonwealth Land -

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Breeding known to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species

Name	Threatened	Type of Presence
		habitat likely to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Extra Information

Invasive Species [Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Passer montanus Eurasian Tree Sparrow [406]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Streptopelia senegalensis Laughing Turtle-dove, Laughing Dove [781]		Species or species habitat likely to occur

Name	Status	Type of Presence
		within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Turdus merula Common Blackbird, Eurasian Blackbird [596]		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Funambulus pennantii Northern Palm Squirrel, Five-striped Palm Squirrel [129]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus norvegicus Brown Rat, Norway Rat [83]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Anredera cordifolia Madeira Vine, Jalap, Lamb's-tail, Mignonette Vine, Anredera, Gulf Madeiravine, Heartleaf Madeiravine, Potato Vine [2643]		Species or species habitat likely to occur within area
Asparagus aethiopicus Asparagus Fern, Ground Asparagus, Basket Fern, Sprengi's Fern, Bushy Asparagus, Emerald Asparagus [62425]		Species or species habitat likely to occur within area
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Asparagus plumosus Climbing Asparagus-fern [48993]		Species or species habitat likely to occur within area
Brachiaria mutica Para Grass [5879]		Species or species habitat may occur within area
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat may occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species

Name	Status	Type of Presence
		habitat may occur within area
Chrysanthemoides monilifera subsp. monilifera Boneseed [16905]		Species or species habitat likely to occur within area
Genista linifolia Flax-leaved Broom, Mediterranean Broom, Flax Broom [2800]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Olea europaea Olive, Common Olive [9160]		Species or species habitat may occur within area
Opuntia spp. Prickly Pears [82753]		Species or species habitat likely to occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Sagittaria platyphylla Delta Arrowhead, Arrowhead, Slender Arrowhead [68483]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
Tamarix aphylla Athel Pine, Athel Tree, Tamarisk, Athel Tamarisk, Athel Tamarix, Desert Tamarisk, Flowering Cypress, Salt Cedar [16018]		Species or species habitat likely to occur within area
Reptiles		
Hemidactylus frenatus Asian House Gecko [1708]		Species or species habitat likely to occur within area

Nationally Important Wetlands	[Resource Information]
Name	State
Gibbs Road Swamp System	WA

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

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.

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

Where very little information is available for 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 reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

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

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

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

Coordinates

-32.16028 115.86944

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.

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NatureMap
Mapping Western Australia's biodiversity

NatureMap Species Report

Created By Guest user on 11/03/2020

Current Names Only Yes
Core Datasets Only Yes
Method 'By Circle'
Centre 115° 52' 10" E,32° 09' 37" S
Buffer 2km

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
1.		*?Adenanthos obovatus*			Y
2.		*?Amphipogon turbinatus*			Y
3.		*?Anigozanthos humilis*			
4.		*?Boronia ramosa*			Y
5.		*?Briza maxima*			Y
6.		*?Burchardia congesta*			
7.		*?Caesia sp.*			Y
8.		*?Caladenia discoidea*			Y
9.		*?Calandrinia sp.*			Y
10.		*?Calytrix angulata*			
11.		*?Calytrix flavescens*			Y
12.		*?Calytrix sp.*			Y
13.		*?Chamaescilla corymbosa*			
14.		*?Cirsium vulgare*			Y
15.		*?Conostylis aculeata*			Y
16.		*?Conostylis juncea*			Y
17.		*?Conostylis sp.*			Y
18.		*?Conyza bonariensis*			
19.		*?Dampiera linearis*			
20.		*?Dasypogon bromeliifolius*			Y
21.		*?Ehrharta calycina*			
22.		*?Epilobium hirtigerum*			Y
23.		*?Epilobium sp.*			
24.		*?Eremaea pauciflora*			
25.		*?Euchiton sphaericus*			Y
26.		*?Gonocarpus pithyoides*			Y
27.		*?Haemodorum spicatum*			
28.		*?Hemiandra sp.*			Y
29.		*?Hibbertia subvaginata*			Y
30.		*?Hovea trisperma var. trisperma*			
31.		*?Hypocalymma angustifolia*			Y
32.		*?Kunzea glabrescens*			
33.		*?Lactuca serriola*			
34.		*?Lepidosperma sp.*			Y
35.		*?Lepidosperma squamatum s.l.*			
36.		*?Leptomeria empetriformis*			Y
37.		*?Leucopogon conostephioides*			Y
38.		*?Lomandra caespitosa*			
39.		*?Lomandra sp.*			Y
40.		*?Lomandra suaveolens*			Y
41.		*?Lotus subbiflorus*			
42.		*?Lysimachia arvensis*			
43.		*?Opercularia vaginata*			Y
44.		*?Pelargonium capitatum*			
45.		*?Petrophile linearis*			
46.		*?Petrorhagia dubia*			Y
47.		*?Philotheca spicata*			Y
48.		*?Phlebocarya ciliata*			
49.		*?Phlebocarya filifolia*			Y
50.		*?Phlebocarya sp.*			Y
51.		*?Podotheca sp.*			Y
52.		*?Rhodanthe citrina*			
53.		*?Rytidosperma occidentalis*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
54.		*?Schoenus curvifolius*			Y
55.		*?Stylidium repens*			Y
56.		*?Stylidium schoenoides*			Y
57.		*?Thysanotus manglesianus/patersonii complex*			Y
58.		*?Urospermum picroides*			
59.		*?Wahlenbergia capensis*			
60.		*?Wahlenbergia preissii*			
61.		*?Wahlenbergia sp.*			Y
62.		*?Xanthorrhoea brunonis*			Y
63.		*?Zantedeschia aethiopica*			Y
64.		*Acacia ?pulchella*			
65.	3262	*Acacia cochlearis (Rigid Wattle)*			
66.	3374	*Acacia huegelii*			
67.	17861	*Acacia longifolia*	Y		
68.	3502	*Acacia pulchella (Prickly Moses)*			
69.	30032	*Acacia saligna subsp. saligna*			
70.		*Acacia sp.*			
71.	3557	*Acacia stenoptera (Narrow Winged Wattle)*			
72.	3581	*Acacia trigonophylla*			
73.	24260	*Acanthiza apicalis (Broad-tailed Thornbill, Inland Thornbill)*			
74.	24261	*Acanthiza chrysorrhoa (Yellow-rumped Thornbill)*			
75.	24560	*Acanthorhynchus superciliosus (Western Spinebill)*			
76.	25535	*Accipiter cirrocephalus (Collared Sparrowhawk)*			
77.	42368	*Acritoscincus trilineatus (Western Three-lined Skink)*			
78.	11837	*Adenanthos cygnorum subsp. cygnorum (Common Woollybush)*			
79.	1791	*Adenanthos obovatus (Basket Flower)*			
80.		*Aira caryophyllea/cupaniana group*			
81.	185	*Aira cupaniana (Silvery Hairgrass)*	Y		
82.	187	*Aira praecox (Early Hairgrass)*	Y		
83.	1728	*Allocasuarina fraseriana (Sheoak, Kondil)*			
84.	200	*Amphipogon turbinatus*			
85.	24312	*Anas gracilis (Grey Teal)*			
86.	24316	*Anas superciliosa (Pacific Black Duck)*			
87.	7833	*Angianthus preissianus*			
88.		*Anigozanthos ?humilis*			
89.	11434	*Anigozanthos humilis subsp. humilis*			
90.	1411	*Anigozanthos manglesii (Mangles Kangaroo Paw, Kurulbrang)*			
91.	11261	*Anigozanthos manglesii subsp. manglesii*			
92.		*Anigozanthos sp.*			
93.	24561	*Anthochaera carunculata (Red Wattlebird)*			
94.	24562	*Anthochaera lunulata (Western Little Wattlebird)*			
95.	3692	*Aotus procumbens*			
96.	24991	*Aprasia repens (Sand-plain Worm-lizard)*			
97.	7838	*Arctotheca calendula (Cape Weed, African Marigold)*	Y		
98.	24340	*Ardea novaehollandiae (White-faced Heron)*			
99.	1264	*Arnocrinum preissii*			
100.	24353	*Artamus cyanopterus (Dusky Woodswallow)*			
101.	8779	*Asparagus asparagoides (Bridal Creeper)*	Y		
102.	20283	*Astartea scoparia (Common Astartea)*			
103.		*Asteraceae sp.*			
104.	6334	*Astroloma pallidum (Kick Bush)*			
105.		*Austrostipa ?compressa*			
106.	17234	*Austrostipa compressa*			
107.	17245	*Austrostipa mollis*			
108.	36441	*Babingtonia camphorosmae (Camphor Myrtle)*			
109.		*Banksia ?menziesii*			Y
110.	1800	*Banksia attenuata (Slender Banksia, Piara)*			
111.	32580	*Banksia dallanneyi subsp. dallanneyi var. dallanneyi*			
112.	1822	*Banksia ilicifolia (Holly-leaved Banksia)*			
113.	1830	*Banksia littoralis (Swamp Banksia, Pungura)*			
114.	1834	*Banksia menziesii (Firewood Banksia)*			
115.		*Banksia sp.*			
116.	1852	*Banksia telmatiaea (Swamp Fox Banksia)*			
117.		*Barnardius zonarius*			
118.	48868	*Bellardia viscosa*	Y		
119.	24319	*Biziura lobata (Musk Duck)*			
120.	749	*Bolboschoenus caldwellii (Marsh Club-rush)*			
121.	16636	*Boronia crenulata subsp. viminea*			
122.	4417	*Boronia dichotoma*			
123.	11381	*Boronia ramosa subsp. anethifolia*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
124.	3710	*Bossiaea eriocarpa (Common Brown Pea)*			
125.	6341	*Brachyloma preissii (Globe Heath)*			
126.	42381	*Brachyurophis semifasciatus (Southern Shovel-nosed Snake)*			
127.	3000	*Brassica tournefortii (Mediterranean Turnip)*	Y		
128.	244	*Briza maxima (Blowfly Grass)*	Y		
129.	245	*Briza minor (Shivery Grass)*	Y		
130.	12770	*Burchardia congesta*			
131.	25598	*Cacomantis flabelliformis (Fan-tailed Cuckoo)*			
132.	42307	*Cacomantis pallidus (Pallid Cuckoo)*			
133.	1276	*Caesia micrantha (Pale Grass Lily)*			
134.	1277	*Caesia occidentalis*			
135.		*Caesia sp.*			
136.		*Caladenia ?flava*			
137.	15330	*Caladenia arenicola*			
138.	1592	*Caladenia flava (Cowslip Orchid)*			
139.	1596	*Caladenia huegelii (Grand Spider Orchid)*		T	
140.	1599	*Caladenia latifolia (Pink Fairy Orchid)*			
141.		*Caladenia sp.*			
142.	2848	*Calandrinia corrigioloides (Strap Purslane)*			
143.		*Calandrinia sp.*			
144.	36600	*Callitris pyramidalis (Swamp Cypress)*			
145.	5411	*Calothamnus hirsutus*			
146.	5415	*Calothamnus lateralis*			
147.	24734	*Calyptorhynchus latirostris (Carnaby's Cockatoo, White-tailed Short-billed Black Cockatoo)*		T	
148.		*Calytrix ?angulata*			Y
149.	5439	*Calytrix angulata (Yellow Starflower)*			
150.	5458	*Calytrix flavescens (Summer Starflower)*			
151.	5460	*Calytrix fraseri (Pink Summer Calytrix)*			
152.		*Calytrix sp.*			
153.	2795	*Carpobrotus edulis (Hottentot Fig)*	Y		
154.	1162	*Cartonema philydroides*			
155.	2957	*Cassytha racemosa (Dodder Laurel)*			
156.	6542	*Centaurium tenuiflorum*	Y		
157.	1125	*Centrolepis drummondiana*			
158.	1134	*Centrolepis polygyna (Wiry Centrolepis)*			
159.	2889	*Cerastium glomeratum (Mouse Ear Chickweed)*	Y		
160.	24186	*Chalinolobus gouldii (Gould's Wattled Bat)*			
161.	24187	*Chalinolobus morio (Chocolate Wattled Bat)*			
162.	18156	*Chamaecytisus palmensis (Tagasaste)*	Y		
163.	1280	*Chamaescilla corymbosa (Blue Squill)*			
164.	11299	*Chamaescilla corymbosa var. corymbosa*			
165.	43380	*Chelodina colliei (South-western Snake-necked Turtle)*			
166.	24321	*Chenonetta jubata (Australian Wood Duck, Wood Duck)*			
167.	33939	*Cherax cainii (Marron)*			
168.		*Cherax destructor*			
169.		*Cherax preissii*			
170.		*Cherax quinquecarinatus*			
171.		*Cherax sp.*			
172.	24980	*Christinus marmoratus (Marbled Gecko)*			
173.	7937	*Cirsium vulgare (Spear Thistle, Scotch Thistle)*	Y		
174.	25675	*Colluricincla harmonica (Grey Shrike-thrush)*			
175.	24399	*Columba livia (Domestic Pigeon)*	Y		
176.	4550	*Comesperma calymega (Blue-spike Milkwort)*			
177.	6348	*Conostephium pendulum (Pearl Flower)*			
178.	6349	*Conostephium preissii*			
179.		*Conostylis ?juncea*			Y
180.	1418	*Conostylis aculeata (Prickly Conostylis)*			
181.	11826	*Conostylis aculeata subsp. aculeata*			
182.	1436	*Conostylis juncea*			
183.	11597	*Conostylis setigera subsp. setigera*			
184.		*Conyza ?bonariensis*			
185.	7939	*Conyza bonariensis (Flaxleaf Fleabane)*	Y		
186.		*Conyza sp.*			
187.	20074	*Conyza sumatrensis*	Y		
188.	25568	*Coracina novaehollandiae (Black-faced Cuckoo-shrike)*			
189.	48259	*Cortaderia selloana subsp. selloana*	Y		
190.	25592	*Corvus coronoides (Australian Raven)*			
191.	1285	*Corynotheca micrantha (Sand Lily)*			
192.	7945	*Cotula coronopifolia (Waterbuttons)*	Y		

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
193.	25595	*Cracticus tibicen (Australian Magpie)*			
194.	25596	*Cracticus torquatus (Grey Butcherbird)*			
195.		*Crassula ?colorata*			Y
196.	3137	*Crassula colorata (Dense Stonecrop)*			
197.	11709	*Crassula colorata var. acuminata*			
198.	25399	*Crinia glauerti (Clicking Frog)*			
199.	25400	*Crinia insignifera (Squelching Froglet)*			
200.	30893	*Cryptoblepharus buchananii*			
201.	25027	*Ctenotus australis*			
202.	24322	*Cygnus atratus (Black Swan)*			
203.	30901	*Dacelo novaeguineae (Laughing Kookaburra)*	Y		
204.	7454	*Dampiera linearis (Common Dampiera)*			
205.	1218	*Dasypogon bromeliifolius (Pineapple Bush)*			
206.	6218	*Daucus glochidiatus (Australian Carrot)*			
207.	3832	*Daviesia physodes*			
208.	3845	*Daviesia triflora*			
209.	25766	*Delma fraseri (Fraser's Legless Lizard)*			
210.	16595	*Desmocladus flexuosus*			
211.	19649	*Disa bracteata*	Y		
212.		*Diuris corymbosa/magnifica*			
213.	4763	*Dodonaea hackettiana (Hackett's Hopbush)*		P4	
214.		*Drosera ?porrecta*			
215.		*Drosera ?sp. "climbing"*			
216.	3109	*Drosera menziesii (Pink Rainbow)*			
217.	48710	*Drosera micrantha*			
218.		*Drosera sp.*			
219.		*Drosera sp. "climbing"*			
220.	6681	*Echium plantagineum (Paterson's Curse)*	Y		
221.	25100	*Egernia napoleonis*			
222.		*Egretta novaehollandiae*			
223.	347	*Ehrharta calycina (Perennial Veldt Grass)*	Y		
224.	349	*Ehrharta longiflora (Annual Veldt Grass)*	Y		
225.		*Ehrharta sp.*			
226.	1643	*Elythranthera brunonis (Purple Enamel Orchid)*			
227.		*Eolophus roseicapillus*			
228.	6133	*Epilobium hirtigerum (Hairy Willow Herb)*			
229.	5541	*Eremaea pauciflora*			
230.		*Eucalyptus ?camaldulensis x robusta*			Y
231.		*Eucalyptus ?rudis*			Y
232.	5763	*Eucalyptus rudis (Flooded Gum, Kulurda)*			
233.	5790	*Eucalyptus todtiana (Coastal Blackbutt)*			
234.	15137	*Euchiton sphaericus*			
235.	4648	*Euphorbia terracina (Geraldton Carnation Weed)*	Y		
236.	3880	*Eutaxia virgata*			
237.	25622	*Falco cenchroides (Australian Kestrel, Nankeen Kestrel)*			
238.	1747	*Ficus carica (Common Fig)*	Y		
239.	24761	*Fulica atra subsp. australis (Eurasian Coot)*			
240.		*Fumaria ?capreolata*			Y
241.	7323	*Galium murale (Small Goosegrass)*	Y		
242.	20247	*Gamochaeta calviceps*	Y		
243.	19195	*Gamochaeta pensylvanica*	Y		
244.	20475	*Gastrolobium capitatum*			
245.	4339	*Geranium molle (Dove's Foot Cranesbill)*	Y		
246.	25530	*Gerygone fusca (Western Gerygone)*			
247.	1520	*Gladiolus caryophyllaceus (Wild Gladiolus)*	Y		
248.	6587	*Gomphocarpus fruticosus (Narrowleaf Cottonbush)*	Y		
249.	3957	*Gompholobium tomentosum (Hairy Yellow Pea)*			
250.	6161	*Gonocarpus pithyoides*			
251.	24443	*Grallina cyanoleuca (Magpie-lark)*			
252.	1475	*Haemodorum spicatum (Mardja)*			
253.	2216	*Hakea varia (Variable-leaved Hakea)*			
254.	25410	*Heleioporus eyrei (Moaning Frog)*			
255.	6710	*Heliotropium europaeum (Common Heliotrope)*	Y		
256.	6839	*Hemiandra pungens (Snakebush)*			
257.	38320	*Hemiandra sp. Jurien (B.J. Conn & M.E. Tozer BJC 3885)*			
258.	25119	*Hemiergis quadrilineata*			
259.	45534	*Hibbertia hypericoides subsp. hypericoides*			
260.	5162	*Hibbertia racemosa (Stalked Guinea Flower)*			
261.		*Hibbertia racemosa/subvaginata*			Y
262.	48381	*Hibbertia striata*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
263.	5173	*Hibbertia subvaginata*			
264.	5176	*Hibbertia vaginata*			
265.	47965	*Hieraaetus morphnoides (Little Eagle)*			
266.	24491	*Hirundo neoxena (Welcome Swallow)*			
267.	444	*Holcus lanatus (Yorkshire Fog)*	Y		
268.	6222	*Homalosciadium homalocarpum*			
269.	3968	*Hovea trisperma (Common Hovea)*			
270.	12859	*Hovea trisperma var. trisperma*			
271.	6226	*Hydrocotyle callicarpa (Small Pennywort)*			
272.	35070	*Hypocalymma angustifolium subsp. Swan Coastal Plain (G.J. Keighery 16777)*			
273.	5825	*Hypocalymma robustum (Swan River Myrtle)*			
274.	8086	*Hypochaeris glabra (Smooth Catsear)*	Y		
275.	9352	*Hypochaeris radicata (Flat Weed, Cats-ear)*	Y		
276.	1070	*Hypolaena exsulca*			
277.	17841	*Hypolaena pubescens*			
278.	20200	*Isolepis cernua var. setiformis*			
279.	917	*Isolepis marginata (Coarse Club-rush)*			
280.	48588	*Isoodon fusciventer (Quenda, southwestern brown bandicoot)*		P4	
281.	8092	*Ixiolaena viscosa (Sticky Ixiolaena)*			
282.	20462	*Jacksonia gracillima*		P3	
283.	4029	*Jacksonia sternbergiana (Stinkwood, Kapur)*			
284.	1178	*Juncus bufonius (Toad Rush)*	Y		
285.	1186	*Juncus microcephalus*	Y		
286.	1188	*Juncus pallidus (Pale Rush)*			
287.	1190	*Juncus planifolius (Broadleaf Rush)*			
288.	4035	*Kennedia beckxiana (Cape Arid Kennedia)*		P4	
289.	4044	*Kennedia prostrata (Scarlet Runner)*			
290.	15498	*Kunzea glabrescens (Spearwood)*			
291.	20019	*Lachnagrostis filiformis*			
292.	8096	*Lactuca serriola (Prickly Lettuce)*	Y		
293.	18585	*Lagenophora huegelii*			
294.	467	*Lagurus ovatus (Hare's Tail Grass)*	Y		
295.	11911	*Laxmannia ramosa subsp. ramosa*			
296.	1309	*Laxmannia squarrosa*			
297.	7574	*Lechenaultia floribunda (Free-flowering Leschenaultia)*			
298.	44490	*Leontodon rhagadioloides*	Y		
299.		*Lepidosperma ?sp. Brixton Street broad inflorescence*			Y
300.		*Lepidosperma ?sp. Darling Scarp*			Y
301.		*Lepidosperma aff. Brixton Street*			Y
302.	940	*Lepidosperma pubisquameum*			
303.		*Lepidosperma sp.*			
304.		*Lepidosperma sp. Brixton Street broad inflorescence*			
305.		*Lepidosperma sp. Brixton Street narrow inflorescence*			
306.		*Lepidosperma sp. Darling Scarp*			
307.		*Lepidosperma sp. terete*			Y
308.	945	*Lepidosperma squamatum*			
309.		*Lepidosperma squamatum s.l.*			
310.	1077	*Leptocarpus canus (Hoary Twine-rush)*			
311.	2344	*Leptomeria empetriformis*			
312.	2350	*Leptomeria pauciflora (Sparse-flowered Currant Bush)*			
313.	25133	*Lerista elegans*			
314.	25147	*Lerista lineata (Perth Slider, Lined Skink)*		P3	
315.	6360	*Leucopogon australis (Spiked Beard-heath)*			
316.	6374	*Leucopogon conostephioides*			
317.	6436	*Leucopogon propinquus*			
318.		*Levenhookia pusilla/stipitata*			
319.	7677	*Levenhookia stipitata (Common Stylewort)*			
320.	25005	*Lialis burtonis*			
321.	25661	*Lichmera indistincta (Brown Honeyeater)*			
322.	25415	*Limnodynastes dorsalis (Western Banjo Frog)*			
323.	25378	*Litoria adelaidensis (Slender Tree Frog)*			
324.	25388	*Litoria moorei (Motorbike Frog)*			
325.	9289	*Lobelia anceps (Angled Lobelia)*			
326.	7408	*Lobelia tenuior (Slender Lobelia)*			
327.	478	*Lolium rigidum (Wimmera Ryegrass)*	Y		
328.		*Lomandra ?caespitosa*			
329.		*Lomandra ?hermaphrodita*			Y
330.		*Lomandra ?nigricans*			
331.		*Lomandra ?preissii*			
332.		*Lomandra ?suaveolens*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
333.	1223	*Lomandra caespitosa (Tufted Mat Rush)*			
334.		*Lomandra caespitosa/suaveolens*			Y
335.	1228	*Lomandra hermaphrodita*			
336.	1234	*Lomandra nigricans*			
337.	1239	*Lomandra preissii*			
338.	1243	*Lomandra sericea (Silky Mat Rush)*			
339.		*Lomandra sp.*			
340.	1246	*Lomandra suaveolens*			
341.	8564	*Lotus subbiflorus*	Y		
342.	1097	*Lyginia barbata*			
343.		*Lyginia barbata/imberbis*			
344.	18049	*Lyginia imberbis*			
345.	36375	*Lysimachia arvensis (Pimpernel)*	Y		
346.	5281	*Lythrum hyssopifolia (Lesser Loosestrife)*	Y		
347.	2838	*Macarthuria apetala*			
348.	2839	*Macarthuria australis*			
349.	24132	*Macropus fuliginosus (Western Grey Kangaroo)*			
350.	25654	*Malurus splendens (Splendid Fairy-wren)*			
351.	4079	*Medicago polymorpha (Burr Medic)*	Y		
352.		*Melaleuca ?thymoides*			Y
353.	5900	*Melaleuca cuticularis (Saltwater Paperbark)*			
354.	5921	*Melaleuca incana (Grey Honeymyrtle)*			
355.	13273	*Melaleuca incana subsp. incana*			
356.	5926	*Melaleuca lateritia (Robin Redbreast Bush)*			
357.	5964	*Melaleuca seriata*			
358.	5978	*Melaleuca teretifolia (Banbar)*			
359.	5980	*Melaleuca thymoides*			
360.	4085	*Melilotus indicus*	Y		
361.	25184	*Menetia greyii*			
362.	3050	*Menkea australis (Fairy Spectacles)*			
363.	24598	*Merops ornatus (Rainbow Bee-eater)*			
364.	953	*Mesomelaena graciliceps*			
365.		*Microcarbo melanoleucos*			
366.	485	*Microlaena stipoides (Weeping Grass)*			
367.	15419	*Microtis media subsp. media*			
368.	14344	*Millotia tenuifolia var. tenuifolia (Soft Millotia)*			
369.	4666	*Monotaxis occidentalis*			
370.	24223	*Mus musculus (House Mouse)*	Y		
371.	25420	*Myobatrachus gouldii (Turtle Frog)*			
372.		*Myrtaceae sp.*			
373.	24738	*Neophema elegans (Elegant Parrot)*			
374.	2401	*Nuytsia floribunda (Christmas Tree, Mudja)*			
375.	24194	*Nyctophilus geoffroyi (Lesser Long-eared Bat)*			
376.	24407	*Ocyphaps lophotes (Crested Pigeon)*			
377.	6140	*Oenothera mollissima*	Y		
378.	18255	*Opercularia vaginata (Dog Weed)*			
379.	25680	*Pachycephala rufiventris (Rufous Whistler)*			
380.	25682	*Pardalotus striatus (Striated Pardalote)*			
381.	527	*Paspalum dilatatum*	Y		
382.	1550	*Patersonia occidentalis (Purple Flag, Koma)*			
383.	30472	*Patersonia occidentalis var. occidentalis*			
384.	4343	*Pelargonium capitatum (Rose Pelargonium)*	Y		
385.	4346	*Pelargonium littorale*			
386.	16477	*Pericalymma ellipticum var. ellipticum*			
387.	48061	*Petrochelidon nigricans (Tree Martin)*			
388.	48066	*Petroica boodang (Scarlet Robin)*			
389.	2299	*Petrophile linearis (Pixie Mops)*			
390.	19825	*Petrorhagia dubia*	Y		
391.	25698	*Phalacrocorax melanoleucos (Little Pied Cormorant)*			
392.	24667	*Phalacrocorax sulcirostris (Little Black Cormorant)*			
393.	24409	*Phaps chalcoptera (Common Bronzewing)*			
394.	18529	*Philotheca spicata (Pepper and Salt)*			
395.	1478	*Phlebocarya ciliata*			
396.	1479	*Phlebocarya filifolia*			
397.		*Phlebocarya sp.*			
398.	48071	*Phylidonyris niger (White-cheeked Honeyeater)*			
399.	24596	*Phylidonyris novaehollandiae (New Holland Honeyeater)*			
400.	16177	*Phyllangium paradoxum*			
401.	2793	*Phytolacca octandra (Red Ink Plant)*	Y		
402.		*Phytophthora cinnamomi*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
403.	24841	*Platalea flavipes (Yellow-billed Spoonbill)*			
404.	6253	*Platysace filiformis*			
405.	571	*Poa annua (Winter Grass)*	Y		
406.		*Poaceae sp.*			
407.		*Podotheca ?chrysantha*			Y
408.		*Podotheca ?gnaphalioides*			
409.		*Podotheca angustifolia/gnaphalioides*			Y
410.	8183	*Podotheca chrysantha (Yellow Podotheca)*			
411.	8184	*Podotheca gnaphalioides (Golden Long-heads)*			
412.		*Podotheca sp.*			
413.	25510	*Pogona minor (Dwarf Bearded Dragon)*			
414.	2905	*Polycarpon tetraphyllum (Fourleaf Allseed)*	Y		
415.	582	*Polypogon monspeliensis (Annual Beardgrass)*	Y		
416.		*Poranthera microphylla/moorokatta*			
417.	42022	*Poranthera moorokatta*		P2	
418.	8189	*Pseudognaphalium luteoalbum (Jersey Cudweed)*			
419.	25511	*Pseudonaja affinis (Dugite)*			
420.	12217	*Pterostylis sanguinea*			
421.	4177	*Pultenaea ochreata*			
422.	4181	*Pultenaea reticulata*			
423.		*Purpureicephalus spurius*			
424.	25008	*Pygopus lepidopodus (Common Scaly Foot)*			
425.	8195	*Quinetia urvillei*			
426.	24245	*Rattus rattus (Black Rat)*	Y		
427.	6012	*Regelia ciliata*			
428.	48096	*Rhipidura albiscapa (Grey Fantail)*			
429.	25614	*Rhipidura leucophrys (Willie Wagtail)*			
430.	13300	*Rhodanthe citrina*			
431.	14485	*Romulea flava var. minor*	Y		
432.	1556	*Romulea rosea (Guildford Grass)*	Y		
433.	14924	*Romulea rosea var. communis*	Y		
434.	10970	*Rostraria cristata*	Y		
435.	2429	*Rumex acetosella (Sorrel)*	Y		
436.	40426	*Rytidosperma occidentale*			
437.	2907	*Sagina procumbens (Spreading Pearlwort)*	Y		
438.	984	*Schoenus curvifolius*			
439.	992	*Schoenus grandiflorus (Large Flowered Bogrush)*			
440.	16251	*Schoenus subflavus subsp. long leaves (K.L. Wilson 2865)*			
441.	6033	*Scholtzia involucrata (Spiked Scholtzia)*			
442.	25878	*Senecio condylus*			
443.		*Senecio diaschides/glomeratus*			Y
444.	25534	*Sericornis frontalis (White-browed Scrubwren)*			
445.	8225	*Siloxerus humifusus (Procumbent Siloxerus)*			
446.	7020	*Solanum linnaeanum (Apple of Sodom)*	Y		
447.	7022	*Solanum nigrum (Black Berry Nightshade)*	Y		
448.	8230	*Sonchus asper (Rough Sowthistle)*	Y		
449.	8231	*Sonchus oleraceus (Common Sowthistle)*	Y		
450.	1312	*Sowerbaea laxiflora (Purple Tassels)*			
451.	2316	*Stirlingia latifolia (Blueboy)*			
452.	25589	*Streptopelia chinensis (Spotted Turtle-Dove)*	Y		
453.	25590	*Streptopelia senegalensis (Laughing Turtle-Dove)*	Y		
454.		*Stylidium ?araeophyllum*			Y
455.	25831	*Stylidium araeophyllum (Stilt Walker)*			
456.		*Stylidium araeophyllum/neurophyllum*			
457.	7699	*Stylidium carnosum (Fleshy-leaved Triggerplant)*			
458.	25829	*Stylidium neurophyllum (Coastal Plain Triggerplant)*			
459.	7774	*Stylidium piliferum (Common Butterfly Triggerplant)*			
460.	7785	*Stylidium repens (Matted Triggerplant)*			
461.	25806	*Stylidium scariosum*			
462.	7798	*Stylidium schoenoides (Cow Kicks)*			
463.		*Stylidium sp.*			
464.	1260	*Stypandra glauca (Blind Grass)*			
465.	25902	*Symphyotrichum squamatum (Bushy Starwort)*	Y		
466.	24331	*Tadorna tadornoides (Australian Shelduck, Mountain Duck)*			
467.		*Thelymitra benthamiana/crinita/fuscolutea*			Y
468.		*Thelymitra sp.*			
469.		*Thysanotus ?arbuscula*			Y
470.		*Thysanotus ?thyrsoideus*			
471.	1318	*Thysanotus arbuscula*			
472.	1338	*Thysanotus manglesianus (Fringed Lily)*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
473.		*Thysanotus manglesianus/patersonii complex*			
474.	1343	*Thysanotus patersonii*			
475.		*Thysanotus sp.*			
476.	1351	*Thysanotus sparteus*			
477.	1358	*Thysanotus triandrus*			
478.	25519	*Tiliqua rugosa*			
479.	25204	*Tiliqua rugosa subsp. aspera*			
480.	25207	*Tiliqua rugosa subsp. rugosa*			
481.	45838	*Tilletia ehrhartae*			
482.	6280	*Trachymene pilosa (Native Parsnip)*			
483.	25723	*Trichoglossus haematodus (Rainbow Lorikeet)*			
484.	25521	*Trichosurus vulpecula (Common Brushtail Possum)*			
485.	1363	*Tricoryne tenella*			
486.	1038	*Tricostularia neesii*			
487.		*Trifolium ?campestre*			
488.	17145	*Trifolium angustifolium var. angustifolium*	Y		
489.	17763	*Trifolium campestre var. campestre (Hop Clover)*	Y		
490.		*Trifolium campestre/dubium*			
491.	14738	*Trifolium resupinatum var. resupinatum*	Y		
492.		*Trifolium sp.*			
493.	24808	*Tringa nebularia (Common Greenshank, greenshank)*		IA	
494.	44444	*Tripterococcus sp. Brachylobus (A.S. George 14234)*		P4	
495.	4360	*Tropaeolum majus (Garden Nasturtium)*	Y		
496.	8254	*Urospermum picroides (False Hawkbit)*	Y		
497.	8255	*Ursinia anthemoides (Ursinia)*	Y		
498.	38388	*Ursinia anthemoides subsp. anthemoides*	Y		
499.	24386	*Vanellus tricolor (Banded Lapwing)*			
500.	15432	*Verticordia densiflora var. densiflora*			
501.	14714	*Verticordia lindleyi subsp. lindleyi*		P4	
502.	24206	*Vespadelus regulus (Southern Forest Bat)*			
503.	11474	*Vicia sativa subsp. nigra*	Y		
504.		*Vulpia sp.*			
505.		*Wahlenbergia ?capensis*			
506.	7384	*Wahlenbergia capensis (Cape Bluebell)*	Y		
507.	7389	*Wahlenbergia preissii*			
508.		*Wahlenbergia sp.*			
509.	1251	*Xanthorrhoea brunonis*			
510.	1256	*Xanthorrhoea preissii (Grass tree, Palga)*			
511.	6289	*Xanthosia huegelii*			
512.	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 E
Black Cockatoo and Banksia Woodland TEC Assessment

Our Ref: 2123AA

04/04/2017

Kris Kennedy
Manager - Planning
Aigle Royal Developments
225 St Georges Terrace
Perth, WA 6000
Via Email: kkennedy@aigleroyal.com.au

Dear Kris,

Black Cockatoo Habitat Assessment and Desktop Banksia Woodlands of the Swan Coastal Plain TEC Assessment - Lots 11 and 74 Beenyup Road, Banjup.

1. Introduction and Background

360 Environmental is pleased to provide Aigle Royal Developments with this letter report to provide information in relation to the Black Cockatoo habitat assessment and desktop Banksia Woodlands of the Swan Coastal Plain Threatened Ecological Community (BW TEC) assessment for Lots 11 and 74 Beenyup Road, Banjup (Survey Area) (Figure 1).

In February 2015, 360 Environmental undertook a level 2 flora survey and identified a total of 145 taxa from 45 families in the Survey Area (360 Environmental 2015). Of these, a number of species are considered to be Black Cockatoo habitat and others are considered to be species included in the Banksia Woodland TEC. Subsequently a Black Cockatoo habitat assessment and BW TEC desktop assessment were commissioned.

1.1. Background to Black Cockatoos

All three Black Cockatoo species that occur in the south west (this includes the Perth metropolitan area) are listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act): Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*) is listed as Endangered, the Forest Red-tailed Black Cockatoo (FRTBC [*Calyptorhynchus banksii naso*]) and Baudin's Black Cockatoo (*Calyptorhynchus baudinii*) are classified as Vulnerable. All three Black Cockatoos have suffered a substantial decline in numbers and breeding distribution in the past 50 years (Johnstone & Storr 1998). Direct causes of population decline include the large numbers shot by orchardists (mainly associated with Baudin's Black Cockatoo), clearing and fragmentation of habitat (especially the loss of breeding hollows), the impact of hollow competitors including the Galah (*Cacatua roseicapilla*), corellas including Butler's Corella (*Cacatua pastinator butleri*), Australian Shelduck (*Tadorna tadornoides*), Australian Wood Duck (*Chenonetta jubata*), the feral European honey bee (*Apis mellifera*), and also vehicle strikes. Around 60% of the original vegetation on the Swan Coastal Plain has been cleared and up to 85% in other parts of the south-west region for agriculture (crops), meat production, dairying, farms, orchards, vineyards, pine plantations, mining, timber and wood chipping, cities and towns. At present, extensive tracts of uncleared land only remain in State forest and conservation reserves and what is left of remnant vegetation (in roadside verges etc.) is often disturbed to a varying degree (Johnstone & Kirkby 2011).

The south-west region is now a severely fragmented landscape and the further loss of foraging habitat, the lack of suitable breeding sites, climate change, and alterations in the landscape led to significant changes in forest structure. Almost every part of the Jarrah-Marri forest has been logged in the past, and most present day trees are too young to form hollows, and competition with exotic species, exacerbate the future conservation of Carnaby's Black Cockatoo, FRTBC's and Baudin's Black Cockatoo (Johnstone & Kirkby 2011).

The distribution of all three Black Cockatoo species can be seen in the 2014 Department of the Environment and Energy (DEE) distribution maps in Appendix A. The Survey Area is within the known distribution of Carnaby's Black Cockatoo and FRTBC; however, it is on the western extremity of Baudin's Cockatoo. Nevertheless, all three species of Black Cockatoo have been included for consideration in this document, particularly given that they are all highly mobile and the DEE distribution maps are indicative only. In addition there is some difficulty in distinguishing between Carnaby's Black Cockatoo and Baudin's Black Cockatoo, particularly when on the wing, therefore it advisable to include both species.

1.2. Background to BW TEC

BW TEC was listed (16 September 2016) as an Endangered community under the EPBC Act. A Level 2 flora and vegetation assessment of the Survey Area was undertaken prior to this listing (360 Environmental 2015), thus determination of whether the BW TEC is present in the Survey Area needed to be determined.

The BW TEC is restricted to the Swan Coastal Plain Interim Biogeographic Regionalisation for Australia (IBRA) and immediate adjacent areas. These include the Dandaragan plateau from Jurien Bay in the North, to Dunsborough in the South, and north/east on the Whicher and Darling Escarpments. The BW TEC typically has a prominent tree layer of Banksia species with scattered Eucalypts and other tree species present within or emerging above the Banksia canopy with a species rich understorey.

Key diagnostic characteristics and condition thresholds are used to determine whether a remnant of BW TEC when being surveyed. These are: location and physical environment, structure, composition and condition. Other parameters also include minimum patch size, cover of native species and native plant species diversity.

2. Objectives

The objective of the Black Cockatoo habitat assessment was to:

- Identify and determine the type and extent of habitat (breeding and foraging) suitable for Black Cockatoos in the Survey Area with reference to the EPBC Act referral guidelines for three threatened Black Cockatoo species (DSEWPaC 2012).

The objective of the BW TEC assessment was to:

- Compare and analyse the existing Level 2 flora and vegetation survey data with the key diagnostic characteristics and condition thresholds of the BW TEC to determine if the banksia woodlands in the Survey Area would be considered favourable for National protection.

3. Methods

3.1. Black Cockatoo Habitat Assessment

This Black Cockatoo habitat assessment was undertaken on 9 February 2017. The assessment involved traversing the Survey Area on foot; any trees meeting each of the

following criteria for potential breeding were recorded and electronically logged using a hand held Global Positioning System (GPS) unit:

- Native trees (e.g. [Marri [*Corymbia calophylla*], Jarrah [*Eucalyptus marginata*], Tuart [*E. gomphocephala*] etc.);
- Diameter at breast height (DBH) > 500 mm (>300 mm for Wandoo [*E. wandoo*] and Salmon [*E. salmonophloia*] Gum) regardless of the presence or absence of hollows;
- Trees were placed in the following size class categories:
  - A = 500 – 1000 mm DBH
  - B = 1000 – 2000 mm DBH
  - C = >2000 mm DBH

The Black Cockatoo habitat assessment involved assessing the habitat for tree and shrub species known to be important dietary items e.g. Marri and *Banksia sp*. It also included looking for:

- Evidence of feeding (chewed cones, seed and nut material); and
- Opportunistic observations of Black Cockatoos in the Survey Area.

3.2. TEC Assessment

The results of the statistical (multivariate) analysis and data interpretation from the Level 2 flora and vegetation report (360 Environmental 2015) were used to determine which areas of the Survey Area are sub-communities of the BW TEC. The mapping of condition and vegetation association boundaries was overlaid to determine the amount of banksia woodland for each condition category.

4. Results

4.1. Black Cockatoos

During the Black Cockatoo habitat assessment, no Black Cockatoos were observed flying over or heard in the Survey Area.

4.1.1. Potential Breeding Trees

Two species of Eucalypts, Jarrah and Flooded Gum (*E. rudis*) recorded in the Survey Area are considered Black Cockatoo potential breeding habitat. The current Survey Area contains 19 potential breeding trees with a DBH of more than 500 mm (Jarrah [11] and

Flooded Gum [8]). The dimensions and the locations of these 19 potential breeding trees are displayed in Table 1 and Figure 2.

No hollows observed from the ground were considered to be large enough at the entrances (i.e. >100 mm) or deep enough to be considered as potential breeding hollows.

Table 1: Black Cockatoo Potential Breeding Trees

*Co-Ordinates are in UTMs (GDA 94)

No.	Species	DBH	Height (M)	*Easting	*Northing	Comments
1	Jarrah	B	12	0393358	6441096	Stag, lots of fallen branches
2	Jarrah	A	12	0393384	6441087	Stag
3	Jarrah	A	10	0393444	6441095	Stag
4	Jarrah	A	12	0393471	6441009	
5	Jarrah	A	12	0393480	6441025	Stag
6	Jarrah	A	12	0393480	6441025	Stag
7	Jarrah	A	12	0393500	6441001	Shallow hollow
8	Jarrah	A	14	0393367	6441084	Splits at 4m
9	Jarrah	A	15	0393537	6441295	
10	Flooded Gum	A	17	0393565	6441205	
11	Flooded Gum	A	17	0393565	6441205	
12	Flooded Gum	A	16	0393549	6441201	
13	Flooded Gum	A	16	0393528	6441200	
14	Flooded Gum	A	16	0393567	6441189	
15	Flooded Gum	A	16	0393567	6441197	
16	Flooded Gum	A	16	0393567	6441197	
17	Flooded Gum	A	17	0393575	6441198	5 branches
18	Jarrah	A	14	0393065	6441270	
19	Jarrah	A	8	0393055	6441288	

4.1.2. Foraging Habitat

During the assessment a total of 14.73 ha of foraging habitat was identified.

Two species of Eucalypts recorded in the Survey Area; Jarrah and Flooded Gum are known dietary items of Black Cockatoos and as such are considered foraging habitat. This foraging habitat includes trees that are also potential breeding trees with a DBH of >500 mm (see Table 1 on the previous page). Other known foraging species present in the Survey Area included *Banksia attenuata*, *B. menziesii*, *B. ilicifolia*, *Allocasuarina fraseriana* and *Xanthorrhoea preissii*. These species are important foraging habitat for all three species of Black Cockatoo.

A small quantity of foraging evidence was found in the form of chewed Banksia cones and chewed Allocasuarina nuts (Plates 1 and 2).

Plate 1: Black Cockatoo Foraging Evidence - Chewed Banksia Cones

Plate 2: Black Cockatoo Foraging Evidence - Chewed Allocasuarina Nuts

4.2. Threatened Ecological Community

4.2.1. Vegetation Associations

Thirteen natural vegetation associations were recorded in the Survey Area. Descriptions of these are provided in Table 2.

Table 2: Vegetation Association Descriptions and their Extent in the Survey Area.

Vegetation Association Code	Description	Area (ha)
BaBm(a)	Low Woodland of *Banksia attenuata, Banksia menziesii, Allocasuarina fraseriana, Eucalyptus marginata* over *Kunzea glabrescens, Acacia pulchella, Hibbertia hypericoides, Xanthorrhoea preissii, Bossiaea eriocarpa* and *Conostylis aculeata*.	2.42
BaBm(b)	Low Woodland of *Banksia attenuata, Banksia menziesii, Allocasuarina fraseriana* over *Kunzea glabrescens, Dasypogon bromeliifolius, Hibbertia subvaginata, Calytrix fraseri* and *Bossiaea eriocarpa*.	4.37
AfEmBi	Open Woodland of *Allocasuarina fraseriana*, *Eucalyptus marginata* and *Banksia ilicifolia* over *Xanthorrhoea preissii*, *Dasypogon bromeliifolius*, *Bossiaea eriocarpa*, *Gompholobium tomentosum* and *Phlebocarya ciliata.*	1.47
BiKg	Woodland of *Banksia ilicifolia* and *Banksia attenuata* over *Kunzea glabrescens*, *Xanthorrhoea preissii*, *Dasypogon bromeliifolius* and *Desmocladus flexuosus*.	1.12
ErMp	Woodland of *Eucalyptus rudis* and *Melaleuca preissiana* over *Kunzea glabrescens, Xanthorrhoea preissii, Adenanthos cygnorum* and *Hypocalymma angustifolium*.	1.14
KgHa	Low Open Woodland of *Melaleuca preissiana* and *Melaleuca rhaphiophylla* over *Kunzea glabrescens, Hypocalymma angustifolium, Astartea scoparia, Melaleuca teretifolia, Meeboldina scariosa* and *Lepidosperma longitudinale.*	3.32
MpKg	Low Open Woodland of *Melaleuca preissiana* over *Kunzea glabrescens, Hakea varia, Acacia pulchella* var. *glaberrima, Calothamnus lateralis* var. *lateralis* and *Meeboldina coangustata*.	2.86
MrBa	Low Closed Forest of *Melaleuca rhaphiophylla* over *Baumea articulata*.	2.80
MtMr	*Closed Tall Scrub of Melaleuca teretifolia, Melaleuca rhaphiophylla, Meeboldina coangustata and Juncus capitatus.*	1.24

Vegetation Association Code	Description	Area (ha)
MrMl	*Low Woodland of Melaleuca rhaphiophylla over Melaleuca lateritia, Astartea scoparia, Meeboldina coangustata, Lepidosperma longitudinale and Juncus pallidus.*	3.64
Ec	Ecotone of *Banksia ilicifolia* and *Banksia menziesii* over *Kunzea glabrescens, Dasypogon bromeliifolius* and *Phlebocarya ciliata.*	0.8
Ha	Closed Heath of *Hypocalymma angustifolium, Kunzea glabrescens, Dielsia stenostachya, Dasypogon bromeliifolius* and *Boronia crenulata* var. *crenulata.*	7.64
Mr	Monoculture of young *Melaleuca rhaphiophylla* over water.	0.47

4.2.2. Floristic Community Types

The quadrat data was tested for similarity against each of the 509 Gibson *et al.* 1994 quadrats that were established as part of a regional study to describe the vegetation types present on the Swan Coastal Plain in 1994. Results from the statistical analysis and the site information, identified six Floristic Community Types (FCTs) as occurring in the Survey Area (Appendix B).

4.2.3. Threatened and Priority Ecological Communities

Vegetation association BaBm(a) has been determined to have affiliation with FCT SCP23a, AfEmBi has been determined to have affiliation with FCT 21a and BiKg and BaBm(b) have been determined to have affiliation with FCT 21c. These FCTs are listed as sub-communities of the BW TEC. The vegetation association Ec is an Ecotone of *Banksia ilicifolia* and *Banksia menziesii* over *Kunzea glabrescens, Dasypogon bromeliifolius* and *Phlebocarya ciliata*. This community is an ecotone between the drier BaBm association and the wetland. Even though the association is a mix of both dry land and wetland species, it has been included in the analysis due to the presence of Banksia species.

TECs and their associated buffers are regarded as Environmentally Sensitive Areas (ESAs).

4.2.4. Vegetation Condition

The condition of the vegetation associations BaBm (a&b), AfEmBi, BiKg and Ec varies greatly from Excellent to Good to Degraded (Table 4). There are areas considered high in diversity, however, there are pockets where the understory is low in both diversity and density and is weed infested.

Table 3: Vegetation Condition of Associations with Banksia Species

Condition	Area (ha)	Vegetation Association
Good - Degraded	0.56	BaBm (A), BiKg
Good	4.65	AfEmBi, BaBm (A), BaBm (B)
Very Good - Good	0.79	AfEmBi
Excellent - Very Good	2.94	AfEmBi, BiKg, Ec, BaBm (B)
Excellent	1.21	BaBm (A)

5. Discussion

5.1. Black Cockatoo Potential Breeding Habitat

Black Cockatoos breed in large hollow-bearing trees, generally within woodlands or forests (Johnstone *et al.* 2013). The size of the tree can be a useful indication of the hollow-bearing potential of the tree. Trees of suitable DBH are potentially important for maintaining breeding in the long-term, through maintaining the integrity of the habitat and allowing trees to provide future nest hollows. Maintaining the long-term supply of trees of a size to provide suitable nest hollows is particularly important in woodland stands that are known to support Black Cockatoo breeding (DSEWPaC 2012). Hollow formation in trees (in Eucalypt woodlands and forests) is a result of a number of processes including fungal attack, termites and fire and the propensity for hollow formation varies between the Eucalypt species (Whitford 2002).

During the Black Cockatoo habitat assessment 19 trees (Jarrah [11] and Flooded Gum [8]) were recorded in the Survey Area that have reached a size that are considered to be potential future hollow bearing trees, therefore potential breeding trees (>500 mm DBH [>300 mm for Wandoo]) according to the EPBC Act Black Cockatoo referral guidelines. No observable hollows were recorded in these trees in the Survey Area.

There were other Jarrah and Flooded Gum trees that are considered foraging habitat, however, they were under the threshold of 500 mm to be considered as potential breeding trees.

5.2. Black Cockatoo Foraging Habitat

Carnaby's Black Cockatoos feed on a variety of seeds, nuts and flowers from a range of native and exotic plants. Food plants include a number of Banksia species, Pine trees

(*Pinus* sp.), Marri, Jarrah and Allocasuarina, (Shah 2006; Johnstone & Storr 1998). The FRTBC feeds primarily on Marri and Jarrah fruit (Johnstone & Kirkby 1999; Cooper et al. 2002) which makes up 90% of the diet. Baudin's Black Cockatoo forages primarily in Eucalypt forest, where it feeds on Marri seeds, flowers, nectar and buds. They also feed on a wide range of seeds from other Eucalypt and Banksia species, and Pines (*Pinus* sp.) (Johnstone & Storr 1998).

The total area of Black Cockatoo foraging habitat present in the Survey Area is 14.73 ha. This foraging habitat consisted of Jarrah, Flooded Gum, *B. attenuata, B. menziesii, B. ilicifolia, A. fraseriana* and *X. preissii*. These species are known dietary items of all three Black Cockatoo species (Johnstone & Kirkby 2011).

5.3. BW TEC

The BW TEC is considered to occur in the Survey Area. A key diagnostic feature is a prominent tree layer of Banksia, with scattered Eucalypts and other tree species often present among the Banksia canopy. To determine if the BW TEC is present in the Survey Area, the results of the statistical analysis from the 2015 survey were compared to the list of sub-communities which were drawn from the FCT descriptions outlined in Gibson *et al.* (1994), Government of WA (2000) and Keighery *et al.* (2008).

The statistical analysis resulted in:

- BaBm(a) being most simular to SCP23a;
- AfEmBi being most simular to FCT 21a; and
- BiKg and BaBm(b) being most simular to FCT 21c.
- Vegetation association Ec has also been included due to the presence of Banksia species.

These FCTs have been listed as sub-communities under the EPBC Act listed BW TEC (DEE 2016). The vegetation associations BaBm(a), AfEmBi, BiKg, BaBm(b) and Ec are therefore considered to be the BW TEC. For vegetation remnants to be under full national protection the community has to meet key diagnostic characteristics. In regards to the presence of the TEC, the Approved Conservation Advice for the thresholds state that:

- Vegetation in Excellent Condition should have a minimum patch size of 0.5 ha;
- Vegetation in Very Good condition should be a minimum of 1 ha; and
- Vegetation in Good condition should be a minimum of 2 ha.

If a vegetation patch is considered Degraded or worse it is not considered favourable for national protection.

Based on this information, and the survey results, the vegetation in Good – Degraded condition is not suitable for National protection based on the size and condition thresholds. Vegetation mapped as Good, Good – Very Good, Excellent – Very Good and Excellent are considered suitable for National protection. Therefore, the vegetation considered to represent the BW TEC in the Survey Area equates to 9.59 ha (Figure 3).

6. References

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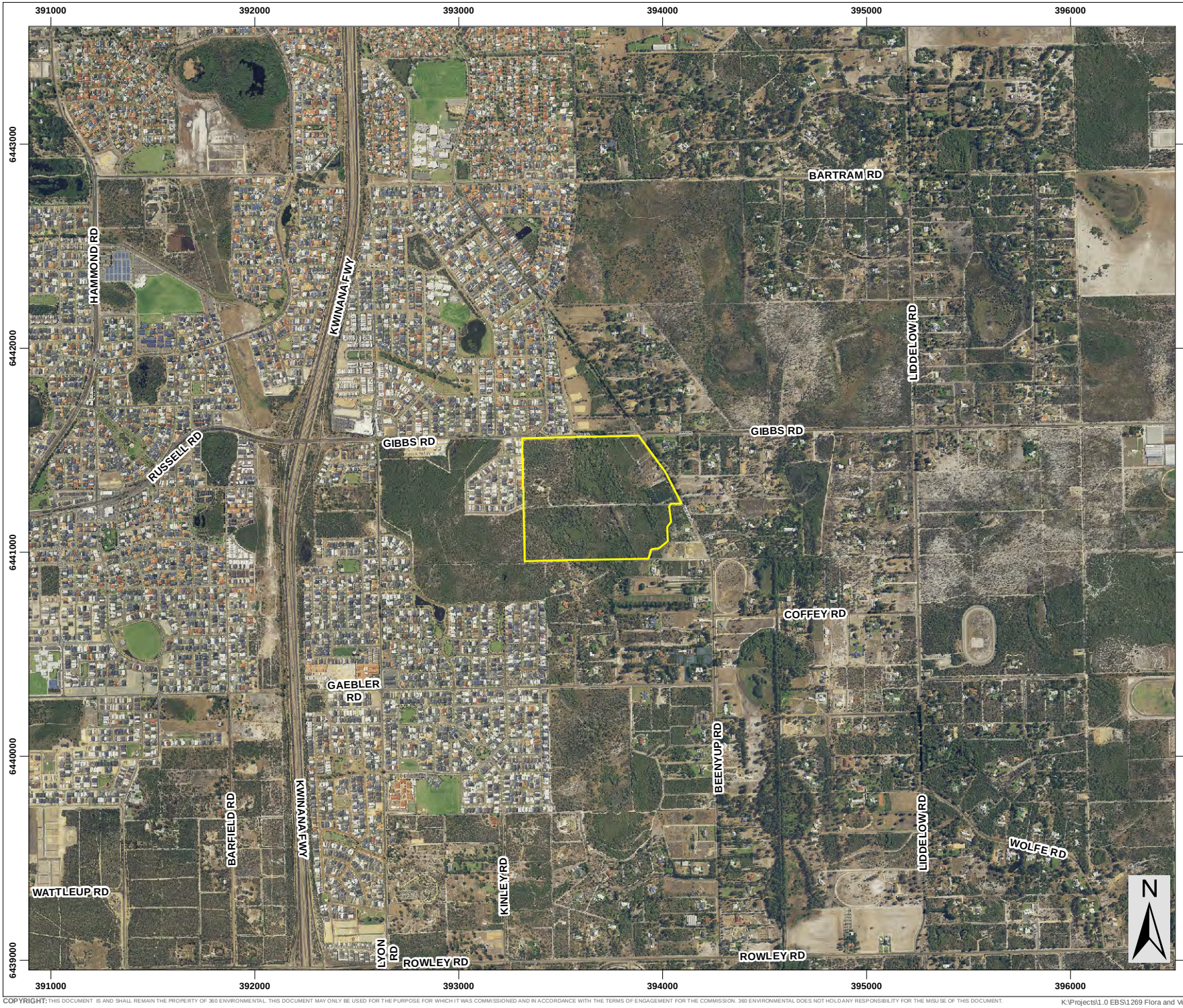
FIGURES



Legend

- Survey Area
- Roads

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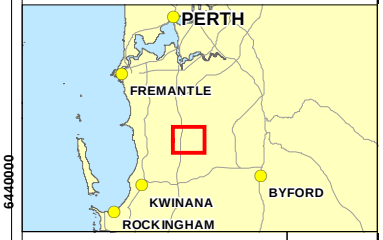
Meters
1:25,000 @ A4

LOCALITY MAP



PROJECT ID	2123	DATE	13/12/2017

HORIZONTAL DATUM AND PROJECTION
GDA 1994 MGA Zone 50

CREATED	CHECKED	APPROVED	REVISION
CS	NW	TS	0

Aigle Royal Developments
Beenyup Road, Banjup

Black Cockatoo & TEC Assessment

Figure 1 -
Survey Area

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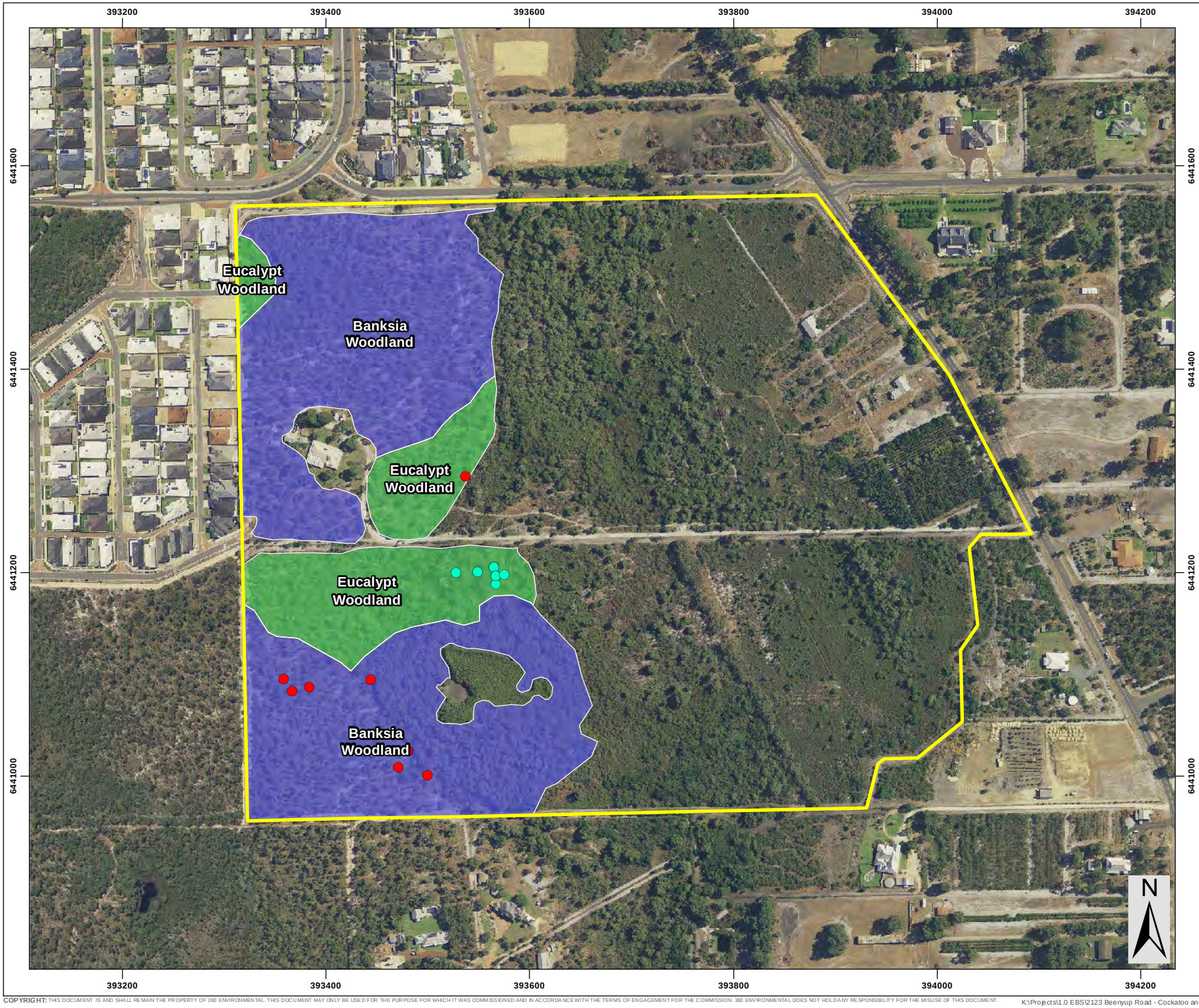

Legend

- Survey Area (41.4 ha)

Potential Breeding Trees

- Flooded Gum
- Jarrah

Fauna Habitat

- Banksia Woodland (11.26 ha)
- Eucalypt Woodland (3.47 ha)

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LOCALITY MAP

PROJECT ID	DATE
2123	21/02/2017

HORIZONTAL DATUM AND PROJECTION
GDA 1994 MGA Zone 50

CREATED	CHECKED	APPROVED	REVISION
MH	LS	RF	0

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Black Cockatoo Habitat Assessment

Figure 2 -
Black Cockatoo Habitat

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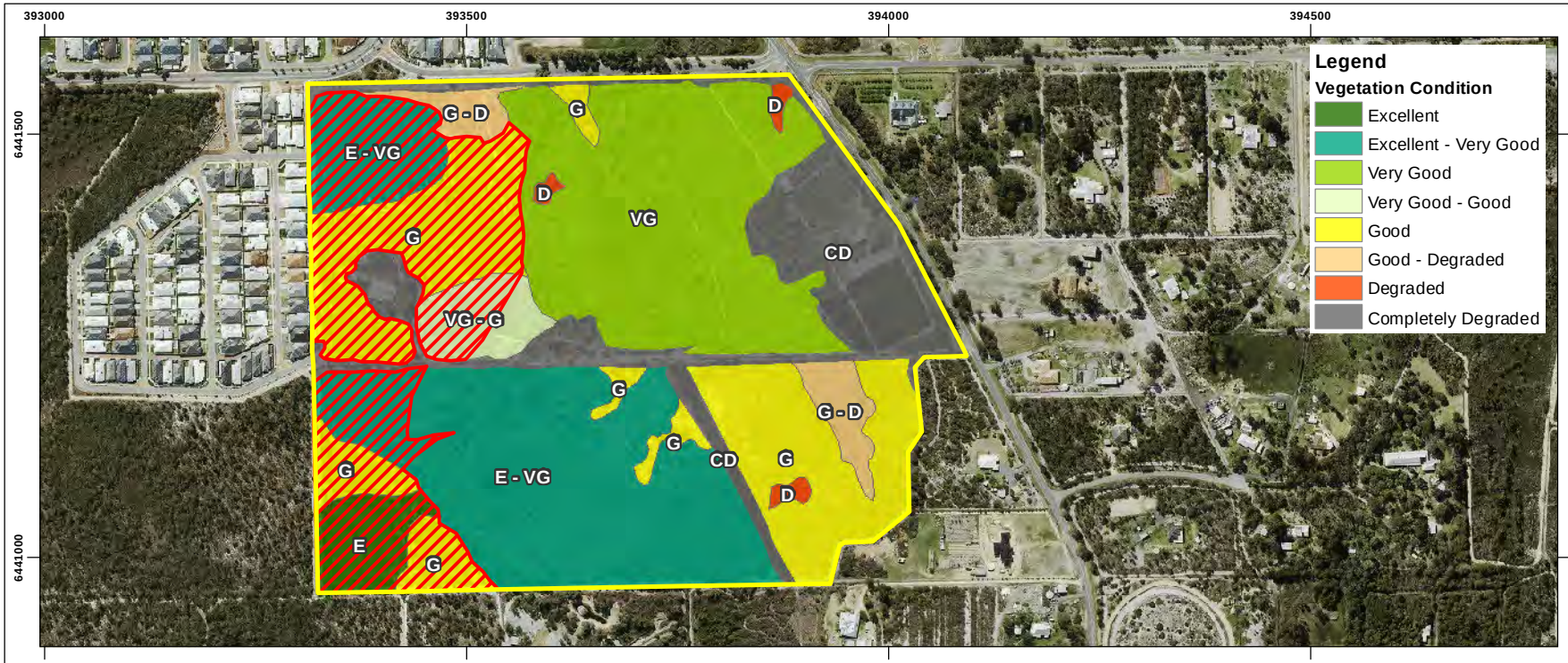

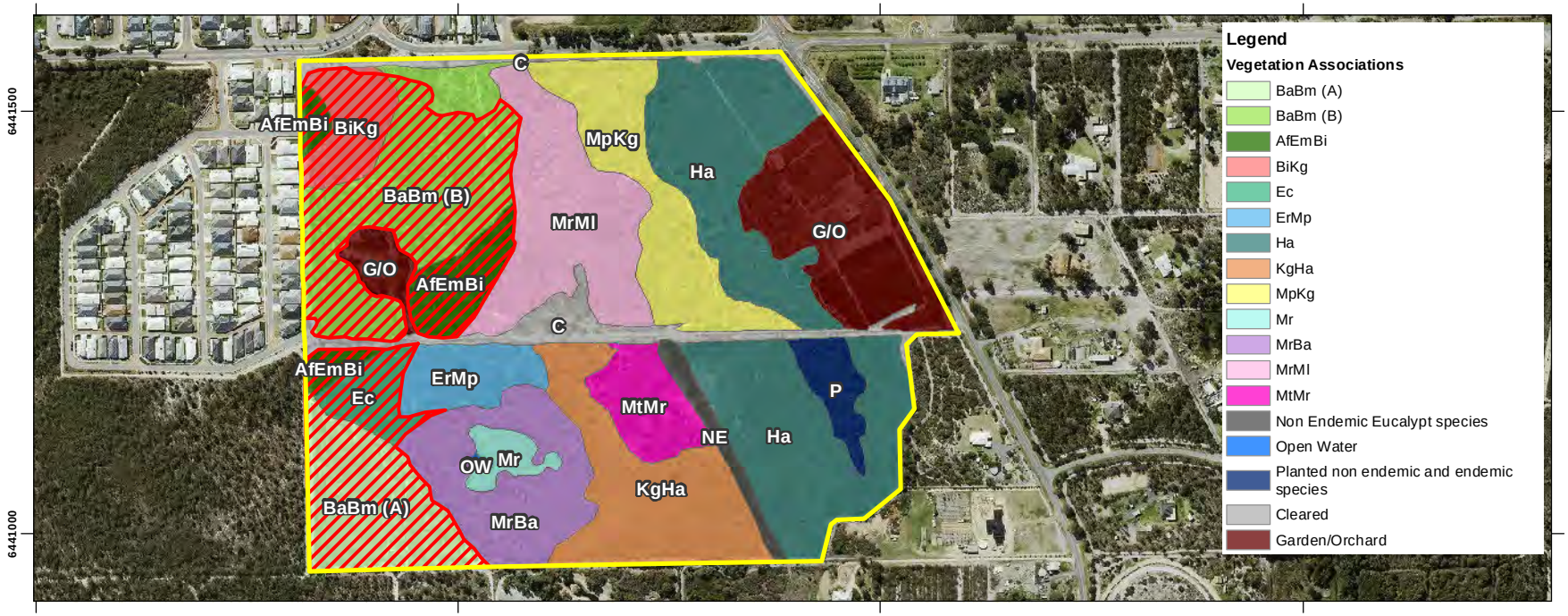

Legend

Survey Area

Banksia TEC

- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS
- LOCALITY MAP SOURCED LANDGATE 2006
- CADASTRE SOURCED FROM LANDGATE 22 DEC 2015
- AERIAL PHOTOGRAPHY SOURCED LANDGATE SEPT 2015
(© Western Australian Land Information Authority 2015)

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LOCALITY MAP

PROJECT ID	DATE
2123	21/02/2017

HORIZONTAL DATUM AND PROJECTION
GDA 1994 MGA Zone 50

CREATED	CHECKED	APPROVED	REVISION
MH	NW	RF	0

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Black Cockatoo Habitat and TEC Assessment

Figure 3

TEC Boundary Location

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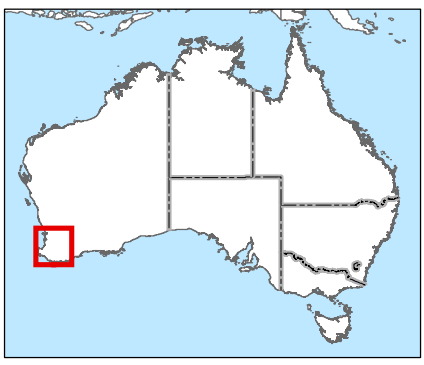
APPENDIX A

DEE Black Cockatoo Distribution Maps

Map 1: Modelled distribution of Baudin's black cockatoo (*Calyptorhynchus baudinii*)

INDICATIVE MAP ONLY: For the latest departmental information, please refer to the Protected Matters Search Tool at www.environment.gov.au/epbc/index.html



0 20 40 60 80 100 km

Australian Government

Department of Sustainability, Environment, Water, Population and Communities

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Contextual data sources:
DEWHA (2006), Collaborative Australian Protected Areas Database
Geoscience Australia (2006), Geodata Topo 250K Topographic Data

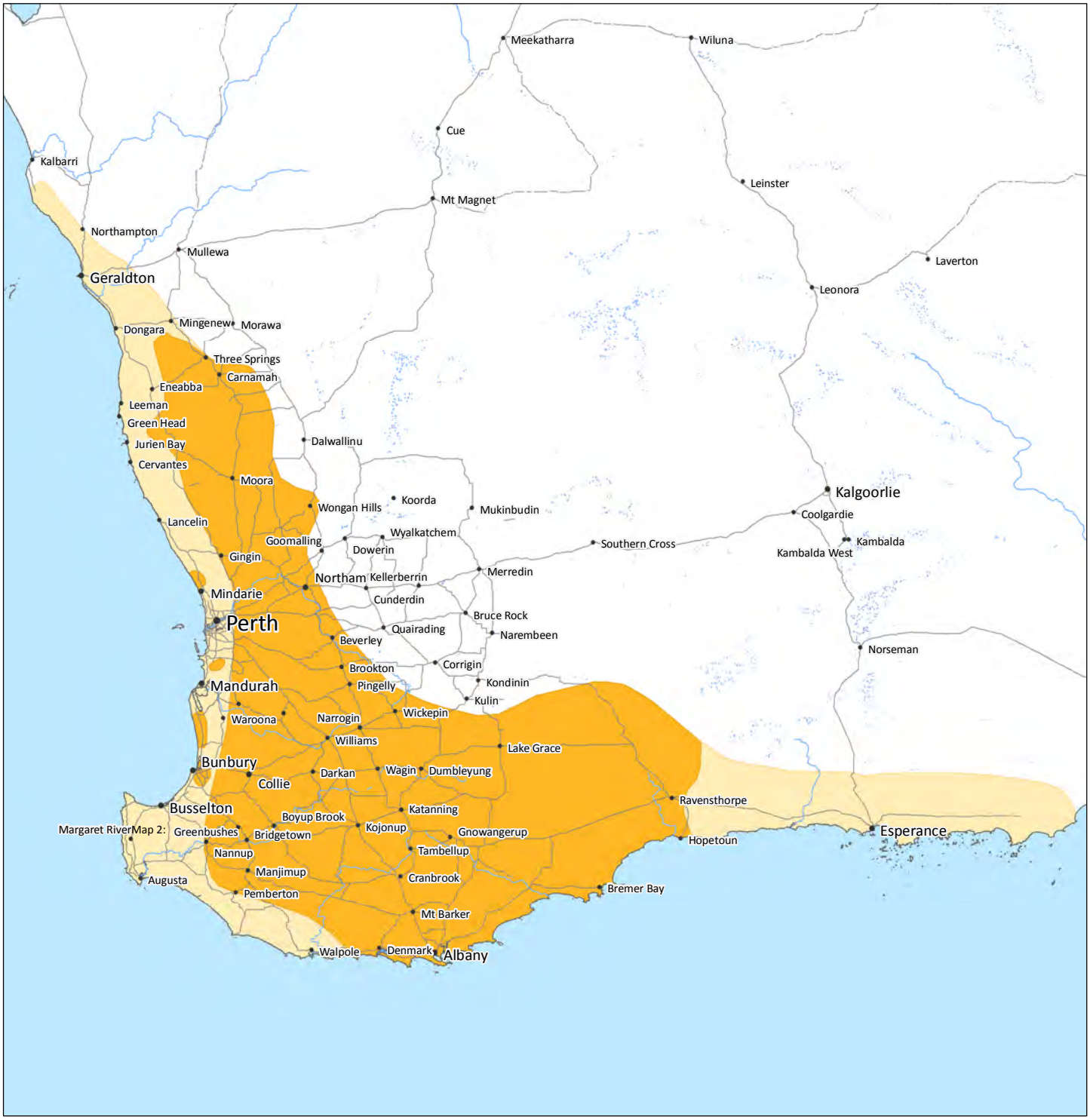
Legend

- Known Breeding Areas
- Predicted Breeding Range
- Main Wintering Area
- Species May Occur
- Cities & Towns
- Roads
- Major Rivers
- Lakes

Please Note: Known breeding areas represent locations known to be used by birds for breeding as at December 2009. As habitat has been lost in traditional breeding areas, birds have begun breeding at new locations.

CAVEAT: The information presented in this map has been provided by a range of groups and agencies. While every effort has been made to ensure accuracy and completeness, no guarantee is given, nor responsibility taken by the Commonwealth for errors or omissions, and the Commonwealth does not accept responsibility in respect of any information or advice given in relation to, or as a consequence of, anything containing herein. **INDICATIVE MAP ONLY:** This map has been compiled from datasets with a range of geographic scales and quality. Species or ecological community distributions are indicative only and not to be used for local assessment. Local knowledge and information should be sought to confirm the presence of the species, or species habitat, at the location of interest.

Map 2: Modelled distribution of Carnaby's black cockatoo (*Calyptorhynchus latirostris*)



INDICATIVE MAP ONLY: For the latest departmental information, please refer to the Protected Matters Search Tool at www.environment.gov.au/epbc/index.html

0 50 100 150 200 250 km

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Contextual data sources:
DEWHA (2006), Collaborative Australian Protected Areas Database
Geoscience Australia (2006), Geodata Topo 250K Topographic Data

Legend

- Breeding Range
- Non-breeding Range
- Cities & Towns
- Roads
- Major Rivers
- Lakes

Please Note: The breeding range represents the areas known to be used by birds for breeding as at December 2009. As habitat has been lost in traditional breeding areas, birds have begun breeding at new locations.

CAVEAT: The information presented in this map has been provided by a range of groups and agencies. While every effort has been made to ensure accuracy and completeness, no guarantee is given, nor responsibility taken by the Commonwealth for errors or omissions, and the Commonwealth does not accept responsibility in respect of any information or advice given in relation to, or as a consequence of, anything containing herein. **INDICATIVE MAP ONLY:** This map has been compiled from datasets with a range of geographic scales and quality. Species or ecological community distributions are indicative only and not to be used for local assessment. Local knowledge and information should be sought to confirm the presence of the species, or species habitat, at the location of interest.

Map 3: Modelled distribution of forest red-tailed black cockatoo (*Calyptorhynchus banksii naso*)

INDICATIVE MAP ONLY: For the latest departmental information, please refer to the Protected Matters Search Tool at www.environment.gov.au/epbc/index.html

0 20 40 60 80 100 km

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Legend

- Species May Occur
- Cities & Towns
- Roads
- Major Rivers
- Lakes

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APPENDIX B

Floristic Community Types Analysis

Floristic Community Type Analysis

Vegetation Association	Gibson *et al.* Quadrat & FCT	Similarity Based on Statistical Analysis	Comments	Inferred Floristic Community Type
BJQ1 (BaBm[a])	CRES01 (FCT SCP 23a)	55.0	The top three results in the analysis were SCP23a. This result seems appropriate given the species present and the location of the community on the higher dunes of the Survey Area.	FCT SCP23a – Central *Banksia attenuata* – *B. menziesii* woodlands
	BANK-3 (FCT SCP 23a)	54.7		
	YULE-2 (FCT SCP 23a)	53.7		
BJQ2 (MrBa)	Chid06 (FCT SCP s17)	50	This quadrat was characterised by large mature *Melaleuca preissiana* over either sedges or exposed soil which had evidence of inundation.	FCT SCP13 – Deeper wetlands on heavy soils
	White04 (FCT SCP s17)	35.2		
	WN020 (FCT SCP s19)	30.7		
BJQ3 (MrBa)	HYMUS05 (FCT SCP 11)	28.5	The association had both *Melaleuca preissiana* and *M. rhaphiophylla* with an open understorey which showed signs of being inundated.	FCT SCP13 – Deeper wetlands on heavy soils
	HYMUS01 (FCT SCP 11)	25.8		
	CAVS06 (FCT SCP s07)	25.8		
BJQ4 (Mr)	MTB-5 (FCT SCP 17)	25	This quadrat was established in the core of the wetland and was still inundated with water to approximately 30 cm, consisting of only *Melaleuca preissiana*.	FCT SCP13 – Deeper wetlands on heavy soils
	CHID06 (FCT SCP 17)	22.2		
	WATER-2 (FCT SCP 13)	20		
BJQ5 (KgHa)	CHID06 (FCT SCP 17)	36.3	This association was characterised by high	FCT SCP5 – Mixed shrub

Vegetation Association	Gibson *et al.* Quadrat & FCT	Similarity Based on Statistical Analysis	Comments	Inferred Floristic Community Type
	PINJ02 (FCT SCP s03)	32.2	density wetland shrubs with scattered *Melaleuca preissiana* and *M. rhaphiophylla*. It is more analogous to SCP5 rather than SCP4. This is based on the low diversity of the dense shrub layer.	damplands
	GOSN05 (FCT SCP s03)	29.6		
BJQ6 (MtMr)	McLART-1 (FCT SCP 13)	35.7	This quadrat consisted of dense wetland shrubs and sedges with scattered *Melaleuca rhaphiophylla.*	**FCT SCP5** – Mixed shrub damplands
	ELLIS-1(FCT SCP 17)	29.6		
	CAPEL-9 (FCT SCP 12)	28.5		
BJQ7 (AfEmBi)	ELE33 (FCT SCP 4)	48.1	Regardless of the analysis results that indicate a higher similarity with SCP4, because of the presence of more dry land species and the dominance of *Allocasuarina fraseriana* and *Eucalyptus marginata* it is thought to be more similar with SCP21a.	**FCT SCP21a** – Central *Banksia attenuata* – *E. marginata* woodlands
	MODO-2 (FCT SCP 21c)	44.8		
	ELE04 (FCT SCP 21a)	42.1		
BJQ8 (Ha)	TWIN-1 (FCT SCP 6)	34.4	This association had been historically cleared and is now natural regrowth with very low diversity.	**FCT SCP5** – Mixed shrub damplands
	PINJ13 (FCT	33.3		

Vegetation Association	Gibson *et al.* Quadrat & FCT	Similarity Based on Statistical Analysis	Comments	Inferred Floristic Community Type
	SCP s17)		Due to the lack of upper- storey species, it is most analogous to SCP5.	
	AUSTB-4 (FCT SCP 5)	30		
BJQ9 (MrMl)	McLART-1 (FCT SCP 13)	31.25	Due to the dominance of *Melaleuca preissiana* and *M. rhaphiophylla* along with the typical understorey species it is thought that this association is more similar to SCP4. The area also did not appear to be subject to deep inundation in the winter months due to the species and ground litter present.	FCT SCP4 - *Melaleuca preissiana* damplands
	LESCH-6 (FCT SCP 17)	27.7		
	BEEL03 (FCT SCP 11)	27.5		
BJQ10 (BiKg)	LOW07 (FCT SCP 21c)	52.1	The analysis indicated that BJQ10 is most similar to SCP21c, given the species present, and the location of the association in the landscape SCP21c.	FCT SCP21c – Low Lying *Banksia attenuata* woodlands or shrublands
	MODO-2 (FCT SCP 21c)	48.3		
	GOSN13 (FCT SCP 23a)	46.6		
BJQ11 (MrMl)	WHITE08 (FCT SCP 21a)	33.3	Due to the dominance of *Melaleuca preissiana* and *M. rhaphiophylla* along with the typical understorey species	FCT SCP4 - *Melaleuca preissiana* damplands
	GOSN05 (FCT SCP s03)	28.5		

Vegetation Association	Gibson *et al.* Quadrat & FCT	Similarity Based on Statistical Analysis	Comments	Inferred Floristic Community Type
	McLART-1(FCT SCP 13)	28.5	it is thought that the association is more analogous to SCP4. The area also did not appear to be subject to deep inundation in the winter months.	
BJQ12 (BaBm[b])	FL-5 (FCT SCP 21c)	55	The analysis showed that BJQ10 is most similar to SCP21c. This is due to the species present and the location of the association in the landscape. .	**FCT SCP21c** – Low Lying *Banksia attenuata* woodlands or shrublands
	ELE02 (FCT SCP 21c)	49.3		
	HURST03 (FCT SCP 23a)	49.0		
BJQ13 (MpKg)	McLART-1 (FCT SCP 13)	36.3	Due to the dominance of *Melaleuca preissiana* along with the typical understorey species it is thought that the association is more similar to SCP4. The association is not part of the core wetland and did not appear to be subject to deep inundation in the winter months due to the species and ground litter present.	**FCT SCP4** - *Melaleuca preissiana* damplands
	WHITE08 (FCT SCP s17)	34.0		
	GOS05 (FCT SCP s03)	30.3		
BJQ14 (Ha)	PERTH10 (FCT SCP 4)	44.0	The location of this association had been historically disturbed and consequently has low diversity.	**FCT SCP5** – Mixed shrub damplands
	GUTHR-4 (FCT	36.6		

Vegetation Association	Gibson *et al.* Quadrat & FCT	Similarity Based on Statistical analysis	Comments	Inferred Floristic Community Type
	SCP 5)		Due to the lack of upper- storey species and in its present state it is most analogous with SCP5.	
	GOSN01 (FCT SCP 4)	34.9		
BJQ15 (BaBm[a])	HURST03 (FCT SCP 23a)	50.9	The top two results in the analysis were for SCP23a, this result seems appropriate given the species present and the location of the community on the higher dunes of the Survey Area.	FCT SCP23a – Central *Banksia attenuata* – *B. menziesii* woodlands
	CRESW01 (FCT SCP 23a)	49.4		
	CAVS11 (FCT SCP 21a)	49.4		

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APPENDIX 4
LANDSCAPE MASTER PLAN

ROWE GROUP DESIGN

GIBBS ROAD

PROSPERITY LOOP

ASTOUNDING WAY

SITE AREA

EXISTING URBAN DEFERRED 4.77ha

PASSIVE TURF

SHELTER & PICNIC FACILITIES

DRAINAGE BASIN

RESIDENTIAL LOTS

CCW BUFFER

PASSIVE TURF

PLAY

SHELTER & PICNIC FACILITIES

DRAINAGE BASIN

CONSERVATION FENCING (RED LINE)

RESIDENTIAL LOTS

CONSERVATION CATEGORY WETLAND (CCW)

JANDAKOT RESERVE

CCW BOUNDARY

ECOLOGICAL CORRIDOR

LOT 11 & LOT 74 GIBBS ROAD, BANJUP

LANDSCAPE MASTERPLAN

DWG **BE-MP-02**
REV **J**
DATE **07.04.20**

0 10 20 30 40 50 m

SCALE **1 : 2000 @ A3**

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emerge ASSOCIATES

APPENDIX 5

TRAFFIC ASSESSMENT (TRAFFIC NOTE)

ROWE GROUP DESIGN

TECHNICAL NOTE

ubject:	Lots 11 and 74 Beenyup Road – Traffic Assessment
Date:	12/02/16
Author:	T Shaw
Attention:	K Kennedy

A Local Structure Plan has been prepared by the Rowe Group for the development of approximately 120 residential lots on Lots 11 and 74 Beenyup Road in Banjup. The configuration of the site is shown on Figure 1 with road connections indicated at Gibbs Road and Prosperity Loop (North and South).

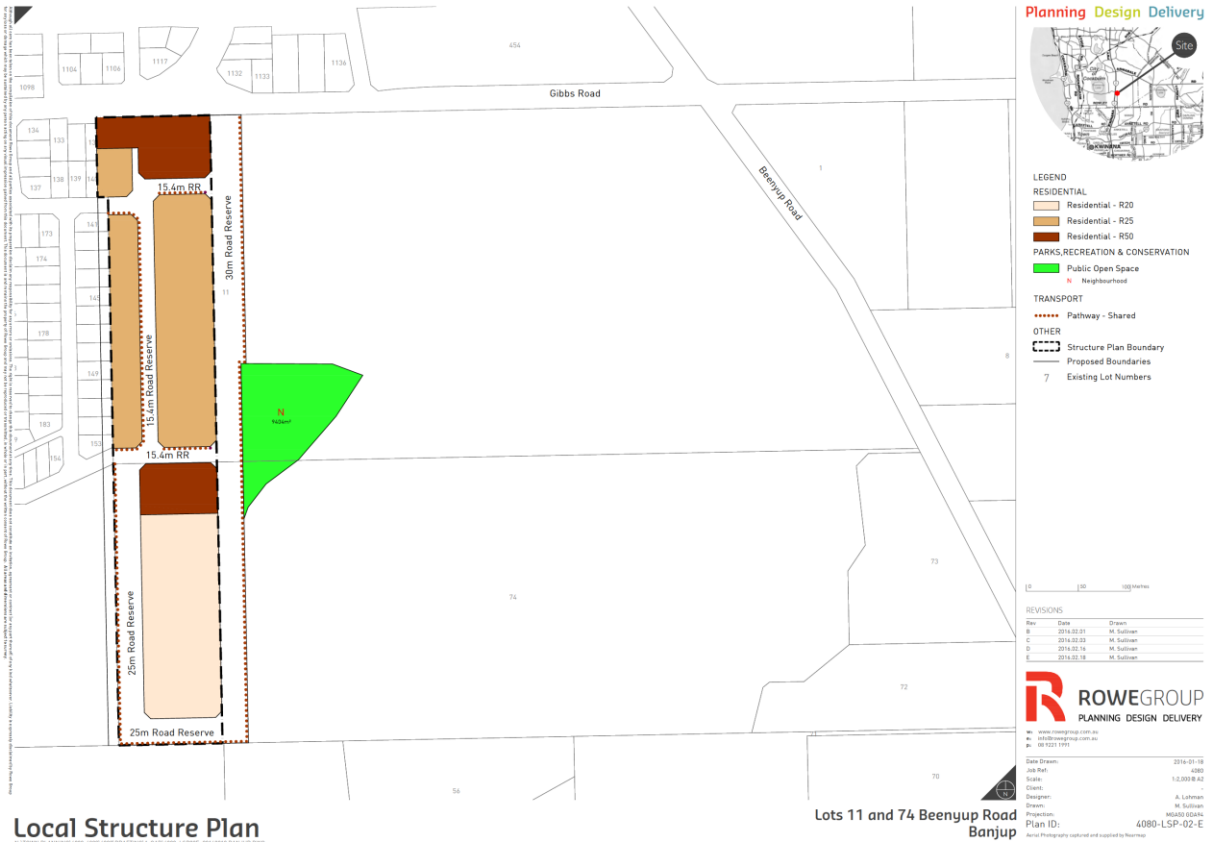

Figure 1 - Proposed Local Structure Plan

Traffic counts undertaken by the City of Cockburn in 2009 indicated in the order of 900 vehicles per day (vpd) on Gibbs Road; no data is available for Prosperity Loop but flows are expected to be less than 1,000 vpd.

Gibbs Road and Prosperity Loop are classified as "Access" roads under the MRWA Metropolitan Functional Road Hierarchy and have a desirable maximum traffic volume of 3,000 vpd.

At the zonings shown, the likely number of housing lots to be yielded from the site is estimated to be in the order of 120. At a generation rate of 10 trips per dwelling, total traffic generated from the site is expected to be in the order of 1,200 trips per day. Distribution of the trips onto the adjacent road network will be via the connections to Prosperity Loop and Gibbs Road with the potential level of distribution as shown below:

Connection to Prosperity Loop North	+ 300 vpd; + 30 vph (Peak hours)
Connection to Prosperity Loop South	+ 200 vpd; + 20 vph (Peak hours)
Connection to Gibbs Road	+ 700 vpd; + 70 vph (Peak hours)

With the distribution of traffic onto the adjacent road network, all roads are predicted to operate within their capacity.

With respect to the connection to external roads, the following comments are made:

Prosperity Loop (south):

Prosperity Loop South connects with the proposed new road at an angle and an appropriate radius should be provided between the two roads consistent with the design speed (60 km/h). The extension of Prosperity Loop will form a staggered "T" junction with the two western most internal north - south roads and a standard T junction with the most easterly north – south road. The configuration is considered to be acceptable for local access roads.

Prosperity Loop (north):

Prosperity Loop North connects with the proposed new north – south road at ninety degrees in a standard T junction. The configuration is considered to be acceptable for local access roads.

Gibbs Road:

The connection to Gibbs Road is located adjacent to the intersection of Gibbs Road and Tapper Road and it is considered desirable to configure the intersection generally as shown on Figure 2.

Given the expected peak hour traffic volumes moving through the intersection of Gibbs Road and Tapper Road (Approximately 250 vph on Tapper Road and 100 vph on Gibbs Road) queue lengths on Gibbs Road are not expected to be greater than 1 to 2 vehicles and as such are not expected to impact on the ability of vehicles to safely exit the new road intersection. Similarly, westbound traffic volumes on Gibbs Road are not likely to be high enough to cause eastbound right vehicles turning on Gibbs Road to prop or queue for any length of time. As such, vehicles turning into the new road are not expected to pose an unacceptable hazard to following vehicles.

The configuration as shown will also permit crossover access to part of the northern-most higher density lot.

Figure 2 - Proposed Intersection Configuration

APPENDIX 6

LOCAL WATER MANAGEMENT STRATEGY

ROWE GROUP DESIGN

ochrewest.com.au

Lots 11 & 74 Beenyup Road, Banjup

LOCAL WATER MANAGEMENT STRATEGY

Document No: 16015/01 Rev 2 April 2020

Project : Lots 11 & 74 Beenyup Road, Banjup

OCHREWEST
CONSULTING ENGINEERS

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EXECUTIVE SUMMARY

Ochre West Consulting Engineers (OWCE) has been commissioned by Aigle Royal Developments (ARD) to prepare a Local Water Management Startgey (LWMS) for the proposed future subdivision of Lots 11 & 74 Beenyup Road, Banjup.

The development will be completed in on stage

The key elements of the LWMS are summarised below.

Key LWMS Elements	Design and Compliance to Objectives
Stormwater Management	Structural and Non Structural BMP's will be used to improve water quality by reducing exposure to pollutants, encouraging infiltration and restricting water velocities within the development. Individual lots will have soakwells designed to capture and infiltrate Lot runoff up to 1 in 20 year (5 minute duration) ARI rainfall events. Lot runoff for larger than 1 in 20 up to 1 in 100 ARI rainfall event will be conveyed to the road reserve via overland flow and directed to the POS area. Pipe network will be sized to wholly contain the 1 in 5 year ARI rainfall event. Roads will be designed to convey up to the 1 in 100 year ARI rainfall event to the retention areas. Lot levels will be absolute minimum 0.5m above the 1 in 100 year ARI rainfall event flood level within the basin. Lot levels will be absolute minimum 0.3m above the 1 in 100 year ARI rainfall event flood level within road reserves.
Groundwater Management	Site will be filled to a minimum 2.0m separation to Controlled Groundwater Levels (CGL). Drainage system will utilise generally high site infiltration rates. Depth between the base of soakwells and CGLs is to be a minimum of 1.0m.

Key LWMS Elements	Design and Compliance to Objectives
Water Quality Management	Best Management Practices (BMPs) will be maintained to improve water quality which apply to principals of Water Sensitive Urban Design (WSUD)
Vegetation and POS Management	Native plantings will be used in the POS and infiltration basin to reduce water and fertiliser requirements.
Subdivision Management	Management of subdivision works will ensure potential impacts to surrounding environment and conservation areas are minimised.
Monitoring	Pre-development monitoring has been undertaken; analysis of samples includes physical parameters and nutrients which are provided in Appendix C and discussed in Section 3. Post-development monitoring will continue for not less than 3 years after construction if complete. Monitoring will include groundwater levels and water quality analysis.
Implementation	Roles and responsibilities involved in the implementation of the UWMP are identified in Section 9.

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1 INTRODUCTION

This Local Water Management Strategy (LWMS) has been prepared to support the Local Structure Plan for Lots 11 & 74 Beenyup Road, Banjup.

1.1 LOCATION

Lot 11 and 74 Beenyup Road are located south west of the Gibbs and Beenyup Road intersection bound by a residential development to the west, Woodland Park to the south west and private land holding to the south, approximately 23km south of the Perth CBD as shown in **Figure 1**.

1.2 PREVIOUS STUDIES AND POLICY FRAMEWORKS

This document takes due cognisance of the following documents:

- Better Urban Water Management (WAPC, 2008);
- Decision Process for Stormwater Management in Western Australia (DoW, 2009);
- Geotechnical Report on Lots 252 & 268 Beenyup Rd, Banjup (Bioscience, 2012).
- Liveable Neighbourhoods Edition 4 (WAPC, 2007);
- Planning Bulletin No. 64: Acid Sulphate Soils (WAPC, 2007);
- State Planning Policy 2.9 (WAPC, 2006);
- State Water Strategy (Government of WA, 2003);
- Statement of Planning Policy No. 3: Urban Growth and Settlement (WAPC, 2006); and
- Stormwater Management Manual for Western Australia (DoW, 2007).

1.3 OBJECTIVES

The objectives of this LWMS are based on requirements from Better Urban Water Management (WAPC, 2008), the Department of Water, and the City of Cockburn.

This report is submitted and covers the following BUWM objectives:

This report incorporates the integrated water cycle management principles discussed in the BUWM guidelines and the Objectives of this report also include the principles discussed in the BUWMP guidelines for a **Local Water management Scheme** and include:

- Considering water resources
- Integrating water and land use planning;
- Using a whole catchment integration of natural resource use ad management;
- Promoting the sustainable and equitable use of all water sources and having consideration of the needs of all water users including the environment.
- Maintaining or improving the surface and groundwater quality within the development relative to predevelopment conditions;
- Maintaining the total water cycle balance within the development relative to the pre- development conditions;
- Maximising the reuse of stormwater;
- Retaining natural drainage systems and protecting ecosystem health;
- Implementing stormwater management systems which are economically viable in the long term;
- Maintain the surface water and groundwater quality and quantity within the development areas to predevelopment conditions;
- Utilising onsite infiltration to groundwater where possible;
- Protect existing wetlands from reductions in underlying groundwater levels;
- Integrate stormwater treatment into the landscape by incorporating swales/basins that enhance the visual and recreational amenity of developments.
- Maintain or improve surface and groundwater quality at or above pre-development levels;
- Manage catchment runoff up to the 1 in 100 year ARI event in the development area;
- Prevent adverse impacts to natural environments that may be sensitive to changes in the natural hydrological cycle (Liveable Neighborhoods);

- Minimise the public risk of injury or loss of life, and protect the built environment from flooding; and
- Ensure best practice stormwater management is delivered through planning and development of high quality developed areas, that are consistent with sustainability and ensuring the long term viability of the stormwater management systems.

2 PROPOSED DEVELOPMENT

The site comprises of two lots Lot 11 (22.71 Ha) and Lot 74 (18.68 Ha) with a total area of approximately 41.39 hectares. A western portion of both lots 11 and 74, approximately 5.7 ha is zoned as Urban Deferred and is the subject of the proposed development. The remainder of the site is zoned as Rural - Water Protection under the Metropolitan Region Scheme (MRS) (**Figure 2**).

There is currently no District Structure Plan (DSP) prepared for the site. A LSP for which this document is intended to support has been prepared by ARD (**Figure 3**). A preliminary development lot layout for which this LWMS has been based on is illustrated in **Figure 4**. This area shall be referred to as the *Study Area*.

Key elements of the development layout include:

- A total of 114 urban residential lots ranging in size from 288m^2 to 430m^2 plus one 2718 m^2 group housing lot.
- Entry from Gibbs Road and both ends of Prosperity Loop;
- The creation of swale drainage to the wetland;
- Retention of established native vegetation, where possible, within POS areas; and
- Retaining a 30m buffer between the development and wetlands.

3 PRE-DEVELOPMENT ENVIRONMENT (STAGE 1 AND 2)

3.1 CURRENT AND HISTORICAL LANDUSE

The western portion of the site, zoned “Urban deferred”, contains a single dwelling with surrounding grounds cleared for outbuildings, access & gardens including grassed areas. The balance of the site contains remnant vegetation in various condition or state of disturbance.

The eastern third of the site has been historically cleared in the early 1980’s for a native plant nursery. The clearing took place over majority of the Resource Enhancement Wetland (REW) within Lot 74. The eastern portion of Lot 11 remains disturbed due to the presence of the nursery, with the plantations extending into as much as 50 m of the Conservation Category Wetland (CCW) (**Figure 11**). Clearing along the western portion of the site took place in the early 1990’s which included wide tracks and a residence being built. In the early 2000’s, extensive disturbance occurred within western portion of land through clearing for tracks.

3.2 TOPOGRAPHY

The western portion of the site and area identified as the *Study Area* and subject of this structure plan is relatively steep with 80% of the *Study Area* with an average gradient of upto approximately 7% from west to east.

A small section of approximately 0.90 Ha grades to the north west of Lot 11 towards Gibbs Road.

The remainder of the site referred to as Rural – Water Protection area can be described a gently sloping and grade to the central CCW location.

Lot 11 has a high point of approximately RL 34m AHD in the north west, sloping to the south east low level of 27m AHD. Lot 74 has a high point level of RL 31m AHD in the north west corner grading east to a low level of RL 26m AHD before rising to 34m AHD at the southern boundary as shown in **Figure 5**.

3.3 GEOTECHNICAL INFORMATION

3.3.1 Soil Geology

Geological mapping indicates the site is comprised of predominately sandy soils of the Bassendean Sand surface geology type as shown in **Figure 6**.

A preliminary geotechnical investigation was undertaken by Bioscience in September 2011, the investigation included the drilling of twelve piezometers, and the laboratory testing of selected samples.

The investigation confirmed site profiles are as described in **Figure 6** consisting of sandy black topsoil overlaying a white/grey/brown, medium, sub-angular sand layer, down to a depth of 9 m below ground level. In some bores a dark brown, non-cemented coffee rock was observed.

The location of the monitoring bores are shown in **Figure 7** and a particle size distribution of the bore logs can be found in **Appendix A**.

The Stormwater Management Manual (DoW, 2007) specifies a permeability rate of 0.35mm/sec or more for Bassendean sands.

The Bioscience investigation included PSD testing on 16 selected samples from different bores and confirmed almost all the samples are in medium sand fraction range. PSD test results can provide a reliable indirect permeability value for the area. Generally medium sand fraction soils have a permeability value of 10-4 to 10-2 (m/s). These soils will therefore be suitable for at-source retention of surface water runoff through soakwells, open drains, and infiltration basins provided there is adequate clearance to groundwater. The

Soils with higher infiltration rates tend to have lower Phosphorous Retention Index (PRI), the PRI of Bassendean sands is estimated 0 to 0.5 It is recommended that for areas to be used for drainage infiltration that imported fill with a PRI index greater than 10 be utilised to maximise retention of nutrients.

3.3.2 *Acid Sulphate Management*

Perth Groundwater Atlas mapping for Acid Sulphate Soils (ASS) classified the area subject to structure planning to be an area of Class 2 - Moderate to low risk of ASS occurring within depths of 3m from the surface, but high to moderate risk of ASS beyond 3m of natural soil surface (see **Figure 8**).

It is not considered that ASS will pose any risks to future development as any potential impacts are manageable through proper investigations and management plans in accordance with Department of Environment Regulation (DER) requirements.

3.4 ENVIRONMENTAL CHARACTERISTICS

360 Environmental have undertaken an Environmental Assessment Report of Lots 11 and 74. The 360 report reference 135OAN_Rev3 titled “Lots 11 and 74 Beenyup Road, Banjup Environmental Assessment Report” dated April 2020 and is attached as **Appendix B**.

The summary of the 360 Environmental report is as follows.

3.4.1 *Flora and Vegetation*

360 Environmental undertook a 2km radial DPaW NatureMap and DotEE Protected Matters Search Tool (PMST). The NatureMap and PMST databased identified 23 conservation significant flora species as potentially occurring in the vicinity of the site. Of these nine are classed as Threatened, one as Priority 1, six as Priority 3 and seven as Priority 4 (360 Environmental 2020).

The likelihood assessment determined that of the 23 Conservation significant species (listed under the EPBC Act and the Wildlife Conservation Act) flora as potentially occurring in the vicinity of the survey area. Of this, there are 10 considered likely or possible to occur on the site (refer to Appendix B Table 10 (360 Environmental 2020).

Despite some species being considered likely or possible to occur, the Level 2 Flora and Vegetation Survey did not identify any Priority species as listed by DPaW or Threatened Species as listed under the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) or the *Wildlife Conservation Act 1950* (WC Act). In addition, the DPaW database did not identify any conservation significant flora species within the site (360 Environmental 2020).

A vegetation survey completed by Bioscience in 2012 prior to the 360 Environmental study, found the majority of the site consisted of Banksia, Melaleuca, Kunzea, or Eucalyptus woodlands. Parts of the site are considered to be ‘Completely Degraded’ due to human disturbances such as tracks, a residence and a nursery. On account of the presence of Banksia Woodland, Aigle Royal Developments has referred the proposal to the Commonwealth Department of Environment of Energy for assessment of significance.

The remaining area in the site that has been left uncleared remains in ‘Good’ to ‘Excellent’ condition

3.4.2 *Fauna*

A DPaW NatureMap Fauna Search was undertaken by 360 nvironmental with a 2 km and 5 km buffer of the site and a DotEE PMST search was undertaken with a 1 km buffer of the site and a likelihood assessment was undertaken (refer to Appendix B (Table 12)).

A likelihood assessment found that a number of conservation significant fauna species have the potential to occur within the site. However, this is based on a desktop assessment rather than a site survey. On account of the possible presence of black cockatoos, Aigle Royal Developments has referred the proposal to the Commonwealth Department of Environment of Energy for assessment of significance. At the time of completing this report the Department had not published a decision on the referral.

3.4.3 *Surface Water and Wetlands*

A CCW exists in the central and eastern portion of the site (refer to **Figure 11**) and a REW exists in the south-eastern portion of the site, adjoining the CCW. A perennial lake subject to inundation all year round exists in the southern central portion of the site. A Wetland Management Plan will be prepared at subdivision stage to provide details of the revegetation and management proposed for the wetland. It is proposed to cede the CCW as reserve at the subdivision stage for conservation in perpetuity. The management of surface water and groundwater has been addressed in the & LWMS that will accompany the LSP submission. An Urban Water Management Plan that will be prepared at urban subdivision approval stage.

3.4.4 Potential Contamination:

A search of the Department of Environment Regulation (DER) Contaminated Sites Database did not identify any contaminated sites present within the site. The plant nursery in the east of the site is a potential contaminating land use. Prior to development of any special rural lots on the eastern part of the site, the potential for any historical or current contaminating activities associated with the nursery will be considered.

3.4.5 Groundwater

The western part of the site is classified as a 'Priority 3 Area' and the remainder of the site is classified as a 'Priority 2 Area' under the Jandakot Underground Water Pollution Control Area. The site contains shallow groundwater, with water ponding at the surface in the Conservation Category Wetland (CCW) in the southern central part of the site.

3.4.6 Acid Sulfate Soils (ASS)

The central portion of the site is classified as having a high to moderate risk ASS and the western and eastern parts of the site are classified as having a moderate to low risk of ASS. An ASS self-assessment form will be completed for the site once detailed engineering design has been undertaken. This will inform the risk of ASS and whether an investigation will be required.

3.5 SURFACE WATER

There are no known areas of inundation within the. *Study Area.* The site topography proposes surface runoff will tend toward the existing wetland east of the *Study Area* but no existing drain or flow paths are observable.

All surface runoff within both lots 11 and 74 is contained within lot boundaries- but for a small section of the north west corner of Lot 11 which naturally grades toward the Gibbs Road/Beenyup Road Intersection. The natural terrain of the remainder of Lot 11 and 74 grades toward the CCW located centrally within the site.

Due to the high infiltration rate of soils in the *Study Area* it is unlikely any surface runoff will occur.

Urban development of the land will require the establishment of an improved drainage system and incorporating water management design principles and structures set out in the Department of Water's Better Urban Water Management (BUWM) guidelines.

The implementation of improvements to the drainage system according to the principles and methods set out in the BUWM guidelines will likely have a benefit to local and regional water quality.

3.6 GROUND WATER

3.6.1 Investigation

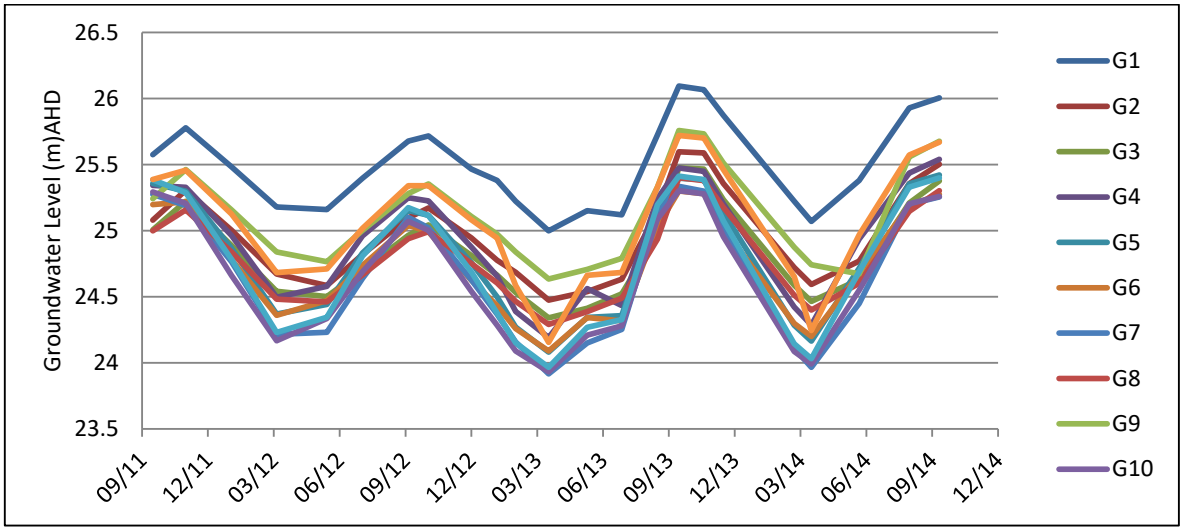
Initial desktop study of Perth Groundwater Atlas, indicates the groundwater levels range from 25.85mAHD at the north west of Lot 11 to 25.2 m AHD on the south west side of the project site near Beenyup road. The groundwater level for the *Study Area* is approximately 25.6m AHD.

12 monitoring bores were installed by Bioscience during the 2011 investigation at the locations shown in **Figure 7**. This data set captured three winter peaks and the bore monitoring results collated are detailed in **Appendix A**.

The *Study Area* is located within the Southern Suburbs District Structure Planning Area detailed within the Russell Road Arterial Drain Scheme, the remaining area of Lot 11 and 74 is outside the area of Controlled Groundwater Levels (CGL)

3.6.2 Groundwater Levels

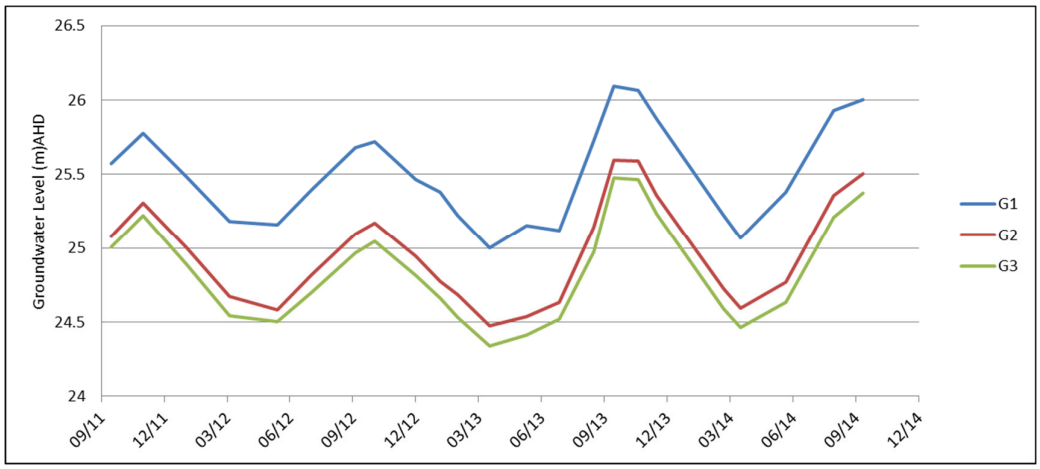
Groundwater levels from the 12 onsite monitoring bores varied from 26.0m AHD to 23.92m AHD. Representation of groundwater data collation is shown in Graph 1



Graph 1: Time Series Groundwater Level Data

There are 3 monitoring bores located within the *Study Area* Bores G1, G2 and G3.

Representation of the monitored groundwater levels for the 3 bores is shown in Graph 2



Graph 2: Time Series Groundwater Level Data Bores G1, G2 and G3

The *Study Area* is within the boundary of the Russell Road Arterial Drain Scheme (DWA, 2003) which has been adopted by the City of Cockburn. The Control Groundwater Levels (CGL) vary between 25.0m AHD and 25.25m AHD as displayed in **Figure 10**.

Groundwater level values taken from the on-site monitoring are comparable to those presented in the Russell Road Arterial Drain Scheme and are considered acceptable in accuracy.

As such, the CGL from the Russel Road Arterial Drain Scheme have been used as the basis of the design for this LWMS. It is anticipated that the earthwork levels will also be predominately determined based on satisfying the 100 year flood water level requirement (Section 5.2.4) rather than the groundwater requirements (Section 4.5).

3.6.3 Groundwater Quality

Stage 1 of Lot 11 and 74 as identified in the Jandakot Groundwater Protection Policy, lies within a Priority 3 Underground Water Pollution Control Area, established under the Western Australian Metropolitan Water Supply, Sewerage and Drainage Act 1909.

The objective of Priority 3 Areas is to minimise the risk of pollution to water sources through the application of management controls, rather than by land use restrictions. Residential housing is a compatible land use in Priority 3 areas.

Groundwater quality sampling for physiochemical parameters and nutrient concentrations were conducted on a biannual basis for a period of 4 years (from September 2011 to September 2014) following installation of the monitoring bores (Bioscience 2012).

A total of 12 monitoring bores have been located throughout Lot 11 and 74. Three bores G1, G2 and G3 are located within the *Study Area,*data tabled refer specifically to these monitoring bores specifically.
The groundwater quality data is given in **Appendix C**.

Table 1 below provides that results of the pre-development monitored physico-chemical parameters and the results of predevelopment measurement for nutirents as well as the ANZECC water· quality guidelines for wetlands as indicative comparison for the, *Study Area*.

Table 1: Pre-development Physical and Nutrient Parameters

Bore Number	G1	G2	G3	Average	ANZECC Guidelines
pH	5.85	4.3	3.7	4.63	7.0-8.5
EC (mS/cm)	0.473	0.444	0.519	0.45	0.3-1.5
Fe (mg/L)	0.069	0.244	0.226	.217	N/A
NH_4^+(mg/L)	0.008	0.565	0.0325	0.024	0.04
N02 (mg/L)	<0.01	<0.01	<0.01	0.02	NA
NOx (mg/L)	1.06	0.017	10.75	0.55	0.1
TN (mg/L)	0.085	0.107	0.026	0.086	1.5
FRP (mg/L)	0.020	0.0115	<0.01	0.015	0.03
TP (mg/L)	0.051	0.052	0.063	0.057	0.06

Analysis of the monitored physical parameters indicates that the groundwater is fresh, acidic with low level of oxygen. This result was expected due to the nature of the soils on site.

Analysis of the monitored water quality parameter indicates that TN is mainly in the organic form. This result was expected due to the extent of native vegetation on both Lot 11 and 74. Comparison of on-site nutrient levels with ANZECC guidelines reveals that nutrient levels are below the ANZECC guidelines within the *Study Area* for bores G1, G2 and G3.

This result was expected as it reflects the anthropogenic elevated nutrient conditions under native vegetation on Bassendean Sands.

4 WATER SUSTAINABILITY INITIATIVES

4.1 WATER CONSERVATION OBJECTIVES

The proposed development will significantly increase the demand for water as there will be an increase in the number of residents. Water conservation management is therefore needed to make sure that use of water is minimised. The objectives for water conservation management are to minimise the net use of water by maximising surface infiltration/recharge in addition to minimising the irrigation water requirements for establishing and maintaining gardens and public open spaces by utilising waterwise principles such as low water requirement plants and species.

The current state government requirement to increase the efficiency of water use in new developments to a target of less than 100kl per person per year is proposed to be implemented within the development.

The State government identified demand reduction for potable water use and consideration include the use of alternative, fit-for-purpose and water supplies in new residential developments. The initiatives include:

- The BCA 5 Star Plus initiative, by Government of Western Australia, requires that new homes will have water efficient hot water systems, showerheads, taps and toilets; stage 2 of the initiative require alternative water supply for flushing toilets and for washing machines where single dwellings are located on larger lots.
- The Water Corporation's waterwise Rebate Program which include swimming pool covers, rain sensors, subsurface irrigation system, grey water re-use, rainwater tanks, and garden bores.
- The DoW has developed a waterwise Communities Toolkit that provides access to information on wise water use, availability of sources for recycling.
- Encouragement of the use of rainwater tanks to supplement scheme water for irrigation.
- The use of low water requirement plants and minimizing turf areas for gardens and POS areas.

4.2 LOT OWNERS

4.2.1 Design Criteria

- The criteria of water efficiency initiatives for households include:
- Consumption target of water of 100kL/per/year including not more than 40-60kL/person/year of scheme water.
- Meeting 5 Star Plus provisions for all new dwellings.
- Use of rainwater tanks to be promoted to achieve water consumption targets.
- Use alternative water resources for irrigation.

4.2.2 Management Measures

All requirements for the purchaser will be outlined in their purchase contract and associated information handouts.

At the development stage, water conservation could be achieved by implementation of the following management measures:

- Encouraging at-source surface recharge where possible using soakwells, vegetated retention basins and swales,
- Retention of native trees within POS where possible to reduce demand for water during POS area establishment.
- Use of non-potable groundwater for irrigation of POS areas.
- Manage irrigation within POS areas to minimise losses to evaporation.

It will be the responsibility of the local Council to ensure that the building licence applicant details how they expect to manage stormwater with the view to conserving water and to maximise the reuse of this water.

4.3 ESTATE PUBLIC OPEN SPACE

The treatment of the POS areas will typically consist of grassed areas with designated areas of native planting and mulching. All areas will be designed to minimise irrigation requirements with predominantly native plantings incorporated into the landscape design and the use of low water requirement grasses such as kikuyu.

A Public Open Space Management Plan (POSMP) will be prepared in accordance the Department of Water's (DoW) and City of Cockburn requirements which will address the objectives outlines in Section 4.3.1.

4.3.1 Design Criteria

The drainage impacts of the POS will be managed to ensure that:

- The maximum depth of water within drainage basins during a 100 year storm is limited to 1.2m.
- Bio Retention areas will be provided on site to ensure for low ARI rainfall events the water will be contained and maximise the useability of the adjacent POS areas.

Any proposed landscaping development of the POS areas will address the following objectives:

- Minimising irrigation & fertiliser demands via appropriate species selection
- Managing fertiliser application to minimise impacts on water quality.
- Weed Management
- Fauna Protection

4.3.2 Irrigation

For the POS irrigation the overall water use is limited to a maximum of 7500kl per hectare per annum in accord with the Department of Water requirements. Given that the total area to be irrigated over the total development is approximately 0.940 ha requiring an annual bore yield of some 7270kL per annum.

There is an existing bore license in place sufficient to cover the irrigation requirement.

The requirement for construction groundwater is unknown at present and will vary depending on the time of year the works are done, the required staging, the existing cadastral boundaries and if water is sourced from a hydrant or from a bore. This will be resolved at the time of preparation of the UWMP. Water use for construction purposes will be mainly used for dust control and compaction, meaning that the water will be infiltrated and there will be minimal implications on the water balance.

4.4 WATER AND WASTEWATER

Water Corporation has confirmed the development will be able to be connected to existing water reticulation and sewer reticulation mains for Gibbs Road and Prosperity Loop.

4.5 GROUNDWATER MANAGEMENT

The design objectives for groundwater management are:

- Minimise changes to the underlying groundwater levels as a result of development;
- Maintain a 2m separation between lot levels and CGL;
- Minimise the risk of nutrient enrichment of downstream receiving surface water bodies from groundwater sources;
- Implement strategies to reduce the nutrient transport into the groundwater; and
- Protect wetlands that are dependent on the underlying groundwater.

4.6 SURFACE WATER MANAGEMENT

4.6.1 Stormwater Quantity

The proposed stormwater management design criteria are:

- Retain catchment runoff up to the 1 in 100 year ARI rainfall event within the development site;
- Convey the 1 in 5 year ARI rainfall event within the pipe network;
- Contain flows within individual lots within property soakwells sized for storage and infiltration of the 1 in 20 year (5 minute) ARI rainfall event.
- Ensure that the 1 in 100 year ARI rainfall event can be conveyed and contained within road reserves;
- The floor levels of all habitual buildings are a minimum of 300mm above the 1 in 100 year ARI rainfall event flood level within road reserves;
- The floor levels of all habitable buildings are a minimum of 500mm above the 1 in 100 year ARI rainfall event flood levels within storage areas (basin).

4.7 STORMWATER QUALITY

The design objectives for stormwater quality are:

- Maintain or improve the nutrient concentrations of the groundwater compared to pre-development levels;
- Use of imported fill and/or amended soils with a minimum PRI of 10 within POS and drainage areas;
- Retain the 1 in 1 year – 1 hour duration ARI rainfall event onsite as close to source as practical; and
- Vegetated bio-retention areas to be sized at 2% of the connected impervious area.

5 STORMWATER MANAGEMENT STRATEGY

5.1 INTRODUCTION

A stormwater management strategy will be completed when a structure plan is prepared. The preparation of a structure plan will occur upon completion of rezoning to “Urban” in the Metropolitan Region Scheme. Development of the SMS will be guided by the following objectives:

- Maintaining or improving the surface and groundwater quality within the development relative to predevelopment conditions;
- Maintaining the total water cycle balance within the development relative to the pre- development conditions;
- Maximising the reuse of stormwater;
- Retaining natural drainage systems and protecting ecosystem health;
- Implementing stormwater management systems which are economically viable in the long term;
- Maintain the surface water and groundwater quality and quantity within the development areas to predevelopment conditions;
- Utilising onsite infiltration to groundwater where possible;
- Protect existing wetlands from reductions in underlying groundwater levels;
- Integrate stormwater treatment into the landscape by incorporating swales/basins that enhance the visual and recreational amenity of developments.
- Maintain or improve surface and groundwater quality at or above pre-development levels;
- Manage catchment runoff up to the 1 in 100 year ARI event in the development area;
- Prevent adverse impacts to natural environments that may be sensitive to changes in the natural hydrological cycle (Liveable Neighborhoods);
- Minimise the public risk of injury or loss of life, and protect the built environment from flooding; and
- Ensure best practice stormwater management is delivered through planning and development of high quality developed areas, that are consistent with sustainability and ensuring the long term viability of the stormwater management systems.

5.2 STORMWATER DRAINAGE

Surface water runoff needs to be managed at both lot level and development scale. To manage the stormwater runoff at the post development stage, a preliminary earthwork site level and drainage system is proposed to manage minor and major events up to the 1 in 100 ARI event based on maintaining existing hydrology by infiltrating surface water as close to the source as possible.

The principle drainage system of the development will be based on the Better Urban Water Management (BUWM) guideline and also local government subdivision development guidelines as directed by the City of Cockburn, and the DoW.

The principle design allows for all run off at post development stage to be contained within both lots and drainage basins up to 1 in 100 ARI event.

Preliminary site finished levels and associated post development catchments and stormwater measures are attached as **Appendix D**.

The stormwater management system will include the following design concepts:

Lot Level

- Retain catchment runoff up to the 1 in 100 ARI rainfall event within the development site;
- Convey the 1 in 5 ARI rainfall event within the pipe network;
- Contain flows within individual lots within property soakwells sized for storage and infiltration of the 1 in 20 (5 minute) ARI rainfall event.
- Ensure that the 1 in 100 ARI rainfall event can be conveyed and contained within road reserves;
- The floor levels of all habitual buildings are a minimum of 300mm above the 1 in 100 ARI rainfall event flood level within road reserves;

- The floor levels of all habitual buildings are a minimum of 500mm above the 1 in 100 ARI rainfall event flood levels within storage areas (basin).

Road Reserve

- To ensure the water balance for both pre and post development, where practical, stormwater is to be conveyed to the infiltration basin within the POS of the subdivision boundaries.
- Road Reserve drainage will be via a conventional piped system sized to capture, manage and convey up to the 1 in 5 ARI event wholly within system for road reserve catchment direct to the POS infiltration basin.
- Pits will have drainage weepholes and raised pipe inverts above the base for source infiltration for minor short duration events.
- For events in excess of the 1 in 5 ARI event up to the 1 in 100 ARI event, road reserve runoff in addition to lot runoff for events exceeding the 1 in 20 ARI will be conveyed to the POS via overland flow within the road carriageway.
- Bubble-up pit for inlet of flows into the drainage basin to promote flow and velocity control upon entry to basin.
- Gross Pollutant Trap (GPT) to be installed prior to discharge of street drainage system into Basin within the POS area.

Flood Mitigation & Infiltration Basin

- The Infiltration basin within Public Open Space (POS) is sized to cater for 1 in 5 ARI stormwater event, with outflow of water from basin through infiltration...
- Use of imported fill and/or amended soils with a minimum PRI of 10 within POS and drainage areas;
- Retain the 1 in 1 ARI – 1 hour duration ARI rainfall event onsite as close to source as practical; and
- Vegetated bio-retention areas to be sized at 2% of the connected impervious area.
- Basin area designed to ensure it empties within 72 hours maximum.
- Basin to have 1 in 7 batter slopes to ensure accessibility for maintenance purposes.
- For larger event of 1 in 100 ARI event, water will be allowed to flood the POS with freeboard of 300mm to prevent overflow into residential lots.
- Minimum Lot levels will be 500mm above 1 in 100 ARI flood level in the POS.

5.3 ASSESSMENT OF STORMWATER STRATEGY

A summary of management design is outlined in the sections below.

5.3.1 1 in 1 ARI Event

The drainage plan has been designed to cater for the minor event runoff without exporting pollutants in surface water from the site. The 1 in 1 ARI will be retained as high in the catchment as practical, this will be achieved by combination of the following:

- Roof and lot runoff from each property will be detained in the property soakwells.
- POS drainage basin is designed to ensure that for a 1 in 1 ARI event, the maximum water depth does not exceed 0.5m.
- Use of amended soils with PRI>10 in basins

5.3.2 1 in 5 ARI Event

The pipe drainage system and infiltration basin in the POS are designed to cater for the 1 in 5 ARI event from the road reserve catchment fully within the system. The stormwater runoff within the area will enter the pipe system through side entry pits; to be conveyed to the POS infiltration basin, via the Gross Pollutant Trap (GPT) and the Bubble-Up pit.

POS drainage basin has been sized to store a 1 in 5 ARI event and to empty via infiltration within 72 hours.

5.3.3 1 in 20 year ARI Event

Individual lots will contain flows within property soakwells sized for storage and infiltration of the 1 in 20 ARI (5 minute duration) event. Larger events, lot runoff will be directed into the road reserve for conveyance via overland flow in the road carriageway to the POS major flood area.

5.3.4 1 in 100 year ARI Event

For events exceeding the 1 in 5 ARI event from the road reserve catchment and exceeding the 1 in 20 ARI event from lot runoff, stormwater will be conveyed through both the pipe system and ovelrand flow within the road pavement carriageway into the infiltration basin and POS Area

5.4 STORMWATER CALCULATION METHODOLOGY

XP-SWWM software has been used to model post-development conditions for the 1 year, 5 year and 100 year ARI design events adopting the Laurenson routing method.

The system has been modeled using a conservative infiltration rate of 5 m/day, well below the infiltration rate recommended in the Bioscience site investigation report of between 9 and >200m/day.

XPSWWM stage modelling diagrams are attached in **Appendix E**.

5.4.1 Catchment Areas

The *Study Area* has 2 distinct catchments divided by a contour ridge located midway within Lot 11 as shown in **Figure11.**

The north catchment has a gross area of 3.8 hectares. The majority of the surplus runoff collected will be stored in a limestone walled detention swale with infiltration through the base, the basin will detain all events upto the 1 in 10 year event. For rainfall events exceeding the 1 in 10 year event a discharge outlet pipe is to be installed to discharge to a 2.0metre wide 90 metre long vegetation swale to be located as a temporary storage facility. The temporary swale has been sized to contain overflow from the basin upto the 1 in 100 year event at a maximum depth of 0.34m. Rainfall events in excess of the 100 yr ARI will overflow to swale toward the wetlands.

The south catchment has a gross area of 2.75 hectares and grades to a proposed drainage infiltration basin located within the Estate Public Open Space.

5.4.2 Method used

XP-SWWM software has been used to model post-development conditions for the 1 year, 5 year, 10 year and 100 year ARI design events adopting the Laurenson routing method.

The system has been modeled using a conservative infiltration rate of 5 m/day, well below the infiltration rate recommended in the Bioscience site investigation report of between 9 and >200m/day.

Multiple storm events have been examined using XP-SWWM software calculating a maximum 1 in 100 year flood level as shown in Table 2 and Figure E5 and 6 contained in **Appendix E**.

XPSWWM Hydraulic and Hydrology results together with pipe profile with TWL are shown in **Appendix E.**

5.4.3 On Site Lot Disposal

Owners have a mandatory requirement to retain the 5 minute 1 in 20 year rainfall event within the properties enforced by the City of Cockburn during building approval.

The average area of proposed lots is approximately 350 sqm.

The average volume of storage (ignoring infiltration) required to be provided by owners is

I_{20} 5min	=	155.3 mm/hr.
Ave Area of lots	=	350 sqm
Volume to be retained in average lot	=	4.5 bcum.

This volume can be provided by infiltration through landscape/grass areas as well as soakwell structures/rain watertanks etc.

For the lower ARI storms – less than 20 year ARI, there will be no surcharge or run-off. For the larger storms, stormwater will surcharge and soak in the landscape strip between the house and the street then overflow into the street drainage system.

5.4.4 Pipe design

Appendix E shows the XPSWWM results of drainage software modelling. Pipes have been sized with a minimum 300mm diameter throughto a maximum pipe diamenter of 450mm. The maximum peak flow for the 1 year, 5 year, 10 year and 100 year ARI events are shown in Table 2. All rainfall events upto the 5 year ARI will be contained within the pipe network system

Prior to discharge to each the north and south basin pipe flow will be routed through a gross pollutant trap (GPT) for treatment prior to discharge to the infiltration basin via a bubble up pit.

5.4.5 Infiltration Basin & Public Open Space (POS)

The City of Cockburn requires the designated infiltration basin within the POS to be able to store the 1 in 5 ARI wholly within the system. For events greater than 1 in 5 ARI and up to the 1 in 100 ARI event, the POS area is permitted to be flooded.

Two infiltration swales/basins are proposed one for each the north and south catchment as shown on Drg 16015-C-101 and 102 in **Appendix D**. Additionally, a second storage detention structure is also proposed higher in the for the south catchment to enhance disposal of runoff close to source as allowable, runoff collected will be detained and infiltrated through the basin base. The maximum water level has been limited to the depth of the limestone swale with surplus storage outletting through an open notch weir and directed to the downstream basin located in the POS. Details of the detention swale basin are provided on drawing 16015-C-103 attached in **Appendix D**.

The details of both infiltration basin and detention swale include storage capacity and maximum water level for the 1 year ARI, 5 year ARI, 10 year ARI and 100 year ARI events as shown in Table 2.

The base of the landscape basin will be vegetated to provide treatment for the first flush. The 1 year and 5 year rainfall events will be contained within the basin while the surrounding area of the POS will provide storage for larger events.

The pipe network will be conveyed through a GPT, before discharge into the infiltration basin by bubble up pit located centrally within the infiltration basin.

The assumptions for calculating the basin size and POS are as follows (Stormwater Management Manual, DoW 2008):

Table 2 Catchment Drainage Basin/Swale Data

Details	NORTH DETENTION BASIN AND VEGETATION SWALE	SOUTH RETENTION BASIN
Gross Catchment Area (Ha)	3.80	2.75
Effective Impervious Area (100yr)	2.26	1.90
Base RL (m)	27.6	28.00
Base Area (sqm)	180	636
Basin Capacity (cubm)	303	625
100yr TWL (m)	28.39	28.96
10yr TWL (m)	28.17	26.67
5yr TWL (m)	27.93	26.43
1yr TWL (m)	27.72	28.21
Peak Flow (l/sec)		
1 yr	48	74
5yr	74	96
10yr	86	100
100yr	104	135
Storage Volume (bcum)		
1 yr	29	86
5yr	59	273
10yr	111	476
100yr	303	590
Basin Depth (mm)		
1 yr	121	131
5yr	330	433
10yr	620	892
100yr	700	963
100yr Freeboard	300 min	300 min

5.5 SURFACE WATER QUALITY

To achieve water conservation and efficiency, the project will need to ensure that the use of Best Management Practices (BMP's) will be adapted so as to manage the stormwater at the pre-development conditions, as well as nutrient and sediment management of the stormwater. The primary strategy is utilise devices to maintain and/or improve the water quality for minor 1 in 1 ARI event runoff.

This will be implemented where possible through the use of unconnected property soakwells, however the ability to do so for road reserve runoff is restricted in this case by soil types and steep grades of the natural surface of the site. The implementation of vegetated biorentention basins within POS areas strategically located throughout the development structure plan is proposed to meet the quality objectives and setout by the Stormwater Management Manual of Western Australia regarding bioretention system areas and non-structural measures. The bioretention/detention basin areas are to be vegetated with local native species selected for their ability to take up nutrients. A detailed list of species will be provided in the UWMP phase of the planning process.

Where the presence of limestone is an issue the implementation of soakage pits into the road piped system will aid the infiltration at source for road reserve runoff for minor events.

Implementation of at source measures and any potential constraints will be investigated during the UWMP phase when geotechnical and other details are known such as the presence and clearance to limestone.

5.6 STRUCTURAL BEST MANAGEMENT PRACTICES (BMPS)

The key structural BMP's implemented as part of this development, are summarised in Table 3 below.

Table 3 – Key Structural BMP's

Scale	Ownership & Maintenance	BMP
Lot	Lot Owner	Infiltration System: • Reduced impervious areas • Soakwells, Water Efficiency Devices
Street	Local Authority	Conveyance System: • Gravity piped drainage system designed for the 1 in 5 ARI event or and equally designed open trench drainage system. Pollutant Control System: • Vegetated sedimentation basins and Gross Water Pollutant Traps
Precinct	Local Authority	Infiltration System: • Vegetated detention basin designed to cater for the 1 in 100 ARI event.

Requirements for the Lot owners will be required to be enforced at the building stage as part of building application.

5.6.1 Separation System

The street drainage system is designed to cater for the 1 in 5 ARI event, within a suitable system. All drainage networks are proposed to be directed to a separation system such as sedimentation basin.

Up to 1 in 5 ARI events will discharge into the piped drainage system which direct the flow into the detention swales/ infiltration control basins or other approved structures. Overland flows higher than 1 in 5 ARI event ARI which will have a higher quality of water will be allowed to bypass the designated pollution control systems flowing directly into the detention basin.

Incorporating a sediment and pollution control component within the system provides additional water quality treatment for water sensitive urban design purposes.

5.7 NON-STRUCTURAL BMP'S

Non-structural BMP's are recommended with the view to provide additional stormwater quality management and can include; public awareness, community education, establishing operation, maintenance activities and management of land use.

The following are considered most relevant to the development:

- Implementation of sediment and erosion control measures at construction phase.
- Ensure all structural BMP's are maintained according to relevant maintenance plans.
- Maintenance shall include regular vegetation trimming and removal to promote growth and nutrient take-up, as well as removal of sedimentation.
- Sweeping to capture pollutants such as litter, organic matter and other sediments so that they are not collected by the drainage system.

6 GROUNDWATER MANAGEMENT STRATEGY

6.1 GROUNDWATER LEVEL MANAGEMENT

The Russel Road Arterial Drainage Scheme (RRDS) (DWA, 2003) proposes to control the rise of groundwater and protect infrastructure by ensuring 3.0 metres clearance to the nominated site CGL. The use of subsoil drains was proposed for areas where separation to the proposed CGL is less than 3m (DWA, 2003).

The RRDS is not seen as being consistent with current WSUD principles that could be applied at Banjup, which will promote retention of stormwater within the catchment, maximisation of groundwater recharge and minimisation of off-site transport of water that will cause a net change to the overall water balance at the site.

On this basis, subsoil drains are not seen keeping with the guidelines set out in the *Stormwater Management Manual for Western Australia* (DoW, 2007) and the *Decision Process for Stormwater Management in WA* (DoW, 2009), it is proposed that the 3 metre clearance to the CGL is too conservative and that a clearance of 2.0 metres is proposed as being more suitable to the Banjup area.

The design philosophy for the *Site Area* provides a minimum of 2.0m clearance from finished Lot level to the CGL.

Detention basins shall not intersect groundwater and emptying of the basins within 72 hours is likely.

Infiltration both at source and form the POS/Drainage areas will ensure groundwater levels should be maintained close to predevelopment levels.

6.2 GROUNDWATER QUALITY MEASURES

The lot areas typically have high permeability sand, which allows high amount of soakage from the post development flows, to infiltrate into the ground. Sediment and gross pollution control systems have been included in this design, thus preventing pollutants from entering the aquifers and therefore improving the water quality of the stormwater before infiltration at the detention basin takes place.

6.2.1 Detention Basins

Detention basins will also be vegetated with local species to encourage stripping of nutrients before being infiltrated into the ground, thus increasing the water quality before being recharged into the ground.

It is also possible to combine all measurements to control the sediment and gross pollution movements with one arrangement, i.e. a vegetated bio-retention basin.

7 SUBDIVISION AND URBAN WATER MANAGEMENT PLAN

A UWMP containing a more detailed water management plans will be required to be submitted as a condition of subdivision; the areas that will need to be investigated further at UWMP stage include and not limited to the following:

- Completion of Geotechnical Investigation
- Design of water management strategy which demonstrate compliance to the satisfaction of the City of Cockburn and Department of Water design criteria and this document.
- Detailed methodology for implementation of water conservation strategies.
- A further detailed study which include:
- hydrogeological Investigation to determine depth of groundwater and infiltration capacity of soil;
- detailed earthworks design and stormwater drainage management design and calculation and modelling to determine drainage strategy and flood storage requirements; and
- detailed Monitoring of Surface and Groundwater targets for water quality, flows and levels that are to be maintained at post development
- The landscape concept ensuring that the concept promotes the water conservation strategy and stormwater management.
- Completion of Contaminated Site Investigation
- Construction management of subdivisional works to ensure minimum disturbance to environment.
- Maintenance strategy including roles and responsibilities of each stakeholder.
- Implementation of UWMP including roles, responsibilities, funding, and maintenance arrangements.

7.1 GEOTECHNICAL INVESTIGATION

A detailed Geotechnical site investigation should be completed prior to finalisation of the UWMP. The geotechnical investigation will confirm infiltration rates for proposed basin locations and will include investigation for ASS and contamination investigations. However, the investigation is unlikely to impact on the proposed stormwater management strategy.

7.2 ACID SULFATE SOILS OR CONTAMINATION

Perth Groundwater Atlas mapping of ASS indicates the Subject Site Area is Class 2 (Moderate to Low risk of ASS occurring within 3m of natural soil surface).

There are potentially areas where excavation from current natural surface levels to design levels may exceed 3.0m during service installation.

During the final UWMP an assessment of the 100 cum trigger point identified in the Department of Environment Regulation (DER) self-assessment form should be completed and if exceeded a comprehensive ASS management plan can be prepared and approved by the DER prior to commencing construction.

7.3 STORMWATER CONTROL, DUST AND SEDIMENT MANAGEMENT

Prior to commencement of construction works, the contractor shall prepare a dust management plan, as well as implement measures for sediment and stormwater control during construction to ensure minimised effects to the surrounding environment.

Dust control measures will include:

- Wet areas of exposed soils to limit dust levels;
- Limit operations in high winds;
- Cover truck loads transporting fill to site;
- Clearing only to proceed once clearing perimeters have been identified, setout and checked; and
- Stabilisation of disturbed areas through mulching.
- Sediment and stormwater control shall consist of:
- Designated and clearly identified transport routes within site to minimise disturbance to soils and
- vegetation;
- Regular clean out of sediment trapped by fences and drains;
- Sweep sediment from roadways; and

- Stabilisation of berms/channels and repair where needed in a timely manner.

7.4 MAINTENANCE OF BMP'S

The maintenance of BMPs during construction is required to ensure function is retained during subsequent operations.
The following are procedures required during construction:

- Adherence to geotechnical/engineering specifications to prevent damage during construction, in particular
- compaction;
- Install temporary sediment fences/controls to protect stormwater infrastructure, during construction; and
- Inspection and clean out of sediment and litter from stormwater devices upon completion of construction works, and prior to council handover.

8 MONITORING PROGRAM

Monitoring requirements in this section is in accordance with DoW's Draft "Water monitoring guidelines for better urban water management strategies/plans".

8.1 PRE-DEVELOPMENT MONITORING

Bioscience have set up 3 monitoring bores within the *Study Area* for the pre-development monitoring within the subject land.

The groundwater monitoring data collected to 2012 is detailed in Appendix C.

Further predevelopment groundwater quality monitoring of following parameters is also to be undertaken prior to the next phase of development:

- In-situ pH, electrical conductivity, turbidity, dissolved oxygen, and oxidation reduction potential
- Laboratory
    - Heavy metals: aluminium, arsenic, cadmium, chromium, copper, iron, lead mercury, nickel, zinc
    - Total suspended solids
    - Nutrients: ammonia, nitrate and nitrite, total nitrogen and total phosphorous
    - Total titratable acidicity, and total alkalinity
    - Major cations (calcium, magnesium, sodium, and potassium) and anions (chloride and sulphate)
- Potential ASS effects and contaminants to the subsoil drainage system and groundwater conveyance.

The design and requirements of the final UWMP will be updated based on the results fo the monitoring programme.

8.2 POST DEVELOPMENT MONITORING

The location of the current groundwater monitoring bores are indicated in **Figure 12**. For post development monitoirng, bores located in private land (i.e new lots) pose access and bore managmeent issues. Upon completion of the detailed design and confirmation of devleopment final layout, the location of the monitoring bores with respect to the lots will be assessed and detailed in the UWMP. Should additonal bores be required for the post development monitoring, these will be implemented and clarified in the UWMP at subdivision stage.

The implementation and funding for the post development monitoring programme and reporting are the repsonsibilty of the developer Mainlake Holdings Pty Ltd for a period of 36 months post construction of the subdivision.

A post development monitoring program will be implemented with activities pertaining to the following:

- biannual water quality monitoring for nutrients, total suspended solids and other physical parameters at the outlet of the stormwater treatment swale. This will be opportunistic based on flow.
- Nutrients should be measured on a quarterly basis with some initial first flush monitoring for heavy metals and pesticides. Groundwater levels and field parameters should be measured every two months.

8.2.1 Groundwater Quantity

Groundwater level measurements will continue for 36 months after completion of the development and should be undertaken on a quarterly basis.

Monitoring will continue at the same borehole locations used for predevelopment monitoring to allow for consistent and direct comparison of pre to post development.

8.2.2 Groundwater Quality

Groundwater quality monitoring is to be undertaken within the project site, nutrients are to be measured on a quarterly basis. Groundwater parameters, such as salinity, pH, alkalinity, calcium and sulphate concentrations, will be measured every two months. Monitoring will continue until subdivision is handed over to City of Cockburn.

An annual report will be provided to Department of Water and City of Cockburn.

8.2.3 Surface Water Monitoring

Surface water flows should be monitored at drainage controls (Basin inlets) on a quarterly basis and on the first flush.

The following parameters are to be analysed for:

- In-situ pH, electrical conductivity, turbidity, dissolved oxygen, and oxidation reduction potential
- Laboratory
- Heavy metals: aluminium, arsenic, cadmium, chromium, copper, iron, lead mercury, nickel, zinc
- Total suspended solids
- Nutrients: ammonia, nitrate and nitrite, total nitrogen and total phosphorous
- Total titratable acidicity, and total alkalinity
- Major cations (calcium, magnesium, sodium, and potassium) and anions (chloride and sulphate)

8.3 CONTINGENCY RESPONSE

Minimum Trigger values have been set in the LWMS for in accordance with the Healthy Rivers Action Plan (SRT, 2008) and Australian Drinking Water Guidelines (ANZECC, 2000) and are shown in.

Table 4: Trigger Values

Parameter	Trigger Value
Nutrients	Surface Water: Total Suspended Solids: measured as Turbidity: <5NTU. Total Phosphorous: 0.1 mg/L Total Nitrogen: 1.0 mg/L Groundwater: Total Phosphorus: 0.1 mg/L Nitrate: 1.0mg/L Trigger values for all remaining determinants are to be set at ambient concentrations taking due cognisance of the short and long term triggers of the Healthy Rivers Action Plan (SRT, 2008) and ANZECC 2000

Where initial trigger value is exceeded, monitoring will be repeated to determine if there are any sampling errors; where exceeding trigger values are found to be accurate, the following will be implemented:

- Determination of whether the breach:
    - is genuine, outside natural variability of the parameter and signifies a real decline;
    - may have caused by external events;
    - caused by failure of structural BMP's provided during sub-division works; and
    - Caused an impact on local or downstream receiving environment.

- Contingency measures, in consultation with relevant authority, will address majority of physical deteriorations that may occur, they are as follow:
    - identify the source of water quality deterioration and remove/replace as appropriate;
    - prevent continuing deterioration with temporary controls; and
    - if required, remove/replace/repair existing structural control, provide/construct additional controls or modify controls/procedures to prevent further deterioration in water quality.

- If measures above has been done and breaches still occur, the following are advised:
    - construction/operation management and maintenance plans and practices should be revised and modified if required; and
    - revision of trigger values may be sought with consultation with City of Cockburn, and Department of Water in consideration of all data collected and actions taken.

9 IMPLEMENTATION PLAN

9.1 DEVELOPER COMMITMENTS

The developer is committed to implement this LWMS, in consultation with the City of Cockburn and the Department of Water, and to subsequently develop an UWMP and detailed engineering design to support an application for subdivision.

9.2 ROLES/RESPONSIBILTIES AND FUNDING

The following key stakeholders and their roles, responsibilities and funding to the operation and maintenance program is proposed and is shown in Table 5 below:

Table 5 - Roles and Responsibilities for Implementation

Organisation	Role/Responsibility	Funding
City of Cockburn	Approval of this document and provide guidance during developmen of an UWMP	Rates
Water Corporation	Assumes responsibilty for the potable and non-potable water supply and sewerage infrastructure constructed, including ongoing operations and maintenance.	Rates
Developer: Aigle Royal Developments(WA) Pty Ltd	Satisfy WAPC Conditions including preparation of LWMS and implement a UWMP in consultation with DoW and City of Cockburn Demonstrated that UWMP for subdivion proposal comply with LWMS and achieve water quantity and quality objectives and criteria set by this document. Design and construct water supply and sewerage infrastructure to Water Corporation standards. Apply for water use license. Contribute for sampling and analysis of post development monitoring activities for submission to the regulatory authorities.	Developer
Lot Owner	Construction and management, consistent with City of Cockburn requirements	Lot Owner

10 NEXT STAGE

This LWMS provides guidance on water management in the study area. The objectives, strategies andcontained in this Strategy should be implemented as part of the preparation of appropriate water management documents which are to accompany, subdivision and development, consistent with the principles of total water cycle management (section 4) and the requirements of Better Urban Water Management (WAPC, 2008) (Figure 19).

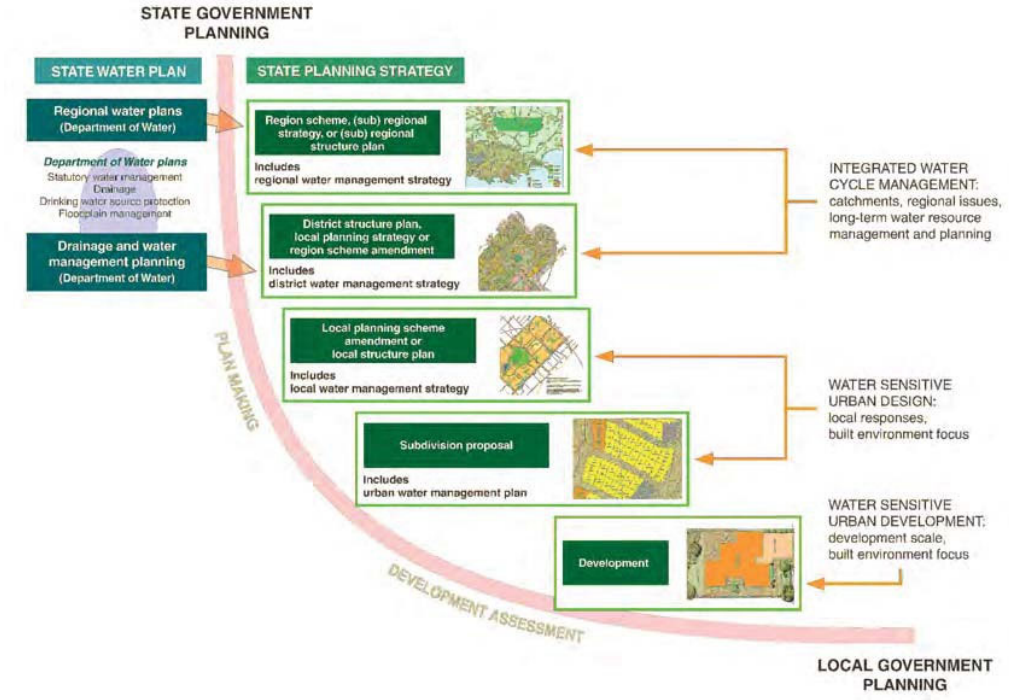


Figure 11: Integrating water planning into the land use planning system (Source: WAPC, 2008)

10.1 LOCAL STRUCTURE PLANNING

Local Structure Planning (LSP) effectively guide subdivision and development of an area. LSPs provide the planning contaxt of the development area including regional and neuighbourhood structure, in particular residential areas, open space, school sites, commercial uses and community uses, mixed use, industrial and mixed business uses; and the proposed indicative lot pattern. LSPs also outline constraints and opportunites associated with the site, along with solutions to deliver the identified outcomes.

10.1.1 Urban Water Management Plans

Preparation of an Urban Water Management Plan (UWMP) will be required as a condition of subdivision approval following acceptance of this LWMS. The UWMP will build on this LWMS, providing further details on the concepts outlined herein and clarifying details which have not yet been provided. The main areas that will require further clarification.

The areas to be investigated includes not limited to the following:

- Completion of Geotechnical Investigation
- Design of water management strategy which demonstrate compliance to the satisfaction of the City of Cockburn and Department of Water design criteria and this document.
- Detailed methodology for implementation of water conservation strategies.
- Hydrogeological Investigation to determine depth of groundwater and infiltration capacity of soil;
- Detailed earthworks design and stormwater drainage management design;

- Computuer stormwater modelling to determine drainage strategy and flood storage requirements;
- Detailed Monitoring of Surface and Groundwater targets for water quality, flows and levels;
- Landscape design ensuring that the concept promotes the water conservation strategy and stormwater management.
- Completion of Contaminated Site Investigation
- Construction management of subdivisional works to ensure minimum disturbance to environment.
- Maintenance strategy including roles and responsibilities of each stakeholder.
- Implementation of UWMP including roles, responsibilities, funding, and maintenance arrangements. Detailed subdivision development design;
- Construction period management strategy;
- Completion of geotechnical investigation;
- Completion of ASSMP, if required;
- Details and proposed implementation processes of water conservation strategies;
- Non-structural water quality improvement measures to be implemented;
- Clarification of monitoring bore locations for post development monitoring;
- Updated monitoring program including requirements, trigger values and duration; and
- Implementation process including roles, responsibilities, funding, and maintenance arrangements.
-

10.2 GEOTECHNICAL INVESTIGATION

A detailed Geotechnical site investigation should be completed prior to finalisation of the UWMP. The geotechnical investigation will confirm infiltration rates for proposed basin locations and will include investigation for ASS and contamination investigations. However, the investigation is unlikely to impact on the proposed stormwater management strategy.

10.3 ACID SULFATE SOILS OR CONTAMINATION

Perth Groundwater Atlas mapping of ASS indicates the Subject Site Area is Class 2 (Moderate to Low risk of ASS occurring within 3m of natural soil surface).

There are potentially areas where excavation from current natural surface levels to design levels may exceed 3.0m during service installation.

During the final UWMP an assessment of the 100 cum trigger point identified in the Department of Environment Regulation (DER) self-assessment form should be completed and if exceeded a comprehensive ASS management plan can be prepared and approved by the DER prior to commencing construction.

10.4 STORMWATER CONTROL, DUST AND SEDIMENT MANAGEMENT

Prior to commencement of construction works, the contractor shall prepare a dust management plan, as well as implement measures for sediment and stormwater control during construction to ensure minimised effects to the surrounding environment.

Dust control measures will include:

- Wet areas of exposed soils to limit dust levels;
- Limit operations in high winds;
- Cover truck loads transporting fill to site;
- Clearing only to proceed once clearing perimeters have been identified, setout and checked; and
- Stabilisation of disturbed areas through mulching.
- Sediment and stormwater control shall consist of:
- Designated and clearly identified transport routes within site to minimise disturbance to soils and
- vegetation;
- Regular clean out of sediment trapped by fences and drains;
- Sweep sediment from roadways; and
- Stabilisation of berms/channels and repair where needed in a timely manner.

10.5 MAINTENANCE OF BMP'S

The maintenance of BMPs during construction is required to ensure function is retained during subsequent operations.
The following are procedures required during construction:

- Adherence to geotechnical/engineering specifications to prevent damage during construction, in particular
- compaction;
- Install temporary sediment fences/controls to protect stormwater infrastructure, during construction; and
- Inspection and clean out of sediment and litter from stormwater devices upon completion of construction works, and prior to council handover.

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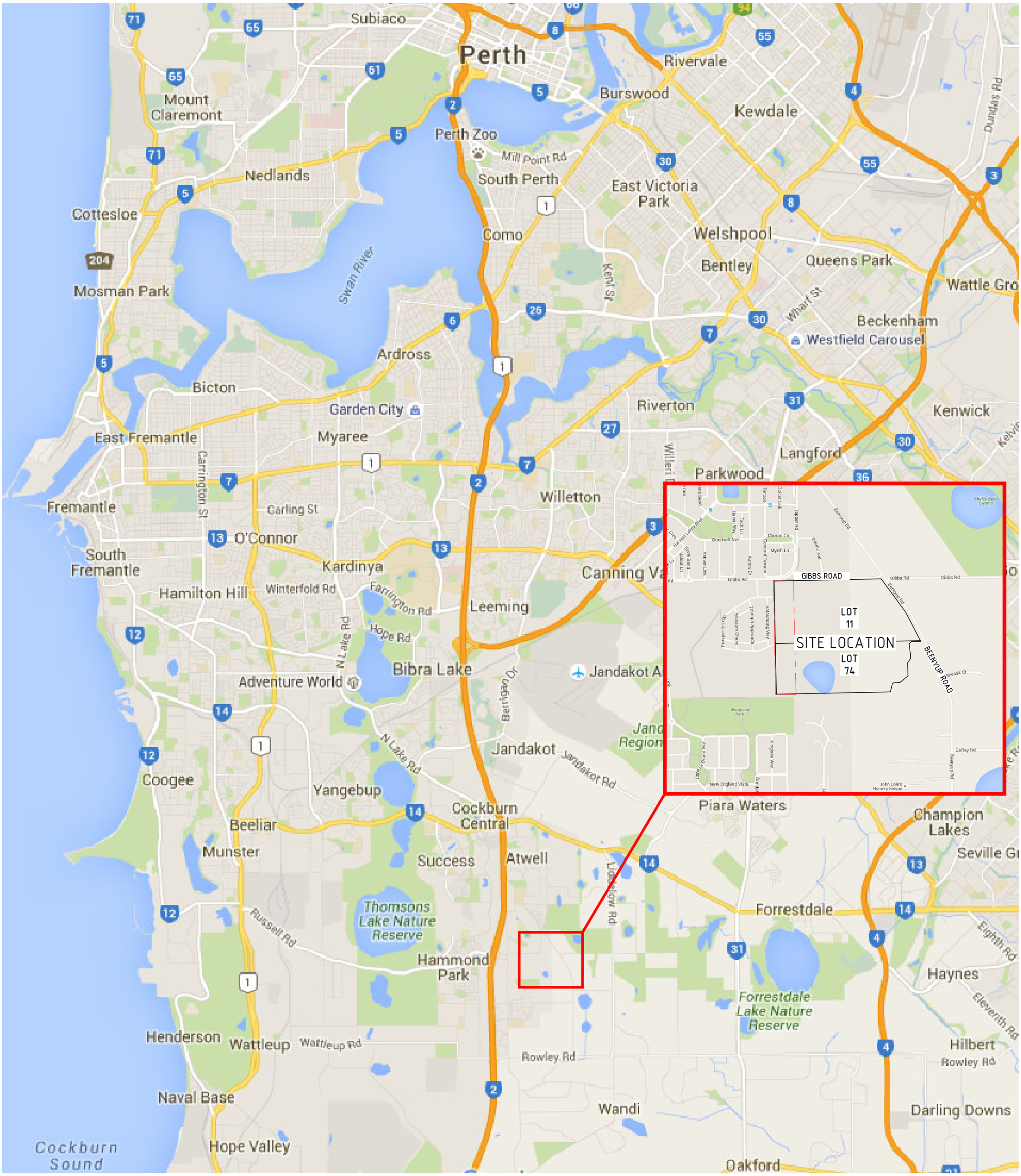

PROJECT LWMS LOTS 11 & 74 BEENYUP ROAD, BANJUP.

FIGURE FIGURE 1

TITLE LOCALITY PLAN

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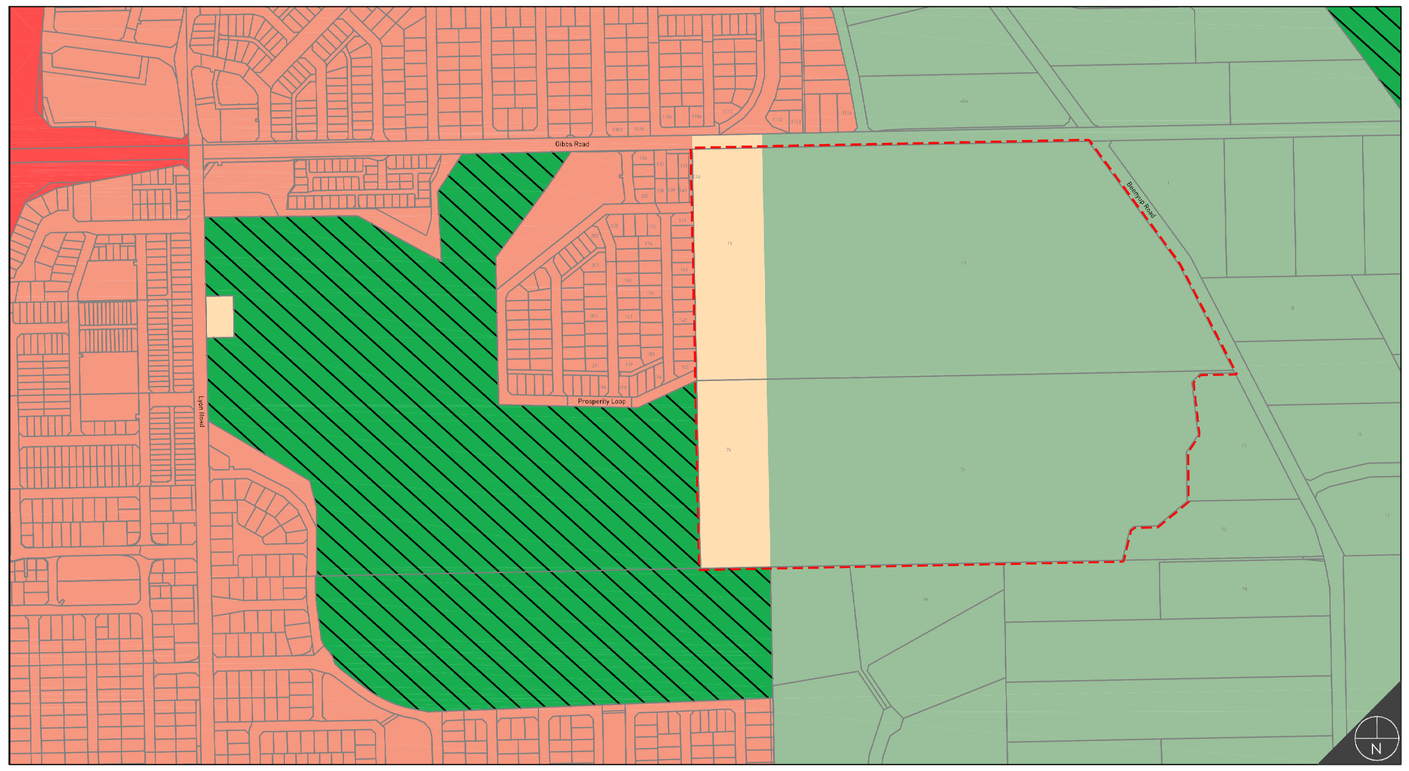
Metropolitan Region Scheme Amendment



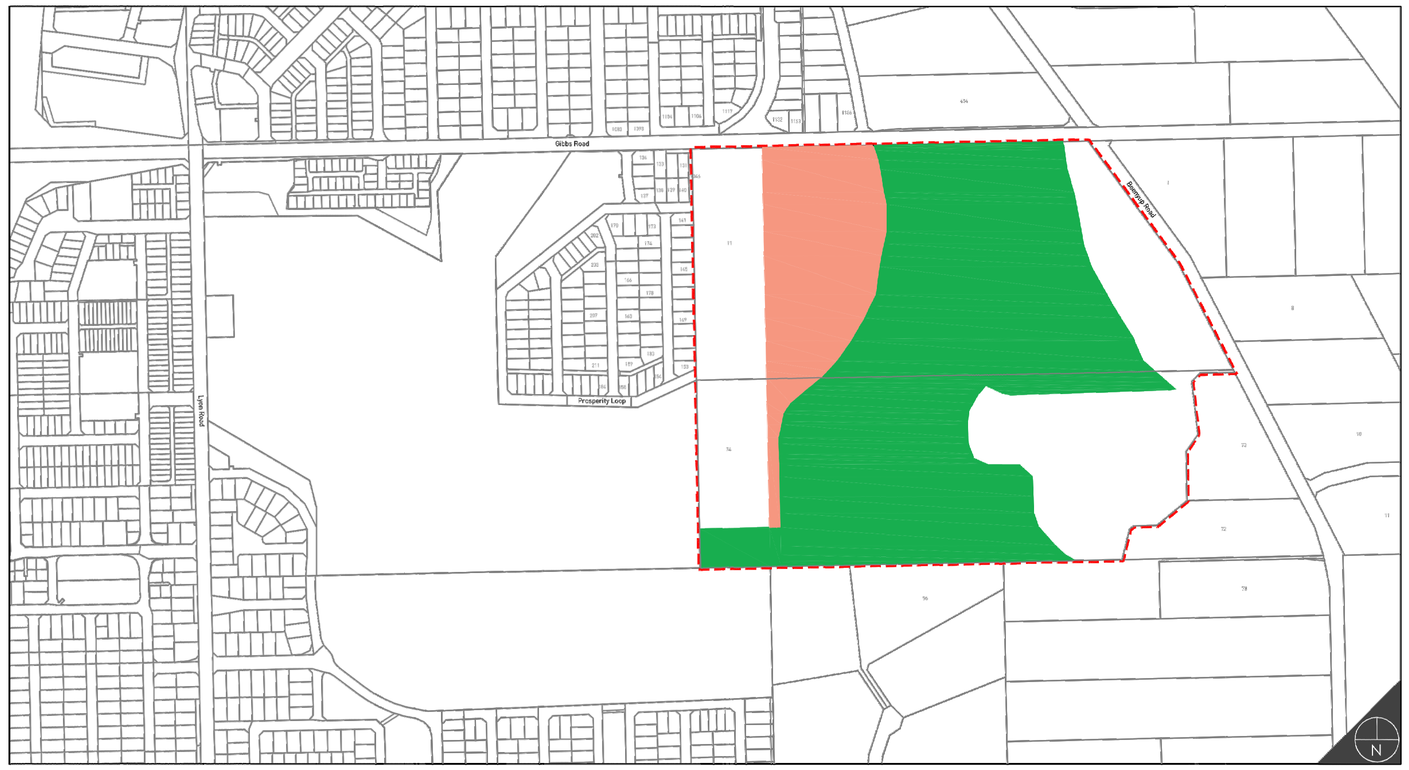
LEGEND
- Subject Site
- 7 Existing Lot Numbers
- Existing Boundaries

RESERVED LANDS
- Parks and Recreation

ZONES
- Rural - Water Protection
- Urban
- Urban Deferred

Notice of Delegation
- Bush Forever Area

Existing Zoning



LEGEND
- Subject Site
- 7 Existing Lot Numbers
- Existing Boundaries

RESERVED LANDS
- Parks and Recreation

ZONES
- Urban

Proposed Zoning

0 250 500 Metres @ A3

N:\TOWN PLANNING\4000-4999\4080\DRAFTING\A-CAD\4080_FIG13B_20170324 BANJUP (MRS REZONING).DWG
Matt Sullivan 24 March 2017

Plan ID: 4080_FIG13B_20170324 BANJUP (MRS REZONING).DWG

PROJECT LWMS LOTS 11 & 74 BEENYUP ROAD, BANJUP.
FIGURE FIGURE 2
TITLE ZONING
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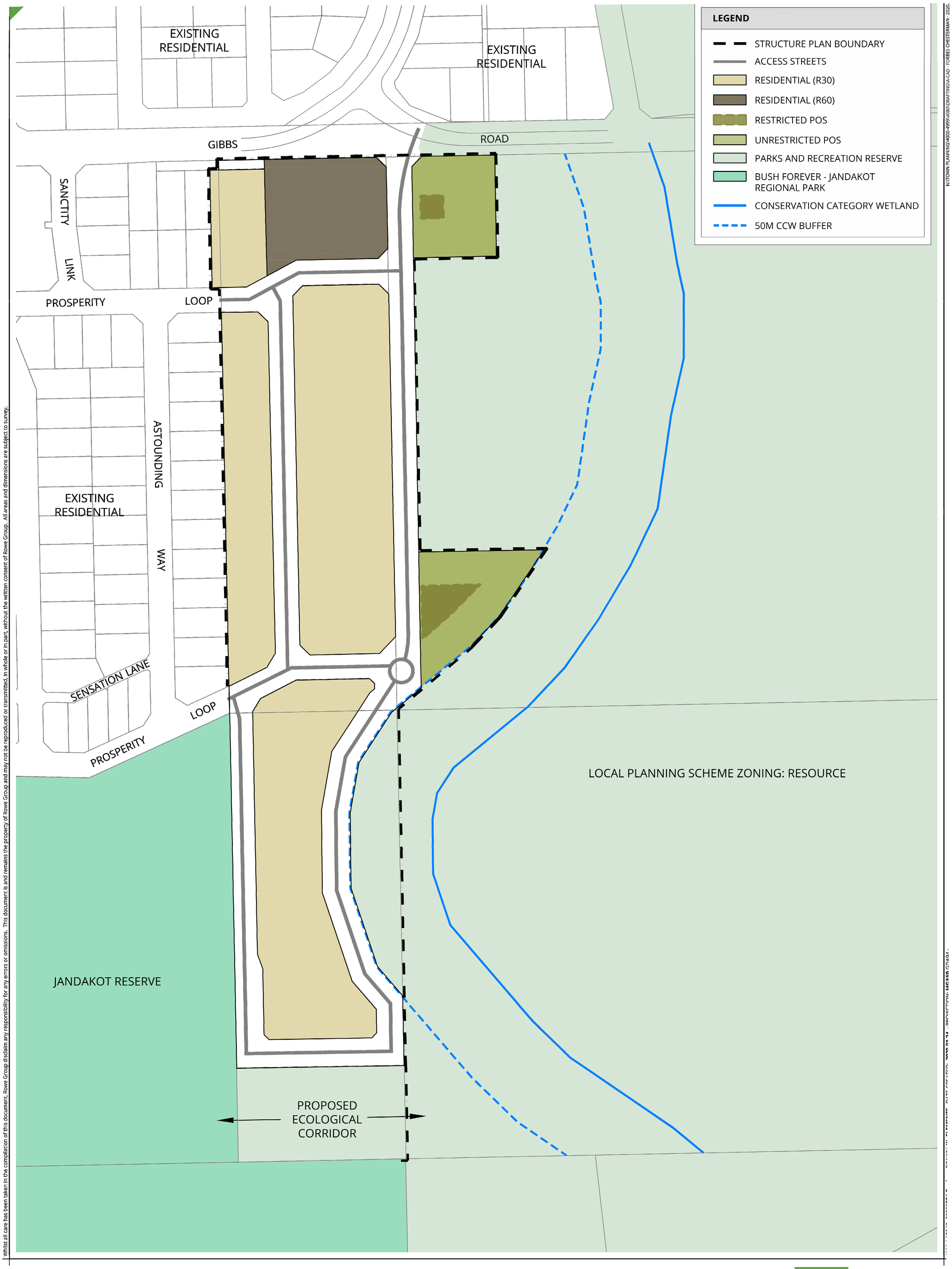

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LOCAL STRUCTURE PLAN

LOT 11 AND LOT 74 GIBBS ROAD
BANJUP

NORTH

0 50 m
SCALE @ A3: 1:2000

4080-LSP-04-D

ROWE GROUP DESIGN

PROJECT LWMS LOTS 11 & 74 BEENYUP ROAD, BANJUP.
FIGURE FIGURE 3
TITLE INDICATIVE STRUCTURE PLAN
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PROJECT LWMS LOTS 11 & 74 BEENYUP ROAD, BANJUP.

FIGURE FIGURE 4

TITLE PRELIMINARY DEVELOPMENT PLAN

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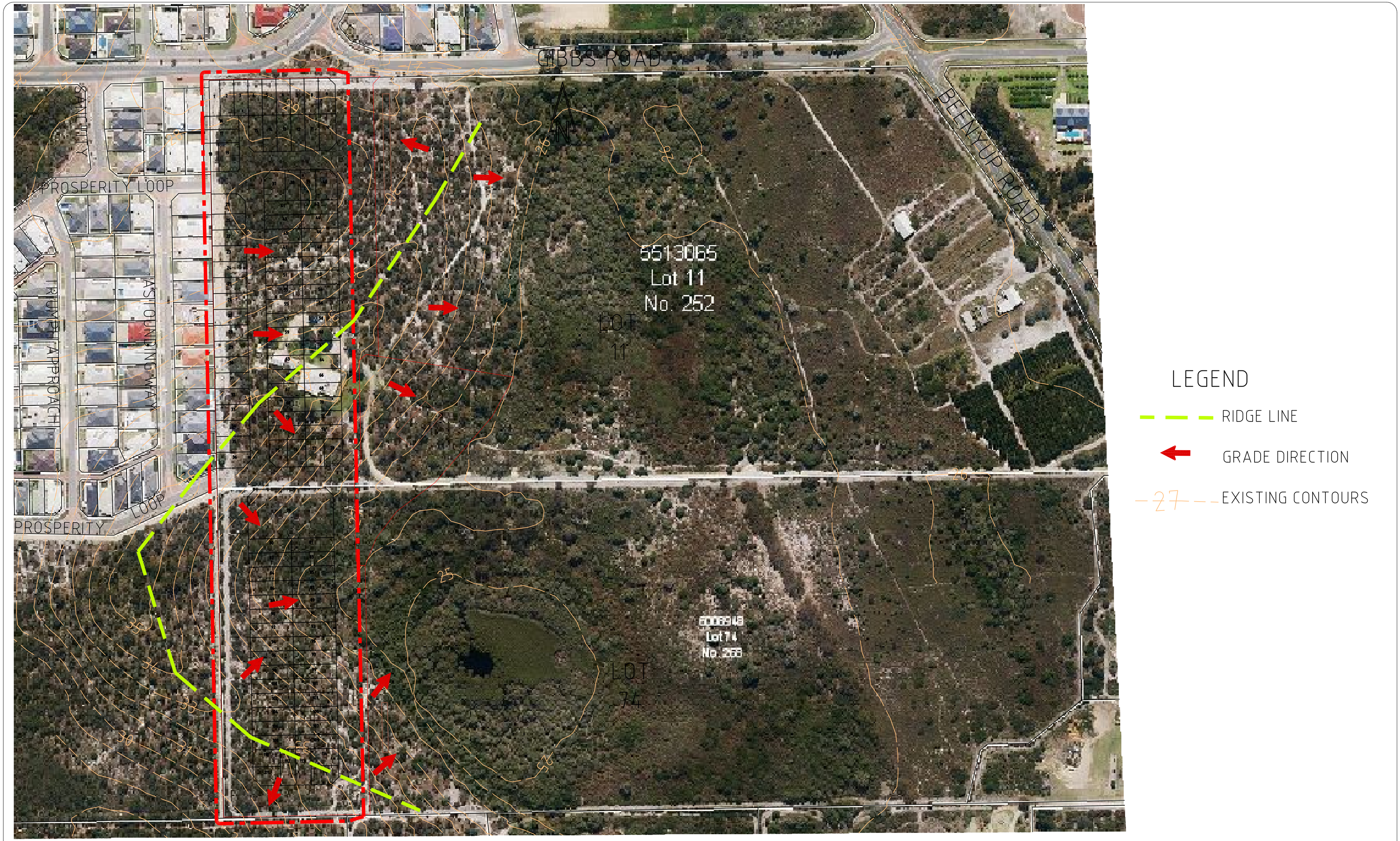

PROJECT LWS LOTS 11 & 74 BEENYUP ROAD, BANJUP.

FIGURE FIGURE 5

TITLE TOPOGRAPHY

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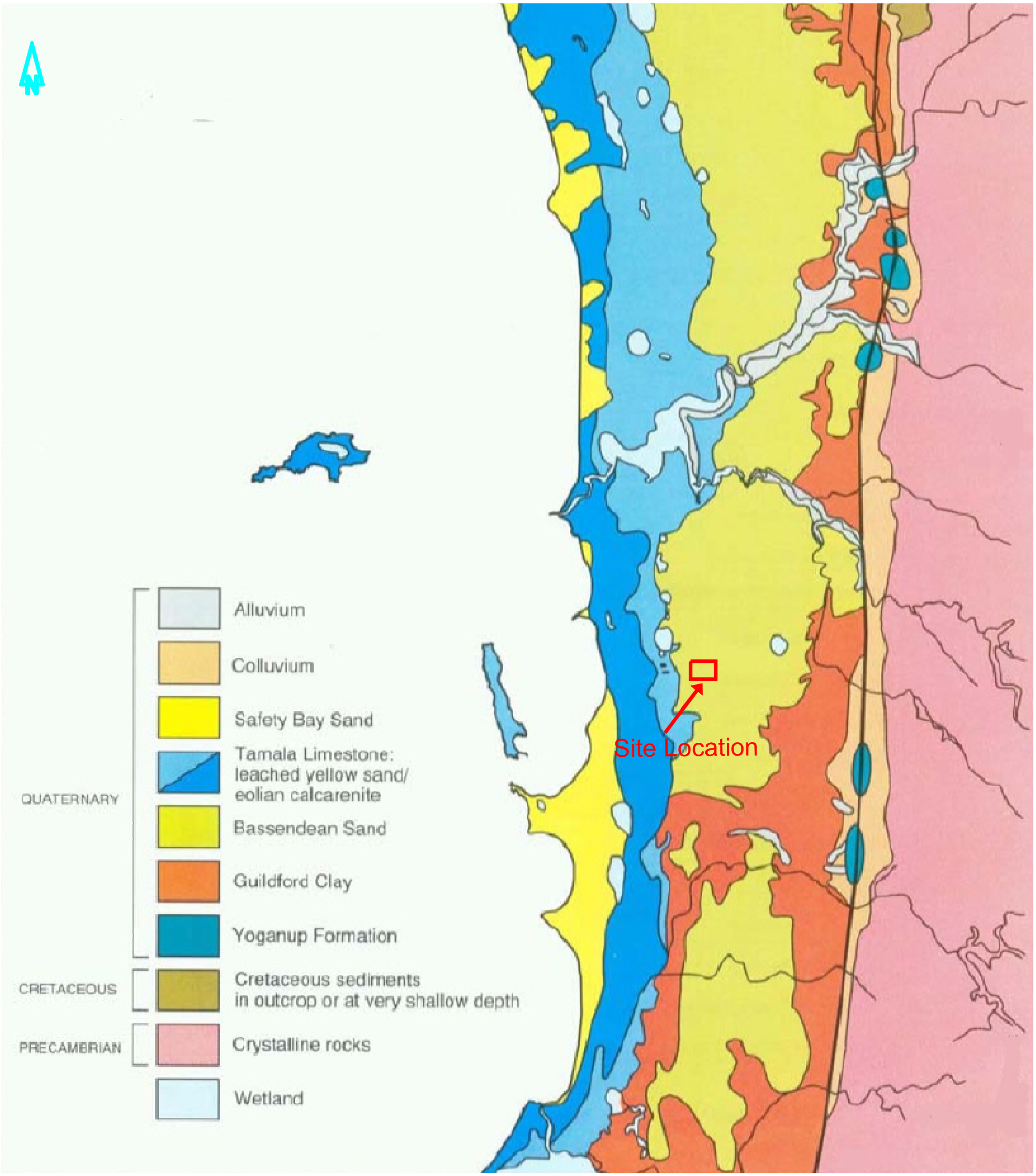

PROJECT LWMS LOTS 11 & 74 BEENYUP ROAD, BANJUP.

FIGURE FIGURE 6

TITLE GEOLOGICAL MAPPING

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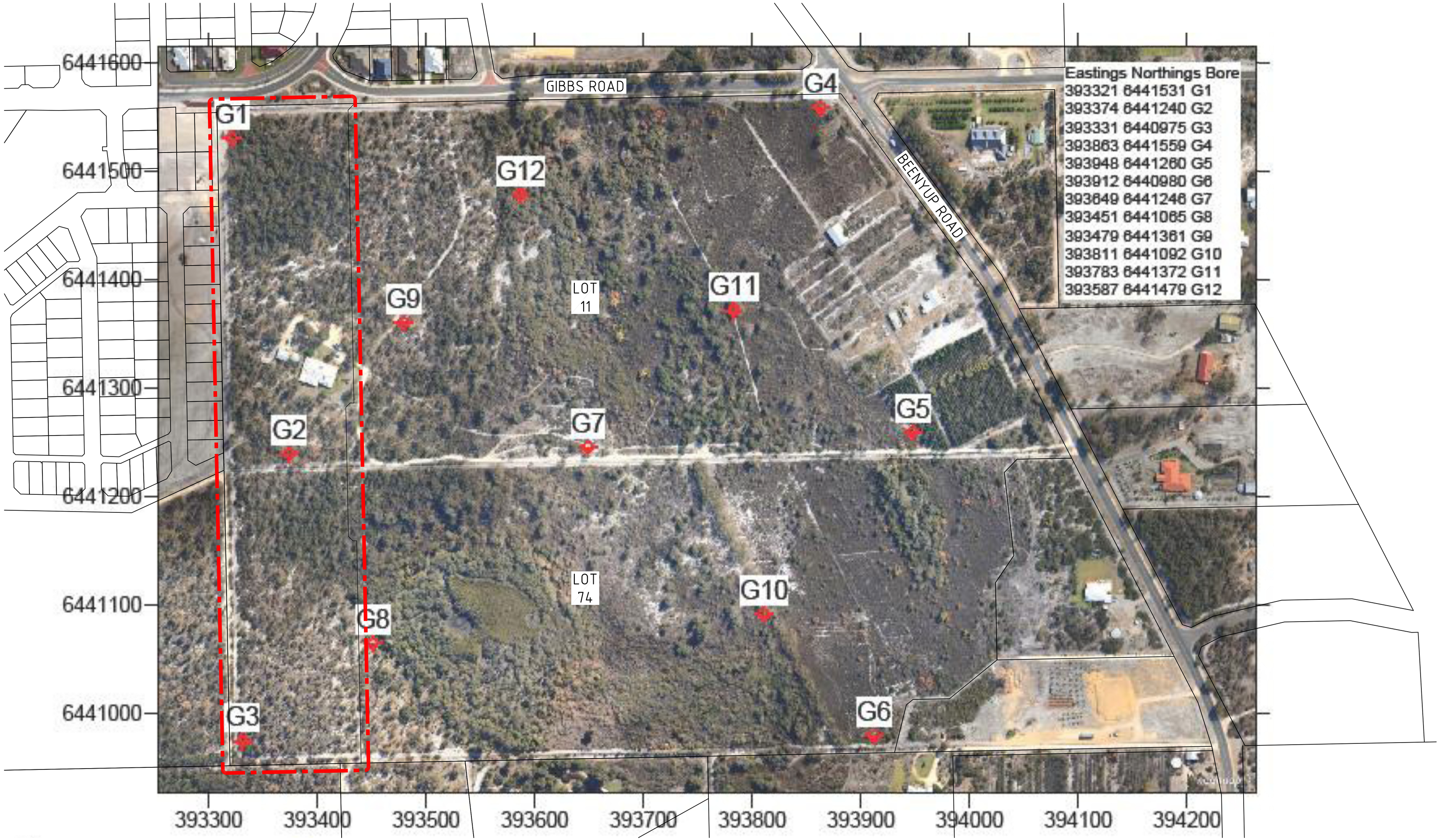

PROJECT LWMS LOTS 11 & 74 BEENYUP ROAD, BANJUP.

FIGURE FIGURE 7

TITLE MONITORING BORE LOCATIONS

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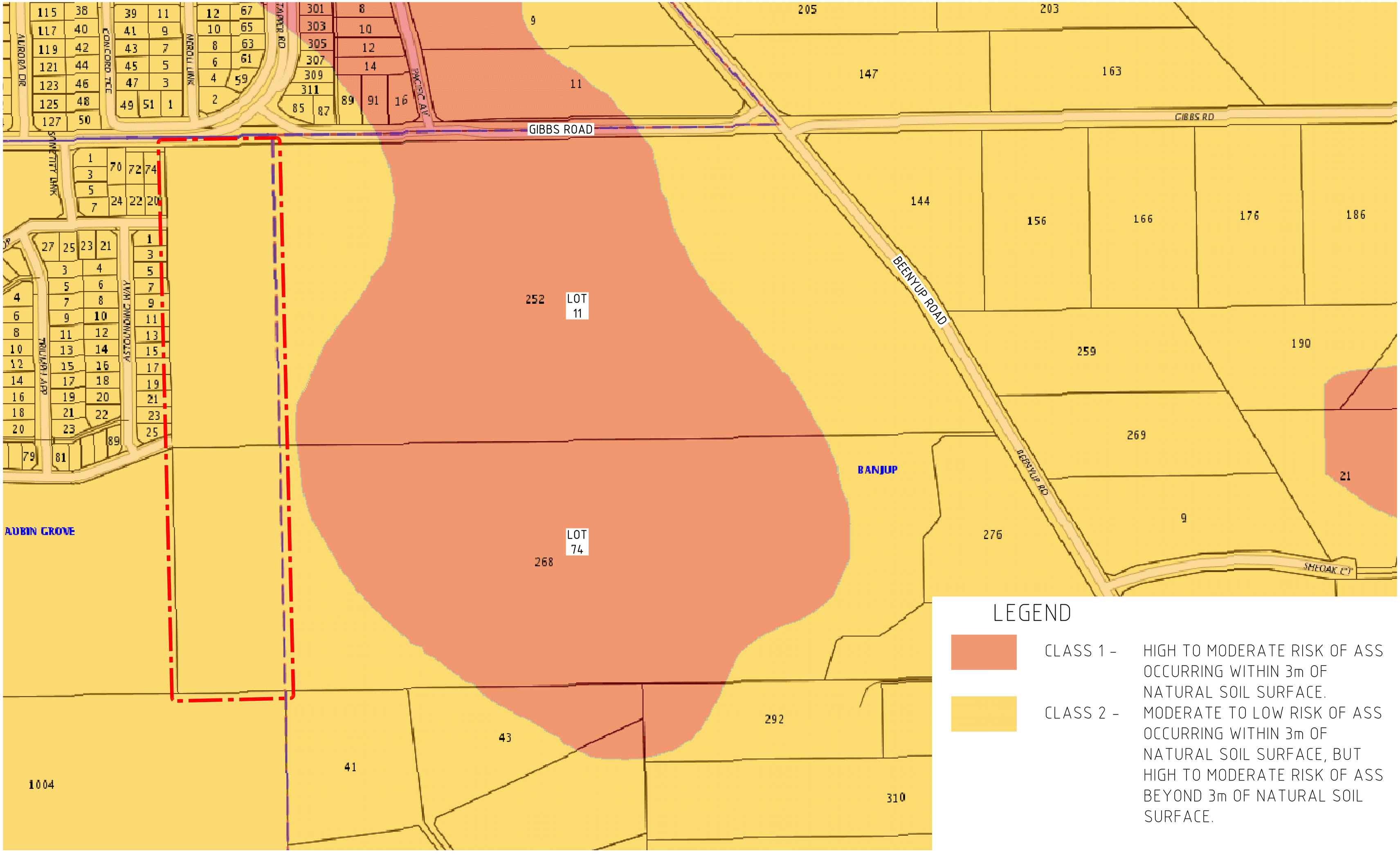

LEGEND

- CLASS 1 – HIGH TO MODERATE RISK OF ASS OCCURRING WITHIN 3m OF NATURAL SOIL SURFACE.
- CLASS 2 – MODERATE TO LOW RISK OF ASS OCCURRING WITHIN 3m OF NATURAL SOIL SURFACE, BUT HIGH TO MODERATE RISK OF ASS BEYOND 3m OF NATURAL SOIL SURFACE.

PROJECT LWMS LOTS 11 & 74 BEENYUP ROAD, BANJUP.

FIGURE FIGURE 8

TITLE ACID SULPHATE SOIL RISK

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PROJECT LMS LOTS 11 & 74 BEENYUP ROAD, BANJUP.

FIGURE FIGURE 10

TITLE CONTROLLED GROUNDWATER LEVELS

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PROJECT LMS LOTS 11 & 74 BEENYUP ROAD, BANJUP.

FIGURE FIGURE 10

TITLE CONTROLLED GROUNDWATER LEVELS

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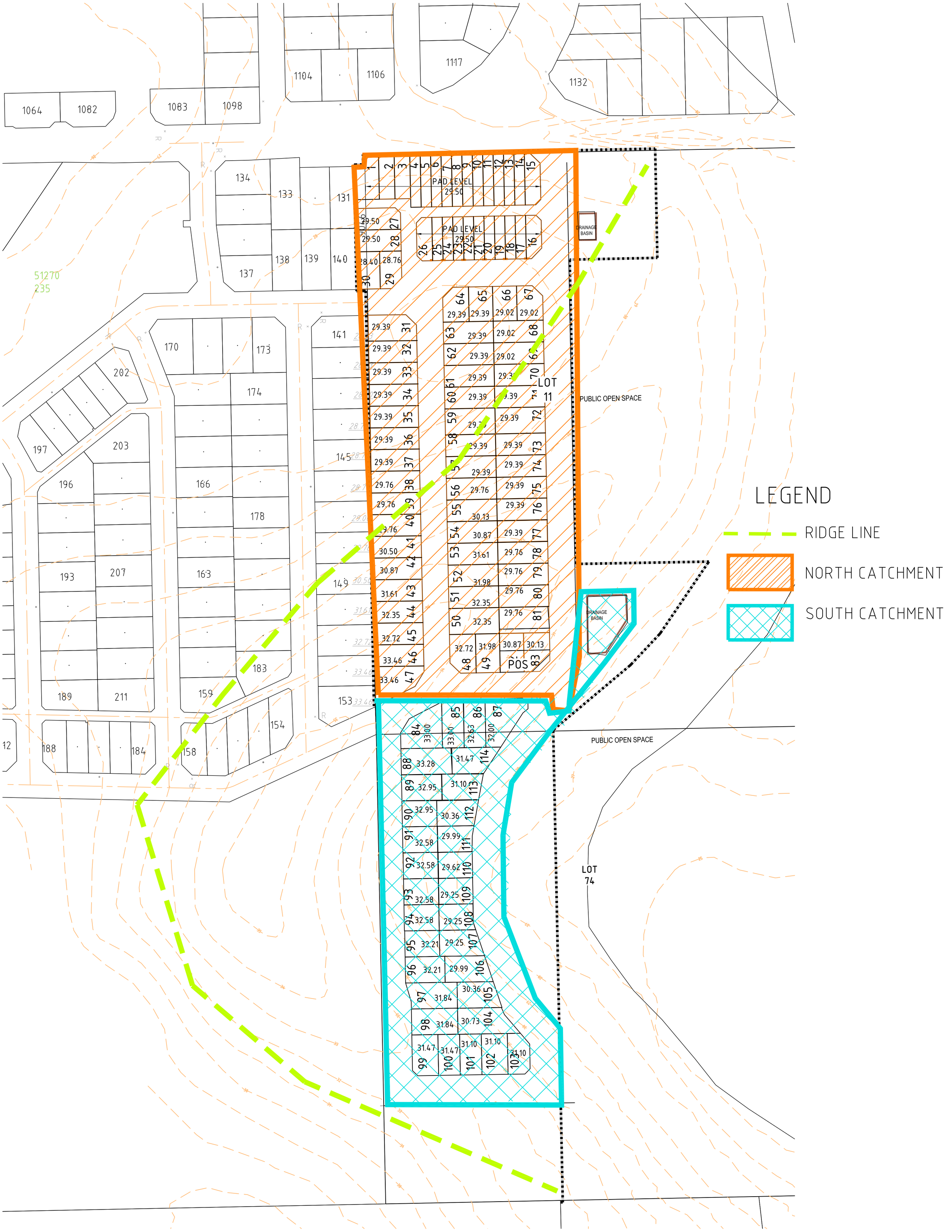

PROJECT LMS LOTS 11 & 74 BEENYUP ROAD, BANJUP.

FIGURE FIGURE 11

TITLE DRAINAGE CATCHMENT PLAN

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Appendix A – GEOTECHNICAL REPORT (Bioscience, 2012)

Bioscience PTY LTD
488 Nicholson Rd Forrestdale WA 6112
TELEPHONE (08) 93972446
EMAIL bioscience@biosciencewa.com

GEOTECHNICAL REPORT
Lots 252 & 268 Beenyup Rd
Banjup

This report describes the geotechnical investigations undertaken by Bioscience Pty Ltd for a proposed residential development at Lots 252 and 268 Beenyup Road, Banjup, WA.
The aim of the investigation was to assess the subsurface soil, groundwater level, permeability and acid sulfate of soil across the site and thus:

- Determine the suitability of the site to support the proposed development.
- Provide recommendations on site preparation and earthworks, so as to allow the proposed development.
- Assess the groundwater level beneath the site at the time of the field work, if encountered.
- Assess the permeability of the soils across the site and provide comments on suitable stormwater disposal and site drainage.
- Assess the risk of acid sulphate soils beneath the site based upon readily available desktop information and sampling and analysis.

The investigation included the drilling of twelve piezometers, and laboratory testing of selected samples. The details of the field work are presented in this report, together with comments and recommendations on the issues listed above.

The site comprises a rectangular shaped area of approximately 44.8 ha, identified as Lots 252 and 268 Beenyap Street in Banjup, Western Australia. It is bounded by Gibbs Rd to the north, Beenyup Rd to the east and neighbouring properties to the west and south.
At the time of investigation, the site was mostly covered by native bush and trees. There was a wetland area in middle of the both lots, covered by shallow water. There were three empty

sheds in the east side, and a residual house in the west side of lot 252. A gravel road in the middle of the site separates lot 252 and 268.

The geology at the site as per the Geological Survey of Western Australia 1:50000 Environmental Geological Series FREMANTLE Map Sheets 2033 I and 2033 IV are either:

- S8 – SAND – Very light grey at surface, yellow at depth, fine to medium grained, sub-rounded quartz, moderately well sorted, of eolian origin. (Bassendean Sand).
- S10 – SAND – as S8 as relatively thin veneer over strong, blocky, brown silts and clay (Bassendean Sand over Guildford Formation).
- Ms_5 - SANDY SILT-dark brownish grey silt, with disseminated fine-grained quartz sand, firm, variable clay content, of lacustrine origin (Swamp deposits)

The Perth Groundwater Atlas (2004) shows the site has a natural surface contour of 26 - 28 m AHD and groundwater contour of 24 - 25 m AHD (May 2003).

In September 2011 twelve piezometers (G1 to G12) were installed in the site by Edge Drilling to monitor groundwater level fluctuation and its flow regime, as well as investigating the sub-soil characteristics and collect representative samples for laboratory testing.
The test pits (G1 to G12) were excavated to a maximum depth of 9 m using a mechanical Hollow Stem auger. Test pit locations are shown in Figure 1. Each test pit was logged in general accordance with test procedure AS 1726–1993 by a suitably experienced representative from Bioscience. Soil samples were recovered from selected locations for Particle Size Distribution and acid sulfate testing in laboratory. These soil samples were placed in air tight sample bags and chilled in insulated coolers. Soil samples remained in cooled storage during transport to the laboratory.

In general, the sub-ground strata in the site are, sandy black topsoil overlaying a white/grey/brown, medium, sub-angular sand layer, down to a depth of 9 m below ground level. In some bores a dark brown, non-cemented coffee rock was observed.
In the bore 12, a dark brown loamy sand layer (1.5 - 3 m bGL) overlying a brown silty/clay sand layer (3 - 4 m bGL).

Particle Size Distribution test

PSD test was conducted on 16 selected samples from different bores and depth in the area. Almost all the samples are in medium sand fraction range on the graph (Figure 2).

Permeability value

Although neither field or laboratory test was conducted to determine permeability values directly, however PSD test results can provide a reliable indirect permeability value for the area. Generally medium sand fraction soils have a permeability value of 10^{-4} to 10^{-2} (m/s). Such soils are suitable for stormwater infiltration and open drains. In further stage of the project more detailed analysis might be required to verify more accurate permeability values.

Acid Sulfate

Perth Groundwater Atlas classified the area as high to moderate risk of ASS, that means ASS might be occur at a depth lower than 3 m.

Soils recovered from test pits were subjected to analysis to determine the likelihood of acid sulfate soils being present, and thus any requirement for more detailed investigations as and when development plans are advanced to the point of specifying excavation location and depths. The work involved undertaking "Field pH testing" which is considered a useful, but not completely reliable indicator of PASS and AASS, and laboratory analysis of total sulfur present. The rationale for Total S testing is that DEC guidance set an action threshold which triggers the requirement for management plans when oxidisable sulfur exceeds 0.03%. Bioscience uses a LECO CS200 sulfur analyser to rapidly and reliable determine whether this threshold could be exceeded, which thereby triggers the need for further testing.

A total of 16 soil samples were tested. The results (Figure 3) show that, the reaction with peroxide is very low in 14 samples and moderate in two samples (G12, 2-3 m & 4-5 m). Also the reduction in peroxide pH is very minor. The 0.03% sulfur threshold was exceeded in half of the samples, G3,G5, G10 (0-1 m &1-2m), G11 (0-1m & 1-2m), G12 (2-3m & 4-5m).

Results:

The majority of soils encountered were sands of the Bassendean Formation (see PSD graph).

The results of this assessment indicate that the site can be classified as 'Class A' in accordance with AS 2870-1996, provided site preparation is carried out as detailed in Section 8.2. It is emphasised that the given classification will need reassessment if bulk earthworks for the proposed development include cutting the site.

According the geotechnical investigation results the following site preparation procedure is recommended:

- Identification and diversion or protection of any buried services within the work areas.
- Removal of topsoil, organics, roots, old services, rubbish and any other deleterious material from the site.
- Any clay layer underlying the top soil in the Lots should be removed and refilled by suitable fill material.
- Proof compact the exposed surface using a suitable compaction plant.
- Where the surface deforms excessively during compaction or wet and/or week material is exposed, over-excavation and replacement with compacted few draining sand fill may be required.
- Confirm that adequate compaction is achieved as outlined below.
- Place and compact approved clean free draining fill material in layers of no greater than 0.3m thickness, up to the level required.

Limitations

Bioscience Pty Ltd has prepared this report for a project at Lots 252 & 268 Beenyup Road, in Banjup, WA. The work was carried out under Bioscience's Conditions of Engagement. This report is provided for the exclusive use of Miluc Pty Ltd for this project only and for the purposes described in the report. It should not be used by or relied upon for other projects or purposes on the same or other site or by a third party. In preparing this report Bioscience has necessarily relied upon information provided by the client and/or their agents.

The results provided in the report are indicative of the sub-surface conditions only at the specific sampling or testing locations, and then only to the depths investigated and at the time the work was carried out. Sub-surface conditions can change abruptly due to variable geological processes and also as a result of anthropogenic influences. Such changes may occur after Bioscience's field testing has been completed.

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Azin Kusari BE(civil) MEng.St

13 October 201

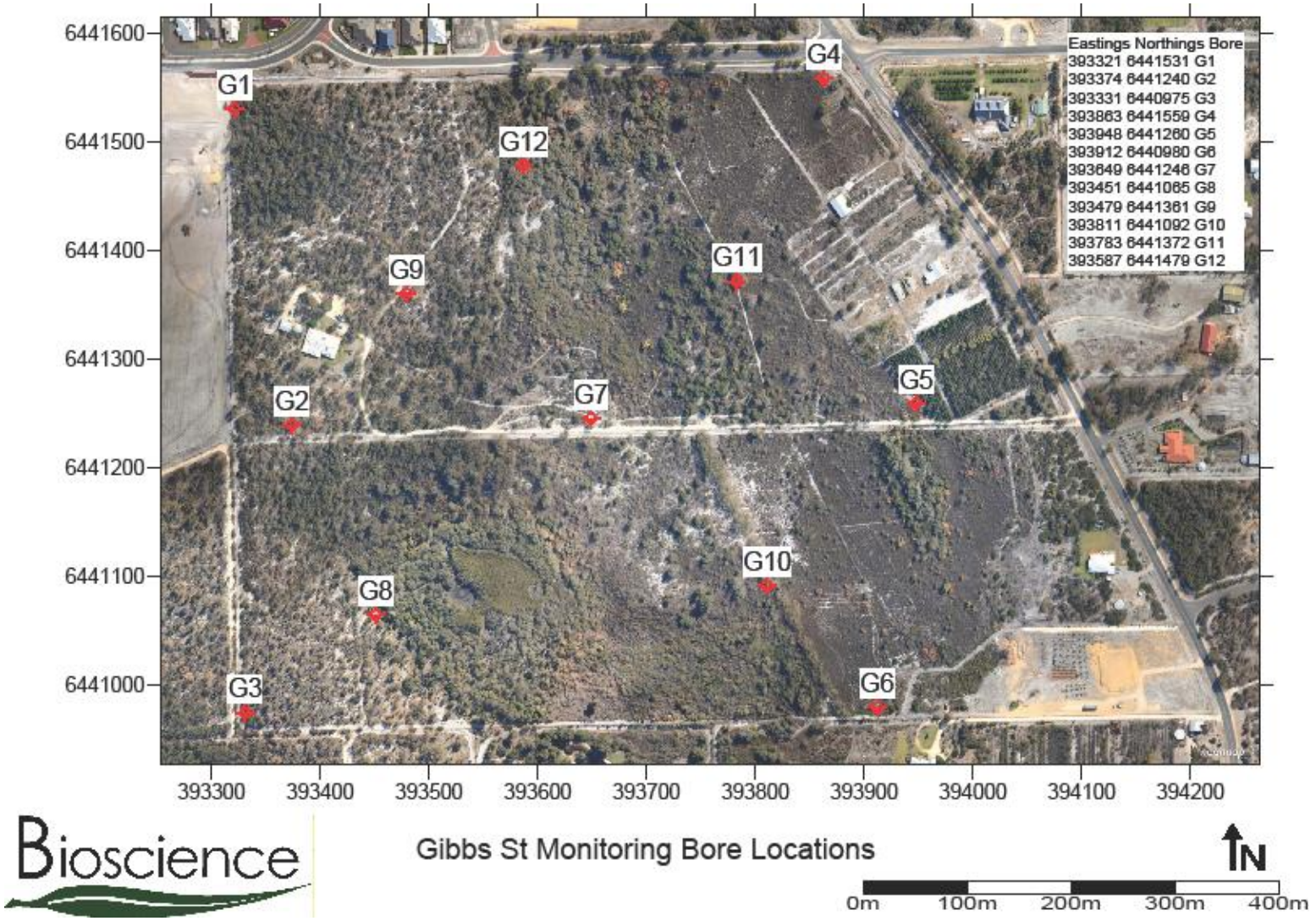

Figure 1: Lots 252 &268

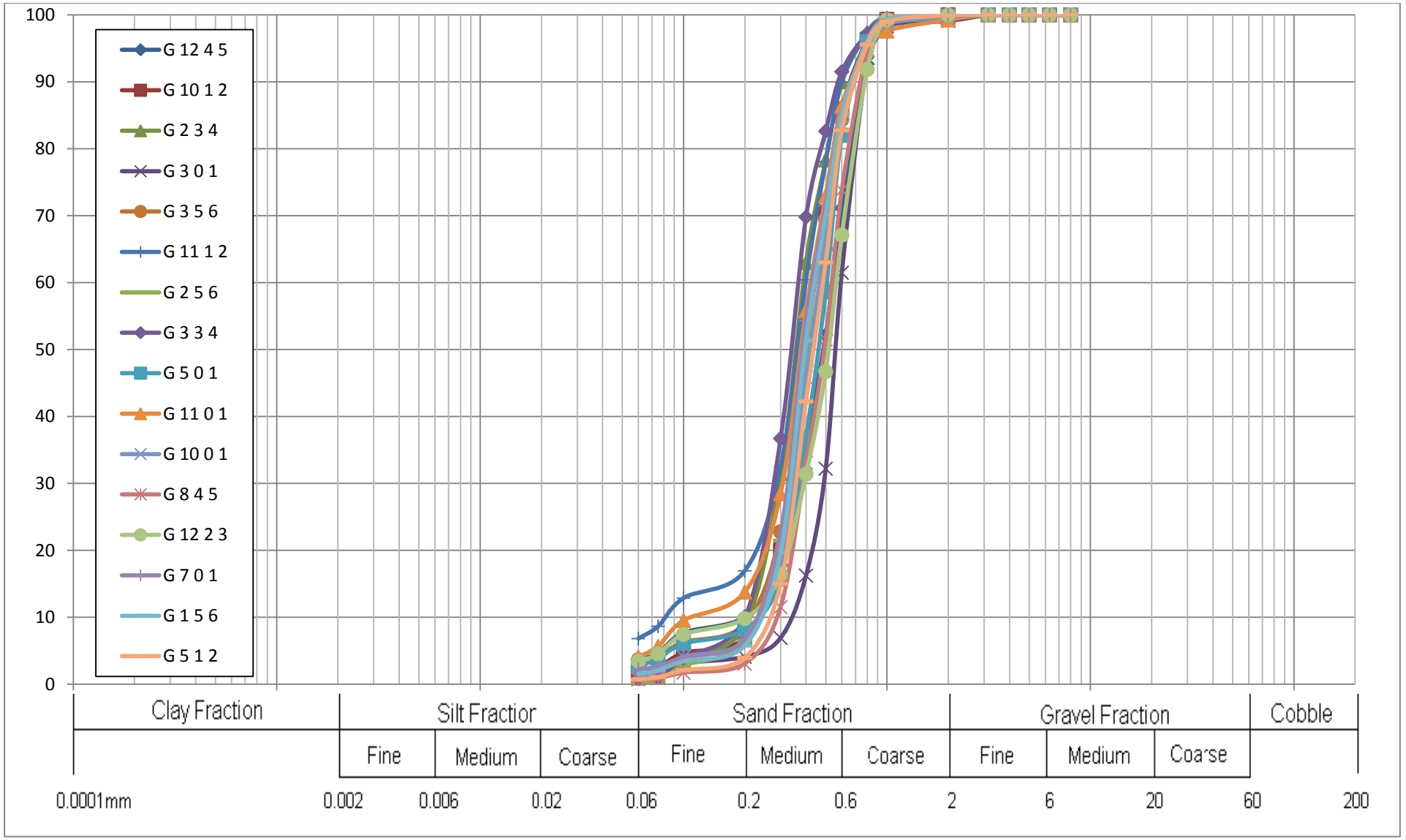

Figure 2: Particle Size Distribution graph for selected locations and depths

Sample	Depth (m)	pH (H_2O)	pH (H_2O_2)	ΔpH	Reactivity	Carbon (%)	Sulphur (%)	Soil Profile Description
G1	5-6	4.30	3.85	0.45	Low	0.3275	0.00616	Dark brown SM
G2	5-6	4.97	3.97	1.00	Low	0.00781	-0.00495	White SP
G3	0-1	4.07	3.11	0.96	Low	6.088	0.03993	Dark Pt
G3	5-6	4.06	3.21	0.85	Low	1.124	0.00141	Dark Pt
G4	3-4	5.45	4.88	0.57	Low	0.09266	-0.00321	Light brown SP
G5	0-1	3.93	3.05	0.88	Low	2.936	0.00473	Dark Pt
G5	1-2	4.44	2.91	1.53	Low	7.161	0.06979	Brown ML
G6	3-4	4.46	3.74	0.72	Low	0.1080	-0.00435	Brown ML
G7	0-1	3.05	1.62	1.43	Low	0.1847	0.00311	Dark brown SM
G8	4-5	5.27	3.81	1.46	Low	0.05981	-0.000339	Light brown SP
G10	0-1	4.33	3.03	1.3	Low	2.043	0.08251	Brown SP
G10	1-2	4.29	3.55	0.74	Low	1.149	0.04552	Dark brown SM
G11	0-1	3.52	2.96	0.56	Low	10.56	0.1915	Dark Pt
G11	1-2	3.47	2.86	0.61	Low	10.04	0.1512	Brown OL
G12	2-3	4.00	2.89	1.11	Medium	0.3488	0.04274	Dark brown SC
G12	4-5	5.08	3.57	1.51	Medium	0.2479	0.06008	Dark brown SC

Figure 3: Hydrogen peroxide test for acid sulphate soils

Appendix A: Bore Profiles

Investigator/s:	AK	**Date:**	12/09/2011	**Notes:**	WT between 3 to 3.75 m
Client:		**Photo No:**			bGL
Location:	Gibbs Rd, Banjup	**Eastings/Long:**	393321		
Site No:	G 1	**Northings/Lat:**	6441531		

Depth (mm)		Type	Colour	Grade	Shape	Condition	Consistency	Structure	Organic / Fill / Waste	Cobble (%)	Gravel (%)	Sand (%)	Silt/Clay (%)
To	From									>6.3mm	>2mm	<2mm	<0.075
0	750	Sandy top soil	Grey/Black	Medium		Moist	Non-cohesive	Layer	-				
750	1500	Sand	White mottled grey	Medium		Moist	Non-cohesive	Layer	-				
1500	3750	Sand	White	Medium		Moist	Non-cohesive	Layer	-				
3750	6000	Sand	Yellow	Medium		Moist	Non-cohesive	Layer	-				

Investigator/s:	AK	**Date:**	12/09/2011	**Notes:**	WT at 6.75m
Client:		**Photo No:**			bGL
Location:	Gibbs Rd, Banjup	**Eastings/Long:**	393374		
Site No:	G 2	**Northings/Lat:**	6441240		

Depth (mm)		Type	Colour	Grade	Shape	Condition	Consistency	Structure	Organic / Fill / Waste	Cobble (%)	Gravel (%)	Sand (%)	Silt/Clay (%)
To	From									>6.3mm	>2mm	<2mm	<0.075
0	1000	Sand	Grey/black	Medium		Moist	Non-cohesive	Layer					
1000	8000	Sand	white	Medium		Moist	Non-cohesive	Layer					
8000	9000	Sand	Yellow	Medium		Moist	Non-cohesive	Layer					

Investigator/s: AK | **Date:** 12/09/2011 | **Notes:** WT at 5.6m Coffee rock is not

Client: | **Photo No:** | bGL cemented

Location: Gibbs Rd, Banjup | **Eastings/Long:** 393331

Site No: G3 | **Northings/Lat:** 6440975

Depth (mm)		Type	Colour	Grade	Shape	Condition	Consistency	Structure	Organic / Fill / Waste	Cobble (%)	Gravel (%)	Sand (%)	Silt/Clay (%)
To	From									>6.3mm	>2mm	<2mm	<0.075
0	1200	Peaty top soil	black			Moist	Non-cohesive	Layer	Organic mat.				
1200	2000	Sand	White mottled grey	Medium		Moist	Non-cohesive	Layer					
2000	5000	Sand	White	Medium		Moist	Non-cohesive	Layer					
5000	8000	Sandy coffee rock	Dark brown	Medium		Moist	Non-cemented	Layer					

Investigator/s: AK | **Date:** 09/09/2011 | **Notes:** WT at 1.5 m

Client: | **Photo No:** | bGL

Location: Gibbs Rd, Banjup | **Eastings/Long:** 393863

Site No: G4 | **Northings/Lat:** 6441559

Depth (mm)		Type	Colour	Grade	Shape	Condition	Consistency	Structure	Organic / Fill / Waste	Cobble (%)	Gravel (%)	Sand (%)	Silt/Clay (%)
To	From									>6.3mm	>2mm	<2mm	<0.075
0	100	Sandy top soil	Grey/ black	Medium		Moist	Non-cohesive	Layer	-				
100	750	Sand	Black	Medium		Moist	Non-cohesive	Layer	-				
750	1500	Sand	Black/white	Medium		Moist	Non-cohesive	Layer	-				
1500	2250	Sand	White/Grey	Medium		Moist	Non-cohesive	Layer	-				
2250	4000	Sand	White/Grey	Medium		Wet	Non-cohesive	Layer	-				

Investigator/s:	PK	**Date:**	10/09/2011	**Notes:**	WT at 1.5 m bGL
Client:		**Photo No:**			
Location:	Gibbs Rd, Banjup	**Eastings/Long:**	393948		
Site No:	G5	**Northings/Lat:**	6441260		

Depth (mm)		Type	Colour	Grade	Shape	Condition	Consistency	Structure	Organic / Fill / Waste	Cobble (%)	Gravel (%)	Sand (%)	Silt/Clay (%)
To	From									>6.3mm	>2mm	<2mm	<0.075
0	310	Silty top soil	Black	Medium		Dry	cohesive	Layer					
310	1500	Sand	White/brown	Medium		Moist	Non-cohesive	Layer					
1500	3000	Sand	Brown	Medium		Wet	Non-cohesive	Layer					
3000	4000	Sand	Grey	Medium		Wet	Non-cohesive	Layer					

Investigator/s:	AK	**Date:**	12/09/2011	**Notes:**	WT at 1.5 m bGL Coffee rock is not cemented
Client:		**Photo No:**			
Location:	Gibbs Rd, Banjup	**Eastings/Long:**	393912		
Site No:	G6	**Northings/Lat:**	6440980		

Depth (mm)		Type	Colour	Grade	Shape	Condition	Consistency	Structure	Organic / Fill / Waste	Cobble (%)	Gravel (%)	Sand (%)	Silt/Clay (%)
To	From									>6.3mm	>2mm	<2mm	<0.075
0	900	Sandy Top soil	black	Medium		Moist	Non-cohesive	Layer					
900	2000	Sand	White	Medium		Moist	Non-cohesive	Layer					
2000	4000	Sandy coffee rock	Dark Brown	Medium		Moist	Non-cohesive	Layer					

Investigator/s: PK **Date:** 10/09/2011 **Notes:** WT at 1.3m

Client: **Photo No:** bGL

Location: Gibbs Rd, Banjup **Eastings/Long:** 393649

Site No: G7 **Northings/Lat:** 6441246

Depth (mm)		Type	Colour	Grade	Shape	Condition	Consistency	Structure	Organic / Fill / Waste	Cobble (%)	Gravel (%)	Sand (%)	Silt/Clay (%)
To	From									>6.3mm	>2mm	<2mm	<0.075
0	220	Sandy Top soil	Black	Medium		Moist	Non-cohesive	Layer					
220	2800	Sand	Brown	Medium		Moist	Non-cohesive	Layer					
2800	4100	Sand	Brown	Medium		Wet	Non-cohesive	Layer					

Investigator/s: AK **Date:** 12/09/2011 **Notes:** WT at 2.7m bGL

Client: **Photo No:**

Location: Gibbs Rd, Banjup **Eastings/Long:** 393451

Site No: G8 **Northings/Lat:** 6441065

Depth (mm)		Type	Colour	Grade	Shape	Condition	Consistency	Structure	Organic / Fill / Waste	Cobble (%)	Gravel (%)	Sand (%)	Silt/Clay (%)
To	From									>6.3mm	>2mm	<2mm	<0.075
0	1500	Sandy Top soil	Black	Medium		Moist	Non-cohesive	Layer					
1500	5500	Sand	White	Medium		Moist	Non-cohesive	Layer					

Investigator/s:	AK	**Date:**	12/09/2011	**Notes:**	WT at 5.8 m bGL
Client:		**Photo No:**			
Location:	Gibbs Rd, Banjup	**Eastings/Long:**	393479		
Site No:	G9	**Northings/Lat:**	6441361		

Depth (mm)		Type	Colour	Grade	Shape	Condition	Consistency	Structure	Organic / Fill / Waste	Cobble (%)	Gravel (%)	Sand (%)	Silt/Clay (%)
To	From									>6.3mm	>2mm	<2mm	<0.075
0	800	Sandy Top soil	Black	Medium		Moist	Non-cohesive	Layer					
800	8000	Sand	White	Medium		Moist	Non-cohesive	Layer					

Investigator/s:	PK	**Date:**	10/09/2011	**Notes:**	WT at 1.3 m bGL
Client:		**Photo No:**			
Location:	Gibbs Rd, Banjup	**Eastings/Long:**	393811		Ferrous sand is not
Site No:	G10	**Northings/Lat:**	6441097		cemented

Depth (mm)		Type	Colour	Grade	Shape	Condition	Consistency	Structure	Organic / Fill / Waste	Cobble (%)	Gravel (%)	Sand (%)	Silt/Clay (%)
To	From									>6.3mm	>2mm	<2mm	<0.075
0	200	Peaty top soil	Black	Medium		Moist	Non-cohesive	Layer					
200	610	Sand	White	Medium		Moist	Non-cohesive	Layer					
610	750	Ferrous	Brown	Medium		Moist	Non-cohesive	Layer					
750	4000	Sand	Brown	Medium		Wet	Non-cohesive	Layer					

Investigator/s:	PK	**Date:**	10/08/2011	**Notes:**	WT at 1.2m bGL
Client:		**Photo No:**			
Location:	Gibbs Rd, Banjup	**Eastings/Long:**	393783		
Site No:	G11	**Northings/Lat:**	6441372		

Depth (mm)		Type	Colour	Grade	Shape	Condition	Consistency	Structure	Organic / Fill / Waste	Cobble (%)	Gravel (%)	Sand (%)	Silt/Clay (%)
To	From									>6.3mm	>2mm	<2mm	<0.075
0	220	Sandy Top soil	Black	Medium		Moist	Non-cohesive	Layer					
220	600	Sand	White/brown	Medium		Moist	Non-cohesive	Layer					
600	1100	Sand	Brown/ black	Medium		Moist	Non-cohesive	Layer					
1100	1500	Ironstone	Brown	Medium		Dry	Firm	Layer					
1500	4000	Sand	White/grey	Medium		Wet	Non-cohesive	Layer					

Investigator/s:	AK	**Date:**	12/09/2011	**Notes:**	WT at 0.6m bGL
Client:		**Photo No:**			
Location:	Gibbs Rd, Banjup	**Eastings/Long:**	393587		
Site No:	G12	**Northings/Lat:**	6441479		

Depth (mm)		Type	Colour	Grade	Shape	Condition	Consistency	Structure	Organic / Fill / Waste	Cobble (%)	Gravel (%)	Sand (%)	Silt/Clay (%)
To	From									>6.3mm	>2mm	<2mm	<0.075
0	1500	Sand Top soil	Black	Medium		Moist	Non-cohesive	Layer					
1500	3000	Loamy Sand	Dark brown	Medium		Wet	Cohesive	Layer					
3000	4000	Silty Sand	Brown	Medium		Wet	Cohesive	Layer					

Bore	Easting	Northing	Upstick	Surface elevation (mAHD)	Total Depth
G1	393321	6441531	0.79	28.405	6.4
G2	393374	6441240	0.38	31.72	9.1
G3	393331	6440975	0.685	30.293	8.47
G4	393863	6441559	0.59	26.496	4.4
G5	393948	6441260	0.665	26.232	4.6
G6	393912	6440980	0.37	26.48	4.3
G7	393649	6441246	0.55	25.845	4.45
G8	393451	6441065	0.7	27.152	5.1
G9	393479	6441361	0.49	30.818	8.4
G10	393811	6441092	0.535	25.987	4.5
G11	393783	6441372	0.65	26.366	4.5
G12	393587	6441479	0.63	25.752	4.45

mBTOC

Bore	16/09/2011	1/11/2011	4/01/2012	7/03/2012	16/05/2012	5/07/2012	7/09/2012	5/10/2012	4/12/2012	9/01/2013	4/02/2013	22/03/2013	15/05/2013	2/07/2013	21/08/2013	20/09/2013	25/10/2013	21/11/2013	28/02/2014	24/03/2014	30/05/2014	8/08/2014	19/09/2014
G1	3.62	3.417	3.712	4.016	4.036	3.797	3.517	3.478	3.729	3.815	3.973	4.197	4.044	4.075	3.471	3.101	3.129	3.322	3.972	4.124	3.815	3.267	3.19
G2	7.02	6.794	7.097	7.428	7.516	7.281	7.003	6.928	7.155	7.325	7.415	7.626	7.562	7.467	6.957	6.503	6.512	6.744	7.379	7.507	7.33	6.745	6.598
G3	5.972	5.756	6.09	6.437	6.477	6.278	6.013	5.935	6.166	6.315	6.445	6.638	6.566	6.457	6.008	5.502	5.512	5.743	6.392	6.514	6.348	5.769	5.602
G4	1.743	1.758	2.122	2.59	2.508	2.125	1.837	1.86	2.21	2.43	2.698	2.895	2.525	2.653	1.842	1.611	1.637	1.883	2.664	2.8	2.149	1.65	1.546
G5	1.54	1.599	2.03	2.528	2.455	2.066	1.745	1.781	2.14	2.398	2.627	2.816	2.553	2.54	1.72	1.5	1.512	1.762	2.612	2.733	2.182	1.543	1.476
G6	1.653	1.633	2.07	2.49	2.38	2.113	1.81	1.859	2.226	2.418	2.592	2.761	2.507	2.534	1.822	1.55	1.571	1.831	2.553	2.651	2.175	1.661	1.576
G7	1.12	1.205	1.63	2.18	2.164	1.756	1.295	1.374	1.768	2.027	2.238	2.479	2.245	2.142	1.272	1.06	1.097	1.365	2.285	2.43	1.947	1.196	1.14
G8	2.853	2.695	3.014	3.37	3.391	3.186	2.913	2.86	3.1	3.249	3.388	3.562	3.465	3.364	2.916	2.452	2.473	2.676	3.34	3.453	3.251	2.706	2.549
G9	6.065	5.846	6.151	6.469	6.543	6.306	6.027	5.955	6.201	6.335	6.47	6.674	6.601	6.518	5.979	5.55	5.576	5.796	6.433	6.565	6.635	5.75	5.631
G10	1.229	1.315	1.862	2.355	2.187	1.832	1.452	1.52	1.981	2.237	2.432	2.59	2.313	2.243	1.436	1.22	1.244	1.567	2.437	2.532	1.972	1.319	1.264
G11	1.631	1.729	2.233	2.786	2.671	2.207	1.842	1.902	2.328	2.64	2.865	3.05	2.747	2.689	1.82	1.603	1.63	1.941	2.873	2.985	2.325	1.687	1.616
G12	0.995	0.924	1.257	1.7	1.672	1.364	1.041	1.041	1.3	1.438	1.798	2.227	1.72	1.699	1.053	0.662	0.681	0.92	1.729	2.137	1.414	0.809	0.712

mBGL

Bore	16/09/2011	1/11/2011	4/01/2012	7/03/2012	16/05/2012	5/07/2012	7/09/2012	5/10/2012	4/12/2012	9/01/2013	4/02/2013	22/03/2013	15/05/2013	2/07/2013	21/08/2013	20/09/2013	25/10/2013	21/11/2013	28/02/2014	24/03/2014	30/05/2014	8/08/2014	19/09/2014
G1	2.83	2.627	2.922	3.226	3.246	3.007	2.727	2.688	2.939	3.025	3.183	3.407	3.254	3.285	2.681	2.311	2.339	2.532	3.182	3.334	3.025	2.477	2.4
G2	6.64	6.414	6.717	7.048	7.136	6.901	6.623	6.548	6.775	6.945	7.035	7.246	7.182	7.087	6.577	6.123	6.132	6.364	6.999	7.127	6.95	6.365	6.218
G3	5.287	5.071	5.405	5.752	5.792	5.593	5.328	5.25	5.481	5.63	5.76	5.953	5.881	5.772	5.323	4.817	4.827	5.058	5.707	5.829	5.663	5.084	4.917
G4	1.153	1.168	1.532	2	1.918	1.535	1.247	1.27	1.62	1.84	2.108	2.305	1.935	2.063	1.252	1.021	1.047	1.293	2.074	2.21	1.559	1.06	0.956
G5	0.875	0.934	1.365	1.863	1.79	1.401	1.08	1.116	1.475	1.733	1.962	2.151	1.888	1.875	1.055	0.835	0.847	1.097	1.947	2.068	1.517	0.878	0.811
G6	1.283	1.263	1.7	2.12	2.01	1.743	1.44	1.489	1.856	2.048	2.222	2.391	2.137	2.164	1.452	1.18	1.201	1.461	2.183	2.281	1.805	1.291	1.206
G7	0.57	0.655	1.08	1.63	1.614	1.206	0.745	0.824	1.218	1.477	1.688	1.929	1.695	1.592	0.722	0.51	0.547	0.815	1.735	1.88	1.397	0.646	0.59
G8	2.153	1.995	2.314	2.67	2.691	2.486	2.213	2.16	2.4	2.549	2.688	2.862	2.765	2.664	2.216	1.752	1.773	1.976	2.64	2.753	2.551	2.006	1.849
G9	5.575	5.356	5.661	5.979	6.053	5.816	5.537	5.465	5.711	5.845	5.98	6.184	6.111	6.028	5.489	5.06	5.086	5.306	5.943	6.075	6.145	5.26	5.141
G10	0.694	0.78	1.327	1.82	1.652	1.297	0.917	0.985	1.446	1.702	1.897	2.055	1.778	1.708	0.901	0.685	0.709	1.032	1.902	1.997	1.437	0.784	0.729
G11	0.981	1.079	1.583	2.136	2.021	1.557	1.192	1.252	1.678	1.99	2.215	2.4	2.097	2.039	1.17	0.953	0.98	1.291	2.223	2.335	1.675	1.037	0.966
G12	0.365	0.294	0.627	1.07	1.042	0.734	0.411	0.411	0.67	0.808	1.168	1.597	1.09	1.069	0.423	0.032	0.051	0.29	1.099	1.507	0.784	0.179	0.082

mAHD

Bore	16/09/2011	1/11/2011	4/01/2012	7/03/2012	16/05/2012	5/07/2012	7/09/2012	5/10/2012	4/12/2012	9/01/2013	4/02/2013	22/03/2013	15/05/2013	2/07/2013	21/08/2013	20/09/2013	25/10/2013	21/11/2013	28/02/2014	24/03/2014	30/05/2014	8/08/2014	19/09/2014
G1	25.575	25.778	25.483	25.179	25.159	25.398	25.678	25.717	25.466	25.38	25.222	24.998	25.151	25.12	25.724	26.094	26.066	25.873	25.223	25.071	25.38	25.928	26.005
G2	25.08	25.306	25.003	24.672	24.584	24.819	25.097	25.172	24.945	24.775	24.685	24.474	24.538	24.633	25.143	25.597	25.588	25.356	24.721	24.593	24.77	25.355	25.502
G3	25.006	25.222	24.888	24.541	24.501	24.7	24.965	25.043	24.812	24.663	24.533	24.34	24.412	24.521	24.97	25.476	25.466	25.235	24.586	24.464	24.63	25.209	25.376
G4	25.343	25.328	24.964	24.496	24.578	24.961	25.249	25.226	24.876	24.656	24.388	24.191	24.561	24.433	25.244	25.475	25.449	25.203	24.422	24.286	24.937	25.436	25.54
G5	25.357	25.298	24.867	24.369	24.442	24.831	25.152	25.116	24.757	24.499	24.27	24.081	24.344	24.357	25.177	25.397	25.385	25.135	24.285	24.164	24.715	25.354	25.421
G6	25.197	25.217	24.78	24.36	24.47	24.737	25.04	24.991	24.624	24.432	24.258	24.089	24.343	24.316	25.028	25.3	25.279	25.019	24.297	24.199	24.675	25.189	25.274
G7	25.275	25.19	24.765	24.215	24.231	24.639	25.1	25.021	24.627	24.368	24.157	23.916	24.15	24.253	25.123	25.335	25.298	25.03	24.11	23.965	24.448	25.199	25.255
G8	24.999	25.157	24.838	24.482	24.461	24.666	24.939	24.992	24.752	24.603	24.464	24.29	24.387	24.488	24.936	25.4	25.379	25.176	24.512	24.399	24.601	25.146	25.303
G9	25.243	25.462	25.157	24.839	24.765	25.002	25.281	25.353	25.107	24.973	24.838	24.634	24.707	24.79	25.329	25.758	25.732	25.512	24.875	24.743	24.673	25.558	25.677
G10	25.293	25.207	24.66	24.167	24.335	24.69	25.07	25.002	24.541	24.285	24.09	23.932	24.209	24.279	25.086	25.302	25.278	24.955	24.085	23.99	24.55	25.203	25.258
G11	25.385	25.287	24.783	24.23	24.345	24.809	25.174	25.114	24.688	24.376	24.151	23.966	24.269	24.327	25.196	25.413	25.386	25.075	24.143	24.031	24.691	25.329	25.4
G12	25.387	25.458	25.125	24.682	24.71	25.018	25.341	25.341	25.082	24.944	24.584	24.155	24.662	24.683	25.329	25.72	25.701	25.462	24.653	24.245	24.968	25.573	25.67

Appendix B – 360 ENVIRONMENT REPORT

360 environmental

Part Lots 11 and 74 Gibbs Road Banjup

Local Structure Plan: Environmental Assessment Report

Prepared for

Aigle Royal Development

April 2020

people • planet • professional

Document Reference	Revision	Prepared by	Reviewed by	Admin Review	Submitted to Client	
					Copies	Date
1350AN_Rev0	Internal Draft	KAC	TS	-	1 x electronic	
1350AN_Rev1	Client Draft	KAC	-	NL	1 x electronic	17/03/2020
1350AN_Rev2	LSP Design and text update	KAC	-	NL	1 x electronic	08/04/2020
1350AN_Rev3	Text update	KAC		SH	1 x electronic	22/04/2020

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Executive Summary

360 Environmental Pty Ltd has been engaged by Aigle Royal Developments (the proponent) to prepare an Environmental Assessment Report (EAR) to support urban development within part Lots 11 and 74 Gibbs Road, Banjup (approximately 7.27 ha) ('the site') (Figure 1). The site is located in City of Cockburn, approximately 24 km south of Perth.

The site is currently zoned 'Urban Deferment' and 'Rural- Water Protection' under the Metropolitan Region Scheme (MRS) and 'Development Zone' and 'Resource Zone' under the City Local Planning Scheme (LPS) No. 3 (Figure 2).

The Lifting of 'Urban Deferment' under the MRS Amendment will be initiated to facilitate development on site in accordance with the proposed Local Structure Plan (LSP). Under the City's LPS the current zoning 'Development Zone' permits the proposed land use (Figure 2). It is understood that road reserves and Public Open Space (POS) are applicable land uses under the Rural (MRS) and Resources (LPS) zonings.

The proposed Local Structure Plan (LSP) has been developed for the site and includes the following:

- Residential lots (traditional and laneway product)
- Active and restricted Public Open Space (includes drainage)
- Ecological Corridor.

Key Environmental Aspects

Wetlands

The entire site is mapped as within the Gibbs Road Swamp System wetland listed under the Directory of Nationally Important Wetlands (DoE 2008). The Gibbs Road system wetland mapping covers a total area of 70 ha which includes large areas of residential developments, small rural landholdings and conservation areas. The Directory of Nationally Important Wetlands is not protected by any legislative mechanism; however, it is acknowledged and considered for future planning and development. There are no Department of Biodiversity Conservation and Attractions (DBCA) geomorphic wetland within the site. A Conservation Category Wetland (CCW) (UFI 12984) and Multiple Use Wetland (MUW (UFI 6657) located adjacent to the LSP area.

The 50m CCW buffer impinges the southern section of the site.

Jandakot Underground Water Pollution Control Area

The site forms part of the Jandakot Underground Water Pollution Control Area (UWPCA) and is classified as Priority 3. The identified LSP land uses and their compatibility within a P3 area are Residential Area: acceptable (connected to deep sewerage) and Public Open Space (POS) (unrestricted): compatible with conditions.

A LWMS has been prepared and addresses the water management requirements for future development.

Remnant Vegetation

The site contains 5.98 ha of remnant vegetation which consists of Floristic Community Type (FCT) representative of the Threatened Ecological Community: Banksia Woodlands of the Swan Coastal Plain. The proposed development will involve the clearing of 4.71 ha and the retention of 1.27 ha within the CCW buffer and ecological linkage. It is proposed that the ecological linkage which contains Banksia Woodlands TEC in 'Excellent' condition will be retained on site.

Additional management measures will be implemented through management plans and at subsequent stages of planning.

Black Cockatoo Habitat

The site contains 6.02 ha of Black Cockatoo foraging habitat and four potential breeding trees. The project will involve the clearing of 4.93 ha of foraging habitat and five potential breeding trees. However, 1.09 ha of foraging habitat will be retained in CCW buffer and proposed ecological linkage. Subject to engineering [cut and fill] specifications and assessment against AS 4970-2009, further black cockatoo foraging habitat may be viable for retention within the proposed LSP POS and road reserves.

The maintenance of this ecological corridor will allow continued movement of fauna species through the landscape, particularly to the CCW as a potential watering source.

Additional mitigation and management measures will be implemented through management plans and at subsequent stages of planning.

Environmentally Sensitive Areas

The site is mapped as an Environmentally Sensitive Area (ESA) which relates to the Gibbs Road Swamp System and its associated buffers. ESA's are protected by legislation and areas within the extent of an ESA are not subject to native vegetation clearing exemptions (such as exemptions associated with subdivision approval).

Hydrology and Water Quality

A Local Water Management Strategy (LWMS) has been developed by Ochre West to support the LSP processes. The LWMS provides management strategies to ensure hydrological flows and regimes reflect predevelopment flows of the site and prevent water quality degradation from the development.

Environmental Outcomes

Future residential development through the implementation of the LSP will deliver the following key environmental outcomes:

- Provision of an ecological linkages in the southern section of the site which provides a continues linkage from the adjacent Bush Forever Site/Jandakot Regional Park and

remnant vegetation and CCW located east of the site. The interface with the linkage and development area will be fenced

- The development will be fenced along the interface with the adjacent Bush Forever site to provide protection of fauna and fauna habitat (i.e. black cockatoo)
- Incorporation of a 50m buffer to the adjacent CCW
- Development and implementation of environmental management plans (i.e. Fauna Management and Relocation Plan and Vegetation and Wetland Buffer Management Plan) will ensure the long-term management and viability of the proposed conservation areas
- Application of water management initiatives and a framework to the guide future development of the site to ensure water sensitive urban design is achieved. This will be done through a combined DLWMS and an Urban Water Management Plan (UWMP).

Other environmental issues (such as acid sulfate soils, potential contamination, etc.) are capable of being resolved (i.e. avoided or managed) through site-specific investigations and detailed engineering drainage design.

A significant environmental outcome of the proposed LSP is maintaining the ecological corridor between the adjacent Bush Forever Site 492 and CCW.

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1 Introduction

1.1 Background

360 Environmental Pty Ltd has been engaged by Aigle Royal Developments (the proponent) to prepare an Environmental Assessment Report (EAR) to support urban development within part Lots 11 and 74 Gibbs Road, Banjup (approximately 7.27 ha) ('the site') (Figure 1). The site is located within City of Cockburn, approximately 24 km south of Perth

The site is currently zoned 'Urban Deferment' and 'Rural- Water Protection' under the Metropolitan Region Scheme (MRS) and 'Development Zone' and 'Resource Zone' under the City Local Planning Scheme (LPS) No. 3 (Figure 2).

The Lifting of 'Urban Deferment' under the MRS Amendment will be initiated to facilitate development on site in accordance with the proposed Local Structure Plan (LSP). Under the City's LPS the current zoning 'Development Zone' permits the proposed land use (Figure 2). It is understood that road reserves and Public Open Space (POS) are applicable land uses under the Rural (MRS) and Resources (LPS) zonings.

1.2 Environmental Assessment Objectives

The objective of this EAR is to provide an overview of the general environmental features of the site, identify the key environmental issues and the potential impacts associated with the proposed development and the measures proposed to manage these impacts.

1.3 Proposed Local Structure Plan

An Indicative Concept Plan, has been developed for the site and includes the following:

- Residential lots (traditional and laneway product)
- Active and restricted Public Open Space (includes drainage)
- Ecological Corridor.

1.4 Other Documentation

A Bushfire Management Plan (BMP) and Local Water Management Strategy (LWMS) has been developed to support the LSP. These documents should be read in conjunction with this EAR.

2 Key Legislation and Policies

2.1 Federal

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is the central piece of environmental legislation which protects Matters of National Environmental Significant (MNES) and broadly, to conserve Australia's biodiversity. If a proposed action is likely to have a significant impact on any MNES, a referral to the Commonwealth Department of Agriculture Water and Environment (DAWE) (formally known as the Department of Environment and Energy -DEE) may be warranted.

A proposed action which included the development of the site was referred under the EPBC Act (ref 2017/7923) for DAWE assessment, which was deemed a 'Controlled Action' and assessment by Preliminary Documentation (PD) which includes an offset strategy (Appendix A). It was determined that the proposed action is likely to, or may, have a significant impact on the following MNES:

- Banksia Woodlands of the Swan Coastal Plain (SCP) Threatened Ecological Community (TEC) – Endangered
- Carnaby's Cockatoo (*Calyptorhynchus latirostris*) – Endangered
- King Spider-orchid (*Caladenia huegelii) - Endangered*
- Dwarf Hammer-orchid (*Drakaea micrantha*) - Vulnerable.

The public comment period for the PD closed on the 24 March 2020. The PD approvals process is continuing with the DAWE.

2.2 State

The *Environmental Protection Act 1986* (EP Act) is the key legislative tool for environmental protection in Western Australia. Under Part IV of the EP Act, the Environmental Protection Authority (EPA) EPA undertakes environmental impact assessment of proposals and schemes to provide advice on environmental acceptability of developments. The lifting of 'Urban Deferment' is typically not referred to the EPA for assessment. The Western Australian Planning Commission (WAPC) may seek comment from the EPA during the lifting processes under the *Planning and Development Act 2005*.

All future development will be required to comply with the requirements of other relevant state legislation and regulations. Table 1 provides a summary of the key state legislation and regulations relevant to the proposed residential development.

Table 1: Legislation

Key Legislation	Responsible Government Agency	Aspect
Aboriginal Heritage Act 1972	Department of Planning, Lands and Heritage	Archaeological and ethnographic heritage

Key Legislation	Responsible Government Agency	Aspect
Biodiversity Conservation Act 2016 (BC Act)	Department of Biodiversity Conservation and Attractions	Listing of and protection of native species, threatened species, ecological communities, fauna, critical habitat and threatening processes
Biosecurity and Agriculture Management Act 2007 (BAM Act)	Department of Primary Industries and Regional Development	Weeds / pests / diseases
Bush Fires Act 1954	Department of Fires and Emergency Services	Bush fire control
Environmental Protection Act 1986 (EP Act)	Environmental Protection Authority Department of Water and Environmental Regulation	Part IV – Environmental Impact Assessment Part V – Works Approvals and Licences, Clearing Permits
Environmental Protection (Clearing of Native Vegetation) Regulations 2004	Department of Water and Environmental Regulation	Clearing of native vegetation
Contaminated Sites Act 2003	Department of Water and Environmental Regulation	Management of contaminated soils and water
Conservation and Land Management Act 1984	Department of Biodiversity Conservation and Attractions Department of Agriculture	Flora and fauna / habitat / weeds / pests / diseases

The following table details the key standards, guidelines and State Planning Policies relevant to the site.

Table 2: Relevant Policies and Guidelines

Document	Description
EPA Policies and Guidance	
Statement of Environmental Principles, Factors and Objectives (EPA 2016a)	This statement communicates the EPA considers the object and principles of the EP Act, uses environmental factors and objectives to organise and systemise environmental impact assessment, taking a holistic view of the environment and considering significance of a proposal.
Environmental Factor Guideline – Flora and Vegetation (EPA 2016b)	Provides guidance to protect flora and vegetation so that biological diversity and ecological integrity are maintained.
Environmental Factor Guideline – Terrestrial Environmental Quality (EPA 2016c)	Provides guidance with the objective to maintain the quality of land and soils so that environmental values are protected.
Environmental Factor Guideline – Terrestrial Fauna (EPA 2016d)	Provides guidance with the objective to protect terrestrial fauna so that biological diversity and ecological integrity at maintained.
Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment (EPA 2016e)	Provides technical guidance to ensure adequate flora and vegetation data of an appropriate standard are obtained and used in environmental impact assessment.
Technical Guidance – Terrestrial Fauna Surveys (EPA 2016)	Provides technical on the direction and information on general standards and protocols for terrestrial fauna surveys for environmental impact assessment.

Document	Description
Guidance Statement No. 33: *Environmental Guidance for Planning and Development* (EPA 2008)	Provides information and advice to assist land use planning and development processes to protect, conserve and enhance the environment. Describes the processes the EPA may apply under the EP Act to land use planning and development in Western Australia, and the environmental impact assessment process applied by the EPA to schemes.
WA Environmental Offsets Policy (EPA 2011)	Seeks to protect and conserve environmental and biodiversity values for present and future generations. The policy ensures that economic and social development may occur while supporting long term environmental and conservation values.
EPA Bulletins	
Environmental Protection Bulletin No. 1: *Environmental Offsets* (EPA, 2011)	Clarifies how the EPA will consider offsets through the environmental impact assessment process.
State Planning Policies	
State Planning Policy 2.3: Jandakot Groundwater Protection Policy (WAPC 2003)	Provides policy framework to ensure protection of the Jandakot Groundwater Protection areas from development and land uses that may have a detrimental impact on the water resource.
State Planning Policy 2.7: Public Drinking Water Source	Addresses land use and development in public drinking water supply areas (PDWSA).
State Planning Policy 2.8: *Bushland Policy for the Perth Metropolitan Region* (WAPC 2010)	Provide policy and implementation framework that will ensure bushland protection and management issues in the Perth Metropolitan Region are appropriately addressed and integrated with broader land use planning and decision making. Ensure the long-term protection of biodiversity and associated environmental values.
State Planning Policy 2.9: Water Resources (WAPC 2006)	Provides clarification and additional guidance to planning decision-makers for consideration of water resources identified as having significant economic, social, cultural or environmental values.
State Planning Policy 3.7: *Planning in Bushfire Prone Areas* (WAPC 2015)	Provides guidance on the implementation of effective risk-based land use planning and development to preserve life and reduce the impact of bushfire on property and infrastructure.

2.3 Local

The City of Cockburn has Local Planning Policies (LPP) which are guidelines used to assist Council in making decisions under the City's LPS. Due regard to the LPPs and their application should be considered for the LSP.

2.3.1 Public Open Space-LLP 5.1

This policy applies to the assessment of structure plan proposals in relation to POS reserves within the City of Cockburn (2019). This Policy identifies such land features which will not be accepted by the City as part of the POS requirement, including separate matters pertaining to bushfire risk matters.

This policy states that the City will not accept bushfire protection areas within areas of natural bushland that are existing or proposed to be revegetated through rehabilitation as part of undertaking subdivision and development on the land.

The City discusses that land where public access is incapable, restricted or denied will not be accepted by the City as part of any public open space.

The application of the policy may be applicable for the CCW Buffer (50m) which partly impinges the south eastern section of the site.

2.3.2 Incorporating Natural Areas in Public Open Space and/or Drainage Areas- LLP 5.2

Natural Areas which include wetlands and their buffers and bushland and are commonly located within in POS and/or drainage reserves are managed and maintained by the City after handover from developer/landowner (City of Cockburn 2019a).

One of the LLP objectives is to require that development adjacent to wetlands be suitably set back from the wetland boundary to allow for the retention of the wetland dependent vegetation and to maintain its environmental values and functions.

It is noted by the City that where development includes or is adjacent to a wetland, buffers are provided and managed to protect and maintain wetland values. The City will apply buffer distances as outlined in Department of Environment and Department of Planning wetland buffer guidelines. A 50m buffer is generally required (City of Cockburn, 2019a).

There is a CCW located west of the site, as part of the LSP design a 50 m wetland buffer has been provided to maintain the wetlands values and function. The 50 m buffer intrudes the site and will be fenced to reduced uncontrolled access. For further information refer to Section 4.

2.3.3 Control Measures for Protecting Water Resources in Receiving Environments- LLP 5.3

The purpose of this policy is to ensure drainage generated from subdivision can be controlled through best practice water sensitive urban design to protect of water resources in receiving environments (City of Cockburn, 2019b).

A LWMS has been developed in accordance with the Stormwater Management Manual of Western Australia (Department of Water), the LWMS sets out current best management principles and practices in relation to stormwater management for the LSP.

2.3.4 Uniform Fencing- LLP 5.7

Uniform fencing is generally required where development of land abuts the public domain including roads and public open space. Uniform Fencing abutting POS should consist of the following:

1. Uniform fencing abutting POS shall provide visually permeable infill panels to promote passive surveillance.

2. Minor portions of solid uniform fencing may be permitted to screen some areas of residential land including drying areas.

3. Pedestrian access gates (and stairs if required) are encouraged to be constructed as part of the uniform fencing between residential lots and POS to encourage use of the POS by the adjoining residents.

Due regard to the above specification will be given within subsequent vegetation and wetland and buffer management plans for the site.

3 Existing Environment

3.1 Topography and Geology

The topography of the site sits at an elevation of between 32 m Australian Height Datum (AHD) in the central portion of the site, to 27 m AHD in the northern and south eastern portion of the site to 34 m (DoW 2012) (Figure 3).

Surfacing geology profile mapping at 1:250 000 indicates the geology of the project area is typically defined as Bassendean sand: basal conglomerate overlain by dune quartz sand with heavy mineral concentrations, Aeolian coastal sediment(Department of Agriculture and Food WA (DWFWA), 2012).

The site is within the Bassendean Land System (DAFWA 2012):

- Bassendean System: Sand dunes and sandplains with pale deep sand, semi-wet and wet soil. Banksia-paperbark woodlands and mixed heaths.

The Department of Agriculture and Food WA (DAFWA) Soil Subsystems mapping indicates that the site falls within the Bassendean System and within five soil subsystems (DAFWA 2006). These subsystems are described below and displayed in Figure 3.

- Bassendean B2 Phase - Deep bleached grey sands with a pale yellow B horizon or a weak iron-organic hardpan 1-2 m
- Bassendean B3 Phase - Moderately deep, bleached sands with an iron-organic pan, or clay subsoil. Surfaces are dark grey sand or sandy loam.

3.2 Acid Sulphate Soils

Department of Water and Environmental Regulation (DWER) regional mapping indicates that the site is mapped as moderate to low risk of Acid Sulphate Soils (ASS) disturbance within <3m below the natural ground surface (Figure 4).

3.3 Hydrology

3.3.1 Groundwater

Pre-development groundwater monitoring was undertaken by Bioscience between September 2011 and September 2014. Results from the groundwater monitoring program found that the Average Annual Maximum Groundwater Level (AAMGL) ranges from 25.2 m AHD in the southern central portion of the site to 25.85 m AHD in the north-western portion of the site (Figure 5) (Ochre West 2017).

Based on existing topography and DWER maximum regional groundwater contours AAMGL groundwater contours, the depth to groundwater within the site ranges from approximately from 4.8 metres below ground level (mbgl) in the northern part of the site, 8 mbgl in the centre of the site and approximately 2.8 mbgl in the eastern section of Lot 74 (within the wetland buffer) (Department of Water and Environmental Regulation, 2019).

Information sourced from DWER identify aquifers underlying the site; each assigned the name of the major geological unit in which the aquifer occurs (Department of Water and Environmental Regulation, 2019b). In descending order of depth from natural surface they are:

- Perth Superficial Swan (Banjup): Allocation Available
- Perth Yarragadee North Aquifer (Jandakot confined): Limited Information.

There is current one licence to take groundwater within the site. Details of the licence are provided in Table 3.

Table 3: Groundwater Licences

Licence No.	Location	Allocation	Expiry
163844 Elite Developments (WA) Pty Ltd	11, BEENYUP RD, BANJUP	23,400 KL	14/08/2027

3.3.2 Public Drinking Water Source Areas

The site is within Priority 3 (P3) Public Drinking Water Source Area (PDWSA) of the Jandakot Underground Water Pollution Control Area (UWPCA) (Department of Water, 2016b) and is therefore subject to the provisions of the Statement of Planning Policy No. 2.3- *Jandakot Groundwater Protection Policy and Department of Water (DoW) Water Quality Protection Note No. 25*. P3 areas are defined and managed to maintain the quality of the drinking water source for as long as possible with the objective of risk management. P3 areas occur within PDWSAs where the land is zoned for urban and commercial or light industrial uses (Department of Water, 2016a).

Department of Water (2016) sets out 'protection zones' that are defined in the immediate vicinity of drinking water extraction points, as these areas are the most vulnerable to contamination (DoW 2016). Protection zones can be located within P1, P2 or P3 areas. There are two types of protection zones: wellhead protection zones (WPZs) defined for groundwater sources; and reservoir protection zones (RPZs) defined for surface water sources (DoW 2016).

No WPZs or RPZs exist in the vicinity of the site that requires a 'buffer' from urban development (DoP 2017).

3.3.3 Surface Water and Wetlands

There are no mapped open water bodies or drainage lines within the site. There are no mapped geomorphic wetlands within the site. There is a Conservation Category Wetland (CCW) (UFI 12984) and Multiple Use Wetland (MUW (UFI 6657) located adjacent to the LSP area.

Wetland categories and their management objectives are described within Table 4 below:

Table 4: Wetland Categories and Management Objectives (Western Australian Planning Commission, 2005)

Category	Category Description	Management Objective
Conservation Category	High conservation and ecological value	To preserve the wetlands (natural) attributes and functions
Multiple Use	Little remaining important wetland attributes, functions and ecological value	To use, develop and manage wetlands in the context of water, town and environmental planning

The EPA recommends a minimum 50 m wetland buffer to CCWs. While it is noted that generic 50 m buffer is generally applicable to CCW to protect the wetlands ecosystem, a site buffer assessment can be undertaken to determine the buffer widths (Environmental Protection Authority, 2008).

The wetlands (CCW [UFI 12984] and MUW [UFI 6657] are not listed as Ramsar sites. The entire site and the wider surrounding environment are mapped as the Gibbs Road Swamp System under the Directory of Nationally Important Wetlands (Australian Government, 2010).

3.4 Flora and Vegetation

3.4.1 Overview

The site is located within the Swan Coastal Plain (SCP) bioregion of the Interim Biogeographic Regionalisation of Australia (IBRA) of the Southwest botanical district. The Swan Coastal Plain 2 (SWA02) sub-region is an area composed of colluvial and Aeolian sands, alluvial river flats, coastal limestone. Heath and Tuart woodlands on limestone, Banksia and Jarrah-Banksia woodlands on Quaternary marine dunes of various ages, Marri on colluvial and alluvial and includes a complex series of seasonal wetlands (Mitchell, Williams, & Desmond, 2002).

There is one vegetation association mapped across the site which includes, 1001 (e2Mb cbLi) – Bassendean; Medium very sparse woodland; *E. marginata* with low woodland, Banksia sp. and Casuarina sp. Its representation within the site, subregion and state is shown in Table 5.

Table 5: Broad Vegetation Type within the Site and its State and Regional Representation (Government of Western Australia, 2019)

	Pre-European Area (Ha)	Current Extent (Ha)	Remaining (%)	Current Extent in DBCA Reserves (%)
Statewide				
1001	57,410.23	12,660.76	22.05	14.19
IBRA Region Swan Coastal Plain				
1001	57,410.23	12,660.76	22.05	14.19
Local Government Authority – City of Cockburn				
1001	7,328.39	2,002.93	27.33	14.92

Vegetation complexes of the SCP have been mapped by Heddle et al. (1980). The site contains one vegetation complex which relates to the underlying soil profile, its representation is provided in Table 6:

- 'Bassendean Complex - Central and South': vegetation ranging from woodland of *Eucalyptus marginata - Allocasuarina fraseriana* - Banksia spp. to low woodland of Melaleuca spp. and sedgelands on the moister sites. This area includes the transition of *Eucalyptus marginata* to *Eucalyptus todtiana* in the vicinity of Perth.

Table 6: Broad Vegetation Complex within the Site and its State and Regional Representation (Government of Western Australia, 2019)

	Pre-European Area (Ha)	Current Extent (Ha)	Remaining (%)	Current Extent in DBCA Reserves (%)
Swan Coastal Plain				
Bassendean Complex - Central and South'	87,476.25	23,508.66	26.87	2.15
Perth Metropolitan Region				
Bassendean Complex - Central and South'	46,278.61	10,175.29	21.99	3.54

Within constrained areas on the SCP (i.e. PMR), the EPA Guidance Statement 33: Environmental Guidance for Planning and Development has set a threshold for retention of 10% of the pre-existing extent of native vegetation (EPA, 2008). Based on the Government of Western Australia (2019) data presented in Table 5 and Table 6 the current vegetation extents are greater than the above-mentioned 10% threshold.

3.4.2 Site Survey

360 Environmental undertook a Detailed (Level 2) Flora and Vegetation Survey of the site on the in September 2015. The complete Flora and Vegetation report can be found in Appendix B. The flora survey was undertaken within the recommended season and flowering period for the south west botanical province.

A subsequent Targeted Flora survey was undertaken in October 2017 by a Senior Botanist to identify the presence of any conservation significant flora species identified as Likely to occur within the 2015 survey and perennial orchids that are difficult to detect (*Caladenia huegelii* and *Drakaea micrantha*). From the 2017 survey, the vegetation condition within the site was re-assessed and the condition rescored from the original survey in 2015 (Appendix C).

3.4.3 Threatened and Priority Flora

A 2 km radial DBCA NatureMap and DAWE Protected Matters Search Tool (PMST) was undertaken. The NatureMap and PMST databases identified 13 conservation significant flora species as potentially occurring in the vicinity of the site. Of these eight are classed as Threatened, one as Priority 3 and four as Priority 4 (Appendix D).

The likelihood of occurrence of conservation significant flora species was determined by comparing the plant species requirements to the vegetation descriptions obtained from a Level 2 Flora and Vegetation Survey of the site. The likelihood assessment determined that of the 13 Conservation significant species (listed under the EPBC Act and the BC Act 2016) flora as potentially occurring in the vicinity of the site. Of this, there are eight considered likely or possible to occur on the site (Table 7) (360 Environmental 2016).

Table 7: Conservation Significant Flora Potentially Occurring within 2 km of the Site

Species	EPBC Act Listing	BC Act Listing	Likelihood
Caladenia huegelii	Threatened	Threatened	Likely
Diuris purdiei	Endangered	Threatened	Possible
Diuris drummondii	Vulnerable	Threatened	Possible
Drakaea elastica	Endangered	Threatened	Possible
Drakaea micrantha	Vulnerable	Threatened	Possible
Lepidosperma rostratum	Endangered	Threatened	Possible
Jacksonia gracillima	-	Priority 3	Likely
Verticordia lindleyi subsp. lindleyi	-	Priority 4	Possible

The 2016, Detailed (Level 2) Flora and Vegetation Survey did not identify any Priority species as listed by DBCA or Threatened Species as listed under the EPBC Act or BC Act (previously known as the *Wildlife Conservation Act 1950*). In addition, the DBCA database did not identify any conservation significant flora species within the site (360 Environmental 2016) (Appendix B).

360 Environmental conducted a Targeted Flora Survey for the King Spider-orchid (*Caladenia huegelii*), the Dwarf Hammer-orchid (*Drakaea micrantha*) and other conservation significant flora species identified as likely to occur within the site. The targeted flora survey was undertaken on 11 October 2017 during the optimal flowering period for these species (September and October) (360 Environmental 2018).

The site was sufficiently surveyed by an experienced Principal Botanist. No Threatened species pursuant to the EPBC Act or BC Act or Priority listed species were recorded during the targeted survey (Appendix C).

3.4.4 Vegetation Types

Five vegetation types were recorded on the site; their extents and descriptions are provided in Table 8 and represented in Figure 6.

Table 8: Vegetation Types (360 Environmental, 2016)

Vegetation Type	Description	Area (ha)
BaBm(a)*	Low Woodland of *Banksia attenuata, Banksia menziesii, Allocasuarina fraseriana, Eucalyptus marginata* over *Kunzea glabrescens, Acacia pulchella, Hibbertia hypericoides, Xanthorrhoea preissii, Bossiaea eriocarpa and Conostylis aculeata.*	1.67
BaBm(b)*	Low Woodland of *Banksia attenuata, Banksia menziesii, Allocasuarina fraseriana* over *Kunzea glabrescens, Dasypogon bromeliifolius, Hibbertia subvaginata, Calytrix fraseri* and *Bossiaea eriocarpa*.	1.92
AfEmBi*	Open Woodland of *Allocasuarina fraseriana*, *Eucalyptus marginata* and *Banksia ilicifolia* over *Xanthorrhoea preissii*, *Dasypogon bromeliifolius, Bossiaea eriocarpa, Gompholobium tomentosum* and *Phlebocarya ciliata.*	0.70
BiKg*[1]	Woodland of *Banksia ilicifolia* and *Banksia attenuata* over *Kunzea glabrescens*, *Xanthorrhoea preissii*, *Dasypogon bromeliifolius* and *Desmocladus flexuosus*.	1.12

[1] *Vegetation types which represent Banksia Woodland SCP TEC, refer to Section 2.4.5 for further information.

Vegetation Type	Description	Area (ha)
Ec*	Ecotone of *Banksia ilicifolia* and *Banksia menziesii* over *Kunzea glabrescens, Dasypogon bromeliifolius* and *Phlebocarya ciliata.*	0.57
C	Cleared.	0.72
G/O	Garden and Orchard	0.57
TOTAL		**7.27**

3.4.5 Vegetation Condition

Vegetation condition within the site ranged from 'Completely Degraded' to 'Excellent' (360 Environmental 2016) (Figure 7). Historical vegetation clearing, weeds, housing, a nursery and the presence of tracks in the site were the most frequently observed impacts on native vegetation. A major portion of the site (30%) was mapped to be in 'Good' condition, with 19% mapped as 'Degraded' to 'Completely Degraded' (Table 9).

Table 9: Vegetation Condition (360 Environmental, 2016)

Vegetation Condition	Area (ha)
Excellent	1.05
Excellent - Very Good	0.84
Very Good - Good	1.73
Good	2.21
Degraded	0.15
Completely Degraded	1.29
Total	**7.27**

3.4.6 Threatened and Priority Ecological Communities

The results from the Detailed (Level 2) Flora and Vegetation Survey (2015) was used to identify if any Threatened Ecological Communities (TECs) occur on the site (Appendix C) (360 Environmental 2018).

The statistical analysis identified vegetation associations; BaBm(a), AfEmBi, BiKg, BaBm(b) as having the most affiliation to the following Floristic Community Types (FCT):

- SCP 21a: Central *Banksia attenuata-Eucalyptus marginata* woodlands
- SCP21c: Low lying *Banksia attenuata* woodlands or shrublands
- SCP 23s: Central *Banksia attenuata-Banksia menziesii* woodlands.

These FCTs are listed as sub-communities of the Banksia Woodland SCP TEC (DotEE 2016). The site contains approximately 5.84 ha of TEC, which are all of the mapped vegetation types (refer to Table 8).

3.4.7 Weeds

A total of 27 introduced species were recorded during the Detailed (Level 2) Flora and Vegetation Survey undertaken in 2015. Two species **Asparagus asparagoides* (Bridal Creeper) and **Zantedeschia* aethiopica (Arum Lily) are listed as Declared under the *Biosecurity and Agriculture Management Act 2007* (BAM Act). One species, **Asparagus asparagoides* (Bridal Creeper) is listed as a Weed of National Significance (WONS) (360 Environmental, 2016).

Table 10: Weed Species Identified within the Site and Their Status (360 Environmental 2016)

Species	Common Name	WONS	BAM Act
**Acacia iteaphylla*	Flinders Ranges Wattle	-	s11 permitted
**Acacia longifolia*	Sydney Golden Wattle	-	s11 permitted
**Arctotheca calendula*	Cape Weed	-	s11 permitted
**Avena barbata*	Bearded Oat	-	s11 permitted
**Asparagus asparagoides*	Bridal Creeper	Yes	s22(2) (C3)
**Briza maxima*	Blowfly Grass	-	s11 permitted
**Carpobrotus edulis*	Pigface	-	s11 permitted
**Cotula coronopifolia*	Waterbuttons	-	s11 permitted
**Crassula natans var. minus*	-	-	-
**Cyperus tenellus*	Tiny Flat-Sedge	-	s11 permitted
**Ehrharta calycina*	Perennial Veld Grass	-	s11 permitted
**Ehrharta longiflora*	Annual Veld Grass	-	s11 permitted
**Eragrostis curvula*	African Lovegrass	-	s11 permitted
**Euphorbia terracina*	Geraldton Carnation Weed	-	s11 permitted
**Fumaria capreolata*	Whiteflower Fumitory	-	s11 permitted
**Galium murale*	Small Bedstraw	-	s11 permitted
**Gladiolus caryophyllaceus*	Wild Gladiolus	-	s11 permitted
**Hypochaeris glabra*	Smooth Cats ear	-	s11 permitted
**Juncus capitatus*	-	-	s11 permitted
**Lysimachia arvensis*	Pimpernel	-	s11 permitted
**Pelargonium capitatum*	Rose Pelargonium	-	s11 permitted
**Romulea rosea var. australis*	Guildford Grass	-	s11 permitted
**Sonchus oleraceus*	Common Sowthistle	-	s11 permitted
**Trifolium sp.*	Hop Clover	-	s11 permitted

Species	Common Name	WONS	BAM Act
**Ursinia anthemoides*	Ursinia	-	s11 permitted
**Vulpia bromoides*	Squirrels Tail Fescue	-	s11 permitted
**Zantedeschia aethiopica*	Arum Lily	-	s22(2) (C3)

3.5 Fauna and Habitats

3.5.1 Overview

DBCA NatureMap and DAWE Protected Matters Search Tool (PMST) was undertaken with a 2 km buffer (Appendix D). As there are no open water bodies/ wetland on the site marine and migratory birds have not been further discussed due to the absence of suitable habitat on site. The site mainly consists of terrestrial habitat associated with Banksia woodlands.

Table 11: Conservation Significant Fauna Species Likelihood Assessment

Species	State Status	EPBC Act Status	Likelihood	Likelihood justification*
Botaurus poiciloptilus (Australasian Bittern)	Endangered	Endangered	Unlikely	Not found within a 5km NatureMap Search.
Calyptorhynchus banksii subsp. *naso* (Forest Red-tailed Black Cockatoo)	Vulnerable	Vulnerable	Likely	Not found within 2km NatureMap Search; however suitable habitat present (Eucalypt woodland) and in species known distribution.
Calyptorhynchus latirostris (Carnaby's Cockatoo)	Endangered	Endangered	Likely	Found within a 2km NatureMap Search. Suitable habitat present (Banksia and Eucalypt woodland) and in species known distribution.
Dasyurus geoffroii (Chuditch)	Vulnerable	Vulnerable	Possible	Not found within 2km NatureMap Search, however suitable habitat on-site (Eucalypt woodland).
Leipoa ocellata (Malleefowl)	Vulnerable	Vulnerable	Unlikely	Not found within 5 km NatureMap Search.
Rostratula australis (Australian Painted Snipe)	Endangered	Endangered	Unlikely	Not found within 5km NatureMap Search.
Isoodon obesulus spp. fusciventer	Priority 4	-	Likely	Found within a 2km NatureMap Search. Suitable

Species	State Status	EPBC Act Status	Likelihood	Likelihood justification*
(Southern Brown Bandicoot; Quenda)				woodland habitat with sandy soils on site. The WALGA (2019) Environmental Planning tool maps the site as potential Quenda habitat.
Lerista lineata (Perth Slider, Lined Skink)	Priority 3	-	Likely	Found within the Jandakot area. Suitable woodland habitat with sandy soils on site.

3.5.2 Black Cockatoos

A Black Cockatoo Habitat Assessment was undertaken on 9 February 2017 and a follow up site visit was undertaken on 11 October 2017 to confirm the presence and size of tree hollows (Appendix E). The initial assessment identified that the site is mainly composed of Eucalypt Woodlands and Banksia Woodlands which are known habitats of three species of the Black Cockatoo (Figure 8). The site is not currently utilised by black cockatoos for breeding. The primary value of the area is a foraging resource for the Carnaby's cockatoo (360 Environmental 2017).

3.5.2.1 Foraging Habitat

Carnaby's Cockatoos feed on a variety of seeds, nuts and flowers from a range of native and exotic plants. Food plants include a number of Banksia species, Pine trees, Marri, Jarrah and Allocasuarina (Shah, 2006; Johnstone & Storr, 1998). The Forest Red-tailed Black Cockatoo (FRTBC) feeds primarily on Marri and Jarrah Fruit which makes up 90% of the diet (Johnstone & Kirkby 1999; Cooper et al., 2002). Baudin's Black Cockatoo forages primarily in Eucalypt forest, where it feeds on Marri seeds, flowers, nectar and buds. They also feed on a wide range of seeds from other Eucalypt and Banksia species and Pines (Johnstone & Storr 1998).

Approximately 6.01 ha of black cockatoo foraging habitat is within the site and consists of the following:

- 4.45 ha: Banksia Woodland
- 1.56 ha: Eucalyptus Woodland.

3.5.2.2 Potential Breeding Habitat

Black Cockatoos breed in large hollow-bearing trees, generally within woodlands or forests (Johnstone et al. 2013). The size of the tree can be a useful indication of the hollow-bearing potential of the tree. Trees of suitable DBH (>500mm diameter breast height [DBH] are potentially important for maintaining breeding in the long-term, through maintaining the integrity of the habitat and allowing trees to provide future nest hollows. The potential breeding trees have been placed in one of the following size categories:

- A = 500 – 1000 mm DBH or
- B = 1000 – 2000 mm DBH.

The black cockatoo habitat assessment and follow-up site visit identified five potential black cockatoo breeding trees (360 Environmental 2017). Two of the five trees were stags one of which contained hollows not utilized by Carnaby's cockatoo (Appendix E). 360 Environmental (2020) reports that breeding of the Carnaby's cockatoo is unlikely to occur within the site.

Table 12: Potential Black Cockatoo Habitat Trees

	Species	DBH*	Height (M)	Easting	Northing	Comments
1	Jarrah	B	12	0393358	6441096	No hollows, stag, lots of fallen branches, beehive present
2	Jarrah	A	12	0393384	6441087	Hollows, stag, red cap parrot on ends of branches during site
8	Jarrah	A	14	0393367	6441084	No hollows, splits at 4m height
18	Jarrah	A	8	0393055	6441295	No hollows
20	Jarrah	A	8	0393384	6441081	Burnt, 1 hollow with beehive

3.6 Conservation Areas

3.6.1 Environmentally Sensitive Areas

Environmentally Sensitive Areas (ESAs) are areas that have been identified for protection due to their environmental significance as outlined in the Western Australian *Environmental Protection (Environmentally Sensitive Areas) Notice 2005* under Section 51B of the EP Act. ESAs include the following:

- World Heritage areas
- areas included on the National Estate Register
- defined conservation wetlands and associated buffers
- vegetation within 50 m of a listed rare flora or TEC
- Bush Forever Site.

ESA mapping (which includes a buffer) indicates that the entire site and surround is mapped as an ESA (Figure 9). The boundary of the ESA correlates to the Gibbs Road Swamp System and associated buffers according to the Directory of Important Wetlands and Bush Forever Site.

3.6.2 Regional Park and Bush Forever

It is noted that the City of Cockburn (2002) Southern Suburbs District Structure Plan presented the southern portion of the site as a possible addition to the Bush Forever site. The WAPC (2000)

Bush Forever (Volumes 1 and 2) did not identify the southern portion of the site as a bush forever site or as a strategic negotiated planning solution or an urban/urban deferred/industrial negotiated planning solution (agreement proposed or to be determined). The current Bush Forever mapping is provided in Figure 9.

The current mapping confirms that the southern portion of the site is not identified as or proposed to be an extension to the adjoining Bush Forever site. In relation to this matter the district structure plan is redundant and of no relevance to the assessment of the proposed structure plan.

Jandakot Regional Park and Bush Forever Site (492) adjoins the western and southern part of Lot 74 (Figure 9). There are no mapped Bush Forever Sites within the site.

Bush Forever Site (263, 344) within the Jandakot Regional Park exists approximately 650 m to the north and 1.17 km to the east of the site. There are extensive areas of Bush Forever Sites (392, 391) surrounding the site associated with Forrestdale Lake Nature Reserve and Beeliar Regional Park (including Thompsons Lake Nature Reserve) (Department of Planning, 2014) .

3.6.3 Ecological Linkages

According to Del Marco et al. (2004) the importance of ecological linkage is to connect natural areas, preferably with continuous corridors of native vegetation, which assists in fauna movement between the areas and to access resources and habitats. The protection, management and buffering of existing natural areas within an ecological linkage is a higher priority than revegetation of cleared portions of the link.

Perth Regional Ecological Linkage (ID 52) runs through the northern portion of the site (Western Australian Local Government Authority, 2014) (Figure 9).

3.7 Heritage

3.7.1 Aboriginal Heritage

In Western Australia, the *Aboriginal Heritage Act 1972* protects places and objects customarily used by or traditional to the original habitants of Australia. A register of such places and objects is maintained under the Act, however all sites are protected under the Act whether they are registered or not. A search of the Department of Planning, Lands and Heritage's (DPLH) Aboriginal Heritage Inquiry System did not identify any 'Registered Aboriginal Sites' or 'Other Heritage Places' within the site (DPLH, 2018).

There are three registered sites within the vicinity of the site which include Mather Reserve (3447) (1.28 km), Thompsons Lake 01 (15934) 1.36 km and Kraemer Reserve (21811) 2.32 km.

3.7.2 European heritage

A search of the Heritage Council of Western Australia database of culturally significant sites in Western Australia was undertaken for the site. No State Heritage Places exist within or nearby the site (SHO 2018).

3.8 Potential Contamination

Under the *Contaminated Sites Act 2003*, contaminated sites must be reported to the Department of Water and Environmental Regulation (DWER), investigated and, if necessary, remediated. The DWER Contaminated Sites database was searched are there are no registered site within or immediately adjacent to the site. The database identified a contaminated site across several Lots within Aubin Grove and within 1 km of the site. The contamination is described in Table 13.

Table 13: Contaminated Sites within 1 km radius of the site (DWER 2018)

Site Number	Lot Number	Nature of Contamination	Status	Approx Distance to Site
15634	Lot 8001 on Plan 53298 Aubin Grove containing 85 Parcels.	Microbiological indicators of possible pathogens (Thermo tolerant coliforms, Enterococci /Faecal Streptococci and E.coli) are present in groundwater across the Site.	Remediated for restricted use	800 m

3.9 Bushfire Risk

The site is situated within a designated bushfire prone area as outlined by the WA Map of Bush Fire Prone Areas (Western Australian Planning Commission, 2015). As a result of the bushfire prone status of the site, a BMP has been developed to address the requirements of State Planning Policy 3.7 Planning in Bushfire Prone Areas (SPP 3.7) in support of the LSP.

4 Potential Impacts, Management Measures and Local Structure Plan Response

The potential impacts that may result from implementation of the proposed development based on the LSP design (Figure 10) and the site's key environmental features are discussed in this section. Management measures based on key legislation, guidelines and policies are also outlined with the intent to mitigate the potential impacts.

4.1 Acid Sulphate Soils

4.1.1 Overview

As discussed in Section 3.2, while ASS is not considered to be a limited factor to the development potential of the site. The site is within a moderate to low ASS disturbance risk (<3 m from surface) (Class II) (Figure 4) which may require an ASS investigation subject to the following being undertaken at the site:

- Works involving lowering of watertable (temporary or permanent)
- Earthworks extending to beyond 3 metres below natural ground surface
- Works within 500m of wetlands (Department of Environment Regulation, 2015).

4.1.2 Further Environmental Considerations

Subject to engineering specifications, earthworks (cut and fill) of the site may be required and can be determined during subsequent planning phase i.e. Subdivision. The WAPC's ASS Self-Assessment form can be filled out to identify the need of an ASS investigation. If required, prior to ground disturbing activities an ASS and Dewatering Management Plan (ASSDMP) can be developed to manage the ASS risk within the site and adjacent CCW and its buffer.

4.2 Groundwater and Surface Water

4.2.1 Overview

Potential impacts to hydrological processes from the implementation of the LSP include:

- Groundwater level changes from changes in land use and clearing. Residential development has the potential to increase recharge of rainfall into groundwater through increased surface area of residential roofs, driveways, carparks and roads
- Increased runoff from hard urban surfaces into surrounding retained environments
- Diminished water quality (nutrients, organic compounds, suspended solids, toxic compounds and salinity).

A LWMS has been developed by Orche West to support both the lifting of 'Urban Deferment' and LSP. The LWMS guides the key requirements for water sensitive urban design based on Better Urban Water Management (WAPC 2008) guidance. Potential environmental impacts to inland waters environmental quality will be addressed through the implementation of the

following measures at subsequent planning stages to ensure the site's hydrology is not altered during or post development:

- Urban development of the land will require the establishment of an improved drainage system and incorporating urban water management design principles
- Bio-retention areas will be provided to ensure water from the low ARI rainfall events will be contained and maximise the usability of the POS areas
- The site will be filled to a minimum of 2 m separation to Controlled Groundwater Levels, the drainage system will utilise generally high site infiltration
- Encouraging on-source surface water recharge wherever possible
- Retention of native trees within POS to reduce the demand for water, minimise irrigation and fertiliser demands.

4.2.2 LSP Mitigation and Management Measures

The stormwater catchments on site are directed to two drainage basins within the POS located in the north eastern section of the site (refer to Figure 10). The LSP incorporates a 50m buffer to the adjacent CCW (UFI 12984) (Figure 5 and Figure 10). No drainage treatment or discharge is currently proposed within the CCW buffer.

The DWER standard irrigations rates for POS (ovals) is typically 7,500KL/ha for POS. The LPS proposes passive POS (approximately 0.35 ha). The minimum water requirement for the POS would be approximately 2,625 KL /year which is 11% of the current groundwater allocation (est. 23,400 KL of existing license within the site).

For further detailed information, refer to the site's LWMS.

4.2.3 Further Environmental Considerations

An Urban Water Management Plan (UWMP) will be prepared and implemented at subdivision stage to the requirements of the Local Government authority. The proposed development of the site to urban will influence the total water cycle as a result of clearing native vegetation, increased impervious areas and changes to surface and stormwater runoff. The UWMP will be prepared in accordance with, but not limited to, the following documents in consultation with the City of Cockburn to ensure pre-development hydrological conditions are maintained during and post construction:

- Better Urban Water Management (WAPC 2008)
- State Planning Policy 2.9 (SPP 2.9) Water Resources
- Local Planning Policy 5.3 (LPP 5.3) Control Measures for Protecting Water Resources in Receiving Environments.

The UWMP will include measures for stormwater management, stormwater modelling, water quality protection, serviceability requirements, flood protection, groundwater management and the protection of receiving environments.

In particular, the water and drainage management measures will ensure the following are met in line with LPP 5.3 (City of Cockburn 2019):

- Water quality and quantity is tied to long term community needs
- The ecological integrity of the receiving environment and the quality of water is preserved and enhanced
- Provision is made for local groundwater recharge.

4.3 Public Drinking Water Source Areas

As discussed in Section 3.3.2, the site is located within the Priority 3 PDWSA. The identified LSP land uses and their compatibility within a P3 area are as follows:

- Residential Area: acceptable (connected to deep sewerage)
- POS (unrestricted): compatible with conditions.

4.3.1 LSP Mitigation and Management Measures

The LSP proposes POS and urban development (sewered) within the P3 area, these are compatible land uses in accordance with DoW (2016) guidelines.

4.4 Flora and Vegetation

4.4.1 Overview

The key potential impacts on terrestrial flora and vegetation from future development of the site include:

- Clearing of 4.71 ha of remnant vegetation. Refer to Table 14
- Ecological linkage fragmentation
- Associated urban degradation and disturbances, including rubbish dumping, uncontrolled access and flower/seed harvesting
- Edge effects due to the proposed development caused by the interaction of native vegetation with surrounding urban land uses, leading to inhibition or promotion of certain species from establishing populations along edges and imitating a decline in vegetation condition
- Potential introduction of Dieback disease
- Introduction and spread of invasive weed species
- Hydrological changes.

Table 14: Remnant Vegetation Proposed Areas to be Cleared and Retained

Vegetation Unit	Area(ha)	Areas to be Cleared (ha)	Areas to be Retained (ha)
BaBm(a)*	1.67	0.91	0.76
BaBm(b)*	1.92	1.92	0
AfEmBi*	0.70	0.53	0.17
BiKg*[2]	1.12	1.12	0
Ec*	0.57	0.23	0.34
Subtotal Vegetation Unit	-	**4.71**	**1.27**
Cleared	0.72	0.66	0
G/O	0.57	0.57	0
Total	7.27	5.94	1.27

4.4.2 LSP Mitigation and Management Measures

The LSP proposes to retain 1.27 ha (0.93ha of Banksia Woodland [and 0.34 ha of Eucalypt woodland within the CCW buffer and/or proposed ecological corridor (Figure 10).

An ecological linkage (50m wide) is proposed within the southern section of the site which provides for a continuous connection from Jandakot Regional Park (Bush Forever Site 492) to the CCW area within Lot 74. Vegetation within the proposed ecological linkage is recorded to be in 'Excellent' condition. The only location of vegetation on site in 'Excellent' condition is the southern section of the site. A significant portion of this is proposed to be retained within an ecological linkage (Figure 10).

Del Marco *et al.* (2004) discusses that several studies have found that linear corridors of native vegetation need to be at least 25 to 50m wide to function effectively as linkage for a range of bird species. A width of 50m is considered to be the minimum required for maintaining long term viability. The width determination of urban ecological corridors varies and are dependent on the influencing factors that may impact on the ecological processes of the area (Peng et al. 2016). As the ecological linkage will be fenced, there will be limited access hence, degradation processes such as weed encroachment and uncontrolled access will be minimal. Therefore, supporting the requirement width of 50 m for the ecological corridor.

Regarding the interface of the proposed development and Bush Forever Site No. 492 and Jandakot Regional Park, the LPS includes a road reserve around the periphery of the site, which provides a hard edge and conservation style fencing (subject to City of Cockburn LLP 5.7 specifications). The fencing will limit uncontrolled access to the Bush Forever Site 492/ Jandakot

[2] *Vegetation types which represent Banksia Woodland SCP TEC, refer to Section 2.4.5 for further information.

Regional Park. The restricted access within the CCW buffer will be addressed within a Vegetation and Wetland Buffer Management Plan (refer to Section 4.4.3).

For tree retention outside the CCW buffer, as part of future subdivision design it is recommended that remnant trees within POS and road reserves are surveyed and assessed by an arborist, in accordance with AS 4970-2009 Protection of Trees on Site. The assessment will identify other significant trees, whether the tree(s) are viable for retention and determine tree protection zones. This will guide potential tree retention within these areas.

4.4.3 Further Environmental Considerations

Prior to subdivision a Vegetation and Wetland Buffer Management Plan (or equivalent) will be prepared to mitigate potential impact to the CCW and its buffer and management measures. The plan will also include EPBC referral commitments (360 Environmental 2020) and the following:

- A buffer distance of 50 m from the CCW (UFI 12984) will be implemented to ensure the CCW is protected from the proposed residential development. Refer to LSP design in Figure 10
- The wetland buffer will be revegetated with low fuel native vegetation to support, compliment and protect the CCW as well as providing adequate bushfire protection for the proposed development. Due regard will be given to the City of Cockburn's revegetation criteria presented in LLP 5.2
- The CCW, buffer, and retained Black Cockatoo habitat will be rehabilitated where required, including revegetation and weed control measures to preserve the ecological attributes and functions of the wetland's Conservation Category
- Monitoring for *Phytophthora cinnamomi* (Dieback) infestation and early management of new infestations
- The CCW buffer will be fenced from the development to prevent unauthorised access and control access by feral and domestic animals from entering areas reserved for conservation. This will be undertaken in line with the City of Cockburns LPP 5.7 – Uniform Fencing
- Prior to clearing, significant trees to be cleared or retained will be clearly demarcated and all site personnel will be inducted on the clearing areas
- Structural and non-structural best management practices will be used to improve water quality within the CCW by reducing exposure to pollutants in line with the UWMP and LWMS
- Controlled access to the wetland and buffer for maintenance and fire access
- Revegetation, monitoring and annual reporting for two years post construction to the City of Cockburn's requirements.

4.5 Fauna and Habitat

4.5.1 Overview

The potential environmental impacts on terrestrial fauna from the implementation of the LSP and subsequent future development of the site include:

- Animal deaths during the clearing process
- Habitat removal and modification
- Clearing of 4.93 ha of black cockatoo habitat (Table 15)
- Removal of five potential black cockatoo breeding trees
- Habitat fragmentation
- An increased abundance of introduced species
- Inappropriate recreational use.

Table 15: Potential Black Cockatoo Foraging Habitat Proposed to be Cleared and Retained

Habitat	Area (ha)	Areas to be Cleared (ha)	Areas to be Retained (ha)
Banksia Woodland	4.45	3.71	0.74
Eucalyptus Woodland	1.57	1.22	0.34
Total	**6.02**	**4.93**	**1.09**

4.5.2 LSP Mitigation and Management Measures

The LSP proposes to retain approximately 1.09 ha of black cockatoo foraging habitat within the proposed CCW buffer and ecological linkage on site.

Subject to engineering specifications and assessment against AS 4970-2009, further black cockatoo foraging habitat may be viable for retention within the proposed LSP POS and road reserves.

The ecological linkage proposed allows for connection from adjacent Bush Forever Site No. 492 (Jandakot Regional Parks) . The width of the ecological linkage is approximately 50m. This will assist fauna movement across the site.

The wetland buffer area captures a variety of fauna habitats such as, transition zones from low lying to uplands to Banksia woodlands.

4.5.3 Further Environmental Considerations

Before the commencement of subdivision, a Fauna Management and Relocation Plan will be developed and will include the following management measures in detail:

- Development and implementation of clearing and site disturbance protocols
- All site personnel will be inducted on the purpose, content and processes of the Fauna Management and Relocation Plan

- Prior to clearing, all trees (including stags) and hollows will be inspected for the presence of fauna occupying them. Any fauna present, with the exception of black cockatoos and other birds, will be removed and relocated by authorised personnel
- Development of a trapping program and methods, relocation process and identifying the indicators to successful trapping prior to clearing
- Fauna handling and rescue measures, including stopping works in the immediate vicinity of small and large animals that are injured, shocked or uninjured
- Inclusion and implementation of a feral species control program which includes targeted surveys, if required, threat prevention and elimination, threat management techniques
- All areas to be cleared or retained will be clearly demarcated
- Clearing will be undertaken outside of the breeding period for the Carnaby's cockatoos, where practicable
- Clearing will occur in a staged process from the north towards the CCW and retained vegetated areas to the south to allow fauna to escape to adjacent vegetated areas
- Monitoring during clearing and construction activities will occur to ensure Black Cockatoo habitat to be retained is not impacted and to ensure any fauna identified within clearing areas are managed through relocation
- Wildlife protection during construction activities and post development to ensure the management of foxes, cats and domestic animals.

5 Conclusion

The implementation of the LSP will result in clearing approximately 4.71 ha of remnant vegetation with the retention of 1.09 ha within CCW buffer and ecological linkage. Subject to engineering specifications and assessment against AS 4970-2009, further remnant vegetation/black cockatoo foraging habitat may be viable for retention within the proposed LSP POS and road reserves. Four potential black cockatoo breeding trees will also be cleared.

Future residential development will deliver the following key environmental outcomes:

- Provision of an ecological linkages in the southern section of the site which provides a continues linkage from the adjacent Bush Forever Site/Jandakot Regional Park and remnant vegetation and CCW located east of the site.
- The development will be fenced to provide protection of fauna and fauna habitat (i.e. black cockatoo) from future urban development.
- Incorporation of a 50m buffer to the adjacent CCW.
- Development and implementation of environmental management plans (i.e. Fauna Management and Relocation Plan and Vegetation and Wetland Buffer Management Plan) will ensure the long-term management and viability of the proposed conservation areas.
- Application of water management initiatives and a framework to the guide future development of the site to ensure water sensitive urban design is achieved. This will be done through a combined DLWMS and an Urban Water Management Plan (UWMP).

Other environmental issues (such as acid sulfate soils, potential contamination, etc.) are capable of being resolved (i.e. avoided or managed) through site-specific investigations and detailed engineering drainage design.

A significant environmental outcome of the proposed LSP is maintaining the ecological corridor between the adjacent Bush Forever Site 492 and CCW.

6 Limitations

This report is produced strictly in accordance with the scope of services set out in the contract or otherwise agreed in accordance with the contract. 360 Environmental makes no representations or warranties in relation to the nature and quality of soil and water other than the visual observation and analytical data in this report.

In the preparation of this report, 360 Environmental has relied upon documents, information, data and analyses ("client's information") provided by the client and other individuals and entities. In most cases where client's information has been relied upon, such reliance has been indicated in this report. Unless expressly set out in this report, 360 Environmental has not verified that the client's information is accurate, exhaustive or current and the validity and accuracy of any aspect of the report including, or based upon, any part of the client's information is contingent upon the accuracy, exhaustiveness and currency of the client's information. 360 Environmental shall not be liable to the client or any other person in connection with any invalid or inaccurate aspect of this report where that invalidity or inaccuracy arose because the client's information was not accurate, exhaustive and current or arose because of any information or condition that was concealed, withheld, misrepresented, or otherwise not fully disclosed or available to 360 Environmental.

Aspects of this report, including the opinions, conclusions and recommendations it contains, are based on the results of the investigation, sampling and testing set out in the contract and otherwise in accordance with normal practices and standards. The investigation, sampling and testing are designed to produce results that represent a reasonable interpretation of the general conditions of the site that is the subject of this report. However, due to the characteristics of the site, including natural variations in site conditions, the results of the investigation, sampling and testing may not accurately represent the actual state of the whole site at all points.

It is important to recognise that site conditions, including the extent and concentration of contaminants, can change with time. This is particularly relevant if this report, including the data, opinions, conclusions and recommendations it contains, are to be used a considerable time after it was prepared. In these circumstances, further investigation of the site may be necessary.

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7 References

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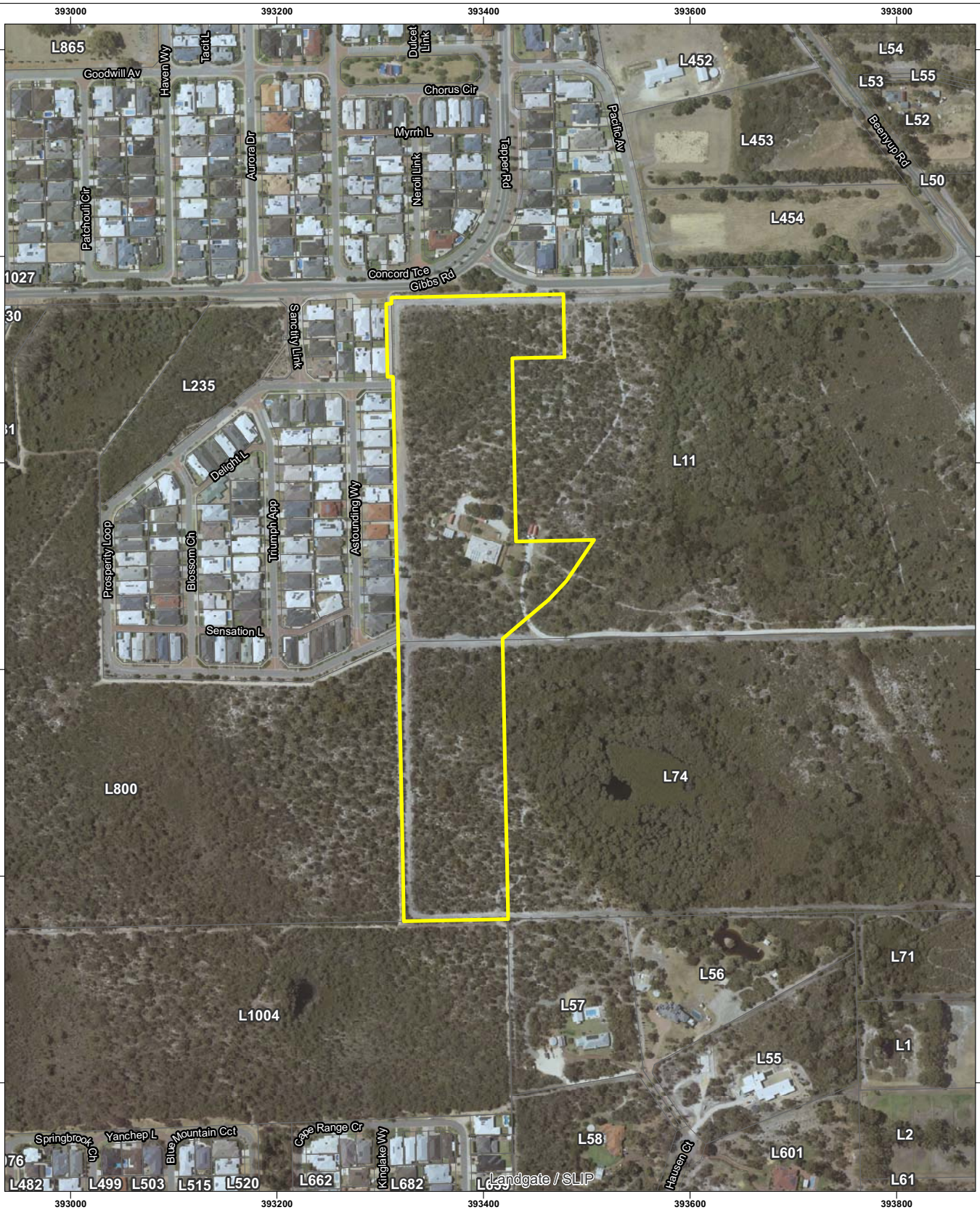
Figures



Legend

- Site Boundary (7.27 ha)
- Lot Boundaries

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LOCALITY MAP

AIGLE ROYAL

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Aigle Royal Developments
Part Lot 11 and 71 Gibbs Road Banjup

Environmental Assessment Report: Local Structure Plan

Figure 1
Site Location

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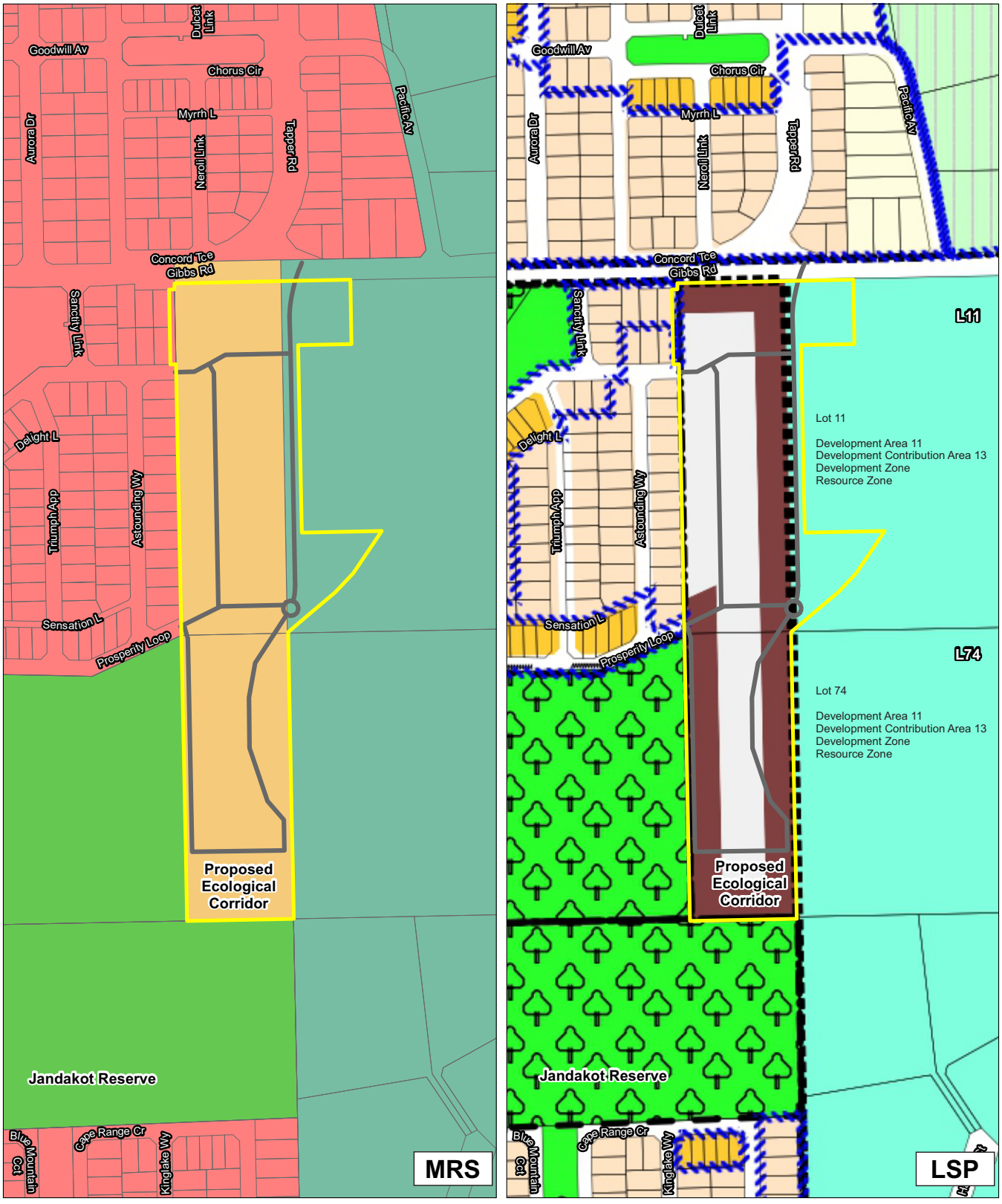

Legend

- Site Boundary (7.27 ha)
- Lot Boundaries

Regional Scheme Zones and Reserves

- Parks and Recreation
- Rural - Water Protection
- Urban
- Urban Deferred

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Figure 2
Zoning and Local Structure Plan

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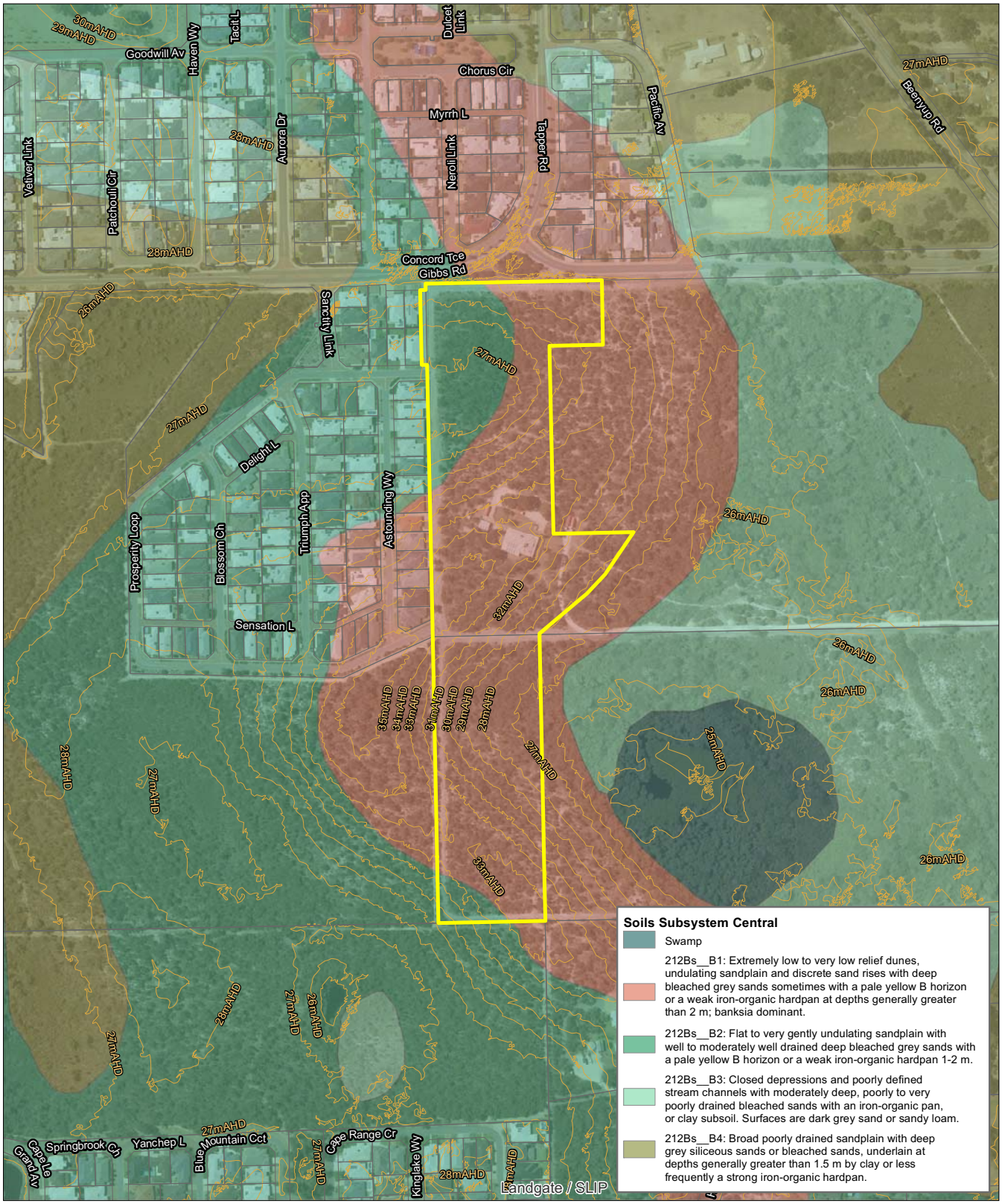

Legend

- Site Boundary (7.27 ha)
- Lot Boundaries
- Contours 1m Interval

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Figure 3
Topography and Geology

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Legend

- Site Boundary (7.27 ha)
- Lot Boundaries

Acid Sulfate Soils Risk

- High to moderate risk
- Moderate to low risk

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Figure 4
Acid Sulphate Soils

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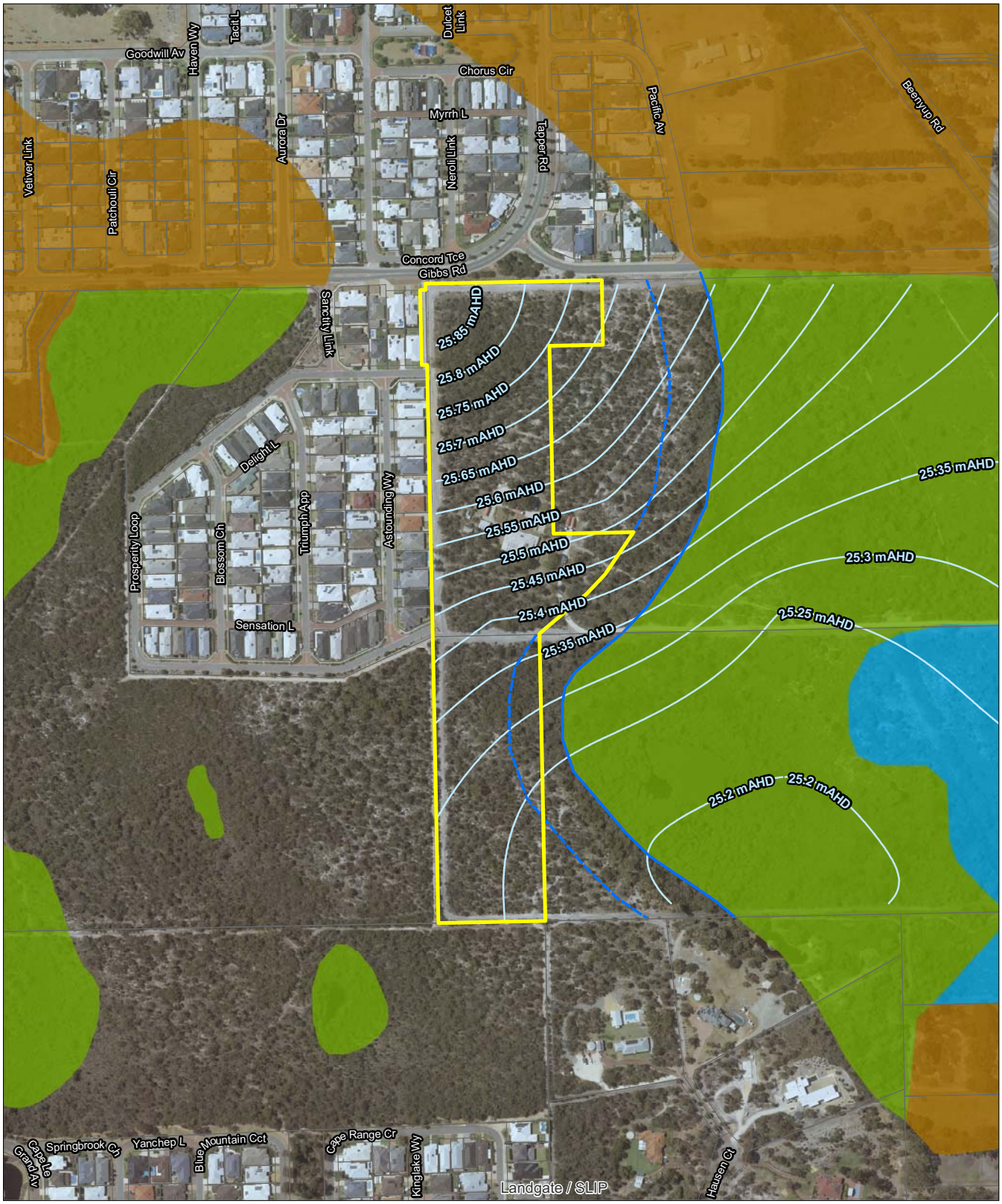

Legend

- Site Boundary (7.27 ha)
- Lot Boundaries
- Conservation Category Wetland (CCW)
- 50m CCW Buffer
- Groundwater Contours (mAHD; AAMGL)

Geomorphic Wetlands

- Conservation Category
- Resource Enhancement Category
- Multiple Use Category

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Figure 5
Hydrology

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Legend

- Site Boundary (7.27 ha)
- Proposed Road Network

Vegetation Associations

- AfEmBi (0.70 ha)
- BaBm (A) (1.67 ha)
- BaBm (B) (1.92 ha)
- BiKg (1.12 ha)
- Ec (0.57 ha)
- Garden or Orchard (0.57 ha)
- Cleared (0.72 ha)

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Aigle Royal Developments
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Environmental Assessment Report: Local Structure Plan

Figure 6
Vegetation Type

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Legend

- Site Boundary (7.27 ha)
- Proposed Road Network

Vegetation Condition

- Excellent (1.05 ha)
- Excellent - Very Good (0.84 ha)
- Very Good - Good (1.73 ha)
- Good (2.21 ha)
- Degraded (0.15 ha)
- Completely Degraded (1.29 ha)

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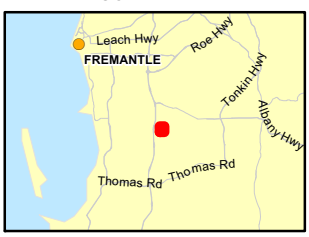

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Figure 7
Vegetation Condition

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Legend

- Site Boundary (7.27 ha)
- Proposed Road Network

Potential Breeding Trees

- Jarrah

Black Cockatoo Foraging Habitat

- Banksia Woodland (3.71 ha)
- Eucalypt Woodland (1.22 ha)
- Banksia Woodland, Remaining (0.74 ha)
- Eucalypt Woodland, Remaining (0.34)

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Environmental Assessment Report: Local Structure Plan

Figure 8
Black Cockatoo Foraging Habitat

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Legend

- Site Boundary (7.27 ha)
- Lot Boundaries
- Bush Forever Sites
- Regional Ecological Linkage
- Environmentally Sensitive Areas
- Regional Parks

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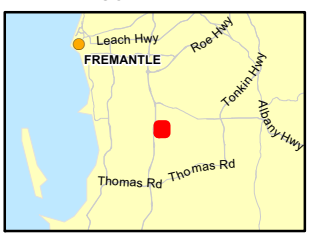

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Aigle Royal Developments
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Environmental Assessment Report: Local Structure Plan

Figure 9
Environmental Conservation Areas

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ROWE GROUP DESIGN

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NOT TO SCALE @ A4

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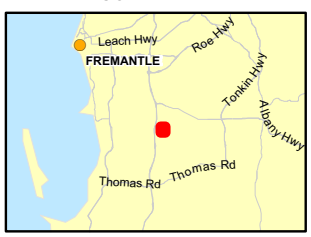

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Environmental Assessment Report: Local Structure Plan

Figure 10
Proposed Local Structure Plan

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Appendices

Appendix A
EPBC Referral (2017/7923)

Notification of
REFERRAL DECISION AND DESIGNATED PROPONENT – controlled action
Residential Development on Lot 11 and 74 Beenyup Road, Banjup, WA (EPBC 2017/7923)

This decision is made under section 75 and section 87 of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

proposed action	To clear vegetation to develop Lot 11 and 74 Beenyup Road, Banjup, Western Australia, for residential housing [See EPBC Act Referral 2017/7923].
decision on proposed action	The proposed action is a controlled action. The project will require assessment and approval under the EPBC Act before it can proceed.
relevant controlling provisions	• Listed threatened species and communities (sections 18 & 18A)
designated proponent	The trustee for The Bellridge Trust ABN: 12 585 998 898
assessment approach	The project will be assessed by preliminary documentation.

Decision-maker

Name and position	Gregory Manning Assistant Secretary Assessments (WA, SA, NT) and Air Branch
Signature	
date of decision	20 July 2017

Appendix B
360 Environmental (2016) Flora and Vegetation Report

360 environmental

Beenyup Road

Level 2 Flora and Vegetation Survey

Prepared for:
Aigle Royal Developments

February 2016

people • planet • professional

Document Reference	Revision	Prepared by	Reviewed by	Submitted to Client	
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Executive Summary

360 Environmental was commissioned by Aigle Royal Developments (ARD) to conduct a Level 2 flora and vegetation survey at Lots 11 and 74 Beenyup Road in Banjup (Survey Area). The Survey Area is approximately 41.1 ha in size and is located approximately 22 km south of Perth Central Business District (CBD), in the Swan Coastal Plain (SCP) biogeographic region of WA.

A total of 145 taxa (including species, subspecies, varieties and forms) from 101 genera and 45 families were recorded in the Survey Area. The commonly occurring families were; Myrtaceae (18 taxa), Fabaceae (15 taxa) and Orchidaceae (13 taxa).

Portions of the Survey Area have been completely cleared for residential and a nursery, while other areas have been allowed to regenerate naturally and some sections have had endemic and non-endemic species planted. There is also a large proportion of the site that is original native vegetation.

A total of 27 introduced species were recorded during the survey (Table 6). Two species, **Asparagus asparagoides* and **Zantedeschia aethiopica*, are listed as Declared under the BAM Act. One species **Asparagus asparagoides* is listed as a Weed of National Significance (WONS).

The database searches identified 24 conservation significant flora as potentially occurring in the vicinity of the Survey Area. Of these, nine are classed as Threatened, one as Priority 1, eight as Priority 3 and six as Priority 4.

No Threatened flora species listed under the *Environment Protection and Biodiversity Conservation Act 1999* or gazetted as Declared Rare Flora (Threatened) pursuant to the Wildlife Conservation Act were recorded during the survey. No Priority species were found during the survey.

Vegetation condition ranged from Completely Degraded to Excellent. Historical vegetation clearing, weeds, housing, a nursery and the presence of tracks in the Survey Area were the most frequently observed impacts on native vegetation.

Two Priority 3 vegetation communities, SCP21c - Low lying *Banksia attenuata* woodlands or shrublands and SCP22 – *Banksia ilicifolia* woodlands, are known to occur in close proximity to the Survey Area with their buffers encroaching into the north east corner of the Survey Areas boundary.

One listed Priority 3 vegetation community from the database search was identified as occurring in the Survey Area. Vegetation associations BaBm (b) and BiKg are thought to represent FCT SCP 21c – Low lying *Banksia attenuata* woodlands or shrublands.

The vegetation association BaBm (a), has been identified as FCT SCP23a - Central *Banksia attenuata – B. menziesii* woodlands. Although the database search did not identify SCP23a, it is included in the PEC "Banksia dominated woodlands of the Swan Coastal Plain IBRA region", which is now listed as a Priority 3.

The entire Survey Area is identified as an Environmentally Sensitive area (ESA). Although there is no publicly available information detailing the reasoning behind the ESA mapping, the boundaries are found to correlate with the Gibbs Road Swamp System according to the Directory of Important Wetlands.

The DPaW Geomorphic Wetlands Dataset identifies one Conservation Category Wetland (CCW) and one Resource Enhancement Wetland (REW) as occurring in the Survey Area. CCWs and their associated buffers are considered ESAs.

Environmentally Sensitive Areas are declared to prevent degradation of important environmental values such as T/DRF, TECs or significant wetlands. Exemptions contained in the Environmental Protection (Clearing of Native vegetation) Regulations 2004 for low impact land clearing do not apply in ESAs and a clearing permit is required.

Permits

This flora survey was conducted under the following licences issued by DPaW; Licence to take flora for scientific or other prescribed purposes SL011541 and Permit to take Declared Rare Flora 44-1516 issued to Narelle Whittington.

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1 Introduction

1.1 The Project

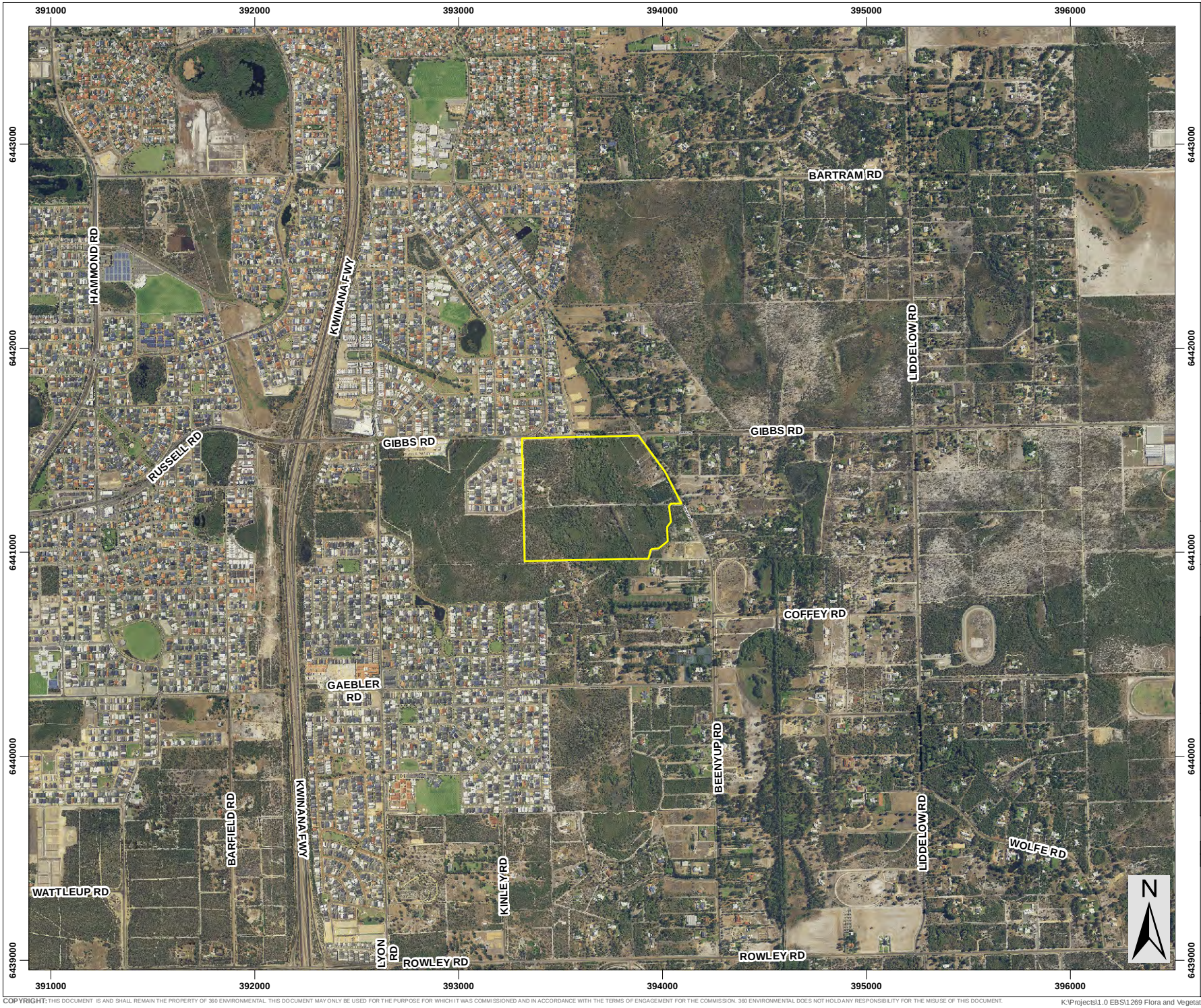
360 Environmental was commissioned by Aigle Royal Developments (ARD) to conduct a Level 2 flora and vegetation survey at Lots 11 and 74 Beenyup Road in Banjup (Survey Area). The Survey Area is approximately 41.1 ha in size and is located about 22 km south of Perth CBD, in the Swan Coastal Plain (SCP) biogeographic region of Western Australia (WA) (Figure 1).

360 Environmental understands from communications with ARD that a flora assessment was previously undertaken in the Survey Area and that this data is not accessible, as such a new survey is required. This flora and vegetation survey is required to support a local structure plan and to undertake wetland assessments and possible boundary changes.

1.1.1 Objectives

The objectives of the flora and vegetation assessment were to:

- Conduct a desktop assessment of databases and spatial datasets to determine the environmental values and any potential issues, such as Threatened/Rare and significant species, Threatened Ecological Communities (TECs) and Priority Ecological Communities (PECs), that may be present in the Survey Area and the surrounding areas;
- Produce a list of plant species (including weed species);
- Document and map the location of any Threatened/Declared Rare Flora (T/DRF), Priority flora and any other flora of local or taxonomic significance;
- Identify, map and discuss the significance of any TECs, PECs and any other areas of ecological importance (e.g. National Parks, wetlands and Environmentally Sensitive Areas [ESAs] etc.);
- Assess, map and photograph vegetation condition; and
- Document, describe and map the vegetation associations present.



Legend

- Survey Area
- Roads

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Meters
1:25,000 @ A4

LOCALITY MAP

PROJECT ID	DATE
1269	11/12/2015

HORIZONTAL DATUM AND PROJECTION
GDA 1994 MGA Zone 50

CREATED	CHECKED	APPROVED	REVISION
CS	NW	TS	0

Aigle Royal Developments
Beenyup Road, Banjup

Level 2 Flora and Vegetation Survey

Figure 1 -
Vegetation Condition

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1.2 Background to the Protection of Flora and Vegetation

WA flora is protected formally and informally by various legislative and non-legislative measures, which are as follows:

Legislative measures:

- *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act);
- *Wildlife Conservation Act 1950* (WC Act);
- *Environmental Protection Act 1986* (EP Act); and
- *Biosecurity and Agriculture Management Act 2007* (BAM Act).

Non-legislative measures:

- WA Department of Parks and Wildlife (DPaW) Priority lists for flora and ecological communities;
- Weeds of National Significance (WONS); and
- Recognition of locally significant populations by the DPaW.

A short description of each is given below. Other definitions, including species conservation categories, are provided in Appendix A. Conservation categories for ecological communities are provided in Appendix B.

1.2.1 EPBC Act

The EPBC Act aims to protect matters of national environmental significance (MNES). Under the EPBC Act, the Commonwealth Department of the Environment (DoE) lists threatened species and communities in categories determined by criteria set out in the Act (Appendix A and B).

Projects likely to cause a significant impact on MNES should be referred to the DoE for assessment under the EPBC Act.

1.2.2 WC Act

The WA DPaW lists flora under the provisions of the WC Act as protected according to their need for protection (Appendix A).

Flora is given Declared Rare status when populations are geographically restricted or are threatened by local processes. In addition, under the WC Act, by Notice in the WA Government Gazette of 9 October 1987, all native flora are protected throughout the State.

1.2.3 EP Act

T/DRF and TECs are given special consideration in environmental impact assessments, and have special status as ESAs under the EP Act and the *Environmental Protection*

(Clearing of Native Vegetation) Regulations 2004. Exemptions for a clearing permit do not apply in an ESA.

1.2.4 BAM Act

Plants may be 'Declared' by the Agriculture Protection Board (APB) under the BAM Act 2007 (WA). Declared Plants are gazetted under three categories (C1-C3), which define the action required. Details of the definitions of these categories are provided in Appendix C. A declaration may apply to the whole State, to districts, individual properties or even to single paddocks. If a plant is 'Declared', landholders are obliged to control that plant on their properties (Department of Agriculture and Food WA [DAFWA] 2014).

1.2.5 DPaW Weed Prioritisation Process

The DPaW Weed Prioritisation Process (WPP) was developed to progress the Environmental Weed Strategy of WA. The Weed Prioritisation Process for DPaW (DPaW 2013) prioritises weeds in each of the DPaW Regions, with the aim being to establish both a species-led and an asset-protection-based approach to weed management.

The species-led process assesses weed species for their invasiveness, ecological impacts, potential and current distribution and feasibility of control. The resulting priorities focus on infestations of species which are considered to be high impact, rapidly invasive and still at a population size which is feasible to eradicate or contain to a manageable size. Weed species which are already widespread do not rank as a high priority through this part of the process.

The next stage of the process investigates the use of an asset-protection-based approach to guide the management of widespread weeds. This approach focuses on identifying high value biodiversity assets, the weeds that pose a threat to these assets and the sites where control will have the greatest biodiversity benefit and cost effectiveness. Social, cultural and economic assets as well as good neighbour issues are considered at a later stage of the process.

1.2.6 Weeds of National Significance

The Australian Government along with the State and Territory governments has endorsed 32 WONS. Four major criteria were used in determining WONS:

- The invasiveness of a weed species;
- A weed's impacts;
- The potential for spread of a weed; and
- Socio-economic and environmental values.

Each WONS has a national strategy and a national coordinator, responsible for implementing the strategy. WONS are regarded as the worst weeds in Australia because of their invasiveness, potential for spread, economic and environmental impacts (Thorp & Lynch 2000).

1.2.7 DPAW Priority Lists

The DPaW lists 'Priority' flora that have not been assigned statutory protection as Declared Rare or 'Scheduled' under the WC Act, but which are under consideration for declaration as DRF. Flora assessed as Priority 1-3 are considered to be in urgent need of further survey. Priority 4 flora requires monitoring every 5-10 years and Priority 5 flora is subject to a specific conservation programme (Appendix A).

The DPaW maintains a list of PECs which identifies ecologically valuable communities that need further investigation before possible nomination for TEC status. Once listed, a community is a PEC, and when endorsed by the WA Minister of Environment becomes a TEC, and protected as an ESA under *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* (Appendix B).

1.2.8 Informal Recognition of Flora

Certain populations or communities of flora may be of local significance or interest because of their patterns of distribution and abundance. For example, specific locations of flora may be locally significant because they are range extensions to the previously known distribution, or are newly discovered taxa (and have the potential to be of more than local significance). In addition, many species are in decline as a result of threatening processes (land clearing, grazing, changed fire regimes), and relict populations of such species assume local importance for the DPaW. It is not uncommon for the DPaW to make comment on these species of interest.

2 Biophysical Environment

2.1 Climate

The closest long term official Bureau of Meteorology (BoM) weather station currently operating near the Survey Area, is Jandakot Airport (Station number 009172), approximately 7 km north of the Survey Area. The climate for the area is described as warm Mediterranean (Mitchell *et al*. 2002), with mean minima of 11.5 °C, a maxima of 24.5 °C and an average of 820.1 mm of rainfall per annum (BoM 2015).

Jandakot Airport recorded 530.8 mm of rain prior to the survey (January 2015 – August 2015). This is 121.4 mm below the long term average rainfall of 652.2 mm for the same period (BoM 2015). For the three months prior to the survey (June 2015 – August 2015), Jandakot Airport recorded 351.6 mm of rainfall, 23% below the 456.4 mm long term average rainfall for the same period (BoM 2015).

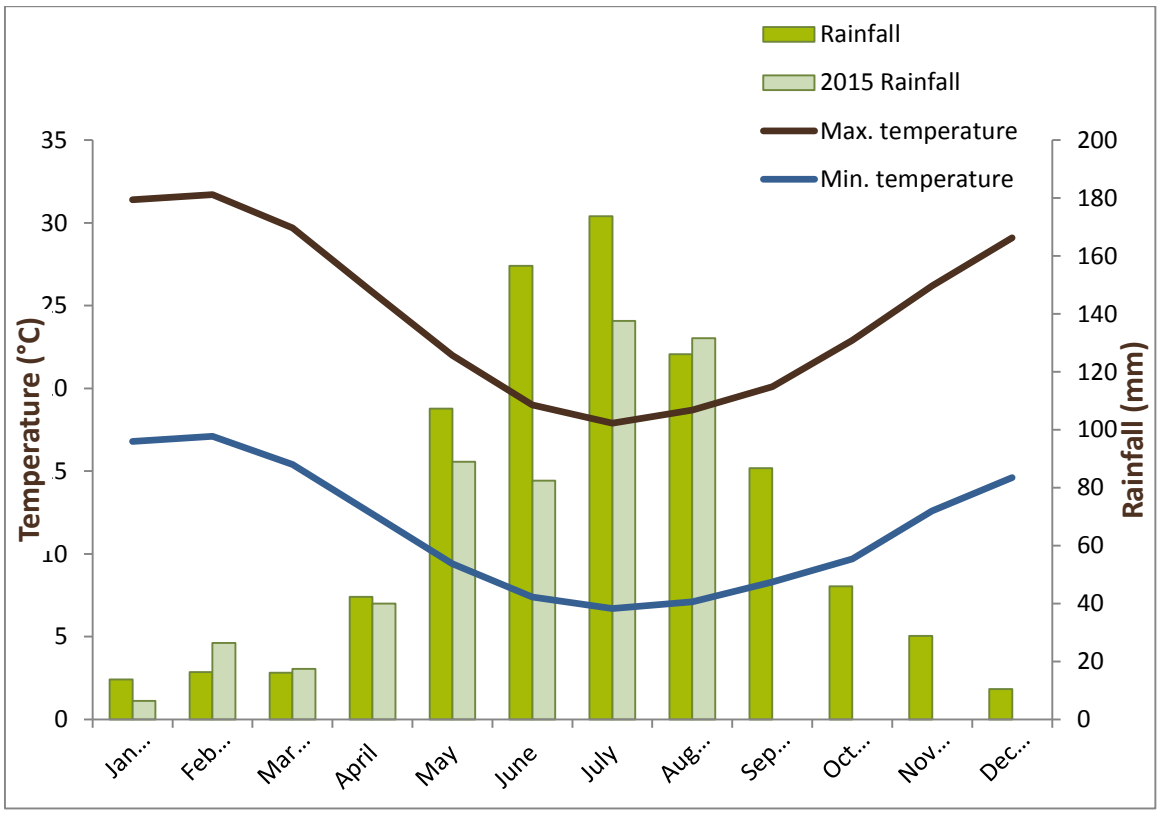

Figure 2: Mean Rainfall (from 1944 to 2015) and Temperature Data (from 1944 to 2015) for Jandakot Airport Weather Station (009172) (BoM 2015).

2.2 Geology and Soils

Soil-landscape mapping of South West WA has been captured at scales ranging from 1:20 000 to 1:250 000 (DAFWA 2012). Soil-landscape mapping describes broad soil and landscape characteristics from regional to local scales.

The Survey Area contains the following geological units and soil types:

- 212Bs – Swan Coastal Plain from Busselton to Jurian. Sand Dunes and sandplains with pale deep sand, semi-wet and wet soil. Banksia-paperbark woodlands and mixed heaths.

2.3 Hydrology

The Geomorphic Wetlands dataset is identified and utilised by the Environmental Protection Authority (EPA), Department of Environment Regulation (DER) and the Department of Planning as a basis for planning and decision making. The wetland management categories as set out by Hill *et al.* (1996) along with the management objectives utilised by the EPA and the DPaW for wetlands are displayed in Table 1.

The DPaW Geomorphic Wetlands Dataset identifies two wetlands as occurring in the Survey Area (DPAW 2015a) (Figure 3).

The DPaW Geomorphic Wetlands Dataset identifies one Conservation Category Wetland (CCW) and one Resource Enhancement Wetland (REW) as occurring in the Survey Area. The unique identification numbers (UFI) and management category of these wetlands are provided in Table 1.

Table 1: Geomorphic Wetlands in the Survey Area

MANAGEMENT CATEGORY	WETLAND UFI
Resource Enhancement Wetland	15180
Conservation Wetland	12984

2.4 Bush Forever

Bush Forever is a State Government Policy and programme that identifies 51,200 ha of regionally significant vegetation for protection, covering 26 vegetation complexes. This amounts to approximately 18% of the original vegetation on the SCP biogeographic region of the Perth metropolitan area.

Regionally significant vegetation has been identified based on criteria relating to its conservation value. Important criteria in the identification process include the achievement, where possible, of a comprehensive representation of all the ecological communities originally occurring in the region, principally through protecting a target of at least 10% of each vegetation complex in the Bush Forever project boundary (Government of WA 2000).

No Bush Forever Sites are in the Survey Area; however, there is one Bush Forever site adjacent to the site on the south west corner (Figure 3):

- BF 492 – Lyon Road Bushland, Banjup.

There is also another Bush Forever Site, 263 – Banjup Bushland, Banjup which, is approximately 250 m to the east.

2.5 Ecological Linkages

The Survey Area forms part of the Perth Biodiversity Project's (PBP) Draft Regional Ecological Linkage Network presented in Figure 3. The purpose of the Regional Ecological Linkages identified by the PBP was to link protected natural areas with other areas of mapped native vegetation. Priority was given to identifying linkages through those areas having the greatest assumed protection and to those areas that maximised opportunities to form continuous corridors of native vegetation. The Survey Area is intersected by ecological linkage 52 which includes approximately 50% of the Survey Area and joins ecological linkage 46 that runs in a northern direction.

2.6 Environmentally Sensitive Areas

The entire Survey Area is mapped as an ESA (Figure 4).

2.7 Biogeographic Regionalisation for Australia

The Biogeographic Regionalisation of Australia (IBRA7) divides Australia into 89 bioregions based on major biological and geographical/geological attributes. These bioregions are subdivided into 419 subregions, as part of a refinement of the IBRA framework (DoE 2014a). The Survey Area lies within the Swan Coastal Plain Bioregion and Perth subregion (SWA2) of WA.

2.8 Broad Vegetation Types

Mapping of the vegetation of the Perth region of WA was completed on a broad scale (1:250,000) by Beard (1981). These vegetation units were re-assessed by Shepherd *et al*. (2001) to account for clearing in the intensive land use zone, dividing some larger vegetation units into smaller units.

There is one Beard / Shepherd vegetation unit in the Survey Area. The Shepherd *et al.* (2001) vegetation types (along with the corresponding Beard [1981] type in brackets), is described below, and its representation within the Survey Area, subregion, region and state is shown in Table 2.

- **1001** (e2Mb cbLi) – **Bassendean;** Medium very sparse woodland; *E. marginata* with low woodland, *Banksia* sp. and *Casuarina* sp.

Table 2: Broad Vegetation Types within the Survey Area and its State and Regional Representation (Government of WA 2013).

	Pre-European area (ha)	Current extent (ha) 1	Remaining (%)	Current extent % in IUCN Class I-IV Reserves1
Vegetation Types (Beard 1981/ Shepherd *et al*. 2001) in the state				
1001	57,410.23	13,240.22	23.06	1.14
Vegetation Types (Beard 1981/ Shepherd *et al*. 2001) in the Swan Coastal Bioregion				
1001	57,410.23	13,240.22	23.06	1.14
Vegetation Types (Beard 1981/ Shepherd *et al*. 2001) in the Perth Subregion				
1001	57,410.23	13,240.22	23.06	1.14

Mapping by Heddle *et al.* (1980) is based on the relationship to the landform-soil units determined by Churchward & McArthur (1980). This mapping identified one vegetation complex occurring in the Survey Area and this is summarised in Table 3. The delineation of vegetation complexes is based on the concept of series of plant communities forming regularly repeating complexes associated with a particular soil unit. The Heddle *et al.* (1980) vegetation complex that occurs across the Survey Area is described below:

- **Bassendean Complex – Central and South** Woodland to low woodland and sedgelands;

Table 3: Vegetation Complex within the Survey Area and their State and Regional Representation.

	Pre-European area (ha)	Current extent (ha)	Remaining (%)	Current extent Secure Tenure Reserves (%)
Vegetation Complex (Heddle *et al.* 1980) in the System 6/part System 1 area (EPA 2006)				
Bassendean Complex–Central and South	87,477	23,624	27.0	0.7
Vegetation (Heddle *et al.* 1980) in the Swan Coastal Bioregion (PBP 2013)				
Bassendean Complex–Central and South	87,392.73	24,206.24	27.70	2.57

3 Methods

3.1 Background

The flora survey was consistent with a single season Level 2 survey as per the EPA requirements for environmental surveying and reporting for flora and vegetation in WA where practical and relevant, as set out in the following documents:

- EPA Guidance for the Assessment of Environmental Factors: Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in WA No. 51 (EPA 2004); and
- EPA Guidance for the Level of Assessment for Proposals affecting Natural Areas within the System 6 Region and Swan Coastal Plain Portion of the System 1 region. Guidance Statement No. 10 (EPA 2006).

3.2 Flora and Vegetation Survey Methods

3.2.1 Flora and Vegetation Database Review

The desktop study provided background information on the flora and vegetation of the Survey Area. This involved a search of the following sources:

- DPaW Threatened and Priority Flora database (DPaW 2015b);
- DPaW Threatened and Priority Ecological Communities database (DPaW 2015c); and
- DoE Protected Matters Search Tool (DoE 2015b).

A request for a database search was submitted to the DPaW on the 8th September 2015 (5 km buffer search around the Survey Area) to obtain a list of Declared Rare Flora/Threatened or Priority flora, and TECs and PECs in and near the Survey Area. These sources were used to compile a list of expected DRF or Priority species and TECs and PECs that may occur based on the landforms in the Survey Area.

3.2.2 Flora and Vegetation Field Survey

The field survey was conducted by two botanists, on the 15th and 16th September 2015.

The survey included the assessment of 15 quadrats and seven relevés and vegetation mapping notes. Quadrats are vegetation survey plots which are accurately measured out as 10 x 10 m (or an area equivalent to 100 m2) and marked at the NW corner using a handheld Garmin GPS unit. Relevés are unbounded vegetation survey plots with information recorded including landscape features, surface soil colour and texture, bare ground, litter cover, disturbance, fire age, aspect and vegetation condition. Each species

of dominant plant at each relevé was recorded, including information on height and percentage cover.

3.2.3 Taxonomy and Nomenclature

Where field identification of plant taxa was not possible, specimens were collected systematically for later identification utilising resources of the Western Australian Herbarium (WAH).

The species list was checked against FloraBase (WAH 2014) to determine the species conservation status. Threatened and Priority Flora were verified against the EPBC Act listing of threatened species to determine Commonwealth listing.

Introduced species were checked against the DPaW Weed Prioritisation Process (WPP) (DPaW 2013), to determine their ranking in terms of environmental impact. The BAM Act Declared Plants list was consulted to determine if any are Declared Plants, and the WONS list to determine the presence of any WONS (Thorp & Lynch 2000).

3.2.4 Vegetation Mapping

The vegetation mapping units were described based on their structure and species composition, as defined by quadrat data and field observations. Vegetation was mapped in the field using handheld GPS (Garmin) units and high-resolution aerial photographs (1:2,000 scale), which in the office were digitised using GIS software.

Vegetation condition was mapped in the field using handheld GPS (Garmin) units and high-resolution aerial photographs (1:2,000 scale), which in the office were digitised using GIS software. Vegetation condition was assessed based on Bush Forever (Government of WA 2000) (Appendix D).

4 Results

4.1 Flora and Vegetation Survey Limitations and Constraints

Survey constraints are often difficult to predict, as is the extent to which they influence survey effort. Survey limitations and constraints of the flora and vegetation survey are detailed in Table 4.

Table 4: Limitations and Constraints Associated with the Survey.

VARIABLE	IMPACT ON SURVEY OUTCOMES
Access	The whole Survey Area was accessed and traversed. Particular focus was given to areas expected to be impacted and or that may have species of conservation significance.
Experience	The personnel who executed these surveys were practitioners suitably qualified in their respective fields: ● Coordinating Principal Botanist: Narelle Whittington; ● Field Staff: Narelle Whittington and Hayden Ajduk; ● Data Interpretation and Reporting: Narelle Whittington and Hayden Adjuk ● Report Review: Dr Ron Firth.
Timing, weather, season	The survey was conducted during spring after three months of below average rainfall (refer to section 2.1). The climate for the area is described as warm Mediterranean (Mitchell *et al.* 2002), with mean minima of 11.5 °C, a maxima of 24.5 °C and an average of 820.1 mm of rainfall per annum (BoM 2015). Flora composition changes with time, particularly seasonally as a result of seasonal conditions. Therefore, botanical surveys completed at different times will have varying results.
Scope: Life forms sampled	The scope of this project included the detailed surveying of flora and vegetation and searching for conservation significant species or communities.
Sources of information	Relevant DPaW searches were undertaken for the Survey Area and are listed in section 3.2. The desktop analysis used several sources to produce a list

	of flora species previously recorded in the vicinity of the Survey Area. This includes records from the EPBC Protected Matters Search Tool (DoE 2015b), NatureMap (DoE 2015c), DPaW Threatened & Priority Flora Search (DPaW 2015b) and DPaW Threatened & Priority Ecological Communities Search (DPaW 2015c), as well as field guides and other scientific literature.
Completeness	The entire Survey Area was accessible; the time spent conducting the survey was considered adequate for the size and complexity of the site. All vegetation associations were sufficiently surveyed; with 15 quadrats and seven relevés and additional vegetation mapping notes recorded.
Disturbances	The disturbance of the Survey Area varies. Portions of the Survey Area have been completely cleared for housing and the nursery. Some areas have been allowed to regenerate naturally and others have had endemic and non-endemic species planted. A large proportion of the site has not been cleared and remains intact.

4.2 Flora Results

4.2.1 Database Results

The database searches identified 24 conservation significant flora species as potentially occurring in the vicinity of the Survey Area. Of these, nine are classed as Threatened, one as Priority 1, eight as Priority 3 and six as Priority 4.

The likelihood of these 24 conservation significant flora occurring in the Survey Area is shown in Table 5 (refer also to Figure 5).

No TECs listed by the State or under the EPBC Act were present in the databases within a 5 km radius of the Survey Area. However, three State PECs were identified as occurring within 5 km of the Survey Area:

- SCP21c – Low lying *Banksia attenuata* woodlands or shrublands (Priority 3 (DPaW);
- SCP22 – *Banksia ilicifolia* woodlands (Priority 3 (DPaW)); and
- SCP24 – Northern *Spearwood shrublands and woodlands* (Priority 3 (DPaW));

Table 5: Assessment of the Likelihood of Occurrence of Significant Flora in the Survey Area.

[1]Closest record to Survey Area based on DPaW 2014.
Likely = Suitable habitat present and records less than 2 km from the Survey Area, Possible = Suitable habitat present and records between 2 km and 5 km from the Survey Area, Unlikely = No suitable habitat present and/or records greater than 5 km from the Survey Area, EN = Endangered, CR = Critically Endangered, VU = Vulnerable and T=Threatened.

Conservation Status		Species	Habitat Information (WAH 2014)	Suitable Habitat	Closest Record[1]	Likelihood
EPBC	DPaW					
EN	T	*Andersonia gracilis*	White/grey sand, sandy clay, gravelly loam. Winter-wet areas, near swamps.	Yes	16.0 km	Unlikely
CR	T	*Caladenia huegelii*	Grey or brown sand, clay loam.	Yes	1 km	Likely
CR	T	*Darwinia foetida*	Information unavailable	Unknown	56.1 km	Unlikely
VU	T	*Diuris micrantha*	Brown loamy clay. Winter-wet swamps, in shallow water.	Yes	6.3 km	Unlikely
EN	T	*Diuris purdiei*	Grey-black moist sand. Winter-wet swamps.	Yes	4.2 km	Possible
EN	T	*Drakaea elastica*	White or grey sand. Low-lying situations adjoining winter-wet swamps.	Yes	3.1 km	Possible
EN	T	*Drakaea micrantha*	White-grey sand.	Yes	3.6 km	Possible
EN	T	*Lepidosperma rostratum*	Peaty sand, clay.	Yes	7.3 km	Unlikely
EN	T	*Thelymitra dedmaniarum*	Granite	No	41.1 km	Unlikely
-	P1	*Acacia lasiocarpa* var. *bracteolata* long peduncle variant	Grey or Black sand over clay. Swampy areas, winter wet lowlands	Yes	Not available	Possible

Conservation Status		Species	Habitat Information (WAH 2014)	Suitable Habitat	Closest Record[1]	Likelihood
EPBC	DPaW					
-	P3	*Byblis gigantea*	Sandy-peat swamps. Seasonally wet areas.	Yes	6.3 km	Unlikely
-	P3	*Cyathochaeta teretifolia*	Grey sand, sandy clay. Swamps, creek edges.	Yes	2.7 km	Possible
-	P3	*Eryngium pinnatifidum* subsp. *palustre*	No information available	Unknown	Not available	Unknown
-	P3	*Jacksonia gracillima*	No information available	Yes	500 m	Likely
-	P3	*Pimelea calcicola*	Coastal limestone ridges	No	3.4 km	Unlikely
-	P3	*Stylidium longitubum*	Sandy clay, clay. Seasonal wetlands.	Yes	5.8 km	Possible
-	P3	*Stylidium paludicola*	Peaty sand over clay. Winter-wet areas. Marri and *Melaleuca* woodland, *Melaleuca* shrubland.	Yes	3.2 km	Possible
-	P4	*Dodonaea hackettiana*	Sand. Outcropping limestone.	No	3.6 km	Unlikely
-	P4	*Microtis quadrata*	No information available	Unknown	6.0 km	Unknown
-	P4	*Ornduffia submersa*	No information available	Unknown	6.9 km	Unknown
-	P4	*Thysanotus glaucus*	White, grey or yellow sand, sandy gravel	Yes	9.3 km	Unlikely
-	P4	*Tripterococcus* sp. *Brachylobus*	No information available	Unknown	1.2 km	Unknown

Conservation Status		Species	Habitat Information (WAH 2014)	Suitable Habitat	Closest Record[1]	Likelihood
EPBC	DPaW					
-	P4	*Verticordia lindleyi* subsp. *lindleyi*	Sand, sandy clay. Winter-wet depressions.	Yes	1.5 km	Likely

4.2.2 Overview of Flora

A total of 145 taxa (including species, subspecies, varieties and forms) from 101 genera and 45 families were recorded in the Survey Area. The commonly occurring families were; Myrtaceae (18 taxa), Fabaceae (15 taxa) and Orchidaceae (13 taxa.)

Of the 146 taxa, 27 are introduced species. Portions of the Survey Area have been completely cleared for residential and nursery purposes, some areas have been allowed to regenerate naturally and others have had endemic and non-endemic species planted (Figure 6). There is also a large proportion of the site that is original native vegetation.

The flora inventory is provided in Appendix E and the Survey Area data sheets in Appendix F.

4.2.3 Flora of Conservation Significance

A targeted search for conservation significant flora species resulted in:

- No Priority species as listed by DPaW were recorded during the survey; and
- No Threatened species listed under the EPBC Act or gazetted as Declared Rare Flora (Threatened) pursuant to the WC Act were recorded during the survey.

4.2.4 Introduced Flora

A total of 27 introduced species were recorded during the survey (Table 6). Two species, **Asparagus asparagoides* and **Zantedeschia aethiopica*, are listed as Declared under the BAM Act. One species **Asparagus asparagoides* is listed as a WONS.

Table 6: Introduced Flora Recorded in the Survey Area and Their Ranking under the DPaW Weed Prioritisation Process (DPaW 2013).

Taxon	Common Name	DPaW WPP ranking	Declared BAM Act	WONS
**Acacia iteaphylla*	Flinders Range Wattle	High	No	No
**Acacia longifolia*	Sydney Golden Wattle	High	No	No
**Arctotheca calendula*	Cape Weed	Low	No	No
**Avena barbata*	Bearded Oat	Low	No	No
**Asparagus asparagoides*	Bridal Creeper	Low	Yes	Yes
**Briza maxima*	Blowfly Grass	Low	No	No
**Carpobrotus edulis*	Pigface	Under review	No	No
**Cotula coronopifolia*	Waterbuttons	Under review	No	No
**Crassula natans* var. *minus*	-	Under review	No	No

**Cyperus tenellus*	Tiny Flat-Sedge	Under review	No	No
**Ehrharta calycina*	Perennial Veld Grass	Low	No	No
**Ehrharta longiflora*	Annual Veld Grass	Low	No	No
**Eragrostis curvula*	African Lovegrass	Low	No	No
**Euphorbia terracina*	Geraldton Carnation Weed	Moderate	No	No
**Fumaria capreolata*	Whiteflower Fumitory	Low	No	No
**Galium murale*	Small Bedstraw	Under review	No	No
**Gladiolus caryophyllaceus*	Wild Gladiolus	Moderate	No	No
**Hypochaeris glabra*	Smooth Catsear	Low	No	No
**Juncus capitatus*	-	Under review	No	No
**Lysimachia arvensis*	Pimpernel	Under review	No	No
**Pelargonium capitatum*	Rose Pelargonium	Low	No	No
**Romulea rosea* var. *australis*	Guildford Grass	Negligible	No	No
**Sonchus oleraceus*	Common Sowthistle	Negligible	No	No
**Trifolium* sp.	Hop Clover	information unavailable	No	No
**Ursinia anthemoides*	Ursinia	Negligible	No	No
**Vulpia bromoides*	Squirrels Tail Fescue	Under review	No	No
**Zantedeschia aethiopica*	Arum Lily	Moderate	Yes	No

4.2.5 Vegetation Associations

Thirteen natural vegetation associations were recorded in the Survey Area, there are also five other mapping units. Descriptions of these are provided in Table 7 and 8 and Figure 6.

Table 7: Vegetation Association Descriptions and their Extent in the Survey Area.

Vegetation Association Code	Description	Area (ha)
BaBm(a)	Low Woodland of *Banksia attenuata*, *Banksia menziesii*, *Allocasuarina fraseriana*, *Eucalyptus marginata* over *Kunzea glabrescens*, *Acacia pulchella*, *Hibbertia hypericoides*, *Xanthorrhoea preissii*, *Bossiaea eriocarpa* and *Conostylis aculeata*.	2.64
BaBm(b)	Low Woodland of *Banksia attenuata*, *Banksia menziesii*, *Allocasuarina fraseriana* over *Kunzea glabrescens*, *Dasypogon bromeliifolius*, *Hibbertia subvaginata*, *Calytrix fraseri* and *Bossiaea eriocarpa*.	4.67
AfEmBi	Open Woodland of *Allocasuarina fraseriana*, *Eucalyptus marginata* and *Banksia ilicifolia* over *Xanthorrhoea preissii*, *Dasypogon bromeliifolius*, *Bossiaea eriocarpa*, *Gompholobium tomentosum* and *Phlebocarya ciliata*.	1.53
BiKg	Woodland of *Banksia ilicifolia* and *Banksia attenuata* over *Kunzea glabrescens*, *Xanthorrhoea preissii*, *Dasypogon bromeliifolius* and *Desmocladus flexuosus*.	1.12
ErMp	Woodland of *Eucalyptus rudis* and *Melaleuca preissiana* over *Kunzea glabrescens*, *Xanthorrhoea preissii*, *Adenanthos cygnorum* and *Hypocalymma angustifolium*.	1.14
KgHa	Low Open Woodland of *Melaleuca preissiana* and *Melaleuca rhaphiophylla* over *Kunzea glabrescens*, *Hypocalymma angustifolium*, *Astartea scoparia*, *Melaleuca teretifolia*, *Meeboldina scariosa* and *Lepidosperma longitudinale*.	3.38
MpKg	Low Open Woodland of *Melaleuca preissiana* over *Kunzea glabrescens*, *Hakea varia*, *Acacia pulchella* var. *glaberrima*, *Calothamnus lateralis* var. *lateralis* and *Meeboldina coangustata*.	2.89
MrBa	Low Closed Forest of *Melaleuca rhaphiophylla* over *Baumea articulata*.	2.83

MtMr	*Closed Tall Scrub of Melaleuca teretifolia, Melaleuca rhaphiophylla, Meeboldina coangustata and Juncus capitatus.*	1.24
MrMl	*Low Woodland of Melaleuca rhaphiophylla over Melaleuca lateritia, Astartea scoparia, Meeboldina coangustata, Lepidosperma longitudinale and Juncus pallidus.*	3.65
Ec	Ecotone of *Banksia ilicifolia* and *Banksia menziesii* over *Kunzea glabrescens, Dasypogon bromeliifolius* and *Phlebocarya ciliata.*	0.8
Ha	Closed Heath of *Hypocalymma angustifolium, Kunzea glabrescens, Dielsia stenostachya, Dasypogon bromeliifolius* and *Boronia crenulata* var. *crenulata.*	7.87
Mr	Monoculture of young *Melaleuca rhaphiophylla* over water.	0.47

Table 8: Other Mapping Unit Descriptions and their Extent in the Survey Area

VEGETATION ASSOCIATION CODE	DESCRIPTION	AREA (HA)
NE	Non-endemic Eucalypt species.	0.49
G/O	Garden and Orchard.	3.96
Cleared	Cleared.	1.95
P	Planted non-endemic and endemic species.	0.73
OW	Open Water	0.04

4.2.6 Vegetation Condition

Vegetation condition ranged from Completely Degraded to Excellent (Figure 7). Historical vegetation clearing, weeds, housing, a nursery and the presence of tracks in the survey area were the most frequently observed impacts on native vegetation.

As evident from historical photographs clearing of the eastern side of the Survey Area was undertaken around 1983 for residential and agriculture use (Figure 8). This has had a direct effect on vegetation association 'Ha' and 'P' which have regrown and now has very low diversity. Vegetation 'P' has had supplementary planting undertaken and is now interspersed with non-endemic species along with naturally occurring vegetation. Additional tracks and clearing have been undertaken since then, including another residence on the western side.

The CCW in the middle of the Survey Area has remained relatively intact and the majority is considered to be in Very Good to Excellent condition with a couple of areas of vegetation in Good condition along with the tracks and a couple of small pockets considered to be in Degraded to Completely Degraded condition. The extent of each vegetation condition is presented in Tables 9.

Table 9: Vegetation Condition and Extent in the Survey Area.

CONDITION	EXTENT (HA)
Excellent	1.29
Excellent – Very Good	11.71
Very Good	9.52
Very Good - Good	1.25
Good	9.70
Good - Degraded	1.29
Degraded	0.28
Completely Degraded	3.36

4.2.7 Floristic Community Types

Statistical analysis (multivariate analysis) and data interpretation, as shown in Table 10 was undertaken to help determine the FCTs represented by the vegetation in the project area. This involves reviewing site data for other factors that are diagnostic for FCTs, including the presence of indicator species, soil types and landform position. The quadrat data was tested for similarity against each of the 509 Gibson *et al.* quadrats that were established as part of a regional study to describe the vegetation types present on the Swan Coastal Plain in 1994. Results from the statistical analysis and the site information, identified six FCTs as occurring in the Survey Area

Table 10: Floristic Community Type Analysis

VEGETATION ASSOCIATION	GIBSON *ET AL.* QUADRAT & FCT	SIMILARITY BASED ON STATISTICAL ANALYSIS	COMMENTS	INFERRED FLORISTIC COMMUNITY TYPE
BJQ1 (BaBm[a])	CRES01 (FCT SCP 23a)	55.0	The top three results in the analysis were SCP23a. This result seems appropriate given the species present and the location of the	**FCT SCP23a** – Central *Banksia attenuata* – *B. menziesii* woodlands
	BANK-3 (FCT SCP 23a)	54.7		
	YULE-2 (FCT	53.7		

Vegetation Association	Gibson *et al.* Quadrat & FCT	Similarity Based on Statistical analysis	Comments	Inferred Floristic Community Type
	SCP 23a)		community on the higher dunes of the Survey Area.	
BJQ2 (MrBa)	Chid06 (FCT SCP s17)	50	This quadrat was characterised by large mature *Melaleuca preissiana* over either sedges or exposed soil which had evidence of inundation.	FCT SCP13 – Deeper wetlands on heavy soils
	White04 (FCT SCP s17)	35.2		
	WN020 (FCT SCP s19)	30.7		
BJQ3 (MrBa)	HYMUS05 (FCT SCP 11)	28.5	The association had both *Melaleuca preissiana* and *M. rhaphiophylla* with an open understorey which showed signs of being inundated.	FCT SCP13 – Deeper wetlands on heavy soils
	HYMUS01 (FCT SCP 11)	25.8		
	CAVS06 (FCT SCP s07)	25.8		
BJQ4 (Mr)	MTB-5 (FCT SCP 17)	25	This quadrat was established in the core of the wetland and was still inundated with water to approximately 30 cm, consisting of only *Melaleuca preissiana*.	FCT SCP13 – Deeper wetlands on heavy soils
	CHID06 (FCT SCP 17)	22.2		
	WATER-2 (FCT SCP 13)	20		
BJQ5 (KgHa)	CHID06 (FCT SCP 17)	36.3	This association was characterised by high density wetland shrubs with scattered *Melaleuca preissiana* and *M. rhaphiophylla*. It is more analogous to SCP5 rather than	FCT SCP5 – Mixed shrub damplands
	PINJ02 (FCT SCP s03)	32.2		
	GOSN05 (FCT SCP s03)	29.6		

Vegetation Association	Gibson *et al.* Quadrat & FCT	Similarity Based on Statistical analysis	Comments	Inferred Floristic Community Type
			SCP4. This is based on the low diversity of the dense shrub layer.	
BJQ6 (MtMr)	McLART-1 (FCT SCP 13)	35.7	This quadrat consisted of dense wetland shrubs and sedges with scattered *Melaleuca rhaphiophylla*.	FCT SCP5 – Mixed shrub damplands
	ELLIS-1(FCT SCP 17)	29.6		
	CAPEL-9 (FCT SCP 12)	28.5		
BJQ7 (AfEmBi)	ELE33 (FCT SCP 4)	48.1	Regardless of the analysis results that indicate a higher similarity with SCP4, because of the presence of more dry land species and the dominance of *Allocasuarina fraseriana* and *Eucalyptus marginata* it is thought to be more similar with SCP21a.	FCT SCP21a – Central *Banksia attenuata* – *E. marginata* woodlands
	MODO-2 (FCT SCP 21c)	44.8		
	ELE04 (FCT SCP 21a)	42.1		
BJQ8 (Ha)	TWIN-1 (FCT SCP 6)	34.4	This association had been historically cleared and is now natural regrowth with very low diversity. Due to the lack of upper- storey species, it is most analogous to SCP5.	FCT SCP5 – Mixed shrub damplands
	PINJ13 (FCT SCP s17)	33.3		
	AUSTB-4 (FCT SCP 5)	30		
BJQ9	McLART-1 (FCT	31.25	Due to the	FCT SCP4 -

Vegetation Association	Gibson *et al.* Quadrat & FCT	Similarity Based on Statistical analysis	Comments	Inferred Floristic Community Type
(MrMl)	SCP 13)		dominance of *Melaleuca preissiana* and *M. rhaphiophylla* along with the typical understorey species it is thought that this association is more similar to SCP4. The area also did not appear to be subject to deep inundation in the winter months due to the species and ground litter present.	Melaleuca preissiana damplands
	LESCH-6 (FCT SCP 17)	27.7		
	BEEL03 (FCT SCP 11)	27.5		
BJQ10 (BiKg)	LOW07 (FCT SCP 21c)	52.1	The analysis indicated that BJQ10 is most similar to SCP21c, given the species present, and the location of the association in the landscape SCP21c.	**FCT SCP21c** – Low Lying *Banksia attenuata* woodlands or shrublands
	MODO-2 (FCT SCP 21c)	48.3		
	GOSN13 (FCT SCP 23a)	46.6		
BJQ11 (MrMl)	WHITE08 (FCT SCP 21a)	33.3	Due to the dominance of *Melaleuca preissiana* and *M. rhaphiophylla* along with the typical understorey species it is thought that the association is more analogous to SCP4. The area also did not appear to be subject to deep inundation in the winter months.	**FCT SCP4** - Melaleuca preissiana damplands
	GOSN05 (FCT SCP s03)	28.5		
	McLART-1(FCT SCP 13)	28.5		

Vegetation Association	Gibson *et al.* Quadrat & FCT	Similarity Based on Statistical analysis	Comments	Inferred Floristic Community Type
BJQ12 (BaBm[b])	FL-5 (FCT SCP 21c)	55	The analysis showed that BJQ10 is most similar to SCP21c. This is due to the species present and the location of the association in the landscape. .	FCT SCP21c – Low Lying *Banksia attenuata* woodlands or shrublands
	ELE02 (FCT SCP 21c)	49.3		
	HURST03 (FCT SCP 23a)	49.0		
BJQ13 (MpKg)	McLART-1 (FCT SCP 13)	36.3	Due to the dominance of *Melaleuca preissiana* along with the typical understorey species it is thought that the association is more similar to SCP4. The association is not part of the core wetland and did not appear to be subject to deep inundation in the winter months due to the species and ground litter present.	FCT SCP4 - *Melaleuca preissiana* damplands
	WHITE08 (FCT SCP s17)	34.0		
	GOS05 (FCT SCP s03)	30.3		
BJQ14 (Ha)	PERTH10 (FCT SCP 4)	44.0	The location of this association had been historically disturbed and consequently has low diversity. Due to the lack of upper- storey species and in its present state it is most analogous with SCP5.	FCT SCP5 – Mixed shrub damplands
	GUTHR-4 (FCT SCP 5)	36.6		
	GOSN01 (FCT SCP 4)	34.9		

Vegetation Association	Gibson *et al.* Quadrat & FCT	Similarity Based on Statistical Analysis	Comments	Inferred Floristic Community Type
BJQ15 (BaBm[a])	HURST03 (FCT SCP 23a)	50.9	The top two results in the analysis were for SCP23a, this result seems appropriate given the species present and the location of the community on the higher dunes of the Survey Area.	FCT SCP23a – Central Banksia attenuata – B. menziesii woodlands
	CRESW01 (FCT SCP 23a)	49.4		
	CAVS11 (FCT SCP 21a)	49.4		

Table 11: Referred Floristic Community Types

Vegetation Association	Comments	Inferred Floristic Community Type
ErMp (BJR4)	This community had an over storey of species found in wetland areas (*Eucalyptus rudis* and *Melaleuca preissiana*), however, it also had upland species present such as *Xanthorrhoea preissii* and *Adenanthos cygnorum*. This characteristic as well as nearby occurrences makes it simular to SCP5,	FCT SCP5 - Mixed shrub damplands
Ec	This community is an ecotone between the drier BaBm association and the wetland. Due to the mix of both dry land and wetland species a FCT couldn't be determined.	-

4.2.8 Threatened and Priority Ecological Communities

A search of the DPaW TEC and PEC database identified no TECs listed by the State or under the EPBC Act within a 5 km radius of the Survey Area. Three PECs were identified as occurring within 5 km of the Survey Area:

Two Priority 3 vegetation communities, SCP21c - Low lying *Banksia attenuata* woodlands or shrublands and SCP22 – *Banksia ilicifolia* woodlands, are known to occur in close proximity to the Survey Area with their buffers encroaching into the north east corner of the Survey Areas boundary.

One listed Priority 3 vegetation community was identified as occurring in the Survey Area. Vegetation associations BaBm (b) and BiKg are thought to represent FCT SCP 21c – Low lying *Banksia attenuata* woodlands or shrublands.

Although the database search did not identify "Banksia dominated woodlands of the Swan Coastal Plain IBRA region", all vegetation that has an over storey dominated by *Banksia* are all listed as Priority 3 ecological communities and have been nominated to become a federally listed TEC under the EPBC Act. The nomination is currently being assessed by the DoE and the corresponding threatened species scientific committee. The key feature of these *Banksia* woodlands is the presence of *Banksia attenuata* and/or *B. menziesii* occurring on deep sands. The vegetation association BaBm (a), which has been identified as FCT SCP23a - Central *Banksia attenuata – B. menziesii* woodlands, may also be considered the Priority 3 ecological community. With this taken into consideration vegetation association BaBm (a) is considered Priority 3.

4.2.9 Regional Representation

Vegetation mapping units described in the Survey Area were correlated with the Beard (1981) and Shepherd *et al*. (2001) broad vegetation types as much as possible by examining similarities in vegetation descriptions (Table 11). Differences exist with the terminology used in the descriptions as they are based on different methods of categorising and characterising vegetation types, and the different spatial scale of the analysis (i.e. region vs. local scale). Due to the altered state of some of the vegetation and the majority of the vegetation being wetland dependant many of the vegetation associations could not be correlated.

Table 12: Representation of broad vegetation types and corresponding vegetation associations.

Vegetation Type and Description (Shepherd *et al.* 2001 / Beard 1981)	Corresponding Vegetation Association (Current Survey)	Vegetation Association Extent in Survey Area (ha)
1001 (e2Mb cbLi)	BaBm, AfEmBt, Ec	9.64

5 Discussion

5.1 Flora Context

A total of 145 taxa (including species, subspecies, varieties and forms) from 101 genera and 45 families were recorded in the Survey Area.

Of the 145 taxa, 27 are introduced species. Portions of the Survey Area have been completely cleared for residential and a nursery, some areas have been allowed to regenerate naturally and others have had endemic and non-endemic species planted. There is also a large proportion of the site that is original native vegetation.

5.2 Flora of Conservation Significance

No Threatened species listed under the EPBC Act or gazetted as Declared Rare Flora (Threatened) pursuant to the WC Act were recorded during the survey. No Priority Flora were recorded during the survey.

The review of the database searches identified nine T/DRF flora species potentially occurring in the vicinity of the Survey Area. Of these species, five are unlikely, three are possible and one is likely. Two of these possible species are perennial, so would have been detectable at the time of the survey if they occurred in the Survey Area. Five species, *Caladenia huegelii*, *Diuris micrantha, Diuris purdiei, Drakaea elastica* and *Drakaea micrantha,* are perennial (tuberous) short-lived herbs (orchids) that need various conditions to flower and exhibit different flowering patterns. Regardless of these attributes, the survey was undertaken during the optimum time for the flowering of these species and targeted searches were undertaken in their preferred habitats and none were found.

A further 14 priority flora taxa were identified as potentially occurring in the Survey Area based on database searches. Of these species, four do not have information available to determine whether it could occur in the Survey Area, two are considered likely to occur, four are considered possible and four are considered unlikely. Five of the potential species are perennial so would have been able to be located at the time of the survey. The remaining two species are annual; *Stylidium longitudinale* would have been able to be detected during the survey based on the species flowering period.

5.3 Vegetation of Conservation Significance

A search of the DPaW TEC and PEC database identified three PEC occurring within 5 km of the Survey Area (DPaW 2013c). Two PECs are considered likely to occur in the Survey Area.

Results from the statistical analysis (multivariate analysis) and data interpretation indicate that there are two Priority 3 ecological communities in the Survey Area. Vegetation associations BaBm (b) and BiKg are thought to represent FCT SCP 21c – Low lying *Banksia attenuata* woodlands or shrublands. These two associations equate to 5.79 ha of the survey area. The majority of this FCT is considered to be in good condition. On the northern boundary there is a small area that is very weed infested and has some *Banksia* death, therefore this area has been given a condition rating of Good to Degraded. There are a few localised patches of weeds in the north west corner, however, these haven't effected the overall condition of the vegetation, therefore, its considered to be in Excellent condition.

The vegetation association BaBm(a), has been identified as FCT SCP23a - Central *Banksia attenuata – B. menziesii* woodlands. Although the database search did not identify SCP23a, it is included in the PEC "*Banksia* dominated woodlands of the Swan Coastal Plain IBRA region", which is now listed as a Priority 3 and is being currently assessed to become a federally listed TEC. With this taken into consideration vegetation association BaBm(a) is considered Priority 3 and equates to 2.64 ha of the Survey Area. This FCT is considered to be in a Good to Excellent condition.

Two Priority 3 vegetation communities, SCP21c - Low lying *Banksia attenuata* woodlands or shrublands and SCP22 – *Banksia ilicifolia* woodlands, are known to occur in close proximity to the Survey Area with their buffers encroaching into the north east corner of the Survey Areas boundary.

PECs are known as ecologically valuable communities that need further investigation before possible nomination for TEC status. Priority communities listed by DPaW have no formal protection. There is no written policy on how to respond to the presence of PECs within proposed development sites and the presence of these communities is dealt with by DPaW on a case by case basis.

5.4 ESAs

There are no TECs or DRF present in the Survey Area, however, the entire Survey Area is identified as an ESA. Although there is no publicly available information detailing the reasoning behind the ESA mapping, the boundaries are found to correlate with the Gibbs Road Swamp System according to the Directory of Important Wetlands (2008).

Under the EP Act, any clearing of native vegetation requires a permit unless done for an exempt purpose. ESAs are declared to prevent degradation of important environmental values such as T/DRF, TECs or significant wetlands. Exemptions contained in the Environmental Protection (Clearing of Native vegetation) Regulations 2004 for low impact land clearing do not apply in ESAs and a native vegetation clearing permit is required. A specific permit must therefore be obtained prior to any clearing in an ESA.

5.5 Vegetation Condition and Introduced Flora

Vegetation condition ranged from Completely Degraded to Excellent (Figure 7). Historical vegetation clearing, weeds, housing, a nursery and the presence of tracks in the survey area were the most frequently observed impacts on native vegetation.

Historical and present land use has altered areas of the vegetation, which is reflected in the low diversity and non-endemic species that have been planted to supplement the regrowth of the natural vegetation. This has mainly affected the eastern side of the CCW.

The CCW in the middle of the Survey Area has remained relatively intact and is considered to be in Very Good to Excellent condition with a couple of areas of vegetation in Good condition along with the tracks that are cleared.

The upland vegetation on the Western side of the Survey Area varies greatly in condition from Excellent to Good to Degraded. There are areas considered high in diversity, however, there are pockets where the understory is low in both diversity and density and is weed infested.

A total of 27 introduced species were recorded during the survey. Two species, **Asparagus asparagoides* and **Zantedeschia aethiopica*, are listed as Declared under the BAM Act. One species **Asparagus asparagoides* is listed as a WONS.

5.6 Regional Representation

The PBP has mapped native vegetation extent by vegetation complex on the Swan Coastal Plain. It is estimated that Bassendean Complex – Central and South has 27.7% native vegetation remaining based on the pre-European extent.

The EPA recognises vegetation complexes that are not well represented as being significant. Vegetation complexes which have 10%-30% remaining may be considered regionally significant. Proposals that would affect a vegetation complex with 10% or less remaining are likely to be formally assessed by the EPA (EPA 2006).

5.7 Geomorphic Wetlands

The DPaW Geomorphic Wetlands Dataset identifies two wetlands as occurring within the Survey Area including one CCW and one REW. CCWs and their associated buffers are considered ESAs and as such exemptions offered for clearing under Regulation 5 of the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* do not apply.

5.8 Ecological Linkages

The Survey Area forms part of the PBPs Draft Regional Ecological linkage network. The Survey Area is intersected by ecological linkage 52 which includes approximately 50% of the Survey Area and joins ecological linkage 46 that runs in a northern direction (Figure 3). The linkage portion of the Survey Area is fully vegetated and could be considered to be important in providing vegetated habitat in a non-continuous linkage across the landscape.

Recognised by the EPA, DPaW and local government, the retention of native vegetation and fauna habitat within the Regional Ecological Linkages aims to reduce the loss of biodiversity and key ecological functions across the South West. The EPA expects that in preparing plans and proposals for development, consideration will be given to both the site-specific biodiversity conservation values of patches of native vegetation, as well as the landscape function and core linkage significance of a patch in supporting the maintenance of an ecological linkage.

6 Conclusions

The targeted flora survey was undertaken within the recommended season and flowering period for the south west botanical province. The Survey Area was sufficiently surveyed and as such the following conclusions can be drawn:

- The condition varies greatly across the site, this being influenced by historical clearing and land use;
- Results from the statistical analysis (multivariate analysis) and data interpretation indicate that there are two Priority 3 ecological communities in the Survey Area;
- Vegetation associations BaBm (b) and BiKg are thought to represent FCT SCP 21c – Low lying *Banksia attenuata* woodlands or shrublands;
- The vegetation association BaBm (a), has been identified as FCT SCP23a - Central *Banksia attenuata – B. menziesii* woodlands. Although the database search did not identify SCP23a, it is included in the PEC "*Banksia* dominated woodlands of the Swan Coastal Plain IBRA region", which is now listed as a Priority 3;
- No Threatened species listed under the EPBC Act and/or gazetted as Declared Rare Flora (Threatened) pursuant to the WC Act were recorded during the survey;
- No Priority flora were recorded during the survey;
- No Bush Forever sites occur in the Survey Area, however, there is one adjacent to the boundary in the south west corner;
- The DPaW Geomorphic Wetlands Dataset identifies one CCW and one REW as occurring in the Survey Area; and
- The Survey Area is identified as part of a larger ESA, and part of the PBP's Draft Regional Ecological linkage network.

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Aspects of this report, including the opinions, conclusions and recommendations it contains, are based on the results of the investigation, sampling and testing set out in the contract and otherwise in accordance with normal practices and standards. The investigation, sampling and testing are designed to produce results that represent a reasonable interpretation of the general conditions of the site that is the subject of this report. However, due to the characteristics of the site, including natural variations in site conditions, the results of the investigation, sampling and testing may not accurately represent the actual state of the whole site at all points.

It is important to recognise that site conditions, including the extent and concentration of contaminants, can change with time. This is particularly relevant if this report, including the data, opinions, conclusions and recommendations it contains, are to be used a considerable time after it was prepared. In these circumstances, further investigation of the site may be necessary.

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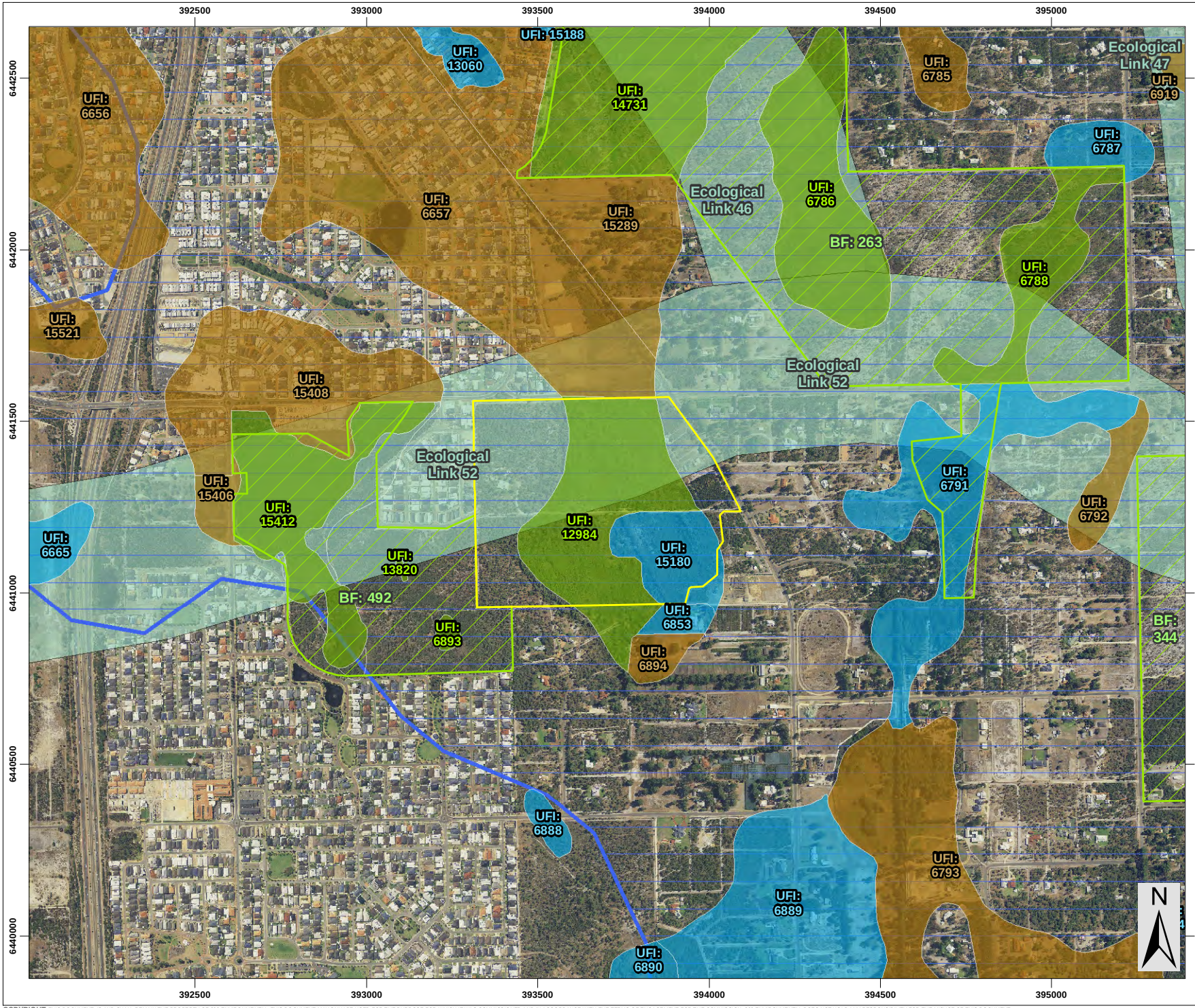
FIGURES



Legend

- Survey Area
- Bush Forever Sites
- DPaW Managed Lands
- Perth Regional Ecological Linkages
- Directory of Important Wetlands DIWA Australia

Geomorphic Wetlands

- Conservation
- Resource Enhancement
- Multiple Use
- Not Assessed

- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS
- WETLANDS SOURCED DPAW 2015
- ECOLOGICAL LINKAGES SOURCED WALGA 2014
- BUSH FOREVER SOURCED DOP 2014
- DIWA SOURCED DoE 2008
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LOCALITY MAP

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HORIZONTAL DATUM AND PROJECTION
GDA 1994 MGA Zone 50

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Level 2 Flora and Vegetation Survey

Figure 3 -
Conservation Areas

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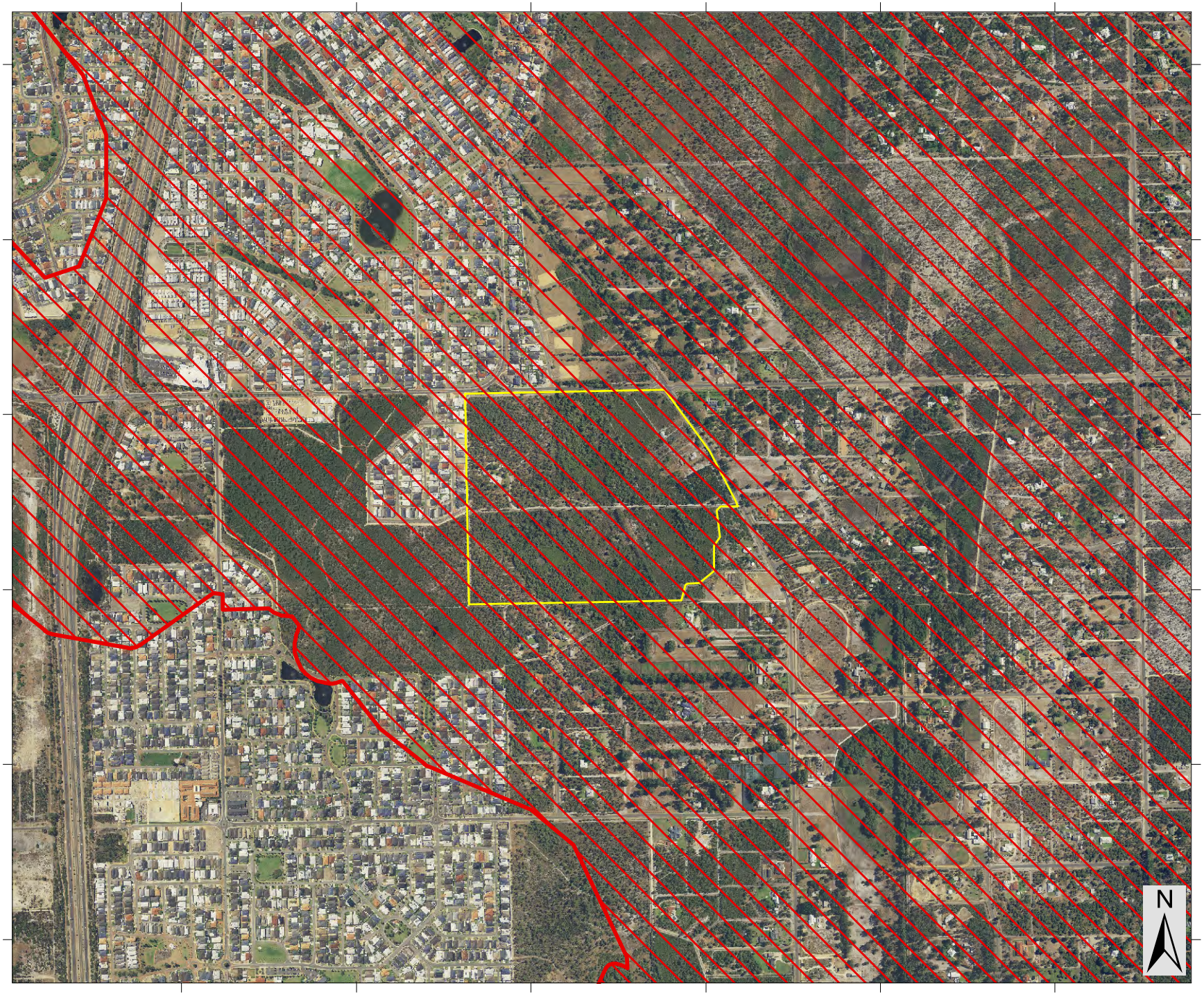

Legend

- Survey Area
- Environmentally Sensitive Areas

- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS
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Figure 4 -
Environmentally Sensitive Areas

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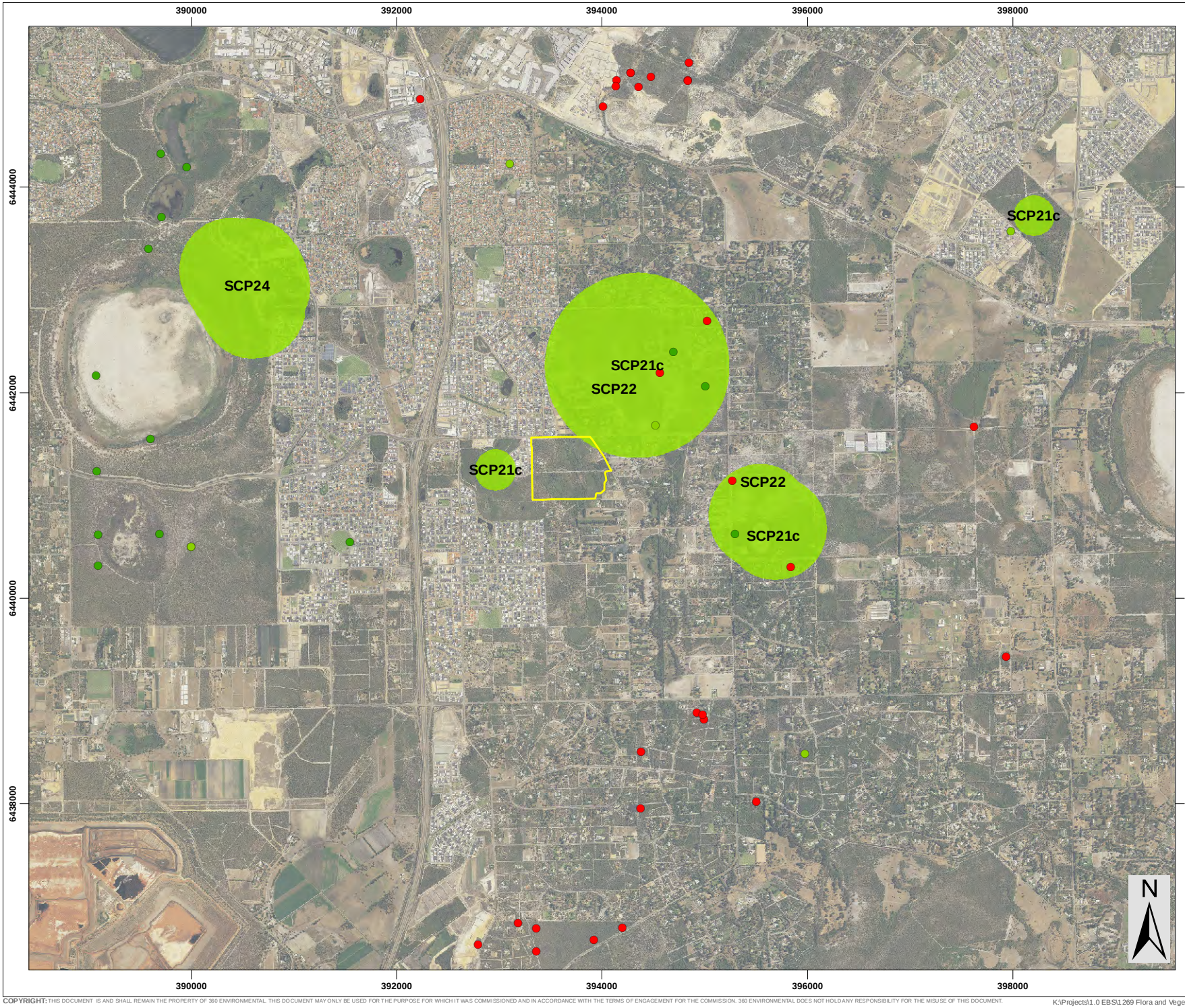

Legend

Survey Area

Rare and Priority Flora

- Priority 4
- Priority 3
- Priority 2
- Priority 1
- Declared Rare

TECs/PECs

- Priority 4
- Priority 3
- Priority 2
- Priority 1
- Vulnerable
- Endangered
- Critically Endangered

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Figure 5 -
DPAW Results

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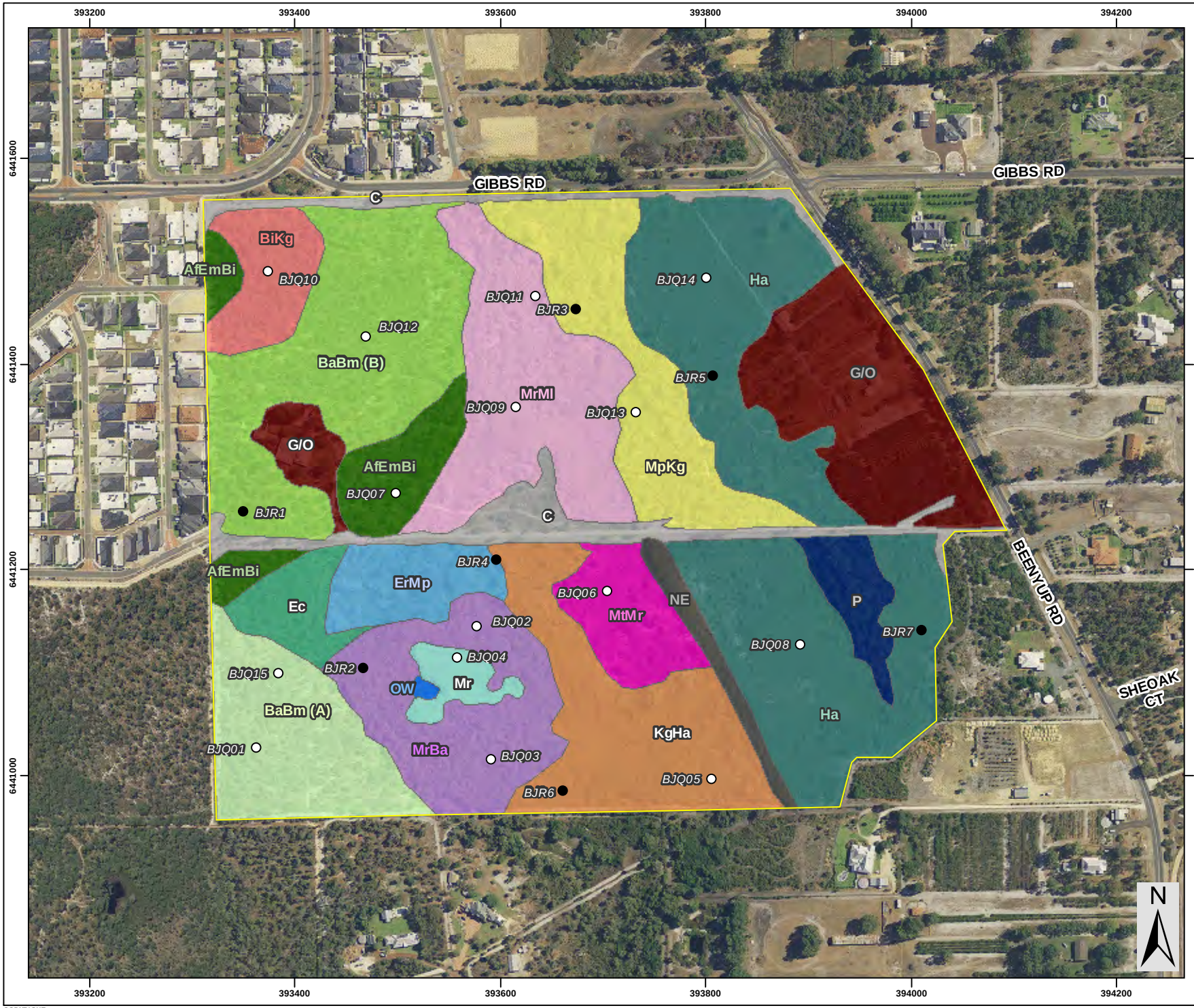

Legend

- Survey Area (41.4 ha)

Vegetation Association

- BaBm (A)
- BaBm (B)
- AfEmBi
- BiKg
- Ec
- ErMp
- Ha
- KgHa
- MpKg
- Mr
- MrBa
- MrMl
- MtMr
- Non Endemic Eucalypt species
- Open Water
- Planted non endemic and endemic species
- Cleared
- Garden/Orchard

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Figure 6 -
Vegetation Associations

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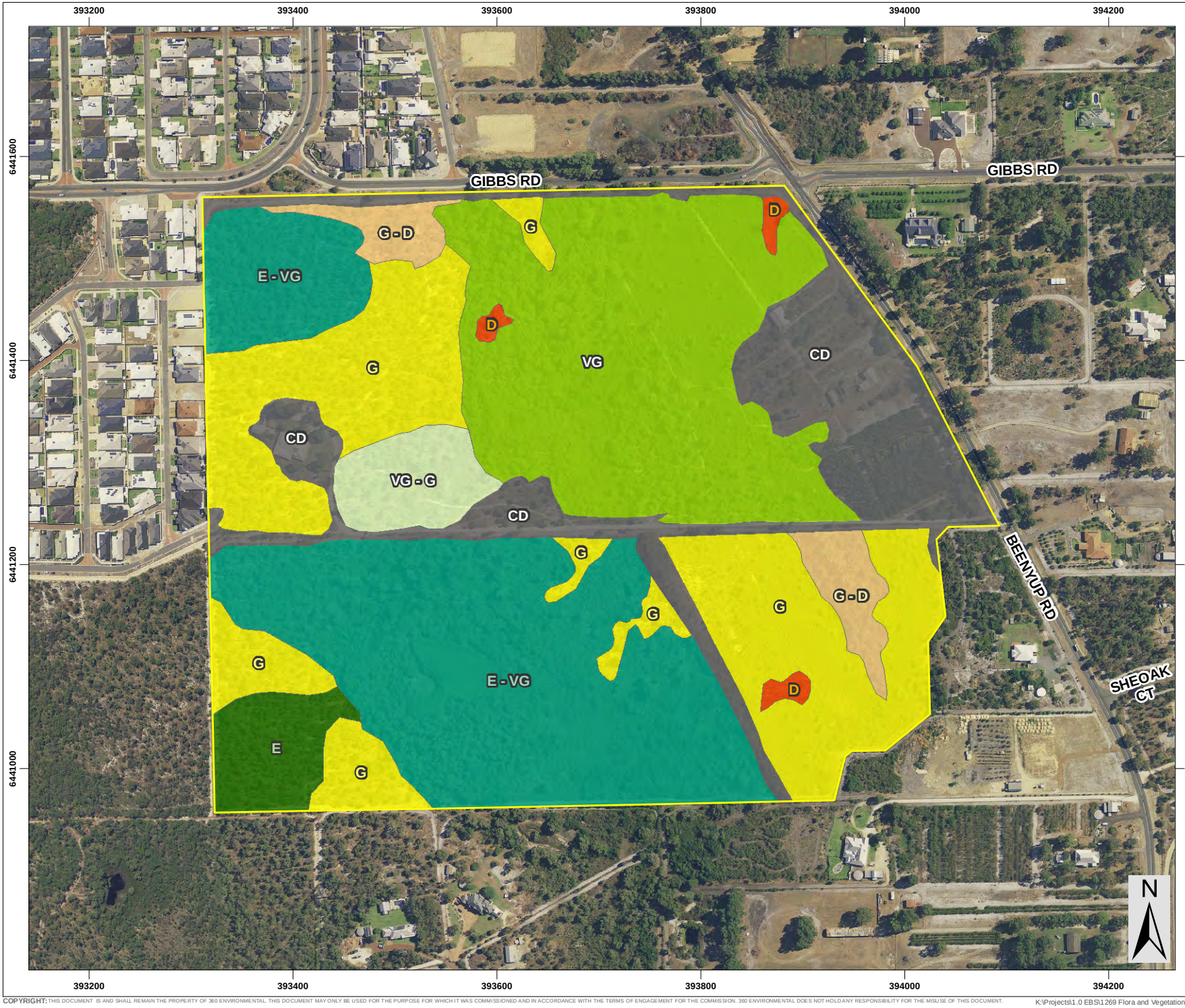

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Survey Area

Vegetation Condition

- Excellent (1.29 ha)
- Excellent - Very Good (11.71 ha)
- Very Good (9.52 ha)
- Very Good - Good (1.25 ha)
- Good (9.70 ha)
- Good - Degraded (1.29 ha)
- Degraded (0.28 ha)
- Completely Degraded (6.36 ha)

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Figure 7 -
Vegetation Condition Mapping

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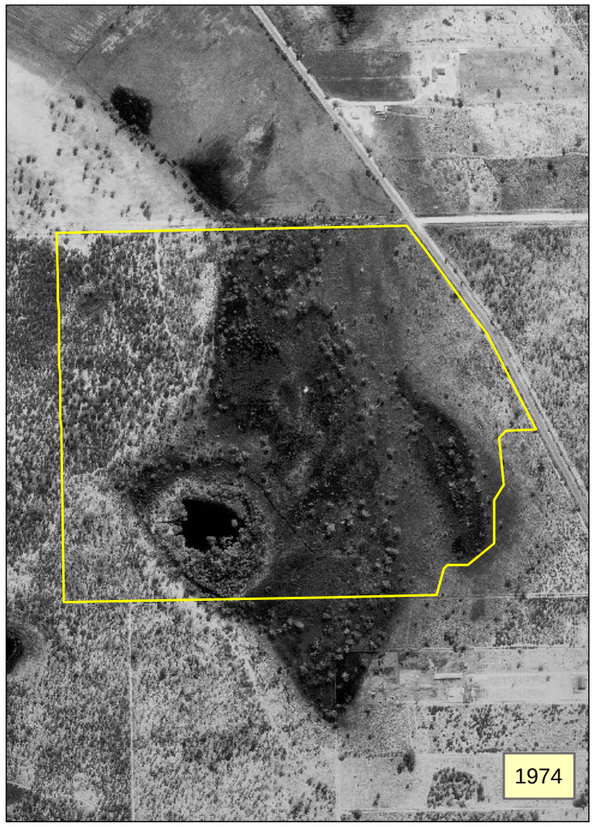

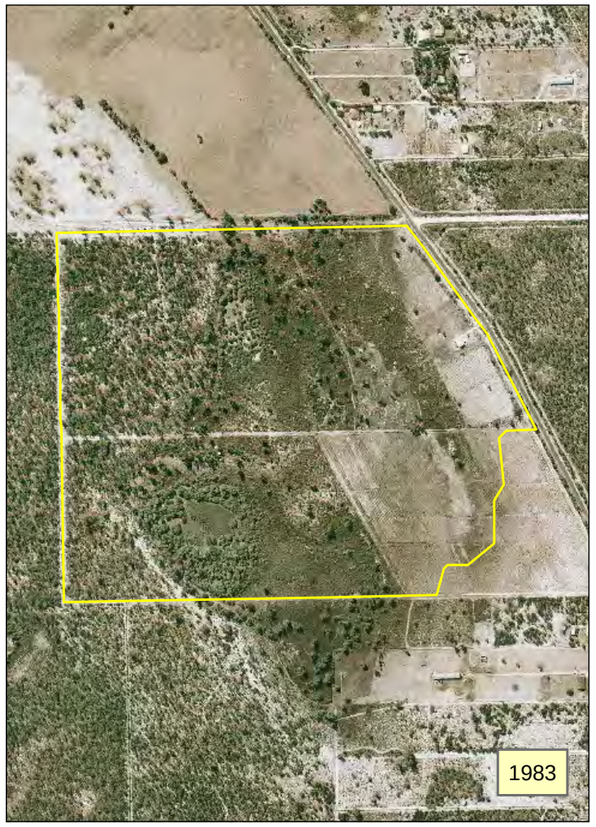

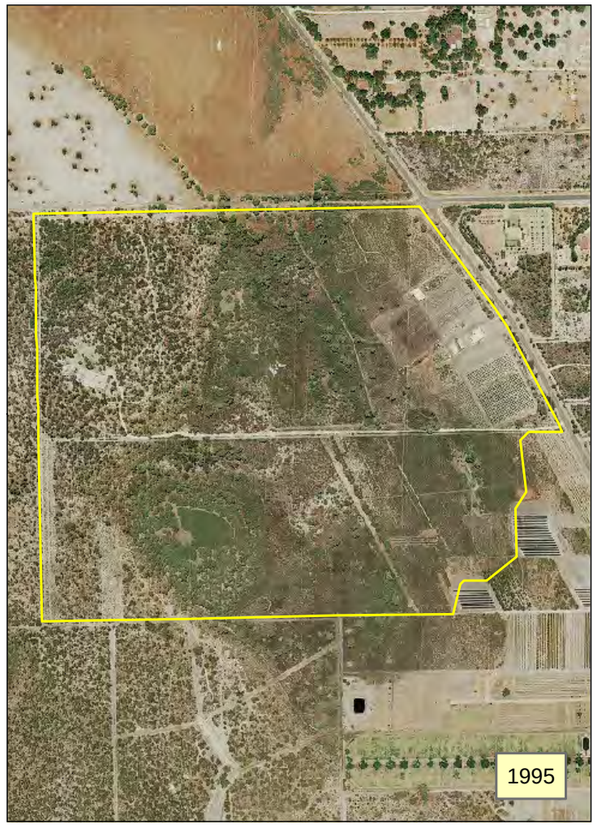

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Site Location

- CADASTRAL BOUNDARY SOURCED LANDGATE 2009
- LOCALITY MAP SOURCED LANDGATE 2006
- CADASTRE SOURCED SLIP SERVICES 15 JAN 2015
- AERIAL PHOTOGRAPHY SOURCED LANDGATE 2014
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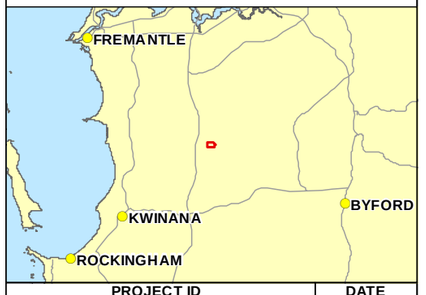

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Figure 8 -
Historical Aerial Imagery

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APPENDIX A

Definition of Declared Rare / Priority / Threatened Flora and Fauna Species

Categories of Declared Rare Flora (WC act) and Priority listings (DPaW)

Conservation Code	Description
X	**Presumed Extinct Flora (Declared Rare Flora – Extinct)** "Taxa which have been adequately searched for and there is no reasonable doubt that the last individual has died, and have been gazetted as such (Schedule 2 under the *Wildlife Conservation Act 1950*)."
T	**Threatened Flora (Declared Rare Flora – Extant)** "Taxa which have been adequately searched for and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection, and have been gazetted as such (Schedule 1 under the *Wildlife Conservation Act 1950*)." "Threatened Flora (Schedule 1) are further ranked by the Department according to their level of threat using IUCN Red List criteria: CR: Critically Endangered – considered to be facing an extremely high risk of extinction in the wild; EN: Endangered – considered to be facing a very high risk of extinction in the wild; VU: Vulnerable – considered to be facing a high risk of extinction in the wild."
P1	**Priority One: Poorly-known taxa** "Taxa which are known from one or a few collections or sight records (generally less than five), all on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, Shire, Westrail and Main Roads WA road, gravel and soil reserves, and active mineral leases and under threat of habitat destruction or degradation. Taxa may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes."
P2	**Priority Two: Poorly-known taxa** "Taxa which are known from one or a few collections or sight records, some of which are on lands not under imminent threat of habitat destruction or degradation, e.g. national parks, conservation parks, nature reserves, State forest, vacant Crown Land, water reserves, etc. Taxa may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes."
P3	**Priority Three: Poorly-known taxa** "Taxa which are known from collections or sight records from several localities not under imminent threat, or few but widespread localities with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Taxa may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and known threatening

	processes exist that could affect them."
P4	**Priority Four: Rare, Near Threatened and other taxa in need of monitoring** a. Rare. "Taxa which 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 taxa are usually represented on conservation lands." b. Near Threatened. "Taxa that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable." c. "Taxa that have been removed from the list of threatened species during the past five years for reasons other than taxonomy."
P5	**Priority Five: Conservation Dependent taxa** "Taxa that are not threatened but are subject to a specific conservation program, the cessation of which would result in the taxon becoming threatened within five years."

Source: Department of Parks and Wildlife (2013). Online: http://florabase.dpaw.wa.gov.au.

Western Australian Threatened Fauna Categories Wildlife Conservation Act 1950 (WA)

CATEGORY	CODE	DESCRIPTION
Schedule 1	S1	Rare or likely to become extinct.
Schedule 2	S2	Presumed extinct.
Schedule 3	S3	Birds subject to an agreement between the governments of Australia and Japan, the People's Republic of China & the Republic of Korea relating to the protection of migratory birds and birds in danger of extinction.
Schedule 4	S4	Other specially protected fauna.

Department of Environment and Conservation Fauna Priority Codes

CATEGORY	CODE	DESCRIPTION
Priority 1	P1	Taxa with few, poorly known populations on threatened lands.
Priority 2	P2	Taxa with few, poorly known populations on conservation lands.
Priority 3	P3	Taxa with several, poorly known populations, some on conservation lands.
Priority 4	P4	Taxa in need of monitoring: not currently threatened or in need of special protection, but could become so. Usually represented on conservation lands.
Priority 5	P5	Taxa in need of monitoring: not considered threatened, but the subject of a specific conservation program, the cessation of which would result in the species becoming threatened within five years.

Categories of Threatened Flora and Fauna Species under the EPBC Act

CONSERVATION CODE	DESCRIPTION
Ex	**Extinct** Taxa which at a particular time if, at the time, there is no reasonable doubt that the last member of the species has died.
ExW	**Extinct in the Wild** Taxa which is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or it has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
CE	**Critically Endangered** Taxa which at a particular time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
E	**Endangered** Taxa which is not critically endangered and it is facing a very high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.
V	**Vulnerable** Taxa which is not critically endangered or endangered and is facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.
CD	**Conservation Dependent** Taxa which at a particular time if, at that time, the species is the focus of a specific conservation program, the cessation of which would result in the species becoming vulnerable, endangered or critically endangered within a period of 5 years.

Source: *Environment Protection and Biodiversity Conservation Act 1999*

APPENDIX B

Definition of Threatened and Priority Ecological Communities

Definitions of Threatened Ecological Communities as Endorsed by the Western Australian Minister for the Environment

Presumed Totally Destroyed (PD)

An ecological community will be listed as presumed totally destroyed if there are no recent records of the community being extant and either of the following applies (A or B);

A) Records within the last 50 years have not been confirmed despite thorough searches or known or likely habitats or

B) All occurrences recorded within the last 50 years have since been destroyed.

Critically Endangered (CR)

An ecological community will be listed as Critically Endangered when it has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future. This will be determined on the basis of the best available information, by it meeting any one or more of the following criteria (A, B or C):

A) The estimated geographic range, and/or total area occupied, and/or number of discrete occurrences since European settlement have been reduced by at least 90% and either or both of the following apply (i or ii)

i) geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is imminent (within approximately 5 years)

ii) modification throughout its range is continuing such that in the immediate future (within approximately 5 years) the community is unlikely to be capable of being substantially rehabilitated.

B) Current distribution is limited, and one or more of the following apply (i, ii or iii):

i) geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the immediate future (within approximately 5 years)

ii) there are very few occurrences, each of which is small and/or isolated and extremely vulnerable to known threatening processes

iii) there may be many occurrences but total area is very small and each occurrence is small and/or isolated and extremely vulnerable to known threatening processes

C) The ecological community exists only as highly modified occurrences which may be capable of being rehabilitated if such work begins in the immediate future (within approximately 5 years)

Endangered (EN)

An ecological community will be listed as Endangered when it has been adequately surveyed and is not Critically Endangered but is facing a very high risk of total destruction in the near future. This will be determined on the basis of the best available information, by it meeting any one or more of the following criteria (A, B or C):

A) The estimated geographic range, and/or total area occupied, and/or number of discrete occurrences since European settlement have been reduced by at least 70% and either or both of the following apply (i or ii)

i) geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is likely in the short term (within approximately 10 years)

ii) modification throughout its range is continuing such that in the short term future (within approximately 10 years) the community is unlikely to be capable of being substantially restored or rehabilitated.

B) Current distribution is limited, and one or more of the following apply (i, ii or iii):

i) geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the short term future (within approximately 10 years)

ii) there are very few occurrences, each of which is small and/or isolated and extremely vulnerable to known threatening processes

iii) there may be many occurrences but total area is very small and each occurrence is small and/or isolated and extremely vulnerable to known threatening processes

C) The ecological community exists only as highly modified occurrences which may be capable of being rehabilitated if such work begins in the short term future (within approximately 10 years).

Vulnerable (VU)

An ecological community will be listed as Vulnerable when it has been adequately surveyed and is not Critically Endangered or Endangered but is facing a high risk of total destruction in the medium to long term future. This will be determined on the basis of the best available information, by it meeting any one or more of the following criteria (A, B or C):

A) The ecological community exists largely as modified occurrences which are likely to be capable of being substantially restored or rehabilitated.

B) The ecological community can be modified or destroyed and would be vulnerable to threatening processes, is restricted in area and/or range and/or is only found at a few locations.

C) The ecological community may still be widespread but is believed likely to move into a category of higher threat in the medium to long term future because of existing or impending threatening processes.

Source: Department of Environment and Conservation (2010). Definitions, Categories and Criteria for Threatened and Priority Ecological Communities. Department of Environment and Conservation, Perth, WA. Online: www.naturebase.net/

Definitions of Priority Ecological Communities as listed DPaW

Possible threatened ecological communities that do not meet survey criteria or that are not adequately defined are added to the Priority Ecological Community Lists under Priorities 1, 2 and 3. These three categories are ranked in order of priority for survey and/or definition of the community, and evaluation of conservation status, so that consideration can be given to their declaration as threatened ecological communities. Ecological Communities that are adequately known, and are rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list, are placed in Priority 4. These ecological communities require regular monitoring. Conservation Dependent ecological communities are placed in Priority 5.

Priority One: Poorly known ecological communities

Ecological communities with apparently few, small occurrences, all or most not actively managed for conservation (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) and for which current threats exist. Communities may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under immediate threat from known threatening processes across their range.

Priority Two: Poorly known ecological communities

Communities that are known from few small occurrences, all or most of which are actively managed for conservation (e.g. within national parks, conservation parks, nature reserves, State forest, unallocated Crown land, water reserves, etc.) and not under imminent threat of destruction or degradation.

Communities may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under threat from known threatening processes.

Priority Three: Poorly known ecological communities

(i) Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation or:

(ii) Communities known from a few widespread occurrences, which are either large or within significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat, or;

(iii) Communities made up of large, and/or widespread occurrences that may or not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, and inappropriate fire regimes.

Communities may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and/or are not well defined, and known threatening processes exist that could affect them.

Priority Four: Ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened or that have been recently removed from the threatened list.

These communities require regular monitoring.

(a) Rare. Ecological communities known from few occurrences 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 communities are usually represented on conservation lands.

(b) Near Threatened. Ecological communities that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable.

(c) Ecological communities that have been removed from the list of threatened communities during the past five years.

Priority Five: Conservation Dependent ecological communities.

Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.

Source: Department of Parks and Wildlife (2013). Definitions, Categories and Criteria for Threatened and Priority Ecological Communities. Department of Environment and Conservation, Perth, WA. Online: www.naturebase.net/

APPENDIX C

Environmental Weeds and Declared Plant Categories

Criteria used for Ranking Environmental Weeds

The Weed Prioritisation Process for DPaW contains criteria for the assessment and ranking of weeds in terms of their environmental impact on biodiversity. These criteria are as follows:

- **Potential Distribution** – Area of potential habitat in the Region that could be occupied or the area at risk of invasion by the weed.
- **Current Distribution** - Area of habitat in the Region currently occupied by the weed, in relation to the habitat that it could invade.
- **Ecological Impact** - Impact of species within the Region, from low impact (causes minimal disruption to ecological processes or loss of biodiversity) to high (causes acute disruption of ecological processes, dominates and/or significantly alters vegetation structure, composition and function of ecosystems).
- **Invasiveness** – rate of spread of a weed in native vegetative, encompassing factors of establishment, reproduction and long distance dispersal (>100m).
- **Feasibility of Control** - The longer a coordinated control program takes to achieve its desired goal, the more expensive and less feasible it becomes. Is it feasible to eradicate or at least contain the infestation?

Source: DPaW (2013). Weed Prioritisation Process for DPaW (formerly DEC) – "An integrated approach to Weed Management on DPaW-managed lands in WA"

Standard Meanings of Declared Plant Categories

Under the Biosecurity and Agriculture Management Act 2007 (the BAM Act), all declared pests are placed in one of three categories, namely C1 (exclusion), C2 (eradication) or C3 (management).

C1 category (Exclusion) - Pests will be assigned to this category if they are not established in WA and control measures are to be taken, including border checks, in order to prevent them entering and establishing in the State.

C2 category (Eradication) – Pests will be assigned to this category if they are present in WA in low enough numbers or in sufficiently limited areas that their eradication is still a possibility.

C3 category (Management) – Pests will be assigned to this category if they are established in WA but it is feasible, or desirable, to manage them in order to limit their damage. Control measures can prevent a C3 pest from increasing in population size or density or moving from an area in which it is established into an area which currently is free of that pest.

Source: Department of Agriculture and Food, WA. Online: http://www.biosecurity.wa.gov.au/western-australian-organism-list-waol

APPENDIX D

Vegetation Condition Scale

Condition Scale Code	Condition Scale
P	**Pristine (1)** Pristine or nearly so, no obvious signs of disturbance
E	**Excellent (2)** Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.
VG	**Very Good (3)** Vegetation structure altered 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.
G	**Good (4)** Vegetation structure significantly altered by very obvious signs of multiple disturbance. Retains basic vegetation structure or ability to regenerate 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.
D	**Degraded (5)** 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.
CD	**Completely Degraded (6)** The structure of the vegetation is 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 comprising weed or crop species with isolated native trees or shrubs.

Source: Bush Forever Vegetation Condition Scale as developed by Keighery (1994) and summarized in Bush Forever (Government of WA (2000b)

APPENDIX E

Flora Inventory

Family	Name
Aizoaceae	**Carpobrotus edulis*
Anarthriaceae	*Lyginia barbata*
	Lyginia imberbis
Apiaceae	*Actinotus glomeratus*
Araceae	**Zantedeschia aethiopica*
Araliaceae	*Trachymene pilosa*
Asparagaceae	**Asparagus asparagoides*
	Chamaescilla corymbosa
	Laxmannia squarrosa
	Lomandra caespitosa
	Lomandra hermaphrodita
	Lomandra micrantha subsp. *micrantha*
	Lomandra suaveolens
	Thysanotus manglesianus
	Thysanotus patersonii
Asteraceae	**Arctotheca calendula*
	**Cotula coronopifolia*
	**Hypochaeris glabra*
	Lagenifera huegelii
	Quinetia urvillei
	Siloxerus humifusus
	**Sonchus oleraceus*
	**Ursinia anthemoides*
	Waitzia suaveolens var. *suaveolens*
	Asteraceae sp.
Campanulaceae	*Lobelia alata*
	Lobelia anceps
	Wahlenbergia sp.
Casuarinaceae	*Allocasuarina fraseriana*
Colchicaceae	*Burchardia congesta*
Crassulaceae	*Crassula closiana*
	Crassula colorata var. *colorata*
	**Crassula natans* var. *minus*
Cupressaceae	*Callitris preissii*
Cyperaceae	*Baumea articulata*
	Cyathochaeta avenacea
	**Cyperus tenellus*
	Lepidosperma ? longitudinale
	Lepidosperma longitudinale
	Lepidosperma sp.
	Lepidosperma squamatum

Family	Name
	Lepidosperma squamatum
	Schoenus efoliatus
Dasypogonaceae	*Dasypogon bromeliifolius*
Dilleniaceae	*Hibbertia hypericoides*
	Hibbertia racemosa
	Hibbertia subvaginata
Droseraceae	*Drosera erythrorhiza*
	Drosera macrantha subsp. *macrantha*
	Drosera pulchella
	Drosera glanduligera
Ericaceae	*Leucopogon* aff. *conostephioides*
	Leucopogon conostephioides
Euphorbiaceae	**Euphorbia terracina*
Fabaceae	**Acacia iteaphylla*
	**Acacia longifolia*
	Acacia pulchella var. *glaberrima*
	Acacia stenoptera
	Aotus sp.
	Bossiaea eriocarpa
	Daviesia triflora
	Eutaxia virgata
	Gompholobium tomentosum
	Hovea pungens
	Jacksonia furcellata
	Kennedia prostrata
	Pultenaea ochreata
	Pultenaea reticulata
	**Trifolium* sp.
Geraniaceae	**Pelargonium capitatum*
Goodeniaceae	*Dampiera linearis*
Haemodoraceae	*Anigozanthos humilis*
	Anigozanthos manglesii
	Conostylis aculeata subsp. *aculeata*
	Conostylis juncea
	Phlebocarya ciliata
Haloragaceae	*Glischrocaryon angustifolium*
Iridaceae	**Gladiolus caryophyllaceus*
	Patersonia occidentalis var. *occidentalis*
	**Romulea rosea* var. *australis*
Juncaceae	**Juncus capitatus*
	Juncus pallidus

Family	Name
	Juncus planifolius
Lamiaceae	*Hemiandra pungens*
Lauraceae	*Cassytha racemosa*
	Cassytha sp.
Loganiaceae	*Phyllangium divergens*
Loranthaceae	*Nuytsia floribunda*
Menyanthaceae	*Liparophyllum* sp.
Molluginaceae	*Macarthuria australis*
Myrtaceae	*Astartea scoparia*
	Calothamnus lateralis var. *lateralis*
	Calytrix fraseri
	Chamelaucium uncinatum
	Eucalyptus camaldulensis
	Eucalyptus marginata
	Eucalyptus rudis
	Eucalyptus todtiana
	Hypocalymma angustifolium
	Hypocalymma robustum
	Kunzea glabrescens
	Melaleuca lateritia
	Melaleuca preissiana
	Melaleuca rhaphiophylla
	Melaleuca teretifolia
	Melaleuca thymoides
	Pericalymma ellipticum var. *ellipticum*
	Scholtzia involucrata
Orchidaceae	*Caladenia discoidea*
	Caladenia flava subsp. *flava*
	Caladenia latifolia
	Diuris corymbosa
	Diuris laxiflora
	Diuris sp.
	Pterostylis recurva
	Pterostylis sanguinea
	Pterostylis sp. crinkled leaf (G.J. Keighery 13426)
	Pterostylis sp. short sepals (W. Jackson BJ259)
	Pterostylis vittata
	Thelymitra sp.
	Orchidaceae sp.
Papaveraceae	**Fumaria capreolata*
Phyllanthaceae	*Poranthera microphylla*

Family	Name
Poaceae	*Amphipogon turbinatus*
	**Avena barbata*
	**Briza maxima*
	**Ehrharta calycina*
	**Ehrharta longiflora*
	**Eragrostis curvula*
	Neurachne alopecuroidea
	**Vulpia bromoides*
	Poaceae sp.
Primulaceae	**Lysimachia arvensis*
Proteaceae	*Adenanthos cygnorum* subsp. *cygnorum*
	Banksia attenuata
	Banksia ilicifolia
	Banksia menziesii
	Banksia prionotes
	Hakea varia
	Persoonia saccata
	Petrophile linearis
	Stirlingia latifolia
	Xylomelum occidentale
Restionaceae	*Desmocladus flexuosus*
	Dielsia stenostachya
	Hypolaena exsulca
	Meeboldina coangustata
	Meeboldina scariosa
Rubiaceae	**Galium murale*
	Opercularia vaginata
Rutaceae	*Boronia crenulata*
	Philotheca spicata
Santalaceae	*Leptomeria pauciflora*
Stylidiaceae	*Stylidium brunonianum*
	Stylidium piliferum
	Stylidium repens
Violaceae	*Hybanthus calycinus*
Xanthorrhoeaceae	*Xanthorrhoea preissii*
Zamiaceae	*Macrozamia riedlei*

APPENDIX F

Flora Survey Area Data Sheets

Site BJQ01

Described by HA
Date 16/09/2015
Type Quadrat 10 X 10m
MGA Zone 50 393363 **mE** 6441026 **mN**
Habitat Top dune
Soil Grey sands
Vegetation Low woodland of Banksia attenuata, Banksia menziesii, Allocasuarina fraseriana and Eucalyptus marginata over mixed low shrubs over Conostylis aculeata subsp. aculeata and Dasypogon bromeliifolius with Desmocladus flexuosus with Stylidium repens.
Veg Condition Excellent - Very Good
Fire Age Old (8-12)
Notes Aspect: North
Disturbance: Weeds, Clearing
Ground Cover: 2% Bareground, 1% Logs, 1% Twigs, 45% Leaves

SPECIES LIST:

Name	Cover	Height	Specimen Notes
Acacia pulchella var. glaberrima	1.5	50	BJ01-02
Acacia stenoptera	+	30	BJ01-23
Allocasuarina fraseriana	4	400	nc
Amphipogon turbinatus	+	15	BJ01-11
Anigozanthos manglesii	+	50	nc
Banksia attenuata	17	600	nc
Banksia menziesii	4	500	nc
Bossiaea eriocarpa	1	40	BJ01-06
Briza maxima	+	10	nc
Burchardia congesta	+	50	nc
Caladenia discoidea	+	20	BJHA02
Caladenia flava subsp. flava	+	20	nc
Chamaescilla corymbosa	+	20	BJ01-X1
Conostylis aculeata subsp. aculeata	3	30	BJ01-10
Conostylis juncea	1	50	BJ01-04
Dampiera linearis	+	20	BJ01-09
Dasypogon bromeliifolius	2	40	nc
Desmocladus flexuosus	8	20	BJ01-07
Drosera erythrorhiza	+	1	nc
Drosera macrantha subsp. macrantha	+	<1	BJ01-28
Ehrharta calycina	+	40	nc
Eucalyptus marginata	3	350	nc
Gladiolus caryophyllaceus	+	50	nc
Gompholobium tomentosum	+	40	BJ01-08
Hibbertia hypericoides	2	50	nc
Hibbertia racemosa	1.5	30	BJ01-19
Hypocalymma robustum	3	50	BJ01-03
Hypochaeris glabra	+	1	nc
Kennedia prostrata	+		nc
Kunzea glabrescens	2	50-200	BJ01-01
Lagenifera huegelii	+	40	BJ01-14
Laxmannia squarrosa	+	20	BJ01-24
Lepidosperma squamatum	+	50	BJ01-13
Leucopogon conostephioides	1	20	BJ01-16
Lomandra hermaphrodita	+	20	BJ01-22
Lomandra micrantha subsp. micrantha	+	30	BJ01-27
Lomandra suaveolens	+	10	BJ01-25
Lyginia barbata	1	50	BJ01-17
Macrozamia riedlei	+	50	nc
Opercularia vaginata	+	20	BJ01-12
Patersonia occidentalis var. occidentalis	1	30	nc
Petrophile linearis	+	30	nc
Philotheca spicata	1	60	BJ01-05
Pterostylis sanguinea	+	20	BJ01-26
Stirlingia latifolia	+	70	nc
Stylidium brunonianum	+	20	BJ01-21
Stylidium piliferum	+	30	BJ01-15
Stylidium repens	3	10	nc
Thysanotus patersonii	+	<1	BJ01-18
Trachymene pilosa	+	10	BJ01-20
Ursinia anthemoides	+	10	nc

Site BJQ02

Described by NW
Date 15/09/2015
Type Q 10 x 10m
MGA Zone 50 393578 **mE** 6441144 **mN**
Habitat Wetland
Soil Brown loam peat
Vegetation Closed woodland of *Melaleuca rhaphiophylla* over *Baumea articulata*
Veg Condition Excellent
Fire Age Very Old (>12)
Notes Aspect: N/A
Disturbance: -
Ground Cover: 41% Bareground, 4% Logs, 8% Twigs, 85% Leaves

SPECIES LIST:

Name	Cover	Height	Specimen Notes
Acacia longifolia	1.5	200	nc
Baumea articulata	70	150	nc
Lepidosperma longitudinale	2	45	nc
Melaleuca rhaphiophylla	85	800	nc
Pterostylis sp. short sepals (W. Jackson BJ259)	+	10	BJQ2-1

Site BJQ03

Described by HA
Date 15/09/2015
Type Q 10 x 10m
MGA Zone 50 393591 **mE** 6441015 **mN**
Habitat Wetland
Soil dark brown peaty soils
Vegetation *Melaleuca rhaphiophylla* low forest with very open tussock grassland of **Ehrharta longiflora* with very open herbland of **Cotula coronopifolia*
Veg Condition Very Good - Good
Fire Age Old (8-12)
Notes Aspect: North
Disturbance: Weeds, Clearing
Ground Cover: 5% Bareground, 2% Logs, 3% Twigs, 85% Leaves

SPECIES LIST:

Name	Cover	Height	Specimen Notes
Acacia longifolia	+	40	nc
Carpobrotus edulis	1	Pr	nc
Cotula coronopifolia	4	10	BJ03-01
Crassula natans var. *minus*	+	1	BJ03-05
Ehrharta longiflora	3	30	nc
Fumaria capreolata	+		nc
Hypochaeris glabra	+	1	nc
Juncus planifolius	+	100	BJ03-03
Melaleuca rhaphiophylla	65	350-700	nc
Sonchus oleraceus	+	10	nc
Trifolium sp.	+	5	BJ03-04
Vulpia bromoides	+	10	BJ03-02
Zantedeschia aethiopica	+	30	nc

Site BJQ04

Described by NW
Date 15/09/2015
Type Q 10x10m
MGA Zone 50 393559 **mE** 6441114 **mN**
Habitat Wetland
Soil peat
Vegetation Surface water, dense saplings of *Melaleuca rhaphiophylla*
Veg Condition Excellent
Fire Age Old (8-12)
Notes Aspect: N/A
Disturbance:
Ground Cover: -% Bareground, -% Logs, -% Twigs, -% Leaves

SPECIES LIST:

Name	Cover	Height	Specimen Notes
Melaleuca rhaphiophylla	95	400	nc

Site BJQ05

Described by HA
Date 15/09/2015
Type Q 10 x 10m
MGA Zone 50 393806 **mE** 6440996 **mN**
Habitat Wetland/Dampland
Soil dark brown peat and grey sands
Vegetation Low scattered trees of *Melaleuca preissiana* and Melaleuca rhaphiophylla over tall open scrub of *Kunzea glabrescens* and *Astartea scoparia* over *Hypocalymma angustifolium* and *Acacia pulchella* var. *glaberrima* shrubland with scattered sedges of *Lepidosperma longitudinale*
Veg Condition Excellent - Very Good
Fire Age Old (>12)
Notes Aspect: North
Disturbance: Weeds, Clearing
Ground Cover: 90% Bareground, <1% Logs, 1% Twigs, 7% Leaves

SPECIES LIST:

Name	Cover	Height	Specimen Notes
Acacia longifolia	+	150	nc
Acacia pulchella var. *glaberrima*	5	180-200	BJ05-08
Aotus sp.	+	100	BJ05-03
Astartea scoparia	25	200-250	BJ05-04
Cassytha racemosa	+	<1	BJ05-05
Hypocalymma angustifolium	15	180	BJ05-01
Hypochaeris glabra	+	1	nc
Kunzea glabrescens	25	300	nc
Lepidosperma longitudinale	1	100	BJ05-10
Meeboldina scariosa	+	180	BJ05-02
Melaleuca lateritia	+	100	BJ05-07
Melaleuca preissiana	0.5	600	nc
Melaleuca rhaphiophylla	0.5	600	nc
Melaleuca teretifolia	+	150	BJ05-06
Orchidaceae sp.	+	2	BJ05-11
Pterostylis recurva	+	40	BJ05-09
Pterostylis sp. crinkled leaf (G.J. Keighery 13426)	+	20	BJHA-08

Site BJQ06

Described by NW
Date 15/09/2015
Type Q 10x10m
MGA Zone 50 393704 **mE** 6441178 **mN**
Habitat Flat
Soil grey/black loamy sand
Vegetation Dense shrubland of *Melaleuca teretifolia* and *Melaleuca rhaphiophylla* over sedges
Veg Condition Excellent
Fire Age Old (8-12)
Notes Aspect: North
Disturbance: Weeds, Clearing
Ground Cover: 4% Bareground, 0% Logs, 2% Twigs, 3% Leaves

SPECIES LIST:

Name	Cover	Height	Specimen Notes
Acacia longifolia	2	240	nc
Acacia pulchella var. *glaberrima*	1	130	nc
Briza maxima	2	35	nc
Cassytha racemosa	35	+	BJQ6-4
Crassula closiana	+	1	BJQ6-7
Galium murale	+	3	BJQ6-6
Galium murale	+	3	BJQ6-5
Hypochaeris glabra	5	1	nc
Juncus capitatus	+	2	BJQ6-8
Juncus pallidus	+	120	nc
Lepidosperma longitudinale	25	60	nc
Lysimachia arvensis	+	5	nc
Meeboldina coangustata	4	10	BJQ6-3
Melaleuca rhaphiophylla	55	170	BJQ6-2
Melaleuca teretifolia	8	90	BJQ6-1
Zantedeschia aethiopica	+	15	nc

Site BJQ07

Described by HA
Date 15/09/2015
Type Q 10 x 10m
MGA Zone 50 393499 **mE** 6441274 **mN**
Habitat Lower slope above wetland
Soil Grey sands
Vegetation *Allocasuarina fraseriana* and *Eucalyptus marginata* and *Banksia ilicifolia* over *Xanthorrhoea preissii* open heath over *Dasypogon bromeliifolius*, *Phlebocarya ciliata* and *Gompholobium tomentosum* over very open herbland of *Stylidium repens* and *Ursinia anthemoides*
Veg Condition Very Good
Fire Age Very Old (>12)
Notes Aspect: NA
Disturbance: Some tracks, weeds, historic clearing
Ground Cover: 1% Bareground, <1% Logs, <1% Twigs, 60% Leaves

SPECIES LIST:

Name	Cover	C Class	Height	Specimen Notes
Allocasuarina fraseriana	8		1000	nc
Banksia ilicifolia	2		600	nc
Bossiaea eriocarpa	+		30	BJ01-06
Briza maxima	+		20	nc
Chamaescilla corymbosa	+		10	BJ01-X1
Conostylis juncea	+		20	BJ07-04
Crassula colorata var. *colorata*	+		1	BJ07-07
Dasypogon bromeliifolius	15		30	nc
Drosera erythrorhiza	+		1	nc
Ehrharta longiflora	+		30	nc
Eucalyptus marginata	4		1000	nc
Gladiolus caryophyllaceus	+		20	nc
Gompholobium tomentosum	1		30	BJ01-08
Hypochaeris glabra	+		1	nc
Hypolaena exsulca	+		30	BJ07-06
Jacksonia furcellata	+		120	nc
Laxmannia squarrosa	+		20	BJ01-24
Lepidosperma sp.	+		30	BJ07-05
Phlebocarya ciliata	3		30	BJ07-03
Phyllangium divergens	+		10	BJ07-01
Pterostylis sanguinea	+		20	BJ01-26
Stylidium piliferum	+		10	BJ01-15
Stylidium repens	1		5	nc
Trachymene pilosa	+		10	BJ01-20
Ursinia anthemoides	1		10	nc
Wahlenbergia sp.	+		10	BJ07-02
Xanthorrhoea preissii	38		120	nc

Site BJQ08

Described by NW
Date 15/09/2015
Type Q 10x10m
MGA Zone 50 393892 **mE** 6441127 **mN**
Habitat flat wetland plain
Soil blank sand with a little silt
Vegetation Heath of *Hypocalymma angustifolium*
Veg Condition Excellent
Fire Age Old (8-12)
Notes Aspect: NA
Disturbance: ? historic clearing
Ground Cover: 7% Bareground, 0% Logs, 1% Twigs, 1% Leaves

SPECIES LIST:

Name	Cover	C Class	Height	Specimen Notes
Acacia pulchella var. *glaberrima*	1		120	nc
Caladenia flava subsp. *flava*	+		15	nc
Cassytha racemosa	4		+	BJQ6.04
Dielsia stenostachya	7		20	BJR04.02
Gladiolus caryophyllaceus	+		60	nc
Hypocalymma angustifolium	90		110	nc
Hypochaeris glabra	+		1	nc
Kunzea glabrescens	1		170	nc
Siloxerus humifusus	+		2	nc
Trachymene pilosa	+		3	nc
Ursinia anthemoides	+		10	nc

Site BJQ09

Described by HA
Date 15/09/2015
Type Q 10x10m
MGA Zone 50 393615 **mE** 6441358 **mN**
Habitat Wetland
Soil dark grey sands and peat
Vegetation *Melaleuca rhaphiophylla* tall open shrubland over *Acacia longifolia* over scattered shrubs of *Melaleuca lateritia* over *Lepidosperma longitudinale*, *Meeboldina coangustata* and *Juncus pallidus* sedgeland over open herbland of *Zantedeschia aethiopica* over scattered grasses of *Ehrharta longiflora*
Veg Condition Very Good
Fire Age Very Old (>12)
Notes Aspect: NA
Disturbance: Some tracks, weeds, historic clearing
Ground Cover: 20% Bareground, 1% Logs, 5% Twigs, 45% Leaves

SPECIES LIST:

Name	Cover	C Class	Height	Specimen Notes
Acacia longifolia	10		400	nc
Asparagus asparagoides	+		C1	nc
Astartea scoparia	+		180	BJ05.04
Briza maxima	+		20	nc
Cassytha sp.	+		C1	nc
Chamaescilla corymbosa	+		10	BJ01.X1
Ehrharta longiflora	1		30	nc
Galium murale	+		2	BJ09.05
Gladiolus caryophyllaceus	+		60	nc
Hypochaeris glabra	+		1	nc
Juncus pallidus	1		100	BJ03.03
Lepidosperma longitudinale	25		100	BJ09.03
Liparophyllum sp.	+		10	BJ09.07
Lobelia alata	+		10	BJ09.06
Meeboldina coangustata	8		100	BJ09.02
Melaleuca lateritia	1		120	BJ05.07
Melaleuca rhaphiophylla	1		500	nc
Melaleuca rhaphiophylla	20		300	BJ09.01
Pelargonium capitatum	+		30	BJ09.04
Sonchus oleraceus	+		10	nc
Trachymene pilosa	+		10	BJ01.20
Trifolium sp.	+		10	BJ03.04
Zantedeschia aethiopica	3		50	nc

Site BJQ10

Described by NW
Date 15/09/2015
Type Q 10x10m
MGA Zone 50 393374 **mE** 6441490 **mN**
Habitat Plain
Soil grey sand - some loam
Vegetation Woodland of *Banksia ilicifolia*, *Banksia attenuata* over *Kunzea glabrescens*, *Xanthorrhoea preissii*, *Dasypogon bromeliifolius*
Veg Condition Very Good to Excellent
Fire Age Old (8-12)
Notes Aspect: NA
Disturbance: Some weeds
Ground Cover: 2% Bareground, 0% Logs, 4% Twigs, 15% Leaves

SPECIES LIST:

Name	Cover	Height	Specimen Notes
Acacia longifolia	+	120	nc
Allocasuarina fraseriana	+	35	nc
Banksia attenuata	5	700	nc
Banksia ilicifolia	12	1100	nc
Bossiaea eriocarpa	+	40	nc
Briza maxima	4	15	nc
Burchardia congesta	+	50	nc
Caladenia flava subsp. *flava*	+	15	nc
Chamaescilla corymbosa	+	1	nc
Conostylis juncea	+	15	nc
Dasypogon bromeliifolius	15	40	nc
Desmocladus flexuosus	50	25	BJQ10.01
Drosera erythrorhiza	1	1	nc
Gompholobium tomentosum	1.5	40	nc
Hemiandra pungens	+	15	BJQ10.05
Hibbertia subvaginata	+	20	nc
Hypolaena exsulca	+	30	BJQ10.03
Kunzea glabrescens	55	600	nc
Leucopogon aff. *conostephioides*	+	35	BJQ10.04
Philotheca spicata	+	15	nc
Phlebocarya ciliata	1	30	nc
Pterostylis recurva	+	70	BJQ10.02
Stylidium brunonianum	+	45	nc
Stylidium piliferum	+	15	nc
Stylidium repens	+	3	nc
Thelymitra sp.	+	25	nc
Thysanotus manglesianus	+	C	nc
Xanthorrhoea preissii	4	110	nc
Zantedeschia aethiopica	1	45	nc

Site BJQ11

Described by HA
Date 16/09/2015
Type Q 10x10m
MGA Zone 50 393635 **mE** 6441466 **mN**
Habitat wetland
Soil dark grey sands and peat
Vegetation Low open forest of *Melaleuca rhaphiophylla* and *Acacia longifolia* over scattered shrubs of *Astartea scoparia* over *Lepidosperma ? longitudinale* and *Meeboldina coangustata* sedgeland over open herbland of *Zantedeschia aethiopica*
Veg Condition Very Good
Fire Age Very Old (>12)
Notes Aspect: NA
Disturbance: Some tracks, weeds, historic clearing
Ground Cover: 1% Bareground, <1% Logs, <1% Twigs, 30% Leaves

SPECIES LIST:

Name	Cover	Height	Specimen Notes
Acacia longifolia	5	300	nc
Acacia pulchella var. *glaberrima*	+	70	BJ05.08
Asparagus asparagoides	ASS		nc
Astartea scoparia	2	180	BJ05.04
Briza maxima	+	10	nc
Cassytha racemosa	+	C1	BJ11.03
Eutaxia virgata	+	50	BJ11.05
Galium murale	+	10	BJ11.07
Hypocalymma angustifolium	+	80	BJ05.01
Hypochaeris glabra	+	1	nc
Lepidosperma ? longitudinale	40	120	BJ11.02
Lobelia anceps	+	10	BJ11.04
Lysimachia arvensis	+	30	BJ11.06
Meeboldina coangustata	20	120	BJ11.01
Melaleuca lateritia	+	60	BJ05.07
Melaleuca preissiana	ASS		nc
Melaleuca rhaphiophylla	20	300	nc
Melaleuca rhaphiophylla	25	250	BJ09.01
Zantedeschia aethiopica	3	50	nc

Site BJQ12

Described by NW
Date 15/09/2015
Type Q 10x10
MGA Zone 50 393470 **mE** 6441426 **mN**
Habitat Mid slope
Soil grey sand
Vegetation Woodland of *Banksia menziesii*, *Banksia attenuata*, *Nuytsia floribunda* over *Stirlingia latifolia*, *Calytrix fraseri*, *Jacksonia furcellata*, *Adenanthos cygnorum* subsp. *cygnorum* & grass weeds
Veg Condition Good
Fire Age Moderate (4-8)
Notes Aspect: NA
Disturbance: Weeds, Banksia death
Ground Cover: 6% Bareground, 1.5% Logs, 4% Twigs, 3% Leaves

SPECIES LIST:

Name	Cover	Height	Specimen Notes
Adenanthos cygnorum subsp. *cygnorum*	6	400	nc
Allocasuarina fraseriana	1.5	400	nc
Anigozanthos manglesii	1	80	nc
Banksia attenuata	5	700	nc
Banksia menziesii	6	500	nc
Bossiaea eriocarpa	40	+	nc
Briza maxima	3	20	nc
Burchardia congesta	+	40	nc
Caladenia flava subsp. *flava*	+	15	nc
Calytrix fraseri	8	150	nc
Conostylis aculeata subsp. aculeata	+	30	nc
Crassula colorata var. colorata	+	2	BJQ12.03
Dasypogon bromeliifolius	2	45	nc
Desmocladus flexuosus	3	15	BJQ10.01
Diuris corymbosa	+	30	OPPNW01
Drosera erythrorhiza	+	1	nc
Ehrharta calycina	20	80	nc
Gladiolus caryophyllaceus	+	60	nc
Gompholobium tomentosum	1	45	nc
Hibbertia subvaginata	1	30	nc
Hypochaeris glabra	4	1	nc
Hypolaena exsulca	+	35	nc
Jacksonia furcellata	1	130	nc
Kunzea glabrescens	2	300	nc
Lomandra caespitosa	+	25	BJQ12.04
Lyginia imberbis	1	40	nc
Neurachne alopecuroidea	+	25	nc
Nuytsia floribunda	6	600	nc
Pterostylis vittata	+	35	BJQ12.05
Quinetia urvillei	+	4	BJQ12.01
Scholtzia involucrata	1	30	nc
Sonchus oleraceus	+	25	nc
Stirlingia latifolia	4	120	nc
Stylidium brunonianum	+	30	nc
Thysanotus manglesianus	+	C	nc
Trachymene pilosa	+	3	nc
Ursinia anthemoides	+	10	nc
Vulpia bromoides	+	3	BJQ12.02
Zantedeschia aethiopica	1.5	80	nc

Site BJQ13

Described by HA
Date 16/09/2015
Type Q 10x10m
MGA Zone 50 393733 **mE** 6441353 **mN**
Habitat dampland/wetland
Soil dark grey sands with peat
Vegetation Low woodland of *Melaleuca preissiana* over *Kunzea glabrescens*, *Acacia longifolia* and *Hakea varia* tall scrub over mixed shrubs over *Meeboldina coangustata* sedgeland
Veg Condition Very Good to Excellent
Fire Age Very Old (>12)
Notes Aspect: NA
Disturbance: Weeds
Ground Cover: 3% Bareground, <1% Logs, 5% Twigs, 40% Leaves

SPECIES LIST:

Name	Cover	Height	Specimen Notes
Acacia longifolia	12	350	nc
Acacia pulchella var. *glaberrima*	1	120	BJ05.08
Astartea scoparia	2	150	BJ05.04
Briza maxima	+	20	nc
Caladenia flava subsp. *flava*	+	10	nc
Calothamnus lateralis var. *lateralis*	2	210	BJ13.01
Cassytha racemosa	+	C1	BJ11.03
Ehrharta calycina	+	100	nc
Hakea varia	3	310	BJ13.02
Hypochaeris glabra	+	1	nc
Kunzea glabrescens	12	350	nc
Lepidosperma longitudinale	2	90	BJ11.02
Liparophyllum sp.	+	10	BJ09.07
Meeboldina coangustata	40	130	BJ11.01
Melaleuca lateritia	+	120	BJ05.07
Melaleuca preissiana	10	800-600	nc
Melaleuca rhaphiophylla	+	190	BJ09.01
Melaleuca teretifolia	+	180	BJ13.05
Pericalymma ellipticum var. *ellipticum*	2	120	BJ13.03
Poaceae sp.	+	10	BJ13.04
Trachymene pilosa	+	1	BJ01.20
Zantedeschia aethiopica	+	10	nc

Site BJQ14

Described by HA
Date 16/09/2015
Type Q 10x10m
MGA Zone 50 393801 **mE** 6441483 **mN**
Habitat dampland
Soil grey sands and some peat
Vegetation Low scattered trees of *Melaleuca preissiana* over scattered *Kunzea glabrescens* over low open health of *Hypocalymma angustifolium* and *Boronia crenulata* over *Dielsia stenostachya, Schoenus efoliatus* and *Dasypogon bromeliifolius* sedgeland or scattered *Hypochaeris glabra* & *Ursinia anthemoides* herbs

Veg Condition Excellent (Very Good in surrounding area)
Fire Age Old (8-12)
Notes Aspect: NA
Disturbance: Minor weeds, historic clearing
Ground Cover: 3% Bareground,<1% Logs, +% Twigs, 2% Leaves

SPECIES LIST:

Name	Cover	Height	Specimen Notes
Acacia pulchella var. *glaberrima*	+	60	nc
Actinotus glomeratus	0.5	15	BJ15.02
Asteraceae sp.	+	1	BJ15.06
Boronia crenulata	7	70	BJ15.01
Briza maxima	+	20	nc
Carpobrotus edulis	+	10	nc
Cassytha racemosa	+	Cl	BJ15.10
Crassula colorata var. *colorata*	+	1	BJ15.05
Cyperus tenellus	+	10	BJ15.07
Dasypogon bromeliifolius	2	40	nc
Dielsia stenostachya	28	30	BJR5.01
Drosera pulchella	+	1	BJ15.03
Ehrharta calycina	+	30	nc
Gladiolus caryophyllaceus	+	60	nc
Hypocalymma angustifolium	45	70	BJ05.01
Hypochaeris glabra	0.5	1	nc
Kunzea glabrescens	2	180	nc
Melaleuca preissiana	1.5	300	nc
Phyllangium divergens	+	8	BJ15.09
Poranthera microphylla	+	10	BJ15.11
Pultenaea reticulata	+	60	BJ15.08
Schoenus efoliatus	3	3	BJR3.01
Stylidium brunonianum	+	20	BJ15.04
Stylidium repens	+	10	nc
Ursinia anthemoides	0.5	20	nc
Xanthorrhoea preissii	1	100	nc

Site BJQ15

Described by HA
Date 16/09/2015
Type Q 10x10m
MGA Zone 50 393384 **mE** 6441099 **mN**
Habitat lower slope above wetland
Soil grey sands
Vegetation Low woodland of *Banksia ilicifolia* and *Eucalyptus marginata* over tall shrubland of *Kunzea glabrescens* over scattered *Leucopogon conostephioides* and *Scholtzia involucrata* over *Desmocladus flexuosus*, *Conostylis aculeata* subsp. *aculeata*, *Dasypogon bromeliifolius* and *Phlebocarya ciliata* over very open herb land of *Carpobrotus edulis* and *Stylidium repens* over *Briza maxima* and *Ehrharta calycina* grasses

Veg Condition Good

Fire Age Old (8-12)

Notes Aspect: East
Disturbance: Some tracks, weeds, historic clearing
Ground Cover: 5% Bareground, <1% Logs, 1% Twigs, 70% Leaves

SPECIES LIST:

Name	Cover	C Class	Height	Specimen Notes
Allocasuarina fraseriana	+		120	nc
Anigozanthos humilis	+		100	nc
Banksia ilicifolia	8		700	nc
Banksia menziesii	+		100	nc
Bossiaea eriocarpa	+		30	BJ01.06
Briza maxima	3		20	nc
Burchardia congesta	+		50	nc
Caladenia flava subsp. *flava*	+		20	nc
Carpobrotus edulis	2		Pr	nc
Conostylis aculeata subsp. *aculeata*	2		30	BJ01.10
Conostylis juncea	+		20	BJR01.03
Crassula colorata var. *colorata*	+		1	BJ17.06
Dampiera linearis	+		10	BJ01.09
Dasypogon bromeliifolius	1		30	nc
Desmocladus flexuosus	20		10	BJ01.07
Drosera erythrorhiza	+		1	nc
Ehrharta calycina	1		100	nc
Eucalyptus marginata	2		500	nc
Gladiolus caryophyllaceus	+		50	nc
Gompholobium tomentosum	+		100	BJ01.08
Hovea pungens	ASS			BJ17.X1
Hypochaeris glabra	+		1	nc
Jacksonia furcellata	1		180	nc
Kennedia prostrata	+		Pr	nc
Kunzea glabrescens	28		300	BJ01.01
Lepidosperma sp.	+		10	BJ17.04
Lepidosperma squamatum	+		30	BJ17.02
Lepidosperma squamatum	+		30	BJ17.03
Leucopogon conostephioides	1		30	BJ17.05
Lyginia imberbis	+		30	nc
Melaleuca thymoides	+		180	BJ07.X1
Nuytsia floribunda	ASS			nc
Philotheca spicata	+		40	BJ01.01
Phlebocarya ciliata	3		30	BJ17.01
Scholtzia involucrata	1		30	nc
Stylidium repens	2		20	nc
Thysanotus patersonii	+		Cl	BJ01.01
Trachymene pilosa	+		10	BJ01.20
Ursinia anthemoides	+		30	nc
Xanthorrhoea preissii	ASS			nc

Site BJR1

Described by HA
Date 15/09/2015
Type R
MGA Zone 50 393350 **mE** 6441256 **mN**
Habitat Hill top / sand dune-
Soil Grey sands
Vegetation Low woodland of *Banksia menziesii*, *B. attenuata* & *Allocasuarina fraseriana* over tall open shrubland of *Adenanthos cygnorum* subsp. *cygnorum* over low open shrubland of *Leucopogon conostephioides* and *Stirlingia latifolia* over *Briza maxima*

Veg Condition Good

Fire Age 8-12

Notes Disturbance: Weeds
Ground Cover: 4% Bareground, 1% Logs, 2% Twigs, 70% Leaves

SPECIES LIST:

Name	Cover	Height	Specimen Notes
Adenanthos cygnorum subsp. *cygnorum*	3	210	nc
Allocasuarina fraseriana	4	800	nc
Anigozanthos manglesii	+	100	nc
Banksia attenuata	5	600	nc
Banksia menziesii	18	800	nc
Bossiaea eriocarpa	+	30	Q1-6
Briza maxima	9	20	nc
Burchardia congesta	+	50	nc
Caladenia flava subsp. *flava*	+	10	nc
Conostylis aculeata subsp. *aculeata*	1.0	30	21-10
Conostylis juncea	+	20	R1-3
Dasypogon bromeliifolius	2	30	nc
Drosera erythrorhiza	1	1	nc
Ehrharta longiflora	+	30	nc
Gompholobium tomentosum	+	50	21-8
Hibbertia hypericoides	+	50	nc
Hypochaeris glabra	+	1	nc
Kunzea glabrescens	+	Cl	R1-1
Kunzea glabrescens	1	180	nc
Leucopogon conostephioides	2	30	R1-2
Petrophile linearis	+	30	nc
Stirlingia latifolia	2	50	nc
Stylidium brunonianum	+	30	Q1-21
Stylidium repens	+	20	nc
Thysanotus patersonii	+	Cl	BJR01.07
Ursinia anthemoides	2	30	nc
Zantedeschia aethiopica	+	30	nc

Site BJR2

Described by NW
Date 15/09/2015
Type R
MGA Zone 50 393467 **mE** 6441104 **mN**
Habitat Wetland - with water
Soil Brown Loam
Vegetation Low closed forest of *Melaleuca rhaphiophylla* over water
Veg Condition Excellent
Fire Age Very Old (>12)
Notes Disturbance:
Ground Cover: 3% Bareground, 4% Logs, 6% Twigs, 85% Leaves

SPECIES LIST:

Name	Cover	Height	Specimen Notes
Acacia longifolia	1.5	450	
Baumea articulata	3	200	
Hypochaeris glabra	+	1	
Lepidosperma longitudinale	3	60	
Melaleuca rhaphiophylla	90	600	

Site BJR3

Described by HA
Date 16/09/2015
Type R
MGA Zone 50 393674 **mE** 6441453 **mN**
Habitat Dampland
Soil
Vegetation Low open woodland of *Melaleuca preissiana* over tall open shrubland of *Kunzea glabrescens* over low open heath of *Hypocalymma angustifolium* and *Acacia pulchella* var. *glaberrima* over *Hypolaena exsulca* and *Schoenus efoliatus*
Veg Condition Good
Fire Age >12
Notes Disturbance: Weeds, Clearing
Ground Cover: 30%Bareground, 1% Logs, 2% Twigs, 20% Leaves

SPECIES LIST:

Name	Cover	Height	Specimen Notes
Acacia longifolia	+	200-300	nc
Acacia pulchella var. *glaberrima*	2	50	BJQ05-8
Briza maxima	+	10	nc
Caladenia flava subsp. *flava*	+	10	nc
Dampiera linearis	+	10	BJR03.03
Ehrharta calycina	1	30	nc
Hypocalymma angustifolium	35	60	BJQ5-1
Hypochaeris glabra	1	1	nc
Hypolaena exsulca	10	20	BJR3-2
Kunzea glabrescens	4	200	BJQ1-1
Melaleuca preissiana	5	300-1000	nc
Schoenus efoliatus	1	30	BJR3-1
Ursinia anthemoides	3	20	nc
Xanthorrhoea preissii	+	100	nc

Site BJR4

Described by NW
Date 15/09/2015
Type R
MGA Zone 50 393596 **mE** 6441209 **mN**
Habitat Lower slope however higher edge of wetland
Soil Grey sands
Vegetation Open woodland of *Melaleuca preissiana* and *Eucalyptus rudis* over dense understorey of *Hypocalymma angustifolium*, *Xanthorrhoea preissii* and sedges
Veg Condition Excellent
Fire Age Old (8-12)
Notes Disturbance: Some weeds
Ground Cover: 0% Bareground, 0% Logs, 6% Twigs, 30% Leaves

SPECIES LIST:

Name	Cover	Height	Specimen Notes
Acacia pulchella var. glaberrima	1	120	nc
Avena barbata	6	40	nc
Caladenia latifolia	+	30	nc
Carpobrotus edulis	1.5	15	nc
Chamaescilla corymbosa	3	5	nc
Cyathochaeta avenacea	3	100	BJR4-1
Dielsia stenostachya	5	25	BJR4-2
Eucalyptus rudis	5	1200	nc
Hypocalymma angustifolium	20	140	nc
Kunzea glabrescens	2	140	nc
Lepidosperma longitudinale	2	50	nc
Lepidosperma sp.	8	80	BJR4-3
Melaleuca preissiana	10	1100	nc
Xanthorrhoea preissii	8	130	nc

Site BJR5

Described by HA
Date 16/09/2015
Type R
MGA Zone 50 393808 **mE** 6441388 **mN**
Habitat Dampland
Soil Grey sands and peat
Vegetation Low open woodland of *Melaleuca preissiana* over tall shrubland of *Kunzea glabrescens* and *Acacia longifolia* over *Hypocalymma angustifolium* heath over *Dielsia stenostachya* sedgeland
Veg Condition Very Good
Fire Age Old (8-12)
Notes Disturbance: Some weeds
Ground Cover: 1% Bareground,<1% Logs, <1% Twigs, 5% Leaves

SPECIES LIST:

Name	Cover	Height	Specimen Notes
Acacia longifolia	0.5	300	nc
Acacia pulchella var. *glaberrima*	+	60	BJQ05.08
Astartea scoparia	+	180	BJQ05.04
Briza maxima	+	20	nc
Cassytha racemosa	+	Cl	BJQ11.03
Dielsia stenostachya	30	30	BJR05.01
Drosera pulchella	+	1	BJQ15.03
Glischrocaryon angustifolium	+	50	BJR05.03
Hypocalymma angustifolium	60	50	BJQ05.01
Kunzea glabrescens	12	150-250	nc
Melaleuca preissiana	5	300-800	nc
Ursinia anthemoides	+	20	nc
Xanthorrhoea preissii	1	100	nc

Site BJR6

Described by HA
Date 16/09/2015
Type R
MGA Zone 50 393661 **mE** 6440984 **mN**
Habitat Dampland / Wetland
Soil Grey sands and peat
Vegetation Scattered *Melaleuca preissiana* trees over *Kunzea glabrescens* and *Melaleuca rhaphiophylla* and *Acacia longifolia* tall shrubland over *Lepidosperma longitudinale* and *Meeboldina coangustata* sedgeland
Veg Condition Very Good
Fire Age Very Old (>12)
Notes Disturbance: Some weeds
Ground Cover: 5% Bareground, <1% Logs, <1% Twigs, 12% Leaves

SPECIES LIST:

Name	Cover	Height	Specimen Notes
Acacia longifolia	3	300	nc
Astartea scoparia	+	150	BJQ05.04
Carpobrotus edulis	+	Cr	nc
Cassytha racemosa	+	Cl	BJQ11.03
Hypocalymma angustifolium	5	90	BJQ05.01
Hypochaeris glabra	+	1	nc
Kunzea glabrescens	10	300	BJQ01.01
Lepidosperma longitudinale	38	100	BJQ11.02
Meeboldina coangustata	15	100	BJQ11.01
Melaleuca lateritia	+	100	BJQ05.07
Melaleuca preissiana	1	600	nc
Melaleuca rhaphiophylla	15	250	BJQ09.01
Pericalymma ellipticum var. *ellipticum*	+	120	BJQ13.03
Ursinia anthemoides	+	30	nc
Zantedeschia aethiopica	+	30	nc

Site BJR7

Described by HA
Date 16/09/2015
Type R
MGA Zone 50 394011 **mE** 6441140 **mN**
Habitat Dampland
Soil Grey sand and peat
Vegetation Scattered low trees of *Melaleuca preissiana* over scattered tall shrubs of *Acacia longifolia* and *Kunzea glabrescens* over *Hypocalymma angustifolium* low heath over *Dielsia stenostachya* and *Schoenus efoliatus* open sedgeland.
Veg Condition Very Good
Fire Age Old (8-12)
Notes Disturbance: Some weeds
Ground Cover: 5% Bareground, <1% Logs, <1% Twigs, 12% Leaves

SPECIES LIST:

Name	Cover	Height	Specimen Notes
Acacia longifolia	1	300	nc
Astartea scoparia	1	150	BJQ05.04
Briza maxima	+	20	nc
Dampiera linearis	+	10	BJR03.03
Dielsia stenostachya	10	30	BJR05.01
Glischrocaryon angustifolium	+	50	BJR05.03
Hypocalymma angustifolium	80	60	BJQ05.01
Hypochaeris glabra	+	1	nc
Kunzea glabrescens	1	250	BJQ01.01
Melaleuca preissiana	+	300	nc
Schoenus efoliatus	1	30	BJR03.01
Stylidium brunonianum	+		BJQ15.04

Banjup Beenyup Rd | Site BJOPPCOLL

Described by | Date | Type O

Season | Uniformity

Location

MGA Zone | mE | mN | E | S

Habitat

Soil

Rock Type

Vegetation

Veg Condition

Fire Age

Notes

SPECIES LIST:

Name	Cover	C Class	Height	Specimen	Notes
Acacia iteaphylla	-			nc	Acacia lteaphylla
Adenanthos cygnorum subsp. cygnorum	-			nc	adenanthos cyg
Arctotheca calendula	-			nc	Arcotheca cal
Banksia prionotes	-			nc	Banksia prionotes
Caladenia discoidea	-			BJHA02	orchid
Caladenia flava subsp. flava	-			nc	Caladenia flava
Caladenia flava subsp. flava	-			nc	Caladenia flava
Caladenia latifolia	-			nc	Calandenia lati
Caladenia latifolia	-			nc	Caladenia lat
Callitris preissii	-			BJHA15	? Callitris
Chamelaucium uncinatum	-			BJHA16	Geraldton wax
Daviesia triflora	-			BJHA07	Daviesa physoides
Diuris corymbosa	-			OPPNW01	pale donkey orchid
Diuris corymbosa	-			BJHA21	Diuris large
Diuris corymbosa	-			OPPNW01	Pale donkey orchid
Diuris laxiflora	-			BJHA19	Diuris
Diuris sp.	-			BJHA01	diuris
Drosera glanduligera	-			BJHA11a	
Eragrostis curvula	-			nc	Eragrostis
Eucalyptus camaldulensis	-			BJHA14	Euc camlad
Eucalyptus todtiana	-			nc	Euc tod
Euphorbia terracina	-			BJHA12	Euphorbia terra
Hemiandra pungens	-			BJHA06	Hemiandra creeper
Hovea pungens	-			BJHA05	Hovea
Hybanthus calycinus	-			BJHA09	Hybanthus blue
Lepidosperma longitudinale	-			BJHA13	Lepidosperma longi
Leptomeria pauciflora	-			OPPNW03	Strange white flw stick
Macarthuria australis	-			BJHA03	Macarthuria aust
Persoonia saccata	-			BJHA04	Dunno
Pterostylis sp. crinkled leaf (G.J. Keighery 13426)	-			BJHA08	Snail orhicd
Pultenaea ochreata	-			BJHA11a	Pea wetland
Pultenaea reticulata	-			BJHA18	Pea
Romulea rosea var. australis	-			BJHA17	Romulea rosea
Trachymene pilosa	-			BJHA10	Trachymene oprnata
Waitzia suaveolens var. suaveolens	-			BJHA20	Waitzia
Xylomelum occidentale	-			nc	Xylomelum occi
Zantedeschia aethiopica	-			nc	Arum lily
Zantedeschia aethiopica	-			nc	Arum lily
Zantedeschia aethiopica	-			nc	Arum lily

APPENDIX G

Desktop Searches

Australian Government

Department of 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.

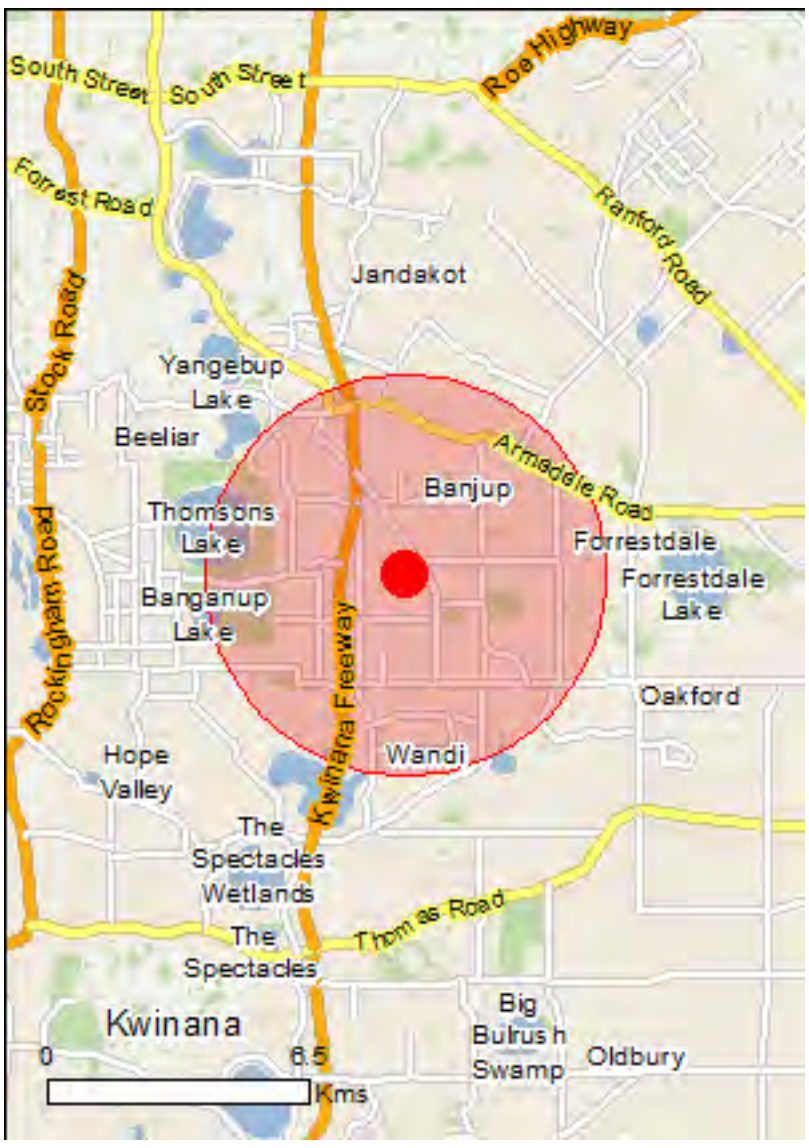
Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 14/12/15 12:44:39

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

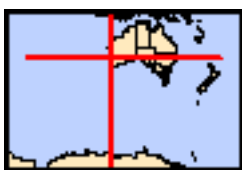
Caveat
Acknowledgements



This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2010

Coordinates

Buffer: 5.0Km



Summary

Matters of National Environmental 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:	2
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	19
Listed Migratory Species:	18

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 environment anywhere.

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 Land:	1
Commonwealth Heritage Places:	None
Listed Marine Species:	24
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Commonwealth Reserves Marine:	None

Extra Information

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

State and Territory Reserves:	6
Regional Forest Agreements:	None
Invasive Species:	44
Nationally Important Wetlands:	2
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar)	[Resource Information]
Name	Proximity
Forrestdale and thomsons lakes	Within Ramsar site
Peel-yalgorup system	30 - 40km upstream

Listed Threatened Species		[Resource Information]
Name	Status	Type of Presence
Birds		
Botaurus poiciloptilus		
Australasian Bittern [1001]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calyptorhynchus banksii naso		
Forest Red-tailed Black-Cockatoo, Karrak [67034]	Vulnerable	Species or species habitat may occur within area
Calyptorhynchus baudinii		
Baudin's Black-Cockatoo, Long-billed Black-Cockatoo [769]	Vulnerable	Species or species habitat likely to occur within area
Calyptorhynchus latirostris		
Carnaby's Black-Cockatoo, Short-billed Black-Cockatoo [59523]	Endangered	Species or species habitat likely to occur within area
Leipoa ocellata		
Malleefowl [934]	Vulnerable	Species or species habitat likely to occur within area
Rostratula australis		
Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area
Insects		
Neopasiphae simplicior		
A native bee [66821]	Critically Endangered	Species or species habitat may occur within area
Mammals		
Dasyurus geoffroii		
Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat known to occur within area
Pseudocheirus occidentalis		
Western Ringtail Possum, Ngwayir [25911]	Vulnerable	Species or species habitat likely to occur within area
Plants		
Andersonia gracilis		
Slender Andersonia [14470]	Endangered	Species or species habitat may occur within area

Name	Status	Type of Presence
Caladenia huegelii King Spider-orchid, Grand Spider-orchid, Rusty Spider-orchid [7309]	Endangered	Species or species habitat known to occur within area
Darwinia foetida Muchea Bell [83190]	Critically Endangered	Species or species habitat likely to occur within area
Diuris micrantha Dwarf Bee-orchid [55082]	Vulnerable	Species or species habitat known to occur within area
Diuris purdiei Purdie's Donkey-orchid [12950]	Endangered	Species or species habitat likely to occur within area
Drakaea elastica Glossy-leafed Hammer-orchid, Praying Virgin [16753]	Endangered	Species or species habitat likely to occur within area
Drakaea micrantha Dwarf Hammer-orchid [56755]	Vulnerable	Species or species habitat known to occur within area
Lepidosperma rostratum Beaked Lepidosperma [14152]	Endangered	Species or species habitat likely to occur within area
Thelymitra dedmaniarum Cinnamon Sun Orchid [65105]	Endangered	Species or species habitat may occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Migratory Wetlands Species		
Ardea alba Great Egret, White Egret [59541]		Breeding known to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]		Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species

Name	Threatened	Type of Presence
		habitat known to occur within area
[Calidris ruficollis](#) Red-necked Stint [860]		Species or species habitat known to occur within area
[Calidris subminuta](#) Long-toed Stint [861]		Species or species habitat known to occur within area
[Charadrius dubius](#) Little Ringed Plover [896]		Species or species habitat known to occur within area
[Limosa limosa](#) Black-tailed Godwit [845]		Species or species habitat known to occur within area
[Pandion haliaetus](#) Osprey [952]		Species or species habitat likely to occur within area
[Philomachus pugnax](#) Ruff (Reeve) [850]		Species or species habitat known to occur within area
[Tringa glareola](#) Wood Sandpiper [829]		Species or species habitat known to occur within area
[Tringa nebularia](#) Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
[Tringa stagnatilis](#) Marsh Sandpiper, Little Greenshank [833]		Species or species habitat known to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land [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.

Name
Commonwealth Land -

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
[Apus pacificus](#) Fork-tailed Swift [678]		Species or species habitat likely to occur within area
[Ardea alba](#) Great Egret, White Egret [59541]		Breeding known to occur within area
[Ardea ibis](#) Cattle Egret [59542]		Species or species habitat may occur within area
[Calidris acuminata](#) Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Calidris canutus Red Knot, Knot [855]		Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat known to occur within area
Calidris ruficollis Red-necked Stint [860]		Species or species habitat known to occur within area
Calidris subminuta Long-toed Stint [861]		Species or species habitat known to occur within area
Charadrius dubius Little Ringed Plover [896]		Species or species habitat known to occur within area
Charadrius ruficapillus Red-capped Plover [881]		Species or species habitat known to occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Himantopus himantopus Black-winged Stilt [870]		Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]		Species or species habitat known to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat likely to occur within area
Philomachus pugnax Ruff (Reeve) [850]		Species or species habitat known to occur within area
Recurvirostra novaehollandiae Red-necked Avocet [871]		Species or species habitat known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat may occur within area
Thinornis rubricollis Hooded Plover [59510]		Species or species habitat known to occur within area
Tringa glareola Wood Sandpiper [829]		Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Tringa nebularia		
Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
Tringa stagnatilis		
Marsh Sandpiper, Little Greenshank [833]		Species or species habitat known to occur within area

Extra Information

State and Territory Reserves [Resource Information]

Name	State
Gibbs Road	WA
Harry Waring Marsupial Reserve	WA
Thomsons Lake	WA
Unnamed WA48291	WA
Unnamed WA49561	WA
Wandi	WA

Invasive Species [Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Acridotheres tristis		
Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Anas platyrhynchos		
Mallard [974]		Species or species habitat likely to occur within area
Carduelis carduelis		
European Goldfinch [403]		Species or species habitat likely to occur within area
Columba livia		
Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Passer domesticus		
House Sparrow [405]		Species or species habitat likely to occur within area
Passer montanus		
Eurasian Tree Sparrow [406]		Species or species habitat likely to occur within area
Streptopelia chinensis		
Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Streptopelia senegalensis		
Laughing Turtle-dove, Laughing Dove [781]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Turdus merula Common Blackbird, Eurasian Blackbird [596]		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Funambulus pennantii Northern Palm Squirrel, Five-striped Palm Squirrel [129]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus norvegicus Brown Rat, Norway Rat [83]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Anredera cordifolia Madeira Vine, Jalap, Lamb's-tail, Mignonette Vine, Anredera, Gulf Madeiravine, Heartleaf Madeiravine, Potato Vine [2643]		Species or species habitat likely to occur within area
Asparagus aethiopicus Asparagus Fern, Ground Asparagus, Basket Fern, Sprengi's Fern, Bushy Asparagus, Emerald Asparagus [62425]		Species or species habitat likely to occur within area
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Asparagus plumosus Climbing Asparagus-fern [48993]		Species or species habitat likely to occur within area
Brachiaria mutica Para Grass [5879]		Species or species habitat may occur within area
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat may occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat may occur within

Name	Status	Type of Presence
		area
Chrysanthemoides monilifera subsp. monilifera Boneseed [16905]		Species or species habitat likely to occur within area
Genista linifolia Flax-leaved Broom, Mediterranean Broom, Flax Broom [2800]		Species or species habitat likely to occur within area
Genista monspessulana Montpellier Broom, Cape Broom, Canary Broom, Common Broom, French Broom, Soft Broom [20126]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Olea europaea Olive, Common Olive [9160]		Species or species habitat may occur within area
Opuntia spp. Prickly Pears [82753]		Species or species habitat likely to occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Protasparagus densiflorus Asparagus Fern, Plume Asparagus [5015]		Species or species habitat likely to occur within area
Protasparagus plumosus Climbing Asparagus-fern, Ferny Asparagus [11747]		Species or species habitat likely to occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Sagittaria platyphylla Delta Arrowhead, Arrowhead, Slender Arrowhead [68483]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
Solanum elaeagnifolium Silver Nightshade, Silver-leaved Nightshade, White Horse Nettle, Silver-leaf Nightshade, Tomato Weed, White Nightshade, Bull-nettle, Prairie-berry, Satansbos, Silver-leaf Bitter-apple, Silverleaf-nettle, Trompillo [12323]		Species or species habitat likely to occur within area
Tamarix aphylla Athel Pine, Athel Tree, Tamarisk, Athel Tamarisk, Athel Tamarix, Desert Tamarisk, Flowering Cypress, Salt Cedar [16018]		Species or species habitat likely to occur within area
Reptiles		

Name	Status	Type of Presence
Hemidactylus frenatus Asian House Gecko [1708]		Species or species habitat likely to occur within area

Nationally Important Wetlands [Resource Information]

Name	State
Gibbs Road Swamp System	WA
Thomsons Lake	WA

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

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.

For species where the distributions are well known, maps are digitised from sources such as recovery plans and detailed habitat studies. Where appropriate, core breeding, foraging and roosting areas are indicated under 'type of presence'. For species whose distributions are less well known, point locations are collated from government wildlife authorities, museums, and non-government organisations; bioclimatic distribution models are generated and these validated by experts. In some cases, the distribution maps are based solely on expert knowledge.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

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

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

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

Coordinates

-32.15964 115.87145

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
-Parks and Wildlife Commission NT, Northern Territory Government
-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, Atherton and Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-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.

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NatureMap
Mapping Western Australia's biodiversity

NatureMap Species Report

Created By Guest user on 13/12/2015

Current Names Only	Yes
Core Datasets Only	Yes
Method	'By Circle'
Centre	115°52' 19" E,32°09' 35" S
Buffer	5km
Group By	Conservation Status

Conservation Status	Species	Records
Non-conservation taxon	625	8384
Other specially protected fauna	1	6
Priority 1	1	3
Priority 3	7	139
Priority 4	7	35
Priority 5	3	83
Protected under international agreement	11	228
Rare or likely to become extinct	12	121
TOTAL	**667**	**8999**

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
Rare or likely to become extinct					
1.	1596	*Caladenia huegelii (Grand Spider Orchid)*		T	
2.	24784	*Calidris ferruginea (Curlew Sandpiper)*		T	
3.	24731	*Calyptorhynchus banksii subsp. naso (Forest Red-tailed Black-Cockatoo)*		T	
4.	24734	*Calyptorhynchus latirostris (Carnaby's Cockatoo (short-billed black-cockatoo), Carnaby's Cockatoo)*		T	
5.	24092	*Dasyurus geoffroii (Chuditch, Western Quoll)*		T	
6.	1637	*Diuris purdiei (Purdie's Donkey Orchid)*		T	
7.	1639	*Drakaea elastica (Glossy-leaved Hammer Orchid)*		T	
8.	13635	*Drakaea micrantha*		T	
9.	24146	*Myrmecobius fasciatus (Numbat, Walpurti)*		T	
Protected under international agreement					
10.	41324	*Ardea modesta (Eastern Great Egret)*		IA	
11.	24779	*Calidris acuminata (Sharp-tailed Sandpiper)*		IA	
12.	24786	*Calidris melanotos (Pectoral Sandpiper)*		IA	
13.	24788	*Calidris ruficollis (Red-necked Stint)*		IA	
14.	24789	*Calidris subminuta (Long-toed Stint)*		IA	
15.	24293	*Haliaeetus leucogaster (White-bellied Sea-Eagle)*		IA	
16.	25741	*Limosa limosa (Black-tailed Godwit)*		IA	
17.	24598	*Merops ornatus (Rainbow Bee-eater)*		IA	
18.	24843	*Plegadis falcinellus (Glossy Ibis)*		IA	
19.	24806	*Tringa glareola (Wood Sandpiper)*		IA	
20.	24808	*Tringa nebularia (Common Greenshank)*		IA	
Other specially protected fauna					
21.	25624	*Falco peregrinus (Peregrine Falcon)*		S	
Priority 1					
22.	33994	*Throscodectes xiphos (cricket)*		P1	
Priority 3					
23.	16245	*Cyathochaeta teretifolia*		P3	
24.	20462	*Jacksonia gracillima*		P3	
25.	25147	*Lerista lineata (Perth Slider, Lined Skink)*		P3	
26.	25249	*Neelaps calonotos (Black-striped Snake)*		P3	
27.	5237	*Pimelea calcicola*		P3	
28.	8163	*Pithocarpa corymbulosa (Corymbose Pithocarpa)*		P3	
29.	25800	*Stylidium paludicola*		P3	
Priority 4					
30.	4763	*Dodonaea hackettiana (Hackett's Hopbush)*		P4	
31.	24189	*Falsistrellus mackenziei (Western False Pipistrelle)*		P4	

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
32.	24328	*Oxyura australis (Blue-billed Duck)*		P4	
33.	24663	*Phaethon rubricauda (Red-tailed Tropicbird)*		P4	
34.	33992	*Synemon gratiosa (Graceful Sunmoth)*		P4	
35.	44444	*Tripterococcus sp. Brachylobus (A.S. George 14234)*		P4	
36.	14714	*Verticordia lindleyi subsp. lindleyi*		P4	
Priority 5					
37.	25478	*Isoodon obesulus (Southern Brown Bandicoot)*		P5	
38.	24153	*Isoodon obesulus subsp. fusciventer (Quenda, Southern Brown Bandicoot)*		P5	
39.	24131	*Macropus eugenii subsp. derbianus (Tammar Wallaby (WA subsp))*		P5	
Non-conservation taxon					
40.	11731	*Acacia browniana var. browniana*			
41.	3262	*Acacia cochlearis (Rigid Wattle)*			
42.	3282	*Acacia cyclops (Coastal Wattle)*			
43.	3374	*Acacia huegelii*			
44.	3502	*Acacia pulchella (Prickly Moses)*			
45.	15481	*Acacia pulchella var. glaberrima*			
46.	30032	*Acacia saligna subsp. saligna*			
47.	3557	*Acacia stenoptera (Narrow Winged Wattle)*			
48.	24260	*Acanthiza apicalis (Broad-tailed Thornbill, Inland Thornbill)*			
49.	24261	*Acanthiza chrysorrhoa (Yellow-rumped Thornbill)*			
50.	24262	*Acanthiza inornata (Western Thornbill)*			
51.		*Acantholophus hypoleucus*			
52.	24560	*Acanthorhynchus superciliosus (Western Spinebill)*			
53.	25535	*Accipiter cirrocephalus (Collared Sparrowhawk)*			
54.	25536	*Accipiter fasciatus (Brown Goshawk)*			
55.	42368	*Acritoscincus trilineatus (Western Three-lined Skink)*			
56.	25755	*Acrocephalus australis (Australian Reed Warbler)*			
57.	1775	*Adenanthos cygnorum (Common Woollybush)*			
58.	11837	*Adenanthos cygnorum subsp. cygnorum (Common Woollybush)*			
59.	1791	*Adenanthos obovatus (Basket Flower)*			
60.	17202	*Agonis flexuosa var. flexuosa*			
61.	184	*Aira caryophyllea (Silvery Hairgrass)*	Y		
62.	185	*Aira cupaniana (Silvery Hairgrass)*	Y		
63.	1728	*Allocasuarina fraseriana (Sheoak, Kondil)*			
64.	1732	*Allocasuarina humilis (Dwarf Sheoak)*			
65.	198	*Amphipogon laguroides*			
66.	200	*Amphipogon turbinatus*			
67.	13267	*Amyema linophylla subsp. linophylla*			
68.	24310	*Anas castanea (Chestnut Teal)*			
69.	24312	*Anas gracilis (Grey Teal)*			
70.	24313	*Anas platyrhynchos (Mallard)*			
71.	24315	*Anas rhynchotis (Australasian Shoveler)*			
72.	24316	*Anas superciliosa (Pacific Black Duck)*			
73.	7833	*Angianthus preissianus*			
74.	25553	*Anhinga melanogaster (Darter)*			
75.		*Anhinga novaehollandiae*			
76.	11434	*Anigozanthos humilis subsp. humilis*			
77.	1411	*Anigozanthos manglesii (Mangles Kangaroo Paw, Kurulbrang)*			
78.	11566	*Anigozanthos viridis subsp. viridis*			
79.	44629	*Anilios australis*			
80.		*Anser sp.*			
81.	24561	*Anthochaera carunculata (Red Wattlebird)*			
82.	24562	*Anthochaera lunulata (Western Little Wattlebird)*			
83.	3688	*Aotus gracillima*			
84.	3692	*Aotus procumbens*			
85.	24991	*Aprasia repens (Sand-plain Worm-lizard)*			
86.	24285	*Aquila audax (Wedge-tailed Eagle)*			
87.		*Archiargiolestes parvulus*			
88.		*Archiargiolestes pusillus*			
89.		*Arcuatula glaberrima*			
90.	38968	*Arcyria insignis*			
91.	24340	*Ardea novaehollandiae (White-faced Heron)*			
92.	24341	*Ardea pacifica (White-necked Heron)*			
93.	1264	*Arnocrinum preissii*			
94.	25566	*Artamus cinereus (Black-faced Woodswallow)*			
95.	24353	*Artamus cyanopterus (Dusky Woodswallow)*			
96.	8779	*Asparagus asparagoides (Bridal Creeper)*	Y		
97.	20283	*Astartea scoparia*			
98.	7851	*Asteridea pulverulenta (Common Bristle Daisy)*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
99.	6334	*Astroloma pallidum (Kick Bush)*			
100.	2471	*Atriplex prostrata (Hastate Orache)*	Y		
101.	17234	*Austrostipa compressa*			
102.	17240	*Austrostipa flavescens*			
103.	17245	*Austrostipa mollis*			
104.	17257	*Austrostipa variabilis*			
105.		*Aythya (Nyroca) australis*			
106.	24318	*Aythya australis (Hardhead)*			
107.	17737	*Azolla pinnata*			
108.	36441	*Babingtonia camphorosmae (Camphor Myrtle)*			
109.	1800	*Banksia attenuata (Slender Banksia, Piara)*			
110.	32580	*Banksia dallanneyi var. dallanneyi*			
111.	1822	*Banksia ilicifolia (Holly-leaved Banksia)*			
112.	1830	*Banksia littoralis (Swamp Banksia, Pungura)*			
113.	1834	*Banksia menziesii (Firewood Banksia)*			
114.	32077	*Banksia sessilis var. cygnorum*			
115.	1852	*Banksia telmatiaea (Swamp Fox Banksia)*			
116.		*Barnardius zonarius*			
117.	741	*Baumea articulata (Jointed Rush)*			
118.	743	*Baumea juncea (Bare Twigrush)*			
119.	744	*Baumea laxa*			
120.	5382	*Beaufortia elegans*			
121.	24319	*Biziura lobata (Musk Duck)*			
122.	1417	*Blancoa canescens (Winter Bell)*			
123.	749	*Bolboschoenus caldwellii (Marsh Club-rush)*			
124.	4413	*Boronia crenulata (Aniseed Boronia)*			
125.	16636	*Boronia crenulata subsp. viminea*			
126.	11503	*Boronia crenulata var. crenulata*			
127.	4417	*Boronia dichotoma*			
128.	11381	*Boronia ramosa subsp. anethifolia*			
129.	3710	*Bossiaea eriocarpa (Common Brown Pea)*			
130.	6341	*Brachyloma preissii (Globe Heath)*			
131.	30142	*Brachyloma preissii subsp. obtusifolium*			
132.	30136	*Brachyloma preissii subsp. preissii*			
133.	8661	*Brachypodium distachyon (False Brome)*	Y		
134.	42381	*Brachyurophis semifasciatus (Southern Shovel-nosed Snake)*			
135.	244	*Briza maxima (Blowfly Grass)*	Y		
136.	245	*Briza minor (Shivery Grass)*	Y		
137.	249	*Bromus diandrus (Great Brome)*	Y		
138.	12770	*Burchardia congesta*			
139.	25714	*Cacatua pastinator (Western Long-billed Corella)*			
140.	25716	*Cacatua sanguinea (Little Corella)*			
141.		*Cacatua sp.*			
142.	24729	*Cacatua tenuirostris (Eastern Long-billed Corella)*	Y		
143.	25598	*Cacomantis flabelliformis (Fan-tailed Cuckoo)*			
144.	42307	*Cacomantis pallidus (Pallid Cuckoo)*			
145.	1277	*Caesia occidentalis*			
146.	1586	*Caladenia discoidea (Dancing Orchid)*			
147.	1592	*Caladenia flava (Cowslip Orchid)*			
148.	15352	*Caladenia georgei*			
149.	1599	*Caladenia latifolia (Pink Fairy Orchid)*			
150.	15361	*Caladenia longicauda subsp. calcigena*			
151.	1605	*Caladenia marginata (White Fairy Orchid)*			
152.	2848	*Calandrinia corrigioloides (Strap Purslane)*			
153.	2856	*Calandrinia liniflora (Parakeelya)*			
154.	19309	*Calectasia narragara*			
155.	34942	*Callitriche brutia subsp. brutia*	Y		
156.	36600	*Callitris pyramidalis (Swamp Cypress)*			
157.	5411	*Calothamnus hirsutus*			
158.	5415	*Calothamnus lateralis*			
159.	25717	*Calyptorhynchus banksii (Red-tailed Black-Cockatoo)*			
160.		*Calyptorhynchus sp.*			
161.	5439	*Calytrix angulata (Yellow Starflower)*			
162.	5458	*Calytrix flavescens (Summer Starflower)*			
163.	5460	*Calytrix fraseri (Pink Summer Calytrix)*			
164.		*Calytrix sp.*			
165.	2794	*Carpobrotus aequilaterus (Angular Pigface)*	Y		
166.	2795	*Carpobrotus edulis (Hottentot Fig)*	Y		
167.	1162	*Cartonema philydroides*			
168.	2951	*Cassytha flava (Dodder Laurel)*			

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169.	2957	*Cassytha racemosa (Dodder Laurel)*			
170.		*Castiarina anchoralis*			
171.	1742	*Casuarina obesa (Swamp Sheoak, Kuli)*			
172.	41568	*Cenchrus setaceus (Fountain Grass)*	Y		
173.	6542	*Centaurium tenuiflorum*	Y		
174.	6214	*Centella asiatica*			
175.	1125	*Centrolepis drummondiana*			
176.	1134	*Centrolepis polygyna (Wiry Centrolepis)*			
177.	2889	*Cerastium glomeratum (Mouse Ear Chickweed)*	Y		
178.	24186	*Chalinolobus gouldii (Gould's Wattled Bat)*			
179.	18156	*Chamaecytisus palmensis (Tagasaste)*	Y		
180.	1280	*Chamaescilla corymbosa (Blue Squill)*			
181.	24373	*Charadrius melanops (Black-fronted Dotterel)*			
182.	24377	*Charadrius ruficapillus (Red-capped Plover)*			
183.	43380	*Chelodina colliei (Oblong Turtle)*			
184.	24321	*Chenonetta jubata (Australian Wood Duck, Wood Duck)*			
185.	2490	*Chenopodium glaucum (Glaucous Goosefoot)*	Y		
186.	24980	*Christinus marmoratus (Marbled Gecko)*			
187.		*Chroicocephalus novaehollandiae*			
188.	24288	*Circus approximans (Swamp Harrier)*			
189.	7937	*Cirsium vulgare (Spear Thistle)*	Y		
190.	24774	*Cladorhynchus leucocephalus (Banded Stilt)*			
191.	38983	*Clastoderma debaryanum*			
192.	25675	*Colluricincla harmonica (Grey Shrike-thrush)*			
193.	24399	*Columba livia (Domestic Pigeon)*	Y		
194.	38990	*Comatricha nigra*			
195.	4550	*Comesperma calymega (Blue-spike Milkwort)*			
196.	1858	*Conospermum amoenum (Blue Smokebush)*			
197.	15611	*Conospermum stoechadis subsp. stoechadis (Common Smokebush)*			
198.	6348	*Conostephium pendulum (Pearl Flower)*			
199.	6349	*Conostephium preissii*			
200.	1418	*Conostylis aculeata (Prickly Conostylis)*			
201.	11826	*Conostylis aculeata subsp. aculeata*			
202.	1436	*Conostylis juncea*			
203.	1454	*Conostylis setigera (Bristly Cottonhead)*			
204.	11597	*Conostylis setigera subsp. setigera*			
205.	20074	*Conyza sumatrensis*	Y		
206.	25568	*Coracina novaehollandiae (Black-faced Cuckoo-shrike)*			
207.	277	*Cortaderia selloana (Pampas Grass)*	Y		
208.	25592	*Corvus coronoides (Australian Raven)*			
209.	1285	*Corynotheca micrantha (Sand Lily)*			
210.	7945	*Cotula coronopifolia (Waterbuttons)*	Y		
211.	24671	*Coturnix pectoralis (Stubble Quail)*			
212.	25701	*Coturnix ypsilophora (Brown Quail)*			
213.	24420	*Cracticus nigrogularis (Pied Butcherbird)*			
214.	25595	*Cracticus tibicen (Australian Magpie)*			
215.	25596	*Cracticus torquatus (Grey Butcherbird)*			
216.	3137	*Crassula colorata (Dense Stonecrop)*			
217.	3139	*Crassula exserta*			
218.	3140	*Crassula glomerata*	Y		
219.	25399	*Crinia glauerti (Clicking Frog)*			
220.	25400	*Crinia insignifera (Squelching Froglet)*			
221.	30893	*Cryptoblepharus buchananii*			
222.	30899	*Ctenophorus adelaidensis (Southern Heath Dragon, Western Heath Dragon)*			
223.	25027	*Ctenotus australis*			
224.	25040	*Ctenotus gemmula (Jewelled South-west Ctenotus (Swan Coastal Plain pop P3), skink)*			
225.		*Cubicorhynchus crenicollis*			
226.	40660	*Cycnogeton huegelii*			
227.	24322	*Cygnus atratus (Black Swan)*			
228.	19625	*Cymbalaria muralis subsp. muralis*	Y		
229.	816	*Cyperus tenuiflorus (Scaly Sedge)*	Y		
230.	30901	*Dacelo novaeguineae (Laughing Kookaburra)*	Y		
231.	7454	*Dampiera linearis (Common Dampiera)*			
232.	7462	*Dampiera pedunculata*			
233.	25673	*Daphoenositta chrysoptera (Varied Sittella)*			
234.	5508	*Darwinia citriodora (Lemon-scented Darwinia)*			
235.	35618	*Darwinia sp. Karonie (K. Newbey 8503)*			
236.	1218	*Dasypogon bromeliifolius (Pineapple Bush)*			
237.	3832	*Daviesia physodes*			

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238.	3845	*Daviesia triflora*			
239.	25766	*Delma fraseri (Fraser's Legless Lizard)*			
240.	24999	*Delma grayii*			
241.	25296	*Demansia psammophis subsp. reticulata (Yellow-faced Whipsnake)*			
242.		*Descolea maculata*			
243.	16595	*Desmocladus flexuosus*			
244.	299	*Deyeuxia quadriseta (Reed Bentgrass)*			
245.	1259	*Dianella revoluta (Blueberry Lily)*			
246.	25607	*Dicaeum hirundinaceum (Mistletoebird)*			
247.	1287	*Dichopogon capillipes*			
248.	17838	*Dielsia stenostachya*			
249.	1634	*Diuris laxiflora (Bee Orchid)*			
250.	1636	*Diuris pauciflora*			
251.	1640	*Drakaea glyptodon (King-in-his-carriage)*			
252.	3095	*Drosera erythrorhiza (Red Ink Sundew)*			
253.	3098	*Drosera glanduligera (Pimpernel Sundew)*			
254.	3106	*Drosera macrantha (Bridal Rainbow)*			
255.	14298	*Drosera macrantha subsp. macrantha*			
256.	3109	*Drosera menziesii (Pink Rainbow)*			
257.	13216	*Drosera menziesii subsp. penicillaris*			
258.	3117	*Drosera paleacea (Dwarf Sundew)*			
259.	13188	*Drosera paleacea subsp. paleacea*			
260.	3135	*Drosera zonaria (Painted Sundew)*			
261.	11105	*Echinochloa crus-galli*	Y		
262.		*Ecnomus pansus*			
263.	25100	*Egernia napoleonis*			
264.		*Egretta garzetta*			
265.		*Egretta novaehollandiae*			
266.	347	*Ehrharta calycina (Perennial Veldt Grass)*	Y		
267.	349	*Ehrharta longiflora (Annual Veldt Grass)*	Y		
268.		*Elanus axillaris*			
269.	25250	*Elapognathus coronatus (Crowned Snake)*			
270.		*Elseyornis melanops*			
271.		*Eolophus roseicapillus*			
272.	1645	*Epiblema grandiflorum (Babe-in-a-cradle)*			
273.	6133	*Epilobium hirtigerum (Hairy Willow Herb)*			
274.	24567	*Epthianura albifrons (White-fronted Chat)*			
275.	13950	*Eremaea asterocarpa subsp. asterocarpa*			
276.	5541	*Eremaea pauciflora*			
277.	14104	*Eremaea pauciflora var. pauciflora*			
278.		*Eremaea sp.*			
279.	1647	*Eriochilus scaber (Pink Bunny Orchid)*			
280.	15446	*Eryngium pinnatifidum subsp. pinnatifidum*			
281.	24379	*Erythrogonys cinctus (Red-kneed Dotterel)*			
282.	5615	*Eucalyptus decipiens (Limestone Marlock, Moit)*			
283.	5708	*Eucalyptus marginata (Jarrah, Djara)*			
284.	13547	*Eucalyptus marginata subsp. marginata (Jarrah)*			
285.	5763	*Eucalyptus rudis (Flooded Gum, Kulurda)*			
286.	13511	*Eucalyptus rudis subsp. rudis*			
287.	5790	*Eucalyptus todtiana (Coastal Blackbutt)*			
288.	3872	*Euchilopsis linearis (Swamp Pea)*			
289.	20014	*Euphorbia hyssopifolia*	Y		
290.	4648	*Euphorbia terracina (Geraldton Carnation Weed)*	Y		
291.	3880	*Eutaxia virgata*			
292.	25621	*Falco berigora (Brown Falcon)*			
293.	25622	*Falco cenchroides (Australian Kestrel)*			
294.	25623	*Falco longipennis (Australian Hobby)*			
295.	24041	*Felis catus (Cat)*	Y		
296.	1747	*Ficus carica (Common Fig)*	Y		
297.	25727	*Fulica atra (Eurasian Coot)*			
298.	24761	*Fulica atra subsp. australis (Eurasian Coot)*			
299.	2969	*Fumaria capreolata (Whiteflower Fumitory)*	Y		
300.	25729	*Gallinula tenebrosa (Dusky Moorhen)*			
301.	24763	*Gallinula tenebrosa subsp. tenebrosa (Dusky Moorhen)*			
302.	24764	*Gallinula ventralis (Black-tailed Native-hen)*			
303.	25730	*Gallirallus philippensis (Buff-banded Rail)*			
304.	20475	*Gastrolobium capitatum*			
305.	20483	*Gastrolobium linearifolium*			
306.	3921	*Gastrolobium reticulatum*			
307.	24959	*Gehyra variegata*			

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308.		*Gelochelidon nilotica*			
309.	25530	*Gerygone fusca (Western Gerygone)*			
310.	1520	*Gladiolus caryophyllaceus (Wild Gladiolus)*	Y		
311.	24735	*Glossopsitta porphyrocephala (Purple-crowned Lorikeet)*			
312.	12624	*Gnephosis angianthoides*			
313.	6587	*Gomphocarpus fruticosus (Narrowleaf Cottonbush)*	Y		
314.	3957	*Gompholobium tomentosum (Hairy Yellow Pea)*			
315.	6161	*Gonocarpus pithyoides*			
316.	24443	*Grallina cyanoleuca (Magpie-lark)*			
317.	14282	*Gratiola pubescens*			
318.	2032	*Grevillea leucopteris (White Plume Grevillea)*			
319.	1475	*Haemodorum spicatum (Mardja)*			
320.	2197	*Hakea prostrata (Harsh Hakea)*			
321.	2216	*Hakea varia (Variable-leaved Hakea)*			
322.	24295	*Haliastur sphenurus (Whistling Kite)*			
323.	3961	*Hardenbergia comptoniana (Native Wisteria)*			
324.	25410	*Heleioporus eyrei (Moaning Frog)*			
325.		*Heleioporus sp.*			
326.	29594	*Helichrysum luteoalbum (Jersey Cudweed)*			
327.	6710	*Heliotropium europaeum (Common Heliotrope)*	Y		
328.	6839	*Hemiandra pungens (Snakebush)*			
329.		*Hemiandra sp.*			
330.	38320	*Hemiandra sp. Jurien (B.J. Conn & M.E. Tozer BJC 3885)*			
331.		*Hemiandra sp. Jurien (B.J.Conn 3885 & M.E.Tozer)*			
332.	25119	*Hemiergis quadrilineata*			
333.	1293	*Hensmania turbinata*			
334.	27778	*Heterodermia speciosa*			
335.		*Heurodes turritus*			
336.	5134	*Hibbertia huegelii*			
337.	5135	*Hibbertia hypericoides (Yellow Buttercups)*			
338.	5162	*Hibbertia racemosa (Stalked Guinea Flower)*			
339.	43280	*Hibbertia sericosepala*			
340.	5173	*Hibbertia subvaginata*			
341.	5176	*Hibbertia vaginata*			
342.	25734	*Himantopus himantopus (Black-winged Stilt)*			
343.	24491	*Hirundo neoxena (Welcome Swallow)*			
344.	444	*Holcus lanatus (Yorkshire Fog)*	Y		
345.	6222	*Homalosciadium homalocarpum*			
346.	12859	*Hovea trisperma var. trisperma*			
347.	12741	*Hyalosperma cotula*			
348.	5216	*Hybanthus calycinus (Wild Violet)*			
349.	5817	*Hypocalymma angustifolium (White Myrtle, Kudjid)*			
350.	35070	*Hypocalymma angustifolium subsp. Swan Coastal Plain (G.J. Keighery 16777)*			
351.	5825	*Hypocalymma robustum (Swan River Myrtle)*			
352.	8086	*Hypochaeris glabra (Smooth Catsear)*	Y		
353.	9352	*Hypochaeris radicata (Flat Weed)*	Y		
354.	1070	*Hypolaena exsulca*			
355.	17841	*Hypolaena pubescens*			
356.		*Idiommata blackwalli*			
357.		*Iridomyrmex conifer*			
358.	20200	*Isolepis cernua var. setiformis*			
359.	917	*Isolepis marginata (Coarse Club-rush)*			
360.	921	*Isolepis producta*			
361.		*Ixobrychus dubius*			
362.	4012	*Jacksonia furcellata (Grey Stinkwood)*			
363.	4029	*Jacksonia sternbergiana (Stinkwood, Kapur)*			
364.	1178	*Juncus bufonius (Toad Rush)*	Y		
365.	1186	*Juncus microcephalus*	Y		
366.	1188	*Juncus pallidus (Pale Rush)*			
367.	1190	*Juncus planifolius (Broadleaf Rush)*			
368.	4044	*Kennedia prostrata (Scarlet Runner)*			
369.	5832	*Kunzea ericifolia (Spearwood, Pondil)*			
370.	15498	*Kunzea glabrescens (Spearwood)*			
371.	20019	*Lachnagrostis filiformis*			
372.	6777	*Lachnostachys albicans*			
373.	18585	*Lagenophora huegelii*			
374.		*Latrodectus hasseltii*			
375.	1307	*Laxmannia ramosa (Branching Lily)*			
376.	11911	*Laxmannia ramosa subsp. ramosa*			
377.	11464	*Laxmannia sessiliflora subsp. australis*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
378.	1309	*Laxmannia squarrosa*			
379.	7572	*Lechenaultia expansa*			
380.	7574	*Lechenaultia floribunda (Free-flowering Leschenaultia)*			
381.		*Lechenaultia sp.*			
382.	8099	*Leontodon saxatilis (Hairy Hawkbit)*	Y		
383.	925	*Lepidosperma angustatum*			
384.	937	*Lepidosperma longitudinale (Pithy Sword-sedge)*			
385.	940	*Lepidosperma pubisquameum*			
386.	41649	*Lepidosperma rigidulum*			
387.		*Lepidosperma sp.*			
388.	945	*Lepidosperma squamatum*			
389.	19833	*Leptocarpus laxus*			
390.	2342	*Leptomeria cunninghamii*			
391.	2344	*Leptomeria empetriformis*			
392.	2350	*Leptomeria pauciflora (Sparse-flowered Currant Bush)*			
393.	5850	*Leptospermum laevigatum (Coast Teatree)*	Y		
394.	25131	*Lerista distinguenda*			
395.	25133	*Lerista elegans*			
396.	6360	*Leucopogon australis (Spiked Beard-heath)*			
397.	6374	*Leucopogon conostephioides*			
398.	6425	*Leucopogon oxycedrus*			
399.	6434	*Leucopogon polymorphus*			
400.	6436	*Leucopogon propinquus*			
401.	7676	*Levenhookia pusilla (Midget Stylewort)*			
402.	7677	*Levenhookia stipitata (Common Stylewort)*			
403.	25005	*Lialis burtonis*			
404.	31280	*Lichenomphalia chromacea*			
405.	25661	*Lichmera indistincta (Brown Honeyeater)*			
406.	25415	*Limnodynastes dorsalis (Western Banjo Frog)*			
407.	25378	*Litoria adelaidensis (Slender Tree Frog)*			
408.	25388	*Litoria moorei (Motorbike Frog)*			
409.	9289	*Lobelia anceps (Angled Lobelia)*			
410.	7408	*Lobelia tenuior (Slender Lobelia)*			
411.	6515	*Logania vaginalis (White Spray)*			
412.	478	*Lolium rigidum (Wimmera Ryegrass)*	Y		
413.	1223	*Lomandra caespitosa (Tufted Mat Rush)*			
414.	1228	*Lomandra hermaphrodita*			
415.	1234	*Lomandra nigricans*			
416.	1239	*Lomandra preissii*			
417.	1243	*Lomandra sericea (Silky Mat Rush)*			
418.	1246	*Lomandra suaveolens*			
419.	25683	*Lonchura castaneothorax (Chestnut-breasted Mannikin)*			
420.		*Lophoictinia isura*			
421.	8564	*Lotus subbiflorus*	Y		
422.	4065	*Lupinus angustifolius (Narrowleaf Lupin)*	Y		
423.	1097	*Lyginia barbata*			
424.	18049	*Lyginia imberbis*			
425.	6456	*Lysinema ciliatum (Curry Flower)*			
426.	6458	*Lysinema elegans*			
427.	34736	*Lysinema pentapetalum*			
428.	5281	*Lythrum hyssopifolia (Lesser Loosestrife)*	Y		
429.	2839	*Macarthuria australis*			
430.	85	*Macrozamia riedlei (Zamia, Djiridji)*			
431.	24326	*Malacorhynchus membranaceus (Pink-eared Duck)*			
432.	25651	*Malurus lamberti (Variegated Fairy-wren)*			
433.	25654	*Malurus splendens (Splendid Fairy-wren)*			
434.	4079	*Medicago polymorpha (Burr Medic)*	Y		
435.	17683	*Meeboldina cana*			
436.		*Meeboldina roycei MS*			
437.	25758	*Megalurus gramineus (Little Grassbird)*			
438.	34676	*Meionectes brownii (Swamp Raspwort)*			
439.	5900	*Melaleuca cuticularis (Saltwater Paperbark)*			
440.	5917	*Melaleuca hamulosa*			
441.	13271	*Melaleuca huegelii subsp. huegelii*			
442.	13273	*Melaleuca incana subsp. incana*			
443.	5926	*Melaleuca lateritia (Robin Redbreast Bush)*			
444.	5946	*Melaleuca pauciflora*			
445.	5952	*Melaleuca preissiana (Moonah)*			
446.	5959	*Melaleuca rhaphiophylla (Swamp Paperbark)*			
447.	18598	*Melaleuca systena*			

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448.	5978	*Melaleuca teretifolia (Banbar)*			
449.	5980	*Melaleuca thymoides*			
450.	5987	*Melaleuca viminea (Mohan)*			
451.	4085	*Melilotus indicus*	Y		
452.	25663	*Melithreptus brevirostris (Brown-headed Honeyeater)*			
453.	25184	*Menetia greyii*			
454.	955	*Mesomelaena pseudostygia*			
455.	957	*Mesomelaena tetragona (Semaphore Sedge)*			
456.		*Metaballus litus*			
457.		*Microcarbo melanoleucos*			
458.	485	*Microlaena stipoides (Weeping Grass)*			
459.	15419	*Microtis media subsp. media*			
460.		*Microtis sp.*			
461.	25191	*Morethia lineoocellata*			
462.	25192	*Morethia obscura*			
463.	24223	*Mus musculus (House Mouse)*	Y		
464.	25420	*Myobatrachus gouldii (Turtle Frog)*			
465.	6189	*Myriophyllum crispatum*			
466.	6199	*Myriophyllum tillaeoides*			
467.		*Nassarius sp.*			
468.	25248	*Neelaps bimaculatus (Black-naped Snake)*			
469.	24738	*Neophema elegans (Elegant Parrot)*			
470.	6974	*Nicotiana glauca (Tree Tobacco)*	Y		
471.		*Nidula emodensis*			
472.	25748	*Ninox novaeseelandiae (Boobook Owl)*			
473.	25252	*Notechis scutatus (Tiger Snake)*			
474.	25564	*Nycticorax caledonicus (Rufous Night Heron)*			
475.	24194	*Nyctophilus geoffroyi (Lesser Long-eared Bat)*			
476.	24407	*Ocyphaps lophotes (Crested Pigeon)*			
477.		*Oecetis pechana*			
478.	14293	*Oenothera indecora subsp. bonariensis*	Y		
479.	16347	*Oenothera laciniata*	Y		
480.	6140	*Oenothera mollissima*	Y		
481.	36177	*Ornduffia albiflora*			
482.	4113	*Ornithopus compressus (Yellow Serradella)*	Y		
483.	24085	*Oryctolagus cuniculus (Rabbit)*	Y		
484.	25679	*Pachycephala pectoralis (Golden Whistler)*			
485.	25680	*Pachycephala rufiventris (Rufous Whistler)*			
486.		*Paramphisopus sp.*			
487.	25253	*Parasuta gouldii*			
488.	25681	*Pardalotus punctatus (Spotted Pardalote)*			
489.	25682	*Pardalotus striatus (Striated Pardalote)*			
490.	7090	*Parentucellia viscosa (Sticky Bartsia)*	Y		
491.	527	*Paspalum dilatatum*	Y		
492.	1550	*Patersonia occidentalis (Purple Flag, Koma)*			
493.	30471	*Patersonia occidentalis var. angustifolia*			
494.	30472	*Patersonia occidentalis var. occidentalis*			
495.	4343	*Pelargonium capitatum (Rose Pelargonium)*	Y		
496.	24648	*Pelecanus conspicillatus (Australian Pelican)*			
497.	6006	*Pericalymma ellipticum (Swamp Teatree)*			
498.	16477	*Pericalymma ellipticum var. ellipticum*			
499.	2273	*Persoonia saccata (Snottygobble)*			
500.	24659	*Petroica goodenovii (Red-capped Robin)*			
501.	2299	*Petrophile linearis (Pixie Mops)*			
502.	2301	*Petrophile macrostachya*			
503.	2312	*Petrophile striata*			
504.	19825	*Petrorhagia dubia*	Y		
505.	25697	*Phalacrocorax carbo (Great Cormorant)*			
506.	25698	*Phalacrocorax melanoleucos (Little Pied Cormorant)*			
507.	24667	*Phalacrocorax sulcirostris (Little Black Cormorant)*			
508.	25699	*Phalacrocorax varius (Pied Cormorant)*			
509.	24409	*Phaps chalcoptera (Common Bronzewing)*			
510.	20460	*Pheladenia deformis*			
511.	1478	*Phlebocarya ciliata*			
512.	1479	*Phlebocarya filifolia*			
513.	24596	*Phylidonyris novaehollandiae (New Holland Honeyeater)*			
514.	16177	*Phyllangium paradoxum*			
515.	4675	*Phyllanthus calycinus (False Boronia)*			
516.	4141	*Phyllota gracilis*			
517.	2793	*Phytolacca octandra (Red Ink Plant)*	Y		

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518.		*Phytophthora cinnamomi*			
519.	18117	*Pimelea rosea subsp. rosea*			
520.		*Piona murleyi*			
521.	24841	*Platalea flavipes (Yellow-billed Spoonbill)*			
522.	25720	*Platycercus icterotis (Western Rosella)*			
523.	6249	*Platysace compressa (Tapeworm Plant)*			
524.	6253	*Platysace filiformis*			
525.	4524	*Platytheca galioides*			
526.	25509	*Pletholax gracilis (Keeled Legless Lizard)*			
527.	25007	*Pletholax gracilis subsp. gracilis (Keeled Legless Lizard)*			
528.	25703	*Podargus strigoides (Tawny Frogmouth)*			
529.	25704	*Podiceps cristatus (Great Crested Grebe)*			
530.	8175	*Podolepis gracilis (Slender Podolepis)*			
531.	8182	*Podotheca angustifolia (Sticky Longheads)*			
532.	8183	*Podotheca chrysantha (Yellow Podotheca)*			
533.	8184	*Podotheca gnaphalioides (Golden Long-heads)*			
534.	25510	*Pogona minor (Dwarf Bearded Dragon)*			
535.	24907	*Pogona minor subsp. minor (Dwarf Bearded Dragon)*			
536.	24681	*Poliocephalus poliocephalus (Hoary-headed Grebe)*			
537.	582	*Polypogon monspeliensis (Annual Beardgrass)*	Y		
538.	25722	*Polytelis anthopeplus (Regent Parrot)*			
539.	4691	*Poranthera microphylla (Small Poranthera)*			
540.	25731	*Porphyrio porphyrio (Purple Swamphen)*			
541.	24767	*Porphyrio porphyrio subsp. bellus (Purple Swamphen)*			
542.	24769	*Porzana fluminea (Australian Spotted Crake)*			
543.	25732	*Porzana pusilla (Baillon's Crake)*			
544.	24771	*Porzana tabuensis (Spotless Crake)*			
545.	1670	*Prasophyllum drummondii (Swamp Leek Orchid)*			
546.	1672	*Prasophyllum fimbria (Fringed Leek Orchid)*			
547.	1673	*Prasophyllum gibbosum (Humped Leek Orchid)*			
548.	1680	*Prasophyllum parvifolium (Autumn Leek Orchid)*			
549.	10853	*Prasophyllum plumiforme*			
550.	25511	*Pseudonaja affinis (Dugite)*			
551.	25259	*Pseudonaja affinis subsp. affinis (Dugite)*			
552.	25433	*Pseudophryne guentheri (Crawling Toadlet)*			
553.		*Pterostylis sp.*			
554.	4177	*Pultenaea ochreata*			
555.	4181	*Pultenaea reticulata*			
556.		*Purpureicephalus spurius*			
557.		*Pycnoporus coccineus*			
558.	25008	*Pygopus lepidopodus (Common Scaly Foot)*			
559.	8195	*Quinetia urvillei*			
560.	24243	*Rattus fuscipes (Western Bush Rat)*			
561.	24245	*Rattus rattus (Black Rat)*	Y		
562.	24776	*Recurvirostra novaehollandiae (Red-necked Avocet)*			
563.	6012	*Regelia ciliata*			
564.	3083	*Reseda alba (White Mingnonette)*	Y		
565.	4822	*Rhamnus alaternus (Buckthorn)*	Y		
566.	25614	*Rhipidura leucophrys (Willie Wagtail)*			
567.	13300	*Rhodanthe citrina*			
568.		*Rimelia sp.*			
569.	14485	*Romulea flava var. minor*	Y		
570.	1556	*Romulea rosea (Guildford Grass)*	Y		
571.	14924	*Romulea rosea var. communis*	Y		
572.	40426	*Rytidosperma occidentale*			
573.	11647	*Samolus repens var. repens*			
574.	978	*Schoenus brevisetis*			
575.	982	*Schoenus clandestinus*			
576.	984	*Schoenus curvifolius*			
577.	986	*Schoenus efoliatus*			
578.	992	*Schoenus grandiflorus (Large Flowered Bogrush)*			
579.	1011	*Schoenus rigens*			
580.	1017	*Schoenus subbulbosus*			
581.	6033	*Scholtzia involucrata (Spiked Scholtzia)*			
582.		*Sclerorrhinella crawshawi*			
583.	6	*Selaginella gracillima (Tiny Clubmoss)*			
584.	25534	*Sericornis frontalis (White-browed Scrubwren)*			
585.	8225	*Siloxerus humifusus (Procumbent Siloxerus)*			
586.	25266	*Simoselaps bertholdi (Jan's Banded Snake)*			
587.	30948	*Smicrornis brevirostris (Weebill)*			

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588.	7020	*Solanum linnaeanum (Apple of Sodom)*	Y		
589.	8231	*Sonchus oleraceus (Common Sowthistle)*	Y		
590.	1312	*Sowerbaea laxiflora (Purple Tassels)*			
591.	4211	*Sphaerolobium vimineum (Leafless Globe Pea)*			
592.		*Stackhousia sp.*			
593.	2918	*Stellaria media (Chickweed)*	Y		
594.	24329	*Stictonetta naevosa (Freckled Duck)*			
595.	2316	*Stirlingia latifolia (Blueboy)*			
596.	25597	*Strepera versicolor (Grey Currawong)*			
597.	25589	*Streptopelia chinensis (Spotted Turtle-Dove)*	Y		
598.	25590	*Streptopelia senegalensis (Laughing Turtle-Dove)*	Y		
599.	25831	*Stylidium araeophyllum (Stilt Walker)*			
600.	7693	*Stylidium brunonianum (Pink Fountain Triggerplant)*			
601.	7696	*Stylidium calcaratum (Book Triggerplant)*			
602.	7745	*Stylidium junceum (Reed Triggerplant)*			
603.	25829	*Stylidium neurophyllum (Coastal Plain Triggerplant)*			
604.	7774	*Stylidium piliferum (Common Butterfly Triggerplant)*			
605.	7785	*Stylidium repens (Matted Triggerplant)*			
606.	25806	*Stylidium scariosum*			
607.	7798	*Stylidium schoenoides (Cow Kicks)*			
608.	23511	*Stylidium thesioides (Delicate Triggerplant)*			
609.	1260	*Stypandra glauca (Blind Grass)*			
610.	15532	*Synaphea spinulosa subsp. spinulosa*			
611.	25705	*Tachybaptus novaehollandiae (Australasian Grebe, Black-throated Grebe)*			
612.	24682	*Tachybaptus novaehollandiae subsp. novaehollandiae (Australasian Grebe, Black-throated Grebe)*			
613.	24331	*Tadorna tadornoides (Australian Shelduck, Mountain Duck)*			
614.		*Talaurinus carbonarius*			
615.		*Talaurinus sp.*			
616.	24167	*Tarsipes rostratus (Honey Possum, Noolbenger)*			
617.		*Tellina sp.*			
618.		*Thalotia conica*			
619.	1716	*Thelymitra tigrina (Tiger Orchid)*			
620.		*Thinornis rubricollis*			
621.	24844	*Threskiornis molucca (Australian White Ibis)*			
622.	24845	*Threskiornis spinicollis (Straw-necked Ibis)*			
623.	1318	*Thysanotus arbuscula*			
624.	1338	*Thysanotus manglesianus (Fringed Lily)*			
625.	1339	*Thysanotus multiflorus (Many-flowered Fringe Lily)*			
626.	1343	*Thysanotus patersonii*			
627.	1351	*Thysanotus sparteus*			
628.	1357	*Thysanotus thyrsoideus*			
629.	1358	*Thysanotus triandrus*			
630.	25519	*Tiliqua rugosa*			
631.	25204	*Tiliqua rugosa subsp. aspera*			
632.	25207	*Tiliqua rugosa subsp. rugosa*			
633.	25549	*Todiramphus sanctus (Sacred Kingfisher)*			
634.	6280	*Trachymene pilosa (Native Parsnip)*			
635.		*Tribonyx ventralis*			
636.	4383	*Tribulus terrestris (Caltrop)*	Y		
637.	25723	*Trichoglossus haematodus (Rainbow Lorikeet)*			
638.	25521	*Trichosurus vulpecula (Common Brushtail Possum)*			
639.	1361	*Tricoryne elatior (Yellow Autumn Lily)*			
640.	1363	*Tricoryne tenella*			
641.	1038	*Tricostularia neesii*			
642.	17145	*Trifolium angustifolium var. angustifolium*	Y		
643.	14738	*Trifolium resupinatum var. resupinatum*	Y		
644.	150	*Triglochin stowardii*			
645.	4360	*Tropaeolum majus (Garden Nasturtium)*	Y		
646.	98	*Typha domingensis (Bulrush, Djandjid)*			
647.		*Urodacus novaehollandiae*			
648.	8255	*Ursinia anthemoides (Ursinia)*	Y		
649.	38388	*Ursinia anthemoides subsp. anthemoides*	Y		
650.	24386	*Vanellus tricolor (Banded Lapwing)*			
651.		*Venator immansueta*			
652.	15432	*Verticordia densiflora var. densiflora*			
653.	4320	*Vicia hirsuta (Hairy Vetch)*	Y		
654.	11474	*Vicia sativa subsp. nigra*	Y		
655.	4325	*Viminaria juncea (Swishbush, Koweda)*			
656.	722	*Vulpia bromoides (Squirrel Tail Fescue)*	Y		

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657.	7384	*Wahlenbergia capensis (Cape Bluebell)*	Y		
658.	7389	*Wahlenbergia preissii*			
659.	8282	*Waitzia suaveolens (Fragrant Waitzia)*			
660.	1256	*Xanthorrhoea preissii (Grass tree, Palga)*			
661.	6289	*Xanthosia huegelii*			
662.	1049	*Zantedeschia aethiopica (Arum Lily)*	Y		
663.		*Zoila friendii*			
664.	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.

FID_	Sheet	NameID	Taxon	Cons_Code	Plant_Desc	Site_Descr	Vegetation	Frequency	Other_Note	Locality	Latitude	Longitude	Geocode_T	Accuracy	Date
	4421213	1596	Caladenia huegelii	T	Up to 60 cm high.	Coastal plain. Grey sand.	Closed Banksia woodland. Banksia sp., Stirlingia latifolia, Hibbertia spp., Hypocalymma robustum, Conostephium pendulum		Abundance: 23 plants flowering. Plants found only in 'depression' ca 50 m x 75 m.	300 m E (right) on sand track, 300 m N up Fraser Road from Forrest Road, Banjup	-32.1254	115.8793	GPS	1	20/09/1996
	4421205	1596	Caladenia huegelii	T	Up to 60 cm high.	Coastal plain. Grey sand.	Closed Banksia woodland. Banksia sp., Stirlingia latifolia, Hibbertia spp., Hypocalymma robustum, Conostephium pendulum		Abundance: 23 plants flowering. Plants found only in 'depression' ca 50 m x 75 m.	300 m E (right) on sand track, 300 m N up Fraser Road from Forrest Road, Banjup	-32.1254	115.8793	GPS	1	20/09/1996
	6752624	1596	Caladenia huegelii	T	Ca 30 cm tall. Linear hairy leaf 15 cm x 1 cm.	Grey sand.	Low open woodland of Melaleuca preissiana over Low Open Shrubland of Melaleuca thymoides over Dasypogon sp. and Desmocladus sp. herbland on lower slopes.	2 mature plants, one dead over 2 sq m.	Condition of population: healthy.	Bush Forever Site 390, Fraser Road Bushland, Banjup	-32.1262	115.8851	GPS	1	30/10/2003
	7439938	1596	Caladenia huegelii	T		Private land. Flat. White / grey sand.		452 mature plants.	Healthy population but at risk from disturbance given location and proximity to sand.	Lot 4, 131, 135 and 136, Fraser road. Fro, Armadale road head E onto Fraser road, Banjup	-32.1267	115.88	GPS	1	21/10/2004
	6534163	16245	Cyathochaeta teretifolia		3					In or adjacent to Emma Treeby Reserve, S Armadale Road, Banjup	-32.1333	115.8667	MAN	3	10/12/1995
	4260171	4763	Dodonaea hackettiana		4					Russell Road (S side of Reserve) between Thomsons Lake and Marsupial Reserves, Wattleup	-32.1664	115.8497	AUTO	2	28/11/1993
	1157655	4763	Dodonaea hackettiana		4				2159/62/2.	Thomson's Lake Reserve, Jandakot	-32.1333	115.8333	MAN	3	/09/1962
	231282	1639	Drakaea elastica	T		In deep grey sand on gradual slopes in undulating plain.	Low woodland of Banksia attenuata, B. menziesii, B. ilicifolia, and Jarrah over scrub of Adenanthos cygnorum and Kunzea over herbs.	ca 60 plants.	Abundance: ca 60 plants.	Mandogalup, S of Perth, 0.8 km S of Hope Valley Road, along Treeby Road	-32.2	115.8667	MAN	3	28/10/1982
	8415331	20462	Jacksonia gracillima		3 Decumbent perennial to 0.3 m high x 1.4 m diam.	Flat, well-drained but adjacent to winter-wet swamp; pale grey sand.	Banksia woodland.	infrequent.		Bushland near Shirley Balla Swamp, north of Gibbs Rd, Banjup	-32.1564	115.8814	GPS	1	14/11/2010
	6836445	20462	Jacksonia gracillima		3 Low spreading shrub to 30 cm x 120 cm. Standard yellow-orange with red band close to base and yellow eye; wings yellow-orange in distal half, red basally, keel red.	Coastal plain, low flat. Dry, but in area of high water table. Grey sand.	Open heath over dense herbs. Kunzea glabrescens, Melaleuca thymoides, Dasypogon bromelilifolius, Phlebocarya ciliata.	occasional.		Piara Nature Reserve, Forrestdale, off N-S track ca 300 m from powerline access track	-32.1397	115.9183	GPS	1	12/11/2003
	5592224	5237	Pimelea calcicola		3 Erect, perennial, dwarf shrub.	Brown sand and protruding limestone.	Melaleuca/Acacia rostellifera patches. Associated vegetation: Dryandra sessilis, Phyllanthus calycinus, Hibbertia hypericoides, Ehrharta calycina.			ca 75 m N of Retta Street on E side of Cockburn Road, Mount Brown (Beeliar) Regional Park,	-32.1667	115.8333	MAN	0	10/11/1997
	2857685	25800	Stylidium paludicola		3 0.5 m tall, flowers pink.	Near edge of swamp.	Amongst Juncus.			Jandakot Marsupial Breeding Station at Banganup Lake	-32.1667	115.8333	MAN	0	4/12/1974
	7279906	25800	Stylidium paludicola		3 Herb to 0.4 m high. Flowers pink/red.	Gentle slope, south aspect, surface soil is dark grey loamy sand and sub surface soil is very dark grey brown sandy loam, drainage is poor and wet during winter and spring only.	Melaleuca preissiana, Kunzea glabrescens low open forest over Astartea scoparia, Hypocalymma angustifolium open shrubland over Lepidosperma longitudinale open sedgeland. Vegetation is in a pristine to excellent condition with some rabbit diggings and pot	scattered.		Robinson Road, Wandi	-32.1853	115.8965	GPS	1	22/11/2005
	2521296	44444	Tripterococcus sp. Brachylobus (A.S. George 14234)		4 Slender erect multi-stemmed shrub to 40 cm. Flowers orange-yellow, in full flower.	Winter wet flats, peaty sand over clay.	Hypocalymma angustifolium low heath.	scattered groups of 5-15 plants.		Gazetted Reserve 418 [Reserve No. 41438], Bartrum Road swamp, Jandakot	-32.15	115.8833	MAN	3	21/02/1992

Taxon	Status	Rank	IUCNCriteria	EPBC	DPaWRegion	DPaWDistrict	Distribution	FloweringPeriod	RecoveryPlan
Acacia lasiocarpa var. bracteolata long peduncle variant (G.J. Keighery 5026)		1			SWAN	PERTH HILLS,SWAN COASTAL	North Dandalup, Mundijong, Gosnells, Jandakot, Serpentine, Mundijong	My,Aug	
Amanita drummondii		3			SCST,SWAN,WARR	ALBANY,DONNELLY,FRANKLAND,SWAN COASTAL	Jandakot, Yunderup, Perup, Mount Roe N.P., Denmark, Albany		
Byblis gigantea		3			MWST,SWAN	MOORA,PERTH HILLS,SWAN COASTAL	Yule Brook, Cannington, Jandakot, Brookton Highway, Cervantes	Sep-Jan	
Dodonaea hackettiana		4			SWAN	SWAN COASTAL	Wattleup, Thompson Lake, Kings Park, Jandakot, Bibra Lake-The Spectacles, Gingin, Peron, Baldivis, Beeliar, Baldivis, Harry Waring Marsupial Reserve	Jul-Oct	
Eryngium pinnatifidum subsp. Palustre (G.J. Keighery 13459)		3			SWAN	SWAN COASTAL	Serpentine, Kenwick, Upper Swan, Gingin, Forrestdale, Bullsbrook, Mandurah, Arrowsmith, Capel	-	
Jacksonia gracillima		3			SWAN,SWST	BLACKWOOD,SWAN COASTAL	Mundijong, Forrestdale, Capel, Elgin, Modong N.R., Forrestfield, Ambergate	Oct-Nov	
Lepidosperma rostratum	T	EN	B1ab(iii)+2ab(iii)	EN	SWAN	SWAN COASTAL	Cannington, Kenwick, Forrestdale Lake NR	Aug	
Microtis quadrata		4			SCST,SWAN,WARR,WHTB	ALBANY,FRANKLAND,SWAN COASTAL,GREAT SOUTHERN	Pinjarra, Jandakot, Albany, Lake Barker, Denamrk , Baufort Inlet	Dec-Jan	
Ornduffia submersa		4			SCST,SWAN,SWST,WARR	ALBANY,DONNELLY,FRANKLAND,PERTH HILLS,SWAN COASTAL,WELLINGTON	Gunapin, Boyanup, Lake Muir, Denmark, Forrestdale, Kenwick, Frankland River, Lane Poole	Sep-Oct	
Stylidium longitubum		3			SWAN,SWST,WHTB	BLACKWOOD,SWAN COASTAL,WELLINGTON,GREAT SOUTHERN	Upper Swan, Bullsbrook, Bunbury, Midland, Busselton, Arthur River, Jandakot, Mundijong, Karnup	Nov	
Stylidium paludicola		3			SWAN,SWST	BLACKWOOD,SWAN COASTAL,WELLINGTON	Bullsbrook, Ruabon, Mandogalup, Lake Clifton, Cookernup, Capel, Dardanup		
Thysanotus glaucus		4			MWST,SCST,SWAN,SWST,WHTB	BLACKWOOD,ALBANY,ESPERANCE,MOORA,PERTH HILLS,SWAN COASTAL,GREAT SOUTHERN	Regans Ford, Forrestdale, Busselton, Lake King, West Mt Barren, Lesueur NPk	Nov-Feb	
Verticordia lindleyi subsp. lindleyi		4			MWST,SWAN	MOORA,PERTH HILLS,SWAN COASTAL	Gillingarra-Forrestdale, Cannington, Guildford, Muchea, Gingin, Murray River, Moore River, Serpentine	Nov-Jan	

FID_	PopId	Nameid	Taxon	ConsStatus	WARank	PopNumbe	SubPopCoc	Gda94Lat	Gda94Long	PopStatus	Location	District	Vesting	Purpose1	Purpose2	CountDate	Method	MatureCou	JuvenileCo	SeedlingCo	LiveTotal	PlantTypeC	AreaOccup	inFlower	Population
	84932	1596	Caladenia h	T	CR	12		-32.1771	115.9174	X	*Extinct?*	SWAN COA	PRI			15/10/1997 0:00	ACT_IND	0			0			N	
	84944	1596	Caladenia h	T	CR	41		-32.1276	115.8575	X	EXTINCT - A	SWAN COA	MRD	VER		23/10/2006 0:00		0			0			N	
	97288	1596	Caladenia h	T	CR	42	A	-32.1258	115.8813		Lot 820 (pr	SWAN COA	SPC	GVT		23/09/2011 0:00	ACT_IND	447			0	PLANTS	112380	Y	HEALTHY
	97289	1596	Caladenia h	T	CR	42	B	-32.1261	115.8778		Lot 9004 (L	SWAN COA	PRI			14/10/2005 0:00	ACT_IND	0			0			Y	MODERATE
	97290	1596	Caladenia h	T	CR	42	C	-32.1246	115.8853		Lot 131 Fra	SWAN COA	PRI			9/10/2004 0:00		5			5			Y	
	97291	1596	Caladenia h	T	CR	42	D	-32.1266	115.8777		Fraser Roa	SWAN COA	LGA	VER		23/09/2011 0:00		0			0			N	
	106241	1596	Caladenia h	T	CR	42	E	-32.1284	115.8763		Lot 821 (pr	SWAN COA	PRI			14/10/2005 0:00	ACT_IND	0			0			Y	MODERATE
	106242	1596	Caladenia h	T	CR	42	F	-32.1262	115.8851		Private Pro	SWAN COA	PRI			14/10/2005 0:00	ACT_IND	0			0			Y	MODERATE
	97306	1596	Caladenia h	T	CR	59	A	-32.2004	115.8686		The north v	SWAN COA	CC	CFF		21/09/2004 0:00		1			1			N	
	97308	1596	Caladenia h	T	CR	59	C	-32.2024	115.8686		Western bc	SWAN COA	CC	CFF		4/10/2010 0:00	ACT_IND	0			0			N	
	97309	1596	Caladenia h	T	CR	59	D	-32.2016	115.8745		The southe	SWAN COA	CC	CFF		4/10/2010 0:00	ACT_IND	1		1	1			Y	
	97310	1596	Caladenia h	T	CR	59	E	-32.2005	115.8775		Approx 15(	SWAN COA	CC	CFF		4/10/2010 0:00	ACT_IND	26		14	26			Y	
	97312	1596	Caladenia h	T	CR	60	A	-32.1822	115.8861		Private Pro	SWAN COA	PRI			11/10/2005 0:00	ACT_IND	6			6			Y	
	97313	1596	Caladenia h	T	CR	60	B	-32.1817	115.8854		Private Pro	SWAN COA	PRI			11/10/2005 0:00	ACT_IND	11			0			Y	
	97314	1596	Caladenia h	T	CR	60	C	-32.185	115.8796		Private Pro	SWAN COA	PRI			16/10/2005 0:00	ACT_IND	3			3			Y	
	106221	1596	Caladenia h	T	CR	60	D	-32.1818	115.886		Private Pro	SWAN COA	PRI			10/10/2005 0:00	ACT_IND	5			0			Y	
	84954	1596	Caladenia h	T	CR	61		-32.1473	115.8869		Private Pro	SWAN COA	PRI			5/10/2005 0:00		1			1			Y	
	84955	1596	Caladenia h	T	CR	62		-32.1614	115.8893		Western ec	SWAN COA	LGA	REC		3/10/2005 0:00	ACT_IND	18			18			N	
	84960	1596	Caladenia h	T	CR	67		-32.1518	115.8819		Unvested R	SWAN COA	NON	GVT		8/10/2006 0:00	ACT_IND	4			4			Y	
	84964	1596	Caladenia h	T	CR	72		-32.1689	115.8953		Private Pro	SWAN COA	PRI			19/09/2007 0:00	ACT_IND	1			1			Y	
	84968	1596	Caladenia h	T	CR	76		-32.1895	115.8914		Private pro	SWAN COA	PRI			1/10/2009 0:00	ACT_IND	1		0	1			Y	
	106981	1596	Caladenia h	T	CR	78	A	-32.2018	115.8625		Private Pro	SWAN COA	PRI			25/09/2012 0:00	ACT_IND	1	1		0	PLANTS	1	Y	HEALTHY
	99183	4763	Dodonaea	4		4	A	-32.1321	115.8307		Along the N	SWAN COA	PRI			15/10/1980 0:00		0			0			N	
	99184	4763	Dodonaea	4		4	B	-32.1377	115.8307		N verge of	SWAN COA	LGA	VER		15/10/1980 0:00		0			0			N	
	99185	4763	Dodonaea	4		4	C	-32.1404	115.8293		N edge of T	SWAN COA	NON	OTH		15/10/1980 0:00		0			0			N	
	99189	4763	Dodonaea	4		5	A	-32.1599	115.8237		Russell Rd,	SWAN COA	LGA	VER		15/10/1980 0:00	ACT_IND	27			27			N	
	99190	4763	Dodonaea	4		5	B	-32.1516	115.8237		S side of Ru	SWAN COA	CC	CFF	OTH	15/10/1980 0:00	ACT_IND	13			13			N	
	99191	4763	Dodonaea	4		5	C	-32.1571	115.8293		S edge of T	SWAN COA	LGA	NRE	CFA	15/10/1980 0:00		0			0			N	
	99192	4763	Dodonaea	4		5	D	-32.1655	115.8237		Harry Wari	SWAN COA	CC	CFF	OTH	15/10/1980 0:00	ESTMT	700			1750			N	
	99193	4763	Dodonaea	4		5	E	-32.1655	115.8301		Harry Wari	SWAN COA	CC	CFF	OTH	15/10/1980 0:00	ESTMT	15			23			N	
	99194	4763	Dodonaea	4		5	F	-32.1682	115.8237		WSW edge	SWAN COA	PRI			15/10/1980 0:00		0			0			N	
	85074	1639	Drakaea ela	T	CR	31		-32.19	115.8795		Private Pro	SWAN COA	PRI			17/08/2010 0:00		0			0			N	
	91320	13635	Drakaea mi	T	EN	15		-32.1568	115.9143		PP (Loc 33,	SWAN COA	PRI			14/11/2002 0:00		0			0			N	
	93725	16998	Tripterococ	4		6		-32.153	115.8866		Reserve 41	SWAN COA	NON	GVT		21/02/1992 0:00	ESTMT	10			10			N	
	92664	14714	Verticordia	4		22		-32.166	115.8895		Denis De Y	SWAN COA	LGA	REC		15/06/1991 0:00		0			0			N	

Appendix C
360 Enviromental (2017) Targeted Flora Survey

Our Ref: 2493AB

16 May 2018

Kris Kennedy
Manager-Planning
Aigle Royal Developments
Via Email: kkennedy@aigleroyal.com.au

Dear Kris

Targeted Flora Survey – Lots 11 and 74 Beenyup Road, Banjup

1. Background

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360 Environmental Pty Ltd (360 Environmental) was commissioned by Aigle Royal Developments to address the additional information request by Department of Environment and Energy (DEE) in regards to the assessment of the proposed redevelopment of Lots 11 and 74 Beenyup Road, Banjup under the Environmental Protection and Biodiversity Conservation (EPBC) Act 1999 (Figure 1).

360 Environmental (2015) undertook a Level 2 Flora and Vegetation Survey for the proposed development on 15 and 16 September 2015, which involved a database and desktop study. No Threatened species pursuant to the EPBC Act 1999 and/or gazetted as Declared Rare Flora (DRF) pursuant to the Wildlife Conservation (WC) Act 1950 or Priority species were recorded during the 2015 survey.

From the 2015 report, 24 species listed as Threatened by the EPBC Act, listed under the WC Act, or considered Priority flora, were identified as potentially occurring in the Survey Area. Two of these species, *Caladenia huegelii and Drakaea micrantha* have been identified as having the potential to occur in the Survey Area due to the presence of suitable habitat and the close proximity to the site of previous records. *The 2015 survey was undertaken at the optimum time for these species; however, due to their growth habits and therefore the difficulty in locating them, the DEE raised their concerns of these orchids being present and requested a second survey to be undertaken (DEE letter 22 September, Comment 10).*

2. Methods

The targeted search was undertaken on 11 October 2017. The survey involved traversing the Survey Area on foot to search for species of conservation significance, particularly *Drakaea micrantha*, *Caladenia huegelii* and other species identified during the 2015 desktop assessment.

For each population of suspected significant flora located in the Survey Area the following was recorded:

- Co-ordinate locations (using handheld GPS units);
- Photograph; and
- Estimation of population size.

3. Results

3.1. Vegetation Description

Thirteen vegetation associations were described for the Survey Area:

- Low Woodland of *Banksia attenuata*, *Banksia menziesii*, *Allocasuarina fraseriana*, *Eucalyptus marginata* over *Kunzea glabrescens*, *Acacia pulchella*, *Hibbertia hypericoides*, *Xanthorrhoea preissii*, *Bossiaea eriocarpa* and Conostylis aculeata;
- Low Woodland of *Banksia attenuata*, *Banksia menziesii*, *Allocasuarina fraseriana* over *Kunzea glabrescens*, *Dasypogon bromeliifolius*, *Hibbertia subvaginata*, *Calytrix fraseri* and *Bossiaea eriocarpa*;
- Open Woodland of *Allocasuarina fraseriana*, *Eucalyptus marginata* and *Banksia ilicifolia* over *Xanthorrhoea preissii*, *Dasypogon bromeliifolius*, *Bossiaea eriocarpa*, *Gompholobium tomentosum* and *Phlebocarya ciliata*;
- Woodland of *Banksia ilicifolia* and *Banksia attenuata* over *Kunzea glabrescens*, *Xanthorrhoea preissii*, *Dasypogon bromeliifolius* and *Desmocladus flexuosus*;
- Woodland of *Eucalyptus rudis* and *Melaleuca preissiana* over *Kunzea glabrescens*, *Xanthorrhoea preissii*, *Adenanthos cygnorum* and *Hypocalymma angustifolium*;
- Low Open Woodland of *Melaleuca preissiana* and *Melaleuca rhaphiophylla* over *Kunzea glabrescens*, *Hypocalymma angustifolium*, *Astartea scoparia*, *Melaleuca teretifolia*, *Meeboldina scariosa* and *Lepidosperma longitudinale*;

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- Low Open Woodland of *Melaleuca preissiana* over *Kunzea glabrescens, Hakea varia, Acacia pulchella* var. *glaberrima, Calothamnus lateralis* var. *lateralis* and *Meeboldina coangustata*;
- Low Closed Forest of *Melaleuca rhaphiophylla* over *Baumea articulata*;
- Closed Tall Scrub of *Melaleuca teretifolia, Melaleuca rhaphiophylla*, *Meeboldina coangustata* and *Juncus capitatus*;
- Low Woodland of *Melaleuca rhaphiophylla* over *Melaleuca lateritia, Astartea scoparia, Meeboldina coangustata*, *Lepidosperma longitudinale* and *Juncus pallidus*;
- Ecotone of *Banksia ilicifolia* and *Banksia menziesii* over *Kunzea glabrescens*, *Dasypogon bromeliifolius* and *Phlebocarya ciliata*;
- Closed Heath of *Hypocalymma angustifolium, Kunzea glabrescens, Dielsia stenostachya, Dasypogon bromeliifolius* and *Boronia crenulata* var. *crenulata*; and
- Monoculture of young *Melaleuca rhaphiophylla* over water.

3.2. Vegetation Condition

The vegetation condition within the site ranged from Excellent to Completely Degraded. Historical vegetation clearing, weeds, housing, a nursery and the presence of tracks within the Survey Area were the most frequently observed impacts on native vegetation.

Clearing of the eastern side of the Survey Area was undertaken around 1983 for residential and agriculture use. Additional tracks and clearing have been undertaken since then, including the construction of an additional residence on the western side.

The vegetation condition mapping undertaken in 2015 was reassessed and re-scored to reflect the current vegetation condition. This resulted in vegetation in the northern portion of the Survey Area to be re-scored from Good to Degraded condition to Degraded condition (Figure 2).

The Conservation Category Wetland (CCW) in the middle of the Survey Area has remained relatively intact and the majority is considered to be in Very Good to Excellent condition. There are a couple of areas within the wetland in Good condition along with tracks and a couple of small pockets considered to be in Degraded to Completely Degraded condition.

The upland vegetation ranges from Excellent to Degraded condition, with the majority considered to be in Good condition.

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3.3. Flora of Conservation Significance

The aim of this survey was to undertake a targeted search for *Drakaea micrantha* and *Caladenia huegelii*; however, no specimens of these species were recorded during the survey.

4. Discussion

No threatened species pursuant to the EPBC Act or to the WC Act or priority species were recorded in the project area during the field survey. *Caladenia huegelii* is a tuberous, perennial orchid that grows to 0.6 m high that is easily recognizable during its flowering period from September to October (WAH 2017). Outside of this period *C. huegelii* remains as an underground tuber and is difficult to detect in the field. Soil preferable for the species is usually deep grey-white sand associated with the Bassendean sand-dune system. However, specimens have been known to extend into the Spearwood system in some areas. The species grows in well-drained, deep sandy soils in low mixed woodlands of *Banksia attenuata*, *Banksia menziesii*, *Banksia ilicifolia*, *Allocasuarina fraseriana* and *Eucalyptus marginata*. It tends to favour areas of lush undergrowth (Brown et al. 1998; Hoffman & Brown 1998; Kelly et al. 1993). Therefore, there is vegetation in the Survey Area that is favourable habitat for *Caladenia huegelii*. As the Survey Area was extensively searched for a second time at the optimal time for this species, it can be concluded that *Caladenia huegelii* is not present.

Drakaea micrantha is a tuberous, terrestrial herb which has a diminutive flower and a heart shaped leaf which is silvery grey with prominent green veins. The species flowers from September to October and is usually found on cleared firebreaks or open sandy patches that have been disturbed, where competition from other plants has been removed (Brown et al. 1998; Hearn et al. 2006). It occurs in infertile grey sands, in *Eucalyptus marginata* and *Allocasuarina fraseriana* woodland or forest associated with *Banksia* species. It is often found under thickets of Spearwood *Kunzea glabrescens* with the Flying Duck-orchid (Paracaleana nigrita) and other Drakaea species (Brown et al. 1998; Hoffman & Brown 1992; Robinson & Coates 1995). Regardless of the Survey Area containing suitable habitat for the species, the Survey Area was extensively searched and no specimens were found.

The 2017 targeted flora survey was completed within the recommended season and optimum flowering period for the south west botanical province and the targeted conservation significant species *Caladenia huegelii* and *Drakaea micrantha*. The project area was sufficiently surveyed and as such the following conclusions can be drawn:

- No Threatened species are present in the Survey Area

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We trust this meets your requirements at this time. Should you have any questions or require further action please do not hesitate to contact Narelle Whittington on (08) 9388 8360.

For and on behalf of

360 Environmental Pty Ltd

Narelle Whittington - Principal Botanist

Enc:
Attachment 1.0 – Figure 1: Site Location
Attachment 2.0 – Figure 2: Updated Vegetation Condition

DRAFT

5. References

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DRAFT

DRAFT

FIGURE

Legend

Survey Area

- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS
- LOCALITY MAP SOURCED LANDGATE 2016
- AERIAL PHOTOGRAPHY SOURCED LANDGATE 2018
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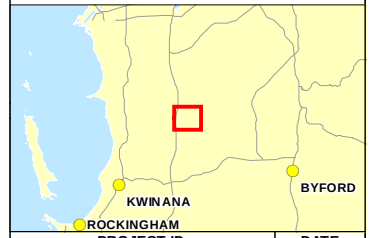
0 100 200 300 400 500 N

Meters

1:15,000 @ A3

LOCALITY MAP



PROJECT ID	DATE
2493	16/05/2018

HORIZONTAL DATUM AND PROJECTION
GDA 1994 MGA Zone 50

CREATED	CHECKED	APPROVED	REVISION
SL	NW	NW	0

Aigle Royal Developments
Beenup Road, Banjup

Targeted Flora Survey

Figure 1
Site Location

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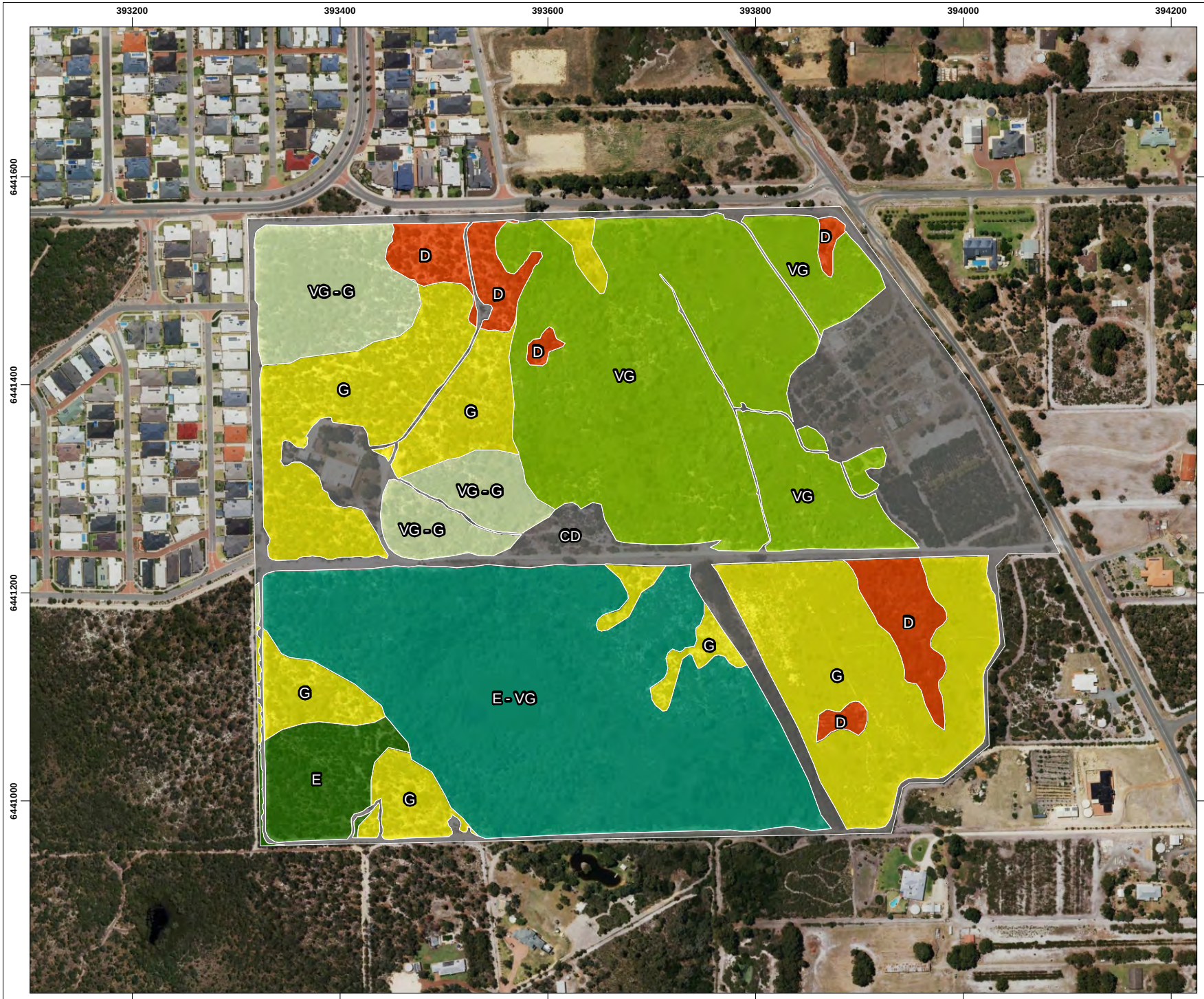
K:\Projects\1.0 EBS\2493 Aigle Royal Developments\Figures\Figure 1 Site Location.mxd



Legend

Vegetation Conditions

- Excellent
- Excellent - Very Good
- Very Good
- Very Good - Good
- Good
- Degraded
- Completely Degraded

- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS
- LOCALITY MAP SOURCED LANDGATE 2016
- AERIAL PHOTOGRAPHY SOURCED LANDGATE 2018
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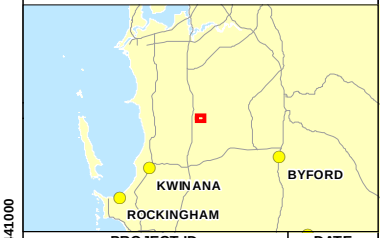
0 50 100 150 Meters
1:5,000 @ A3

N

LOCALITY MAP



PROJECT ID	DATE
2493	16/05/2018

HORIZONTAL DATUM AND PROJECTION
GDA 1994 MGA Zone 50

CREATED	CHECKED	APPROVED	REVISION
SL	NW	NW	0

Aigle Royal Developments
Beenup Road, Banjup

Targeted Flora Survey

Figure 2
Vegetation Condition

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Appendix D
DBCA NatureMap and DAWE PMST Database Searches

Australian Government
Department of the Environment and Energy

EPBC Act Protected Matters Report

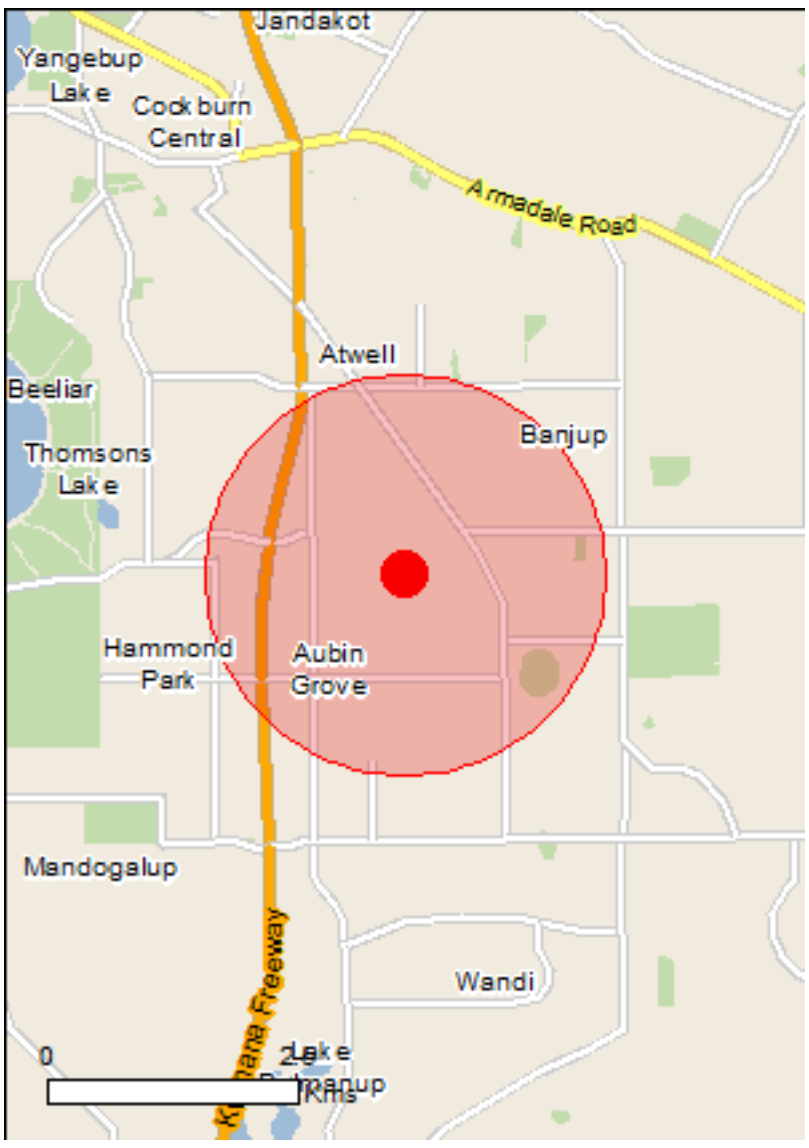
This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 11/03/20 16:17:36

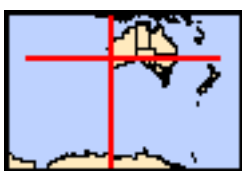
Summary
Details
Matters of NES
Other Matters Protected by the EPBC Act
Extra Information
Caveat
Acknowledgements



This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2010

Coordinates

Buffer: 2.0Km



Summary

Matters of National Environmental 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:	1
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	2
Listed Threatened Species:	20
Listed Migratory Species:	10

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 environment anywhere.

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 Land:	1
Commonwealth Heritage Places:	None
Listed Marine Species:	15
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

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

State and Territory Reserves:	None
Regional Forest Agreements:	None
Invasive Species:	40
Nationally Important Wetlands:	1
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar) [Resource Information]

Name	Proximity
Forrestdale and thomsons lakes	Within 10km of Ramsar

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.

Name	Status	Type of Presence
Banksia Woodlands of the Swan Coastal Plain ecological community	Endangered	Community likely to occur within area
Tuart (Eucalyptus gomphocephala) Woodlands and Forests of the Swan Coastal Plain ecological community	Critically Endangered	Community likely to occur within area

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat may occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calyptorhynchus banksii naso Forest Red-tailed Black-Cockatoo, Karrak [67034]	Vulnerable	Species or species habitat known to occur within area
Calyptorhynchus baudinii Baudin's Cockatoo, Long-billed Black-Cockatoo [769]	Endangered	Species or species habitat likely to occur within area
Calyptorhynchus latirostris Carnaby's Cockatoo, Short-billed Black-Cockatoo [59523]	Endangered	Species or species habitat known to occur within area
Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species habitat likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area

Name	Status	Type of Presence
Sternula nereis nereis		
Australian Fairy Tern [82950]	Vulnerable	Species or species habitat may occur within area
Mammals		
Dasyurus geoffroii		
Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat likely to occur within area
Pseudocheirus occidentalis		
Western Ringtail Possum, Ngwayir, Womp, Woder, Ngoor, Ngoolangit [25911]	Critically Endangered	Species or species habitat may occur within area
Plants		
Andersonia gracilis		
Slender Andersonia [14470]	Endangered	Species or species habitat may occur within area
Caladenia huegelii		
King Spider-orchid, Grand Spider-orchid, Rusty Spider-orchid [7309]	Endangered	Species or species habitat known to occur within area
Diuris drummondii		
Tall Donkey Orchid [4365]	Vulnerable	Species or species habitat may occur within area
Diuris micrantha		
Dwarf Bee-orchid [55082]	Vulnerable	Species or species habitat known to occur within area
Diuris purdiei		
Purdie's Donkey-orchid [12950]	Endangered	Species or species habitat likely to occur within area
Drakaea elastica		
Glossy-leafed Hammer Orchid, Glossy-leaved Hammer Orchid, Warty Hammer Orchid [16753]	Endangered	Species or species habitat likely to occur within area
Drakaea micrantha		
Dwarf Hammer-orchid [56755]	Vulnerable	Species or species habitat likely to occur within area
Lepidosperma rostratum		
Beaked Lepidosperma [14152]	Endangered	Species or species habitat likely to occur within area

Listed Migratory Species [Resource Information]		
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Motacilla cinerea		
Grey Wagtail [642]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos		
Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata		
Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris canutus		
Red Knot, Knot [855]	Endangered	Species or species habitat may occur within

Name	Threatened	Type of Presence
		area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land [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.

Name
Commonwealth Land -

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Breeding known to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species

Name	Threatened	Type of Presence
		habitat likely to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Extra Information

Invasive Species [Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Passer montanus Eurasian Tree Sparrow [406]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Streptopelia senegalensis Laughing Turtle-dove, Laughing Dove [781]		Species or species habitat likely to occur

Name	Status	Type of Presence
		within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Turdus merula Common Blackbird, Eurasian Blackbird [596]		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Funambulus pennantii Northern Palm Squirrel, Five-striped Palm Squirrel [129]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus norvegicus Brown Rat, Norway Rat [83]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Anredera cordifolia Madeira Vine, Jalap, Lamb's-tail, Mignonette Vine, Anredera, Gulf Madeiravine, Heartleaf Madeiravine, Potato Vine [2643]		Species or species habitat likely to occur within area
Asparagus aethiopicus Asparagus Fern, Ground Asparagus, Basket Fern, Sprengi's Fern, Bushy Asparagus, Emerald Asparagus [62425]		Species or species habitat likely to occur within area
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Asparagus plumosus Climbing Asparagus-fern [48993]		Species or species habitat likely to occur within area
Brachiaria mutica Para Grass [5879]		Species or species habitat may occur within area
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat may occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species

Name	Status	Type of Presence
		habitat may occur within area
Chrysanthemoides monilifera subsp. monilifera Boneseed [16905]		Species or species habitat likely to occur within area
Genista linifolia Flax-leaved Broom, Mediterranean Broom, Flax Broom [2800]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Olea europaea Olive, Common Olive [9160]		Species or species habitat may occur within area
Opuntia spp. Prickly Pears [82753]		Species or species habitat likely to occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Sagittaria platyphylla Delta Arrowhead, Arrowhead, Slender Arrowhead [68483]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
Tamarix aphylla Athel Pine, Athel Tree, Tamarisk, Athel Tamarisk, Athel Tamarix, Desert Tamarisk, Flowering Cypress, Salt Cedar [16018]		Species or species habitat likely to occur within area
Reptiles		
Hemidactylus frenatus Asian House Gecko [1708]		Species or species habitat likely to occur within area

Nationally Important Wetlands	[Resource Information]
Name	State
Gibbs Road Swamp System	WA

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

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.

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

Where very little information is available for 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 reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

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

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

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

Coordinates

-32.16028 115.86944

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.

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NatureMap
Mapping Western Australia's biodiversity

NatureMap Species Report

Created By Guest user on 11/03/2020

Current Names Only Yes
Core Datasets Only Yes
Method 'By Circle'
Centre 115° 52' 10" E,32° 09' 37" S
Buffer 2km

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
1.		*?Adenanthos obovatus*			Y
2.		*?Amphipogon turbinatus*			Y
3.		*?Anigozanthos humilis*			
4.		*?Boronia ramosa*			Y
5.		*?Briza maxima*			Y
6.		*?Burchardia congesta*			
7.		*?Caesia sp.*			Y
8.		*?Caladenia discoidea*			Y
9.		*?Calandrinia sp.*			Y
10.		*?Calytrix angulata*			
11.		*?Calytrix flavescens*			Y
12.		*?Calytrix sp.*			Y
13.		*?Chamaescilla corymbosa*			
14.		*?Cirsium vulgare*			Y
15.		*?Conostylis aculeata*			Y
16.		*?Conostylis juncea*			Y
17.		*?Conostylis sp.*			Y
18.		*?Conyza bonariensis*			
19.		*?Dampiera linearis*			
20.		*?Dasypogon bromeliifolius*			Y
21.		*?Ehrharta calycina*			
22.		*?Epilobium hirtigerum*			Y
23.		*?Epilobium sp.*			
24.		*?Eremaea pauciflora*			
25.		*?Euchiton sphaericus*			Y
26.		*?Gonocarpus pithyoides*			Y
27.		*?Haemodorum spicatum*			
28.		*?Hemiandra sp.*			Y
29.		*?Hibbertia subvaginata*			Y
30.		*?Hovea trisperma var. trisperma*			
31.		*?Hypocalymma angustifolia*			Y
32.		*?Kunzea glabrescens*			
33.		*?Lactuca serriola*			
34.		*?Lepidosperma sp.*			Y
35.		*?Lepidosperma squamatum s.l.*			
36.		*?Leptomeria empetriformis*			Y
37.		*?Leucopogon conostephioides*			Y
38.		*?Lomandra caespitosa*			
39.		*?Lomandra sp.*			Y
40.		*?Lomandra suaveolens*			Y
41.		*?Lotus subbiflorus*			
42.		*?Lysimachia arvensis*			
43.		*?Opercularia vaginata*			Y
44.		*?Pelargonium capitatum*			
45.		*?Petrophile linearis*			
46.		*?Petrorhagia dubia*			Y
47.		*?Philotheca spicata*			Y
48.		*?Phlebocarya ciliata*			
49.		*?Phlebocarya filifolia*			Y
50.		*?Phlebocarya sp.*			Y
51.		*?Podotheca sp.*			Y
52.		*?Rhodanthe citrina*			
53.		*?Rytidosperma occidentalis*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
54.		*?Schoenus curvifolius*			Y
55.		*?Stylidium repens*			Y
56.		*?Stylidium schoenoides*			Y
57.		*?Thysanotus manglesianus/patersonii complex*			Y
58.		*?Urospermum picroides*			
59.		*?Wahlenbergia capensis*			
60.		*?Wahlenbergia preissii*			
61.		*?Wahlenbergia sp.*			Y
62.		*?Xanthorrhoea brunonis*			Y
63.		*?Zantedeschia aethiopica*			Y
64.		*Acacia ?pulchella*			
65.	3262	*Acacia cochlearis (Rigid Wattle)*			
66.	3374	*Acacia huegelii*			
67.	17861	*Acacia longifolia*	Y		
68.	3502	*Acacia pulchella (Prickly Moses)*			
69.	30032	*Acacia saligna subsp. saligna*			
70.		*Acacia sp.*			
71.	3557	*Acacia stenoptera (Narrow Winged Wattle)*			
72.	3581	*Acacia trigonophylla*			
73.	24260	*Acanthiza apicalis (Broad-tailed Thornbill, Inland Thornbill)*			
74.	24261	*Acanthiza chrysorrhoa (Yellow-rumped Thornbill)*			
75.	24560	*Acanthorhynchus superciliosus (Western Spinebill)*			
76.	25535	*Accipiter cirrocephalus (Collared Sparrowhawk)*			
77.	42368	*Acritoscincus trilineatus (Western Three-lined Skink)*			
78.	11837	*Adenanthos cygnorum subsp. cygnorum (Common Woollybush)*			
79.	1791	*Adenanthos obovatus (Basket Flower)*			
80.		*Aira caryophyllea/cupaniana group*			
81.	185	*Aira cupaniana (Silvery Hairgrass)*	Y		
82.	187	*Aira praecox (Early Hairgrass)*	Y		
83.	1728	*Allocasuarina fraseriana (Sheoak, Kondil)*			
84.	200	*Amphipogon turbinatus*			
85.	24312	*Anas gracilis (Grey Teal)*			
86.	24316	*Anas superciliosa (Pacific Black Duck)*			
87.	7833	*Angianthus preissianus*			
88.		*Anigozanthos ?humilis*			
89.	11434	*Anigozanthos humilis subsp. humilis*			
90.	1411	*Anigozanthos manglesii (Mangles Kangaroo Paw, Kurulbrang)*			
91.	11261	*Anigozanthos manglesii subsp. manglesii*			
92.		*Anigozanthos sp.*			
93.	24561	*Anthochaera carunculata (Red Wattlebird)*			
94.	24562	*Anthochaera lunulata (Western Little Wattlebird)*			
95.	3692	*Aotus procumbens*			
96.	24991	*Aprasia repens (Sand-plain Worm-lizard)*			
97.	7838	*Arctotheca calendula (Cape Weed, African Marigold)*	Y		
98.	24340	*Ardea novaehollandiae (White-faced Heron)*			
99.	1264	*Arnocrinum preissii*			
100.	24353	*Artamus cyanopterus (Dusky Woodswallow)*			
101.	8779	*Asparagus asparagoides (Bridal Creeper)*	Y		
102.	20283	*Astartea scoparia (Common Astartea)*			
103.		*Asteraceae sp.*			
104.	6334	*Astroloma pallidum (Kick Bush)*			
105.		*Austrostipa ?compressa*			
106.	17234	*Austrostipa compressa*			
107.	17245	*Austrostipa mollis*			
108.	36441	*Babingtonia camphorosmae (Camphor Myrtle)*			
109.		*Banksia ?menziesii*			Y
110.	1800	*Banksia attenuata (Slender Banksia, Piara)*			
111.	32580	*Banksia dallanneyi subsp. dallanneyi var. dallanneyi*			
112.	1822	*Banksia ilicifolia (Holly-leaved Banksia)*			
113.	1830	*Banksia littoralis (Swamp Banksia, Pungura)*			
114.	1834	*Banksia menziesii (Firewood Banksia)*			
115.		*Banksia sp.*			
116.	1852	*Banksia telmatiaea (Swamp Fox Banksia)*			
117.		*Barnardius zonarius*			
118.	48868	*Bellardia viscosa*	Y		
119.	24319	*Biziura lobata (Musk Duck)*			
120.	749	*Bolboschoenus caldwellii (Marsh Club-rush)*			
121.	16636	*Boronia crenulata subsp. viminea*			
122.	4417	*Boronia dichotoma*			
123.	11381	*Boronia ramosa subsp. anethifolia*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
124.	3710	*Bossiaea eriocarpa (Common Brown Pea)*			
125.	6341	*Brachyloma preissii (Globe Heath)*			
126.	42381	*Brachyurophis semifasciatus (Southern Shovel-nosed Snake)*			
127.	3000	*Brassica tournefortii (Mediterranean Turnip)*	Y		
128.	244	*Briza maxima (Blowfly Grass)*	Y		
129.	245	*Briza minor (Shivery Grass)*	Y		
130.	12770	*Burchardia congesta*			
131.	25598	*Cacomantis flabelliformis (Fan-tailed Cuckoo)*			
132.	42307	*Cacomantis pallidus (Pallid Cuckoo)*			
133.	1276	*Caesia micrantha (Pale Grass Lily)*			
134.	1277	*Caesia occidentalis*			
135.		*Caesia sp.*			
136.		*Caladenia ?flava*			
137.	15330	*Caladenia arenicola*			
138.	1592	*Caladenia flava (Cowslip Orchid)*			
139.	1596	*Caladenia huegelii (Grand Spider Orchid)*		T	
140.	1599	*Caladenia latifolia (Pink Fairy Orchid)*			
141.		*Caladenia sp.*			
142.	2848	*Calandrinia corrigioloides (Strap Purslane)*			
143.		*Calandrinia sp.*			
144.	36600	*Callitris pyramidalis (Swamp Cypress)*			
145.	5411	*Calothamnus hirsutus*			
146.	5415	*Calothamnus lateralis*			
147.	24734	*Calyptorhynchus latirostris (Carnaby's Cockatoo, White-tailed Short-billed Black Cockatoo)*		T	
148.		*Calytrix ?angulata*			Y
149.	5439	*Calytrix angulata (Yellow Starflower)*			
150.	5458	*Calytrix flavescens (Summer Starflower)*			
151.	5460	*Calytrix fraseri (Pink Summer Calytrix)*			
152.		*Calytrix sp.*			
153.	2795	*Carpobrotus edulis (Hottentot Fig)*	Y		
154.	1162	*Cartonema philydroides*			
155.	2957	*Cassytha racemosa (Dodder Laurel)*			
156.	6542	*Centaurium tenuiflorum*	Y		
157.	1125	*Centrolepis drummondiana*			
158.	1134	*Centrolepis polygyna (Wiry Centrolepis)*			
159.	2889	*Cerastium glomeratum (Mouse Ear Chickweed)*	Y		
160.	24186	*Chalinolobus gouldii (Gould's Wattled Bat)*			
161.	24187	*Chalinolobus morio (Chocolate Wattled Bat)*			
162.	18156	*Chamaecytisus palmensis (Tagasaste)*	Y		
163.	1280	*Chamaescilla corymbosa (Blue Squill)*			
164.	11299	*Chamaescilla corymbosa var. corymbosa*			
165.	43380	*Chelodina colliei (South-western Snake-necked Turtle)*			
166.	24321	*Chenonetta jubata (Australian Wood Duck, Wood Duck)*			
167.	33939	*Cherax cainii (Marron)*			
168.		*Cherax destructor*			
169.		*Cherax preissii*			
170.		*Cherax quinquecarinatus*			
171.		*Cherax sp.*			
172.	24980	*Christinus marmoratus (Marbled Gecko)*			
173.	7937	*Cirsium vulgare (Spear Thistle, Scotch Thistle)*	Y		
174.	25675	*Colluricincla harmonica (Grey Shrike-thrush)*			
175.	24399	*Columba livia (Domestic Pigeon)*	Y		
176.	4550	*Comesperma calymega (Blue-spike Milkwort)*			
177.	6348	*Conostephium pendulum (Pearl Flower)*			
178.	6349	*Conostephium preissii*			
179.		*Conostylis ?juncea*			Y
180.	1418	*Conostylis aculeata (Prickly Conostylis)*			
181.	11826	*Conostylis aculeata subsp. aculeata*			
182.	1436	*Conostylis juncea*			
183.	11597	*Conostylis setigera subsp. setigera*			
184.		*Conyza ?bonariensis*			
185.	7939	*Conyza bonariensis (Flaxleaf Fleabane)*	Y		
186.		*Conyza sp.*			
187.	20074	*Conyza sumatrensis*	Y		
188.	25568	*Coracina novaehollandiae (Black-faced Cuckoo-shrike)*			
189.	48259	*Cortaderia selloana subsp. selloana*	Y		
190.	25592	*Corvus coronoides (Australian Raven)*			
191.	1285	*Corynotheca micrantha (Sand Lily)*			
192.	7945	*Cotula coronopifolia (Waterbuttons)*	Y		

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193.	25595	*Cracticus tibicen (Australian Magpie)*			
194.	25596	*Cracticus torquatus (Grey Butcherbird)*			
195.		*Crassula ?colorata*			Y
196.	3137	*Crassula colorata (Dense Stonecrop)*			
197.	11709	*Crassula colorata var. acuminata*			
198.	25399	*Crinia glauerti (Clicking Frog)*			
199.	25400	*Crinia insignifera (Squelching Froglet)*			
200.	30893	*Cryptoblepharus buchananii*			
201.	25027	*Ctenotus australis*			
202.	24322	*Cygnus atratus (Black Swan)*			
203.	30901	*Dacelo novaeguineae (Laughing Kookaburra)*	Y		
204.	7454	*Dampiera linearis (Common Dampiera)*			
205.	1218	*Dasypogon bromeliifolius (Pineapple Bush)*			
206.	6218	*Daucus glochidiatus (Australian Carrot)*			
207.	3832	*Daviesia physodes*			
208.	3845	*Daviesia triflora*			
209.	25766	*Delma fraseri (Fraser's Legless Lizard)*			
210.	16595	*Desmocladus flexuosus*			
211.	19649	*Disa bracteata*	Y		
212.		*Diuris corymbosa/magnifica*			
213.	4763	*Dodonaea hackettiana (Hackett's Hopbush)*		P4	
214.		*Drosera ?porrecta*			
215.		*Drosera ?sp. "climbing"*			
216.	3109	*Drosera menziesii (Pink Rainbow)*			
217.	48710	*Drosera micrantha*			
218.		*Drosera sp.*			
219.		*Drosera sp. "climbing"*			
220.	6681	*Echium plantagineum (Paterson's Curse)*	Y		
221.	25100	*Egernia napoleonis*			
222.		*Egretta novaehollandiae*			
223.	347	*Ehrharta calycina (Perennial Veldt Grass)*	Y		
224.	349	*Ehrharta longiflora (Annual Veldt Grass)*	Y		
225.		*Ehrharta sp.*			
226.	1643	*Elythranthera brunonis (Purple Enamel Orchid)*			
227.		*Eolophus roseicapillus*			
228.	6133	*Epilobium hirtigerum (Hairy Willow Herb)*			
229.	5541	*Eremaea pauciflora*			
230.		*Eucalyptus ?camaldulensis x robusta*			Y
231.		*Eucalyptus ?rudis*			Y
232.	5763	*Eucalyptus rudis (Flooded Gum, Kulurda)*			
233.	5790	*Eucalyptus todtiana (Coastal Blackbutt)*			
234.	15137	*Euchiton sphaericus*			
235.	4648	*Euphorbia terracina (Geraldton Carnation Weed)*	Y		
236.	3880	*Eutaxia virgata*			
237.	25622	*Falco cenchroides (Australian Kestrel, Nankeen Kestrel)*			
238.	1747	*Ficus carica (Common Fig)*	Y		
239.	24761	*Fulica atra subsp. australis (Eurasian Coot)*			
240.		*Fumaria ?capreolata*			Y
241.	7323	*Galium murale (Small Goosegrass)*	Y		
242.	20247	*Gamochaeta calviceps*	Y		
243.	19195	*Gamochaeta pensylvanica*	Y		
244.	20475	*Gastrolobium capitatum*			
245.	4339	*Geranium molle (Dove's Foot Cranesbill)*	Y		
246.	25530	*Gerygone fusca (Western Gerygone)*			
247.	1520	*Gladiolus caryophyllaceus (Wild Gladiolus)*	Y		
248.	6587	*Gomphocarpus fruticosus (Narrowleaf Cottonbush)*	Y		
249.	3957	*Gompholobium tomentosum (Hairy Yellow Pea)*			
250.	6161	*Gonocarpus pithyoides*			
251.	24443	*Grallina cyanoleuca (Magpie-lark)*			
252.	1475	*Haemodorum spicatum (Mardja)*			
253.	2216	*Hakea varia (Variable-leaved Hakea)*			
254.	25410	*Heleioporus eyrei (Moaning Frog)*			
255.	6710	*Heliotropium europaeum (Common Heliotrope)*	Y		
256.	6839	*Hemiandra pungens (Snakebush)*			
257.	38320	*Hemiandra sp. Jurien (B.J. Conn & M.E. Tozer BJC 3885)*			
258.	25119	*Hemiergis quadrilineata*			
259.	45534	*Hibbertia hypericoides subsp. hypericoides*			
260.	5162	*Hibbertia racemosa (Stalked Guinea Flower)*			
261.		*Hibbertia racemosa/subvaginata*			Y
262.	48381	*Hibbertia striata*			

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263.	5173	*Hibbertia subvaginata*			
264.	5176	*Hibbertia vaginata*			
265.	47965	*Hieraaetus morphnoides (Little Eagle)*			
266.	24491	*Hirundo neoxena (Welcome Swallow)*			
267.	444	*Holcus lanatus (Yorkshire Fog)*	Y		
268.	6222	*Homalosciadium homalocarpum*			
269.	3968	*Hovea trisperma (Common Hovea)*			
270.	12859	*Hovea trisperma var. trisperma*			
271.	6226	*Hydrocotyle callicarpa (Small Pennywort)*			
272.	35070	*Hypocalymma angustifolium subsp. Swan Coastal Plain (G.J. Keighery 16777)*			
273.	5825	*Hypocalymma robustum (Swan River Myrtle)*			
274.	8086	*Hypochaeris glabra (Smooth Catsear)*	Y		
275.	9352	*Hypochaeris radicata (Flat Weed, Cats-ear)*	Y		
276.	1070	*Hypolaena exsulca*			
277.	17841	*Hypolaena pubescens*			
278.	20200	*Isolepis cernua var. setiformis*			
279.	917	*Isolepis marginata (Coarse Club-rush)*			
280.	48588	*Isoodon fusciventer (Quenda, southwestern brown bandicoot)*		P4	
281.	8092	*Ixiolaena viscosa (Sticky Ixiolaena)*			
282.	20462	*Jacksonia gracillima*		P3	
283.	4029	*Jacksonia sternbergiana (Stinkwood, Kapur)*			
284.	1178	*Juncus bufonius (Toad Rush)*	Y		
285.	1186	*Juncus microcephalus*	Y		
286.	1188	*Juncus pallidus (Pale Rush)*			
287.	1190	*Juncus planifolius (Broadleaf Rush)*			
288.	4035	*Kennedia beckxiana (Cape Arid Kennedia)*		P4	
289.	4044	*Kennedia prostrata (Scarlet Runner)*			
290.	15498	*Kunzea glabrescens (Spearwood)*			
291.	20019	*Lachnagrostis filiformis*			
292.	8096	*Lactuca serriola (Prickly Lettuce)*	Y		
293.	18585	*Lagenophora huegelii*			
294.	467	*Lagurus ovatus (Hare's Tail Grass)*	Y		
295.	11911	*Laxmannia ramosa subsp. ramosa*			
296.	1309	*Laxmannia squarrosa*			
297.	7574	*Lechenaultia floribunda (Free-flowering Leschenaultia)*			
298.	44490	*Leontodon rhagadioloides*	Y		
299.		*Lepidosperma ?sp. Brixton Street broad inflorescence*			Y
300.		*Lepidosperma ?sp. Darling Scarp*			Y
301.		*Lepidosperma aff. Brixton Street*			Y
302.	940	*Lepidosperma pubisquameum*			
303.		*Lepidosperma sp.*			
304.		*Lepidosperma sp. Brixton Street broad inflorescence*			
305.		*Lepidosperma sp. Brixton Street narrow inflorescence*			
306.		*Lepidosperma sp. Darling Scarp*			
307.		*Lepidosperma sp. terete*			Y
308.	945	*Lepidosperma squamatum*			
309.		*Lepidosperma squamatum s.l.*			
310.	1077	*Leptocarpus canus (Hoary Twine-rush)*			
311.	2344	*Leptomeria empetriformis*			
312.	2350	*Leptomeria pauciflora (Sparse-flowered Currant Bush)*			
313.	25133	*Lerista elegans*			
314.	25147	*Lerista lineata (Perth Slider, Lined Skink)*		P3	
315.	6360	*Leucopogon australis (Spiked Beard-heath)*			
316.	6374	*Leucopogon conostephioides*			
317.	6436	*Leucopogon propinquus*			
318.		*Levenhookia pusilla/stipitata*			
319.	7677	*Levenhookia stipitata (Common Stylewort)*			
320.	25005	*Lialis burtonis*			
321.	25661	*Lichmera indistincta (Brown Honeyeater)*			
322.	25415	*Limnodynastes dorsalis (Western Banjo Frog)*			
323.	25378	*Litoria adelaidensis (Slender Tree Frog)*			
324.	25388	*Litoria moorei (Motorbike Frog)*			
325.	9289	*Lobelia anceps (Angled Lobelia)*			
326.	7408	*Lobelia tenuior (Slender Lobelia)*			
327.	478	*Lolium rigidum (Wimmera Ryegrass)*	Y		
328.		*Lomandra ?caespitosa*			
329.		*Lomandra ?hermaphrodita*			Y
330.		*Lomandra ?nigricans*			
331.		*Lomandra ?preissii*			
332.		*Lomandra ?suaveolens*			

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333.	1223	*Lomandra caespitosa (Tufted Mat Rush)*			
334.		*Lomandra caespitosa/suaveolens*			Y
335.	1228	*Lomandra hermaphrodita*			
336.	1234	*Lomandra nigricans*			
337.	1239	*Lomandra preissii*			
338.	1243	*Lomandra sericea (Silky Mat Rush)*			
339.		*Lomandra sp.*			
340.	1246	*Lomandra suaveolens*			
341.	8564	*Lotus subbiflorus*	Y		
342.	1097	*Lyginia barbata*			
343.		*Lyginia barbata/imberbis*			
344.	18049	*Lyginia imberbis*			
345.	36375	*Lysimachia arvensis (Pimpernel)*	Y		
346.	5281	*Lythrum hyssopifolia (Lesser Loosestrife)*	Y		
347.	2838	*Macarthuria apetala*			
348.	2839	*Macarthuria australis*			
349.	24132	*Macropus fuliginosus (Western Grey Kangaroo)*			
350.	25654	*Malurus splendens (Splendid Fairy-wren)*			
351.	4079	*Medicago polymorpha (Burr Medic)*	Y		
352.		*Melaleuca ?thymoides*			Y
353.	5900	*Melaleuca cuticularis (Saltwater Paperbark)*			
354.	5921	*Melaleuca incana (Grey Honeymyrtle)*			
355.	13273	*Melaleuca incana subsp. incana*			
356.	5926	*Melaleuca lateritia (Robin Redbreast Bush)*			
357.	5964	*Melaleuca seriata*			
358.	5978	*Melaleuca teretifolia (Banbar)*			
359.	5980	*Melaleuca thymoides*			
360.	4085	*Melilotus indicus*	Y		
361.	25184	*Menetia greyii*			
362.	3050	*Menkea australis (Fairy Spectacles)*			
363.	24598	*Merops ornatus (Rainbow Bee-eater)*			
364.	953	*Mesomelaena graciliceps*			
365.		*Microcarbo melanoleucos*			
366.	485	*Microlaena stipoides (Weeping Grass)*			
367.	15419	*Microtis media subsp. media*			
368.	14344	*Millotia tenuifolia var. tenuifolia (Soft Millotia)*			
369.	4666	*Monotaxis occidentalis*			
370.	24223	*Mus musculus (House Mouse)*	Y		
371.	25420	*Myobatrachus gouldii (Turtle Frog)*			
372.		*Myrtaceae sp.*			
373.	24738	*Neophema elegans (Elegant Parrot)*			
374.	2401	*Nuytsia floribunda (Christmas Tree, Mudja)*			
375.	24194	*Nyctophilus geoffroyi (Lesser Long-eared Bat)*			
376.	24407	*Ocyphaps lophotes (Crested Pigeon)*			
377.	6140	*Oenothera mollissima*	Y		
378.	18255	*Opercularia vaginata (Dog Weed)*			
379.	25680	*Pachycephala rufiventris (Rufous Whistler)*			
380.	25682	*Pardalotus striatus (Striated Pardalote)*			
381.	527	*Paspalum dilatatum*	Y		
382.	1550	*Patersonia occidentalis (Purple Flag, Koma)*			
383.	30472	*Patersonia occidentalis var. occidentalis*			
384.	4343	*Pelargonium capitatum (Rose Pelargonium)*	Y		
385.	4346	*Pelargonium littorale*			
386.	16477	*Pericalymma ellipticum var. ellipticum*			
387.	48061	*Petrochelidon nigricans (Tree Martin)*			
388.	48066	*Petroica boodang (Scarlet Robin)*			
389.	2299	*Petrophile linearis (Pixie Mops)*			
390.	19825	*Petrorhagia dubia*	Y		
391.	25698	*Phalacrocorax melanoleucos (Little Pied Cormorant)*			
392.	24667	*Phalacrocorax sulcirostris (Little Black Cormorant)*			
393.	24409	*Phaps chalcoptera (Common Bronzewing)*			
394.	18529	*Philotheca spicata (Pepper and Salt)*			
395.	1478	*Phlebocarya ciliata*			
396.	1479	*Phlebocarya filifolia*			
397.		*Phlebocarya sp.*			
398.	48071	*Phylidonyris niger (White-cheeked Honeyeater)*			
399.	24596	*Phylidonyris novaehollandiae (New Holland Honeyeater)*			
400.	16177	*Phyllangium paradoxum*			
401.	2793	*Phytolacca octandra (Red Ink Plant)*	Y		
402.		*Phytophthora cinnamomi*			

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403.	24841	*Platalea flavipes (Yellow-billed Spoonbill)*			
404.	6253	*Platysace filiformis*			
405.	571	*Poa annua (Winter Grass)*	Y		
406.		*Poaceae sp.*			
407.		*Podotheca ?chrysantha*			Y
408.		*Podotheca ?gnaphalioides*			
409.		*Podotheca angustifolia/gnaphalioides*			Y
410.	8183	*Podotheca chrysantha (Yellow Podotheca)*			
411.	8184	*Podotheca gnaphalioides (Golden Long-heads)*			
412.		*Podotheca sp.*			
413.	25510	*Pogona minor (Dwarf Bearded Dragon)*			
414.	2905	*Polycarpon tetraphyllum (Fourleaf Allseed)*	Y		
415.	582	*Polypogon monspeliensis (Annual Beardgrass)*	Y		
416.		*Poranthera microphylla/moorokatta*			
417.	42022	*Poranthera moorokatta*		P2	
418.	8189	*Pseudognaphalium luteoalbum (Jersey Cudweed)*			
419.	25511	*Pseudonaja affinis (Dugite)*			
420.	12217	*Pterostylis sanguinea*			
421.	4177	*Pultenaea ochreata*			
422.	4181	*Pultenaea reticulata*			
423.		*Purpureicephalus spurius*			
424.	25008	*Pygopus lepidopodus (Common Scaly Foot)*			
425.	8195	*Quinetia urvillei*			
426.	24245	*Rattus rattus (Black Rat)*	Y		
427.	6012	*Regelia ciliata*			
428.	48096	*Rhipidura albiscapa (Grey Fantail)*			
429.	25614	*Rhipidura leucophrys (Willie Wagtail)*			
430.	13300	*Rhodanthe citrina*			
431.	14485	*Romulea flava var. minor*	Y		
432.	1556	*Romulea rosea (Guildford Grass)*	Y		
433.	14924	*Romulea rosea var. communis*	Y		
434.	10970	*Rostraria cristata*	Y		
435.	2429	*Rumex acetosella (Sorrel)*	Y		
436.	40426	*Rytidosperma occidentale*			
437.	2907	*Sagina procumbens (Spreading Pearlwort)*	Y		
438.	984	*Schoenus curvifolius*			
439.	992	*Schoenus grandiflorus (Large Flowered Bogrush)*			
440.	16251	*Schoenus subflavus subsp. long leaves (K.L. Wilson 2865)*			
441.	6033	*Scholtzia involucrata (Spiked Scholtzia)*			
442.	25878	*Senecio condylus*			
443.		*Senecio diaschides/glomeratus*			Y
444.	25534	*Sericornis frontalis (White-browed Scrubwren)*			
445.	8225	*Siloxerus humifusus (Procumbent Siloxerus)*			
446.	7020	*Solanum linnaeanum (Apple of Sodom)*	Y		
447.	7022	*Solanum nigrum (Black Berry Nightshade)*	Y		
448.	8230	*Sonchus asper (Rough Sowthistle)*	Y		
449.	8231	*Sonchus oleraceus (Common Sowthistle)*	Y		
450.	1312	*Sowerbaea laxiflora (Purple Tassels)*			
451.	2316	*Stirlingia latifolia (Blueboy)*			
452.	25589	*Streptopelia chinensis (Spotted Turtle-Dove)*	Y		
453.	25590	*Streptopelia senegalensis (Laughing Turtle-Dove)*	Y		
454.		*Stylidium ?araeophyllum*			Y
455.	25831	*Stylidium araeophyllum (Stilt Walker)*			
456.		*Stylidium araeophyllum/neurophyllum*			
457.	7699	*Stylidium carnosum (Fleshy-leaved Triggerplant)*			
458.	25829	*Stylidium neurophyllum (Coastal Plain Triggerplant)*			
459.	7774	*Stylidium piliferum (Common Butterfly Triggerplant)*			
460.	7785	*Stylidium repens (Matted Triggerplant)*			
461.	25806	*Stylidium scariosum*			
462.	7798	*Stylidium schoenoides (Cow Kicks)*			
463.		*Stylidium sp.*			
464.	1260	*Stypandra glauca (Blind Grass)*			
465.	25902	*Symphyotrichum squamatum (Bushy Starwort)*	Y		
466.	24331	*Tadorna tadornoides (Australian Shelduck, Mountain Duck)*			
467.		*Thelymitra benthamiana/crinita/fuscolutea*			Y
468.		*Thelymitra sp.*			
469.		*Thysanotus ?arbuscula*			Y
470.		*Thysanotus ?thyrsoideus*			
471.	1318	*Thysanotus arbuscula*			
472.	1338	*Thysanotus manglesianus (Fringed Lily)*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
473.		*Thysanotus manglesianus/patersonii complex*			
474.	1343	*Thysanotus patersonii*			
475.		*Thysanotus sp.*			
476.	1351	*Thysanotus sparteus*			
477.	1358	*Thysanotus triandrus*			
478.	25519	*Tiliqua rugosa*			
479.	25204	*Tiliqua rugosa subsp. aspera*			
480.	25207	*Tiliqua rugosa subsp. rugosa*			
481.	45838	*Tilletia ehrhartae*			
482.	6280	*Trachymene pilosa (Native Parsnip)*			
483.	25723	*Trichoglossus haematodus (Rainbow Lorikeet)*			
484.	25521	*Trichosurus vulpecula (Common Brushtail Possum)*			
485.	1363	*Tricoryne tenella*			
486.	1038	*Tricostularia neesii*			
487.		*Trifolium ?campestre*			
488.	17145	*Trifolium angustifolium var. angustifolium*	Y		
489.	17763	*Trifolium campestre var. campestre (Hop Clover)*	Y		
490.		*Trifolium campestre/dubium*			
491.	14738	*Trifolium resupinatum var. resupinatum*	Y		
492.		*Trifolium sp.*			
493.	24808	*Tringa nebularia (Common Greenshank, greenshank)*		IA	
494.	44444	*Tripterococcus sp. Brachylobus (A.S. George 14234)*		P4	
495.	4360	*Tropaeolum majus (Garden Nasturtium)*	Y		
496.	8254	*Urospermum picroides (False Hawkbit)*	Y		
497.	8255	*Ursinia anthemoides (Ursinia)*	Y		
498.	38388	*Ursinia anthemoides subsp. anthemoides*	Y		
499.	24386	*Vanellus tricolor (Banded Lapwing)*			
500.	15432	*Verticordia densiflora var. densiflora*			
501.	14714	*Verticordia lindleyi subsp. lindleyi*		P4	
502.	24206	*Vespadelus regulus (Southern Forest Bat)*			
503.	11474	*Vicia sativa subsp. nigra*	Y		
504.		*Vulpia sp.*			
505.		*Wahlenbergia ?capensis*			
506.	7384	*Wahlenbergia capensis (Cape Bluebell)*	Y		
507.	7389	*Wahlenbergia preissii*			
508.		*Wahlenbergia sp.*			
509.	1251	*Xanthorrhoea brunonis*			
510.	1256	*Xanthorrhoea preissii (Grass tree, Palga)*			
511.	6289	*Xanthosia huegelii*			
512.	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 E
Black Cockatoo and Banksia Woodland TEC Assessment

Our Ref: 2123AA

04/04/2017

Kris Kennedy
Manager - Planning
Aigle Royal Developments
225 St Georges Terrace
Perth, WA 6000
Via Email: kkennedy@aigleroyal.com.au

Dear Kris,

Black Cockatoo Habitat Assessment and Desktop Banksia Woodlands of the Swan Coastal Plain TEC Assessment - Lots 11 and 74 Beenyup Road, Banjup.

1. Introduction and Background

360 Environmental is pleased to provide Aigle Royal Developments with this letter report to provide information in relation to the Black Cockatoo habitat assessment and desktop Banksia Woodlands of the Swan Coastal Plain Threatened Ecological Community (BW TEC) assessment for Lots 11 and 74 Beenyup Road, Banjup (Survey Area) (Figure 1).

In February 2015, 360 Environmental undertook a level 2 flora survey and identified a total of 145 taxa from 45 families in the Survey Area (360 Environmental 2015). Of these, a number of species are considered to be Black Cockatoo habitat and others are considered to be species included in the Banksia Woodland TEC. Subsequently a Black Cockatoo habitat assessment and BW TEC desktop assessment were commissioned.

1.1. Background to Black Cockatoos

All three Black Cockatoo species that occur in the south west (this includes the Perth metropolitan area) are listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act): Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*) is listed as Endangered, the Forest Red-tailed Black Cockatoo (FRTBC [*Calyptorhynchus banksii naso*]) and Baudin's Black Cockatoo (*Calyptorhynchus baudinii*) are classified as Vulnerable. All three Black Cockatoos have suffered a substantial decline in numbers and breeding distribution in the past 50 years (Johnstone & Storr 1998). Direct causes of population decline include the large numbers shot by orchardists (mainly associated with Baudin's Black Cockatoo), clearing and fragmentation of habitat (especially the loss of breeding hollows), the impact of hollow competitors including the Galah (*Cacatua roseicapilla*), corellas including Butler's Corella (*Cacatua pastinator butleri*), Australian Shelduck (*Tadorna tadornoides*), Australian Wood Duck (*Chenonetta jubata*), the feral European honey bee (*Apis mellifera*), and also vehicle strikes. Around 60% of the original vegetation on the Swan Coastal Plain has been cleared and up to 85% in other parts of the south-west region for agriculture (crops), meat production, dairying, farms, orchards, vineyards, pine plantations, mining, timber and wood chipping, cities and towns. At present, extensive tracts of uncleared land only remain in State forest and conservation reserves and what is left of remnant vegetation (in roadside verges etc.) is often disturbed to a varying degree (Johnstone & Kirkby 2011).

The south-west region is now a severely fragmented landscape and the further loss of foraging habitat, the lack of suitable breeding sites, climate change, and alterations in the landscape led to significant changes in forest structure. Almost every part of the Jarrah-Marri forest has been logged in the past, and most present day trees are too young to form hollows, and competition with exotic species, exacerbate the future conservation of Carnaby's Black Cockatoo, FRTBC's and Baudin's Black Cockatoo (Johnstone & Kirkby 2011).

The distribution of all three Black Cockatoo species can be seen in the 2014 Department of the Environment and Energy (DEE) distribution maps in Appendix A. The Survey Area is within the known distribution of Carnaby's Black Cockatoo and FRTBC; however, it is on the western extremity of Baudin's Cockatoo. Nevertheless, all three species of Black Cockatoo have been included for consideration in this document, particularly given that they are all highly mobile and the DEE distribution maps are indicative only. In addition there is some difficulty in distinguishing between Carnaby's Black Cockatoo and Baudin's Black Cockatoo, particularly when on the wing, therefore it advisable to include both species.

1.2. Background to BW TEC

BW TEC was listed (16 September 2016) as an Endangered community under the EPBC Act. A Level 2 flora and vegetation assessment of the Survey Area was undertaken prior to this listing (360 Environmental 2015), thus determination of whether the BW TEC is present in the Survey Area needed to be determined.

The BW TEC is restricted to the Swan Coastal Plain Interim Biogeographic Regionalisation for Australia (IBRA) and immediate adjacent areas. These include the Dandaragan plateau from Jurien Bay in the North, to Dunsborough in the South, and north/east on the Whicher and Darling Escarpments. The BW TEC typically has a prominent tree layer of Banksia species with scattered Eucalypts and other tree species present within or emerging above the Banksia canopy with a species rich understorey.

Key diagnostic characteristics and condition thresholds are used to determine whether a remnant of BW TEC when being surveyed. These are: location and physical environment, structure, composition and condition. Other parameters also include minimum patch size, cover of native species and native plant species diversity.

2. Objectives

The objective of the Black Cockatoo habitat assessment was to:

- Identify and determine the type and extent of habitat (breeding and foraging) suitable for Black Cockatoos in the Survey Area with reference to the EPBC Act referral guidelines for three threatened Black Cockatoo species (DSEWPaC 2012).

The objective of the BW TEC assessment was to:

- Compare and analyse the existing Level 2 flora and vegetation survey data with the key diagnostic characteristics and condition thresholds of the BW TEC to determine if the banksia woodlands in the Survey Area would be considered favourable for National protection.

3. Methods

3.1. Black Cockatoo Habitat Assessment

This Black Cockatoo habitat assessment was undertaken on 9 February 2017. The assessment involved traversing the Survey Area on foot; any trees meeting each of the

following criteria for potential breeding were recorded and electronically logged using a hand held Global Positioning System (GPS) unit:

- Native trees (e.g. [Marri [*Corymbia calophylla*], Jarrah [*Eucalyptus marginata*], Tuart [*E. gomphocephala*] etc.);
- Diameter at breast height (DBH) > 500 mm (>300 mm for Wandoo [*E. wandoo*] and Salmon [*E. salmonophloia*] Gum) regardless of the presence or absence of hollows;
- Trees were placed in the following size class categories:
  - A = 500 – 1000 mm DBH
  - B = 1000 – 2000 mm DBH
  - C = >2000 mm DBH

The Black Cockatoo habitat assessment involved assessing the habitat for tree and shrub species known to be important dietary items e.g. Marri and *Banksia sp*. It also included looking for:

- Evidence of feeding (chewed cones, seed and nut material); and
- Opportunistic observations of Black Cockatoos in the Survey Area.

3.2. TEC Assessment

The results of the statistical (multivariate) analysis and data interpretation from the Level 2 flora and vegetation report (360 Environmental 2015) were used to determine which areas of the Survey Area are sub-communities of the BW TEC. The mapping of condition and vegetation association boundaries was overlaid to determine the amount of banksia woodland for each condition category.

4. Results

4.1. Black Cockatoos

During the Black Cockatoo habitat assessment, no Black Cockatoos were observed flying over or heard in the Survey Area.

4.1.1. Potential Breeding Trees

Two species of Eucalypts, Jarrah and Flooded Gum (*E. rudis*) recorded in the Survey Area are considered Black Cockatoo potential breeding habitat. The current Survey Area contains 19 potential breeding trees with a DBH of more than 500 mm (Jarrah [11] and

Flooded Gum [8]). The dimensions and the locations of these 19 potential breeding trees are displayed in Table 1 and Figure 2.

No hollows observed from the ground were considered to be large enough at the entrances (i.e. >100 mm) or deep enough to be considered as potential breeding hollows.

Table 1: Black Cockatoo Potential Breeding Trees

*Co-Ordinates are in UTMs (GDA 94)

No.	Species	DBH	Height (M)	*Easting	*Northing	Comments
1	Jarrah	B	12	0393358	6441096	Stag, lots of fallen branches
2	Jarrah	A	12	0393384	6441087	Stag
3	Jarrah	A	10	0393444	6441095	Stag
4	Jarrah	A	12	0393471	6441009	
5	Jarrah	A	12	0393480	6441025	Stag
6	Jarrah	A	12	0393480	6441025	Stag
7	Jarrah	A	12	0393500	6441001	Shallow hollow
8	Jarrah	A	14	0393367	6441084	Splits at 4m
9	Jarrah	A	15	0393537	6441295	
10	Flooded Gum	A	17	0393565	6441205	
11	Flooded Gum	A	17	0393565	6441205	
12	Flooded Gum	A	16	0393549	6441201	
13	Flooded Gum	A	16	0393528	6441200	
14	Flooded Gum	A	16	0393567	6441189	
15	Flooded Gum	A	16	0393567	6441197	
16	Flooded Gum	A	16	0393567	6441197	
17	Flooded Gum	A	17	0393575	6441198	5 branches
18	Jarrah	A	14	0393065	6441270	
19	Jarrah	A	8	0393055	6441288	

4.1.2. Foraging Habitat

During the assessment a total of 14.73 ha of foraging habitat was identified.

Two species of Eucalypts recorded in the Survey Area; Jarrah and Flooded Gum are known dietary items of Black Cockatoos and as such are considered foraging habitat. This foraging habitat includes trees that are also potential breeding trees with a DBH of >500 mm (see Table 1 on the previous page). Other known foraging species present in the Survey Area included *Banksia attenuata*, *B. menziesii*, *B. ilicifolia*, *Allocasuarina fraseriana* and *Xanthorrhoea preissii*. These species are important foraging habitat for all three species of Black Cockatoo.

A small quantity of foraging evidence was found in the form of chewed Banksia cones and chewed Allocasuarina nuts (Plates 1 and 2).

Plate 1: Black Cockatoo Foraging Evidence - Chewed Banksia Cones

Plate 2: Black Cockatoo Foraging Evidence - Chewed Allocasuarina Nuts

4.2. Threatened Ecological Community

4.2.1. Vegetation Associations

Thirteen natural vegetation associations were recorded in the Survey Area. Descriptions of these are provided in Table 2.

Table 2: Vegetation Association Descriptions and their Extent in the Survey Area.

Vegetation Association Code	Description	Area (ha)
BaBm(a)	Low Woodland of *Banksia attenuata, Banksia menziesii, Allocasuarina fraseriana, Eucalyptus marginata* over *Kunzea glabrescens, Acacia pulchella, Hibbertia hypericoides, Xanthorrhoea preissii, Bossiaea eriocarpa* and *Conostylis aculeata*.	2.42
BaBm(b)	Low Woodland of *Banksia attenuata, Banksia menziesii, Allocasuarina fraseriana* over *Kunzea glabrescens, Dasypogon bromeliifolius, Hibbertia subvaginata, Calytrix fraseri* and *Bossiaea eriocarpa*.	4.37
AfEmBi	Open Woodland of *Allocasuarina fraseriana*, *Eucalyptus marginata* and *Banksia ilicifolia* over *Xanthorrhoea preissii*, *Dasypogon bromeliifolius*, *Bossiaea eriocarpa*, *Gompholobium tomentosum* and *Phlebocarya ciliata.*	1.47
BiKg	Woodland of *Banksia ilicifolia* and *Banksia attenuata* over *Kunzea glabrescens*, *Xanthorrhoea preissii*, *Dasypogon bromeliifolius* and *Desmocladus flexuosus*.	1.12
ErMp	Woodland of *Eucalyptus rudis* and *Melaleuca preissiana* over *Kunzea glabrescens, Xanthorrhoea preissii, Adenanthos cygnorum* and *Hypocalymma angustifolium*.	1.14
KgHa	Low Open Woodland of *Melaleuca preissiana* and *Melaleuca rhaphiophylla* over *Kunzea glabrescens, Hypocalymma angustifolium, Astartea scoparia, Melaleuca teretifolia, Meeboldina scariosa* and *Lepidosperma longitudinale.*	3.32
MpKg	Low Open Woodland of *Melaleuca preissiana* over *Kunzea glabrescens, Hakea varia, Acacia pulchella* var. *glaberrima, Calothamnus lateralis* var. *lateralis* and *Meeboldina coangustata*.	2.86
MrBa	Low Closed Forest of *Melaleuca rhaphiophylla* over *Baumea articulata*.	2.80
MtMr	*Closed Tall Scrub of Melaleuca teretifolia, Melaleuca rhaphiophylla, Meeboldina coangustata and Juncus capitatus.*	1.24

Vegetation Association Code	Description	Area (ha)
MrMl	*Low Woodland of Melaleuca rhaphiophylla over Melaleuca lateritia, Astartea scoparia, Meeboldina coangustata, Lepidosperma longitudinale and Juncus pallidus.*	3.64
Ec	Ecotone of *Banksia ilicifolia* and *Banksia menziesii* over *Kunzea glabrescens, Dasypogon bromeliifolius* and *Phlebocarya ciliata.*	0.8
Ha	Closed Heath of *Hypocalymma angustifolium, Kunzea glabrescens, Dielsia stenostachya, Dasypogon bromeliifolius* and *Boronia crenulata* var. *crenulata.*	7.64
Mr	Monoculture of young *Melaleuca rhaphiophylla* over water.	0.47

4.2.2. Floristic Community Types

The quadrat data was tested for similarity against each of the 509 Gibson *et al.* 1994 quadrats that were established as part of a regional study to describe the vegetation types present on the Swan Coastal Plain in 1994. Results from the statistical analysis and the site information, identified six Floristic Community Types (FCTs) as occurring in the Survey Area (Appendix B).

4.2.3. Threatened and Priority Ecological Communities

Vegetation association BaBm(a) has been determined to have affiliation with FCT SCP23a, AfEmBi has been determined to have affiliation with FCT 21a and BiKg and BaBm(b) have been determined to have affiliation with FCT 21c. These FCTs are listed as sub-communities of the BW TEC. The vegetation association Ec is an Ecotone of *Banksia ilicifolia* and *Banksia menziesii* over *Kunzea glabrescens, Dasypogon bromeliifolius* and *Phlebocarya ciliata*. This community is an ecotone between the drier BaBm association and the wetland. Even though the association is a mix of both dry land and wetland species, it has been included in the analysis due to the presence of Banksia species.

TECs and their associated buffers are regarded as Environmentally Sensitive Areas (ESAs).

4.2.4. Vegetation Condition

The condition of the vegetation associations BaBm (a&b), AfEmBi, BiKg and Ec varies greatly from Excellent to Good to Degraded (Table 4). There are areas considered high in diversity, however, there are pockets where the understory is low in both diversity and density and is weed infested.

Table 3: Vegetation Condition of Associations with Banksia Species

Condition	Area (ha)	Vegetation Association
Good - Degraded	0.56	BaBm (A), BiKg
Good	4.65	AfEmBi, BaBm (A), BaBm (B)
Very Good - Good	0.79	AfEmBi
Excellent - Very Good	2.94	AfEmBi, BiKg, Ec, BaBm (B)
Excellent	1.21	BaBm (A)

5. Discussion

5.1. Black Cockatoo Potential Breeding Habitat

Black Cockatoos breed in large hollow-bearing trees, generally within woodlands or forests (Johnstone *et al.* 2013). The size of the tree can be a useful indication of the hollow-bearing potential of the tree. Trees of suitable DBH are potentially important for maintaining breeding in the long-term, through maintaining the integrity of the habitat and allowing trees to provide future nest hollows. Maintaining the long-term supply of trees of a size to provide suitable nest hollows is particularly important in woodland stands that are known to support Black Cockatoo breeding (DSEWPaC 2012). Hollow formation in trees (in Eucalypt woodlands and forests) is a result of a number of processes including fungal attack, termites and fire and the propensity for hollow formation varies between the Eucalypt species (Whitford 2002).

During the Black Cockatoo habitat assessment 19 trees (Jarrah [11] and Flooded Gum [8]) were recorded in the Survey Area that have reached a size that are considered to be potential future hollow bearing trees, therefore potential breeding trees (>500 mm DBH [>300 mm for Wandoo]) according to the EPBC Act Black Cockatoo referral guidelines. No observable hollows were recorded in these trees in the Survey Area.

There were other Jarrah and Flooded Gum trees that are considered foraging habitat, however, they were under the threshold of 500 mm to be considered as potential breeding trees.

5.2. Black Cockatoo Foraging Habitat

Carnaby's Black Cockatoos feed on a variety of seeds, nuts and flowers from a range of native and exotic plants. Food plants include a number of Banksia species, Pine trees

(*Pinus* sp.), Marri, Jarrah and Allocasuarina, (Shah 2006; Johnstone & Storr 1998). The FRTBC feeds primarily on Marri and Jarrah fruit (Johnstone & Kirkby 1999; Cooper et al. 2002) which makes up 90% of the diet. Baudin's Black Cockatoo forages primarily in Eucalypt forest, where it feeds on Marri seeds, flowers, nectar and buds. They also feed on a wide range of seeds from other Eucalypt and Banksia species, and Pines (*Pinus* sp.) (Johnstone & Storr 1998).

The total area of Black Cockatoo foraging habitat present in the Survey Area is 14.73 ha. This foraging habitat consisted of Jarrah, Flooded Gum, *B. attenuata, B. menziesii, B. ilicifolia, A. fraseriana* and *X. preissii*. These species are known dietary items of all three Black Cockatoo species (Johnstone & Kirkby 2011).

5.3. BW TEC

The BW TEC is considered to occur in the Survey Area. A key diagnostic feature is a prominent tree layer of Banksia, with scattered Eucalypts and other tree species often present among the Banksia canopy. To determine if the BW TEC is present in the Survey Area, the results of the statistical analysis from the 2015 survey were compared to the list of sub-communities which were drawn from the FCT descriptions outlined in Gibson *et al.* (1994), Government of WA (2000) and Keighery *et al.* (2008).

The statistical analysis resulted in:

- BaBm(a) being most simular to SCP23a;
- AfEmBi being most simular to FCT 21a; and
- BiKg and BaBm(b) being most simular to FCT 21c.
- Vegetation association Ec has also been included due to the presence of Banksia species.

These FCTs have been listed as sub-communities under the EPBC Act listed BW TEC (DEE 2016). The vegetation associations BaBm(a), AfEmBi, BiKg, BaBm(b) and Ec are therefore considered to be the BW TEC. For vegetation remnants to be under full national protection the community has to meet key diagnostic characteristics. In regards to the presence of the TEC, the Approved Conservation Advice for the thresholds state that:

- Vegetation in Excellent Condition should have a minimum patch size of 0.5 ha;
- Vegetation in Very Good condition should be a minimum of 1 ha; and
- Vegetation in Good condition should be a minimum of 2 ha.

If a vegetation patch is considered Degraded or worse it is not considered favourable for national protection.

Based on this information, and the survey results, the vegetation in Good – Degraded condition is not suitable for National protection based on the size and condition thresholds. Vegetation mapped as Good, Good – Very Good, Excellent – Very Good and Excellent are considered suitable for National protection. Therefore, the vegetation considered to represent the BW TEC in the Survey Area equates to 9.59 ha (Figure 3).

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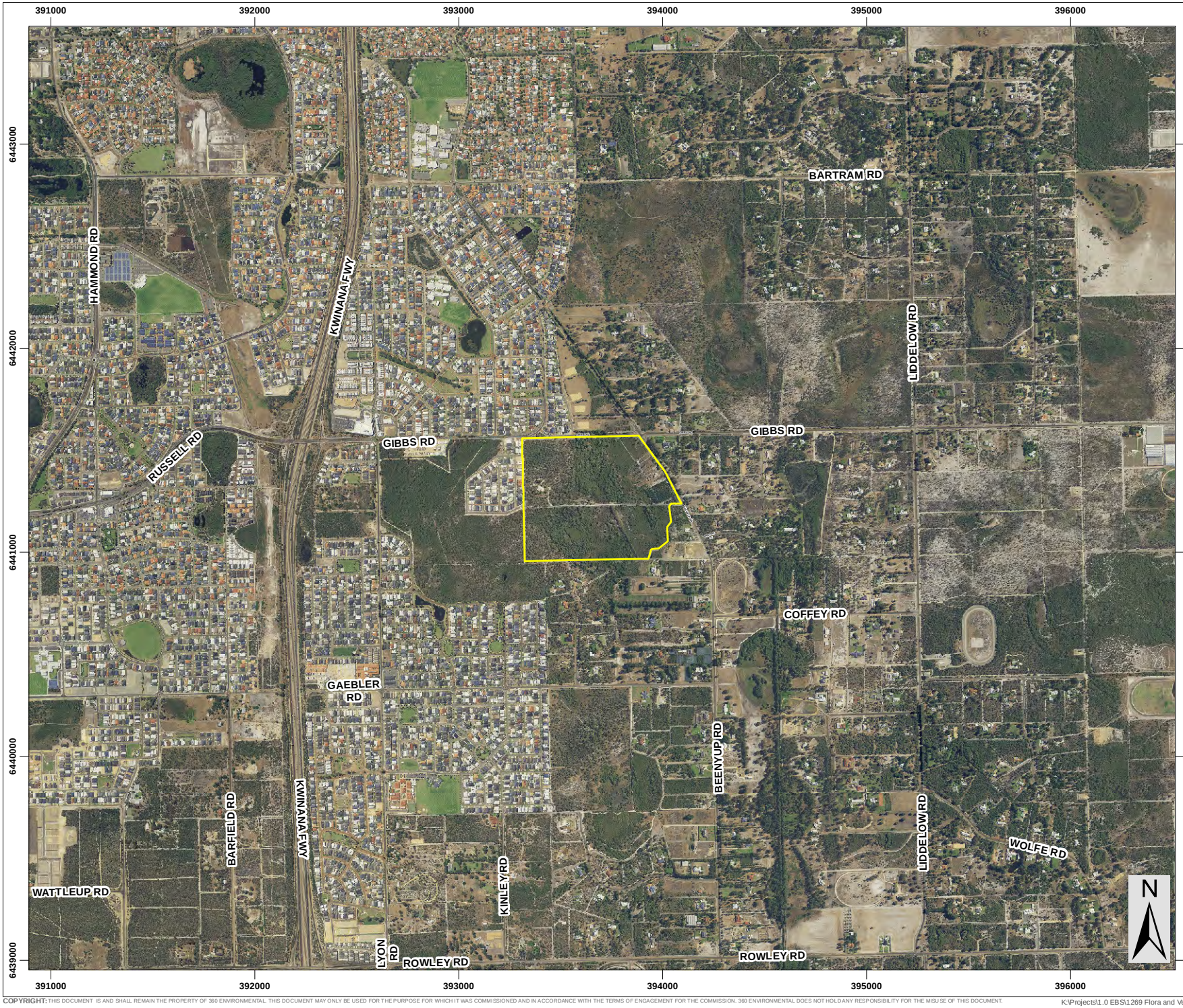
FIGURES



Legend

- Survey Area
- Roads

SLIP ENABLER

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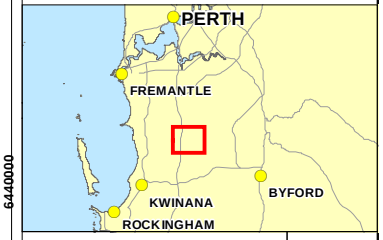
LOCALITY MAP



PROJECT ID	2123	DATE	13/12/2017

HORIZONTAL DATUM AND PROJECTION
GDA 1994 MGA Zone 50

CREATED	CHECKED	APPROVED	REVISION
CS	NW	TS	0

Aigle Royal Developments
Beenyup Road, Banjup

Black Cockatoo & TEC Assessment

Figure 1 -
Survey Area

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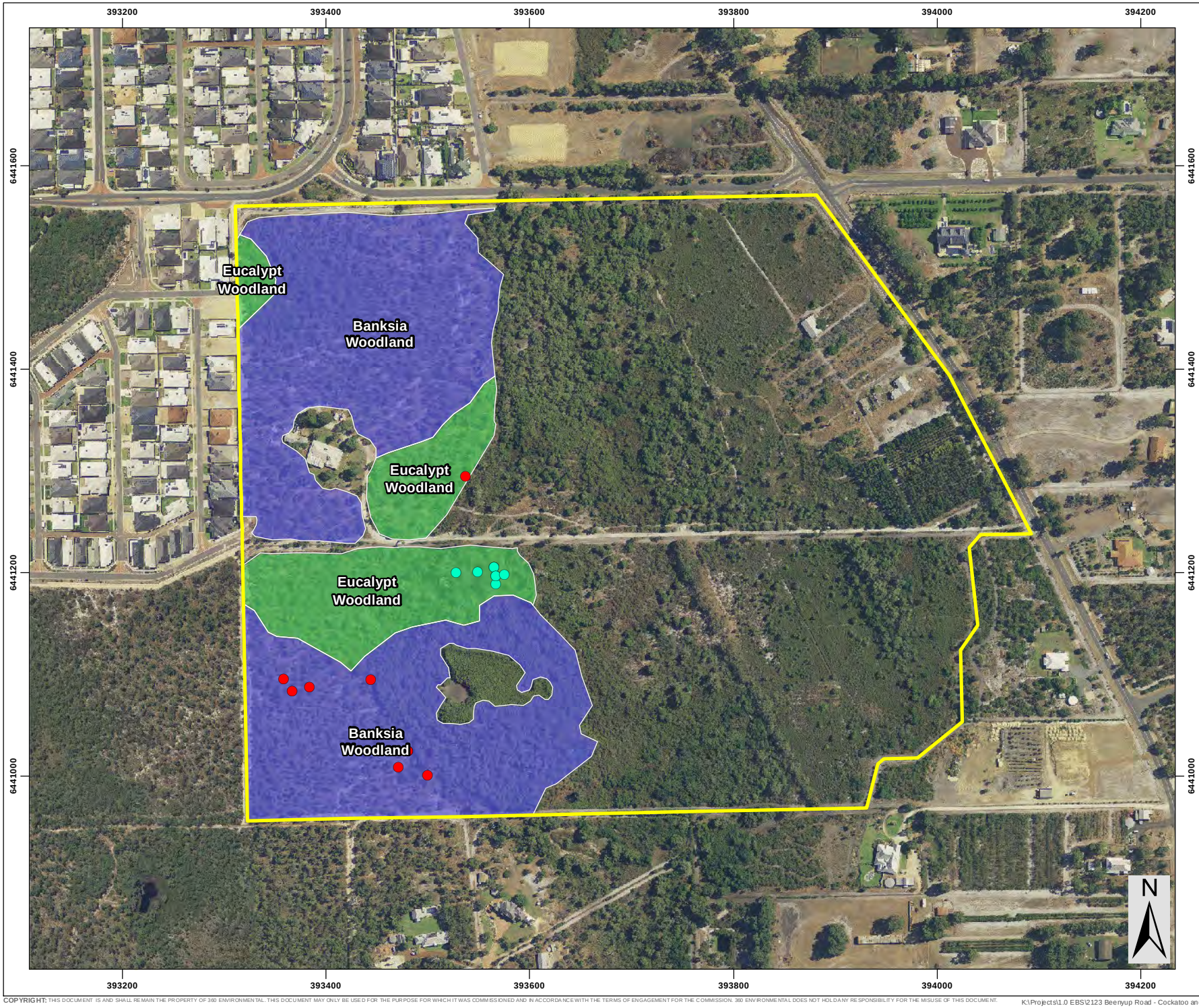

Legend

- Survey Area (41.4 ha)

Potential Breeding Trees

- Flooded Gum
- Jarrah

Fauna Habitat

- Banksia Woodland (11.26 ha)
- Eucalypt Woodland (3.47 ha)

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Meters
1:5,000 @ A4

LOCALITY MAP

PROJECT ID	DATE
2123	21/02/2017

HORIZONTAL DATUM AND PROJECTION
GDA 1994 MGA Zone 50

CREATED	CHECKED	APPROVED	REVISION
MH	LS	RF	0

Aigle Royal Developments
Beenup Road, Banjup

Black Cockatoo Habitat Assessment

Figure 2 -
Black Cockatoo Habitat

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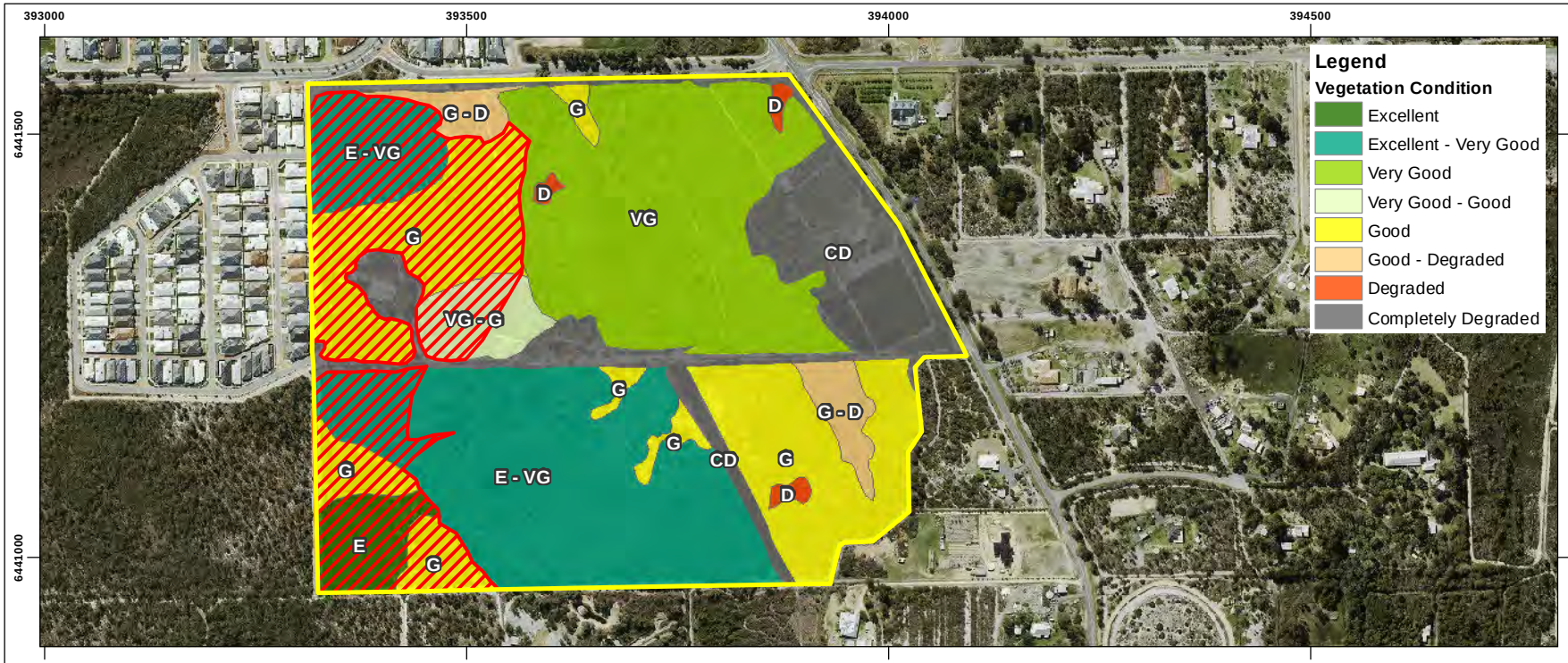
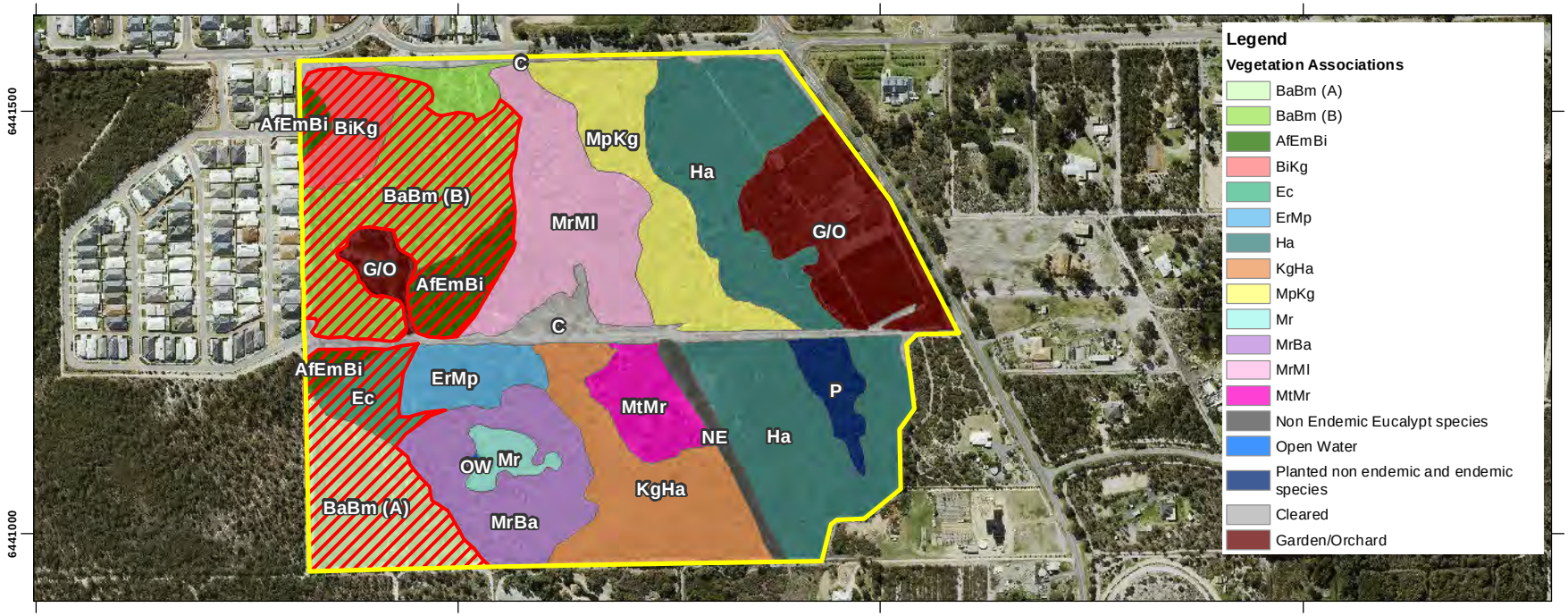
K:\Projects\1.0 EBS\2123 Beenyup Road - Cockatoo and Banksia Assessment\Figures\2123 Figure 2 - Black Cockatoo Habitat.mxd





Legend

Survey Area

Banksia TEC

- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS
- LOCALITY MAP SOURCED LANDGATE 2006
- CADASTRE SOURCED FROM LANDGATE 22 DEC 2015
- AERIAL PHOTOGRAPHY SOURCED LANDGATE SEPT 2015
(© Western Australian Land Information Authority 2015)

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Meters
1:8,000 @ A3

LOCALITY MAP

PROJECT ID	DATE
2123	21/02/2017

HORIZONTAL DATUM AND PROJECTION
GDA 1994 MGA Zone 50

CREATED	CHECKED	APPROVED	REVISION
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Black Cockatoo Habitat and TEC Assessment

Figure 3

TEC Boundary Location

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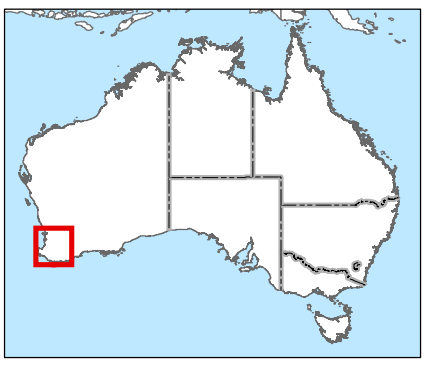
APPENDIX A

DEE Black Cockatoo Distribution Maps

Map 1: Modelled distribution of Baudin's black cockatoo (*Calyptorhynchus baudinii*)

INDICATIVE MAP ONLY: For the latest departmental information, please refer to the Protected Matters Search Tool at www.environment.gov.au/epbc/index.html



0 20 40 60 80 100 km

Australian Government

Department of Sustainability, Environment, Water, Population and Communities

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Contextual data sources:
DEWHA (2006), Collaborative Australian Protected Areas Database
Geoscience Australia (2006), Geodata Topo 250K Topographic Data

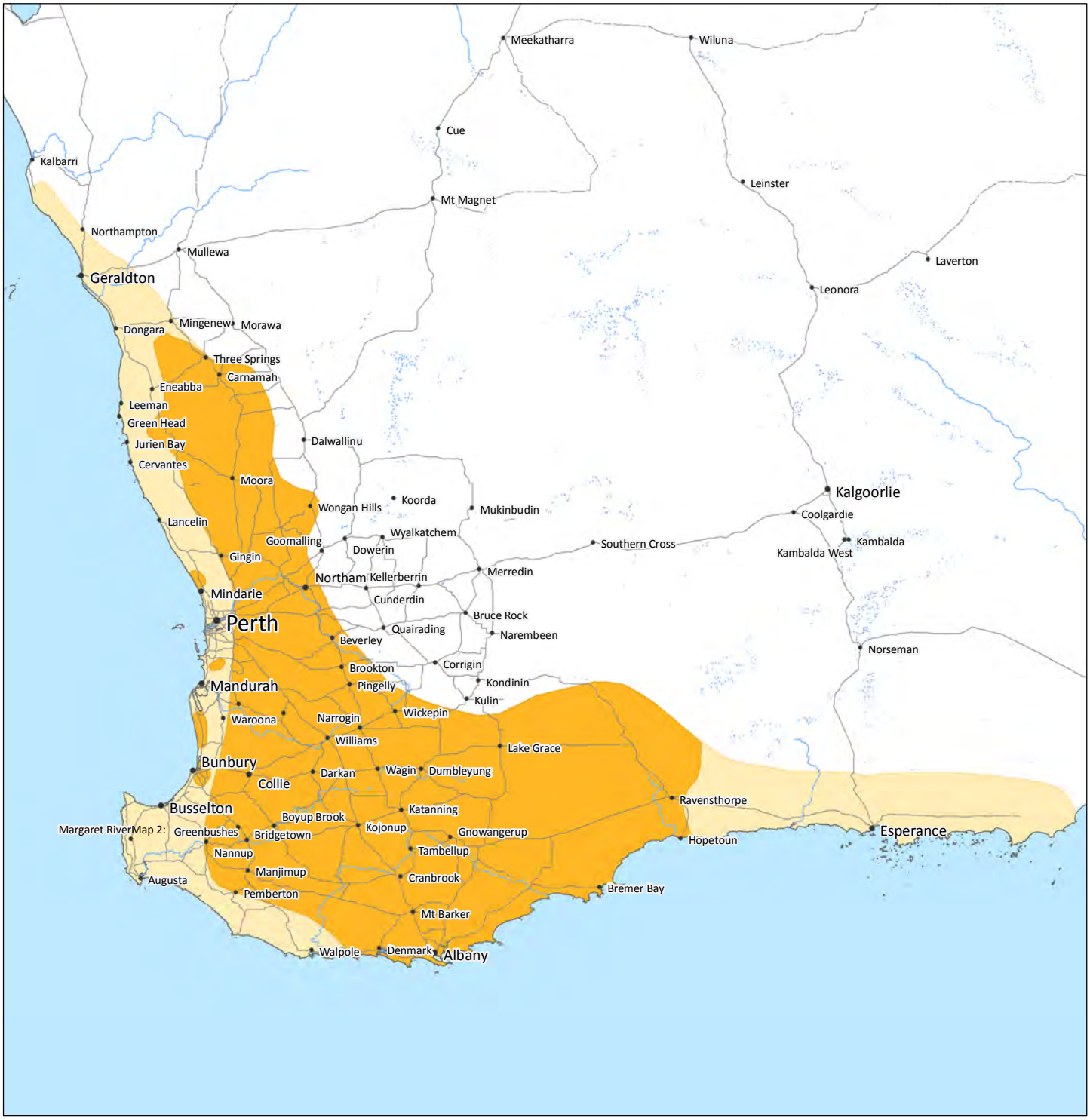
Legend

- Known Breeding Areas
- Predicted Breeding Range
- Main Wintering Area
- Species May Occur
- Cities & Towns
- Roads
- Major Rivers
- Lakes

Please Note: Known breeding areas represent locations known to be used by birds for breeding as at December 2009. As habitat has been lost in traditional breeding areas, birds have begun breeding at new locations.

CAVEAT: The information presented in this map has been provided by a range of groups and agencies. While every effort has been made to ensure accuracy and completeness, no guarantee is given, nor responsibility taken by the Commonwealth for errors or omissions, and the Commonwealth does not accept responsibility in respect of any information or advice given in relation to, or as a consequence of, anything containing herein. **INDICATIVE MAP ONLY:** This map has been compiled from datasets with a range of geographic scales and quality. Species or ecological community distributions are indicative only and not to be used for local assessment. Local knowledge and information should be sought to confirm the presence of the species, or species habitat, at the location of interest.

Map 2: Modelled distribution of Carnaby's black cockatoo (*Calyptorhynchus latirostris*)



INDICATIVE MAP ONLY: For the latest departmental information, please refer to the Protected Matters Search Tool at www.environment.gov.au/epbc/index.html

0 50 100 150 200 250 km

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Department of Sustainability, Environment, Water, Population and Communities

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Contextual data sources:
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Geoscience Australia (2006), Geodata Topo 250K Topographic Data

Legend

- Breeding Range
- Non-breeding Range
- Cities & Towns
- Roads
- Major Rivers
- Lakes

Please Note: The breeding range represents the areas known to be used by birds for breeding as at December 2009. As habitat has been lost in traditional breeding areas, birds have begun breeding at new locations.

CAVEAT: The information presented in this map has been provided by a range of groups and agencies. While every effort has been made to ensure accuracy and completeness, no guarantee is given, nor responsibility taken by the Commonwealth for errors or omissions, and the Commonwealth does not accept responsibility in respect of any information or advice given in relation to, or as a consequence of, anything containing herein. **INDICATIVE MAP ONLY:** This map has been compiled from datasets with a range of geographic scales and quality. Species or ecological community distributions are indicative only and not to be used for local assessment. Local knowledge and information should be sought to confirm the presence of the species, or species habitat, at the location of interest.

Map 3: Modelled distribution of forest red-tailed black cockatoo (*Calyptorhynchus banksii naso*)

INDICATIVE MAP ONLY: For the latest departmental information, please refer to the Protected Matters Search Tool at www.environment.gov.au/epbc/index.html

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Legend

- Species May Occur
- Cities & Towns
- Roads
- Major Rivers
- Lakes

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APPENDIX B

Floristic Community Types Analysis

Floristic Community Type Analysis

Vegetation Association	Gibson *et al.* Quadrat & FCT	Similarity Based on Statistical Analysis	Comments	Inferred Floristic Community Type
BJQ1 (BaBm[a])	CRES01 (FCT SCP 23a)	55.0	The top three results in the analysis were SCP23a. This result seems appropriate given the species present and the location of the community on the higher dunes of the Survey Area.	FCT SCP23a – Central *Banksia attenuata* – *B. menziesii* woodlands
	BANK-3 (FCT SCP 23a)	54.7		
	YULE-2 (FCT SCP 23a)	53.7		
BJQ2 (MrBa)	Chid06 (FCT SCP s17)	50	This quadrat was characterised by large mature *Melaleuca preissiana* over either sedges or exposed soil which had evidence of inundation.	FCT SCP13 – Deeper wetlands on heavy soils
	White04 (FCT SCP s17)	35.2		
	WN020 (FCT SCP s19)	30.7		
BJQ3 (MrBa)	HYMUS05 (FCT SCP 11)	28.5	The association had both *Melaleuca preissiana* and *M. rhaphiophylla* with an open understorey which showed signs of being inundated.	FCT SCP13 – Deeper wetlands on heavy soils
	HYMUS01 (FCT SCP 11)	25.8		
	CAVS06 (FCT SCP s07)	25.8		
BJQ4 (Mr)	MTB-5 (FCT SCP 17)	25	This quadrat was established in the core of the wetland and was still inundated with water to approximately 30 cm, consisting of only *Melaleuca preissiana*.	FCT SCP13 – Deeper wetlands on heavy soils
	CHID06 (FCT SCP 17)	22.2		
	WATER-2 (FCT SCP 13)	20		
BJQ5 (KgHa)	CHID06 (FCT SCP 17)	36.3	This association was characterised by high	FCT SCP5 – Mixed shrub

Vegetation Association	Gibson *et al.* Quadrat & FCT	Similarity Based on Statistical Analysis	Comments	Inferred Floristic Community Type
	PINJ02 (FCT SCP s03)	32.2	density wetland shrubs with scattered *Melaleuca preissiana* and *M. rhaphiophylla*. It is more analogous to SCP5 rather than SCP4. This is based on the low diversity of the dense shrub layer.	damplands
	GOSN05 (FCT SCP s03)	29.6		
BJQ6 (MtMr)	McLART-1 (FCT SCP 13)	35.7	This quadrat consisted of dense wetland shrubs and sedges with scattered *Melaleuca rhaphiophylla.*	**FCT SCP5** – Mixed shrub damplands
	ELLIS-1(FCT SCP 17)	29.6		
	CAPEL-9 (FCT SCP 12)	28.5		
BJQ7 (AfEmBi)	ELE33 (FCT SCP 4)	48.1	Regardless of the analysis results that indicate a higher similarity with SCP4, because of the presence of more dry land species and the dominance of *Allocasuarina fraseriana* and *Eucalyptus marginata* it is thought to be more similar with SCP21a.	**FCT SCP21a** – Central *Banksia attenuata* – *E. marginata* woodlands
	MODO-2 (FCT SCP 21c)	44.8		
	ELE04 (FCT SCP 21a)	42.1		
BJQ8 (Ha)	TWIN-1 (FCT SCP 6)	34.4	This association had been historically cleared and is now natural regrowth with very low diversity.	**FCT SCP5** – Mixed shrub damplands
	PINJ13 (FCT	33.3		

Vegetation Association	Gibson *et al.* Quadrat & FCT	Similarity Based on Statistical Analysis	Comments	Inferred Floristic Community Type
	SCP s17)		Due to the lack of upper- storey species, it is most analogous to SCP5.	
	AUSTB-4 (FCT SCP 5)	30		
BJQ9 (MrMl)	McLART-1 (FCT SCP 13)	31.25	Due to the dominance of *Melaleuca preissiana* and *M. rhaphiophylla* along with the typical understorey species it is thought that this association is more similar to SCP4. The area also did not appear to be subject to deep inundation in the winter months due to the species and ground litter present.	FCT SCP4 - *Melaleuca preissiana* damplands
	LESCH-6 (FCT SCP 17)	27.7		
	BEEL03 (FCT SCP 11)	27.5		
BJQ10 (BiKg)	LOW07 (FCT SCP 21c)	52.1	The analysis indicated that BJQ10 is most similar to SCP21c, given the species present, and the location of the association in the landscape SCP21c.	FCT SCP21c – Low Lying *Banksia attenuata* woodlands or shrublands
	MODO-2 (FCT SCP 21c)	48.3		
	GOSN13 (FCT SCP 23a)	46.6		
BJQ11 (MrMl)	WHITE08 (FCT SCP 21a)	33.3	Due to the dominance of *Melaleuca preissiana* and *M. rhaphiophylla* along with the typical understorey species	FCT SCP4 - *Melaleuca preissiana* damplands
	GOSN05 (FCT SCP s03)	28.5		

Vegetation Association	Gibson *et al.* Quadrat & FCT	Similarity Based on Statistical Analysis	Comments	Inferred Floristic Community Type
	McLART-1(FCT SCP 13)	28.5	it is thought that the association is more analogous to SCP4. The area also did not appear to be subject to deep inundation in the winter months.	
BJQ12 (BaBm[b])	FL-5 (FCT SCP 21c)	55	The analysis showed that BJQ10 is most similar to SCP21c. This is due to the species present and the location of the association in the landscape. .	**FCT SCP21c** – Low Lying *Banksia attenuata* woodlands or shrublands
	ELE02 (FCT SCP 21c)	49.3		
	HURST03 (FCT SCP 23a)	49.0		
BJQ13 (MpKg)	McLART-1 (FCT SCP 13)	36.3	Due to the dominance of *Melaleuca preissiana* along with the typical understorey species it is thought that the association is more similar to SCP4. The association is not part of the core wetland and did not appear to be subject to deep inundation in the winter months due to the species and ground litter present.	**FCT SCP4** - *Melaleuca preissiana* damplands
	WHITE08 (FCT SCP s17)	34.0		
	GOS05 (FCT SCP s03)	30.3		
BJQ14 (Ha)	PERTH10 (FCT SCP 4)	44.0	The location of this association had been historically disturbed and consequently has low diversity.	**FCT SCP5** – Mixed shrub damplands
	GUTHR-4 (FCT	36.6		

Vegetation Association	Gibson *et al.* Quadrat & FCT	Similarity Based on Statistical analysis	Comments	Inferred Floristic Community Type
	SCP 5)		Due to the lack of upper- storey species and in its present state it is most analogous with SCP5.	
	GOSN01 (FCT SCP 4)	34.9		
BJQ15 (BaBm[a])	HURST03 (FCT SCP 23a)	50.9	The top two results in the analysis were for SCP23a, this result seems appropriate given the species present and the location of the community on the higher dunes of the Survey Area.	FCT SCP23a – Central *Banksia attenuata* – *B. menziesii* woodlands
	CRESW01 (FCT SCP 23a)	49.4		
	CAVS11 (FCT SCP 21a)	49.4		

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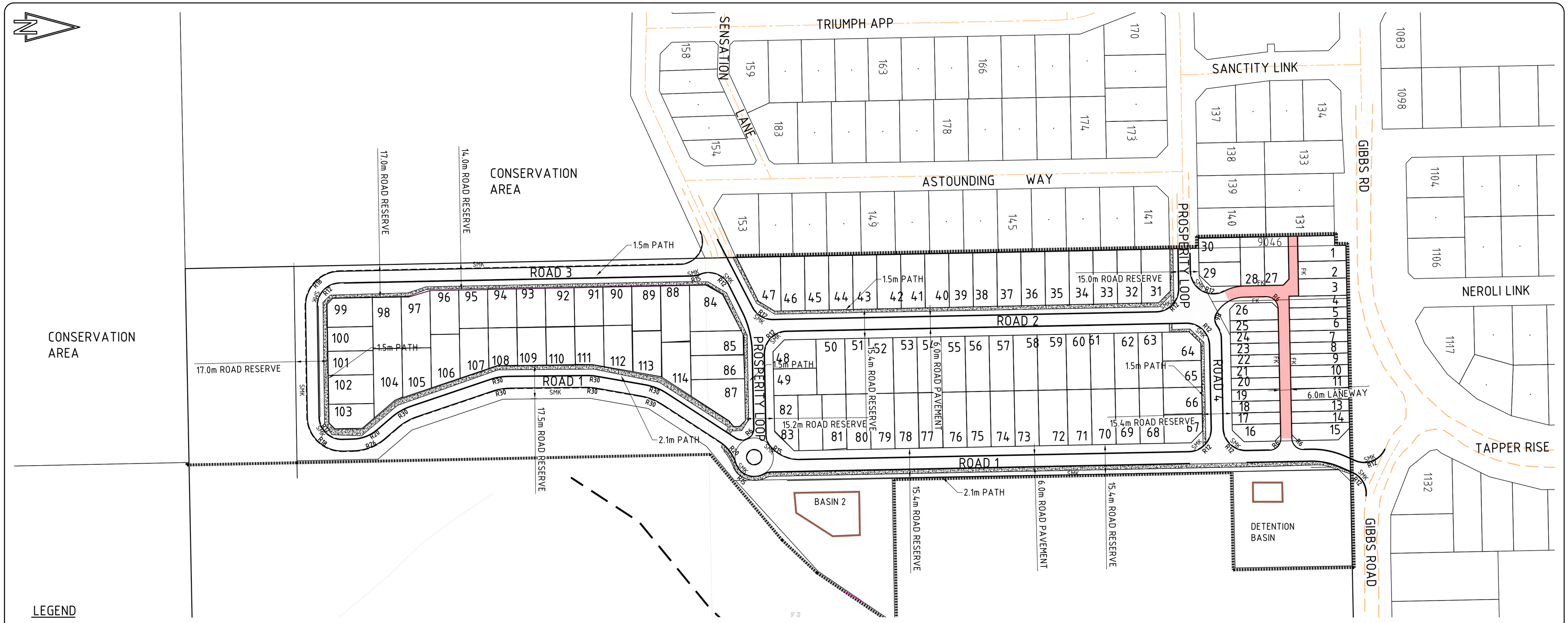
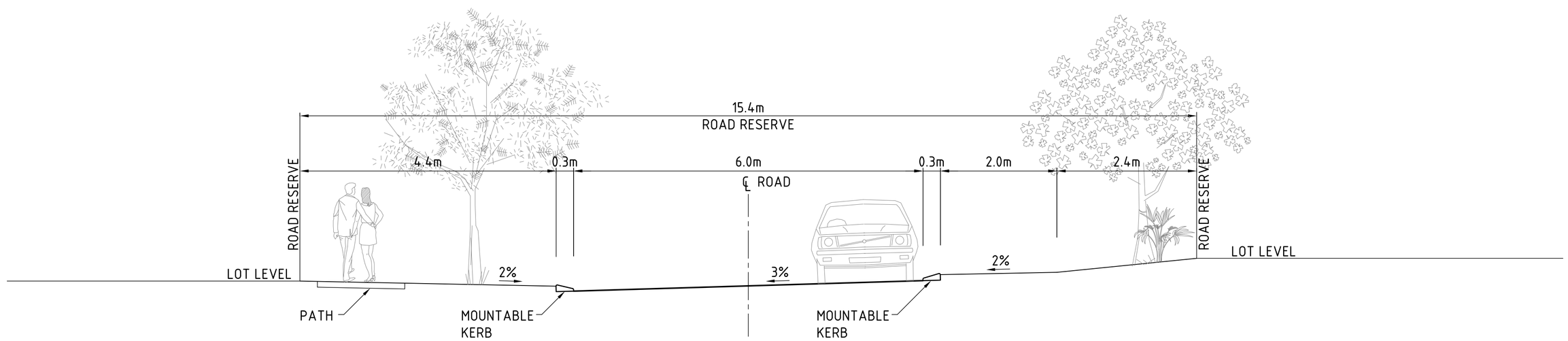
Appendix D – PRELIMINARY ENGINEERING DESIGN DRAWINGS



LEGEND

- ROAD CENTRELINE
- MOUNTABLE KERB
- SMK — SEMI-MOUNTABLE KERB
- FK — FLUSH KERB
- FOOTPATH
- ASPHALT SEAL
- EXISTING ROAD EDGE
- BATTLE-AXE ACCESS



TYPICAL SECTION THROUGH ROAD RESERVE

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DIRECTOR	C.FINGHER	APPROVED FOR ISSUE: Colin Fingher	DATE: 16.04.2020

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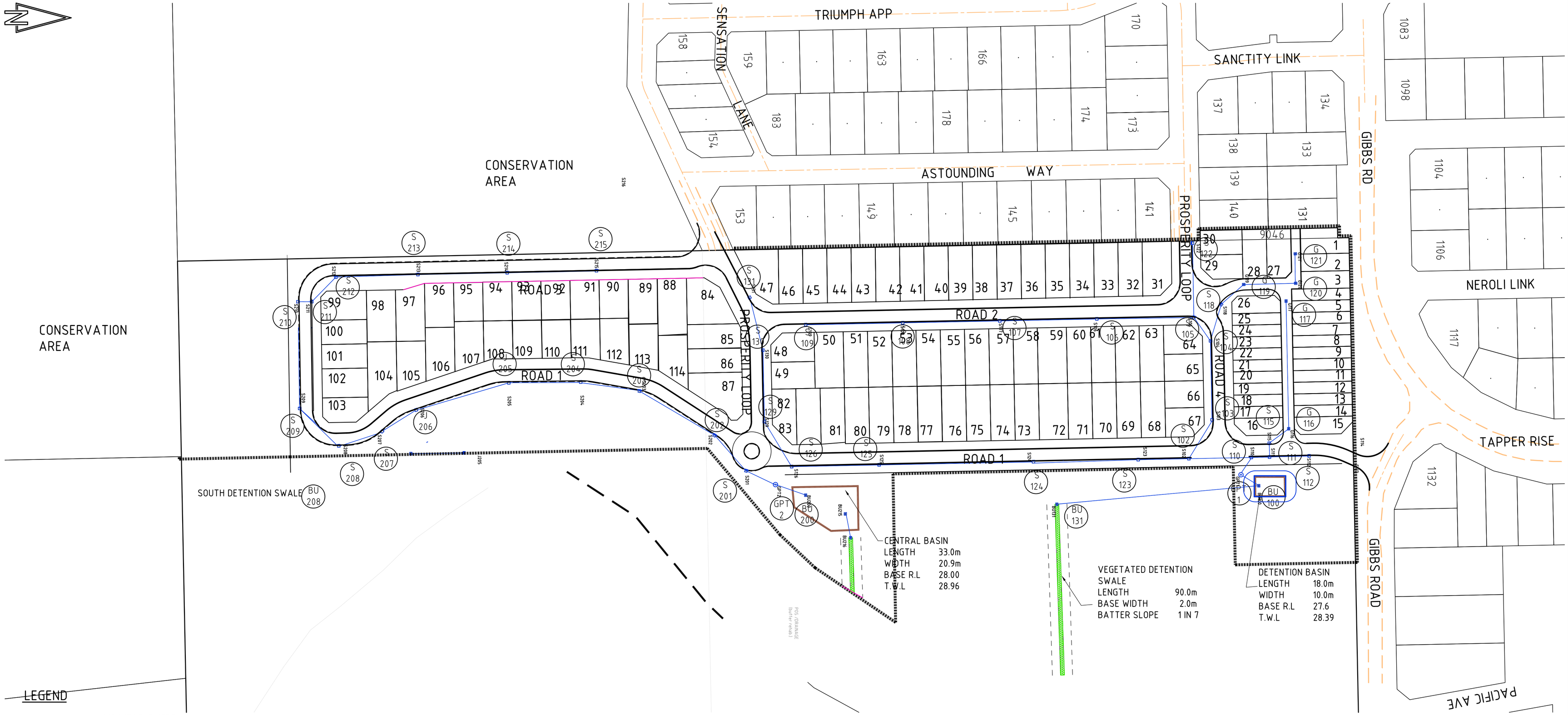

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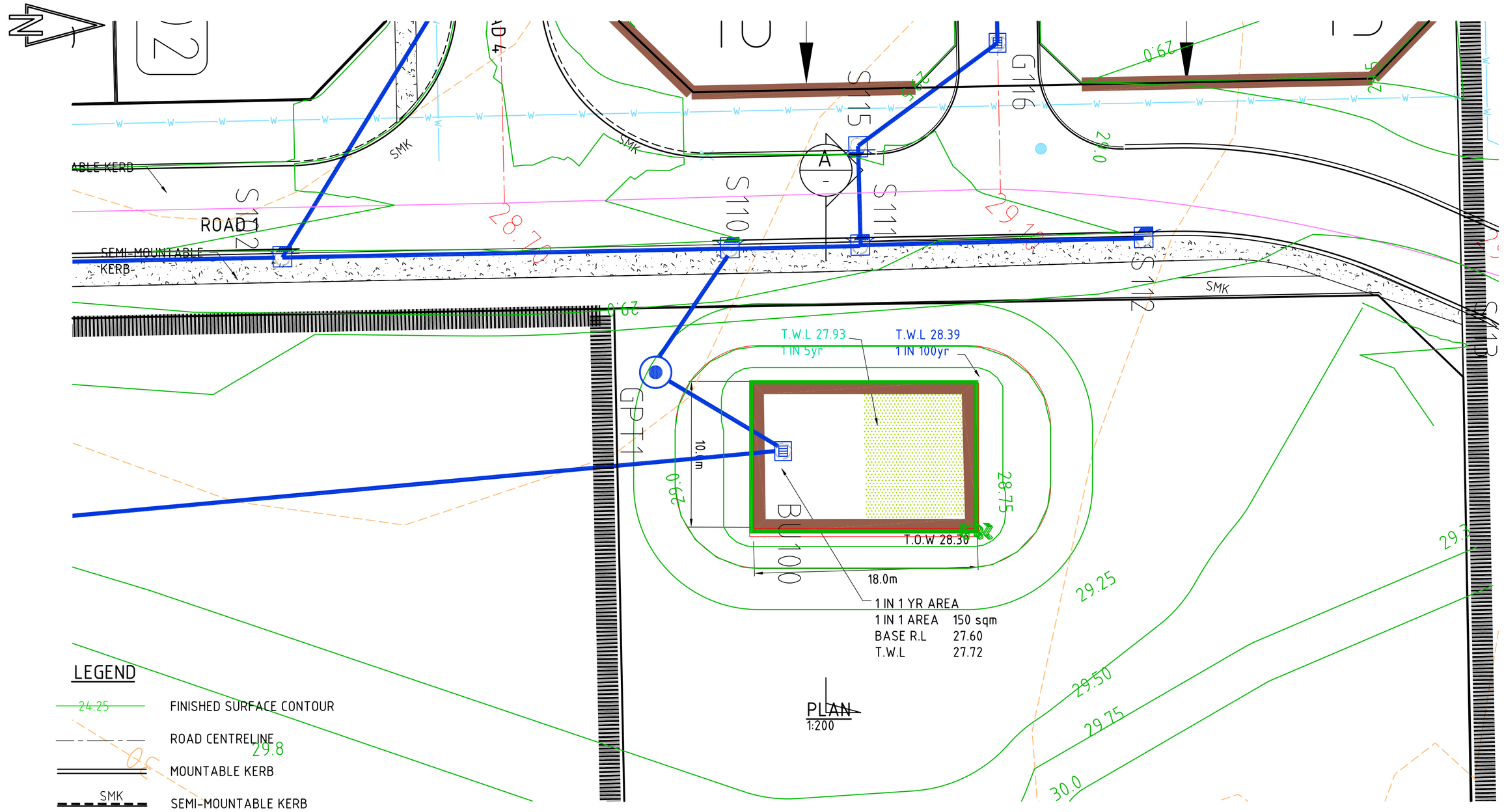


100Yr CRITERIA

MINIMUM STORAGE VOLUME REQUIRED:	126m³
DEPTH TO STORE REQUIRED VOLUME:	0.79m
BASE LEVEL	27.6m
1 IN 100 YR ARI LEVEL	28.39m
FREEBOARD PROVIDED	0.30m
STORAGE PROVIDED	303m³

5Yr CRITERIA

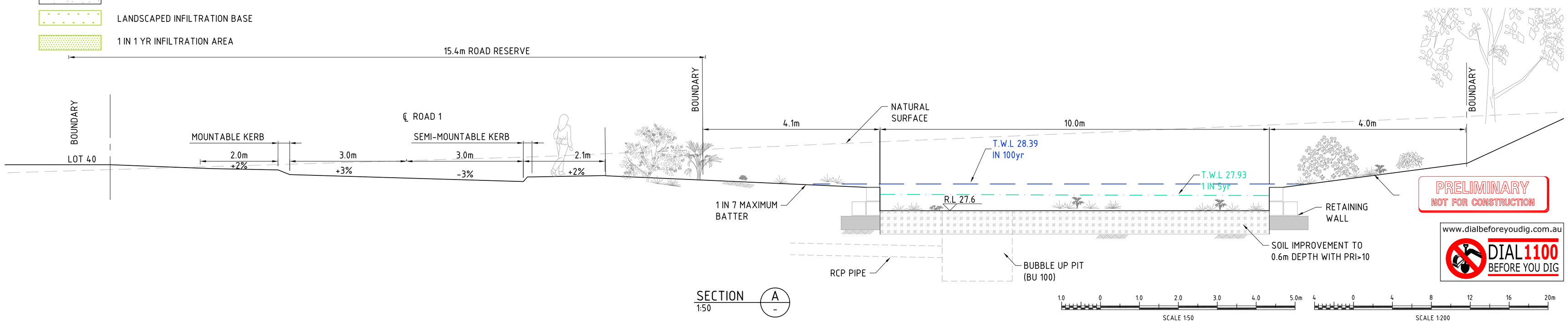
MINIMUM STORAGE VOLUME REQUIRED:	59m³
DEPTH TO STORE REQUIRED VOLUME:	0.33m
1IN 5 YR ARI LEVEL:	27.93m
SURFACE AREA:	180m²

1Yr CRITERIA

MINIMUM STORAGE VOLUME REQUIRED:	29m³
DEPTH TO STORE REQUIRED VOLUME:	0.12m
1 IN 1 YR ARI LEVEL	27.72m
SURFACE AREA:	180m²

LEGEND

- FINISHED SURFACE CONTOUR
- ROAD CENTRELINE
- MOUNTABLE KERB
- SMK — SEMI-MOUNTABLE KERB
- FK — FLUSH KERB
- LIMESTONE RETAINING WALL
- DRAINAGE PITS & PIPE
- FOOTPATH
- LANDSCAPED INFILTRATION BASE
- 1 IN 1 YR INFILTRATION AREA



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DIRECTOR	C.FINGHER		

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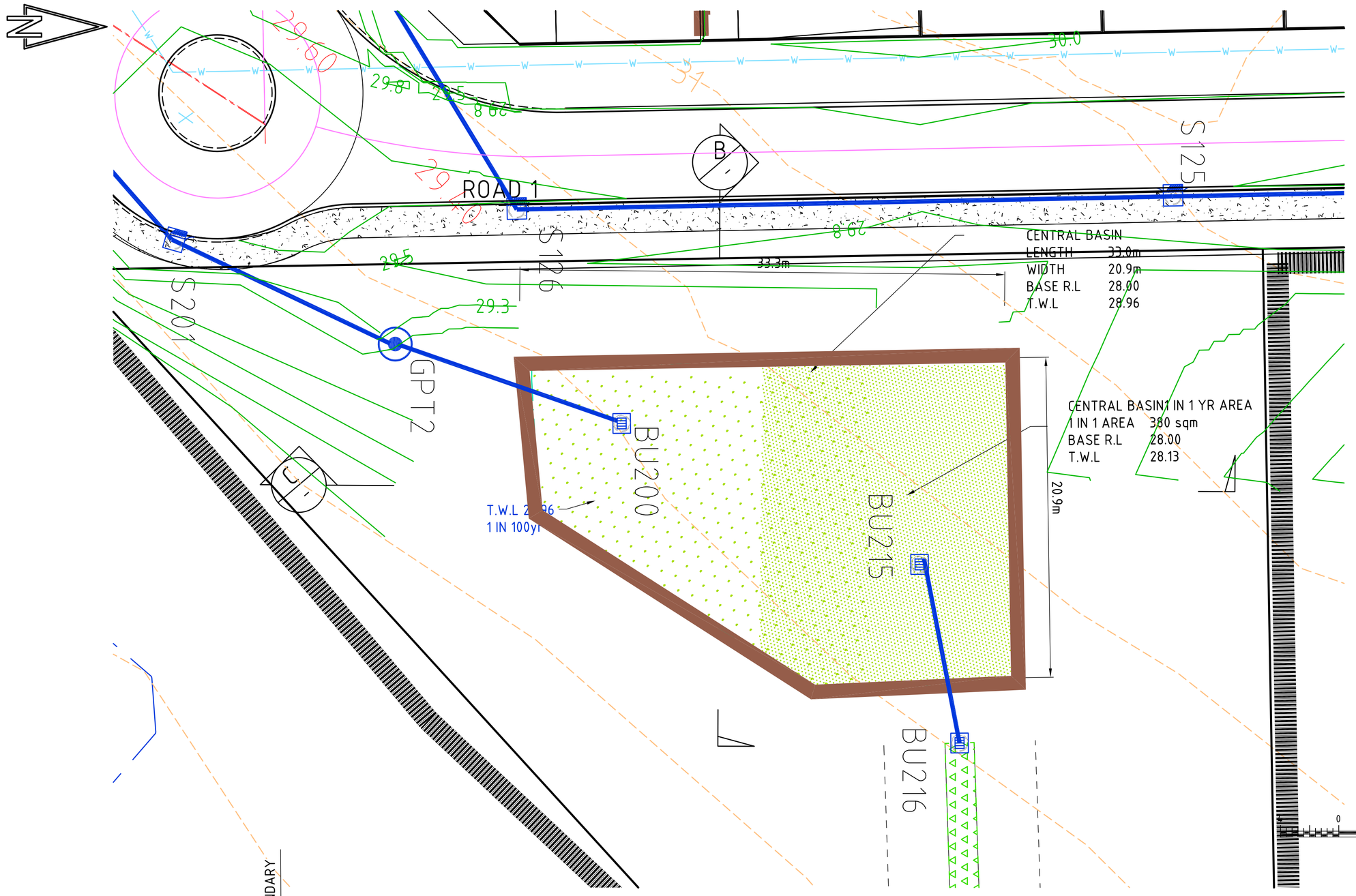

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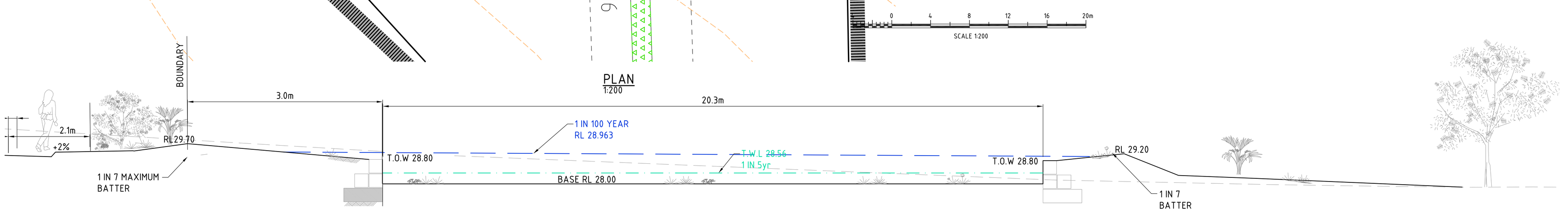
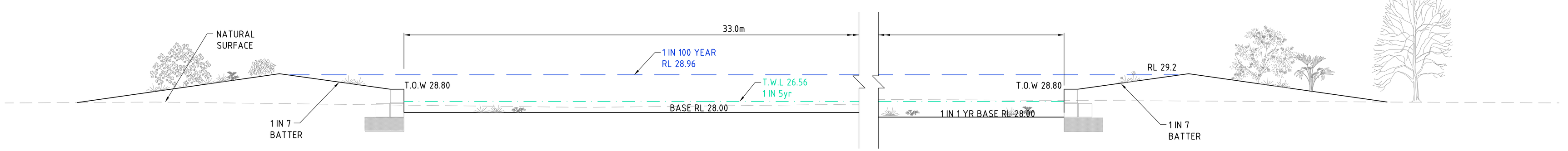


SECTION B
1:50

RCP PIPE



SECTION C
1:50

LEGEND

- 24.25 — FINISHED SURFACE CONTOUR
- ROAD CENTRELINE
- MOUNTABLE KERB
- SMK — SEMI-MOUNTABLE KERB
- FK — FLUSH KERB
- LIMESTONE RETAINING WALL
- DRAINAGE PITS & PIPE
- FOOTPATH
- LANDSCAPED INFILTRATION BASE
- 1 IN 1 YR INFILTRATION AREA

100Yr CRITERIA

MINIMUM STORAGE VOLUME REQUIRED:	590m³
DEPTH TO STORE REQUIRED VOLUME:	0.95m
BASE LEVEL	28.00m
1 IN 100 YR ARI LEVEL	28.96m
FREEBOARD PROVIDED	0.30m
STORAGE PROVIDED	740m³

5Yr CRITERIA

MINIMUM STORAGE VOLUME REQUIRED:	273m³
DEPTH TO STORE REQUIRED VOLUME:	0.14m
1IN 5 YR ARI LEVEL:	28.43m
SURFACE AREA:	636m²

1Yr CRITERIA

MINIMUM STORAGE VOLUME REQUIRED:	83m³
DEPTH TO STORE REQUIRED VOLUME:	0.131m
1 IN 1 YR ARI LEVEL	28.13m
SURFACE AREA:	636m²

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TITLE
CENTRAL RETENTION BASIN
LAYOUT & SECTION PLAN

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REV DATE DRN DSIGN DESCRIPTION

LEGEND

- ROAD CENTRELINE
- MOUNTABLE KERB
- SMK — SEMI-MOUNTABLE KERB
- FK — FLUSH KERB
- SEWER PIPE & PIT
- WATER PIPE & HYDRANT
- FOOTPATH
- DRAINAGE PIPE & PITS
- EXISTING ROAD EDGE
- EXISTING SEWER RETICULATION
- EXISTING WATER RETICULATION

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LEGEND

- ROAD EDGE
- DRAINAGE PIPE & PITS
- RETAINING WALL
- 1 IN 5 YEAR ARI FLOODING AREA
- DIRECTION OF FLOW WITHIN PIPED BOUNDARY
- ROAD PAVEMENT LEVEL

NOTE:
FOR ONE IN ONE YEAR ARI EVENT, THE STORMWATER WILL BE CONVEYED IN A SIMILAR MANNER TO THE ONE IN FIVE YEAR ARI EVENT AS SHOWN ON THE PLAN

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STORMWATER DRAINAGE UP TO 1 IN 5 YEAR ARI EVENT

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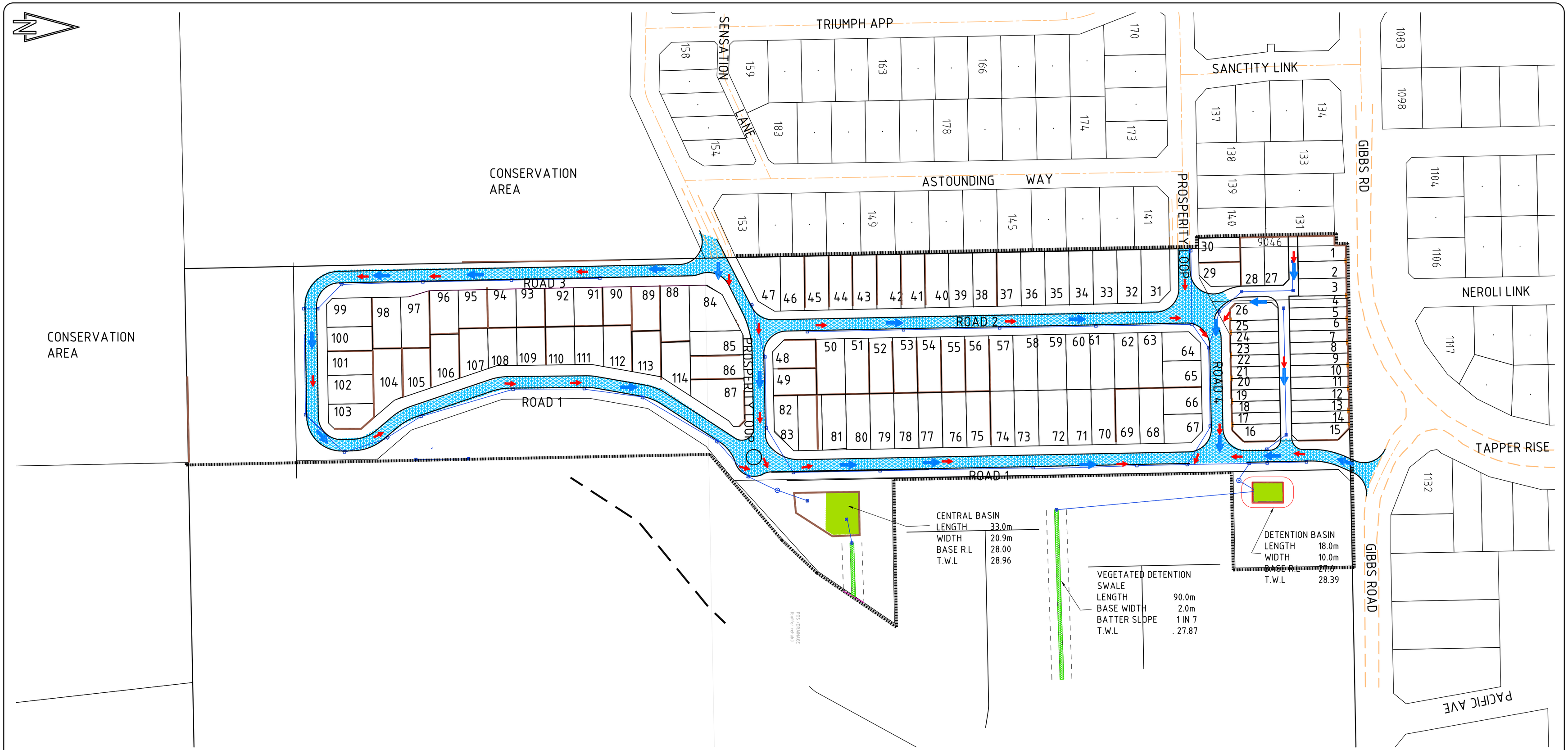

LEGEND

- ROAD EDGE
- DRAINAGE PIPE & PITS
- RETAINING WALL
- 1 IN 100 YEAR ARI FLOODING AREA
- OVERLAND FLOW
- DIRECTION OF FLOW WITHIN PIPED BOUNDARY
- ROAD PAVEMENT LEVEL

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TITLE
STORMWATER DRAINAGE UP TO 1 IN 100 YEAR ARI EVENT

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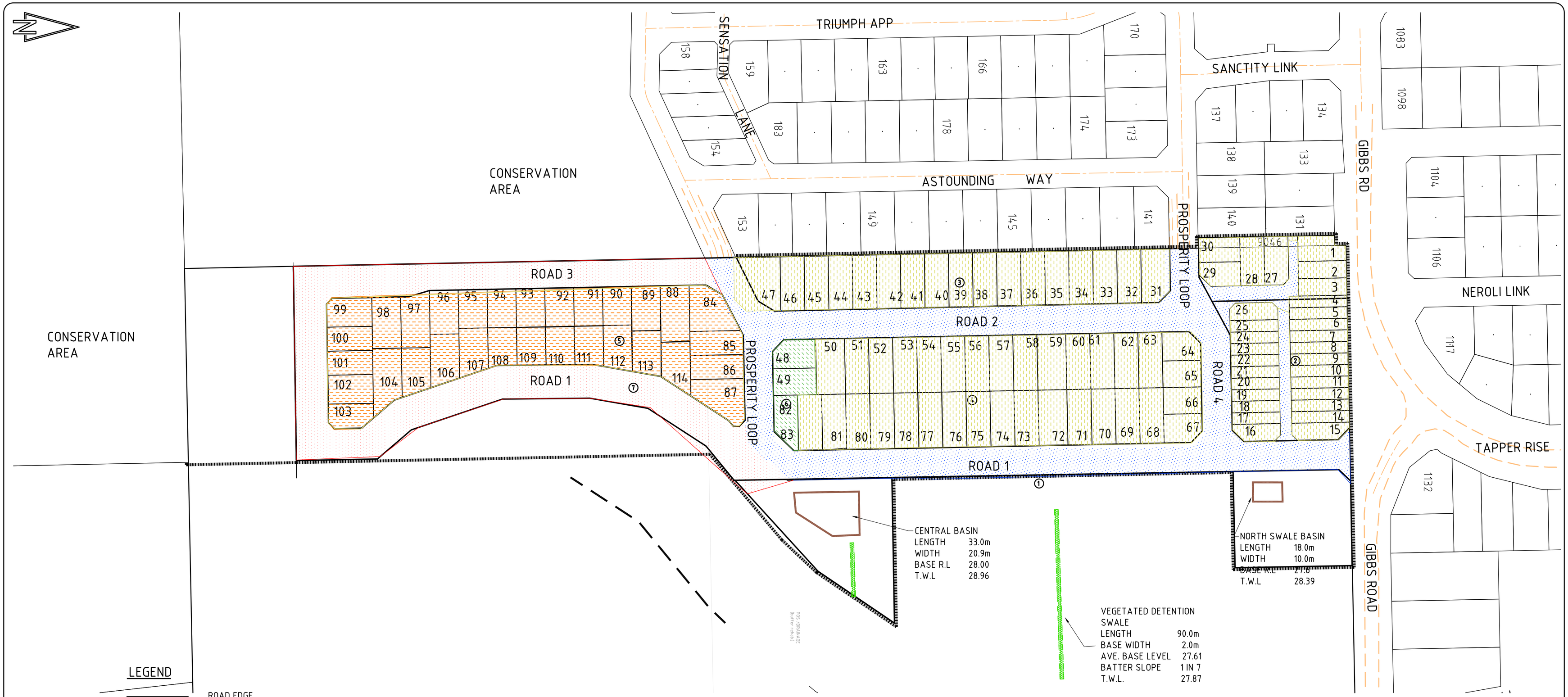

LEGEND

- ROAD EDGE
- DRAINAGE PIPE & PITS
- RETAINING WALL
- NORTHERN CATCHMENT AREA FOR 1 IN 1 YEAR ARI EVENT
- SOUTHERN CATCHMENT AREA FOR 1 IN 1 YEAR ARI EVENT
- NORTHERN CATCHMENT AREA FOR 1 IN 5 YEAR ARI EVENT
- SOUTHERN CATCHMENT AREA FOR 1 IN 5 YEAR ARI EVENT
- (5) CATCHMENT BOUNDARY No.

CATCHMENT AREA

No.	AREA (m^2)
1	12734.0
2	5820.0
3	6248.0
4	12743.0
5	10540.0
6	896.0
7	9653.0
TOTAL	58634.0

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TITLE
STORMWATER CATCHMENT PLAN
1 IN 1 & 1 IN 5 YEAR ARI EVENT

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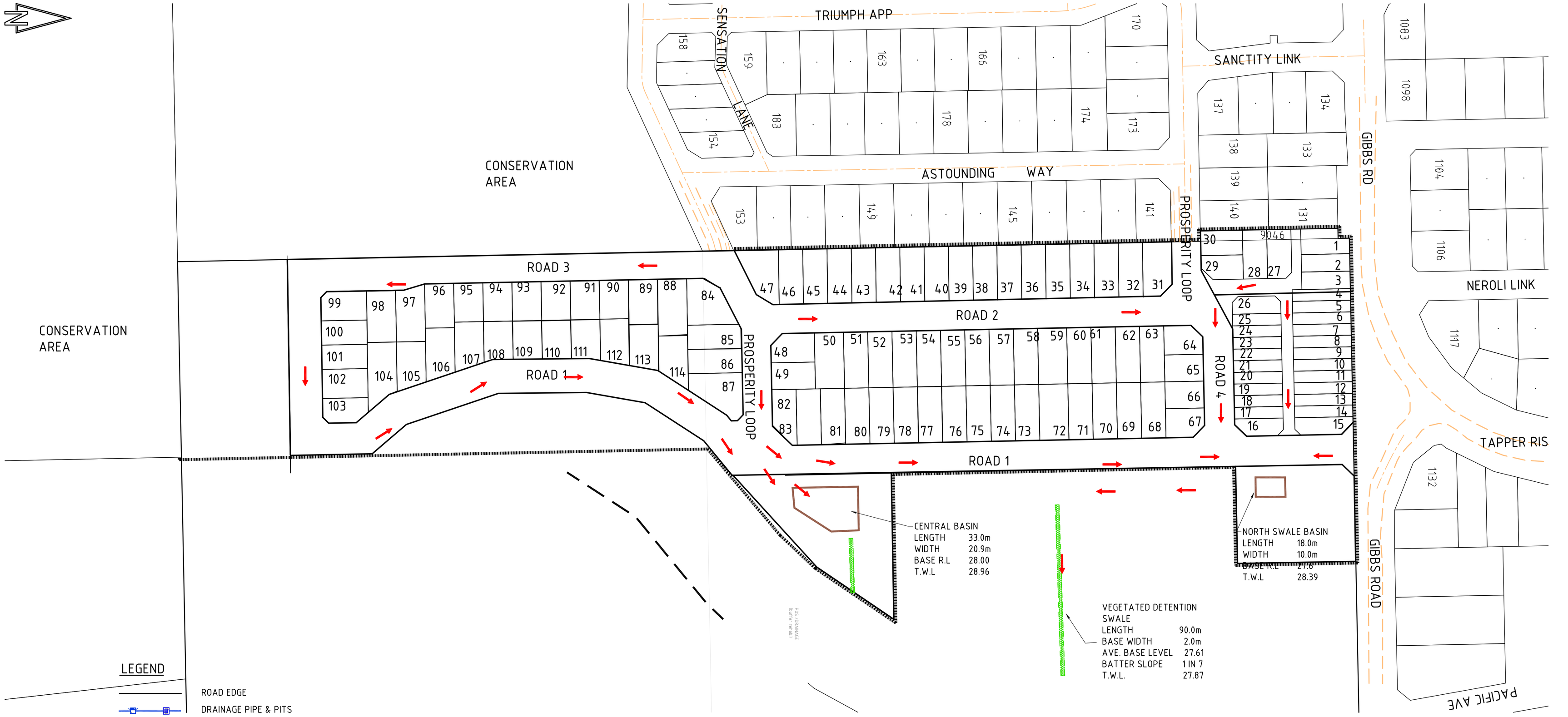

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STORMWATER CATCHMENT PLAN
1 IN 100 YEAR ARI EVENT

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Appendix E – XPSWWM RESULTS

XPSWWM PARAMETERS

A. METHODOLOGY

Laurenson routing method modelled for the 10 min, 30 min, 1 hr, 2hr, 6hr, 12hr and 72 hr storm events.

B. INFILTRATION

i. Road reserve 90 % of road reserve to be 100% impermeable, infiltration method Uniform Loss method with 0mm initial loss

ii. Lots allowed for 70% building/hardstand areas to be 100% impermeable, infiltration method Uniform Loss with 0mm initial loss

iii. Lots allowed for 30% infiltration to grass/landscape areas, infiltration method Horton with maximum infiltration rate 83mm/hr (2 m/day). The Bioscience 2012 report recommends 8.64 m/day, modelling has adopted a conservative value of 2 m/day with allowance for cloggage

C. LOT STORAGE

Allowance has been included at lot nodes for the storage of the 20 year 5 min ARI event.

D. DRAINAGE BASIN/POS

Modelling has allowed for infiltration in the of 3m/day and a reduce infiltration of 2m/day within the drainage basin and swale.

E. DRAINAGE NETWORK PLAN PROFILES

Figure E1 100 YEAR ARI – NORTH RETENTION SWALE CATCHMENT PLAN

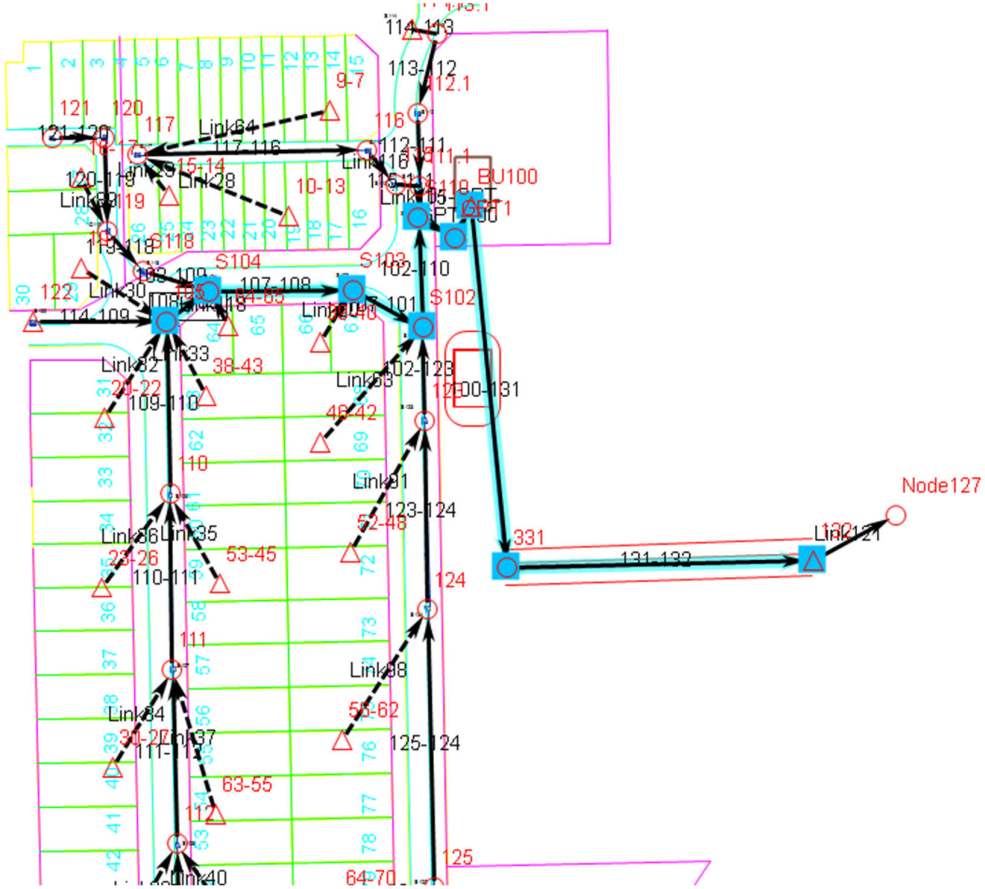


Figure E2 100 YEAR ARI – CENTRAL BASIN PIPELINE 206 TO RETENTION BASIN BUP 200

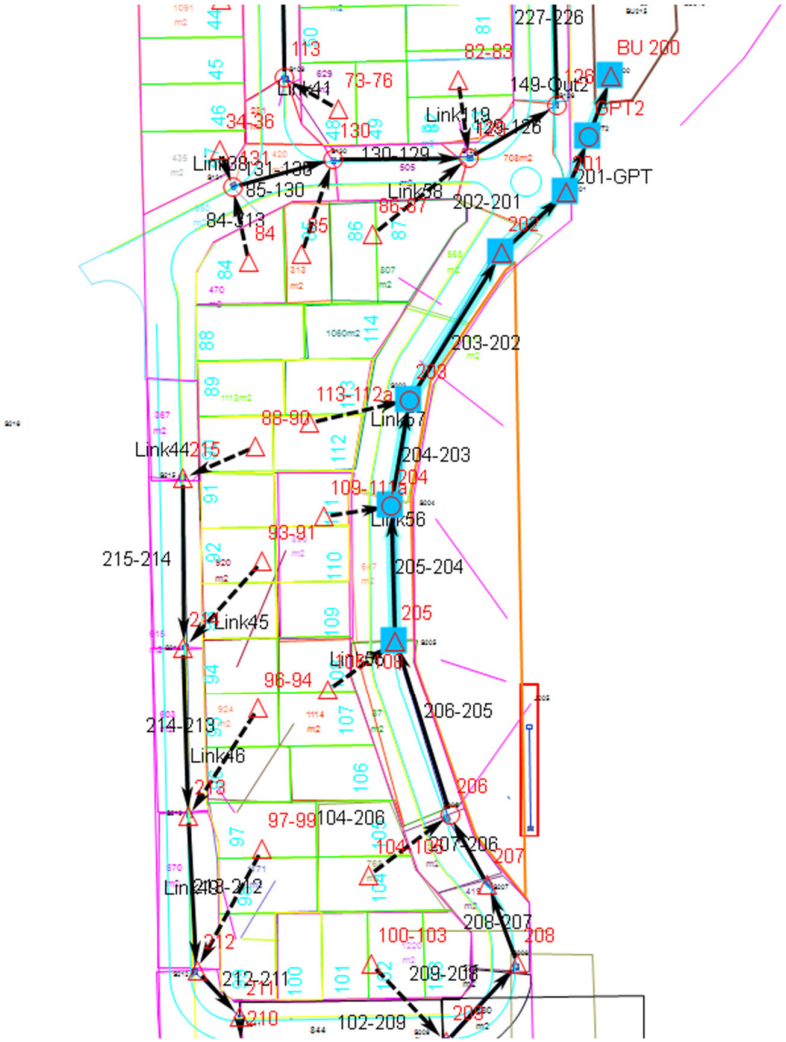
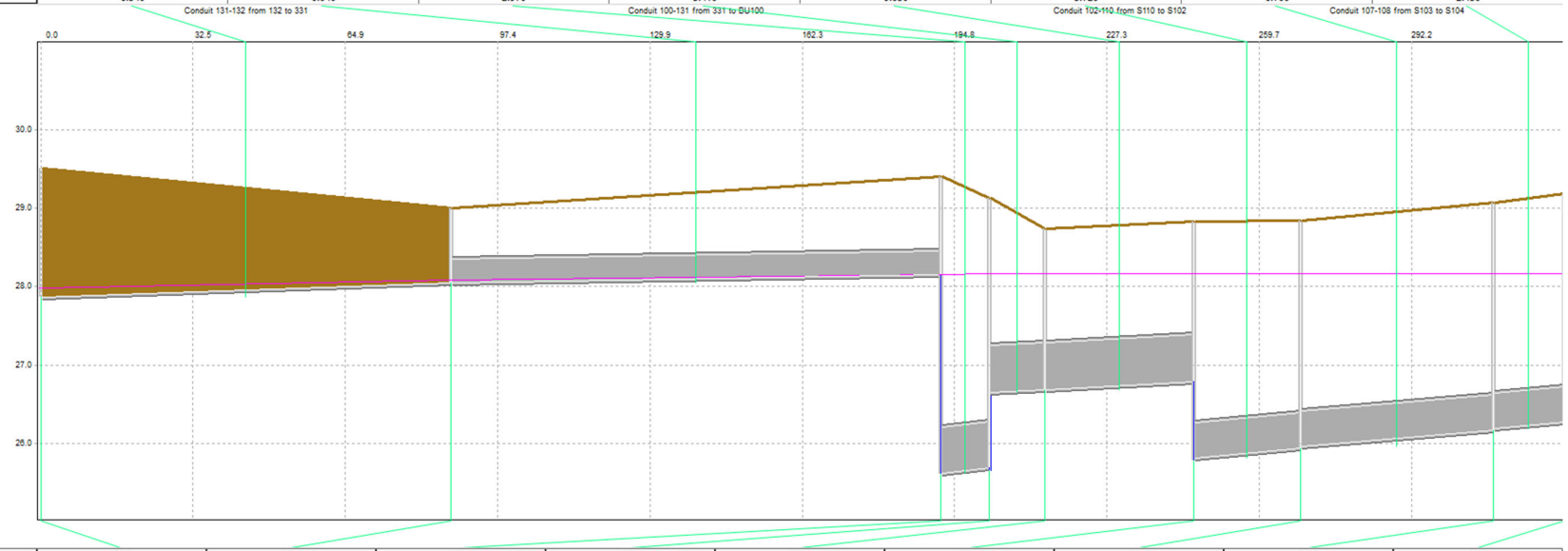


Figure E3 100 YEAR ARI – NORTH DETENTION BASIN AND VEGETATION SWALE PIPE PROFILE 212 TO BUBBLEUP OUTLET 100

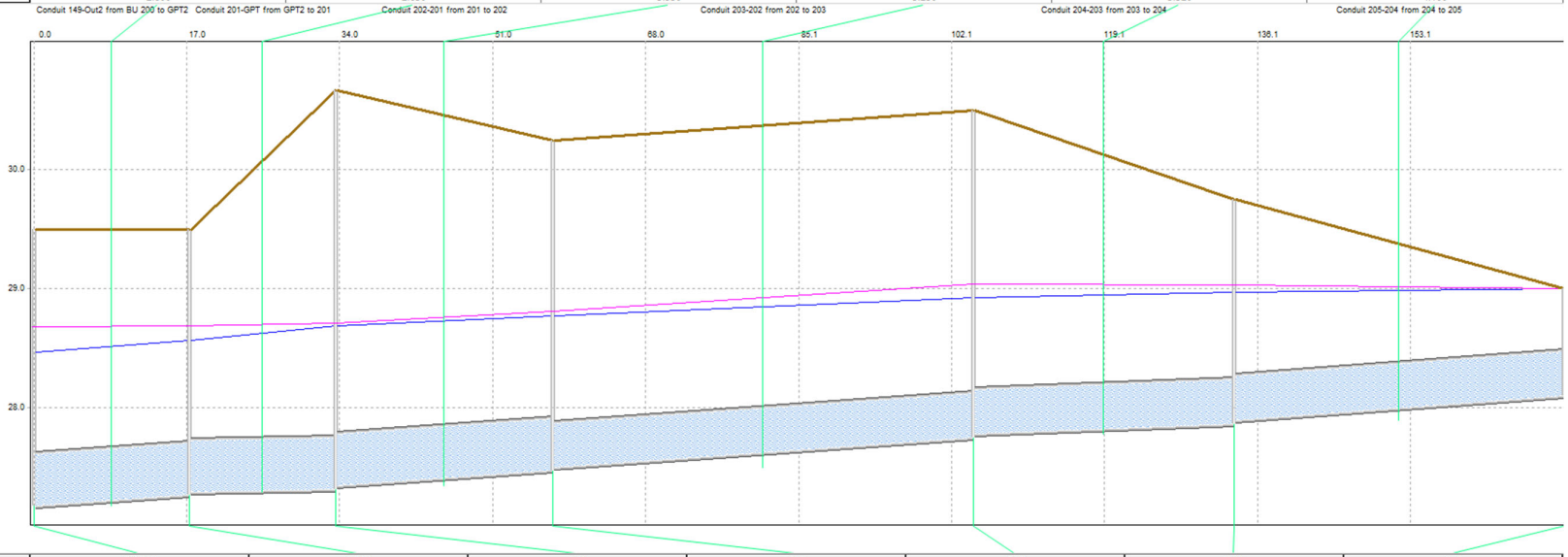
	131-132	100-131	GPT-100	101-GPT	102-110	107-101	107-108	108-109
Storm	Banjup 100yr 60m	Banjup 100yr 60m	Banjup 100yr 60m	Banjup 100yr 60m	Banjup 100yr 60m	Banjup 100yr 60m	Banjup 100yr 60m	Banjup 100yr 60m
Link Name	131-132	100-131	GPT-100	101-GPT	102-110	107-101	107-108	108-109
Max Flow	0.009	0.000	0.087	0.084	0.125	0.074	0.069	0.057
Total Flow	19.644	0.190	1207.600	1185.027	972.760	449.775	438.514	477.535
Max Velocity	0.140	0.060	0.310	0.580	0.900	0.460	0.630	0.580
Max Volume	6.340	0.040	2.970	3.410	9.030	3.720	6.700	2.430



	132	331	BU100	GPT1	S110	S102	S103	S104	105
Storm	Banjup 100yr 60m	Banjup 100yr 60m	Banjup 100yr 60m	Banjup 100yr 60m	Banjup 100yr 60m	Banjup 100yr 60m	Banjup 100yr 60m	Banjup 100yr 60m	Banjup 100yr 60m
Node Name	132	331	BU100	GPT1	S110	S102	S103	S104	105
Ground Elevation (Spill Crest)	29.500	29.000	29.400	29.133	28.741	28.826	28.840	29.071	29.189
Maximum Crown Elevation	29.300	28.500	29.400	27.250	28.741	27.600	27.900	27.800	27.800
Max Water Elevation	27.978	28.081	28.160	28.162	28.165	28.166	28.166	28.166	28.166
Time of Maximum HGL	1.167	0.683	2.283	2.283	2.267	2.267	2.250	2.233	2.200

Figure E4 100 YEAR ARI –CENTRAL RETENTION BASIN PIPE PROFILE 206 TO BUBBLEUP OUTLET 200

	149-Out2	201-GPT	202-201	203-202	204-203	205-204
Storm	Banjup 100yr 60m	Banjup 100yr 60m	Banjup 100yr 60m	Banjup 100yr 60m	Banjup 100yr 60m	Banjup 100yr 60m
Link Name	149-Out2	201-GPT	202-201	203-202	204-203	205-204
Max Flow	0.136	0.134	0.122	0.113	0.058	0.078
Total Flow	644.230	643.038	629.813	614.100	201.264	147.122
Max Velocity	0.850	0.830	0.760	1.060	0.520	0.700
Max Volume	2.800	2.630	3.930	5.250	3.320	4.100



	BU 200	GPT2	201	202	203	204	205
Storm	Banjup 100yr 60m	Banjup 100yr 60m	Banjup 100yr 60m	Banjup 100yr 60m	Banjup 100yr 60m	Banjup 100yr 60m	Banjup 100yr 60m
Node Name	BU 200	GPT2	201	202	203	204	205
Ground Elevation (Spill Crest)	29.500	29.500	30.668	30.250	30.500	29.750	29.000
Maximum Crown Elevation	27.620	27.740	27.790	27.920	28.230	28.275	28.700
Max Water Elevation	28.687	28.691	28.713	28.816	29.045	29.037	29.000
Time of Maximum HGL	1.967	1.850	1.567	0.600	0.533	0.600	0.367

Figure E5 100 YEAR ARI – NORTH BASIN STORAGE

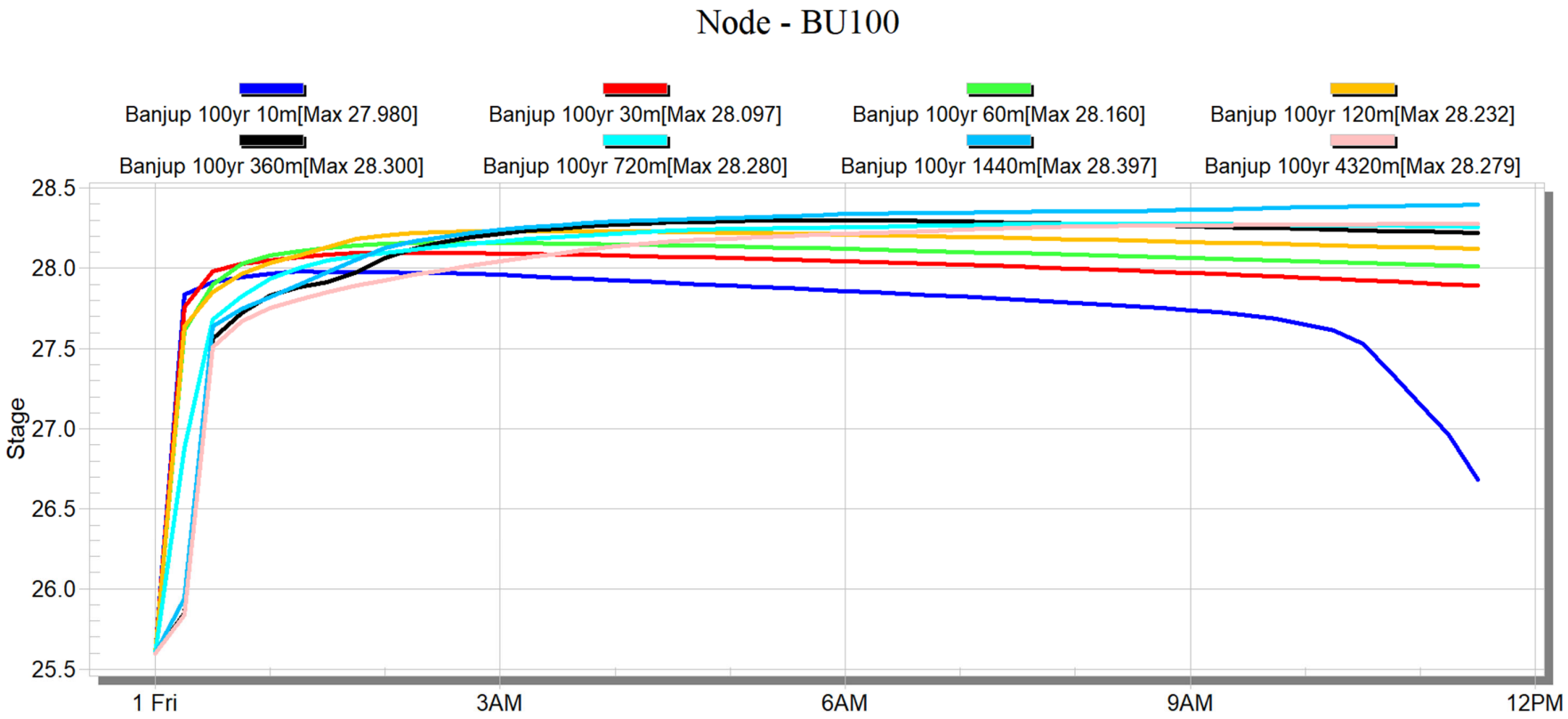


Figure E6 100 YEAR ARI –CENTRAL BASIN STORAGE

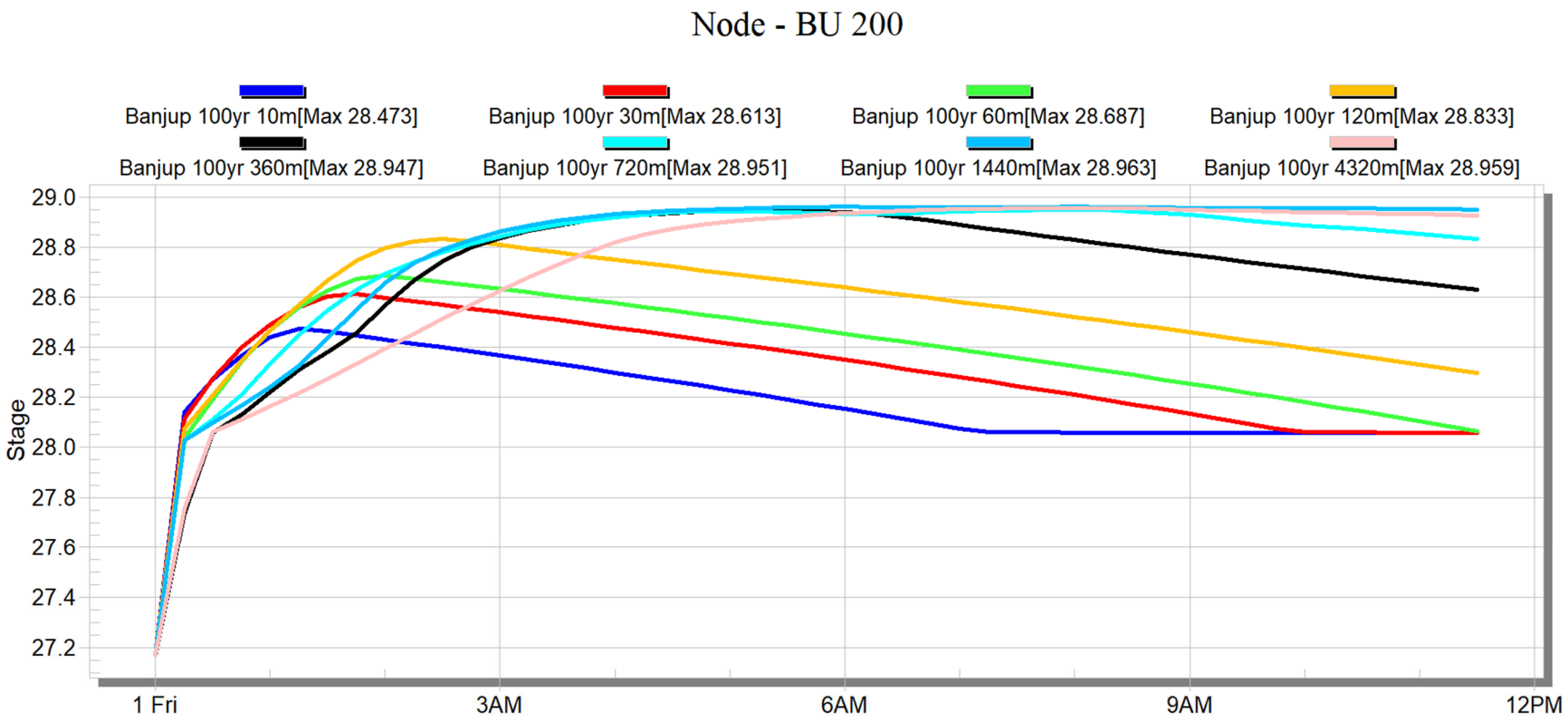


Figure E7 5 YEAR ARI – NORTH DETENTION BASIN AND VEGEATAION SWALE STAGE DISCHARGE

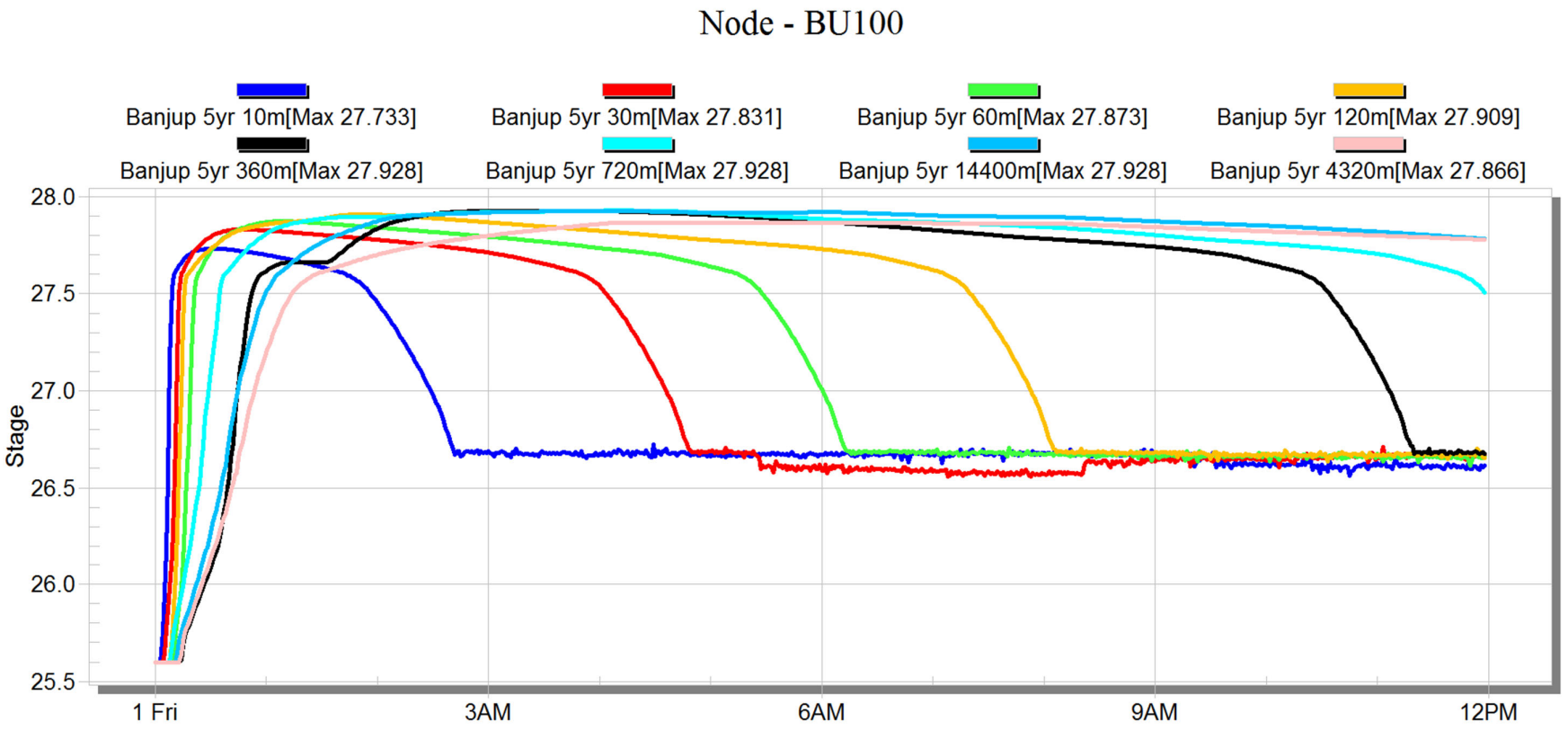
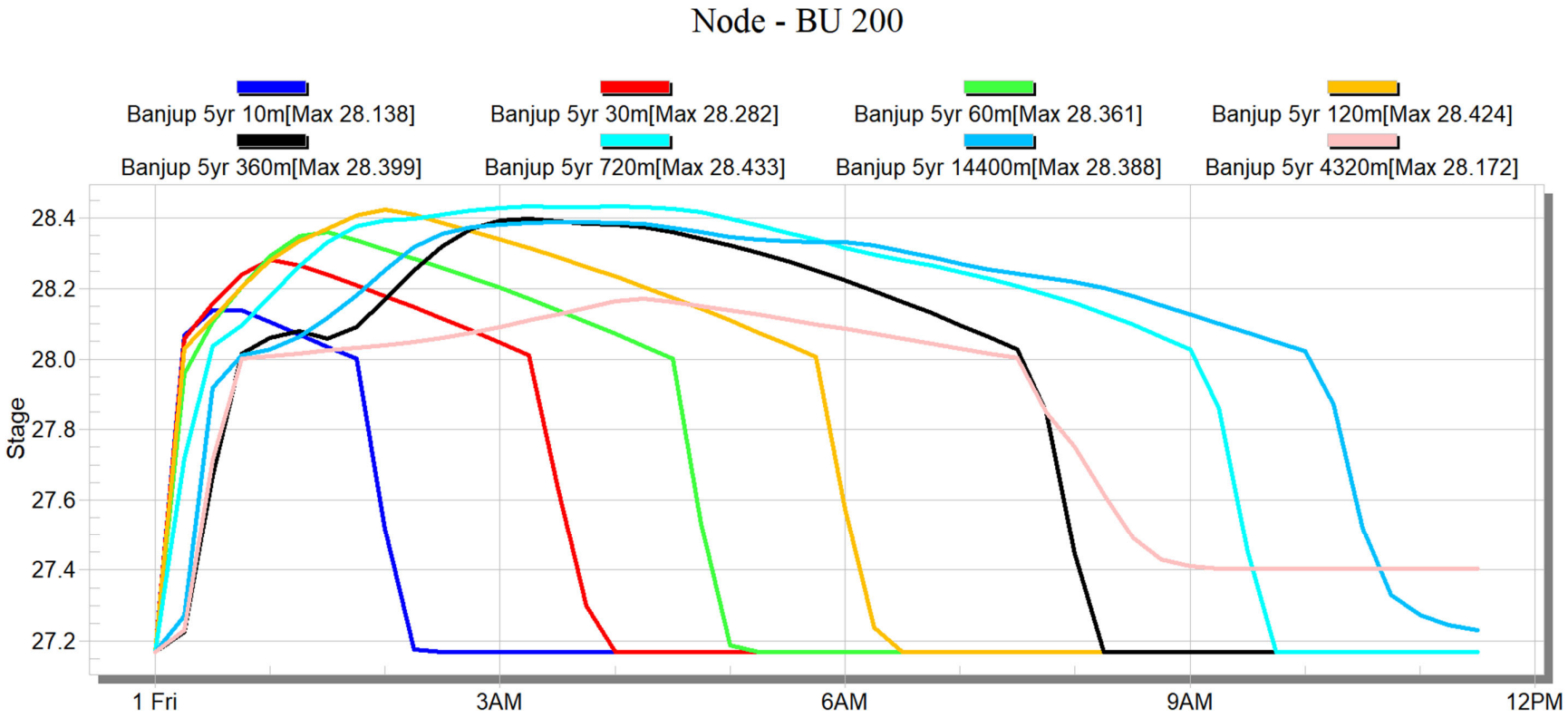


Figure E8 5YEAR ARI –CENTRAL RETENTION BASIN STAGE DISCHARGE



F. XPSWWM RESULT TABLES

Figure F1 100 YEAR ARI – PIPE NETWORK DETAILS

PIPE LENGTH	Diameter (Height) m	Pipe Length	Design Full Flow cms	Design Velocity ft/s	Max Flow cms	Max Velocity m/s	Max Flow/Design Flow (fraction) %	Max Water Depth m	Max Water Depth m
100-131	0.3	104.34	0.03	0.39	0.009	0.35	0.34	2.68	0.093
101-GPT	0.6	11.95	0.33	1.17	0.081	0.59	0.262	1.599	2.634
102-110	0.6	31.63	0.32	1.13	0.089	0.81	0.277	2.501	1.599
102-123	0.3	26.59	0.16	2.27	0.052	0.86	0.328	2.336	2.501
103-109	0.3	19.55	0.07	1	-0.016	0.5	0.283	1.194	2.124
107-101	0.45	22.8	0.19	1.21	0.038	0.37	0.228	2.352	2.501
107-108	0.45	41.12	0.18	1.16	0.038	0.6	0.237	2.124	2.352
108-109	0.45	14.97	0.19	1.22	0.039	0.56	0.205	2.015	2.124
109-110	0.3	49.23	0.06	0.91	0.062	0.87	0.977	1.522	2.015
110-111	0.3	50.58	0.06	0.88	0.075	1.05	1.218	1.559	1.522
111-112	0.3	49.46	0.09	1.3	0.047	1.12	0.506	1.158	1.559
112-111	0.375	20.74	0.01	0.1	0.014	0.13	1.339	1.084	1.942
112-113	0.3	50.13	0.19	2.7	0.015	1.25	0.078	0.657	1.158
113-112	0.3	23.35	0	0.06	0.008	0.11	1.956	2.081	1.084
114-109	0.3	38.05	0.06	0.9	-0.014	-0.22	0.562	2.395	2.015
115-111	0.3	7	0	0.06	0.004	0.05	0.912	1.618	1.942
117-116	0.3	65.52	0.06	0.89	-0.004	0.35	0.077	0.564	1.978
119-118	0.3	15.31	0.06	0.86	-0.011	0.43	0.225	1.095	1.194
120-119	0.3	26.8	0.06	0.88	0.011	0.46	0.189	0.935	1.095
123-124	0.3	54.27	0.07	1.03	0.051	0.82	0.701	2.081	2.336
125-124	0.3	78.98	0.07	1.04	0.05	0.88	0.689	1.604	2.081
129-126	0.3	27.79	0.09	1.28	0.09	1.3	1.003	2.043	2.055
130-129	0.3	36.64	0.22	3.15	0.018	1.12	0.079	0.657	2.043
131-130	0.3	28.25	0.14	1.97	0.009	0.96	0.067	0.089	0.657
131-132	0.45	87.55	1.01	0.69	0.009	0.13	0.009	0.093	0.272
149-Out2	0.45	17.37	0.19	1.2	0.107	0.67	0.561	1.699	1.781
201-GPT	0.45	16.23	0.09	0.58	0.106	0.66	1.14	1.658	1.699
202-201	0.45	24.08	0.19	1.22	0.101	0.68	0.518	1.506	1.658
203-202	0.375	46.77	0.12	1.08	0.098	1.03	0.827	1.243	1.506
204-203	0.375	29	0.09	0.82	0.047	0.42	0.514	1.127	1.243
205-204	0.375	36.65	0.12	1.09	0.077	0.69	0.644	0.9	1.127
206-205	0.45	49.68	0.25	1.6	0.103	0.85	0.404	0.59	0.9
207-206	0.375	21.4	0.16	1.46	0.09	1.14	0.559	0.448	0.59
208-207	0.3	22.89	0.09	1.3	0.086	1.21	0.934	0.681	0.448
209-208	0.3	28.56	0.09	1.26	0.082	1.14	0.919	0.869	0.681
210-209	0.3	55.36	0.09	1.28	0.069	1.16	0.761	0.551	0.869
211-210	0.3	7.98	0.1	1.42	0.067	1.26	0.665	0.465	0.551
212-211	0.3	17.09	0.09	1.27	0.065	1.21	0.722	0.336	0.465
213-212	0.3	41.9	0.06	0.88	0.048	0.92	0.77	0.235	0.336
214-213	0.3	45.88	0.06	0.9	0.035	0.86	0.558	0.167	0.235
215-214	0.3	45.76	0.06	0.9	0.019	0.75	0.297	1.114	0.167
227-226	0.3	45.37	0.06	0.9	0.097	1.34	1.513	2.055	1.604
GPT-100	0.6	10.29	0.47	1.66	0.054	0.31	0.195	2.634	2.68

APPENDIX 7

ENGINEERING SERVICES REPORT

ROWE GROUP DESIGN

ochrewest.com.au

Lots 11 & 74 Beenyup Road, Banjup

ENGINEERING SERVICES REPORT

Document No: 16015/02 Rev 0 APRIL 2020

Project : Lots 11 & 74 Beenyup Road, Banjup

OCHREWEST
CONSULTING ENGINEERS

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APPENDICES

Appendix A: Bioscience Geotechnical Investigation
Appendix B: OWCE Preliminary Engineering
Appendix C: Water Corporation Service Details

1 INTRODUCTION

1.1.1 Purpose of Report

Ochre West Consulting Engineers (OWCE) has been commissioned by Aigle Royal Developments (ARD) to assess the engineering servicing requirements of the proposed urban development of part of lots 11 & 74 Beenyup Road, Banjup. This report is supplied to support the application by ARD for approval of a Local Structure Plan (LSP) over the subject area.

The site is located south west of the Gibbs Road and Beenyup Road intersection bound by a residential development to the west, Woodland Park to the south, and remainder of lots 11 & 74 to the east, approximately 23km south of the Perth CBD as shown in Figure 1

The landholding is currently zoned for Development as part of Development Area 11 under the City of Cockburn's (CoC) Local Town Planning Scheme, which is not a Development Contribution Area.

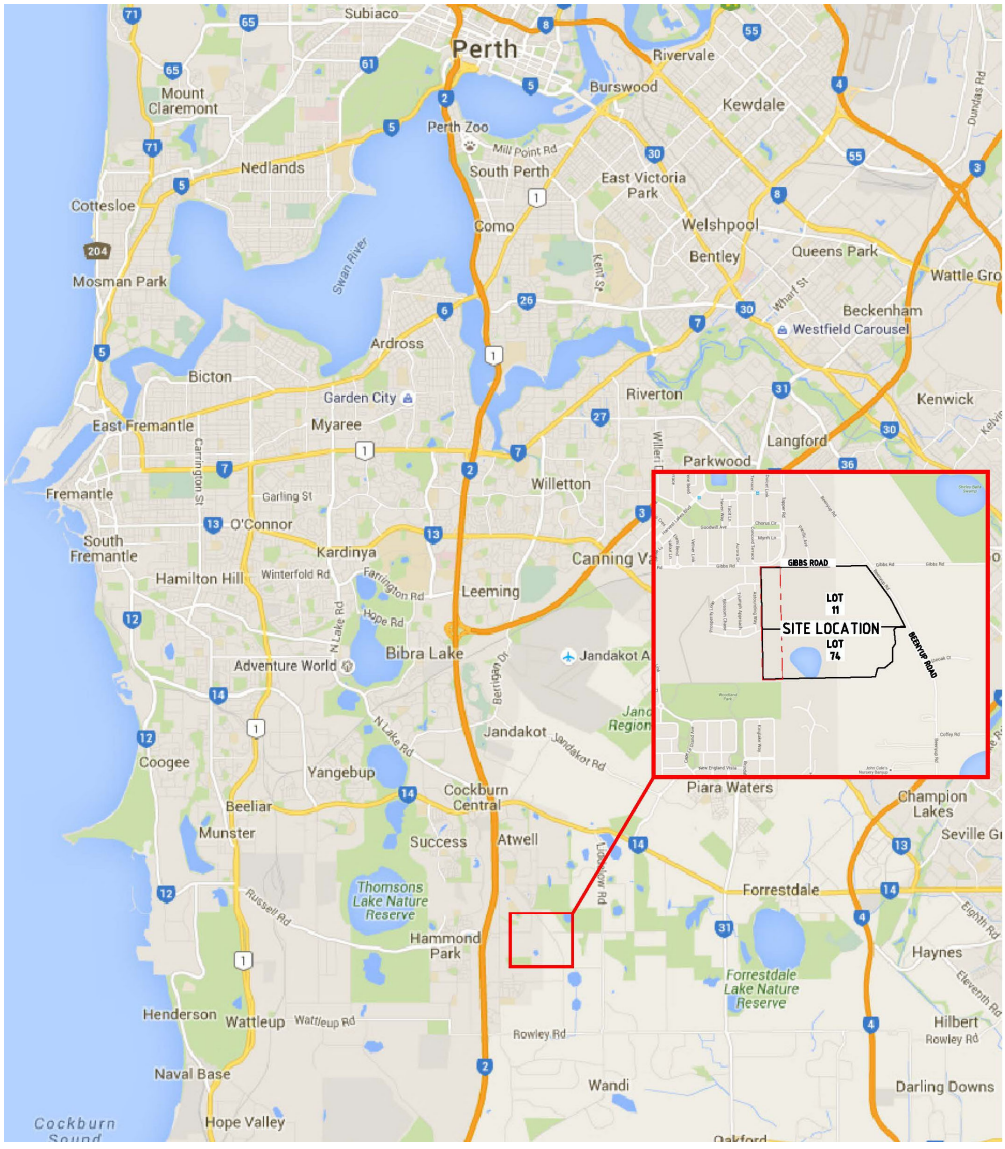


Figure 1 Locality Plan

1.1.2 Study Brief

The study brief include following key activities:

- Review of the subdivisional layout provided by (ARD).
- An appraisal of engineering servicing requirements for the site.
- Identify key infrastructure requirements.

1.1.3 Terms of Reference

This report has been compiled based on the following terms of reference:

- Perth Groundwater Atlas (Department of Water website)
- Bioscience Geotechnical Investigation
- 360 Environmental Study
- Consultation with the Water Corporation, Local Council, and various other service authorities in relation to servicing requirements for the site description

The site comprises of two lots Lot 11 (22.71 Ha) and Lot 74 (18.68 Ha) with a total area of approximately 41.39 hectares.

A western portion of both lots 11 and 74, approximately 5.7 ha is zoned as Urban Deferred and is the subject of the proposed development. The remainder of the site is zoned as Rural - Water Protection under the Metropolitan Region Scheme (MRS).

There is currently no District Structure Plan (DSP) prepared for the site. A Local Structure Plan (LSP) for which this document is intended to support has been prepared by ARD. A preliminary development lot layout for which this Engineering Report has been based on is illustrated in Figure 2.

Figure 2 Proposed Local Structure Plan

A preliminary lot layout has been developed for stage 1 study purposes as shown in Figure 3

Figure 3 Proposed Lot Layout

1.2 PREVIOUS USE

The entirety of lots 11 & 74 Beenyup Road, Banjup were previously a Resource zone before the proposed development was reclassified as a Development zone under the City of Cockburn's (CoC)'s Town Planning Scheme (TPS). The current land is mostly covered by native bush and trees with minimal clearing in the centre of lot 11 for a residence and access tracks built in the early 1990's. In the mid 2010's the land to the west was developed as part of the Aubin Grove structure planning and rezoning of the area to urban residential.

1.3 TOPOGRAPHY

The western portion of the site and area identified as the *Study Area* and subject of this structure plan is relatively steep with 80% of the *Study Area* with an average gradient of upto approximately 7% from west to east.

A small section of approximately 0.90 Ha grades to the north west of Lot 11 towards Gibbs Road.

The remainder of the site referred to as Rural – Water Protection area can be described a gently sloping and grade to the central CCW location.

Lot 11 has a high point of approximately RL 34m AHD in the north west, sloping to the south east low level of 27m AHD. Lot 74 has a high point level of RL 31m AHD in the north west corner grading east to a low level of RL 26m AHD before rising to 34m AHD at the southern boundary. Refer to Figure 3.

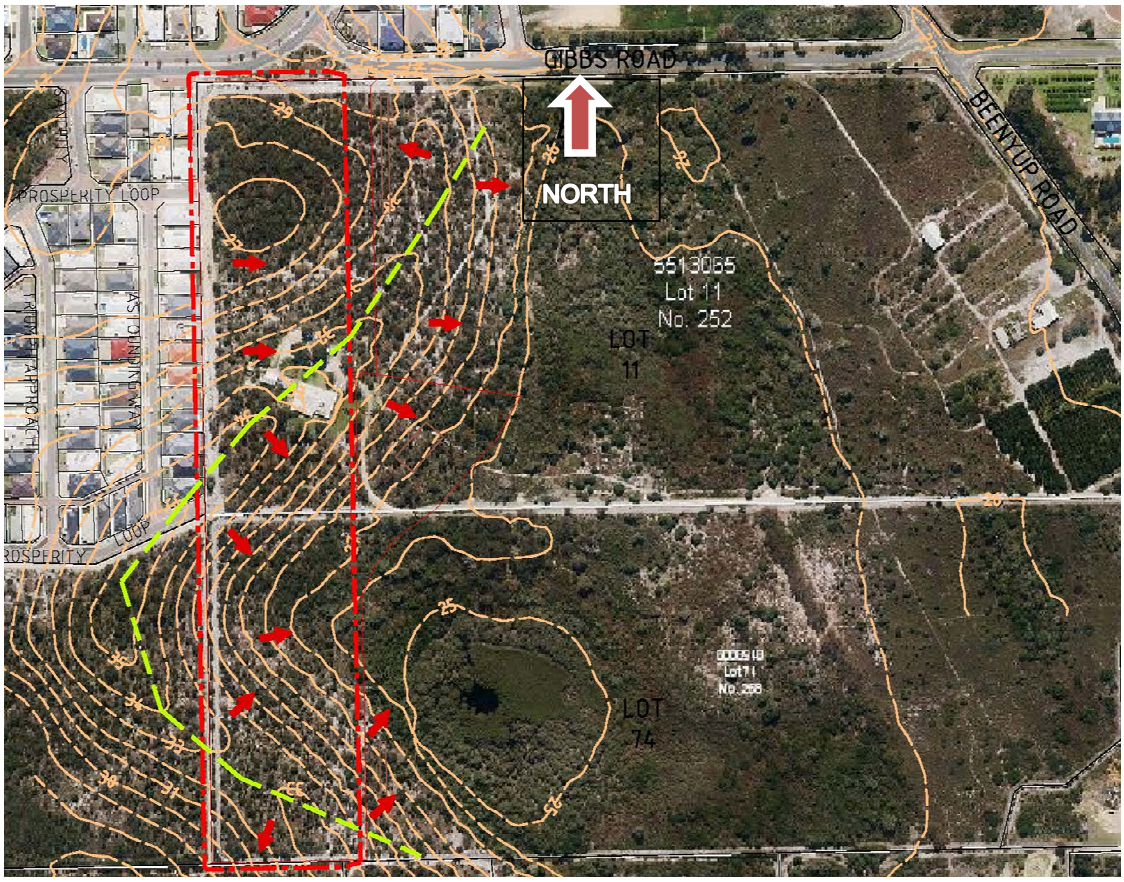


Figure 4 Topography Plan

1.4 VEGETATION

A vegetation survey completed by Bioscience in 2012 prior to the 360 Environmental study, found the majority of the site consisted of Banksia, Melaleuca, Kunzea, or Eucalyptus woodlands. Parts of the site are considered to be 'Completely Degraded' due to human disturbances such as tracks, a residence and a nursery. The remaining area in the site that has been left uncleared remains in 'Good' to 'Excellent' condition

1.5 GEOLOGY

Geological mapping indicates the site is comprised of predominately sandy soils of the Bassendean Sand surface geology type which was confirmed through a preliminary geotechnical investigation by Bioscience (2012).

A preliminary geotechnical investigation was undertaken by Bioscience in September 2011, the investigation included the drilling of twelve piezometers, and the laboratory testing of selected samples, the investigation report is attached as Appendix A.

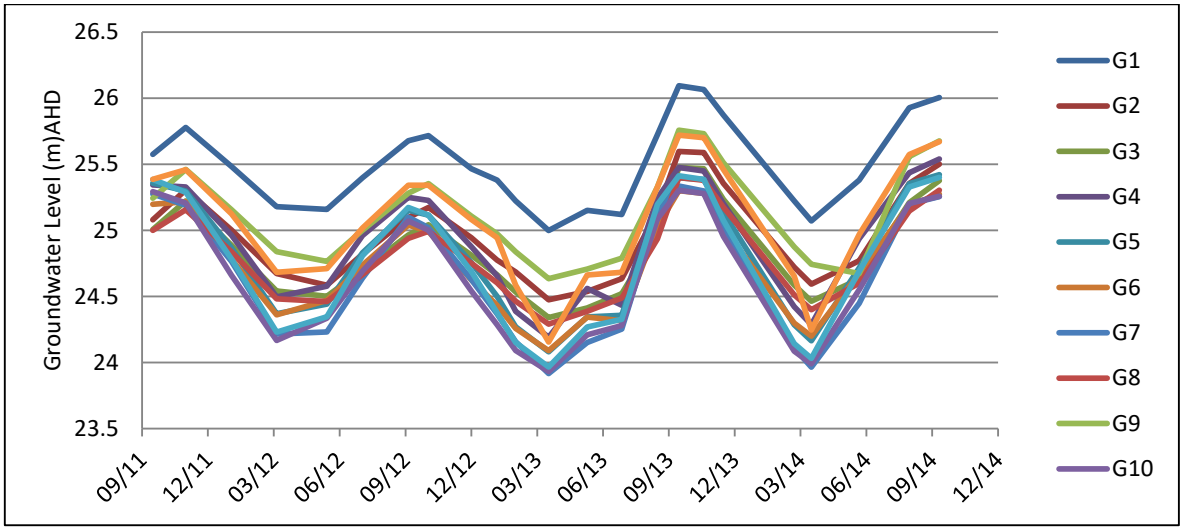
The investigation confirmed site profiles are as described in Geological Mapping consisting of sandy black topsoil overlaying a white/grey/brown, medium, sub-angular sand layer, down to a depth of 9 m below ground level. In some bores a dark brown, non-cemented coffee rock was observed.

1.6 GROUNDWATER

Initial desktop study of Perth Groundwater Atlas, indicates the groundwater levels range from 24mAHD at the north west of Lot 11 to 24.5 m AHD on the south west side of the project site near Beenyup road. The groundwater level for the *Study Area* is approximately 24.0m AHD.

12 monitoring were installed by Bioscience during the 2011. This data set captured three winter peaks and the bore monitoring results collated are detailed in Appendix A.

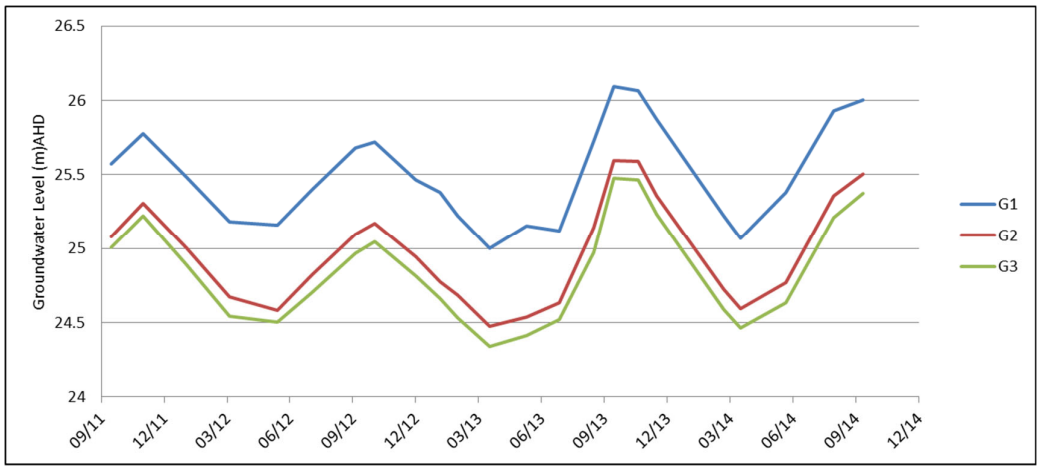
Groundwater levels from the 12 onsite monitoring bores varied from 26.0m AHD to 23.92m AHD. Representation of groundwater data collation is shown in Graph 1



Graph 1: Time Series Groundwater Level Data

There are 3 monitoring bores located within the *Study Area* Bores G1, G2 and G3.

Representation of the monitored groundwater levels for the 3 bores is shown in Graph 2



Graph 2: Time Series Groundwater Level Data Bores G1, G2 and G3

The site resides within the boundary of the Russell Road Arterial Drain Scheme (DWA, 2003) and has Control Groundwater Levels (CGL) between 25.0m AHD and 25.25m AHD. Data collected between September 2011 and September 2014 from three groundwater monitoring bores installed in lots 11 & 74 are comparable to the CGLs from the Russell Road Arterial Drain Scheme.

1.7 ACID SULFATE SOILS

Perth Groundwater Atlas mapping for Acid Sulfate Soils (ASS) classified the site to be an area of Class 2 - Moderate to low risk of ASS occurring within depths of 3m from the surface, but high to moderate risk of ASS beyond 3m of natural soil surface. Refer to Figure 4. Where ASS is to be disturbed as part of the development comprehensive management plans and measures will need to be implemented. Should deep excavation work such as sewer installation and/or subsoil drainage be likely to cause potential disturbance, a suitable Acid Sulfate Soil Management Plan (ASSMP) will be prepared and implemented.

1.8 WETLANDS

A Conservation Category Wetland (CCW) exists to the east of the site (in the centre of both lots 11 and 74) while a Resource Enhancement Wetland (REW) is located in the eastern portion of lot 74.

1.9 EXISTING BUILDING

As mentioned earlier, the majority of the site remains uncleared and undeveloped however there is a habitable building located on the western edge of lot 11 which will require demolition.

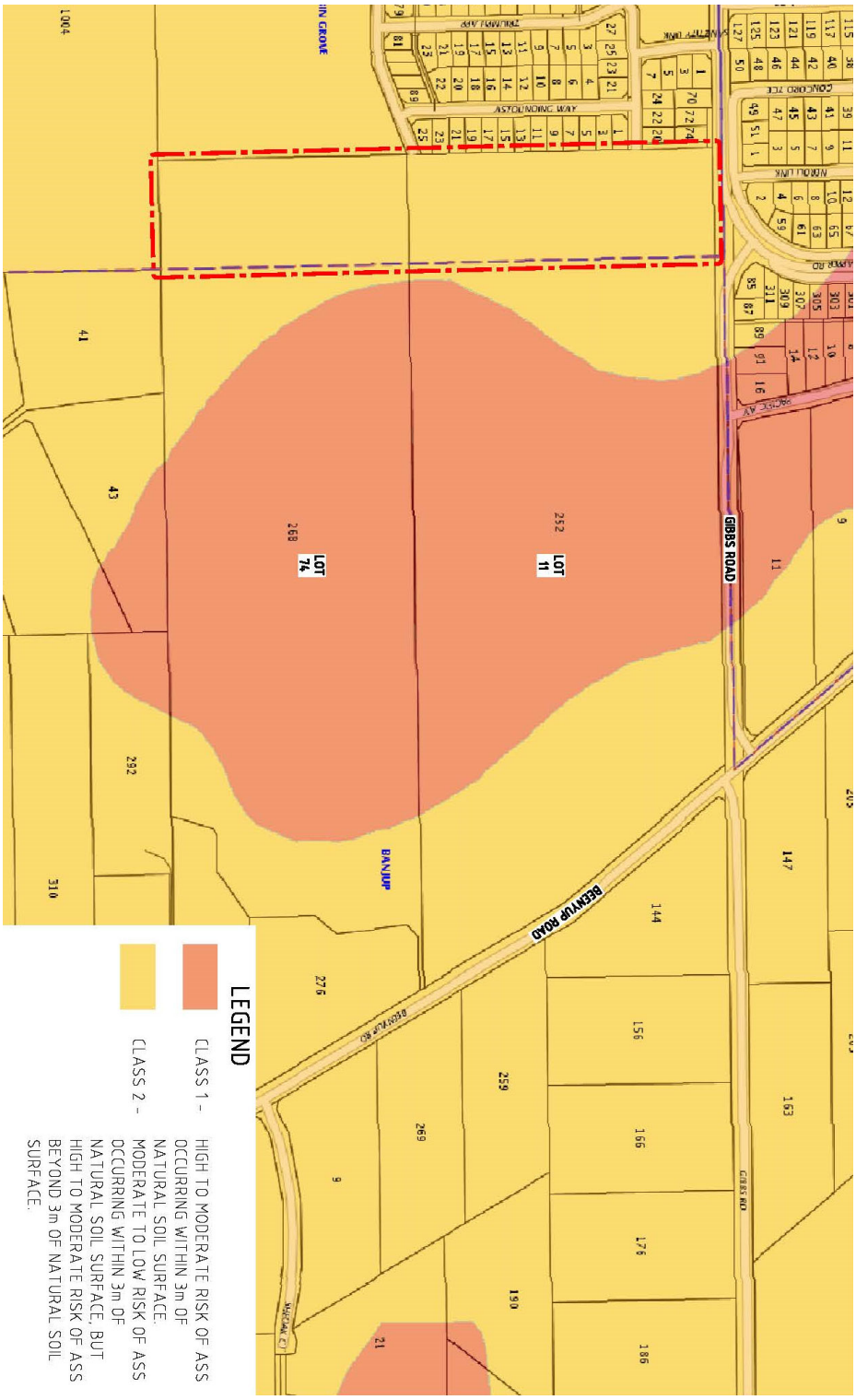


Figure 5 Perth Groundwater Atlas mapping for Acid Sulphate

2 BULK EARTHWORKS

The majority of the site remains undeveloped and is covered with natural vegetation.

Preparatory earthworks are expected to include the following:

- Demolition of existing structures.
- Stripping and clearing of areas (clear existing vegetation).
- Removing topsoil and storing for future use.
- Cut to fill earthworks to form flat building pads
- Installation of retaining walls

Earthworks design will be determined assuming flat sand pads will be required for the limited size of individual lots

It is expected that earthwork operations will be balanced with good quality sand fill available from excavations.

3 ROADWORKS

The internal road network will be designed to meet the City of Cockburn standards with a minimum 6.0m kerbed carriageway.

The LSP indicates location of a shared path network prosed for this development, concrete pathways shall be provided upto 2.4 metres in width.

A preliminary Road Layout plan is attached as drawing 16015-C-102 in Appendix B.

4 SEWER RETICULATION

Details of the Water Corporation Wastewater Planning is attached as Appendix C and shows the Study Area subject to the application is within Thomson's Lake Sewer District catchment boundary of the existing sewer located in Gibbs Road

The Wastewater connection is available from two locations:

1) from the existing 150mm dia sewer located on Prosperity Loop and
2) From existing 150mm dia stub located on Gibbs Road.

5 WATER RETICULATION

The Water Corporation have indicated there is not yet a detailed water reticulation plan for this area but will looked at when a structure plan is advertised.

Water Services to the subdivision of this land will be most likely served by mains extension from the existing network in the subdivision to the west of the site.

The Water Corporation has also identified that the single feed 150P main in Sanctity Loop will potentially not have the capacity to service both subdivisions and that an additional 150P feed may need to be run from the 250P main along Gibbs Road.

A preliminary services location plan is attached as drawing 16015-C-007 in Appendix B.

6 POWER, TELECOMUNICATIONS AND GAS

6.1 POWER

Western Power Mapping indicates there is existing HV overhead power reticulation servicing the habitual building on lot 11 from Beenyup Road to the east and both HV and LV underground power reticulation in the

subdivision to the west. The existing underground reticulation would be the suitable connection point for any proposed development of lots 11 & 74.

6.2 TELECOMUNICATIONS

NBN Co has advised that there are underground facilities in the vicinity of the site. The most likely connection to this existing infrastructure will be from the development to the west.

6.3 GAS RETICULATION

There are existing high pressure 40 PE and 110 PE ATCO gas pipelines on the northern and southern ends of Prosperity Loop respectively. As this is high pressure infrastructure the developer will need to request approval from ATCO for construction on the site.

7 STORMWATER AND GROUNDWATER MANAGEMENT

As mentioned in Section 2.5 the site falls within the Russell Road Arterial Drain Scheme which requires a minimum 3.0m separation between lot levels and CGLs without the use of subsoil drains.

A Local Water Management Strategy has been prepared by OWCE and proposes the following key factors:

- Site will be cut and filled to form flat pads;
- Development will achieve a minimum 3.0m separation between finished lot levels and CGLs;
- Pipe network system will be sized to wholly contain the 1 in 5 year ARI rainfall event;
- Roads will be designed to convey up to the 1 in 100 year ARI rainfall event to the retention areas;
- Stormwater runoff from lots to be stored in soakwells for up to the 1 in 20 year ARI rainfall event;
- Lot runoff for rainfall events larger than the 1 in 20 year ARI will be conveyed to the road reserve via overland flow and directed to the POS;
- Lot levels will be minimum 500mm above the 1 in 100 year ARI rainfall event flood level within the basin;
- Lot levels will be minimum 300mm above the 1 in 100 year ARI rainfall event flood level within the road reserve;

The City of Cockburn requires the designated infiltration basin within the POS to be able to store the 1 in 5 ARI wholly within the system. For events greater than 1 in 5 ARI and up to the 1 in 100 ARI event, the POS area is permitted to be flooded.

A preliminary stormwater pipe plan is attached as drawing 16015-C-103 in Appendix B.

It is proposed to retain all stormwater runoff from the south catchment in the Central basin, this basin has been designed to retain the 1 in 100 year rainfall event and dispose through infiltration;

The north catchment will be collected and detained within a second drainage basin prior to surplus runoff discharging to a 2.0 m wide vegetated detention swale. The detention basin and swale will have capacity to dispose of all rainfall events upto the 1 in 10 year ARI.

Additionally, the proposal includes the installation of a below Ground Drainage Storage Cell system to promote infiltration close to the point of collection. Runoff collected will be detained in drainage detention cells approximately 3.0m wide and 2 cells in height for a length of 30 metres and will allow infiltration through the basin base. The maximum water level will be limited to the outlet pipe invert established at the top of the drainage cells.

8 CONCLUSION

The engineering requirements of the site have been assessed and it is concluded that water, sewerage and other utility services are readily available and can be extended to service the proposed development.

Appendix A – BIOSECIENCE GEOTECHNICAL INVESTIGATION

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GEOTECHNICAL REPORT
Lots 252 & 268 Beenyup Rd
Banjup

This report describes the geotechnical investigations undertaken by Bioscience Pty Ltd for a proposed residential development at Lots 252 and 268 Beenyup Road, Banjup, WA.
The aim of the investigation was to assess the subsurface soil, groundwater level, permeability and acid sulfate of soil across the site and thus:

- Determine the suitability of the site to support the proposed development.
- Provide recommendations on site preparation and earthworks, so as to allow the proposed development.
- Assess the groundwater level beneath the site at the time of the field work, if encountered.
- Assess the permeability of the soils across the site and provide comments on suitable stormwater disposal and site drainage.
- Assess the risk of acid sulphate soils beneath the site based upon readily available desktop information and sampling and analysis.

The investigation included the drilling of twelve piezometers, and laboratory testing of selected samples. The details of the field work are presented in this report, together with comments and recommendations on the issues listed above.

The site comprises a rectangular shaped area of approximately 44.8 ha, identified as Lots 252 and 268 Beenyap Street in Banjup, Western Australia. It is bounded by Gibbs Rd to the north, Beenyup Rd to the east and neighbouring properties to the west and south.
At the time of investigation, the site was mostly covered by native bush and trees. There was a wetland area in middle of the both lots, covered by shallow water. There were three empty

sheds in the east side, and a residual house in the west side of lot 252. A gravel road in the middle of the site separates lot 252 and 268.

The geology at the site as per the Geological Survey of Western Australia 1:50000 Environmental Geological Series FREMANTLE Map Sheets 2033 I and 2033 IV are either:

- S8 – SAND – Very light grey at surface, yellow at depth, fine to medium grained, sub-rounded quartz, moderately well sorted, of eolian origin. (Bassendean Sand).
- S10 – SAND – as S8 as relatively thin veneer over strong, blocky, brown silts and clay (Bassendean Sand over Guildford Formation).
- Ms_5 - SANDY SILT-dark brownish grey silt, with disseminated fine-grained quartz sand, firm, variable clay content, of lacustrine origin (Swamp deposits)

The Perth Groundwater Atlas (2004) shows the site has a natural surface contour of 26 - 28 m AHD and groundwater contour of 24 - 25 m AHD (May 2003).

In September 2011 twelve piezometers (G1 to G12) were installed in the site by Edge Drilling to monitor groundwater level fluctuation and its flow regime, as well as investigating the sub-soil characteristics and collect representative samples for laboratory testing.
The test pits (G1 to G12) were excavated to a maximum depth of 9 m using a mechanical Hollow Stem auger. Test pit locations are shown in Figure 1. Each test pit was logged in general accordance with test procedure AS 1726–1993 by a suitably experienced representative from Bioscience. Soil samples were recovered from selected locations for Particle Size Distribution and acid sulfate testing in laboratory. These soil samples were placed in air tight sample bags and chilled in insulated coolers. Soil samples remained in cooled storage during transport to the laboratory.

In general, the sub-ground strata in the site are, sandy black topsoil overlaying a white/grey/brown, medium, sub-angular sand layer, down to a depth of 9 m below ground level. In some bores a dark brown, non-cemented coffee rock was observed.
In the bore 12, a dark brown loamy sand layer (1.5 - 3 m bGL) overlying a brown silty/clay sand layer (3 - 4 m bGL).

Particle Size Distribution test

PSD test was conducted on 16 selected samples from different bores and depth in the area. Almost all the samples are in medium sand fraction range on the graph (Figure 2).

Permeability value

Although neither field or laboratory test was conducted to determine permeability values directly, however PSD test results can provide a reliable indirect permeability value for the area. Generally medium sand fraction soils have a permeability value of 10^{-4} to 10^{-2} (m/s). Such soils are suitable for stormwater infiltration and open drains. In further stage of the project more detailed analysis might be required to verify more accurate permeability values.

Acid Sulfate

Perth Groundwater Atlas classified the area as high to moderate risk of ASS, that means ASS might be occur at a depth lower than 3 m.

Soils recovered from test pits were subjected to analysis to determine the likelihood of acid sulfate soils being present, and thus any requirement for more detailed investigations as and when development plans are advanced to the point of specifying excavation location and depths. The work involved undertaking "Field pH testing" which is considered a useful, but not completely reliable indicator of PASS and AASS, and laboratory analysis of total sulfur present. The rationale for Total S testing is that DEC guidance set an action threshold which triggers the requirement for management plans when oxidisable sulfur exceeds 0.03%. Bioscience uses a LECO CS200 sulfur analyser to rapidly and reliable determine whether this threshold could be exceeded, which thereby triggers the need for further testing.

A total of 16 soil samples were tested. The results (Figure 3) show that, the reaction with peroxide is very low in 14 samples and moderate in two samples (G12, 2-3 m & 4-5 m). Also the reduction in peroxide pH is very minor. The 0.03% sulfur threshold was exceeded in half of the samples, G3,G5, G10 (0-1 m &1-2m), G11 (0-1m & 1-2m), G12 (2-3m & 4-5m).

Results:

The majority of soils encountered were sands of the Bassendean Formation (see PSD graph).

The results of this assessment indicate that the site can be classified as 'Class A' in accordance with AS 2870-1996, provided site preparation is carried out as detailed in Section 8.2. It is emphasised that the given classification will need reassessment if bulk earthworks for the proposed development include cutting the site.

According the geotechnical investigation results the following site preparation procedure is recommended:

- Identification and diversion or protection of any buried services within the work areas.
- Removal of topsoil, organics, roots, old services, rubbish and any other deleterious material from the site.
- Any clay layer underlying the top soil in the Lots should be removed and refilled by suitable fill material.
- Proof compact the exposed surface using a suitable compaction plant.
- Where the surface deforms excessively during compaction or wet and/or week material is exposed, over-excavation and replacement with compacted few draining sand fill may be required.
- Confirm that adequate compaction is achieved as outlined below.
- Place and compact approved clean free draining fill material in layers of no greater than 0.3m thickness, up to the level required.

Limitations

Bioscience Pty Ltd has prepared this report for a project at Lots 252 & 268 Beenyup Road, in Banjup, WA. The work was carried out under Bioscience's Conditions of Engagement. This report is provided for the exclusive use of Miluc Pty Ltd for this project only and for the purposes described in the report. It should not be used by or relied upon for other projects or purposes on the same or other site or by a third party. In preparing this report Bioscience has necessarily relied upon information provided by the client and/or their agents.

The results provided in the report are indicative of the sub-surface conditions only at the specific sampling or testing locations, and then only to the depths investigated and at the time the work was carried out. Sub-surface conditions can change abruptly due to variable geological processes and also as a result of anthropogenic influences. Such changes may occur after Bioscience's field testing has been completed.

Bioscience's advice is based upon the conditions encountered during this investigation. The accuracy of the advice provided by Bioscience in this report may be limited by undetected variations in ground conditions between sampling locations. The advice may also be limited by budget constraints imposed by others or by site accessibility.

This report must be read in conjunction with all of the attached notes and should be kept in its entirety without separation of individual pages or sections. Bioscience cannot be held responsible for interpretations or conclusions made by others unless they are supported by an expressed statement, interpretation, outcome or conclusion given in this report.

This report, or sections from this report, should not be used as part of a specification for a project, without review and agreement by Bioscience. This is because this report has been written as advice and opinion rather than instructions for construction.

Azin Kusari BE(civil) MEng.St

13 October 201

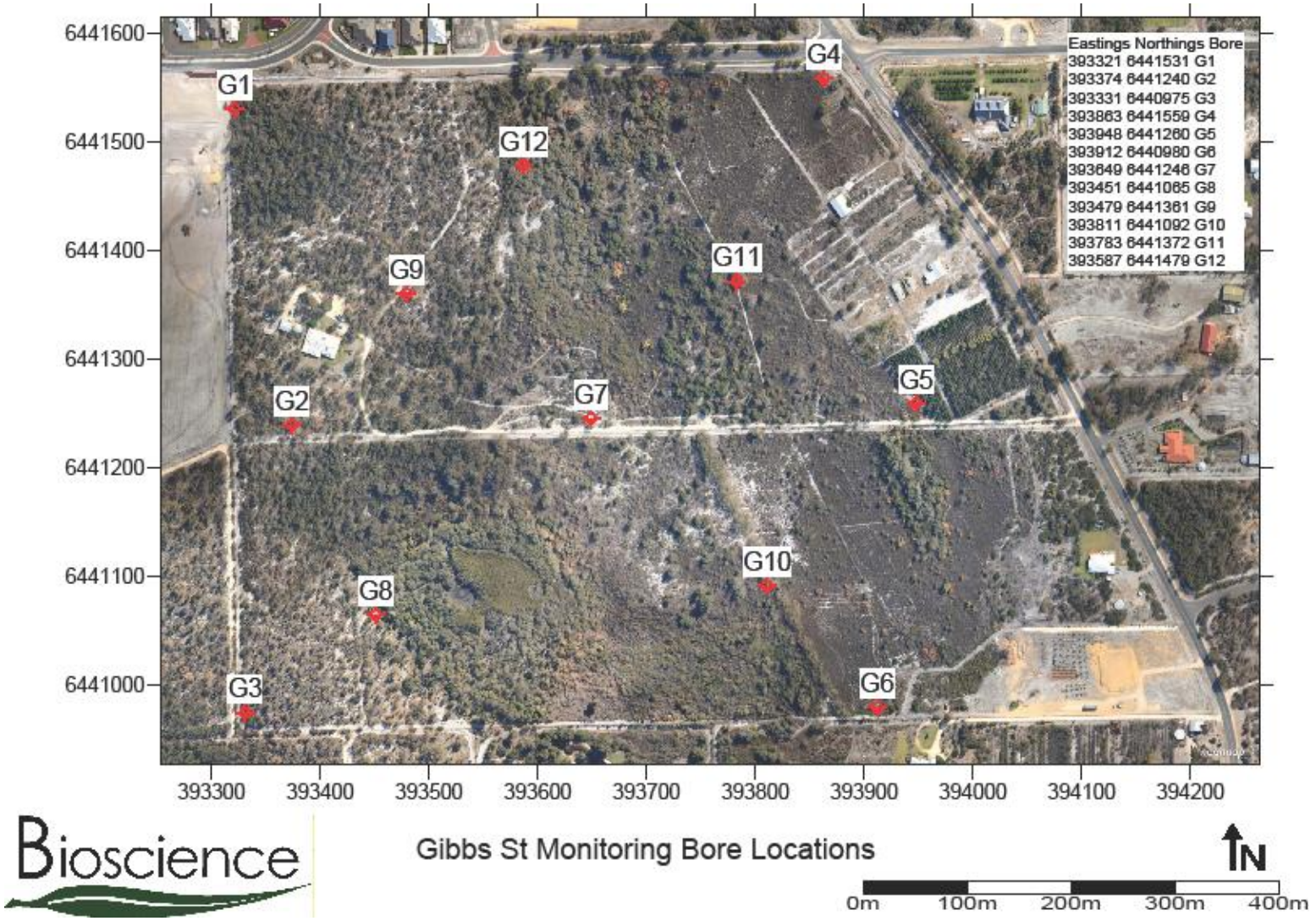


Figure 1: Lots 252 &268

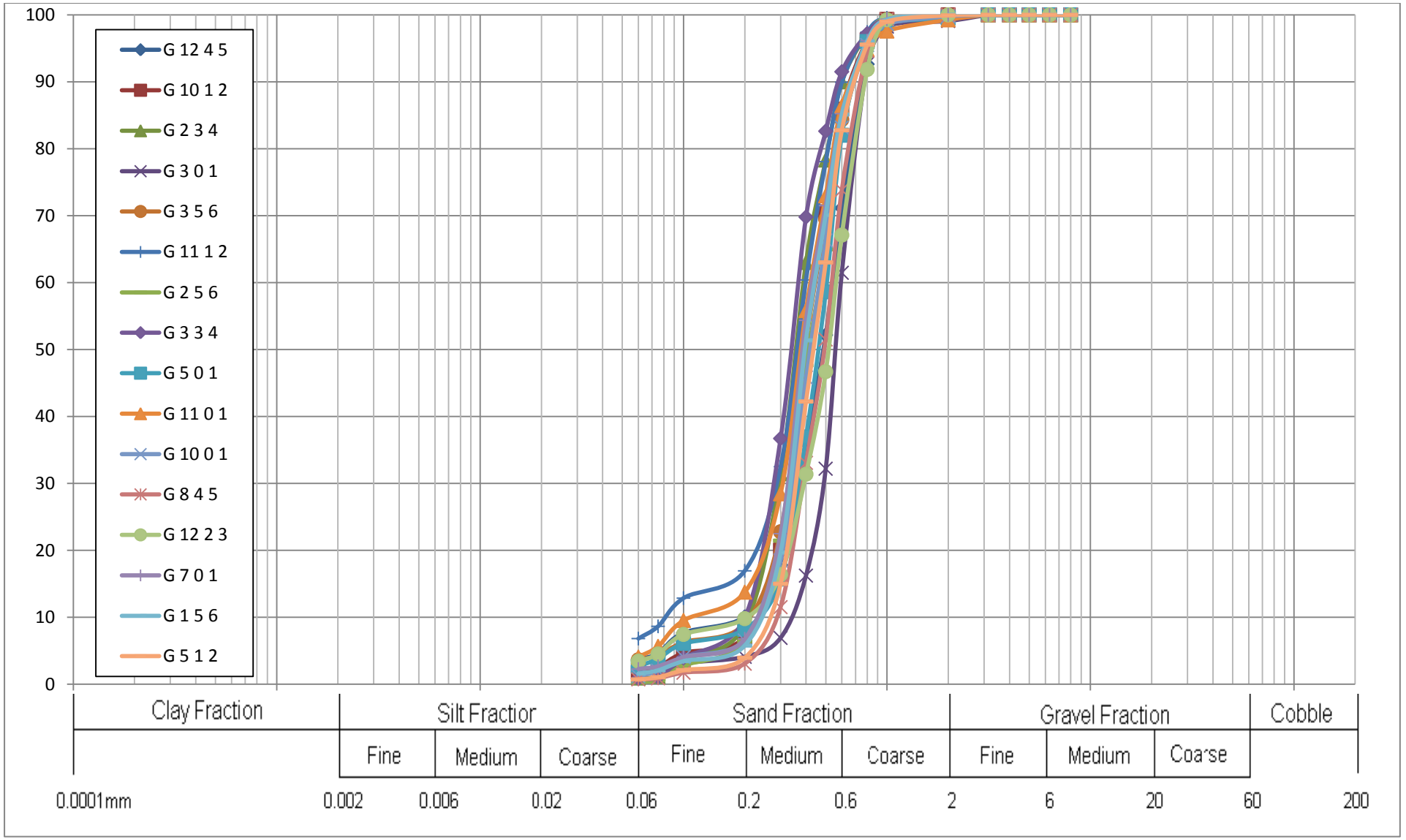


Figure 2: Particle Size Distribution graph for selected locations and depths

Sample	Depth (m)	pH (H_2O)	pH (H_2O_2)	ΔpH	Reactivity	Carbon (%)	Sulphur (%)	Soil Profile Description
G1	5-6	4.30	3.85	0.45	Low	0.3275	0.00616	Dark brown SM
G2	5-6	4.97	3.97	1.00	Low	0.00781	-0.00495	White SP
G3	0-1	4.07	3.11	0.96	Low	6.088	0.03993	Dark Pt
G3	5-6	4.06	3.21	0.85	Low	1.124	0.00141	Dark Pt
G4	3-4	5.45	4.88	0.57	Low	0.09266	-0.00321	Light brown SP
G5	0-1	3.93	3.05	0.88	Low	2.936	0.00473	Dark Pt
G5	1-2	4.44	2.91	1.53	Low	7.161	0.06979	Brown ML
G6	3-4	4.46	3.74	0.72	Low	0.1080	-0.00435	Brown ML
G7	0-1	3.05	1.62	1.43	Low	0.1847	0.00311	Dark brown SM
G8	4-5	5.27	3.81	1.46	Low	0.05981	-0.000339	Light brown SP
G10	0-1	4.33	3.03	1.3	Low	2.043	0.08251	Brown SP
G10	1-2	4.29	3.55	0.74	Low	1.149	0.04552	Dark brown SM
G11	0-1	3.52	2.96	0.56	Low	10.56	0.1915	Dark Pt
G11	1-2	3.47	2.86	0.61	Low	10.04	0.1512	Brown OL
G12	2-3	4.00	2.89	1.11	Medium	0.3488	0.04274	Dark brown SC
G12	4-5	5.08	3.57	1.51	Medium	0.2479	0.06008	Dark brown SC

Figure 3: Hydrogen peroxide test for acid sulphate soils

Appendix A: Bore Profiles

Investigator/s:	AK	**Date:**	12/09/2011	**Notes:**	WT between 3 to 3.75 m
Client:		**Photo No:**			bGL
Location:	Gibbs Rd, Banjup	**Eastings/Long:**	393321		
Site No:	G 1	**Northings/Lat:**	6441531		

Depth (mm)		Type	Colour	Grade	Shape	Condition	Consistency	Structure	Organic / Fill / Waste	Cobble (%)	Gravel (%)	Sand (%)	Silt/Clay (%)
To	From									>6.3mm	>2mm	<2mm	<0.075
0	750	Sandy top soil	Grey/Black	Medium		Moist	Non-cohesive	Layer	-				
750	1500	Sand	White mottled grey	Medium		Moist	Non-cohesive	Layer	-				
1500	3750	Sand	White	Medium		Moist	Non-cohesive	Layer	-				
3750	6000	Sand	Yellow	Medium		Moist	Non-cohesive	Layer	-				

Investigator/s:	AK	**Date:**	12/09/2011	**Notes:**	WT at 6.75m
Client:		**Photo No:**			bGL
Location:	Gibbs Rd, Banjup	**Eastings/Long:**	393374		
Site No:	G 2	**Northings/Lat:**	6441240		

Depth (mm)		Type	Colour	Grade	Shape	Condition	Consistency	Structure	Organic / Fill / Waste	Cobble (%)	Gravel (%)	Sand (%)	Silt/Clay (%)
To	From									>6.3mm	>2mm	<2mm	<0.075
0	1000	Sand	Grey/black	Medium		Moist	Non-cohesive	Layer					
1000	8000	Sand	white	Medium		Moist	Non-cohesive	Layer					
8000	9000	Sand	Yellow	Medium		Moist	Non-cohesive	Layer					

Investigator/s: AK | **Date:** 12/09/2011 | **Notes:** WT at 5.6m Coffee rock is not

Client: | **Photo No:** | bGL cemented

Location: Gibbs Rd, Banjup | **Eastings/Long:** 393331

Site No: G3 | **Northings/Lat:** 6440975

Depth (mm)		Type	Colour	Grade	Shape	Condition	Consistency	Structure	Organic / Fill / Waste	Cobble (%)	Gravel (%)	Sand (%)	Silt/Clay (%)
To	From									>6.3mm	>2mm	<2mm	<0.075
0	1200	Peaty top soil	black			Moist	Non-cohesive	Layer	Organic mat.				
1200	2000	Sand	White mottled grey	Medium		Moist	Non-cohesive	Layer					
2000	5000	Sand	White	Medium		Moist	Non-cohesive	Layer					
5000	8000	Sandy coffee rock	Dark brown	Medium		Moist	Non-cemented	Layer					

Investigator/s: AK | **Date:** 09/09/2011 | **Notes:** WT at 1.5 m

Client: | **Photo No:** | bGL

Location: Gibbs Rd, Banjup | **Eastings/Long:** 393863

Site No: G4 | **Northings/Lat:** 6441559

Depth (mm)		Type	Colour	Grade	Shape	Condition	Consistency	Structure	Organic / Fill / Waste	Cobble (%)	Gravel (%)	Sand (%)	Silt/Clay (%)
To	From									>6.3mm	>2mm	<2mm	<0.075
0	100	Sandy top soil	Grey/ black	Medium		Moist	Non-cohesive	Layer	-				
100	750	Sand	Black	Medium		Moist	Non-cohesive	Layer	-				
750	1500	Sand	Black/white	Medium		Moist	Non-cohesive	Layer	-				
1500	2250	Sand	White/Grey	Medium		Moist	Non-cohesive	Layer	-				
2250	4000	Sand	White/Grey	Medium		Wet	Non-cohesive	Layer	-				

Investigator/s:	PK	**Date:**	10/09/2011	**Notes:**	WT at 1.5 m bGL
Client:		**Photo No:**			
Location:	Gibbs Rd, Banjup	**Eastings/Long:**	393948		
Site No:	G5	**Northings/Lat:**	6441260		

Depth (mm)		Type	Colour	Grade	Shape	Condition	Consistency	Structure	Organic / Fill / Waste	Cobble (%)	Gravel (%)	Sand (%)	Silt/Clay (%)
To	From									>6.3mm	>2mm	<2mm	<0.075
0	310	Silty top soil	Black	Medium		Dry	cohesive	Layer					
310	1500	Sand	White/brown	Medium		Moist	Non-cohesive	Layer					
1500	3000	Sand	Brown	Medium		Wet	Non-cohesive	Layer					
3000	4000	Sand	Grey	Medium		Wet	Non-cohesive	Layer					

Investigator/s:	AK	**Date:**	12/09/2011	**Notes:**	WT at 1.5 m bGL Coffee rock is not cemented
Client:		**Photo No:**			
Location:	Gibbs Rd, Banjup	**Eastings/Long:**	393912		
Site No:	G6	**Northings/Lat:**	6440980		

Depth (mm)		Type	Colour	Grade	Shape	Condition	Consistency	Structure	Organic / Fill / Waste	Cobble (%)	Gravel (%)	Sand (%)	Silt/Clay (%)
To	From									>6.3mm	>2mm	<2mm	<0.075
0	900	Sandy Top soil	black	Medium		Moist	Non-cohesive	Layer					
900	2000	Sand	White	Medium		Moist	Non-cohesive	Layer					
2000	4000	Sandy coffee rock	Dark Brown	Medium		Moist	Non-cohesive	Layer					

Investigator/s: PK **Date:** 10/09/2011 **Notes:** WT at 1.3m

Client: **Photo No:** bGL

Location: Gibbs Rd, Banjup **Eastings/Long:** 393649

Site No: G7 **Northings/Lat:** 6441246

Depth (mm)		Type	Colour	Grade	Shape	Condition	Consistency	Structure	Organic / Fill / Waste	Cobble (%)	Gravel (%)	Sand (%)	Silt/Clay (%)
To	From									>6.3mm	>2mm	<2mm	<0.075
0	220	Sandy Top soil	Black	Medium		Moist	Non-cohesive	Layer					
220	2800	Sand	Brown	Medium		Moist	Non-cohesive	Layer					
2800	4100	Sand	Brown	Medium		Wet	Non-cohesive	Layer					

Investigator/s: AK **Date:** 12/09/2011 **Notes:** WT at 2.7m bGL

Client: **Photo No:**

Location: Gibbs Rd, Banjup **Eastings/Long:** 393451

Site No: G8 **Northings/Lat:** 6441065

Depth (mm)		Type	Colour	Grade	Shape	Condition	Consistency	Structure	Organic / Fill / Waste	Cobble (%)	Gravel (%)	Sand (%)	Silt/Clay (%)
To	From									>6.3mm	>2mm	<2mm	<0.075
0	1500	Sandy Top soil	Black	Medium		Moist	Non-cohesive	Layer					
1500	5500	Sand	White	Medium		Moist	Non-cohesive	Layer					

Investigator/s:	AK	**Date:**	12/09/2011	**Notes:**	WT at 5.8 m bGL
Client:		**Photo No:**			
Location:	Gibbs Rd, Banjup	**Eastings/Long:**	393479		
Site No:	G9	**Northings/Lat:**	6441361		

Depth (mm)		Type	Colour	Grade	Shape	Condition	Consistency	Structure	Organic / Fill / Waste	Cobble (%)	Gravel (%)	Sand (%)	Silt/Clay (%)
To	From									>6.3mm	>2mm	<2mm	<0.075
0	800	Sandy Top soil	Black	Medium		Moist	Non-cohesive	Layer					
800	8000	Sand	White	Medium		Moist	Non-cohesive	Layer					

Investigator/s:	PK	**Date:**	10/09/2011	**Notes:**	WT at 1.3 m bGL
Client:		**Photo No:**			
Location:	Gibbs Rd, Banjup	**Eastings/Long:**	393811		Ferrous sand is not
Site No:	G10	**Northings/Lat:**	6441097		cemented

Depth (mm)		Type	Colour	Grade	Shape	Condition	Consistency	Structure	Organic / Fill / Waste	Cobble (%)	Gravel (%)	Sand (%)	Silt/Clay (%)
To	From									>6.3mm	>2mm	<2mm	<0.075
0	200	Peaty top soil	Black	Medium		Moist	Non-cohesive	Layer					
200	610	Sand	White	Medium		Moist	Non-cohesive	Layer					
610	750	Ferrous	Brown	Medium		Moist	Non-cohesive	Layer					
750	4000	Sand	Brown	Medium		Wet	Non-cohesive	Layer					

Investigator/s:	PK	**Date:**	10/08/2011	**Notes:**	WT at 1.2m bGL
Client:		**Photo No:**			
Location:	Gibbs Rd, Banjup	**Eastings/Long:**	393783		
Site No:	G11	**Northings/Lat:**	6441372		

Depth (mm)		Type	Colour	Grade	Shape	Condition	Consistency	Structure	Organic / Fill / Waste	Cobble (%)	Gravel (%)	Sand (%)	Silt/Clay (%)
To	From									>6.3mm	>2mm	<2mm	<0.075
0	220	Sandy Top soil	Black	Medium		Moist	Non-cohesive	Layer					
220	600	Sand	White/brown	Medium		Moist	Non-cohesive	Layer					
600	1100	Sand	Brown/ black	Medium		Moist	Non-cohesive	Layer					
1100	1500	Ironstone	Brown	Medium		Dry	Firm	Layer					
1500	4000	Sand	White/grey	Medium		Wet	Non-cohesive	Layer					

Investigator/s:	AK	**Date:**	12/09/2011	**Notes:**	WT at 0.6m bGL
Client:		**Photo No:**			
Location:	Gibbs Rd, Banjup	**Eastings/Long:**	393587		
Site No:	G12	**Northings/Lat:**	6441479		

Depth (mm)		Type	Colour	Grade	Shape	Condition	Consistency	Structure	Organic / Fill / Waste	Cobble (%)	Gravel (%)	Sand (%)	Silt/Clay (%)
To	From									>6.3mm	>2mm	<2mm	<0.075
0	1500	Sand Top soil	Black	Medium		Moist	Non-cohesive	Layer					
1500	3000	Loamy Sand	Dark brown	Medium		Wet	Cohesive	Layer					
3000	4000	Silty Sand	Brown	Medium		Wet	Cohesive	Layer					

Bore	Easting	Northing	Upstick	Surface elevation (mAHD)	Total Depth
G1	393321	6441531	0.79	28.405	6.4
G2	393374	6441240	0.38	31.72	9.1
G3	393331	6440975	0.685	30.293	8.47
G4	393863	6441559	0.59	26.496	4.4
G5	393948	6441260	0.665	26.232	4.6
G6	393912	6440980	0.37	26.48	4.3
G7	393649	6441246	0.55	25.845	4.45
G8	393451	6441065	0.7	27.152	5.1
G9	393479	6441361	0.49	30.818	8.4
G10	393811	6441092	0.535	25.987	4.5
G11	393783	6441372	0.65	26.366	4.5
G12	393587	6441479	0.63	25.752	4.45

mBTOC

Bore	16/09/2011	1/11/2011	4/01/2012	7/03/2012	16/05/2012	5/07/2012	7/09/2012	5/10/2012	4/12/2012	9/01/2013	4/02/2013	22/03/2013	15/05/2013	2/07/2013	21/08/2013	20/09/2013	25/10/2013	21/11/2013	28/02/2014	24/03/2014	30/05/2014	8/08/2014	19/09/2014
G1	3.62	3.417	3.712	4.016	4.036	3.797	3.517	3.478	3.729	3.815	3.973	4.197	4.044	4.075	3.471	3.101	3.129	3.322	3.972	4.124	3.815	3.267	3.19
G2	7.02	6.794	7.097	7.428	7.516	7.281	7.003	6.928	7.155	7.325	7.415	7.626	7.562	7.467	6.957	6.503	6.512	6.744	7.379	7.507	7.33	6.745	6.598
G3	5.972	5.756	6.09	6.437	6.477	6.278	6.013	5.935	6.166	6.315	6.445	6.638	6.566	6.457	6.008	5.502	5.512	5.743	6.392	6.514	6.348	5.769	5.602
G4	1.743	1.758	2.122	2.59	2.508	2.125	1.837	1.86	2.21	2.43	2.698	2.895	2.525	2.653	1.842	1.611	1.637	1.883	2.664	2.8	2.149	1.65	1.546
G5	1.54	1.599	2.03	2.528	2.455	2.066	1.745	1.781	2.14	2.398	2.627	2.816	2.553	2.54	1.72	1.5	1.512	1.762	2.612	2.733	2.182	1.543	1.476
G6	1.653	1.633	2.07	2.49	2.38	2.113	1.81	1.859	2.226	2.418	2.592	2.761	2.507	2.534	1.822	1.55	1.571	1.831	2.553	2.651	2.175	1.661	1.576
G7	1.12	1.205	1.63	2.18	2.164	1.756	1.295	1.374	1.768	2.027	2.238	2.479	2.245	2.142	1.272	1.06	1.097	1.365	2.285	2.43	1.947	1.196	1.14
G8	2.853	2.695	3.014	3.37	3.391	3.186	2.913	2.86	3.1	3.249	3.388	3.562	3.465	3.364	2.916	2.452	2.473	2.676	3.34	3.453	3.251	2.706	2.549
G9	6.065	5.846	6.151	6.469	6.543	6.306	6.027	5.955	6.201	6.335	6.47	6.674	6.601	6.518	5.979	5.55	5.576	5.796	6.433	6.565	6.635	5.75	5.631
G10	1.229	1.315	1.862	2.355	2.187	1.832	1.452	1.52	1.981	2.237	2.432	2.59	2.313	2.243	1.436	1.22	1.244	1.567	2.437	2.532	1.972	1.319	1.264
G11	1.631	1.729	2.233	2.786	2.671	2.207	1.842	1.902	2.328	2.64	2.865	3.05	2.747	2.689	1.82	1.603	1.63	1.941	2.873	2.985	2.325	1.687	1.616
G12	0.995	0.924	1.257	1.7	1.672	1.364	1.041	1.041	1.3	1.438	1.798	2.227	1.72	1.699	1.053	0.662	0.681	0.92	1.729	2.137	1.414	0.809	0.712

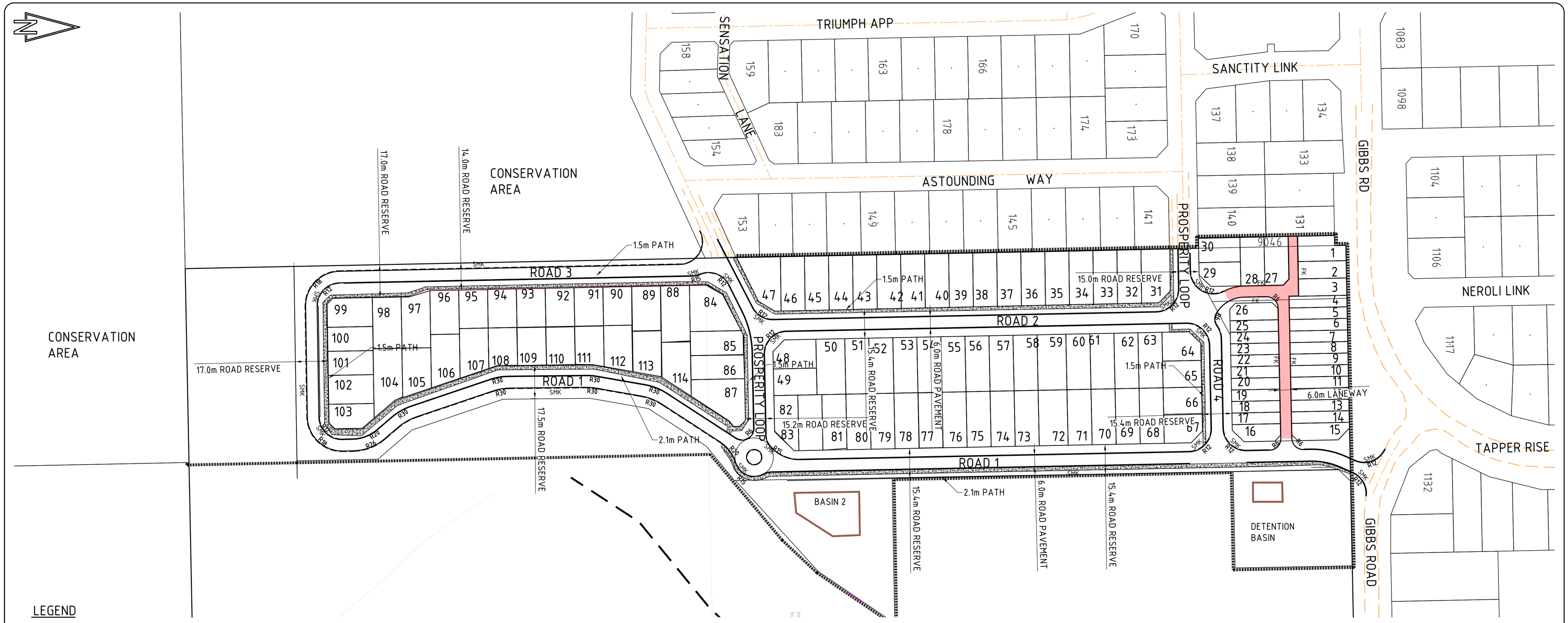
mBGL

Bore	16/09/2011	1/11/2011	4/01/2012	7/03/2012	16/05/2012	5/07/2012	7/09/2012	5/10/2012	4/12/2012	9/01/2013	4/02/2013	22/03/2013	15/05/2013	2/07/2013	21/08/2013	20/09/2013	25/10/2013	21/11/2013	28/02/2014	24/03/2014	30/05/2014	8/08/2014	19/09/2014
G1	2.83	2.627	2.922	3.226	3.246	3.007	2.727	2.688	2.939	3.025	3.183	3.407	3.254	3.285	2.681	2.311	2.339	2.532	3.182	3.334	3.025	2.477	2.4
G2	6.64	6.414	6.717	7.048	7.136	6.901	6.623	6.548	6.775	6.945	7.035	7.246	7.182	7.087	6.577	6.123	6.132	6.364	6.999	7.127	6.95	6.365	6.218
G3	5.287	5.071	5.405	5.752	5.792	5.593	5.328	5.25	5.481	5.63	5.76	5.953	5.881	5.772	5.323	4.817	4.827	5.058	5.707	5.829	5.663	5.084	4.917
G4	1.153	1.168	1.532	2	1.918	1.535	1.247	1.27	1.62	1.84	2.108	2.305	1.935	2.063	1.252	1.021	1.047	1.293	2.074	2.21	1.559	1.06	0.956
G5	0.875	0.934	1.365	1.863	1.79	1.401	1.08	1.116	1.475	1.733	1.962	2.151	1.888	1.875	1.055	0.835	0.847	1.097	1.947	2.068	1.517	0.878	0.811
G6	1.283	1.263	1.7	2.12	2.01	1.743	1.44	1.489	1.856	2.048	2.222	2.391	2.137	2.164	1.452	1.18	1.201	1.461	2.183	2.281	1.805	1.291	1.206
G7	0.57	0.655	1.08	1.63	1.614	1.206	0.745	0.824	1.218	1.477	1.688	1.929	1.695	1.592	0.722	0.51	0.547	0.815	1.735	1.88	1.397	0.646	0.59
G8	2.153	1.995	2.314	2.67	2.691	2.486	2.213	2.16	2.4	2.549	2.688	2.862	2.765	2.664	2.216	1.752	1.773	1.976	2.64	2.753	2.551	2.006	1.849
G9	5.575	5.356	5.661	5.979	6.053	5.816	5.537	5.465	5.711	5.845	5.98	6.184	6.111	6.028	5.489	5.06	5.086	5.306	5.943	6.075	6.145	5.26	5.141
G10	0.694	0.78	1.327	1.82	1.652	1.297	0.917	0.985	1.446	1.702	1.897	2.055	1.778	1.708	0.901	0.685	0.709	1.032	1.902	1.997	1.437	0.784	0.729
G11	0.981	1.079	1.583	2.136	2.021	1.557	1.192	1.252	1.678	1.99	2.215	2.4	2.097	2.039	1.17	0.953	0.98	1.291	2.223	2.335	1.675	1.037	0.966
G12	0.365	0.294	0.627	1.07	1.042	0.734	0.411	0.411	0.67	0.808	1.168	1.597	1.09	1.069	0.423	0.032	0.051	0.29	1.099	1.507	0.784	0.179	0.082

mAHD

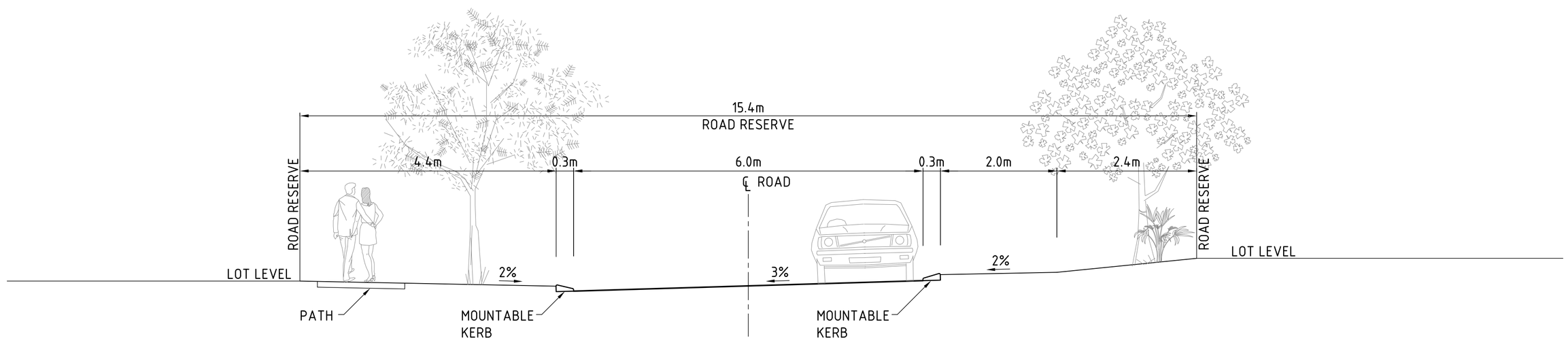
Bore	16/09/2011	1/11/2011	4/01/2012	7/03/2012	16/05/2012	5/07/2012	7/09/2012	5/10/2012	4/12/2012	9/01/2013	4/02/2013	22/03/2013	15/05/2013	2/07/2013	21/08/2013	20/09/2013	25/10/2013	21/11/2013	28/02/2014	24/03/2014	30/05/2014	8/08/2014	19/09/2014
G1	25.575	25.778	25.483	25.179	25.159	25.398	25.678	25.717	25.466	25.38	25.222	24.998	25.151	25.12	25.724	26.094	26.066	25.873	25.223	25.071	25.38	25.928	26.005
G2	25.08	25.306	25.003	24.672	24.584	24.819	25.097	25.172	24.945	24.775	24.685	24.474	24.538	24.633	25.143	25.597	25.588	25.356	24.721	24.593	24.77	25.355	25.502
G3	25.006	25.222	24.888	24.541	24.501	24.7	24.965	25.043	24.812	24.663	24.533	24.34	24.412	24.521	24.97	25.476	25.466	25.235	24.586	24.464	24.63	25.209	25.376
G4	25.343	25.328	24.964	24.496	24.578	24.961	25.249	25.226	24.876	24.656	24.388	24.191	24.561	24.433	25.244	25.475	25.449	25.203	24.422	24.286	24.937	25.436	25.54
G5	25.357	25.298	24.867	24.369	24.442	24.831	25.152	25.116	24.757	24.499	24.27	24.081	24.344	24.357	25.177	25.397	25.385	25.135	24.285	24.164	24.715	25.354	25.421
G6	25.197	25.217	24.78	24.36	24.47	24.737	25.04	24.991	24.624	24.432	24.258	24.089	24.343	24.316	25.028	25.3	25.279	25.019	24.297	24.199	24.675	25.189	25.274
G7	25.275	25.19	24.765	24.215	24.231	24.639	25.1	25.021	24.627	24.368	24.157	23.916	24.15	24.253	25.123	25.335	25.298	25.03	24.11	23.965	24.448	25.199	25.255
G8	24.999	25.157	24.838	24.482	24.461	24.666	24.939	24.992	24.752	24.603	24.464	24.29	24.387	24.488	24.936	25.4	25.379	25.176	24.512	24.399	24.601	25.146	25.303
G9	25.243	25.462	25.157	24.839	24.765	25.002	25.281	25.353	25.107	24.973	24.838	24.634	24.707	24.79	25.329	25.758	25.732	25.512	24.875	24.743	24.673	25.558	25.677
G10	25.293	25.207	24.66	24.167	24.335	24.69	25.07	25.002	24.541	24.285	24.09	23.932	24.209	24.279	25.086	25.302	25.278	24.955	24.085	23.99	24.55	25.203	25.258
G11	25.385	25.287	24.783	24.23	24.345	24.809	25.174	25.114	24.688	24.376	24.151	23.966	24.269	24.327	25.196	25.413	25.386	25.075	24.143	24.031	24.691	25.329	25.4
G12	25.387	25.458	25.125	24.682	24.71	25.018	25.341	25.341	25.082	24.944	24.584	24.155	24.662	24.683	25.329	25.72	25.701	25.462	24.653	24.245	24.968	25.573	25.67

Appendix B – OWCE PRELIMINARY ENGINEERING DRAWINGS



LEGEND

- ROAD CENTRELINE
- MOUNTABLE KERB
- SMK — SEMI-MOUNTABLE KERB
- FK — FLUSH KERB
- FOOTPATH
- ASPHALT SEAL
- EXISTING ROAD EDGE
- BATTLE-AXE ACCESS



TYPICAL SECTION THROUGH ROAD RESERVE

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20 0 20 40 60 80 100m
SCALE 1:1000

Rev.	Date	Drn.	Des.	Issue Description
B	16.04.2020	JF	CF	ISSUED FOR COMMENT
A	27.06.2017	JF	CF	ISSUED FOR COMMENT

CLIENT
AIGLE ROYAL DEVELOPMENTS PTY LTD

OCHREWEST CONSULTING ENGINEERS

PROJECT
LOTS 11 & 74 BEENYUP ROAD
BANJUP

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DRN	N.McDONALD	REVIEWED	DATE
DESIGN	E.METCALF	Colin Fingher	16.04.2020
DIRECTOR	C.FINGHER	APPROVED FOR ISSUE: Colin Fingher	DATE: 16.04.2020

TITLE
PROPOSED ROAD LAYOUT PLAN

SCALE	SIZE	DRAWING No	REV
1:1000	A1	16015-C-102	B

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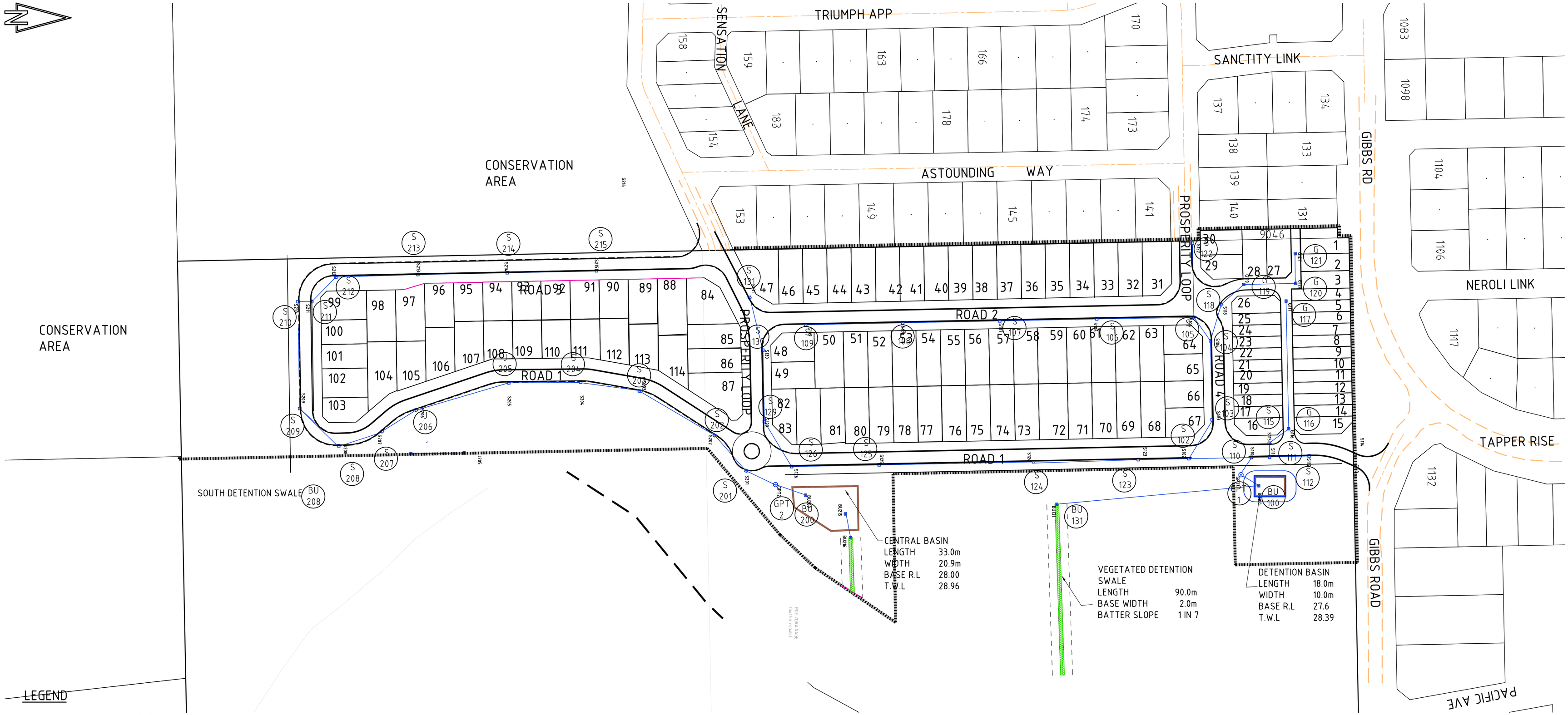
REV DATE DRN DSIGN DESCRIPTION



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Rev.	Date	Drn.	Des.	Issue Description
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A	27.06.2017	JF	CF	ISSUED FOR COMMENT

CLIENT
AIGLE ROYAL DEVELOPMENTS PTY LTD

OCHREWEST CONSULTING ENGINEERS

PROJECT
LOTS 11 & 74 BEENYUP ROAD BANJUP

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DRN	N.McDONALD	REVIEWED	DATE 16.04.2020
DESIGN	C.FINGHER	APPROVED FOR ISSUE	DATE 16.04.2020
DIRECTOR	C.FINGHER		

TITLE
DRAINAGE LAYOUT PLAN

SCALE	SIZE	DRAWING No	REV
1:1000	A1	16015-C-103	B

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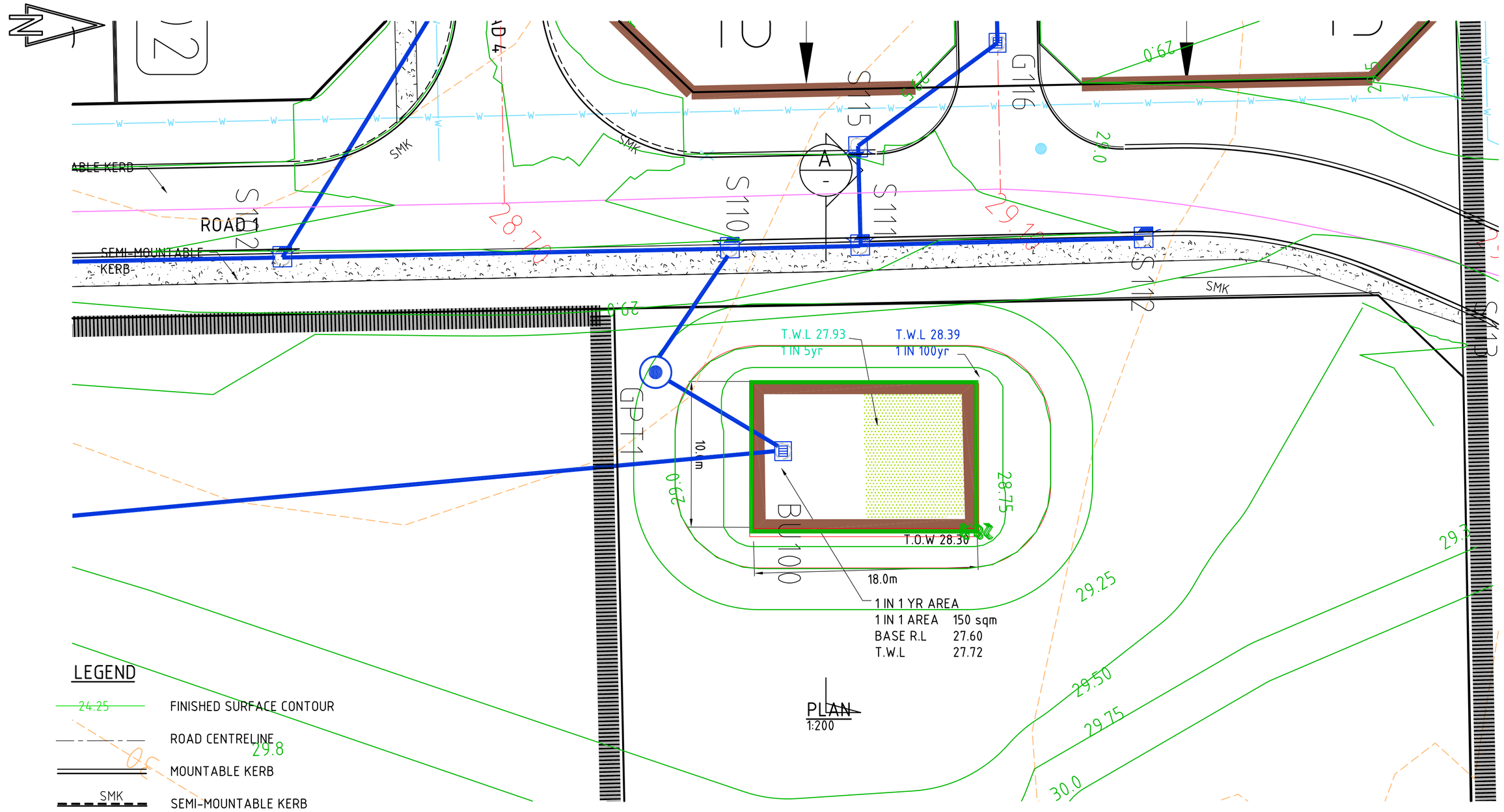


100Yr CRITERIA

MINIMUM STORAGE VOLUME REQUIRED:	126m³
DEPTH TO STORE REQUIRED VOLUME:	0.79m
BASE LEVEL	27.6m
1 IN 100 YR ARI LEVEL	28.39m
FREEBOARD PROVIDED	0.30m
STORAGE PROVIDED	303m³

5Yr CRITERIA

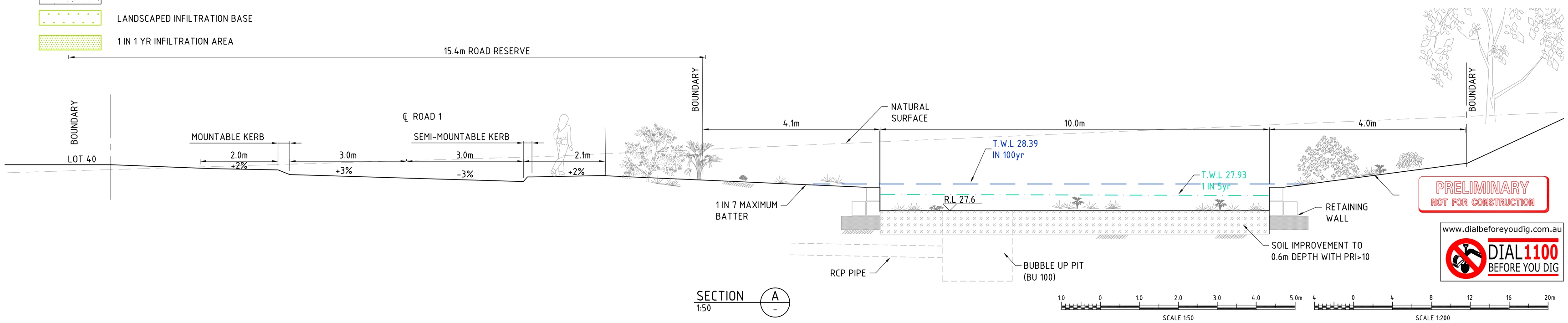
MINIMUM STORAGE VOLUME REQUIRED:	59m³
DEPTH TO STORE REQUIRED VOLUME:	0.33m
1IN 5 YR ARI LEVEL:	27.93m
SURFACE AREA:	180m²

1Yr CRITERIA

MINIMUM STORAGE VOLUME REQUIRED:	29m³
DEPTH TO STORE REQUIRED VOLUME:	0.12m
1 IN 1 YR ARI LEVEL	27.72m
SURFACE AREA:	180m²

LEGEND

- FINISHED SURFACE CONTOUR
- ROAD CENTRELINE
- MOUNTABLE KERB
- SMK — SEMI-MOUNTABLE KERB
- FK — FLUSH KERB
- LIMESTONE RETAINING WALL
- DRAINAGE PITS & PIPE
- FOOTPATH
- LANDSCAPED INFILTRATION BASE
- 1 IN 1 YR INFILTRATION AREA



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Rev.	Date	Drn.	Des.	Issue Description
B	16.04.2020	JF	CF	ISSUED FOR COMMENT
A	27.06.2017	JF	CF	ISSUED FOR APPROVAL

CLIENT
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OCHREWEST CONSULTING ENGINEERS

PROJECT
LOTS 11 & 74 BEENYUP ROAD
BANJUP

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DRN	J.FINGHER	REVIEWED	DATE 16.04.2020
DESIGN	C.FINGHER	APPROVED FOR ISSUE	DATE 16.04.2020
DIRECTOR	C.FINGHER		

TITLE
NORTH DETENTION BASIN
LAYOUT & SECTION PLAN

SCALE	SIZE	DRAWING No	REV
1:200	A1	16015-C-104	B

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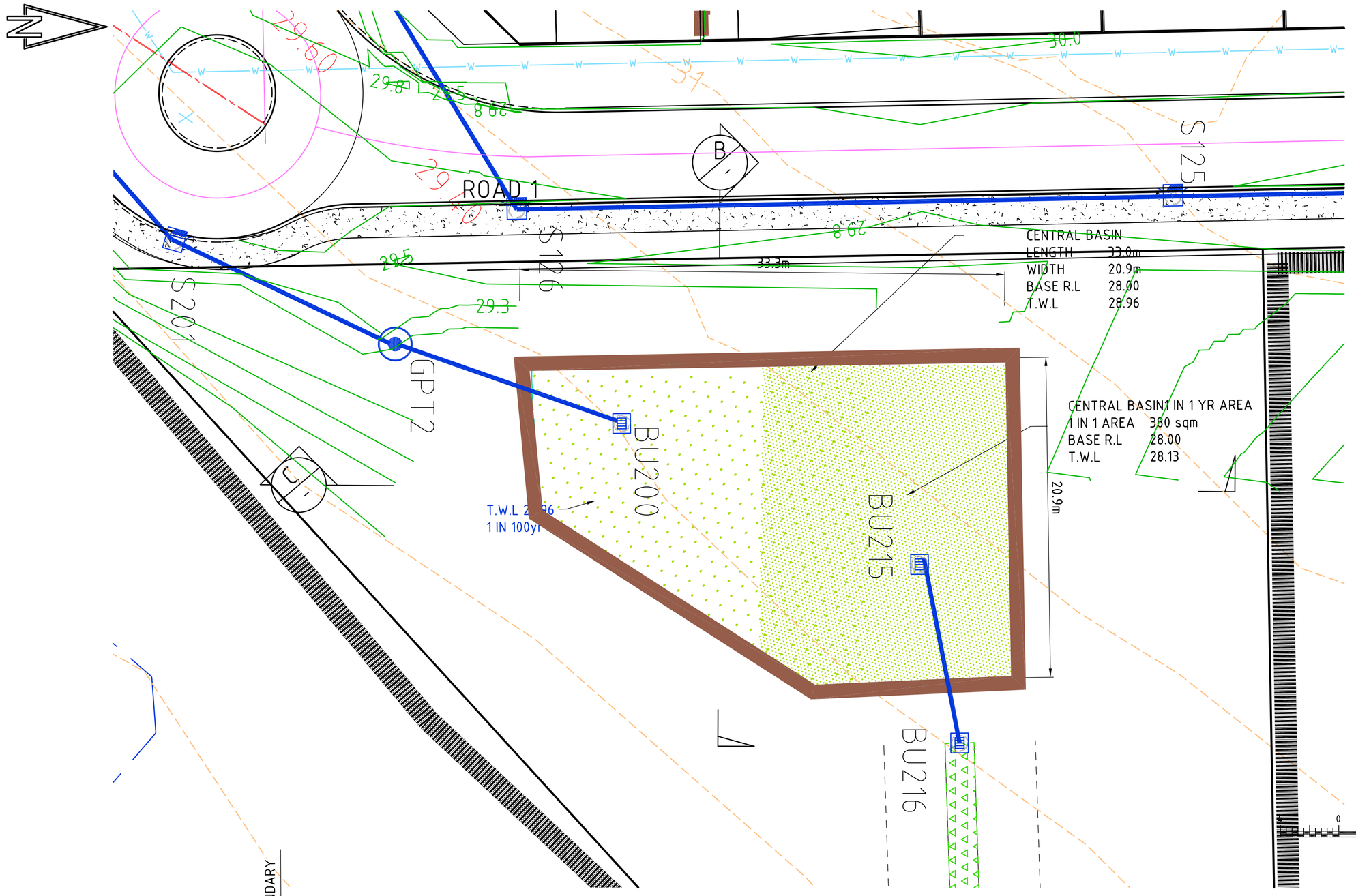
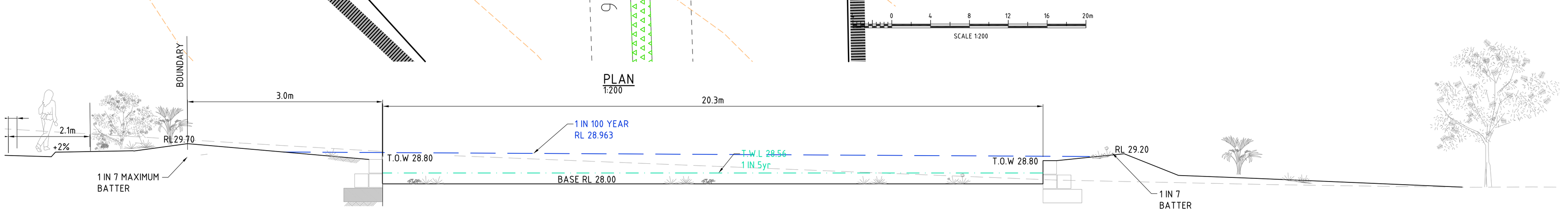
REV. DATE DRN. DSIGN. DESCRIPTION

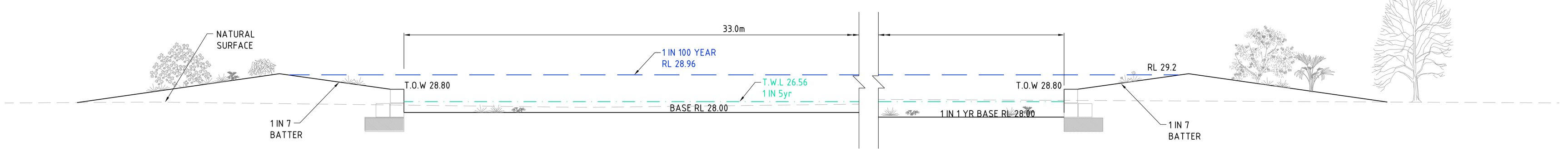


PLAN
1:200



SECTION B
1:50

RCP PIPE



SECTION C
1:50

LEGEND

- 24.25 — FINISHED SURFACE CONTOUR
- ROAD CENTRELINE
- MOUNTABLE KERB
- SMK — SEMI-MOUNTABLE KERB
- FK — FLUSH KERB
- LIMESTONE RETAINING WALL
- DRAINAGE PITS & PIPE
- FOOTPATH
- LANDSCAPED INFILTRATION BASE
- 1 IN 1 YR INFILTRATION AREA

100Yr CRITERIA

MINIMUM STORAGE VOLUME REQUIRED:	590m³
DEPTH TO STORE REQUIRED VOLUME:	0.95m
BASE LEVEL	28.00m
1 IN 100 YR ARI LEVEL	28.96m
FREEBOARD PROVIDED	0.30m
STORAGE PROVIDED	740m³

5Yr CRITERIA

MINIMUM STORAGE VOLUME REQUIRED:	273m³
DEPTH TO STORE REQUIRED VOLUME:	0.14m
1IN 5 YR ARI LEVEL:	28.43m
SURFACE AREA:	636m²

1Yr CRITERIA

MINIMUM STORAGE VOLUME REQUIRED:	83m³
DEPTH TO STORE REQUIRED VOLUME:	0.131m
1 IN 1 YR ARI LEVEL	28.13m
SURFACE AREA:	636m²

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DIAL 1100 BEFORE YOU DIG

PRELIMINARY
NOT FOR CONSTRUCTION

Rev.	Date	Drn.	Des.	Issue Description
B	16.04.2020	JF	CF	ISSUED FOR COMMENT
A	27.06.2017	JF	CF	ISSUED FOR APPROVAL

CLIENT
AIGLE ROYAL DEVELOPMENTS PTY LTD

OCHREWEST CONSULTING ENGINEERS

PROJECT
LOTS 11 & 74 BEENYUP ROAD
BANJUP

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DRN	J.FINGHER	REVIEWED	DATE 16.04.2020
DESIGN	C.FINGHER	APPROVED FOR ISSUE	DATE 16.04.2020
DIRECTOR	C.FINGHER		

TITLE
CENTRAL RETENTION BASIN
LAYOUT & SECTION PLAN

SCALE	SIZE	DRAWING No	REV
1:200	A1	16015-C-105	B

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REV DATE DRN DSIGN DESCRIPTION

LEGEND

- ROAD CENTRELINE
- MOUNTABLE KERB
- SMK — SEMI-MOUNTABLE KERB
- FK — FLUSH KERB
- SEWER PIPE & PIT
- WATER PIPE & HYDRANT
- FOOTPATH
- DRAINAGE PIPE & PITS
- EXISTING ROAD EDGE
- EXISTING SEWER RETICULATION
- EXISTING WATER RETICULATION

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20 0 20 40 60 80 100m
SCALE 1:1000

Rev.	Date	Drn.	Des.	Issue Description
B	16.04.2020	JF	CF	ISSUED FOR COMMENT
A	26.07.2017	JF	CF	ISSUED FOR COMMENT

CLIENT
AIGLE ROYAL DEVELOPMENTS PTY LTD

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PROJECT
LOTS 11 & 74 BEENYUP ROAD
BANJUP

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DRN	N.McDONALD	REVIEWED	DATE 16.04.2020
DESIGN	C.FINGHER	APPROVED FOR ISSUE	DATE 16.04.2020
DIRECTOR	C.FINGHER		

TITLE
SERVICES PLAN

SCALE	SIZE	DRAWING No	REV
1:1000	A1	16015-C-107	B

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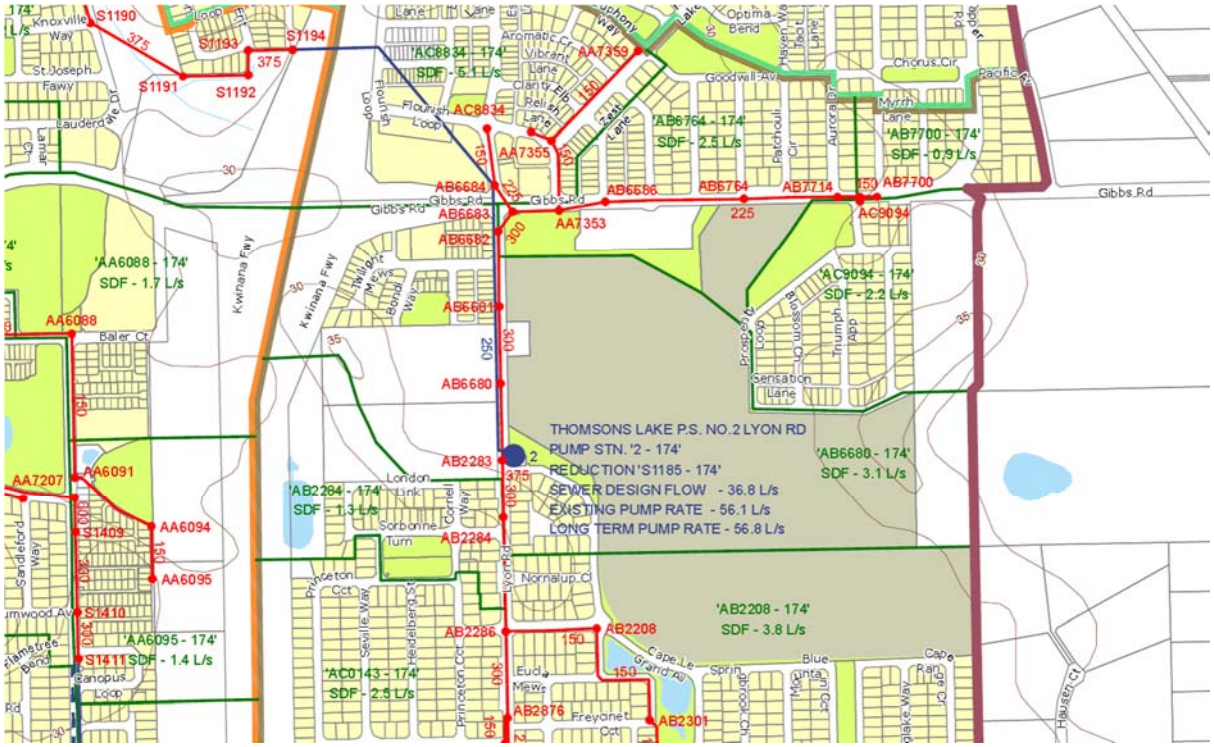
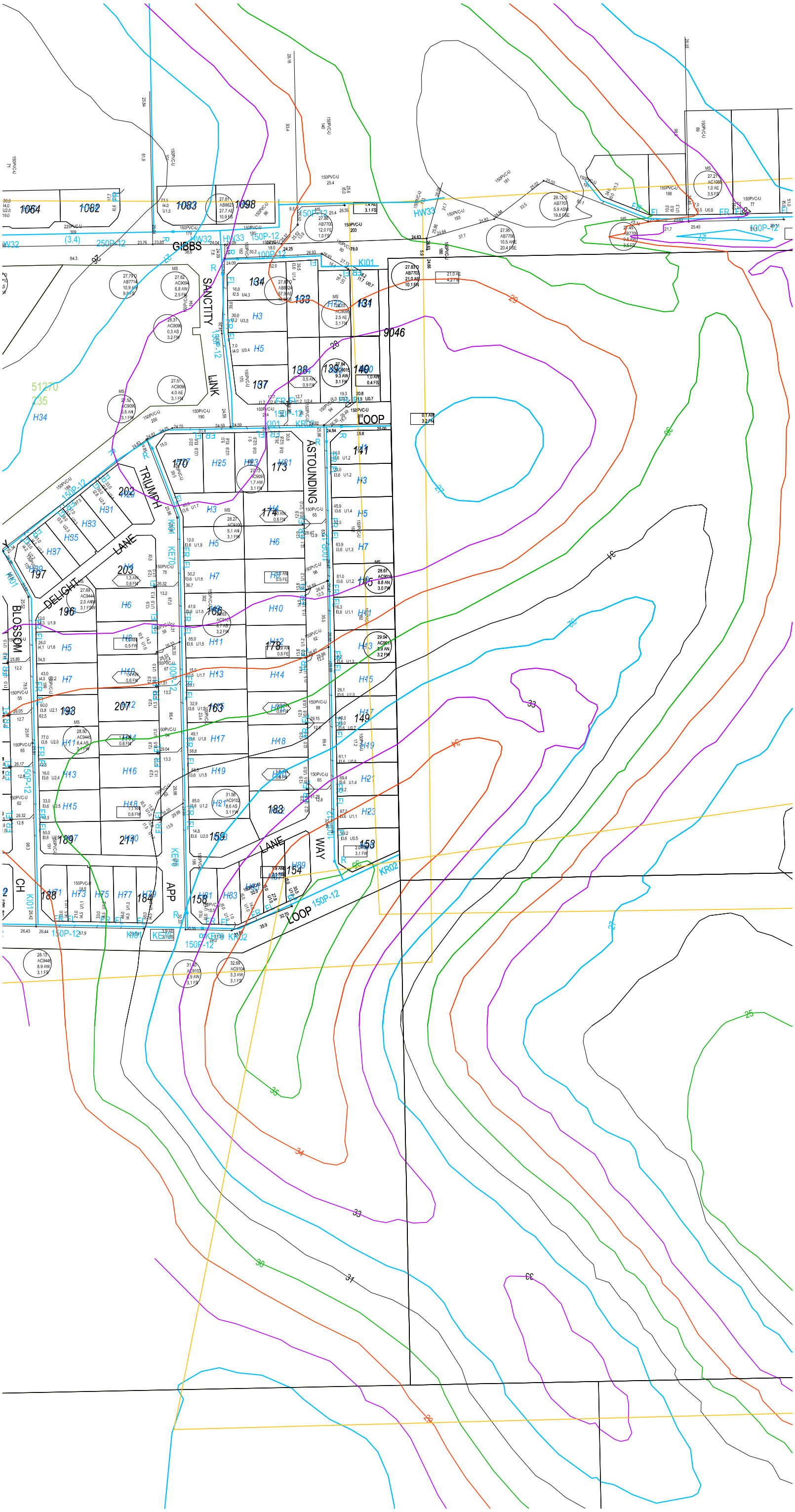
REV DATE DRN DSIGN DESCRIPTION

Appendix C –WATER CORPORATION SERVICE DETAILS


THOMSONS LAKE P.S. NO.2 LYON RD
PUMP STN. '2 - 174'
REDUCTION 'S1185 - 174'
SEWER DESIGN FLOW - 36.8 L/s
EXISTING PUMP RATE - 56.1 L/s
LONG TERM PUMP RATE - 56.8 L/s
'AC8834 - 174'
SDF - 5.1 L/s
'AB6764 - 174'
SDF - 2.5 L/s
'AB7700 - 174'
SDF - 0.9 L/s
'AA6088 - 174'
SDF - 1.7 L/s
'AC9094 - 174'
SDF - 2.2 L/s
'AB6680 - 174'
SDF - 3.1 L/s
'AB2284 - 174'
SDF - 1.3 L/s
'AB2208 - 174'
SDF - 3.8 L/s
'AA6095 - 174'
SDF - 1.4 L/s
'AC0143 - 174'
SDF - 2.5 L/s
S1190
S1193
S1194
S1191
S1192
AA7359
AC8834
AA7355
AB6684
AB6683
AB6682
AB6686
AB6764
AB7714
AB7700
AC9094
AA7353
AB6681
AB6680
AB2283
AB2284
AB2286
AB2208
AB2876
AB2301
AA6088
AA6091
AA7207
AA6094
AA6095
S1409
S1410
S1411
Gibbs Rd
Kwinana Fwy
Lyon Rd
Cape Le Grand Av
Goodwill Av
Chorus Cir
Myrrh Lane
Sensation Lane
Nornalup Cl
Princeton Cct
Sorbonne Turn
London Link
Baler Ct
Knoxville Way
St Joseph Fawy
Lauderdale Dr
Flourish Loop
Aromatic Cr
Vibrant Lane
Clarity Elb
Relish Lane
Zest Lane
Optima Bend
Patchouli Cir
Aurora Dr
Prospect Loop
Blossom Ch
Triumph App
Seville Way
Heidelberg St
Princeton Cct
Eucla Mews
Freycinet Cct
Blue Cape Ranger
Hausen Ct
Sandleford Way
Flamstree Bend
Canopus Loop
Twilight Mews
Bondi Way
Cornell Way
Lauderdale Dr
Lamar Ct
375
150
225
300
250
35
30
2


GIBBS
SANCTITY
LANE
TRIUMPH
DELIGHT
BLOSSOM
ASTOUNDING
WAY
APP
LOOP
9046
51270
235
H34
1064
1082
1083
1098
134
133
131
H3
H5
137
138
139
140
141
170
H25
173
H81
202
H31
H33
H35
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H19
H21
H23
H39
100P-12
150P-12
KI01
KR02
KE70
KE69
HW32
HW33
250P-12
(3.4)
LOOP
29
28
27
26
25
33
34
35