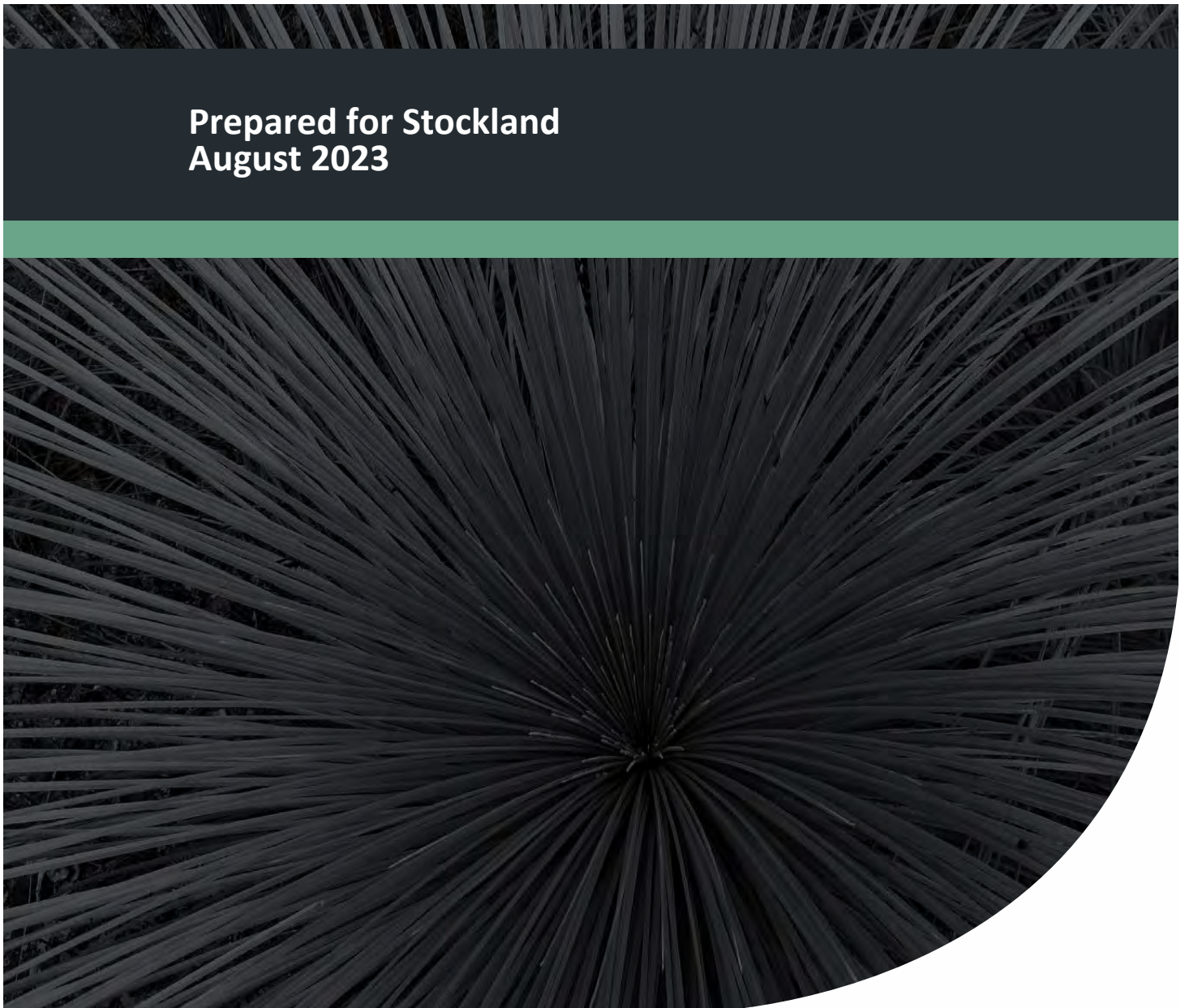


Environmental Assessment Report

Precinct 15 Structure Plan

Project No: EP22-019(15)

**Prepared for Stockland
August 2023**



Environmental Assessment Report

Precinct 15 Structure Plan



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Executive Summary

Stockland (the proponent) are progressing structure planning to enable future development of the land parcels comprising Precinct 15 of the East Wanneroo District Structure Plan (EWDSP) area. The Precinct 15 Structure Plan (SP) area extends across multiple land parcels under control of multiple proprietors; however, the proponent is seeking to progress planning across the whole of Precinct 15 in accordance with the requirements of the EWDSP. The SP will guide the future development of Precinct 15, an area of approximately 310 hectares (ha) incorporating a total of 14 lots (herein referred to as 'the site').

The EWDSP guides the progressive urbanisation of East Wanneroo and outlines the requirement to prepare individual structure plans for each of the 28 precincts to inform future urban development. The EWDSP has established the district-scale layout of future land uses, which each SP is to be consistent with. The key EWDSP land use elements that have informed and been accommodated within the proposed Precinct 15 SP layout include a 'regional sporting facility', an area of regional 'parkland' (associated with a significant wetland feature), a co-located railway and regional road alignment, a railway station and neighbourhood centre. Whilst accommodating these district layout elements, the SP also provides a localised level of layout resolution which has been designed to respond to the onsite conditions and environmental values, amongst other considerations.

This Environmental Assessment Report (EAR) supports the SP and is the principal supporting environmental document for the SP process. It includes a preliminary assessment of the proposed SP land uses, future management considerations and associated predicted environmental outcomes, against the applicable environmental factors (as defined by the Environmental Protection Authority).

The primary structural basis of the SP layout has been guided informed by the location and extent of the various district-scale land uses shown in the EWDSP, as discussed above. This has provided a level of restriction to the ability for the SP layout to strategically respond to environmental values within the site. Notwithstanding, the proponent has taken a range of measures to provide for the future retention of significant environmental values where possible (i.e. where there remains flexibility in the layout design process outside of the key structural elements defined by the EWDSP). This is primarily achieved through the strategic location and sizing of the future local public open space (POS) areas, which are not stipulated in the EWDSP layout.

In this context, the SP layout has been specifically designed to respond to the identified environmental values within the site where possible including the proposed future retention of:

- Two resource enhancement wetlands (unique feature identifiers #15433, #14254, #14261 and #14244), covering an area of 21.4 ha in size in addition to provision of 30 m buffer areas.
- Up to 200 mature native trees with a diameter at breast height of greater than 50 cm (which also represent potential nesting trees for conservation significant black cockatoo species; namely Carnaby's black cockatoo and forest red-tailed black cockatoo).
- Up to 6.7 ha of potential suitable black cockatoo foraging habitat.

In addition to targeted REW and mature retention outcomes discussed above; other native trees, shrubs and flora (including priority flora species *Jacksonia sericea*) may also be opportunistically

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retained where possible and appropriate within intersecting POS areas, through incorporation as part of the urban development landscaping process. These values may therefore continue to also provide habitat for conservation significant native fauna recorded within the site, including black cockatoos, quenda and the black-striped burrowing snake. As such, it is likely that heightened retention outcomes beyond those discussed above will ultimately be realised.

As part of the future subdivision and development process, the following management plans may be necessary, the implementation of which would further minimise potential environmental impacts that have the potential to arise through implementation of the SP:

- Acid Sulfate Soil and Dewatering Management Plan
- Construction Environmental Management Plan
- Urban Water Management Plan/s
- Foreshore Management Plan
- Aboriginal Cultural Heritage Management Plan
- Bushfire Management Plan.

Overall, a range of environmental impact mitigation measures (primarily impact avoidance and minimisation) are proposed within the SP layout and through the future environmental management framework. In this context, it is anticipated that implementation of the proposed SP can be suitably managed through future stages of the land use planning processes (including subdivision and development) such that the EPA objectives for the relevant environmental factors can be achieved.

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Appendices

Appendix A

Precinct 15 Structure Plan and Indicative Master Plan (CDP 2023)

Appendix B

East Wannon District Structure Plan (DPLH 2022)

Appendix C

Detailed Flora and Vegetation Assessment (Emerge Associates 2023)

Appendix D

Detailed Fauna and Targeted Black Cockatoo Assessment (Emerge Associates 2023)

Appendix E

Aboriginal Heritage Desktop Assessment (Horizon 2023)

Appendix F

Landscape Masterplan (Emerge Associates 2023)

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List of Abbreviations

Table A1: Abbreviations – General terms

General terms	
AHD	Australian Height Datum
AHIS	Aboriginal Heritage Inquiry System
ASS	Acid Sulfate Soil
BMP	Bushfire Management Plan
CBC	Carnaby's Black Cockatoo
CCW	Conservation Category Wetland
DWMS	District Water Management Strategy
EAR	Environmental Assessment Report
ESA	Environmentally Sensitive Area
FRTBC	Forest Red-tailed Black Cockatoo
ha	Hectares
km	Kilometres
LMP	Landscape Master Plan
LWMS	Local Water Management Strategy
MNES	Matters of National Environmental Significance
MUW	Multiple Use Wetland
PEC	Priority Ecological Community
PDWSA	Public Drinking Water Source Area
POS	Public Open Space
REW	Resource Enhancement Wetland
TEC	Threatened Ecological Community
UFI	Unique Feature Identifier
WoNS	Weeds of National Significance
WBA	Wetland Buffer Assessment

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Table A2: Abbreviations – Legislation and policies

Legislation and policies	
ACH Act	Aboriginal Cultural Heritage Act 2021
AH Act	Aboriginal Heritage Act 1972
BC Act	Biodiversity Conservation Act 2016
EP Act	Environmental Protection Act 1986
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999

Table A3: Abbreviations – Organisations

Organisations	
CoW	City of Wanneroo
DBCA	Department of Biodiversity Conservation and Attractions
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DPLH	Department of Planning, Lands and Heritage
DWER	Department of Water and Environmental Regulation
EPA	Environmental Protection Authority
WAPC	Western Australian Planning Commission

Table A4: Abbreviations – Planning and building terms

Planning and building terms	
DPS	District Planning Scheme
EWDSP	East Wanneroo District Structure Plan
EWSP	East Wanneroo Structure Plan
SP	Structure Plan
MRS	Metropolitan Region Scheme

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1 Introduction

1.1 Background

Stockland (the proponent) are progressing structure planning to enable future development of the land parcels comprising Precinct 15 of the East Wanneroo District Structure Plan (EWDSP) area. The Precinct 15 Structure Plan (SP) area extends across multiple land parcels under control of multiple proprietors; however, the proponent is seeking to progress planning across the whole of Precinct 15 in accordance with the requirements of the EWDSP. The SP will guide the future development of Precinct 15 incorporating a total of 14 lots, as outlined in **Table 1**, an area herein referred to as 'the site'. The Precinct 15 SP and associated Indicative Master Plan is provided in **Appendix A**.

The site is situated approximately 25 km north of the Perth Central Business District within the City of Wanneroo (CoW) and is bounded by harvested state forest plantations to the east, remnant bushland and rural-residential areas to the north, rural-residential land and Marignilup Lake (Bush Forever area 147) to the west and Lakeview Street and Bush Forever area 324 to the south. The location of the site, cadastral boundaries and lot numbers are shown in **Figure 1**.

The site is approximately 310 hectares (ha) in size and is predominantly zoned 'Urban Deferred' under the Metropolitan Region Scheme (MRS), whilst a portion along the eastern site boundary is zoned 'Rural - Water Protection'. The site is zoned 'General Rural' and 'Rural Resource' under the CoW *District Planning Scheme No. 2* (DPS No. 2). The MRS zones and reserves are shown in **Plate 1**.

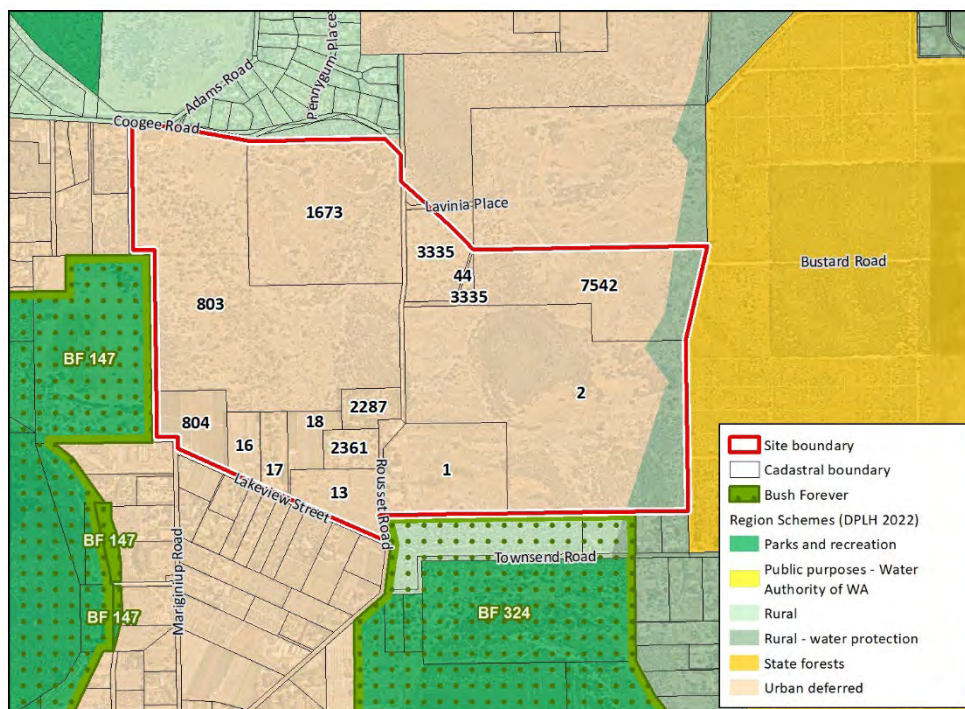


Plate 1: Metropolitan Region Scheme zones and reserves within and surrounding the site

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The EWDSP guides the progressive urbanisation of East Wanneroo, consistent with the land uses identified in the *North-West Sub-regional Planning Framework 2018*. It provides an additional level of detail to the historical sub-regional level *East Wanneroo Structure Plan* (DoP 2011). The EWDSP outlines the requirement to prepare a structure for each of the 28 precincts to inform future urban development. The EWDSP has established the district-scale layout of future land uses, which each SP is required to be consistent with. The EWDSP map is provided in **Appendix B**.

The key EWDSP land use elements that have informed and been accommodated within the proposed Precinct 15 SP layout include a 'regional sporting facility', an area of regional 'parkland' (associated with a significant wetland feature), a co-located railway and regional road alignment, a railway station and neighbourhood centre. Whilst accommodating these district layout elements, the SP also provides a localised level of layout resolution which has been designed to respond to the onsite conditions and environmental values, amongst other considerations.

Table 1: Lot description and ownership

Lot no.	Address	CoW DPS No.2 zoning	Land ownership	Area (ha)
1	170 Rousset Road	General Rural	Agostino Nominees Pty Ltd	20.2
2	220 Rousset Road	General Rural	Justin Corporation Pty Ltd	84.5
13	38 Lakeview Street	Rural Resource	Lakewood Estate Development Pty Ltd	8.2
16	62 Lakeview Street	Rural Resource	Private ownership	4.1
17	54 Lakeview Street	Rural Resource	Lakewood Estate Development Pty Ltd	4.0
18	46 Lakeview Street	Rural Resource	Private ownership	4.6
803	200 Mariginiup Road	General Rural	Justin Corporation and Shafto Pty Ltd	83.1
804	90 Lakeview Street	General Rural	Justin Corporation and Shafto Pty Ltd	8.1
1673*	285 Rousset Road	General Rural	Milino Pty Ltd and Ramat Pty Ltd	*40.7
2287	201 Rousset Road	Rural Resource	Private ownership	4.0
2361	175 Rousset Road	Rural Resource	Private ownership	4.0
3335*	264 Rousset Road	General Rural	Leghorn Pty Ltd and Milino Pty Ltd	*11.2
7541*	310 Rousset Road	General Rural	Shafto Pty Ltd and private ownership	*75.0
7542	30 McCaffrey Road	General Rural	Michael Neil Pty Ltd	30.3

*Lot partially included within site boundary (lot area includes the entirety of the lot)

1.2 Purpose of this report

The proponent engaged Emerge Associates (Emerge) to prepare an Environmental Assessment Report (EAR), which is the principal supporting environmental document for the Precinct 15 SP. The EAR supports the structure planning process and provides a synthesis of information regarding the environmental values and attributes of the site. The EAR is consistent with the Western Australia Planning Commission's (WAPC) *Structure Plan Framework* (WAPC 2015) and:

- Identifies and assesses the existing environmental values and attributes of the site (**Section 2**).

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- Discusses the land use planning context and the proposed SP, in the context of applicable statutory requirements under applicable legislation (**Section 3**).
- Provides an assessment of the proposed SP layout and land uses and predicted environmental outcomes against the applicable Environmental Protection Authority (EPA) environmental factors and objectives (**Section 4**).

1.3 Previous surveys and assessments

The following surveys, investigations and assessment reports were prepared to support preparation of the SP in accordance with the EWDSR requirements and are relevant to this EAR:

- Detailed Fauna and Targeted Black Cockatoo Assessment (Emerge Associates 2023b)
- Detailed Flora and Vegetation Assessment (Emerge Associates 2023c)
- Aboriginal Heritage Investigation Report (Horizon 2023)
- Landscape Masterplan (Emerge 2023)
- Bushfire Management Plan (Emerge 2023)
- Local Water Management Strategy (Pentium 2023).

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2 Existing Environment

The outcomes of desktop and site-specific investigations undertaken by Emerge and others have informed the identification and assessment of the existing environmental attributes and values within the site and are discussed in the below sections.

The Environmental Protection Authority (EPA) identifies a number of environmental principles, factors and objectives within the *Statement of Environmental Principles, Factors and Objectives* (EPA 2018), which are used to guide the determination of significant environmental impacts and whether impacts can be appropriately mitigated or managed. Existing environmental values have been described according to their applicable EPA environmental factor (where applicable to the site), which include:

- Landforms
- Terrestrial environmental quality
- Flora and vegetation
- Terrestrial fauna
- Inland waters
- Social surroundings.

2.1 Landforms

2.1.1 Landform, soils and geology

The site occurs on the Swan Coastal Plain, the geomorphic unit that characterises much of the Perth metropolitan area, and specifically within the transition between the Spearwood dune system and the Bassendean dune system. The Spearwood Dunes system typically consists of siliceous sands over limestone, with hilly to undulating terrain, whilst the older Bassendean Dune system is characterised by lower relief, with variable depth to groundwater, consisting of lower sandy hills interspersed with permanent and seasonal wetlands (Churchward and McArthur 1980; Gozzard 2011).

Fine scale soil landscape mapping by DPIRD (2019) shows seven units as occurring within the site, as described in **Table 2** and shown in **Figure 2**.

Table 2: Soil landscape mapping units within the site (DPIRD 2019)

Soil landscape unit	Description
Spearwood seasonal swamps phase	Depressions with free water in winter. Humus podzols and peat.
Karrakatta sand yellow phase	Low hilly to gently undulating terrain. Yellow sand over limestone at 1-2 m.
Bassendean seasonal swamps phase	Depressions with free water in winter. Humus podzols and peat.
Bassendean permanent lakes and swamps phase	Depressions. Humus podzols and peats around the edges often with some diatomite zoned vegetation with heath on upper slopes.
Bassendean, Jandakot phase	Jandakot low dunes. Slopes <10% and generally more than 5m relief. Grey sand over pale yellow sands generally underlain by humic and iron podsols.

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Table 2: Soil landscape mapping units within the site (DPIRD 2019) (continued)

Soil landscape unit	Description
Bassendean, Joel phase	Poorly drained depressions. Humus podzols.
Bassendean, Gavin phase	Flat or gently undulating landscape. Iron-humus podzols and some diatomite deposits.

Douglas Partners (2022b, a) conducted geotechnical investigations in 2022 within a large portion of the site, including Lots 2, 803, 1673, 3335 and Lot 7542. The investigations across the site included the excavation of a total of 69 test pits. Detailed logs indicate that the site is generally underlain by sand derived from tamala limestone and Bassendean sands consistent with the regional geological mapping. Ground conditions across the site generally comprise a layer of sandy topsoil between 0.05 m and 0.2 m thick followed by a 1 m- 3 m thick layer of sand, whilst localized cement soils and organic soils were also encountered in portions of the site.

Desktop research and field surveys completed to date did not identify any restricted landforms or unique geological features within the site. Notwithstanding, the site contains a prominent dunal ridgeline in its western extent.

2.1.2 Topography

The site is generally flat with the exception of the dunal ridgeline in the western portion of the site marking the transition between the Bassendean to the Spearwood dunal systems. Elevations across the site range from a minimum of 46 m Australian height datum (AHD) in the central portion of the site, largely associated with existing wetland features, to 59 mAHD along the dunal ridgeline in the western portion, as shown in **Figure 2**.

2.2 Terrestrial Environmental Quality

2.2.1 Acid sulfate soils

Acid sulfate soils (ASS) is the name commonly given to naturally occurring soils and sediment containing iron sulphide (iron pyrite) materials. In their natural state, ASS is generally present in waterlogged and/or anoxic conditions and do not present any risk to the environment. However, when oxidised, ASS can pose issues through sulphuric acid production, which can present a range of risks for the surrounding environment, infrastructure, and human health.

The Department of Water and Environmental Regulation (DWER) provides broad-scale mapping indicating areas of potential ASS risk (DWER 2023). A review of the DWER mapping indicates that discrete areas in the eastern portion of the site are classified as having a 'high to moderate' risk of ASS occurring within 3 m of the natural soil surface, which generally aligns with mapped wetland features within the site. Additionally, a large portion of the site is classified as having a 'moderate to low' risk of ASS occurring within 3 m of the natural soil surface but 'high to moderate' risk of ASS beyond 3 m of the natural soil surface. The western portion of the site associated with the ridgeline is classified as having no known risk of ASS occurring, as shown in **Figure 3**.

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2.2.2 Potential site contamination

A review of the publicly available DWER Contaminated Sites Database indicates that no areas within the site are registered as a contaminated site pursuant to the *Contaminated Sites Act 2003*.

Geotechnical investigations undertaken by Douglas Partners in 2022 did not include the assessment of surface or sub-surface materials or groundwater for contaminants.

2.2.3 Historical context

Historical aerial images available from 1965 and onwards (Landgate 2023) show that the western and central portion of the site were subject to vegetation clearing likely for agricultural land uses such as cattle grazing prior to 1965, as shown in **Plate 2**.



Plate 2: Historical aerial imagery 1965

By circa 1970, vegetation clearing extended in particular in the north eastern portion of the site likely to expand the agricultural land to this area. Scattered remnant and/or planted trees remained in the balance of the site whilst vegetation regrowth is evident in some portions of the site between 1965 and the 1970s, as shown in **Plate 3**.

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Plate 3: Historical aerial imagery 1970

By 1983 the wetland features within the site appear to have become depleted of surface water, as shown in **Plate 4**. Pine plantations to the east of the site are also clearly visible and extensive. Whilst patches of vegetation in portions of the site have been left to regenerate and largely still occur to date, periodic clearing of vegetation occurred throughout the 1980s and likely into the 2000s.



Plate 4: Historical aerial imagery year 1983

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Since the early 2000s it appears that vegetation regrowth within the site has increased (**Plate 5**), to this date the site has remained largely unchanged and vegetation has continued to regenerate in portions of the site.

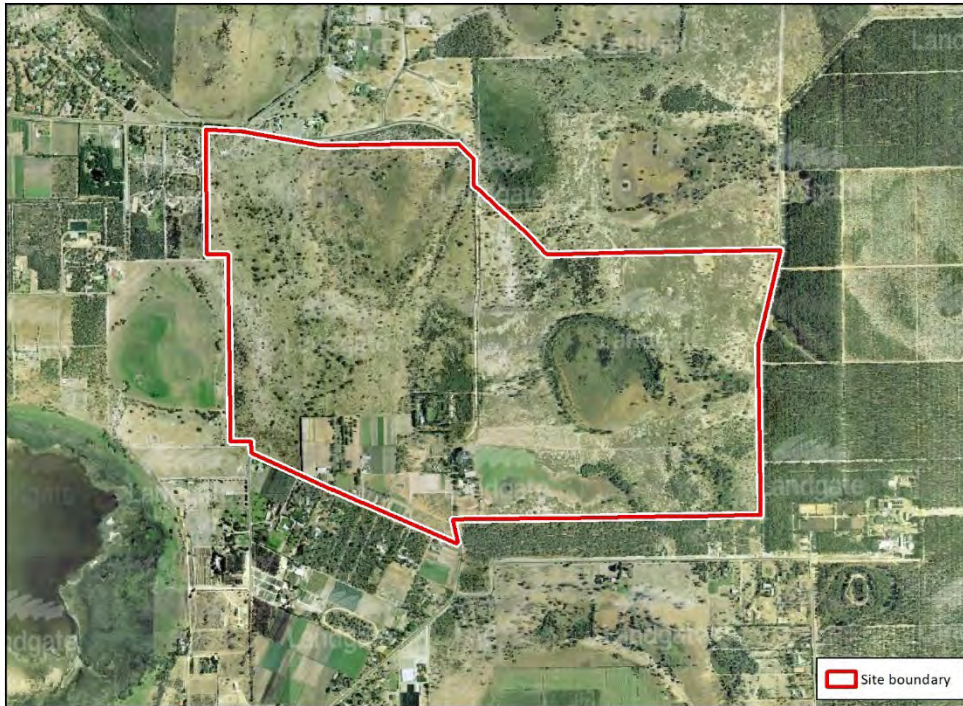


Plate 5: Historical aerial imagery year 2000

Overall, the site has been subject to extensive historical disturbance, primarily associated with clearing of most vegetation across the site prior to 1965. Some remnant vegetation remains today, along with areas that have naturally regenerated over time.

2.3 Flora and Vegetation

2.3.1 Regional context

Variations in native vegetation within the site can be classified based on regional vegetation associations. Hedde *et al.* (1980) mapping shows the site as comprising the 'Pinjar' complex, which is described as 'vegetation ranging from woodland to *Eucalyptus marginata* – *Banksia* spp. to a fringing woodland of *Eucalyptus rudis* – *Melaleuca preissiana* and sedgelands'. This complex was determined to have 35.5% remaining of its original pre-European extent within the Swan Coastal Plain, of which 4.6% is protected for conservation purposes (Government of Western Australia 2019).

The EPA's *Environmental Guidance for Planning and Development Studies* (EPA 2008b) states that the loss of biodiversity caused by habitat fragmentation is significantly greater once a habitat type falls below 30% of its original extent. The Guidance also references the biodiversity conservation national objective and target of retaining 30% of the original extent of each vegetation complex, and the states' minimum target of 10% for constrained urban areas such as the Swan Coastal Plain. The percentage remaining of the 'Pinjar' vegetation complex (35.5%) is above the 30% retention objective and above the 10% minimum retention target for the Swan Coastal Plain.

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Vegetation is typically considered to represent an intact occurrence of its overarching vegetation complex when it is in 'good' or better condition. As outlined in **Section 2.3.4**, vegetation in some portions of the site has been assessed to be in 'good' or 'very good' condition; therefore, this indicates that these areas of remnant native vegetation within the site, in particular where there is an abundance of *Eucalyptus marginata*, *Banksia* spp., *Eucalyptus rudis* and *Melaleuca preissiana*, is consistent with vegetation associations of the 'Pinjar' complex.

2.3.2 Site-specific investigations

Emerge (2023c) completed a detailed flora and vegetation assessment of the site on multiple dates between August 2022 and February 2023, including during the spring flowering period. The assessment boundary incorporates the site in addition to parts of the unconstructed Mariginiup Road reserve along the western site boundary, given it is anticipated that this road will be constructed to support residential development of the area.

Multiple lots within the southern portion of the site were unable to be directly accessed during the survey (refer to **Appendix B** Figure 2); however, observations of flora and vegetation was completed from the lot boundaries of adjacent lots and public road reserves. The lots which could not be directly accessed were observed to primarily contain market gardens and highly cleared rural-residential areas. As such the access restriction was considered unlikely to represent a significant limitation with respect to assigning vegetation types, vegetation condition or threatened and priority ecological communities. The primary limitation relates to compiling a full species list (primarily understorey species), and therefore the confirmation of presence/absence of threatened and priority species, although such values were considered unlikely to occur within lots comprising market gardens.

The assessment was completed to a 'detailed' survey standard of a flora and vegetation survey in accordance with EPA's *Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA 2016). The assessment report is provided in **Appendix B**.

The results of the assessment have been used to inform the following sections.

2.3.3 Vegetation types

Emerge (2023c) recorded 17 broad plant communities within the site, as described in **Table 3** and shown in **Figure 4**. Plant communities have been grouped as either 'upland' or 'wetland' type vegetation communities. Whilst wetland features within the site were observed to be dry year-round during the field surveys, the 'wetland' type communities are likely associated, if not dependent on shallow groundwater, and have therefore been classified as 'wetland' vegetation.

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Table 3: Description and extent of plant communities within the site (Emerge Associates 2023)

Plant community	Description	Area (ha)
Upland communities		
BaBmEpAn	Low woodland of <i>Banksia menziesii</i> , <i>Banksia attenuata</i> , <i>Eucalyptus todtiana</i> and <i>Nuytsia floribunda</i> over open shrubland of <i>Adenanthos cygnorum</i> , <i>Eremaea pauciflora</i> and <i>Jacksonia furcellata</i> over low shrubland of <i>Hibbertia hypericoides</i> , <i>Hypocalymma robustum</i> and <i>Scholtzia involucreta</i> over forbland of <i>Alexgeorgea nitens</i> , <i>Lyginia barbata</i> and open grassland of <i>*Ehrharta calycina</i> and <i>*Briza maxima</i> .	5.4
BaBmJfXp	Low woodland of <i>Banksia menziesii</i> , <i>Banksia attenuata</i> and <i>Allocasuarina fraseriana</i> over shrubland of <i>Jacksonia furcellata</i> over low shrubland of <i>Hibbertia hypericoides</i> , <i>Acacia huegelii</i> and <i>Conostephium pendulum</i> over forbland of <i>Desmocladus flexuosus</i> and <i>Alexgeorgea nitens</i> over open grassland of <i>*Ehrharta calycina</i> and <i>*Briza maxima</i> .	0.6
EmXp	Woodland of <i>Eucalyptus marginata</i> over low woodland of <i>Banksia menziesii</i> (or absent) over shrubland of <i>Xanthorrhoea preissii</i> and <i>Jacksonia sternbergiana</i> over low open shrubland of <i>Hibbertia hypericoides</i> , <i>Jacksonia sericea</i> and <i>Persoonia saccata</i> over forbland of <i>Mesomelaena pseudostygia</i> and <i>Desmocladus flexuosus</i> over open grassland of <i>*Ehrharta calycina</i> and <i>*Briza maxima</i> .	23.7
Xp	Scattered <i>Eucalyptus todtiana</i> over open shrubland of <i>Xanthorrhoea preissii</i> and <i>Jacksonia furcellata</i> over open low shrubland of <i>Lechenaultia biloba</i> over forbland of <i>Haemodorum spicatum</i> and <i>Patersonia occidentalis</i> over open grassland of <i>*Ehrharta calycina</i> and <i>*Briza maxima</i> .	21.4
Wetland communities		
BaBmKgSi	Low woodland of <i>Banksia attenuata</i> and <i>Banksia menziesii</i> over shrubland of <i>Kunzea glabrescens</i> and <i>Adenanthos cygnorum</i> over low shrubland of <i>Acacia pulchella</i> var. <i>pulchella</i> , <i>Bossiaea eriocarpa</i> and <i>Scholtzia involucreta</i> over forbland of <i>Sowerbaea laxiflora</i> , <i>Stylidium repens</i> and <i>Lyginia barbata</i> over open grassland of <i>*Ehrharta calycina</i> and <i>*Briza maxima</i> .	1.8
BiAc	Low open woodland of <i>Banksia ilicifolia</i> and <i>Eucalyptus todtiana</i> over open shrubland of <i>Adenanthos cygnorum</i> , <i>*Acacia longifolia</i> and <i>Kunzea glabrescens</i> over low shrubland of <i>Macarthuria australis</i> , <i>Scholtzia involucreta</i> and <i>Acacia pulchella</i> var. <i>pulchella</i> over forbland of <i>Alexgeorgea nitens</i> , <i>Desmocladus flexuosus</i> and <i>*Carpobrotus edulis</i> open grassland of <i>Microlaena stipoides</i> , <i>*Ehrharta</i> spp. and <i>*Briza maxima</i> .	5.0
Cc	Closed forest of <i>Corymbia calophylla</i> and <i>Eucalyptus rudis</i> over open shrubland of <i>Xanthorrhoea preissii</i> over closed fernland of <i>Pteridium esculentum</i> over forbland of <i>Sowerbaea laxiflora</i> and open grassland of <i>*Ehrharta calycina</i> and <i>*Briza maxima</i> .	0.7
EmKg	Open forest of <i>Eucalyptus marginata</i> and <i>Melaleuca preissiana</i> over tall shrubland of <i>Kunzea glabrescens</i> and <i>*Acacia longifolia</i> over shrubland of <i>Xanthorrhoea preissii</i> , <i>Pultenaea reticulata</i> and <i>Conostephium pendulum</i> over forbland of <i>Phlebocarya ciliata</i> and <i>Dasypogon bromeliifolius</i> over open grassland of <i>*Ehrharta calycina</i> and <i>*Briza maxima</i> .	4.7
ErAc	Open forest of <i>Eucalyptus rudis</i> over shrubland of <i>Adenanthos cygnorum</i> , <i>Regelia ciliata</i> and <i>Kunzea glabrescens</i> over forbland of <i>*Carpobrotus edulis</i> and <i>Trachymene pilosa</i> over open grassland of <i>*Ehrharta calycina</i> and <i>*Vulpia myuros</i> .	7.8
ErAs	Open forest of <i>Eucalyptus rudis</i> over open tall shrubland of <i>Astartea scoparia</i> and <i>*Acacia longifolia</i> over sparse open shrubland of <i>Hibbertia cuneiformis</i> over forbland of <i>Dielsia stenostachya</i> over open grassland of <i>*Briza maxima</i> and <i>*Romulea rosea</i> .	10.8

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Plant community	Description	Area (ha)
ErLb	Open forest of <i>Eucalyptus rudis</i> over open tall shrubland of <i>Exocarpos sparteus</i> , <i>Astartea scoparia</i> and <i>Jacksonia furcellata</i> over forbland of <i>Lyginia barbata</i> , <i>Lepidosperma longitudinale</i> and <i>Hypolaena exsulca</i> over grassland of <i>Ehrharta</i> spp. and <i>*Pentameris airoides</i> .	8.6
HaRc	Scattered <i>Melaleuca preissiana</i> over shrubland of <i>Hypocalymma angustifolium</i> and <i>Regelia ciliata</i> over forbland of <i>Dasypogon bromeliifolius</i> , <i>Hypolaena exsulca</i> and <i>Lyginia barbata</i> over open grassland of <i>*Ehrharta calycina</i> and <i>*Briza maxima</i> .	4.6
Kg	Scattered <i>Eucalyptus rudis</i> over closed tall shrubland of <i>Kunzea glabrescens</i> and <i>*Acacia longifolia</i> over shrubland of <i>Hypocalymma angustifolium</i> over scattered grassland of <i>*Ehrharta longiflora</i> .	12.1
KgAl	Scattered <i>Eucalyptus rudis</i> and <i>*Pinus pinaster</i> over closed tall shrubland of <i>Kunzea glabrescens</i> and <i>*Acacia longifolia</i> over shrubland of <i>Pultenaea reticulata</i> over forbland of <i>Machaerina vaginalis</i> and <i>Lyginia barbata</i> over scattered grassland of <i>*Ehrharta longiflora</i> and <i>*Briza maxima</i> .	10.4
Mp	Open forest of <i>Melaleuca preissiana</i> over shrubland of <i>Adenanthos cygnorum</i> and <i>Xanthorrhoea preissii</i> over forbland of <i>Dasypogon bromeliifolius</i> , <i>Patersonia occidentalis</i> and <i>Phlebocarya ciliata</i> over open grassland of <i>*Ehrharta calycina</i> .	2.7
Mt	Open shrubland of <i>Melaleuca teretifolia</i> over forbland of <i>*Carpobrotus edulis</i> and <i>*Lotus angustissimus</i> over grassland of <i>*Bromus diandrus</i> , <i>*Ehrharta</i> spp and <i>*Pentameris airoides</i> .	11.4
Other		
Non-native	Heavily disturbed areas comprising non-native or planted vegetation with occasional scattered native trees, shrubs or forbs. Buildings, bare ground and areas of horticulture were also included in this community.	181.8

2.3.4 Vegetation condition

Emerge (2023c) assessed vegetation condition within the site to range from 'Very Good' to 'Completely Degraded', as shown in **Figure 5** and detailed in **Table 4**.

Table 4: Vegetation condition within the site

Condition category (Keighery 1994)	Area (ha)
Pristine	0
Excellent	0
Very good	25.2
Good	64.6
Good - degraded	2.0
Degraded	40.2
Completely degraded	181.8

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2.3.5 Threatened and Priority Ecological Communities

Threatened Ecological Communities (TECs) are recognised as ecological communities that are rare or under threat and therefore warrant special protection.

At a Commonwealth level, TECs are afforded statutory protection under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). At the State level, TECs are afforded statutory protection under the *Biodiversity Conservation Act 2016* (BC Act). Under both Acts, TECs are listed as either 'critically endangered', 'endangered' or 'vulnerable', noting listing status may be different between Commonwealth and State levels.

At a State level, an ecological community under consideration for listing as a TEC but which does not yet meet survey criteria or has not been adequately defined, or which is rare but not currently threatened, is referred to as a 'Priority Ecological Community' (PEC). Whilst PECs are not afforded statutory protection under the BC Act, they are recognised and categorised by the Department of Biodiversity, Conservation and Attractions (DBCA) and are considered through approval processes.

Emerge Associates (2023c) identified the following TECs and PECs as occurring within the site:

- 12.1 ha of 'Banksia Woodlands of the Swan Coastal Plain' TEC (EPBC Act 'Endangered') and PEC (DBCA 'Priority 3(iii)')¹
- 6.9 ha of low lying *Banksia attenuata* woodlands or shrublands PEC (DBCA 'Priority 3(i)').

With respect to the identified PECs, DBCA define the respective categories as follows:

- Priority 3(i): Poorly known ecological 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.
- Priority 3(iii): Poorly known ecological communities, made up of large, and/or widespread occurrences, that may or may 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, inappropriate fire regimes, clearing, hydrological change etc.

The extent and location of the TEC and PECs across the site is shown in **Figure 6** with photographic representation provided in **Plate 6** and **Plate 7**.

No other TECs or PECs were recorded or considered likely to occur within the site.

¹ The Banksia Woodlands of the Swan Coastal Plain TEC and PEC have the same description, area and condition thresholds, but have different listing status at Commonwealth and State levels.

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Plate 6: Banksia Woodlands TEC and PEC within the site



Plate 7: 'Low lying Banksia attenuata woodlands or shrublands' PEC

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2.3.6 Significant flora

Certain flora species that are considered to be rare or under threat warrant special protection under Commonwealth and/or State legislation. At a Commonwealth level, flora species may be listed as 'threatened' pursuant to the EPBC Act. At a State level, plant species may also be classed as 'threatened' under the BC Act. Species that are potentially rare or threatened, meet the criteria for near-threatened, or have recently been removed from the threatened species list are classed as 'priority' flora species. However, priority flora species are not afforded statutory protection.

As part of the detailed flora assessment undertaken by Emerge (2023c), one priority flora species was recorded within the site namely *Jacksonia sericea* (Priority 4).

DBCA define Priority 4 (P4) species as 'rare, near threatened and other species in need of monitoring' that are not currently threatened and are considered to have been adequately surveyed and/or have been removed from the list of threatened species.

Jacksonia sericea (P4) is locally common within the western portion of the site. The species is also common across calcareous and sandy soils of the Swan Coastal Plain from the south of Mandurah to the north of Joondalup, with numerous records occurring within 10 km of the site. A total of 301 individual plants were recorded within the **BaBmEpAn**, **BaBmJfXp**, **BaBmKgSi** and **EmXp** plant communities. All recorded locations of the species are shown in **Figure 6**. Photographic representation of *Jacksonia sericea* is provided in **Plate 8** and **Plate 9**.

No other priority or threatened flora were recorded or considered likely to occur within the site.



Plate 8: *Jacksonia sericea* (P4) habit



Plate 9: *Jacksonia sericea* (P4) flower

2.3.7 Weeds

The term 'weed' can refer to any plant that requires some form of action to reduce its effect on the economy, the environment, human health and amenity. At a State level, a particularly invasive or detrimental weed species may be listed as a 'declared pest' pursuant to the *Biosecurity and Agriculture Management Act 2007* (BAM Act), indicating that it warrants special management to limit its spread. At a Commonwealth level, the Australian government has compiled a list of 32 Weeds of National Significance (WoNS) (DoEE 2019c).

Emerge (2023c) recorded a total 51 introduced flora species, two of which are listed as declared pests under the BAM Act namely *Asparagus asparagoides* (bridal creeper) and *Moraea flaccida* (one-leaf cape tulip). Bridal creeper is also listed as a WoN.

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2.3.8 Bush Forever

The Government of Western Australia's *Bush Forever Policy* (Government of WA 2000) is a strategic plan for conserving regionally significant bushland within the Swan Coastal Plain portion of the Perth Metropolitan Region. The objective of Bush Forever is to protect comprehensive representations of all original vegetation complexes by targeting a minimum of 10% of each for protection. Bush Forever areas represent regional ecosystems and habitat and have a vital role in conserving Perth's biodiversity. Bush Forever areas are mapped within the MRS.

No Bush Forever areas occur within the site. Bush Forever area 147 (Mariginiup Lake and Adjacent Bushland, Mariginiup) directly abuts the south-western corner of the site, and Bush Forever area 324 (Jandabup Lake and Adjacent Bushland, Jandabup/Mariginiup) lies adjacent to the southern boundary. Bush Forever area 324 extends to the south, and significant flora species are known to occur in this site. The location of both Bush Forever areas external to the site are shown in **Plate 1** and **Figure 7**.

2.3.9 Ecological linkages

Ecological linkages are linear landscape elements that allow the movement of fauna, flora and genetic material between areas of remnant habitat. The Perth Biodiversity Project, supported by the Western Australian Local Government Association have identified and mapped regional ecological linkages within the Perth Metropolitan Region (WALGA and PBP 2004). While the linkages generally align with areas of vegetation and Bush Forever areas, in many locations these linkages are not contiguous with vegetation coverage.

Regional Ecological Linkage No. 16 extends over the south eastern portion of the site further to the south and east intersecting with Ecological Linkage No. 12, which runs in a north to south direction adjacent to the western site boundary, as shown in **Figure 7**.

2.3.10 Environmentally Sensitive Areas

'Environmentally sensitive areas' (ESAs) are prescribed under the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* and identify where the Clearing Permit exemptions prescribed under the Regulations do not apply. They include areas of native vegetation associated with significant wetlands, threatened flora, threatened communities and Bush Forever areas.

The site is not mapped as an ESA; however, multiple ESA's occur abutting the site boundary to the south and west associated with Bush Forever areas 147 and 324 and to the north likely associated with mapped conservation category wetlands.

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2.3.11 City of Wanneroo Local Biodiversity Plan

The CoW's Local Biodiversity Plan (LBP) (CoW 2018) outlines targets for the retention, protection and management of local natural areas (LNAs), which are defined in the LBP as all unprotected natural areas over which the CoW can exercise the most control through its decision-making powers, policies and reserve management. LNAs are identified within private property, public or regional open space and state government freehold land not zoned 'Parks and Recreation' under the MRS.

The LBP maps and prioritises LNAs based on their relative ecological value, which is determined through a weighted multi-criteria spatial analysis considering the following ecological criteria:

- Regional vegetation complex (and the percentage of the complex remaining)
- Proximity to conservation areas or Bush Forever areas
- Environmentally Sensitive Areas
- Patch size
- Occurrence of/proximity to threatened or priority flora
- Occurrence of/proximity to threatened or priority ecological communities
- Black cockatoo foraging habitat
- Proximity to wetlands or wetland buffers
- Ecological linkages.

Based on the multi-criteria analysis, the LBP assigns each LNA a relative ecological value score between 0 and 10 (low to high priority). Based on this score, the LBP identifies those areas with the highest prioritisation for protection and conservation.

Within the site, LBP maps a number of LNAs which range in a priority score from a minimum of 4 to a maximum of 8 (out of a possible score of 10), as shown in **Plate 10**.

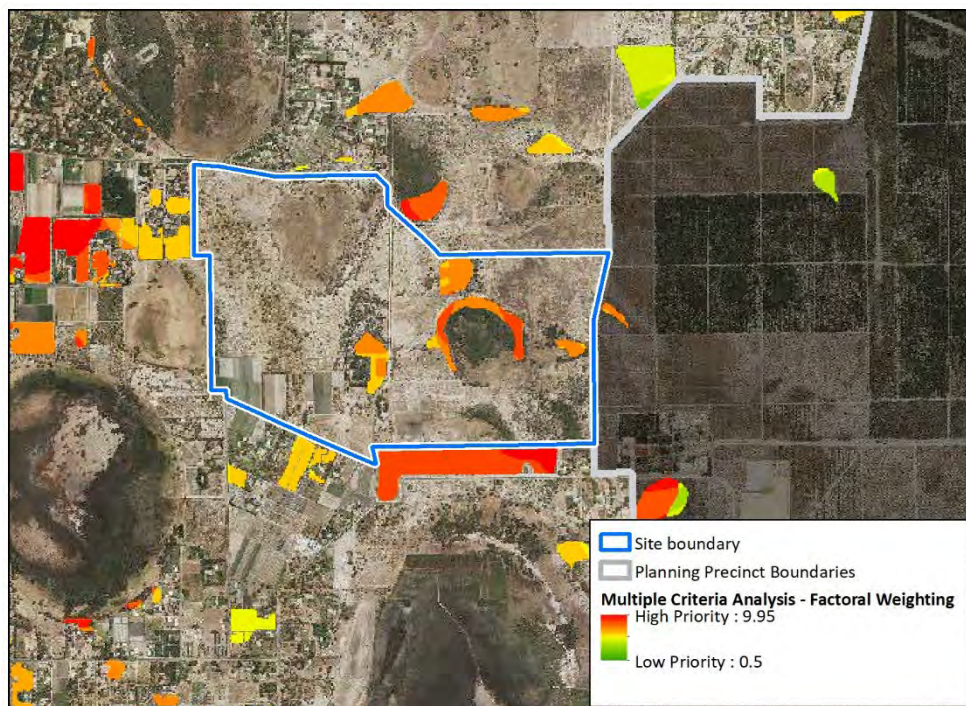


Plate 10: Local natural area priority rating, City of Wanneroo

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2.4 Terrestrial Fauna

2.4.1 Site-specific surveys and investigations

Emerge (2023b) completed a detailed fauna and targeted black cockatoo assessment of the site (and the unconstructed Mariginiup Road reserve) between 28 March and 12 December 2022. The assessment methodology included:

- A fauna trapping program
- An assessment of fauna habitat within the site and its suitability to provide habitat for conservation significant fauna.
- A targeted survey to determine the presence of habitat for threatened black cockatoo species.

Multiple lots within the southern portion of the site were unable to be accessed during the survey (refer to **Appendix C** Figure 2); however, observations of fauna habitat was completed from the lot boundaries of adjacent lots and road reserves. The lots which could not be directly accessed were observed to primarily contain market gardens and highly cleared rural-residential areas. As such the access restriction is unlikely to represent a significant limitation with respect to assigning fauna habitat types, but instead limit the ability to provide a complete record of mature native trees with a diameter at breast height of > 50 cm potentially providing suitable habitat for conservation significant species such as black cockatoo, although these are unlikely to occur in areas actively used as market gardens.

The assessment was completed to the standard of a 'detailed' fauna survey and a 'targeted' black cockatoo survey with reference to the Environmental Protection Authority's (EPA's) technical guidance (EPA 2020) and the *Environment Protection and Biodiversity Conservation Act* black cockatoo referral guidelines (DAWE 2022). The assessment report is provided in **Appendix C**.

2.4.2 Fauna habitat

Emerge (2023b) identified 11 broad fauna habitats within the site, as outlined in **Table 5** and shown in **Figure 8**.

The majority of the site (59%) comprises **cleared** fauna habitat, which consist of heavily disturbed areas of grassland with the occasional scattered native tree or shrubs and would potentially only provide suitable habitat for common and widespread non-native species.

The highest fauna habitat values were considered to be associated with the **jarrah forest, banksia woodland**, and **jarrah woodland** habitats which occur over approximately 12.05% of the site. The remainder of the site comprises various forest, woodland and shrubland habitats with little to no understorey.

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Table 5: Fauna habitats identified within the site

Fauna habitat	Description	Area (ha)
Jarrah forest	Open forest of <i>Eucalyptus marginata</i> and <i>Melaleuca preissiana</i> over native shrubs and non-native grasses.	4.7
Marri forest	Closed forest of <i>Corymbia calophylla</i> and <i>Eucalyptus rudis</i> over shrubland of <i>Xanthorrhoea preissii</i> over fernland of <i>Pteridium esculentum</i> .	0.7
Melaleuca forest	Open forest of <i>Melaleuca preissiana</i> over shrubland of <i>Adenanthos cygnorum</i> and <i>Xanthorrhoea preissii</i> over native forbland and non-native grasses.	2.7
Banksia woodland	Open woodland of <i>Banksia attenuata</i> , <i>B. menziesii</i> , <i>Eucalyptus todtiana</i> and <i>Nuytsia floribunda</i> over native shrubs and non-native grasses.	12.8
Flooded gum woodland	Closed woodland to open forest of <i>Eucalyptus rudis</i> over native shrubs over native forbland and non-native grasses.	27.1
Jarrah woodland	Open woodland of <i>Eucalyptus marginata</i> and <i>E. todtiana</i> over shrubland of <i>Xanthorrhoea preissii</i> over non-native grasses.	20.2
Balga shrubland	Open shrubland of <i>Xanthorrhoea preissii</i> over non-native grasses.	19.5
Melaleuca shrubland	Open shrubland of <i>Melaleuca teretifolia</i> over non-native forbland and grasses.	11.4
Myrtle shrubland	Scattered <i>Eucalyptus rudis</i> or <i>Melaleuca Preissiana</i> over tall shrubland of <i>Kunzea glabrescens</i> or <i>Hypocalymma angustifolia</i> over non-native grasses.	26.9
Non-native planted	Predominantly planted non-native trees and shrubs.	8.0
Cleared	Heavily disturbed areas comprising predominantly grassland with the occasional scattered tree or shrub. Areas of hardstands, tracks, buildings or agricultural land were also included in this habitat type.	179.5

2.4.3 Species of conservation significance

Certain fauna species that are considered to be rare or under threat warrant special protection under state and/or federal legislation. At a Commonwealth level, fauna species may be listed as ‘threatened’ pursuant to the EPBC Act. At a State level, fauna species may also be classed as ‘threatened’ under the BC Act. In addition to this, the DBCA maintains a list of priority fauna species which, while not considered ‘threatened’ under the BC Act and therefore are not afforded statutory protection, elicit some concern over their long-term survival.

Emerge Associates (2023b) recorded four fauna species of conservation significance within the site during site-specific investigations and fauna trapping, namely:

- Carnaby’s black cockatoo (*Calyptorhynchus latirostris*), listed as ‘endangered’ under the EPBC Act and BC Act, discussed in **Section 2.4.3.1**.
- Forest red-tailed black cockatoo (*Calyptorhynchus banksii naso*), listed as ‘vulnerable’ under the EPBC Act and BC Act, discussed in **Section 2.4.3.2**.
- Black-striped burrowing snake (*Neelaps calonotos*), DBCA ‘priority 3’, discussed in **Section 2.4.3.3**.
- Quenda (*Isoodon fusciventer*), DBCA ‘priority 4’, discussed in **Section 2.4.3.4**.

In addition, a further ten species of conservation significance were identified as ‘possible’ to occur within the site due to the presence of suitable habitat, discussed in **Section 2.4.3.5**.

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2.4.3.1 Carnaby's black cockatoo

Carnaby's black cockatoo (CBC) were observed flying over the site, which was not unexpected as the site is within the modelled distribution range of the species.

Dominant primary food plants for CBC within the site are *Banksia menziesii* (firewood banksia), *Banksia attenuata* (candle stick banksia), jarrah and marri. The dominant secondary food plant is *Xanthorrhoea preissii* (grass tree). A total of up to 38.5 ha of potential primary foraging habitat for CBC and up to 19.5 ha of secondary foraging habitat for CBC was recorded within the site, as shown in **Figure 9**. These areas are likely an over-estimation of actual CBC foraging habitat, given they are based on broad fauna habitat type mapping which does not exclude cleared areas between patches of vegetation and trees (which are common across the highly disturbed site), nor does it exclude flora species within these areas which are not known to be foraged upon by black cockatoos.

A total of 365 black cockatoo habitat trees were recorded within the site, as shown in **Figure 9**. A 'habitat tree' was defined as a native eucalypt that is typically known to support black cockatoo breeding (such as marri, jarrah, blackbutt, tuart, wandoo, salmon gum or to a lesser extent flooded gum), with a diameter at breast height (DBH) of greater than 50 cm (or DBH greater than 30 cm for wandoo or salmon gum). The habitat trees identified within the site comprise 156 *Eucalyptus rudis* (flooded gum), 155 jarrah, 30 marri, 15 stag (dead) trees and nine *E. totiana* (pricklybark). Of the recorded 365 habitat trees, 37 were assessed to potentially contain hollows suitable for black cockatoo nesting based on an initial inspection from ground level. These 37 habitat trees were then further assessed through an internal hollow inspection, which determined none contained hollows of suitable morphology to support black cockatoo nesting.

No evidence of CBC roosting activity was observed within the site; however, it is noted that the habitat trees within the site would provide suitable roosting habitat for CBC.

2.4.3.2 Forest red-tailed black cockatoo

Forest red-tailed black cockatoo (FRTBC) were observed foraging within the site, which was not unexpected as the site is within the modelled distribution range of the species.

Dominant primary food plants for FRTBC within the site are jarrah and marri. A total of up to 29.2 ha of potential native primary foraging habitat for FRTBC was recorded within the site, as shown in **Figure 10**. No secondary foraging habitat was identified for FRTBC. As outlined in **Section 2.4.3.1**, these areas are likely an over-estimation of actual FRTBC foraging habitat.

As discussed above, a total of 365 black cockatoo habitat trees were recorded within the site, as shown in **Figure 10**. No habitat trees were determined to contain suitable hollows for black cockatoo breeding.

No evidence of FRTBC roosting activity was observed within the site; however, it is noted that the habitat trees within the site would provide suitable roosting habitat for FRTBC.

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2.4.3.3 Black-striped burrowing snake

The black-striped burrowing snake was recorded within the site by cage trap within the **banksia woodland** habitat area (**Plate 11**). This habitat is considered ideal for the species and banksia woodland vegetation, which is common across the local area, has likely supported a healthy population of this species for some time. A DBCA record from 1976 recorded the species 300 m to the west of the trapping location within the site. The species is known to inhabit sandy soils found in banksia or eucalyptus woodlands, but has also been observed on coastal dunes vegetated with heath. Based on this, areas of sandy soils with relatively intact vegetation cover within the site were mapped as suitable habitat for this species, as shown in **Figure 11**. Notwithstanding, it is acknowledged that the species being a burrower, it is possible that it could inhabit any area within the site comprising sandy soils including areas of 'cleared' habitat.



Plate 11: Black striped burrowing snake caught within the site

2.4.3.4 Quenda

On preliminary assessment, multiple areas within the site were considered suitable habitat for quenda and the field survey confirmed this with multiple sightings. Quenda were recorded on cameras in multiple areas of the site (**Plate 12**) and were also caught by cage traps. The unique conical diggings of quenda were also observed throughout the site.

Given quenda inhabit vegetation with dense understorey occurrence of the species within the site would likely be limited to sections within the site where vegetation provides suitable habitat (including the majority of woodland and shrubland type vegetation within the site), likely excluding any areas comprising sparse grassland with little to no native vegetation cover; however, quenda may also forage across or traverse other habitats within the site. Areas of potential Quenda habitat within the site have been mapped on this basis, as shown in **Figure 12**.

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Plate 12: Quenda recorded on camera trap within the site.

2.4.3.5 Other species that possibly occur

At the time of the site-specific survey, a total of ten species of conservation significance were identified as 'possible' to occur within the site as it contains habitat of at least marginal quality and/or extent for a species, and the site being located within the known distribution range, which is supported by recent literature from near the site (Emerge Associates 2023b). However, these species were not recorded and include migratory species that may only opportunistically fly over the site on commute or while searching for food. This include the following species:

- Douglas's broad-headed bee (*Hylaeus globuliferus*), listed as 'critically endangered' under the EPBC Act and BC Act.
- Chuditch (*Dasyurus geoffroii*), listed as 'vulnerable' under the EPBC Act and BC Act.
- Pacific swift (*Apus pacificus*), listed as 'migratory' under the EPBC Act and BC Act.
- Peregrine falcon (*Falco peregrinus*), listed as 'other specially protected' under the BC Act.
- Spiny katydid (*Austrosaga spinifer*), DBCA 'priority 2'.
- Swan Coastal Plain shield-backed trapdoor spider (*Idiosoma sigillatum*), DBCA 'priority 3'.
- A short-tongued bee (*Leioproctus contrarius*), DBCA 'priority 3'.
- Woollybush bee (*Hylaeus globuliferus*), DBCA 'priority 3'.
- Graceful sun-moth (*Synemon gratiosa*), DBCA 'priority 4'.
- Western brush wallaby (*Notamacropus irma*), DBCA 'priority 4'.

The conservation significant invertebrates (bees, graceful sun moth, Swan Coastal Plain shield-backed trapdoor spider and spiny katydid) could all occur within the site based on the soils and vegetation present. However, records of these species are sparse in the local area. While numerous common invertebrates were captured in pitfall and funnel traps, the Emerge (2023b) survey was targeting vertebrate fauna and as such targeted invertebrate surveys would be required to determine the presence of these species.

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Chuditch are a small to medium sized mammal that occur in a range of woodland and shrubland habitats. Emerge (2023b) did not record evidence of this species within the site. Whilst the survey used camera and cage traps, which can capture chuditch, the survey was not designed to specifically target the detection of this species. Notwithstanding, given that there are no recent records in the local area, Emerge (2023b) considered it is not likely chuditch occur in the site. Chuditch are threatened species and are rarely recorded in developed portions of the Swan Coastal Plain. Nonetheless, as chuditch can roam over a large range, and suitable habitat is present in the site, it is possible that chuditch may occasionally or temporarily occur.

Habitat suitable for the western brush wallaby also exists within the site but evidence of the species was not recorded during the Emerge (2023b) survey. Similar to the chuditch, they may visit the site as suitable habitat is present although it is likely on an occasional and temporary basis.

Pacific swift and peregrine falcon are highly mobile species that may opportunistically fly over or forage in the site for short periods of time as part of a much larger home range. Neither of these species would breed within the site. Any occurrence of Pacific swift or peregrine falcon in the site would likely be in the air space and largely independent from terrestrial habitat.

2.5 Inland Waters

2.5.1 East Wanneroo District Water Management Strategy

In accordance with *Better Urban Water Management* (WAPC 2008), a district water management strategy (DWMS) was prepared on behalf of DPLH to support the EWDSP in 2021, which incorporated the site. The DWMS provides a summary of the existing water resources and environmental conditions within the EWDSP area to demonstrate that the land is capable of urban land uses. The DWMS highlights the need for a more detailed investigation for individual precincts including the preparation of a local water management strategy (LWMS) and urban water management plans at later planning stages.

2.5.2 Local Water Management Strategy

Pentium Water (2023) prepared an LWMS the site which provides a comprehensive assessment of the existing hydrological settings and how the future proposed development within the site will integrate water sensitive urban design outcomes and how the proposed land use addresses the protection of water dependent environments, water use and identify existing and required stormwater management infrastructure.

2.5.3 Groundwater

2.5.3.1 Regional groundwater

Information on the regional groundwater resources (DWER 2023) indicates that the site is underlain by a multi-layered aquifer system comprised of the following resources:

- Perth - Superficial Swan (unconfined)
- Perth - Leederville (confined)
- Perth – Yarragadee North (confined).

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The historic maximum groundwater level (MGL) dataset shown in the *Perth Groundwater Map* (DWER 2022a) shows the depth to groundwater levels from soil surface across the site range from 1 m within wetland features in the eastern portion of the site to 15 m in the western portion of the site along the ridgeline. Depth to water within the majority of the site is between 4 m and 5 m.

2.5.3.2 Site-specific groundwater data

Groundwater monitoring has been undertaken within the site from May 2022 to July 2023. Pentium Water (2023) installed ten groundwater bores and four piezometers across the site in May and August 2022 for the purpose of pre and post - development monitoring with the groundwater monitoring undertaken across the site on a monthly basis (with the exception of December 2022) since installation.

Groundwater levels across the site have ranged from a minimum of 42.50 mAHD in April 2023 in the north western portion of the site to a maximum of 49.44 mAHD in November in the north eastern corner of the site (Pentium 2023). Relative to existing surface levels, the measured groundwater levels ranged from a minimum of 0.86 metres below ground level (mbgl) in the south eastern portion of the site in September 2022 to a maximum of 8.03 mbgl in the central east portion of the site in April 2023 (Pentium 2023).

Based on the MGL contours, groundwater flows generally east to west across the site, which is consistent with the regional mapping (Pentium 2023).

2.5.4 Surface water

The *Hydrography Linear* dataset (DWER 2020) shows the following surface water related features within the site:

- Two 'earth dams' within the northern and central portion of the site.
- Two 'areas subject to inundation' within the north-western and southern portion of the site, comprising multiple use wetland #15022 and #14252 respectively.
- A 'lake – non-perennial' in the eastern portion of the site associated with resource enhancement wetland #15443.
- A 'drain – major' in the central portion of the site intersecting through multiple use wetland #14248 linking resource enhancement wetlands #14247 and #15443.

The majority of the site drains into local depressions that are associated with the multiple use wetlands and resource enhancement wetlands within the site, whilst the ridge in the western portion of the site results in drainage into Little Mariginiup Lake (CCW #8161) located to the west of the site (Pentium 2023).

2.5.5 Wetlands

Wetlands include “*areas of seasonally, intermittently or permanently waterlogged soils or inundated land, whether natural or otherwise, fresh and saline, e.g. waterlogged soils, ponds, billabongs, lakes, swamps, tidal flats, estuaries, rivers and their tributaries*” (Wetlands Advisory Committee 1977).

Wetlands can further be recognised by the presence of vegetation associated with waterlogging or the presence of hydric soils such as peat, peaty sand or carbonate mud (Hill *et al.* 1996).

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Wetlands of international significance (such as Ramsar wetlands) are afforded protection under the EPBC Act. No such wetlands occur within or in proximity to the site.

At a regional level, DBCA maintains the Geomorphic Wetlands of the Swan Coastal Plain dataset (DBCA 2023), which categorises wetland features into management categories to guide land use and conservation, as outlined in **Table 6**. Wetland types are based on landform shape and water permanence, whilst management categories of wetlands are determined based on hydrological, biological and human use features.

Table 6: Geomorphic wetland management categories

Management Category	Description of wetland	Management objectives
Conservation Category Wetland (CCW)	Support high levels of attributes	Preserve wetland attributes and functions through reservation in national parks, crown reserves and state owned land. Protection provided under environmental protection policies.
Resource Enhancement Wetland (REW)	Modified or degraded but still supporting substantial attributes and functions	Restore wetland through maintenance and enhancement of wetland functions and attributes. Protection via crown reserves, state or local government owned land, environmental protection policies and sustainable management on private properties.
Multiple Use Wetland (MUW)	Few remaining important wetland attributes and functions but still provide important hydrological functions	Use, development and management considered in the context of water, town and environmental planning through land care.

A review of the dataset indicated that there are multiple REWs and MUWs occurring within the site and several CCWs within close proximity of the site, as outlined in **Table 7** and shown in **Figure 13**.

Table 7: Geomorphic wetlands present within the site and surrounds.

UFI	Geomorphic classification	Location	Area (ha)
Conservation category wetlands			
14241	Sumpland	Approximately 30 m to the north of the site	12.8
7960 (Lake Adams)	Dampland	Approximately 90 m to the north-west of the site	33.2
7959 (Lake Adams)	Dampland	Approximately 90 m to the north-west of the site	56.7
8161 (Little Mariginiup)	Sumpland	Approximately 60 m to the west of the site	17.5
Resource enhancement wetlands			
15443	Dampland	Eastern portion of the site	17.3
14244	Dampland	Eastern portion of the site	1.2
14245	Dampland	Eastern portion of the site	2.9
14253	Dampland	South eastern portion of the site	2.6
14247	Dampland	Central portion of the site	5.3
14261	Dampland	Eastern portion of the site	1.4
14254	Dampland	Eastern portion of the site	1.6

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UFI	Geomorphic classification	Location	Area (ha)
Multiple use wetlands			
15022	Dampland	North western portion of the site	38.3
8164	Dampland	Central portion of the site	9.7
14252	Dampland	Southern portion of the site	8.7
14248	Dampland	Central portion of the site	1.8
15442	Dampland	Eastern Portion of the site	6.4

2.5.6 Public drinking water source areas

DWER proclaims Public Drinking Water Source Areas (PDWSAs) to protect identified drinking water sources, including surface water and groundwater sources (DoW 2009). They are proclaimed under the *Metropolitan Water Supply, Sewerage and Drainage Act 1909* or the *Country Areas Water Supply Act 1947* as Water Reserves, Catchment Areas or Underground Water Pollution Control Areas.

The eastern portion of the site zoned 'rural – water protection' under the MRS is associated with the Priority 2 (P2) Gnangara Underground Water Pollution Control Area, as shown in **Figure 13**. *Water Quality Protection Note (WQPN) 25 Landuse Compatibility Tables for Public Drinking Water Source Areas* (DoW 2016) indicates that subdivision of land for residential purposes within a P2 in an area zoned 'Urban Residential' or 'Urban Deferred' and the creation of recreational parks and/or sporting ovals is incompatible. However, it is envisaged that the future rezoning of land within the site that intersects the PDWSA will trigger reclassification of the areas of P2 to P3* (which are defined as areas changed from P1 or P2 as a result of government-approved strategic planning for urban development in the MRS), as outlined in WQPN 38 (DWER 2018).

Parts of multiple wellhead protection zones intersect the eastern portion of the site, associated with the nearby location of the Wanneroo groundwater treatment plant (WGTP). The WGTP draws water from shallow and deep groundwater aquifers, prior to treating the water and then piping the water for distribution. This would be considered as part of any PDWSA reclassification from P2 to P3*.

2.6 Social Surroundings

2.6.1 Aboriginal cultural heritage

In Western Australia, Aboriginal cultural heritage is currently managed pursuant to the *Aboriginal Cultural Heritage Act 2021*². DPLH maintain the Aboriginal Cultural Heritage Inquiry System (ACHIS), which is a directory containing locations and information about Aboriginal Cultural Heritage (ACH) in the State. A desktop assessment of the ACHIS identified ACH 'Directory Place 22160 Marringinup' extending across the majority of the site, whilst two other ACH features are mapped in proximity to the site, as shown in **Figure 14** and detailed in **Table 8**.

² In August 2023, the WA Government announced that the ACH Act would be repealed and replaced by an amended version of the *Aboriginal Heritage Act 1972* (AH Act). At the time of writing, this change to the statutory framework is yet to be legislated.

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Table 8: Aboriginal cultural heritage within and in proximity to the site

Site ID & name	Status	ACH type	Site description	Location (ACHIS, DPLH)
22160 (Marrynginup)	ACH Directory	Place	<ul style="list-style-type: none"> • Artefacts/scatter • Ceremonial • Historical • Modified tree • Camp • Hunting place • Meeting place • Water resource • Named place • Natural feature 	Extending across the majority of the site.
3741 (Lake Mariginiup)	ACH Directory	Place	<ul style="list-style-type: none"> • Of mythological significance • Hunting Place 	Approximately 400 m south-west of the site, west of Mariginiup Road.
3396 (Lake Adams)	ACH Historic	Place	<ul style="list-style-type: none"> • Of mythological significance • Hunting Place • Plant resource • Water source 	Approximately 100 m north-west of the site, north of Coogee Road

Horizon Heritage completed an Aboriginal Heritage desktop assessment of the site and surrounding area (**Appendix E**). The scope of this assessment was to understand the extent of the characteristics of any known or likely ACH values within the site, based on a desktop assessment and research. The assessment did not include onsite archaeological or ethnographic Aboriginal heritage surveys.

'ACH Directory Place 22160 Marrynginup' is mapped on the DPLH directory with a large polygon, which restricts publicly displaying its reliable location and site boundary. The site custodian gave Horizon permission to access and geographically define the actual ACH Place boundary and for Emerge to utilise any geographical information in this EAR.

The true extent and spatial boundary of ACH Place 22160 Marrynginup is largely associated with CCW UFI 14241 to the north of the site and only slightly intersects into the north central portion of the site, as shown in **Figure 14**. ACH Place 22160 is identified in the ACHIS to be a very significant and sensitive area (healing area) important for Aboriginal spiritual health and cultural well-being, as was confirmed by Horizon (2023).

It is possible that surface expressions of *in situ* cultural material (artefacts) could be present (Horizon 2023) within the portion of ACH Place 22160 intersecting into the site, albeit unlikely given the area having been subject to historical vegetation clearing and ground disturbance. It is also possible that artefacts potentially occur around the margins of landscape features like lakes, swamps, wetlands and any sand hill features within the broader site. Wetland features within and surrounding the site have been determined to be of particular significance as numerous camp sites have previously been identified in proximity of freshwater lakes in the broader Wanneroo area (Horizon 2023).

Horizon (2023) recommended that consultation with the Whadjuk People (Whadjuk Aboriginal Corporation) and the site custodian should be undertaken and that an Aboriginal Cultural Heritage Management Plan should be prepared and implemented prior to vegetation clearing and other ground disturbance works associated with development of the site.

The need for statutory approvals or consents (pursuant to the ACH Act or AH Act, pending resolution of the legislative framework) will require consideration prior to development works commencing.

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2.6.2 Non-Indigenous heritage

A desktop search of the Australian Heritage Database (Department of the Environment 2019), the State Heritage Office database and City of Wanneroo Scheme Heritage List, indicates there are no listed non-indigenous heritage sites located within, or in proximity to the site.

2.6.3 Surrounding land uses

The East Wanneroo area supports a variety of exiting land uses, some of which have the potential to be incompatible within sensitive urban land uses due to the potential for amenity impacts associated with dust, noise, gaseous or odour emissions. Such land uses relevant to the site and surrounding area include existing poultry farms, basic raw materials extraction areas, market gardens, turf farms and nurseries.

EPA (2005) *Guidance Statement No. 3. Separation Distances between Industrial and Sensitive Land Uses* includes recommended generic separation distances between industrial and sensitive land uses to avoid land use conflicts.

2.6.3.1 Poultry farms

No existing poultry farms are known to occur within or nearby to the site. The closest known poultry farm operation is situated approximately 1.3 km west of the site.

EPA (2005) recommends a generic separation distance of 300-1000 m between sensitive land uses and poultry farms, depending on size of the operations.

2.6.3.2 Market gardens, turf farms and nurseries

The south-western portion of the site contains existing market garden land uses, which will ultimately transition to urban land uses through implementation of the SP.

A range of market gardens, orchards and plant or tree nurseries occur in proximity to the site. Where these occur within 500 m, these are shown in **Figure 15**. The type and scale of these existing operations is variable. No existing turf farms are known to occur in proximity to the site.

Table 9 outlines the EPA's (2005) recommended generic separation distance for the above land uses.

Table 9: EPA (2005) recommended generic separation distances for various land uses

Industry type and description	Recommended generic separation distance (EPA 2005)
Greenhouse (using manure or compost)	200-300 m
Market gardens (broad-scale operations)	300-500 m, depending on size
Nurseries (no composting)	100 m
Orchards (broad-scale operations)	500 m
Turf farms and lawns (broad-scale turf production)	500 m

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2.6.3.3 Basic raw materials

State Planning Policy (SPP) 2.4 Basic Raw Materials (BRM) (WAPC 2021) provides a policy framework to ensure BRM and extractive industries matters are considered during planning and development decision-making, to facilitate the responsible extraction and use of the State's BRM resources. SPP 2.4 identifies (and spatially defines) two supply categories for BRM:

- **Significant geological supplies (SGS)**, which are identified as the highest priority extraction areas for BRM. SGS are BRM identified by the Department of Mines, Industry Regulation and Safety (DMIRS) that represent strategic, long-term supplies of BRM requiring protection.
- **Extraction sites**, which comprise all commercial sites from which BRM are extracted, and quarries. These may overlap with SGS areas but many occur outside of SGS areas. ES may include future, proposed, approved and operating commercial extractive industries under the *Planning and Development (Local Planning Schemes) Regulations 2015*, the *Local Government Act 1995*, the *Mining Act 1978* or a combination of these Acts.

In the Perth and Peel regions, SPP 2.4 also identifies BRM 'exclusion areas' – for either environmental, resource conflict or land use planning reasons – which must be avoided.

No SPP 2.4 SGS, extraction sites or exclusion areas are mapped within the site, as shown in **Figure 15**. The nearest SPP 2.4 SGS is approximately 5km south-east of the site within the locality of Melaleuca, part of which is subject to active sand resource extraction being undertaken at the Hanson Gaskell Quarry.

Large areas of harvested or remaining pine plantations immediately east of the site are mapped within a SPP 2.4 'extraction site'. Two existing sand quarries currently operate within a small portion of the mapped SPP 2.4 'extraction site', as shown in **Figure 15**:

- Hanson Jandabup Quarry, situated approximately 0.9 km east of the site
- Holcim Jandabup Quarry, situated approximately 1.2 km south-east of the site.

EPA (2005) recommends a generic separation distance of 300-500 m between sensitive land uses and "extractive industries – sand and limestone, with no grinding or milling works".

2.7 Other considerations

2.7.1 Bushfire hazards

The majority of the site is identified within a 'bushfire prone area' on the state-wide Map of Bush Fire Prone Areas (OBRM 2022), as shown in **Plate 13**. State Planning Policy (SPP) 3.7 *Planning in Bushfire Prone Areas* and the associated Guidelines require strategic planning proposals, including structure plans, to be supported by a bushfire hazard level assessment. Emerge Associates (2023a) have prepared a Bushfire Management Plan (BMP) for the site and addresses this requirement, and examines the various responses to the identified bushfire risk (following development) that will make the ultimate use of the land suitable for its intended purpose.

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The BMP identified a variety of bushfire hazards within and surrounding the site, including different patches of forest, woodland, scrub and grassland hazards. Further information is provided in the BMP, which also provides an assessment of how future development within the site can satisfy the policy measures of SPP 3.7.

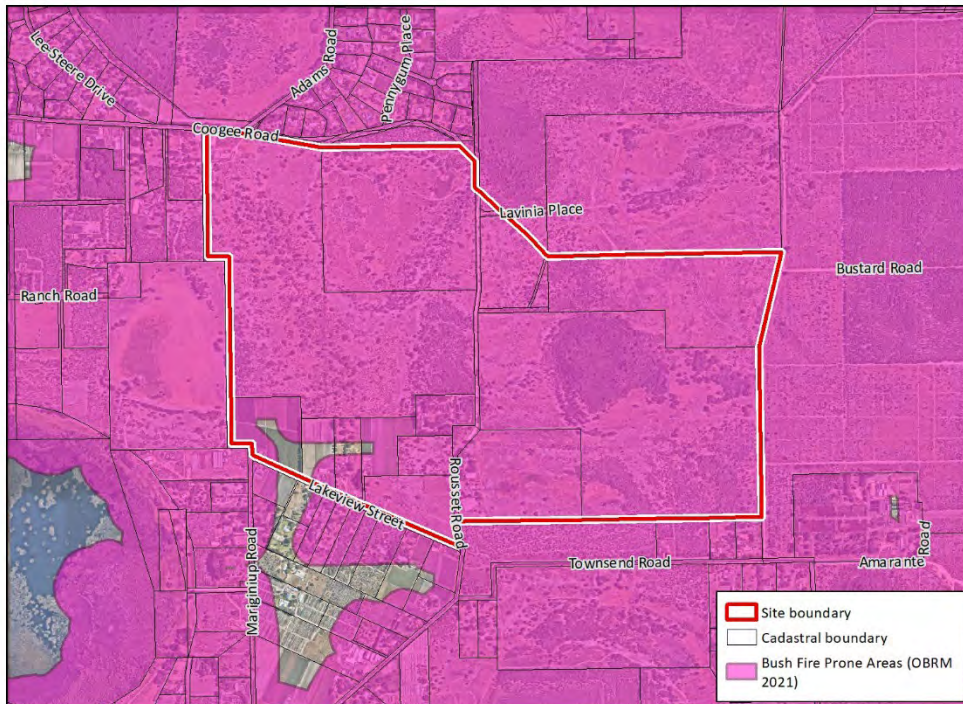


Plate 13: Bushfire prone areas

2.8 Summary of existing environmental values

Table 10 summarises the existing environmental values occurring within the site, as outlined and discussed in **Sections 2.1 to 2.6**.

Table 10: Summary of existing environmental values within the site by EPA factor

EPA factor	Summary of existing environmental values within the site
Landforms	<ul style="list-style-type: none"> No restricted landforms or unique geological features have been identified within the site. Notwithstanding, the site contains a prominent dunal ridgeline in its western extent.
Terrestrial environmental quality	<ul style="list-style-type: none"> Areas in the eastern portion of the site are classified as having a 'high to moderate' risk of ASS occurring within 3 m of the natural soil surface. Additionally, a large portion of the site is classified as having a 'moderate to low' risk of ASS occurring within 3 m of the natural soil surface but a 'high to moderate' risk of ASS beyond 3 m of the natural soil surface. The western portion of the site associated with the ridgeline is classified as having no known risk of ASS occurring. The site is not registered as a contaminated site pursuant to the <i>Contaminated Sites Act 2003</i>.
Flora and vegetation	<ul style="list-style-type: none"> 181.1 ha (58%) of the site comprises non-native or planted vegetation with occasional scattered native trees or shrubs in 'Completely Degraded' condition. A further 40.2 ha (13%) of the site supports vegetation in 'Degraded' condition. These areas are no longer representative of an intact native plant community due to significant historical disturbance. 89.8 ha (29%) of the site comprises native vegetation in 'good' or better condition and represents intact occurrences of the Pinjar regional vegetation complex.

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EPA factor	Summary of existing environmental values within the site
	<ul style="list-style-type: none"> • 12.1 ha of the Banksia Woodlands TEC and PEC and 6.9 ha of the Low Lying Banksia Priority 3 PEC occurs within the site. No other TECs or PECs have been identified or are likely to occur. • No threatened flora species have been recorded or are likely to occur within the site. • One priority flora species has been identified within the site; being 301 individuals of <i>Jacksonia sericea</i> (P4). No other priority flora species are likely to occur within the site. • No existing conservation areas or reserves such as Bush Forever areas intersect the site. • One ecological linkage partially crosses the site. A variety of significant environmental values (as outlined in this Table) occur in this area of the site and may contribute to the function of the mapped ecological linkages in this area.
Terrestrial fauna	<ul style="list-style-type: none"> • A total of 10 fauna habitats were identified within the site associated with patches of native wetland and upland type vegetation in varying condition. • Four conservation significant species were recorded within the site including CBC (threatened – endangered) , forest red-tailed black cockatoo (threatened - vulnerable), black-striped burrowing snake (priority 3) and quenda (priority 4). • Native vegetation within the site provides for up to 38.5 ha of potential primary foraging habitat for CBC and 25.7 ha for FRTBC. These values are likely an over-estimation of actual foraging habitat within the site for each species. • A total of 365 mature native black cockatoo habitat trees occur within the site, none of which contain suitable nesting hollows. • A total of 69.6 ha of vegetation within the site provides potential habitat for quenda and 65.4 ha of potential habitat for the black-striped burrowing snake. This is based on broad fauna habitat type mapping. • A total of ten conservation significant species were determined 'possible' to occur within the site; however, most of which would use the site only opportunistically.
Inland waters	<ul style="list-style-type: none"> • No conservation category wetlands (CCWs) have been identified within the site; however, multiple CCWs occur adjacent to the site. • Multiple REW features occur within the site including REWs UFI 15443, 14254, 14261 and 14244.
Social surroundings	<ul style="list-style-type: none"> • Aboriginal Cultural Heritage Directory Place 22160 Marrynginup is mapped with a large polygon across the majority of the site with the true extent situated north of the site (with a partial intersection) and was determined to be a significant and sensitive area (healing area) which is important for Aboriginal spiritual health and cultural well-being. • No listed non-indigenous heritage places are known to occur within the site. • A range of existing market gardens, nurseries, orchards and SPP 2.4 BRM policy areas occur in proximity to the site.
Other considerations	<ul style="list-style-type: none"> • Vegetation surrounding the site will pose a permanent bushfire hazard to the development within the site, which has been considered as part of the Bushfire Management Plan prepared to support the SP and future development within the site.

In addition, the following environmental values known to occur within the site are also listed as matters of national environmental significance (MNES) and therefore afforded protection under the EPBC Act:

- Banksia Woodlands TEC
- Black cockatoo habitat (CBC and FRTBC).

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3 Land Use Planning Context

3.1 Historical land use planning content

3.1.1 East Wanneroo Structure Plan (2011)

The East Wanneroo Structure Plan (EWSP) was approved in 2011 to provide a high level response to the potential opportunities, issues and constraints within the East Wanneroo area, including the site, and an implementation framework for future MRS amendments and district structure planning processes. The EWSP identified the East Wanneroo area for urban development and raised emphasis on the district structure planning requirements due to the multiplicity of landholdings in the area and the need to coordinate and stage the provision of required infrastructure and facilities.

3.1.2 MRS Amendment 1308/41 (2018)

Following approval of the EWSP in 2011, the WAPC initiated MRS amendment 1308/41 in 2015 to rezone more than 2200 ha of land (including the majority of the site) from 'Rural' to 'Urban Deferred'. The proposed amendment was advertised for public comment in April 2016 and subsequently updated to include additional areas within the proposed 'Urban Deferred' zone. The amendment came into effect in September 2018.

MRS Amendment 1308/41 aligned with the approved EWSP and the State Government's *North-West Sub-Regional Planning Framework* (published March 2018), which identified the amendment area for 'urban expansion'. Subsequent to the MRS amendment, the Department of Planning, Lands and Heritage (DPLH) proceeded with the preparation of the EWSP, which considered the entire East Wanneroo area and not just land limited to the MRS amendment, as discussed in **Section 3.1.3**.

3.1.2.1 Environmental Protection Authority advice

In February 2016 the EPA determined that MRS amendment 1308/41 should not be assessed under the EP Act as the environmental impacts of the scheme amendment were not so significant as to warrant formal assessment. Notwithstanding this, the EPA provided advice and recommendations.

The EPA advised that the amendment could be managed to meet the EPA's environmental objectives, through the preparation of future local planning scheme provisions and structure plans to manage and protect the identified environmental factors of flora and vegetation, terrestrial fauna, amenity and human health (now social surroundings) and inland waters environmental quality (now inland waters). The EPA further recommended that future amendments to the City of Wanneroo LPS would need to contain specific mechanisms and provisions to adequately secure, protect and manage environmental values within the amendment area. The key environmental considerations identified by the EPA included:

- Flora and vegetation: TECs, TF and vegetation complexes with less than 30% remaining.
- Terrestrial fauna: CBC habitat.
- Inland waters: CCWs.
- Social surroundings: separation distances between proposed sensitive land uses and existing market gardens, poultry, mushroom farms, turf farms and plant nurseries.

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3.1.3 East Wanneroo District Structure Plan (2021)

The EWDSP guides the progressive urbanisation of an 85 km² area of East Wanneroo and builds upon the EWSP (2011), *North-West Sub-regional Planning Framework* (2018) and MRS Amendment 1308/41 (2018). Future implementation of the EWDSP is anticipated to provide for forecasted increases in the local population from the existing 15,000 to approximately 150,000 people. The EWDSP is provided in **Appendix B** with precinct 15 (the site) highlighted.

The EWDSP requires a structure plan to be prepared for each of the identified 28 EWDSP precincts, to guide future urban development. The EWDSP has established the district-scale layout of future land uses, which each SP is required to be consistent with. The key EWDSP land use elements that have informed and been accommodated within the proposed Precinct 15 SP layout include a 'regional sporting facility', an area of regional 'parkland' (associated with a significant wetland feature), a co-located railway and regional road alignment, a railway station and neighbourhood centre. Whilst accommodating these district layout elements, the SP also provides a localised level of layout resolution which has been designed to respond to the onsite conditions and environmental values, amongst other considerations, as further outlined in **Section 3.2**.

3.1.3.1 Environmental Assessment Study

Emerge Associates (2018) prepared an environmental assessment study (EAS) commissioned by DPLH to support preparation of the EWDSP. The EAS identified 'priority areas for further investigation' across the EWDSP area, which are identified as 'Parklands (subject to confirmation)' on the EWDSP map. No such areas are identified within the site.

3.2 Precinct 15 Structure Plan

The Precinct 15 SP prepared for the site (**Appendix A**) provides a framework for the provision of future land use, subdivision and development within the site. Additionally, an Indicative Master Plan (**Appendix A**) has been prepared for the site which provides a more detailed conceptual layout for residential cells, the road network, public open spaces (POS) areas, schools, the neighbourhood centre, sporting fields, the rail corridor and park and ride facilities.

The SP has been developed through an iterative and collaborative design process involving a variety of stakeholders, including a multi-disciplinary design team providing expertise in the following fields:

- Town planning and urban design
- Environmental planning
- Aboriginal heritage
- Hydrology
- Civil and geotechnical engineering
- Traffic engineering
- Economic analysis.

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3.2.1 Structure plan layout

As outlined in **Section 3.1.3**, the SP layout is required to be consistent with the approved EWDSPP layout and associated land uses. In this context, provision of the following land uses identified in the EWDSPP within the site form the structural basis of the SP and indicative Master Plan layout:

- 'Regional sporting fields' in the south-east of the site.
- 'Parklands' area associated with the major REW feature in the east of the site (UFIs 15443, 14254 and 14261).
- 'Parkland link' running north-south through the centre of the site.
- 'Integrator arterial roads' running north-south and east-west (Lakeview Road) through the site.
- 'Transit corridor (underground)' running north-south through the site, with an associated 'transit station', providing a combined rail (underground) and road (above ground) corridor.
- 'Centre' associated with a neighbourhood centre adjacent to the transit station.
- 'Urban neighborhood' and 'suburban neighborhood' areas across the balance of the site, including provision of a primary school and high school.

The location and extent of these land uses is spatially defined in the EWDSPP map, which have been reflected in the SP layout and associated Indicative Master Plan to ensure the required consistency with the EWDSPP.

In this context, the SP layout provides for a transit orientated community hub amongst wider residential land uses, which integrates natural features retained and preserved within public open space (POS) areas to protect key ecological values as well as significant regional sporting facilities. Specifically, the SP and indicative Master Plan layout provide:

- Approximately 110 ha of mixed density residential land.
- Development of a local neighbourhood centre providing retail and commercial land uses.
- POS areas comprising approximately 10% of the overall site's development footprint, providing vegetation retention opportunities and wetland protection areas including 30 m buffer zones.
- Potential provision of a new Mariginiup train station including a Park n Ride.
- An integrated movement and access network with connections to nearby existing and future major roads.
- Approximately 50 ha of regional sporting fields including ovals, tennis courts, playgrounds, club rooms, indoor sporting facilities, car parks and dog parks.
- Approximately 12 ha for Land Lease Community housing.

3.2.2 Environmental considerations in preparation of the structure plan

Environmental values and considerations have been a core pillar of the iterative and collaborative SP design process, which has culminated in the proposed SP and Indicative Master Plan layout provided in **Appendix A**.

As outlined above, the primary structural basis of the SP layout has been guided informed by the location and extent of the various district-scale land uses shown in the EWDSPP, as discussed above. This has provided a level of restriction to the ability for the SP layout to strategically respond to environmental values within the site. Minimum residential density requirements specified in the EWDSPP also restrict the ability to respond to and retain environmental assets within the site.

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Notwithstanding, the proponent has taken a range of measures to provide for the future retention of significant environmental values where possible (i.e. where there remains flexibility in the layout design process outside of the key structural elements defined by the EWDSP). This is primarily achieved through the strategic location and sizing of the future local public open space (POS) areas, which are not stipulated in the EWDSP layout.

3.2.2.1 Mature trees

Mature native trees are a significant environmental asset within the site. Amongst other values, mature trees identified within the site provide black cockatoo habitat (foraging, potential roosting and potential breeding), are generally of a large and mature size, can largely be grouped into discrete consolidated patches, and also co-align with other environmental features such as wetlands and the natural ridgeline.

In this context, the mature trees within the site are generally of high retention value and the SP layout design process has appropriately responded to this. The key design considerations and outcomes in this respect are summarised as follows:

- Early conceptual designs for the SP would have resulted in removal of the western ridgeline to facilitate use of the significant BRM sand resource underlying this area, which would essentially remove any ability for trees to be retained in this area due to the significant reduction in existing surface levels. The proponent chose to explore alternative options whereby tree retention could instead be facilitated in this area, resulting in significant modifications to the conceptual bulk earthworks design being undertaken.
- As a result of this, the multi-disciplinary design team worked collaboratively to facilitate the proposed SP layout whereby three core POS areas have been provided at different points along the ridgeline, which focus on the most dense patches of mature tree occurrence to maximise tree retention. Existing levels will generally be maintained in these areas to facilitate tree retention, meaning considerable modification to the bulk earthworks design was necessary. Overall, this has provided for the retention of up to 58 mature trees with a DBH > 50 cm in this area, in addition to a significant further number of co-located trees with a DBH < 50 cm that have not been assessed in onsite surveys to date (due to their smaller size).
- Separately, significant tree retention outcomes are proposed in the east of the site through the retention of two key REW features. The large central REW proposed for retention, along with its associated buffer, provides for the retention of an addition 64 mature trees. An additional 21 mature trees are also identified for future retention in the smaller REW proposed for retention and its associated buffer. Further opportunities then exist to retain a further mature tree in a potential green link between these REWs. This is discussed further below.

3.2.2.2 Wetlands

Wetland retention considerations across the site have been driven by the core retention of the main REW in the east of the site (UFIs 15443, 14254 and 14261), given this was identified at a district-scale for retention in the EWDSP. There are no mapped CCW features within the site, but four other REWs are also mapped within the site.

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Through the iterative SP layout design process, it was considered infeasible to retain all four remaining REW values within the site whilst also achieving the necessary requirements of the EWDSP; specifically the Precinct 15 dwelling number and density requirements, as well as provision of the required number and type of sporting fields within the regional open space areas.

In this context, a comparative assessment of retention opportunities for each of the four REWs was undertaken as part of the SP layout design process, to understand if any of the REWs would be suitable and feasible to retain (whilst also achieving the necessary EWDSP outcomes for Precinct 15).

This included consideration of:

- Whether it would be viable to retain the REW and maintain the integrity of its ecological and hydrological functions, whilst also accommodating the required EWDSP land uses.
- Co-alignment with mature trees, to maximise retention outcomes that provide for both wetland and mature tree retention.
- Vegetation condition of the wetland, with wetlands containing more intact native vegetation more likely to remain viable into the future and provide a greater conservation asset.
- Linkage opportunities to other POS areas, to maximise potential green links between POS areas within the site.

Table 11 provides a summary of how these considerations were comparatively assessed for each of the four remaining REWs not identified for retention in the EWDSP.

Table 11: REW retention considerations

	REW 14253	REW 14247	REW 14245	REW 14244
EWDSP status & spatial constraints	<ul style="list-style-type: none"> • Not identified for retention at DSP stage. • Severed by identified future east-west integrator arterial road. • Within identified future regional sporting fields. 	<ul style="list-style-type: none"> • Not identified for retention at DSP stage. • Severed by proposed major transit corridor (road and rail). • Within area identified for residential land use. 	<ul style="list-style-type: none"> • Not identified for retention at DSP stage. • Severed by identified future east-west integrator arterial road. • Within identified future regional sporting fields. 	<ul style="list-style-type: none"> • Not identified for retention at DSP stage. • <u>Not</u> severed by any road or rail. • Within identified regional sporting fields.
Relative occurrence of mature trees (DBH > 50 cm)	• Low	• Low	• High	• High
Vegetation condition	• Primarily 'good' condition	• Combination of 'good', 'degraded' and 'completely degraded' condition.	• Primarily 'very good' condition	• Primarily 'good' condition
Linkage opportunities to other POS	• Moderate, but would inhibit regional sporting field functionality.	• Low	• Moderate, but would inhibit regional sporting field functionality.	• Moderate, but would inhibit regional sporting field functionality.

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Based on the outcomes of the above, and in addition to REWs 15443, 14254 and 14261, an additional REW has been identified for retention in the SP, being REW 14244. This wetland contains native vegetation in an intact condition, is co-aligned with a large patch of mature trees, and critically is not severed by any arterial road or railway corridors identified in the EWDSPP. Whilst it is located within the regional sporting fields, its location, size and dimensions allow for the required number and type of playing fields to still be provided around the retained wetland. Furthermore, there are also opportunities to provide a green linkage between REW 14244 with the primary REW feature (UFIs 15443, 14254 and 14261). Additional retention of REWs within the regional sporting fields (e.g. REW 14253 or 14245) would not be feasible whilst also achieving the required sporting field requirements of EWDSPP due to area constraints. It is also noted that both of these wetlands will also be severed by the regional arterial road identified in the EWDSPP.

Overall, the retention of the primary REW feature (UFIs 15443, 14254 and 14261) as well as REW 14244 provides a conservation outcome that balances achieving environmental outcomes within the significant spatial constraints of the site and EWDSPP design and density requirements.

3.2.2.3 Other retention considerations

The EWDSPP design constraints discussed above also limit the ability for other environmental values within the site to be retained in future POS, including occurrences of the Banksia Woodlands TEC, as this occurs solely within the EWDSPP regional sporting fields area and the unconstructed Mariginiup Road reserve, within which the ability to retain intact vegetation communities within conservation POS is significantly restricted. Furthermore, the potential to retain small patches of intact native vegetation with the intent of maintaining an intact native vegetation community within relatively small POS areas (with a high perimeter to area ratio) is not conducive to those areas being ecologically viable in the long term – due to edge effects and proliferation of weeds, amongst other threatening processes.

Notwithstanding this, and in addition to targeted REW and mature retention outcomes discussed above; other native trees, shrubs and flora (including priority flora species *Jacksonia sericea*) may also be opportunistically retained where possible and appropriate within intersecting POS areas, through incorporation as part of the urban development landscaping process. These values may therefore continue to also provide habitat for conservation significant native fauna recorded within the site, including black cockatoos, quenda and the black-striped burrowing snake. As such, it is likely that heightened retention outcomes beyond those discussed above will ultimately be realised which include environmental values beyond just wetlands and mature trees.

The key aspects of the SP layout considerations to the environmental values are shown in **Figure 16**.

3.2.3 Wetland buffer assessment

The EWDSPP outlines that a wetland buffer assessment (WBA) is to be completed to support the Precinct 15 SP, given the EWDSPP identifies REW 15433 in the eastern portion of the site to be retained and therefore requiring a buffer adjacent to urban land uses.

CoW *Local Planning Policy 4.1 Wetlands* intends for any development to appropriately protect and manage the environmental attributes of wetlands, and also requires wetland buffers to be determined, protected and managed for all wetlands identified for protection.

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As outlined above, the SP accommodates for the future retention of two dampland type REW features in the eastern portion of the site:

- REW UFI #15443, REW UFI #14254 and REW UFI #14261
- REW UFI #14244.

3.2.3.1 Policy context

There is currently a gap in contemporary policy and guidance in Western Australia in relation to the determination of wetland buffers and as such, older guidance has been used (*Environmental Guidance for Planning and Development Guidance Statement (GS) 33* (EPA 2008a) and the draft *Guideline for the Determination of Wetland Buffer Requirements* (WAPC 2005)) for the purpose of this assessment.

The role of a wetland buffer is to maintain the ecological processes, values and functions of a wetland and to protect the wetland from potential adverse impacts (EPA 2008a). GS 33 states that wetlands that are to be protected require a minimum 50 m buffer distance. GS 33 does not outline a scientific rationale as to why a 50 m buffer is prescribed as the minimum separation distance, but also states that alternatively a site-specific buffer assessment could be undertaken. The WAPC (2005) developed draft guidelines which can be used for site-specific buffer assessments, and notes that buffering may involve a combination of a setback distance and/or a physical barrier.

3.2.3.2 Separation distance

A separation distance requirement for a wetland buffer is effectively based on the combined distance and management necessary to counterbalance potential impacts on the wetland, such as but not limited to habitat protection, edge effects on wetland values, bushfire management and water quality management.

In determining a setback using site-specific studies the overall setback should be determined by:

- The wetland's values
- The activities, land uses or development near the wetland, existing and proposed; and
- The threats posed by the adjacent activities, land uses or development.

Wetland values

The environmental values of the two REWs proposed for retention are summarised as follows:

- Similar to most wetlands across the Swan Coastal Plain, both wetlands are expressions of groundwater. They also act as natural low-points in the landscape where surface water runoff flows toward and drains.
- Based on a review of historical aerial imagery, onsite observations and historical groundwater trends, both wetlands historically held free surface water routinely or permanently across an annual period. However, as groundwater levels have historically lowered across the Gnangara Mound region (generally correlated with the expansion and growth of pine plantations and introduction of land uses with high groundwater abstraction, such as market gardens) this is no longer common for either wetland, with both features typically absent of free surface water throughout an annual period.

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- Existing vegetation within the wetlands comprise a mixture of native and non-native (weed) species, comprising the following plant communities in 'good' or 'very good' condition:
 - **ErAs:** open forest of *Eucalyptus rudis* over open tall shrubland of *Astartea scoparia* and **Acacia longifolia* over sparse open shrubland of *Hibbertia cuneiformis* over forbland of *Dielsia stenostachya* over open grassland of **Briza maxima* and **Romulea rosea*.
 - **KgAl:** scattered *Eucalyptus rudis* and **Pinus pinaster* over closed tall shrubland of *Kunzea glabrescens* and **Acacia longifolia* over shrubland of *Pultenaea reticulata* over forbland of *Machaerina vaginalis* and *Lyginia barbata* over scattered grassland of **Ehrharta longiflora* and **Briza maxima*.
- Photographs of each wetland are provided in **Plate 14** to **Plate 17**.



Plate 14: Outer edge of REW 15443/14254/14261



Plate 15: Inner portion of REW 15443/14254/14261

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Plate 16: External view of REW 14244



Plate 17: Internal view of REW 14244

Activities, land uses or development near the wetlands, existing and proposed

Currently, rural land uses occur adjacent to the wetlands predominantly characterised by highly disturbed former agricultural grazing land. In the future, proposed land uses adjacent to the wetlands (as identified in the proposed structure plan) include residential lots, local roads, active public open space areas and regional sporting fields.

As outlined in the DWMS and LWMS, it is anticipated that urbanisation of East Wanneroo will cause groundwater levels to substantially rise from their existing levels (in the order of 3-4m across the EWDSF area) over time, due to the following changes in land use across the wider area:

- Removal of rural land uses with high groundwater abstraction needs (e.g. market gardens).

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- Introduction of urban land uses that will increase impervious surfaces and decrease vegetation coverage, leading to decreased evapotranspiration (uptake of groundwater by plants).
- Harvesting of remaining pine plantation (which have a high groundwater uptake) and transition to other land uses.

This may result in future groundwater levels being near or at the existing ground surface. Retained wetlands which are linked to groundwater are therefore anticipated to contain more free standing surface water over an annual period.

The EWDSP proposes an artificial groundwater level control system (via a subsoil drainage pipe network) and the use of imported fill to manage the anticipated increased groundwater levels in future development areas. The EWDSP identifies a 'groundwater holding facility' to be co-located with REW 15443, where subsoil drainage is intended to discharge to enable centralised treatment and transfer of excess harvested groundwater, however whether this will ultimately be progressed in this location is yet to be confirmed. DPLH are currently preparing the district-scale developer contribution plan for the EWDSP, which includes consideration of how excess harvested water will be utilised and/or re-used elsewhere. Further information is provided in the LWMS.

Threats posed to the wetlands by the adjacent activities, land uses or development

Table 12 outlines the potential threats to the retained REWs and associated potential impacts, based on the existing wetlands values and the existing and proposed land uses in proximity to the wetlands identified for retention. The WAPC guidance recommends separation distances and management measures on the basis of potential threats. Separation measures are required to mitigate only those threats that are present – for example, if there is no threat from potential loss of vegetation, there is no need for a separation requirement to manage this impact (WAPC 2005).

Table 12: Threats to retained wetlands and associated potential impacts

Threat	Potential impacts
Changes to hydrology (altered water levels and flow rates)	<p>As outlined above, urbanisation of the East Wanneroo area in accordance with the EWDSP is anticipated to result in increased groundwater levels at a district-scale, including within the site. Given the wetlands proposed for retention are expressions of groundwater, it is expected that development of the site and the wider East Wanneroo area will impact existing wetland water levels, specifically resulting in altered (increased) levels. Given this represents an in-part reversal of the historical drying (and wetland level reduction) trend, these impacts may not be necessarily detrimental and conversely may potentially improve the overall function and health of the wetland, as it returns toward its historical 'pre-disturbance' state. However, increases in wetland water levels do also result in an increased risk of localised flooding if groundwater (and wetland) levels become too high, which may in turn potentially modify the current flora and vegetation composition and fauna usage patterns. Groundwater levels across the EWDSP area are proposed to be artificially controlled to a set level, through the use of a subsoil drainage network, and transfer of excess/harvested water for re-use elsewhere, which will manage flood risk.</p> <p>Whilst having connectivity with groundwater, the retained wetlands also act as natural low-points in the landscape where surface water runoff currently flows toward and drains. The lower elevation of the wetlands relative to adjacent areas will remain through implementation of urban development, with treated surface water runoff continuing to flow toward retained wetlands. However, the quantity of surface water runoff is likely to increase due to the increase in impermeable surfaces leading to a net reduction in at-source infiltration. This could lead to increased surface water flow rates and quantities which, without management, have the potential to impact retained wetlands through increased erosion and sedimentation, increased total water levels and increased flood risk.</p>

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Threat	Potential impacts
	<p>Some of these impacts, such as increases to total water levels may not necessarily be a detrimental impacts, given it may serve as an in-part reversal of historical declines in wetland water levels as discussed above. However, to mitigate the potential detrimental impacts, the LWMS proposes a stormwater management strategy that will manage post-development peak flow rates of stormwater runoff to wetlands to not exceed pre-development peak flow rates, through the use of stormwater detention infrastructure.</p> <p>Overall, changes to hydrology of wetlands are anticipated as a result of urbanisation at a district and local scale. This may result in some positive impacts to wetland function, such as in-part reversal of the historical drying and wetland level reductions. Many of the potential detrimental impacts are proposed to be managed through the artificially controlled groundwater system (subsoil drainage network) as well as stormwater management infrastructure to manage peak flow rates to retained wetlands.</p>
Changes to hydrology (reduced water quality)	<p>Historical clearing of much of the site, particularly in areas upstream of wetlands, has reduced the extent of natural water treatment areas via vegetation (through nutrient uptake). Furthermore, these areas were historically replaced by nutrient-loading land uses such as cattle grazing and general agricultural land uses. Whilst the proposed urbanisation of the site will result in the removal of nutrient inputs due to a change in land use from grazing and general agricultural land uses, it will also introduce other potential nutrient input sources from residential land uses. Without mitigation, this has potential to result in increased nutrient loads or contaminants within groundwater or surface water runoff feeding wetlands, potentially resulting in eutrophication issues.</p> <p>The LWMSs propose a range of groundwater and stormwater management criteria and strategies to be implemented to achieve the criteria and that will manage water quality for retained wetlands. Generally, these are captured by the following requirements set out in the LWMS:</p> <ul style="list-style-type: none"> • Treating stormwater runoff at, or close to, source within proposed bio-retention areas. • Use of reticulated sewerage systems. <p>Implementation of the LWMS and the proposed groundwater and stormwater management strategies and design requirements will minimise the likelihood of potential impacts to retained wetlands occurring.</p>
Clearing or ground disturbance	<p>Where wetlands are proposed for retention, no clearing of native vegetation is proposed within the wetland areas. However, where development occurs adjacent to wetlands, there is a risk that construction activities extend beyond the intended/approved works area, potentially resulting in clearing or ground disturbance in these areas. Implementation of standard construction and environmental management plans would control the potential for unauthorised clearing, such that the potential impacts are unlikely to occur.</p>
Dust, noise and light emissions	<p>Future development is likely to result in:</p> <ul style="list-style-type: none"> • temporarily increased dust generation and dust emissions, primarily associated with construction activities and particularly if undertaken in dryer months. Dust emissions have the potential to impact wetlands through covering of vegetation and the ground surface with layers of dust. • increased noise generation during construction and also long-term due to the increased amount of human activity and more intensive land use. This has the potential to impact upon wetland fauna presence and behaviours. • Introduction of street lighting, which could spill to retained wetland areas. This has the potential to impact upon wetland fauna presence and behaviours, as well as vegetation growth cycles in wetlands. <p>Potential impacts related to construction processes will be temporary and typically can be suitably minimised through implementation of standard construction environmental management protocols. More permanent increases in noise and lighting generation may be more suitably managed through separation distances provided by wetland buffers.</p>
Shading	<p>There is a risk that future development may include structures that result in shading of adjacent areas. Shading has the potential to decrease the amount of natural light experienced by adjacent wetlands, potentially affecting vegetation growth cycles.</p>
Introduction or spread of weeds	<p>Weeds are common across the site. Whilst future development is likely to reduce the total amount of weeds across the site due to the removal of existing rural land uses, if new weeds are introduced or existing weeds spread into wetlands then the potential impact would be an increase in weed diversity and density which could then outcompete and displace native vegetation.</p>

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Threat	Potential impacts
Introduction or spread of disease (<i>Phytophthora</i> dieback)	If dieback is introduced or spread into retained wetlands then potential impacts would be the loss of native vegetation susceptible to dieback. Implementation of hygiene protocols during construction can mitigate the risk of dieback spread. More permanent risks of dieback spread relate to increases in human activity in areas adjacent to retained wetlands.
Increase in feral animals	Feral animals are known to occur within the site. Future development is likely to increase domestic pet ownership and may also result in attraction of feral animals such as foxes and cats. An increase in domestic and feral animal populations could impact upon retained wetlands through increased risk of native fauna predation (including quenda, which are known to occur within the site). Implementation of suitable fencing, domestic pet local laws and feral animal control programs could mitigate some risk, but potential impacts remain possible.
Increased fire risk	There is potential for an increased fire risk to retained wetlands if a buffer is provided which contains revegetation and/or unmanaged vegetation, due to the increased fuel load. This has the potential to increase fire frequency and intensity within retained wetlands.
Unauthorised access (pedestrian)	Unauthorised pedestrian access has the potential to impact wetlands through trampling or taking of vegetation, bank erosion, introduction of weeds and disease, litter accumulation, and disturbance of fauna.
Unauthorised access (vehicle)	Unauthorised vehicle access has the potential to impact wetlands through trampling or taking of vegetation, bank erosion, introduction of weeds and disease, litter accumulation, disturbance of fauna, increased fire risk and risk of pollution due to oil and fuel spills.

3.2.3.3 Comparative risk assessment

A risk-based assessment of the identified threats (and their potential impacts) of future development to retained wetlands at each of three different buffer widths (0 m, 30 m, and 50 m) has been undertaken. This assessment uses risk categories outlined in Australian Standard AS4360 (**Table 13**) and the results are provided in **Table 14**.

Table 13: Risk Assessment Matrix (AS4360)

Likelihood	Consequence				
	Insignificant (A)	Minor (B)	Moderate (C)	Major (D)	Catastrophic (E)
Almost certain (5)	Low	Moderate	High	Extreme	Extreme
Likely (4)	Low	Low	Moderate	High	Extreme
Possible (3)	Low	Low	Moderate	High	Extreme
Unlikely (2)	Very Low	Low	Low	Moderate	High
Very Unlikely (1)	Very Low	Very Low	Low	Moderate	Moderate

For the purpose of this assessment, it is assumed that a 0 m buffer would result solely in the installation of a boundary fence and no further buffer treatment. In contrast, it is assumed that a 30 m or 50 m buffer would include revegetation and landscaping of the buffer zone incorporating design elements consistent with those outlined in the Foreshore Strategy (**Section 3.2.4**).

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Table 14: Wetland buffer risk assessment

Threat to retained wetland	Risk rating			Comment
	0 m buffer	30 m buffer	50 m buffer	
Changes to hydrology (altered water levels and flow rates)	Low (2C)	Very Low (1B)	Very Low (1B)	<p>Anticipated district-scale changes to hydrology (e.g. rise in regional groundwater levels and wetland levels due to district scale change in land use) will be similar irrespective of wetland buffer widths and therefore have not been considered in this comparative assessment. As such, this comparative assessment focuses on potential increases to surface water flow rates which are relevant in the local (site) context.</p> <p>As outlined above, Peak flow rates to wetlands will be managed through the provision of contemporary stormwater management infrastructure, and it is assumed that all such infrastructure will be required to be located <u>outside</u> of any wetland buffer area, as reflected in the proposed SP. As such, there is negligible difference in risk between each of the three buffer widths if the potential impacts will be managed the same way for each option <u>outside</u> of the wetland buffer. Notwithstanding, a vegetated 30 or 50 m provides an added level of contingency if stormwater infrastructure fails, as the revegetation areas will reduce the potential impacts (in terms of both likelihood and consequence) of erosion, sedimentation and flood risks to the wetland core.</p>
Changes to hydrology (reduced water quality)	Low (2C)	Very Low (1B)	Very Low (1B)	<p>Similarly, impacts to retained wetlands associated with reduced water quality are proposed to be mitigated through measures that do not rely on a wetland buffer (reticulated sewerage is proposed across the site and stormwater treatment bio-retention areas are proposed, <u>outside</u> of wetland buffers). As such, there is negligible difference in risk between each of the three buffer widths, assuming that the potential impacts will be managed the same way for each option <u>outside</u> of the wetland buffer. Notwithstanding, a vegetated 30 or 50 m provides an added level of contingency if stormwater infrastructure fails, as the revegetation areas will reduce the potential impacts (in terms of both likelihood and consequence) of reduced water quality by providing a nutrient uptake function.</p>
Clearing or ground disturbance	Low (2C)	Low (1C)	Low (1C)	<p>The likelihood is reduced assuming suitable construction management measures are implemented. Notwithstanding, the likelihood is comparatively higher if no buffer is provided, as construction works have no separation to the retained wetland, therefore increasing the risk of accidental incursion.</p>
Dust emissions	Low (3A)	Very Low (2A)	Very Low (2A)	<p>The likelihood is reduced assuming suitable construction management measures are implemented. Notwithstanding, the likelihood of residual risk of dust impacts to the wetland is higher with no buffer width as there is no separation distance between works areas and the wetland core, unlike a 30 m or 50 m buffer.</p>
Noise emissions	Moderate (4C)	Moderate (3C)	Moderate (3C)	<p>The likelihood is reduced assuming suitable construction management measures are implemented. Notwithstanding, the likelihood of residual risk of more permanent noise impacts is higher with no buffer width as there is no separation distance between works areas and the wetland core over which noise levels will reduce, unlike a 30 m or 50 m buffer.</p>
Light emissions	Moderate (4C)	Low (2C)	Low (2C)	<p>The likelihood of risk of permanent light impacts is higher with no buffer width as there is no separation distance between roads and residential areas to the wetland core over which light levels will disipate.</p>

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Threat to retained wetland	Risk rating			Comment
	0 m buffer	30 m buffer	50 m buffer	
Shading	Low (2C)	Low (1C)	Low (1C)	Overall, the likelihood and consequence of shading impacts are likely to be relatively low given residential buildings are typically not large (compared to commercial or industrial land uses, for example). Notwithstanding, no buffer has the greatest likelihood of shade from built form, the likelihood of which decreases as buffer distance increases.
Introduction/spread of weeds	High (5C)	Moderate (3C)	Moderate (3C)	A 0 m buffer provides no separation between the wetland and residential areas, increasing the likelihood of impact as weeds from adjacent residential areas, roads or parklands can easily extend into the adjacent wetland core. A 30 or 50 m buffer would be revegetated, which if implemented and maintained to a suitable standard will provide increased protection from the introduction or spread of weeds. However, the risk of these buffers is that weed management is not consistently implemented to suitable levels thereby providing additional areas for weed proliferation and spread.
Introduction/spread of disease (<i>Phytophthora dieback</i>)	Low (2C)	Moderate (3C)	Moderate (3C)	The risk of spread or introduction of disease increases with greater human and vehicle activity. The provision of a 30 or 50 m buffer will increase areas of revegetation and required management activities will occur over a larger area in proximity to the wetland, increasing the risk of disease introduction or spread into the adjacent wetland.
Increase in feral animals	Low (2C)	Moderate (3C)	Moderate (3C)	A 0 m buffer would involve installation of wetland boundary fencing, restricted movement of feral animals into the wetland area and therefore reducing the risk of native fauna predation. In contrast, a 30 or 50 m buffer with walking trails and boardwalks is unlikely to include a fence and therefore will provide less restriction to feral animal movement and increase the risk of native fauna predation.
Increased fire risk	Very Low (1A)	High (4D)	High (4D)	Larger buffers will result in increased bushfire fuels being present adjacent to wetlands (either in the form of revegetation and/or unmanaged vegetation). These fuels have a greater likelihood of resulting in more consequential bushfires that may impact wetlands. Where no buffer is applied, there is no increase in available bushfire fuels.
Unauthorised access (pedestrian)	Low (2B)	Low (3B)	Low (3B)	A 0 m buffer and associated hard fenceline would restrict access to the wetland core. A 30 or 50 m buffer incorporating revegetation and landscaping elements would provide controlled public access to the surrounding wetland area and is unlikely to utilise a fence at the wetland boundary. As such, there is an increase likelihood with larger buffer areas that pedestrian may try to access the wetland area via leaving the landscaped walking tracks, boardwalks or trails.
Unauthorised access (vehicle)	Low (2C)	Low (1C)	Low (1C)	All buffer widths will restrict unauthorised vehicle access to the site through either fencing or revegetation and landscaping elements. The risk has a slightly higher likelihood with a 0 m buffer due to the potential for a vehicle to push through a fenceline and directly into a wetland, albeit this remains unlikely due to passive surveillance of immediately adjacent residential areas. Compared to unauthorised pedestrian access, the likelihood of vehicle access is lower, but the consequence is higher.

Based on the results of this comparative risk assessment, some risks to wetlands are better mitigated by provision of a physical separation element only (e.g. a fence) with no separation distance (i.e. a 0 m buffer), such as potential increases to fire risk, introduction/spread of disease and increase in feral animals. In contrast, others risks are better mitigated through provision of a separation distance and associated revegetation and landscaping treatment (i.e. a 30 or 50 m buffer), such as potential changes to hydrology, dust and light emissions and introduction/spread of weeds. Furthermore, the risk assessment did not identify a discernible differences between the risk mitigation afforded to retained wetlands by a 30 m buffer compared to a 50 m buffer.

As outlined in **Section 3.2.1**, the structure plan has provided 30 m buffer zones to retained REWs, in consideration of the results of this wetland buffer assessment.

3.2.3.4 Proposed wetland buffer treatment

The wetland buffer treatment will be consistent with the Foreshore Strategy in **Section 3.2.4**.

3.2.4 Foreshore Strategy

The EWDSP requires a Foreshore Strategy to be provided to support the Precinct 15 SP in order to detail the proposed functions, broad development layout and conservation areas within the foreshore; all of which is provided in the following sections.

A Foreshore Management Plan may be required in the future to support the subdivision process, which would facilitate implementation of this Foreshore Strategy.

3.2.4.1 Foreshore area

The Foreshore Strategy is applicable to foreshore areas within the site, which will ultimately be protected within a foreshore reserve to be established through the future subdivision process. For the purpose of this Foreshore Strategy, the foreshore area is defined as the combination of:

- The foreshore core, which includes:
 - The core wetland area of REW wetlands proposed for retention within the SP layout (REWs 15443, 14254, 14261 and 14244).
 - The surrounding wetland buffer areas adjacent to REW wetlands to be retained. As outlined in **Section 3.2.3**, the SP provides a 30 m buffer around retained wetlands.
- The foreshore transition area, which comprises:
 - POS areas (including regional sporting fields) that adjoin the wetland buffer areas, extending up to 100 m from the wetland core areas.³

The above components of the foreshore area are spatially defined on **Figure 17**.

³ These portions of adjacent POS (including the regional sporting field areas) have been included given their public use and being a transitional zone from the foreshore core to nearby roads and residential areas. Due to a lack of policy guidance in relation to development a Foreshore Strategy for wetlands (as opposed to waterways or coastal areas), a 100 m transitional zone has been assumed. This may be subject to change if an alternate width or approach is determined to be more suitable.

3.2.4.2 Proposed functions of foreshore area

Table 15 provides a summary of the proposed approach and function for each component of the foreshore area.

Table 15: Proposed approach and function for the foreshore area

Foreshore area component	Foreshore area sub-component	Proposed functional intent	Permissible land uses and infrastructure	Management approach
Foreshore core	Wetland core	<ul style="list-style-type: none"> To retain and maintain the existing ecological and hydrological function of the wetland, with low impact public activation in select areas. Existing intact vegetation will be retained. 	<ul style="list-style-type: none"> Conservation land management activities, such as invasive species management and revegetation works. Low impact and environmentally sensitive (i.e. low footprint) infrastructure in select areas to provide controlled public access to environmental assets, such as boardwalks. 	<ul style="list-style-type: none"> To be managed as a conservation asset.
	Wetland buffer	<ul style="list-style-type: none"> To provide separation and protection between the wetland core and adjacent active POS, residential development areas and regional sporting fields, whilst facilitating controlled and appropriate public engagement and enjoyment of the natural environment. Existing intact vegetation will be retained. 	<ul style="list-style-type: none"> Conservation land management activities, such as invasive species management and revegetation works. Low-intensity public activation infrastructure compatible with conservation land management, for example bushwalking tracks, interpretative signage, lookouts, firebreaks, dual use paths, management tracks and fencing. 	<ul style="list-style-type: none"> To be managed as a conservation asset, with controlled low-intensity public access that is compatible with conservation land management.
Foreshore transition area	Adjacent active public open space, within 100 m of wetland core	<ul style="list-style-type: none"> To provide landscaped POS to enable active use for recreational purposes, providing a transition zone between the wetland (and wetland buffer areas) and adjacent residential land uses. Mature trees will be retained where feasible. 	<ul style="list-style-type: none"> Active open space and associated landscape elements, such as turfed areas, landscape feature planting, picnic shelters, barbeques, play equipment, seating, exercise equipment, stormwater management areas, access roads, carparks, sporting fields. 	<ul style="list-style-type: none"> To be managed as active recreational parkland.

3.2.4.3 Broad development layout of foreshore area

A Landscape Masterplan (Emerge Associates 2023) has been prepared to provide a conceptual landscape design across the site (**Appendix F**), including within the foreshore areas consistent with the approach outlined in **Table 15**.

3.2.4.4 Conservation areas within foreshore area

As outlined in **Table 16**, the ‘foreshore core’ components of the foreshore area will be managed as conservation areas, being the wetland core and wetland buffer areas.

3.3 Future planning and environmental approvals process

3.3.1 Metropolitan Region Scheme

3.3.1.1 Amendment/s for public land reservations

The majority of the site is currently zoned 'Urban Deferred' pursuant to the MRS and as such a request will need to be lodged with the WAPC to lift urban deferment prior to urban development commencing. The EWDSP outlines that prior to urban deferment being lifted, the MRS is required to be amended to reserve land for future primary distributor roads, integrator arterial roads, parks and recreation reserves, transit corridors and special purpose areas for the proposed public school.

As outlined in the overarching EWDSP, the WAPC will be the responsible authority for preparing and initiating the required amendments to the MRS in relation to integrator arterial roads and parks and recreation reserves. MRS land reservations necessary for any transit corridors within the site and the surrounding 500 m will be referred to the Public Transport Authority for comment, whilst reservation for school sites under the MRS will be initiated by developers.

3.3.1.2 Lifting of urban deferment

As outlined above, the existing urban deferred zoning across the majority of the site will need to be lifted to enable implementation of the proposed SP. Lifting of urban development does not constitute a formal amendment to the MRS.

The WAPC's *Lifting of Urban Deferment Guidelines* (DPLH 2019) set out the information requirements necessary to support the request for lifting of urban deferment, which includes the requirement for a draft SP in addition to the following items related to environmental matters:

- Description of the physical condition of the land.
- Identification of the means by which natural features such as foreshores, wetlands and remnant vegetation will be protected.
- Identification of any environmental issues which may impact on future development such as water catchment and groundwater protection areas and how these will be addressed.

Furthermore, the EWDSP requires the following information to be submitted with any request to lift urban deferment:

- A conceptual SP for the applicable precinct
- Confirmation from servicing agencies on the position of water and wastewater services
- Any other requirements which may be specific to an area
- A district development contribution scheme has been initiated by local government.

3.3.1.3 Amendment to 'Rural - Water Protection' zone

The eastern portion of the site zoned 'rural – water protection' will require an MRS amendment to establish an 'urban' zone in order to facilitate the proposed urban land use identified in the EWDSP and the Precinct 15 SP. As discussed in **Section 2.5.6**, it is envisaged that this land will also trigger reclassification of the corresponding PDWSA from P2 to P3*.

3.3.2 District Planning Scheme No.2 amendments

Given the site is zoned 'General Rural' and 'Rural Resource' under the CoW DPS No. 2, rezoning to an urban development zone (or equivalent) will be required to enable the proposed urban land use.

Where the WAPC amends the MRS to include land in the 'Urban' zone or progresses 'lifting of urban deferment', the WAPC may concurrently amend the zoning of the land under a local planning scheme to a development zone (or equivalent), as provided for by Section 126(3) of the *Planning and Development Act 2005*. As such, a concurrent amendment approach may be progressed for the site (or portions of the site), noting that lifting of urban deferment and/or the 'rural – water protection' MRS amendment may be progressed in stages (i.e. parts of the site at a time).

3.3.3 *Environmental Protection Act 1986* – Section 48 scheme amendment referral

Any amendment to a planning scheme (regional or local) is required to be referred to the EPA to determine whether environmental assessment is required, pursuant to Section 48 of the *Environmental Protection Act 1986* (EP Act).

On this basis, future amendments to the MRS or CoW DPS No. 2 required for the site (as outlined above) will trigger this Section 48 EPA referral process. However, lifting of urban deferment does not constitute a formal MRS amendment and therefore would not trigger Section 48 EPA referral. Consequently, any concurrent amendments to the CoW DPS No. 2 that are linked to a lifting of urban deferment process would also not trigger Section 48 referral to the EPA.

Whilst this EAR primarily supports the Precinct 15 SP process, a preliminary assessment of the anticipated environmental outcomes as a result of the anticipated future urban development (based on the SP layout) has been undertaken against relevant EPA factors and objectives, which is outlined in **Section 4**.

3.3.4 Subdivision and development

Following resolution of the required MRS and DSP No.2 amendments, and subject to the approval of the SP by the WAPC, urban development of the site will be progressed through future subdivision and/or development approvals.

It is anticipated that future subdivision approvals for the staged development of the site will include a range of conditions, some of which may relate to environmental matters. These conditions will need to be implemented before titles for lots are issued. Other components of development may be progressed through development approval, for example, forward bulk earthworks or other non-subdivisional works.

It is anticipated that all environmental impacts associated with the implementation of urban subdivision and development works across the site will be considered by the EPA under Section 48A of the EP Act, either through consideration of previous MRS amendment 1308/41 (to establish the current 'Urban Deferred' zoning), future MRS amendments (to establish reservations or to rezone the 'Rural-Water Protection' area) or future CoW DPS No.2 amendments.

3.3.5 *Environmental Protection Act 1986 – Section 38 proposals*

Section 38 of the EP Act enables any person to refer a ‘proposal’ (as opposed to a planning scheme, as per Section 48) likely to have a significant impact on the environment to the EPA, who then decide whether or not to assess the proposal.

Section 48I outlines that any proposal likely to have a significant impact on the environment, but which is within an area and for a land use that is subject to an assessed scheme (i.e. a scheme for which a determination has been made by the EPA under Section 48A), is not required to be referred to the EPA under Section 38 of the EP Act.

Given the environmental impacts associated with implementation of urban subdivision and development works across the site will be considered by the EPA under Section 48A of the EP Act (as discussed in **Section 3.3.4**), it is not anticipated that the implementation of urban development works within the site would be referred under Section 38 of the EP Act. However, this only applies to proposed works which are consistent with those considered through the Section 48A process and where the potential environmental impacts were considered by the EPA. The EPA may choose to defer assessment of environmental factors to subsequent stages of the planning process, which would mean Section 48I would not apply in such instances.

3.3.6 *Environment Protection and Biodiversity Conservation Act 1999*

The EPBC act provides statutory protection for listed Matters of National Environmental Significance (MNES). The most relevant MNES considerations within the site are the Banksia Woodlands TEC and threatened species of black cockatoo (CBC and FRTBC).

Individual proponents of future development within the site will need to consider their obligations under the EPBC Act and the potential need to refer any proposed action that may have a significant impact on MNES.

4 Assessment of Predicted Environmental Outcomes

The predicted environmental outcomes that would be realised as a result of implementation of the proposed SP, through future subdivision and development, have been assessed against the EPA objectives for each environmental factor relevant to the site (as listed in **Section 2**).

This is provided in **Table 15**, which considers the spatial layout responses of the SP and provision of future regional or local reserves (POS) intended to provide for the protection and conservation of existing environmental assets within the site. In addition, **Table 15** outlines the future management considerations of environmental values that will require further specific consideration as part of the future development of the site.

A range of environmental impact mitigation measures (primarily impact avoidance and minimisation) are proposed within the SP layout and through the future environmental management framework. In this context, it is anticipated that implementation of the proposed SP can be suitably managed through future stages of the land use planning processes (including subdivision and development) such that the EPA objectives for the relevant environmental factors can be achieved.

A key element of the potential future environmental management framework is the implementation of a Construction Environmental Management Plan (CEMP), which is likely to be a future conditional requirement at the subdivision planning approval stage and would likely address the following construction elements:

- Vegetation clearing protocols
- Measures to minimise and manage impacts on flora and fauna
- Fauna management prior to potential removal of habitat
- Hygiene measures to stop the spread of flora and fauna disease during construction
- Dust management
- Fire management
- Access management
- Fencing.

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Table 16: Summary of EPA environmental factors and objectives relevant to the proposed future land use

Environmental factor	EPA objective	Precinct 15 Structure Plan spatial response	Future management considerations	Predicted environmental outcome
Landforms	To maintain the variety and integrity of distinctive physical landforms so that environmental values are protected.	The proposed SP and indicative Master Plan (Appendix A) strategically provides three key POS areas along the dunal ridgeline in the western portion of the site, that will facilitate retention of existing surface levels and the associated landform (i.e. high points of the ridgeline). This will also facilitate tree retention outcomes in these POS areas. The conceptual bulk earthworks were redesigned to enable this outcome, whilst still achieving feasible and logical levels for adjacent urban development areas.	No future management considerations.	Although no restricted landforms or unique geological features occur within the site, the SP responds to the natural landform values of the dunal ridgeline in the western portion of the site. Retention of the existing surface levels and the associated landform will also facilitate tree retention outcomes within POS areas.
Terrestrial environmental quality	To maintain the quality of land and soils so that environmental values are protected.	There are no SP spatial responses to terrestrial environmental quality considerations, which primarily relate to ASS risk.	<p>To facilitate urban development within the site, ASS investigations and management considerations for the site will likely be required (as a portion of the site is mapped as Class 1 'high to moderate' risk of ASS occurring within 3 m of the natural soil surface), particularly for the installation of deep sewer. Given the relatively low depths to groundwater within portions of the site, dewatering may be required to facilitate future subdivision and development works, which would likely trigger the need for a dewatering and an ASS management plan.</p> <p>If required, any future ASS considerations will be identified and suitably managed as part of the future subdivision and development process in accordance with the WAPC's <i>Acid Sulfate Soils Planning Guidelines</i> (2008).</p>	Any potential impacts on ASS can be suitably minimised at future subdivision and development stages within the site. If determined to be required, an ASS management plan and dewatering management plan would be prepared and implemented as part of subdivision and development works. If required, this would be included as a condition of future subdivision or development approval.

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Table 16: Summary of EPA environmental factors and objectives relevant to the proposed future land use (continued)

Environmental factor	EPA objective	Precinct 15 Structure Plan spatial response	Future management considerations	Predicted environmental outcome
Flora and vegetation	To protect flora and vegetation so that biological diversity and ecological integrity are maintained.	<p>The SP layout has been strategically designed to locate POS areas in locations that will provide for the future retention of the following flora and vegetation values:</p> <ul style="list-style-type: none"> • Up to 200 mature native trees with a DBH > 50 cm, noting there are also likely to be additional native trees with a smaller DBH also retained. This includes 148 trees within POS areas and 52 within the proposed regional sporting fields (where retention feasibility is subject to final sport field layouts and locations). • Up to 48 individuals of P4 flora species <i>Jacksonia sericea</i>. • Up to 29.6 ha of native vegetation in 'good' or better condition. It is anticipated that retained intact native vegetation will likely occur within retained REWs and associated buffers. 	<p>Implementation of a future CEMP would further minimise potential impacts to retained flora and vegetation values during construction, which will be confirmed at the future subdivision and development stage.</p> <p>Where future subdivision and development works will result in residual impacts to MNES (including the Banksia Woodlands TEC), proponents will need to consider their EPBC Act obligations and need for referral, based on the specific impacts of their proposed action. Individual proposed actions can be addressed through preliminary self-assessment against the <i>Matters of National Environmental Significance Significant Impact Guidelines</i> (DotE 2013) in relation to any potential impacts on MNES.</p>	<p>Overall, the SP layout responds to significant flora and vegetation values where possible, primarily associated with provision for future retention of mature trees and intact wetland native vegetation. Opportunistic retention of P4 species <i>Jacksonia sericea</i> is also provided for. Notwithstanding, residual impacts to Banksia Woodland TEC are anticipated and EPBC Act obligations will need to be considered by proponents of development.</p>
Terrestrial fauna	To protect terrestrial fauna so that biological diversity and ecological integrity are maintained.	<p>The SP layout has been strategically designed to locate POS areas in locations that will provide for the future retention of the following terrestrial fauna values:</p> <ul style="list-style-type: none"> • Up to 200 mature native trees with a DBH > 50 cm that represent potential breeding habitat trees for CBC and FRTBC, as well as providing foraging and roosting habitat. As outlined above, there are likely to be additional native trees with a smaller DBH also retained. This includes 148 trees within POS areas and 52 within the proposed regional sporting fields (where retention feasibility is subject to final sport field layouts and locations). • Up to 6.7 ha of foraging habitat for CBC and FRTBC. • Up to 9.8 ha of potential habitat for black striped burrowing snake. • Up to 27.5 ha of potential habitat for quenda. 	<p>Implementation of a future CEMP would further minimise potential impacts to terrestrial fauna during construction, the which will be confirmed at the future subdivision and development stage.</p> <p>Where future subdivision and development works will result in residual impacts to MNES (including CBC and FRTBC), proponents will need to consider their EPBC Act obligations and need for referral, based on the specific impacts of their proposed action.</p>	<p>Overall, the SP layout responds to significant terrestrial fauna values where possible, primarily associated with provision for future retention of mature trees providing black cockatoo habitat, as well as intact native vegetation (where possible) providing potential habitat for quenda and the black striped burrowing snake. Notwithstanding, residual impacts to MNES such as black cockatoo are anticipated and EPBC Act obligations will need to be considered by proponents of development.</p>

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Table 16: Summary of EPA environmental factors and objectives relevant to the proposed future land use (continued)

Environmental factor	EPA objective	Precinct 15 Structure Plan spatial response	Future management considerations	Predicted environmental outcome
Inland waters	To maintain the hydrological regimes of groundwater and surface water so that environmental values are protected.	<p>The SP layout has been strategically designed to locate POS areas in locations that will provide for the future retention of the following inland water values:</p> <ul style="list-style-type: none"> • REW 15443, 14254 and 14261. • REW 14244. • 30 m wetland buffer zone to all retained REWs. <p>Whilst not a spatial response, a Local Water Management Strategy (LWMS) has also been prepared for the site to support the proposed SP (Pentium 2023). The principal management objective for hydrology within the site is to ensure that post-development environmental flows and/or hydrological cycles are maintained or improved upon pre-development conditions, especially regarding natural wetland features retained within the site. Surface water runoff will be managed in accordance with the <i>Better Urban Water Management Framework</i>, which includes maintenance of the post-development environment in accordance with the pre-development environment.</p> <p>A Foreshore Strategy has also been developed to define how retained wetlands, buffers and adjacent POS and development interfaces will be designed, landscaped and managed.</p>	<p>As part of future stages of the future subdivision process, the following management plans will likely be required to be prepared and implemented:</p> <ul style="list-style-type: none"> • Urban Water Management Plan (UWMP) to implement the LWMS. • Foreshore Management Plan (FMP) to implement the Foreshore Strategy. 	<p>Overall, the SP layout responds to significant inland water values where possible, primarily associated with provision for future retention of various REW wetlands and spatial provision for wetland buffer zones. Notwithstanding, some residual impacts to REWs are predicted, however the overall outcome balances wetland retention with satisfying the design and design requirements of the approved EWDSPP, noting many existing wetlands are proposed to be dissected by proposed district roads and rail corridors identified in the EWDSPP. The LWMS and Foreshore Strategy define the intended hydrological and foreshore management approach, which will be implemented through future UWMPs and FMPs.</p>

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Table 16: Summary of EPA environmental factors and objectives relevant to the proposed future land use (continued)

Environmental factor	EPA objective	Precinct 15 Structure Plan spatial response	Future management considerations	Environmental outcome
Social Surroundings	To protect social surroundings from significant harm.	Aboriginal Cultural Heritage (ACH) Directory Place 22160 Marraynginup was determined to be a significant and sensitive area. The location where ACH Directory Place 22160 intersects into the site has been historically severely disturbed and it is unlikely any undiscovered artefacts remain within this portion of the site. ACH Directory Place 22160 is likely to be more associated with CCW 14241 to the north of the site, which is not identified for development in the SP. Notwithstanding this, future management measures need to be considered.	<p>Preparation and implementation of an Aboriginal Cultural Heritage Management Plan in addition to early consultation with the Whadjuk People and site custodian prior to any ground disturbance works has been recommended for the protection of ACH Directory Place 22160. This will provide a management framework to implement if any Aboriginal artefacts or sites (although unlikely) are uncovered and whether future development within the site may result in potential harm to ACH. The proponent will need to adhere to any statutory requirements under the <i>Aboriginal Cultural Heritage Act 2021</i> (or AH Act, subject to the proposed repealing of the ACH Act).</p> <p>With respect to potential surrounding land use conflicts:</p> <ul style="list-style-type: none"> • Staging of future subdivision and development may have to consider and respond to existing and active market gardening land uses in proximity to the site, as there is potential for the amenity of future residential land uses to be impacted as a result of mark garden emissions (e.g. dust, noise, odour or gaseous). However, many of these operations appear to be of low intensity and/or of small scale and therefore may not inhibit progressing of adjacent residential development. • Similarly with respect to BRM, whilst there are no active quarrying activities close to the site, a mapped BRM 'excavation site' policy area is mapped directly to the east which has the potential to support future sand and/or limestone quarrying. Any such quarrying operations have the potential to impact the amenity of nearby future residential land uses as a result of emissions (e.g. noise and dust). This has the potential to impact staging of future subdivision and development within the site. <p>As these relate to development staging and timing considerations, it is anticipated that they will be addressed through the future scheme amendment and/or lifting of urban deferment processes.</p>	Any potential impacts to social surroundings can be suitably mitigated through a range of impact avoidance and minimisation measures such that it is unlikely any significant residual impacts will occur.

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5 Conclusion

The primary structural basis of the SP layout has been guided informed by the location and extent of the various district-scale land uses shown in the EWDSP. This has provided a level of restriction to the ability for the SP layout to strategically respond to environmental values within the site.

Notwithstanding, the proponent has taken a range of measures to provide for the future retention of significant environmental values where possible (i.e. where there remains flexibility in the layout design process outside of the key structural elements defined by the EWDSP). This is primarily achieved through the strategic location and sizing of the future local public open space (POS) areas, which are not stipulated in the EWDSP layout.

In this context, the SP layout has been specifically designed to respond to the identified environmental values within the site where possible including the proposed future retention of:

- Two resource enhancement wetlands (unique feature identifiers #15433, #14254, #14261 and #14244), covering an area of 21.4 ha in size in addition to provision of 30 m buffer areas.
- Up to 200 mature native trees with a diameter at breast height of greater than 50 cm (which also represent potential nesting trees for conservation significant black cockatoo species; namely Carnaby's black cockatoo and forest red-tailed black cockatoo).
- Up to 6.7 ha of potential suitable black cockatoo foraging habitat.

In addition to targeted REW and mature retention outcomes discussed above; other native trees, shrubs and flora (including priority flora species *Jacksonia sericea*) may also be opportunistically retained where possible and appropriate within intersecting POS areas, through incorporation as part of the urban development landscaping process. These values may therefore continue to also provide habitat for conservation significant native fauna recorded within the site, including black cockatoos, quenda and the black-striped burrowing snake. As such, it is likely that heightened retention outcomes beyond those discussed above will ultimately be realised.

As part of the future subdivision and development process, the following management plans may be necessary, the implementation of which would further minimise potential environmental impacts that have the potential to arise through implementation of the SP:

- Acid Sulfate Soil and Dewatering Management Plan
- Construction Environmental Management Plan
- Urban Water Management Plan/s
- Foreshore Management Plan
- Aboriginal Cultural Heritage Management Plan
- Bushfire Management Plan.

Overall, a range of environmental impact mitigation measures (primarily impact avoidance and minimisation) are proposed within the SP layout and through the future environmental management framework. In this context, it is anticipated that implementation of the proposed SP can be suitably managed through future stages of the land use planning processes (including subdivision and development) such that the EPA objectives for the relevant environmental factors can be achieved.

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6 References

6.1 General references

Amergin Consulting (Australia) 2013, Report of an Aboriginal Heritage Assessment at Karnup, Western Australia, 1.

Churchward, H. M. and McArthur, W. M. 1980, 'Landforms and Soils of the Darling System, Western Australia', in Department of Conservation and Environment (ed.), Atlas of Natural Resources Darling System Western Australia, Department of Conservation and Environment.

City of Wanneroo (CoW) 2018, Local Biodiversity Plan 2018/19 - 2023/2024, Wanneroo.

Department of Agriculture, Water and the Environment (DAWE) 2022, Referral guideline for 3 WA threatened black cockatoo species: Carnaby's Cockatoo, Baudin's Cockatoo and the Forest Red-tailed Black cockatoo, Canberra.

Department of the Environment (DotE) 2013, Matters of National Environmental Significance - Significant impact guidelines 1.1 Environment Protection and Biodiversity Conservation Act 1999, Canberra.

Douglas Partners 2022a, Preliminary Geotechnical Investigation Proposed Residential Development Lot 803 Coogee Road and Lot 1673 Rousset Road, Mariginiup, WA, R.001.Rev0, 0.

Douglas Partners 2022b, Preliminary Geotechnical Investigation Proposed Residential Development Stage 2 - Rousset Road, Mariginiup, WA, R.002.Rev0, 0.

Department of Water (DoW) 2016, Land use compatibility tables for public drinking water source areas, Western Australia.

Department of Primary Industries and Regional Development (DPIRD) 2019, Soil Landscape Mapping - Best Available (DPIRD-027), <<https://catalogue.data.wa.gov.au/dataset/soil-landscape-mapping-best-available>>.

Department of Planning, Lands and Heritage (DPLH) 2019, Lifting of Urban Deferment Guidelines, Western Australian Planning Commission, Perth.

Department of Water and Environmental Regulation (DWER) 2018, Water Quality Protection Note No 38: Priority 3* (P3*) areas, Perth.

Emerge Associates 2018, Environmental Assessment Study - East Wanneroo District Structure Plan, EP17-106(04)--001, Version 1B.

Emerge Associates 2023a, Bushfire Management Plan Precinct 15 - Central Mariginiup Local Structure Plan, EP22-019(16)--014 PPS, 1.

Emerge Associates 2023b, Detailed Fauna and Targeted Black Cockatoo Assessment Various Lots, Mariginiup, EP22-019(02)--010 WJC, 1.

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Emerge Associates 2023c, Detailed Flora and Vegetation Assessment Various Lots, Mariginiup, EP22-019(01)--011 SCM, 1.

Environmental Protection Authority (EPA) 2005, Guidance Statement No. 3. Separation Distances between Industrial and Sensitive Land Uses, Perth.

Environmental Protection Authority (EPA) 2008a, Environmental Guidance for Planning and Development - Guidance Statement No. 33, Western Australia.

Environmental Protection Authority (EPA) 2008b, Guidance Statement No. 33. Environmental Guidance for Planning and Development, Perth.

Environmental Protection Authority (EPA) 2016, Technical Guidance - Flora and Vegetation Surveys for Environmental Impact Assessment Perth.

Environmental Protection Authority (EPA) 2018, Statement of Environmental Principles, Factors and Objectives, Perth.

Environmental Protection Authority (EPA) 2020, Technical Guidance - Terrestrial vertebrate fauna surveys for environmental impact assessment, Joondalup, Western Australia.

Government of WA 2000, Bush Forever - Volume 1: Policies, principles and processes, Perth.

Government of Western Australia 2019, 2018 Statewide Vegetation Statistics incorporating the CAR Reserve Analysis (Full Report). Current as of March 2019, WA Department of Biodiversity, Conservation and Attractions, Perth.

Gozzard, J. 2011, Sea to scarp - geology, landscape, and land use planning in the southern Swan Coastal Plain, Geological Survey of Western Australia.

Hedde, E. M., Loneragan, O. W. and Havel, J. J. 1980, 'Vegetation Complexes of the Darling System Western Australia', in Department of Conservation and Environment (ed.), Atlas of Natural Resources Darling System Western Australia, Perth.

Hill, A. L., Semeniuk, C. A., Semeniuk, V. and Del Marco, A. 1996, Wetlands of the Swan Coastal Plain: Volume 2A - Wetland Mapping, Classification and Evaluation, Water and Rivers Commission and the Department of Environmental Protection, Perth.

Horizon Heritage Management (Horizon) 2023, Precinct 15 Central Mariginiup Local Structure Plan Aboriginal Heritage Desktop Assessment Report.

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

Pentium 2023, LOCAL WATER MANAGEMENT STRATEGY Mariginiup - Precinct 15, STOMAR_01, 1.

Western Australian Local Government Association and Perth Biodiversity Project (WALGA and PBP) 2004, Local Government Biodiversity Planning Guidelines for the Perth Metropolitan Region, Perth.

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Precinct 15 Structure Plan



Western Australian Planning Commission (WAPC) 2005, Guidelines for the Determination of Wetland Buffer Requirements, Perth.

Western Australian Planning Commission (WAPC) 2008, Better Urban Water Management Perth.

Western Australian Planning Commission (WAPC) 2015, Structure Plan Framework, Planning and Development (Local Planning Schemes) Regulations 2015.

Wetlands Advisory Committee 1977, The status of reserves in System Six, Environmental Protection Authority, Perth.

6.2 Online references

Department of Agriculture, Water and the Environment (DAWE) 2022, *Protected Matters Search Tool*, <https://www.environment.gov.au/epbc/protected-matters-search-tool>

Department of Water and Environmental Regulation (DWER) 2018c, *ASS Risk Maps*, viewed on February 10 2023, https://gmapgis.com/acid_sulfate_soils_risk_map_western_australia.htm

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Figures



Figure 1: Site Location and Lot Details

Figure 2: Soils and Topography

Figure 3: Acid Sulfate Soil Risk Map

Figure 4: Vegetation Types

Figure 5: Vegetation Condition

Figure 6: Conservation Significant Values

Figure 7: Environmental Features

Figure 8: Fauna Habitat

Figure 9: Conservation Significant Fauna Habitat – Carnaby’s Black Cockatoo

Figure 10: Conservation Significant Fauna Habitat – Forest Red-tailed Black Cockatoo

Figure 11: Conservation Significant Fauna Habitat – Black Striped Burrowing Snake

Figure 12: Conservation Significant Fauna Habitat – Quenda

Figure 13: Wetlands and Hydrological Features

Figure 14: Aboriginal Heritage

Figure 15: Surrounding Land Uses

Figure 16: Significant Environmental Values – Structure Plan Considerations

Figure 17: Foreshore Area

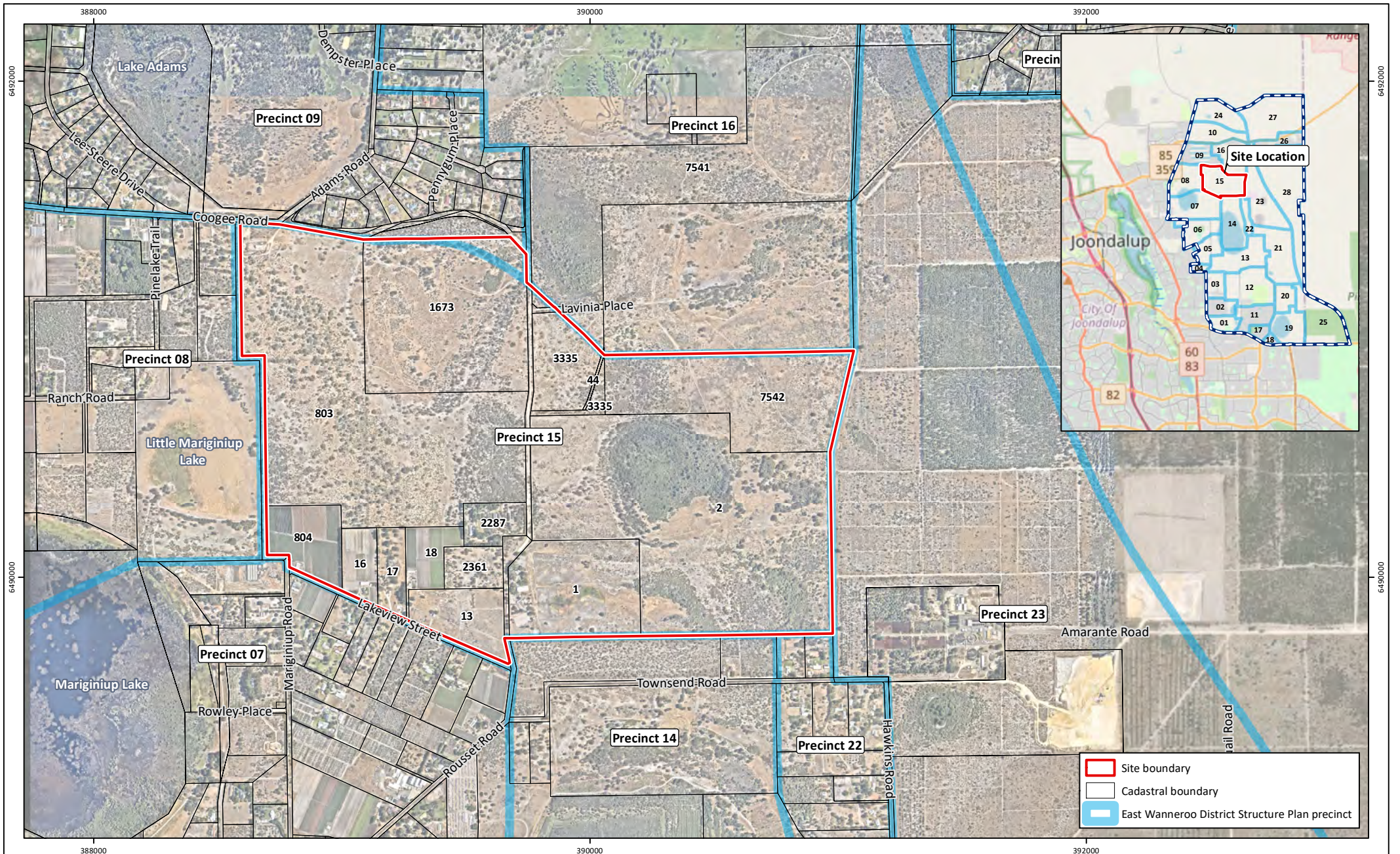


Figure 1: Site Location and Lot Details

Project: Environmental Assessment Report
Precinct 15 Structure Plan
Client: Stockland

Plan Number:
EP22-019(15)--F36
Drawn: GAR
Date: 23/02/2023
Checked: PPS
Approved: ADB
Date: 06/04/2023



0 200 400 600
Meters
Scale: 1:270,000@A4
GDA 1994 MGA Zone 50



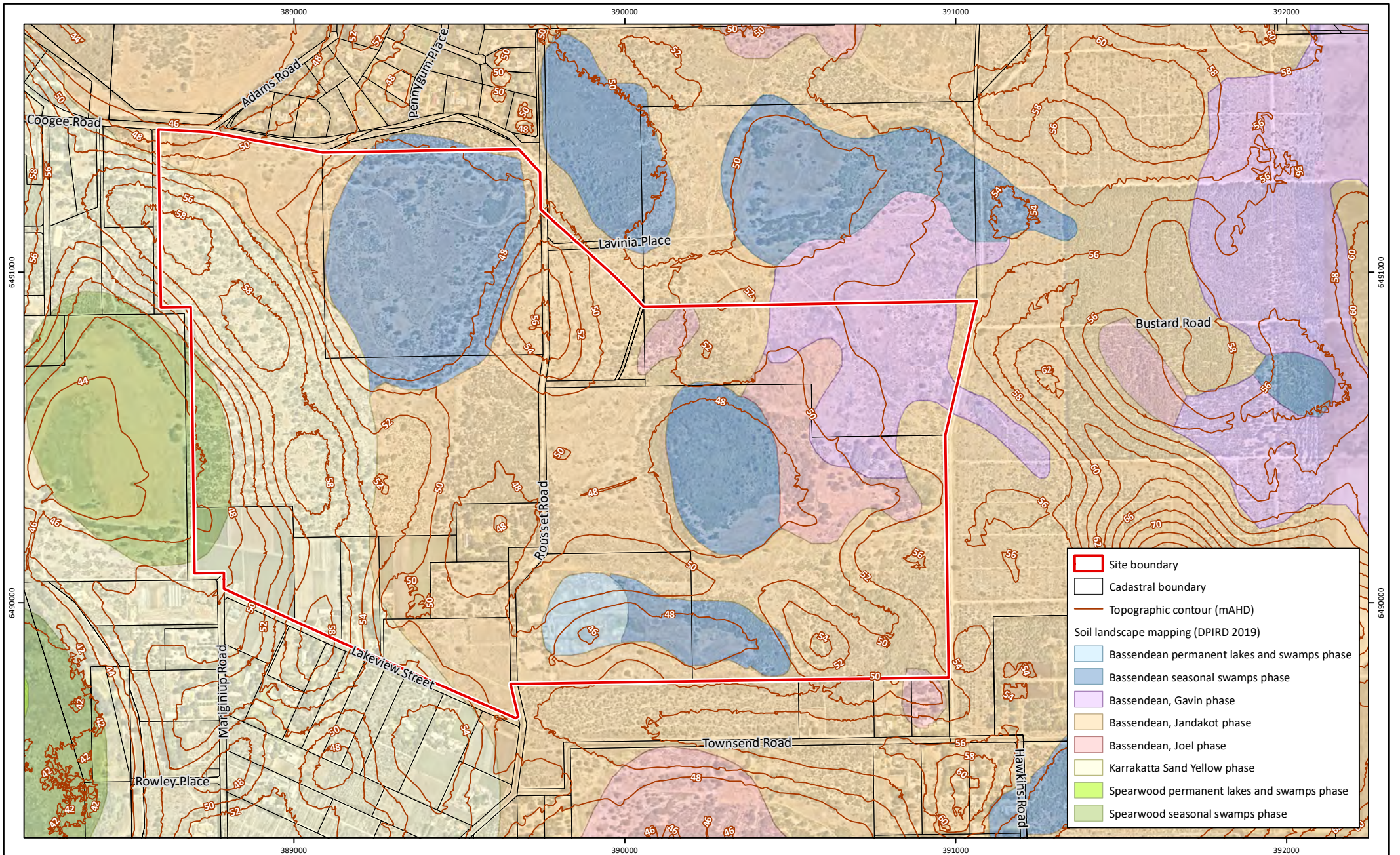


Figure 2: Soils and Topography

Project: Environmental Assessment Report
Precinct 15 Structure Plan

Client: Stockland

Plan Number:
EP22-019(15)-F37

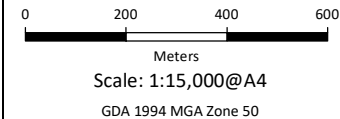
Drawn: GAR

Date: 23/02/2023

Checked: PPS

Approved: ADB

Date: 06/04/2023



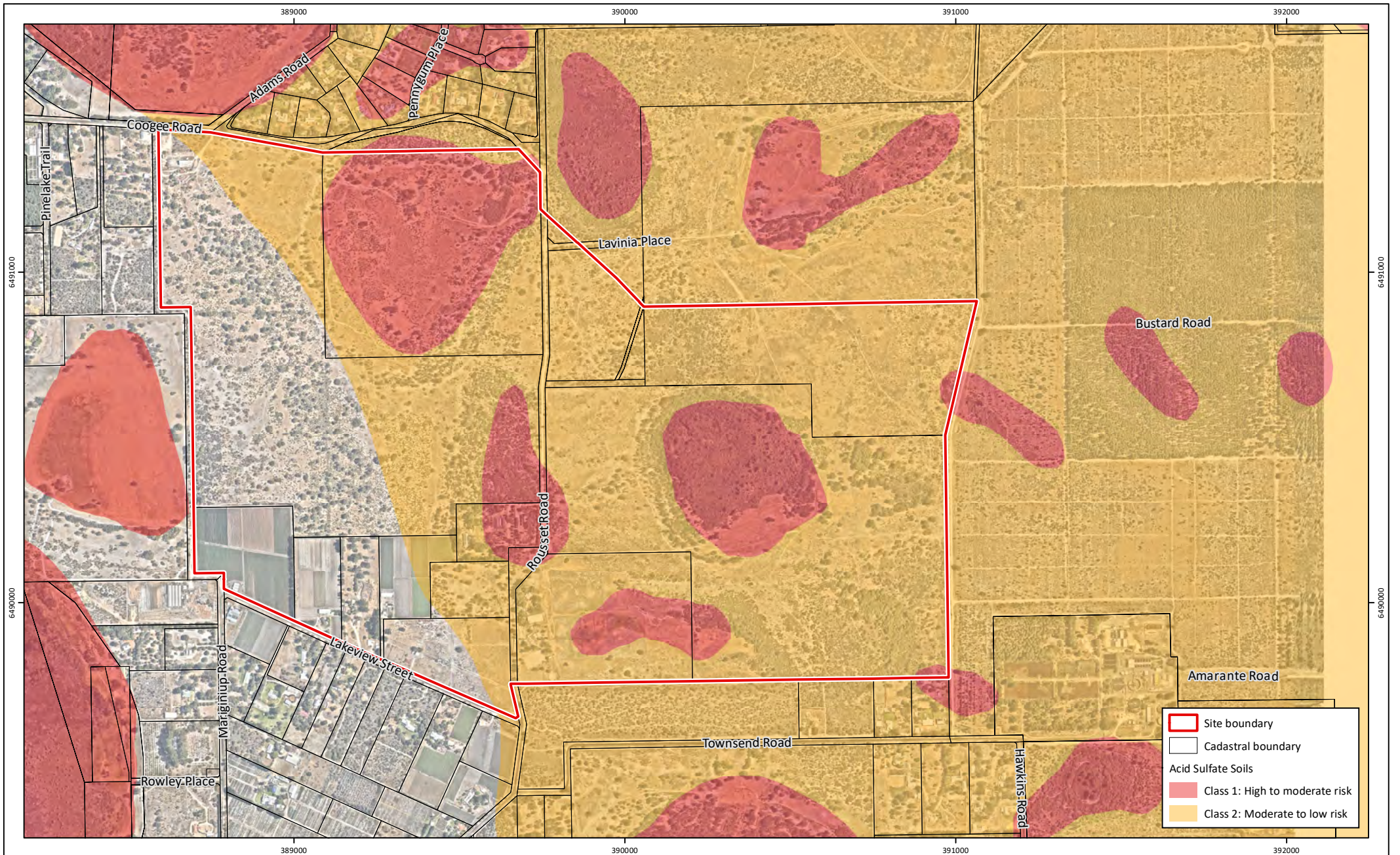
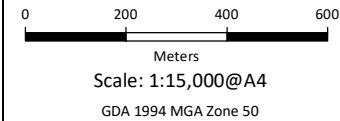


Figure 3: Acid Sulfate Soil Risk Map

Project: Environmental Assessment Report
Precinct 15 Structure Plan
Client: Stockland

Plan Number:
EP22-019(15)-F38
Drawn: GAR
Date: 23/02/2023
Checked: PPS
Approved: ADB
Date: 06/04/2023



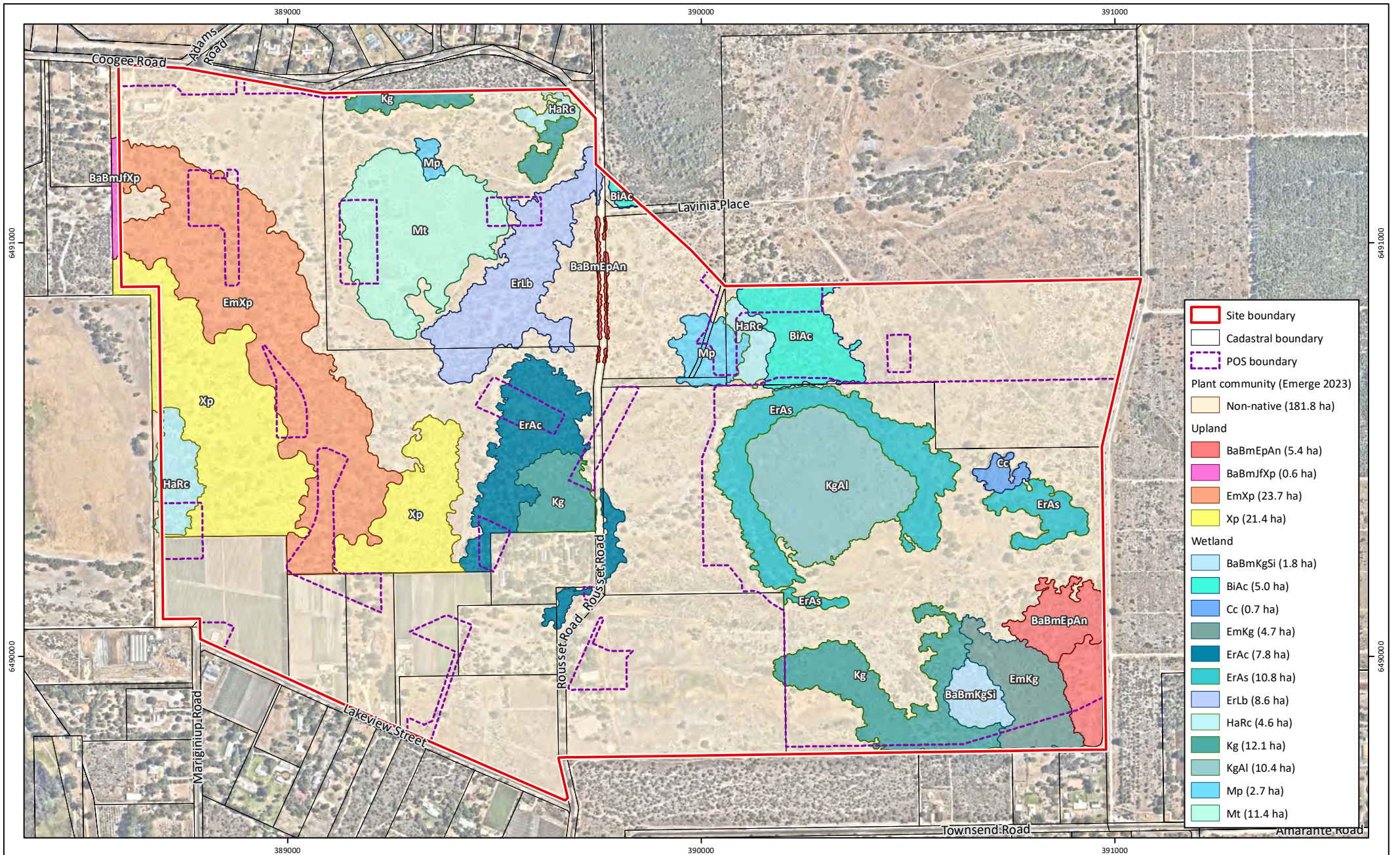
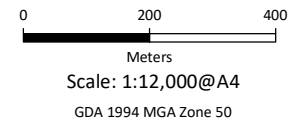


Figure 4: Vegetation Types

Project: Environmental Assessment Report
 Precinct 15 Structure Plan
Client: Stockland

Plan Number:
 EP22-019(15)-F39a
Drawn: SCM
Date: 01/08/2023
Checked: PPS
Approved: ADB
Date: 01/08/2023



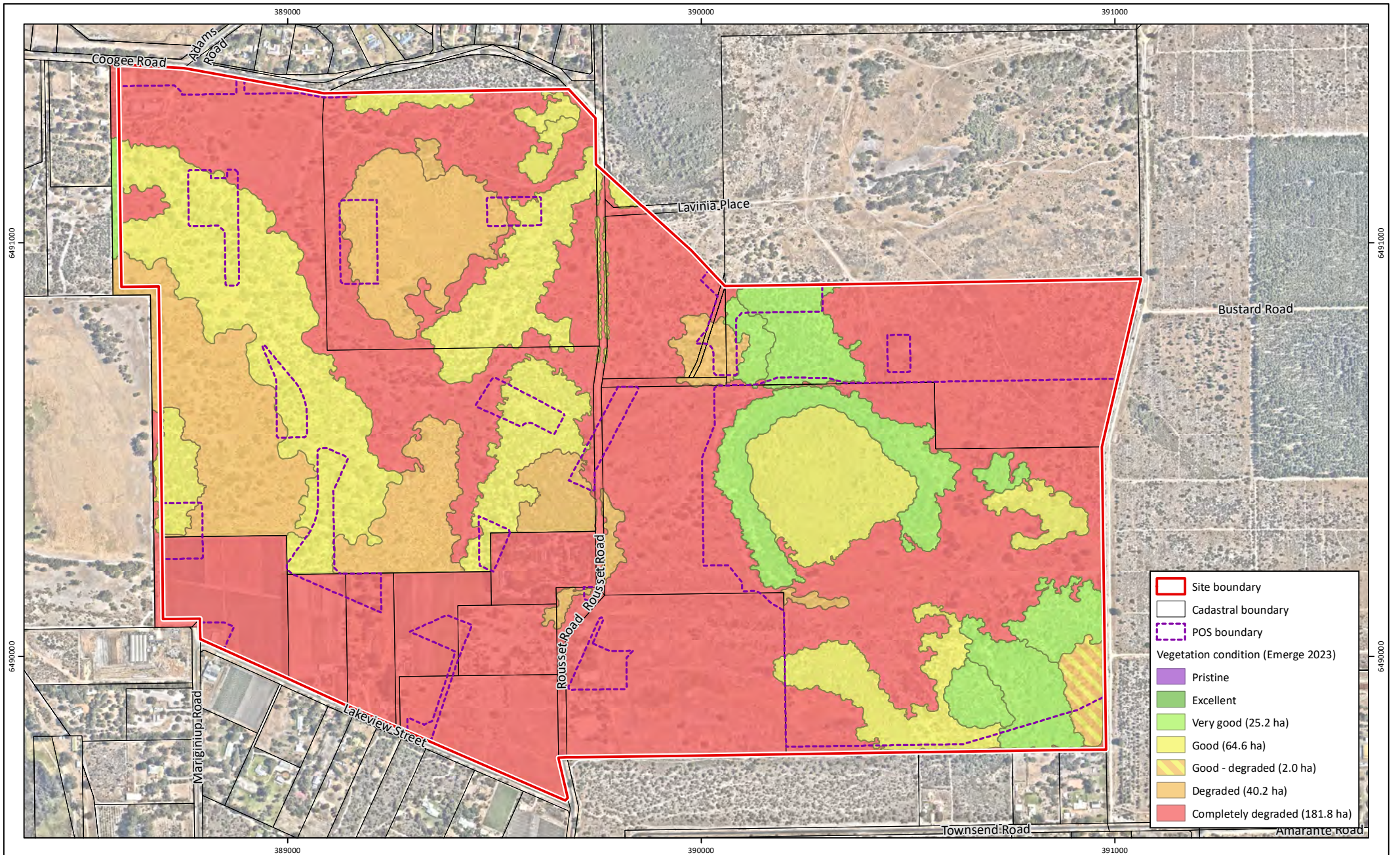


Figure 5: Vegetation Condition

Project: Environmental Assessment Report
Precinct 15 Structure Plan
Client: Stockland

Plan Number:
EP22-019(15)--F40a
Drawn: SCM
Date: 01/08/2023
Checked: PPS
Approved: ADB
Date: 01/08/2023



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Meters
Scale: 1:12,000@A4
GDA 1994 MGA Zone 50



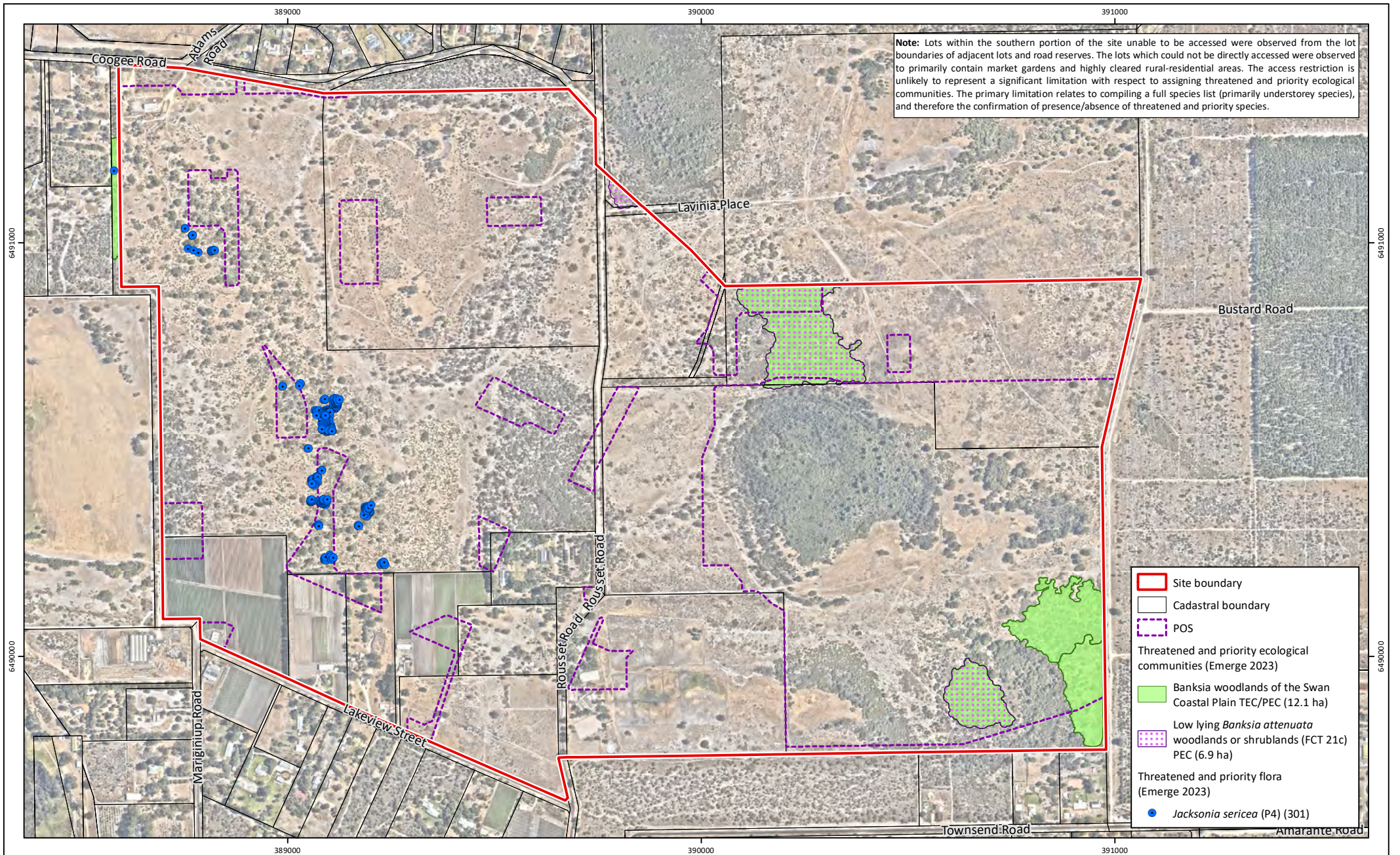


Figure 6: Conservation Significant Flora and Vegetation

Project: Environmental Assessment Report
Precinct 15 Structure Plan

Client: Stockland

Plan Number:
EP22-019(15)--F41a

Drawn: SCM

Date: 01/08/2023

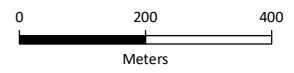
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Approved: ADB

Date: 01/08/2023

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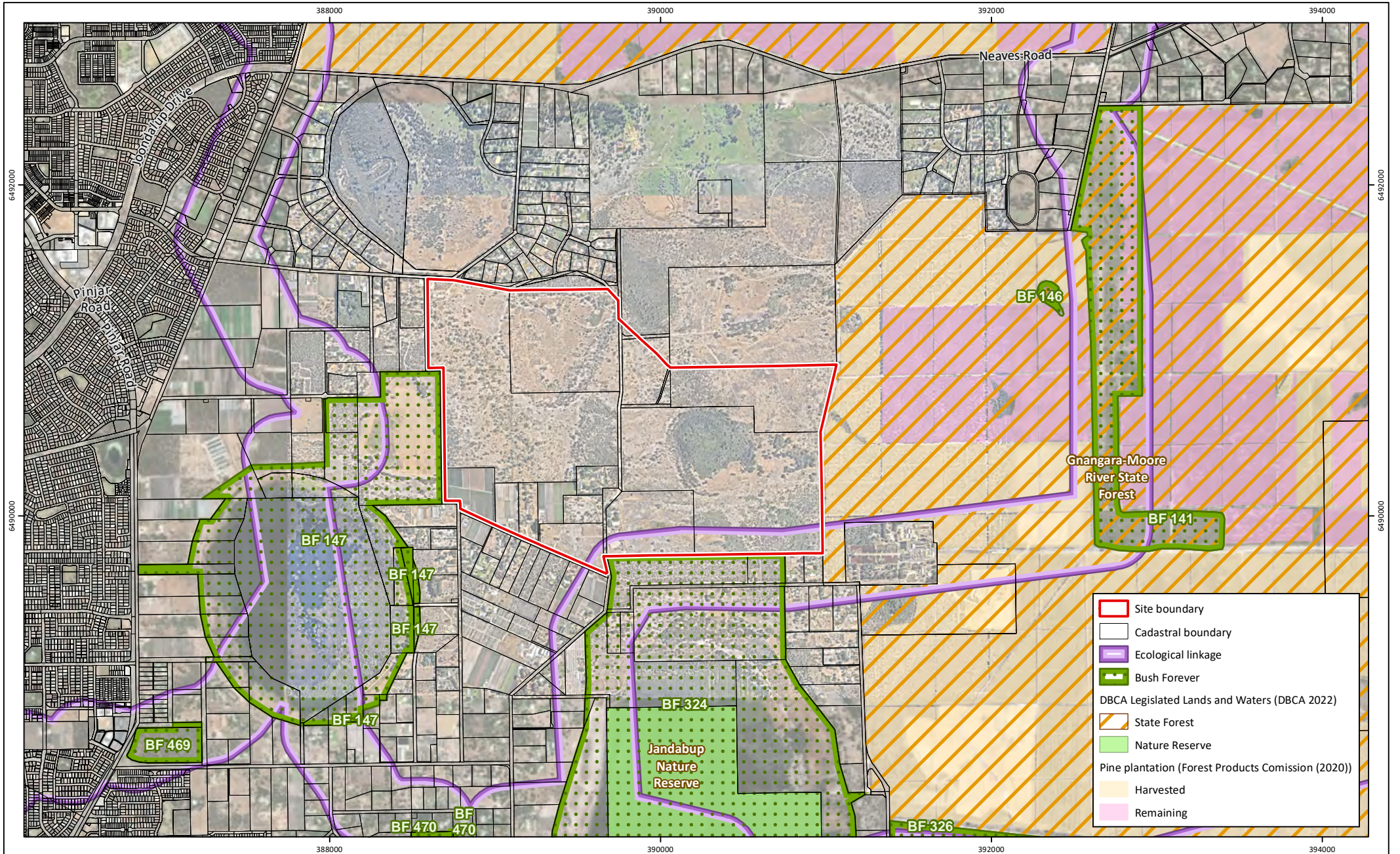
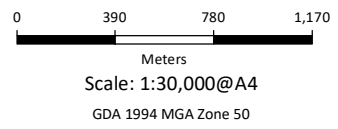


Figure 7: Environmental Features

Project: Environmental Assessment Report
Precinct 15 Structure Plan
Client: Stockland

Plan Number:
EP22-019(15)-F42
Drawn: GAR
Date: 24/02/2023
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Date: 06/04/2023



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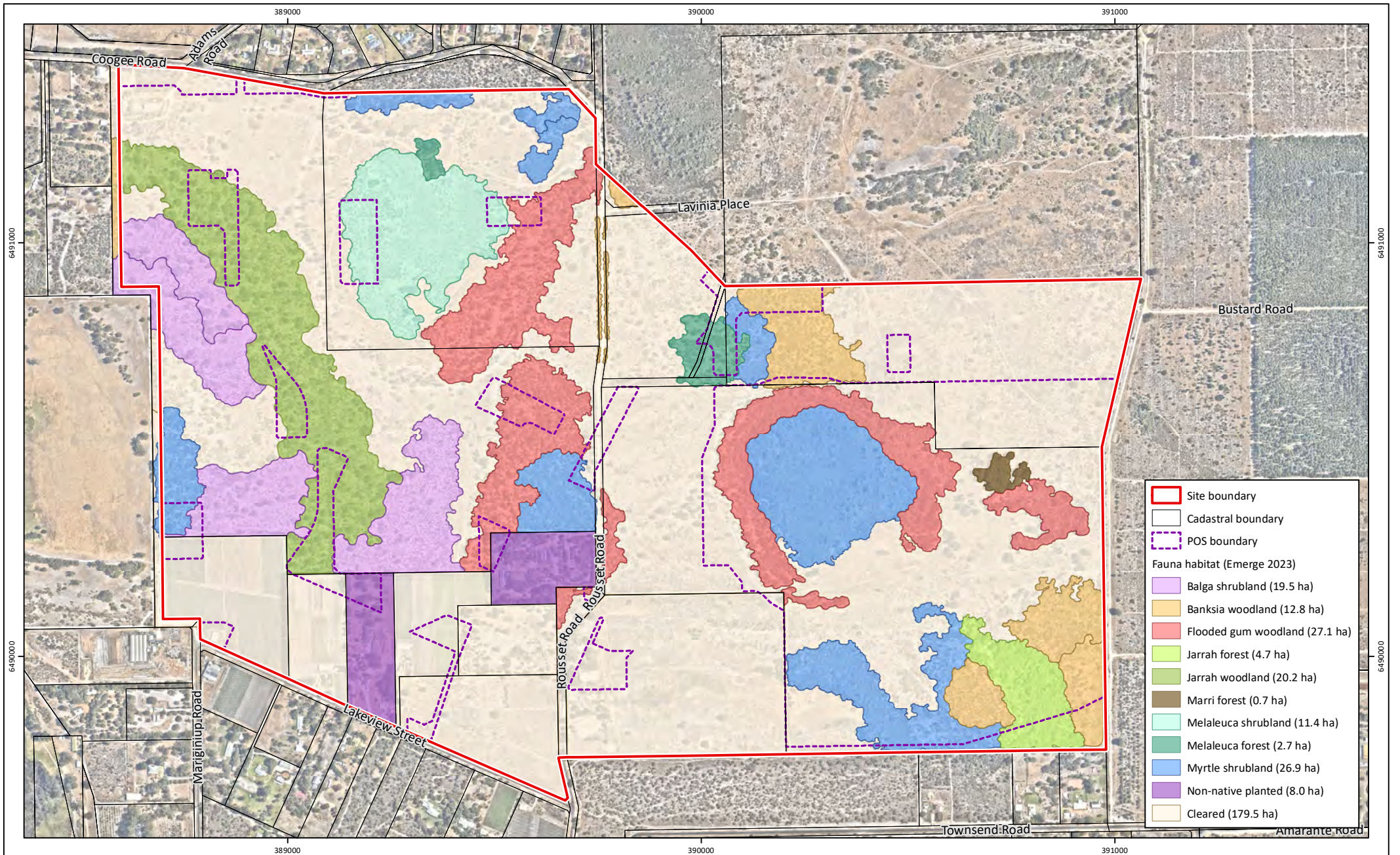


Figure 8: Fauna Habitat

Project: Environmental Assessment Report
Precinct 15 Structure Plan
Client: Stockland

Plan Number:
EP22-019(15)--F43a
Drawn: SCM
Date: 01/08/2023
Checked: PPS
Approved: ADB
Date: 01/08/2023



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Scale: 1:12,000@A4
GDA 1994 MGA Zone 50



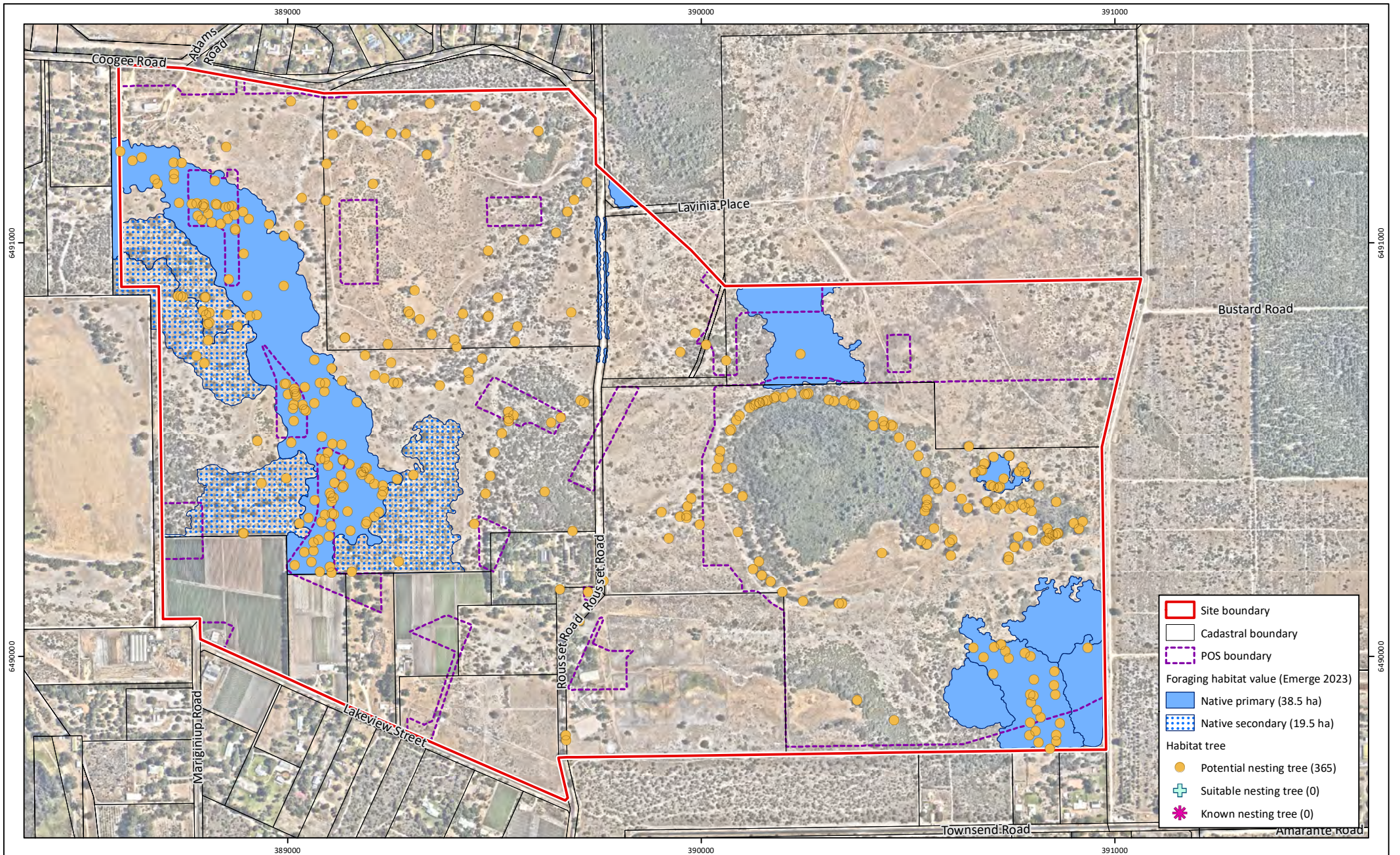


Figure 9: Conservation Significant Fauna Habitat - Carnaby's Cockatoo

Project: Environmental Assessment Report
Precinct 15 Structure Plan
Client: Stockland

Plan Number:
EP22-019(15)-F44a
Drawn: SCM
Date: 01/08/2023
Checked: PPS
Approved: ADB
Date: 01/08/2023



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Scale: 1:12,000@A4
GDA 1994 MGA Zone 50



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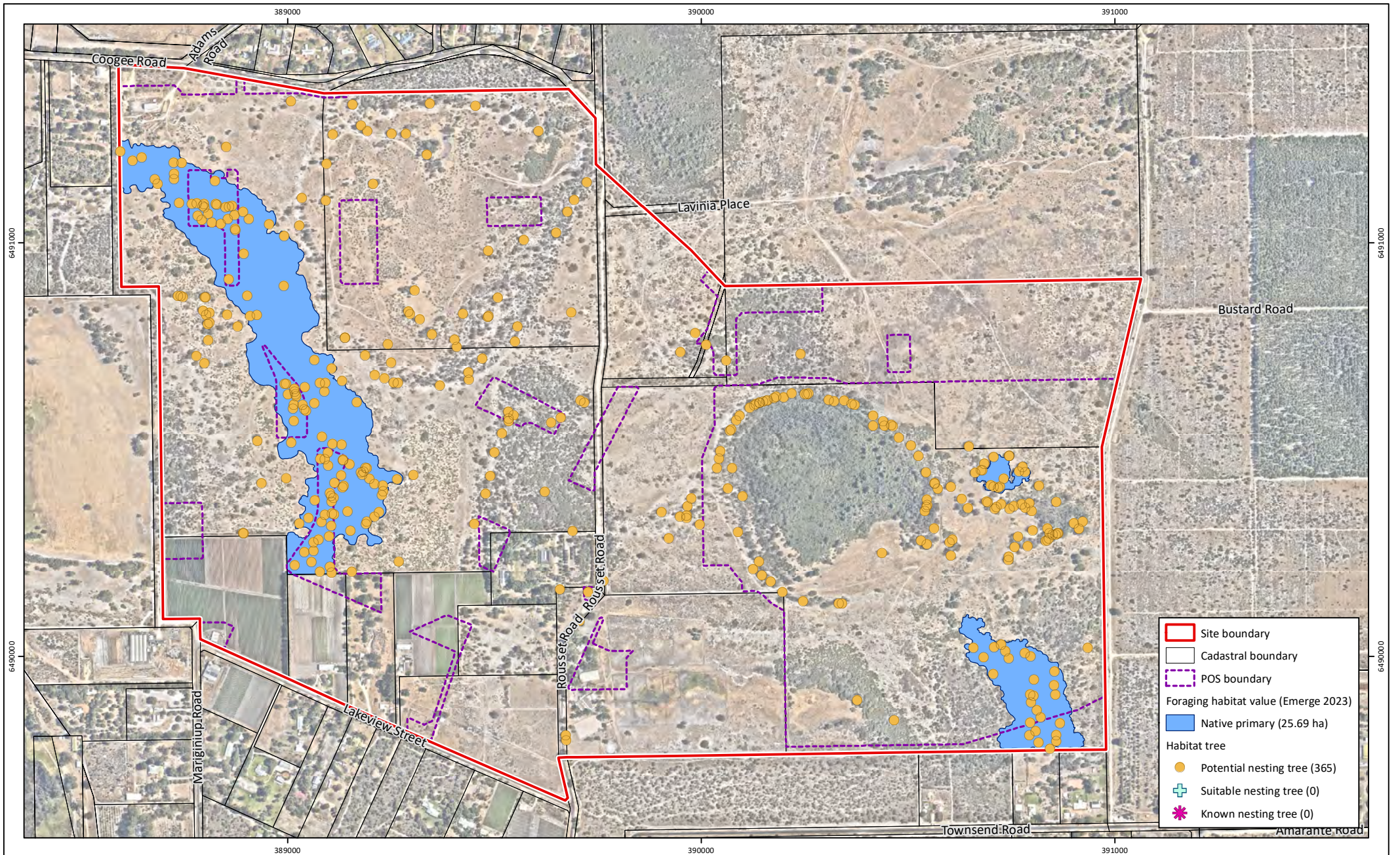


Figure 10: Conservation Significant Fauna Habitat - Forest Red-tailed Black Cockatoo

Project: Environmental Assessment Report
Precinct 15 Structure Plan

Client: Stockland

Plan Number: EP22-019(15)-F45a
Drawn: SCM
Date: 01/08/2023
Checked: PPS
Approved: ADB
Date: 01/08/2023

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Scale: 1:12,000@A4
GDA 1994 MGA Zone 50



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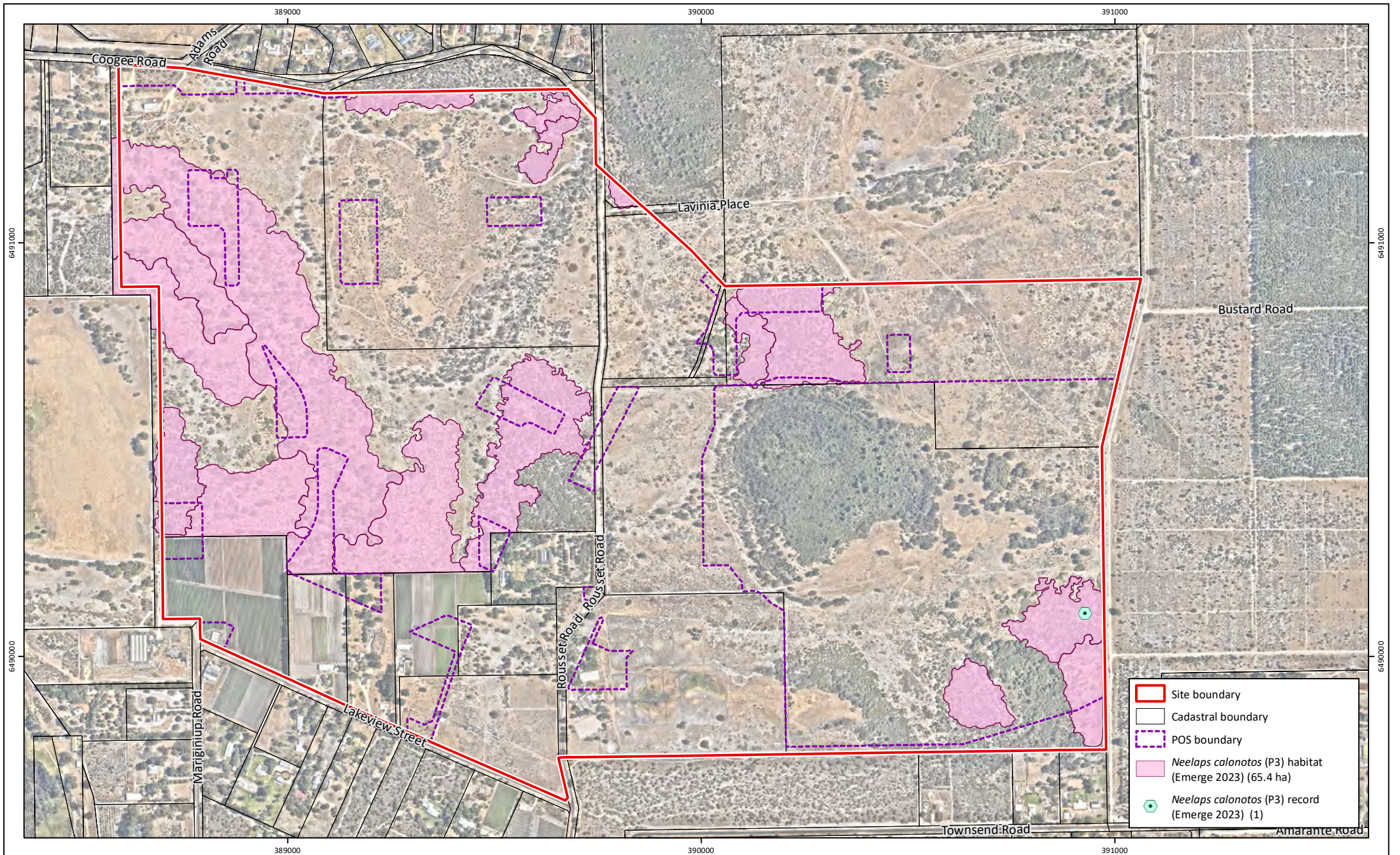
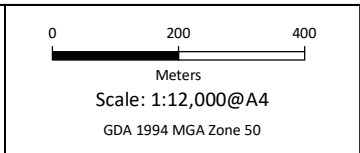


Figure 11: Conservation Significant Fauna Habitat - Black Striped Burrowing Snake

Project: Environmental Assessment Report
Precinct 15 Structure Plan

Client: Stockland

Plan Number: EP22-019(15)--F51a
Drawn: SCM
Date: 01/08/2023
Checked: PPS
Approved: ADB
Date: 01/08/2023



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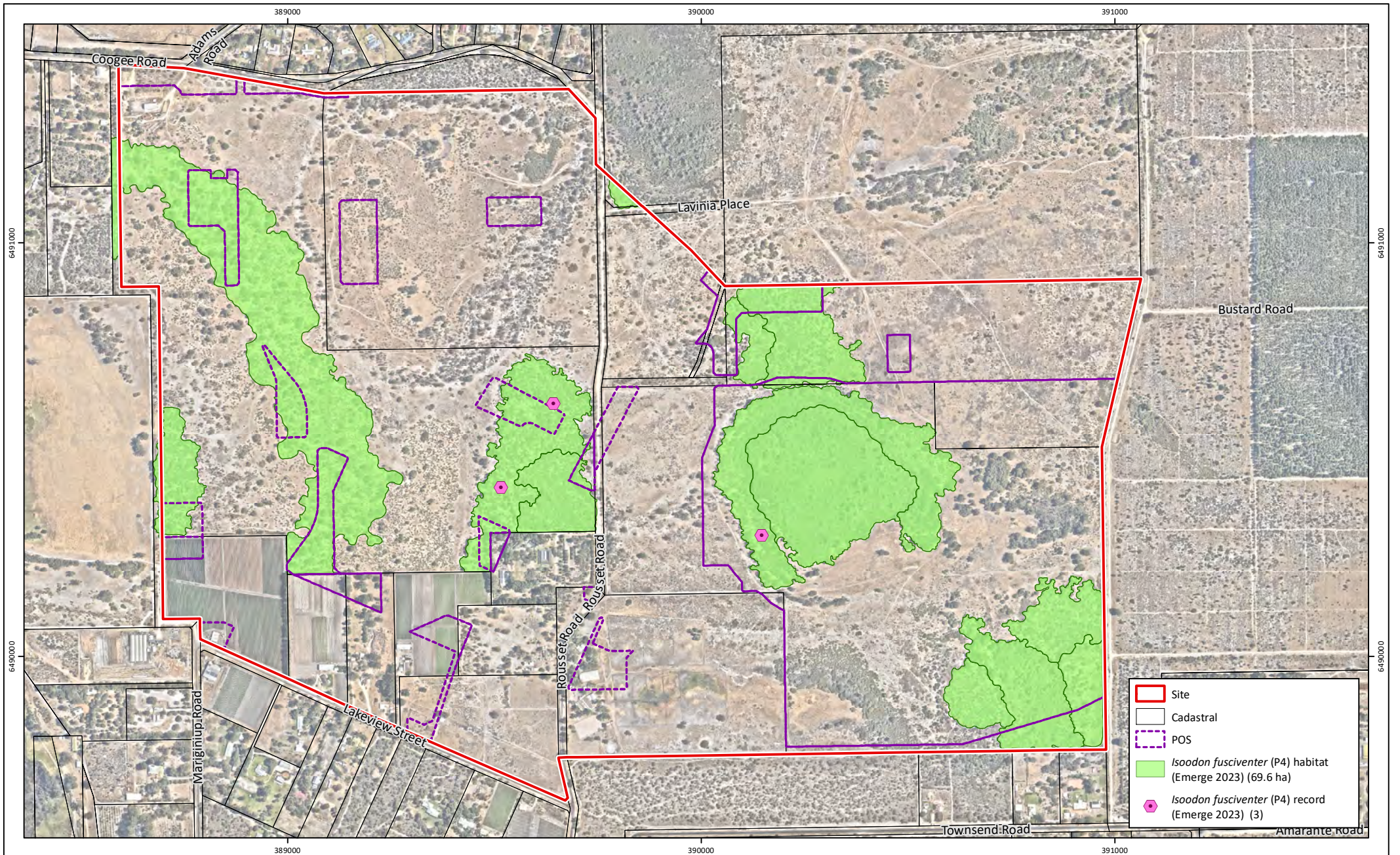


Figure 12: Conservation Significant Fauna Habitat – Quenda

Project: Environmental Assessment Report
Precinct 15 Structure Plan
Client: Stockland

Plan Number:
EP22-019(15)--F46a
Drawn: SCM
Date: 01/08/2023
Checked: PPS
Approved: ADB
Date: 01/08/2023



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Meters
Scale: 1:12,000@A4
GDA 1994 MGA Zone 50



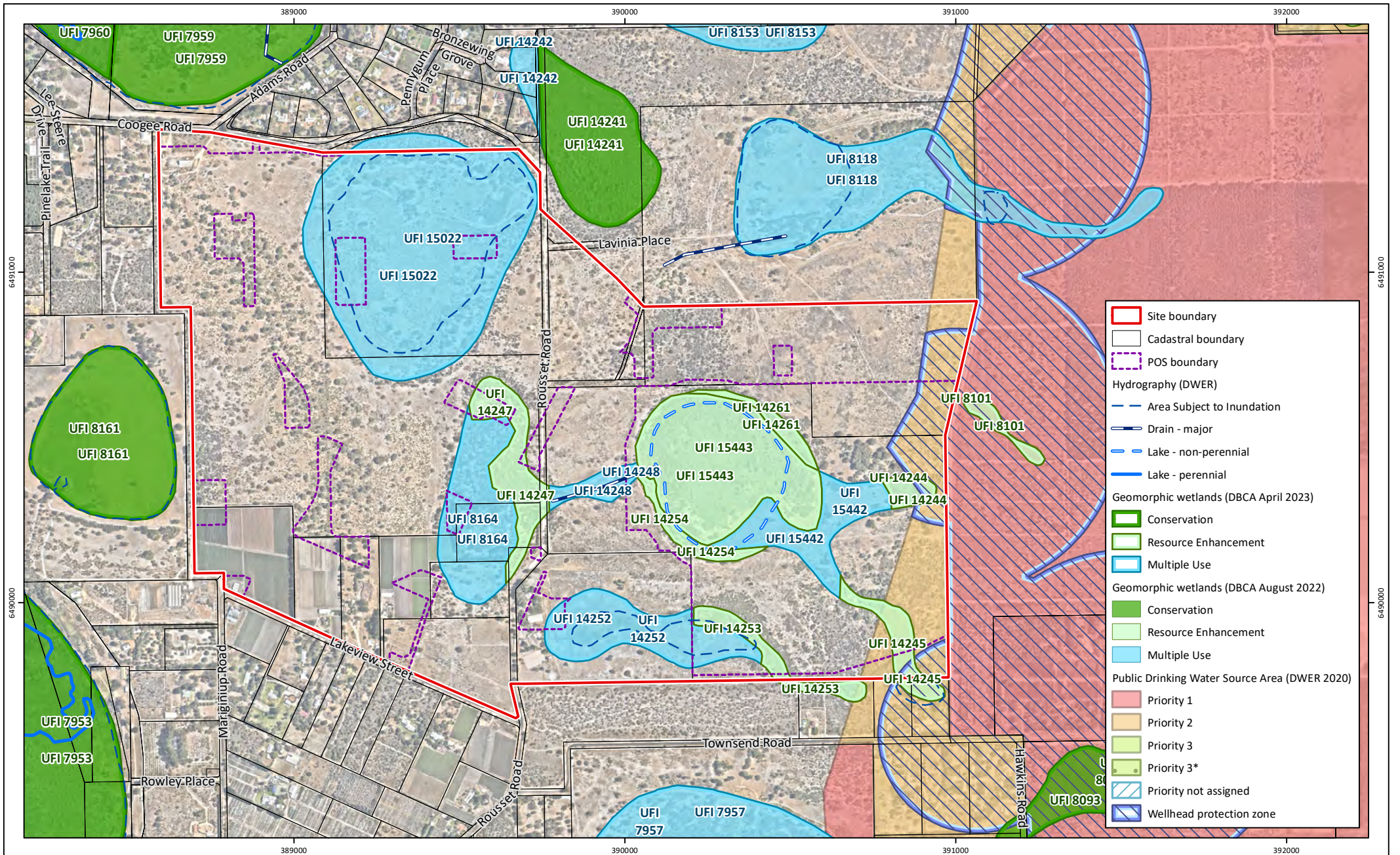
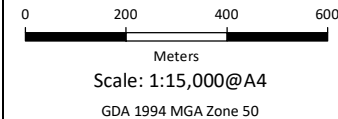


Figure 13: Wetlands and Hydrological Features

Project: Environmental Assessment Report
Precinct 15 Structure Plan
Client: Stockland

Plan Number:
EP22-019(15)--F47a
Drawn: SCM
Date: 01/08/2023
Checked: PPS
Approved: ADB
Date: 01/08/2023



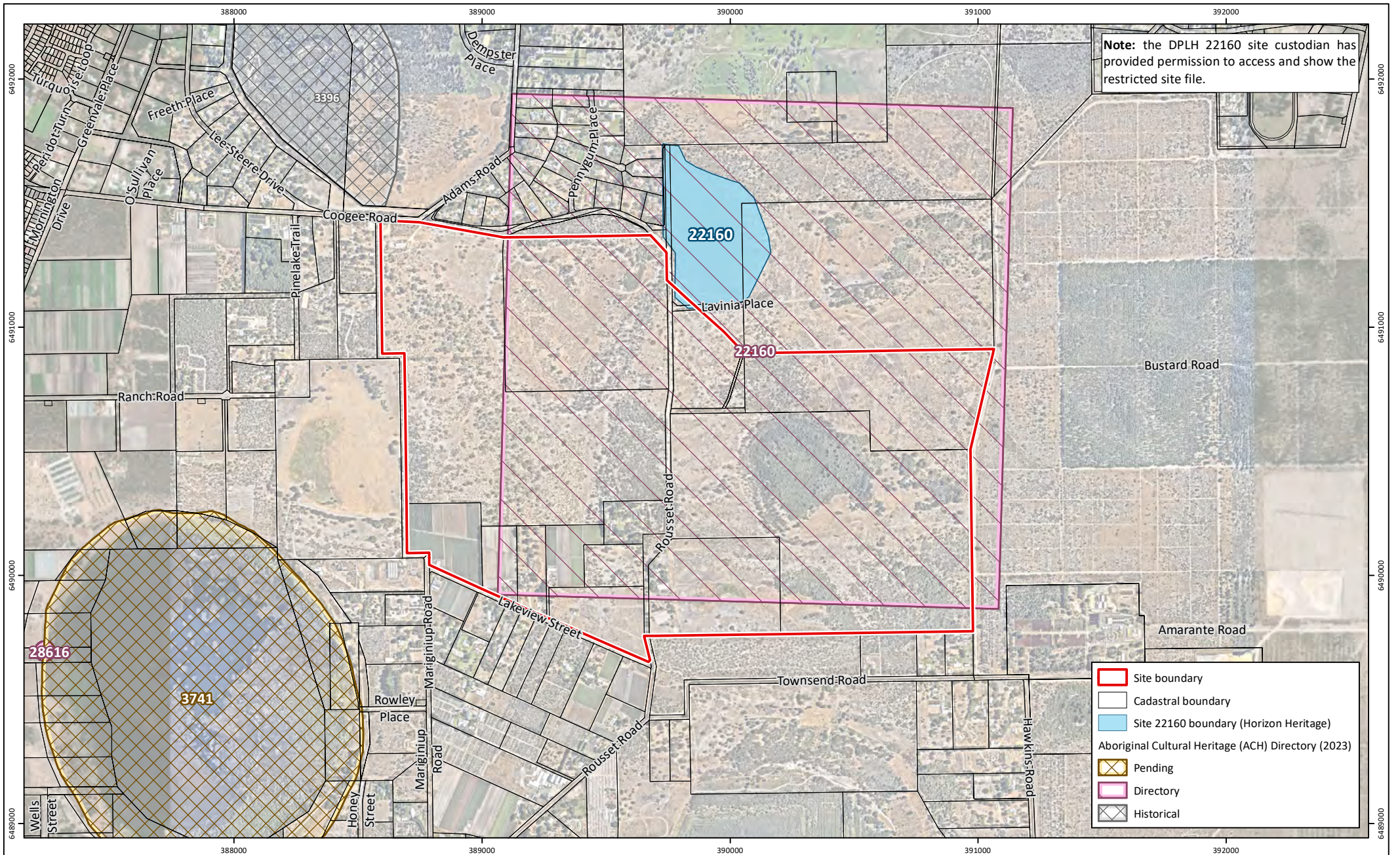


Figure 14: Aboriginal Heritage

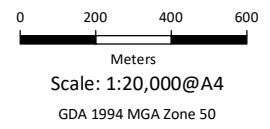
Project: Environmental Assessment Report
Precinct 15 - Central Marigniuip Local Structure Plan

Client: Stockland

Plan Number:
EP22-019(15)--F48a

Drawn: SCM
Date: 01/08/2023

Checked: PPS
Approved: ADB
Date: 01/08/2023



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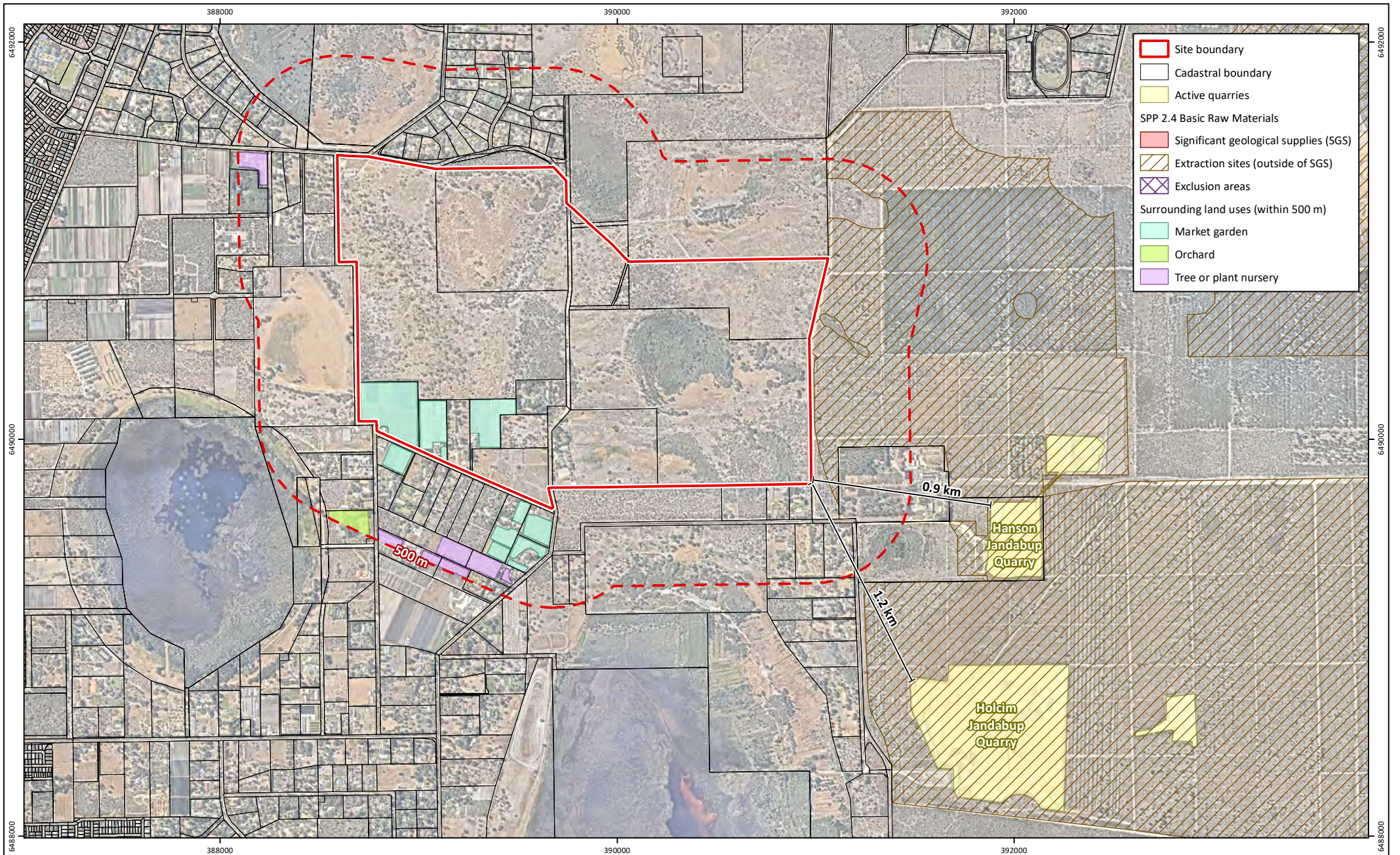
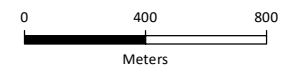


Figure 15: Surrounding Land Uses

Project: Environmental Assessment Report
Precinct 15 Structure Plan
Client: Stockland

Plan Number:
EP22-019(15)--F56
Drawn: GAR
Date: 05/04/2023
Checked: PPS
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Date: 06/04/2023



Meters
Scale: 1:25,000@A4
GDA 1994 MGA Zone 50



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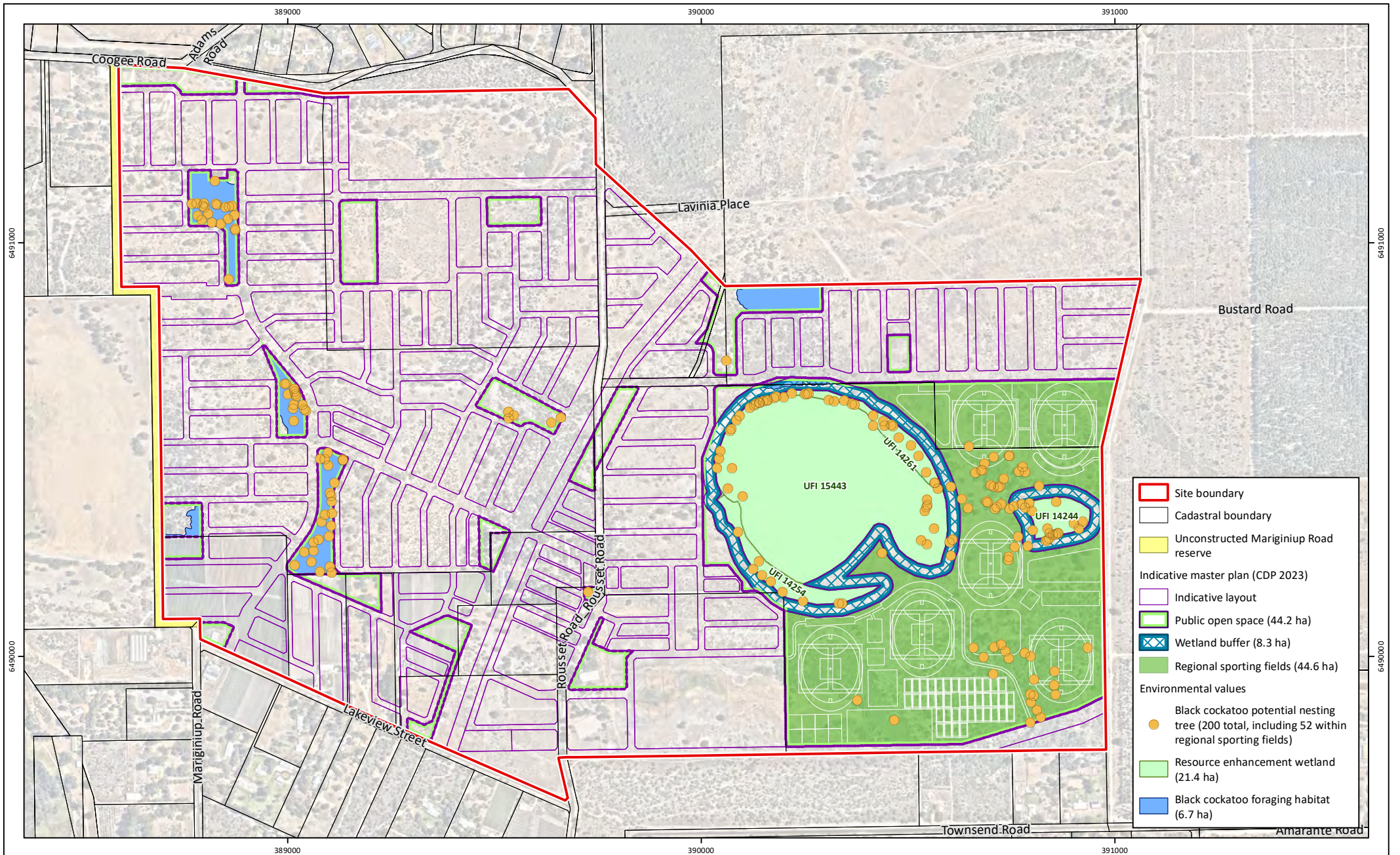


Figure 16: Significant Environmental Values - Local Structure Plan Considerations

Project: Environmental Assessment Report
Precinct 15 Structure Plan

Client: Stockland

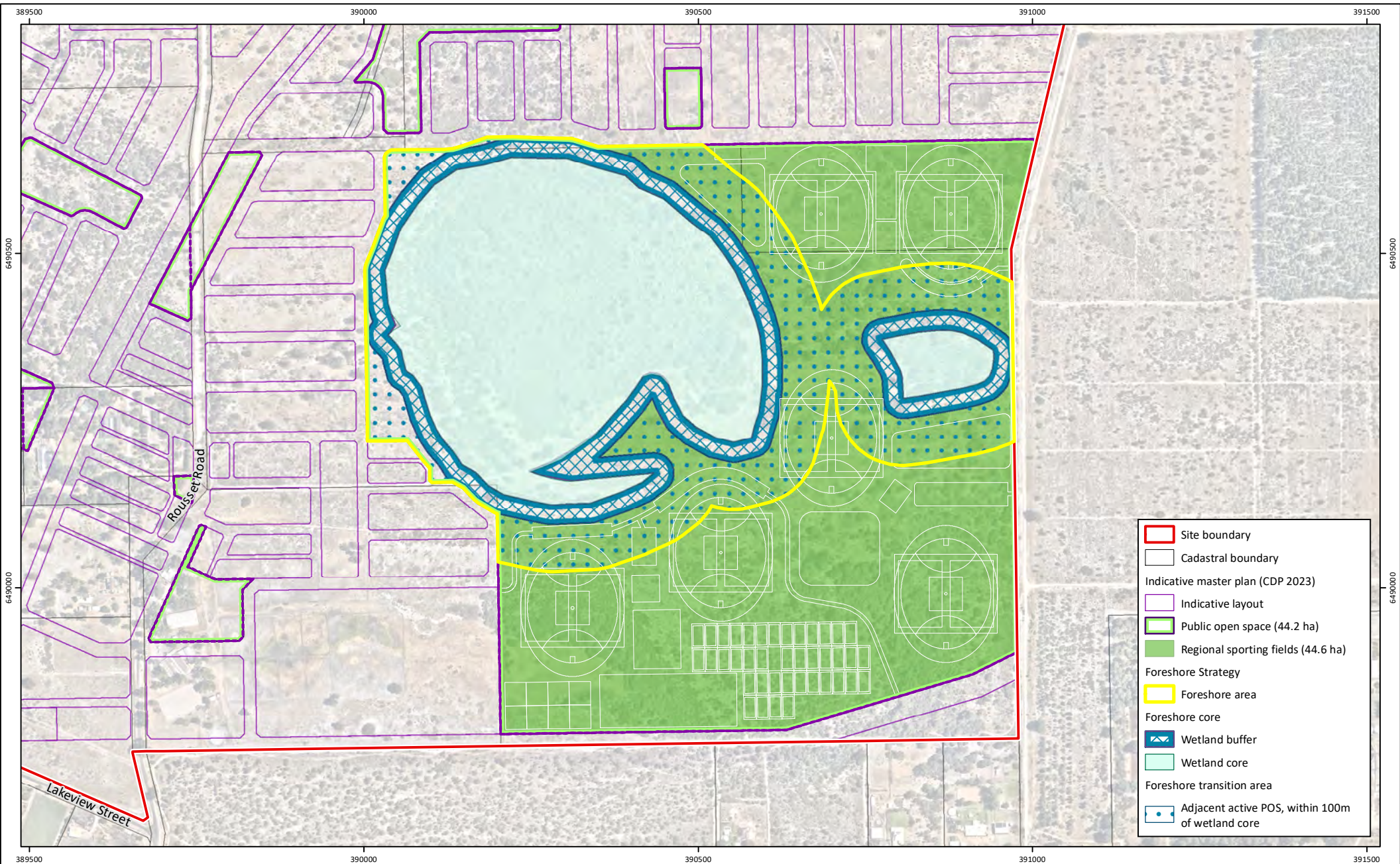
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Drawn: SCM
Date: 01/08/2023
Checked: PPS
Approved: ADB
Date: 01/08/2023



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Meters
Scale: 1:12,000@A4
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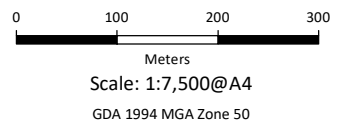


- Site boundary
- Cadastral boundary
- Indicative master plan (CDP 2023)
- Indicative layout
- Public open space (44.2 ha)
- Regional sporting fields (44.6 ha)
- Foreshore Strategy
- Foreshore area
- Foreshore core
- Wetland buffer
- Wetland core
- Foreshore transition area
- Adjacent active POS, within 100m of wetland core

Figure 17: Foreshore Area

Project: Environmental Assessment Report
Precinct 15 Structure Plan
Client: Stockland

Plan Number:
EP22-019(15)-F75
Drawn: GAR
Date: 17/08/2023
Checked: PPS
Approved: ADB
Date: 17/08/2023

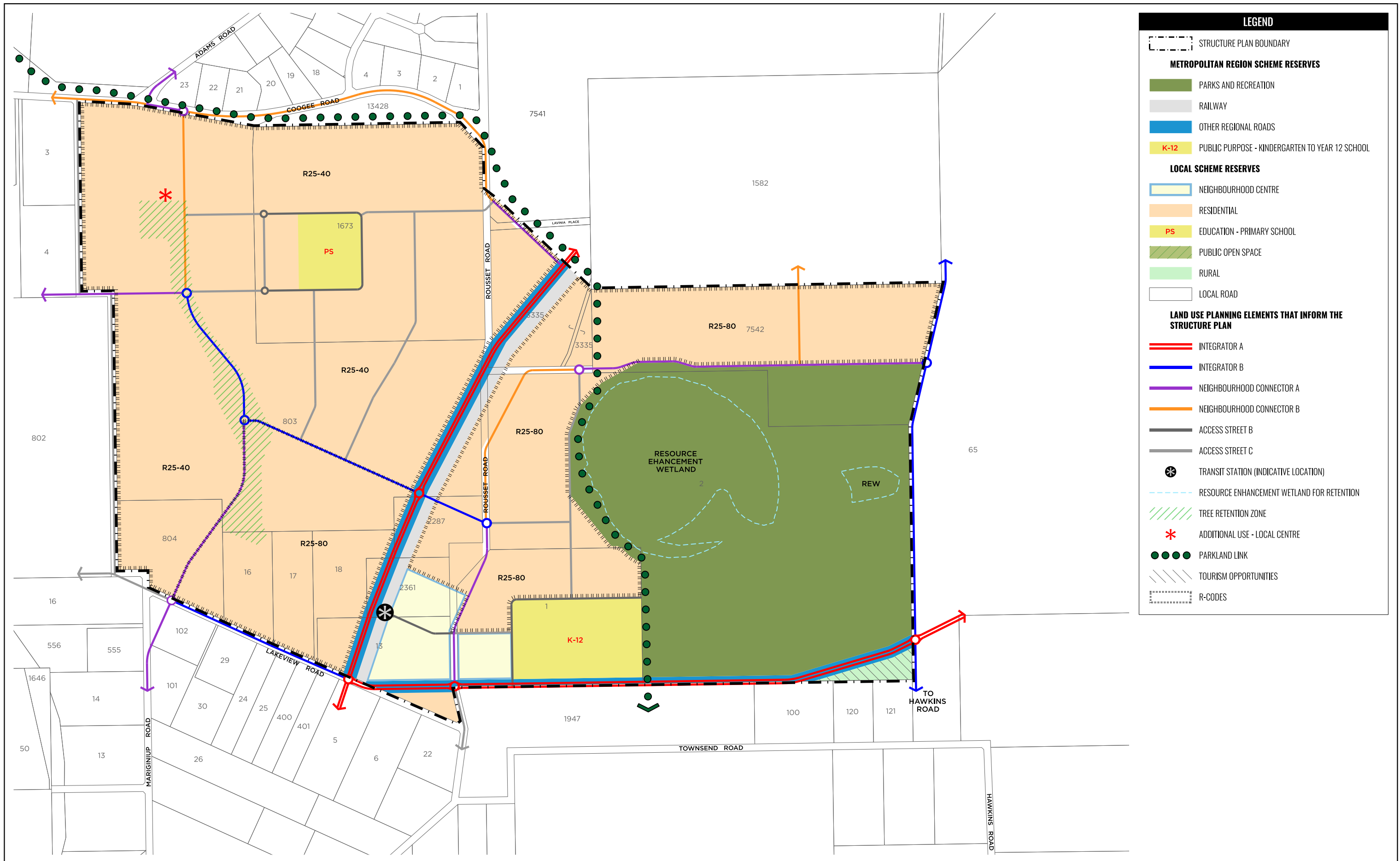


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Appendix A

Precinct 15 Structure Plan and Indicative Master Plan (CDP 2023)



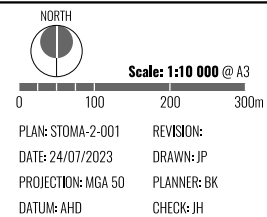


PRECINCT 15 STRUCTURE PLAN

Various Lots, MARIGINIUP

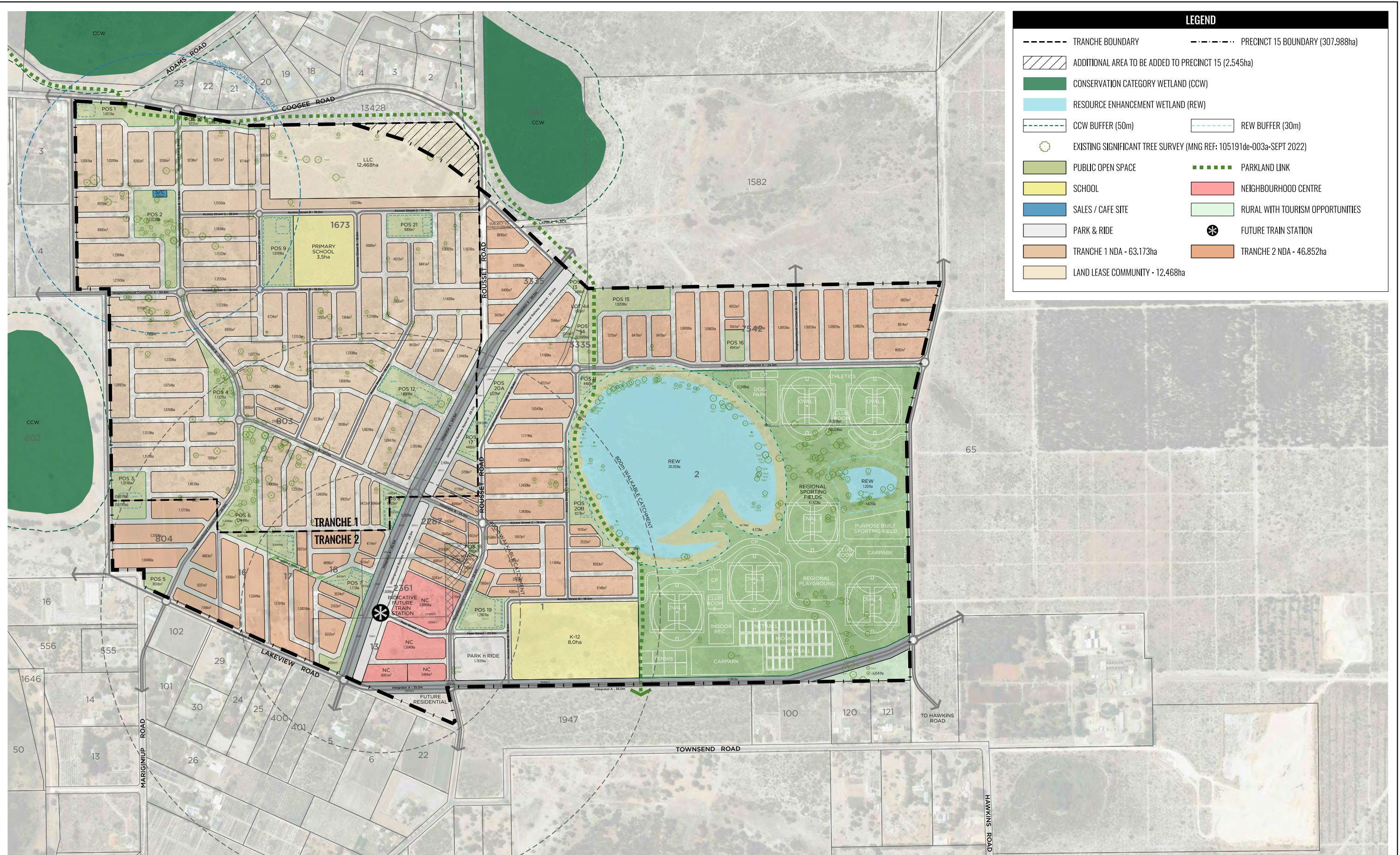
A Stockland Project

DRAFT



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Perth WA 6000
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LEGEND			
-----	TRANCHE BOUNDARY	-----	PRECINCT 15 BOUNDARY (307.988ha)
	ADDITIONAL AREA TO BE ADDED TO PRECINCT 15 (2,545ha)		CONSERVATION CATEGORY WETLAND (CCW)
	RESOURCE ENHANCEMENT WETLAND (REW)		CCW BUFFER (50m)
	REW BUFFER (30m)		EXISTING SIGNIFICANT TREE SURVEY (MNG REF: 105191de-003a-SEPT 2022)
	PUBLIC OPEN SPACE		PARKLAND LINK
	SCHOOL		NEIGHBOURHOOD CENTRE
	SALES / CAFE SITE		RURAL WITH TOURISM OPPORTUNITIES
	PARK & RIDE		FUTURE TRAIN STATION
	TRANCHE 1 NDA - 63.173ha		TRANCHE 2 NDA - 46.852ha
	LAND LEASE COMMUNITY - 12.468ha		

INDICATIVE MASTER PLAN
 Precinct 15
 A Stockland Project

DRAFT

NORTH
 Scale: 1:10 000 @ A3
 0 100 200 300m
 PLAN: STOMA-1-010
 DATE: 15/06/2023
 PROJECTION: MGA 50
 DATUM: AHD



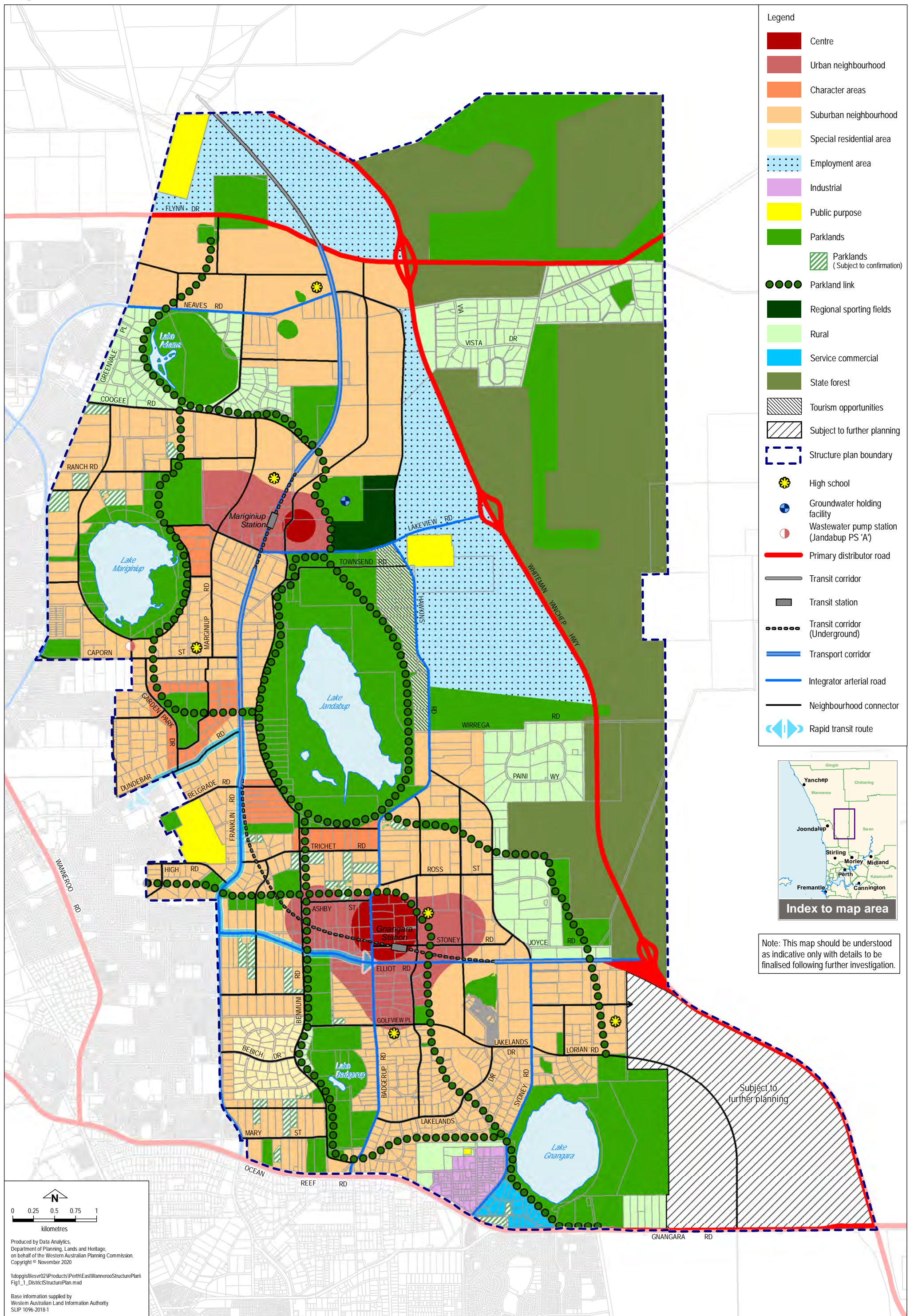
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Appendix B

East Wanneroo District Structure Plan (DPLH 2022)



Figure 1.1 East Wanneroo District Structure Plan



East Wanneroo District Structure Plan

Appendix C

Detailed Flora and Vegetation Assessment (Emerge Associates 2023)

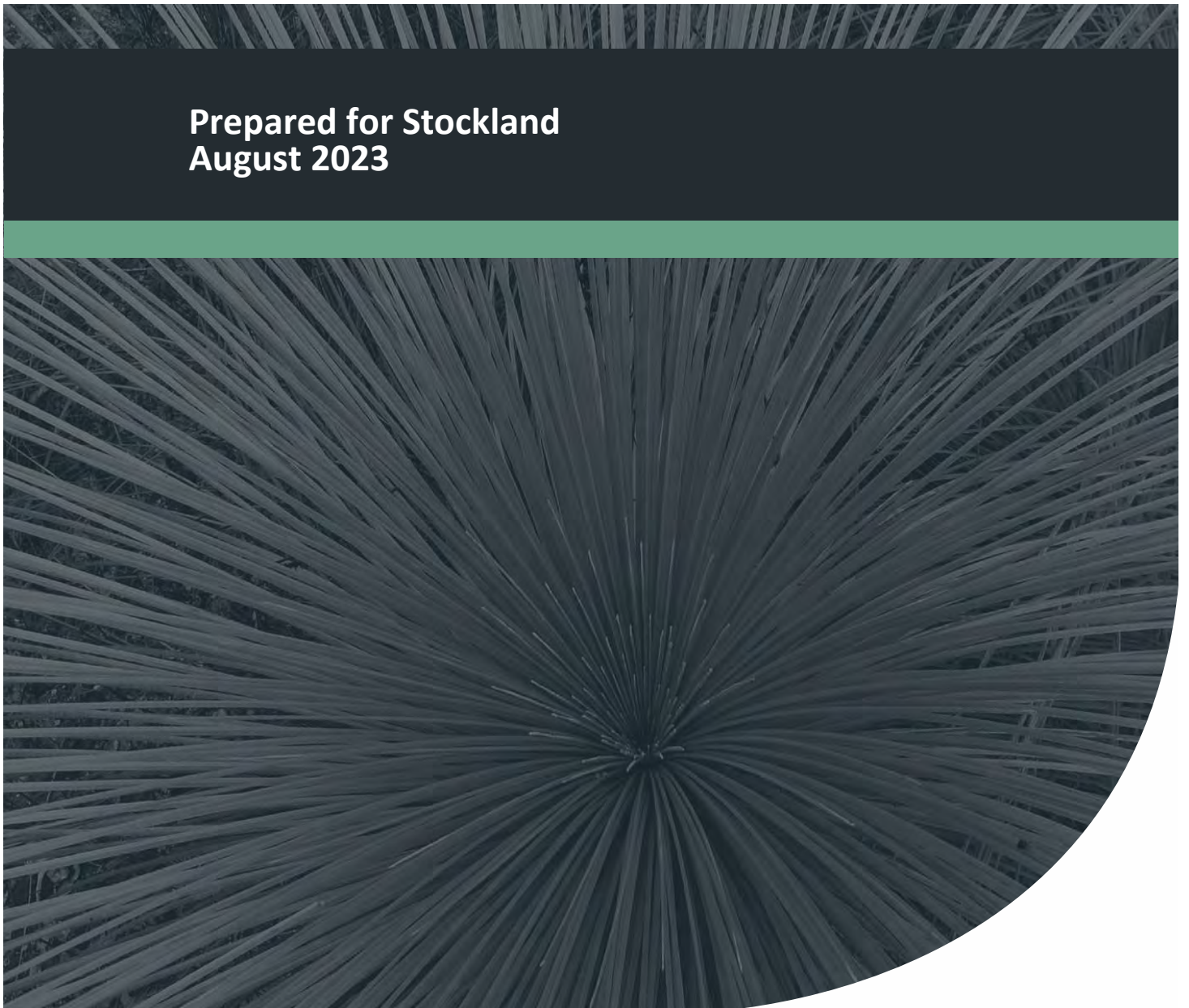


Detailed Flora and Vegetation Assessment

Various Lots, Mariginiup

Project No: EP22-019(01)

**Prepared for Stockland
August 2023**



Detailed Flora and Vegetation Assessment

Various Lots, Mariginiup



Document Control

Doc name:	Detailed Flora and Vegetation Assessment Various Lots, Mariginiup				
Doc no.:	EP22-019(01)--011B SCM				
Version	Date	Author		Reviewer	
1	March 2023	Sean Moylan	SCM	Tom Atkinson	TAA
	Submitted for client review				
A	July 2023	Sean Moylan	SCM	Tom Atkinson	TAA
	Updated based on Western Australian Herbarium specimen identification				
B	August 2023	Sean Moylan	SCM	Tom Atkinson	TAA
	Minor text updates				

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Detailed Flora and Vegetation Assessment

Various Lots, Mariginiup



Executive Summary

Stockland engaged Emerge Associates to conduct a detailed flora and vegetation assessment to characterise the flora and vegetation values within various lots in Mariginiup (referred to herein as the 'site').

A desktop review of relevant background information was completed and field surveys were undertaken across multiple dates between August 2022 – February 2023, including during the spring flowering season. During the field surveys an assessment was made on the type, condition and values of vegetation across the site.

Outcomes of the assessment include the following:

- Remnant native vegetation is present across 131.94 ha of the site in varying levels of condition. Non-native vegetation occurs across the remaining 181.84 ha of the site.
- A total of 198 native and 51 non-native (weed) species were recorded in the site.
- No threatened flora species were recorded or are considered likely to occur. A total of 301 individuals of priority 4 species *Jacksonia sericea* were recorded within the site. No other priority species were considered likely to occur. The presence or absence of threatened and priority flora within the lots in which access was not possible could not be confirmed.
- Seventeen plant communities were identified that are present in 'very good', 'good', 'good - degraded', 'degraded' and 'completely degraded' condition.
 - Plant community **BaBmEpAn** was determined to represent FCT 23a 'central *Banksia attenuata* – *B. menziesii* woodlands'.
 - Plant community **BaBmJfXp** was determined to represent FCT 28 'Spearwood *Banksia attenuata* or *Banksia attenuata* – *Eucalyptus* woodlands'.
 - Plant community **BaBmKgSi** and **BiAc** was determined to represent FCT 21c 'low lying *Banksia attenuata* woodlands of shrublands'.
 - Plant community **EmXp** was determined to represent FCT 28.
 - Plant community **EmKg** was determined to represent FCT 21c.
 - Plant communities **Cc** and **ErAs** were determined to represent FCT 11 'wet forests and woodlands'.
 - Plant communities **EmAc** and **KgAl** were determined to represent FCT 14 'deeper wetlands on sandy soils'.
 - Plant community **HaRc** was determined to represent FCT 4 'Melaleuca preissiana damplands'.
 - Plant communities **ErLb** and **Kg** were determined to represent FCT 6 'weed dominated wetlands on heavy soils'.
 - Plant communities **Mp**, **Mt** and **Xp** were too degraded to undertake an FCT analysis.
 - Non-native vegetation is present over the majority of the site and contains non-native vegetation, market gardens and bare areas.
- A total of 12.10 ha of **BaBmEpAn**, **BaBmJfXp**, **BaBmKgSi** and **BiAc** vegetation is considered to represent the Commonwealth listed 'threatened ecological community' (TEC) 'banksia woodlands of the Swan Coastal Plain' and associated State listed 'priority ecological community' (PEC).

Detailed Flora and Vegetation Assessment

Various Lots, Mariginiup



- A total of 6.89 ha of **BaBmKgSi** and **BiAc** vegetation is considered to represent the State listed PEC 'low lying *Banksia attenuata* woodlands of shrublands' (P3).
- Plant communities **BaBmKgSi**, **BiAc**, **Cc**, **EmKg**, **ErAc**, **ErAs**, **ErLb**, **HaRc**, **Kg**, **KgAl**, **Mp** and **Mt** are associated with wetland features and contain facultative and/or obligate wetland species.
- Vegetation within the site may provide habitat for conservation significant fauna, including black cockatoo species, quenda and black-striped burrowing snake.

Detailed Flora and Vegetation Assessment

Various Lots, Mariginiup



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Detailed Flora and Vegetation Assessment

Various Lots, Mariginiup



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Detailed Flora and Vegetation Assessment

Various Lots, Mariginiup



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Appendices

Appendix A

Additional Information

Appendix B

Conservation Significant Flora Species and Likelihood of Occurrence Assessment

Appendix C

Species List

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Abbreviation Tables

Table A1: Abbreviations – Organisations

Organisations	
DBCA	Department of Biodiversity, Conservation and Attractions
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DPIRD	Department of Primary Industries and Regional Development
DWER	Department of Water and Environmental Regulation
EPA	Environmental Protection Authority
WALGA	Western Australia Local Government Association

Table A2: Abbreviations – General terms

General terms	
FCT	Floristic community type
IBRA	Interim Biogeographic Regionalisation of Australia
NVIS	National Vegetation Inventory System (ESCAVI 2003)
P1	Priority 1
P2	Priority 2
P3	Priority 3
P4	Priority 4
P5	Priority 5
PEC	Priority ecological community
T	Threatened
TEC	Threatened ecological communities
UFI	Unique feature identifier
WoNS	Weed of National Significance

Table A3: Abbreviations – Legislation

Legislation	
BAM Act	<i>Biosecurity and Agriculture Management Act 2007</i>
BC Act	<i>Biodiversity Conservation Act 2016</i>
EP Act	<i>Environmental Protection Act 1986</i>
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>

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Table A4: Abbreviations – Units of measurement

Units of measurement	
cm	Centimetre
ha	Hectare
m	Metre
m AHD	m in relation to the Australian height datum
mm	Millimetre

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1 Introduction

1.1 Project background

Emerge Associates (Emerge) were engaged by Stockland to characterise the flora and vegetation values across the following lots associated with Precinct 15 of the East Wanneroo District Structure Plan area in Mariginiup (referred to herein as the 'site'):

- Lot 803 (no. 200) Mariginiup Road
- Lot 1673 (no. 285) Rousset Road
- Lot 804 (no. 90) Lakeview Street
- Lot 16 (no. 62) Lakeview Street
- Lot 17 (no. 54) Lakeview Street
- Lot 18 (no. 46) Lakeview Street
- Lot 13 (no. 13) Lakeview Street
- Lot 2361 (no. 175) Rousset Road
- Lot 2287 (no. 201) Rousset Road
- Lot 1 (no. 170) Rousset Road
- Lot 2 (no. 220) Rousset Road
- Lot 7542 (no. 30) McCaffrey Road
- Lot 44 McCaffery Road
- part Lot 3335 (no. 264) Rousset Road
- part Lot 7541 (no. 310) Rousset Road
- part Rousset Road reserve
- McCaffery Road reserve (unconstructed)
- part Lavinia Place reserve (unconstructed).

In addition to the landholdings within the Precinct 15 of the East Wanneroo District Structure Plan area, part of the unconstructed Mariginiup Road reserve was also surveyed.

The site is located approximately 25 kilometres (km) north of the Perth Central Business District within the City of Wanneroo and is approximately 313.78 hectares (ha) in size. The site is bounded by state forest plantations to the east, remnant bushland and rural-residential areas to the north, rural-residential land and Mariginiup Lake to the west and Lakeview Street and remnant vegetation to the south. The location and extent of the site is shown in **Figure 1**.

Not all lots were accessible at the time of the site visit, with the lot access within the site shown in **Figure 2**. Those lots not accessed were assessed from adjacent lots and public road reserves, as discussed in **Section 3.2**.

1.2 Purpose and scope of work

The scope of work was specifically to undertake a flora and vegetation assessment to the standard required of a detailed survey with reference to the Environmental Protection Authority's (EPA's) technical guidance (EPA 2016).

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As part of this scope of work, the following tasks were undertaken:

- Desktop review of relevant background information pertaining to the site and surrounds, including database searches for threatened flora species and ecological communities.
- A field survey to record a comprehensive list of flora species and assess vegetation type and condition.
- Mapping of plant communities, vegetation condition and conservation significant flora and vegetation.
- Identification of potential habitat for conservation significant flora and vegetation and an assessment of likelihood of occurrence.
- Documentation of the desktop assessment, methodology, field survey and results into a report.

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2 Environmental Context

2.1 Climate

Climate influences the types of vegetation that grow in a region and the life cycles of the flora present. Therefore, it is critical for a flora and vegetation survey to respond appropriately to climatic conditions to ensure that surveys are conducted during times when flora species are easiest to detect and identify.

The south-west of Western Australia experiences a Mediterranean climate of hot dry summers and cool wet winters. In Mediterranean type climates some flora species will typically spend part of their lifecycle as either underground storage organs or as seed. This is an adaptation to unfavourable environmental conditions such as excessive heat and drought that occur over the summer period. These species, known as 'geophytes' or 'annuals', tend to re-emerge during winter when favourable conditions return and are most visible during spring, which is the flowering period for a majority of plant species. Therefore, spring is the optimal time to complete flora and vegetation surveys in the south-west of WA.

An average of 794.3 millimetres (mm) of rainfall is recorded annually from the Wanneroo weather station (no. 9105), which is the closest weather station, located approximately 1 km from the site. The majority of this rainfall is received between the months of May and September. Mean maximum temperatures at the Pearce RAAF weather station (no. 9053), which is the nearest temperature recording station approximately 16.7 km north-east of the site, range from 17.9°C in July to 33.6°C in January, while mean minimum temperatures range from 8.2°C in August to 17.6°C in February (BoM 2023).

A total of 624.7 mm of rain was recorded from May to September 2022 prior to the survey, which is slightly lower than the mean of 636.4 mm for this period (BoM 2023). This amount of rainfall was considered to have been sufficient to promote the flowering and emergence of native flora.

2.2 Geomorphology and soils

Landform and soils influence vegetation types at regional and local scales. The site occurs on the Swan Coastal Plain, which is the geomorphic unit that characterises much of the Perth metropolitan area. The Swan Coastal Plain is approximately 500 km long and 20 to 30 km wide and is roughly bound by the Indian Ocean to the west and the Darling Scarp to the east. Broadly the Swan Coastal Plain consists of two sedimentary belts of different origin. Its eastern side comprises the Pinjarra Plain which formed from the deposition of alluvial material washed down from the Darling Scarp, while its western side comprises three dune systems that run roughly parallel to the Indian Ocean coastline (Seddon 2004). These dune systems, referred to as Quindalup, Spearwood and Bassendean associations, represent a succession of coastal deposition that has occurred since the late Quaternary period (approximately two million years ago) (Kendrick *et al.* 1991) and, as a result, they contain soils at different stages of leaching and formation.

Physiographic mapping places the western portion of the site within the Spearwood system, described as sand dunes and sandplains with pale deep sand, semi-wet and wet soil. The remainder

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of the site is located within the Bassendean system, described as sand dunes and plains with yellow deep sands, pale deep sands and yellow/brown shallow sands (DPIRD 2018).

Examination of broad scale soil mapping places the site within the Bassendean association (Churchward and McArthur 1980). The Bassendean association comprises sand plains with low dunes and occasional swamps, iron or humus podzols and areas of complex steep dunes.

Fine scale soil landscape mapping by the Department of Primary Industries and Regional Development (DPIRD 2019) shows seven units as occurring within the site, as described in **Table 1** and shown in **Figure 3**.

Table 1: Soil landscape mapping units within the site (DPIRD 2019)

Soil landscape unit	Location within site	Description
Spearwood seasonal swamps phase	Western portion	Depressions with free water in winter. Humus podzols and peat.
Karrakatta sand yellow phase	Western portion	Low hilly to gently undulating terrain. Yellow sand over limestone at 1-2 m.
Bassendean seasonal swamps phase	Northern, central and southern portions	Depressions with free water in winter. Humus podzols and peat.
Bassendean permanent lakes and swamps phase	Southern portion	Depressions. Humus podzols and peats around the edges often with some diatomite zoned vegetation with heath on upper slopes.
Bassendean, Jandakot phase	Central and eastern portions	Jandakot low dunes. Slopes <10% and generally more than 5m relief. Grey sand over pale yellow sands generally underlain by humic and iron podsols.
Bassendean, Joel phase	Eastern portion	Poorly drained depressions. Humus podzols.
Bassendean, Gavin phase	North-eastern portion	Flat or gently undulating landscape. Iron-humus podzols and some diatomite deposits.

The site is not known to contain any restricted landforms or unique geological features.

2.3 Topography

The elevation of the site ranges from 46 m in relation to the Australian height datum (mAHD) on the western and central portions of the site to 59 mAHD on the western side of the site which supports a dunal ridge (MNG 2021) (**Figure 3**).

2.4 Hydrology and wetlands

Wetlands are areas of seasonally, intermittently or permanently waterlogged land such as poorly drained soils, ponds, billabongs, lakes, swamps, tidal flats, estuaries, rivers and their tributaries (Wetlands Advisory Committee 1977). Wetlands can be recognised by the presence of vegetation associated with waterlogging or the presence of hydric soils such as peat, peaty sand or carbonate mud (Hill *et al.* 1996).

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Wetlands of national or international significance may be afforded special protection under Commonwealth or international agreements. The following lists of important wetlands were checked as part of this assessment:

- *Ramsar List of Wetlands of International Importance* (DBCA 2017c)
- *A Directory of Important Wetlands in Australia* (DBCA 2018)

No Ramsar or listed 'important wetlands' are located within or near the site.

Examination of the Department of Water and Environmental Regulation (DWER) hydrography dataset (DWER 2018) shows the following six wetland or water related features occur within the site:

- two 'earth dams' within the northern and central portions;
- two 'areas subject to inundation' within the north-western and southern portions;
- a 'lake – non-perennial' in the eastern portion; and,
- a 'drain – major' in the central portion.

The Department of Biodiversity, Conservation and Attractions (DBCA) has developed the *Geomorphic Wetlands of the Swan Coastal Plain* dataset (DBCA 2021). This dataset maps geomorphic wetland features and classifies them based on their landform shape and water permanence, and is assigned a unique feature identifier (UFI). Each feature is assigned to one of three management categories which guides land use and conservation.

A review of the *Geomorphic Wetlands, Swan Coastal Plain* dataset indicated that seven 'resource enhancement' category wetland features (UFIs 14244, 14245, 14247, 14253, 14254, 14261 and 15443) occur within the central, eastern and south-eastern portions of the site (DBCA 2022a). Five 'multiple use' category wetland feature (UFIs 8164, 14248, 14252, 15022 and 15442) occurs within the northern, central and south-eastern portions of the site. The locations of the geomorphic wetlands in the site is shown in **Figure 3**.

2.5 Regional vegetation

Native vegetation is described and mapped at different scales in order to illustrate patterns in its distribution. At a continental scale the *Interim Biogeographic Regionalisation of Australia* (IBRA) divides Australia into floristic subregions (Environment Australia 2000).

The site is contained within the Swan Coastal Plain IBRA region and within the 'SWA02' or Perth subregion. The Perth subregion is characterised by mainly banksia low woodland on leached sands with melaleuca swamps where ill-drained; and woodland of *Eucalyptus gomphocephala* (tuart), *E. marginata* (jarrah) and *Corymbia calophylla* (marri) on less leached soils (Beard 1990). This subregion is recognised as a biodiversity hotspot and contains a wide variety of endemic flora and vegetation types.

Variations in native vegetation can be further classified based on regional vegetation mapping.

Hedde *et al.* (1980) mapping shows the site as comprising the 'Pinjar complex', which is described as vegetation ranging from woodland of *Eucalyptus marginata* - *Banksia* spp. to a fringing woodland of *Eucalyptus rudis* - *Melaleuca preissiana* and sedgelands. The north-eastern portion of the site

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intersects the 'Bassendean complex - north' association. However, given the broad-scale mapping indicates that this complex extends into the site by 4 m, it is not considered to be relevant to the composition of vegetation within the site.

The Pinjar complex was determined to have 35.47% of its pre-European extent remaining, of which 4.57% is protected for conservation purposes (Government of Western Australia 2019).

2.6 Historical land use

Review of historical images available from 1965 onwards shows that the majority of the site was cleared of native vegetation prior to 1970, likely for grazing. Native vegetation was retained in a larger patch in the south-eastern portion of the site and scattered paddock trees across the remainder of the site (WALIA 2023). The south-western portion of the site appears to have been cultivated for horticultural purposes since 1977, with market gardens still evident in 2022. Native vegetation regrowth has occurred over time, most extensively within the central portion of the site.

2.7 Conservation significant values

2.7.1 Threatened and priority flora

Certain flora taxa that are considered to be rare or under threat warrant special protection under Commonwealth and/or State legislation. At a Commonwealth level, flora taxa may be listed as 'threatened' under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Threatened flora species listed under the EPBC Act are assigned a conservation status according to attributes such as population size and geographic distribution. Any action likely to have a significant impact on a taxon listed under the EPBC Act requires Ministerial approval.

In Western Australia flora species may also be classed as 'threatened' under the *Biodiversity Conservation Act 2016* (BC Act). Similarly, it is an offence to 'take' or 'disturb' threatened flora listed under the BC Act without Ministerial approval.

Flora species that do not currently meet the criteria for listing as threatened but are potentially rare or threatened may be added to the DBCA's *Priority Flora List*. These species are classified into 'priority' levels based on threat. Whilst priority species are not under direct statutory protection, they are considered during State approval processes.

Further information on threatened and priority species and their categories is provided in **Appendix A**. An assessment of the likelihood of occurrence of threatened and priority flora within the site was undertaken (refer to **Sections 3.1** and **4.2.1**).

2.7.2 Threatened and priority ecological communities

An ecological community is a naturally occurring group of native plants, animals and other organisms that are interacting in a unique habitat. An ecological community's structure, composition and distribution are influenced by environmental factors such as soil type, position in the landscape, altitude, climate and water availability (DCCEEW 2021). 'Threatened ecological communities' (TECs)

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are ecological communities that are recognised as rare or under threat and therefore warrant special protection.

Selected TECs are afforded statutory protection at a Commonwealth level under the EPBC Act. Similar to flora species, TECs listed under the EPBC Act are assigned a conservation status. Any action likely to have a significant impact on a community listed under the EPBC Act requires Ministerial approval.

TECs are also listed within Western Australia under the BC Act and the BC Regulations. Their significance is also acknowledged through other state environmental approval processes such as 'environmental impact assessment' pursuant to Part IV of the *Environmental Protection Act 1986* (EP Act) and the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*.

An ecological community that is under consideration for listing as a TEC in Western Australia but does not yet meet survey criteria or has not been adequately defined may be listed as a 'priority ecological community' (PEC). Listing as a PEC is similarly considered during State approval processes.

Further information on categories of TECs and PECs is provided in **Appendix A**. An assessment of the likelihood of occurrence of threatened and priority flora within the site was undertaken (refer to **Sections 3.1** and **4.3.1**).

2.8 Weeds and pests

The term 'weed' can refer to any plant that requires some form of action to reduce its effect on the economy, the environment, human health and amenity. Many non-native flora species and some native species are considered to be weeds. The likelihood of weeds occurring is higher in areas disturbed areas, especially areas that have been agricultural or urban landuse.

A particularly invasive or detrimental weed species may be listed as a 'declared pest' pursuant to *Western Australia's Biosecurity and Agriculture Management Act 2007* (BAM Act), indicating that it warrants special management to limit its spread.

The Commonwealth government has further compiled a list of 32 *Weeds of National Significance* (WoNS) (Weeds Australia 2021). Whilst the WoNS list is non-statutory, many WoNS are also listed under the BAM Act. Further information on weeds and declared pests is provided in **Appendix A**.

2.9 Bush Forever

The Government of Western Australia's *Bush Forever* policy is a strategic plan for conserving regionally significant bushland within the Swan Coastal Plain portion of the Perth Metropolitan Region. The objective of *Bush Forever* is to protect comprehensive representations of all original ecological communities by targeting a minimum of 10% of each vegetation complex for protection (Government of WA 2000a). *Bush Forever* sites are representative of regional ecosystems and habitat and have a key role in the conservation of Perth's biodiversity. Flora considered to be 'significant', irrespective of Commonwealth and state conservation significance status, are listed in *Bush Forever* documentation.

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No *Bush Forever* sites occur within the site. Bush Forever Site 147 (Mariginiup Lake and Adjacent Bushland, Mariginiup) lies adjacent to the south-western corner of the site, and Bush Forever Site 324 (Jandabup Lake and Adjacent Bushland, Jandabup/Mariginiup) lies adjacent to the southern boundary. Bush Forever Site 324 extends to the south, and significant flora species are known to occur in this site. Bush Forever Site 147 extends to the south-east of the site, and the location of both Bush Forever sites associated with the site is shown in **Figure 3**.

2.10 DBCA managed or legislated land

DBCA has tenure of or interests in numerous areas of land across the state for a range of purposes. Tenure categories include national parks, nature reserves, conservation parks, marine parks, marine nature reserves, marine management areas, section 5(1)(g) reserves, state forest and timber reserves. These areas are mapped within the *Legislated Lands and Waters* (DBCA 2017a) and *Lands of Interest* (DBCA 2017b) datasets. The *Legislated Lands and Waters* (DBCA 2017a) dataset includes lands subject to the following legislation; the *Conservation and Land Management Act 1984* (CALM Act 1984), *Swan and Canning Rivers Management Act 2006* (SCRM Act) and lands identified under the *Land Administration Act 1997* (LA Act). The *Lands of Interest* (DBCA 2017b) dataset includes all other lands of which DBCA is recognised as the manager but is not vested under any act. These lands comprise of crown land and freehold land which DBCA has been acknowledged by the Department of Lands as the responsible agency.

Land adjacent to the eastern boundary is mapped as state forest, which is also located approximately 1.2 km to the north, whilst Jandabup Nature Reserve is located approximately 900 m to the south of the site (DBCA 2017a).

2.11 Ecological linkages

Ecological linkages are linear landscape elements that allow the movement of fauna, flora and genetic material between areas of remnant habitat. This exchange of genetic material between vegetation remnants improves the viability of those remnants by allowing greater access to breeding partners and food sources, refuge from disturbances such as fire and maintenance of genetic diversity of plant communities and populations. Ecological linkages are ideally continuous or near-continuous as the more fractured a linkage is, the less ease flora and fauna have in moving within the corridor (Alan Tingay and Associates 1998).

The Perth Biodiversity Project, supported by the Western Australia Local Government Association (WALGA), have identified and mapped regional ecological linkages within the Perth Metropolitan Region (WALGA and PBP 2004).

One regional ecological linkage (No. 16) is mapped within the south-eastern portion of the site, extending to the south and east, which intersects with another ecological linkage (No. 12), which runs north-south adjacent to the western boundary, as shown in **Figure 4**.

Review of aerial imagery indicates that native vegetation within the site is connected to small patches of native vegetation to the north-west, north and south of the site, but is otherwise disconnected from vegetation in the broader area.

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2.12 Previous surveys

AECOM undertook a *Flora, Vegetation and Fauna Assessment* as part of environmental investigations within a corridor between Yanchep and the Wanneroo reservoir in November 2017 and January 2018 (AECOM 2018). This survey extended over a broad area to the north and south, and intersected the central portion of the site along the Rousset Road reserve and adjacent areas. This assessment did not identify any conservation significant species or communities within the portion of the corridor survey area that intersected the site.

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3 Methods

3.1 Database searches

A search was conducted for threatened and priority flora that may occur or have been recorded within a 10 km radius of the site using the *Protected Matters Search Tool* (DAWE 2022), *NatureMap* (DBCA 2022b) and DBCA's threatened and priority flora database (reference no. 03-0322FL).

A search was also conducted for TECs and PECs that may occur or have been recorded within a 10 km radius of the site using the *Protected Matters Search Tool* (DAWE 2022), the *weed and native flora dataset* (Keighery *et al.* 2012) and DBCA's threatened and priority ecological communities' database (reference no. 03-0322EC).

Prior to undertaking the field survey, information on the habitat preferences of threatened and priority flora species and communities identified from database searches was reviewed. This was compared to existing environmental information available for the site, such as geomorphology, soils, regional vegetation and historic land use, to identify species and communities for which habitat may occur in the site.

3.2 Field survey

Botanists and ecologists from Emerge visited the site on multiple dates in 2022 and 2023:

- 11th August 2022
- 7th, 16th and 30th September 2022
- 7th and 18th October 2022
- 8th November 2022
- 9th February 2023.

The site was traversed on foot and the composition and condition of vegetation was recorded. Photographs were taken throughout the field visit to show particular site conditions.

Several lots within the southern portion of the site were unable to be accessed during the survey dates. Observations of flora and vegetation was completed from the boundary of adjacent lots and road reserves. The location of these lots are shown in **Figure 2**.

Plant specimens collected during the field survey were dried, pressed and named in accordance with requirements of the Western Australian Herbarium (2022). Identification of specimens occurred through comparison with named material and through the use of taxonomic keys. Flora species not native to Western Australia are denoted by an asterisk ('*') in text and raw data.

3.2.1 Sampling

Detailed sampling of the vegetation was undertaken using a combination of non-permanent 10 x 10 m quadrats and relevés. A total of 21 locations were sampled, comprised of 12 quadrats and nine relevés, as shown in **Figure 5**.

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The quadrats were established using fence droppers bound by measuring tape. The relevés were completed over an equivalent 10 x 10 m area without the use of physical markers and were included to provide a more rapid sample of patches of vegetation in poorer condition and/or of smaller size. The position of each sample was recorded with a hand-held GPS unit.

The data recorded within each sample included:

- site details (site name, site number, observers, date, location)
- environmental information (slope, aspect, bare-ground, rock outcropping soil type and colour class, litter layer, topographical position, time since last fire event)
- biological information (vegetation structure and condition, 'foliage projective cover' (FPC), degree of disturbance and species present).

Additional plant taxa not observed within samples were recorded opportunistically as the botanists traversed the site.

3.2.2 Targeted searches

The suitability of habitat within the site for conservation significant flora and communities identified in the desktop assessment was assessed (refer **Section 3.1**). Areas of suitable habitat were traversed along transects and searched for conservation significant species, as required.

3.2.3 Vegetation condition

Vegetation condition was assigned at each sample and changes in vegetation condition were also noted and mapped across the site. The condition of the vegetation was assessed using the Keighery (1994) scale (**Table 2**). For vegetation in the site containing *Banksia* spp., the condition scale provided in the conservation advice for the 'banksia woodlands of the Swan Coastal Plain TEC' (DoEE 2016a) was applied in addition to the Keighery scale, as shown in **Table 2**.

Table 2: Vegetation condition scale applied during the field assessment

Condition category	Definition (Keighery 1994)	Indicator (DoEE 2016a)	
		Typical native vegetation composition	Typical weed cover
Pristine	Pristine or nearly so, no obvious signs of disturbance.	Native plant species diversity fully retained or almost so	Zero or close to
Excellent	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.	High native plant species diversity	Less than 10%
Very good	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.	Moderate native plant species diversity	5-20%

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Table 2: Vegetation condition scale applied during the field assessment (continued)

Condition category	Definition (Keighery 1994)	Indicator (DoEE 2016a)	
		Typical native vegetation composition	Typical weed cover
Good	Vegetation structure significantly altered by very obvious signs of multiple disturbances. 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.	Low native plant species diversity	5-50%
Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example, disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.	Very low native plant species diversity	20-70%
Completely degraded	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.	Very low to no native species diversity	Greater than 70%

3.3 Mapping and analysis

3.3.1 Conservation significant flora and communities

Based on the database searches and information recorded during the field survey, an assessment of the likelihood of occurrence of threatened and priority flora species and communities within the site was undertaken using the categories outlined in **Table 3**.

Table 3: Likelihood of occurrence assessment categories and definitions

Likelihood	Definition
Recorded	The species was recorded during the current field survey.
Likely	The site contains suitable habitat for the species and it is likely the species may occur based on presence of a recent historical record within or close to the site.
Possible	The site contains suitable habitat for the species but there is no other information to suggest that the species may occur within or close to the site.
Unlikely	The site does not contain suitable habitat for the species or the site contains suitable habitat for the species within which thorough targeted searches were completed and conclusion has been made that the species is unlikely to be present.

3.3.2 Plant community identification and description

The plant communities within the site were identified from the sample data collected during the field survey. The vegetation was described according to the dominant species present using the structural formation descriptions of the *National Vegetation Inventory System (NVIS)* (NVIS Technical Working Group 2017). The identified plant communities were mapped on aerial photography from the sample

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locations and boundaries were interpreted from aerial photography and notes taken in the field. Vegetation condition was mapped on aerial photography based on the samples and notes recorded during the field survey to define areas with differing condition.

3.3.3 Floristic community type assignment

The identified plant communities were then compared to the regional 'floristic community type' (FCT) dataset *A floristic survey of the southern Swan Coastal Plain* (Gibson *et al.* 1994). Each sample was compared to Gibson *et al.* (1994) separately to limit the influence of spatial correlation when assigning an FCT. FCT analysis was not undertaken for samples located within disturbed vegetation with low native species diversity as the vegetation was considered unlikely to currently represent an FCT.

Sample data (presence/absence) was first reconciled with Gibson *et al.* (1994) by standardising the names of taxa with those used in the earlier study. This was necessary due to changes in nomenclature in the intervening period. Taxa that were only identified to genus level were excluded, while some infra-species that have been identified since 1994 were reduced to species level. The combined dataset was then imported into the statistical analysis package PRIMER v6 (Clarke and Gorley 2006).

A resemblance matrix was generated using the Bray-Curtis distance measure which provided the percentage similarity between all pairs of samples. Subsequently, a cluster analysis was undertaken using the resemblance matrix and hierarchical agglomerative clustering, to produce a dendrogram.

Where a sample tended to cluster with a grouping of different FCTs, the resemblance matrix was examined. Ultimately a combination of cluster analysis, resemblance matrix and contextual information relating to the soils, landforms and known FCTs within the region was considered in the final determination of an FCT for vegetation within the site.

3.3.4 Threatened and priority ecological communities

Areas of native vegetation potentially representing a TEC or PEC were assessed against key diagnostic characteristics and, if available, size and/or vegetation condition thresholds.

3.3.5 Species accumulation curve

A species accumulation curve was plotted from sample data by generating a trendline (log) in Microsoft Excel. The trendline was forecast to locate the asymptote of the curve (the point at which the curve flattens), which provides an indication of amount of sampling that would be required before it can be assumed few species remain undetected. PRIMER v6 also offers a range of estimators to predict minimum species richness (Clarke and Gorley 2006). Both the Jackknife1 and Chao2 non-parametric estimators are reported, as these are known to perform well in comparison to simulated and real data sets and are also recommended for small sample sizes (Gotelli and Colwell 2011). Comparison between actual and estimated species accumulation assists in evaluating the adequacy of sampling effort.

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3.4 Survey limitations

It is important to note the specific constraints imposed on surveys and the degree to which these may have limited survey outcomes. An evaluation of the survey methodology against standard constraints outlined in the EPA document *Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA 2016) is provided in **Table 4**.

Table 4: Evaluation of survey methodology against standard constraints outlined in EPA (2016)

Constraint	Degree of limitation	Details
Availability of contextual information	No limitation	The broad scale contextual information described in Section 2 is adequate to place the site and vegetation in context.
	Minor limitation	Regarding assignment of FCTs, the authoritative Gibson <i>et al.</i> (1994) dataset was derived from a necessarily limited sample of vegetation from largely publicly owned land which is now more than 20 years out of date. Consequently, it is unknown to what degree official FCTs are appropriate reference to biodiverse vegetation across the Swan Coastal Plain. Furthermore, Gibson <i>et al.</i> (1994) collected data in the spring main flowering period and in many cases sampled plots multiple times to provide a complete species list. This detailed survey sampled the site twice during the main flowering period which was considered appropriate to compare FCT data to the Gibson <i>et al.</i> dataset.
Experience level of personnel	No limitation	This flora and vegetation assessment was undertaken by qualified botanists with five to 13 years of botanical experience in Western Australia. Technical review was undertaken by a senior environmental consultant with over 20 years' experience in environmental science in Western Australia.
Suitability of timing	No limitation	The main survey was conducted over multiple days between August and November and thus within the main flowering season. Sufficient rainfall was recorded from May to September 2022 in the months preceding the site visit. Therefore, it is likely that many plant species would have been in flower and/or visible at the time of survey. The degraded nature of the site limits the potential habitat for native geophytic plants such as orchids and the majority of threatened and priority flora species with potential to occur are perennial species. The survey timing was considered adequate to allow the detection of species for which seasonal timing is critical.
Temporal coverage	No limitation	Detailed flora and vegetation assessments can require multiple visits, at different times of year, and over a period of a number of years, to enable observation of all species present. The site was visited multiple times between August 2022 and February 2023. The November and February site visits provided an insight into the vegetation condition and composition at the end of the main flowering period.

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Table 4: Evaluation of survey methodology against standard constraints outlined in EPA (2016) (continued)

Constraint	Degree of limitation	Details
Spatial coverage and access	Limitation	<p>A number of lots in the southern portion of the site could not be accessed (Section 1.1). These lots were viewed from the road or adjacent lots wherever possible. The lots that could not be accessed are indicated in the figures and the results were extrapolated from high resolution aerial imagery and adjacent areas.</p> <p>The lots which could not be directly accessed were observed to primarily support market gardens and disturbed rural-residential lots. As such the access restriction is unlikely to represent a significant limitation with regard to assigning plant communities, vegetation condition and the presence/absence of TECs and PECs. Whilst the vegetation within the inaccessible lots was observed to be disturbed, and the suitability of habitat for threatened and priority flora species was limited, the primary limitation relates to compiling a full species list and the confirmation of presence/absence of threatened and priority flora species.</p>
	No limitation	Site coverage (where accessible) was comprehensive (track logged).
Sampling intensity	No limitation	<p>A total of 249 species were recorded, of which 214 were recorded from 21 sample locations and 35 were recorded opportunistically. Minimum species richness within site is estimated at between 302 (Jackknife1) and 363 (Chao2) species (as per the species accumulation curve shown in Plate 20). The number of species recorded in the site is less than predicted by the species accumulation curve.</p> <p>As a variety of different plant communities were recorded (wetland, transition and upland), which were often significantly disturbed ('degraded' or 'completely degraded'), it is understandable that species accumulation estimators forecast more species occur in the site than were recorded from sampling. Degraded areas of vegetation were generally not sampled, and given a small number of species were recorded opportunistically, the site was likely under-sampled at scale. However, the most intact vegetation was surveyed and sampled across multiple occasions and it is considered survey effort was adequate to prepare a near-comprehensive species inventory for the site.</p>
Influence of disturbance	Minor limitation	Time since fire is greater than 60 years as interpreted from aerial imagery and therefore short-lived species more common after fire may not have been visible.
	No limitation	Historical ground disturbance was evident in parts of the site. The disturbance history of the site was considered when undertaking field sampling.
Adequacy of resources	No limitation	All resources required to perform the survey were available.

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4 Results

4.1 General site conditions

The site encompasses a variety of landforms. A ridge running roughly north to south is located within the western portion of the site and a separate dune peak occurs in the south east. Between these areas the site generally flat or gently sloping and includes several sumpland wetland features. Soils are predominantly sandy, but areas of heavier soils tending to loam or clayey/silty sand occur in lower areas.

Patches of native vegetation occur over much of the site. The native vegetation is most intact on the eastern side of the site and otherwise generally occurs as native overstorey with limited understorey structure. The remainder of the site has been historically cleared and is cultivated (market gardens) or supports non-native pastures species.

4.2 Flora

4.2.1 Desktop assessment

The database search results identified a total of 18 threatened and 23 priority flora species occurring or potentially occurring within a 10 km radius of the site. Information on these species including their habitat preferences and flowering period is provided in **Appendix B**.

Based on background information available for the site, suitable habitat was considered to potentially occur within the site for 12 threatened and 22 priority flora species as shown in **Table 5**.

Table 5: Conservation significant flora species considered to have potential to occur in the site based on known habitat preferences

Species	Level of significance		Life strategy	Habitat	Flowering period
	State	EPBC Act			
<i>Darwinia foetida</i>	EN	CR	P	Grey-white sand on swampy, seasonally wet sites.	Oct-Nov
<i>Caladenia huegelii</i>	CR	EN	PG	Well-drained, deep sandy soils in lush undergrowth in a variety of moisture levels.	Sep-early Nov
<i>Chamelaucium lullfitzii</i>	VU	EN	P	White yellow sand in low woodland.	Oct-Nov
<i>Diuris purdiei</i>	EN	EN	PG	Sand to sandy clay soils in areas subject to winter inundation.	late September to mid-October, but only after a summer or early autumn fire
<i>Drakaea elastica</i>	CR	EN	PG	Bare patches of sand within otherwise dense vegetation in low-lying areas alongside winter-wet swamps. Typically in banksia woodland or thickets of <i>Kunzea glabrescens</i> .	late Sep-Oct/Nov, survey Jul-Aug

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Table 5: Conservation significant flora species considered to have potential to occur in the site based on known habitat preferences (continued)

Species	Level of significance		Life strategy	Habitat	Flowering period
	State	EPBC Act			
<i>Grevillea curviloba</i>	EN	EN	P	Grey sand, sandy loam. Winter-wet heath.	Aug-Oct
<i>Macarthuria keigheryi</i>	EN	EN	P	Low-lying winter-wet damp grey/white sands in open patches.	Sep-Dec or Feb-Mar
<i>Melaleuca</i> sp. Wanneroo (G.J. Keighery 16705)	EN	EN	P	Over sand on limestone slopes	Nov-Apr
<i>Anigozanthos viridis</i> subsp. <i>terraspectans</i>	VU	VU	P	Grey sand, clay loam. Winter-wet depressions.	Aug-Sep
<i>Diuris micrantha</i>	VU	VU	PG	Dark grey-black sandy clay-loam in winter wet depressions or swamps. Often in shallow standing water.	Aug/Sep- early Oct
<i>Drakaea micrantha</i>	EN	VU	PG	Open sandy patches often adjacent to winter-wet swamps.	Sept- early Oct
<i>Eucalyptus argutifolia</i>	VU	VU	P	Shallow soils over limestone. Slopes or gullies of limestone ridges, outcrops	Mar-Apr
<i>Baeckeia</i> sp. Limestone (N. Gibson & M.N. Lyons 1425)	P1	-	P	Grey yellow sand over limestone.	Sep-Dec
<i>Drosera patens</i>	P1	-	P	Sandy soils on margins of winter-wet depressions, swamps and lakes.	Aug-Dec
<i>Drosera x sidjamesii</i>	P1	-	P	Along lake margins, close to winter high-water line	Nov-Dec or Jan-Mar
<i>Grevillea</i> sp. Ocean Reef (D. Pike Joon 4)	P1	-	P	Dry, bare, light yellow-brown/grey sand. Sand dunes.	Nov
<i>Acacia benthamii</i>	P2	-	P	Sand, typically on limestone breakaways	Aug-Sept
<i>Calectasia elegans</i>	P2	-	P	Grey yellow sand on plains.	Sep-Oct
<i>Poranthera moorokatta</i>	P2	-	A	Sandy or clay soils. Dampland or low sandy dunes in banksia woodland.	Sep-early Nov
<i>Stenanthemum sublineare</i>	P2	-	P	White sand on coastal plains.	Oct-Dec
<i>Thelymitra variegata</i>	P2	-	P	Sandy clay, sand, laterite.	Jun-Sep
<i>Austrostipa mundula</i>	P3	-	P	Grey sand over limestone.	Sept-Nov
<i>Conostylis bracteata</i>	P3	-	P	Sand, limestone. Consolidated sand dunes	Aug-Sep

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Table 5: Conservation significant flora species considered to have potential to occur in the site based on known habitat preferences (continued)

Species	Level of significance		Life strategy	Habitat	Flowering period
	State	EPBC Act			
<i>Cyathochaeta teretifolia</i>	P3	-	P	Grey sand, sandy clay in swamps and creek edges.	Oct-Jan
<i>Dampiera triloba</i>	P3	-	P	Damp peat/loam soil.	Aug-Dec
<i>Hibbertia leptotheca</i>	P3	-	P	Brown to white sand with limestone.	Aug-Oct
<i>Pimelea calcicola</i>	P3	-	P	Sand, limestone on coastal ridges.	Sep-Nov
<i>Sarcozona bicarinata</i>	P3	-	P	White sand.	Aug
<i>Stylidium paludicola</i>	P3	-	P	Peaty sand over clay. Winter wet habitats. Marri and Melaleuca woodland, Melaleuca shrubland	Oct-Dec
<i>Styphelia filifolia</i>	P3	-	P	Brown over pale yellow sand.	Feb-Apr
<i>Anigozanthos humilis</i> subsp. <i>chrysanthus</i>	P4	-	P	Grey or yellow sand	Jul-Oct
<i>Jacksonia sericea</i>	P4	-	P	Calcareous and sandy soils on Swan Coastal Plain	Dec-Feb
<i>Stylidium longitubum</i>	P4	-	A	Sandy clay, clay. Seasonal wetlands.	Oct-Dec
<i>Tripterococcus</i> sp. <i>Brachylobus</i> (A.S. George 14234)	P4	-	P	Winter-wet areas on grey sand.	Oct-Feb

CR=critically endangered, EN=endangered, VU=vulnerable, P1-P4=Priority 1-Priority 4, P=perennial, PG=perennial geophyte.

4.2.2 Species inventory

A total of 198 native and 51 non-native (weed) species were recorded within the site during the field survey, representing 53 families and 163 genera. The dominant families containing native taxa were Fabaceae (28 native taxa and seven weed taxa) and Myrtaceae (22 native taxa and two weed taxa). The most common genus was *Acacia* and *Lomandra* with seven taxa each. Of the species recorded 214 were recorded in sample locations and 35 were recorded opportunistically.

A complete species list is provided in **Appendix C**.

4.2.3 Threatened and priority flora

One priority flora species was recorded within the site, *Jacksonia sericea* (P4) (**Plate 1** and **Plate 2**). *J. sericea* (P4) was locally common within the western portion of the site where 301 individual plants were recorded within the **BaBmJfXp** and **EmXp** plant communities. The locations of the priority flora is shown in **Figure 7**.

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Plate 1: *Jacksonia sericea* (P4) habit



Plate 2: *Jacksonia sericea* (P4) flower

No other priority or threatened flora species were recorded within the site or are considered likely to occur. The majority of the threatened and priority flora species identified in the desktop assessment are not considered to occur in the site due to lack of suitable habitat and/or because they were not recorded during the field survey. The likelihood of occurrence of threatened and priority flora species results are provided in **Appendix B**.

4.2.4 Locally and regionally significant flora

Two regionally significant flora species, *Dielsia stenostachya* and *Hensmania turbinata* were recorded within the site. *D. stenostachya* is listed as 'significant flora of the Bassendean Dunes in the Perth metropolitan region' as it is endemic to the Swan Coastal Plain. *H. turbinata* is listed as significant because the site is at the 'northern or southern limit of its known geographical range' (Government of WA 2000b).

4.2.5 Declared pests

Two species listed as a declared pest (C3) pursuant to the BAM Act, **Asparagus asparagoides* (bridal creeper) and **Moraea flaccida* (one leaf cape tulip), was recorded within the site. Bridal creeper is also listed as a WoNs.

4.3 Vegetation

4.3.1 Desktop assessment

The database search results identified 10 TECs and eight PECs occurring or potentially occurring within a 10 km radius of the site. Information on these communities is provided in **Appendix D**.

Based on geomorphology, soils and regional vegetation patterns, seven TECs and five PECs were considered to have potential to occur in the site:

- 'Shrublands on dry clay flats' which is listed as 'critically endangered' under the EPBC Act and 'endangered' in WA.
- '*Banksia attenuata* woodlands over species rich dense shrublands' which is listed as endangered under the EPBC Act and in WA.
- '*Banksia* woodlands of the Swan Coastal Plain' TEC/PEC which is listed as 'endangered' under EPBC Act and as Priority 3 in WA.

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- ‘*Banksia ilicifolia* woodlands’ which is listed as ‘endangered’ under EPBC Act and as Priority 3 in WA.
- ‘Low lying *Banksia attenuata* woodlands or shrublands’ which is listed as ‘endangered’ under EPBC Act and as Priority 3 in WA.
- ‘Swan Coastal Plain *Banksia attenuata* - *Banksia menziesii* woodlands’ which is listed as ‘endangered’ under EPBC Act and as Priority 3 in WA.
- ‘Tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain’ which is listed as ‘critically endangered’ under the EPBC Act and Priority 3 in WA.

4.3.2 Plant communities

A total of 17 plant communities were identified within the site. Plant community **EmXp** was the largest native plant community, mapped across the ridge present within the western portion of the site. Plant communities **BaBmEpAn**, **BaBmJfXp** and **Xp** were associated with upland areas of the site, within the western and south-eastern portions.

Plant communities **BaBmKgSi**, **BiAc**, **Cc**, **EmKg**, **ErAc**, **ErAs**, **ErLb**, **HaRc**, **Kg**, **KgAl**, **Mp** and **Mt** are located across the lower-lying areas of the site, associated with wetland features, and are present in different structural formations ranging from shrubland to closed forest. Whilst the wetland features were associated were observed to be dry year-round during the field surveys, these communities are likely associated, if not dependent on shallow groundwater, and have therefore been classified as ‘wetland’ vegetation.

The majority of the site contains non-native vegetation, dominated by non-native pasture grasses. Vegetation present within lots that were not accessed during the survey was able to be assessed from neighbouring lots, road reserves and aerial imagery.

A description and the area of each plant community is provided in **Table 6** and representative photographs of each are provided in **Plate 3** to **Plate 19**. The location of each plant community is shown in **Figure 5**. A matrix of species recorded within each plant community is provided in **Appendix E** and raw sample data in **Appendix F**.

Table 6: Description and extent of plant communities identified within the site

Plant community	Description	Area (ha)
Upland		
BaBmEpAn	Low woodland of <i>Banksia menziesii</i> , <i>Banksia attenuata</i> , <i>Eucalyptus todtiana</i> and <i>Nuytsia floribunda</i> over open shrubland of <i>Adenanthos cygnorum</i> , <i>Eremaea pauciflora</i> and <i>Jacksonia furcellata</i> over low shrubland of <i>Hibbertia hypericoides</i> , <i>Hypocalymma robustum</i> and <i>Scholtzia involucrata</i> over forbland of <i>Alexgeorgea nitens</i> , <i>Lyginia barbata</i> and open grassland of * <i>Ehrharta calycina</i> and * <i>Briza maxima</i> (Plate 3).	5.40
BaBmJfXp	Low woodland of <i>Banksia menziesii</i> , <i>Banksia attenuata</i> and <i>Allocasuarina fraseriana</i> over shrubland of <i>Jacksonia furcellata</i> over low shrubland of <i>Hibbertia hypericoides</i> , <i>Acacia huegelii</i> and <i>Conostephium pendulum</i> over forbland of <i>Desmocladus flexuosus</i> and <i>Alexgeorgea nitens</i> over open grassland of * <i>Ehrharta calycina</i> and * <i>Briza maxima</i> (Plate 4)	0.57

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Table 6: Description and extent of plant communities identified within the site (continued)

Plant community	Description	Area (ha)
Upland		
EmXp	Woodland of <i>Eucalyptus marginata</i> over low woodland of <i>Banksia menziesii</i> (or absent) over shrubland of <i>Xanthorrhoea preissii</i> and <i>Jacksonia sternbergiana</i> over low open shrubland of <i>Hibbertia hypericoides</i> , <i>Jacksonia sericea</i> and <i>Persoonia saccata</i> over forbland of <i>Mesomelaena pseudostygia</i> and <i>Desmocladius flexuosus</i> over open grassland of * <i>Ehrharta calycina</i> and * <i>Briza maxima</i> (Plate 5).	23.7
Xp	Scattered <i>Eucalyptus todtiana</i> over open shrubland of <i>Xanthorrhoea preissii</i> and <i>Jacksonia furcellata</i> over open low shrubland of <i>Lechenaultia biloba</i> over forbland of <i>Haemodorum spicatum</i> and <i>Patersonia occidentalis</i> over open grassland of * <i>Ehrharta calycina</i> and * <i>Briza maxima</i> (Plate 6).	21.43
Wetland		
BaBmKgSi	Low woodland of <i>Banksia attenuata</i> and <i>Banksia menziesii</i> over shrubland of <i>Kunzea glabrescens</i> and <i>Adenanthos cygnorum</i> over low shrubland of <i>Acacia pulchella</i> var. <i>pulchella</i> , <i>Bossiaea eriocarpa</i> and <i>Scholtzia involucrata</i> over forbland of <i>Sowerbaea laxiflora</i> , <i>Stylidium repens</i> and <i>Lyginia barbata</i> over open grassland of * <i>Ehrharta calycina</i> and * <i>Briza maxima</i> (Plate 7)	1.84
BiAc	Low open woodland of <i>Banksia ilicifolia</i> and <i>Eucalyptus todtiana</i> over open shrubland of <i>Adenanthos cygnorum</i> , * <i>Acacia longifolia</i> and <i>Kunzea glabrescens</i> over low shrubland of <i>Macarthuria australis</i> , <i>Scholtzia involucrata</i> and <i>Acacia pulchella</i> var. <i>pulchella</i> over forbland of <i>Alexgeorgea nitens</i> , <i>Desmocladius flexuosus</i> and * <i>Carpobrotus edulis</i> open grassland of <i>Microlaena stipoides</i> , * <i>Ehrharta</i> spp. and * <i>Briza maxima</i> (Plate 8).	5.05
Cc	Closed forest of <i>Corymbia calophylla</i> and <i>Eucalyptus rudis</i> over open shrubland of <i>Xanthorrhoea preissii</i> over closed fernland of <i>Pteridium esculentum</i> over forbland of <i>Sowerbaea laxiflora</i> and open grassland of * <i>Ehrharta calycina</i> and * <i>Briza maxima</i> (Plate 9).	0.73
EmKg	Open forest of <i>Eucalyptus marginata</i> and <i>Melaleuca preissiana</i> over tall shrubland of <i>Kunzea glabrescens</i> and * <i>Acacia longifolia</i> over shrubland of <i>Xanthorrhoea preissii</i> , <i>Pultenaea reticulata</i> and <i>Conostephium pendulum</i> over forbland of <i>Phlebocarya ciliata</i> and <i>Dasyogon bromeliifolius</i> over open grassland of * <i>Ehrharta calycina</i> and * <i>Briza maxima</i> (Plate 10).	4.74
ErAc	Open forest of <i>Eucalyptus rudis</i> over shrubland of <i>Adenanthos cygnorum</i> , <i>Regelia ciliata</i> and <i>Kunzea glabrescens</i> over forbland of * <i>Carpobrotus edulis</i> and <i>Trachymene pilosa</i> over open grassland of * <i>Ehrharta calycina</i> and * <i>Vulpia myuros</i> (Plate 11).	7.83
ErAs	Open forest of <i>Eucalyptus rudis</i> over open tall shrubland of <i>Astartea scoparia</i> and * <i>Acacia longifolia</i> over sparse open shrubland of <i>Hibbertia cuneiformis</i> over forbland of <i>Dielsia stenostachya</i> over open grassland of * <i>Briza maxima</i> and * <i>Romulea rosea</i> (Plate 12).	10.79
ErLb	Open forest of <i>Eucalyptus rudis</i> over open tall shrubland of <i>Exocarpos sparteus</i> , <i>Astartea scoparia</i> and <i>Jacksonia furcellata</i> over forbland of <i>Lyginia barbata</i> , <i>Lepidosperma longitudinale</i> and <i>Hypolaena exsulca</i> over grassland of <i>Ehrharta</i> spp. and * <i>Pentameris airoides</i> (Plate 13).	8.58
HaRc	Scattered <i>Melaleuca preissiana</i> over shrubland of <i>Hypocalymma angustifolium</i> and <i>Regelia ciliata</i> over forbland of <i>Dasyogon bromeliifolius</i> , <i>Hypolaena exsulca</i> and <i>Lyginia barbata</i> over open grassland of * <i>Ehrharta calycina</i> and * <i>Briza maxima</i> (Plate 14).	4.64
Kg	Scattered <i>Eucalyptus rudis</i> over closed tall shrubland of <i>Kunzea glabrescens</i> and * <i>Acacia longifolia</i> over shrubland of <i>Hypocalymma angustifolium</i> over scattered grassland of * <i>Ehrharta longiflora</i> (Plate 15).	12.07

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Table 6: Description and extent of plant communities identified within the site (continued)

Plant community	Description	Area (ha)
Wetland		
KgAI	Scattered <i>Eucalyptus rudis</i> and * <i>Pinus pinaster</i> over closed tall shrubland of <i>Kunzea glabrescens</i> and * <i>Acacia longifolia</i> over shrubland of <i>Pultenaea reticulata</i> over forbland of <i>Machaerina vaginalis</i> and <i>Lyginia barbata</i> over scattered grassland of * <i>Ehrharta longiflora</i> and * <i>Briza maxima</i> (Plate 16).	10.42
Mp	Open forest of <i>Melaleuca preissiana</i> over shrubland of <i>Adenanthos cygnorum</i> and <i>Xanthorrhoea preissii</i> over forbland of <i>Dasypogon bromeliifolius</i> , <i>Patersonia occidentalis</i> and <i>Phlebocarya ciliata</i> over open grassland of * <i>Ehrharta calycina</i> (Plate 17).	2.74
Mt	Open shrubland of <i>Melaleuca teretifolia</i> over forbland of * <i>Carpobrotus edulis</i> and * <i>Lotus angustissimus</i> over grassland of * <i>Bromus diandrus</i> , * <i>Ehrharta</i> spp and * <i>Pentameris airoides</i> (Plate 18).	11.43
Non-native	Heavily disturbed areas comprising non-native or planted vegetation with occasional scattered native trees, shrubs or forbs. Buildings, bare ground and areas of horticulture were also included in this community (Plate 19).	181.84



Plate 3: Plant community **BaBmEpAn** in 'very good' condition

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Plate 4: Plant community **BaBmJfXp** in 'very good' condition



Plate 5: Plant community **EmXp** in 'good' condition

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Plate 6: Plant community **Xp** in 'degraded' condition



Plate 7: Plant community **BaBmKgSi** in 'very good' condition

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Plate 8: Plant community BiAc in 'very good' condition



Plate 9: Plant community Cc in 'very good' condition

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Plate 10: Plant community **EmKg** in 'very good' condition



Plate 11: Plant community **ErAc** in 'good' condition

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Plate 12: Plant community *ErAs* in 'good' condition



Plate 13: Plant community *ErLb* in 'good' condition

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Plate 14: Plant community **HaRc** in 'good' condition



Plate 15: Plant community **Kg** in 'good' condition

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Plate 16: Plant community **KgAI** in 'good' condition



Plate 17: Plant community **Mp** in 'degraded' condition

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Plate 18: Plant community Mt in 'degraded' condition



Plate 19: Non-native vegetation in 'completely degraded' condition

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4.3.3 Vegetation condition

The most intact native vegetation is located in the eastern portion of the site. Plant communities **BaBmJfXp**, **BaBmKgSi** and **Cc** and portions of communities **BaBmEpAn**, **BiAc**, **EmKg**, **ErAs** and **HaRc** were mapped as being in 'very good' condition. The remainder of the native vegetation within the site was mapped in condition ranging from 'good' to 'degraded'.

The areas of non-native vegetation within the site were mapped in 'completely degraded' condition and consist of scattered native species including *Jacksonia furcellata* and *Xanthorrhoea preissii* over non-native species of pasture grasses. Market gardens, roads and areas of buildings and bare earth were also mapped as being in 'completely degraded' condition.

The extent of vegetation by condition category is detailed in **Table 7** and shown in **Figure 6**.

Table 7: Extent of vegetation condition categories within the site

Condition category (Keighery 1994)	Size (ha)
Pristine	0
Excellent	0
Very good	25.16
Good	64.59
Good - degraded	2.04
Degraded	40.16
Completely degraded	181.84

4.3.4 Floristic community types

The areas of upland vegetation within the site were determined to represent the following FCTs:

- FCT 23a 'central *Banksia attenuata* – *B. menziesii* woodlands'
- FCT 28 'Spearwood *Banksia attenuata* or *Banksia attenuata* – *Eucalyptus* woodlands'.

Areas of vegetation located in lower-lying areas of the site, associated with wetland features were determined to represent several FCTs:

- FCT 4: '*Melaleuca preissiana* damplands'
- FCT 6: 'weed dominated wetlands on heavy soils'
- FCT 11: 'wet forests and woodlands'
- FCT 14: 'deeper wetlands on sandy soils'
- FCT 21c 'low lying *Banksia attenuata* woodlands or shrublands'

Areas of the site where the plant communities were in 'degraded' condition were considered too disturbed to assign an FCT. Nevertheless they are likely remnants of the aforementioned FCTs.

The plant community alignment with the Gibson *et al.* (1994) FCT sites are shown in **Table 8** and the relevant portions of the cluster dendrograms showing Q1, Q5, R6, R7, Q10, Q11, R17, R20 and R21 are provided in **Appendix G**.

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Table 8: Plant community and likely FCT represented within the site for each sample

Plant community	Sample unit	Most similar Gibson <i>et al.</i> (1994) sites	Similarity (%)	Most likely floristic community type (FCT)	Reservation and conservation status (Gibson <i>et al.</i> 1994)
BaBmEpAn	Q1	WIRR-1 (FCT 23a)	46	FCT 23a: Central <i>Banksia attenuata</i> – <i>B. menziesii</i> woodlands	Well reserved Low risk
	Q2^	WIRR-2 (FCT 23a)	41		
		HURST04 (FCT 23a)	40		
		MODO-2 (FCT 21c)	39		
BaBmJfXp	Q11	KING-2 (FCT 28)	49	FCT 28: Spearwood <i>Banksia attenuata</i> or <i>Banksia attenuata</i> – <i>Eucalyptus</i> woodlands	Well reserved Low risk
BaBmKgSi	Q5	HYMUS03 (FCT 21c)	40	FCT 21c: Low lying <i>Banksia attenuata</i> woodlands or shrublands	Well reserved Susceptible
BiAc	Q9^	THOM-2 (FCT 24)	50	FCT 21c: Low lying <i>Banksia attenuata</i> woodlands or shrublands	Well reserved Susceptible
		FL-5 (FCT 21c)	49		
		WAND-1 (FCT 23a)	48		
Cc	R7	ROWE01 (FCT 11)	36	FCT 11: Wet forests and woodlands	Well reserved Low risk
EmKg	R3^	MODO-2 (FCT 21c)	40	FCT 21c: Low lying <i>Banksia attenuata</i> woodlands or shrublands	Well reserved Susceptible
		HARRY-4 (FCT 23a)	39		
	Q4^	LOW07 (FCT 21c)	40		
		HARRY-5 (FCT 21a)	40		
EmXp	Q12^	SHENT-1 (FCT 28)	45	FCT 28: Spearwood <i>Banksia attenuata</i> or <i>Banksia attenuata</i> – <i>Eucalyptus</i> woodlands	Well reserved Low risk
		KING-2 (FCT 28)	42		
	Q13^	WARI-2 (FCT 28)	49		
		SHENT-1 (FCT 28)	46		
ErAc	R17	YAN-21 (FCT 14)	26	FCT 14: Deeper wetlands on sandy soils	Unreserved Insufficiently known
ErAs	R20	HYMUS01 (FCT 11)	48	FCT 11: Wet forests and woodlands	Well reserved Low risk
ErLb	Q14^	CARD-11 (FCT 6)	30	FCT 6: Weed dominated wetlands on heavy soils	Well reserved Low risk
		ELLEN-7 (FCT 6)	30		
HaRc	Q15^	MODO-3 (FCT 11)	32	FCT 4: <i>Melaleuca preissiana</i> damplands	Well reserved Low risk
		FL-9 (FCT 4)	32		
		MELA-1 (FCT 4)	31		

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Table 8: Plant community and likely FCT represented within the site for each sample (continued)

Plant community	Sample unit	Most similar Gibson <i>et al.</i> (1994) sites	Similarity (%)	Most likely floristic community type (FCT)	Reservation and conservation status (Gibson <i>et al.</i> 1994)
Kg	R6	PEARCE-1 (FCT 6)	18	FCT 6: Weed dominated wetlands on heavy soils	Well reserved Low risk
	R21	CARD10 (FCT 6)	19		
KgAI	Q10	YAN-21 (FCT 14)	34	FCT 14: Deeper wetlands on sandy soils	Unreserved Insufficiently known

Note: ^ shows highest percent similarity to individual Gibson *et al.* (1994) samples rather than similarity to a cluster of samples.

4.3.5 Threatened and priority ecological communities

The following TECs and PECs were identified within the site:

- 'Banksia woodlands of the Swan Coastal Plain' TEC/PEC.
- 'Low lying *Banksia attenuata* woodlands or shrublands' PEC

The locations of the TECs and PECs within the site are shown in **Figure 7**.

The structure, composition and patch sizes of portions of plant community **BaBmEpAn**, **BaBmJfXp**, **BaBmKgSi** and **BaAc** indicates that it represents the Commonwealth listed 'banksia woodlands of the Swan Coastal Plain' TEC (banksia woodland TEC), as outlined in **Table 8**.

Table 9: Criteria for determining presence of Banksia Woodlands of the Swan Coastal Plain TEC adapted from DoEE (2016a)

Criteria	Requirements for meeting criteria	Site implications
1. Must meet key diagnostic characteristics	A variety of factors relating to: <ul style="list-style-type: none"> • Location • Soils • Structure • Composition 	<ul style="list-style-type: none"> • Site meets location and soils criteria. • The BaBmEpAn, BaBmJfXp, BaBmKgSi and BiAc vegetation includes the key diagnostic feature of a tree layer of <i>Banksia attenuata</i>, <i>Banksia menziesii</i> and/or <i>Banksia ilicifolia</i>. • The BaBmEpAn, BaBmJfXp, BaBmKgSi and BiAc vegetation within site also meets structure and composition criterion. FCTs 21c, 23a and 28 are identified as constituent FCTs comprising the banksia woodland TEC.
2. Must meet condition thresholds	<ul style="list-style-type: none"> • A patch should at least meet the 'good' condition category (see Table 2) 	<ul style="list-style-type: none"> • The BaBmEpAn vegetation within the south-eastern portion is present in 'very good' and 'good - degraded' condition. The conservation advice indicates that a single patch may include areas of variable condition, meaning the BaBmEpAn vegetation in 'good - degraded' condition may still be considered the TEC as they are contiguous with vegetation in 'very good' condition. • The BaBmJfXp vegetation within the western portion is in 'very good' condition. • The BaBmKgSi vegetation within the western portion is in 'very good' condition • The BiAc vegetation within the eastern portion of the site is present in 'very good' condition.

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Table 9: Criteria for determining presence of Banksia Woodlands of the Swan Coastal Plain TEC adapted from DoEE (2016a) (continued)

Criteria	Requirements for meeting criteria	Site implications
3. Must meet minimum patch size	Minimum size of patch: <ul style="list-style-type: none"> • Pristine=no minimum size • Excellent=0.5 ha • Very Good=1 ha • Good=2 ha 	<ul style="list-style-type: none"> • The BaBmEpAn vegetation in 'very good' condition in the south-eastern portion is 2.87 ha, which meet this criterion. • The BaBmEpAn vegetation in 'good – degraded' condition is mapped across 2.04 ha. This vegetation would be viewed as contiguous with the 2.87 ha patch, and therefore increases the patch of TEC to 4.91 ha. • The BaBmJfXp vegetation within the western portion of the site is present in 'very good' condition that is mapped across 0.57 ha. This patch alone does not meet the minimum patch size criterion. However, the vegetation in the adjacent lot to the west of the site represents banksia woodland TEC (Emerge Associates 2018). As the BaBmJfXp vegetation within the western portion of the site is contiguous with the vegetation to the west of the site, it forms a patch of the TEC. • The BaBmKgSi vegetation in 'very good' condition in the south-eastern portion is 1.84 ha, which meets this criterion. • The BaBmEpAn vegetation within the central portion of the site in 'good' condition is mapped across 0.49 ha. This vegetation does not independently meet this criterion. • The BiAc vegetation within the eastern portion of the site in 'very good' condition that is mapped across 4.78 ha, which meets the minimum patch size. • The BiAc vegetation within the northern portion in 'good' condition and is mapped across 0.27 ha which does not independently meet this criterion.
4. Must incorporate surrounding context	<ul style="list-style-type: none"> • Breaks (e.g. tracks) < 30 m do not separate vegetation into separate patches • Buffer zones may apply (20-50 m recommended from patch edge) • The site should be thoroughly sampled (2 surveys in same spring). • Survey timing should be appropriate. • Surrounding environment should be considered (e.g. connectivity, conservation values, fauna habitat) 	<ul style="list-style-type: none"> • Small scale tracks (<30 m wide) exist within the BaBmEpAn, BaBmJfXp, BaBmKgSi patches within the western and the south-eastern portions. • Land surrounding the patches is a combination of native vegetation, cleared areas and rural-residential properties. • This survey was conducted between August and November (within the main flowering period). • Formal assessment of vegetation to the north of the northern BiAc patch was not undertaken. However, photos taken during the surveys and review of aerial imagery indicates that this vegetation tends towards wetland vegetation that would not meet the diagnostic criteria for the banksia woodland TEC and would not form a patch with the vegetation within the site.
Result	The site supports 12.10 ha of the banksia woodland of the Swan Coastal Plain TEC.	

DBCA's *Priority Ecological Community* list indicates that the description, area and condition thresholds that apply to the Commonwealth-listed TEC of the same name also apply to the 'banksia woodlands of the Swan Coastal Plain' PEC (DBCA 2022c). Therefore, total of 12.10 ha of this PEC occurs within the site as shown in **Figure 7**.

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FCT 21c is synonymous with the State listed SCP21c 'low lying *Banksia attenuata* woodlands of shrublands' PEC. No conservation advice exists for the SCP21c PEC so it is unclear whether a condition threshold should be applied when identifying its presence. DBCA has historically applied 'good' condition as a threshold for the identification of conservation significant vegetation. The **BaBmKgSi** and **BiAc** vegetation that represents FCT 21c occurs in 'good' or 'very good' condition and therefore is considered to represent this PEC. A total of 6.89 ha of this PEC occurs within the site as shown in **Figure 7**.

No other TECs or PECs were recorded or are considered likely to occur within the site.

4.3.6 Locally and regionally significant vegetation

Plant communities **BiAc**, **Cc**, **EmKg**, **ErAc**, **ErAs**, **ErLb**, **HaRc**, **Kg**, **KgAl**, **Mp** and **Mt** were associated with wetland features. Whilst the wetland features were apparently dry year-round (from observation during the field survey), these communities are likely associated, if not dependent on shallow groundwater.

Multiple plant species within the site provide habitat for threatened species of black cockatoo. In particular, the *Corymbia calophylla*, *Eucalyptus marginata*, *E. todtiana*, *E. rudis* and *Banksia* spp. trees may provide potential breeding, roosting and/or foraging habitat for black cockatoos.

Areas of vegetation in 'good' or better condition where intact native understorey provides suitable habitat for native fauna including some that may be conservation significant.

4.4 Species richness

A total of 214 species were recorded from 21 samples. A species accumulation curve derived from sample data is presented in **Plate 20**. After 21 samples the curve is still increasing and has not reached its asymptote. This indicates that a proportion of species likely remain undetected by sampling.

Species richness was estimated in PRIMER v6 to be between 302 (Jackknife1) and 363 (Chao2). Based on the trend of the species accumulation curve more than 50 samples would be required to capture that many species. Including the 35 additional species recorded opportunistically, a total of 249 species was recorded in the site. This indicates that between 69 and 82% of the estimated 302 - 363 species in the site were recorded.

As a variety of different plant communities were recorded (wetland, transition and upland), which were often significantly disturbed ('degraded' or 'completely degraded'), it is understandable that species accumulation estimators forecast more species occur in the site than were recorded from sampling. Degraded areas of vegetation were generally not sampled, and given a small number of species were recorded opportunistically, the site was likely under-sampled at scale. However, the most intact vegetation was surveyed and sampled across multiple occasions and it is considered survey effort was adequate to prepare a near-comprehensive species inventory for the site.

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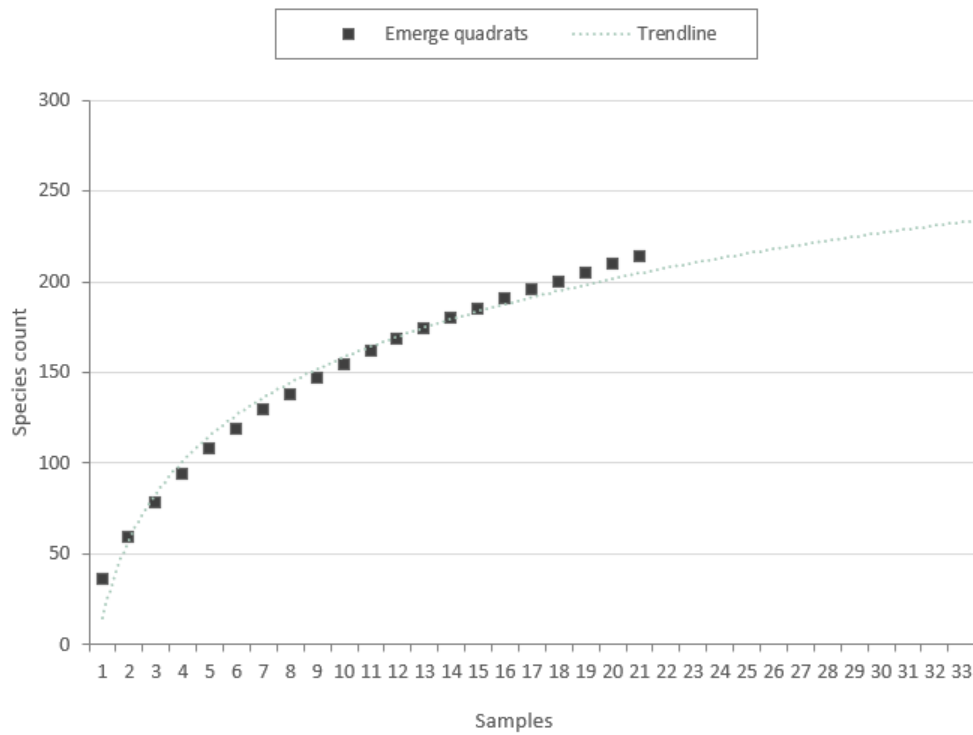


Plate 20: Species accumulation curve derived from sample data ($y = 62.335\ln(x) + 14.96$, $R^2 = 0.9809$)

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5 Discussion

5.1 Threatened and priority flora

Jacksonia sericea (P4) was common where it was recorded in the western portion of the site. The low shrub habit of this species is readily detectable and it is likely most if not all, individuals were recorded. *J. sericea* is known to extend across calcareous and sandy soils of the Swan Coastal Plain, from south of Mandurah to north of Joondalup, with numerous records occur within 10 km of the site. With regard to other threatened or priority flora with potential to occur (refer **Section 4.2.1**), the absence of the larger perennial species such as *Eucalyptus argutifolia*, *Grevillea curviloba* subsp. *incurva* and *Melaleuca* sp. Wanneroo (G.J. Keighery 16705) was relatively easy to confirm. However, due to their size and seasonal lifeform, smaller annual or geophytic species such as *Caladenia huegelii*, *Drakaea elastica*, *D. micrantha*, *Diuris micrantha*, *Poranthera moorokatta* and *Stylidium longitubum* can be more difficult to detect.

The timing of the surveys coincided with the main flowering period of the majority of smaller annual or geophytic conservation significant flora identified in the desktop assessment and therefore they should have been visible, if present. Areas of suitable habitat were searched intensively for these species and, as none were detected, it is considered unlikely that they occur in the site.

It is very unlikely that any threatened and priority flora species occur within the lots that could not be accessed in the south of the site as vegetation in these lots appears completely degraded. However, the presence or absence of such species could not be confirmed given physical access was not possible.

5.2 Vegetation condition

The method applied to assess vegetation condition was robust, as it combined the standard qualitative, categorical scheme of Keighery (1994), with the additional indicators for diversity and weed cover outlined in DoEE (2016b).

BaBmEpAn, **BaBmJfXp** and **BaBmKgSi** vegetation was mapped as being in 'very good' condition as it retains the structure expected of a banksia woodland community and has moderate native species diversity. A patch of the **BaBmEpAn** was mapped in 'good – degraded' condition as there were localised patches of low native species diversity, with high grassy weed cover across the majority of the patch. The structure of this patch of **BaBmEpAn** vegetation is significantly altered by obvious signs of disturbance, particularly historical clearing. Weed cover also exceeded 50% across the majority of the patch, aligning with 'degraded' condition (DoEE 2016b). However, whilst native species diversity was low there were enough species present to align the patch with a 'good' condition rating (DoEE 2016b).

Similarly, the **BiAc**, **HaRc** and **ErAs** vegetation retains the structure composition expected of heathland or wetland communities. The **EmKg** vegetation has high species diversity and low weed cover, with structure that is appropriate for the transitional zone between areas of adjacent banksia woodland and wetland vegetation.

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Plant communities **EmKg**, **ErLb** and **KgAl** and portions of communities **BaBmEpAn**, **BiAc**, **ErAs**, **ErAc**, **HaRc**, **Kg** were mapped in 'good' condition due to higher weed cover and lower native species cover. Weed cover was predominantly grassy weed species, with woody weeds (**Acacia longifolia*) the dominant weed in the **KgAl** community.

Plant communities **Mp**, **Mt** and **Xp** and portions of communities **ErAc**, **ErAs** and **Kg** were mapped in 'degraded' condition due to the basic vegetation structure being severely impacted by disturbance with minimal understorey structure and high weed cover. Localised patches of the **Xp** community contained reasonable native cover in parts. However, due to the high degree of disturbance and high weed cover, it was mapped in 'degraded' condition.

The vegetation within lots that were unable to be accessed was predominantly assigned 'completely degraded' condition, except where it could be confirmed over the boundary that native plant communities occur (that is extended over the boundary from accessible lots). Otherwise, it was apparent that most vegetation had been subject to significant historical disturbance, and appeared to support predominantly planted vegetation and non-native pasture grasses.

5.3 Floristic community type assignment

The site is relatively large and prior to historical disturbance would have supported a mosaic of plant communities associated with upland and wetland environments linked by transitional assemblages.

Samples within the **BaBmEpAn** plant community clustered with FCT 23a 'central *Banksia attenuata* – *B. menziesii* woodlands', whilst Q11 within the **BaBmJfXp** plant community clustered with FCT 28 'Spearwood *Banksia attenuata* or *Banksia attenuata* – *Eucalyptus* woodlands'. Sample Q5 within the **BaBmKgSi** plant community clustered with FCT 21c 'low lying *Banksia attenuata* woodlands or shrublands'. These banksia woodland samples clustered with high similarity, and appropriately reflect the variation in topography and soil associations within the site.

Sample R3 in plant community **EmKg** clustered with FCT 4 '*Melaleuca preissiana* damplands' and showed highest similarity to a Gibson *et al.* (1994) site representing FCT 21c (40%). Q4 in **EmKg** clustered with two FCT 21a 'Central *Banksia attenuata* – *Eucalyptus marginata* woodlands' sites. As plant community **EmKg** was mapped within a lower-lying area of the site, in association with a wetland feature, and the predominant overstorey of *Eucalyptus marginata* and *Melaleuca preissiana*, it is considered assignment of the **EmKg** community to FCT 21c was the most appropriate FCT classification for this vegetation.

Plant community **EmXp** clustered with FCT 6 'weed dominated wetlands on heavy soils' with moderate similarity (32%), which was unexpected as the community was dominated by upland vegetation. Examination of the Gibson *et al.* (1994) data showed a highest similarity to a site representing FCT 28 (45%). Given the location of the plant community with the Spearwood dune system, and the presence of upland flora species, it is considered assignment of the **EmXp** community to FCT 28 was the most appropriate FCT classification for this vegetation, albeit without a dominant overstorey of *Banksia* spp.

Plant community **BiAc** clustered with FCT 24 'northern Spearwood shrublands and woodlands' and showed highest similarity with Gibson *et al.* (1994) sites representing FCT 24 and FCT 21c. FCT 24 are

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predominantly heath communities, and are located on the Spearwood dune systems. Given plant community **BiAc** is located on the Bassendean dune system and is a low open woodland community within a low-lying area adjacent to a wetland feature, it is considered that assignment to FCT 24 is not appropriate. Due to the presence of species including *Banksia menziesii*, *Kunzea glabrescens*, *Gompholobium tomentosum*, *Lyginia barbata* and *Stylidium repens*, it is considered assignment of the **BiAc** community to FCT 21c was the most appropriate FCT classification for this vegetation.

Plant community **HaRc** clustered with FCT 11, and showed highest similarity with Gibson *et al.* (1994) sites representing FCT 11 and FCT 4. FCT 11 is dominated by an overstorey of *Corymbia calophylla* or *Eucalyptus rudis*, which were absent from the **HaRc** plant community. Given the absence of the dominant FCT 11 overstorey species, presence of key FCT 4 species including *M. preissiana*, *Hypocalymma angustifolium* and *Hypolaena exsulca* and the location of the patches of the **HaRc** plant communities adjacent to wetland features, it is considered assignment of the **HaRc** community to FCT 4 was the most appropriate FCT classification for this vegetation.

Plant communities **ErLb** and **Kg** clustered with two FCT 6 sites which was considered appropriate as these communities occur association with wetland features that have been disturbed by historical clearing, and as a result has low native species diversity and high weed cover.

Sample R7 in the **Cc** plant community and R20 within the **ErAs** plant community clustered with FCT 11 'wet forests and woodlands'. This was considered appropriate, due to the forest structure of the vegetation and growth in association with a wetland feature.

Sample R17 in the **ErAc** plant community and Q10 within the **KgAl** plant community clustered with FCT 14 'deeper wetlands on sandy soils'. The assignment of these two communities to FCT 14 is considered appropriate due to their association with wetland features that appeared to have historically had wetter hydrological regimes than currently occurs.

No FCT analysis was undertaken for plant communities **Mp**, **Mt** and **Xp** due to the low number of native species present and the high weed cover. Plant community **Mp** was inferred to represent FCT 4 due to the *M. preissiana* overstorey and adjacent **HaRc** community that was determined to represent the same FCT. Plant community **Mt** was dominated by *Melaleuca teretifolia* and did not align with any of the FCTs. A review of historical aerial imagery shows that this area was previously regularly inundated and the change in hydrological regime has impacted the native vegetation communities. Plant community **Xp** was significantly disturbed and lacked a native understorey. The community was located adjacent to the **BaBmJfXp** community that aligned with FCT 28, and it was inferred that the **Xp** plant community would represent a degraded form of this FCT.

5.4 Threatened and priority ecological communities

Four patches of vegetation were determined to meet the criteria for the banksia woodlands TEC/PEC, as shown in **Figure 7**. The three patches of **BaBmEpAn**, **BaBmKgSi** and **BiAc** vegetation within the eastern portion of the site meet the diagnostic criteria. This includes 2.04 ha of **BaBmEpAn** vegetation in 'good – degraded' condition which does not independently meet the diagnostic criteria, as a patch is required to be in 'good' condition or better. However, as this vegetation is contiguous with a 2.87 ha patch in 'very good' condition, the **BaBmEpAn** vegetation is a single patch extending across 4.91 ha, in predominantly 'very good' condition.

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The **BiAc** vegetation within the northern portion of the site does not meet the minimum patch size required to be mapped as the banksia woodland TEC/PEC. The vegetation adjacent to the site was not surveyed. However, assessment of this vegetation from within the site indicated that the vegetation was not representative of the banksia woodland TEC due to a lack of *Banksia* overstorey. Therefore, the **BiAc** vegetation within the northern portion is not independently mapped as the banksia woodland TEC, nor is it part of a larger patch extending outside of the site.

The **BaBmJfXp** vegetation within the western portion (0.57 ha) of the site does not independently meet the minimum patch size criteria for the banksia woodland TEC/PEC. However, vegetation within the adjacent Lot 4 Coogee Road is mapped as representing 2.94 of the banksia woodland TEC/PEC in 'very good' and 'very good – good' condition (Emerge Associates 2018). The vegetation within the site is separated from the adjacent vegetation through small breaks (< 30 m) which do not break up the overall patch. Accordingly, the **BaBmJfXp** vegetation within the site forms part of a larger patch of the banksia woodland TEC/PEC which extends to the west.

An additional 1.08 ha of the banksia woodland TEC/PEC is known to occur within Lot 3 Coogee Road (Strategen 2017). Lot 3 is adjacent to the western boundary of the site and directly north of Lot 4. The banksia woodland TEC/PEC patch therefore extends over at least 4.59 ha, including the vegetation within the site and adjacent Lots 3 and 4. Emerge Associates (2018) noted that the banksia woodland TEC/PEC is likely to extend further to the west of Lots 3 and 4, and therefore the patch size is likely to be larger than 4.59 ha.

Plant communities **EmKg** and **EmXp** were determined to represent communities that are constituent FCTs of the banksia woodland TEC (FCT 21c and FCT 28 respectively) (DoEE 2016). As these plant communities do not have the key diagnostic feature of a tree layer of *Banksia attenuata* and/or *B. menziesii* they were determined not to represent the banksia woodland TEC.

Plant communities **BaBmKgSi** and **BiAc** were determined to represent FCT 21c which is associated with the State listed PEC 'low lying *Banksia attenuata* woodlands of shrublands' (P3). No conservation advice exists for this PEC. However, DBCA has historically applied 'good' condition as a threshold for the identification of conservation significant vegetation. Based on this, 6.89 ha of this PEC was identified within the eastern portion of the site.

5.5 Wetland vegetation

Plant communities **BaBmKgSi**, **BiAc**, **Cc**, **EmKg**, **ErAc**, **ErAs**, **ErLb**, **HaRc**, **Kg**, **KgAl**, **Mp** and **Mt** are located across the lower-lying areas of the site, are associated with wetland features, and contain a number of plant species that are likely to be dependent on wetter soil conditions such as *Eucalyptus rudis*, *Melaleuca preissiana*, *Astartea scoparia* and *Machaerina juncea*. These plant communities may therefore be considered wetland vegetation.

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5.6 Locally and regionally significant flora and vegetation

Flora and vegetation may be significant irrespective of protection under policy or legislation. Two key reasons that flora or vegetation within the site may be significant are listed below:

- The vegetation has potential value as habitat for threatened or priority fauna species. In particular, mature *Corymbia calophylla*, *Eucalyptus marginata* and to a lesser extent *Eucalyptus rudis* and *Eucalyptus todtiana* trees have the potential to provide breeding or foraging habitat for black cockatoos listed as threatened under the EPBC Act and BC Act. Where native vegetation is relatively intact it provides habitat for quenda (P4) and banksia woodland vegetation provides habitat for black-striped burrowing snake (P3) (Emerge Associates 2023).
- Two flora species listed in *Bush Forever* 'significant flora of the Bassendean dunes in the Perth metropolitan region', *Dielsia stenostachya* and *Hensmania turbinata*, occur within the site (Government of WA 2000b).

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6 Conclusions

Over half the site is highly disturbed and modified, with approximately 181.84 ha comprising non-native vegetation, market gardens and roads in 'completely degraded' condition. The remaining 131.94 ha of the site supports native vegetation.

Seventeen plant communities were identified that are present in 'very good', 'good', 'good - degraded', 'degraded' and 'completely degraded' condition.

One priority flora species were recorded within the site, *Jacksonia sericea* (P4). A total 301 individuals of *J. sericea* (P4) were recorded.

A total of 12.10 ha of the Commonwealth listed TEC and State listed PEC 'banksia woodlands of the Swan Coastal Plain' was recorded in the site.

A total of 6.89 ha of the State listed PEC 'low lying *Banksia attenuata* woodlands of shrublands' (P3) was recorded within the site.

Plant communities **BaBmKgSi**, **BiAc**, **Cc**, **EmKg**, **ErAc**, **ErAs**, **ErLb**, **HaRc**, **Kg**, **KgAl**, **Mp** and **Mt** are associated with wetland features and contain a number of plant species that are likely to be dependent on wetter soil conditions.

Vegetation within the site includes wetland vegetation and vegetation that provides habitat for conservation significant fauna, including black cockatoo species, quenda and black-striped burrowing snake.

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7 References

7.1 General references

AECOM 2018, *Flora, Vegetation and Fauna Assessment - Spring 2017*, 60553895, Version 0.

Alan Tingay and Associates 1998, *A Strategic Plan for Perth's Greenways - Final Report*. December 1998.

Bureau of Meteorology (BoM) 2023, *Climate Data Online*, <<http://www.bom.gov.au/climate/data/>>.

Churchward, H. M. and McArthur, W. M. 1980, 'Landforms and Soils of the Darling System, Western Australia', in Department of Conservation and Environment (ed.), *Atlas of Natural Resources Darling System Western Australia*, Department of Conservation and Environment.

Clarke, K. R. and Gorley, R. N. 2006, *PRIMER v6: User Manual/Tutorial*, PRIMER-E, Plymouth.

Department of Agriculture, Water and the Environment (DAWE) 2022, *Protected Matters Search Tool*, <<https://pmst.awe.gov.au/#>>.

Department of Biodiversity, Conservation and Attractions (DBCA) 2017a, *DBCA - Legislated Lands and Waters (DBCA-011)*.

Department of Biodiversity, Conservation and Attractions (DBCA) 2017b, *Lands of Interest (DBCA-012)*.

Department of Biodiversity, Conservation and Attractions (DBCA) 2017c, *Ramsar Sites (DBCA-010)*.

Department of Biodiversity, Conservation and Attractions (DBCA) 2018, *Directory of Important Wetlands in Australia - Western Australia (DBCA-045)*.

Department of Biodiversity, Conservation and Attractions (DBCA) 2021, *Geomorphic Wetlands, Swan Coastal Plain (DBCA-019)*, <<https://catalogue.data.wa.gov.au/dataset/geomorphic-wetlands-swan-coastal-plain>>.

Department of Biodiversity, Conservation and Attractions (DBCA) 2022a, *Geomorphic Wetlands, Swan Coastal Plain (DBCA-019)*, Western Australia, <<https://catalogue.data.wa.gov.au/dataset/geomorphic-wetlands-swan-coastal-plain>>.

Department of Biodiversity, Conservation and Attractions (DBCA) 2022b, *NatureMap*, <<https://naturemap.dbca.wa.gov.au/>>.

Department of Biodiversity, Conservation and Attractions (DBCA) 2022c, *Priority Ecological Communities for Western Australian Version 34*.

Department of Climate Change, Energy, the Environment and Water (DCCEEW) 2021, *Threatened Ecological Communities*, <<https://www.dcceew.gov.au/environment/biodiversity/threatened/communities>>.

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Department of Environment and Energy (DoEE) 2016a, *Approved Conservation Advice (incorporating listing advice) for the Banksia Woodlands of the Swan Coastal Plain ecological community*, Canberra.

Department of the Environment and Energy (DoEE) 2016b, *Banksia Woodlands of the Swan Coastal Plain in Community and Species Profile and Threats Database*, Canberra.

Department of Primary Industries and Regional Development (DPIRD) 2018, *Soil Landscape Mapping - Systems (DPIRD-064)*, Data WA,
<<https://catalogue.data.wa.gov.au/dataset/soil-landscape-mapping-systems>>.

Department of Primary Industries and Regional Development (DPIRD) 2019, *Soil Landscape Mapping - Best Available (DPIRD-027)*,
<<https://catalogue.data.wa.gov.au/dataset/soil-landscape-mapping-best-available>>.

Department of Water and Environmental Regulation (DWER) 2018, *Hydrography Linear (Heirarchy) (DWER-031)*, Perth.

Emerge Associates 2018, *Detailed Flora and Vegetation Assessment - Lot 4 Coogee Road Mariginiup*, EP18-042(01), rev 1.

Emerge Associates 2023, *Detailed Fauna and Targeted Black Cockatoo Assessment - Various Lots, Mariginiup*, EP22-019(02)--010 WJC, 1.

Environment Australia 2000, *Revision of the Interim Biogeographic Regionalisation for Australia (IBRA) and Development of Version 5.1 - Summary Report*, Department of Environment and Heritage.

Environmental Protection Authority (EPA) 2016, *Technical Guidance - Flora and Vegetation Surveys for Environmental Impact Assessment* Perth.

Gibson, N., Keighery, B., Keighery, G., Burbidge, A. and Lyons, M. 1994, *A Floristic survey of the southern Swan Coastal Plain*, Department of Conservation and Land Management and the Conservation Council of Western Australia, Perth.

Gotelli, N. J. and Colwell, R. K. 2011, *Estimating species richness*, Oxford University Press, Oxford.

Government of WA 2000a, *Bush Forever - Volume 1: Policies, principles and processes*, Perth.

Government of WA 2000b, *Bush Forever, Volume 2: Bush Forever Site Descriptions*, Perth.

Government of Western Australia 2019, *2018 South West Vegetation Complex Statistics. Current as of March 2019*, WA Department of Biodiversity, Conservation and Attractions, Perth.

Hedde, E. M., Loneragan, O. W. and Havel, J. J. 1980, 'Vegetation Complexes of the Darling System Western Australia', in Department of Conservation and Environment (ed.), *Atlas of Natural Resources Darling System Western Australia*, Perth.

Hill, A. L., Semeniuk, C. A., Semeniuk, V. and Del Marco, A. 1996, *Wetlands of the Swan Coastal Plain: Volume 2A - Wetland Mapping, Classification and Evaluation*, Water and Rivers Commission and the Department of Environmental Protection, Perth.

Detailed Flora and Vegetation Assessment

Various Lots, Mariginiup



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

Keighery, B. J., Keighery, G. J., Longman, V. M. and Clarke, K. A. 2012, *Weed and Native Flora Data for the Swan Coastal Plain*, Departments of Environmental Protection and Conservation and Land Management, Western Australia.

Kendrick, G. W., Wyrwoll, K. H. and Szabo, B. J. 1991, *Pliocene-Pleistocene coastal events and history along the western margin of Australia*, Quaternary Science Reviews, 10: 419-439.

M. N. Group (MNG) 2021, *Orthophoto Plan, Mariginiup*. 104539-OPM-004-A, Version A.

NVIS Technical Working Group 2017, *Australian Vegetation Attribute Manual: National Vegetation Information System*, Department of the Environment and Energy, Canberra.

Seddon, G. 2004, *A Sense of Place: a response to an environment, the Swan Coastal Plain Western Australia*, Blooming Books, Melbourne.

Strategen 2017, *Level 2 Flora and Vegetation Survey and Black Cockatoo Assessment - 118 Coogee Road Mariginiup*, HAU164681_01, rev 0.

Western Australian Local Government Association and Perth Biodiversity Project (WALGA and PBP) 2004, *Local Government Biodiversity Planning Guidelines for the Perth Metropolitan Region*, Perth.

Western Australian Land Information Authority (WALIA) 2023, *Landgate Map Viewer Plus*.

Weeds Australia 2021, *Weeds of National Significance (WoNS)*, Department of Agriculture, Fisheries and Forestry, <<https://weeds.org.au/weeds-profiles/>>.

Western Australian Herbarium 2022, *Florabase*, Department of Biodiversity, Conservation and Attractions (DBCA), <<https://florabase.dpaw.wa.gov.au/>>.

Wetlands Advisory Committee 1977, *The status of reserves in System Six*, Environmental Protection Authority, Perth.

Detailed Flora and Vegetation Assessment

Various Lots, Mariginiup



7.2 Online references

The online resources that have been utilised in the preparation of this report are referenced in **Section 7.1**, with access date information provided in **Table R 1**.

Table R 1 Access dates for online references

Reference	Date accessed	Website or dataset name
BoM (2023)	16 January 2023	Climate Data Online
DAWE (2022)	25 March 2022	Protected Matters Search Tool
DBCA (2022)	22 March 2022	NatureMap
DCCEEW (2021)	16 January 2023	Threatened Ecological Communities
WALIA (2023)	16 January 2023	Landgate Map Viewer
Weeds Australia (2021)	16 January 2023	Weeds of National Significance (WoNS)
Western Australian Herbarium (2022)	22 March 2022	Florabase

Detailed Flora and Vegetation Assessment

Various Lots, Mariginiup



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Figures



Figure 1: Site Location

Figure 2: Lot Access

Figure 3: Hydrography, Soils and Topography

Figure 4: Environmental Features

Figure 5: Plant Communities

Figure 6: Vegetation Condition

Figure 7: Conservation Significant Values

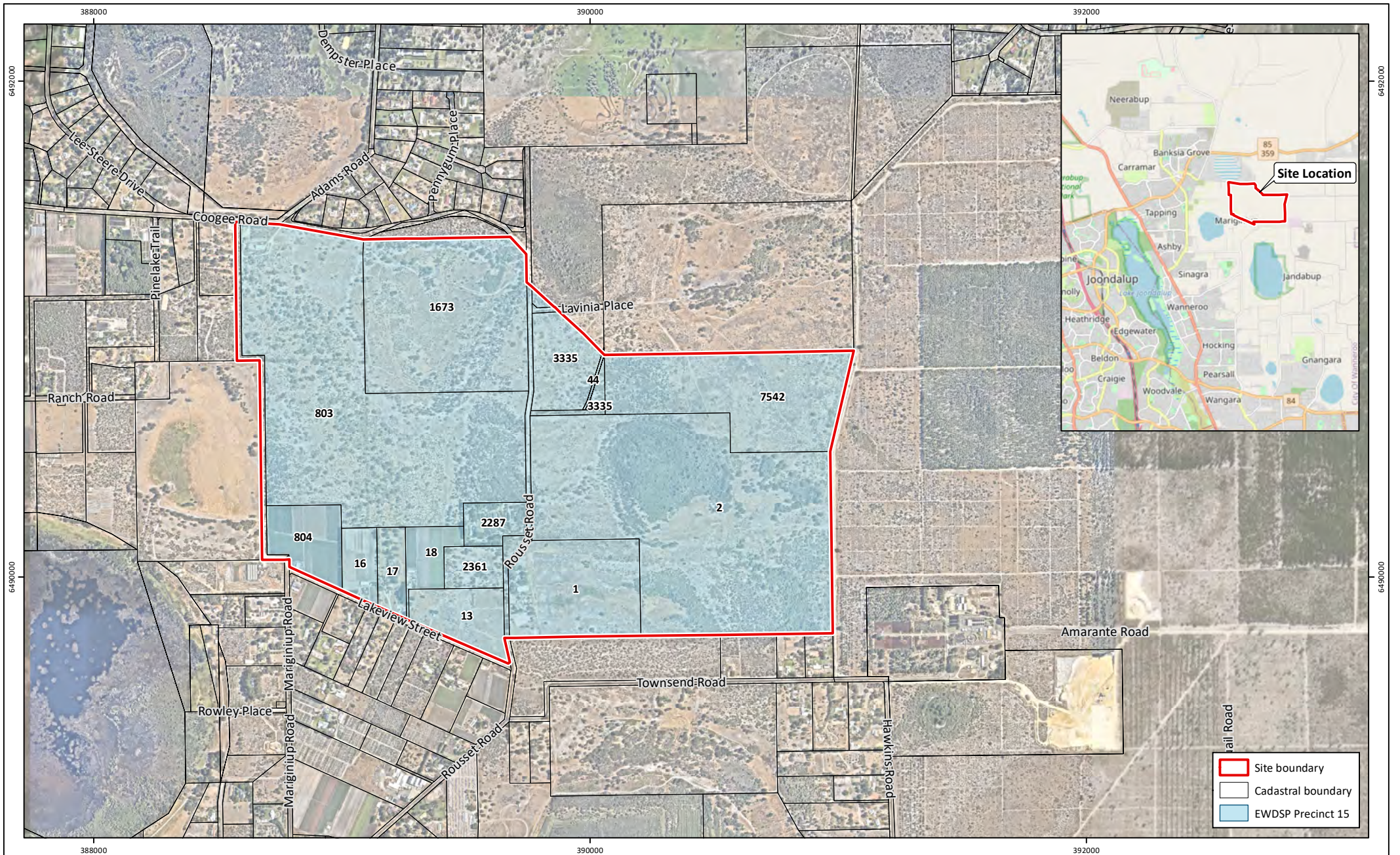
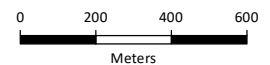


Figure 1: Site Location

Project: Detailed Flora and Vegetation Assessment
 Various Lots, Marigniuip
Client: Stockland

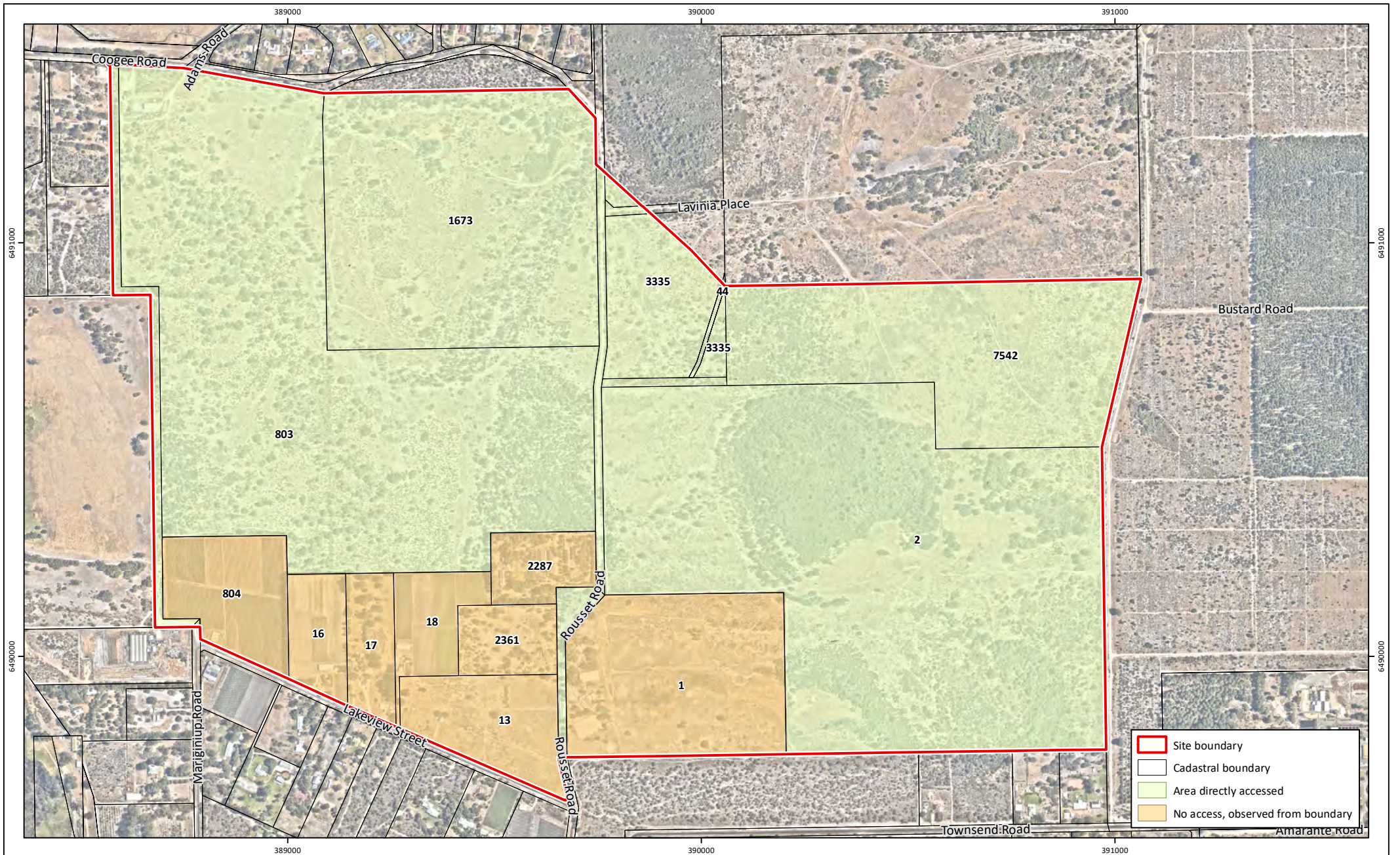
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Drawn: SCM
Date: 22/02/2023
Checked: SCM
Approved: TAA
Date: 28/02/2023



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Scale: 1:20,000@A4
 GDA 1994 MGA Zone 50



While Emmerge Associates makes every attempt to ensure the accuracy and completeness of data, Emmerge accepts no responsibility for externally sourced data used
 ©Landgate (2023). Nearmap Imagery date: 14/01/2023

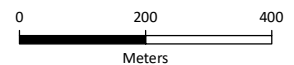


	Site boundary
	Cadastral boundary
	Area directly accessed
	No access, observed from boundary

Figure 2: Lot Access

Project: Detailed Flora and Vegetation Assessment
Various Lots, Mariginup
Client: Stockland

Plan Number:
EP22-019(01)-F54
Drawn: GAR
Date: 22/02/2023
Checked: SCM
Approved: TAA
Date: 28/02/2023



Scale: 1:12,000@A4
GDA 1994 MGA Zone 50



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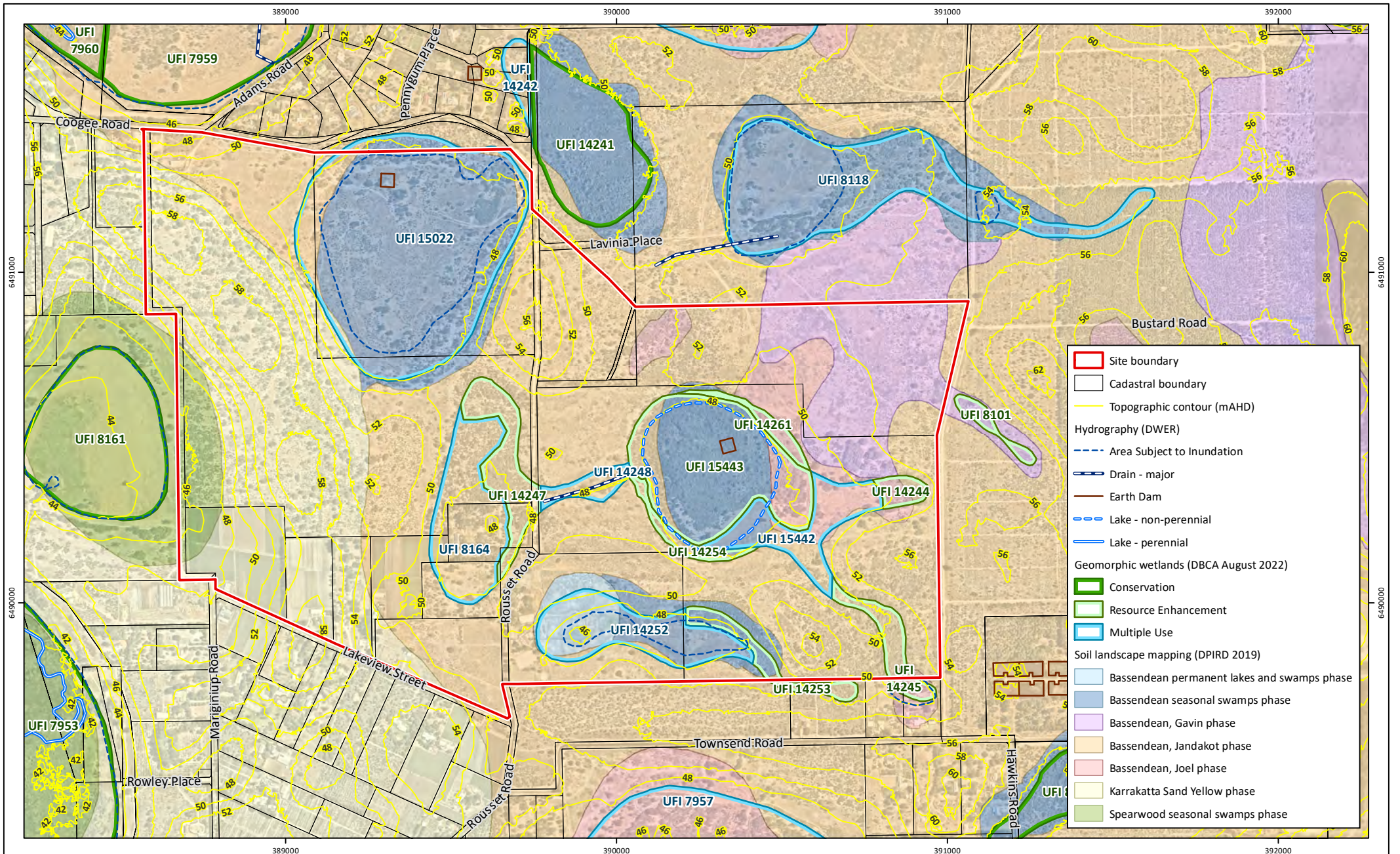
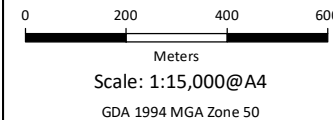


Figure 3: Hydrography, Soils and Topography

Project: Detailed Flora and Vegetation Assessment
Various Lots, Mariginiup
Client: Stockland

Plan Number:
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Checked: SCM
Approved: TAA
Date: 28/02/2023



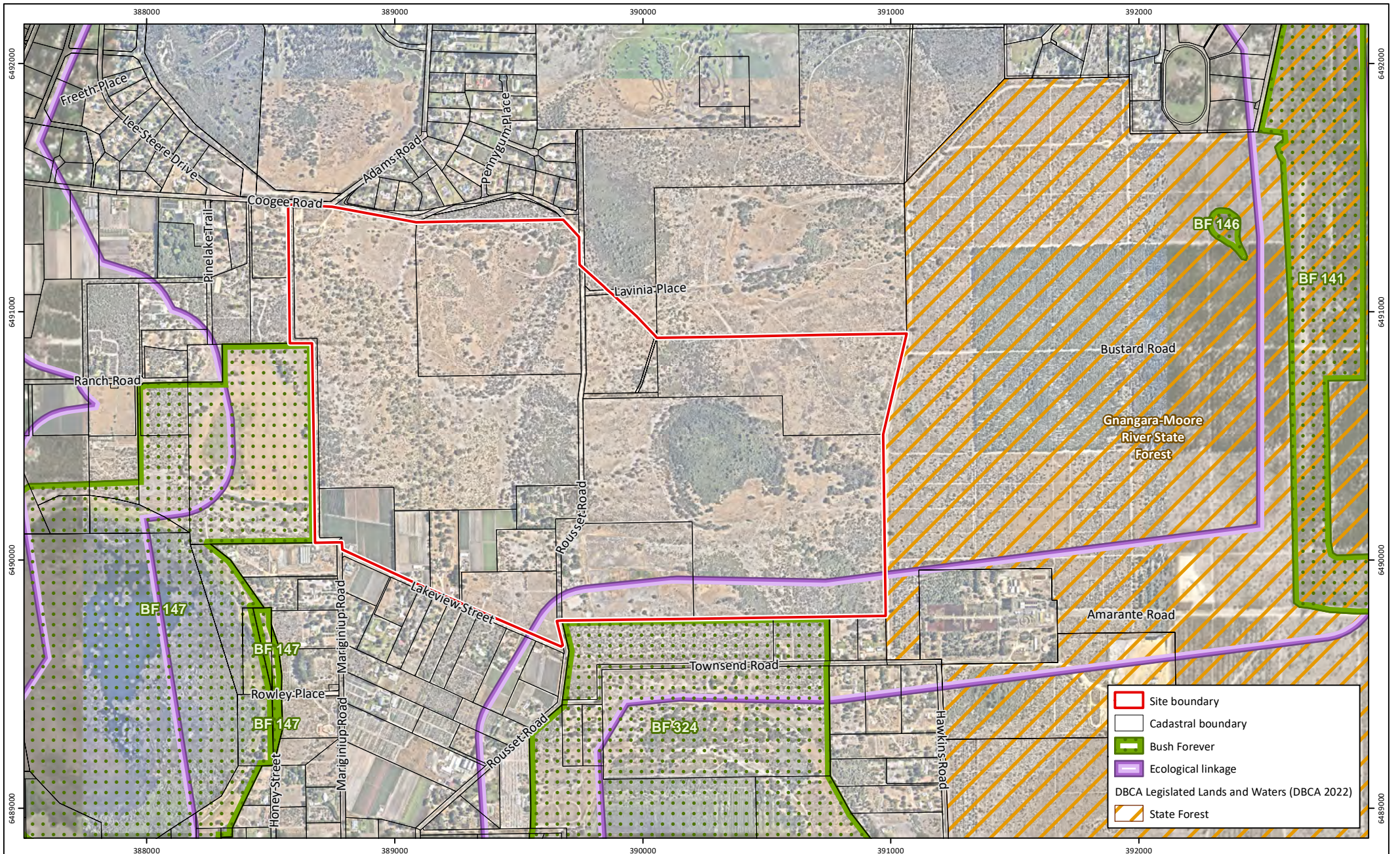


Figure 4: Environmental Features

Project:	Detailed Flora and Vegetation Assessment Various Lots, Marigninup
Client:	Stockland

Plan Number:	EP22-019(01)-F32
Drawn:	SCM
Date:	22/02/2023
Checked:	SCM
Approved:	TAA
Date:	28/02/2023

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GDA 1994 MGA Zone 50



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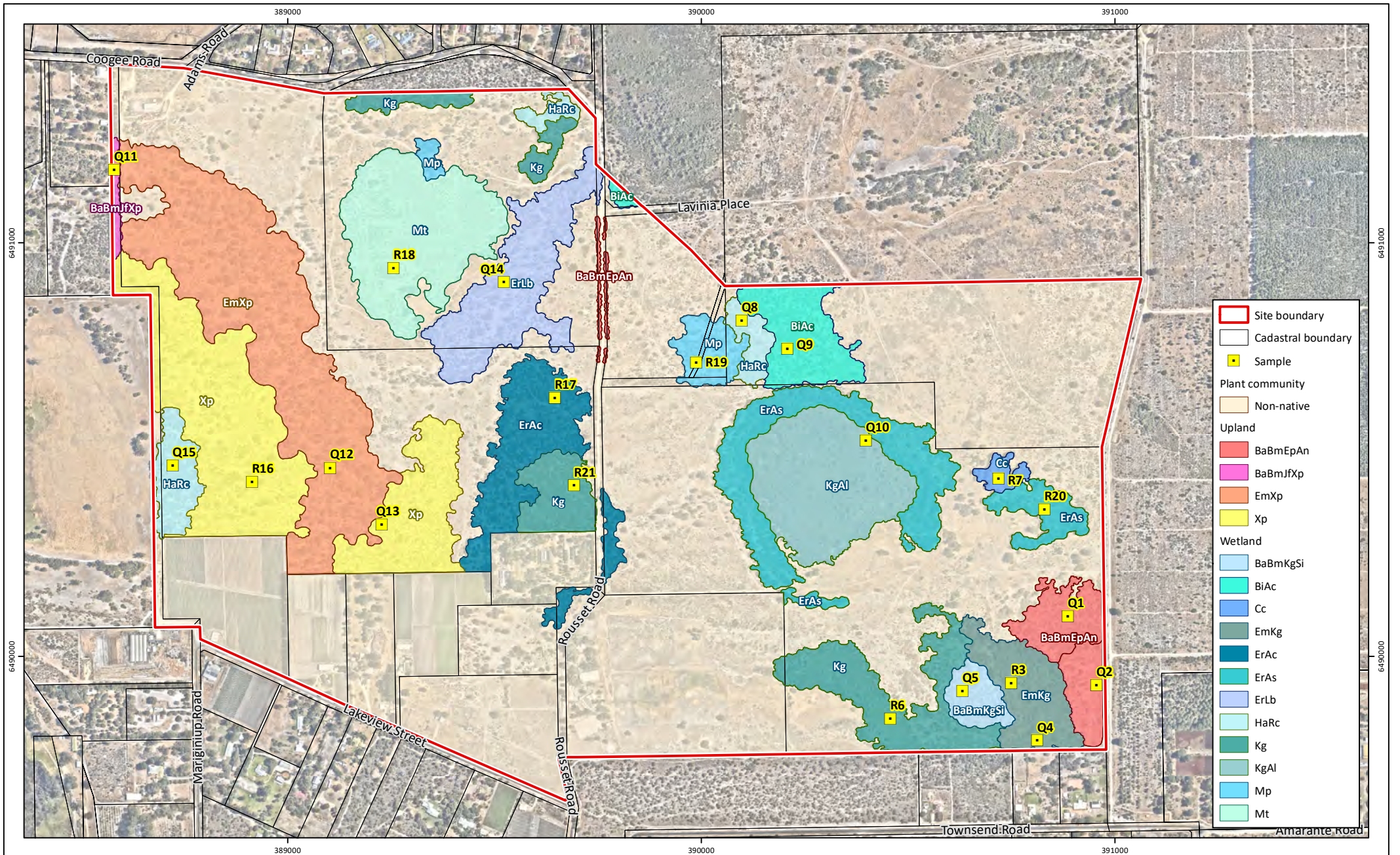


Figure 5: Plant Communities

Project: Detailed Flora and Vegetation Assessment
Various Lots, Mariginiup
Client: Stockland

Plan Number:
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Drawn: SCM
Date: 22/02/2023
Checked: SCM
Approved: TAA
Date: 28/02/2023



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Scale: 1:12,000@A4
GDA 1994 MGA Zone 50



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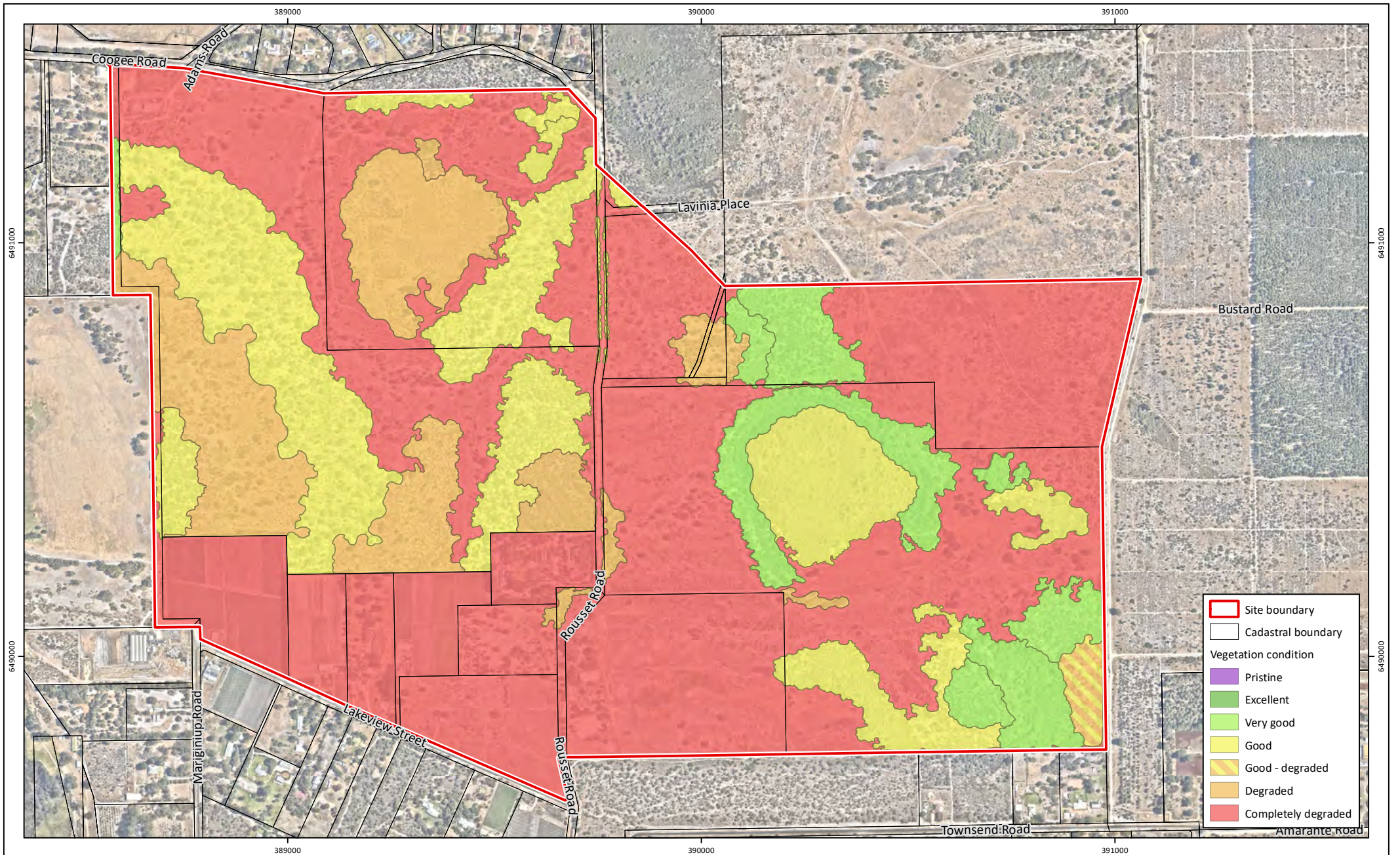
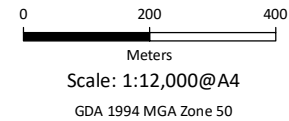


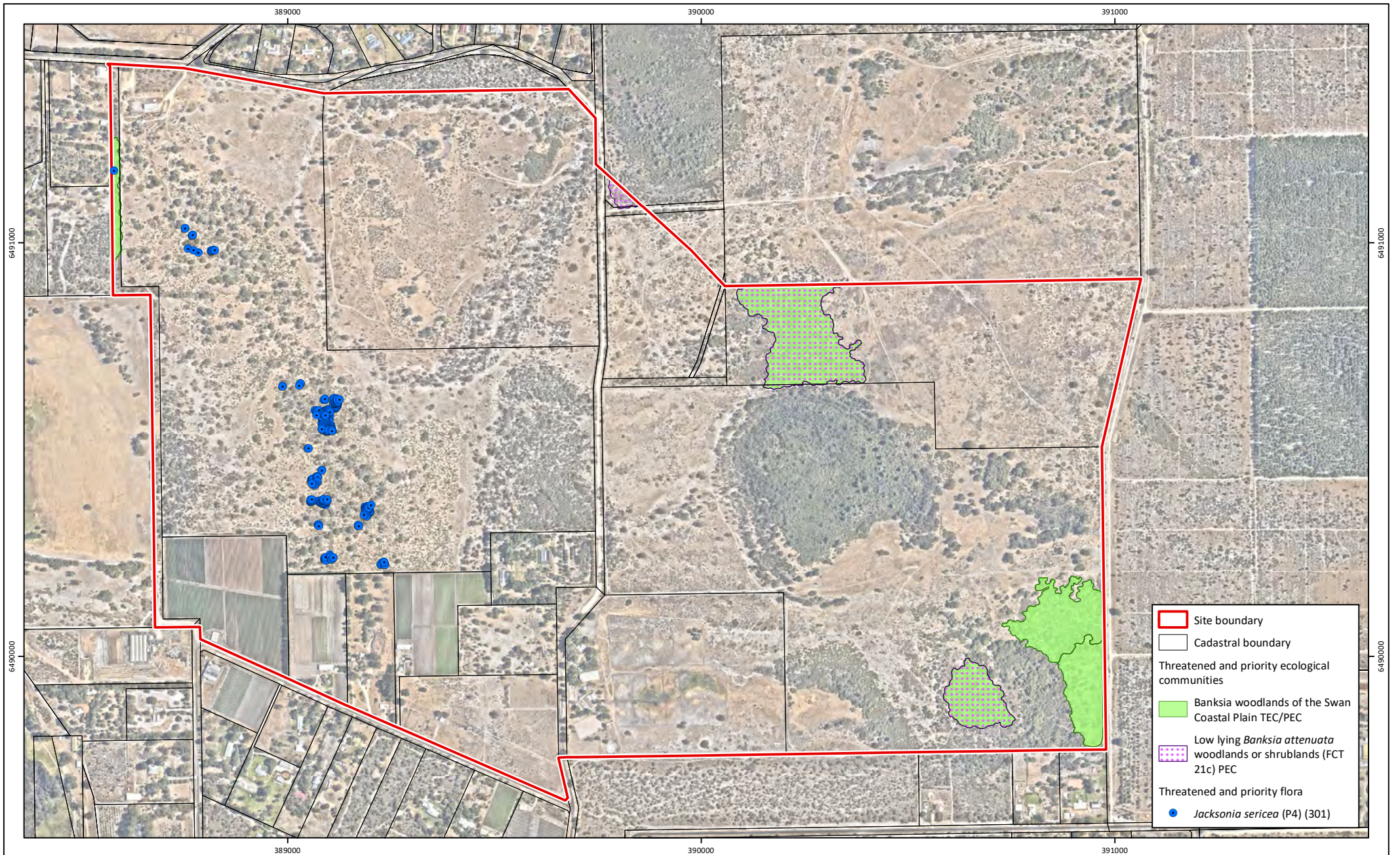
Figure 6: Vegetation Condition

Project: Detailed Flora and Vegetation Assessment
 Various Lots, Marigninup
Client: Stockland

Plan Number:
 EP22-019(01)-F34
Drawn: SCM
Date: 22/02/2023
Checked: SCM
Approved: TAA
Date: 28/02/2023



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	Site boundary
	Cadastral boundary
Threatened and priority ecological communities	
	Banksia woodlands of the Swan Coastal Plain TEC/PEC
	Low lying <i>Banksia attenuata</i> woodlands or shrublands (FCT 21c) PEC
Threatened and priority flora	
	<i>Jacksonia sericea</i> (P4) (301)

Figure 7: Conservation Significant Values

Project: Detailed Flora and Vegetation Assessment
Various Lots, Mariginiup

Client: Stockland

Plan Number:
EP22-019(01)-F35a

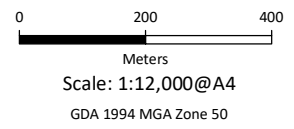
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Date: 25/07/2023

Checked: SCM

Approved: TAA

Date: 25/07/2023



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Appendix A

Additional Information



Conservation Significant Flora and Vegetation

Threatened and priority flora

Flora species considered rare or under threat warrant special protection under Commonwealth and/or State legislation. At the Commonwealth level, flora species can be listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Flora species considered 'threatened' pursuant to Schedule 1 of the EPBC Act are assigned categories according to their conservation status, as outlined in **Table 1**.

In Western Australia, plant taxa may be classed as 'threatened' under the *Biodiversity Conservation Act 2016* (BC Act) which is enforced by Department of Biodiversity Conservation and Attractions (DBCA). Threatened flora species are listed under sections 19(1) and 26(2) of the BC Act. It is an offence to 'take' or disturb threatened flora without Ministerial approval. Section 5(1)1 of the Act defines to take as including "... to gather, pluck, cut, pull up, destroy, dig up, remove, harvest or damage flora by any means" or to cause or permit the same to be done. The definition of threatened flora under the BC Act is provided in **Table 1**.

Section 43 of the BC Act requires that an occurrence of a threatened species or threatened ecological community is reported to DBCA where the occurrence has been identified as part of field work completed:

- as part of an assessment under Part IV of the *Environmental Protection Act 1986*; or
- in relation to an application for a clearing permit under the *Environmental Protection Act 1986* section 51E(1)(d).

Penalties apply to individuals and organisations that fail to provide accurate reports of threatened species or communities.

The *Biodiversity Conservation Regulations 2018* (BC Regulations 2018) came into effect on January 1 2019. The BC Regulations include provisions for licencing, charges, penalties and other provisions associated with the BC Act.

Flora species that may be threatened or near threatened but lack sufficient information to be listed under the BC Act may be added to the DBCA's *Priority Flora List* (DBCA 2018c). Priority flora species are considered during State approval processes. Priority flora categories and definitions are listed in **Table 1**.

Additional Background Information



Table 1: Definitions of conservation significant flora species pursuant to the EPBC Act and BC Act and on DBCA's Priority Flora List (DBCA 2018c)

Conservation code	Description
EX [†]	Threatened Flora – Presumed Extinct Taxa which have not been collected, or otherwise verified, over the past 50 years despite thorough searching, or of which all known wild populations have been destroyed more recently, and have been gazetted as such.
T [†]	Threatened Flora – Extant Taxa which are declared to be likely to become extinct or is rare, or otherwise in need of special protection.
CR [^]	Threatened Flora – Critically Endangered Taxa which are considered to be facing an extremely high risk of extinction in the wild.
EN [^]	Threatened Flora – Endangered Taxa which are considered to be facing a very high risk of extinction in the wild.
VU [^]	Threatened Flora – Vulnerable Taxa which are considered to be facing a high risk of extinction in the wild.
P1 [□]	Priority One – Poorly Known Taxa which are known from one or a few (generally <5) populations which are under threat, either due to small population size, or being on lands under immediate threat e.g. road verges, urban areas, farmland, active mineral leases etc., or the plants are under threat, e.g. from disease, grazing by feral animals etc. May include taxa with threatened populations on protected lands. Such taxa are under consideration for declaration as 'rare flora', but are in urgent need of further survey.
P2 [□]	Priority Two – Poorly Known Taxa which are known from one or a few (generally <5) populations, at least some of which are not believed to be under immediate threat (i.e. not currently endangered). Such taxa are under consideration for declaration as 'rare flora', but urgently need further survey.
P3 [□]	Priority Three – Poorly Known Taxa which are known from several populations, and the taxa are not believed to be under immediate threat (i.e. not currently endangered), either due to the number of known populations (generally >5), or known populations being large, and either widespread or protected. Such taxa are under consideration for declaration as 'rare flora' but needs further survey.
P4 [□]	Priority Four – Rare Taxa which are considered to have been adequately surveyed and which, whilst being rare (in Australia), are not currently threatened by any identifiable factors. These taxa require monitoring every 5-10 years.

[^]pursuant to the EPBC Act, [†]pursuant to the BC Act, [□]on DBCA's Priority Flora List

Threatened and priority ecological communities

'Threatened ecological communities' (TECs) are recognised as ecological communities that are rare or under threat and therefore warrant special protection. Selected TECs are afforded statutory protection at a Commonwealth level under section 181 of the EPBC Act. TECs nominated for listing under the EPBC Act are considered by the Threatened Species Scientific Committee and a final decision is made by the Commonwealth Minister for the Environment. Once listed under the EPBC Act, communities are categorised as either 'critically endangered', 'endangered' or 'vulnerable' as defined in **Table 2**. Any action likely to have a significant impact on a community listed under the EPBC Act requires approval from the Minister for the Environment.

Additional Background Information

Within Western Australia TECs are determined by the Western Australian Threatened Ecological Communities Scientific Advisory Committee (WATECSAC) and endorsed by the State Minister for the Environment. The WATECSAC is an independent group comprised of representatives from organisations including tertiary institutions, the Western Australian Museum and DBCA. The TECs endorsed by the State Minister are published by DBCA (DBCA 2018b).

TECs are assigned to one of the categories outlined in **Table 2** according to their status (in relation to the level of threat). TECs are afforded direct statutory protection at a State level under the BC Act and BC Regulations. Ecological communities are listed under Section 27(1) and 33 of the BC Act. Their significance is also acknowledged through other state environmental approval processes such as 'environmental impact assessment' pursuant to Part IV of the *Environmental Protection Act 1986* (EP Act) and the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*.

Table 2: Categories of threatened ecological communities (English and Blyth 1997; DEC 2009)

Conservation code	Description
PD	Presumably Totally Destroyed An ecological community that has been adequately searched for but for which no representative occurrences have been located.
CE	Critically Endangered An ecological community that has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future.
E	Endangered An ecological community that has been adequately surveyed and is not critically endangered but is facing a very high risk of total destruction in the near future.
V	Vulnerable An ecological community that has been adequately surveyed and is not critically endangered or endangered but is facing a high risk of total destruction or significant modification in the medium to long-term future.

An ecological community that is under consideration for listing as a TEC, but does not yet meet survey criteria or has not been adequately defined may be listed as a 'priority ecological community' (PEC). PECs are categorised as priority category 1, 2 or 3 as described in **Table 3**. 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' (DEC 2013). Listed PECs are published by DBCA (DBCA 2017b).

Additional Background Information

Table 3: Categories of priority ecological communities (DEC 2013)

Priority code	Description
P1	<p>Priority One: Poorly known ecological communities</p> <p>Ecological communities that are known from very few occurrences with a very restricted distribution (generally ≤ 5 occurrences or a total area of ≤ 100ha). Occurrences are believed to be under threat either due to limited extent, or being on lands under immediate threat (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) or for which current threats exist. May include communities with occurrences on protected lands. 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.</p>
P2	<p>Priority Two: Poorly known ecological communities</p> <p>Communities that are known from few occurrences with a restricted distribution (generally ≤ 10 occurrences or a total area of ≤ 200ha). At least some occurrences are not believed to be under immediate threat (within approximately 10 years) 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.</p>
P3	<p>Priority Three: Poorly known ecological communities</p> <p>(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:</p> <p>(ii) communities known from a few widespread occurrences, which are either large or with significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat (within approximately 10 years), or;</p> <p>(iii) communities made up of large, and/or widespread occurrences, that may or may 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, inappropriate fire regimes, clearing, hydrological change etc.</p> <p>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.</p>
P4	<p>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.</p> <p>(i) 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.</p> <p>(ii) 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 a higher threat category.</p> <p>(iii) Ecological communities that have been removed from the list of threatened communities during the past five years.</p>
P5	<p>Priority Five: Conservation Dependent ecological communities</p> <p>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.</p>

Weeds

A number of legislative and policy documents exist in relation to weed management at state and national levels. The *Biosecurity and Agriculture Management Act 2007* (BAM Act) is the principle legislation guiding weed management in Western Australia and lists declared pest species. At a national level, the Australian government has compiled a list of 32 Weeds of National Significance (WoNS) (DoEE 2018), of which many are also listed under the BAM Act.

Declared Pests

Part 2.3.23 of the BAM Act requires a person must not; “a) keep, breed or cultivate the declared pest; b) keep, breed or cultivate an animal, plant or other thing that is infected or infested with the declared pest; c) release into the environment the declared pest, or an animal, plant or other thing that is infected or infested with the declared pest; or d) intentionally infect or infest, or expose to infection or infestation, a plant, animal or other thing with a declared pest”.

Under the BAM Act, all declared pests are assigned a legal status, as described in **Table 7**. Species assigned to the ‘declared pest, prohibited - s12’ category are placed in one of three control categories, as described in **Table 8**.

The *Biosecurity and Agriculture Management Regulations 2013* specify keeping categories for species assigned to the ‘declared pest - s22(2)’ category, which relate to the purposes of which species can be kept, as well as the entities that can keep them. The categories are described in **Table 9**.

The Western Australian Organism List (WAOL) provides the status of organisms which have been categorised under the BAM Act (DPIRD 2020).

Table 4: Legal status of declared pest species listed under the BAM Act (DPIRD 2020)

Category	Description
Declared Pest Prohibited - s12	May only be imported and kept subject to permits. Permit conditions applicable to some species may only be appropriate or available to research organisations or similarly secure institutions.
Declared Pest s22(2)	Must satisfy any applicable import requirements when imported, and may be subject to an import permit if they are potential carriers of high-risk organisms. They may also be subject to control and keeping requirements once within Western Australia

Table 5: Control categories of declared pest species listed under the BAM Act (DPIRD 2020)

Category	Description
C1	Exclusion Not established in Western Australia and control measures are to be taken, including border checks, in order to prevent them entering and establishing in the State.
C2	Eradication Present in Western Australia in low enough numbers or in sufficiently limited areas that their eradication is still a possibility.
C3	Management Established in Western Australia but it is feasible, or desirable, to manage them in order to limit their

Additional Background Information

Category	Description
	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.

Table 6: Keeping categories of declared pest species listed under the BAM Act (DPIRD 2020)

Category	Description
Prohibited	Can only be kept under a permit for public display and education purposes, and/or genuine scientific research, by entities approved by the state authority.
Exempt	No permit or conditions are required for keeping.
Restricted	Organisms which, relative to other species, have a low risk of becoming a problem for the environment, primary industry or public safety and can be kept under a permit by private individuals.

Wetland Habitat

Geomorphic wetland types

On the Swan Coastal Plain DBCA (2017a) have used the geomorphic wetland classification system developed by Semeniuk (1987) and Semeniuk and Semeniuk (1995) to classify wetlands based on the landform shape and water permanence (hydro-period) as outlined in **Table 10**.

Table 7: Geomorphic Wetlands of the Swan Coastal Plain classification categories (DBCA 2017a)

Level of inundation	Geomorphology			
	Basin	Flat	Channel	Slope
Permanently inundated	Lake	-	River	-
Seasonally inundated	Sumpland	Floodplain	Creek	-
Seasonally waterlogged	Dampland	Palusplain	-	Paluslope

Wetland management categories

DBCA maintains the *Geomorphic Wetland of the Swan Coastal Plain* dataset (DBCA 2018a), which also categorises individual wetlands into specific management categories as described in **Table 11**.

Table 8: Geomorphic Wetlands of the Swan Coastal Plain classification categories (DBCA 2017a)

Management category	Description of wetland	Management objectives
Conservation (CCW)	Support high levels of attributes	Preserve wetland attributes and functions through reservation in national parks, crown reserves and state owned land. Protection provided under environmental protection policies.
Resource enhancement (REW)	Partly modified but still supporting substantial functions and attributes	Restore wetland through maintenance and enhancement of wetland functions and attributes. Protection via crown reserves, state or local government owned land, environmental protection policies and sustainable management on private properties.
Multiple use (MUW)	Few wetland attributes but still provide important hydrological functions	Use, development and management considered in the context of water, town and environmental planning through land care.

The management categories of wetland features are determined based on hydrological, biological and human use features. The DBCA document *A methodology for the evaluation of specific wetland types on the Swan Coastal Plain, Western Australia* (DBCA 2017a) details the methodology by which wetlands on the Swan Coastal Plain are assigned management categories based on a two tiered evaluation system, with preliminary and secondary evaluation stages. The preliminary evaluation aims to identify any features of conservation significance that would immediately place the wetland within the CCW management category. Examples of these significant features include presence on significant wetland lists, presence of TECs or PECs (Priority 1 and 2), presence of threatened flora and

over 90% of vegetation in good or better condition based on the Keighery (1994) scale. If such environmental values are identified the wetland would be categorised as CCW without further evaluation.

Should the preliminary evaluation indicate that no such features occur, the secondary evaluation and site assessment are then applied. In the secondary evaluation, an appropriate management category is determined through the assessment of a range of environmental attributes, functions and values.

Wetland reclassification

DBCA have a protocol for proposing changes to the wetland boundaries and management categories of the existing geomorphic wetland dataset (DEC 2007). The procedure involves a wetland desktop evaluation and site assessment which culminates in a recommended management category. Relevant information should be obtained in the optimal season for vegetation condition and water levels, which is usually spring (DEC 2007). In the case of larger wetlands that have undergone a degree of disturbance, a separate management category may be assigned to parts of the wetland in order to reflect the current values.

References

General references

Department of Biodiversity, Conservation and Attractions (DBCA) 2017a, *A methodology for the evaluation of wetlands on the Swan Coastal Plain*, draft prepared by the Wetlands Section of the Department of Biodiversity, Conservation and Attractions and the Urban Water Branch of the Department of Water and Environmental Regulation, Perth.

Department of Biodiversity Conservation and Attractions (DBCA) 2017b, *Priority Ecological Communities for Western Australia Version 27*, Species and Communities Branch, Department of Biodiversity, Conservation and Attractions.

Department of Biodiversity, Conservation and Attractions (DBCA) 2018a, *Geomorphic Wetlands, Swan Coastal Plain (DBCA-019)*.

Department of Biodiversity, Conservation and Attractions (DBCA) 2018b, *List of Threatened Ecological Communities endorsed by the Western Australian Minister for Environment*, Perth.

Department of Biodiversity, Conservation and Attractions (DBCA) 2018c, *Threatened and Priority Flora List 16 January 2018*, Perth.

Department of Environment and Conservation (DEC) 2007, *Protocol for proposing modifications to the Geomorphic Wetlands Swan Coastal Plain dataset*, Perth.

Department of Environment and Conservation (DEC) 2009, *Definitions, Categories and Criteria for Threatened and Priority Ecological Communities*, Perth.

Department of Environment and Conservation (DEC) 2013, *Definitions, Categories and Criteria for Threatened and Priority Ecological Communities*, Perth.

English, V. and Blyth, J. 1997, *Identifying and Conserving Threatened Ecological Communities in the South West Botanical Province*, ANCA National Reserves System Cooperative Program, Project Number N702, Perth.

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

Semeniuk, C. A. 1987, *Wetlands of the Darling System - a geomorphic approach to habitat classification*, Journal of the Royal Society of Western Australia, 69: 95-112.

Semeniuk, C. A. and Semeniuk, V. 1995, *A Geomorphic Approach to Global Classification for Inland Wetlands*, Vegetatio, 118(1/2): 103-124.

Online references

Department of Environment and Energy (DoEE) 2018, *Weeds of National Significance*, <<http://www.environment.gov.au/biodiversity/invasive/weeds/weeds/lists/wons.html>>.

Additional Background Information



Department of Primary Industries and Regional Development (DPIRD) 2020, The Western Australian Organism List (WAOL), < <https://www.agric.wa.gov.au/bam/western-australian-organism-list-waol>>.

Appendix B

Conservation Significant Flora Species and Likelihood of
Occurrence Assessment



Species name	Level of significance		Life strategy	Habitat	Flowering period	Likelihood of occurrence
	WA	EPBC Act				
<i>Darwinia foetida</i>	EN	CR	P	Grey-white sand on swampy, seasonally wet sites.	Oct-Nov	Unlikely
<i>Synaphea</i> sp. Fairbridge Farm (D. Papenfus 696)	CR	CR	P	Low woodland on grey, clayey sand with lateritic pebbles (Pinjarra Plain) near winter wet flats.	Sep-Nov	Unlikely
<i>Andersonia gracilis</i>	VU	EN	P	Seasonally damp, black sandy clay flats near or on the margins of swamps.	Sep-Nov	Unlikely
<i>Caladenia huegelii</i>	CR	EN	PG	Well-drained, deep sandy soils in lush undergrowth in a variety of moisture levels.	Sep-early Nov	Unlikely
<i>Chamelaucium lullfitzii</i>	VU	EN	P	White yellow sand in low woodland.	Oct-Nov	Unlikely
<i>Diuris purdiei</i>	EN	EN	PG	Sand to sandy clay soils in areas subject to winter inundation.	late September to mid-October, but only after a summer or early autumn fire	Unlikely
<i>Drakaea elastica</i>	CR	EN	PG	Bare patches of sand within otherwise dense vegetation in low-lying areas alongside winter-wet swamps. Typically in banksia woodland or thickets of <i>Kunzea glabrescens</i> .	late Sep-Oct/Nov, survey Jul-Aug	Unlikely
<i>Grevillea christineae</i>	EN	EN	P	Clay loam, sandy clay, often moist.	Aug-Sep	Unlikely
<i>Grevillea curviloba</i>	EN	EN	P	Grey sand, sandy loam. Winter-wet heath.	Aug-Oct	Unlikely
<i>Macarthuria keigheryi</i>	EN	EN	P	Low-lying winter-wet damp grey/white sands in open patches.	Sep-Dec or Feb-Mar	Unlikely
<i>Marianthus paralius</i>	EN	EN	P	White sand over limestone. Low coastal cliffs	Sep-Nov	Unlikely
<i>Melaleuca</i> sp. Wanneroo (G.J. Keighery 16705)	EN	EN	P	Over sand on limestone slopes	Nov-Apr	Unlikely
<i>Thelymitra dedmaniarum</i>	CR	EN	PG	Red brown sandy loam with dolerite and granite outcrops.	Oct-Nov	Unlikely

Species name	Level of significance		Life strategy	Habitat	Flowering period	Likelihood of occurrence
	WA	EPBC Act				
<i>Anigozanthos viridis</i> subsp. <i>terraspectans</i>	VU	VU	P	Grey sand, clay loam. Winter-wet depressions.	Aug-Sep	Unlikely
<i>Diuris micrantha</i>	VU	VU	PG	Dark grey-black sandy clay-loam in winter wet depressions or swamps. Often in shallow standing water.	Aug/Sep-early Oct	Unlikely
<i>Drakaea micrantha</i>	EN	VU	PG	Open sandy patches often adjacent to winter-wet swamps.	Sept- early Oct	Unlikely
<i>Eleocharis keigheryi</i>	VU	VU	P	Clay or sandy loam in freshwater creeks and transient waterbodies such as seasonally wet clay pans.	Aug-Dec	Unlikely
<i>Eucalyptus argutifolia</i>	VU	VU	P	Shallow soils over limestone. Slopes or gullies of limestone ridges, outcrops	Mar-Apr	Unlikely
<i>Baeckea</i> sp. Limestone (N. Gibson & M.N. Lyons 1425)	P1	-	P	Grey yellow sand over limestone.	Sep-Dec	Unlikely
<i>Drosera patens</i>	P1	-	P	Sandy soils on margins of winter-wet depressions, swamps and lakes.	Aug-Dec	Unlikely
<i>Drosera x sidjamesii</i>	P1	-	P	Along lake margins, close to winter high-water line.	Nov-Dec or Jan-Mar	Unlikely
<i>Grevillea</i> sp. Ocean Reef (D. Pike Joon 4)	P1	-	P	Dry, bare, light yellow-brown/grey sand. Sand dunes.	Nov	Unlikely
<i>Acacia benthamii</i>	P2	-	P	Sand, typically on limestone breakaways.	Aug-Sept	Unlikely
<i>Calectasia elegans</i>	P2	-	P	Grey yellow sand on plains.	Sep-Oct	Unlikely
<i>Poranthera moorokatta</i>	P2	-	A	Sandy or clay soils. Dampland or low sandy dunes in banksia woodland.	Sep-early Nov	Unlikely
<i>Stenanthemum sublineare</i>	P2	-	P	White sand on coastal plains.	Oct-Dec	Unlikely
<i>Thelymitra variegata</i>	P2	-	P	Sandy clay, sand, laterite.	Jun-Sep	Unlikely
<i>Austrostipa mundula</i>	P3	-	P	Grey sand over limestone.	Sept-Nov	Unlikely
<i>Conostylis bracteata</i>	P3	-	P	Sand, limestone. Consolidated sand dunes.	Aug-Sep	Unlikely
<i>Cyathochaeta teretifolia</i>	P3	-	P	Grey sand, sandy clay in swamps and creek edges.	Oct-Jan	Unlikely
<i>Dampiera triloba</i>	P3	-	P	Damp peat/loam soil.	Aug-Dec	Unlikely

Species name	Level of significance		Life strategy	Habitat	Flowering period	Likelihood of occurrence
	WA	EPBC Act				
<i>Hibbertia leptotheca</i>	P3	-	P	Brown to white sand with limestone.	Aug-Oct	Unlikely
<i>Pimelea calcicola</i>	P3	-	P	Sand, limestone on coastal ridges.	Sep-Nov	Unlikely
<i>Sarcozona bicarinata</i>	P3	-	P	White sand.	Aug	Unlikely
<i>Stylidium paludicola</i>	P3	-	P	Peaty sand over clay. Winter wet habitats. Marri and Melaleuca woodland, Melaleuca shrubland	Oct-Dec	Unlikely
<i>Styphelia filifolia</i>	P3	-	P	Brown over pale yellow sand.	Feb-Apr	Unlikely
<i>Anigozanthos humilis</i> subsp. <i>chrysanthus</i>	P4	-	P	Grey or yellow sand	Jul-Oct	Unlikely
<i>Jacksonia sericea</i>	P4	-	P	Calcareous and sandy soils on Swan Coastal Plain.	Dec-Feb	Recorded
<i>Schoenus griffinianus</i>	P4	-	P	White sand.	Sep-Oct	Unlikely
<i>Stylidium longitubum</i>	P4	-	A	Sandy clay, clay. Seasonal wetlands.	Oct-Dec	Unlikely
<i>Tripterococcus</i> sp. Brachylobus (A.S. George 14234)	P4	-	P	Winter-wet areas on grey sand.	Oct-Feb	Unlikely
<p>Note: T=threatened, CE=critically endangered, E=endangered, V=vulnerable, P1=Priority 1, P2=Priority 2, P3=Priority 3, P4=Priority 4, P=perennial, PG=perennial geophyte, A=annual. Species recorded or considered to potentially occur within the site are shaded green</p>						

Appendix C

Species List



Family	Status	Species
Aizoaceae	*	<i>Carpobrotus edulis</i>
Amaranthaceae		<i>Ptilotus manglesii</i> <i>Ptilotus polystachyus</i>
Anarthriaceae		<i>Lyginia barbata</i>
Apiaceae		<i>Centella asiatica</i> <i>Xanthosia huegelii</i>
Araliaceae		<i>Trachymene pilosa</i>
Asparagaceae	*DP, WoNS	<i>Asparagus asparagoides</i> <i>Laxmannia ramosa</i> <i>Laxmannia squarrosa</i> <i>Lomandra caespitosa</i> <i>Lomandra hermaphrodita</i> <i>Lomandra ?micrantha</i> <i>Lomandra ?odora</i> <i>Lomandra ?preissii</i> <i>Lomandra sericea</i> <i>Lomandra suaveolens</i> <i>Sowerbaea laxiflora</i> <i>Thysanotus manglesianus</i> <i>Thysanotus sp.</i> <i>Thysanotus thyrsoides</i>
Asteraceae	*	<i>Arctotheca calendula</i> <i>Asteraceae sp.</i>
	*	<i>Erigeron sp.</i> <i>Hyalosperma cotula</i>
	*	<i>Hypochaeris glabra</i>
	*	<i>Hypochaeris radicata</i>
	*	<i>Lactuca serriola</i>
	*	<i>Monoculus monstrosus</i> <i>Podotheca gnaphalioides</i> <i>Quinetia urvillei</i> <i>Siloxerus humifusus</i>
	*	<i>Sonchus oleraceus</i> <i>Ursinia anthemoides</i> <i>Waitzia suaveolens</i>
Bignoniaceae	*	<i>Campsis radicans</i>
Campanulaceae		<i>Lobelia tenuior</i>
	*	<i>Wahlenbergia capensis</i>

Family	Status	Species
Caprifoliaceae	*	<i>Sisylx atropurpurea</i>
Caryophyllaceae	*	? <i>Cerastium sp</i>
Casuarinaceae		<i>Allocasuarina fraseriana</i> <i>Allocasuarina humilis</i>
Centrolepidaceae		<i>Centrolepis drummondiana</i>
Colchicaceae		<i>Burchardia congesta</i>
Commelinaceae		<i>Cartonema philydroides</i>
Crassulaceae		<i>Crassula colorata</i>
Cyperaceae		<i>Chaetospora curvifolia</i> <i>Isolepis marginata</i> <i>Lepidosperma calcicola</i> <i>Lepidosperma leptostachyum</i> <i>Lepidosperma longitudinale</i> <i>Lepidosperma pubisquameum</i> <i>Lepidosperma scabrum</i> <i>Lepidosperma striatum</i> <i>Machaerina juncea</i> <i>Machaerina vaginalis</i> <i>Mesomelaena pseudostygia</i> <i>Mesomelaena tetragona</i> <i>Schoenus efoliatus</i>
Dasypogonaceae		<i>Calectasia narragara</i> <i>Dasypogon bromeliifolius</i>
Dennstaedtiaceae		<i>Pteridium esculentum</i>
Dilleniaceae		<i>Hibbertia cuneiformis</i> <i>Hibbertia huegelii</i> <i>Hibbertia hypericoides</i> <i>Hibbertia racemosa</i> <i>Hibbertia stellaris</i> <i>Hibbertia subvaginata</i>
Droseraceae		<i>Drosera erythrorhiza</i> <i>Drosera glanduligera</i> <i>Drosera ?pallida</i> <i>Drosera pulchella</i> <i>Drosera sp. (climbing)</i>

Family	Status	Species
Ericaceae		<i>Conostephium pendulum</i> <i>Leucopogon polymorphus</i> <i>Styphelia conostephioides</i> <i>Styphelia sp (sterile)</i>
Euphorbiaceae	*	<i>Euphorbia peplus</i> <i>Monotaxis grandiflora</i>
Fabaceae		<i>Acacia huegelii</i> * <i>Acacia iteaphylla</i> * <i>Acacia longifolia</i> <i>Acacia pulchella var. glaberrima</i> <i>Acacia pulchella var. pulchella</i> <i>Acacia saligna</i> <i>Acacia sessilis</i> <i>Acacia willdenowiana</i> <i>Aotus gracillima</i> <i>Bossiaea eriocarpa</i> * <i>Chamaecytisus palmensis</i> <i>Daviesia angulata</i> <i>Daviesia decurrens</i> <i>Daviesia nudiflora</i> <i>Daviesia physodes</i> <i>Daviesia triflora</i> <i>Euchilopsis linearis</i> <i>Eutaxia virgata</i> <i>Gastrolobium capitatum</i> <i>Gompholobium tomentosum</i> <i>Hardenbergia comptoniana</i> <i>Hovea pungens</i> <i>Hovea trisperma</i> <i>Isotropis cuneifolia</i> <i>Jacksonia floribunda</i> <i>Jacksonia furcellata</i> P4 <i>Jacksonia sericea</i> <i>Jacksonia sternbergiana</i> <i>Kennedia prostrata</i> * <i>Lotus angustissimus</i> * <i>Lupinus cosentinii</i> * <i>Ornithopus compressus</i> <i>Pultenaea reticulata</i> * <i>Trifolium campestre</i> <i>Viminaria juncea</i>
Gentianaceae	*	<i>Cicendia filiformis</i>
Geraniaceae	*	<i>Erodium botrys</i>

Family	Status	Species
	*	<i>Pelargonium capitatum</i>
Goodeniaceae		<i>Dampiera linearis</i> <i>Lechenaultia biloba</i> <i>Lechenaultia floribunda</i> <i>Scaevola thesioides</i>
Haemodoraceae		<i>Anigozanthos humilis</i> <i>Anigozanthos manglesii</i> <i>Conostylis aculeata</i> <i>Conostylis aculeata subsp. cygnorum</i> <i>Conostylis juncea</i> <i>Conostylis setigera</i> <i>Haemodorum laxum</i> <i>Haemodorum paniculatum</i> <i>Haemodorum spicatum</i> <i>Phlebocarya ciliata</i>
Hemerocallidaceae		<i>Arnocrinum preissii</i> <i>Corynotheca micrantha</i> <i>Dianella revoluta</i> <i>Hensmania turbinata</i> <i>Tricoryne elatior</i>
Iridaceae	* * *DP * *	<i>Gladiolus caryophyllaceus</i> <i>Iridaceae sp.</i> <i>Moraea flaccida</i> <i>Orthrosanthus laxus</i> <i>Patersonia occidentalis</i> <i>Romulea rosea</i> <i>Watsonia meriana var. bulbillifera</i>
Juncaceae		<i>Juncus pallidus</i>
Lamiaceae		<i>Hemiandra pungens</i>
Loganiaceae		<i>Phyllangium paradoxum</i>
Loranthaceae		<i>Nuytsia floribunda</i>
Macarthuriaceae		<i>Macarthuria australis</i>
Myrtaceae		<i>Astartea scoparia</i> <i>Beaufortia elegans</i> <i>Calothamnus sanguineus</i> <i>Calytrix angulata</i> * <i>Chamelaucium uncinatum</i> <i>Corymbia calophylla</i>

Family	Status	Species
		<i>Eremaea pauciflora</i>
		<i>Eucalyptus marginata</i>
		<i>Eucalyptus rudis</i>
	PI	<i>Eucalyptus sp.</i>
		<i>Eucalyptus todtiana</i>
		<i>Hypocalymma angustifolium</i>
		<i>Hypocalymma robustum</i>
		<i>Kunzea glabrescens</i>
		<i>Kunzea micrantha</i>
		<i>Melaleuca preissiana</i>
		<i>Melaleuca seriata</i>
		<i>Melaleuca teretifolia</i>
		<i>Melaleuca trichophylla</i>
		<i>Pericalymma ellipticum</i>
		<i>Regelia ciliata</i>
		<i>Regelia inops</i>
		<i>Scholtzia involucrata</i>
		<i>Verticordia densiflora</i>
Oleaceae		
	*	<i>Olea europaea</i>
Orchidaceae		
		<i>Caladenia arenicola</i>
		<i>Caladenia flava</i>
		<i>Caladenia latifolia</i>
		<i>Caladenia sp. (sterile)</i>
	*	<i>Disa bracteata</i>
		<i>Diuris corymbosa</i>
		<i>Diuris magnifica</i>
		<i>Diuris sp.</i>
		<i>Elythranthera brunonis</i>
		<i>Eriochilus ?dilatatus</i>
		<i>Leporella fimbriata</i>
		<i>Microtis media</i>
		<i>Pterostylis brevisepala</i>
		<i>Pterostylis sp.</i>
		<i>Pterostylis vittata</i>
		<i>Pyrorchis nigricans</i>
		<i>Thelymitra crinita</i>
		<i>Thelymitra macrophylla</i>
		<i>Thelymitra sp.</i>
		<i>Thelymitra vulgaris</i>
Papaveraceae		
	*	<i>Fumaria capreolata</i>
Pinaceae		
	*	<i>Pinus pinaster</i>
Poaceae		
		<i>?Amphipogon sp. (sterile)</i>
	*	<i>?Vulpia sp.</i>

Family	Status	Species
		<i>Austrostipa compressa</i>
		<i>Austrostipa flavescens</i>
		<i>Austrostipa sp.</i>
	*	<i>Avena barbata</i>
	*	<i>Briza maxima</i>
	*	<i>Bromus diandrus</i>
	*	<i>Bromus ?madritensis</i>
	*	<i>Cynodon dactylon</i>
	*	<i>Ehrharta calycina</i>
	*	<i>Ehrharta longiflora</i>
	*	<i>Hordeum sp.</i>
	*	<i>Lolium rigidum</i>
	*	<i>Lolium sp.</i>
	*	<i>Melinis repens</i>
		<i>Microlaena stipoides</i>
	*	<i>Pentameris airoides</i>
	*	<i>Pentameris pallida</i>
	*	<i>Vulpia myuros</i>
Polygalaceae		
		<i>Comesperma sp.</i>
Proteaceae		
		<i>Adenanthos cygnorum</i>
		<i>Banksia attenuata</i>
		<i>Banksia ilicifolia</i>
		<i>Banksia littoralis</i>
		<i>Banksia menziesii</i>
		<i>Hakea lissocarpha</i>
		<i>Persoonia saccata</i>
		<i>Petrophile linearis</i>
		<i>Petrophile macrostachya</i>
		<i>Stirlingia latifolia</i>
Restionaceae		
		<i>Alexgeorgea nitens</i>
		<i>Desmocladius fasciculatus</i>
		<i>Desmocladius flexuosus</i>
		<i>Dielsia stenostachya</i>
		<i>Hypolaena exsulca</i>
		<i>Leptocarpus scariosus</i>
Rubiaceae		
		<i>Opercularia hispidula</i>
		<i>Opercularia vaginata</i>
Rutaceae		
		<i>Cyanothamnus ramosus</i>
		<i>Philothea spicata</i>
Santalaceae		
		<i>Exocarpos sparteus</i>
Scrophulariaceae		
	*	<i>Dischisma capitatum</i>

Family	Status	Species
Stylidiaceae		<i>Levenhookia stipitata</i> <i>Stylidium androsaceum</i> <i>Stylidium araeophyllum</i> <i>Stylidium piliferum</i> <i>Stylidium repens</i>
Thymelaeaceae		<i>Pimelea sulphurea</i>
Violaceae		<i>Hybanthus floribundus</i>
Xanthorrhoeaceae		<i>Chamaescilla corymbosa</i> <i>Xanthorrhoea brunonis</i> <i>Xanthorrhoea preissii</i>
Zamiaceae		<i>Macrozamia fraseri</i>

*=non-native, DP=declared pest, PI=planted, WoNS=weed of national significance, P4=priority 4

Appendix D

Conservation Significant Communities and Likelihood of
Occurrence Assessment



Code	Community name	TEC/ PEC	Level of significance		Likelihood of occurrence
			State	EPBC Act	
SCP10a	Shrublands on dry clay flats	TEC	EN	CR	Unlikely
Mound Springs SCP	Assemblages of plants and invertebrate animals of tumulus (organic mound) springs of the Swan Coastal Plain	TEC	CR	EN	Unlikely
SCP20a	Banksia attenuata woodlands over species rich dense shrublands	TEC	EN	EN	Unlikely
SCP30a	Callitris preissii (or Melaleuca lanceolata) forests and woodlands, Swan Coastal Plain	TEC	VU	-	Unlikely
SCP26a	Melaleuca huegelii - Melaleuca systema shrublands on limestone ridges	TEC	EN	-	Unlikely
Banksia WL SCP	Banksia woodlands of the Swan Coastal Plain	TEC/ PEC	P3	EN	Recorded
SCP22	Banksia ilicifolia woodlands	TEC/ PEC	P3	EN	Unlikely
SCP21c	Low lying Banksia attenuata woodlands or shrublands	TEC/ PEC	P3	EN	Recorded
SCP23b	Swan Coastal Plain Banksia attenuata - Banksia menziesii woodlands	TEC/ PEC	P3	EN	Unlikely
	Tuart (Eucalyptus gomphocephala) woodlands and forests of the Swan Coastal Plain ecological community	TEC/ PEC	P3	CR	Unlikely
SCP29a	Coastal shrublands on shallow sands	PEC	P3	-	Unlikely
SCP24	Northern Spearwood shrublands and woodlands	PEC	P3	-	Unlikely
SCP25	Southern Eucalyptus gomphocephala-Agonis flexuosa woodlands	PEC	P3	-	Unlikely
Note: TEC=threatened ecological community, PEC=priority ecological community, CR=critically endangered, EN=endangered, VU=vulnerable, P3=priority 3					

Appendix E

Species x Plant Community Matrix



Species	Plant community														
	BaBm	BiAc	Cc	EmKg	EmXp	ErAc	ErAs	ErLb	HaRc	Kg	KgAl	Mp	Mt	Xp	opp
? <i>Amphipogon sp. (sterile)</i>		X													
? <i>Cerastium sp.</i>	X				X				X						
? <i>Vulpia sp.</i>											X				
<i>Acacia huegelii</i>	X	X							X						
<i>Acacia iteaphylla</i>								X							
<i>Acacia longifolia</i>	X	X	X	X			X		X	X	X				
<i>Acacia pulchella var. pulchella</i>	X	X									X				
<i>Acacia saligna</i>											X				
<i>Acacia sessilis</i>	X														
<i>Acacia willdenowiana</i>	X				X										
<i>Acacia pulchella var. glaberrima</i>															X
<i>Adenanthos cygnorum</i>	X	X				X			X	X		X			
<i>Alexgeorgea nitens</i>	X	X		X	X										
<i>Allocasuarina fraseriana</i>	X	X													
<i>Allocasuarina humilis</i>															X
<i>Anigozanthos manglesii</i>	X														
<i>Anigozanthos humilis</i>	X	X													
<i>Aotus gracillima</i>											X				
<i>Arctotheca calendula</i>	X														
<i>Arnocrinum preissii</i>	X														
<i>Asparagus asparagoides</i>															X
<i>Astartea scoparia</i>				X			X	X	X		X				
<i>Asteraceae sp.</i>	X								X		X				
<i>Austrostipa ?flavescens</i>											X				
<i>Austrostipa compressa</i>	X				X										
<i>Austrostipa flavescens</i>										X					
<i>Austrostipa sp.</i>						X			X						
<i>Avena barbata</i>							X								
<i>Banksia attenuata</i>	X				X										
<i>Banksia ilicifolia</i>		X		X					X						

Species	Plant community														
	BaBm	BiAc	Cc	EmKg	EmXp	ErAc	ErAs	ErLb	HaRc	Kg	KgAl	Mp	Mt	Xp	opp
<i>Conostylis juncea</i>	X								X						
<i>Conostylis setigera</i>															X
<i>Corymbia calophylla</i>			X												
<i>Corynotheca micrantha</i>	X	X										X		X	
<i>Crassula colorata</i>	X	X			X	X		X	X	X				X	
<i>Cyanothamnus ramosus</i>	X														
<i>Cynodon dactylon</i>		X							X						
<i>Dampiera linearis</i>	X	X		X				X	X		X			X	
<i>Dasygogon bromeliifolius</i>				X					X			X			
<i>Daviesia angulata</i>				X											
<i>Daviesia decurrens</i>	X								X						
<i>Daviesia nudiflora</i>	X														
<i>Daviesia physodes</i>															X
<i>Daviesia triflora</i>	X				X										
<i>Desmocladius fasciculatus</i>															X
<i>Desmocladius flexuosus</i>	X	X			X										
<i>Dianella revoluta</i>	X	X			X	X			X	X					
<i>Dielsia stenostachya</i>							X				X				
<i>Disa bracteata</i>	X				X			X			X				
<i>Dischisma capitatum</i>					X										
<i>Diuris corymbosa</i>	X			X											
<i>Diuris magnifica</i>															X
<i>Diuris sp.</i>								X							
<i>Drosera ?pallida</i>	X			X											
<i>Drosera erythrorhiza</i>	X			X	X										
<i>Drosera glanduligera</i>											X				
<i>Drosera pulchella</i>											X				
<i>Drosera sp. (climbing)</i>	X				X										
<i>Ehrharta calycina</i>	X	X	X	X	X	X		X	X	X		X	X	X	
<i>Ehrharta longiflora</i>	X	X	X		X		X	X	X	X	X		X		

Species	Plant community															
	BaBm	BiAc	Cc	EmKg	EmXp	ErAc	ErAs	ErLb	HaRc	Kg	KgAl	Mp	Mt	Xp	opp	
<i>Lepidosperma leptostachyum</i>								X								
<i>Lepidosperma longitudinale</i>			X													
<i>Lepidosperma pubisquameum</i>	X			X												
<i>Lepidosperma scabrum</i>	X															
<i>Lepidosperma striatum</i>								X								
<i>Leporella fimbriata</i>															X	
<i>Leptocarpus scariosus</i>															X	
<i>Leucopogon polymorphus</i>															X	
<i>Levenhookia stipitata</i>	X															
<i>Lobelia tenuior</i>	X															
<i>Lolium rigidum</i>															X	
<i>Lolium sp.</i>		X														
<i>Lomandra ?caespitosa</i>				X					X							
<i>Lomandra ?micrantha</i>		X														
<i>Lomandra ?odora</i>		X														
<i>Lomandra ?preissii</i>	X	X			X											
<i>Lomandra caespitosa</i>	X				X											
<i>Lomandra hermaphrodita</i>	X	X			X											
<i>Lomandra sericea</i>	X				X											
<i>Lomandra suaveolens</i>	X															
<i>Lotus angustissimus</i>													X			
<i>Lupinus cosentinii</i>					X											
<i>Lyginia barbata</i>	X	X						X	X		X	X				
<i>Macarthuria australis</i>		X														
<i>Machaerina juncea</i>															X	
<i>Machaerina vaginalis</i>											X					
<i>Macrozamia fraseri</i>	X	X	X	X	X									X		
<i>Melaleuca preissiana</i>				X			X	X	X		X	X				
<i>Melaleuca seriata</i>	X															
<i>Melaleuca teretifolia</i>								X					X			

Species	Plant community														
	BaBm	BiAc	Cc	EmKg	EmXp	ErAc	ErAs	ErLb	HaRc	Kg	KgAl	Mp	Mt	Xp	opp
<i>Pterostylis brevisepala</i>										X					
<i>Pterostylis sp.</i>	X										X				
<i>Pterostylis sp. (sterile)</i>											X				
<i>Pterostylis vittata</i>															X
<i>Ptilotus manglesii</i>															X
<i>Ptilotus polystachyus</i>					X										
<i>Pultenaea reticulata</i>				X		X				X	X				
<i>Pyrorchis nigricans</i>	X														
<i>Quinetia urvillei</i>	X														
<i>Regelia ciliata</i>				X		X			X			X			
<i>Regelia inops</i>	X								X		X				
<i>Romulea rosea</i>	X			X	X		X						X		
<i>Scaevola thesioides</i>															X
<i>Schoenus efoliatus</i>															X
<i>Scholtzia involucrata</i>	X	X		X					X	X					
<i>Siloxerus humifusus</i>															X
<i>Sixalix atropurpurea</i>															X
<i>Sonchus oleraceus</i>					X		X	X							
<i>Sowerbaea laxiflora</i>	X		X		X										
<i>Stirlingia latifolia</i>	X	X			X										
<i>Stylidium androsaceum</i>	X								X						
<i>Stylidium araeophyllum</i>	X														
<i>Stylidium piliferum</i>									X						
<i>Stylidium repens</i>	X	X		X				X	X						
<i>Styphelia conostephioides</i>	X	X							X						
<i>Styphelia sp (sterile)</i>															X
<i>Styphelia sp. (sterile)</i>	X														
<i>Thelymitra crinita</i>											X				
<i>Thelymitra macrophylla</i>															X
<i>Thelymitra sp.</i>					X						X				

Appendix F

Sample Data



Vegetation Sample Data

Various Lots, Marginiup

Sample Name:

Q1

Project no.: EP22-019

Date: 16/09/2022

Author: SCM,MS

Status: Permanent

Q1: Page 1 of 3

Quadrat and landform details

Sample type: quadrat

Size: 10 m x 10 m

NW corner easting: 390886.7525

NW corner northing: 6490097.178

Altitude (m): 65

Geographic datum/zone: GDA94/Zone 50

Soil water content: slightly damp

Landform: upper slope

Time since fire: no evidence

Disturbance: low - weeds

Soil type/texture sand/

Bare ground (%): 5

Rocks (%) and type: No rocks

Soil colour: white/grey

Litter: 5% (branches,twigs,leaves)

Vegetation condition: very good



Vegetation Sample Data

Various Lots, Marginiup

Sample Name: Q1

Project no.: EP22-019

Date: 16/09/2022

Author: SCM,MS

Status Permanent

Q1: Page 2 of 3

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
	<i>Acacia huegelii</i>	opp
	<i>Acacia pulchella</i> var. <i>pulchella</i>	opp
	<i>Acacia sessilis</i>	1
	<i>Adenanthos cygnorum</i>	2
	<i>Alexgeorgea nitens</i>	50
	<i>Anigozanthos humilis</i>	opp
	<i>Asteraceae</i> sp.	0.1
	<i>Austrostipa compressa</i>	0.1
	<i>Banksia attenuata</i>	opp
	<i>Banksia menziesii</i>	25
	<i>Bossiaea eriocarpa</i>	0.1
*	<i>Briza maxima</i>	0.1
	<i>Burchardia congesta</i>	0.1
	<i>Caladenia flava</i>	0.1
	<i>Conostephium pendulum</i>	opp
	<i>Conostylis aculeata</i> subsp. <i>cygnorum</i>	opp
	<i>Crassula colorata</i>	0.1
	<i>Cyanothamnus ramosus</i>	1
	<i>Daviesia decurrens</i>	1
	<i>Desmocladius flexuosus</i>	0.1
	<i>Dianella revoluta</i>	0.5
*	<i>Disa bracteata</i>	0.1
	<i>Drosera ?pallida</i>	0.1
	<i>Drosera erythrorhiza</i>	0.1
*	<i>Ehrharta calycina</i>	0.5
	<i>Eremaea pauciflora</i>	25
	<i>Eucalyptus todtiana</i>	opp
*	<i>Gladiolus caryophyllaceus</i>	0.1
	<i>Gompholobium tomentosum</i>	0.1
	<i>Haemodorum laxum</i>	0.1
	<i>Hibbertia hypericoides</i>	5
	<i>Hibbertia subvaginata</i>	opp
	<i>Hovea pungens</i>	0.1
	<i>Hyalosperma cotula</i>	opp
	<i>Hypocalymma robustum</i>	2
*	<i>Hypochaeris radicata</i>	0.1
*	<i>Iridaceae</i> sp.	0.1
	<i>Isolepis marginata</i>	opp
	<i>Jacksonia furcellata</i>	opp

Vegetation Sample Data

Various Lots, Marginiup

Sample Name:

Q1

Project no.: EP22-019

Date: 0/01/1900

Author: SCM,MS

Status Permanent

Q1: Page 3 of 3

* <i>Lactuca serriola</i>	0.1
<i>Lepidosperma ?calcicola</i>	0.1
<i>Lobelia tenuior</i>	opp
<i>Lomandra caespitosa</i>	0.1
<i>Lomandra hermaphrodita</i>	opp
<i>Lyginia barbata</i>	10
<i>Macrozamia fraseri</i>	1
<i>Nuytsia floribunda</i>	opp
* <i>Pelargonium capitatum</i>	opp
* <i>Pentameris airoides</i>	0.5
<i>Petrophile linearis</i>	0.1
<i>Phyllangium paradoxum</i>	0.1
<i>Pterostylis sp.</i>	0.1
<i>Pyrorchis nigricans</i>	0.1
<i>Quinetia urvillei</i>	opp
* <i>Romulea rosea</i>	0.1
<i>Scholtzia involucreta</i>	1
<i>Stirlingia latifolia</i>	opp
<i>Stylidium androsaceum</i>	opp
<i>Stylidium araeophyllum</i>	0.1
<i>Stylidium repens</i>	1
<i>Styphelia sp. (sterile)</i>	opp
<i>Thysanotus manglesianus</i>	0.1
<i>Trachymene pilosa</i>	0.1
* <i>Ursinia anthemoides</i>	0.1
* <i>Wahlenbergia capensis</i>	0.1
<i>Waitzia suavolens</i>	0.1
<i>Xanthosia huegelii</i>	opp

Vegetation Sample Data

Various Lots, Marginiup

Sample Name:

Q2

Project no.: EP22-019

Date: 16/09/2022

Author: SCM,MS

Status: Permanent

Q2: Page 1 of 2

Quadrat and landform details

Sample type: quadrat

Size: 10 m x 10 m

NW corner easting: 390955.1267

NW corner northing: 6489930.834

Altitude (m): 59

Geographic datum/zone: GDA94/Zone 50

Soil water content: slightly damp

Landform: mid-slope

Time since fire: no evidence

Disturbance: high - weeds

Soil type/texture sand/

Bare ground (%): 10

Rocks (%) and type: No rocks

Soil colour: white/grey

Litter: 1% (leaves,,)

Vegetation condition: very good



Vegetation Sample Data

Various Lots, Marginiup

Sample Name:

Q2

Project no.: EP22-019

Date: 16/09/2022

Author: SCM,MS

Status Permanent

Q2: Page 2 of 2

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
	* ? <i>Cerastium sp.</i>	0.1
	* <i>Acacia longifolia</i>	opp
	<i>Alexgeorgea nitens</i>	30
	<i>Asteraceae sp.</i>	0.1
	<i>Austrostipa compressa</i>	0.1
	<i>Banksia attenuata</i>	1
	<i>Bossiaea eriocarpa</i>	opp
	* <i>Briza maxima</i>	0.1
	<i>Burchardia congesta</i>	0.1
	<i>Conostephium pendulum</i>	1
	<i>Desmocladus flexuosus</i>	0.1
	* <i>Ehrharta calycina</i>	10
	<i>Gompholobium tomentosum</i>	0.1
	<i>Haemodorum spicatum</i>	opp
	* <i>Hypochaeris radicata</i>	0.1
	<i>Jacksonia floribunda</i>	opp
	<i>Jacksonia furcellata</i>	1
	<i>Kunzea glabrescens</i>	5
	<i>Laxmannia ramosa</i>	0.1
	<i>Lepidosperma pubisquameum</i>	opp
	<i>Lyginia barbata</i>	15
	<i>Macrozamia fraseri</i>	opp
	<i>Melaleuca seriata</i>	2
	* <i>Melinis repens</i>	1
	* <i>Monoculus monstrosus</i>	0.1
	<i>Patersonia occidentalis</i>	opp
	* <i>Pentameris airoides</i>	2
	<i>Petrophile linearis</i>	opp
	<i>Phlebocarya ciliata</i>	15
	<i>Podotheca gnaphalioides</i>	opp
	* <i>Romulea rosea</i>	0.1
	<i>Scholtzia involucreta</i>	5
	<i>Styphelia conostephioides</i>	opp
	* <i>Ursinia anthemoides</i>	opp
	* <i>Wahlenbergia capensis</i>	0.1
	<i>Xanthorrhoea preissii</i>	opp

Vegetation Sample Data

Various Lots, Marginiup

Sample Name:

R3

Project no.: EP22-019

Date: 16/09/2022

Author: SCM,MS

Status: Non-permanent

R3: Page 1 of 2

Quadrat and landform details

Sample type: releve

Size: other

NW corner easting: 390748.7865

NW corner northing: 6489935.415

Altitude (m): 52

Geographic datum/zone: GDA94/Zone 50

Soil water content: slightly damp

Landform: flat

Time since fire: no evidence

Disturbance: low - weeds

Soil type/texture sand/

Bare ground (%): 2

Rocks (%) and type: No rocks

Soil colour: white/grey

Litter: 5% (leaves,,)

Vegetation condition: very good



Vegetation Sample Data

Various Lots, Marginiup

Sample Name:

R3

Project no.: EP22-019

Date: 16/09/2022

Author: SCM,MS

Status Permanent

R3: Page 2 of 2

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
	* <i>Acacia longifolia</i>	
	<i>Alexgeorgea nitens</i>	
	<i>Astartea scoparia</i>	
	<i>Banksia ilicifolia</i>	
	<i>Bossiaea eriocarpa</i>	
	* <i>Briza maxima</i>	
	<i>Caladenia flava</i>	
	<i>Comesperma sp.</i>	
	<i>Dasypogon bromeliifolius</i>	
	<i>Daviesia angulata</i>	
	<i>Diuris corymbosa</i>	
	* <i>Ehrharta calycina</i>	
	<i>Eucalyptus marginata</i>	
	* <i>Gladiolus caryophyllaceus</i>	
	<i>Hypocalymma angustifolium</i>	
	* <i>Hypochaeris glabra</i>	
	* <i>Hypochaeris radicata</i>	
	<i>Isolepis marginata</i>	
	<i>Jacksonia furcellata</i>	
	<i>Lepidosperma pubisquameum</i>	
	<i>Lomandra ?caespitosa</i>	
	<i>Melaleuca preissiana</i>	
	<i>Opercularia vaginata</i>	
	<i>Patersonia occidentalis</i>	
	<i>Petrophile linearis</i>	
	<i>Phlebocarya ciliata</i>	
	<i>Pultanaea reticulata</i>	
	<i>Regelia ciliata</i>	
	* <i>Romulea rosea</i>	
	<i>Scholtzia involucreta</i>	
	<i>Stylidium repens</i>	
	<i>Trachymene pilosa</i>	
	* <i>Ursinia anthemoides</i>	
	<i>Xanthorrhoea preissii</i>	

Vegetation Sample Data

Various Lots, Marginiup

Sample Name:

Q4

Project no.: EP22-019

Date: 16/09/2022

Author: SCM,MS

Status: Permanent

Q4: Page 1 of 2

Quadrat and landform details

Sample type: quadrat

Size: 10 m x 10 m

NW corner easting: 390811.8507

NW corner northing: 6489796.398

Altitude (m): 52

Geographic datum/zone: GDA94/Zone 50

Soil water content: slightly damp

Landform: flat

Time since fire: > 5 yrs

Disturbance: low - weeds

Soil type/texture sand/

Bare ground (%): 0

Rocks (%) and type: No rocks

Soil colour: white/grey

Litter: % (leaves,twigs,branches)

Vegetation condition: very good



Vegetation Sample Data

Various Lots, Marginiup

Sample Name:

Q4

Project no.: EP22-019

Date: 16/09/2022

Author: SCM,MS

Status Permanent

Q4: Page 2 of 2

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
	* <i>Acacia longifolia</i>	2
	<i>Bossiaea eriocarpa</i>	1
	* <i>Briza maxima</i>	0.1
	<i>Caladenia flava</i>	0.1
	* <i>Carpobrotus edulis</i>	1
	<i>Conostephium pendulum</i>	1
	<i>Dampiera linearis</i>	opp
	<i>Dasypogon bromeliifolius</i>	10
	<i>Drosera ?pallida</i>	0.1
	<i>Drosera erythrorhiza</i>	opp
	<i>Eucalyptus marginata</i>	80
	* <i>Gladiolus caryophyllaceus</i>	opp
	<i>Gompholobium tomentosum</i>	0.1
	<i>Hibbertia racemosa</i>	opp
	<i>Hypolaena exsulca</i>	0.1
	<i>Jacksonia furcellata</i>	opp
	<i>Kunzea glabrescens</i>	opp
	<i>Lomandra ?caespitosa</i>	0.1
	<i>Macrozamia fraseri</i>	opp
	<i>Patersonia occidentalis</i>	0.1
	<i>Phlebocarya ciliata</i>	15
	<i>Pultanaea reticulata</i>	1
	<i>Scholtzia involucrata</i>	1
	<i>Trachymene pilosa</i>	opp
	* <i>Ursinia anthemoides</i>	opp
	<i>Xanthorrhoea preissii</i>	20

Vegetation Sample Data

Various Lots, Marginiup

Sample Name:

Q5

Project no.: EP22-019

Date: 16/09/2022

Author: SCM,MS

Status: Permanent

Q5: Page 1 of 3

Quadrat and landform details

Sample type: quadrat

Size: 10 m x 10 m

NW corner easting: 390631.0129

NW corner northing: 6489916.319

Altitude (m): 56

Geographic datum/zone: GDA94/Zone 50

Soil water content: slightly damp

Landform: upper slope

Time since fire: no evidence

Disturbance: moderate - weeds, clearing

Soil type/texture sand/

Bare ground (%): 5

Rocks (%) and type: No rocks

Soil colour: white/grey

Litter: 5% (leaves,,)

Vegetation condition: very good



Vegetation Sample Data

Various Lots, Marginiup

Sample Name: Q5

Project no.: EP22-019

Date: 16/09/2022

Status Permanent

Author: SCM,MS

Q5: Page 2 of 3

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
	<i>Acacia pulchella</i> var. <i>pulchella</i>	2
	<i>Adenanthos cygnorum</i>	5
	<i>Alexgeorgea nitens</i>	15
	<i>Anigozanthos humilis</i>	opp
	<i>Arnocrinum preissii</i>	opp
	<i>Austrostipa compressa</i>	0.1
	<i>Banksia attenuata</i>	20
	<i>Banksia menziesii</i>	opp
	<i>Beaufortia elegans</i>	1
	<i>Bossiaea eriocarpa</i>	2
*	<i>Briza maxima</i>	0.1
	<i>Caladenia flava</i>	opp
	<i>Calytrix angulata</i>	1
	<i>Chaetospora curvifolia</i>	2
	<i>Corynotheca micrantha</i>	opp
	<i>Crassula colorata</i>	0.1
	<i>Desmocladius flexuosus</i>	2
	<i>Dianella revoluta</i>	0.1
*	<i>Disa bracteata</i>	0.1
	<i>Drosera ?pallida</i>	0.1
*	<i>Ehrharta calycina</i>	0.1
*	<i>Gladiolus caryophyllaceus</i>	0.1
	<i>Gompholobium tomentosum</i>	1
	<i>Haemodorum spicatum</i>	0.1
	<i>Hensmania turbinata</i>	2
	<i>Hovea pungens</i>	1
*	<i>Hypochaeris radicata</i>	0.1
	<i>Kunzea glabrescens</i>	2
	<i>Laxmannia squarrosa</i>	opp
	<i>Lechenaultia floribunda</i>	0.1
	<i>Lobelia tenuior</i>	0.1
	<i>Lyginia barbata</i>	2
	<i>Macrozamia fraseri</i>	0.1
	<i>Microtis media</i>	0.1
	<i>Nuytsia floribunda</i>	0.1
	<i>Patersonia occidentalis</i>	1
*	<i>Pentameris airoides</i>	0.1
	<i>Regelia inops</i>	1
	<i>Scholtzia involucreta</i>	5

Vegetation Sample Data

Various Lots, Marginiup

Sample Name:

Q5

Project no.: EP22-019

Date: 16/09/2022

Author: SCM,MS

Status Permanent

Q5: Page 3 of 3

<i>Sowerbaea laxiflora</i>	1
<i>Stylidium araeophyllum</i>	0.1
<i>Stylidium repens</i>	2
<i>Styphelia conostephioides</i>	1
<i>Thysanotus sp.</i>	0.1
<i>Tricoryne elatior</i>	opp
* <i>Ursinia anthemoides</i>	0.1

Vegetation Sample Data

Various Lots, Marginiup

Sample Name:

R6

Project no.: EP22-019

Date: 16/09/2022

Author: SCM,MS

Status: Non-permanent

R6: Page 1 of 2

Quadrat and landform details

Sample type: releve

Size: other

NW corner easting: 390456.4225

NW corner northing: 6489848.95

Altitude (m): 49

Geographic datum/zone: GDA94/Zone 50

Soil water content: slightly damp

Landform: flat

Time since fire: no evidence

Disturbance: low - weeds

Soil type/texture sand/

Bare ground (%): 0

Rocks (%) and type: No rocks

Soil colour: white/grey

Litter: % (twigs,branches,leaves)

Vegetation condition: very good



Vegetation Sample Data

Various Lots, Marginiup

Sample Name:

R6

Project no.: EP22-019

Date: 16/09/2022

Author: SCM,MS

Status Permanent

R6: Page 2 of 2

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
*	<i>Acacia longifolia</i>	
	<i>Adenanthos cygnorum</i>	
*	<i>Briza maxima</i>	
*	<i>Carpobrotus edulis</i>	
	<i>Crassula colorata</i>	
	<i>Dianella revoluta</i>	
*	<i>Ehrharta longiflora</i>	
	<i>Eucalyptus rudis</i>	
	<i>Hypocalymma angustifolium</i>	
*	<i>Hypochoeris radicata</i>	
	<i>Isolepis marginata</i>	
	<i>Kunzea glabrescens</i>	
	<i>Pterostylis brevisepala</i>	
	<i>Pultanaea reticulata</i>	
*	<i>Ursinia anthemoides</i>	

Vegetation Sample Data

Various Lots, Marginiup

Sample Name: R7

Project no.: EP22-019

Date: 16/09/2022

Author: SCM,MS

Status: Non-permanent

R7: Page 1 of 2

Quadrat and landform details

Sample type: releve

Size: other

NW corner easting: 390719.0029

NW corner northing: 6490430.533

Altitude (m): 53

Geographic datum/zone: GDA94/Zone 50

Soil water content: slightly damp

Landform: flat

Time since fire: no evidence

Disturbance: low - weeds

Soil type/texture sand/loam with organic layer

Bare ground (%): 0

Rocks (%) and type: No rocks

Soil colour: grey/black

Litter: % (leaves,twigs,branches)

Vegetation condition: very good



Vegetation Sample Data

Various Lots, Marginiup

Sample Name:

R7

Project no.: EP22-019

Date: 16/09/2022

Author: SCM,MS

Status Permanent

R7: Page 2 of 2

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
	* <i>Acacia longifolia</i>	
	* <i>Briza maxima</i>	
	<i>Corymbia calophylla</i>	
	* <i>Ehrharta calycina</i>	
	* <i>Ehrharta longiflora</i>	
	<i>Eucalyptus rudis</i>	
	* <i>Gladiolus caryophyllaceus</i>	
	<i>Hardenbergia comptoniana</i>	
	<i>Hibbertia cuneiformis</i>	
	<i>Lepidosperma longitudinale</i>	
	<i>Macrozamia fraseri</i>	
	<i>Opercularia hispidula</i>	
	* <i>Pinus pinaster</i>	
	<i>Pteridium esculentum</i>	
	<i>Sowerbaea laxiflora</i>	
	<i>Xanthorrhoea preissii</i>	

Vegetation Sample Data

Various Lots, Marginiup

Sample Name:

Q8

Project no.: EP22-019

Date: 30/09/2022

Author: TAA,MS

Status Permanent

Q8: Page 1 of 3

Quadrat and landform details

Sample type: quadrat

Size: 10 m x 10 m

NW corner easting: 390097.456

NW corner northing: 6490812.169

Altitude (m): 50

Geographic datum/zone: GDA94/Zone 50

Soil water content: slightly damp

Landform: 0

Time since fire: > 5 yrs

Disturbance: moderate - roos rabbits

Soil type/texture sand/other

Bare ground (%): 10

Rocks (%) and type: No rocks

Soil colour: grey/brown

Litter: 5% (leaves,twigs,logs)

Vegetation condition: very good



Vegetation Sample Data

Various Lots, Marginiup

Sample Name:

Q8

Project no.: EP22-019

Date: 30/09/2022

Author: TAA,MS

Status Permanent

Q8: Page 2 of 3

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
	* ? <i>Cerastium</i> sp.	0.1
	<i>Acacia huegelii</i>	opp
	* <i>Acacia longifolia</i>	opp
	<i>Adenanthos cygnorum</i>	1
	<i>Astartea scoparia</i>	1
	<i>Asteraceae</i> sp.	opp
	<i>Austrostipa</i> sp.	opp
	* <i>Briza maxima</i>	0.1
	<i>Caladenia flava</i>	opp
	* <i>Carpobrotus edulis</i>	opp
	<i>Centrolepis drummondiana</i>	opp
	<i>Conostephium pendulum</i>	opp
	<i>Conostylis juncea</i>	opp
	<i>Crassula colorata</i>	opp
	* <i>Cynodon dactylon</i>	opp
	<i>Dampiera linearis</i>	opp
	<i>Dasypogon bromeliifolius</i>	1
	<i>Daviesia decurrens</i>	2
	* <i>Ehrharta calycina</i>	0.5
	* <i>Ehrharta longiflora</i>	opp
	<i>Eucalyptus rudis</i>	opp
	<i>Euchilopsis linearis</i>	0.1
	* <i>Gladiolus caryophyllaceus</i>	0.1
	<i>Gompholobium tomentosum</i>	0.5
	<i>Hyalosperma cotula</i>	opp
	<i>Hypocalymma angustifolium</i>	30
	* <i>Hypochoeris glabra</i>	0.1
	<i>Hypolaena exsulca</i>	5
	<i>Isolepis marginata</i>	opp
	<i>Jacksonia furcellata</i>	opp
	<i>Kunzea glabrescens</i>	opp
	<i>Lomandra ?caespitosa</i>	opp
	<i>Lyginia barbata</i>	1
	<i>Melaleuca preissiana</i>	5
	<i>Nuytsia floribunda</i>	opp
	<i>Patersonia occidentalis</i>	opp
	* <i>Pentameris pallida</i>	opp
	<i>Pericalymma ellipticum</i>	1
	<i>Philothea spicata</i>	opp

Vegetation Sample Data

Various Lots, Marginiup

Sample Name:

Q8

Project no.: EP22-019

Date: 30/09/2022

Author: TAA,MS

Status Permanent

Q8: Page 3 of 3

<i>Phlebocarya ciliata</i>	opp
<i>Podotheca gnaphalioides</i>	0.1
<i>Regelia ciliata</i>	30
<i>Regelia inops</i>	opp
<i>Scholtzia involucreta</i>	opp
<i>Stylidium androsaceum</i>	opp
<i>Stylidium piliferum</i>	opp
<i>Stylidium repens</i>	0.1
<i>Styphelia conostephioides</i>	opp
<i>Trachymene pilosa</i>	0.1
* <i>Ursinia anthemoides</i>	0.1
* <i>Wahlenbergia capensis</i>	0.1
<i>Xanthorrhoea preissii</i>	1

Vegetation Sample Data

Various Lots, Marginiup

Sample Name: Q9

Project no.: EP22-019

Date: 30/09/2022

Author: MS,TAA

Status Permanent

Q9: Page 1 of 3

Quadrat and landform details

Sample type: quadrat

Size: 10 m x 10 m

NW corner easting: 390208.2959

NW corner northing: 6490744.503

Altitude (m): 47

Geographic datum/zone: GDA94/Zone 50

Soil water content: slightly damp

Landform: 0

Time since fire: > 5 yrs

Disturbance: moderate - herbivory

Soil type/texture sand/sand

Bare ground (%): 5

Rocks (%) and type: No rocks

Soil colour: white/brown

Litter: 15% (leaves,twigs,branches)

Vegetation condition: very good



Vegetation Sample Data

Various Lots, Marginiup

Sample Name: Q9

Project no.: EP22-019

Date: 30/09/2022

Author: MS,TAA

Status Permanent

Q9: Page 2 of 3

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
	? <i>Amphipogon sp. (sterile)</i>	opp
	<i>Acacia huegelii</i>	0.1
*	<i>Acacia longifolia</i>	5
	<i>Acacia pulchella var. pulchella</i>	0.1
	<i>Adenanthos cygnorum</i>	15
	<i>Alexgeorgea nitens</i>	20
	<i>Allocasuarina fraseriana</i>	opp
	<i>Anigozanthos humilis</i>	opp
	<i>Banksia ilicifolia</i>	40
	<i>Banksia menziesii</i>	opp
	<i>Bossiaea eriocarpa</i>	opp
*	<i>Briza maxima</i>	1
*	<i>Bromus ?madridentis</i>	opp
	<i>Caladenia flava</i>	0.1
	<i>Calothamnus sp.</i>	opp
*	<i>Carpobrotus edulis</i>	0.5
	<i>Cartonema philydroides</i>	opp
	<i>Comesperma sp.</i>	opp
	<i>Conostylis aculeata</i>	0.1
	<i>Corynotheca micrantha</i>	1
	<i>Crassula colorata</i>	opp
*	<i>Cynodon dactylon</i>	opp
	<i>Dampiera linearis</i>	opp
	<i>Desmocladius flexuosus</i>	2
	<i>Dianella revoluta</i>	opp
*	<i>Ehrharta calycina</i>	1
*	<i>Ehrharta longiflora</i>	opp
	<i>Eremaea pauciflora</i>	opp
	<i>Eucalyptus todtiana</i>	opp
*	<i>Gladiolus caryophyllaceus</i>	0.1
	<i>Gompholobium tomentosum</i>	opp
	<i>Haemodorum spicatum</i>	opp
	<i>Hibbertia hypericoides</i>	opp
	<i>Hibbertia subvaginata</i>	opp
	<i>Hovea pungens</i>	opp
	<i>Hypocalymma robustum</i>	0.1
*	<i>Hypochaeris glabra</i>	0.1
	<i>Isolepis marginata</i>	opp
	<i>Jacksonia furcellata</i>	opp

Vegetation Sample Data

Various Lots, Marginiup

Sample Name:

Q9

Project no.: EP22-019

Date: 30/09/2022

Author: MS,TAA

Status Permanent

Q9: Page 3 of 3

<i>Kunzea glabrescens</i>	5
<i>Laxmannia squarrosa</i>	opp
<i>Lechenaultia biloba</i>	opp
* <i>Lolium sp.</i>	opp
<i>Lomandra ?micrantha</i>	opp
<i>Lomandra ?odora</i>	opp
<i>Lomandra ?preissii</i>	opp
<i>Lomandra hermaphrodita</i>	opp
<i>Lyginia barbata</i>	0.1
<i>Macarthuria australis</i>	1
<i>Macrozamia fraseri</i>	opp
<i>Melaleuca trichophylla</i>	opp
<i>Microlaena stipoides</i>	1
<i>Nuytsia floribunda</i>	opp
<i>Patersonia occidentalis</i>	opp
* <i>Pelargonium capitatum</i>	0.1
* <i>Pentameris airoides</i>	0.5
* <i>Pentameris pallida</i>	opp
<i>Petrophile linearis</i>	1
<i>Phlebocarya ciliata</i>	opp
<i>Podotheca gnaphalioides</i>	opp
<i>Scholtzia involucreta</i>	1
<i>Stirlingia latifolia</i>	opp
<i>Stylidium repens</i>	0.5
<i>Styphelia conostephioides</i>	opp
<i>Thysanotus manglesianus</i>	0.1
* <i>Ursinia anthemoides</i>	0.1
<i>Xanthorrhoea preissii</i>	opp

Vegetation Sample Data

Various Lots, Marginiup

Sample Name: Q10

Project no.: EP22-019

Date: 30/09/2022

Author: TAA,MS

Status Permanent

Q10: Page 1 of 3

Quadrat and landform details

Sample type: quadrat

Size: 10 m x 10 m

NW corner easting: 390398.0125

NW corner northing: 6490522.027

Altitude (m): 43

Geographic datum/zone: GDA94/Zone 50

Soil water content: dry

Landform: 0

Time since fire: > 5 yrs

Disturbance: low - roo tracks qca long

Soil type/texture loam/ with organic layer

Bare ground (%): 5

Rocks (%) and type: No rocks

Soil colour: brown/

Litter: 20% (leaves,twigs,)

Vegetation condition: very good



Vegetation Sample Data

Various Lots, Marginiup

Sample Name: Q10

Project no.: EP22-019

Date: 30/09/2022

Author: TAA,MS

Status Permanent

Q10: Page 2 of 3

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
	* ? <i>Vulpia</i> sp.	opp
	* <i>Acacia longifolia</i>	5
	<i>Acacia pulchella</i> var. <i>pulchella</i>	opp
	<i>Acacia saligna</i>	2
	<i>Aotus gracillima</i>	0.1
	<i>Astartea scoparia</i>	1
	<i>Asteraceae</i> sp.	opp
	<i>Austrostipa</i> ? <i>flavescens</i>	opp
	<i>Banksia littoralis</i>	opp
	* <i>Briza maxima</i>	opp
	<i>Caladenia flava</i>	opp
	<i>Caladenia</i> sp. (sterile)	opp
	* <i>Cicendia filiformis</i>	opp
	<i>Dampiera linearis</i>	0.1
	<i>Dielsia stenostachya</i>	opp
	* <i>Disa bracteata</i>	opp
	<i>Drosera glanduligera</i>	opp
	<i>Drosera pulchella</i>	0.1
	* <i>Ehrharta longiflora</i>	opp
	<i>Eriochilus</i> ? <i>dilatatus</i>	opp
	<i>Eucalyptus rudis</i>	5
	<i>Eutaxia virgata</i>	opp
	<i>Exocarpos sparteus</i>	1
	* <i>Gladiolus caryophyllaceus</i>	opp
	<i>Gompholobium tomentosum</i>	0.1
	<i>Hypocalymma angustifolium</i>	opp
	<i>Jacksonia furcellata</i>	1
	<i>Jacksonia sternbergiana</i>	0.1
	<i>Kennedia prostrata</i>	opp
	<i>Kunzea glabrescens</i>	30
	<i>Lyginia barbata</i>	opp
	<i>Machaerina vaginalis</i>	40
	<i>Melaleuca preissiana</i>	5
	<i>Microtis media</i>	0.1
	<i>Patersonia occidentalis</i>	opp
	<i>Pericalymma ellipticum</i>	1
	* <i>Pinus pinaster</i>	opp
	<i>Pterostylis</i> sp.	opp
	<i>Pterostylis</i> sp. (sterile)	opp

Vegetation Sample Data

Various Lots, Marginiup

Sample Name:

Q10

Project no.: EP22-019

Date: 30/09/2022

Author: TAA,MS

Status Permanent

Q10: Page 3 of 3

<i>Pultanaea reticulata</i>	5
<i>Regelia inops</i>	opp
<i>Thelymitra crinita</i>	opp
<i>Thelymitra sp.</i>	opp
* <i>Ursinia anthemoides</i>	opp

Vegetation Sample Data

Various Lots, Marginiup

Sample Name: Q11

Project no.: EP22-019

Date: 7/10/2022

Author: MS,TDP

Status Permanent

Q11: Page 1 of 3

Quadrat and landform details

Sample type: quadrat

Size: other

NW corner easting: 388579.5028

NW corner northing: 6491176.708

Altitude (m): 57

Geographic datum/zone: GDA94/Zone 50

Soil water content: slightly damp

Landform: mid-slope

Time since fire: no evidence

Disturbance: moderate - weeds, tracks

Soil type/texture loam/sand with organic layer

Bare ground (%): 5

Rocks (%) and type: No rocks

Soil colour: brown/white

Litter: 10% (leaves,logs,twigs)

Vegetation condition: very good



Vegetation Sample Data

Various Lots, Marginiup

Sample Name: Q11

Project no.: EP22-019

Date: 7/10/2022

Author: MS,TDP

Status Permanent

Q11: Page 2 of 3

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
	<i>Acacia huegelii</i>	1
	* <i>Acacia longifolia</i>	opp
	<i>Acacia wildenowiana</i>	0.1
	<i>Adenanthos cygnorum</i>	opp
	<i>Alexgeorgea nitens</i>	0.1
	<i>Allocasuarina fraseriana</i>	10
	<i>Anigozanthos manglesii</i>	1
	* <i>Arctotheca calendula</i>	opp
	<i>Austrostipa compressa</i>	0.1
	<i>Banksia attenuata</i>	25
	<i>Bossiaea eriocarpa</i>	0.1
	* <i>Briza maxima</i>	0.1
	<i>Burchardia congesta</i>	0.1
	* <i>Carpobrotus edulis</i>	0.1
	<i>Chamaescilla corymbosa</i>	0.1
	* <i>Chamelaucium uncinatum</i>	opp
	<i>Conostephium pendulum</i>	1
	<i>Conostylis aculeata</i>	0.1
	<i>Conostylis juncea</i>	0.1
	<i>Dampiera linearis</i>	0.1
	<i>Daviesia nudiflora</i>	opp
	<i>Daviesia triflora</i>	0.1
	<i>Desmocladius flexuosus</i>	2
	<i>Dianella revoluta</i>	0.1
	<i>Diuris corymbosa</i>	0.1
	<i>Drosera erythrorhiza</i>	0.1
	<i>Drosera sp. (climbing)</i>	0.1
	* <i>Ehrharta calycina</i>	3
	* <i>Ehrharta longiflora</i>	1
	<i>Eucalyptus marginata</i>	opp
	* <i>Gladiolus caryophyllaceus</i>	0.1
	<i>Gompholobium tomentosum</i>	1
	<i>Haemodorum ?spicatum</i>	0.1
	<i>Haemodorum laxum</i>	0.1
	<i>Hardenbergia comptoniana</i>	0.1
	<i>Hibbertia hypericoides</i>	7
	<i>Hibbertia racemosa</i>	opp
	* <i>Hordeum sp.</i>	opp
	<i>Hovea trisperma</i>	0.1

Vegetation Sample Data

Various Lots, Marginiup

Sample Name:

Q11

Project no.: EP22-019

Date: 7/10/2022

Author: MS,TDP

Status Permanent

Q11: Page 3 of 3

<i>Hypocalymma robustum</i>	1
* <i>Hypochaeris glabra</i>	0.1
* <i>Hypochaeris radicata</i>	0.1
<i>Isotropis cuneifolia</i>	0.1
<i>Jacksonia furcellata</i>	15
<i>Jacksonia sericea</i>	opp
<i>Jacksonia sternbergiana</i>	2
<i>Kennedia prostrata</i>	opp
<i>Kunzea glabrescens</i>	1
<i>Lepidosperma ?calicicola</i>	0.1
<i>Lepidosperma scabrum</i>	0.1
<i>Levenhookia stipitata</i>	0.1
<i>Lomandra ?preissii</i>	0.1
<i>Lomandra hermaphrodita</i>	0.1
<i>Lomandra sericea</i>	0.1
<i>Lomandra suaveolens</i>	0.1
<i>Lyginia barbata</i>	0.1
<i>Mesomelaena pseudostygia</i>	1
<i>Microtis media</i>	0.1
<i>Opercularia vaginata</i>	opp
<i>Orthrosanthus laxus</i>	0.1
* <i>Pentameris airoides</i>	0.1
<i>Petrophile linearis</i>	0.1
<i>Petrophile macrostachya</i>	opp
<i>Podotheca gnaphalioides</i>	0.1
<i>Pyrorchis nigricans</i>	0.1
<i>Sowerbaea laxiflora</i>	0.1
<i>Stirlingia latifolia</i>	0.1
<i>Stylidium androsaceum</i>	0.1
<i>Thysanotus manglesianus</i>	0.1
<i>Trachymene pilosa</i>	0.1
<i>Tricoryne elatior</i>	0.1
* <i>Ursinia anthemoides</i>	0.1
<i>Xanthorrhoea preissii</i>	10

Vegetation Sample Data

Various Lots, Marginiup

Sample Name:

Q12

Project no.: EP22-019

Date: 7/10/2022

Author: MS,TDP

Status: Permanent

Q12: Page 1 of 3

Quadrat and landform details

Sample type: quadrat

Size: 10 m x 10 m

NW corner easting: 389102.1371

NW corner northing: 6490456.196

Altitude (m): 54

Geographic datum/zone: GDA94/Zone 50

Soil water content: slightly damp

Landform: mid-slope

Time since fire: > 5 yrs

Disturbance: moderate - weeds, tracks

Soil type/texture loam/sand with organic layer

Bare ground (%): 8

Rocks (%) and type: No rocks

Soil colour: brown/yellow

Litter: 5% (leaves,twigs,branches)

Vegetation condition: very good

No photo available

Vegetation Sample Data

Various Lots, Marginiup

Sample Name:

Q12

Project no.: EP22-019

Date: 7/10/2022

Author: MS,TDP

Status Permanent

Q12: Page 2 of 3

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
	<i>Acacia wildenowiana</i>	0.1
	<i>Alexgeorgea nitens</i>	opp
	<i>Austrostipa compressa</i>	0.1
	<i>Bossiaea eriocarpa</i>	0.1
*	<i>Briza maxima</i>	0.1
	<i>Burchardia congesta</i>	0.1
	<i>Cartonema philydroides</i>	0.1
	<i>Conostylis aculeata</i>	0.1
	<i>Desmocladus flexuosus</i>	1
	<i>Dianella revoluta</i>	0.1
*	<i>Disa bracteata</i>	0.1
	<i>Drosera sp. (climbing)</i>	0.1
*	<i>Ehrharta calycina</i>	5
	<i>Eucalyptus marginata</i>	30
*	<i>Gladiolus caryophyllaceus</i>	0.1
	<i>Haemodorum paniculatum</i>	opp
	<i>Hardenbergia comptoniana</i>	0.1
	<i>Hibbertia hypericoides</i>	2
	<i>Hybanthus floribundus</i>	opp
	<i>Hypocalymma robustum</i>	1
*	<i>Hypochaeris glabra</i>	0.1
	<i>Jacksonia furcellata</i>	opp
	<i>Jacksonia sternbergiana</i>	1
	<i>Lomandra ?preissii</i>	0.1
	<i>Lomandra hermaphrodita</i>	opp
	<i>Lomandra sericea</i>	0.1
*	<i>Lupinus consentinii</i>	opp
	<i>Macrozamia fraseri</i>	opp
	<i>Mesomelaena pseudostygia</i>	1
	<i>Mesomelaena tetragona</i>	1
	<i>Monotaxis grandiflora</i>	0.1
*	<i>Olea europaea</i>	opp
	<i>Patersonia occidentalis</i>	1
*	<i>Pentameris airoides</i>	0.1
	<i>Persoonia saccata</i>	opp
	<i>Petrophile linearis</i>	0.1
	<i>Podotheca gnaphalioides</i>	0.1
*	<i>Romulea rosea</i>	0.1
	<i>Sowerbaea laxiflora</i>	0.1



Vegetation Sample Data

Various Lots, Marginiup

Sample Name: Q12

Project no.: EP22-019

Date: 7/10/2022

Author: MS,TDP

Status Permanent

Q12: Page 3 of 3

<i>Stirlingia latifolia</i>	0.1
<i>Tricoryne elatior</i>	opp
* <i>Ursinia anthemoides</i>	0.1
<i>Xanthorrhoea preissii</i>	60

Vegetation Sample Data

Various Lots, Marginiup

Sample Name: Q13

Project no.: EP22-019

Date: 7/10/2022

Author: MS,TDP

Status Permanent

Q13: Page 1 of 3

Quadrat and landform details

Sample type: quadrat

Size: 10 m x 10 m

NW corner easting: 389227.2757

NW corner northing: 6490319.186

Altitude (m): 50

Geographic datum/zone: GDA94/Zone 50

Soil water content: slightly damp

Landform: mid-slope

Time since fire: no evidence

Disturbance: moderate - weeds, tracks

Soil type/texture sand/loam with organic layer

Bare ground (%): 8

Rocks (%) and type: No rocks

Soil colour: white/brown

Litter: 5% (leaves,twigs,branches)

Vegetation condition: very good



Vegetation Sample Data

Various Lots, Marginiup

Sample Name: Q13

Project no.: EP22-019

Date: 7/10/2022

Author: MS,TDP

Status Permanent

Q13: Page 2 of 3

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
	* ? <i>Cerastium sp.</i>	0.1
	<i>Acacia wildenowiana</i>	0.1
	<i>Alexgeorgea nitens</i>	1
	<i>Banksia attenuata</i>	opp
	<i>Banksia menziesii</i>	5
	* <i>Briza maxima</i>	opp
	<i>Burchardia congesta</i>	0.1
	<i>Caladenia flava</i>	0.1
	<i>Crassula colorata</i>	0.1
	<i>Daviesia triflora</i>	1
	<i>Desmodcladus flexuosus</i>	1
	* <i>Disa bracteata</i>	0.1
	* <i>Dischisma capitatum</i>	opp
	<i>Drosera erythrorhiza</i>	0.1
	<i>Drosera sp. (climbing)</i>	0.1
	* <i>Ehrharta calycina</i>	1
	* <i>Ehrharta longiflora</i>	0.1
	<i>Eremaea pauciflora</i>	opp
	<i>Eucalyptus marginata</i>	40
	* <i>Gladiolus caryophyllaceus</i>	0.1
	<i>Gompholobium tomentosum</i>	0.1
	<i>Haemodorum laxum</i>	opp
	<i>Hardenbergia comptoniana</i>	0.1
	<i>Hibbertia huegelii</i>	opp
	<i>Hibbertia hypericoides</i>	5
	* <i>Hypochaeris glabra</i>	0.1
	<i>Hypolaena exsulca</i>	0.1
	<i>Jacksonia sternbergiana</i>	3
	<i>Kunzea glabrescens</i>	opp
	<i>Lepidosperma calcicola</i>	opp
	<i>Lomandra caespitosa</i>	0.1
	<i>Lomandra hermaphrodita</i>	0.1
	<i>Lomandra sericea</i>	0.1
	* <i>Lupinus consentinii</i>	opp
	<i>Macrozamia fraseri</i>	
	<i>Mesomelaena pseudostygia</i>	
	<i>Monotaxis grandiflora</i>	
	*DP <i>Moraea flaccida</i>	
	<i>Patersonia occidentalis</i>	

Vegetation Sample Data

Various Lots, Marginiup

Sample Name:

Q13

Project no.: EP22-019

Date: 7/10/2022

Author: MS,TDP

Status Permanent

Q13: Page 2 of 3

* <i>Pentameris airoides</i>	0.5
<i>Petrophile linearis</i>	0.1
<i>Podotheca gnaphalioides</i>	0.1
<i>Ptilotus polystachyus</i>	opp
* <i>Romulea rosea</i>	0.1
* <i>Sonchus oleraceus</i>	0.1
<i>Sowerbaea laxiflora</i>	0.1
<i>Thelymitra sp.</i>	0.1
<i>Tricoryne elatior</i>	opp
* <i>Ursinia anthemoides</i>	0.1
* <i>Wahlenbergia capensis</i>	0.1
<i>Xanthorrhoea preissii</i>	80

Vegetation Sample Data

Various Lots, Marginiup

Sample Name: Q14

Project no.: EP22-019

Date: 18/10/2022

Author: MS,ASF

Status Permanent

Q14: Page 1 of 2

Quadrat and landform details

Sample type: quadrat

Size: 10 m x 10 m

NW corner easting: 389522.0749

NW corner northing: 6490904.805

Altitude (m): 55

Geographic datum/zone: GDA94/Zone 50

Soil water content: slightly damp

Landform: flat

Time since fire: no evidence

Disturbance: moderate - weeds, tracks

Soil type/texture sand/loam

Bare ground (%): 10

Rocks (%) and type: No rocks

Soil colour: brown/white

Litter: 15% (logs,twigs,leaves)

Vegetation condition: very good



Vegetation Sample Data

Various Lots, Marginiup

Sample Name: Q14

Project no.: EP22-019

Date: 18/10/2022

Author: MS,ASF

Status Permanent

Q14: Page 2 of 2

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
	* <i>Acacia iteaphylla</i>	opp
	<i>Astartea scoparia</i>	3
	<i>Banksia menziesii</i>	opp
	* <i>Briza maxima</i>	0.5
	* <i>Bromus diandrus</i>	0.1
	* <i>Carpobrotus edulis</i>	3
	<i>Cartonema philydroides</i>	0.1
	<i>Crassula colorata</i>	0.1
	<i>Dampiera linearis</i>	0.1
	* <i>Disa bracteata</i>	0.1
	<i>Diuris sp.</i>	0.1
	* <i>Ehrharta calycina</i>	0.1
	* <i>Ehrharta longiflora</i>	0.1
	<i>Eucalyptus rudis</i>	35
	<i>Exocarpos sparteus</i>	15
	* <i>Gladiolus caryophyllaceus</i>	0.1
	* <i>Hypochaeris glabra</i>	0.1
	* <i>Hypochaeris radicata</i>	0.1
	<i>Hypolaena exsulca</i>	2
	<i>Jacksonia furcellata</i>	5
	* <i>Lactuca serriola</i>	0.1
	<i>Lepidosperma leptostachyum</i>	70
	<i>Lepidosperma striatum</i>	0.1
	<i>Lyginia barbata</i>	opp
	<i>Melaleuca preissiana</i>	opp
	<i>Melaleuca teretifolia</i>	1
	<i>Microtis media</i>	opp
	<i>Nuytsia floribunda</i>	opp
	* <i>Pentameris airoides</i>	0.1
	<i>Podotheca gnaphalioides</i>	0.1
	* <i>Sonchus oleraceus</i>	0.1
	<i>Stylidium repens</i>	0.1
	* <i>Ursinia anthemoides</i>	0.5
	<i>Verticordia densiflora</i>	0.1

Vegetation Sample Data

Various Lots, Marginiup

Sample Name: Q15

Project no.: EP22-019

Date: 18/10/2022

Author: MS,ASF

Status Permanent

Q15: Page 1 of 2

Quadrat and landform details

Sample type: quadrat

Size: 10 m x 10 m

NW corner easting: 388720.7417

NW corner northing: 6490461.738

Altitude (m): 46

Geographic datum/zone: GDA94/Zone 50

Soil water content: slightly damp

Landform: lower slope

Time since fire: no evidence

Disturbance: moderate - weeds, tracks

Soil type/texture sand/loam

Bare ground (%): 13

Rocks (%) and type: No rocks

Soil colour: grey/brown

Litter: 5% (leaves,twigs,branches)

Vegetation condition: very good



Vegetation Sample Data

Various Lots, Marginiup

Sample Name: Q15

Project no.: EP22-019

Date: 18/10/2022

Author: MS,ASF

Status Permanent

Q15: Page 2 of 2

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
	* <i>Acacia longifolia</i>	0.1
	<i>Adenanthos cygnorum</i>	5
	<i>Astartea scoparia</i>	2
	<i>Banksia ilicifolia</i>	opp
	* <i>Briza maxima</i>	0.1
	* <i>Carpobrotus edulis</i>	3
	<i>Crassula colorata</i>	0.1
	<i>Dampiera linearis</i>	1
	<i>Dianella revoluta</i>	1
	* <i>Ehrharta calycina</i>	1
	* <i>Ehrharta longiflora</i>	0.1
	<i>Eucalyptus rudis</i>	opp
	* <i>Gladiolus caryophyllaceus</i>	opp
	<i>Hypocalymma angustifolium</i>	60
	* <i>Hypochaeris glabra</i>	0.1
	* <i>Hypochaeris radicata</i>	0.1
	<i>Hypolaena exsulca</i>	opp
	<i>Isolepis marginata</i>	0.1
	<i>Melaleuca preissiana</i>	5
	* <i>Pentameris airoides</i>	0.1
	<i>Podotheca gnaphalioides</i>	opp
	<i>Regelia ciliata</i>	40
	<i>Xanthorrhoea preissii</i>	2

Vegetation Sample Data

Various Lots, Marginiup

Sample Name:

R16

Project no.: EP22-019

Date: 18/10/2022

Author: MS,ASF

Status Non-permanent

R16: Page 1 of 2

Quadrat and landform details

Sample type: releve

Size: other

NW corner easting: 388912.87

NW corner northing: 6490422.899

Altitude (m): 54

Geographic datum/zone: GDA94/Zone 50

Soil water content: dry

Landform: mid-slope

Time since fire: no evidence

Disturbance: moderate - weeds, clearing

Soil type/texture sand/

Bare ground (%): 0

Rocks (%) and type: No rocks

Soil colour: /

Litter: % (,,)

Vegetation condition: very good



Vegetation Sample Data

Various Lots, Marginiup

Sample Name:

R16

Project no.: EP22-019

Date: 18/10/2022

Author: MS,ASF

Status Permanent

R16: Page 2 of 2

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
	* <i>Briza maxima</i>	
	<i>Cartonema philydroides</i>	
	<i>Corynotheca micrantha</i>	
	<i>Crassula colorata</i>	
	<i>Dampiera linearis</i>	
	* <i>Ehrharta calycina</i>	
	<i>Eucalyptus todtiana</i>	
	* <i>Gladiolus caryophyllaceus</i>	
	<i>Gompholobium tomentosum</i>	
	<i>Haemodorum spicatum</i>	
	<i>Hypocalymma robustum</i>	
	<i>Jacksonia furcellata</i>	
	<i>Lechenaultia biloba</i>	
	<i>Macrozamia fraseri</i>	
	<i>Nuytsia floribunda</i>	
	<i>Patersonia occidentalis</i>	
	* <i>Pentameris airoides</i>	
	<i>Petrophile linearis</i>	
	<i>Podotheca gnaphalioides</i>	
	* <i>Ursinia anthemoides</i>	
	<i>Xanthorrhoea preissii</i>	

Vegetation Sample Data

Various Lots, Marginiup

Sample Name: R17

Project no.: EP22-019

Date: 18/10/2022

Author: MS,ASF

Status Non-permanent

R17: Page 1 of 2

Quadrat and landform details

Sample type: releve

Size: other

NW corner easting: 388912.87

NW corner northing: 6490422.899

Altitude (m): 48

Geographic datum/zone: GDA94/Zone 50

Soil water content: dry

Landform: lower slope

Time since fire: no evidence

Disturbance: moderate - weeds, clearing

Soil type/texture sand/

Bare ground (%): 0

Rocks (%) and type: No rocks

Soil colour: /

Litter: % (,,)

Vegetation condition: very good



Vegetation Sample Data

Various Lots, Marginiup

Sample Name:

R17

Project no.: EP22-019

Date: 18/10/2022

Author: MS,ASF

Status Permanent

R17: Page 2 of 2

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
	<i>Adenanthos cygnorum</i>	
	<i>Austrostipa</i> sp.	
*	<i>Briza maxima</i>	
*	<i>Carpobrotus edulis</i>	
	<i>Crassula colorata</i>	
	<i>Dianella revoluta</i>	
*	<i>Ehrharta calycina</i>	
	<i>Eucalyptus rudis</i>	
*	<i>Gladiolus caryophyllaceus</i>	
	<i>Hypocalymma angustifolium</i>	
*	<i>Hypochaeris glabra</i>	
	<i>Isolepis marginata</i>	
	<i>Jacksonia furcellata</i>	
	<i>Kunzea glabrescens</i>	
	<i>Nuytsia floribunda</i>	
	<i>Podotrochea gnaphalioides</i>	
	<i>Pultanaea reticulata</i>	
	<i>Regelia ciliata</i>	
	<i>Trachymene pilosa</i>	
*	<i>Ursinia anthemoides</i>	
*	<i>Vulpia myuros</i>	

Vegetation Sample Data

Various Lots, Marginiup

Sample Name: R18

Project no.: EP22-019

Date: 18/10/2022

Author: MS,ASF

Status Non-permanent

R18: Page 1 of 2

Quadrat and landform details

Sample type: releve

Size: other

NW corner easting: 388912.87

NW corner northing: 6490422.899

Altitude (m): 48

Geographic datum/zone: GDA94/Zone 50

Soil water content: dry

Landform: lower slope

Time since fire: no evidence

Disturbance: moderate - weeds, clearing

Soil type/texture sand/

Bare ground (%): 0

Rocks (%) and type: No rocks

Soil colour: /

Litter: % (,,)

Vegetation condition: very good



Vegetation Sample Data

Various Lots, Marginiup

Sample Name:

R18

Project no.: EP22-019

Date: 18/10/2022

Author: MS,ASF

Status Permanent

R18: Page 2 of 2

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
	* <i>Briza maxima</i>	
	* <i>Bromus diandrus</i>	
	* <i>Carpobrotus edulis</i>	
	<i>Cartonema philydroides</i>	
	* <i>Ehrharta calycina</i>	
	* <i>Ehrharta longiflora</i>	
	* <i>Erodium botrys</i>	
	<i>Exocarpos sparteus</i>	
	* <i>Hypochaeris glabra</i>	
	* <i>Lotus angustissimus</i>	
	<i>Melaleuca teretifolia</i>	
	* <i>Pentameris airoides</i>	
	* <i>Romulea rosea</i>	
	* <i>Trifolium campestre</i>	
	* <i>Ursinia anthemoides</i>	

Vegetation Sample Data

Various Lots, Marginiup

Sample Name: R19

Project no.: EP22-019

Date: 18/10/2022

Author: MS,ASF

Status Non-permanent

R19: Page 1 of 2

Quadrat and landform details

Sample type: releve

Size: other

NW corner easting: 388912.87

NW corner northing: 6490422.899

Altitude (m): 48

Geographic datum/zone: GDA94/Zone 50

Soil water content: dry

Landform: lower slope

Time since fire: no evidence

Disturbance: moderate - weeds, clearing

Soil type/texture sand/

Bare ground (%): 0

Rocks (%) and type: No rocks

Soil colour: /

Litter: % (,,)

Vegetation condition: very good



Vegetation Sample Data

Various Lots, Marginiup

Sample Name:

R19

Project no.: EP22-019

Date: 18/10/2022

Author: MS,ASF

Status Permanent

R19: Page 2 of 2

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
	<i>Adenanthos cygnorum</i>	
*	<i>Briza maxima</i>	
*	<i>Carpobrotus edulis</i>	
	<i>Corynotheca micrantha</i>	
	<i>Dasypogon bromeliifolius</i>	
*	<i>Ehrharta calycina</i>	
	<i>Eucalyptus rudis</i>	
*	<i>Gladiolus caryophyllaceus</i>	
	<i>Haemodorum laxum</i>	
	<i>Haemodorum spicatum</i>	
	<i>Hypolaena exsulca</i>	
	<i>Lechenaultia biloba</i>	
	<i>Lyginia barbata</i>	
	<i>Melaleuca preissiana</i>	
	<i>Opercularia vaginata</i>	
	<i>Patersonia occidentalis</i>	
*	<i>Pentameris airoides</i>	
	<i>Phlebocarya ciliata</i>	
	<i>Regelia ciliata</i>	
*	<i>Ursinia anthemoides</i>	
	<i>Xanthorrhoea preissii</i>	

Vegetation Sample Data

Various Lots, Marginiup

Sample Name: R20

Project no.: EP22-019

Date: 18/10/2022

Author: MS,ASF

Status: Non-permanent

R20: Page 1 of 2

Quadrat and landform details

Sample type: releve

Size: other

NW corner easting: 388912.87

NW corner northing: 6490422.899

Altitude (m): 48

Geographic datum/zone: GDA94/Zone 50

Soil water content: dry

Landform: lower slope

Time since fire: no evidence

Disturbance: moderate - weeds, clearing

Soil type/texture sand/

Bare ground (%): 0

Rocks (%) and type: No rocks

Soil colour: /

Litter: % (,,)

Vegetation condition: very good



Vegetation Sample Data

Various Lots, Marginiup

Sample Name:

R20

Project no.: EP22-019

Date: 18/10/2022

Author: MS,ASF

Status Permanent

R20: Page 2 of 2

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
*	<i>Acacia longifolia</i>	
	<i>Astartea scoparia</i>	
*	<i>Avena barbata</i>	
*	<i>Briza maxima</i>	
*	<i>Bromus diandrus</i>	
	<i>Dielsia stenostachya</i>	
*	<i>Ehrharta longiflora</i>	
	<i>Eucalyptus rudis</i>	
*	<i>Gladiolus caryophyllaceus</i>	
	<i>Hibbertia cuneiformis</i>	
	<i>Kunzea glabrescens</i>	
	<i>Melaleuca preissiana</i>	
*	<i>Pinus pinaster</i>	
*	<i>Romulea rosea</i>	
*	<i>Sonchus oleraceus</i>	

Vegetation Sample Data

Various Lots, Marginiup

Sample Name:

R21

Project no.: EP22-019

Date: 18/10/2022

Author: MS,ASF

Status: Non-permanent

R21: Page 1 of 2

Quadrat and landform details

Sample type: releve

Size: other

NW corner easting: 388912.87

NW corner northing: 6490422.899

Altitude (m): 48

Geographic datum/zone: GDA94/Zone 50

Soil water content: dry

Landform: lower slope

Time since fire: no evidence

Disturbance: moderate - weeds, clearing

Soil type/texture sand/

Bare ground (%): 0

Rocks (%) and type: No rocks

Soil colour: /

Litter: % (,,)

Vegetation condition: very good

No photo available

Vegetation Sample Data

Various Lots, Marginiup

Sample Name:

R21

Project no.: EP22-019

Date: 18/10/2022

Author: MS,ASF

Status Permanent

R21: Page 2 of 2

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
	<i>Adenanthos cygnorum</i>	
	<i>Austrostipa flavescens</i>	
*	<i>Briza maxima</i>	
*	<i>Carpobrotus edulis</i>	
	<i>Crassula colorata</i>	
	<i>Dianella revoluta</i>	
*	<i>Ehrharta calycina</i>	
	<i>Eucalyptus rudis</i>	
*	<i>Gladiolus caryophyllaceus</i>	
	<i>Hibbertia subvaginata</i>	
	<i>Isolepis marginata</i>	
	<i>Kunzea glabrescens</i>	
*	<i>Pentameris airoides</i>	
	<i>Phlebocarya ciliata</i>	
	<i>Scholtzia involucreta</i>	
*	<i>Ursinia anthemoides</i>	
	<i>Xanthorrhoea preissii</i>	

Appendix G

Cluster Dendrograms



Group average

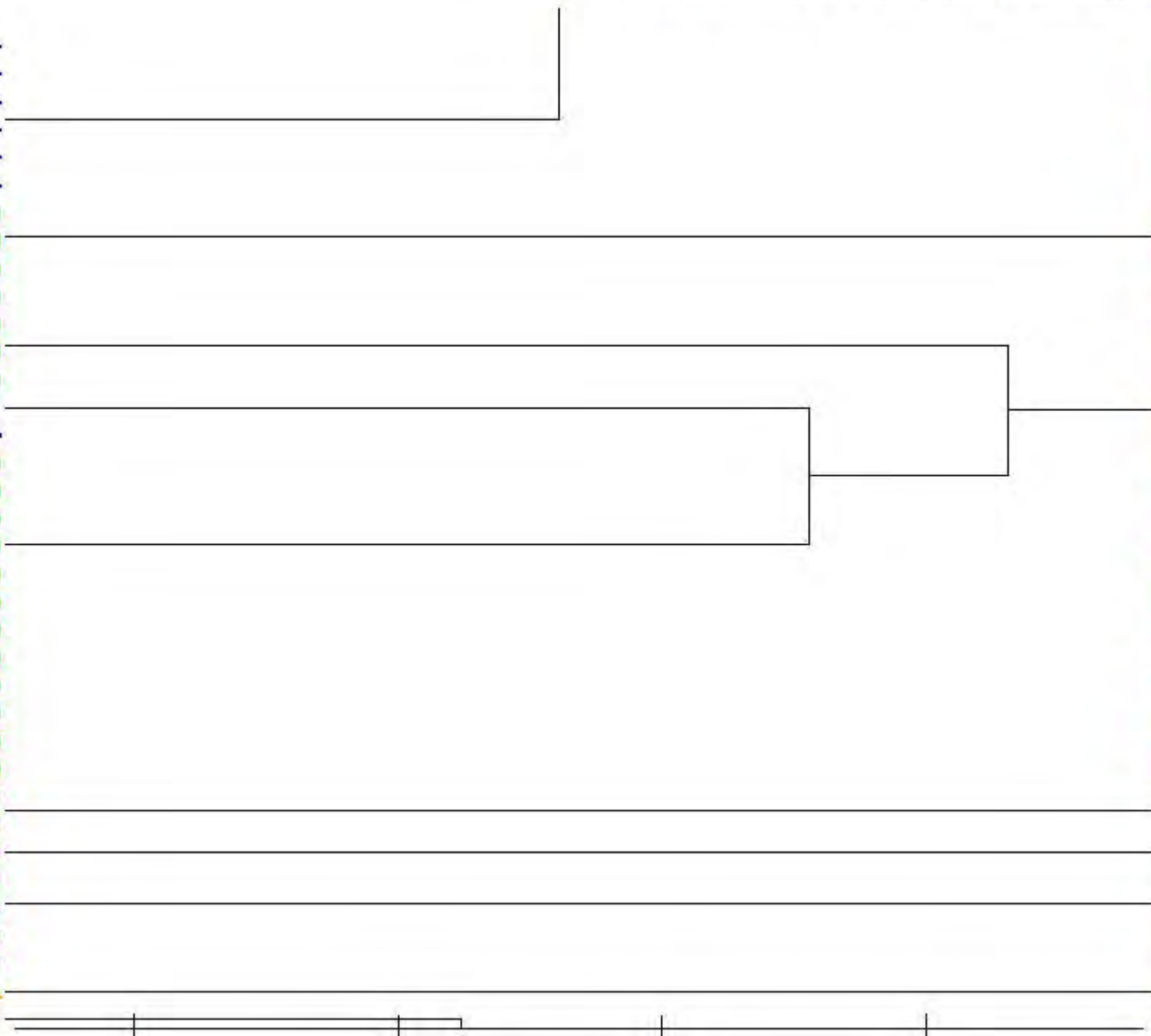
Resemblance: S17 Bray Curtis similarity

FCT

- | | |
|-------|-------|
| ▲ 1a | ▼ 3b |
| ▼ 1b | ◻ 10a |
| ■ 2 | ◇ 25 |
| ◆ 4 | ○ 12 |
| ● 20a | ▲ 6 |
| + 7 | ▼ 26a |
| × 11 | ■ 17 |
| * 5 | ◆ 19 |
| △ 21a | ● 3c |
| ▽ 15 | + 23b |
| ◻ 22 | × 18 |
| ◇ 13 | * 30a |
| ○ 23a | △ 10b |
| ▲ 24 | ▽ 30b |
| ▼ 21b | ◻ 26b |
| ■ 3a | ◇ 30c |
| ◆ 20b | ○ 14 |
| ● 9 | ▲ 16 |
| + 8 | ▼ 29b |
| × 28 | ■ 27 |
| * 21c | ◆ 20c |
| △ 29a | |

Samples

- PLINE-2 23b +
- RAAF-2 23b +
- RAAF-3 23b +
- SINT-1 23b +
- YAN-19 23b +
- YAN-20 23b +
- WAND-1 23a ○
- HARRY-4 23a ○
- BANK-323a ○
- MODO-5 23a ○
- HURST01 23a ○
- HURST02 23a ○
- HURST04 23a ○
- Q1
- MELA-9 23b +
- WARB-3 23a ○
- WIRR-2 23a ○
- WARB-1 23a ○
- WIRR-1 23a ○
- BULL-3 23a ○
- WHITE-1 23a ○
- BANK-2 23a ○
- YULE-1 23a ○
- YULE-2 23a ○
- LOW13B 23a ○
- HURST03 23a ○
- MODO-4 23a ○
- APBF-1 20a ●
- APBF-2 20a ●
- M53 20a ●
- GOLF-1 20a ●
- LAND-1 20a ●
- KOON-1 20a ●
- KOON-2 20a ●
- FL-4 21a △



49 48 47 46

Similarity

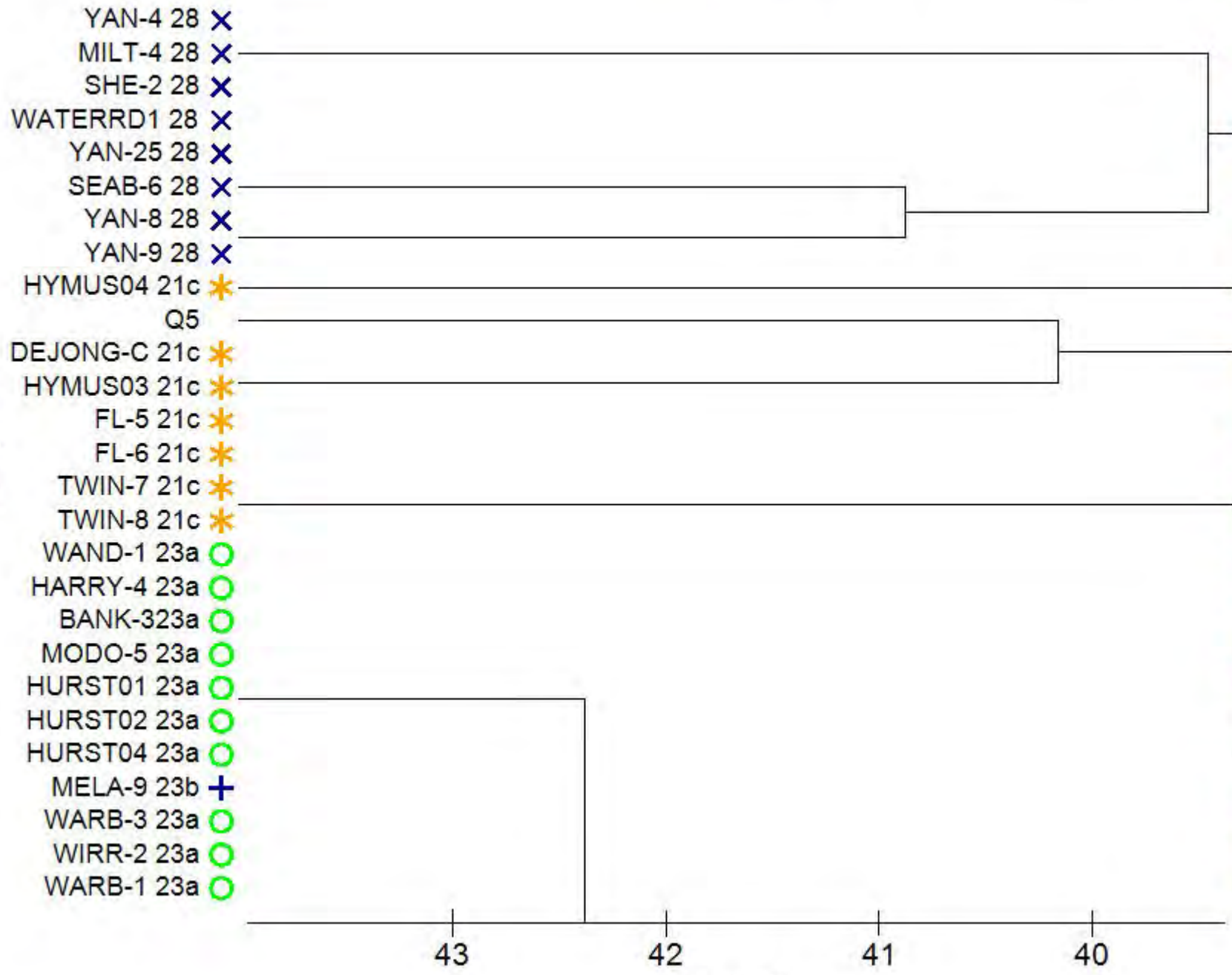
Group average

Resemblance: S17 Bray Curtis similarity

FCT

- | | |
|-------|-------|
| ▲ 1a | ▽ 3b |
| ▼ 1b | ◻ 10a |
| ■ 2 | ◇ 25 |
| ◆ 4 | ○ 12 |
| ● 20a | ▲ 6 |
| + 7 | ▼ 26a |
| × 11 | ■ 17 |
| * 5 | ◆ 19 |
| △ 21a | ● 3c |
| ▽ 15 | + 23b |
| ◻ 22 | × 18 |
| ◇ 13 | * 30a |
| ○ 23a | ▲ 10b |
| ▲ 24 | ▽ 30b |
| ▼ 21b | ◻ 26b |
| ■ 3a | ◇ 30c |
| ◆ 20b | ○ 14 |
| ● 9 | ▲ 16 |
| + 8 | ▼ 29b |
| × 28 | ■ 27 |
| * 21c | ◇ 20c |
| △ 29a | |

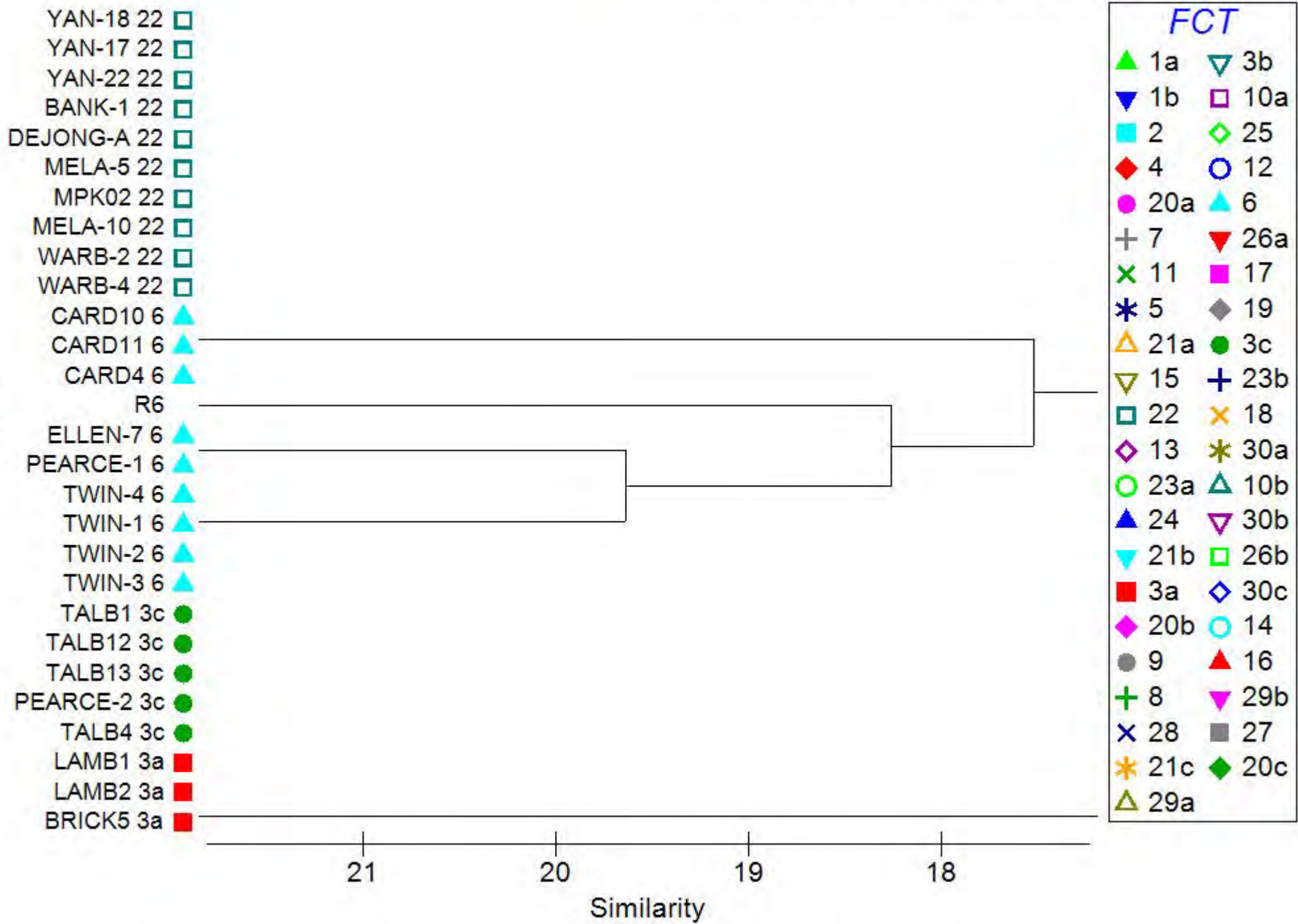
Samples



Similarity

Group average

Resemblance: S17 Bray Curtis similarity



Group average

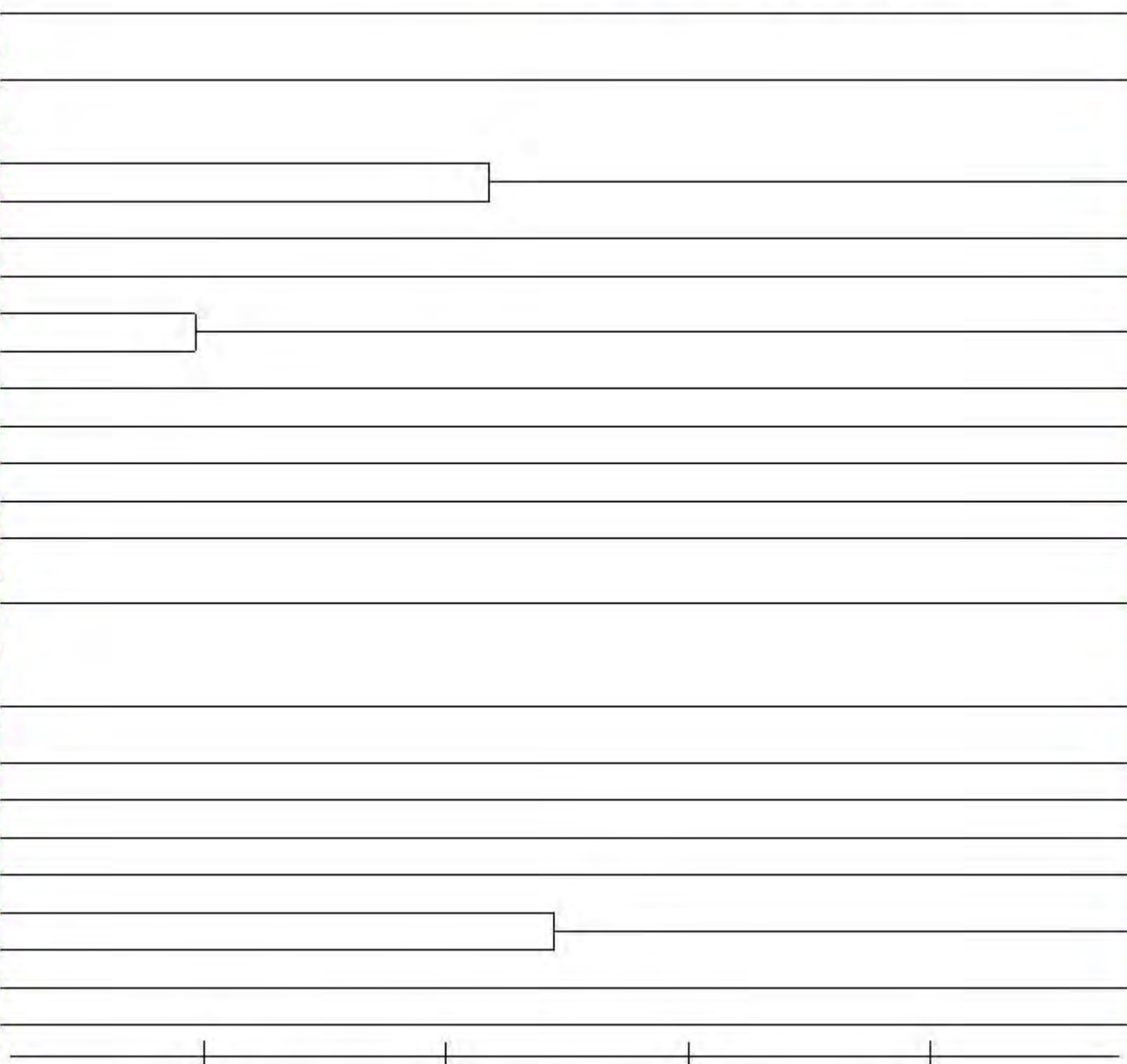
Resemblance: S17 Bray Curtis similarity

FCT

- | | |
|-------|-------|
| ▲ 1a | ▼ 3b |
| ▼ 1b | ◻ 10a |
| ■ 2 | ◇ 25 |
| ◆ 4 | ○ 12 |
| ● 20a | ▲ 6 |
| + 7 | ▼ 26a |
| × 11 | ■ 17 |
| * 5 | ◆ 19 |
| △ 21a | ● 3c |
| ▽ 15 | + 23b |
| ◻ 22 | × 18 |
| ◇ 13 | * 30a |
| ○ 23a | ▲ 10b |
| ▲ 24 | ▽ 30b |
| ▼ 21b | ◻ 26b |
| ■ 3a | ◇ 30c |
| ◆ 20b | ○ 14 |
| ● 9 | ▲ 16 |
| + 8 | ▼ 29b |
| × 28 | ■ 27 |
| * 21c | ◆ 20c |
| △ 29a | |

Samples

- BRIX-4 8 +
- WARO 03 8 +
- WARO 04 8 +
- C58-2 13 ◇
- WATER-1 13 ◇
- LOW10B 11 ×
- CARAB-3 11 ×
- ROWE01 11 ×
- R7
- PAGA-6 25 ◇
- C71-1 11 ×
- HARRY-6 11 ×
- RIVD-1 12 ○
- FL-10 12 ○
- CAPEL-6 12 ○
- CAPEL-8 12 ○
- CAPEL-9 12 ○
- HYMUS05 11 ×
- HYMUS06 11 ×
- AUSTB-3 11 ×
- TWIN-11 11 ×
- BULL-12 11 ×
- MODO-3 11 ×
- HYMUS01 11 ×
- HYMUS02 11 ×
- WOODP-1 30a *
- SEAB-1 30c ◆



37 36 35 34

Similarity

Group average

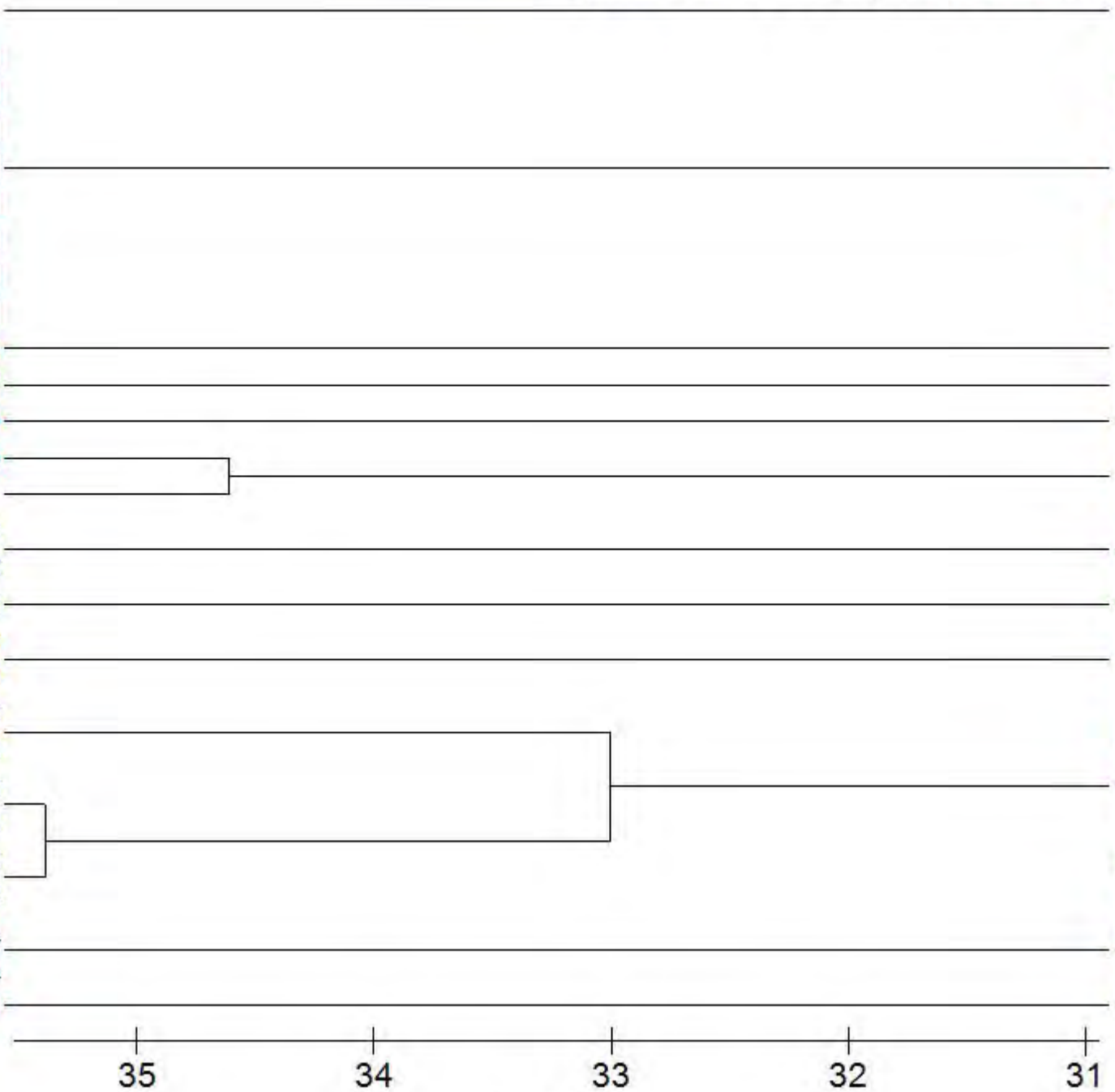
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FCT

- | | |
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| ▼ 1b | ◻ 10a |
| ■ 2 | ◇ 25 |
| ◆ 4 | ○ 12 |
| ● 20a | ▲ 6 |
| + 7 | ▼ 26a |
| × 11 | ■ 17 |
| * 5 | ◆ 19 |
| △ 21a | ● 3c |
| ▽ 15 | + 23b |
| ◻ 22 | × 18 |
| ◇ 13 | * 30a |
| ○ 23a | ▲ 10b |
| ▲ 24 | ▽ 30b |
| ▼ 21b | ◻ 26b |
| ■ 3a | ◇ 30c |
| ◆ 20b | ○ 14 |
| ● 9 | ▲ 16 |
| + 8 | ▼ 29b |
| × 28 | ■ 27 |
| * 21c | ◇ 20c |
| △ 29a | |

Samples

- YAN-22 22 ◻
- BANK-1 22 ◻
- DEJONG-A 22 ◻
- MELA-5 22 ◻
- MPK02 22 ◻
- MELA-10 22 ◻
- WARB-2 22 ◻
- WARB-4 22 ◻
- C71-1 11 ×
- HARRY-6 11 ×
- MILT-5 14 ○
- YAN-21 14 ○
- Q10
- BULL-5 5 *
- BULL-7 5 *
- PLINE-5 5 *
- MODO-2 21c *
- PLINE-7 21c *
- AUSTB-4 5 *
- AUSTB-6 5 *
- GUTHR-2 5 *
- GUTHR-4 5 *
- HARRY-3 5 *
- MILT-1 5 *
- WILL03 10b ▲
- WILL-1 10b ▲
- YOON-2 2 ■



35 34 33 32 31

Similarity

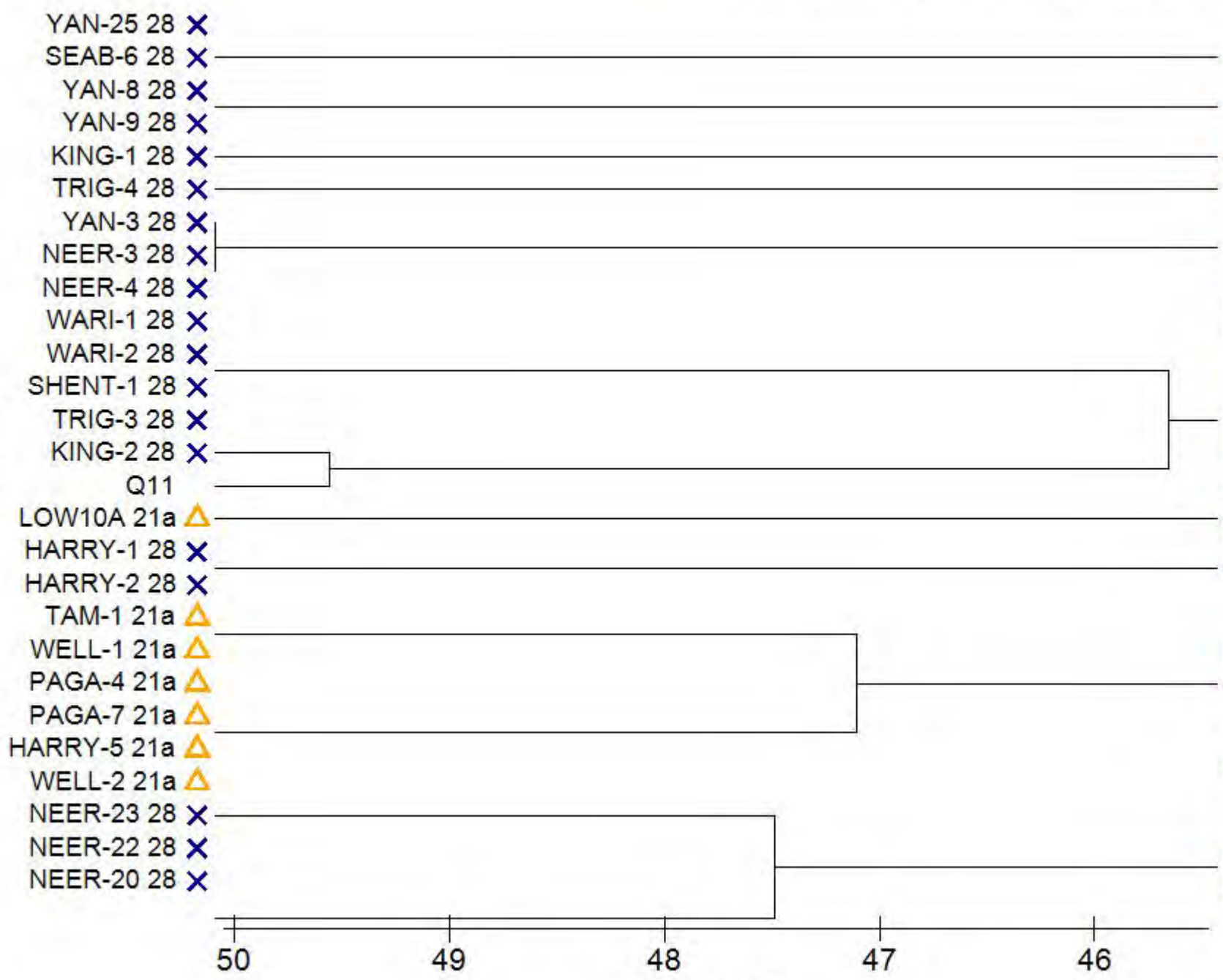
Group average

Resemblance: S17 Bray Curtis similarity

FCT

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|-------|-------|
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| ■ 2 | ◇ 25 |
| ◆ 4 | ○ 12 |
| ● 20a | ▲ 6 |
| + 7 | ▼ 26a |
| × 11 | ■ 17 |
| * 5 | ◆ 19 |
| △ 21a | ● 3c |
| ▽ 15 | + 23b |
| ◻ 22 | × 18 |
| ◇ 13 | * 30a |
| ○ 23a | ▲ 10b |
| ▲ 24 | ▽ 30b |
| ▼ 21b | ◻ 26b |
| ■ 3a | ◇ 30c |
| ◆ 20b | ○ 14 |
| ● 9 | ▲ 16 |
| + 8 | ▼ 29b |
| × 28 | ■ 27 |
| * 21c | ◆ 20c |
| △ 29a | |

Samples



50 49 48 47 46

Similarity

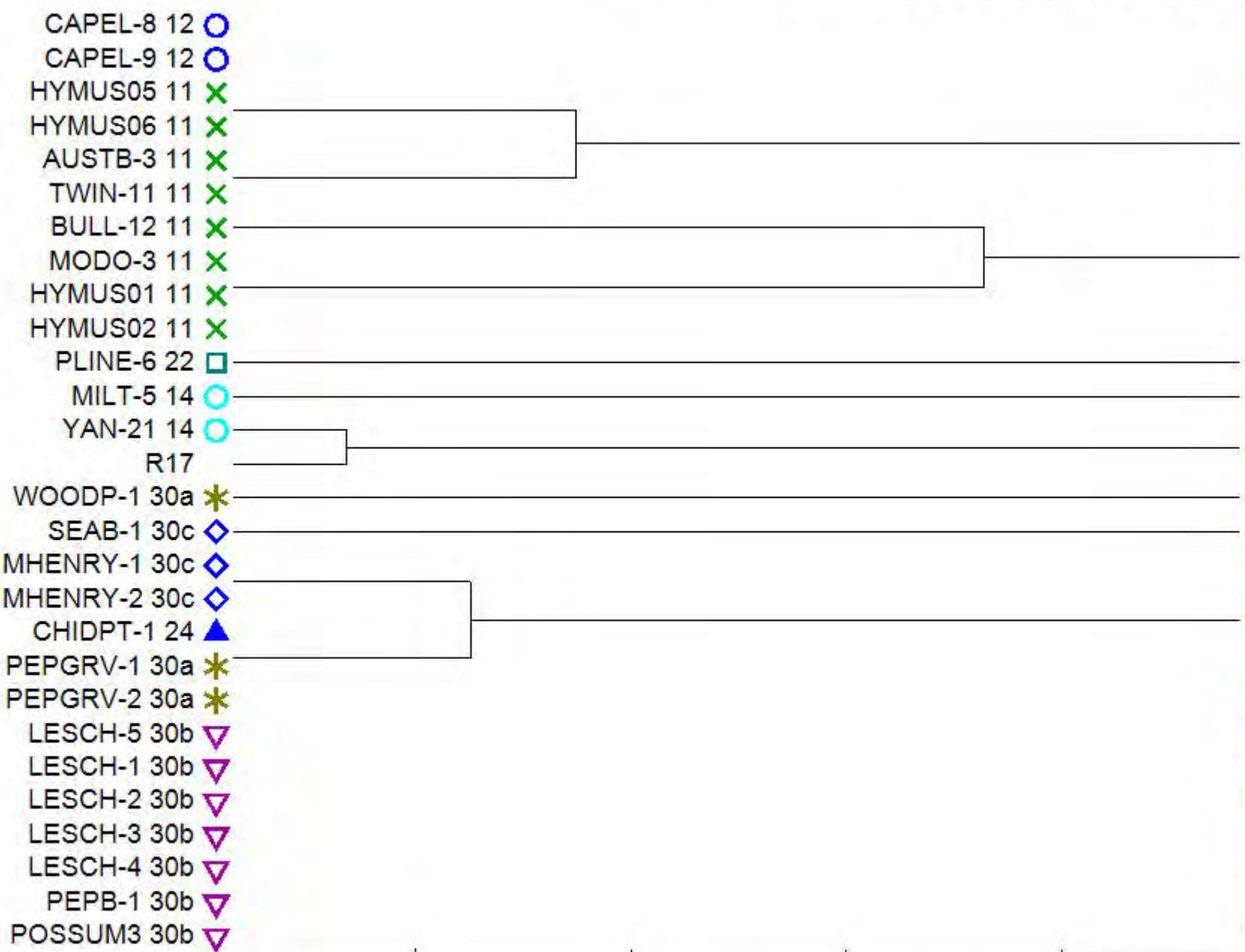
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| ◆ 4 | ○ 12 |
| ● 20a | ▲ 6 |
| + 7 | ▼ 26a |
| × 11 | ■ 17 |
| * 5 | ◆ 19 |
| △ 21a | ● 3c |
| ▽ 15 | + 23b |
| ◻ 22 | × 18 |
| ◇ 13 | * 30a |
| ○ 23a | ▲ 10b |
| ▲ 24 | ▼ 30b |
| ▼ 21b | ◻ 26b |
| ■ 3a | ◇ 30c |
| ◆ 20b | ○ 14 |
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| + 8 | ▼ 29b |
| × 28 | ■ 27 |
| * 21c | ◇ 20c |
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Samples

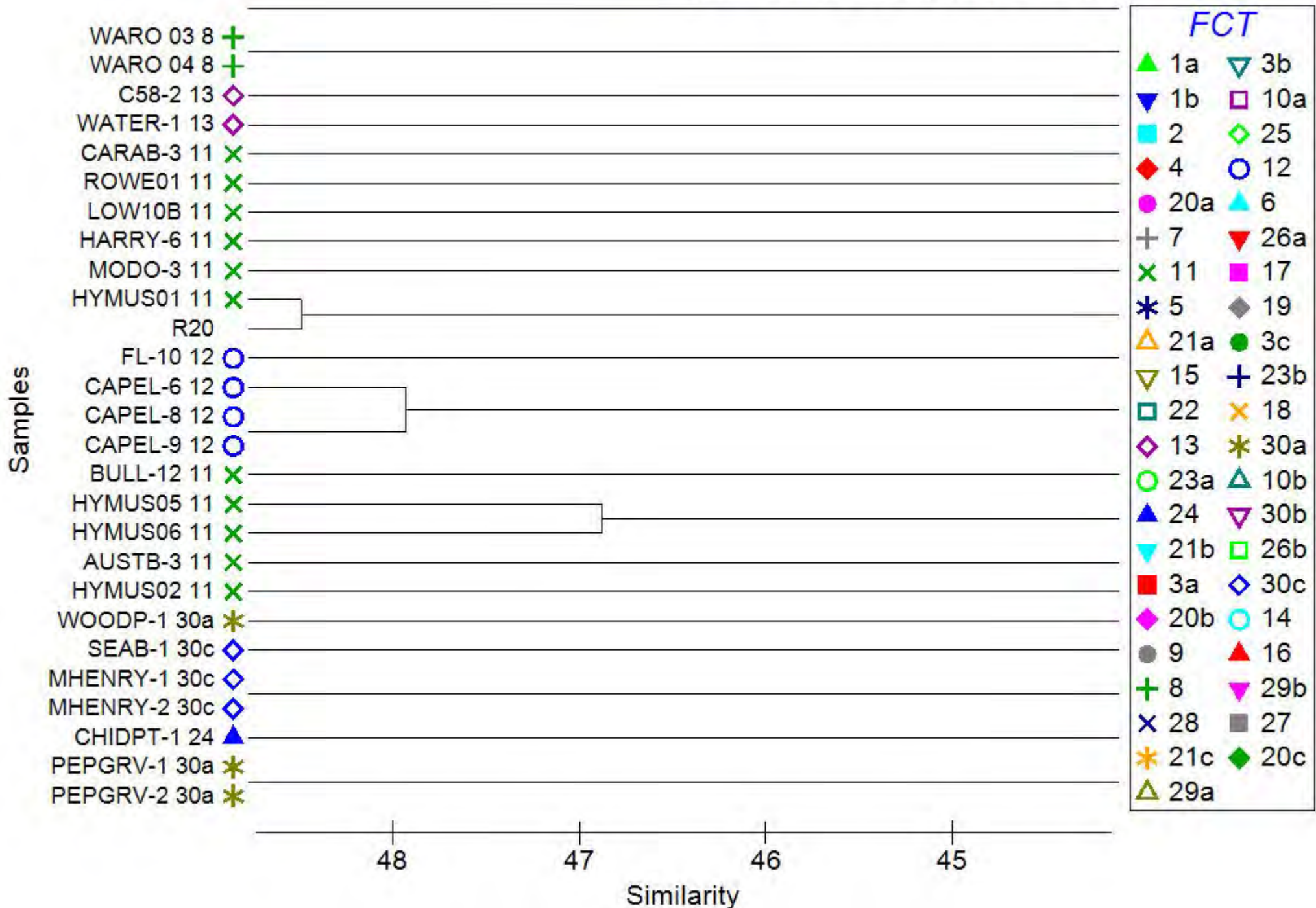


26 25 24 23

Similarity

Group average

Resemblance: S17 Bray Curtis similarity



Group average

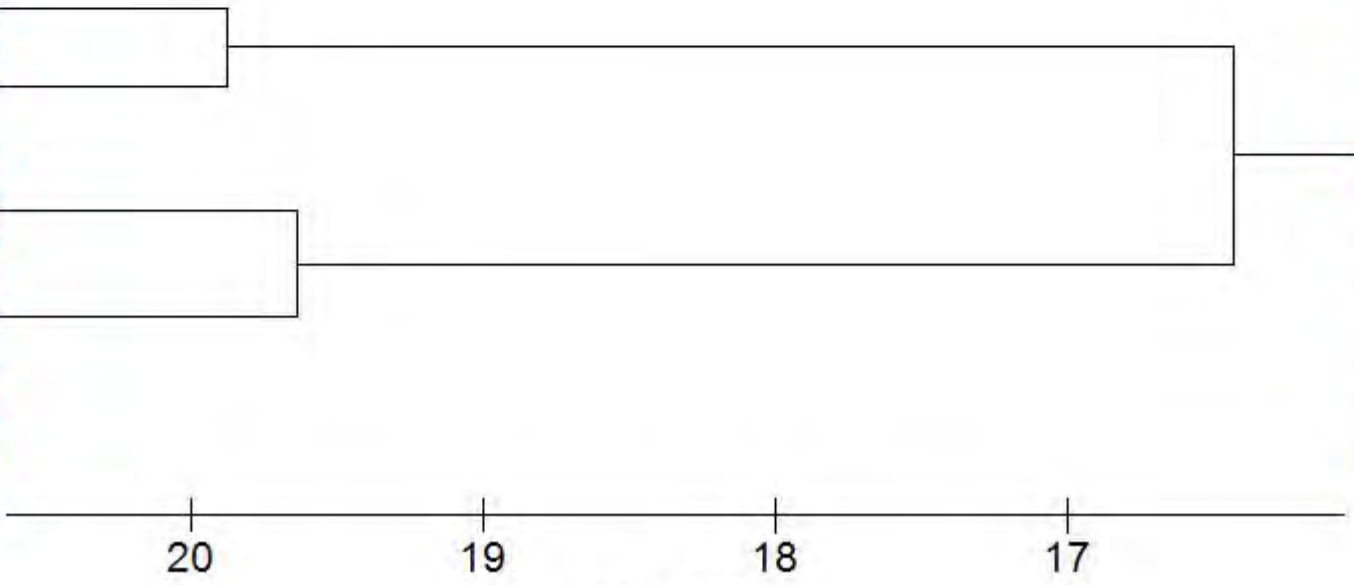
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FCT

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| ● 20a | ▲ 6 |
| + 7 | ▼ 26a |
| × 11 | ■ 17 |
| * 5 | ◆ 19 |
| △ 21a | ● 3c |
| ▽ 15 | + 23b |
| ◻ 22 | × 18 |
| ◇ 13 | * 30a |
| ○ 23a | ▲ 10b |
| ▲ 24 | ▽ 30b |
| ▼ 21b | ◻ 26b |
| ■ 3a | ◇ 30c |
| ◆ 20b | ○ 14 |
| ● 9 | ▲ 16 |
| + 8 | ▼ 29b |
| × 28 | ■ 27 |
| * 21c | ◆ 20c |
| △ 29a | |

Samples

- WARO 01 3b ▽
- WARO 02 3b ▽
- DUNS-1 3b ▽
- KOOLJ-5 3b ▽
- PLINE-4 4 ◆
- WHITE-2 4 ◆
- YAN-18 22 ◻
- YAN-17 22 ◻
- YAN-22 22 ◻
- BANK-1 22 ◻
- DEJONG-A 22 ◻
- MELA-5 22 ◻
- MPK02 22 ◻
- MELA-10 22 ◻
- WARB-2 22 ◻
- WARB-4 22 ◻
- R21
- CARD10 6 ▲
- CARD11 6 ▲
- CARD4 6 ▲
- ELLEN-7 6 ▲
- PEARCE-1 6 ▲
- TWIN-4 6 ▲
- TWIN-1 6 ▲
- TWIN-2 6 ▲
- TWIN-3 6 ▲
- TALB1 3c ●



Similarity

Appendix D

Detailed Fauna and Targeted Black Cockatoo Assessment
(Emerge Associates 2023)

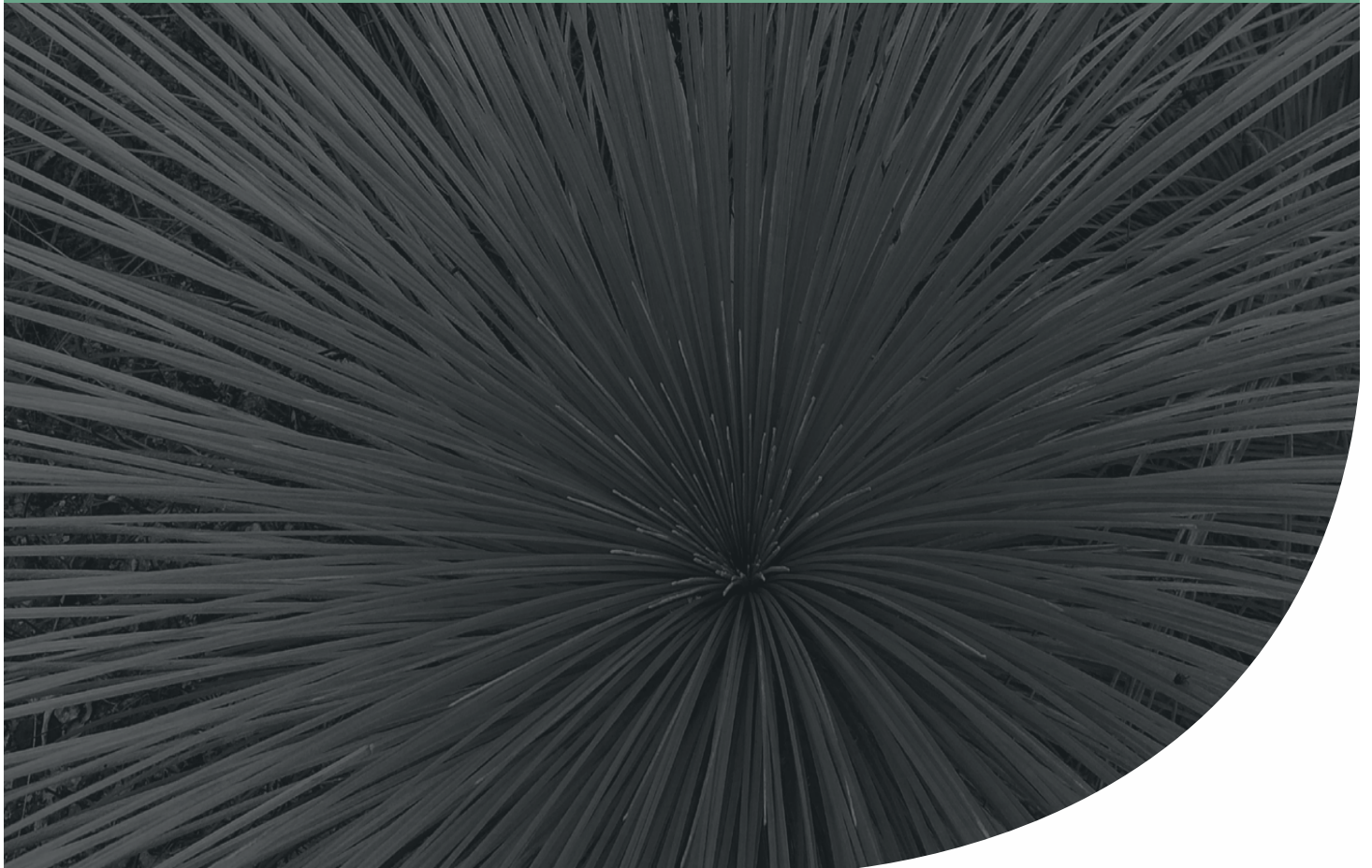


Detailed Fauna and Targeted Black Cockatoo Assessment

Various Lots, Mariginiup

Project No: EP22-019(02)

**Prepared for Stockland
July 2023**



Detailed Fauna and Targeted Black Cockatoo Assessment

Various Lots, Mariginiup



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Submitted for client review					
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		Updates following client review			

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Detailed Fauna and Targeted Black Cockatoo Assessment

Various Lots, Mariginiup



Executive Summary

Stockland engaged Emerge Associates to conduct a detailed fauna and a targeted black cockatoo assessment within multiple lots in Mariginiup that form Precinct 15 of the East Wanneroo District Structure Plan area (referred to herein as the 'site').

As part of the assessment a desktop review of relevant background information was completed and a field survey was undertaken between 28 March and 12 December 2022. A detailed fauna trapping program was undertaken and an assessment was made on the fauna habitat within the site and its suitability to provide habitat for conservation significant fauna. A targeted survey was also undertaken to determine the presence of habitat for threatened black cockatoo species.

Outcomes of the detailed fauna survey include the following:

- The majority of the site (approximately 59%) supports highly disturbed **cleared area** habitat which provides limited value to fauna species of conservation significance and is likely to primarily be used by common and widespread native and non-native fauna with non-specific habitat requirements. The highest fauna habitat values are associated with the **jarrah forest, banksia woodland, jarrah woodland** and **woolly bush shrubland** habitats which occur over approximately 12.05% of the site. The remainder of the site comprises various forest, woodland and shrubland habitats with little to no understorey (approximately 22.17%).
- A total of 68 native and seven introduced species were recorded within the site, including four species of conservation significance, *Zanda latirostris* (Carnaby's black cockatoo, listed as endangered), *Calyptorhynchus banksii naso* (forest red-tailed black cockatoo, listed as vulnerable), *Neelaps calonotus* (black-striped burrowing snake, listed as priority 3) and *Isoodon fusciventer* (quenda, listed as priority 4).
- Ten other species of conservation significance not recorded during the field survey may possibly occur in the site: *Apus pacificus* (pacific swift), *Austrosaga spinifer* (spiny katyid), *Dasyurus geoffroii* (chuditch), *Falco peregrinus* (peregrine falcon), *Hesperocolletes douglasi* (Douglas's broad headed bee), *Hylaeus globuliferus* (woolly bush bee), *Idiosoma sigillatum* (Swan Coastal Plain shield-backed trapdoor spider), *Leioproctus contrarius* (a short-tongued bee), *Notamacropus Irma* (western brush wallaby) and *Synemon gratiosa* (graceful sunmoth).

Outcomes of the targeted black cockatoo survey include the following:

- The site occurs within the modelled distribution of Carnaby's black cockatoo and forest red-tailed black cockatoo but outside of the modelled distribution of Baudin's black cockatoo. Carnaby's black cockatoo and forest red-tailed black cockatoo were recorded in the site during the field survey.
- The site contains 365 habitat trees of which none contain hollows suitable for use by black cockatoos for breeding. Therefore, the site does currently not provide suitable breeding habitat for any species of black cockatoo.
- No roosts or evidence of roosting by any species of black cockatoo was recorded within the site during the field survey. Tall native and non-native trees within the site represent suitable roosting habitat for species of black cockatoo.

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- A total of 58.02 ha of foraging habitat for Carnaby's black cockatoo was mapped within the site of which 38.54ha (66.43%) provides a primary resource and 19.48 ha (33.57%) provides a secondary resource.
- A total of 25.69 ha of foraging habitat for forest red-tailed black cockatoo was mapped within the site of which all provides a primary resource.
- Additional areas of foraging habitat of similar or higher value occur adjacent to the site and in the wider local area.

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Appendices

Appendix A

Additional Information

Appendix B

Database Search Results

Appendix C

Black Cockatoo Foraging Plants

Appendix D

Conservation Significant Species and Likelihood of Occurrence Assessment

Appendix E

Species List

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Appendix F

Species x Trapping Site

Appendix G

Habitat Tree Inventory

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Abbreviation Tables

Table A1: Abbreviations – Organisations

Organisations	
DAWE	Department of Agriculture, Water and the Environment (now DCCEEW)
DBCA	Department of Biodiversity, Conservation and Attractions
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DPaW	Department of Parks and Wildlife (now DBCA)
DPIRD	Department of Primary Industries and Regional Development
EPA	Environmental Protection Authority
WA Museum	Western Australian Museum

Table A2: Abbreviations – General terms

General terms	
EN	Endangered
EX	Extinct
IBRA	<i>Interim Biogeographic Regionalisation of Australia</i>
MI	Migratory
P1	Priority 1
P2	Priority 2
P3	Priority 3
P4	Priority 4
UFI	Unique feature identifier
VU	Vulnerable

Table A3: Abbreviations – Legislation

Legislation	
BAM Act	Biosecurity and Agriculture Management Act 2007
EBPC Act	Environment Protection and Biodiversity Conservation Act 1999
BC Act	Biodiversity Conservation Act 2016

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Table A4: Abbreviations – units of measurement

Units of measurement	
DBH	Diameter at breast height
cm	Centimetre
ha	Hectare
km	Kilometre
m	Metre
m AHD	m in relation to the Australian height datum
mm	Millimetre

Detailed Fauna and Targeted Black Cockatoo Assessment

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1 Introduction

1.1 Project background

Emerge Associates (Emerge) were engaged by Stockland to characterise the fauna and black cockatoo values across part of the Mariginiup Road reserve and the following lots associated with Precinct 15 of the East Wanneroo District Structure Plan area in Mariginiup (referred to herein as the 'site'):

- Lot 803 (no. 200) Mariginiup Road
- Lot 1673 (no. 285) Rousset Road
- Lot 804 (no. 90) Lakeview Street
- Lot 16 (no. 62) Lakeview Street
- Lot 17 (no. 54) Lakeview Street
- Lot 18 (no. 46) Lakeview Street
- Lot 13 (no. 13) Lakeview Street
- Lot 2361 (no. 175) Rousset Road
- Lot 2287 (no. 201) Rousset Road
- Lot 1 (no. 170) Rousset Road
- Lot 2 (no. 220) Rousset Road
- Lot 7542 (no. 30) McCaffrey Road
- Lot 44 McCaffery Road
- part Lot 3335 (no. 264) Rousset Road
- part Lot 7541 (no. 310) Rousset Road
- part Rousset Road reserve.
- McCaffery Road reserve (unconstructed)
- part Lavinia Place reserve (unconstructed).

The site is located approximately 25 kilometres (km) north of the Perth Central Business District within the City of Wanneroo and is approximately 313.78 hectares (ha) in size. The site is bounded by state forest plantations to the east, remnant bushland and rural-residential areas to the north, rural-residential land and Mariginiup Lake to the west and Lakeview Street and remnant vegetation to the south. The location and extent of the site is shown in **Figure 1**. Access within the site is shown in **Figure 2**.

1.2 Purpose and scope of works

The scope of work was specifically to undertake a terrestrial vertebrate fauna assessment to the standard required of a 'detailed' fauna survey and a 'targeted' black cockatoo survey with reference to the Environmental Protection Authority's (EPA's) technical guidance (EPA 2020) and the *Environment Protection and Biodiversity Conservation Act* black cockatoo referral guidelines (DAWE 2022b)

As part of this scope of work, the following tasks were undertaken:

Detailed Fauna and Targeted Black Cockatoo Assessment

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- Desktop assessment of relevant background information pertaining to the site and surrounds, including database and literature searches for fauna species.
- A detailed two-phase field survey to identify terrestrial vertebrate fauna species and habitats within the site.
- Targeted survey identifying breeding, roosting and foraging habitat for species of black cockatoo.
- Identification of potential habitat for conservation significant fauna species and an assessment of likelihood of occurrence.
- Compilation of a list of conservation significant fauna species with potential to occur within the site as identified from the desktop assessment.
- Mapping of fauna and black cockatoo habitat.
- Documentation of the desktop assessment, survey methodology and results into a report.

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2 Environmental context

2.1 Climate

Climate has a strong influence on the fauna habitat and species present in a region and a site. The south-west of Western Australia experiences a Mediterranean climate of hot dry summers and cool wet winters.

A total of 837 millimeter (mm) of rainfall was recorded in the 12 months prior to the start of the survey (March 2022) from the Wanneroo weather station (no. 009105) which is the closest weather station located approximately 3.5 km west of the site (BoM 2022). This is higher than the average rainfall of 794.3 mm for the same period and weather station (BoM 2022).

Temperatures recorded in the 3 months prior to the start of the survey ranged from a mean maximum of 35.1°C to a mean minimum of 17.9°C, as recorded by the Pearce RAAF weather station (no. 009053) which is the closest temperature recording weather station located approximately 16.7 km north-east of the site (BoM 2022). This was higher than the average maximum temperature of 32.5°C and average minimum temperature of 16.4°C for the same period and weather station (BoM 2022).

2.2 Geomorphology and soils

Landform and soils influence fauna habitat and species at regional and local scales. The site occurs on the Swan Coastal Plain, which is the geomorphic unit that characterises much of the Perth metropolitan area. The Swan Coastal Plain is approximately 500 km long and 20 to 30 km wide and is roughly bound by the Indian Ocean to the west and the Darling Scarp to the east. Broadly the Swan Coastal Plain consists of two sedimentary belts of different origin. Its eastern side comprises the Pinjarra Plain which formed from the deposition of alluvial material washed down from the Darling Scarp, while its western side comprises three dune systems that run roughly parallel to the Indian Ocean coastline (Seddon 2004). These dune systems, referred to as Quindalup, Spearwood and Bassendean associations, represent a succession of coastal deposition that has occurred since the late Quaternary period (approximately two million years ago) (Kendrick *et al.* 1991) and, as a result, they contain soils at different stages of leaching and formation.

Examination of physiographic region mapping by (Gozzard 2011) places the site straddling the border of the Spearwood and Bassendean Dune Systems, which was later confirmed during the field survey. The Spearwood Dunes typically comprise a limestone core that is overlain by yellow sand (Churchward and McArthur 1980). The Bassendean Dunes comprise low hills of quartz sand with sandy swamps in depressions (Gozzard 2007). The physiographic regions mapped within the site are shown in **Figure 3**.

The site is not known to contain any restricted landforms or unique geological features.

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2.3 Topography

The elevation of the site ranges from 46 m in relation to the Australian height datum (mAHD) on the western and central portions of the site to 59 mAHD on the western side of the site which supports a dunal ridge (DoW 2008) (**Figure 3**).

2.4 Hydrology and wetlands

Wetlands are areas of seasonally, intermittently or permanently waterlogged land such as poorly drained soils, ponds, billabongs, lakes, swamps, tidal flats, estuaries, rivers and their tributaries (Wetlands Advisory Committee 1977). Many wetlands provide important fauna habitat and support high levels of fauna biodiversity and endemism.

Wetlands of national or international significance may be afforded special protection under Commonwealth or international agreements. The following lists of important wetlands were checked as part of this assessment:

- *Ramsar List of Wetlands of International Importance* (DBCA 2017b)
- *A Directory of Important Wetlands in Australia* (DBCA 2018).

No Ramsar or listed 'important wetlands' are located within or near the site.

Examination of the Department of Water and Environmental Regulation (DWER) hydrography dataset (DWER 2018) shows the following 6 wetland or water related features occur within the site:

- two 'earth dams' within the northern and central portions;
- two 'areas subject to inundation' within the north-western and southern portions;
- a 'lake – non-perennial' in the eastern portion; and,
- a 'drain – major' in the central portion.

The Department of Biodiversity, Conservation and Attractions (DBCA) has developed the *Geomorphic Wetlands of the Swan Coastal Plain* dataset (DBCA 2021a). This dataset maps geomorphic wetland features and classifies them based on their landform shape and water permanence.

A review of the *Geomorphic Wetlands, Swan Coastal Plain* dataset indicated that seven 'resource enhancement' category wetland features (UFIs 14244, 14245, 14247, 14253, 14254, 14261 and 15443) occur within the central, eastern and south-eastern portions of the site (DBCA 2022). Five 'multiple use' category wetland feature (UFIs 8164, 14248, 14252, 15022 and 15442) occurs within the northern, central and south-eastern portions of the site. The locations of the geomorphic wetlands in the site is shown **Figure 4**.

2.5 Regional vegetation

Vegetation types and resulting habitats strongly influence the diversity and composition of fauna taxa present within an area. Native vegetation is described and mapped at different scales in order to illustrate patterns in its distribution. At a continental scale the *Interim Biogeographic Regionalisation of Australia* (IBRA) divides the Swan Coastal Plain into two floristic subregions (Environment Australia 2000).

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The site is contained within the 'SWA02' or Perth subregion, which is characterised as mainly containing *Banksia* low woodland on leached sands with *Melaleuca* swamps where ill-drained; and woodland of *Eucalyptus gomphocephala* (tuart), *E. marginata* (jarrah) and *Corymbia calophylla* (marri) on less leached soils (Beard 1990). This subregion is recognised as a biodiversity hotspot and contains a wide variety of endemic fauna species.

Variations in native vegetation can be further classified based on regional vegetation mapping. Hedde *et al.* (1980) mapping shows the site as comprising the 'Pinjar complex', which is described as vegetation ranging from woodland of *Eucalyptus marginata* and *Banksia* spp. to a fringing woodland of *E. rudis*, *Melaleuca preissiana* and sedgelands.

2.6 Historical land use

Review of historical images available from 1965 onwards shows that the majority of the site was cleared of native vegetation prior to 1970, likely for grazing. Native vegetation was retained in a larger patch in the south-eastern portion of the site and scattered paddock trees across the remainder of the site (WALIA 2023). The south-western portion of the site appears to have been used for horticultural purposes since 1977, with market gardens still evident in 2022. Native vegetation regrowth has occurred in patches across the site, most extensively within the central portion.

2.7 Conservation significant fauna

2.7.1 Threatened fauna

Certain fauna taxa that are considered to be rare or under threat warrant special protection under Commonwealth and/or State legislation. At a Commonwealth level, fauna taxa may be listed as 'threatened' under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Any action likely to have a significant impact on a matter of significance (which includes taxon listed as threatened) under the EPBC Act requires Ministerial approval.

In Western Australia fauna species may also be classed as 'threatened' under the *Biodiversity Conservation Act 2016* (BC Act). It is an offence to 'take' or 'disturb' threatened fauna without Ministerial approval.

Threatened fauna species listed under the EPBC Act and/or BC Act are assigned a conservation status according to attributes such as population size and geographic distribution. Further information on threatened species and their categories is provided in **Appendix A**.

2.7.1.1 Black cockatoos

Three threatened species of black cockatoo occur in the south-west of WA (referred to herein collectively as 'black cockatoos'):

- *Zanda¹ latirostris* (Carnaby's black cockatoo) which is listed as 'endangered' under the EPBC Act and the BC Act.

¹ Previously *Calyptorhynchus*

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- *Zanda² baudinii* (Baudin's black cockatoo) which is listed as 'endangered' under the EPBC Act and the BC Act.
- *Calyptorhynchus banksii naso* (forest red-tailed black cockatoo) which is listed as 'vulnerable' under the EPBC Act and the BC Act.

Black cockatoo habitat is conventionally separated into breeding, roosting and foraging categories:

- Black cockatoos nest in hollows that form in trees which are usually more than ~200 years old. 'Breeding habitat' comprises 'habitat trees' which are trees of a species known to support black cockatoo breeding and which either have a suitably large enough nest hollow or have a large enough diameter at breast height (DBH) to indicate that a suitable nest hollow could develop in time (DAWE 2022b). A minimum DBH for a habitat tree is defined as ≥ 50 centimetres (cm) for most tree species used by black cockatoos and ≥ 30 cm for *Eucalyptus wandoo* (wandoo) and *Eucalyptus salmonophloia* (salmon gum) (DAWE 2022b). Breeding habitat is also generally expected to be located within 6 km of food and water resources (DPaW 2013).
- Roosting refers to black cockatoos congregating in a tree or group of trees to rest overnight. 'Roosting habitat' consists of groups or individual tall trees used for roosting. Roosts generally comprise the tallest trees in an area and can include native and non-native trees (DAWE 2022b). They are often located within 6 km of water and food resources, with additional foraging ranges within 12 km (Shah 2006; Le Roux 2017; DAWE 2022b). The use of a particular roost may vary depending on availability of food and water resources.
- Black cockatoos feed on the fruit and seeds of a range of native and non-native plant species. 'Foraging habitat' is vegetation that contains plant species known to be foraged on by black cockatoos.

Each black cockatoo species has a defined breeding season, with Baudin's black cockatoo breeding from August to January and Carnaby's black cockatoo breeding from July to December (DAWE 2022b). Forest red-tailed black cockatoo breeds in October/November but may breed in March/April if there is good autumn rainfall (DAWE 2022a). There is also evidence that forest red-tail black cockatoos breed throughout the year, with peaks in April – June and August – October (Johnstone *et al.* 2013).

2.7.2 Priority fauna

Fauna species that do not currently meet the criteria for listing as threatened but are potentially rare or threatened may be added to the DBCA *Priority Fauna List*. These species are classified into 'priority' levels based on threat. Whilst priority species are not under direct statutory protection, they are considered during State approval processes. Further information on priority species and their categories is provided in **Appendix A**.

2.7.3 Migratory fauna

Some fauna species that migrate to Australia and its external territories or pass through or over Australian waters during their annual migrations are protected under Commonwealth and State legislation. At a Commonwealth level, migratory fauna taxa may be listed as 'migratory' under *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Any action likely to have a

² Previously *Calyptorhynchus*

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significant impact on a matter of national significance (which includes taxon listed as migratory) under the EPBC Act requires Ministerial approval. Further information on migratory species is provided in **Appendix A**.

2.7.4 Specially protected fauna

In Western Australia, fauna species that are of special conservation interest, including migratory species and cetaceans, species subject to international agreement or species otherwise in need of special protection may be listed as 'specially protected' under the BC Act. Further information on specially protected species and their categories is provided in **Appendix A**.

2.8 Pest fauna

The term 'pest fauna' can refer to any animal that requires some form of action to reduce its effect on the economy, the environment, human health and amenity. Pest fauna species are generally not native but some Australian or Western Australian fauna may also be considered pests.

A particularly invasive or detrimental pest species may be listed as a 'declared pest' pursuant to Western Australia's *Biosecurity and Agriculture Management Act 2007* (BAM Act), indicating that it warrants special management to limit its spread. Current pest status and control categories for Western Australia are provided in the *Western Australian Organism List* (DPIRD 2022). Further information on categories of declared pests is provided in **Appendix A**.

2.9 Bush Forever

The Government of Western Australia's Bush Forever policy is a strategic plan for conserving regionally significant bushland within the Swan Coastal Plain portion of the Perth Metropolitan Region. The objective of *Bush Forever* is to protect comprehensive representations of all original ecological communities by targeting a minimum of 10% of each vegetation complex for protection (Government of WA 2000). *Bush Forever* sites are representative of regional ecosystems and habitat and have a key role in the conservation of Perth's biodiversity.

Two *Bush Forever* sites occur within or adjacent to the site. The closest Bush Forever sites near the site are no. 147 (Mariginiup and Little Mariginiup Lakes) which lies adjacent to the western site boundary, and site no. 324 (Lake Jandabup) which lies adjacent to the southern site boundary. The locations of these Bush Forever sites and additional Bush Forever sites in the wider area of the site are shown in **Figure 5**.

2.10 DBCA managed or legislated land

DBCA has tenure of or interests in numerous areas of land across the state for a range of purposes. Tenure categories include national parks, nature reserves, conservation parks, marine parks, marine nature reserves, marine management areas, section 5(1)(g) reserves, state forest and timber reserves. These areas are mapped within the *Legislated Lands and Waters* (DBCA 2021c) and *Lands of Interest* (DBCA 2021b) datasets. The *Legislated Lands and Waters* (DBCA 2021c) dataset includes lands subject to the following legislation; the *Conservation and Land Management Act 1984* (CALM

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Act 1984), *Swan and Canning Rivers Management Act 2006* (SCRM Act) and lands identified under the *Land Administration Act 1997* (LA Act). The *Lands of Interest* (DBCA 2021b) dataset includes all other lands of which DBCA is recognised as the manager but is not vested under any act. These lands comprise of crown land and freehold land which DBCA has been acknowledged by the Department of Lands as the responsible agency.

One DBCA managed or legislated land of interest occurs adjacent to the eastern site boundary, as shown in **Figure 4** (DBCA 2021c). It is part of the Gngangara-Moore River State Forest, a large area of *Pinus pinaster* plantations.

2.11 Ecological linkages

Ecological linkages are linear landscape elements that allow the movement of fauna, flora and genetic material between areas of remnant habitat. This exchange of genetic material between vegetation remnants improves the viability of those remnants by allowing greater access to breeding partners and food sources, refuge from disturbances such as fire and maintenance of genetic diversity of plant communities and populations. Ecological linkages are ideally continuous or near-continuous as the more fractured a linkage is, the less ease flora and fauna have in moving within the corridor (Alan Tingay and Associates 1998).

The Perth Biodiversity Project, supported by the Western Australia Local Government Association (WALGA), have identified and mapped regional ecological linkages within the Perth Metropolitan Region (WALGA and PBP 2004).

One regional ecological linkage (No. 16) is mapped within the south-eastern portion of the site, extending to the south and east, which intersects with another ecological linkage (No. 12), which runs north-south adjacent to the western boundary.

Review of aerial imagery indicates that native vegetation within the site is connected to small patches of native vegetation to the north-west, north and south of the site, but is otherwise disconnected from vegetation in the broader area.

2.12 Previous surveys

In November 2017 and January 2018, AECOM undertook a *Flora, Vegetation and Fauna Assessment* as part of environmental investigations within a corridor between Yanchep and the Wanneroo reservoir (AECOM 2018). This survey extended over a broad area to the north and south, and intersected the central portion of the site along the Rousset Road reserve and adjacent areas. The survey identified several black cockatoo habitat trees (*Eucalyptus rudis*) situated along the Rousset Road reserve. No foraging habitat or black cockatoo sightings were recorded within the portion of the corridor survey area that intersected the site.

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3 Methods

3.1 Desktop assessment

3.1.1 Detailed fauna

A search was conducted for fauna species that have been recorded within a 10 km radius of the site using the *Protected Matters Search Tool* (DCCEEW 2023b), *NatureMap* (DBCA 2023), DBCA's conservation significant fauna database (reference no. FAUNA#7083) and literature references.

3.1.2 Targeted black cockatoo

A search was conducted for records of black cockatoos and potential black cockatoo habitat mapping occurring within 12 km of the site using a range of publicly available regional studies and datasets. Detailed information on each dataset considered as part of the desktop review is provided in **Appendix A**.

3.2 Field survey

Ecologists from Emerge visited the site between 28 March and 12 December 2022 to conduct a detailed fauna and targeted black cockatoo field surveys under DBCA Regulation 27 licence BA27000764 and DPIRD scientific licence U293/2022. Field survey dates and weather conditions can be seen in **Table 1**.

Table 1: Field survey dates and weather conditions

Date	Minimum Temp (°C)	Maximum Temp (°C)	Rainfall (mm)
Mammal and reptile trapping Phase 1			
29 March 2022	20.1	31	0
30 March 2022	20.5	25.3	0
31 March 2022	20.5	30	0
1 April 2022	22.6	31.3	v
2 April 2022	23.9	31.8	v
3 April 2022	22.7	29.5	v
4 April 2022	19.8	24.9	3
Mammal and reptile trapping Phase 2 (included bat recording)			
6 December 2022	16.6	28.8	0
7 December 2022	15.3	32.5	0

vpart of accumulated total measured on 4 April 2022

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Table 1: Field survey dates and weather conditions (continued)

Date	Minimum Temp (°C)	Maximum Temp (°C)	Rainfall (mm)
8 December 2022	17.6	28.5	0
9 December 2022	14.7	25.3	0
10 December 2022	11.4	26.7	0
11 December 2022	13.8	29.1	0
12 December 2022	14.2	30.6	0
Frog survey			
3 August 2022	9.9	16.4	10.8
Bird survey			
1 November 2022	5.2	24.2	0
Targeted black cockatoo survey			
23 June 2022	11.2	20.9	0
1 July 2022	8.8	18.5	0
20 July 2022	11.9	21.5	0.3
26 July 2022	8.5	19.2	0
11 August 2022	3.6	18.9	0
18 August 2022	2.6	17.6	8

3.2.1 Detailed fauna

A range of trapping techniques were used to detect terrestrial fauna present within the site including pitfall and funnel trap arrays, cage traps, camera traps, sound recorders, and targeted surveys for frogs and birds. The location of traps is shown in **Figure 5**.

3.2.1.1 Pitfall and funnel trap arrays

Twelve pitfall and funnel trap arrays were deployed. The pitfall traps comprised a 20 l bucket dug flush into the substrate in the middle of a 20 m long, 30cm high flywire drift fence. Four funnel traps (18 cm x 18 cm x 75 cm) were installed, either side of the drift fence and pitfall traps as shown in **Plate 1**.

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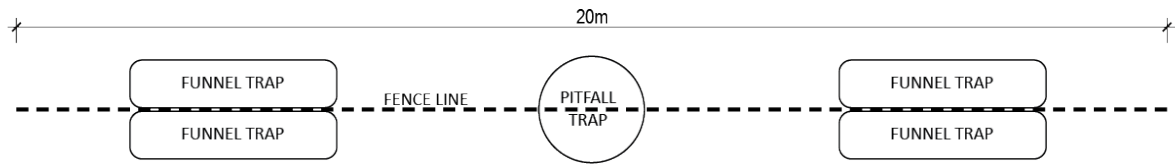


Plate 1: Schematic of pitfall and funnel trap set up

A small amount of soil and a piece of egg carton was added to the bottom of each pitfall trap, and brush used to cover funnel traps to provide shelter for fauna. Pit and funnel traps were checked within 3 hours of sunrise.

3.2.1.2 Cage traps

Fifteen Cage traps (20 cm x 20 cm x 60 cm) were deployed in selected areas of dense vegetation. All cage traps were baited with 'universal bait' (oats, peanut butter and sardines) which was renewed when required. The cage traps were covered by shade cloth and brush to provide shelter for fauna and were checked within 3 hours of sunrise.

3.2.1.3 Camera traps

Up to four camera traps (Ltl acorn Ltl-5310) were installed over three non-consecutive weeks to target ground dwelling species that were difficult or unable to be trapped. Areas were chosen based on the likelihood of ground dwelling fauna being present. An example of the camera trap set up used can be seen in **Plate 2**.



Plate 2: Example of camera set up

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3.2.1.4 Bat recorders

Bat echolocation calls were recorded using two Wildlife Acoustics Song Meter SM4BAT FS bioacoustics recorders placed in areas where bats were most likely to occur. Each device was programmed to record from 30 minutes pre-dusk to 30 minutes post-dawn for each night that was surveyed. Both sites were surveyed for seven nights to identify the bat species present. Recordings were analysed by Bat Call Pty Ltd.

3.2.1.5 Frog survey

Head torching and listening for audible calls were used to help document frog species present within the site that weren't trapped. Two ecologists traversed the site after sunset following rain that had occurred during the day. Areas susceptible to inundation were targeted to maximise the likelihood of encountering frogs.

3.2.1.6 Bird survey

Area searches (20-minute set-time searches of approximately 2 ha areas) were used to document the bird species present at four selected areas within the site. Areas were chosen based on likelihood of bird activity and to cover a range of habitats. During each area search, two ecologists and an ornithologist with >10 years' experience, recorded each bird species observed. Survey effort was concentrated within three hours of dawn, as this time is considered optimal for recording most bird species.

3.2.1.7 Systematic and opportunistic observations

Transects were traversed across the site, during the day, and the characteristics of fauna habitat and presence of fauna species was recorded. Microhabitats such as logs, rocks and leaf litter were investigated and evidence of species presence such as tracks, scats, skeletal remains, foraging evidence or calls was also noted.

3.2.1.8 Survey effort

Survey effort during the detailed fauna survey was consistent with the technical guidance provided in *Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment* (EPA 2020).

Trapping was conducted over two phases for a period of seven nights each. Cameras were also deployed during the black cockatoo targeted survey fieldwork. The bat recorders were deployed during trapping phase 2 only. A summary of the survey effort is shown in **Table 2**.

Table 2: Summary of survey effort (number of traps x survey nights)

Survey	Pitfall	Funnel	Cage	Camera	Bat recorder
Trapping phase 1	84	336	105	4	-
Trapping phase 2	84	336	98	28	14
Black cockatoo targeted survey	-	-	-	14	-
Total	168	672	203	46	14

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The bird survey was undertaken over one day as the site was otherwise visited regularly enough to sufficiently detect the resident bird assemblage.

All trapping methods were undertaken during the months recommended in the technical guidance for the southern climatic region (EPA 2020).

3.2.2 Targeted black cockatoo

Transects were traversed across the site and the presence of potential black cockatoo breeding, night roosting and foraging habitat was recorded. If observed, the presence of black cockatoos within or near the site was noted. Active searches for evidence of breeding, roosting and foraging activity such as chew marks, branch clippings, droppings, moulted feathers and chewed marri or banksia fruit were conducted.

3.2.2.1 Breeding habitat

A 'habitat tree' was defined as a native eucalypt that is typically known to support black cockatoo breeding such as marri, jarrah, blackbutt, tuart, wandoo, salmon gum or to a lesser extent flooded gum, with a DBH ≥ 50 cm or DBH ≥ 30 cm for wandoo or salmon gum. As any tree that has a suitable hollow may provide breeding habitat for black cockatoos, other tree species were also considered to be habitat trees if they contained a suitable hollow.

To be suitable for use as breeding habitat by black cockatoos it was considered a hollow must:

- have an entrance opening of at least 10 cm but preferably 20-30 cm (Saunders *et al.* 1982; Groom 2010; Johnstone *et al.* 2013)
- be located at least 3 m from the ground (Saunders 1979b; Johnstone and Storr 1998; Groom 2010; Saunders 2014)
- be located in a trunk or branch that is generally large enough to contain a hollow that has a floor diameter of at least 40 cm and depth of 50-200 cm such that it could house an adult black cockatoo and nestlings (Saunders 1979a; Johnstone and Storr 1998; Saunders 2014; DPaW 2015)
- have vertical or near vertical orientation (Johnstone and Kirkby 2008; Johnstone *et al.* 2013).

Occasionally, native eucalypts were encountered that met DBH requirements but did not contain a trunk/branch of a sufficient size to support a hollow suitable for use by black cockatoos. For example, the tree may have been less than 3 m tall or had a trunk that forked between 1.3 m and 3 m in height and after the fork no limbs had a diameter of ≥ 50 cm or ≥ 30 cm for wandoo or salmon gum. These trees were not recorded as habitat trees as the likelihood they would form a suitable hollow was low.

Habitat trees were individually identified and the attributes outlined in **Table 3** were recorded for each tree.

Table 3: Attributes recorded for each habitat tree in the site

Attribute	Description
Image	Trees were individually photographed
GPS location	The location was recorded using a handheld GPS unit
Tree species	Species and common name were identified

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Table 3: Attributes recorded for each habitat tree in the site (continued)

Attribute	Description
Diameter at breast height (DBH) (cm)	DBH was measured at breast height (1.3 m) using a diameter tape
Hollows potentially suitable for breeding by a black cockatoo	Number of hollows potentially suitable for breeding by a black cockatoo recorded (assessed from ground level only)

Hollows that appeared potentially suitable for use by a black cockatoo from the ground were further inspected using a drone and/or a pole-mounted camera. During the hollow inspection the internal dimensions of the hollow were confirmed if possible and an assessment was made for signs of use such as chew marks around the hollow entrance, nesting material, eggs, feathers or the presence of birds within the hollow.

Each habitat tree was assigned to a category listed in **Table 4**, which reflects the habitat tree categories defined in the black cockatoo referral guidelines (DAWE 2022b).

Table 4: Habitat tree categories (DAWE 2022)

Category	Specifications
Known nesting tree	Trees (live or dead but still standing) which contains a hollow where black cockatoo breeding has been recorded or which demonstrates evidence of breeding (i.e. showing evidence of use through scratches, chew marks or feathers).
Suitable nesting tree	Trees with suitable nesting hollows present, although no evidence of use. Note that any species of tree may develop suitable hollows for breeding. Hollow confirmed by internal hollow inspection [^] .
Potential nesting tree	Trees that have a suitable DBH to develop a nest hollow, but do not currently have hollows. Trees suitable to develop a nest hollow in the future are 300-500 mm DBH. Note that many species of eucalypt may develop suitable hollows for breeding.

[^]Hollow determined to be suitable for use as breeding habitat by black cockatoos as listed above in **Section 3.2.2.1**

3.2.2.2 Roosting habitat

Roosting habitat is defined as a stand of tall (>8 m) native and/or non-native trees that are situated within 2 km of a water source (Glossop *et al.* 2011; DAWE 2022b). If present, groups of tall native and non-native trees were assumed to provide roosting habitat. The presence of active or historical roosts in these trees was determined through evidence of roosting activity, such as branch clippings, droppings or moulted feathers.

Tall groups of native and non-native trees in the site within 1000 m of an existing large roost (>150 individuals) or 500 m of an existing small roost (<150 individuals) were assumed to be associated with that roost (Glossop *et al.* 2011).

3.2.2.3 Foraging habitat

Foraging habitat was identified by assessing vegetation in the site for plant species known to provide food for black cockatoos (Davies 1966; Saunders 1980; Johnstone and Storr 1998; Johnstone and Kirkby 1999; Groom 2011; Johnstone *et al.* 2011; DAWE 2022b).

Foraging habitat was classified as either 'native' or 'non-native' based on the predominant vegetation's naturalised status. It was also classified as either 'primary' or 'secondary' based on black

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cockatoo foraging preferences. Primary food plants were defined as those with historical and contemporary records of regular consumption by a black cockatoo species. Secondary food plants were defined as plants that black cockatoo species have been recorded consuming occasionally or that, based on their limited extent or agricultural origin, should not be considered a sustaining resource. A list of plant species classified as primary or secondary food plants is provided as **Appendix C**.

Each patch of foraging habitat was assigned a foraging value for each species of black cockatoo likely to occur within the site. As it is not always possible to separate out food plants from non-food plants, mapped foraging habitat may also include vegetation comprising non-food plants. The proportion of non-food plants in mapped foraging habitat was minimised as far as practicable.

Evidence of black cockatoo foraging, such as chewed fruits, was searched for within the site and allocated to a species where possible.

3.3 Data analysis and mapping

3.3.1 Desktop assessment

A total number of species³ that occur or potentially occur within the desktop assessment search area was calculated by adding the total count of non-conservation significant species provided by *NatureMap* to the combined number of conservation significant species provided by *NatureMap* and *Protected Matters Search Tool*. The habitat requirements of conservation significant fauna were specifically reviewed to verify they did in fact have potential to occur in the site (that is marine mammals and fish were omitted).

3.3.2 Fauna habitat

Fauna habitats were described according to the vegetation type present, as determined from observations made during the field survey and information provided in the '*Detailed Flora and Vegetation Assessment*' (Emerge Associates 2023).

The identified fauna habitats were mapped on aerial photography with the boundaries interpreted from aerial photography, Emerge Associates (2023) plant communities and notes taken in the field.

3.3.3 Likelihood of occurrence

Information on habitat preferences and distribution of conservation significant fauna species with potential occur within the site or wider area was reviewed and assessed against the general site conditions and fauna habitat types recorded during the field survey.

³ Total species count includes invertebrates. However, invertebrates have been considered only to the extent of those listed as conservation significant with an assessment of their likelihood of occurrence. No further consideration of invertebrates (i.e. non-conservation significant and/or short-range endemics) has been completed in this assessment.

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Based on the results of the desktop assessment and information recorded during the field survey, an assessment of the likelihood of occurrence of conservation significant fauna within the site was undertaken using the categories outlined in **Table 5**.

Table 5: Likelihood of occurrence assessment categories and definitions

Likelihood of occurrence	Definition
Recorded	The species was recorded during the current field survey or during previous field surveys.
Likely	The site contains suitable habitat for the species and it is likely the species may occur based on presence of a recent historical record within or close to the site.
Possible	The site contains habitat of at least marginal quality and/or extent for the species and the site is located within the known distribution range of the species which is supported by recent literature records from near the site.
Unlikely	The site contains no or marginal habitat for the species and/or no recent literature records occur near the site.

3.3.4 Species accumulation curve

A species accumulation curve was plotted from trap and sound recorder data by generating a trendline (log) in Microsoft Excel. The trendline was forecast to locate the asymptote of the curve (the point at which the curve flattens), which provides an indication of amount of sampling that would be required before it can be assumed few species remain undetected. PRIMER v6 also offers a range of estimators to predict minimum species richness (Clarke and Gorley 2006). Both the Jackknife1 and Chao2 non-parametric estimators are reported, as these are known to perform well in comparison to simulated and real data sets and are also recommended for small sample sizes (Gotelli and Colwell 2011). Comparison between actual and estimated species accumulation assists in evaluating the adequacy of sampling effort.

3.3.5 Conservation significant fauna habitat

Areas of preferred habitat for conservation significant species identified during the fauna survey were mapped using fauna habitats patches stated in **Section 3.3.2**.

3.3.6 Black cockatoo habitat

Habitat trees were mapped in the GDA94 coordinate referencing system. Foraging habitat was mapped separately for each species of black cockatoo likely to occur in the site. Patch boundaries were interpreted from aerial photography and notes taken in the field.

3.4 Nomenclature and sources of information

Taxonomy and nomenclature of scientific and common names for mammals, reptiles and amphibians follow *the Western Australian Museum (WAM) Checklist of the Terrestrial Vertebrate Fauna of Western Australia* (WAM 2022). For birds taxonomy and nomenclature of scientific and common names follows the Australian Faunal Directory (AFD) (DCCEEW 2023a). Where common names were not provided by the WAM or the AFD, these have been derived from other sources as noted.

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Literature listed in **Appendix A** represent the main publications used to identify fauna species and habitats within the site.

3.5 Survey limitations

It is important to note the specific constraints imposed on surveys and the degree to which these may have limited survey outcomes. An evaluation of the survey methodology against standard constraints outlined in the EPA's document *Technical Guidance – Terrestrial vertebrate fauna surveys for environmental impact assessment* (EPA 2020) is provided in **Table 6**.

Table 6: Evaluation of survey methodology against standard constraints outlined in the EPA's Technical Guidance – Terrestrial vertebrate fauna surveys for environmental impact assessment (EPA 2020)

Constraint	Degree of limitation	Details
Level of survey	No limitation	A detailed survey (desktop study and field survey) in combination with a targeted black cockatoo survey was undertaken. The level of survey and survey effort meet the respective EPA (2020) requirements for a 'detailed' fauna and 'targeted' black cockatoo assessment, and are considered adequate to assess the fauna and black cockatoo habitat values within the site.
Scope	No limitation	The survey focused on vertebrate fauna and habitat values, with particular focus on black cockatoos and other conservation significant taxa with potential to occur within the site.
Proportion of fauna identified, recorded and/or collected.	No limitation	All observed vertebrate fauna were identified.
Sources of information e.g. previously available information (whether historic or recent) as distinct from new data.	No limitation	Adequate information was available from database searches, previous surveys and literature references.
The proportion of the task achieved and further work which might be needed.	No limitation	The task was achieved in its entirety.
Experience level of personnel	No limitation	This fauna and black cockatoo assessment was undertaken by qualified ecologists ranging from 1 to >10 years' experience in Western Australia. Technical review was undertaken by a principal environmental consultant with over 20 years' experience in environmental science in Western Australia.
Suitability of timing, weather and season	No limitation	Fieldwork for the detailed survey was undertaken during the recommended timeframes as per the technical guidance (EPA 2020). Weather conditions during the survey were adequate for detecting fauna species. The targeted survey was undertaken during the black cockatoo peak breeding season to maximise the chance of detecting nesting.
Completeness	No limitation	The desktop assessment, field survey and targeted black cockatoo components of the survey were completed comprehensively.
Spatial coverage and access	No limitation	Coverage of the accessible portion of the site was comprehensive (track logged).

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Table 6: Evaluation of survey methodology against standard constraints outlined in the EPA's Technical Guidance – Terrestrial vertebrate fauna surveys for environmental impact assessment (EPA 2020)(continued)

Constraint	Degree of limitation	Details
Spatial coverage and access	Minor limitation	Lots 13, 16, 17, 18 and 804 Lakeview Street and lots 1, 2287 and 2361 Rousset Road were not accessible during the assessment. From aerial imagery and observations at the lot boundaries, habitat values within these properties are limited by disturbance (historical clearing, active agriculture, hardstands etc). Therefore, it was possible to characterise habitat values within these lots without accessing them. Habitat trees could not be assessed in these lots.
Survey intensity	No limitation	The intensity of the survey was adequate given the size of the site and the relatively high amount of low-level habitat.
Influence of disturbance	No limitation	The site is highly modified due to historical disturbance. However, no recent disturbance was noted that may have affected outcomes of the survey.
Adequacy of resources	No limitation	All resources required to perform the survey were available. The guidance currently available from Commonwealth and State agencies on the assessment of black cockatoo habitat is limited and relies heavily on technical experts preparing their own methodology. This assessment applies an internally developed methodology that is considered to provide a systematic and balanced characterisation of black cockatoo habitat.
Compliance with EPA (2020) guidance	Minor limitation	The EPA guidance requires that a full list of all fauna species with potential to occur within the site is compiled. As part of this assessment a comprehensive list of fauna species of conservation significance was compiled. Non-conservation taxa with potential to occur within the site were not compiled into a list but are provided as raw data in Appendix B . Given that all species with potential to occur within the site are still identified within the relevant appendices this is not considered to affect the outcomes of the assessment.

Detailed Fauna and Targeted Black Cockatoo Assessment

Various Lots, Mariginiup



4 Results

4.1 General site conditions

The site encompasses a variety of landforms. A ridge running roughly north to south is located within the western portion of the site and a separate dune peak occurs in the southeast. Between these areas the site generally flat or gently sloping and includes several sumpland wetland features. Soils are predominantly sandy, but areas of heavier soils tending to loam or clayey/silty sand occur in low-lying areas.

Patches of native vegetation occur over much of the site but these are most intact on the eastern side. Otherwise, this vegetation is generally present as native overstorey with limited understorey structure. The remainder of the site has been historically cleared and either comprises non-native pastures species or is cultivated (market gardens).

4.2 Fauna habitat

Eleven broad fauna habitats were identified within the site. A description and the area of each habitat is provided in **Table 7** and representative photographs of each are provided in **Plate 3** to **Plate 12**. The location of each habitat is shown on **Figure 6**.

Table 7: Fauna habitats identified within the site

Fauna habitat	Description	Area (ha)
Jarrah forest	Open forest of <i>Eucalyptus marginata</i> and <i>Melaleuca preissiana</i> over native shrubs and non-native grasses. (Plate 3) Plate 6:	4.74
Marri forest	Closed forest of <i>Corymbia calophylla</i> and <i>Eucalyptus rudis</i> over shrubland of <i>Xanthorrhoea preissii</i> over fernland of <i>Pteridium esculentum</i> (Plate 4).	0.73
Melaleuca forest	Open forest of <i>Melaleuca preissiana</i> over shrubland of <i>Adenanthos cygnorum</i> and <i>Xanthorrhoea preissii</i> over native forbland and non-native grasses (Plate 5)	2.74
Banksia woodland	Open woodland of <i>Banksia attenuata</i> , <i>B. menziesii</i> , <i>Eucalyptus todtiana</i> and <i>Nuytsia floribunda</i> over native shrubs and non-native grasses (Plate 6)	12.85
Flooded gum woodland	Closed woodland to open forest of <i>Eucalyptus rudis</i> over native shrubs over native forbland and non-native grasses (Plate 7)	27.12
Jarrah woodland	Open woodland of <i>Eucalyptus marginata</i> and <i>E. todtiana</i> over shrubland of <i>Xanthorrhoea preissii</i> over non-native grasses (Plate 8)	20.23
Balga shrubland	Open shrubland of <i>Xanthorrhoea preissii</i> over non-native grasses (Plate 9).	19.48
Melaleuca shrubland	Open shrubland of <i>Melaleuca teretifolia</i> over non-native forbland and grasses (Plate 10).	11.43
Myrtle shrubland	Scattered <i>Eucalyptus rudis</i> or <i>Melaleuca Preissiana</i> over tall shrubland of <i>Kunzea glabrescens</i> or <i>Hypocalymma angustifolia</i> over non-native grasses (Plate 11)	26.94
Non-native planted	Predominantly planted non-native trees and shrubs.	8.05
Cleared	Heavily disturbed areas comprising predominantly grassland with the occasional scattered tree or shrub. Areas of hardstands, tracks, buildings or agricultural land were also included in this habitat type. (Plate 12)	179.48

Detailed Fauna and Targeted Black Cockatoo Assessment

Various Lots, Mariginiup



Plate 3: Jarrah forest habitat



Plate 4: Marri forest habitat

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Plate 5: Melaleuca forest habitat



Plate 6: Banksia woodland habitat

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Plate 7: Flooded gum woodland habitat



Plate 8: Jarrah woodland habitat

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Plate 9: Balga shrubland habitat



Plate 10: Melaleuca shrubland habitat

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Plate 11: Myrtle shrubland habitat



Plate 12: Cleared habitat

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4.3 Detailed Fauna

4.3.1 Desktop assessment

A total of 395 fauna species were identified from database searches as occurring or potentially occurring within 10 km of the site⁴ as listed in **Appendix B**.

Of these species, 70 are conservation significant, including 32 threatened, 12 priority, 40 migratory fauna and one other specially protected species as listed in **Appendix D**.

4.3.2 Species inventory

A total of 68 native and seven introduced fauna species, including four fauna species of conservation significance were directly or indirectly recorded during the field survey.

A complete species list is provided in **Appendix E**. The trapping locations of each species is provided in **Appendix F**.

4.3.3 Conservation significant fauna

Four conservation significant fauna species were recorded within the site during the field survey:

- Carnaby's black cockatoo (refer **Sections 2.7.1.1** and **5.3.4**)
- Forest red-tailed black cockatoo (refer **Sections 2.7.1.1** and **5.3.4**)
- *Neelaps calonotos* (black-striped burrowing snake) (refer **Plate 13** and **Section 5.3.1**)
- *Isoodon fusciventer* (quenda) (refer **Plate 14** and **Section 5.3.2**).

No other conservation significant fauna species are considered likely to occur within the site. However, a further 10 conservation significant fauna species may possibly occur in the site based on habitat requirements, species distribution and site conditions, as shown in **Table 8**. The remainder of the conservation significant fauna species identified in the desktop assessment (56 species) are considered unlikely to occur in the site due to lack of suitable habitat or because the site lies outside of the species known distribution. Fauna species classed as unlikely to occur are listed in **Appendix D**.

Table 8: Summary of conservation significant fauna species recorded or deemed possible or likely to occur within the site

Species name	Common name	Level of significance		Habitat	Likelihood of occurrence within the site
		BC Act	EPBC Act		
Birds					
<i>Apus pacificus</i>	Pacific swift	MI	MI	Aerial, migratory species that is most often seen over inland plains and sometimes above open areas, foothills or in coastal areas. Sometimes occurs over settled areas, including towns, urban areas and cities (Johnstone and Storr 1998).	Possible: May opportunistically occur in or fly over the site on commute but only for short periods of time.

⁴ Includes native and non-native species

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Table 8: Summary of conservation significant fauna species recorded or deemed possible or likely to occur within the site (continued)

Species name	Common name	BC Act	EPBC Act	Habitat	Likelihood of occurrence within the site
<i>Calyptorhynchus banksii naso</i>	Forest red-tailed black cockatoo	VU	VU	<i>Eucalypt</i> and <i>Corymbia</i> forests, often in hilly interior. More recently also observed in more open agricultural and suburban areas including Perth metropolitan area. Attracted to seeding <i>Corymbia calophylla</i> , <i>Eucalyptus marginata</i> , introduced <i>Melia azedarach</i> and <i>Eucalyptus</i> spp. trees (Johnstone and Storr 1998).	Recorded: Observed foraging within the site.
<i>Falco peregrinus</i>	Peregrine falcon	OS	-	Mainly found around cliffs along coasts, rivers, ranges and around wooded watercourses and lakes (Johnstone and Storr 1998).	Possible: May opportunistically occur in or fly over the site on commute or while searching for prey but only for short periods of time.
<i>Zanda latirostris</i>	Carnaby's black cockatoo	EN	EN	Mainly proteaceous scrubs and heaths and adjacent eucalypt woodlands and forests; also plantations of <i>Pinus</i> spp. Attracted to seeding <i>Banksia</i> spp., <i>Dryandra</i> spp., <i>Hakea</i> spp., <i>Eucalyptus</i> spp., <i>Corymbia calophylla</i> , <i>Grevillea</i> spp., and <i>Allocasuarina</i> spp. (Johnstone and Storr 1998).	Recorded: Observed flying over site.
Invertebrate					
<i>Austrosaga spinifer</i>	Spiny katydid	P2	-	Unknown.	Possible: Historically recorded approximately 7km west.
<i>Hesperocolletes douglasi</i>	Douglas's broad-headed bee	CR	CR	Banksia woodland vegetation (Pille Arnold 2019).	Possible: Suitable habitat present in the site.
<i>Hylaeus globuliferus</i>	Woollybush bee	P3	-	Males are territorial and may be found perched on the growing tips of <i>Adenanthos</i> sp., <i>Banksia</i> sp. or <i>Jacksonia</i> sp. Has also been recorded visiting the flowers of <i>Grevillea</i> sp. (PaDIL 2022).	Possible: Suitable habitat present in the site.
<i>Idiosoma sigillatum</i>	Swan Coastal Plain shield-backed trapdoor spider	P3	-	Widely distributed in sandy areas on the Swan Coastal Plain and on Rottnest Island (Prince 2003).	Possible: Suitable habitat present in the site.

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Table 8: Summary of conservation significant fauna species recorded or deemed likely or possible to occur within the site (continued)

Species name	Common name	BC Act	EPBC Act	Habitat	Likelihood of occurrence within the site
<i>Leioproctus contrarius</i>	a short-tongued bee	P3	-	Life history and habits are poorly documented/ unknown. It has been recorded only on flowers of Goodeniaceae and possibly <i>Lechenaultia stenosepala</i> (Bamford 2003).	Possible: Suitable habitat present in the site.
<i>Synemon gratiosa</i>	Graceful sun-moth	P4	-	Coastal heathland on Quindalup dunes where it is restricted to secondary sand dunes due to the abundance of the preferred host plant <i>Lomandra maritima</i> . Banksia woodland on Spearwood and Bassendean dunes, where the second known host plant <i>L. hermaphrodita</i> is widespread (DEC 2011).	Possible: Suitable habitat present in the site.
Mammal					
<i>Dasyurus geoffroii</i>	Chuditch	VU	VU	Wide range of habitats from woodlands, dry sclerophyll forests, riparian vegetation, beaches and deserts. Appears to utilise native vegetation along roadsides in the wheatbelt (DEC 2012b).	Possible: Suitable habitats present in the site.
<i>Isoodon fusciventer</i>	Quenda	P4	-	Dense scrubby, often swampy, vegetation with dense cover up to one metre high (DEC 2012)	Recorded: Caught and recorded on cameras in multiple areas in the site.
<i>Notamacropus irma</i>	Western brush wallaby	P4	-	Dry sclerophyll forest, Banksia spp. woodlands and shrublands, typically favouring dense low vegetation that provides dense cover (Christensen and Strahan 1983).	Possible: Suitable habitats present in the site.
Reptile					
<i>Neelaps calonotos</i>	Black-striped burrowing snake	P3	-	Coastal and near-coastal dunes, sandplains supporting heathlands and Banksia spp. woodlands (Bush et al. 2002).	Recorded: Caught in the site during phase 2 trapping.

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Various Lots, Mariginiup



Plate 13: Black striped burrowing snake caught in funnel trap at T21



Plate 14: Quenda caught on camera at T14

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Various Lots, Mariginiup

4.3.4 Declared pests

Three species listed as a declared pest (C3) pursuant to the BAM Act, **Oryctolagus cuniculus* (rabbit), **Trichoglossus haematodus* (rainbow lorikeet) and **Vulpes vulpes* (fox), were recorded within the site.

4.3.5 Species richness

A total of 29 species of trappable fauna were recorded from 21 trap nights (two trapping phases plus an additional week of camera trap deployment) using all trapping methods (pitfall and funnel trap arrays, cage traps, camera traps and bat recorders). A species accumulation curve derived from sample data is presented in **Plate 15**. After 21 trap nights, the curve is flattening and close to reaching its asymptote. This indicates that a small proportion of species likely remain undetected by sampling.

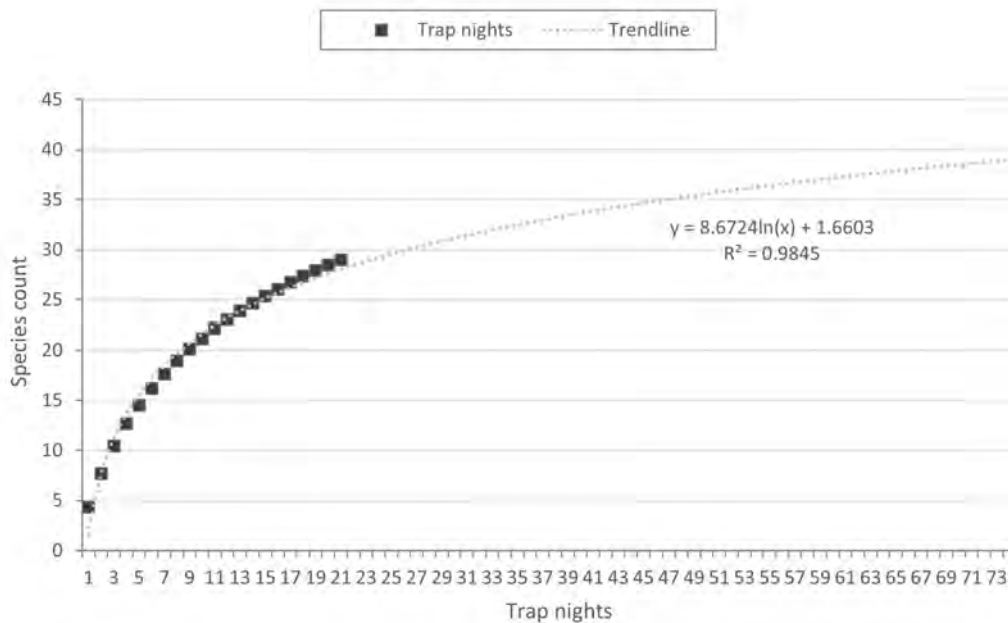


Plate 15: Species accumulation curve derived from sample data ($y = 8.6724\ln(x) + 1.6603$, $R^2 = 0.9845$)

Species richness for trappable fauna was estimated in PRIMER v6 to be approximately 39 (Jackknife1, Chao2). Based on the trend of the species accumulation curve approximately 70 to 80 trap nights would be required to capture that many species. Including the two additional species recorded opportunistically, a total of 31 trappable fauna species were recorded in the site. This indicates that 79.5% of the estimated 39 species in the site were recorded. Considering the disturbance to fauna habitats in the site and numerous site visits, the survey effort was considered to be adequate to prepare a representative species inventory.

4.3.6 Conservation significant fauna habitat

Locations of suitable habitat within the site for black-striped burrowing snake and quenda are shown in **Figure 6** and **Figure 7**.

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Various Lots, Mariginiup



4.4 Black cockatoos

4.4.1 Desktop assessment

The site is located within the distribution range of Carnaby's black cockatoo and forest red-tailed black cockatoo but not the Baudin's black cockatoo (DoEE 2016a, b, c).

The site is outside of the modelled breeding range of Carnaby's black cockatoo (DoEE 2016b).

No breeding range information for forest red-tailed black cockatoo is provided in DoEE (2016c). However, on the Swan Coastal Plain the species is known to breed near Baldivis, Mundijong, Stake Hill, Karnup, Murdoch and possibly Perry Lakes (Johnstone *et al.* 2017). Breeding often occurs within areas that contain a high number of marri trees (DAWE 2022b)

The closest roost associated with white-tailed black cockatoos occurs approximately 1.2 km north of the site and the closest roost associated with forest red-tailed black cockatoos occurs approximately 4.3 km southeast of the site.

The results of the black cockatoo desktop assessment are summarised in **Table 9** and shown in **Figure 8**.

Table 9: Summary of black cockatoo background review

Category	Site context	Source
Species distribution	<ul style="list-style-type: none"> • Site is located within the modelled distribution range of Carnaby's black cockatoo but not within its breeding range. • Site is not located within the modelled distribution range of Baudin's black cockatoo. • Site is located within the modelled distribution range of forest red-tailed black cockatoo. 	(DoEE 2016a, b, c)
Carnaby's black cockatoo breeding areas (12 km radius surrounding breeding sites)	<ul style="list-style-type: none"> • No confirmed breeding areas intersect the site. • No possible breeding areas intersect the site. 	(Glossop <i>et al.</i> 2011)
Important bird areas for Carnaby's black cockatoo	<ul style="list-style-type: none"> • Site is located within the 'Northern Swan Coastal Plain' IBA. • The Northern Swan Coastal Plain IBA is estimated to support 4600-15000 Carnaby's cockatoos during the non-breeding season and a small number of breeding individuals, forming the largest population of non-breeding birds in south-western Australia (BirdLife International 2022). 	(DPaW 2013; BirdLife International 2022)
Roost site	<ul style="list-style-type: none"> • None within the site • 25 roost sites within 12 km of the site (Table 10 and Table 11): <ul style="list-style-type: none"> ◦ 24 associated with white-tailed[^] black cockatoos only. ◦ 6 associated with forest red-tailed black cockatoos only. ◦ 5 associated with white[^] and red-tailed black cockatoos. 	Great Cocky Count (Peck <i>et al.</i> 2022)

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Various Lots, Mariginiup



Table 9: Summary of black cockatoo background review (continued)

Category		Site context	Source
Foraging habitat	Carnaby's black cockatoo	<ul style="list-style-type: none"> Potential native foraging habitat is mapped in the site. Additional areas of potential native foraging habitat mapped within the wider local area, including adjacent to the site. 	(Emerge Associates 2021)
		<ul style="list-style-type: none"> Gnangara pine plantation mapped adjacent to east of site. 	(Forest Products Commission 2020)
	Baudin's black cockatoo	<ul style="list-style-type: none"> Site does not occur within Baudins modelled distribution. 	(Emerge Associates 2021)
	Forest red-tailed black cockatoo [^]	<ul style="list-style-type: none"> Potential native foraging habitat is mapped in the site. Additional areas of potential native foraging habitat mapped within the wider local area, including adjacent to the site. 	(Emerge Associates 2021)

[^]Carnaby's and/or Baudin's black cockatoo

Table 10: White-tailed black cockatoos recorded in roosts within 12 km of the site (Peck et al. 2022)

Roost ID	Year and number of individuals									
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
JOEDGR001	0	0	NS	0	0	23	0	0	0	NS
JOOPADR001	0	NS	1	17	7	7	0	0	0	0
SWALEXR001	0	80	0	0	181	0	0	0	34	753
SWAMELR001	500	41	0	20	480	0	NS	268	0	0
WANCRRR001	NS	NS	NS	191	0	0	0	0	0	NS
WANGNAR001	0	NS	NS	NS	0	NS	454	316	157	255
WANGNAR003	0	14	0	0	0	0	0	0	0	0
WANGNAR004	27	0	0	0	0	0	0	0	0	12
WANGNAR005	NS	NS	NS	100	0	14	0	260	NS	NS
WANGNAR006	NS	NS	NS	NS	40	NS	3	6	0	NS
WANJANR007	NS	16	NS	0	NS	0	NS	NS	NS	NS
WANMARR001	0	20	NS	0	NS	71	0	770	0	0
WANMARR002	0	NS	2	3	3	0	0	0	0	0
WANMARR003	542	152	10	16	147	280	4	1260	625	739
WANMARR004	0	0	0	NS	NS	NS	NS	8	0	0
WANMARR005	NS	NS	NS	NS	NS	NS	NS	0	350	NS
WANNEER001	NS	29	NS	NS	0	NS	0	NS	NS	NS
WANNEER002	604	0	0	0	0	0	0	0	0	NS
WANPINR003	64	0	0	0	0	0	0	0	NS	NS

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Table 10: White-tailed black cockatoos recorded in roosts within 12 km of the site (Peck et al. 2022)(continued)

Roost ID	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
WANPINR005	275	NS	NS	NS	0	0	0	NS	NS	NS
WANPINR006	13	0	0	0	2	0	0	0	NS	0
WANPINR011	0	NS	NS	800	0	179	0	0	0	12
WANTAMR001	NS	NS	0	103	20	10	0	0	NS	0
WANWANR001	0	11	6	0	0	0	0	0	0	0

NS = not surveyed

Table 11: Forest red-tailed black cockatoo recorded in roosts within 12 km of the site (Peck et al. 2022)

Roost ID	Year and number of individuals					
	2014	2015	2016	2017	2018	2019
JOOPADR001	0	0	0	0	0	9
SWAMELR001	0	0	NS	129	0	0
WANGNAR005	0	0	0	7	NS	NS
WANGNAR006	3	NS	0	4	0	NS
WANJANR008	NS	NS	NS	102	156	243
WANMARR002	0	0	0	0	11	20

NS = not surveyed

4.4.2 Habitat

4.4.2.1 Breeding

A total of 365 black cockatoo habitat trees were recorded within the site as shown in **Figure 9**.

The habitat trees comprise 30 marri, 155 jarrah, 156 *Eucalyptus rudis* (flooded gum), nine *E. tottiana* (pricklybark) and 15 stag (dead) trees.

From ground level, 37 of the habitat trees were considered to potentially contain hollows suitable for use by black cockatoos for nesting. An internal hollow inspection was undertaken and none of the hollows were determined to be suitable.

A summary of the habitat trees recorded within the site is provided in **Table 12** and **Appendix G**.

Table 12: Habitat trees recorded within the site

Category	Definition	No. trees
Known nesting tree	Trees which contain a hollow where black cockatoo breeding has been recorded or which demonstrates evidence of breeding.	0
Suitable nesting tree	Trees with suitable nesting hollows present, although no evidence of use.	0
Potential nesting tree	Trees that have a suitable DBH to develop a nest hollow, but do not currently have suitable nesting hollows.	365
Total		365

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4.4.2.2 Roosting

No roosts or evidence of roosting were observed within the site during the survey.

4.4.2.3 Foraging

A total of 58.02 ha of foraging habitat for Carnaby's black cockatoo and 25.69 ha of foraging habitat for forest red-tailed black cockatoo was recorded in the site as shown in **Figure 10** to **Figure 11**. The majority of the foraging habitat occurs as a contiguous area of mixed woodland vegetation and comprises a combination of primary, secondary and non-food plants. Dominant primary food plants include jarrah, marri, *Banksia menziesii* (firewood banksia), and *B. attenuata* (candle stick banksia). The dominant secondary food plant is *Xanthorrhoea preissii* (grass tree). The extent of foraging habitat by value category is detailed in **Table 13**.

Table 13: Foraging habitat values recorded within the site

Foraging habitat	Black cockatoo species and area of foraging habitat (ha)	
	Carnaby's	Forest red-tailed
Native primary	38.54	25.69
Native secondary	19.48	0
Non-native primary	0	0
Non-native secondary	0	0
Total	58.02	25.69

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5 Discussion

5.1 Fauna habitat

The site encompasses a relatively large parcel of land with a variety of different fauna habitats. Despite obvious disturbance these habitats were demonstrated to be utilised by a range of native fauna.

With the exception of black cockatoos, the site generally has limited value for conservation significant fauna. Much of the site was historically cleared and the resulting patchwork of remnant vegetation and parkland cleared or open paddocks would be of most benefit to fauna that don't have particularly specific habitat requirements. The highest habitat values are associated with the **jarrah forest, banksia woodland** and **jarrah woodland** habitats which occur over 12% of the site. These areas have a native understorey that would support increased invertebrate diversity and provide cover for native reptiles and mammals. Other areas of forest, woodland and shrubland habitat occur in varying states of disturbance.

5.2 Fauna

The majority of the fauna species recorded within the site are common to the north Swan Coastal Plain. A high proportion of the recorded fauna assemblage consisted of birds and reptiles which is typical of vertebrate fauna assemblages in Western Australia. While a low proportion of native mammals was anticipated given the habitat values within the site, the presence of *Tarsipes rostratus* (honey possum) and *Tachyglossus aculeatus* (short-beaked echidna) was surprising given that they are less common near urbanised areas. Recent records for either of these species are sparse within the Perth Metropolitan Region.

5.3 Conservation significant fauna

5.3.1 Black-striped burrowing snake

The black-striped burrowing snake is a small elapid listed as priority 3 (P3) in Western Australia. It is restricted to sandy sites on the Swan Coastal Plain as far south as Mandurah with isolated populations found in Dongara and Enneabba (Wilson and Swan 2021). One individual of black-striped burrowing snake was caught during the second phase of trapping in banksia woodland habitat approximately 300 m from a historical DBCA record from 1976. The species features bright orange/red colouring with black banding across the head, eyes and snout (Bush *et al.* 2010). A distinct black vertebral stripe separates it from the related *Neelaps bimaculatus* (black-naped burrowing snake) that was also caught within the site.

5.3.1.1 Habitat preference

The black-striped burrowing snake is known to inhabit sandy soils found in banksia or eucalypt woodlands and has also been observed on coastal dunes vegetated with heath (Bush *et al.* 2010; Wilson and Swan 2021). Accordingly, areas of sandy soils with relatively intact native vegetation cover within the site were mapped as habitat for this species (**Figure 6**). However, being a burrower

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it is possible that it could inhabit any area within the site comprising sandy soil, including areas considered 'cleared' habitat.

5.3.2 Quenda

Quenda are small to medium sized marsupials listed as priority 4 (P4) in Western Australia. Previously categorised as a subspecies of the *Isoodon obesulus* (southern brown bandicoot), it is now considered its own species (Travouillon and Phillips 2018). Quenda are found throughout southwest WA, preferring areas with dense understorey vegetation including residential gardens (Menkhorst and Knight 2011; Kristancic *et al.* 2022). Multiple quenda were caught throughout the site by cage and camera traps and their distinctive conical diggings were frequently observed.

5.3.2.1 Habitat

Quenda inhabit vegetation with dense understorey and are often found near swampy areas (DBCA 2017a). Accordingly, areas with relatively intact understorey cover were mapped as habitat for this species (**Figure 7**), including a majority of woodland and shrubland habitats within the site. Quenda may also forage across or traverse other habitats in the site.

5.3.3 Unrecorded species that may possibly occur

It is possible that a further two marsupial mammals, two birds and six invertebrates with legislative or policy listing may occur in the site.

Chuditch (vulnerable under EPBC Act and BC Act) are a small to medium sized mammal that occur in a range of woodland and shrubland habitats. No evidence of this species was recorded during this assessment. The preferred method to detect chuditch is by the use of camera traps (DSEWPaC 2011). Camera traps were used in this survey. However, cage traps were the primary fauna detection method and camera locations were relatively widely spaced and not baited. Chuditch can also be trapped by cage. However, 'chuditch bait' typically consists of meat meal and in this survey 'universal bait' comprised of oats, peanut butter and sardines was deployed. Therefore, while chuditch were not recorded during the survey, the survey was not designed to specifically target the detection of this species. Given that there are no recent records in the local area, it is not likely chuditch occur in the site. They are threatened species and rarely recorded in developed portions of the Swan Coastal Plain. Nonetheless, as chuditch can roam over a large range, and suitable habitat is present in the site, it is possible that chuditch may occasionally or temporarily occur.

Habitat suitable for the western brush wallaby (P4) also exists within the site but evidence of the species was not recorded during the survey. Similar to the chuditch, they may visit the site as suitable habitat is present although it is likely on an occasional and temporary basis.

Pacific swift (migratory under the EPBC Act and BC Act) and peregrine falcon (other specially protected in WA) are highly mobile species that may opportunistically fly over or forage in the site for short periods of time as part of a much larger home range. Neither of these species would breed within the site. Any occurrence of Pacific swift or peregrine falcon in the site would likely be in the air space and largely independent from terrestrial habitat.

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The conservation significant invertebrates (graceful sun moth (P4), Swan Coastal Plain shield-backed trapdoor spider (P3), spiny katyid (P2) and three native bees (one CR and two P3)) could all occur within the site based on the soils and vegetation present. However, records of these species are sparse in the local area. While numerous common invertebrates were captured in pitfall and funnel traps, this survey was targeting vertebrate fauna. A targeted invertebrate survey would be required to determine the presence of any conservation significant invertebrates.

5.4 Black cockatoos

Carnaby's black cockatoo and forest red-tailed black cockatoo were recorded by visual observation within the site and evidence of foraging attributed to both species was also observed. Records for these species were not unexpected as the site is located within their modelled distribution ranges and suitable habitat occurs within the site and the local area.

The site is located outside of the modelled distribution range of Baudin's black cockatoo (DoEE 2016b) and while short incidental occurrences are conceivable, it is generally unlikely that the species would occur in the site.

5.4.1 Breeding habitat

As none of the habitat trees contain hollows suitable for use by black cockatoos for breeding, the site does not currently provide breeding habitat for any of the three species of black cockatoo. The habitat trees within the site have the potential to form suitable hollows in the future. However, it will likely take many decades for hollows to form that are large enough to be suitable for use by black cockatoos for breeding.

As the site is located outside of the expected breeding distribution of Baudin's black cockatoo, the potential for the future formation of breeding habitat is most relevant to Carnaby's black cockatoo and forest red-tailed black cockatoo.

5.4.2 Roosting habitat

No secondary evidence of roosting such as branch clippings, droppings or feathers were observed within the site. Therefore, there is no reason to suspect that roosting by black cockatoos has recently occurred in the site.

The lack of forest red-tailed black cockatoo roosts in the local area suggests that if roosting were to occur, it would be by Carnaby's black cockatoo. However, Carnaby's black cockatoo have shown a preference to roost amongst the nearby pine plantation with some roosts recording over 1000 individuals. Therefore, while the large trees within the site are suitable for roosting, they are likely a low preference compared to other roost locations available in the local area.

5.4.3 Foraging habitat

The site contains native foraging habitat for both Carnaby's black cockatoo and forest red-tailed black cockatoo.

Detailed Fauna and Targeted Black Cockatoo Assessment

Various Lots, Mariginiup



The highest value foraging resource in the site for both Carnaby's black cockatoo and forest red-tailed black cockatoo is associated with the jarrah trees in the west and southeast and marri trees in the east. Banksia woodland in the southeast and along Rousset Road also provides primary foraging habitat for the Carnaby's black cockatoo. While not insignificant, the foraging habitat within the site is a relatively small resource for the Carnaby's black cockatoo in comparison to the extensive area of pine plantation that occurs adjacent to the site. Pine trees are known to be a high preference food source for Carnaby's black cockatoo.

Secondary foraging habitat for Carnaby's black cockatoo is associated with the high abundance of grass trees in the west. While there are records of Carnaby's black cockatoo consuming the fruit of these plants (Groom 2011; DoEE 2017), they are not as important food sources compared to banksia, marri or jarrah. No secondary foraging habitat for forest red-tailed black cockatoo occurs within the site.

Foraging habitat within the site predominantly supports breeding for forest red-tailed black cockatoos as known breeding areas for Carnaby's black cockatoos occur over 10 km from site.

Detailed Fauna and Targeted Black Cockatoo Assessment

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6 Conclusions

Outcomes of the detailed fauna survey include the following:

- The majority of the site (approximately 59%) supports highly disturbed cleared area habitat which provides limited value to fauna. The highest fauna habitat values are associated with the jarrah forest, banksia woodland and jarrah woodland habitats which occur over approximately 12.05% of the site. The remainder of the site comprises various forest, woodland and shrubland habitats with little to no understorey (approximately 22.17%).
- A total of 68 native and seven introduced species were recorded within the site.
- Four species of conservation significance were recorded in the site: Carnaby's black cockatoo (endangered), forest red-tailed black cockatoo (vulnerable), black-striped burrowing snake (P3) and quenda (P4).
- Ten other species of conservation significance not recorded during the field survey may possibly occur in the site: chuditch, Douglas's broad headed bee, graceful sunmoth, pacific swift, peregrine falcon, spiny katyid, Swan Coastal Plain shield-backed trapdoor spider, western brush wallaby, woolly bush bee and a short-tongued bee (*Leioproctus contrarius*).

Outcomes of the targeted black cockatoo survey include the following:

- The site occurs within the modelled distribution of Carnaby's black cockatoo and forest red-tailed black cockatoo but outside of the modelled distribution of Baudin's black cockatoo. Both Carnaby's black cockatoo and forest red-tailed black cockatoo was recorded in the site during the field survey.
- The site contains 365 habitat trees, none of which contain hollows suitable for use by black cockatoos for breeding. Therefore, the site does currently not provide breeding habitat for any species of black cockatoo.
- No roosts or evidence of roosting by any species of black cockatoo was recorded within the site during the field survey. Tall native and non-native trees within the site represent suitable roosting habitat for species of black cockatoo.
- A total of 58.02 ha of foraging habitat for Carnaby's black cockatoo was mapped within the site of which 38.54ha (66.43%) provides a primary resource and 19.48 ha (33.57) provides a secondary resource.
- A total of 25.69 ha of foraging habitat for forest red-tailed black cockatoo was mapped within the site of which all provides a primary resource.
- Additional areas of foraging habitat of similar or higher value occur adjacent to the site and in the wider local area.

Detailed Fauna and Targeted Black Cockatoo Assessment

Various Lots, Mariginiup



7 References

7.1 General references

AECOM 2018, *Flora, Vegetation and Fauna Assessment - Spring 2017*, 60553895, Version 0.

Alan Tingay and Associates 1998, *A Strategic Plan for Perth's Greenways - Final Report*. December 1998.

BirdLife International 2022, *Important Bird Areas*, <<http://datazone.birdlife.org/site/factsheet/northern-swan-coastal-plain-iba-australia>>.

Bureau of Meteorology (BoM) 2022, *Climate Data Online*, <<http://www.bom.gov.au/climate/data/>>.

Bush, B., Maryan, B., Browne-Cooper, R. and Robinson, D. 2010, *Field Guide to Reptiles and Frogs of the Perth Region*, Western Australian Museum, Perth.

Churchward, H. M. and McArthur, W. M. 1980, 'Landforms and Soils of the Darling System, Western Australia', in Department of Conservation and Environment (ed.), *Atlas of Natural Resources Darling System Western Australia*, Department of Conservation and Environment.

Clarke, K. R. and Gorley, R. N. 2006, *PRIMER v6: User Manual/Tutorial*, PRIMER-E, Plymouth.

Davies, S. J. J. F. 1966, *The movements of the White-tailed Black Cockatoo (Calyptorhynchus baudinii) in south-western Australia*, Western Australian Naturalist 10: 33-42.

Department of Agriculture, Water and the Environment (DAWE) 2022a, *Protected Matters Search Tool*, <<https://pmst.awe.gov.au/#>>.

Department of Agriculture, Water and the Environment (DAWE) 2022b, *Referral guideline for 3 WA threatened black cockatoo species: Carnaby's Cockatoo, Baudin's Cockatoo and the Forest Red-tailed Black cockatoo*, Canberra.

Department of Biodiversity, Conservation and Attractions (DBCA) 2017a, *Fauna Notes – Living with Quenda*.

Department of Biodiversity, Conservation and Attractions (DBCA) 2017b, *Ramsar Sites (DBCA-010)*.

Department of Biodiversity, Conservation and Attractions (DBCA) 2018, *Directory of Important Wetlands in Australia - Western Australia (DBCA-045)*.

Department of Biodiversity, Conservation and Attractions (DBCA) 2021a, *Geomorphic Wetlands, Swan Coastal Plain (DBCA-019)*, <<https://catalogue.data.wa.gov.au/dataset/geomorphic-wetlands-swan-coastal-plain>>.

Department of Biodiversity, Conservation and Attractions (DBCA) 2021b, *Lands of Interest (DBCA-012)*.

Detailed Fauna and Targeted Black Cockatoo Assessment

Various Lots, Mariginiup



Department of Biodiversity Conservation and Attractions (DBCA) 2021c, *Legislated Lands and Waters (DBCA-011)*.

Department of Biodiversity, Conservation and Attractions (DBCA) 2022, *Geomorphic Wetlands, Swan Coastal Plain (DBCA-019)*, Western Australia, <<https://catalogue.data.wa.gov.au/dataset/geomorphic-wetlands-swan-coastal-plain>>.

Department of Biodiversity, Conservation and Attractions (DBCA) 2023, *NatureMap*, <<https://static.dbca.wa.gov.au/pages/naturemap.html>>.

Department of Climate Change, Energy, the Environment and Water (DCCEEW) 2023a, *Australian Faunal Directory*.

Department of Climate Change, Energy, the Environment and Water (DCCEEW) 2023b, *Protected Matters Search Tool*, <<https://pmst.awe.gov.au/#/map>>.

Department of Environment and Energy (DoEE) 2016a, *Modelled distribution for Baudin's Cockatoo (Calyptorhynchus baudinii)*, Canberra.

Department of the Environment and Energy (DoEE) 2016b, *Modelled distribution for Carnaby's Cockatoo (Calyptorhynchus latirostris)*, Canberra.

Department of Environment and Energy (DoEE) 2016c, *Modelled distribution for Forest Red-tailed Black-Cockatoo (Calyptorhynchus banksii naso)*, Canberra.

Department of Environment and Energy (DoEE) 2017, *Revised draft referral guideline for three threatened black cockatoo species: Carnaby's Cockatoo (Endangered) Calyptorhynchus latirostris, Baudin's Cockatoo (Vulnerable) Calyptorhynchus baudinii and Forest Red-tailed Black Cockatoo (Vulnerable) Calyptorhynchus banksii naso*, Canberra, Australia.

Department of Water (DoW) 2008, *LiDAR Elevation Dataset, Swan Coastal Plain*, Perth.

Department of Parks and Wildlife (DPaW) 2013, *Carnaby's Cockatoo (Calyptorhynchus latirostris) Recovery Plan*.

Department of Parks and Wildlife (DPaW) 2015, *How to design and place artificial hollows for Carnaby's cockatoo*, Perth.

Department of Primary Industries and Regional Development (DPIRD) 2022, *Western Australian Organism List*, Perth, WA.

Department of Sustainability, Environment, Water, Population and Communities, (DSEWPaC) 2011, *Survey guidelines for Australia's threatened mammals*, Canberra, ACT.

Department of Water and Environmental Regulation (DWER) 2018, *Hydrography Linear (Heirarchy) (DWER-031)*, Perth.

Emerge Associates 2021, *Potential Habitat Black Cockatoo Habitat Spatial Dataset*, Perth, WA.

Emerge Associates 2023, *Detailed Flora and Vegetation Assessment - Various Lots, Mariginiup, EP22-019(01)--011 SCM, Version 1*.

Detailed Fauna and Targeted Black Cockatoo Assessment

Various Lots, Mariginiup



Environment Australia 2000, *Revision of the Interim Biogeographic Regionalisation for Australia (IBRA) and Development of Version 5.1 - Summary Report*, Department of Environment and Heritage.

Environmental Protection Authority (EPA) 2020, *Technical Guidance - Terrestrial vertebrate fauna surveys for environmental impact assessment*, Joondalup, Western Australia.

Forest Products Commission 2020, *Forest Products Commission Plantations (FPC-001)*.

Glossop, B., Clarke, K., Mitchell, D. and Barrett, G. 2011, *Methods for mapping Carnaby's cockatoo habitat*, Department of Environment and Conservation, Perth.

Gotelli, N. J. and Colwell, R. K. 2011, *Estimating species richness*, Oxford University Press, Oxford.

Government of WA 2000, *Bush Forever - Volume 1: Policies, principles and processes*, Perth.

Gozzard, J. 2011, *Sea to scarp - geology, landscape, and land use planning in the southern Swan Coastal Plain*, Geological Survey of Western Australia.

Gozzard, J. R. 2007, *Geology and Landforms of the Perth Region*, Geological Survey of Western Australia, Perth.

Groom, C. 2010, *Artificial Hollows for Carnaby's Black Cockatoo: An investigation of the placement, use, monitoring and maintenance requirements of artificial hollows for Carnaby's black cockatoo*, Department of Environment and Conservation, Perth.

Groom, C. 2011, *Plants Used by Carnaby's Black Cockatoo*, Department of Environment and Conservation, Perth.

Hedde, E. M., Loneragan, O. W. and Havel, J. J. 1980, 'Vegetation Complexes of the Darling System Western Australia', in Department of Conservation and Environment (ed.), *Atlas of Natural Resources Darling System Western Australia*, Perth.

Johnstone, R., Kirby, T. and Sarti, K. 2013, *The breeding biology of the forest red-tailed black cockatoo *Calyptorhynchus banksii naso* Gould in south-western Australia. I. Characteristics of nest trees and nest hollows*, Pacific Conservation Biology, 19(2): 121-142.

Johnstone, R. E., Johnstone, C. and Kirkby, T. 2011, *Black Cockatoos on the Swan Coastal Plain: Carnaby's Cockatoo (*Calyptorhynchus latirostris*), Baudin's Cockatoo (*Calyptorhynchus baudinii*) and the Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*) on the Swan Coastal Plain (Lancelin–Dunsborough), Western Australia. Studies on distribution, status, breeding, food, movements and historical changes.*, Department of Planning, Western Australia.

Johnstone, R. E. and Kirkby, T. 1999, *Food of the Red-tailed Forest Black Cockatoo *Calyptorhynchus banksii naso* in Western Australia*, Western Australian Naturalist, 22: 167-178.

Johnstone, R. E. and Kirkby, T. 2008, *Distribution, status, social organisation, movements and conservation of Baudin's Cockatoo (*Calyptorhynchus baudinii*) in South-west Western Australia*, Records of the Western Australian Museum, 25: 107-118.

Detailed Fauna and Targeted Black Cockatoo Assessment

Various Lots, Mariginiup



Johnstone, R. E., Kirkby, T. and Sarti, K. 2017, *The distribution, status movements and diet of the forest red-tailed black cockatoo in the south-west with emphasis on the greater Perth region, Western Australia*, *The West Australian Naturalist*, 30(4): 193-219.

Johnstone, R. E. and Storr, G. M. 1998, *Handbook of Western Australian Birds. Volume 1 - Non-Passerines (Emu to Dollarbird)*, Western Australian Museum, Perth.

Kendrick, G. W., Wyrwoll, K. H. and Szabo, B. J. 1991, *Pliocene-Pleistocene coastal events and history along the western margin of Australia*, *Quaternary Science Reviews*, 10: 419-439.

Kristancic, A. R., Kuehs, J., Richardson, B. B., Baudains, C., Hardy, G. E. and Fleming, P. A. 2022, *Biodiversity conservation in urban gardens - Pets and garden design influence activity of a vulnerable digging animal*, *Landscape and urban planning*, 225.

Le Roux, C. 2017, *Nocturnal roost tree, roost site and landscape characteristics of Carnaby's Black-Cockatoo (*Calyptorhynchus latirostris*) on the Swan Coastal Plain*, Edith Cowan University Research Online.

Menkhorst, P. and Knight, F. 2011, *Field guide to the mammals of Australia (Third edition)*, Oxford University Press Australia & New Zealand, Melbourne, VIC, Australia.

Peck, A., Barrett, G. and Williams, M. 2022, *The 2022 Great Cocky Count: a community-based survey for Carnaby's Black-Cockatoo (*Calyptorhynchus latirostris*), Baudin's Black-Cockatoo (*Calyptorhynchus baudinii*) and Forest Red-tailed Black-Cockatoo (*Calyptorhynchus banksii naso*)*, Birdlife Australia, Floreat, Western Australia.

Saunders, D. A. 1979a, *The Availability of Tree Hollows for Use as Nest Sites by White-tailed Black Cockatoos*, *Australian Wildlife Research*, 6: 205-216.

Saunders, D. A. 1979b, *Distribution and taxonomy of the white-tailed and yellow-tailed Black-Cockatoos *Calyptorhynchus* spp.*, *Emu*, 79(215-227).

Saunders, D. A. 1980, *Food and Movements of the Short-billed Form of the White-tailed Black Cockatoo*, *Australian Wildlife Research*, 7: 257-269.

Saunders, D. A., Mawson, P.R., Dawson, R. 2014, *Use of tree hollows by Carnaby's Cockatoo and the fate of large hollow-bearing trees at Coomallo Creek, Western Australia 1969-2013.*, *Biological Conservation*, 177: 185-193.

Saunders, D. A., Smith, G. T. and Rowley, I. 1982, *The availability and dimensions of Tree Hollows that Provide Nest Sites for Cockatoos (*Psittaciformes*) in Western Australia*, *Australian Wildlife Research*, 9: 541-556.

Seddon, G. 2004, *A Sense of Place: a response to an environment, the Swan Coastal Plain Western Australia*, Blooming Books, Melbourne.

Shah, B. 2006, *Conservation of Carnaby's Black Cockatoo on the Swan Coastal Plain, Western Australia*, Birds Australia, Perth.

Travouillon, K. J. and Phillips, M. J. 2018, *Total evidence analysis of the phylogenetic relationships of bandicoots and bilbies (*Marsupialia: Peramelemorphia*): reassessment of two species description of a new species*, *Zootaxa*, 4378(2): 224-256.

Detailed Fauna and Targeted Black Cockatoo Assessment

Various Lots, Mariginiup



Western Australian Local Government Association and Perth Biodiversity Project (WALGA and PBP) 2004, *Local Government Biodiversity Planning Guidelines for the Perth Metropolitan Region*, Perth.

Western Australian Land Information Authority (WALIA) 2023, *Landgate Map Viewer Plus*.

Western Australian Museum (WAM) 2022, *Checklist of the Terrestrial Vertebrate Fauna of Western Australia*, Perth, WA.

Wetlands Advisory Committee 1977, *The status of reserves in System Six*, Environmental Protection Authority, Perth.

Wilson, S. and Swan, G. 2021, *A Complete Guide to Reptiles of Australia*, New Holland Publishers, Sydney, Australia.

7.2 Online references

The online resources that have been utilised in the preparation of this report are referenced in **Section 7.1**, with access date information provided in **Table R 1**.

Table R 1 Access dates for online references

Reference	Date accessed	Website or dataset name
Atlas of Living Australia (2022)	15 February 2023	The Atlas of Living Australia's Spatial Portal
BirdLife International (2022)	15 February 2023	Important Bird Areas
BoM (2022)	15 February 2023	Climate Data Online
DAWE (2022)	25 March 2022	Protected Matters Search Tool
DBCA (2022)	25 March 2022	NatureMap
DoEE (2021)	15 February 2023	Australian Faunal Directory
WALIA (2022)	15 February 2023	Landgate Map Viewer

Detailed Fauna and Targeted Black Cockatoo Assessment

Various Lots, Mariginiup



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Figures



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Figure 9: Black Cockatoo Habitat Trees

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Figure 11: Forest Red-tailed Black Cockatoo Foraging Habitat

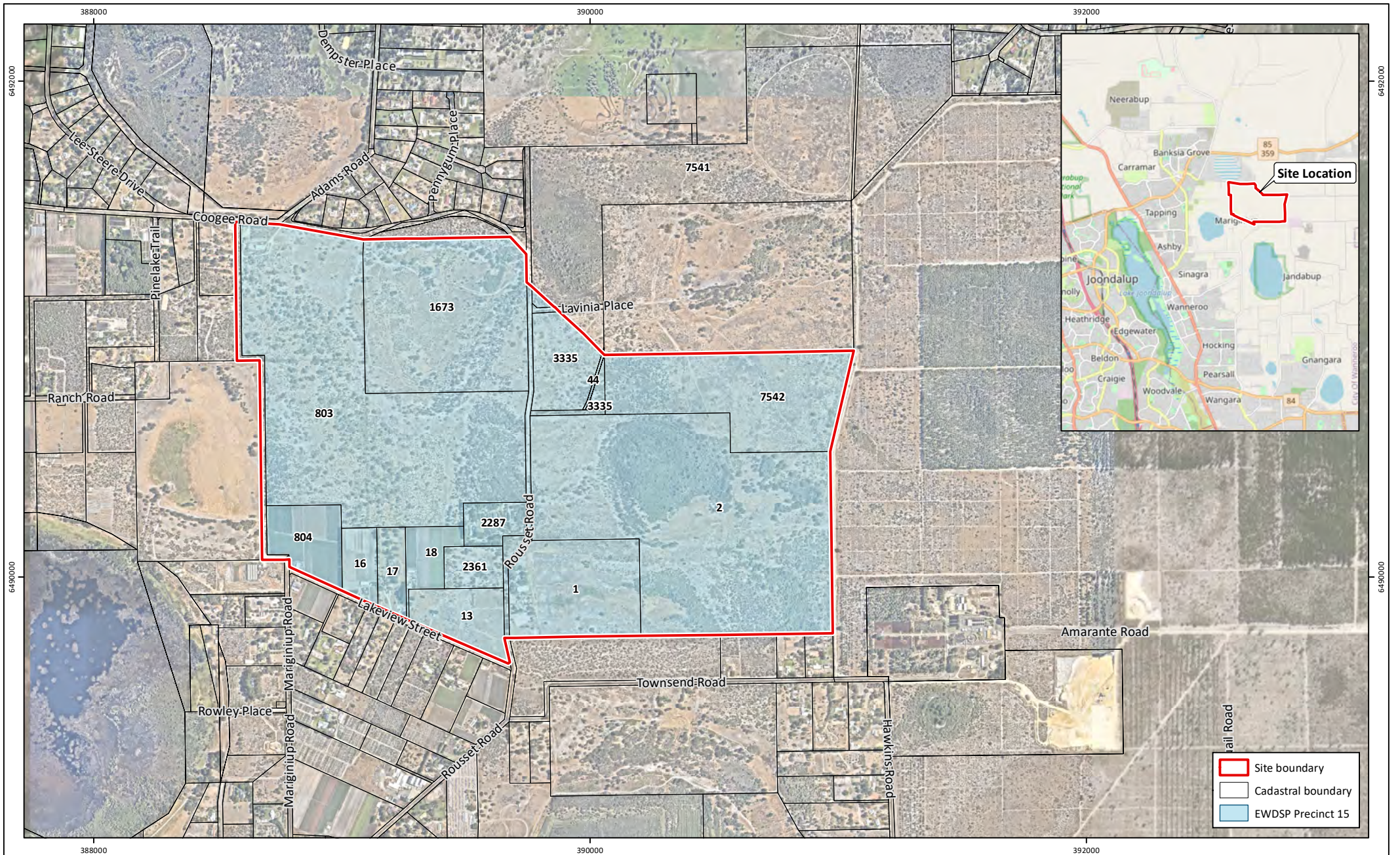
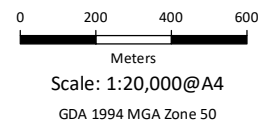


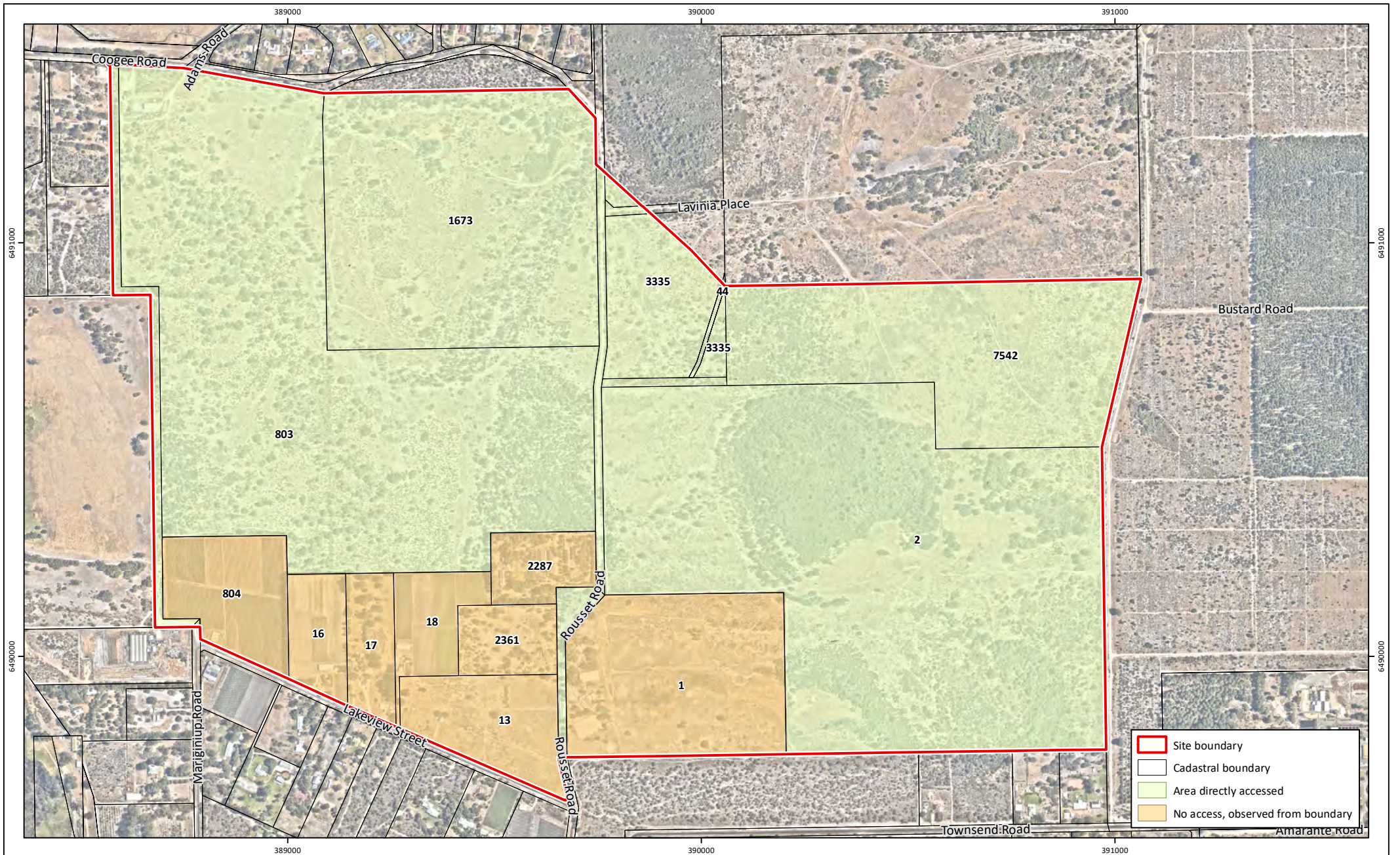
Figure 1: Site Location

Project: Detailed and Targeted Black Cockatoo Assessment
 Various Lots, Marigninup
Client: Stockland

Plan Number:
 EP22-019(02)-F17
Drawn: GAR
Date: 13/02/2023
Checked: NAW
Approved: TAA
Date: 28/02/2023



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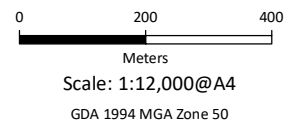
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	Cadastral boundary
	Area directly accessed
	No access, observed from boundary

Figure 2: Lot Access

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 Various Lots, Mariginiup
Client: Stockland

Plan Number:
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Drawn: GAR
Date: 13/02/2023
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Date: 28/02/2023



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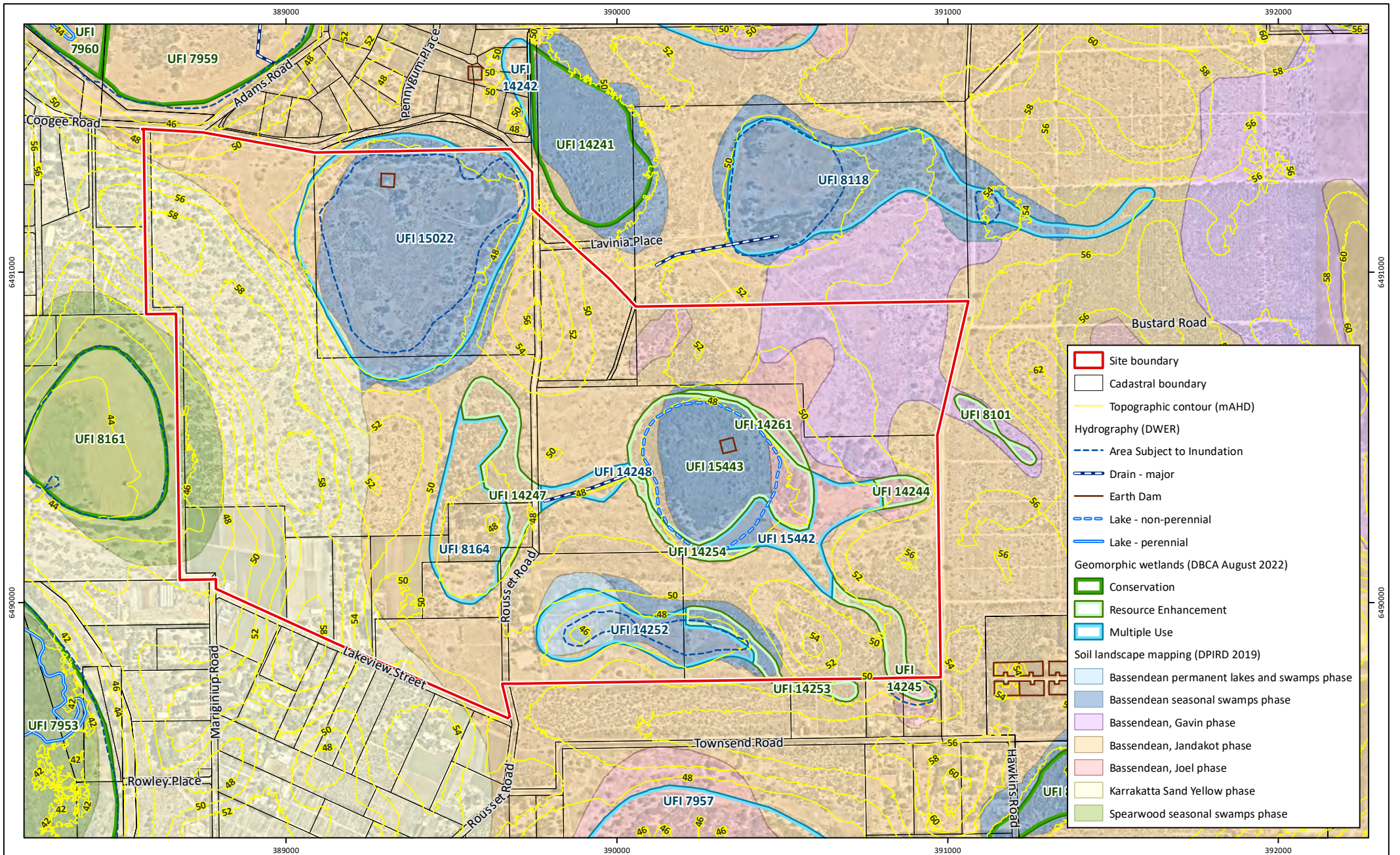


Figure 3: Hydrography, Soils and Topography

Project: Detailed and Targeted Black Cockatoo Assessment
 Various Lots, Marigniniup
Client: Stockland

Plan Number:
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Date: 13/02/2023
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Meters

Scale: 1:15,000@A4
GDA 1994 MGA Zone 50



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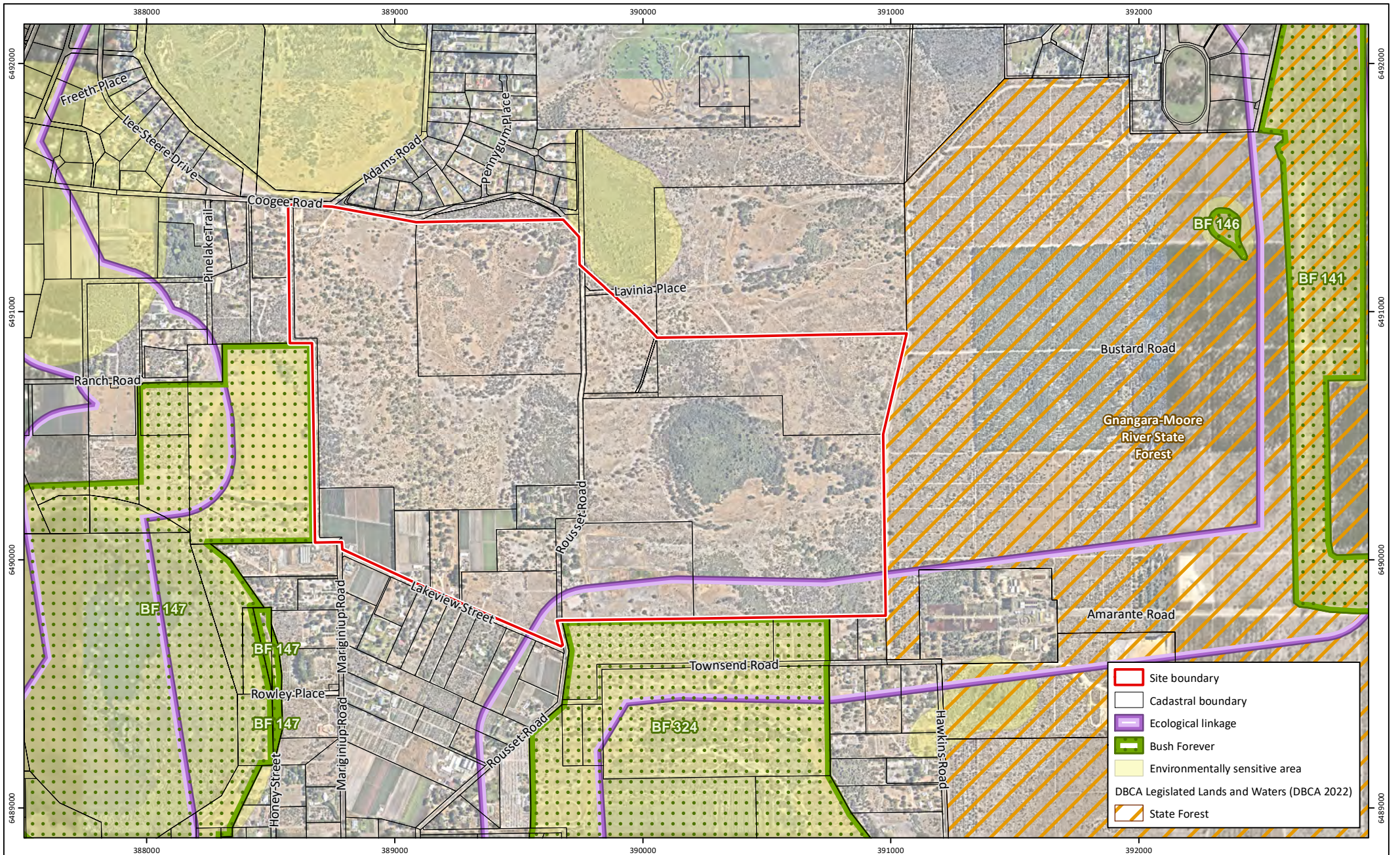


Figure 4: Environmental Features

Project:	Detailed and Targeted Black Cockatoo Assessment Various Lots, Marigninup
Client:	Stockland

Plan Number:	EP22-019(02)-F19
Drawn:	GAR
Date:	13/02/2023
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Approved:	TAA
Date:	28/02/2023

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GDA 1994 MGA Zone 50



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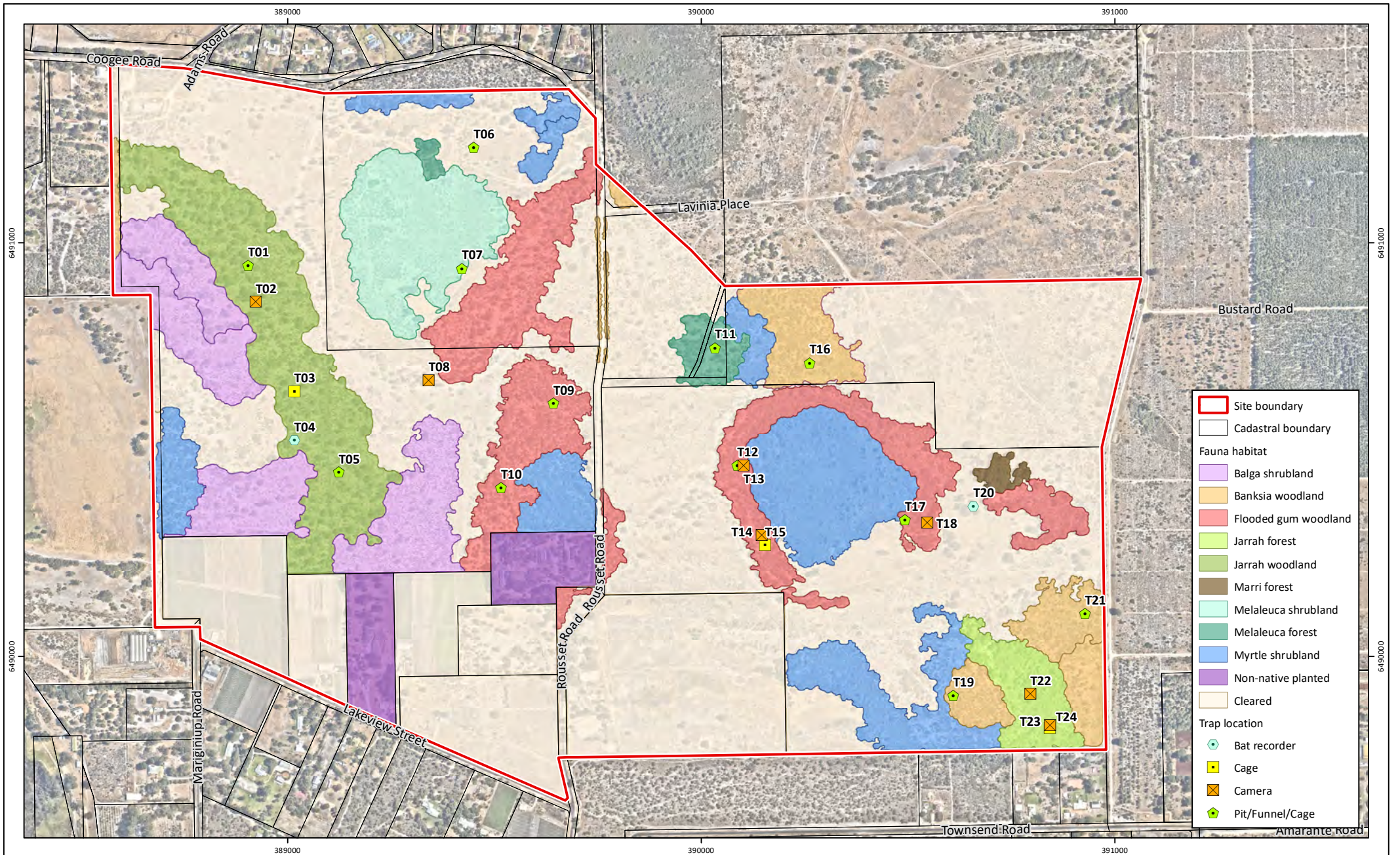


Figure 5: Fauna Habitat and Trap Locations

Project: Detailed and Targeted Black Cockatoo Assessment
Various Lots, Marginiup
Client: Stockland

Plan Number:
EP22-019(02)-F21a
Drawn: SCM
Date: 27/07/2023
Checked: NAW
Approved: TAA
Date: 27/07/2023



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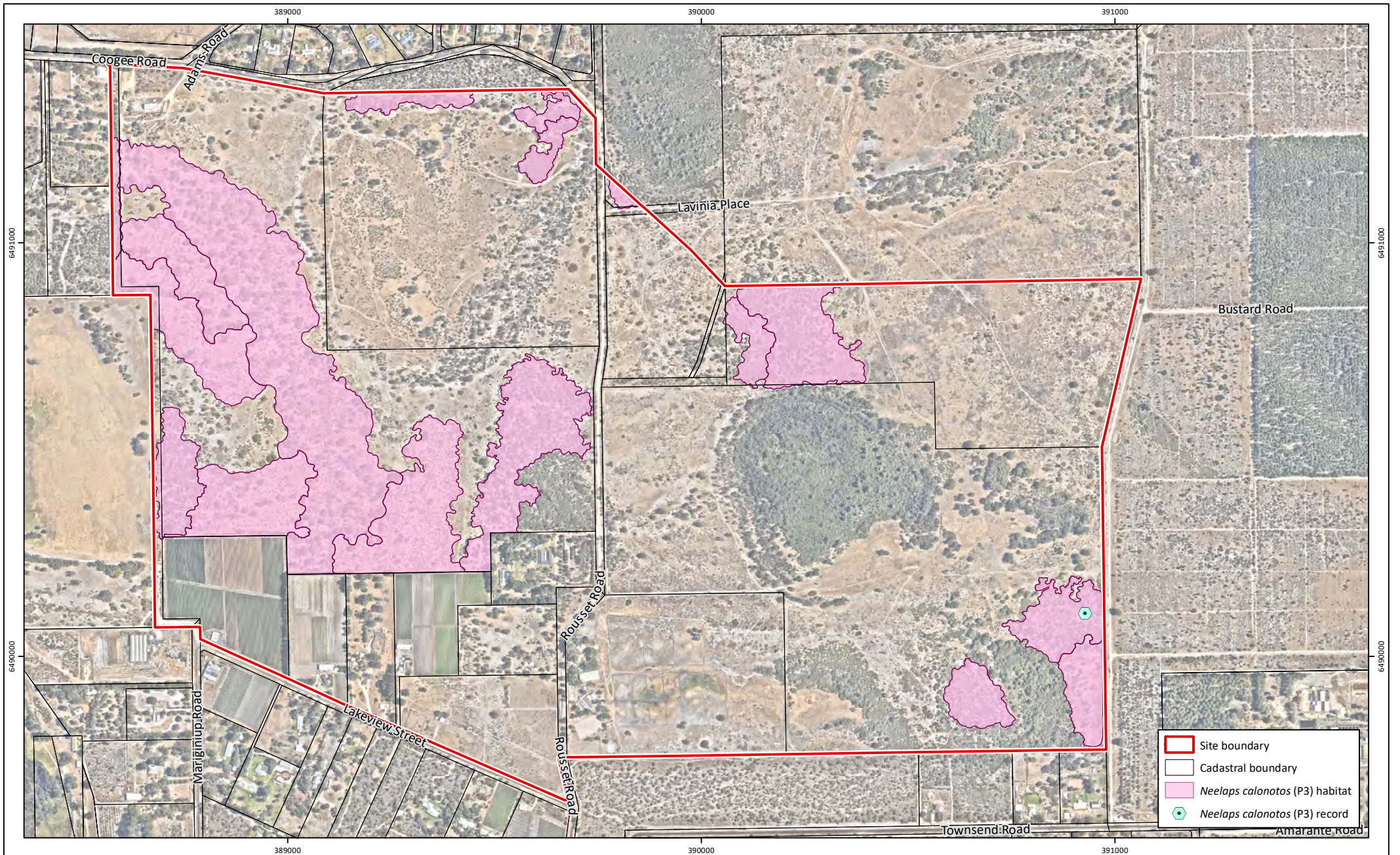
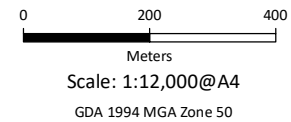


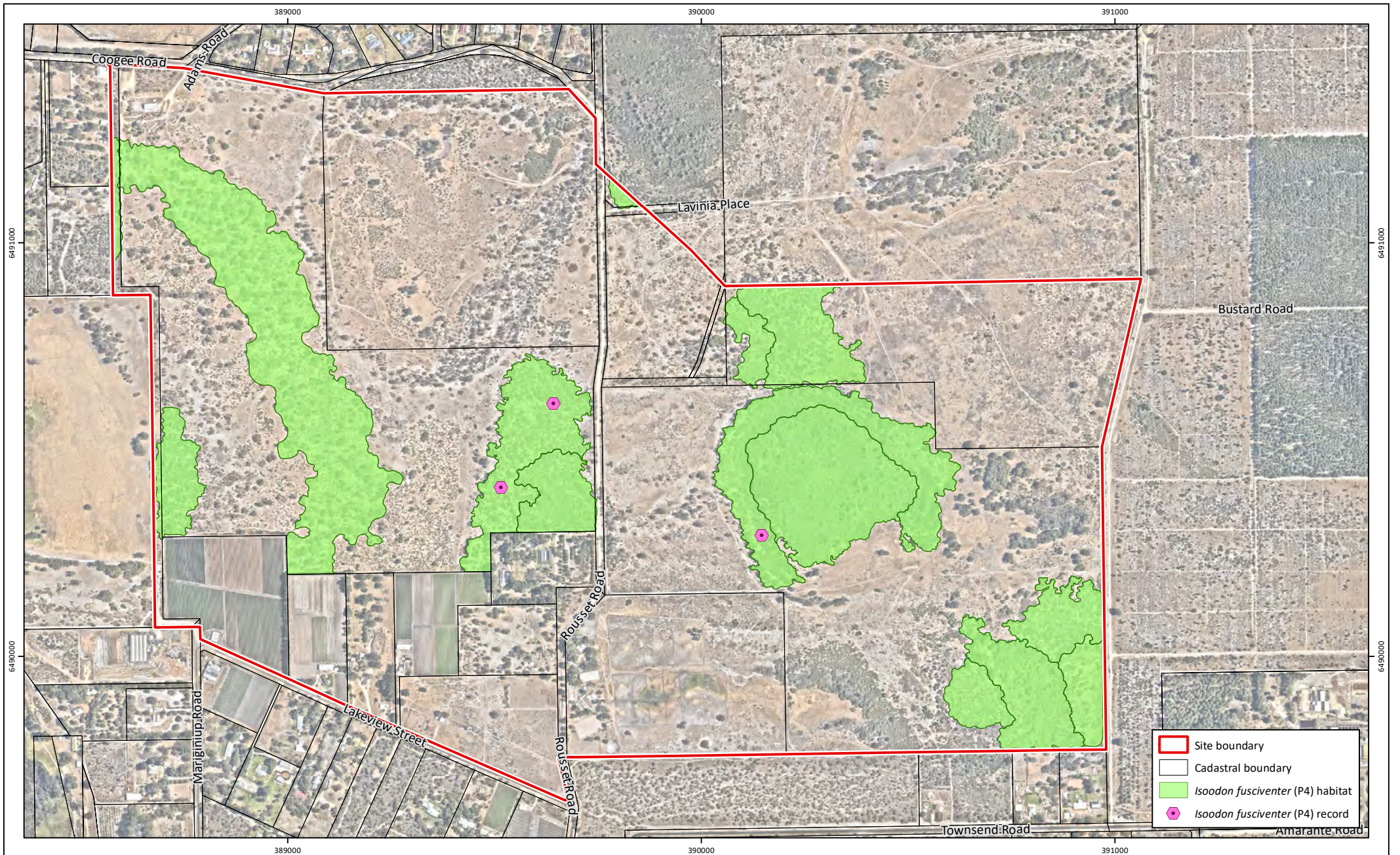
Figure 6: Black-Striped Burrowing Snake Record and Habitat

Project: Detailed and Targeted Black Cockatoo Assessment
 Various Lots, Marigninup
Client: Stockland

Plan Number:
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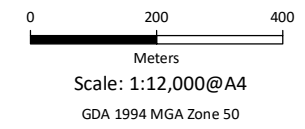
	Site boundary
	Cadastral boundary
	<i>Isodon fusciventer</i> (P4) habitat
	<i>Isodon fusciventer</i> (P4) record

Figure 7: Quenda Records and Habitat

Project: Detailed and Targeted Black Cockatoo Assessment
 Various Lots, Marginiup
Client: Stockland

Plan Number:
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Drawn: GAR
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Checked: NAW
Approved: TAA
Date: 01/03/2023



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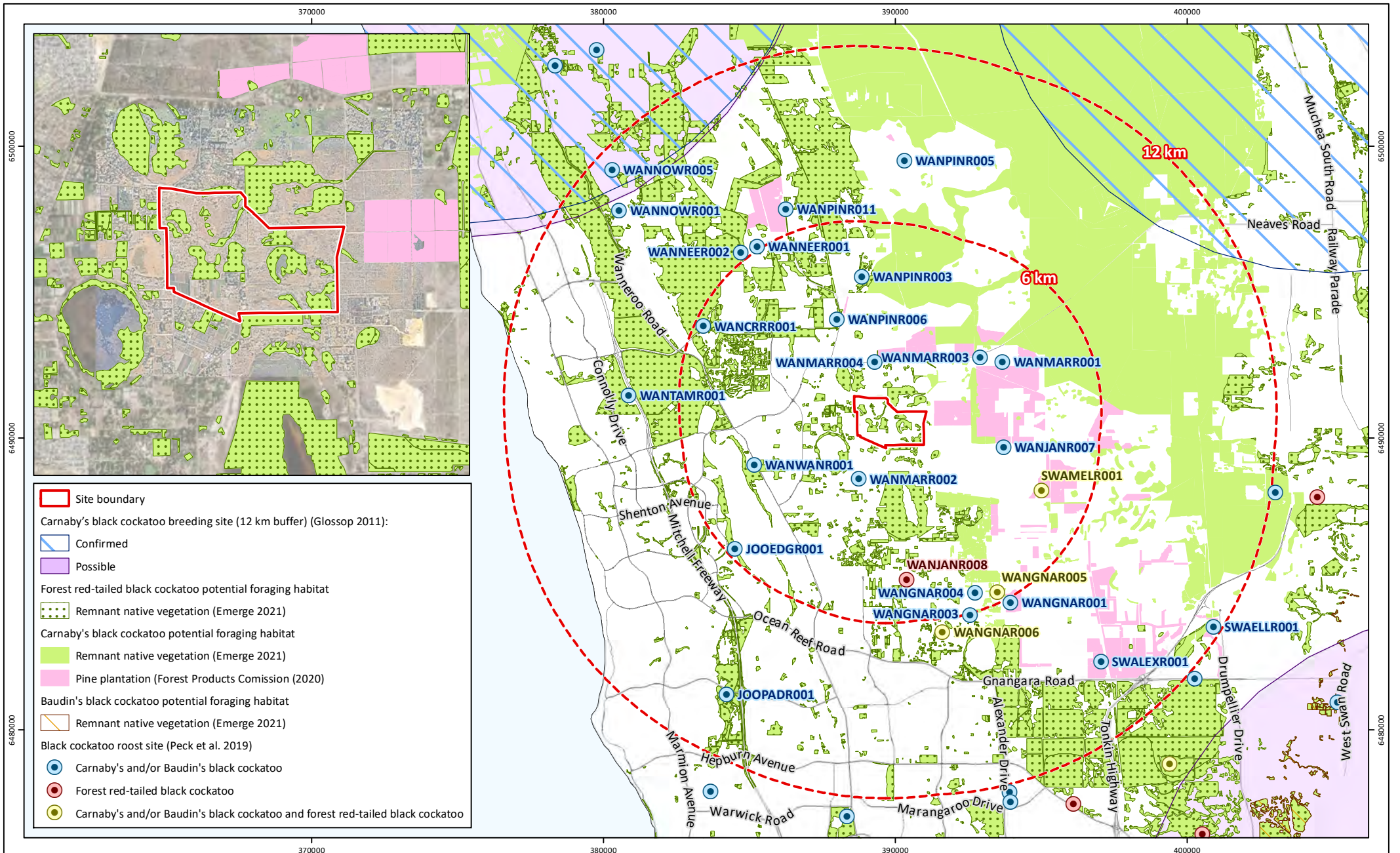
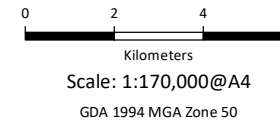


Figure 8: Black Cockatoo Habitat Context

Project: Detailed and Targeted Black Cockatoo Assessment
Various Lots, Mariginiup

Client: Stockland

Plan Number: EP22-019(02)-F22
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Date: 13/02/2023
Checked: NAW
Approved: TAA
Date: 28/02/2023



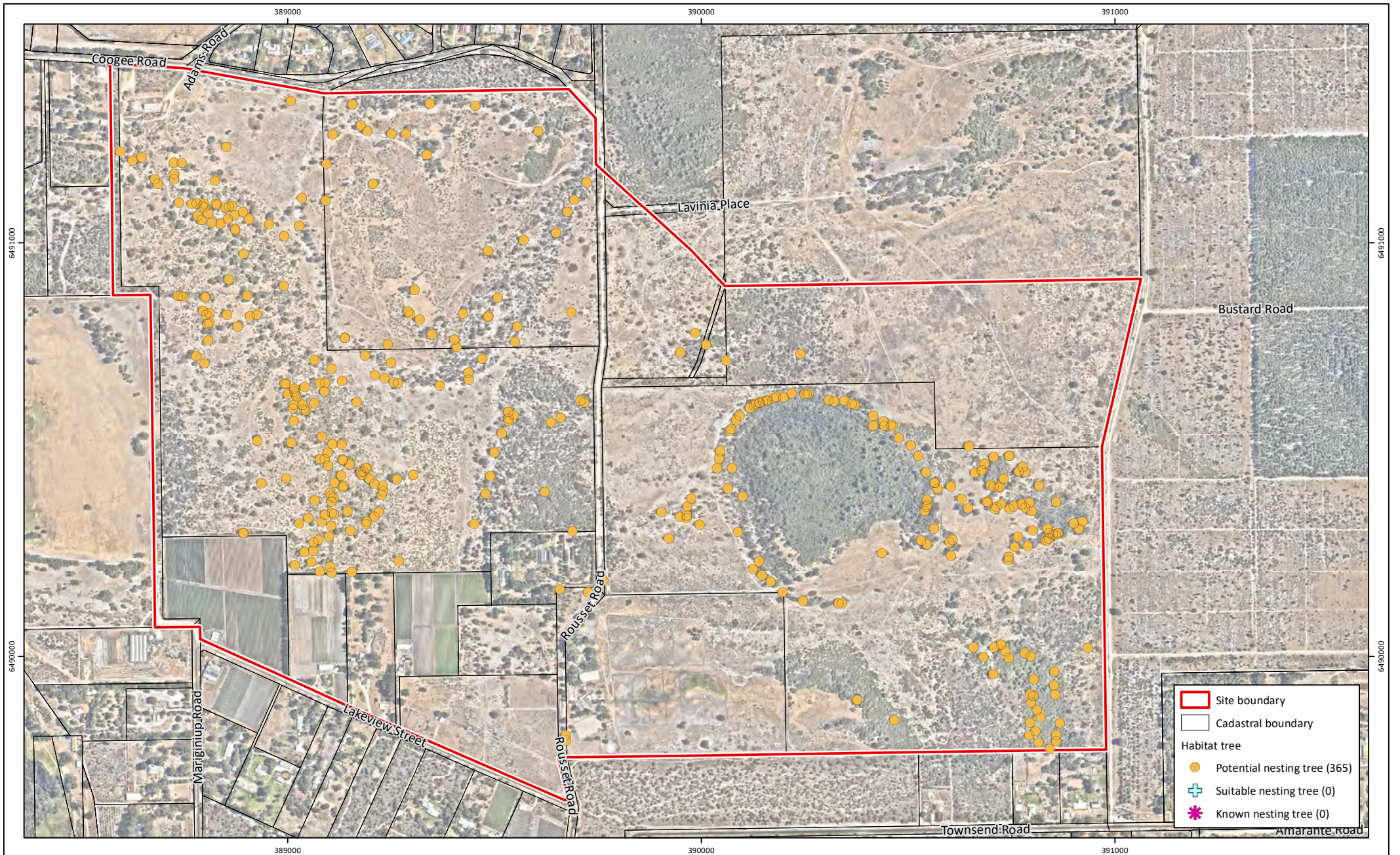
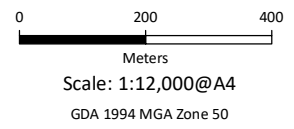


Figure 9: Black Cockatoo Habitat Trees

Project: Detailed and Targeted Black Cockatoo Assessment
 Various Lots, Marigninup
Client: Stockland

Plan Number:
 EP22-019(02)-F23
Drawn: GAR
Date: 13/02/2023
Checked: NAW
Approved: TAA
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	Site boundary
	Cadastral boundary
Habitat tree	
	Potential nesting tree (365)
	Suitable nesting tree (0)
	Known nesting tree (0)

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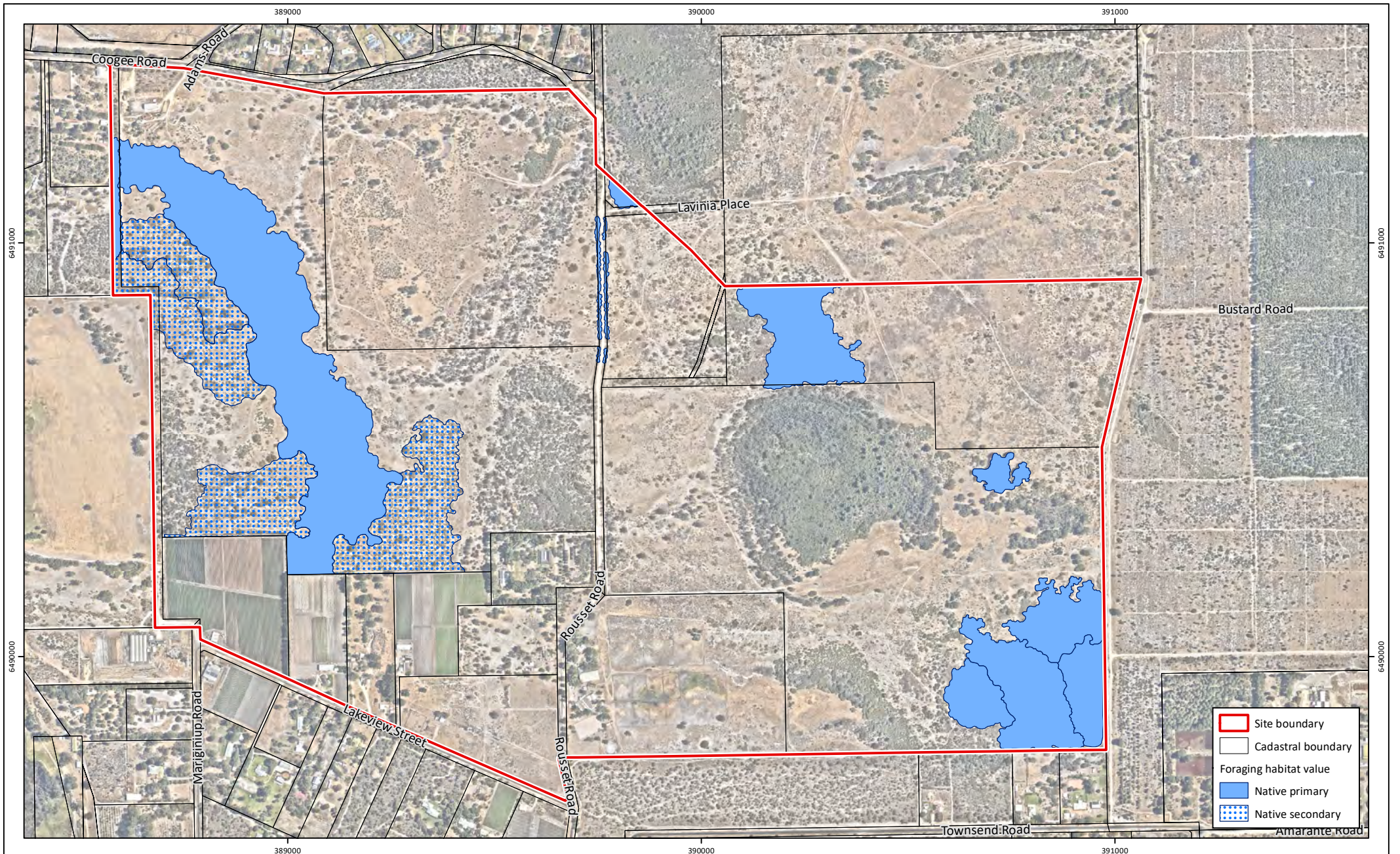
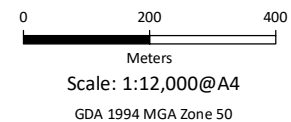


Figure 10: Carnaby's Cockatoo Foraging Habitat

Project: Detailed and Targeted Black Cockatoo Assessment
 Various Lots, Marigninup
Client: Stockland

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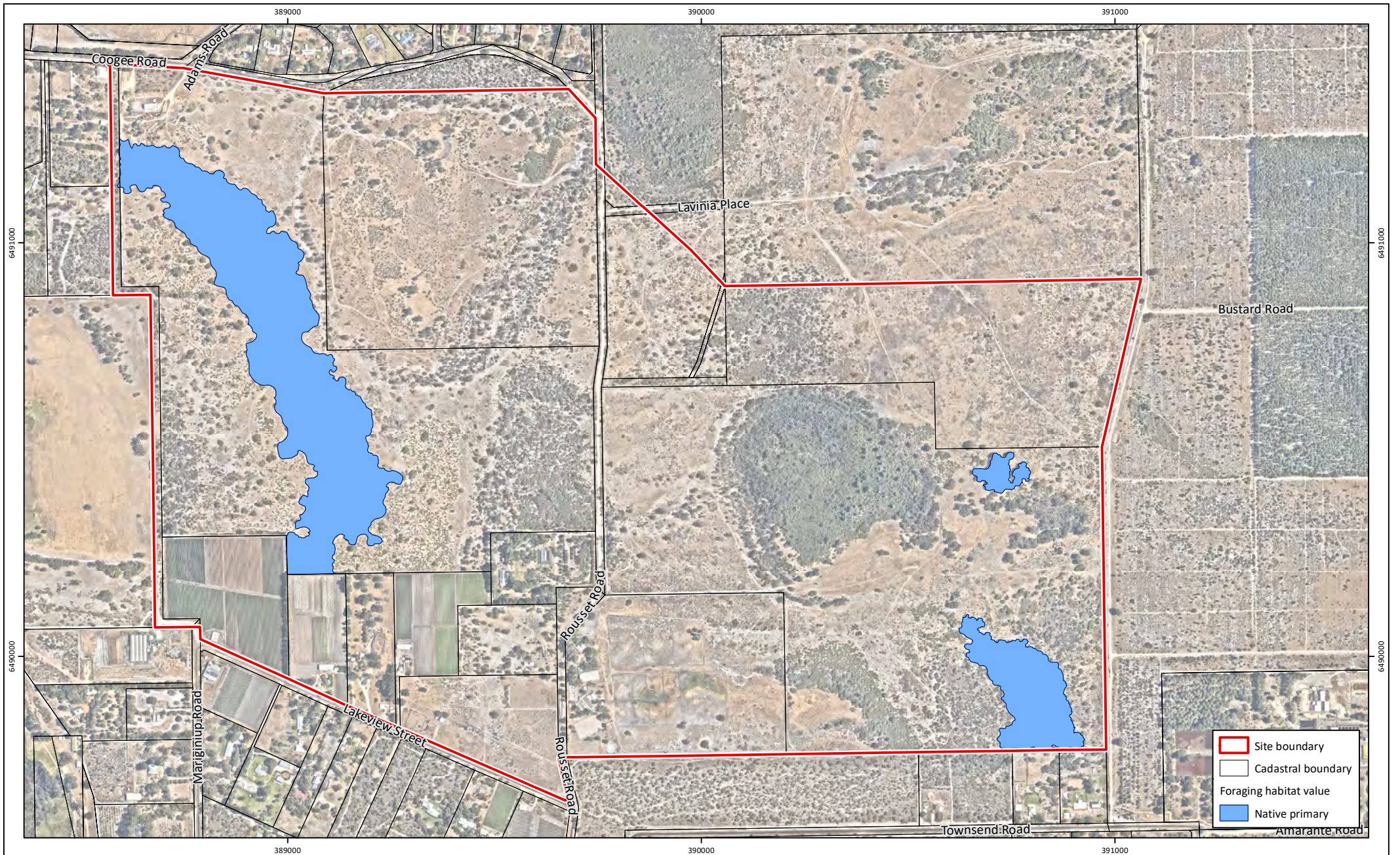
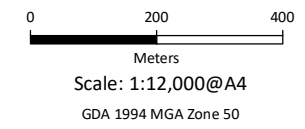


Figure 11: Forest Red-tailed Black Cockatoo Foraging Habitat

Project: Detailed and Targeted Black Cockatoo Assessment
 Various Lots, Mariginup
Client: Stockland

Plan Number:
 EP22-019(02)-F25
Drawn: GAR
Date: 13/02/2023
Checked: NAW
Approved: TAA
Date: 28/02/2023



While Emerge Associates makes every attempt to ensure the accuracy and completeness of data, Emerge accepts no responsibility for externally sourced data used
 ©Landgate (2023). Nearmap Imagery date: 14/01/2023

Appendix A

Additional Information



Conservation Significant Fauna

Threatened and priority fauna

Fauna species considered rare or under threat warrant special protection under Commonwealth and/or State legislation. At the Commonwealth level, fauna species can be listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) as ‘threatened’, ‘migratory’ or ‘marine’ as described in **Table 1**.

Migratory species comprise birds recognised under international treaties including:

- Japan Australia Migratory Bird Agreement 1981 (JAMBA)
- China Australia Migratory Bird Agreement 1998 (CAMBA)
- Republic of Korea-Australia Migratory Bird Agreement 2007 (ROKAMBA)
- Bonn Convention 1979 (The Convention on the Conservation of Migratory Species of Wild Animals).

Fauna species listed as threatened and migratory are protected in Australia as ‘matters of national environmental significance’ (MNES) under the EPBC Act.

Table 1: Definitions of conservation significant fauna species pursuant to the EPBC Act

Conservation Code	Category
EX	Threatened Fauna –Extinct There is no reasonable doubt that the last member of the species has died.
EW [#]	Threatened Fauna –Extinct in the Wild Taxa which are known only to survive in cultivation, captivity or as a naturalised population outside its past range, or taxa which have not been recorded in its known and/or expected habitat despite appropriate exhaustive surveys.
CR [#]	Threatened Fauna – Critically Endangered Taxa which are considered to be facing an extremely high risk of extinction in the wild.
EN [#]	Threatened Fauna – Endangered Taxa which are considered to be facing a very high risk of extinction in the wild.
VU [#]	Threatened Fauna – Vulnerable Taxa which are considered to be facing a high risk of extinction in the wild.
Migratory [#]	Migratory Fauna All migratory species that are: (i) native species; and (ii) from time to time included in the appendices to the Bonn Convention; and (b) all migratory species from time to time included in annexes established under JAMBA, CAMBA and ROKAMBA; and All native species from time to time identified in a list established under, or an instrument made under, an international agreement approved by the Minister.
Ma	Marine Fauna Species in the list established under s248 of the EPBC Act

[#]matters of national environmental significance (MNES) under the EPBC Act

Additional Background Information



In Western Australia, fauna taxa may be classed as ‘threatened’, ‘extinct’, or ‘specially protected’ under the *Biodiversity Conservation Act 2016* (BC Act), which is enforced by Department of Biodiversity Conservation and Attractions (DBCA) (DBCA 2019a). The definitions of these categories are provided in **Table 2**.

Table 2: Definitions of specially protected fauna schedules under the BC Act (DBCA 2019a)

Category	Conservation Code	Definition
Threatened	CR	Critically endangered Threatened species considered to be facing an extremely high risk of extinction in the wild in the immediate future.
	EN	Endangered Threatened species considered to be facing a very high risk of extinction in the wild in the near future.
	VU	Vulnerable Threatened species considered to be facing a high risk of extinction in the wild in the medium-term future.
Extinct	EX	Extinct Species where there is no reasonable doubt that the last member of the species has died.
	EW	Extinct in the wild Species that is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; and it has not been recorded in its known habitat or expected habitat, at appropriate seasons, anywhere in its past range, despite surveys over a time frame appropriate to its life cycle and form. Note that no species are currently listed as EW.
Specially protected	MI	Migratory species Fauna that periodically or occasionally visit Australia or an external Territory or the exclusive economic zone; or the species is subject of an international agreement that relates to the protection of migratory species and that binds the Commonwealth Includes birds that subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and The Republic of Korea (ROKAMBA), and the Bonn Convention, relating to the protection of migratory birds.
	CD	Species of special conservation interest (conservation dependent fauna) Fauna of special conservation need being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened.
	OS	Other specially protected species Fauna otherwise in need of special protection to ensure their conservation.

Additional Background Information



Fauna species that may be threatened or near threatened but lack sufficient information to be legislatively listed may be added to the DBCA's *Priority Fauna List* (DBCA 2018b). Species listed under priorities 1-3 comprise possible threatened species that do not meet survey criteria or are otherwise data deficient. Species listed under priority 4 are those that are adequately known, are rare but not threatened, or meet criteria for near threatened, or that have been recently removed from the threatened species or other specially protected fauna lists for other than taxonomic reasons (DBCA 2019a).

Priority fauna species are considered during State approval processes. Priority fauna categories and definitions are listed in **Table 3** (DBCA 2019a).

Table 3: Definitions of priority fauna categories on DBCA's Priority Fauna List (DBCA 2019a)

Conservation Code	Category
P1	<p>Priority 1 – Poorly known</p> <p>Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.</p>
P2	<p>Priority 2 – Poorly known</p> <p>Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.</p>
P3	<p>Priority 3 – Poorly known</p> <p>Species that are known from several locations and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.</p>
P4	<p>(a) Priority 4 – Rare species</p> <p>Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These species are usually represented on conservation lands.</p> <p>(b) Priority 4 – Near Threatened</p> <p>Species that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable.</p> <p>(c) Priority 4 – Other</p> <p>Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.</p>

Additional Background Information



Black cockatoos

Three threatened species of black cockatoo occur on the Swan Coastal Plain (referred to herein collectively as 'black cockatoos'):

- *Zanda*¹ *latirostris* (Carnaby's black cockatoo) which is listed as 'endangered' under the EPBC Act and the BC Act.
- *Zanda*¹ *baudinii* (Baudin's black cockatoo) which is listed as 'endangered' under the EPBC Act and the BC Act.
- *Calyptorhynchus banksii naso* (forest red-tailed black cockatoo) which is listed as 'vulnerable' under the EPBC Act and the BC Act.

There are a range of regional studies and spatial datasets available which provide information on black cockatoo records and potential habitat mapping. These are detailed below.

Species distribution and breeding range

Broad-scale maps are available for the modelled distribution of Baudin's black cockatoo, Carnaby's black cockatoo and forest red-tailed black cockatoo (DSEWPaC 2011; DoEE 2016a, b).

The modelled distribution maps also include 'known breeding areas' and 'predicted breeding range' for Baudin's black cockatoo and 'breeding range' and 'non-breeding range' for Carnaby's black cockatoo.

No breeding range modelling is available for forest red-tailed black cockatoo but the species is known to breed mainly in the jarrah forest region (DBCA 2017a) and in small populations on the Swan Coastal Plain within the Baldvis, Stake Hill, Lake McLarty and Capel area and increasingly in the Perth metropolitan area (DAWE 2020).

Breeding habitat

Department of Environment and Conservation (DEC, now Department of Biodiversity, Conservation and Attractions (DBCA)) and fauna experts, have identified and mapped Carnaby's black cockatoo habitat on the Swan Coastal Plain and Jarrah Forest regions (Glossop *et al.* 2011). This dataset includes mapping of Carnaby's black cockatoo breeding sites based on point records of breeding from a range of sources. Breeding sites were classified as 'confirmed' where eggs or chicks were recorded and 'possible' where observations relating to Carnaby's black cockatoo breeding that did not include actual records of eggs or chicks (e.g. chewed hollows or records of breeding or nesting behaviour by an expert observer).

A 12 km buffer applies to each site to 'reflect the flexible use of these areas by cockatoos and to indicate the important zone for access to potential feeding habitat' (Glossop *et al.* 2011). Glossop *et al.* (2011) state that the areas mapped in the dataset are not a comprehensive record of Carnaby's black cockatoo breeding and that many nesting sites are not known.

While this dataset only applies to Carnaby's black cockatoo, the information it contains is also applicable for Baudin's black cockatoo and forest red-tailed black cockatoo as they have similar

¹ Previously *Calyptorhynchus*

Additional Background Information



breeding habitat requirements. That is, breeding sites that are suitable for Carnaby's black cockatoo may also be suitable for Baudin's black cockatoo and forest red-tailed black cockatoo, if located within their distribution/breeding ranges.

BirdLife Australia also maintain a database of confirmed black cockatoo breeding sites which is accessible via a paid search system. BirdLife Australia have advised that their database is comprised of data collected during surveys by staff and volunteers of which most (>99%) surveys are of Carnaby's black cockatoo. They have also advised that the dataset is not comprehensive and that an absence of known nests does not necessarily indicate a lack of breeding activity.

The Carnaby's black cockatoo recovery plan also identifies 13 'important bird areas' for Carnaby's black cockatoo, which are identified as 'sites of global bird conservation importance' (DPaW 2013). These 'important bird areas' comprise sites supporting at least 20 breeding pairs or 1% of the population regularly utilising an area in the non-breeding part of the range.

Confirmed roost sites

BirdLife Australia undertakes annual monitoring of black cockatoo overnight roost sites as part of the annual 'Great Cocky Count' community-based survey. Information gathered from these monitoring events provides roost locations and recorded black cockatoo numbers (Peck *et al.* 2019).

Native foraging habitat

Glossop *et al.* (2011) also mapped 'areas requiring investigation as Carnaby's black cockatoo feeding habitat' for the Swan Coastal Plain and Jarrah Forest regions, based on regional vegetation mapping that may contain plant species known to be foraged upon by Carnaby's black cockatoo. Note that this dataset does not include observations or point records of Carnaby's black cockatoo feeding. This dataset represents areas of vegetation that may potentially provide foraging habitat for Carnaby's black cockatoo.

In order to account for clearing of native vegetation that has occurred since the Glossop *et al.* (2011) dataset was created and to incorporate updated vegetation mapping and information on foraging behaviour of Carnaby's black cockatoo, Emerge have revised this dataset to represent the most up to date information available. Furthermore, Emerge have used a similar methodology to Glossop *et al.* (2011) to define potential foraging habitat for Baudin's black cockatoo and forest-red tailed cockatoos.

Specifically, DBCA (2021), DBCA (2019b) and DPIRD (2018) regional vegetation complex mapping was used to determine which areas of remnant vegetation support plant species known to be foraged upon by Carnaby's black cockatoo, Baudin's black cockatoo or forest red-tailed cockatoos. Where these vegetation complexes intersect remnant vegetation mapped by DPIRD (2020) they were considered to represent potential foraging habitat for Carnaby's black cockatoo, Baudin's black cockatoo and/or forest red-tailed cockatoo.

Pine plantations also provide an important food source for Carnaby's black cockatoo, but were not included in the original Glossop *et al.* (2011) dataset. Mapping of pine plantations is available from the Forest Products Commission (Forest Products Commission 2020) and was considered in the assessment of Carnaby's black cockatoo foraging habitat.

Pest fauna

A number of legislative and policy documents exist in relation to pest fauna management at state and national levels. The *Biosecurity and Agriculture Management Act 2007* (BAM Act) is the principle legislation guiding pest fauna management in Western Australia and lists declared pest species.

Declared Pests

Part 2.3.23 of the BAM Act requires a person must not “*a) keep, breed or cultivate the declared pest; b) keep, breed or cultivate an animal, plant or other thing that is infected or infested with the declared pest; c) release into the environment the declared pest, or an animal, plant or other thing that is infected or infested with the declared pest; or d) intentionally infect or infest, or expose to infection or infestation, a plant, animal or other thing with a declared pest*”.

Under the BAM Act, all declared pests are assigned a legal status, as described in **Table 4**. Species assigned to the ‘declared pest, prohibited - s12’ category are placed in one of three control categories, as described in **Table 5**.

The *Biosecurity and Agriculture Management Regulations 2013* specify keeping categories for species assigned to the ‘declared pest - s22(2)’ category, which relate to the purposes of which species can be kept, as well as the entities that can keep them. The categories are described in **Table 6**.

The Western Australian Organism List (WAOL) provides the status of organisms which have been categorised under the BAM Act (DAFWA 2016).

Table 4: Legal status of declared pest species listed under the BAM Act (DAFWA 2016)

Category	Description
Declared Pest Prohibited - s12	May only be imported and kept subject to permits. Permit conditions applicable to some species may only be appropriate or available to research organisations or similarly secure institutions.
Declared Pest s22(2)	Must satisfy any applicable import requirements when imported, and may be subject to an import permit if they are potential carriers of high-risk organisms. They may also be subject to control and keeping requirements once within Western Australia

Table 5: Control categories of declared pest species listed under the BAM Act (DAFWA 2016)

Category	Description
C1	Exclusion Not established in Western Australia and control measures are to be taken, including border checks, in order to prevent them entering and establishing in the State.
C2	Eradication Present in Western Australia in low enough numbers or in sufficiently limited areas that their eradication is still a possibility.
C3	Management Established in Western Australia 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.

Additional Background Information

*Table 6: Keeping categories of declared pest species listed under the BAM Act (DAFWA 2016)*

Category	Description
Prohibited	Can only be kept under a permit for public display and education purposes, and/or genuine scientific research, by entities approved by the state authority.
Exempt	No permit or conditions are required for keeping.
Restricted	Organisms which, relative to other species, have a low risk of becoming a problem for the environment, primary industry or public safety and can be kept under a permit by private individuals.

Wetland Habitat

Geomorphic wetland types

On the Swan Coastal Plain DBCA (2017b) have used the geomorphic wetland classification system developed by Semeniuk (1987) and Semeniuk and Semeniuk (1995) to classify wetlands based on the landform shape and water permanence (hydro-period) as outlined in **Table 7**. DBCA maintains a dataset of the *Geomorphic Wetlands of the Swan Coastal Plain* (DBCA 2018a).

Table 7: Geomorphic Wetlands of the Swan Coastal Plain classification categories (DBCA 2017b)

Level of inundation	Geomorphology			
	Basin	Flat	Channel	Slope
Permanently inundated	Lake	-	River	-
Seasonally inundated	Sumpland	Floodplain	Creek	-
Seasonally waterlogged	Dampland	Palusplain	-	Paluslope

Literature

The main literature used for identifying fauna and fauna habitats is listed in **Table 8** below.

Table 8: Standard literature used for identifying fauna species and habitats.

Conservation Code	Category
Birds	Johnstone and Storr (1998b), Johnstone and Storr (1998a), Pizzey and Knight (2012), Slater <i>et al.</i> (2003)
Mammals	Menkhorst and Knight (2011), Triggs (2003)
Amphibia	Tyler and Doughty (2009), Bush <i>et al.</i> (2002)
Reptiles	Bush <i>et al.</i> (2002)

References

General references

Bush, B., Maryan, B., Browne-Cooper, R. and Robinson, D. 2002, *Reptiles and Frogs of the Perth Region*, UWA Press, Crawley.

department of biodiversity Conservation and Attractions (DBCA) 2017a, *Fauna Profile - Forest red-tailed black cockatoo *Calyptorhynchus banksii naso**, Perth, Western Australia.

Department of Biodiversity, Conservation and Attractions (DBCA) 2017b, *A methodology for the evaluation of wetlands on the Swan Coastal Plain*, draft prepared by the Wetlands Section of the Department of Biodiversity, Conservation and Attractions and the Urban Water Branch of the Department of Water and Environmental Regulation, Perth.

Department of Biodiversity, Conservation and Attractions (DBCA) 2018a, *Geomorphic Wetlands, Swan Coastal Plain (DBCA-019)*.

Department of Biodiversity, Conservation and Attractions (DBCA) 2018b, *Threatened and Priority Fauna List 15 February 2018*, Perth.

Department of Biodiversity Conservation and Attractions (DBCA) 2019a, *Conservation Codes for Western Australian Flora and Fauna - last updated 3 January 2019*.

Department of Biodiversity Conservation and Attractions (DBCA) 2019b, *Vegetation Complexes - South West forest region of Western Australia (DBCA-047)*, Kensington.

Department of Biodiversity Conservation and Attractions (DBCA) 2021, *Vegetation Complexes - Swan Coastal Plain (DBCA_046)*, Perth, Western Australia.

Department of Environment and Energy (DoEE) 2016a, *Modelled distribution for Baudin's Cockatoo (*Calyptorhynchus baudinii*)*, Canberra.

Department of Environment and Energy (DoEE) 2016b, *Modelled distribution for Forest Red-tailed Black-Cockatoo (*Calyptorhynchus banksii naso*)*, Canberra.

Department of Parks and Wildlife (DPaW) 2013, *Carnaby's Cockatoo (*Calyptorhynchus latirostris*) Recovery Plan*.

Department of Primary Industries and Regional Development (DPIRD) 2018, *Pre-European Vegetation - Western Australia (DPIRD-006)*, South Perth.

Department of Primary Industries and Regional Development (DPIRD) 2020, *Current Extent of Native vegetation - Western Australia dataset (DPIRD-005)*, Perth, Western Australia.

Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) 2011, *Modelled distribution of Carnaby's black cockatoo (*Calyptorhynchus latirostris*)*, Commonwealth of Australia, Canberra, Australian Capital Territory.

Additional Background Information



Forest Products Commission 2020, *Forest Products Commission Plantations (FPC-001)*.

Glossop, B., Clarke, K., Mitchell, D. and Barrett, G. 2011, *Methods for mapping Carnaby's cockatoo habitat*, Department of Environment and Conservation, Perth.

Johnstone, R. E. and Storr, G. M. 1998a, *Handbook of Western Australian Birds. Volume 2 - Passerines (Blue-Winged Pitta to Goldfinch)*, Western Australian Museum, Perth.

Johnstone, R. E. and Storr, T. 1998b, *Handbook of Western Australian Birds: Volume 1 - Non-passerines (Emu to Dollarbird)*, Western Australian Museum, Perth.

Menkhorst, P. and Knight, F. 2011, *Field guide to the mammals of Australia (Third edition)*, Oxford University Press Australia & New Zealand, Melbourne, VIC, Australia.

Peck, A., Barret, G. and Williams, M. 2019, *The 2019 Great Cocky Count: a community-based survey for Carnaby's Black-Cockatoo (Calyptorhynchus latirostris), Baudin's Black-Cockatoo (Calyptorhynchus baudinii) and Forest Red-tailed Black-Cockatoo (Calyptorhynchus banksii naso)*. , Birdlife Australia, Floreat, Western Australia.

Pizzey, G. and Knight, F. 2012, *The Fieldguide to the Birds of Australia*, Harper Collins Publishers, Sydney, Australia.

Semeniuk, C. A. 1987, *Wetlands of the Darling System - a geomorphic approach to habitat classification*, Journal of the Royal Society of Western Australia, 69: 95-112.

Semeniuk, C. A. and Semeniuk, V. 1995, *A Geomorphic Approach to Global Classification for Inland Wetlands*, Vegetatio, 118(1/2): 103-124.

Slater, P., Slater, P. and Slater, R. 2003, *The Slater Field Guide to Australian Birds*, Reed New Holland, Australia.

Triggs, B. 2003, *Tracks, Scats and Other Traces A Field Guide to Australian Mammals*, Oxford University Press Australia, Melbourne, Victoria.

Tyler, M. J. and Doughty, P. 2009, *Field Guide to Frogs of Western Australia*, Western Australian Museum, Perth, Western Australia.

Appendix B

Database Search Results





EPBC Act Protected Matters Report

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

Report created: 25-Mar-2022

[Summary](#)

[Details](#)

[Matters of NES](#)

[Other Matters Protected by the EPBC Act](#)

[Extra Information](#)

[Caveat](#)

[Acknowledgements](#)

Summary

Matters of National Environment Significance

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

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance (Ramsar)	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	3
Listed Threatened Species:	62
Listed Migratory Species:	50

Other Matters Protected by the EPBC Act

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

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

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

Commonwealth Lands:	73
Commonwealth Heritage Places:	None
Listed Marine Species:	74
Whales and Other Cetaceans:	12
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None
Habitat Critical to the Survival of Marine Turtles:	None

Extra Information

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

State and Territory Reserves:	10
Regional Forest Agreements:	None
Nationally Important Wetlands:	1
EPBC Act Referrals:	63
Key Ecological Features (Marine):	None
Biologically Important Areas:	11
Bioregional Assessments:	None
Geological and Bioregional Assessments:	None

Details

Matters of National Environmental Significance

Listed Threatened Ecological Communities

[\[Resource Information \]](#)

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

Status of Vulnerable, Disallowed and Ineligible are not MNES under the EPBC Act.

Community Name	Threatened Category	Presence Text	Buffer Status
Assemblages of plants and invertebrate animals of tumulus (organic mound) springs of the Swan Coastal Plain	Endangered	Community known to occur within area	In buffer area only
Banksia Woodlands of the Swan Coastal Plain ecological community	Endangered	Community likely to occur within area	In feature area
Tuart (<i>Eucalyptus gomphocephala</i>) Woodlands and Forests of the Swan Coastal Plain ecological community	Critically Endangered	Community likely to occur within area	In feature area

Listed Threatened Species

[\[Resource Information \]](#)

Status of Conservation Dependent and Extinct are not MNES under the EPBC Act.

Number is the current name ID.

Scientific Name	Threatened Category	Presence Text	Buffer Status
BIRD			
Anous tenuirostris melanops Australian Lesser Noddy [26000]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat may occur within area	In feature area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat likely to occur within area	In feature area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Calyptorhynchus banksii naso Forest Red-tailed Black-Cockatoo, Karrak [67034]	Vulnerable	Species or species habitat known to occur within area	In feature area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
Diomedea amsterdamensis Amsterdam Albatross [64405]	Endangered	Species or species habitat may occur within area	In buffer area only
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In buffer area only
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In buffer area only
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area	In buffer area only
Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Limosa lapponica menzbieri Northern Siberian Bar-tailed Godwit, Russkoye Bar-tailed Godwit [86432]	Critically Endangered	Species or species habitat may occur within area	In buffer area only
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area	In buffer area only
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Pachyptila turtur subantarctica Fairy Prion (southern) [64445]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area	In feature area
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Foraging, feeding or related behaviour known to occur within area	In feature area
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
Thalassarche cauta Shy Albatross [89224]	Endangered	Species or species habitat may occur within area	In buffer area only
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In buffer area only
Zanda latirostris listed as Calyptorhynchus latirostris Carnaby's Black Cockatoo, Short-billed Black-cockatoo [87737]	Endangered	Breeding known to occur within area	In feature area
FISH			
Galaxiella nigrostriata Blackstriped Dwarf Galaxias, Black-stripe Minnow [88677]	Endangered	Species or species habitat likely to occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Thunnus maccoyii Southern Bluefin Tuna [69402]	Conservation Dependent	Species or species habitat likely to occur within area	In buffer area only
INSECT			
Hesperocolletes douglasi Douglas' Broad-headed Bee, Rottnest Bee [66734]	Critically Endangered	Species or species habitat may occur within area	In feature area
MAMMAL			
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area	In buffer area only
Bettongia penicillata ogilbyi Woylie [66844]	Endangered	Species or species habitat likely to occur within area	In buffer area only
Dasyurus geoffroii Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat known to occur within area	In feature area
Eubalaena australis Southern Right Whale [40]	Endangered	Breeding known to occur within area	In buffer area only
Macroderma gigas Ghost Bat [174]	Vulnerable	Species or species habitat may occur within area	In feature area
Neophoca cinerea Australian Sea-lion, Australian Sea Lion [22]	Endangered	Species or species habitat known to occur within area	In buffer area only
PLANT			
Andersonia gracilis Slender Andersonia [14470]	Endangered	Species or species habitat likely to occur within area	In feature area
Anigozanthos viridis subsp. terraspectans Dwarf Green Kangaroo Paw [3435]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Caladenia huegelii King Spider-orchid, Grand Spider-orchid, Rusty Spider-orchid [7309]	Endangered	Species or species habitat likely to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Chamelaucium sp. Gingin (N.G.Marchant 6) Gingin Wax [88881]	Endangered	Species or species habitat may occur within area	In buffer area only
Darwinia foetida Muccha Bell [83190]	Critically Endangered	Species or species habitat may occur within area	In buffer area only
Diuris micrantha Dwarf Bee-orchid [55082]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Diuris purdiei Purdie's Donkey-orchid [12950]	Endangered	Species or species habitat may occur within area	In feature area
Drakaea elastica Glossy-leaved Hammer Orchid, Glossy-leaved Hammer Orchid, Warty Hammer Orchid [16753]	Endangered	Species or species habitat likely to occur within area	In feature area
Drakaea micrantha Dwarf Hammer-orchid [56755]	Vulnerable	Species or species habitat may occur within area	In feature area
Eleocharis keigheryi Keighery's Eleocharis [64893]	Vulnerable	Species or species habitat may occur within area	In feature area
Eucalyptus argutifolia Yanchep Mallee, Wabbling Hill Mallee [24263]	Vulnerable	Species or species habitat known to occur within area	In feature area
Grevillea christineae Christine's Grevillea [64520]	Endangered	Species or species habitat likely to occur within area	In buffer area only
Grevillea curviloba subsp. curviloba Curved-leaf Grevillea [64908]	Endangered	Species or species habitat known to occur within area	In buffer area only
Grevillea curviloba subsp. incurva Narrow curved-leaf Grevillea [64909]	Endangered	Species or species habitat likely to occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Macarthuria keigheryi Keighery's Macarthuria [64930]	Endangered	Species or species habitat may occur within area	In feature area
Marianthus paralius [83925]	Endangered	Species or species habitat known to occur within area	In buffer area only
Melaleuca sp. Wanneroo (G.J. Keighery 16705) [89456]	Endangered	Species or species habitat known to occur within area	In buffer area only
Synaphea sp. Fairbridge Farm (D. Papenfus 696) Selena's Synaphea [82881]	Critically Endangered	Species or species habitat may occur within area	In buffer area only
Thelymitra dedmaniarum Cinnamon Sun Orchid [65105]	Endangered	Species or species habitat may occur within area	In feature area
REPTILE			
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding likely to occur within area	In buffer area only
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding likely to occur within area	In buffer area only
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area	In buffer area only
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding likely to occur within area	In buffer area only
SHARK			
Carcharias taurus (west coast population) Grey Nurse Shark (west coast population) [68752]	Vulnerable	Species or species habitat known to occur within area	In buffer area only
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area	In buffer area only
Pristis pristis Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Sphyrna lewini Scalloped Hammerhead [85267]	Conservation Dependent	Species or species habitat likely to occur within area	In buffer area only

Listed Migratory Species [[Resource Information](#)]

Scientific Name	Threatened Category	Presence Text	Buffer Status
Migratory Marine Birds			
Anous stolidus Common Noddy [825]		Species or species habitat likely to occur within area	In buffer area only
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area	In feature area
Ardeanna carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Species or species habitat likely to occur within area	In buffer area only
Diomedea amsterdamensis Amsterdam Albatross [64405]	Endangered	Species or species habitat may occur within area	In buffer area only
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In buffer area only
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In buffer area only
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area	In buffer area only
Hydroprogne caspia Caspian Tern [808]		Foraging, feeding or related behaviour known to occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area	In buffer area only
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Onychoprion anaethetus Bridled Tern [82845]		Foraging, feeding or related behaviour likely to occur within area	In buffer area only
Phoebastria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Sterna dougallii Roseate Tern [817]		Foraging, feeding or related behaviour likely to occur within area	In buffer area only
Sternula albifrons Little Tern [82849]		Species or species habitat may occur within area	In buffer area only
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
Thalassarche cauta Shy Albatross [89224]	Endangered	Species or species habitat may occur within area	In buffer area only
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Migratory Marine Species			
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area	In buffer area only
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area	In buffer area only
Caperea marginata Pygmy Right Whale [39]		Species or species habitat may occur within area	In buffer area only
Carcharhinus longimanus Oceanic Whitetip Shark [84108]		Species or species habitat may occur within area	In buffer area only
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area	In buffer area only
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding likely to occur within area	In buffer area only
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding likely to occur within area	In buffer area only
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area	In buffer area only
Eubalaena australis as Balaena glacialis australis Southern Right Whale [40]	Endangered	Breeding known to occur within area	In buffer area only
Lamna nasus Porbeagle, Mackerel Shark [83288]		Species or species habitat may occur within area	In buffer area only
Megaptera novaeangliae Humpback Whale [38]		Species or species habitat known to occur within area	In buffer area only
Mobula alfredi as Manta alfredi Reef Manta Ray, Coastal Manta Ray [90033]		Species or species habitat may occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Mobula birostris as Manta birostris Giant Manta Ray [90034]		Species or species habitat may occur within area	In buffer area only
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding likely to occur within area	In buffer area only
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area	In buffer area only
Pristis pristis Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat may occur within area	In feature area
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Migratory Terrestrial Species			
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area	In feature area
Migratory Wetlands Species			
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area	In feature area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area	In feature area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat likely to occur within area	In feature area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area	In feature area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat likely to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Calidris ruficollis Red-necked Stint [860]		Species or species habitat known to occur within area	In feature area
Calidris subminuta Long-toed Stint [861]		Species or species habitat known to occur within area	In feature area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat may occur within area	In buffer area only
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area	In feature area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area	In feature area
Tringa glareola Wood Sandpiper [829]		Species or species habitat known to occur within area	In feature area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area	In feature area

Other Matters Protected by the EPBC Act

Commonwealth Lands [\[Resource Information \]](#)

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

Commonwealth Land Name	State	Buffer Status
Defence		
Defence - MUCHEA ARMAMENT RANGE [50091]	WA	In buffer area only
Defence - MUCHEA ARMAMENT RANGE [50094]	WA	In buffer area only
Defence - MUCHEA ARMAMENT RANGE [50057]	WA	In buffer area only

Commonwealth Land Name	State	Buffer Status
Defence - MUCHEA ARMAMENT RANGE [50073]	WA	In buffer area only
Defence - MUCHEA ARMAMENT RANGE [50076]	WA	In buffer area only
Defence - MUCHEA ARMAMENT RANGE [50074]	WA	In buffer area only
Defence - MUCHEA ARMAMENT RANGE [50066]	WA	In buffer area only
Defence - MUCHEA ARMAMENT RANGE [50075]	WA	In buffer area only
Defence - MUCHEA ARMAMENT RANGE [50071]	WA	In buffer area only
Defence - MUCHEA ARMAMENT RANGE [50082]	WA	In buffer area only
Defence - MUCHEA ARMAMENT RANGE [50095]	WA	In buffer area only
Defence - MUCHEA ARMAMENT RANGE [50085]	WA	In buffer area only
Defence - MUCHEA ARMAMENT RANGE [50084]	WA	In buffer area only
Defence - MUCHEA ARMAMENT RANGE [50083]	WA	In buffer area only
Defence - MUCHEA ARMAMENT RANGE [50062]	WA	In buffer area only
Defence - MUCHEA ARMAMENT RANGE [50065]	WA	In buffer area only
Defence - MUCHEA ARMAMENT RANGE [50064]	WA	In buffer area only
Defence - MUCHEA ARMAMENT RANGE [50067]	WA	In buffer area only
Defence - MUCHEA ARMAMENT RANGE [50069]	WA	In buffer area only
Defence - MUCHEA ARMAMENT RANGE [50093]	WA	In buffer area only
Defence - MUCHEA ARMAMENT RANGE [50090]	WA	In buffer area only
Defence - MUCHEA ARMAMENT RANGE [50088]	WA	In buffer area only
Defence - MUCHEA ARMAMENT RANGE [50089]	WA	In buffer area only
Defence - PEARCE - AP19 HF RECEIVER STATION BULLSBROOK [50020]	WA	In buffer area only
Defence - PEARCE - AP19 HF RECEIVER STATION BULLSBROOK [50019]	WA	In buffer area only
Unknown		
Commonwealth Land - [51111]	WA	In buffer area only
Commonwealth Land - [50561]	WA	In buffer area only
Commonwealth Land - [50560]	WA	In buffer area only

Commonwealth Land Name	State	Buffer Status
Commonwealth Land - [50563]	WA	In buffer area only
Commonwealth Land - [50562]	WA	In buffer area only
Commonwealth Land - [50316]	WA	In buffer area only
Commonwealth Land - [50682]	WA	In buffer area only
Commonwealth Land - [50626]	WA	In buffer area only
Commonwealth Land - [50553]	WA	In buffer area only
Commonwealth Land - [50502]	WA	In buffer area only
Commonwealth Land - [50508]	WA	In buffer area only
Commonwealth Land - [50713]	WA	In buffer area only
Commonwealth Land - [50705]	WA	In buffer area only
Commonwealth Land - [50689]	WA	In buffer area only
Commonwealth Land - [50448]	WA	In buffer area only
Commonwealth Land - [50747]	WA	In buffer area only
Commonwealth Land - [50440]	WA	In buffer area only
Commonwealth Land - [50583]	WA	In buffer area only
Commonwealth Land - [50582]	WA	In buffer area only
Commonwealth Land - [51130]	WA	In buffer area only
Commonwealth Land - [50271]	WA	In buffer area only
Commonwealth Land - [50588]	WA	In buffer area only
Commonwealth Land - [50630]	WA	In buffer area only
Commonwealth Land - [50584]	WA	In buffer area only
Commonwealth Land - [50585]	WA	In buffer area only
Commonwealth Land - [50586]	WA	In buffer area only
Commonwealth Land - [50587]	WA	In buffer area only
Commonwealth Land - [51118]	WA	In buffer area only
Commonwealth Land - [50430]	WA	In buffer area only
Commonwealth Land - [50625]	WA	In buffer area only

Commonwealth Land Name	State	Buffer Status
Commonwealth Land - [50436]	WA	In buffer area only
Commonwealth Land - [50606]	WA	In buffer area only
Commonwealth Land - [50312]	WA	In buffer area only
Commonwealth Land - [50592]	WA	In buffer area only
Commonwealth Land - [50494]	WA	In buffer area only
Commonwealth Land - [50439]	WA	In buffer area only
Commonwealth Land - [50594]	WA	In buffer area only
Commonwealth Land - [50489]	WA	In buffer area only
Commonwealth Land - [50593]	WA	In buffer area only
Commonwealth Land - [50598]	WA	In buffer area only
Commonwealth Land - [50576]	WA	In buffer area only
Commonwealth Land - [50574]	WA	In buffer area only
Commonwealth Land - [50668]	WA	In buffer area only
Commonwealth Land - [50711]	WA	In buffer area only
Commonwealth Land - [50575]	WA	In buffer area only
Commonwealth Land - [51120]	WA	In buffer area only
Commonwealth Land - [50559]	WA	In buffer area only
Commonwealth Land - [50667]	WA	In buffer area only

Listed Marine Species			[Resource Information]
Scientific Name	Threatened Category	Presence Text	Buffer Status
Bird			
Actitis hypoleucos			
Common Sandpiper [59309]		Species or species habitat known to occur within area	In feature area
Anous stolidus			
Common Noddy [825]		Species or species habitat likely to occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Anous tenuirostris melanops Australian Lesser Noddy [26000]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area overfly marine area	In feature area
Ardenna carneipes as Puffinus carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Species or species habitat likely to occur within area	In buffer area only
Bubulcus ibis as Ardea ibis Cattle Egret [66521]		Species or species habitat may occur within area overfly marine area	In feature area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area	In feature area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat likely to occur within area overfly marine area	In feature area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area overfly marine area	In feature area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat likely to occur within area overfly marine area	In feature area
Calidris ruficollis Red-necked Stint [860]		Species or species habitat known to occur within area overfly marine area	In feature area
Calidris subminuta Long-toed Stint [861]		Species or species habitat known to occur within area overfly marine area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
Charadrius ruficapillus Red-capped Plover [881]		Species or species habitat known to occur within area overfly marine area	In feature area
Diomedea amsterdamensis Amsterdam Albatross [64405]	Endangered	Species or species habitat may occur within area	In buffer area only
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In buffer area only
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In buffer area only
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area	In buffer area only
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area	In feature area
Himantopus himantopus Pied Stilt, Black-winged Stilt [870]		Species or species habitat known to occur within area overfly marine area	In feature area
Hydroprogne caspia as Sterna caspia Caspian Tern [808]		Foraging, feeding or related behaviour known to occur within area	In buffer area only
Larus pacificus Pacific Gull [811]		Foraging, feeding or related behaviour may occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat may occur within area	In buffer area only
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area	In buffer area only
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area overfly marine area	In feature area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area overfly marine area	In feature area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area	In feature area
Onychoprion anaethetus as Sterna anaethetus Bridled Tern [82845]		Foraging, feeding or related behaviour likely to occur within area	In buffer area only
Pachyptila turtur Fairy Prion [1066]		Species or species habitat likely to occur within area	In buffer area only
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area	In feature area
Phoebastria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Puffinus assimilis Little Shearwater [59363]		Foraging, feeding or related behaviour known to occur within area	In buffer area only
Recurvirostra novaehollandiae Red-necked Avocet [871]		Species or species habitat known to occur within area overfly marine area	In feature area
Rostratula australis as Rostratula benghalensis (sensu lato) Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area overfly marine area	In feature area
Sterna dougallii Roseate Tern [817]		Foraging, feeding or related behaviour likely to occur within area	In buffer area only
Sternula albifrons as Sterna albifrons Little Tern [82849]		Species or species habitat may occur within area	In buffer area only
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
Thalassarche cauta Shy Albatross [89224]	Endangered	Species or species habitat may occur within area	In buffer area only
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Thinornis cucullatus as Thinornis rubricollis Hooded Dotterel, Hooded Plover [87735]		Species or species habitat may occur within area overfly marine area	In feature area
Tringa glareola Wood Sandpiper [829]		Species or species habitat known to occur within area overfly marine area	In feature area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area overfly marine area	In feature area
Fish			
Acentronura australe Southern Pygmy Pipehorse [66185]		Species or species habitat may occur within area	In buffer area only
Campichthys galei Gale's Pipefish [66191]		Species or species habitat may occur within area	In buffer area only
Choeroichthys suillus Pig-snouted Pipefish [66198]		Species or species habitat may occur within area	In buffer area only
Halicampus brocki Brock's Pipefish [66219]		Species or species habitat may occur within area	In buffer area only
Hippocampus angustus Western Spiny Seahorse, Narrow-bellied Seahorse [66234]		Species or species habitat may occur within area	In buffer area only
Hippocampus breviceps Short-head Seahorse, Short-snouted Seahorse [66235]		Species or species habitat may occur within area	In buffer area only
Hippocampus subelongatus West Australian Seahorse [66722]		Species or species habitat may occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Lissocampus fatiloquus Prophet's Pipefish [66250]		Species or species habitat may occur within area	In buffer area only
Maroubra perserrata Sawtooth Pipefish [66252]		Species or species habitat may occur within area	In buffer area only
Mitotichthys meraculus Western Crested Pipefish [66259]		Species or species habitat may occur within area	In buffer area only
Nannocampus subosseus Bonyhead Pipefish, Bony-headed Pipefish [66264]		Species or species habitat may occur within area	In buffer area only
Phycodurus eques Leafy Seadragon [66267]		Species or species habitat may occur within area	In buffer area only
Phyllopteryx taeniolatus Common Seadragon, Weedy Seadragon [66268]		Species or species habitat may occur within area	In buffer area only
Pugnaso curtirostris Pugnose Pipefish, Pug-nosed Pipefish [66269]		Species or species habitat may occur within area	In buffer area only
Solegnathus lettiensis Gunther's Pipehorse, Indonesian Pipefish [66273]		Species or species habitat may occur within area	In buffer area only
Stigmatopora argus Spotted Pipefish, Gulf Pipefish, Peacock Pipefish [66276]		Species or species habitat may occur within area	In buffer area only
Stigmatopora nigra Widebody Pipefish, Wide-bodied Pipefish, Black Pipefish [66277]		Species or species habitat may occur within area	In buffer area only
Syngnathoides biaculeatus Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish [66279]		Species or species habitat may occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Urocampus carinirostris Hairy Pipefish [66282]		Species or species habitat may occur within area	In buffer area only
Vanacampus margaritifer Mother-of-pearl Pipefish [66283]		Species or species habitat may occur within area	In buffer area only
Mammal			
Arctocephalus forsteri Long-nosed Fur-seal, New Zealand Fur-seal [20]		Species or species habitat may occur within area	In buffer area only
Neophoca cinerea Australian Sea-lion, Australian Sea Lion [22]	Endangered	Species or species habitat known to occur within area	In buffer area only
Reptile			
Aipysurus pooleorum Shark Bay Seasnake [66061]		Species or species habitat may occur within area	In buffer area only
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding likely to occur within area	In buffer area only
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding likely to occur within area	In buffer area only
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area	In buffer area only
Disteira kingii Spectacled Seasnake [1123]		Species or species habitat may occur within area	In buffer area only
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding likely to occur within area	In buffer area only
Pelamis platurus Yellow-bellied Seasnake [1091]		Species or species habitat may occur within area	In buffer area only

Whales and Other Cetaceans			[Resource Information]
Current Scientific Name	Status	Type of Presence	Buffer Status
Mammal			

Current Scientific Name	Status	Type of Presence	Buffer Status
Balaenoptera acutorostrata Minke Whale [33]		Species or species habitat may occur within area	In buffer area only
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area	In buffer area only
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area	In buffer area only
Caperea marginata Pygmy Right Whale [39]		Species or species habitat may occur within area	In buffer area only
Delphinus delphis Common Dolphin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area	In buffer area only
Eubalaena australis Southern Right Whale [40]	Endangered	Breeding known to occur within area	In buffer area only
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area	In buffer area only
Megaptera novaeangliae Humpback Whale [38]		Species or species habitat known to occur within area	In buffer area only
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area	In buffer area only
Stenella attenuata Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area	In buffer area only
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area	In buffer area only

Current Scientific Name	Status	Type of Presence	Buffer Status
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area	In buffer area only

Extra Information

State and Territory Reserves			[Resource Information]
Protected Area Name	Reserve Type	State	Buffer Status
Jandabup	Nature Reserve	WA	In buffer area only
Lake Joondalup	Nature Reserve	WA	In buffer area only
Marmion	Marine Park	WA	In buffer area only
Neerabup	National Park	WA	In buffer area only
Unnamed WA21176	5(1)(h) Reserve	WA	In buffer area only
Unnamed WA43290	Conservation Park	WA	In buffer area only
Unnamed WA46756	Conservation Park	WA	In buffer area only
Unnamed WA46926	5(1)(h) Reserve	WA	In buffer area only
Unnamed WA50514	5(1)(h) Reserve	WA	In buffer area only
Woodvale	5(1)(h) Reserve	WA	In buffer area only

Nationally Important Wetlands		[Resource Information]
Wetland Name	State	Buffer Status
Joondalup Lake	WA	In buffer area only

EPBC Act Referrals				[Resource Information]
Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Controlled action Alkimos Seawater Desalination	2019/8453	Controlled Action	Assessment Approach	In feature area
Catalina Residential Development	2010/5785	Controlled Action	Post-Approval	In buffer area only
East Landsdale Residential Development	2008/4676	Controlled Action	Post-Approval	In buffer area only
East Wanneroo Cell 9 residential subdivision - Lots 50,51,52,154 &	2010/5772	Controlled Action	Completed	In buffer area only

Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Controlled action 404				
Ellenbrook Reliable Water Storage Project, WA	2015/7421	Controlled Action	Post-Approval	In buffer area only
Excavate sand and limestone resources	2010/5621	Controlled Action	Completed	In buffer area only
Land Development, James Street and Well Street, East Wanneroo, Elberton Property	2021/9106	Controlled Action	Assessment Approach	In buffer area only
Limestone extraction on Lot 8 Wattle Avenue, Nowergup	2013/6767	Controlled Action	Post-Approval	In buffer area only
Lot 1665 Wanneroo Road, Sinagra.	2017/7921	Controlled Action	Post-Approval	In buffer area only
Lot 9000 Wanneroo Road Sinagra Mixed Use Development, Western Australia	2020/8798	Controlled Action	Proposed Decision	In buffer area only
Meridian Business Park Industrial Development	2007/3479	Controlled Action	Post-Approval	In buffer area only
Mitchell Freeway Extension and Wanneroo Road Upgrade, WA	2018/8367	Controlled Action	Post-Approval	In buffer area only
Mitchell Freeway Extension between Burns Beach Rd and Hester Av, Neerabup, WA	2013/7091	Controlled Action	Post-Approval	In buffer area only
Mitchell Freeway Principal Shared Path Gaps Project Ocean Reef Road to Hepburn Avenue	2020/8833	Controlled Action	Post-Approval	In buffer area only
National Lifestyle Villages Development	2011/6020	Controlled Action	Post-Approval	In buffer area only
Natural Gas Pipeline Expansion	2006/2813	Controlled Action	Post-Approval	In buffer area only
Neerabup Industrial Area, WA	2021/8917	Controlled Action	Assessment Approach	In buffer area only
Neerabup Industrial Estate, Lot 701 Flynn Drive Neerabup WA	2012/6424	Controlled Action	Post-Approval	In buffer area only
Ocean Reef Marina Development	2009/4937	Controlled Action	Completed	In buffer area only
Perth-Darwin National Highway alignment (Swan Valley Section), WA	2013/7042	Controlled Action	Post-Approval	In buffer area only
Residential Subdivision development	2011/6040	Controlled Action	Post-Approval	In buffer area only

Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Controlled action				
Shark Hazard Mitigation Drum Line Program, WA	2014/7174	Controlled Action	Completed	In buffer area only
Subdivision of Lot 902 Flynn Drive Neerabup for Industrial Development	2021/8977	Controlled Action	Assessment Approach	In buffer area only
Not controlled action				
Commercial development of Lot 9004 Hodges Drive, Joondalup, WA	2016/7844	Not Controlled Action	Completed	In buffer area only
Connect Joondalup - Lot 9000 McLarty Ave and Lot 999 Piccadilly Circus, Joondalup, WA	2016/7758	Not Controlled Action	Completed	In buffer area only
Construction of an International Rifle Range	2011/6068	Not Controlled Action	Completed	In buffer area only
Container Deposit Scheme Project	2019/8517	Not Controlled Action	Completed	In buffer area only
Development of 39 (Lot 3000) Hardcastle Avenue, Landsdale, WA	2017/8100	Not Controlled Action	Completed	In buffer area only
Development of ECU Engineering Annex, Joondalup Campus, WA	2017/7995	Not Controlled Action	Completed	In buffer area only
Eradication of the European House Borer, Perth metropolitan area, WA	2009/5027	Not Controlled Action	Completed	In feature area
Flynn Drive / Pinjar Road Intersection Works, Lot 9000 Flynn Drive, Neerabup, WA	2017/7983	Not Controlled Action	Completed	In buffer area only
Gnangara Road upgrade project, city of Swan, WA	2013/6966	Not Controlled Action	Completed	In buffer area only
Groundwater Replenishment Scheme (GWRS) Stage 2	2016/7786	Not Controlled Action	Completed	In buffer area only
Improving rabbit biocontrol: releasing another strain of RHDV, sthrn two thirds of Australia	2015/7522	Not Controlled Action	Completed	In feature area
Landsdale Primary School Development, WA	2015/7597	Not Controlled Action	Completed	In buffer area only
Landsdale Residential Subdivision Development	2011/6027	Not Controlled Action	Completed	In buffer area only
Lot 158 Landsdale Rd, Landsdale, WA	2012/6403	Not Controlled Action	Completed	In buffer area only
Lot 594 Wanneroo Road development, Hocking	2020/8621	Not Controlled Action	Completed	In buffer area only

Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Not controlled action				
Lots 71 & 72 Queensway Rd, East Landsdale	2012/6541	Not Controlled Action	Completed	In buffer area only
Ocean Reef Marina Development, City of Joondalup, WA	2014/7237	Not Controlled Action	Completed	In buffer area only
Pearsall Primary School, Lots 62, 269, 1008, 1009 & Part Lot 23, Pearsall, WA	2012/6405	Not Controlled Action	Completed	In buffer area only
Pinjar Motorcycle Park Raceway Development	2012/6419	Not Controlled Action	Completed	In buffer area only
Quinns Main sewer extension, Clarkson - Neerabup, WA	2018/8215	Not Controlled Action	Completed	In buffer area only
Realignment of Flynn Drive	2011/6170	Not Controlled Action	Completed	In buffer area only
Residential and commercial development, Lot 1981 Alexander Drive & Lot 152 Gnangara Road, Landsdale, WA	2013/6982	Not Controlled Action	Completed	In buffer area only
Residential Development, 50 Lot 2 Driver Road, Darch, Western Australia	2020/8677	Not Controlled Action	Completed	In buffer area only
Residential development, Landsdale, WA	2013/6964	Not Controlled Action	Completed	In buffer area only
Residential Development, Lot 4 Coogee Road, Mariginiup, WA	2019/8452	Not Controlled Action	Completed	In feature area
Residential development, Lot 55 Alexander Drive, Landsdale, WA	2013/6971	Not Controlled Action	Completed	In buffer area only
Residential Development, Lots 10 Dundobar Road and 28 and 29 Belgrade Road, East Wanneroo, WA	2019/8521	Not Controlled Action	Completed	In buffer area only
Residential development of 118 Coogee Road, Mariginiup, WA	2017/8011	Not Controlled Action	Completed	In feature area
Residential Subdivision	2012/6410	Not Controlled Action	Completed	In buffer area only
Residential subdivision - lot 169 Kingsway Road, Landsdale WA	2012/6412	Not Controlled Action	Completed	In buffer area only
Residential Subdivision - Lots 12, 36 & 38 Capron St, Wanneroo	2012/6409	Not Controlled Action	Completed	In buffer area only
Residential subdivision - Lots 156 and 157 Landsdale Road Landsdale WA	2012/6407	Not Controlled Action	Completed	In buffer area only

Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Not controlled action				
Telstra PITC O3B Clearing Application	2011/6147	Not Controlled Action	Completed	In buffer area only
Wangara Industrial Extension Area, WA	2012/6501	Not Controlled Action	Completed	In buffer area only
Wanneroo Road/Ocean Reef Road Grade Separation, Pearsall, WA	2017/8110	Not Controlled Action	Completed	In buffer area only
Wanneroo Road Duplication, WA	2015/7632	Not Controlled Action	Completed	In buffer area only
Not controlled action (particular manner)				
Ocean Reef Road Extension Works in Wangara	2010/5388	Not Controlled Action (Particular Manner)	Post-Approval	In buffer area only
Road realignment and widening	2009/4926	Not Controlled Action (Particular Manner)	Post-Approval	In buffer area only
Subdivision Lot 4 Flynn Drive and earthworks for industrial development, 240 Fl	2009/5028	Not Controlled Action (Particular Manner)	Post-Approval	In buffer area only
Referral decision				
Boundary Road Sand Quarry	2019/8560	Referral Decision	Completed	In buffer area only
Biologically Important Areas				
Scientific Name		Behaviour	Presence	Buffer Status
Seabirds				
Ardenna pacifica Wedge-tailed Shearwater [84292]		Foraging (in high numbers)	Known to occur	In buffer area only
Hydroprogne caspia Caspian Tern [808]		Foraging (provisioning young)	Known to occur	In buffer area only
Larus pacificus Pacific Gull [811]		Foraging (in high numbers)	Former Range	In buffer area only
Onychoprion anaethetus Bridled Tern [82845]		Foraging (in high numbers)	Known to occur	In buffer area only

Scientific Name	Behaviour	Presence	Buffer Status
Puffinus assimilis tunneyi Little Shearwater [59363]	Foraging (in high numbers)	Known to occur	In buffer area only
Sterna dougallii Roseate Tern [817]	Foraging	Known to occur	In buffer area only
Sternula nereis Fairy Tern [82949]	Foraging (in high numbers)	Known to occur	In buffer area only
Seals			
Neophoca cinerea Australian Sea Lion [22]	Foraging (male)	Likely to occur	In buffer area only
Whales			
Balaenoptera musculus brevipinna Pygmy Blue Whale [81317]	Distribution	Known to occur	In buffer area only
Eubalaena australis Southern Right Whale [40]	Seasonal calving habitat	Known to occur	In buffer area only
Megaptera novaeangliae Humpback Whale [38]	Migration (north and south)	Known to occur	In buffer area only

Caveat

1 PURPOSE

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

The report contains the mapped locations of:

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

2 DISCLAIMER

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

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

3 DATA SOURCES

Threatened ecological communities

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

Threatened, migratory and marine species

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

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

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

4 LIMITATIONS

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

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

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

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

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

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

Acknowledgements

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

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

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

Please feel free to provide feedback via the [Contact Us](#) page.

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Mariginiup Fauna 10km Buffer Report

Created By Guest user on 22/03/2022

Kingdom	Animalia
Current Names Only	Yes
Core Datasets Only	Yes
Method	'By Circle'
Centre	115° 50' 11" E, 31° 42' 59" S
Buffer	10km
Group By	Species Group

Species Group	Species	Records
Amphibian	9	291
Bird	213	23217
Fish	5	5
Invertebrate	47	234
Mammal	19	197
Reptile	58	967
TOTAL	351	24911

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
Amphibian				
1.	25398 <i>Crinia georgiana</i> (Quacking Frog)			
2.	25399 <i>Crinia glauerti</i> (Clicking Frog)			
3.	25400 <i>Crinia insignifera</i> (Squelching Froglet)			
4.	25410 <i>Heleioporus eyrei</i> (Moaning Frog)			
5.	25415 <i>Limnodynastes dorsalis</i> (Western Banjo Frog)			
6.	25378 <i>Litoria adelaidensis</i> (Slender Tree Frog)			
7.	25388 <i>Litoria moorei</i> (Motorbike Frog)			
8.	25420 <i>Myobatrachus gouldii</i> (Turtle Frog)			
9.	25433 <i>Pseudophryne guentheri</i> (Crawling Toadlet)			
Bird				
10.	24559 <i>Acanthagenys rufogularis</i> (Spiny-cheeked Honeyeater)			
11.	24260 <i>Acanthiza apicalis</i> (Broad-tailed Thornbill, Inland Thornbill)			
12.	24261 <i>Acanthiza chrysorrhoa</i> (Yellow-rumped Thornbill)			
13.	24262 <i>Acanthiza inornata</i> (Western Thornbill)			
14.	24560 <i>Acanthorhynchus superciliosus</i> (Western Spinebill)			
15.	25535 <i>Accipiter cirrocephalus</i> (Collared Sparrowhawk)			
16.	24281 <i>Accipiter cirrocephalus</i> subsp. <i>cirrocephalus</i> (Collared Sparrowhawk)			
17.	25536 <i>Accipiter fasciatus</i> (Brown Goshawk)			
18.	24282 <i>Accipiter fasciatus</i> subsp. <i>fasciatus</i> (Brown Goshawk)			
19.	25755 <i>Acrocephalus australis</i> (Australian Reed Warbler)			
20.	41323 <i>Actitis hypoleucos</i> (Common Sandpiper)		IA	
21.	25544 <i>Aegotheles cristatus</i> (Australian Owllet-nightjar)			
22.	24310 <i>Anas castanea</i> (Chestnut Teal)			
23.	24312 <i>Anas gracilis</i> (Grey Teal)			
24.	24313 <i>Anas platyrhynchos</i> (Mallard)			
25.	<i>Anas platyrhynchos</i> subsp. <i>domesticus</i>			
26.	24315 <i>Anas rhynchotis</i> (Australasian Shoveler)			
27.	24316 <i>Anas superciliosa</i> (Pacific Black Duck)			
28.	47414 <i>Anhinga novaehollandiae</i> (Australasian Darter)			
29.	<i>Anser anser</i>			
30.	24561 <i>Anthochaera carunculata</i> (Red Wattlebird)			
31.	24562 <i>Anthochaera lunulata</i> (Western Little Wattlebird)			
32.	25554 <i>Apus pacificus</i> (Fork-tailed Swift, Pacific Swift)		IA	
33.	24285 <i>Aquila audax</i> (Wedge-tailed Eagle)			
34.	25558 <i>Ardea ibis</i> (Cattle Egret)			
35.	25559 <i>Ardea intermedia</i> (Intermediate Egret)			
36.	41324 <i>Ardea modesta</i> (great egret, white egret)			
37.	24340 <i>Ardea novaehollandiae</i> (White-faced Heron)			
38.	24341 <i>Ardea pacifica</i> (White-necked Heron)			
39.	25566 <i>Artamus cinereus</i> (Black-faced Woodswallow)			

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
40.	24353 <i>Artamus cyanopterus</i> (Dusky Woodswallow)			
41.	24318 <i>Aythya australis</i> (Hardhead)			
42.	<i>Barnardius zonarius</i>			
43.	24319 <i>Biziura lobata</i> (Musk Duck)			
44.	24345 <i>Botaurus poiciloptilus</i> (Australasian Bittern)		T	
45.	25713 <i>Cacatua galerita</i> (Sulphur-crested Cockatoo)			
46.	24721 <i>Cacatua galerita subsp. galerita</i> (Sulphur-crested Cockatoo)	Y		
47.	25714 <i>Cacatua pastinator</i> (Western Long-billed Corella)			
48.	25715 <i>Cacatua roseicapilla</i> (Galah)			
49.	25716 <i>Cacatua sanguinea</i> (Little Corella)			
50.	24727 <i>Cacatua sanguinea subsp. westralensis</i> (Little Corella)			
51.	24729 <i>Cacatua tenuirostris</i> (Eastern Long-billed Corella)	Y		
52.	25598 <i>Cacomantis fiabelliformis</i> (Fan-tailed Cuckoo)			
53.	24427 <i>Cacomantis fiabelliformis subsp. fiabelliformis</i> (Fan-tailed Cuckoo)			
54.	42307 <i>Cacomantis pallidus</i> (Pallid Cuckoo)			
55.	24779 <i>Calidris acuminata</i> (Sharp-tailed Sandpiper)		IA	
56.	24784 <i>Calidris ferruginea</i> (Curlew Sandpiper)		T	
57.	24788 <i>Calidris ruficollis</i> (Red-necked Stint)		IA	
58.	25717 <i>Calyptorhynchus banksii</i> (Red-tailed Black-Cockatoo)			
59.	24731 <i>Calyptorhynchus banksii subsp. naso</i> (Forest Red-tailed Black Cockatoo)		T	
60.	24733 <i>Calyptorhynchus baudinii</i> (Baudin's Cockatoo, White-tailed Long-billed Black Cockatoo)		T	
61.	24734 <i>Calyptorhynchus latirostris</i> (Carnaby's Cockatoo, White-tailed Short-billed Black Cockatoo)		T	
62.	48400 <i>Calyptorhynchus sp.</i> (white-tailed black cockatoo)		T	
63.	25575 <i>Charadrius leschenaultii</i> (Greater Sand Plover)		T	
64.	24377 <i>Charadrius ruficapillus</i> (Red-capped Plover)			
65.	24321 <i>Chenonetta jubata</i> (Australian Wood Duck, Wood Duck)			
66.	47909 <i>Cheramoeca leucosterna</i> (White-backed Swallow)			
67.	41332 <i>Chlidonias leucopterus</i> (White-winged Black Tern, white-winged tern)		IA	
68.	<i>Chroicocephalus novaehollandiae</i>			
69.	24431 <i>Chrysococcyx basalis</i> (Horsfield's Bronze Cuckoo)			
70.	24432 <i>Chrysococcyx lucidus subsp. plagosus</i> (Shining Bronze Cuckoo)			
71.	24288 <i>Circus approximans</i> (Swamp Harrier)			
72.	24289 <i>Circus assimilis</i> (Spotted Harrier)			
73.	24774 <i>Cladorhynchus leucocephalus</i> (Banded Stilt)			
74.	25675 <i>Colluricincla harmonica</i> (Grey Shrike-thrush)			
75.	24613 <i>Colluricincla harmonica subsp. rufiventris</i> (Grey Shrike-thrush)			
76.	24399 <i>Columba livia</i> (Domestic Pigeon)	Y		
77.	25568 <i>Coracina novaehollandiae</i> (Black-faced Cuckoo-shrike)			
78.	24416 <i>Corvus bennetti</i> (Little Crow)			
79.	25592 <i>Corvus coronoides</i> (Australian Raven)			
80.	24417 <i>Corvus coronoides subsp. perplexus</i> (Australian Raven)			
81.	24671 <i>Coturnix pectoralis</i> (Stubble Quail)			
82.	25701 <i>Coturnix ypsilophora</i> (Brown Quail)			
83.	24420 <i>Cracticus nigrogularis</i> (Pied Butcherbird)			
84.	25595 <i>Cracticus tibicen</i> (Australian Magpie)			
85.	24422 <i>Cracticus tibicen subsp. dorsalis</i> (White-backed Magpie)			
86.	25596 <i>Cracticus torquatus</i> (Grey Butcherbird)			
87.	24424 <i>Cracticus torquatus subsp. torquatus</i> (Grey Butcherbird)			
88.	24322 <i>Cygnus atratus</i> (Black Swan)			
89.	30901 <i>Dacelo novaeguineae</i> (Laughing Kookaburra)	Y		
90.	25673 <i>Daphoenositta chrysoptera</i> (Varied Sittella)			
91.	24325 <i>Dendrocygna eytoni</i> (Plumed Whistling Duck)			
92.	25607 <i>Dicaeum hirundinaceum</i> (Mistletoebird)			
93.	24470 <i>Dromaius novaehollandiae</i> (Emu)			
94.	<i>Egretta garzetta</i>			
95.	<i>Egretta novaehollandiae</i>			
96.	<i>Elanus axillaris</i>			
97.	24290 <i>Elanus caeruleus subsp. axillaris</i> (Australian Black-shouldered Kite)			
98.	47937 <i>Eiseyornis melanops</i> (Black-fronted Dotterel)			
99.	<i>Eolophus roseicapillus</i>			
100.	24651 <i>Eopsaltria australis subsp. griseogularis</i> (Western Yellow Robin)			
101.	24567 <i>Epthianura albifrons</i> (White-fronted Chat)			
102.	24379 <i>Erythronyx cinctus</i> (Red-kneed Dotterel)			
103.	24368 <i>Eurostopodus argus</i> (Spotted Nightjar)			
104.	25621 <i>Falco berigora</i> (Brown Falcon)			
105.	25622 <i>Falco cenchroides</i> (Australian Kestrel, Nankeen Kestrel)			
106.	24472 <i>Falco cenchroides subsp. cenchroides</i> (Australian Kestrel, Nankeen Kestrel)			
107.	25623 <i>Falco longipennis</i> (Australian Hobby)			

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
108.	25624 <i>Falco peregrinus</i> (Peregrine Falcon)		S	
109.	24475 <i>Falco peregrinus</i> subsp. <i>macropus</i> (Australian Peregrine Falcon)		S	
110.	24616 <i>Falcunculus frontatus</i> subsp. <i>leucogaster</i> (Western Shrike-tit, Crested Shrike-tit)			
111.	25727 <i>Fulca atra</i> (Eurasian Coot)			
112.	24761 <i>Fulca atra</i> subsp. <i>australis</i> (Eurasian Coot)			
113.	25729 <i>Gallinula tenebrosa</i> (Dusky Moorhen)			
114.	24763 <i>Gallinula tenebrosa</i> subsp. <i>tenebrosa</i> (Dusky Moorhen)			
115.	25730 <i>Gallirallus philippensis</i> (Buff-banded Rail)			
116.	25530 <i>Gerygone fusca</i> (Western Gerygone)			
117.	47962 <i>Glyciphila melanops</i> (Tawny-crowned Honeyeater)			
118.	24443 <i>Grallina cyanoleuca</i> (Magpie-lark)			
119.	24293 <i>Haliaeetus leucogaster</i> (White-bellied Sea-Eagle)			
120.	24295 <i>Haliastur sphenurus</i> (Whistling Kite)			
121.	47965 <i>Hieraetus morphnoides</i> (Little Eagle)			
122.	25734 <i>Himantopus himantopus</i> (Black-winged Stilt)			
123.	24491 <i>Hirundo neoxena</i> (Welcome Swallow)			
124.	48587 <i>Hydroprogne caspia</i> (Caspian Tern)		IA	
125.	47975 <i>Ixobrychus dubius</i> (Australian Little Bittern)		P4	
126.	24367 <i>Lalage tricolor</i> (White-winged Triller)			
127.	25637 <i>Larus novaehollandiae</i> (Silver Gull)			
128.	25638 <i>Larus pacificus</i> (Pacific Gull)			
129.	25659 <i>Lichenostomus leucotis</i> (White-eared Honeyeater)			
130.	25661 <i>Lichmera indistincta</i> (Brown Honeyeater)			
131.	42461 <i>Limosa haemastica</i> (Hudsonian Godwit)	Y		Y
132.	25741 <i>Limosa limosa</i> (Black-tailed Godwit)		IA	
133.	<i>Lophoictinia isura</i>			
134.	24690 <i>Macronectes giganteus</i> (Southern Giant Petrel)		IA	
135.	24326 <i>Malacorhynchus membranaceus</i> (Pink-eared Duck)			
136.	25651 <i>Malurus lamberti</i> (Variegated Fairy-wren)			
137.	25652 <i>Malurus leucopterus</i> (White-winged Fairy-wren)			
138.	25654 <i>Malurus splendens</i> (Splendid Fairy-wren)			
139.	24552 <i>Malurus splendens</i> subsp. <i>splendens</i> (Splendid Fairy-wren)			
140.	24583 <i>Manorina flavigula</i> (Yellow-throated Miner)			
141.	25758 <i>Megalurus gramineus</i> (Little Grassbird)			
142.	25663 <i>Melithreptus brevirostris</i> (Brown-headed Honeyeater)			
143.	24598 <i>Merops ornatus</i> (Rainbow Bee-eater)			
144.	<i>Microcarbo melanoleucos</i>			
145.	25693 <i>Microeca fascinans</i> (Jacky Winter)			
146.	25610 <i>Myiagra inquieta</i> (Restless Flycatcher)			
147.	24738 <i>Neophema elegans</i> (Elegant Parrot)			
148.	25747 <i>Ninox connivens</i> (Barking Owl)			
149.	25564 <i>Nycticorax caledonicus</i> (Rufous Night Heron)			
150.	24742 <i>Nymphicus hollandicus</i> (Cockatiel)			
151.	24407 <i>Ocyphaps lophotes</i> (Crested Pigeon)			
152.	24328 <i>Oxyura australis</i> (Blue-billed Duck)		P4	
153.	25680 <i>Pachycephala rufiventris</i> (Rufous Whistler)			
154.	24624 <i>Pachycephala rufiventris</i> subsp. <i>rufiventris</i> (Rufous Whistler)			
155.	24693 <i>Pachyptila desolata</i> (Antarctic Prion)			
156.	48591 <i>Pandion cristatus</i> (Osprey, Eastern Osprey)		IA	
157.	25681 <i>Pardalotus punctatus</i> (Spotted Pardalote)			
158.	25682 <i>Pardalotus striatus</i> (Striated Pardalote)			
159.	25687 <i>Passer domesticus</i> (House Sparrow)	Y		
160.	24641 <i>Passer domesticus</i> subsp. <i>domesticus</i> (House Sparrow)	Y		Y
161.	24648 <i>Pelecanus conspicillatus</i> (Australian Pelican)			
162.	48060 <i>Petrochelidon ariel</i> (Fairy Martin)			
163.	48061 <i>Petrochelidon nigricans</i> (Tree Martin)			
164.	48066 <i>Petroica boodang</i> (Scarlet Robin)			
165.	24659 <i>Petroica goodenovii</i> (Red-capped Robin)			
166.	25697 <i>Phalacrocorax carbo</i> (Great Cormorant)			
167.	25698 <i>Phalacrocorax melanoleucos</i> (Little Pied Cormorant)			
168.	24667 <i>Phalacrocorax sulcirostris</i> (Little Black Cormorant)			
169.	25699 <i>Phalacrocorax varius</i> (Pied Cormorant)			
170.	24409 <i>Phaps chalcoptera</i> (Common Bronzewing)			
171.	48071 <i>Phylidonyris niger</i> (White-cheeked Honeyeater)			
172.	24596 <i>Phylidonyris novaehollandiae</i> (New Holland Honeyeater)			
173.	24841 <i>Platalea flavipes</i> (Yellow-billed Spoonbill)			
174.	24842 <i>Platalea regia</i> (Royal Spoonbill)			
175.	25720 <i>Platycercus icterotis</i> (Western Rosella)			
176.	24747 <i>Platycercus spurius</i> (Red-capped Parrot)			
177.	25721 <i>Platycercus zonarius</i> (Australian Ringneck, Ring-necked Parrot)			

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
178.	24750 <i>Platycercus zonarius</i> subsp. <i>semitorquatus</i> (Twenty-eight Parrot)			
179.	24843 <i>Plegadis falcinellus</i> (Glossy Ibis)		IA	
180.	24382 <i>Pluvialis fulva</i> (Pacific Golden Plover)		IA	
181.	24383 <i>Pluvialis squatarola</i> (Grey Plover)		IA	
182.	25703 <i>Podargus strigoides</i> (Tawny Frogmouth)			
183.	24679 <i>Podargus strigoides</i> subsp. <i>brachypterus</i> (Tawny Frogmouth)			
184.	25704 <i>Podiceps cristatus</i> (Great Crested Grebe)			
185.	24680 <i>Podiceps cristatus</i> subsp. <i>australis</i> (Great Crested Grebe)			
186.	24681 <i>Poliocephalus poliocephalus</i> (Hoary-headed Grebe)			
187.	25722 <i>Polytelis anthopeplus</i> (Regent Parrot)			
188.	25731 <i>Porphyrio porphyrio</i> (Purple Swamphen)			
189.	24767 <i>Porphyrio porphyrio</i> subsp. <i>bellus</i> (Purple Swamphen)			
190.	24769 <i>Porzana fluminea</i> (Australian Spotted Crane)			
191.	25732 <i>Porzana pusilla</i> (Baillon's Crane)			
192.	24771 <i>Porzana tabuensis</i> (Spotless Crane)			
193.	<i>Purpurecephalus spurius</i>			
194.	24776 <i>Recurvirostra novaehollandiae</i> (Red-necked Avocet)			
195.	48096 <i>Rhipidura albiscapa</i> (Grey Fantail)			
196.	25614 <i>Rhipidura leucophrys</i> (Willie Wagtail)			
197.	24454 <i>Rhipidura leucophrys</i> subsp. <i>leucophrys</i> (Willie Wagtail)			
198.	25534 <i>Sericornis frontalis</i> (White-browed Scrubwren)			
199.	30948 <i>Smicrornis brevirostris</i> (Weebill)			
200.	24329 <i>Stictonetta naevosa</i> (Freckled Duck)			
201.	25597 <i>Strepera versicolor</i> (Grey Currawong)			
202.	25589 <i>Streptopelia chinensis</i> (Spotted Turtle-Dove)	Y		
203.	25590 <i>Streptopelia senegalensis</i> (Laughing Turtle-Dove)	Y		
204.	25705 <i>Tachybaptus novaehollandiae</i> (Australasian Grebe, Black-throated Grebe)			
205.	24682 <i>Tachybaptus novaehollandiae</i> subsp. <i>novaehollandiae</i> (Australasian Grebe, Black-throated Grebe)			
206.	24331 <i>Tadorna tadornoides</i> (Australian Shelduck, Mountain Duck)			
207.	24845 <i>Threskiornis spinicollis</i> (Straw-necked Ibis)			
208.	25549 <i>Todiramphus sanctus</i> (Sacred Kingfisher)			
209.	48141 <i>Tribonyx ventralis</i> (Black-tailed Native-hen)			
210.	25723 <i>Trichoglossus haematodus</i> (Rainbow Lorikeet)			
211.	24755 <i>Trichoglossus haematodus</i> subsp. <i>moluccanus</i> (Rainbow Lorikeet)	Y		
212.	24806 <i>Tringa glareola</i> (Wood Sandpiper)		IA	
213.	24808 <i>Tringa nebularia</i> (Common Greenshank, greenshank)		IA	
214.	24809 <i>Tringa stagnatilis</i> (Marsh Sandpiper, little greenshank)		IA	
215.	48147 <i>Turnix varius</i> (Painted Button-quail)			
216.	25762 <i>Tyto alba</i> (Barn Owl)			
217.	24852 <i>Tyto alba</i> subsp. <i>delicatula</i> (Barn Owl)			
218.	24855 <i>Tyto novaehollandiae</i> subsp. <i>novaehollandiae</i> (Masked Owl (southwest))		P3	
219.	25577 <i>Vanellus miles</i> (Masked Lapwing)			
220.	24386 <i>Vanellus tricolor</i> (Banded Lapwing)			
221.	41351 <i>Xenus cinereus</i> (Terek Sandpiper)		IA	
222.	25765 <i>Zosterops lateralis</i> (Grey-breasted White-eye, Silveryeye)			

Fish

223.	<i>Carassius auratus</i>			
224.	<i>Gambusia affinis</i>			
225.	<i>Platycephalus endrachtensis</i>			
226.	<i>Platycephalus</i> sp.			
227.	<i>Pseudogobius olorum</i>			

Invertebrate

228.	<i>Amblyomma triguttatum</i>			
229.	<i>Aname mainae</i>			
230.	<i>Aname tepperi</i>			
231.	<i>Araneus cyphoxis</i>			
232.	<i>Araneus eburneiventris</i>			
233.	<i>Araneus senicaudatus</i>			
234.	<i>Arteria linnaei</i>			
235.	<i>Austracantha minax</i>			
236.	<i>Australomimetes ovidi</i>			
237.	33973 <i>Austrosaga spinifer</i> (spiny katydid (Swan Coastal Plain), bush cricket (Swan Coastal Plain))		P2	
238.	<i>Backobourkia brounii</i>			
239.	<i>Cercophonius sulcatus</i>			
240.	<i>Cormocephalus aurantiipes</i>			
241.	<i>Cormocephalus novaehollandiae</i>			
242.	<i>Cormocephalus rubriceps</i>			

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
243.	<i>Cormocephalus strigosus</i>			
244.	<i>Cormocephalus turneri</i>			
245.	<i>Dingosa serrata</i>			
246.	<i>Eodelena convexa</i>			
247.	<i>Eriophora biapicata</i>			
248.	<i>Ethmostigmus rubripes</i>			
249.	<i>Henicops dentatus</i>			
250.	<i>Hogna crispipes</i>			
251.	33977 <i>Hylaeus globuliferus</i> (woolybush bee)		P3	
252.	<i>Idiommata blackwalli</i>			
253.	48935 <i>Idiosoma sigillatum</i> (Swan Coastal Plain shield-backed trapdoor spider)		P3	
254.	<i>Isometroides vescus</i>			
255.	<i>Isopeida leishmanni</i>			
256.	<i>Lampona cylindrata</i>			
257.	<i>Latrodectus hasseltii</i>			
258.	33982 <i>Leioproctus contrarius</i> (a short-tongued bee)		P3	
259.	<i>Lycosa gilberta</i>			
260.	<i>Maratus pavonis</i>			
261.	<i>Missulena granulosa</i>			
262.	<i>Nephila edulis</i>			
263.	<i>Notiasemus glauerti</i>			
264.	<i>Ocrisiona leucomis</i>			
265.	<i>Oecobius navus</i>			
266.	<i>Ommatoiulus moreletii</i>			
267.	<i>Oratemnus curtus</i>			
268.	<i>Pholcus phalangioides</i>			
269.	<i>Scolopendra laeta</i>			
270.	33992 <i>Synemon gratiosa</i> (Graceful Sunmoth)		P4	
271.	<i>Tasmanicosa leuckartii</i>			
272.	<i>Urodacus novaehollandiae</i>			
273.	<i>Venator immansueta</i>			
274.	<i>Venatrix pullastra</i>			

Mammal

275.	24086 <i>Cercartetus concinnus</i> (Western Pygmy-possum, Mundarda)			
276.	24186 <i>Chalinolobus gouldii</i> (Gould's Wattleed Bat)			
277.	24041 <i>Felis catus</i> (Cat)	Y		
278.	24215 <i>Hydromys chrysogaster</i> (Water-rat, Rakali)		P4	
279.	48588 <i>Isodon fusciventer</i> (Quenda, southwestern brown bandicoot)		P4	
280.	24132 <i>Macropus fuliginosus</i> (Western Grey Kangaroo)			
281.	24223 <i>Mus musculus</i> (House Mouse)	Y		
282.	48022 <i>Notamacropus irma</i> (Western Brush Wallaby)		P4	
283.	24194 <i>Nyctophilus geoffroyi</i> (Lesser Long-eared Bat)			
284.	24085 <i>Oryctolagus cuniculus</i> (Rabbit)	Y		
285.	24230 <i>Pseudomys albocinerus</i> (Ash-grey Mouse)			
286.	24243 <i>Rattus fuscipes</i> (Western Bush Rat)			
287.	24245 <i>Rattus rattus</i> (Black Rat)	Y		
288.	24207 <i>Tachyglossus aculeatus</i> (Short-beaked Echidna)			
289.	24167 <i>Tarsipes rostratus</i> (Honey Possum, Noolbenger)			
290.	25521 <i>Trichosurus vulpecula</i> (Common Brushtail Possum)			
291.	24158 <i>Trichosurus vulpecula</i> subsp. <i>vulpecula</i> (Common Brushtail Possum)			
292.	24206 <i>Vespadelus regulus</i> (Southern Forest Bat)			
293.	24040 <i>Vulpes vulpes</i> (Red Fox)	Y		

Reptile

294.	42368 <i>Acritoscincus trilineatus</i> (Western Three-lined Skink)			
295.	44629 <i>Anilius australis</i>			
296.	24991 <i>Aprasia repens</i> (Sand-plain Worm-lizard)			
297.	42381 <i>Brachyuophis semifasciatus</i> (Southern Shovel-nosed Snake)			
298.	25335 <i>Caretta caretta</i> (Loggerhead Turtle)		T	
299.	43380 <i>Chelodina collii</i> (South-western Snake-necked Turtle)			
300.	24980 <i>Christinus marmoratus</i> (Marbled Gecko)			
301.	24918 <i>Crenadactylus ocellatus</i> subsp. <i>ocellatus</i> (Clawless Gecko)			
302.	30893 <i>Cryptoblepharus buchananii</i>			
303.	25020 <i>Cryptoblepharus plagiocephalus</i>			
304.	30899 <i>Ctenophorus adelaidensis</i> (Southern Heath Dragon, Western Heath Dragon)			
305.	25027 <i>Ctenotus australis</i>			
306.	25039 <i>Ctenotus fallens</i>			
307.	25040 <i>Ctenotus gemmula</i> (Jewelled South-west Ctenotus (Swan Coastal Plain subpop P3), skink)			
308.	25047 <i>Ctenotus impar</i>			

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
309.	25087 <i>Cyclodomorphus celatus</i> (Western Slender Blue-tongue)			
310.	30905 <i>Delma concinna</i> subsp. <i>concinna</i> (Javelin Legless Lizard)			
311.	25766 <i>Delma fraseri</i> (Fraser's Legless Lizard)			
312.	24999 <i>Delma grayii</i>			
313.	25296 <i>Demansia psammophis</i> subsp. <i>reticulata</i> (Yellow-faced Whipsnake)			
314.	24929 <i>Diplodactylus granariensis</i> subsp. <i>granariensis</i>			
315.	24939 <i>Diplodactylus polyophthalmus</i>			
316.	25251 <i>Echiopsis curta</i> (Bardick)			
317.	25100 <i>Egernia napoleonis</i>			
318.	25250 <i>Elapognathus coronatus</i> (Crowned Snake)			
319.	25119 <i>Hemiergis quadrilineata</i>			
320.	25131 <i>Lerista distinguenda</i>			
321.	25133 <i>Lerista elegans</i>			
322.	25148 <i>Lerista lineopunctulata</i>			
323.	25165 <i>Lerista praepecta</i>			
324.	25005 <i>Lialis burtonis</i>			
325.	42414 <i>Lucasium alboguttatum</i>			
326.	25184 <i>Menetia greyii</i>			
327.	25240 <i>Morelia spilota</i> subsp. <i>imbricata</i> (Carpet Python)			
328.	25191 <i>Morethia lineoocellata</i>			
329.	25192 <i>Morethia obscura</i>			
330.	25248 <i>Neelaps bimaculatus</i> (Black-naped Snake)			
331.	25249 <i>Neelaps calonotos</i> (Black-striped Snake, black-striped burrowing snake)		P3	
332.	25252 <i>Notechis scutatus</i> (Tiger Snake)			
333.	25253 <i>Parasuta gouldii</i>			
334.	25255 <i>Parasuta nigriceps</i>			
335.	25509 <i>Pletholax gracilis</i> (Keeled Legless Lizard)			
336.	25007 <i>Pletholax gracilis</i> subsp. <i>gracilis</i> (Keeled Legless Lizard)			
337.	25510 <i>Pogona minor</i> (Dwarf Bearded Dragon)			
338.	24907 <i>Pogona minor</i> subsp. <i>minor</i> (Dwarf Bearded Dragon)			
339.	25511 <i>Pseudonaja affinis</i> (Dugite)			
340.	25259 <i>Pseudonaja affinis</i> subsp. <i>affinis</i> (Dugite)			
341.	25008 <i>Pygopus lepidopodus</i> (Common Scaly Foot)			
342.	25266 <i>Simoselaps bertholdi</i> (Jan's Banded Snake)			
343.	25518 <i>Strophurus spinigerus</i>			
344.	24943 <i>Strophurus spinigerus</i> subsp. <i>inornatus</i>			
345.	24942 <i>Strophurus spinigerus</i> subsp. <i>spinigerus</i>			
346.	25203 <i>Tiliqua occipitalis</i> (Western Bluetongue)			
347.	25519 <i>Tiliqua rugosa</i>			
348.	25207 <i>Tiliqua rugosa</i> subsp. <i>rugosa</i>			
349.	24983 <i>Underwoodisaurus milii</i> (Barking Gecko)			
350.	25218 <i>Varanus gouldii</i> (Bungarra or Sand Monitor)			
351.	25526 <i>Varanus tristis</i> (Racehorse Monitor)			

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 wholly 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 C

Black Cockatoo Foraging Plants



Species name	Common name	Foraging category as assigned by Emerge			Literature references
		CBC	BBC	FRTBC	
<i>Acacia baileyana</i>	Cootamundra wattle	Secondary	-	-	Groom 2011
<i>Acacia pentadenia</i>	Karri wattle	Secondary	-	-	Groom 2011
<i>Acacia saligna</i>	Orange wattle	Secondary	-	-	Groom 2011
<i>Agonis flexuosa</i>	Peppermint tree	Secondary	-	-	Groom 2011
<i>Allocasuarina fraseriana</i>	Sheoak	-	Secondary	Secondary	Johnstone & Storr 1998; Johnstone <i>et al.</i> 2010; Johnstone 2017; DoEE 2017
<i>Allocasuarina spp.</i>		Secondary	-	Secondary	Johnstone <i>et al.</i> 2010; Groom 2011; DSEWPaC 2012; DoEE 2017
<i>Anigozanthos flavidus</i>	Tall kangaroo paw	-	Secondary	-	Johnstone <i>et al.</i> 2010; DSEWPaC 2012; DoEE 2017
<i>Araucaria heterophylla</i>	Norfolk island pine	Secondary	-	-	Groom 2011; DoEE 2017
<i>Banksia ashbyi</i>	Ashby's banksia	Primary	Secondary	-	Saunders 1980; Groom 2011; DoEE 2017
<i>Banksia attenuata</i>	Slender banksia	Primary	Secondary	-	Saunders 1980; Johnstone <i>et al.</i> 2010; Groom 2011; DoEE 2017
<i>Banksia baxteri</i>	Baxter's banksia	Primary	Secondary	-	Johnstone <i>et al.</i> 2010; Groom 2011; DoEE 2017
<i>Banksia carlinoides</i>	Pink dryandra	Primary	Secondary	-	Johnstone <i>et al.</i> 2010; Groom 2011; DoEE 2017
<i>Banksia coccinea</i>	Scarlet banksia	Primary	Secondary	-	Johnstone <i>et al.</i> 2010; Groom 2011; DoEE 2017
<i>Banksia dallanneyi</i>	Couch honeypot dryandra	Primary	Secondary	-	Groom 2011; DoEE 2017
<i>Banksia ericifolia</i>	Heath-leaved banksia	Primary	Secondary	-	Johnstone <i>et al.</i> 2010; Groom 2011; DoEE 2017
<i>Banksia fraseri</i>		Primary	Secondary	-	Johnstone <i>et al.</i> 2010; Groom 2011; DoEE 2017
<i>Banksia gardneri</i>	Prostrate banksia	Primary	Secondary	-	Groom 2011; DoEE 2017
<i>Banksia grandis</i>	Bull banksia	Primary	Secondary	-	Saunders 1980; Johnstone & Storr 1998; Johnstone <i>et al.</i> 2010; Groom 2011; DoEE 2017
<i>Banksia hookeriana</i>	Hooker's banksia	Primary	Secondary	-	Johnstone <i>et al.</i> 2010; Groom 2011; DoEE 2017
<i>Banksia ilicifolia</i>	Holly banksia	Primary	Secondary	-	Johnstone <i>et al.</i> 2010; Groom 2011; Johnstone & Storr 1998; DoEE 2017
<i>Banksia kippistiana</i>		Primary	Secondary	-	Groom 2011; DoEE 2017
<i>Banksia leptophylla</i>		Primary	Secondary	-	Groom 2011; DoEE 2017
<i>Banksia lindleyana</i>	Porcupine banksia	Primary	Secondary	-	Johnstone <i>et al.</i> 2010; DoEE 2017

Species name	Common name	Foraging category as assigned by Emerge			Literature references
		CBC	BBC	FRTBC	
<i>Banksia littoralis</i>	Swamp banksia	Primary	Secondary	-	Saunders 1980; Groom 2011; Johnstone & Storr 1998; Johnstone <i>et al.</i> 2010; DoEE 2017
<i>Banksia menziesii</i>	Firewood banksia	Primary	Secondary	-	Saunders 1980; Johnstone <i>et al.</i> 2010; Groom 2011; DoEE 2017
<i>Banksia mucronulata</i>	Swordfish dryandra	Primary	Secondary	-	Groom 2011; DoEE 2017
<i>Banksia nivea</i>	Honeypot dryandra	Primary	Secondary	-	Saunders 1980; Groom 2011; DoEE 2017
<i>Banksia nobilis</i>	Golden dryandra	Primary	Secondary	-	Saunders 1980; Groom 2011; DoEE 2017
<i>Banksia praemorsa</i>	Cut-leaf banksia	Primary	Secondary	-	Saunders 1980; Johnstone <i>et al.</i> 2010; Groom 2011; DoEE 2017
<i>Banksia prionotes</i>	Acorn banksia	Primary	Secondary	-	Johnstone <i>et al.</i> 2010; Groom 2011; DoEE 2017
<i>Banksia prolata</i>		Primary	Secondary	-	Johnstone <i>et al.</i> 2010; DoEE 2017
<i>Banksia quercifolia</i>	Oak-leaved banksia	Primary	Secondary	-	Johnstone & Storr 1998; Johnstone <i>et al.</i> 2010; Groom 2011; DoEE 2017
<i>Banksia sessilis</i>	Parrot bush	Primary	Secondary	-	Saunders 1980; Johnstone & Storr 1998; Johnstone <i>et al.</i> 2010; Groom 2011; DoEE 2017
<i>Banksia speciosa</i>	Showy banksia	Primary	Secondary	-	Johnstone <i>et al.</i> 2010; Groom 2011; DoEE 2017
<i>Banksia spp.</i>		Primary	Secondary	-	Saunders 1979; DSEWPaC 2012; DoEE 2017
<i>Banksia squarrosa</i>	Pingle	Primary	Secondary	-	Johnstone <i>et al.</i> 2010; Groom 2011; DoEE 2017
<i>Banksia tricuspis</i>	Pine banksia	Primary	Secondary	-	Groom 2011; DoEE 2017
<i>Banksia undata</i>	Urchin dryandra	Primary	Secondary	-	Groom 2011; DoEE 2017
<i>Banksia verticillata</i>	Granite banksia	Primary	Secondary	-	Saunders 1980; Groom 2011; DoEE 2017
<i>Brassica campestris</i>	Canola	Secondary	-	-	Groom 2011; DoEE 2017
<i>Callistemon spp.</i>		Secondary	Secondary	-	Johnstone <i>et al.</i> 2010; DoEE 2017
<i>Callistemon viminalis</i>	Captain cook bottlebrush	Secondary	-	-	Groom 2011
<i>Callitris sp.</i>		Secondary	-	-	Johnstone <i>et al.</i> 2010; Groom 2011
<i>Carya illinoensis</i>	Pecan	Primary	Secondary	-	Johnstone <i>et al.</i> 2010; Groom 2011; Groom 2014; DoEE 2017
<i>Casuarina cunninghamiana</i>	River sheoak	Secondary	-	-	Groom 2011
<i>Citrullus lanatus</i>	Pie or afghan melon	Secondary	-	-	Johnstone <i>et al.</i> 2010; Groom 2011

Species name	Common name	Foraging category as assigned by Emerge			Literature references
		CBC	BBC	FRTBC	
<i>Corymbia calophylla</i>	Marri	Primary	Primary	Primary	Johnstone & Storr 1998; Johnstone & Kirkby 1999; Johnstone <i>et al.</i> 2010; DSEWPaC 2012; DoEE 2017; Johnstone 2017; Saunders 1979; Johnstone & Kirkby 2008
<i>Corymbia citriodora</i>	Lemon scented gum	Secondary	Secondary	Secondary	Johnstone <i>et al.</i> 2010; DSEWPaC 2012; Groom 2011; Johnstone 2017
<i>Corymbia ficifolia</i>	Red flowering gum	Secondary	-	-	Groom 2011
<i>Corymbia haematoxylon</i>	Mountain marri	Secondary	-	Secondary	Groom 2011; DoEE 2012; DoEE 2017
<i>Corymbia maculata</i>	Spotted gum	-	-	-	-
<i>Darwinia citriodora</i>	Lemon-scented darwinia	Secondary	Secondary	-	Groom 2011; Johnstone <i>et al.</i> 2010
<i>Diospyros sp.</i>	Sweet persimmon	Secondary	Secondary	-	Johnstone <i>et al.</i> 2010; Groom 2011; DSEWPaC 2012; DoEE 2017
<i>Eremophila glabra</i>	Tarbush	Secondary	-	-	Groom 2011
<i>Erodium aureum</i>		Secondary	-	-	Groom 2011
<i>Erodium botrys</i>	Long storksbill	Secondary	Secondary	-	Groom 2011; Johnstone & Storr 1998; Johnstone <i>et al.</i> 2010
<i>Erodium spp.</i>		Secondary	Secondary	-	Johnstone <i>et al.</i> 2010; DoEE 2017
<i>Eucalyptus caesia</i>	Silver princess	Secondary	-	Secondary	Johnstone <i>et al.</i> 2010; Groom 2011; DSEWPaC 2012; DoEE 2017; Johnstone 2017
<i>Eucalyptus camaldulensis</i>	River red gum	-	-	Secondary	DoEE 2012; DoEE 2017
<i>Eucalyptus decipiens</i>	Red heart/moit	-	-	Secondary	Johnstone 2017
<i>Eucalyptus diversicolor</i>	Karri	-	-	Primary	Johnstone <i>et al.</i> 2010; DSEWPaC 2012; DoEE 2017; Johnstone & Storr 1998
<i>Eucalyptus erythrocorys</i>	Illyarrie	Secondary	-	Secondary	DSEWPaC 2012; DoEE 2017; Johnstone 2017, Johnstone <i>et al.</i> 2010
<i>Eucalyptus gomphocephala</i>	Tuart	Secondary	-	Secondary	Johnstone <i>et al.</i> 2010; Groom 2011; DSEWPaC 2012; DoEE 2017
<i>Eucalyptus grandis</i>	Flooded gum, rose gum	-	-	Secondary	DoEE 2012; DoEE 2017
<i>Eucalyptus lehmannii</i>	Bushy yate	-	-	Secondary	Johnstone 2017
<i>Eucalyptus leucoxylon</i>	Yellow gum	Secondary	-	-	Groom 2014

Species name	Common name	Foraging category as assigned by Emerge			Literature references
		CBC	BBC	FRTBC	
<i>Eucalyptus loxophleba</i>	York gum	Secondary	-	-	Johnstone <i>et al.</i> 2010; Groom 2011; DSEWPaC 2012; DoEE 2017
<i>Eucalyptus marginata</i>	Jarrah	Primary	Secondary	Primary	Saunders 1980; Johnstone <i>et al.</i> 2010; Groom 2011; DSEWPaC 2012; DoEE 2017; Johnstone & Storr 1998; Johnstone & Kirkby 1999; Johnstone 2017
<i>Eucalyptus patens</i>	Blackbutt	Primary	-	Primary	Johnstone & Storr 1998; Johnstone & Kirkby 1999; Johnstone <i>et al.</i> 2010; DSEWPaC 2012; DoEE 2017; Johnstone 2017; Groom 2011
<i>Eucalyptus pleurocarpa</i>	Tallerack	Secondary	-	-	Groom 2011
<i>Eucalyptus preissiana</i>	Bell-fruited mallee	Secondary	-	-	Groom 2011
<i>Eucalyptus robusta</i>	Swamp mahogany	Secondary	-	-	Johnstone <i>et al.</i> 2010; Groom 2011
<i>Eucalyptus salmonophloia</i>	Salmon gum	Primary	-	-	Johnstone <i>et al.</i> 2010; Groom 2011; DSEWPaC 2012; DSEWPaC 2012; DoEE 2017
<i>Eucalyptus staeri</i>	Albany blackbutt	-	-	Secondary	Johnstone & Storr 1998
<i>Eucalyptus todtiana</i>	Coastal blackbutt	Secondary	-	-	Saunders 1980; Johnstone <i>et al.</i> 2010; Groom 2011; Johnstone & Kirkby 2008
<i>Eucalyptus wandoo</i>	Wandoo	Primary	Secondary	Primary	Saunders 1980; Johnstone <i>et al.</i> 2010; Groom 2011; DSEWPaC 2012; DoEE 2017
<i>Ficus sp.</i>	Fig	Secondary	-	-	Groom 2011
<i>Grevillea armigera</i>	Prickly toothbrushes	Primary	-	-	Groom 2011
<i>Grevillea bipinnatifida</i>	Fuschia grevillea	Primary	-	-	Groom 2011
<i>Grevillea hookeriana</i>	Red toothbrushes	Primary	-	-	Groom 2011
<i>Grevillea hookeriana subsp. apiculata</i>	Black toothbrushes	Primary	-	-	Groom 2011
<i>Grevillea paniculata</i>	Kerosene bush	Primary	-	-	Groom 2011
<i>Grevillea paradoxa</i>	Bottlebrush grevillea	Primary	-	-	Groom 2011
<i>Grevillea petrophiloides</i>	Pink poker	Primary	-	-	Groom 2011
<i>Grevillea robusta</i>	Silky oak	Primary	-	-	Johnstone <i>et al.</i> 2010; Groom 2011

Species name	Common name	Foraging category as assigned by Emerge			Literature references
		CBC	BBC	FRTBC	
<i>Grevillea spp.</i>		Primary	-	-	Saunders 1979; Johnstone <i>et al.</i> 2010; DSEWPac 2012; DoEE 2017
<i>Grevillea wilsonii</i>	Native fuchsia	-	Secondary	-	Johnstone <i>et al.</i> 2010
<i>Hakea auriculata</i>		Primary	-	-	Saunders 1980; Groom 2011
<i>Hakea candolleana</i>		Primary	-	-	Groom 2011
<i>Hakea circumalata</i>	Coastal hakea	Primary	-	-	Groom 2011
<i>Hakea commutata</i>		Primary	-	-	Groom 2011
<i>Hakea conchifolia</i>	Shell-leaved hakea	Primary	-	-	Groom 2011
<i>Hakea costata</i>	Ribbed hakea	Primary	-	-	Groom 2011
<i>Hakea cristata</i>	Snail hakea	Primary	Secondary	-	Groom 2011; Johnstone <i>et al.</i> 2010
<i>Hakea cucullata</i>	Snail hakea	Primary	-	-	Groom 2011
<i>Hakea cyclocarpa</i>	Ramshorn	Primary	-	-	Saunders 1980; Groom 2011
<i>Hakea eneabba</i>		Primary	-	-	Groom 2011
<i>Hakea erinacea</i>	Hedgehog hakea	Primary	Secondary	-	Johnstone <i>et al.</i> 2010; Groom 2011
<i>Hakea falcata</i>	Sickle hakea	Primary	-	-	Groom 2011
<i>Hakea flabellifolia</i>	Fan-leaved hakea	Primary	-	-	Groom 2011
<i>Hakea gilbertii</i>		Primary	-	-	Saunders 1980; Groom 2011
<i>Hakea incrassata</i>	Golfball or marble hakea	Primary	-	-	Johnstone <i>et al.</i> 2010; Groom 2011
<i>Hakea lasiantha</i>	Woolly flowered hakea	Primary	-	-	Johnstone <i>et al.</i> 2010; Groom 2011
<i>Hakea lasianthoides</i>		Primary	Secondary	-	Johnstone <i>et al.</i> 2010; Groom 2011
<i>Hakea laurina</i>	Pin-cushion hakea	Primary	-	-	Johnstone <i>et al.</i> 2010; Groom 2011
<i>Hakea lissocarpa</i>	Honeybush	Primary	Secondary	-	Saunders 1980; Johnstone <i>et al.</i> 2010; Groom 2011
<i>Hakea marginata</i>		-	Secondary	-	Johnstone <i>et al.</i> 2010
<i>Hakea megalosperma</i>	Lesueur hakea	Primary	-	-	Groom 2011
<i>Hakea multilineata</i>	Grass leaf hakea	Primary	-	-	Groom 2011
<i>Hakea neospathulata</i>		Primary	-	-	Groom 2011
<i>Hakea obliqua</i>	Needles and corks	Primary	-	-	Saunders 1980; Groom 2011
<i>Hakea oleifolia</i>	Dungyn	Primary	-	-	Groom 2011

Species name	Common name	Foraging category as assigned by Emerge			Literature references
		CBC	BBC	FRTBC	
<i>Hakea pandanica</i> subsp. <i>crassifolia</i>	Thick-leaved hakea	Primary	-	-	Groom 2011
<i>Hakea petiolaris</i>	Sea urchin hakea	Primary	-	-	Groom 2011
<i>Hakea polyanthema</i>		Primary	-	-	Groom 2011
<i>Hakea preissii</i>	Needle tree	Primary	-	-	Groom 2011
<i>Hakea prostrata</i>	Harsh hakea	Primary	Secondary	-	Saunders 1980; Johnstone <i>et al.</i> 2010; Groom 2011
<i>Hakea psilorrhyncha</i>		Primary	-	-	Groom 2011
<i>Hakea ruscifolia</i>	Candle hakea	Primary	Secondary	-	Saunders 1980; Groom 2011; Johnstone <i>et al.</i> 2010
<i>Hakea scoparia</i>	Kangaroo bush	Primary	-	-	Groom 2011
<i>Hakea smilacifolia</i>		Primary	-	-	Groom 2011
<i>Hakea spp.</i>		Primary	Secondary	-	Saunders 1979; DSEWPac 2012; DoEE 2017
<i>Hakea stenocarpa</i>	Narrow-fruited hakea	Primary	Secondary	-	Johnstone <i>et al.</i> 2010; Groom 2011
<i>Hakea sulcata</i>	Furrowed hakea	Primary	-	-	Groom 2011
<i>Hakea trifurcata</i>	Two-leaved hakea	Primary	Secondary	-	Saunders 1980; Johnstone <i>et al.</i> 2010; Groom 2011
<i>Hakea undulata</i>	Wavy-leaved hakea	Primary	Secondary	-	Saunders 1980; Johnstone <i>et al.</i> 2010; Groom 2011
<i>Hakea varia</i>	Variable-leaved hakea	Primary	Secondary	-	Saunders 1980; Groom 2011
<i>Harpephyllum caffrum</i>	Kaffir plum	-	-	Secondary	Johnstone 2017
<i>Helianthus annuus</i>	Sunflower	Secondary	-	-	Johnstone <i>et al.</i> 2010; Groom 2011
<i>Hibiscus sp.</i>	Hibiscus	Secondary	-	-	Groom 2011
<i>Isopogon scabriusculus</i>		Secondary	-	-	Groom 2011
<i>Jacaranda mimosifolia</i>	Jacaranda	Secondary	Secondary	-	Johnstone <i>et al.</i> 2010; Groom 2011
<i>Jacksonia furcellata</i>	Grey stinkwood	Secondary	-	-	Groom 2011
<i>Kingia australis</i>	Kingia	-	Secondary	-	Johnstone <i>et al.</i> 2010
<i>Lambertia inermis</i>	Chittick	Secondary	-	-	Johnstone & Storr 1998; Groom 2011
<i>Lambertia multiflora</i>	Many-flowered honeysuckle	Secondary	-	-	Saunders 1980; Groom 2011

Species name	Common name	Foraging category as assigned by Emerge			Literature references
		CBC	BBC	FRTBC	
<i>Liquidamber styraciflua</i>	Liquid amber	Primary	-	Secondary	Johnstone <i>et al.</i> 2010; Groom 2011; Groom 2014; Personal observation
<i>Lupinus sp.</i>	Lupin	Secondary	-	-	Saunders 1980; Groom 2011
<i>Macadamia integrifolia</i>	Macadamia	Primary	Secondary	-	Johnstone <i>et al.</i> 2010; Grooms 2011; Groom 2014
<i>Malus domestica</i>	Apple	Secondary	Secondary	-	Johnstone <i>et al.</i> 2010; Johnstone & Storr 1998; DSEWPaC 2012; DoEE 2017; Groom 2011
<i>Melaleuca leuropoma</i>		Secondary	-	-	Saunders 1980; Groom 2011
<i>Melia azedarach</i>	Cape lilac or white cedar	Secondary	-	Primary	Johnstone <i>et al.</i> 2010; Groom 2011
<i>Mesomeleana spp.</i>		Secondary	-	-	Johnstone <i>et al.</i> 2010; Groom 2011
<i>Olea europea</i>	Olive	-	-	Secondary	Johnstone 2017
<i>Persoonia longifolia</i>	Snottygobble	-	-	Secondary	Johnstone & Storr 1998; Johnstone & Kirkby 1999; Johnstone <i>et al.</i> 2010; DSEWPaC 2012; DoEE 2017
<i>Pinus canariensis</i>	Canary island pine	Primary	-	-	Johnstone <i>et al.</i> 2010; Groom 2011
<i>Pinus caribea</i>	Caribbean pine	Primary	-	-	Johnstone <i>et al.</i> 2010; Groom 2011
<i>Pinus pinaster</i>	Pinaster or maritime pine	Primary	-	-	Groom 2011
<i>Pinus radiata</i>	Radiata pine	Primary	Secondary	-	Johnstone <i>et al.</i> 2010; Groom 2011
<i>Pinus spp.</i>		Primary	Secondary	-	Johnstone & Storr 1998; Saunders 1979; Johnstone <i>et al.</i> 2010; DSEWPaC 2012; DoEE 2017
<i>Protea 'Pink Ice'</i>		Secondary	-	-	Groom 2011
<i>Protea repens</i>		Secondary	-	-	Groom 2011
<i>Protea spp.</i>		Secondary	-	-	Johnstone <i>et al.</i> 2010
<i>Prunus amygdalus</i>	Almond tree	Secondary	-	-	Johnstone & Storr 1998; Johnstone <i>et al.</i> 2010; Groom 2011; DoEE 2017
<i>Pyrus communis</i>	European pear	-	Secondary	-	Johnstone & Storr 1998; Johnstone <i>et al.</i> 2010; DSEWPaC 2012; DoEE 2017
<i>Quercus spp.</i>	Oak	-	Secondary	-	Johnstone <i>et al.</i> 2010

Species name	Common name	Foraging category as assigned by Emerge			Literature references
		CBC	BBC	FRTBC	
<i>Raphanus raphanistrum</i>	Wild radish	Secondary	-	-	Groom 2011; DoEE 2017
<i>Reedia spathacea</i>		-	Secondary	-	Johnstone <i>et al.</i> 2010
<i>Rumex hypogaeus</i>	Doublegee	Secondary	-	-	Saunders 1980
<i>Stenocarpus sinuatus</i>		Secondary	-	-	Johnstone <i>et al.</i> 2010
<i>Syzygium smithii</i>	Lilly pilly	Secondary	-	-	Groom 2014
<i>Tipuana tipu</i>	Tipu or rosewood tree	Primary	-	-	Groom 2011, Groom 2014
<i>Xanthorrhoea preissii</i>	Grass tree	Secondary	Secondary	-	Groom 2011; Johnstone <i>et al.</i> 2010
<i>Xylomelum occidentale</i>	Woody pear	Secondary	-	-	Groom 2014

CBC=Carnaby's black cockatoo, BBC=Baudin's black cockatoo and FRTBC=Forest red-tailed black cockatoo

References

Department of the Environment and Energy (DoEE) 2017, 'Revised draft referral guideline for three threatened black cockatoo species: Carnaby's Cockatoo, Baudin's Cockatoo and the Forest Red-tailed Black Cockatoo, Commonwealth of Australia.

Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) 2012, EPBC Act referral guidelines for three threatened black cockatoo species, Australian Government, Canberra.

Groom, C. 2011, Plants Used by Carnaby's Black Cockatoo, Department of Environment and Conservation, Perth.

Groom C. J , Mawson P. R , Roberts J. D. and Mitchell N. J. 2014, Meeting an expanding human population's needs whilst conserving a threatened parrot species in an urban environment, WIT Transactions on Ecology and The Environment, 191: 1199-1212.

Johnstone, R. E. and Storr, G. M. 1998, *Handbook of Western Australian Birds. Volume 1 - Non-Passerines (Emu to Dollarbird)*, Western Australian Museum, Perth.

Johnstone, R. E. and Kirkby, T. 1999, Food of the Red-tailed Forest Black Cockatoo *Calyptorhynchus banksii naso* in Western Australia, *Western Australian Naturalist*, 22: 167-178.

Johnstone, R. E. and Kirkby, T. 2008, Distribution, status, social organisation, movements and conservation of Baudin's cockatoo (*Calyptorhynchus baudinii*) in South-west Western Australia, *Records of the Western Australian Museum*, 25: 107-118.

Johnstone, R. E. and Storr, G. M. 1998, *Handbook of Western Australian Birds. Volume 1 - Non-Passerines (Emu to Dollarbird)*, Western Australian Museum, Perth.

Johnstone, R. E., Johnstone, C. and Kirkby, T. 2010, Black Cockatoos on the Swan Coastal Plain: Carnaby's Cockatoo (*Calyptorhynchus latirostris*), Baudin's Cockatoo (*Calyptorhynchus baudinii*) and the Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*) on the Swan Coastal Plain (Lancelin–Dunsborough), Western Australia. *Studies on distribution, status, breeding, food, movements and historical changes.*, Department of Planning, Western Australia.

Johnstone, R. E., Kirkby, T. and Sarti, K. 2017, The distribution, status movements and diet of the forest red-tailed black cockatoo in the south-west with emphasis on the greater Perth region, *Western Australian Naturalist*, 30(4): 193-219.

Saunders, D. A. 1979, Distribution and taxonomy of the white-tailed and yellow-tailed Black-Cockatoos *Calyptorhynchus* spp., *Emu*, 79(215-227).

Saunders, D. A. 1980, Food and Movements of the Short-billed Form of the White-tailed Black Cockatoo, *Australian Wildlife Research*, 7: 257-269.

Appendix D

Conservation Significant Species and Likelihood of
Occurrence Assessment



Species name	Common name	Level of significance		Habitat	Likelihood of occurrence
		WA	EPBC Act		
Birds					
<i>Actitis hypoleucos</i>	Common sandpiper	MI	MI	Edge of sheltered waters salt or fresh, e.g. estuaries, mangrove creeks, rocky coasts, near-coastal saltlakes (including saltwork ponds), river pools, lagoons, claypans, drying swamps, flood waters, dams and sewage ponds. Preferring situations where low perches are available (Johnstone & Storr 1998).	Unlikely No suitable habitat occurs in the site.
<i>Anous stolidus</i>	Common noddy	MI	MI	Tropical and subtropical seas, cayes, reefs, buoys and piles (Pizzey & Knight 2012).	Unlikely No suitable habitat occurs in the site.
<i>Anous tenuirostris melanops</i>	Australian lesser noddy	EN	VU	Very common in blue-water seas around the Abrolhos (endemic to this area, accidental occurrences on lower west coast of Australia) (Johnstone and Storr 1998).	Unlikely No suitable habitat occurs in the site.
<i>Apus pacificus</i>	Pacific swift	MI	MI	Aerial, migratory species that is most often seen over inland plains and sometimes above open areas, foothills or in coastal areas. Sometimes occurs over settled areas, including towns, urban areas and cities (Pizzey & Knight 2012).	Possible May opportunistically occur in or fly over the site on commute or while searching for prey.
<i>Ardenna carneipes</i>	Flesh-footed shearwater	VU	MI	Marine species that breeds on islands off south coast from near Cape Leeuwin (Johnstone and Storr 1998).	Unlikely No suitable habitat occurs in the site.
<i>Botaurus poiciloptilus</i>	Australasian bittern	EN	EN	In or over water, in tall reedbeds, sedges, rushes, cumbungi, lignum. Also occurs in ricefields, drains in tussocky paddocks and occasionally in saltmarshes and brackish wetlands.	Unlikely No suitable habitat occurs in the site.

Species name	Common name	Level of significance		Habitat	Likelihood of occurrence
		WA	EPBC Act		
<i>Calidris acuminata</i>	Sharp-tailed sandpiper	MI	MI	Occurs in tidal mudflats, saltmarshes and mangroves, as well as, shallow fresh, brackish or saline inland wetlands. It is also known from floodwaters, irrigated pastures and crops, sewage ponds, saltfields.	Unlikely No suitable habitat occurs in the site.
<i>Calidris canutus</i>	Red knot	EN	EN (MI)	Mud and sand flats in estuaries and on sheltered coasts. Also near-coastal saltlakes, including saltwork ponds.	Unlikely No suitable habitat occurs in the site.
<i>Calidris ferruginea</i>	Curlew sandpiper	CR	CR (MI)	Mainly shallows of estuaries and near-coastal saltlakes (including saltwork ponds) and drying near-coastal freshwater lakes and swamps. Also beaches and near-coastal sewage ponds.	Unlikely No suitable habitat occurs in the site.
<i>Calidris melanotos</i>	Pectoral sandpiper	MI	MI	Mainly fresh waters (swamps, lagoons, river pools, irrigation channels and sewage ponds); also samphire flats around estuaries and saltlakes (Johnstone & Storr 1998).	Unlikely No suitable habitat occurs in the site.
<i>Calidris ruficollis</i>	Red-necked stint	MI	MI	Tidal mudflats, saltmarshes, sandy or shelly beaches, saline and freshwater wetlands (coastal and inland), saltfields, sewage ponds (Pizzey and Knight 2012).	Unlikely No suitable habitat occurs in the site.
<i>Calidris subminuta</i>	Long-toed stint	MI	MI	Mainly freshwater swamps (especially when drying and where vegetation is short), river pools, lagoons and claypans; also brackish pools, sewage ponds and samphire flats around estuaries and saltlakes.	Unlikely No suitable habitat occurs in the site.
<i>Calonectris leucomelas</i>	Streaked shearwater	MI	MI	Regular non-breeding visitor to western Australian north of Geraldton.	Unlikely No suitable habitat occurs in the site.

Species name	Common name	Level of significance		Habitat	Likelihood of occurrence
		WA	EPBC Act		
<i>Calyptorhynchus banksii naso</i>	Forest red-tailed black cockatoo	VU	VU	Eucalypt and Corymbia forests, often in hilly interior. More recently also observed in more open agricultural and suburban areas including Perth metropolitan area. Attracted to seeding Corymbia calophylla, Eucalyptus marginata, introduced Melia azedarach and Eucalyptus spp. trees.	Recorded Observed in trees within the site.
<i>Charadrius leschenaultii</i>	Great sand plover	VU	VU (MI)	Wide sandy or shelly beaches, sandpits, tidal mudflats, reefs, sand cays, mangroves, saltmarsh, dune wilderness, bare paddocks, seldom far inland (Pizzey & Knight 2012).	Unlikely No suitable habitat occurs in the site.
<i>Chlidonias leucopterus</i>	White-winged black tern	MI	MI	Vegetated and open wetlands, brackish and saline lakes, saltfields, irrigated lands, sewage ponds and occasionally offshore.	Unlikely No suitable habitat occurs in the site.
<i>Diomedea amsterdamensis</i>	Amsterdam Island albatross	CR	EN (MI)	The Amsterdam albatross is a marine, pelagic seabird. It nests in open patchy vegetation (among tussocks, ferns or shrubs) near exposed ridges or hillocks (Weimerskirch et al. 1985). It sleeps and rests on ocean waters when not breeding (Marchant and Higgins 1990)	Unlikely No suitable habitat occurs in the site.
<i>Diomedea epomophora</i>	Southern royal albatross	VU	VU (MI)	Rare visitor to Western Australian seas; it breeds on subantarctic islands south of New Zealand (Johnstone and Storr 1998).	Unlikely No suitable habitat occurs in the site.
<i>Diomedea exulans</i>	Wandering albatross	VU	VU (MI)	Marine, pelagic and aerial species. It breeds on Macquarie Island and feeds in Australian portions of the Southern Ocean (DoE 2018).	Unlikely No suitable habitat occurs in the site.

Species name	Common name	Level of significance		Habitat	Likelihood of occurrence
		WA	EPBC Act		
<i>Diomedea sanfordi</i>	Northern royal albatross	EN	EN	Species is marine, pelagic and aerial. Habitat includes subantarctic, subtropical, and occasionally Antarctic waters (Marchant & Higgins 1990). Rare visitors to south-western Australian waters.	Unlikely No suitable habitat occurs in the site.
<i>Falco peregrinus</i>	Peregrine falcon	OS	-	Mainly found around cliffs along coasts, rivers, ranges and around wooded watercourses and lakes (Johnstone and Storr 1998).	Possible May opportunistically occur in or fly over the site on commute or while searching for prey.
<i>Glareola maldivarum</i>	Oriental pratincole	MI	MI	Plains, shallow wet and dry edges of open bare wetlands, tidal mudflats and beaches (Pizzey & Knight 2012).	Unlikely No suitable habitat occurs in the site.
<i>Hydroprogne caspia</i>	Caspian tern	MI	MI	Mainly sheltered areas, estuaries (when not laden with silt) and tidal creeks; occasionally near-coastal saltlakes (including saltwork ponds) and brackish pools in lower courses of rivers; rarely fresh waters.	Unlikely No suitable habitat occurs in the site.
<i>Ixobrychus dubius</i>	Australian little bittern	P4	-	Dense vegetation surrounding/within freshwater pools, swamps and lagoons, well screened with trees. Shelters in dense beds of <i>Typha</i> spp., <i>Baumea</i> spp. and tall rushes in freshwater swamps around lakes and along rivers (Johnstone and Storr 1998).	Unlikely No suitable habitat occurs in the site.

Species name	Common name	Level of significance		Habitat	Likelihood of occurrence
		WA	EPBC Act		
<i>Ixobrychus flavicollis australis</i>	Black bittern	P2	-	Freshwater pools, swamps and lagoons, well-screened with trees. Occasionally feeding by day but mainly sheltering in dense waterside vegetation (Melaleuca spp., Eucalyptus camaldulensis, Pandanus spp. and long grass) (Johnstone and Storr 1998).	Unlikely No suitable habitat occurs in the site.
<i>Leipoa ocellata</i>	Malleefowl	VU	VU	Scrubs and thickets of Eucalyptus spp., Melaleuca lanceolata and Acacia linophylla; also other dense litter-forming shrublands. Attracted to fallen wheat in stubbles and along roads (Johnstone and Storr 1998).	Unlikely No longer found on Swan Coastal Plain.
<i>Limosa lapponica</i>	Bar-tailed godwit	MI (& VU or CR at subsp. level)	MI	Estuarine sand and mudflats and sandy beaches with loads of seaweed; also reef flats and near-coastal saltlakes (including saltwork ponds) (Johnstone and Storr 1998).	Unlikely No suitable habitat occurs in the site.
<i>Limosa limosa</i>	Black-tailed godwit	MI	MI	Tidal mudflats, estuaries, sewage ponds, shallow river margins, brackish or saline inland lakes, flooded pastures, airfields (Pizzey & Knight 2012).	Unlikely No suitable habitat occurs in the site.
<i>Macronectes giganteus</i>	Southern giant-petrel	MI	EN (MI)	Breeds on southern subantarctic and antarctic islands. May visit Western Australian waters from February to December (mostly June to September) (Johnstone and Storr 1998).	Unlikely No suitable habitat occurs in the site.
<i>Macronectes halli</i>	Northern giant petrel	MI	VU (MI)	Breeds on subantarctic islands. May visit Western Australian water from February to September (Johnstone and Storr 1998).	Unlikely No suitable habitat occurs in the site.

Species name	Common name	Level of significance		Habitat	Likelihood of occurrence
		WA	EPBC Act		
<i>Motacilla cinerea</i>	Grey wagtail	MI	MI	In Australia mostly near running water in disused quarries, sandy and rocky streams in escarpments and rainforests, sewage ponds, ploughed fields and airfields (Pizzey & Knight 2012).	Unlikely No suitable habitat occurs in the site.
<i>Numenius madagascariensis</i>	Eastern curlew	CR	CR (MI)	Mainly tidal mudflats; also reef flats, sandy beaches and rarely near-coastal lakes (including saltwork ponds) (Johnstone and Storr 1998).	Unlikely No suitable habitat occurs in the site.
<i>Onychoprion anaethetus</i>	Bridled tern	MI	MI	Tropical and subtropical seas, offshore islands, rarely coasts (Pizzey & Knight).	Unlikely No suitable habitat occurs in the site.
<i>Oxyura australis</i>	Blue-billed duck	P4	-	Mainly deeper freshwater swamps and lakes; occasionally saltlakes and estuaries freshened by flood waters (Johnstone and Storr 1998).	Unlikely No suitable habitat occurs in the site.
<i>Pachyptila turtur subantarctica</i>	Fairy prion	-	VU	Breeds on subantarctic islands and is presumed to frequent subtropical waters during non-breeding period (TSSC 2015).	Unlikely No suitable habitat occurs in the site.
<i>Pandion haliaetus</i>	Osprey	MI	MI	Coasts, estuaries, bays, inlets, islands, and surrounding waters; coral atolls, reefs, lagoons, rock cliffs, stacks (Pizzey & Knight 2012).	Unlikely No suitable habitat occurs in the site.
<i>Phoebastria fusca</i>	Sooty albatross	EN	VU (MI)	Marine, pelagic species that tolerates a wide range of sea surface temperatures and salinities. breeds on subtropical and subantarctic islands in the Indian and Atlantic Oceans, on vegetated cliffs and steep slopes that are sheltered from prevailing winds, often amongst tussock grass.	Unlikely No suitable habitat occurs in the site.

Species name	Common name	Level of significance		Habitat	Likelihood of occurrence
		WA	EPBC Act		
<i>Plegadis falcinellus</i>	Glossy Ibis	MI	MI	Well-vegetated wetlands, wet pasture, ricefields, floodwaters, floodplains, brackish or occasionally saline wetlands, mangroves, mudflats and occasionally dry grassland (Pizzey & Knight 2012).	Unlikely No suitable habitat occurs in the site.
<i>Pluvialis squatarola</i>	Grey Plover	MI	MI	Mudflats, saltmarsh, tidal reefs and estuaries, rarely inland (Pizzey and Knight 2012).	Unlikely No suitable habitat occurs in the site.
<i>Rostratula australis</i>	Australian painted snipe	EN	EN	Mainly shallow terrestrial freshwater (occasionally brackish) wetlands, including temporary and permanent lakes, swamps and claypans (Marchant and Higgins 1993).	Unlikely No suitable habitat occurs in the site.
<i>Sterna dougallii</i>	Roseate tern	MI	MI	Offshore waters, islands, coral reefs, sand cays, beaches, tidal inlets (Pizzey & Knight 2012).	Unlikely No suitable habitat occurs in the site.
<i>Sternula albifrons</i>	Little tern	MI	MI	Species is mainly coastal, being found on beaches, sheltered inlets, estuaries, lakes, sewage farms, lagoons, river mouths and deltas.	Unlikely No suitable habitat occurs in the site.
<i>Sternula nereis nereis</i>	Australian fairy tern	VU	VU	Sheltered blue-water seas close to land, estuaries (when free of silt) and near-coastal lakes (Johnstone and Storr 1998).	Unlikely No suitable habitat occurs in the site.
<i>Thalassarche carteri</i>	Indian yellow-nosed albatross	EN	VU (MI)	Marine species that inhabits seas of south and west coast of Western Australia and breeds on islands in the south Indian Ocean and in the south Atlantic (Johnstone & Storr 1998).	Unlikely No suitable habitat occurs in the site.

Species name	Common name	Level of significance		Habitat	Likelihood of occurrence
		WA	EPBC Act		
<i>Thalassarche cauta</i>	Shy albatross	VU	VU (MI)	Scarce visitor (late May to mid-October) to southwestern and western seas. Breeds on islands off Tasmania and south New Zealand (Johnstone and Storr 1998).	Unlikely No suitable habitat occurs in the site.
<i>Thalassarche impavida</i>	Campbell albatross	VU	VU (MI)	Scarce visitor to south-western and western Australian seas. Breeds on Campbell Island.	Unlikely No suitable habitat occurs in the site.
<i>Thalassarche melanophris</i>	Black-browed albatross	EN	VU (MI)	Seas of south and west coasts. Visitor to Western Australian mainland from January to early November (mostly May to September). Breeds on southern subantarctic and antarctic islands (Johnstone and Storr 1998).	Unlikely No suitable habitat occurs in the site.
<i>Thalassarche steadi</i>	White-capped albatross	VU	VU (MI)	Scarce visitor (late May to mid-October) to southwestern and western seas. Breeds on islands off Tasmania and south New Zealand (Johnstone and Storr 1998).	Unlikely No suitable habitat occurs in the site.
<i>Thalasseus bergii</i>	Crested tern	MI	MI	Mainly blue-water seas (especially within 3 km of land), including southern estuaries in summer and autumn (when free of silt); also tidal creeks in north, but not penetrating far into larger estuaries.	Unlikely No suitable habitat occurs in the site.
<i>Tringa glareola</i>	Wood sandpiper	MI	MI	Mainly shallow fresh waters (lagoons, swamps, claypans, river pools, dams, bore overflows and sewage ponds); occasionally brackish swamps, rarely saltlakes and estuaries (Pizzey & Knight).	Unlikely No suitable habitat occurs in the site.

Species name	Common name	Level of significance		Habitat	Likelihood of occurrence
		WA	EPBC Act		
<i>Tringa nebularia</i>	Common greenshank	MI	MI	Mudflats, estuaries, saltmarshes, margins of lakes, wetlands, claypans (fresh and saline), commercial saltfields, sewage ponds (Pizzey & Knight 2012).	Unlikely No suitable habitat occurs in the site.
<i>Tringa stagnatilis</i>	Marsh sandpiper	MI	MI	Mainly shallow fresh or brackish waters: swamps, lakes, river pools, soaks, sewage ponds and bore overflows. Occasionally estuaries and salt ponds, and rarely coasts.	Unlikely No suitable habitat occurs in the site.
<i>Zanda latirostris</i>	Carnaby's black cockatoo	EN	EN	Mainly proteaceous scrubs and heaths and adjacent eucalypt woodlands and forests; also plantations of Pinus spp. Attracted to seeding Banksia spp., Hakea spp., Eucalyptus spp., Corymbia calophylla, Grevillea spp., and Allocasuarina spp. (Johnstone and Storr 1998).	Recorded Observed flying over the site.
Fish					
<i>Galaxiella nigrostriata</i>	Black-stripe minnow	EN	EN	Seasonally dry coastal wetlands. Permanent or ephemeral spring-fed headwater streams, ponds, roadside ditches and small creeks in sandy wetland areas with thick vegetation. Also occurs in the shallow areas of some freshwater lakes with thick vegetation. The water is usually highly tannin-stained and acidic (pH 4.5-6.5) (Bray and Gomon 2017).	Unlikely No suitable habitat occurs in the site.

Species name	Common name	Level of significance		Habitat	Likelihood of occurrence
		WA	EPBC Act		
Invertebrates					
<i>Austrosaga spinifer</i>	spiny katydid	P2	-	Unknown.	Possible Little known however has been historically recorded approximately 7 km west.
<i>Hesperocolletes douglasi</i>	Douglas's broad-headed bee	CR	CR	Banksia woodland vegetation (Pille Arnold 2019).	Possible Banksia woodland occurs in the site.
<i>Hylaeus globuliferus</i>	Woollybush bee	P3	-	Males are territorial and may be found perched on the growing tips of <i>Adenanthos</i> sp., <i>Banksia</i> sp. or <i>Jacksonia</i> sp. Has also been recorded visiting the flowers of <i>Grevillea</i> sp. (PaDIL 2022).	Possible <i>Adenanthos</i> and <i>Banksia</i> spp. recorded within the site.
<i>Idiosoma sigillatum</i>	Swan Coastal Plain shield-backed	P3	-	Widely distributed in sandy areas on the Swan Coastal Plain and on Rottnest Island (Prince 2003).	Possible Sandy areas occur within the site.
<i>Leioproctus contrarius</i>	a short-tongued bee	P3	-	Life history and habits are poorly documented/ unknown. It has been recorded only on flowers of Goodeniaceae and possibly Lechenaultia <i>stenosepala</i> (Bamford 2003).	Possible Goodeniaceae spp. recorded within the site.
<i>Leioproctus douglasiellus</i>	a short-tongued bee	EN	CR	Life history and habits are poorly documented/ unknown. It has been recorded only on the flowers of <i>Goodenia filiformis</i> and <i>Anthotium junciforme</i> (Houston 2000).	Unlikely No suitable habitat occurs in the site.

Species name	Common name	Level of significance		Habitat	Likelihood of occurrence
		WA	EPBC Act		
<i>Synemon gratiosa</i>	Graceful sun-moth	P4	-	Coastal heathland on Quindalup dunes where it is restricted to secondary sand dunes due to the abundance of the preferred host plant <i>Lomandra maritima</i> . Banksia woodland on Spearwood and Bassendean dunes, where the second known host plant <i>L. hermaphrodita</i> is widespread (DEC 2011).	Possible <i>Lomandra hermaphrodita</i> recorded within the site.
<i>Westralunio carteri</i>	Carter's freshwater mussel	VU	VU	Occurs in greatest abundance in slower flowing streams with stable sediments that are soft enough for burrowing amongst woody debris and exposed tree roots. Also occupies lentic systems including large water supply dams and even on-stream farm dams. Salinity tolerance quite low (Morgan et al. 2011).	Unlikely No suitable habitat occurs in the site.
Mammals					
<i>Bettongia penicillata ogilbyi</i>	Woylie	CR	EN	Woodlands and adjacent heaths with a dense understorey of shrubs, particularly <i>Gastrolobium</i> spp. (TSSC 2018).	Unlikely Site occurs outside of current known population. No longer found on the Swan Coastal Plain.
<i>Dasyurus geoffroii</i>	Chuditch	VU	VU	Wide range of habitats from woodlands, dry sclerophyll forests, riparian vegetation, beaches and deserts. Appears to utilise native vegetation along roadsides in the wheatbelt (DEC 2012b).	Possible Woodland forest occurs in the site.

Species name	Common name	Level of significance		Habitat	Likelihood of occurrence
		WA	EPBC Act		
<i>Hydromys chrysogaster</i>	Rakali	P4	-	Areas with permanent water, fresh, brackish or marine. Likely to occur in all major rivers and most of the larger streams as well as bodies of permanent water in the lower south-west (Christensen et al. 1985).	Unlikely No suitable habitat occurs in the site.
<i>Isoodon fusciventer</i>	Quenda	P4	-	Dense scrubby, often swampy, vegetation with dense cover up to one metre high (DEC 2012)	Recorded Caught and recorded on camera traps in multiple locations in site.
<i>Macroderma gigas</i>	Ghost bat	VU	VU	Requires undisturbed roost caves or mineshafts, usually complex systems with several openings (Menkhorst and Knight 2011).	Unlikely No suitable habitat occurs in the site.
<i>Notamacropus irma</i>	Western brush wallaby	P4	-	Dry sclerophyll forest, Banksia spp. woodlands and shrublands, typically favouring dense low vegetation that provides dense cover (Christensen and Strahan 1983).	Possible Banksia woodland and forest occurs in the site.
Reptiles					
<i>Neelaps calonotos</i>	Black-striped snake	P3	-	Coastal and near-coastal dunes, sandplains supporting heathlands and Banksia spp. woodlands (Bush et al. 2002).	Recorded Caught during Phase 2 trapping.
<i>Pseudemydura umbrina</i>	Western swamp tortoise	CR	CR	Clay based ephemeral swamps (Bush et al. 2002).	Unlikely No suitable habitat occurs in the site.
<p>Note: CE=critically endangered, EN=endangered, VU=vulnerable, CD=conservation dependent, MI=migratory, OS=other specially protected, P1=Priority 1, P2=Priority 2, P3=Priority 3, P4=Priority 4. Species recorded or considered to potentially occur within the site are shaded green.</p>					

Species name	Common name	Level of significance		Habitat	Likelihood of occurrence
		WA	EPBC Act		
References					
Bush, B., Maryan, B., Browne-Cooper, R. and Robinson, D. 2007, Reptiles and Frogs in the Bush: Southwestern Australia, UWA Press, Nedlands.					
Bray, D. J. and Gomon, M. F. 2018, Pouch Lamprey, <i>Geotria australis</i> .					
Christensen, P. and Strahan, R. 1984, The Australian Museum Complete Book of Australian Mammals, Angus and Robertson Publishers, Sydney.					
Cronin, L. 2007, Cronin's Key Guide to Australian Wildlife, Oxford University Press, Oxford, United Kingdom.					
Department of Biodiversity, Conservation and Attractions (DBCA) 2017, Fauna Profile: Western Ringtail Possum <i>Pseudocheirus occidentalis</i> , Perth, Western Australia.					
Johnstone, R. E. and Storr, G. M. 1998, Handbook of Western Australian Birds. Volume 1 - Non-Passerines (Emu to Dollarbird), Western Australian Museum, Perth.					
Marchant, S. and Higgins, P. J. 1993, Handbook of Australian, New Zealand and Antarctic Birds. Volume two - Raptors to Lapwings, Oxford University Press, Melbourne, Victoria.					
Morgan, D. L., Beatty, S. J., Klunzinger, M. W., Allen, M. G. and Burnham, Q. E. 2011, Field Guide to the Freshwater Fishes, Crayfishes and Mussels of South Western Australia, SERCUL, Perth, Western Australia.					
Morcombe, M. 2004, Field Guide to Australian Birds, Steve Parish Publishing, Archerfield, Queensland.					
Nevill, S. 2005, Guide to the Wildlife of the Perth Region, Simon Nevill Publications, Perth, Western Australia.					
Pizzey, G. and Knight, F. 2012, The Fieldguide to the Birds of Australia, Harper Collins Publishers, Sydney, Australia.					
Rentz, D. C. F. 1993, Tettigoniidae of Australia 2. The Austrosaginae, Zaprochilinae and Phasmodinae, CSIRO.					
Threatened Species Scientific Committee (TSSC) 2018, Conservation advice for <i>Bettongia penicillata</i> (woylie), Department of the Environment, Canberra.					
Triggs, B. 2003, Tracks, Scats and Other Traces A Field Guide to Australian Mammals, Oxford University Press Australia, Melbourne, Victoria.					
Department of Environment and Conservation (DEC) 2012, Fauna profiles, Quenda <i>Isoodon obesulus</i> (Shaw, 1797), Perth.					
Van Dyck, S. and Strahan, R. 2008, The Mammals of Australia, Queensland Museum, Brisbane.					
Wilson, S. and Swan, G. 2008, A Complete Guide to Reptiles of Australia, Reed New Holland, Sydney.					

Appendix E

Species List



Category	Status	Species name	Common name	Record type
Amphibians		<i>Heleioporus eyrei</i>	Moaning frog	Sight
		<i>Limnodynastes dorsalis</i>	Western Banjo Frog	Sight
Birds		<i>Acanthiza chrysorrhoa</i>	Yellow-rumped thornbill	Sight
		<i>Accipter cirrocephalus</i>	Collared sparrowhawk	Sight
		<i>Anthochaera carunculata</i>	Red wattlebird	Sight
		<i>Anthochaera lunulata</i>	Western wattlebird	Sight
		<i>Aquila audax</i>	Wedge-tailed eagle	Sight
		<i>Artamus cinereus</i>	Black-faced woodswallow	Sight
		<i>Barnardius zonarius</i>	Australian ringneck	Sight
		<i>Cacatua sanguinea</i>	Little corella	Sight
	VU	<i>Calyptorhynchus banksii naso</i>	Forest red-tailed black cockatoo	Sight
		<i>Chalcites lucidus</i>	Shining bronze-cuckoo	Sight
		<i>Colluricincla hamonica</i>	Grey shrike-thrush	Sight
		<i>Coracina novaehollandiae</i>	Black-faced cuckoo-shrike	Sight
		<i>Corvus coronoides</i>	Australian raven	Sight
		<i>Cracticus torquatus</i>	Grey butcherbird	Sight
		<i>Dacelo novaeguineae</i>	Laughing kookaburra	Sight
		<i>Dromaius novaehollandiae</i>	Emu	Sight
		<i>Egretta novaehollandiae</i>	White-faced heron	Sight
		<i>Eolophus roseicapilla</i>	Galah	Sight
		<i>Falco berigora</i>	Brown falcon	Sight
		<i>Gerygone fusca</i>	Western gerygone	Call
		<i>Gymnorhina tibicen</i>	Australian magpie	Sight
		<i>Lichmera indistincta</i>	Brown honeyeater	Call
		<i>Malurus splendens</i>	Splendid fairy-wren	Sight
		<i>Merops ornatus</i>	Rainbow bee-eater	Sight
		<i>Neophema elegans</i>	Elegant parrot	Sight
		<i>Ninox novaeseelandiae</i>	Southern boobook	Remains
		<i>Ocyphaps lophotes</i>	Crested pigeon	Sight
	<i>Pachycephala rufiventris</i>	Rufous whistler	Call	

Category	Status	Species name	Common name	Record type
		<i>Pardalotus striatus</i>	Striated pardalote	Call
		<i>Phaps chalcoptera</i>	Common bronzewing	Sight
		<i>Phylidonyris niger</i>	White-cheeked honeyeater	Sight
		<i>Phylidonyris novaehollandiae</i>	New holland honeyeater	Sight
		<i>Purpureicephalus spurius</i>	Red-capped parrot	Sight
		<i>Rhipidura albiscapa</i>	Grey fantail	Sight
		<i>Rhipidura leucophrys</i>	Willie wagtail	Sight
		<i>Smicrornis brevirostris</i>	Weebil	Call
	DP	<i>Trichoglossus haematodus</i>	Rainbow lorikeet	Sight
	EN	<i>Zanda latirostris</i>	Carnaby's black cockatoo	Sight
		<i>Zosterops lateralis</i>	Silvereye	Sight
Mammals				
		<i>Austronomus australis</i>	White-striped freetail bat	Call
		<i>Chalinolobus gouldii</i>	Gould's wattled bat	Call
	*	<i>Equus caballus</i>	Horse	Sight
	*	<i>Felis catus</i>	Cat	Sight
	P4	<i>Isoodon fusciventer</i>	Quenda	Sight
		<i>Macropus fuliginosus</i>	Western grey kangaroo	Sight
	*	<i>Mus musculus</i>	House mouse	Sight
	DP	<i>Oryctolagus cuniculus</i>	Rabbit	Sight
		<i>Ozimops kitcheneri</i>	Southwestern freetail bat	Call
	*	<i>Rattus rattus</i>	Black rat	Sight
		<i>Tachyglossus aculeatus</i>	Short-beaked echidna	Sight
		<i>Tarsipes rostratus</i>	Honey possum	Sight
		<i>Vespadelus regulus</i>	Southern forest bat	Call
	DP	<i>Vulpes vulpes</i>	Fox	Sight
Reptiles				
		<i>Cryptoblepharus buchananii</i>	Buchanan's snake-eyed skink	Sight
		<i>Ctenotus fallens</i>	West coast ctenotus	Sight
		<i>Delma fraseri</i>	Fraser's delma	Sight
		<i>Delma grayii</i>	Side-barred delma	Sight

Category	Status	Species name	Common name	Record type
		<i>Hemiergis quadrilineatus</i>	Two-toed mulch skink	Sight
		<i>Lerista lineopunctulata</i>	Line-spotted robust lerista	Sight
		<i>Lerista praepedita</i>	West coast worm lerista	Sight
		<i>Lialis burtonis</i>	Burton's legless lizard	Sight
		<i>Menetia greyii</i>	Common dwarf skink	Sight
		<i>Neelaps bimaculatus</i>	Black-naped snake	Sight
	P3	<i>Neelaps calonotos</i>	Black-striped burrowing snake	Sight
		<i>Notechis scutatus</i>	Tiger snake	Sight
		<i>Pagona minor minor</i>	Western bearded dragon	Sight
		<i>Parasuta gouldii</i>	Gould's hooded snake	Sight
		<i>Pletholax gracilis gracilis</i>	West coast keeled legless lizard	Sight
		<i>Pseudonaja affinis affinis</i>	Dugite	Sight
		<i>Simoselaps bertholdi</i>	Jan's banded snake	Sight
		<i>Strophurus spinigerus spinigerus</i>	Southwestern spiny-tailed gecko	Sight
		<i>Suta gouldii</i>	Gould's hooded snake	Sight
		<i>Tiliqua rugosa rugosa</i>	Bobtail	Sight

Note: * = Introduced species, DP = Declared pest, P3 = Priority 3, P4 = Priority 4, EN = Endangered, VU = Vulnerable

Appendix F

Species x Trapping Site



Category	Status	Species name	Common name	T01	T02	T03	T04	T05	T06	T07	T08	T09	T10	T11	T12	T13	T14	T15	T16	T17	T18	T19	T20	T21	T22	T23	T24	Bird survey	Opp.					
		<i>Macropus fuliginosus</i>	Western grey kangaroo								X				X	X									X	X			X					
	*	<i>Mus musculus</i>	House mouse	X				X		X		X										X		X						X				
	DP	<i>Oryctolagus cuniculus</i>	Rabbit														X													X				
		<i>Ozimops kitcheneri</i>	Southwestern freetail bat																				X											
	*	<i>Rattus rattus</i>	Black rat												X			X									X							
		<i>Tachyglossus aculeatus</i>	Short-beaked echidna																						X									
		<i>Tarsipes rostratus</i>	Honey possum																X			X												
		<i>Vespadelus regulus</i>	Southern forest bat																				X											
	DP	<i>Vulpes vulpes</i>	Fox														X									X					X			
Reptiles		<i>Cryptoblepharus buchanani</i>	Buchanan's snake-eyed skink												X				X	X														
		<i>Ctenotus fallens</i>	West coast ctenotus	X				X	X	X												X		X										
		<i>Delma fraseri</i>	Fraser's delma								X		X																					
		<i>Delma grayii</i>	Side-barred delma								X																							
		<i>Hemiergis quadrilineatus</i>	Two-toed mulch skink										X	X						X		X		X										
		<i>Lerista lineopunctulata</i>	Line-spotted robust lerista										X																					
		<i>Lerista praepedita</i>	West coast worm lerista											X								X												
		<i>Lialis burtonis</i>	Burton's legless lizard	X				X																	X									
		<i>Menetia greyii</i>	Common dwarf skink	X					X	X			X		X					X														
		<i>Neelaps bimaculatus</i>	Black-naped snake										X																					
	P3	<i>Neelaps calonotos</i>	Black-striped burrowing snake																										X					
		<i>Notechis scutatus</i>	Tiger snake																						X							X		
		<i>Pagona minor minor</i>	Western bearded dragon																			X												
		<i>Parasuta gouldii</i>	Gould's hooded snake								X																							
		<i>Pletholax gracilis gracilis</i>	West coast keeled legless lizard																						X									
		<i>Pseudonaja affinis affinis</i>	Dugite																														X	
		<i>Simoselaps bertholdi</i>	Jan's banded snake											X											X									
		<i>Strophurus spinigerus spinigerus</i>	Southwestern spiny-tailed gecko						X																									
		<i>Suta gouldii</i>	Gould's hooded snake							X									X															
		<i>Tiliqua rugosa rugosa</i>	Bobtail					X					X																					

Note: * = Introduced species, DP = Declared pest, P3 = Priority 3, P4 = Priority 4, EN = Endangered, VU = Vulnerable

Appendix G

Habitat Tree Inventory



Tag No.	Easting	Northing	DBH (cm)	Species	BC Hollow Category	Hollow Inspection	Recorder
0	389012.12	6490599.44	67	<i>Eucalyptus marginata</i>	Potential nesting tree	No	MS
1	388595.37	6491220.70	115	<i>Eucalyptus marginata</i>	Potential nesting tree	No	NAW
10	389027.94	6491042.07	105	<i>Eucalyptus rudis</i>	Potential nesting tree	No	NAW
101	388851.15	6491232.29	53	<i>Eucalyptus marginata</i>	Potential nesting tree	No	MS
104	388743.76	6491193.54	65	<i>Eucalyptus marginata</i>	Potential nesting tree	No	MS
105	388807.72	6491070.62	79	<i>Eucalyptus marginata</i>	Potential nesting tree	No	MS
106	388798.10	6491086.61	108	<i>Eucalyptus marginata</i>	Potential nesting tree	No	MS
107	388723.93	6491194.26	103	Stag	Potential nesting tree	No	MS
108	388725.17	6491155.15	111	<i>Eucalyptus marginata</i>	Potential nesting tree	No	MS
109	388796.89	6491094.73	64	<i>Eucalyptus marginata</i>	Potential nesting tree	No	MS
11	388878.35	6490796.88	77	<i>Eucalyptus marginata</i>	Potential nesting tree	No	NAW
110	388825.73	6491093.35	64	<i>Eucalyptus marginata</i>	Potential nesting tree	No	MS
111	388828.74	6491092.30	52	<i>Eucalyptus marginata</i>	Potential nesting tree	No	MS
112	388793.78	6491089.35	71	<i>Eucalyptus marginata</i>	Potential nesting tree	No	MS
113	388823.95	6491149.87	93	<i>Eucalyptus marginata</i>	Potential nesting tree	No	MS
114	388724.96	6491166.68	102	<i>Eucalyptus marginata</i>	Potential nesting tree	No	MS
115	389000.31	6490633.89	97	<i>Eucalyptus marginata</i>	Potential nesting tree	No	MS
116	388906.13	6491056.73	84	<i>Eucalyptus marginata</i>	Potential nesting tree	No	MS
117	388780.02	6491096.18	85	<i>Eucalyptus marginata</i>	Potential nesting tree	No	MS
118	388782.36	6491065.35	73	<i>Eucalyptus marginata</i>	Potential nesting tree	No	MS
119	388791.98	6491055.32	63	<i>Eucalyptus marginata</i>	Potential nesting tree	No	MS
12	388852.99	6490826.67	83	<i>Eucalyptus marginata</i>	Potential nesting tree	No	NAW
120	388736.89	6491096.58	52	<i>Eucalyptus marginata</i>	Potential nesting tree	No	MS
121	389020.66	6490628.12	62	<i>Eucalyptus marginata</i>	Potential nesting tree	No	MS
122	388849.23	6491086.87	95	<i>Eucalyptus marginata</i>	Potential nesting tree	No	MS
123	388865.06	6491090.11	55	<i>Eucalyptus marginata</i>	Potential nesting tree	No	MS
124	388857.72	6491087.50	53	<i>Eucalyptus marginata</i>	Potential nesting tree	No	MS
125	388838.24	6491046.15	53	<i>Eucalyptus marginata</i>	Potential nesting tree	No	MS
126	388854.84	6491057.26	68	<i>Eucalyptus marginata</i>	Potential nesting tree	No	MS
127	388816.95	6491048.77	75	<i>Eucalyptus marginata</i>	Potential nesting tree	No	MS
128	388871.62	6491067.42	104	<i>Eucalyptus marginata</i>	Potential nesting tree	No	MS

Tag No.	Easting	Northing	DBH (cm)	Species	BC Hollow Category	Hollow Inspection	Recorder
129	388891.72	6491075.28	115	<i>Eucalyptus marginata</i>	Potential nesting tree	Yes	MS
13	388810.29	6490831.16	109	<i>Eucalyptus marginata</i>	Potential nesting tree	No	NAW
130	389016.44	6490640.63	144	Stag	Potential nesting tree	Yes	MS
131	388767.46	6491093.94	69	<i>Eucalyptus marginata</i>	Potential nesting tree	No	MS
132	388991.21	6491016.80	70	<i>Eucalyptus todtiana</i>	Potential nesting tree	No	MS
133	388871.99	6491033.78	56	<i>Eucalyptus marginata</i>	Potential nesting tree	No	MS
134	388873.52	6491030.90	184	<i>Eucalyptus marginata</i>	Potential nesting tree	Yes	MS
135	389014.54	6490608.80	82	<i>Eucalyptus marginata</i>	Potential nesting tree	No	MS
136	389015.13	6490646.75	111	<i>Eucalyptus marginata</i>	Potential nesting tree	No	MS
137	388996.00	6490659.15	79	<i>Eucalyptus marginata</i>	Potential nesting tree	No	MS
138	389077.66	6490660.87	81	<i>Eucalyptus marginata</i>	Potential nesting tree	No	MS
139	389064.36	6490716.76	117	<i>Eucalyptus marginata</i>	Potential nesting tree	Yes	MS
14	388801.96	6490825.14	93	<i>Eucalyptus marginata</i>	Potential nesting tree	No	NAW
140	389091.21	6490661.41	168	<i>Eucalyptus marginata</i>	Potential nesting tree	Yes	MS
141	389130.90	6490666.46	53	<i>Eucalyptus todtiana</i>	Potential nesting tree	No	MS
142	389106.36	6490696.24	74	<i>Eucalyptus marginata</i>	Potential nesting tree	No	MS
143	388992.21	6490658.70	83	<i>Eucalyptus marginata</i>	Potential nesting tree	No	MS
144	389040.61	6490650.95	102	<i>Eucalyptus marginata</i>	Potential nesting tree	Yes	MS
145	389018.79	6490634.96	121	<i>Eucalyptus marginata</i>	Potential nesting tree	No	MS
146	389088.88	6490640.98	106	<i>Eucalyptus marginata</i>	Potential nesting tree	No	MS
147	388954.38	6491044.91	52	<i>Eucalyptus marginata</i>	Potential nesting tree	No	MS
148	389295.73	6490827.69	76	<i>Eucalyptus rudis</i>	Potential nesting tree	No	MS
149	389233.51	6490671.82	57	<i>Eucalyptus rudis</i>	Potential nesting tree	No	MS
15	388795.49	6490835.31	105	<i>Eucalyptus marginata</i>	Potential nesting tree	No	NAW
150	389210.46	6490680.61	76	<i>Eucalyptus rudis</i>	Potential nesting tree	No	MS
151	389255.91	6490661.72	75	<i>Eucalyptus rudis</i>	Potential nesting tree	No	MS
152	389266.65	6490661.58	59	<i>Eucalyptus rudis</i>	Potential nesting tree	No	MS
153	389063.86	6490612.02	101	<i>Eucalyptus marginata</i>	Potential nesting tree	No	MS
154	389166.45	6490614.44	118	<i>Eucalyptus marginata</i>	Potential nesting tree	No	MS
155	389368.39	6490654.70	91	<i>Eucalyptus rudis</i>	Potential nesting tree	No	MS
156	389438.05	6490668.85	98	<i>Eucalyptus rudis</i>	Potential nesting tree	No	MS

Tag No.	Easting	Northing	DBH (cm)	Species	BC Hollow Category	Hollow Inspection	Recorder
157	389108.02	6490513.48	91	<i>Eucalyptus marginata</i>	Potential nesting tree	No	MS
158	389408.32	6490748.35	69	<i>Eucalyptus rudis</i>	Potential nesting tree	No	MS
159	389187.45	6490728.40	78	<i>Eucalyptus rudis</i>	Potential nesting tree	No	MS
16	388810.85	6490807.59	99	Stag	Potential nesting tree	No	NAW
160	389250.66	6490711.00	101	Stag	Potential nesting tree	No	MS
161	389242.16	6490754.70	84	Stag	Potential nesting tree	No	MS
162	389437.19	6490686.16	54	<i>Eucalyptus rudis</i>	Potential nesting tree	No	MS
164	390783.95	6490445.78	111	<i>Corymbia calophylla</i>	Potential nesting tree	No	MS
165	389470.30	6490720.12	65	<i>Eucalyptus rudis</i>	Potential nesting tree	No	MS
166	389291.64	6490833.71	104	<i>Eucalyptus rudis</i>	Potential nesting tree	No	MS
167	389403.94	6490765.68	67	<i>Eucalyptus rudis</i>	Potential nesting tree	No	MS
168	389348.52	6490778.69	63	<i>Eucalyptus rudis</i>	Potential nesting tree	No	MS
169	389306.75	6490885.48	82	<i>Eucalyptus rudis</i>	Potential nesting tree	No	MS
17	388805.94	6490803.35	73	<i>Eucalyptus marginata</i>	Potential nesting tree	Yes	NAW
170	389483.43	6490820.34	59	<i>Eucalyptus rudis</i>	Potential nesting tree	No	MS
171	389485.52	6490824.06	55	<i>Eucalyptus rudis</i>	Potential nesting tree	No	MS
172	389424.22	6490828.37	58	<i>Eucalyptus rudis</i>	Potential nesting tree	No	MS
173	389508.23	6490867.20	76	<i>Eucalyptus rudis</i>	Potential nesting tree	No	MS
174	389571.23	6491007.66	52	<i>Eucalyptus rudis</i>	Potential nesting tree	No	MS
175	389485.27	6490981.17	62	<i>Eucalyptus rudis</i>	Potential nesting tree	No	MS
176	390816.78	6490411.78	83	<i>Corymbia calophylla</i>	Potential nesting tree	No	MS
177	390725.76	6490368.00	69	<i>Eucalyptus rudis</i>	Potential nesting tree	No	MS
178	390745.75	6490355.91	67	<i>Corymbia calophylla</i>	Potential nesting tree	No	MS
179	390769.00	6490447.74	76	<i>Corymbia calophylla</i>	Potential nesting tree	No	MS
18	388807.51	6490764.62	60	<i>Eucalyptus marginata</i>	Potential nesting tree	No	NAW
180	390693.80	6490372.76	72	<i>Corymbia calophylla</i>	Potential nesting tree	No	MS
181	390745.32	6490484.78	75	<i>Corymbia calophylla</i>	Potential nesting tree	No	MS
182	390710.31	6490356.72	61	<i>Corymbia calophylla</i>	Potential nesting tree	No	MS
183	390778.00	6490457.61	69	<i>Corymbia calophylla</i>	Potential nesting tree	No	MS
184	390756.44	6490363.69	93	<i>Eucalyptus rudis</i>	Potential nesting tree	No	MS
185	390690.82	6490374.63	61	<i>Corymbia calophylla</i>	Potential nesting tree	No	MS

Tag No.	Easting	Northing	DBH (cm)	Species	BC Hollow Category	Hollow Inspection	Recorder
186	390714.33	6490361.61	64	<i>Eucalyptus rudis</i>	Potential nesting tree	No	MS
187	390799.74	6490350.87	62	<i>Eucalyptus rudis</i>	Potential nesting tree	No	MS
188	390085.04	6490570.56	67	<i>Eucalyptus rudis</i>	Potential nesting tree	No	SCM
19	388857.12	6490911.48	119	<i>Eucalyptus marginata</i>	Potential nesting tree	No	NAW
190	390132.30	6490609.93	94	<i>Eucalyptus rudis</i>	Potential nesting tree	No	SCM
191	390069.43	6490545.58	64	<i>Eucalyptus rudis</i>	Potential nesting tree	No	SCM
192	390046.76	6490496.81	67	<i>Eucalyptus rudis</i>	Potential nesting tree	No	SCM
193	390043.49	6490478.04	96	Stag	Potential nesting tree	Yes	SCM
194	389976.81	6490381.44	64	<i>Eucalyptus rudis</i>	Potential nesting tree	No	SCM
195	389967.32	6490364.01	58	<i>Eucalyptus rudis</i>	Potential nesting tree	No	SCM
196	389763.93	6490182.38	52	<i>Eucalyptus rudis</i>	Potential nesting tree	No	SCM
197	389921.24	6490285.02	88	<i>Eucalyptus rudis</i>	Potential nesting tree	No	SCM
198	389948.68	6490337.80	61	<i>Eucalyptus rudis</i>	Potential nesting tree	No	SCM
199	389904.05	6490349.79	92	<i>Eucalyptus rudis</i>	Potential nesting tree	No	SCM
2	388624.42	6491198.70	143	<i>Eucalyptus marginata</i>	Potential nesting tree	Yes	NAW
20	389035.59	6490608.49	90	<i>Eucalyptus marginata</i>	Potential nesting tree	No	NAW
200	389965.50	6490335.21	55	<i>Eucalyptus rudis</i>	Potential nesting tree	No	SCM
201	388734.11	6490870.86	107	<i>Eucalyptus marginata</i>	Potential nesting tree	No	SCM
202	388741.67	6490870.84	105	<i>Eucalyptus marginata</i>	Potential nesting tree	Yes	SCM
203	388746.82	6490869.67	66	<i>Eucalyptus marginata</i>	Potential nesting tree	No	SCM
204	388779.29	6490725.69	71	Stag	Potential nesting tree	No	SCM
205	388891.19	6490298.65	88	<i>Eucalyptus marginata</i>	Potential nesting tree	No	SCM
206	388893.48	6490297.57	62	Stag	Potential nesting tree	Yes	SCM
207	389027.70	6490321.22	139	<i>Eucalyptus marginata</i>	Potential nesting tree	No	SCM
208	389049.97	6490334.53	106	<i>Eucalyptus marginata</i>	Potential nesting tree	Yes	SCM
209	389039.71	6490252.23	125	<i>Eucalyptus marginata</i>	Potential nesting tree	Yes	SCM
21	389040.27	6490598.43	130	<i>Eucalyptus marginata</i>	Potential nesting tree	No	NAW
210	389062.62	6490255.18	102	<i>Eucalyptus marginata</i>	Potential nesting tree	No	SCM
211	389062.46	6490275.96	84	<i>Eucalyptus marginata</i>	Potential nesting tree	No	SCM
212	389074.06	6490282.55	124	<i>Eucalyptus marginata</i>	Potential nesting tree	No	SCM
213	389057.29	6490228.21	145	<i>Eucalyptus marginata</i>	Potential nesting tree	No	SCM

Tag No.	Easting	Northing	DBH (cm)	Species	BC Hollow Category	Hollow Inspection	Recorder
214	389016.42	6490220.52	108	<i>Eucalyptus marginata</i>	Potential nesting tree	No	SCM
215	389077.74	6490205.32	106	<i>Eucalyptus marginata</i>	Potential nesting tree	Yes	SCM
216	389101.42	6490216.10	83	<i>Eucalyptus marginata</i>	Potential nesting tree	Yes	SCM
217	389105.86	6490202.45	71	<i>Eucalyptus marginata</i>	Potential nesting tree	No	SCM
218	389154.94	6490204.49	113	<i>Eucalyptus marginata</i>	Potential nesting tree	No	SCM
219	389151.36	6490304.06	98	<i>Eucalyptus marginata</i>	Potential nesting tree	No	SCM
22	389318.86	6490815.19	106	<i>Eucalyptus rudis</i>	Potential nesting tree	No	MS
220	389100.07	6490290.51	121	<i>Eucalyptus marginata</i>	Potential nesting tree	Yes	SCM
221	389081.59	6490325.07	101	<i>Eucalyptus marginata</i>	Potential nesting tree	No	SCM
222	389089.23	6490341.96	102	<i>Eucalyptus marginata</i>	Potential nesting tree	No	SCM
223	389107.44	6490346.65	87	<i>Eucalyptus marginata</i>	Potential nesting tree	No	SCM
224	389112.05	6490343.04	75	<i>Eucalyptus marginata</i>	Potential nesting tree	No	SCM
225	389104.77	6490315.69	107	<i>Eucalyptus marginata</i>	Potential nesting tree	No	SCM
226	389189.16	6490320.05	108	<i>Eucalyptus marginata</i>	Potential nesting tree	Yes	SCM
227	389191.04	6490326.25	91	<i>Eucalyptus marginata</i>	Potential nesting tree	No	SCM
228	389209.67	6490338.48	98	<i>Eucalyptus marginata</i>	Potential nesting tree	No	SCM
229	389221.09	6490349.16	107	<i>Eucalyptus marginata</i>	Potential nesting tree	No	SCM
23	389043.66	6490593.55	60	<i>Eucalyptus marginata</i>	Potential nesting tree	No	NAW
230	389144.26	6490350.73	103	<i>Eucalyptus marginata</i>	Potential nesting tree	No	SCM
231	389105.83	6490374.40	106	<i>Eucalyptus marginata</i>	Potential nesting tree	Yes	SCM
232	389111.25	6490383.81	74	<i>Eucalyptus marginata</i>	Potential nesting tree	No	SCM
233	389105.20	6490387.75	120	<i>Eucalyptus marginata</i>	Potential nesting tree	Yes	SCM
234	389101.81	6490394.94	79	<i>Eucalyptus marginata</i>	Potential nesting tree	No	SCM
235	389065.67	6490377.69	103	<i>Eucalyptus marginata</i>	Potential nesting tree	No	SCM
236	388996.77	6490430.68	105	<i>Eucalyptus marginata</i>	Potential nesting tree	No	SCM
237	389113.20	6490419.54	153	Stag	Potential nesting tree	Yes	SCM
238	389132.84	6490408.47	111	<i>Eucalyptus marginata</i>	Potential nesting tree	No	SCM
239	389134.99	6490412.59	65	<i>Eucalyptus marginata</i>	Potential nesting tree	No	SCM
24	389082.41	6490531.55	169	<i>Eucalyptus marginata</i>	Potential nesting tree	Yes	NAW
240	389129.76	6490438.02	108	<i>Eucalyptus marginata</i>	Potential nesting tree	Yes	SCM
241	389098.14	6490461.09	138	<i>Eucalyptus marginata</i>	Potential nesting tree	Yes	SCM

Tag No.	Easting	Northing	DBH (cm)	Species	BC Hollow Category	Hollow Inspection	Recorder
242	388926.10	6490521.18	61	<i>Eucalyptus todtiana</i>	Potential nesting tree	No	SCM
243	388936.09	6490418.13	78	<i>Eucalyptus todtiana</i>	Potential nesting tree	No	SCM
244	389008.65	6490516.70	198	<i>Eucalyptus marginata</i>	Potential nesting tree	Yes	SCM
245	389078.74	6490477.70	130	<i>Eucalyptus marginata</i>	Potential nesting tree	Yes	SCM
246	389089.58	6490477.00	95	<i>Eucalyptus marginata</i>	Potential nesting tree	No	SCM
247	389096.95	6490492.85	112	<i>Eucalyptus marginata</i>	Potential nesting tree	No	SCM
248	389133.33	6490474.45	79	<i>Eucalyptus marginata</i>	Potential nesting tree	No	SCM
249	389133.66	6490475.02	102	<i>Eucalyptus marginata</i>	Potential nesting tree	No	SCM
25	389014.14	6490569.26	120	<i>Eucalyptus marginata</i>	Potential nesting tree	Yes	NAW
250	389149.84	6490464.53	129	<i>Eucalyptus marginata</i>	Potential nesting tree	No	SCM
251	389177.28	6490444.86	78	<i>Eucalyptus marginata</i>	Potential nesting tree	No	SCM
252	389183.40	6490446.48	74	<i>Eucalyptus marginata</i>	Potential nesting tree	No	SCM
253	389180.29	6490439.86	73	<i>Eucalyptus marginata</i>	Potential nesting tree	No	SCM
254	389188.72	6490455.78	129	<i>Eucalyptus marginata</i>	Potential nesting tree	No	SCM
255	389191.77	6490455.35	68	<i>Eucalyptus marginata</i>	Potential nesting tree	No	SCM
256	389197.80	6490429.01	108	<i>Eucalyptus marginata</i>	Potential nesting tree	Yes	SCM
257	389209.65	6490417.03	122	<i>Eucalyptus marginata</i>	Potential nesting tree	Yes	SCM
258	389229.68	6490413.54	122	<i>Eucalyptus marginata</i>	Potential nesting tree	No	SCM
259	389230.59	6490399.00	85	<i>Eucalyptus marginata</i>	Potential nesting tree	No	SCM
26	389130.66	6490511.63	76	<i>Eucalyptus marginata</i>	Potential nesting tree	No	NAW
260	389227.88	6490390.11	71	<i>Eucalyptus marginata</i>	Potential nesting tree	No	SCM
261	389268.27	6490229.55	51	<i>Eucalyptus marginata</i>	Potential nesting tree	No	SCM
262	389264.37	6490428.43	57	<i>Corymbia calophylla</i>	Potential nesting tree	No	SCM
263	389303.83	6490439.15	56	<i>Eucalyptus todtiana</i>	Potential nesting tree	No	SCM
264	389451.67	6490320.89	86	<i>Eucalyptus rudis</i>	Potential nesting tree	No	SCM
265	389621.61	6490397.90	55	<i>Eucalyptus rudis</i>	Potential nesting tree	No	SCM
266	389688.43	6490302.16	53	<i>Eucalyptus rudis</i>	Potential nesting tree	No	SCM
267	389716.94	6490613.43	58	<i>Eucalyptus rudis</i>	Potential nesting tree	No	SCM
268	389708.58	6490617.94	65	<i>Eucalyptus rudis</i>	Potential nesting tree	No	SCM
269	388798.21	6490708.85	68	<i>Eucalyptus todtiana</i>	Potential nesting tree	No	SCM
27	389138.55	6490770.59	108	<i>Eucalyptus marginata</i>	Potential nesting tree	No	NAW

Tag No.	Easting	Northing	DBH (cm)	Species	BC Hollow Category	Hollow Inspection	Recorder
270	389660.22	6490576.91	57	<i>Eucalyptus rudis</i>	Potential nesting tree	No	SCM
271	389637.45	6490565.49	105	<i>Eucalyptus rudis</i>	Potential nesting tree	No	SCM
272	389533.18	6490592.11	61	<i>Eucalyptus rudis</i>	Potential nesting tree	No	SCM
273	389534.74	6490575.38	50	<i>Eucalyptus rudis</i>	Potential nesting tree	No	SCM
274	389534.29	6490568.46	52	<i>Eucalyptus rudis</i>	Potential nesting tree	No	SCM
275	389546.69	6490583.34	51	<i>Eucalyptus rudis</i>	Potential nesting tree	No	SCM
276	389518.30	6490539.29	70	<i>Eucalyptus rudis</i>	Potential nesting tree	No	SCM
277	389500.21	6490493.60	78	<i>Eucalyptus rudis</i>	Potential nesting tree	No	SCM
278	389489.94	6490437.10	68	<i>Eucalyptus rudis</i>	Potential nesting tree	No	SCM
279	389478.50	6490392.90	96	<i>Eucalyptus rudis</i>	Potential nesting tree	No	SCM
280	389549.79	6490761.93	78	<i>Eucalyptus rudis</i>	Potential nesting tree	No	SCM
281	389685.99	6490831.60	69	Stag	Potential nesting tree	No	SCM
282	389555.60	6490797.90	68	<i>Eucalyptus rudis</i>	Potential nesting tree	No	SCM
283	390743.14	6490233.49	76	<i>Corymbia calophylla</i>	Potential nesting tree	No	SCM
284	390743.83	6490241.62	79	<i>Corymbia calophylla</i>	Potential nesting tree	No	SCM
285	390758.44	6490264.10	86	<i>Eucalyptus rudis</i>	Potential nesting tree	No	SCM
286	390766.31	6490289.05	57	<i>Eucalyptus rudis</i>	Potential nesting tree	No	SCM
287	390789.97	6490265.91	59	<i>Eucalyptus rudis</i>	Potential nesting tree	No	SCM
288	390802.51	6490304.70	54	<i>Eucalyptus rudis</i>	Potential nesting tree	No	SCM
289	390833.08	6490279.13	57	<i>Eucalyptus rudis</i>	Potential nesting tree	No	SCM
29	389138.73	6490770.92	58	<i>Eucalyptus rudis</i>	Potential nesting tree	No	NAW
290	390841.79	6490285.71	53	<i>Eucalyptus rudis</i>	Potential nesting tree	No	SCM
291	390837.77	6490281.50	57	<i>Eucalyptus rudis</i>	Potential nesting tree	No	SCM
292	390842.93	6490297.87	52	<i>Eucalyptus rudis</i>	Potential nesting tree	No	SCM
293	390837.75	6490309.60	82	<i>Eucalyptus rudis</i>	Potential nesting tree	No	SCM
294	390851.06	6490294.76	79	<i>Corymbia calophylla</i>	Potential nesting tree	No	SCM
295	390857.50	6490294.56	61	<i>Eucalyptus rudis</i>	Potential nesting tree	No	SCM
296	390862.37	6490298.50	55	<i>Corymbia calophylla</i>	Potential nesting tree	No	SCM
297	390864.08	6490297.01	54	<i>Eucalyptus rudis</i>	Potential nesting tree	No	SCM
298	390901.18	6490322.07	54	<i>Eucalyptus rudis</i>	Potential nesting tree	No	SCM
299	390913.67	6490308.70	105	<i>Corymbia calophylla</i>	Potential nesting tree	No	SCM

Tag No.	Easting	Northing	DBH (cm)	Species	BC Hollow Category	Hollow Inspection	Recorder
3	388646.78	6491206.48	208	<i>Eucalyptus marginata</i>	Potential nesting tree	Yes	NAW
30	388909.17	6490822.61	95	<i>Eucalyptus marginata</i>	Potential nesting tree	No	NAW
300	390923.19	6490326.06	88	<i>Corymbia calophylla</i>	Potential nesting tree	No	SCM
301	390859.40	6490373.94	84	<i>Eucalyptus rudis</i>	Potential nesting tree	No	SCM
31	389965.06	6490341.34	52	<i>Eucalyptus rudis</i>	Potential nesting tree	No	SCM
32	388925.35	6490825.41	120	<i>Eucalyptus marginata</i>	Potential nesting tree	No	NAW
33	389034.18	6491107.61	135	<i>Eucalyptus rudis</i>	Potential nesting tree	Yes	NAW
34	389091.37	6491102.10	130	<i>Eucalyptus rudis</i>	Potential nesting tree	No	NAW
35	389093.85	6491191.63	73	<i>Eucalyptus rudis</i>	Potential nesting tree	No	NAW
36	389206.61	6491142.96	62	<i>Eucalyptus rudis</i>	Potential nesting tree	No	NAW
37	389109.27	6491262.06	57	<i>Eucalyptus rudis</i>	Potential nesting tree	No	NAW
38	389007.46	6491342.66	128	<i>Eucalyptus todtiana</i>	Potential nesting tree	No	NAW
39	389156.63	6491334.00	66	<i>Eucalyptus rudis</i>	Potential nesting tree	No	NAW
4	388678.27	6491154.01	82	<i>Eucalyptus marginata</i>	Potential nesting tree	No	NAW
40	389177.48	6491284.04	89	<i>Eucalyptus rudis</i>	Potential nesting tree	No	NAW
401	390128.52	6490607.48	56	<i>Eucalyptus rudis</i>	Potential nesting tree	No	TDP
402	390117.84	6490601.36	59	<i>Eucalyptus rudis</i>	Potential nesting tree	No	TDP
403	390093.55	6490582.16	51	<i>Eucalyptus rudis</i>	Potential nesting tree	No	TDP
404	390072.84	6490549.68	53	<i>Eucalyptus rudis</i>	Potential nesting tree	No	TDP
405	390037.83	6490455.02	91	Stag	Potential nesting tree	No	TDP
406	390074.93	6490455.07	71	<i>Eucalyptus rudis</i>	Potential nesting tree	No	TDP
407	390065.11	6490405.70	52	<i>Eucalyptus rudis</i>	Potential nesting tree	No	TDP
408	390100.08	6490386.70	87	<i>Eucalyptus rudis</i>	Potential nesting tree	No	TDP
409	390088.77	6490300.66	64	Stag	Potential nesting tree	No	TDP
41	389192.64	6491270.25	70	<i>Eucalyptus rudis</i>	Potential nesting tree	No	NAW
410	390125.42	6490211.35	98	Stag	Potential nesting tree	Yes	TDP
411	390146.78	6490195.52	53	<i>Eucalyptus rudis</i>	Potential nesting tree	No	TDP
412	390168.11	6490180.52	53	<i>Eucalyptus rudis</i>	Potential nesting tree	No	TDP
413	390531.56	6490280.54	70	<i>Eucalyptus rudis</i>	Potential nesting tree	No	TDP
414	390545.73	6490271.48	80	<i>Eucalyptus rudis</i>	Potential nesting tree	No	TDP
415	390604.17	6490243.70	51	<i>Eucalyptus rudis</i>	Potential nesting tree	No	TDP

Tag No.	Easting	Northing	DBH (cm)	Species	BC Hollow Category	Hollow Inspection	Recorder
416	390600.67	6490275.88	71	<i>Eucalyptus rudis</i>	Potential nesting tree	No	TDP
417	390608.31	6490281.97	55	<i>Eucalyptus rudis</i>	Potential nesting tree	No	TDP
418	390843.97	6489776.26	133	<i>Eucalyptus marginata</i>	Potential nesting tree	No	TDP
419	390821.08	6489853.00	51	<i>Eucalyptus marginata</i>	Potential nesting tree	No	TDP
42	389251.43	6491264.83	99	<i>Eucalyptus rudis</i>	Potential nesting tree	No	NAW
421	390804.12	6489905.18	85	<i>Eucalyptus marginata</i>	Potential nesting tree	No	TDP
422	390805.35	6489943.66	68	<i>Eucalyptus marginata</i>	Potential nesting tree	No	TDP
423	390743.89	6489996.31	68	<i>Eucalyptus marginata</i>	Potential nesting tree	No	TDP
424	390735.95	6490013.25	59	<i>Eucalyptus marginata</i>	Potential nesting tree	No	TDP
425	390725.75	6490028.14	92	<i>Eucalyptus marginata</i>	Potential nesting tree	No	TDP
426	390708.81	6490022.29	104	<i>Eucalyptus marginata</i>	Potential nesting tree	Yes	TDP
427	390377.50	6489894.02	76	<i>Eucalyptus rudis</i>	Potential nesting tree	No	NAW
43	389285.62	6491263.92	56	<i>Eucalyptus rudis</i>	Potential nesting tree	No	NAW
44	389336.78	6491213.36	62	<i>Eucalyptus rudis</i>	Potential nesting tree	No	NAW
45	389343.58	6491336.25	60	<i>Eucalyptus rudis</i>	Potential nesting tree	No	NAW
452	388894.19	6490973.94	55	<i>Eucalyptus marginata</i>	Potential nesting tree	No	SCM
46	389454.07	6491331.22	54	<i>Eucalyptus rudis</i>	Potential nesting tree	No	NAW
47	389606.92	6491270.74	60	<i>Eucalyptus rudis</i>	Potential nesting tree	No	NAW
48	389723.81	6491146.95	56	<i>Eucalyptus rudis</i>	Potential nesting tree	No	NAW
49	389693.20	6491103.82	105	<i>Eucalyptus rudis</i>	Potential nesting tree	No	NAW
5	388685.01	6491142.74	73	<i>Eucalyptus marginata</i>	Potential nesting tree	No	NAW
50	389676.74	6491075.22	130	<i>Eucalyptus rudis</i>	Potential nesting tree	No	NAW
51	389649.66	6491024.71	90	<i>Eucalyptus rudis</i>	Potential nesting tree	No	NAW
52	390604.21	6490410.03	102	<i>Corymbia calophylla</i>	Potential nesting tree	No	NAW
53	390630.23	6490380.94	58	<i>Eucalyptus rudis</i>	Potential nesting tree	No	NAW
54	390645.80	6490358.20	51	<i>Eucalyptus rudis</i>	Potential nesting tree	No	NAW
55	390663.14	6490443.78	55	<i>Corymbia calophylla</i>	Potential nesting tree	No	NAW
56	390647.67	6490507.76	100	<i>Corymbia calophylla</i>	Potential nesting tree	No	NAW
57	390685.07	6490466.56	70	<i>Corymbia calophylla</i>	Potential nesting tree	No	NAW
58	390676.68	6490450.52	52	<i>Corymbia calophylla</i>	Potential nesting tree	No	NAW
59	390679.77	6490450.10	90	<i>Corymbia calophylla</i>	Potential nesting tree	No	NAW

Tag No.	Easting	Northing	DBH (cm)	Species	BC Hollow Category	Hollow Inspection	Recorder
6	388799.61	6490867.85	101	<i>Eucalyptus marginata</i>	Potential nesting tree	Yes	NAW
60	390700.43	6490413.96	100	<i>Corymbia calophylla</i>	Potential nesting tree	No	NAW
61	390707.75	6490410.95	73	<i>Corymbia calophylla</i>	Potential nesting tree	No	NAW
62	390718.45	6490408.05	67	<i>Corymbia calophylla</i>	Potential nesting tree	No	NAW
63	390722.66	6490410.98	50	<i>Corymbia calophylla</i>	Potential nesting tree	No	NAW
64	390731.80	6490429.78	70	<i>Corymbia calophylla</i>	Potential nesting tree	No	NAW
65	390707.20	6490482.65	78	<i>Corymbia calophylla</i>	Potential nesting tree	No	NAW
66	390744.85	6490484.99	80	<i>Corymbia calophylla</i>	Potential nesting tree	No	NAW
67	390775.33	6490367.36	83	<i>Corymbia calophylla</i>	Potential nesting tree	No	NAW
68	390783.64	6490359.93	50	<i>Eucalyptus rudis</i>	Potential nesting tree	No	NAW
69	390793.93	6490371.04	75	<i>Eucalyptus rudis</i>	Potential nesting tree	No	NAW
7	388801.50	6490867.88	79	<i>Eucalyptus marginata</i>	Potential nesting tree	No	NAW
70	389996.70	6490318.45	58	<i>Eucalyptus rudis</i>	Potential nesting tree	No	SCM
71	390140.15	6490229.79	53	<i>Eucalyptus rudis</i>	Potential nesting tree	No	SCM
72	390197.15	6490154.96	75	<i>Eucalyptus rudis</i>	Potential nesting tree	No	SCM
73	390246.36	6490132.93	51	<i>Eucalyptus rudis</i>	Potential nesting tree	No	SCM
74	390332.70	6490127.95	84	<i>Eucalyptus rudis</i>	Potential nesting tree	No	SCM
75	390341.00	6490128.36	116	<i>Eucalyptus rudis</i>	Potential nesting tree	No	SCM
76	390437.59	6490249.66	86	<i>Eucalyptus rudis</i>	Potential nesting tree	No	SCM
77	390563.76	6490309.81	96	<i>Eucalyptus rudis</i>	Potential nesting tree	No	SCM
78	390544.74	6490361.84	65	<i>Eucalyptus rudis</i>	Potential nesting tree	No	SCM
79	390547.49	6490365.45	54	<i>Eucalyptus rudis</i>	Potential nesting tree	No	SCM
8	388901.35	6490871.86	84	<i>Eucalyptus marginata</i>	Potential nesting tree	No	NAW
80	390540.59	6490351.17	121	<i>Eucalyptus rudis</i>	Potential nesting tree	No	SCM
801	389726.27	6490155.12	61	<i>Eucalyptus rudis</i>	Potential nesting tree	No	SCM
802	389658.69	6490161.89	56	Stag	Potential nesting tree	No	SCM
81	390935.26	6490019.99	65	<i>Eucalyptus todtiana</i>	Potential nesting tree	No	SCM
82	390859.28	6489795.18	71	<i>Eucalyptus marginata</i>	Potential nesting tree	No	SCM
83	390858.65	6489809.66	66	<i>Eucalyptus marginata</i>	Potential nesting tree	No	SCM
84	390867.60	6489837.97	59	<i>Eucalyptus marginata</i>	Potential nesting tree	No	SCM
85	390857.17	6489907.61	60	<i>Eucalyptus marginata</i>	Potential nesting tree	No	SCM

Tag No.	Easting	Northing	DBH (cm)	Species	BC Hollow Category	Hollow Inspection	Recorder
86	390853.63	6489929.76	90	<i>Eucalyptus marginata</i>	Potential nesting tree	No	SCM
87	390854.84	6489963.80	82	<i>Eucalyptus marginata</i>	Potential nesting tree	No	SCM
88	390797.21	6490000.24	149	<i>Eucalyptus marginata</i>	Potential nesting tree	No	SCM
89	390782.51	6490007.70	112	<i>Eucalyptus marginata</i>	Potential nesting tree	No	SCM
9	388989.82	6490895.37	128	<i>Eucalyptus marginata</i>	Potential nesting tree	No	NAW
90	390467.26	6489845.74	90	<i>Eucalyptus rudis</i>	Potential nesting tree	No	NAW
901	389950.03	6490736.13	51	<i>Eucalyptus rudis</i>	Potential nesting tree	No	NAW
902	390011.45	6490753.70	57	<i>Eucalyptus rudis</i>	Potential nesting tree	No	NAW
903	389985.26	6490782.04	54	<i>Eucalyptus rudis</i>	Potential nesting tree	No	NAW
904	390060.65	6490715.15	73	<i>Eucalyptus rudis</i>	Potential nesting tree	No	NAW
905	390240.70	6490730.79	75	<i>Eucalyptus todtiana</i>	Potential nesting tree	No	NAW
906	390141.02	6490612.99	54	<i>Eucalyptus rudis</i>	Potential nesting tree	No	NAW
907	390142.10	6490613.79	57	<i>Eucalyptus rudis</i>	Potential nesting tree	No	NAW
908	390150.37	6490616.00	81	<i>Eucalyptus rudis</i>	Potential nesting tree	No	NAW
909	390157.76	6490618.05	83	<i>Eucalyptus rudis</i>	Potential nesting tree	No	NAW
91	389674.10	6489797.08	64	<i>Eucalyptus rudis</i>	Potential nesting tree	No	SCM
910	390161.31	6490619.66	84	<i>Eucalyptus rudis</i>	Potential nesting tree	No	NAW
911	390176.13	6490624.02	76	<i>Eucalyptus rudis</i>	Potential nesting tree	No	NAW
912	390181.03	6490627.06	60	<i>Eucalyptus marginata</i>	Potential nesting tree	No	NAW
913	390199.78	6490626.91	106	<i>Eucalyptus rudis</i>	Potential nesting tree	No	NAW
914	390218.72	6490635.98	83	<i>Eucalyptus rudis</i>	Potential nesting tree	No	NAW
915	390250.17	6490635.07	100	<i>Eucalyptus rudis</i>	Potential nesting tree	No	NAW
916	390255.47	6490634.14	72	<i>Eucalyptus rudis</i>	Potential nesting tree	No	NAW
917	390259.93	6490636.09	90	<i>Eucalyptus rudis</i>	Potential nesting tree	No	NAW
918	390321.40	6490616.08	52	<i>Eucalyptus rudis</i>	Potential nesting tree	No	NAW
919	390308.86	6490620.35	52	<i>Eucalyptus rudis</i>	Potential nesting tree	No	NAW
92	389672.90	6489808.78	96	<i>Eucalyptus rudis</i>	Potential nesting tree	No	SCM
920	390345.68	6490618.84	52	<i>Eucalyptus rudis</i>	Potential nesting tree	No	NAW
921	390364.05	6490609.84	85	<i>Eucalyptus rudis</i>	Potential nesting tree	No	NAW
922	390371.33	6490608.62	59	<i>Eucalyptus rudis</i>	Potential nesting tree	No	NAW
923	390415.76	6490581.63	105	<i>Eucalyptus rudis</i>	Potential nesting tree	No	NAW

Tag No.	Easting	Northing	DBH (cm)	Species	BC Hollow Category	Hollow Inspection	Recorder
924	390439.97	6490568.42	91	<i>Eucalyptus rudis</i>	Potential nesting tree	No	NAW
925	390443.98	6490557.94	90	<i>Eucalyptus rudis</i>	Potential nesting tree	No	NAW
926	390459.79	6490559.16	70	<i>Eucalyptus rudis</i>	Potential nesting tree	No	NAW
927	390463.47	6490556.73	54	<i>Eucalyptus rudis</i>	Potential nesting tree	No	NAW
928	390478.52	6490529.29	62	<i>Eucalyptus rudis</i>	Potential nesting tree	No	NAW
929	390507.52	6490509.79	90	<i>Eucalyptus rudis</i>	Potential nesting tree	No	NAW
93	389705.68	6490085.83	73	Stag	Potential nesting tree	Yes	SCM
930	390525.29	6490484.42	89	<i>Eucalyptus rudis</i>	Potential nesting tree	No	NAW
931	390544.31	6490444.68	53	<i>Eucalyptus rudis</i>	Potential nesting tree	No	NAW
932	390564.82	6490419.55	60	<i>Eucalyptus rudis</i>	Potential nesting tree	No	NAW
934	390565.11	6490419.38	90	<i>Eucalyptus rudis</i>	Potential nesting tree	No	NAW
935	390572.70	6490405.55	85	<i>Eucalyptus rudis</i>	Potential nesting tree	No	NAW
936	390546.22	6490378.36	82	<i>Eucalyptus rudis</i>	Potential nesting tree	No	NAW
937	390415.93	6490557.17	53	<i>Eucalyptus rudis</i>	Potential nesting tree	No	NAW
938	390815.93	6489791.44	99	<i>Eucalyptus marginata</i>	Potential nesting tree	No	NAW
940	390793.64	6489808.81	82	<i>Eucalyptus marginata</i>	Potential nesting tree	No	NAW
941	390809.32	6489819.10	73	<i>Eucalyptus marginata</i>	Potential nesting tree	No	NAW
942	390796.42	6489839.06	73	<i>Eucalyptus marginata</i>	Potential nesting tree	No	NAW
943	390812.21	6489869.81	96	<i>Eucalyptus marginata</i>	Potential nesting tree	No	NAW
944	390797.81	6489889.53	84	<i>Eucalyptus marginata</i>	Potential nesting tree	No	NAW
945	390796.26	6489908.33	108	<i>Eucalyptus marginata</i>	Potential nesting tree	No	NAW
946	390706.17	6489957.69	122	<i>Eucalyptus marginata</i>	Potential nesting tree	No	NAW
947	390683.50	6489998.20	55	<i>Eucalyptus marginata</i>	Potential nesting tree	No	NAW
948	390658.58	6490020.81	97	<i>Eucalyptus marginata</i>	Potential nesting tree	Yes	NAW

Appendix E

Aboriginal Heritage Desktop Assessment (Horizon 2023)





OPEN REPORT WITH EXCEPTIONS

**Precinct 15 Central Mariginiup Local Structure Plan
Aboriginal Heritage Desktop Assessment Report**

July 2023

Damien Lafrentz

WARNING

**THIS REPORT CONTAINS THE NAME OF A DECEASED ABORIGINAL PERSON.
PAGES 30 AND 31 CONTAIN RESTRICTED PLACE AND BOUNDARY INFORMATION.**

Recognition of People & Country

Horizon Heritage Management acknowledges and pays respect to the Whadjuk Noongar Traditional Owners and community of the land and sea of this ‘*boodja*’ (country). We pay respect to the Elders past, present and emerging who hold the memories, traditions, culture and hopes for the future.

Confidentiality

This is an open report with exceptions for restricted information on pages 30 – 31. The site information for 22160 Marrynginup is restricted with the DPLH. Horizon Heritage Management has permission from the original site informant’s family to use this information publicly within this LSP desktop assessment report.

Disclaimer

This heritage desktop assessment report is being supplied to Stockland so it can manage its requirements and responsibilities under the Western Australia *Aboriginal Cultural Heritage Act (2021)* (ACHA) and to be aware of and minimise risks to Aboriginal heritage and culture associated with the Precinct 15 Central Mariginiup Local Structure Plan (LSP).

Aboriginal places and objects are afforded protection under the ACHA. Any heritage impacts without consultation, agreement and consent with the Whadjuk People could be an offence under Part 5 of the ACHA.

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Acknowledgements

Horizon Heritage Management acknowledges the assistance of Emerge Associates for supplying GIS spatial information for this desktop assessment report.

Abbreviations

ACHC	Aboriginal Cultural Heritage Council
ACHA	<i>Aboriginal Cultural Heritage Act (2021)</i>
DPLH	Department of Planning, Lands and Heritage
GIS	Geographic Information System
GPS	Global Positioning System
LSP	Local Structure Plan
MGA	Map Grid of Australia
NTC	Native Title Claimant Group
SWALSC	South West Aboriginal Sea and Land Council
WGS	World Geodetic System

Spellings

The Waugal is the major spirit for Noongar People and central to their beliefs and customs. Waugal has many different spellings including *Waakal*, *Wagyl*, *Wawgal*, *Woggal* and *Waagal*.

Horizon Heritage acknowledges there are alternative spellings of Noongar (*Nyungar*, *Nyoongar*, *Nyoongah*, *Nyungah*, *Nyugah* and *Yunga*) however Noongar has been used as an inclusive representation of the Noongar societies.

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Executive Summary

Horizon Heritage Management was engaged to undertake a desktop assessment to understand the extent and characteristics of any known and likely Aboriginal heritage values within the Precinct 15 Central Mariginiup Local Structure Plan area (LSP desktop assessment area).

Horizon Heritage Management makes the following conclusions:

- The key Aboriginal stakeholder group for the LSP desktop assessment area is the Whadjuk 'Noongar' People.
- Potentially important landscape features like lakes, swamps and wetlands connected with mythological associations are present within the Central Mariginiup LSP desktop assessment area. Lake Adams is such a feature and is located along the northern boundary of the LSP desktop assessment area. Jandabup Lake is another such a feature and is located along the southern boundary of the LSP desktop assessment area. Further landscape features Little Mariginiup Lake and Mariginiup Lake are located immediately west and southwest of the Precinct 15 Central Mariginiup LSP desktop assessment area.
- One (1) ACH Directory Place 22160 Marrynginup has a closed and restricted boundary which intersects the LSP desktop assessment area and is afforded protection under the *Aboriginal Cultural Heritage Act (2021)*.
- The key Whadjuk Custodian for 22160 Marrynginup is Esandra Colbung. Her father (now deceased) was the original site informant.
- No specific Aboriginal heritage surveys (ethnographic or archaeological) have been undertaken within the LSP desktop assessment area.
- No registered archaeological sites are within the LSP desktop assessment area. It is possible surface expressions of *in situ* cultural material (artefacts) could be present. Care should be taken in those areas with some potential to contain cultural material. These are around the margins of landscape features like lakes, swamps, wetlands, and any sand hill features that maybe within the LSP desktop assessment area.
- Numerous Noongar fringe camps have previously been identified within proximity of the numerous freshwater lakes found in the broader Wanneroo area, potential remains for contemporary Whadjuk People to hold knowledge of any possible Whadjuk land use of the LSP desktop assessment area.

Horizon Heritage Management makes the following recommendations:

1. Horizon Heritage Management recommends that any future development within the LSP area includes consultation with the Whadjuk Aboriginal Corporation and Aboriginal heritage ethnographic and archaeological heritage surveys with the Whadjuk People.
2. Horizon Heritage Management recommends that consultation is undertaken with Esandra Colbung (Whadjuk Site Custodian) for 22160 Marrynginup regarding the LSP desktop assessment area and this significant Aboriginal site.
3. Horizon Heritage Management recommends 22160 Marrynginup is an ACH Directory Place and is afforded protection under the *Aboriginal Cultural Heritage Act (2021)*. To use the land which Aboriginal Places are on the proponent/landowner must engage with the Whadjuk Aboriginal Corporation.
4. Horizon Heritage Management recommends an Aboriginal Cultural Heritage Management Plan (developed with input and consent from the Whadjuk People and endorsed by the new ACH Council) will likely be needed to satisfy the *Aboriginal Cultural Heritage Act (2021)*.

1 PROJECT BRIEF

Horizon Heritage Management was engaged to undertake a desktop assessment to understand the extent and characteristics of any known and likely Aboriginal heritage values within the Precinct 15 Central Mariginiup Local Structure Plan area.

2 PROJECT BACKGROUND

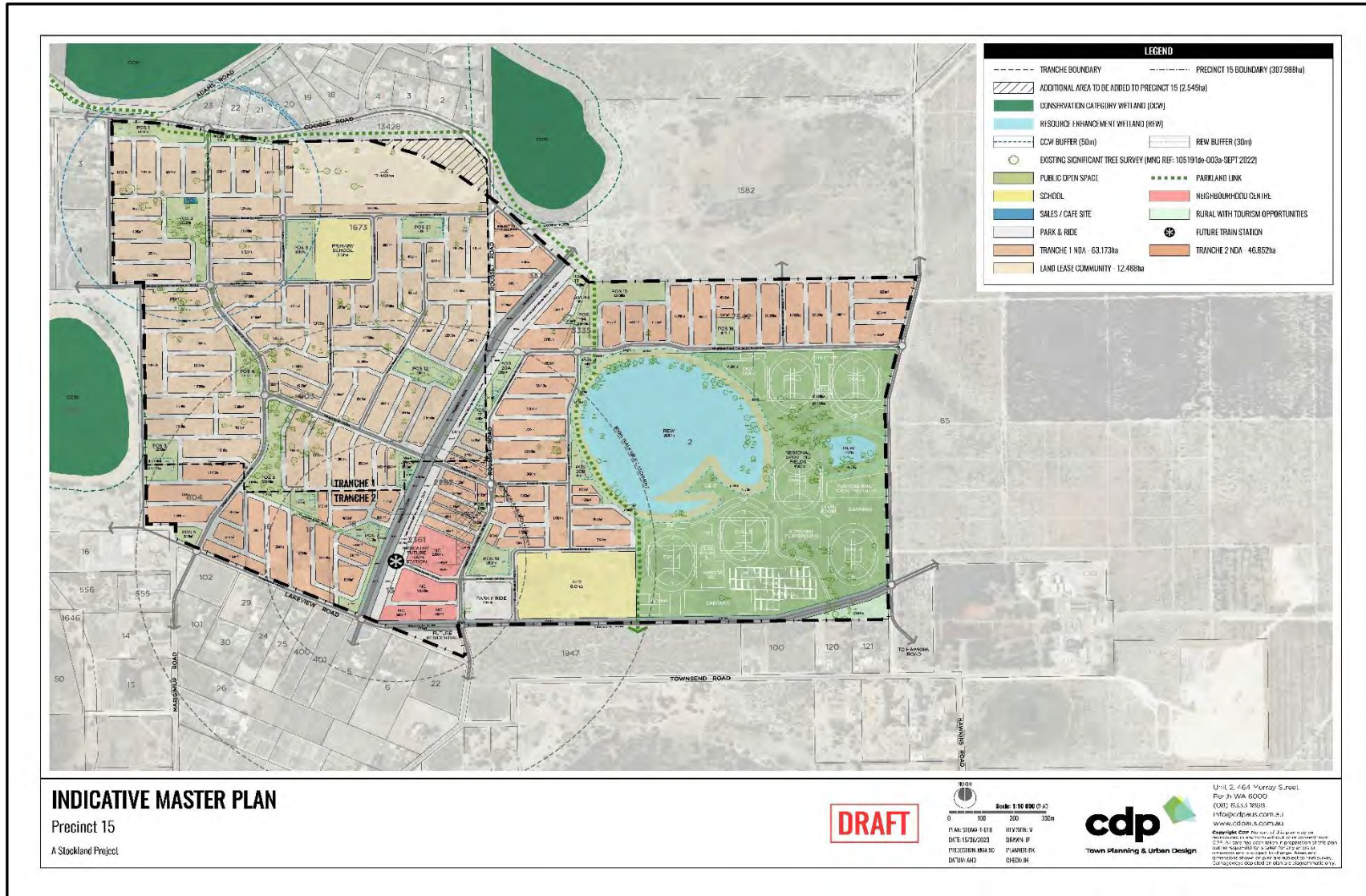
Stockland requires an Aboriginal Heritage Desktop Assessment report as a technical appendix to the Central Mariginiup LSP submission.

The Central Mariginiup precinct is an Urban Expansion Area in the North-West Sub-regional Planning Framework. It is generally flat except for a ridgeline along its western boundary marking the transition from the Bassendean to the Spearwood dunal system. The precinct currently contains market gardens, homesteads, and equestrian facilities.

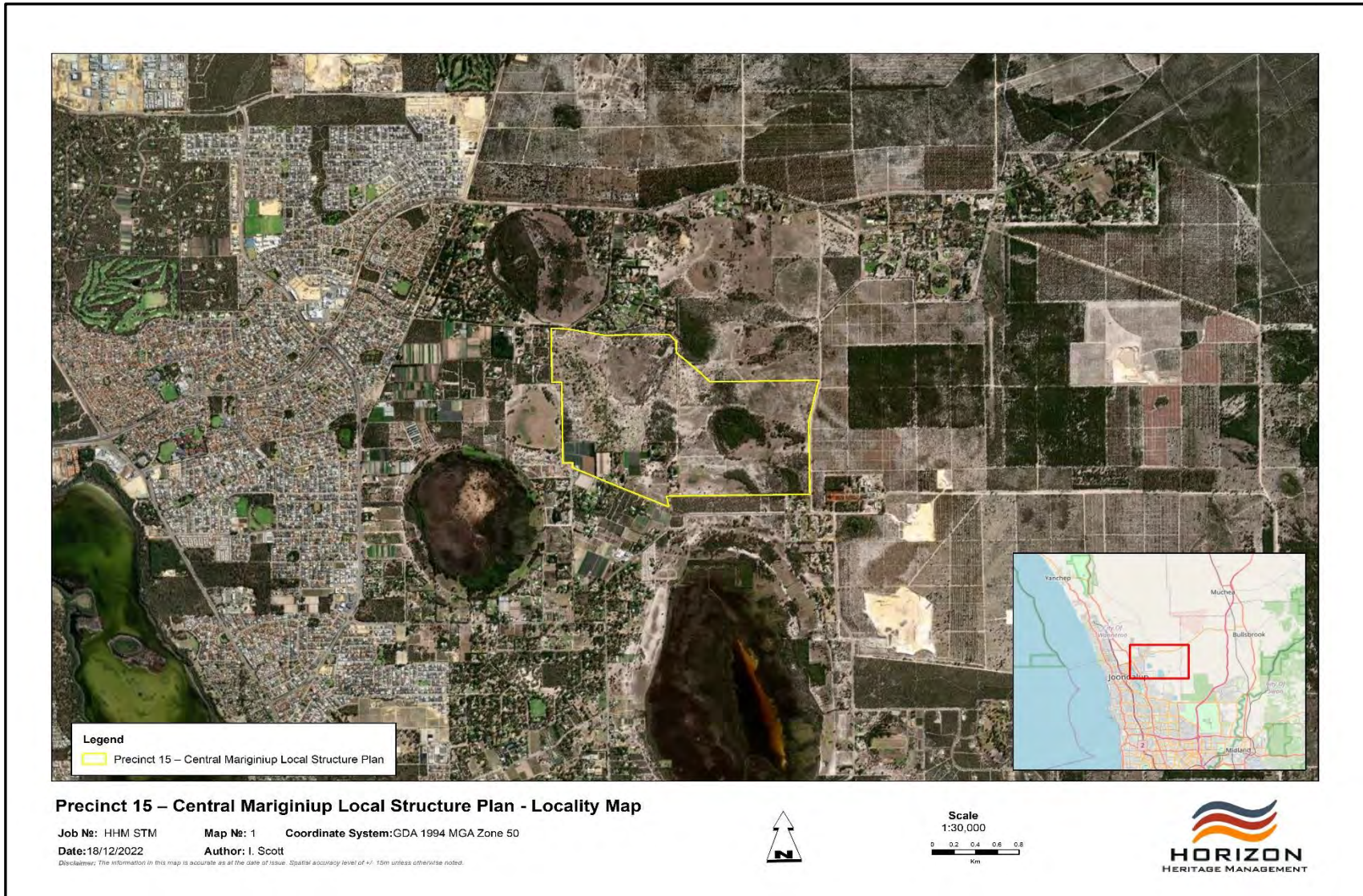
The Resource Enhancement wetland to the east of Rousset Road contains extensive natural vegetation and is of high scenic value. It provides the opportunity to utilize a landmark natural feature as part of the character and sense of place created for this precinct.

The precinct contains an important Aboriginal heritage place 22160 Marraynginup comprising several cultural components and has historical and ongoing contemporary significance to Whadjuk People.

Map 1: Precinct 15 Concept Cell Structure Plan - Central Mariginuiup Map



Map 2: Precinct 15 Central Mariginiup LSP area Locality Map



3 ABORIGINAL CULTURAL HERITAGE ACT 2021

Aboriginal Heritage Legislation Requirements

The *Aboriginal Cultural Heritage Act 2021* (ACH Act) provides a modern framework for the recognition, protection, conservation, and preservation of Aboriginal cultural heritage while recognising the fundamental importance of Aboriginal cultural heritage to Aboriginal people. It represents a significant step towards achieving equity in the relationship between Aboriginal people, industry, and Government by replacing outdated Aboriginal cultural heritage laws in favour of agreement making with Aboriginal people.

The Aboriginal Cultural Heritage Act 2021 came into operation on the 1st of July 2023. The Government has developed the regulations, statutory guidelines, and operational policies to support the new Act and ensure it will have its intended effects.

Local Aboriginal Cultural Heritage Services (LACHS) are established under the *Aboriginal Cultural Heritage Act 2021* to provide Aboriginal people with a statutory role in managing and protecting local Aboriginal cultural heritage, and to devolve decision making to Aboriginal people at a local level. The ACHA will increase the Aboriginal voice by decentralising decision making to local Aboriginal organisations with authority over their Aboriginal cultural heritage.

The ACH Council will grant Aboriginal Cultural Heritage Permits and approve agreed Aboriginal Cultural Heritage Management Plans where the proponent has complied with all its obligations to interested Aboriginal parties (such as consultation and ensuring informed consent).

4 WHADJUK NOONGAR PEOPLE

4.1 Identified Aboriginal Stakeholder Group

The table below outlines the Whadjuk (Noongar) People:

Table 1: Aboriginal group identified as a key stakeholder in the LSP desktop assessment area

STAKEHOLDER GROUP	CONTACT	NATIVE TITLE
Whadjuk (Noongar) People	Whadjuk Aboriginal Corporation c/o South West Aboriginal Sea and Land Council (SWALSC)	South West Native Title Settlement

The South West Native Title Settlement in the form of six Indigenous land use agreements (ILUAs) was negotiated between the Whadjuk Noongar People and the WA Government. The Settlement commenced on 25 February 2021. From 13 April 2021 the native title act ceased to apply over the Settlement area - meaning future act processes no longer occur.

A fundamental component of the Settlement is the recognition of the Noongar people as the Traditional Owners of the south west region of Western Australia. On 6 June 2016, the Noongar people were recognised, through an Act of the WA Parliament, as the Traditional Owners of the south west region of Western Australia.

The Whadjuk Noongar peoples' connection to the land and the desire to improve access and protect places of significance, were key elements in the negotiation of the Settlement.

Whadjuk People

Whadjuk are the people of the Swan River plains, whose country is now occupied by the greater metropolitan area of Perth.

The Whadjuk People cover the: City Of Armadale, City Of Bayswater, City Of Belmont, City Of Canning, City Of Cockburn, City Of Fremantle, City Of Gosnells, City Of Joondalup, City Of Melville, City Of Nedlands, City Of Perth, City Of South Perth, City Of Stirling, City Of Subiaco, City Of Swan, City Of Vincent, City Of Wanneroo, Shire Of Beverley, Shire Of Chittering, Shire Of Gingin, Shire Of Kalamunda, Shire Of Mundaring, Shire Of Northam, Shire Of Peppermint Grove, Shire Of Toodyay, Shire Of York, Town Of Bassendean, Town Of Cambridge, Town Of Claremont, Town Of Cottesloe, Town Of East Fremantle, Town Of Mosman Park and the Town Of Victoria Park.

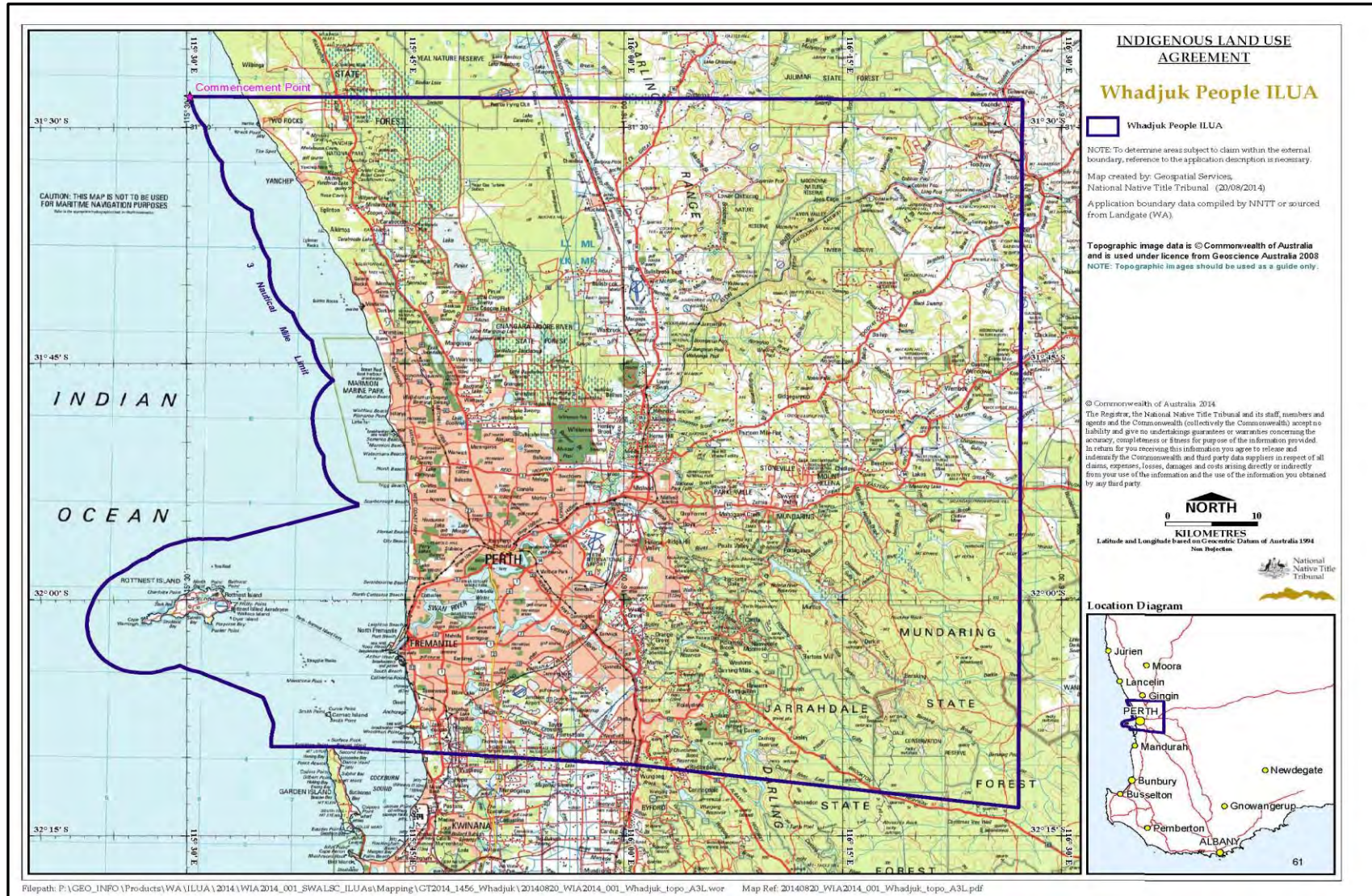
Whadjuk Cultural Advice Committee

The Whadjuk Regional Corporation will have a Cultural Advice Committee (CAC) made up of Elders who consider matters relevant to culture and make decisions to promote and protect their cultural interests.

Matters that may be decided by the committee may include:

- Determining what cultural connection exists, or could exist, to support a piece of land being considered 'Cultural Lands' as part of the Noongar Boodja Trust.
- Determining those people who have most knowledge of relevant lands for surveys to be properly conducted.
- Determining how cultural knowledge should be recorded, and when and how it is shared with others.
- Determining how Noongar cultural protocols and practices should be acknowledged, valued, honoured, and respected, including through welcome to country practices.

Map 3: Whadjuk People ILUA Map



5 ETHNOGRAPHIC BACKGROUND

Introduction: Place, Antiquity, People

Place

The City of Wanneroo is part of a traditional Aboriginal network of communication routes and occupation camps (usually near water sources). According to Jacobs (in Costello, 2002-3; cited in McDonald et al. 2005: 24), the name of Wanneroo comes from the digging stick or *wonner* (*wan-na*, *wanna*, *wonna*, etc. Bindon and Chadwick, 1992: 172, 254). The Wanneroo area is part of a string of lakes that run north-south and is characterised as a wetland:

Thus we see family groups, before European intrusion, centred on the rich alluvial soils along the Swan, particularly in the spring and autumn; moving freely eastward into the hills, mainly in winter and westward to the wetlands of the Wanneroo area, particularly in the summer and autumn (Hallam, 1998: 94, cited in McDonald et al. 2005: 20).

The Swan Coastal Plain has been divided into several 'physiographic elements' starting from the Darling Fault Scarp: a Piedmont Zone of alluvial sediments, a gently undulating Sandy Plain with swampy areas in low-lying land between the dunes, characterised by a string of lakes running north and south, and Coastal Limestone, the Shore Line, shallow waters, and islands and reefs (Jutson, 1950: 89-90). A classification paralleling that of Jutson a decade later appears to be preferred among archaeologists. It is cited by Sylvia Hallam from a CSIRO publication for 1960 using local names of suburbs: Ridge Hill Shelf: the foothills of the Darling Scarp, Pinjarra Plain: the piedmont alluvial plain, Bassendean Dunes: the coastal sand plain, Spearwood Dunes: aeolian limestone, and Quindalup Dunes: the coastal dunes (McArthur and Bettenay, 1960; cited in Hallam 1975: 51). All of these ecological niches are important to the Indigenous people. This profile with its focus on Wanneroo takes in the coastal dunes, and the geomorphic elements of the Swan Coastal Plain close to the dunes, the sea to the west and the lakes to the east.

People

According to Tindale, the traditional territory of the 'Whadjuk' of the Perth Metropolitan area (see Plate 2) includes:

Swan River and northern and eastern tributaries inland to beyond Mount Helena; at Kalamunda, Armadale, Victoria Plains, south of Toodyay, and western vicinity of York; at Perth; south along coast to near Pinjarra (Tindale, 1974: 242-243).

The Whadjuk People spoke one of the Noongar languages (dialects). The Noongar language family is classified as belonging to the 'Nyunga Subgroup' and to the Pama-Nyungan Family of Aboriginal languages (Oates and Oates, 1970: xiii). Thieberger (1996) finds eleven languages of the South West: Yuwat, Balardung, Wajuk, Binjarub, Wiilman, Kaniyang, Wardandi, Bibbulman, Minang, Goreng, and Wudjaarri that are today subsumed under the name 'Nyungar.' Drawing upon twenty-five documented sources, Bindon and Chadwick (1992) in their Nyoongar wordlist include variations between these languages, but they are often differences of pronunciation as recorded by European listeners of the time. Noongar people hear the differences too.

Thieberger (1996) indicates that the Whadjuk were one of eleven languages belonging to the Nyoongah language family. Since the 1930's, the Aboriginal people of the South West began to identify themselves as Nyoongah, the generic term for person ('man').

Antiquity

The Archaeological evidence for Indigenous occupation in the coastal strip from Mandurah through Wanneroo to Yanchep indicates a minimum of some thousands of years of occupation:

Several hundred artefacts of Eocene fossiliferous chert, a rock known from offshore drill-holes, are exposed in Late Pleistocene and early Holocene archaeological horizons along the lower west coast and offshore islands. Chert artefacts are also known from excavations at Devil's Lair, Tunnel Cave, Arumvale, Quninup Brook, Dunsborough, and Walyunga ... fossiliferous chert was quarried from outcrops distributed along now-submerged parts of the coastal plain off the lower west coast; thus most chert artefacts pre-date Mid-Holocene seal-level stabilisation, 6500 years BP (Mulvaney & Kamminga, 1999: 295).

Fossiliferous chert artefacts have been recorded in the Pinjarra area by AIC archaeologists. For the islands offshore from Rockingham:

The many exhaustive surveys by Charlie Dortch on the islands near Fremantle revealed only a few artefacts of fossiliferous chert, mostly on adjacent Garden Island. All these finds must precede the islands' formation. The few artefacts from Rottneest Island, nineteen kilometres offshore, are older than 7000 years BP (Mulvaney & Kamminga, 1999: 338).

In broader terms:

detailed observations of Aboriginal life, documenting the enormous variety of plant and animal foods that the local Nyoongar people obtained from many environments ... One of the most important Holocene sites in southwestern Australia is Walyunga, 40 kilometres north of the Swan River near Perth ... In the early phase, from 8000 to 4500 years BP ... in the later phase, which continues after 3200 years BP' (Mulvaney and Kamminga, 1999: 293-294).

There is further evidence of antiquity in the Perth region. In particular:

The Upper Swan River site near Perth has the distinction of having its age of about 38 000 years old accepted by almost all leading archaeologists ... It is an extensive, open-air camp site on an ancient floodplain bordering the upper Swan River between Perth and Walyunga' (Flood, 1995: 106).

While entertaining doubts about those dates of 32,000 to 38,000 years BP – on questions of radiocarbon dating and insufficient details about the artefacts – Mulvaney and Kamminga are satisfied with other dates for the Perth area: 29,000 years BP for Helena Valley and 10,000 years BP for Minim Cove on the Swan River (Mulvaney and Kamminga, 1999: 137-138, 178).

In the Yanchep area some twenty-five kilometres north of Wanneroo, Hallam found that the 'Orchestra Shell' cave in the Aeolian limestone belt, midway between Perth and Yanchep: 'has on its roof slope straight grooves, a single splayed and many meandering snake-like markings ... and evidence of fire from about 4,500 B.C. to 200 A.D. (Hallam 1975: 83; citing earlier work, 1971).

Putting these dates into perspective, the 'height of the last ice age' came a little before 20,000 years BPE (Before the Present Era), meaning that around 29,000 years BPE – the Late Pleistocene – the world was gripped in an ice age; figures such as 10,000 BP, 8,000 BP, and 4,500 BP belong to the Holocene or Recent Period, after the last ice age, when the Australian climate became as it is today (Flood, 1983/1995: 28). People occupied the Perth region during much of the Late Pleistocene and throughout the Holocene.

The localities of Yanchep, Wanneroo, Fremantle and Mandurah lie along a coastal strip that is of continued significance to Noongar people. Traditionally, they were points on a route connecting the population centres of the coastal plain:

A strip of the twenty-mile wide coastal plain stretching north halfway towards the next centre of population in the Moore River-Gingin district, and south halfway towards the concentration around the Serpentine-Murray-Harvey estuaries ... Eastward it would stop short of the separate groups in the York-Toodyay area. One wonders, however, whether the aggregation Stirling described did not include the Murray men, the Gingin folk, or even the York people, for these are certainly mentioned from time to time as visiting Perth, or having kin there (Hallam, 1975: 108).

Wanneroo lies on the old north-south communication route connecting Aboriginal groups with others down the coast and inland, including along the Swan River, called the Derbal Yaragan by Noongar people (*der-bal* = an estuary; *yaragan* = river; Bindon & Chadwick, 1992: 43, 187):

The Warndoolier, nearer to Perth became the Swan and combined downstream with the Dyarlgarro or Canning River; all then flowing as one to the coast to empty into the Derbal Naral, the expanse of sheltered water that includes the whole of Cockburn Sound from Mangles Bay to the northernmost tip of Rottnest Island (Green, 1984: 2)

The Wanneroo area has this broader context.

Contact & Settlement

Settlement History

The Swan River Colony was proclaimed on the 12th August 1829, the year in which Captain James Stirling arrived in the ship *Parmelia*. The city of Perth was named after Perth city in Scotland, which was the birthplace of the Secretary of State George Murray (Aplin, 1987: 452). Rockingham is named after a ship belonging to Thomas Peel that was wrecked on the coast in the area in 1830 (Aplin, 1987:453-454). Garden Island, about five kilometres off Rockingham, received its name from Governor James Stirling probably around 1829 when he

offloaded settlers from the HMS *Parmelia* before going on to the mainland and proclaiming the colony (Aplin, 1987: 450). The name of Mandurah has an Aboriginal origin, meaning 'watering place,' or 'meeting place of tribes' (Aplin, 1987: 451). For much of its history, Rottnest about twenty kilometres offshore was a prison island. In 1696 Willem de Vlamingh named Rottnest Island after seeing the nests of Quokkas, small short-tailed wallabies he took for rats (Aplin, 1987: 454). Yanchep comes within the northern boundary of the City of Wanneroo. It was established as a tourist park in 1957. The website for the City of Wanneroo contains the following short history:

The City Of Wanneroo, with 48 kms of coastline, covers an area of 786 sq kms and has its southern boundary about 16 kms north of central Perth. In the early days of the Swan River Colony, the district represented an "outer" region and it was not until 1834 [five years after settlement of the Swan River Colony] than an excursion into the area by any explorers or settlers is recorded. In that year, a party of four, led by John Butler, travelled about 35 kms north from Perth to search for lost cattle, and passed through the area just east of Lake Joondalup. Four years later, renowned explorer George Grey also made an excursion northwards from Perth and passed along the shores of Lake Joondalup where the township of Wanneroo is now located ... The well-watered fertile land around the lakes near Wanneroo, though isolated, presented an attractive prospect. A partnership of Thomas Hester, James Dobbins and John Connolly took up the first holding in the district, around the southern shore of Lake Joondalup, in 1837-38 ... Other settlers to land in the area in the 1840's [sic] were William Rogers, Samuel Moore, George Shenton and James Cockman - but the development was confined to a narrow strip of about 2 miles width around the lakes ... There was little development other than farming close to the lakes until 1906, when the Government acquired land on the shores of Lake Joondalup and subdivided it into blocks of 80-100 acres, and also declared it a townsite. Three years earlier, a Road Board, set up under an Act relating to the roads outside municipal districts, was established initially as a road making authority. Its powers grew accordingly and remained in force until the Wanneroo Shire Council was created on July 5th, 1961 (City of Wanneroo, 2002).

Contact History

In the early 1830s, the official Native Interpreter, Francis Armstrong, made population estimates for some of the local Indigenous groups of the Perth coastal plain:

The total number, including women and children, who are in the habit of visiting Perth, Fremantle, Guildford and Kelmscott, are estimated at nearly 700; of whom the Interpreter can recognise, at sight, 400 at least. He averages a tribe to every ten miles square of country (Armstrong, 1836).

The 'weakening' of these local groups noted by Armstrong appears to have come about from a combination of disease and violence, the latter sometimes described in the oral tradition as 'massacres.' In 1832 whooping cough was prevalent, followed in 1833 by cholera (Green, 1979: 95). Green's table itemising 'Aboriginal and Settler Conflict in Western Australia, 1826-1852' in Green (1979: 75) has the following entries for one year alone, 1833:

30th of April Canning John & William Velvick speared at Bull Creek on High Road ...
 1st of May Swan Barracks 9 unarmed Aborigines shot at by soldiers. Soldiers shoot
 1 Aborigine and take 3 prisoners ... 5th of May Murray A brother of Midgegooroo
 shot by Hunts posse searching for Yagan ... May Midgegooroo captured along
 Helena River and executed in Perth ... June Upper Swan Yagan & Heegan shot by
 Keates brothers. William Keates speared.

Robert Menli Lyon arrived at the Swan River Colony in 1829 and took up land on the Swan River for a short time before leaving the colony in 1834. His description of Aboriginal 'tribal districts' in the region from 1832-1833 is among the first to be documented for the Perth coastal plain (Green, 1979: 141-142). Some of the local groups are acknowledged in present-day nomenclature, for example, 'Beeliam' for a major road running east from the Mitchell Freeway, Murray for the Murray River further south (see Attachments II: reproductions of Lyon's map).

Tindale writes that R. M. Lyon (1833) 'when dealing with the people in the immediate vicinity of Perth ... recognized groups on a hordal basis ... As he considered groups further away where he had less information, he recognized the larger units that are called tribes' (Tindale, 1974: 142). The 'horde' in anthropological usage usually denotes a local group, that is, 'the small group that owned and occupied a certain defined territory.' It was exogamous, that is, marrying out, and a number of hordes together may be called a tribe (Tindale, 1974: 16-17). The use of the word tribe by Armstrong and Lyon in this context appears to refer to the local group. Armstrong's observations were made within eight years after the establishment of the Swan River Colony, so we can be confident that he was reporting on pre-contact Aboriginal culture. Arguably the Noongar families that figure in the present-day in Heritage surveys, as Native Title applicant groups, and local associations or in cultural centres represent equivalents of the local group.

From the beginning, the Swan River and other watercourses were of vital importance to both the new settlers and Indigenous people as a communication route, and to the Indigenous people for whom it exerted strong spiritual significance as well, which value holds today.

Not only in a general sense, by utilising the same tracts of country, but in a very specific sense, by using the same network of nodes (at water sources) linked by tracks, the European pattern of land use was based on (and modified) the Aboriginal pattern (Hallam, 1975: 67).

J. E. Hammond uses a metaphor from the cattle industry by calling them 'pads':

All through the South-West there were pads of natives, like cattle pads, and just as plain ... If you take the present site of Perth as the starting point you will find that one pad led along the north bank of the river to where North Fremantle is today. There was very shallow water for more than halfway across the river and only a short distance to swim. The pad continued from this crossing to Bibra Lake, and through Rockingham to Mandurah, and then pads led up both sides of the Murray River to the ford over the river, above the present site of Pinjarra. It was at this ford that the battle of Pinjarra was fought (Hammond, 1933/1980: 17, 19).

Hammond wrote about Aboriginal-European rapprochement when his parents moved to Pinjarra to live in 1863: 'At this period all fear of natives had passed away and good friendship had been established' (Hammond 1933/1980: 11). But before then the settlers' activities severely restricted Indigenous movement and disrupted their traditional fishing areas, to the extent that early hostilities and shootings soon became commonplace. In 1833, two Aboriginal men were shot by firing squad, and in 1834 the South Perth mill was attacked (Green, 1984: 92).

Wanneroo & Yanchep Territory

Lyon's map, reproduced in Green (1984: 50), locates traditional Indigenous country taking in the Wanneroo and Yanchep areas as: 'Mooro, Yellowgonga's Territory.' In a chapter titled 'Yellagonga's Territory,' Neville Green asserts that:

Yellagonga's territorial boundaries were the Indian Ocean to the west, Melville water and the Swan River to the south, Ellen's Brook to the east, and to the north Gyngoorda which is probably the Moore River (Green, 1984: 49).

Green is evidently paraphrasing Lyon, including the *Gyngoorda* reference that is glossed also as the Moore River by Hallam and Tilbrook. Hallam and Tilbrook write that:

Yellowgonga headed the group which ranged over a wide area bounded on the west by the sea, on the southwest by the estuary of the Swan River, on the east by the swan from Perth northwards towards Guildford, and relatively indeterminate on the north ... the focal area of the group's resources lay along the ridge where the city centre of Perth now stands Lyon saw YELLOWGONGA as an important peacemaker (Hallam and Tilbrook, 1990: 349-350).

Yellowgonga is one of several notable Aboriginal family leaders (such as Midgegooroo, Munday and Yagan) with whom Armstrong, Lyons and other colonial figures had dealings in the 1830s. Daisy Bates records him as the father of her key informant Joobaitch:

There was Joobaitch of the kangaroo of Perth, a *Wordungmat* or crow-man, who had been born in Stirling's time, and was the son of that Yalgunga who ceded his spring on the banks of the Swan to Lieutenant Irwin (Bates, 2004: 64).

Yalgunga is also noted under the spelling of 'Yalgoonga' as Ya'-gan's brother (Bates, cited in Carter & Nutter, 2005: 22). However, Hallam and Tilbrook (1990: 349) observe that Bates provides no source for this knowledge. Armstrong records Yellowgonga as frequently visiting the ration depot stationed below Mount Eliza between 1836 and 1837 (Hallam and Tilbrook, 1990: 353), and in 1837 a man identified by Moore as Yellowgonga was said to have died from multiple spearing and to have received a large funeral. But an obituary in 1843 ascribed Yellowgonga's death to drowning after falling from the river bank (Hallam and Tilbrook, 1990: 353-354).

Continuities of the Sacred

The Rainbow Snake

The Swan River, the Canning River and their tributaries, as well as the Murray River further south, the Moore River to the north and the strings of coastal lakes interconnected through the water table, are regarded as sacred to the Rainbow Serpent, the *Wagyl*, by present-day Noongars. Belief in the Rainbow Snake as a creative Dreamtime being is widespread in Aboriginal Australia.

Sylvia Hallam points to the rich complex of associations between the *Wagyl* (which is the name of the Rainbow Serpent in the Noongar South West) and the chief physical elements of nature - fire, water, the sky, the earth - saying that, 'the connection of the serpent with water and also with dark caverns, are themes seen as recurring within and without the South-west of Australia' (Hallam, 1975:82). Descriptions of the Rainbow Serpent have a common core of beliefs about its qualities. It dwells deep within watercourses, waterholes, rivers and rock pools, and maintains the quantity and the quality of the drinking water. If a site closely associated with the Rainbow Snake is desecrated in any manner - and that includes virtually all places where there is water in significant quantities or, in arid areas, water courses albeit dry for most of the year - the persons responsible are in literal physical danger and the land itself is depleted, for the Rainbow Snake will go away.

Dreaming Tracks & Stories

The waterways are interconnected too with the Dreaming tracks of other beings. Dreaming tracks – sometimes called story lines – have been identified throughout the South West. A story line, as the term implies, usually concerns one or more creative spirit ancestor (and other human and non-human beings) that travelled across the landscape. During those travels, the ancestral spirits had encounters with one another and created land features such as the river systems, waterholes, hills and other natural features. The Dreaming story as told by Ken Colbung (dec) of the fight between Shark and Crocodile in Cockburn Sound: 'leaving the marks of their great battle in the landscape' (Colbung in Hill, 2006: 10-13) is a case in point. That tale with other characters (Whale, Waugal, Bush Turkey, Kangaroo, Emu) extends up the coast to the Yanchep area and on to the north (see below).

In Aboriginal Australia, a story line or Dreaming track often passes through the territories of local groups that together comprise 'tribes' or language groups, and is not known in its entirety by the people of any one place – except perhaps by knowledgeable senior men. The known 'episode' 'belongs' to one elder or more who reserve the right to tell/sing the story. Episodes of a longer story are shared during group meetings (connected with Law, ceremonial and ritual) during which one elder after another will sing/recite the part of the story that is their right. This means that although individuals may have a good knowledge of an episode, several episodes, or even a whole Dreaming story, they are not entitled to tell it to another without permission and formal performance because they do not 'own' it. This would have applied in the instances recorded by Daisy Bates.

The sea too has significance to Indigenous people. Daisy Bates notes that:

The Aborigines along the whole line of Western coast believe that when the body dies, the spirit goes away westward through the sea to some country far away, and that there the spirit lives in much the same manner as it has lived when in the flesh ... In the Swan district, Joobaitch, the last Perth man, stated that when his people died, their *kaanya* of spirit went away over the sea to another country, called Koorannup or Woordanung (Bates, 1985: 222).

The Wanneroo area should be seen in a wider context as not only part of nearby stretches of coastline north and south or with the river and lake systems such as that of the Swan and lakes Joondalup and Neerabub (Neerabup), but also as associated intrinsically with the sea and the seabed. Cockburn and other Indigenous centres lie on the east-west route between the world of the living and that of the dead. In 'Legend of the Christmas Bush,' Daisy Bates writes:

A winding tribal road lay from their kalleep (home, ground) to the sea's edge and all along the ground under the sea to a point on the Kurannup shore where the spirits of their people who had preceded them lived and dwelt under the same conditions as they had lived in their earthly kalleep, except that all their Kurannup people were white (Bates, 1992:153; my emphasis).

According to Bates's interpretation, Dreaming tracks in the mythology about an afterlife literally cross the seabed.

A Dreaming story, summarised by Moore, recounts how the islands were cut off from the mainland by the sea:

The natives have a tradition that Rottneest, Carnac, and Garden Island, once formed part of the mainland, and that the intervening ground was thickly covered with trees; which took fire in some unaccountable way, and burned with such intensity that the ground split asunder with a great noise, and the sea rushed in between, cutting off these islands from the mainland (Moore, 1884: 8, cited in Hallam, 1975:112).

In this creation tale, Hallam suggests the 'echo' of rising sea levels that took place around 5000 years ago (ibid.). But Mulvaney and Kamminga, while finding the Rottneest Island story 'intriguing' and 'attractive to prehistorians,' are sceptical about whether such creation myths can be taken as 'factual records of environmental changes' hundreds of generations back. They imply that oral traditions are closer to the present day, their purpose being to instruct younger generations (Mulvaney and Kamminga, 1999: 121).

One can add that to the storytellers and their listeners such accounts may be received as fact. Dreaming stories are an integral part of the Indigenous belief system about the nature of the world and of existence. What these examples tell us is that, as well as the sea westwards being associated with the Land of the Dead, Dreaming tracks extend to the offshore islands. According to Green's map showing 'Place names and territories as told to Robert Lyon by Yagan in 1832,' Garden Island was called Meeandip, Carnac Island Ngooloomayup, Rottneest Island Wadjemup, and Fremantle Walyalup (Green, 1984: 50). (See Plate 1).

Present-day Noongar oral history confirms the importance of the coast, the sea and the islands. Several Noongar elders recount Dreaming stories for the coast from Fremantle to Yanchep. In one version Crocodile, Shark and Whale encountered one another. Their fighting altered different parts of the landscape. Whale is associated with sand dunes at Leighton Beach. Shark and Crocodile fought in Coburn Sound until the Creation Snake 'Waugal' intervened. Crocodile on Waugal's advice travelled to Yanchep where he metamorphosed into Emu (Waitj). (Colbung in Hill, 2006:10-13). In another Dreaming story, a fight between Crocodile and Waugal broke up the land and created Rottnest, Garden and Carnac islands (Wilkes in Hill, 2006: 14-15). The Waugal is regarded as having created the sand dunes that follow the coast, as for all land features:

The Waugal created the water systems, the rivers, the swamps, the soaks and springs and the big body of water that lies under the ground. These were created to keep the swamps and springs and waterholes wet during the dry part of the year. During the wet season the rains falling around York, Toodyay, Northam and the other places further up in the wheat belt comes back into the Swan River plain and replenishes the underground water which then keeps the springs, soaks, wetlands and waterholes going in the metropolitan area (Albert Corunna in Hill, 2006: 18).

Concerning lakes and caves in the coastal zone that takes in Wanneroo, Yanchep and other nearby areas, there is additional evidence from European observers for their importance in other examples, cited by Hallam. In the first decades of European settlement the lakes and swamps of the coastal plain were heavily exploited as food sources by the local Aboriginal people:

Grey adds to the products of the full and late summer to early autumn several which would take the Aborigines regularly to the lakes and swamps which occur in lines through the inter-dunal valleys of the Aeolian limestone belt, and behind in the sandplain zone. Freshwater tortoises were in high season in December and January when the lakes had shrunk. Fish abounded. Large flocks of waterfowl were skilfully felled with throwing sticks or spears – Lake Neerabub was 'covered with wildfowl' at this season. Frogs and 'freshwater shellfish' from the size of 'a prawn to a large crayfish' (Grey here intends crustaceans, not molluscs) were most easily taken 'when the swamps are nearly dried up ...' (Grey 1841:I, 292-7). (Hallam, 1975:39).

In regard to Indigenous spiritual beliefs, Hallam states that: 'For the area around Perth Landor recounts tales of two spirits, one associated specifically with the pools and limestone caverns of the Yanchep area' (Hallam, 1975: 83).

Beside *Chingi*, the evil spirit who haunts the woods, there is another in the shape of an immense serpent, called *Waugal*, that inhabits solitary pools ... One day, whilst bivouacking in a lonely and romantic spot, in a valley of rocks, or Abode of Dogs, I desired a native to lead my horse to a pool, and let him drink. The man, however, declined with terror (Landor, 1847: 210-211; cited in Hallam, *ibid.*).

Another citation comes from George Grey reporting for December 1838. It corroborates (and predates) the first:

I left the main party with two natives, and travelled up a swampy valley, running nearly in the same line as the chain of lakes we had followed in going [north]. The natives insisted on it, that these lakes were all one and the same water; and when, to prove to the contrary, I pointed to a hill running across the valley, they took me to a spot in it, called Yun-de-lup, where there was a limestone cave, on entering which I saw, about ten feet below the level of the bottom of the valley, a stream of water running strong from S. to N. in a channel worn through the limestone. There were several other remarkable caves about here, one of which was called Doorda Mya, or the Dog's house (Grey, 1841: I, 308-309).

Contemporary Context

The Wanneroo area was widely used in pre-contact times and in the immediate years following contact. The Dreaming stories associated with the many natural features of the coast from Mandurah to Yanchep are highly significant and the subject of the struggle to protect and preserve Noongar heritage.

Spiritual connections are just as important now as they were in the past, Noongar people today maintain connection to the Wanneroo area, as well as for many other areas in the Perth Coastal Plain. They continue to hunt and gather bush food, continue to pass on knowledge to the younger generations, and continue to revisit certain locales for spiritual refreshment and to look after the land.

There are continuing associations between Noongar families and the areas where they have lived for generations, as well as their homelands. They still consider waterways as highly significant, continue to pass on cultural knowledge to the younger generations maintain cultural practices.

Mariginiup

This suburb is named after Mariginiup Lake. The lake name was recorded by surveyors in 1844, and in 1904 a townsite was declared here. This Aboriginal name is said to possibly mean "to pull out flag leaved flax". It was named as a locality in 1982 (Landgate).

Plate 1: Robert Lyon's Map with Place Names given by Yagan to Lyon in 1832 (see Green, *Broken Spears*, 1984: 50).

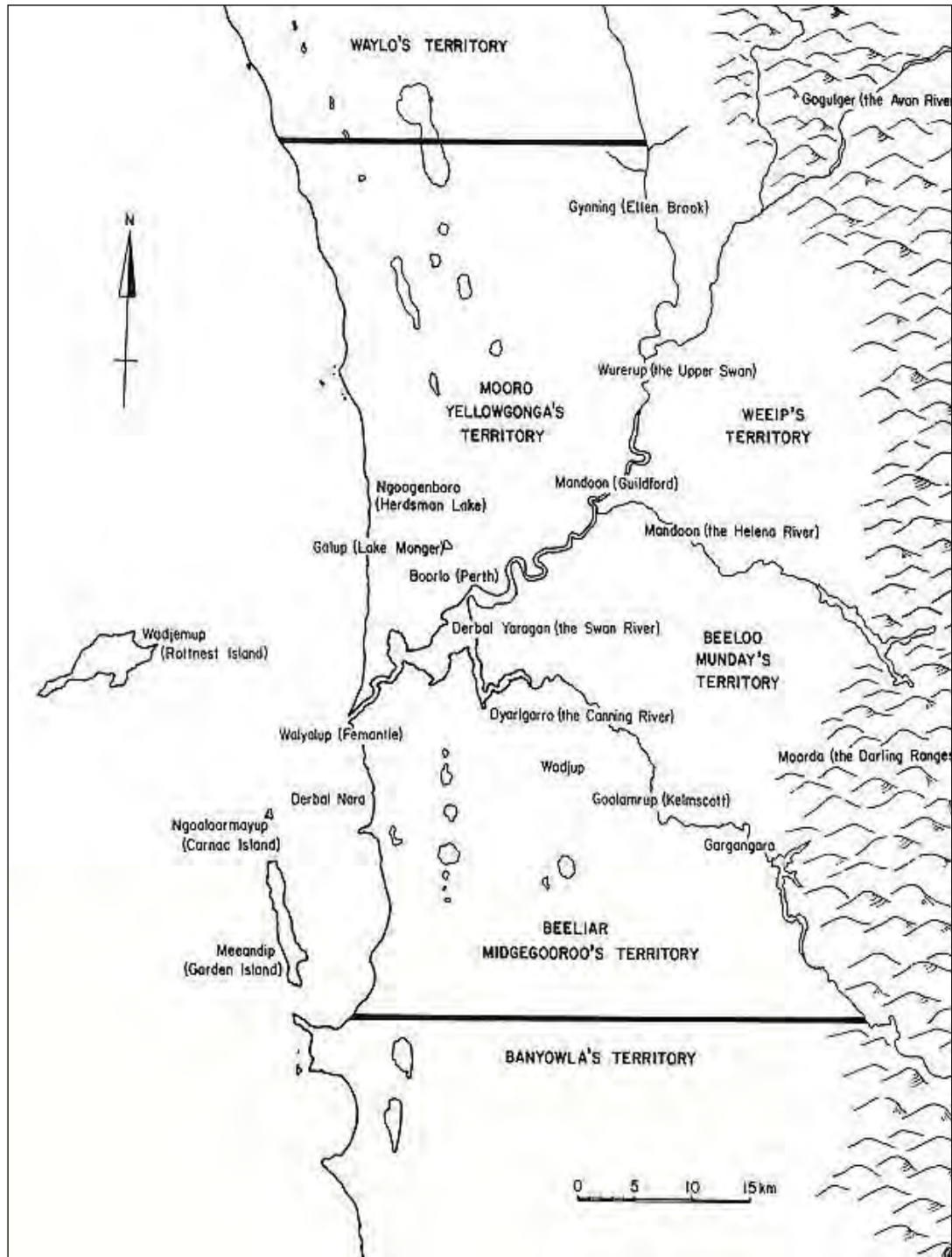
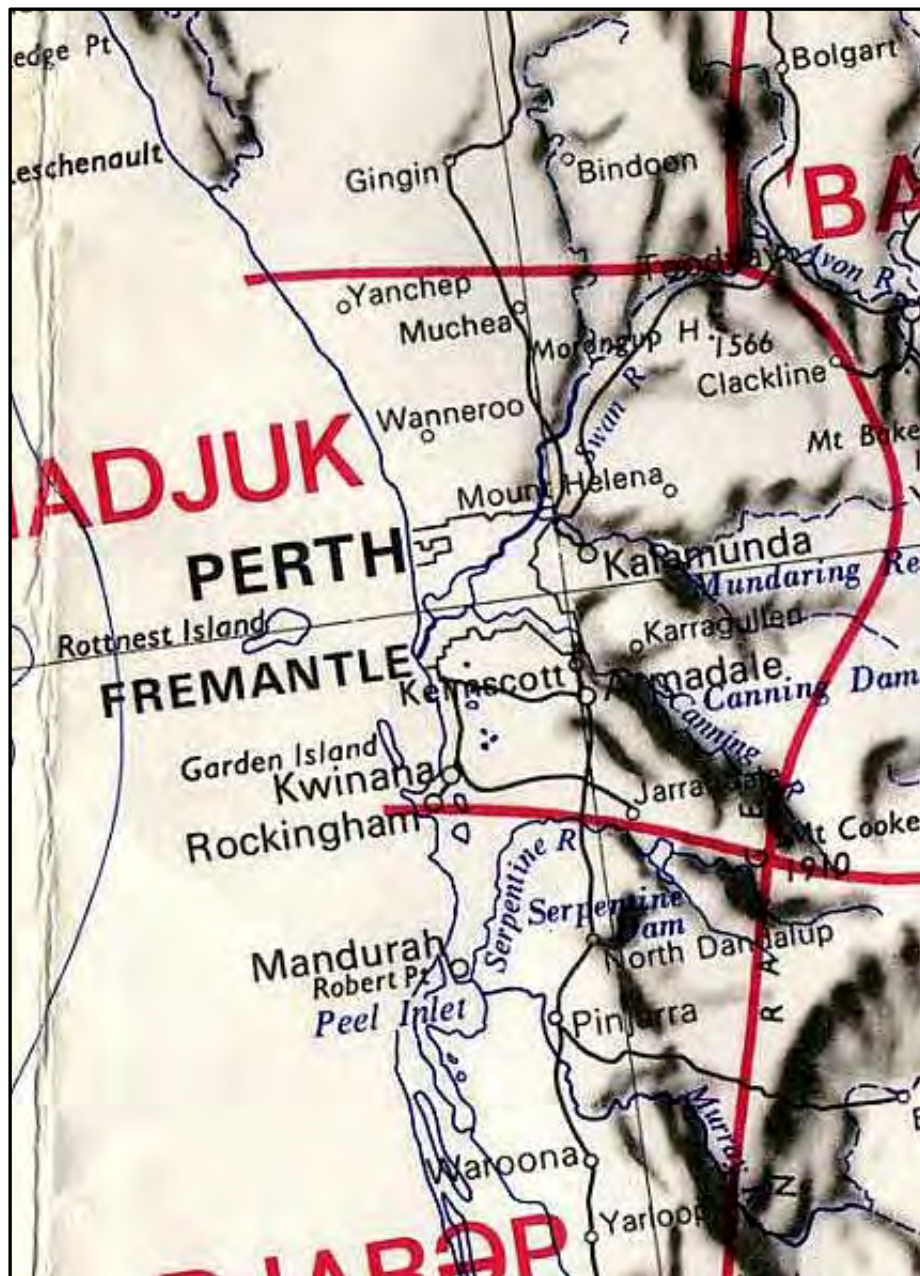


Plate 2: Tindale: The Swan Coastal Plain



6 ARCHAEOLOGICAL BACKGROUND

The increased rate of urbanisation in the Perth metropolitan area has resulted in substantial disturbance to original environmental contexts. This directly affects the likelihood of locating further intact surface archaeological material. Despite this, an indication of potential Aboriginal heritage within the vicinity of development may be derived from examining the original environmental context and ascertaining what sites have previously been reported from such land units, as well as what has been reported by previous research conducted in the surrounding area.

The primary source of archaeological information for Perth and the surrounding areas comes from the Perth Archaeological Survey undertaken by Hallam in the 1970s which covered a section of Perth from the coast to the Darling Scarp (Hallam 1986). Over 380 sites were located and the survey remains the most extensive research yet undertaken for the area.

The survey attempted to explain the variations in occupation patterns of pre-contact Aboriginal groups. Four phases of usage were suggested for the plain:

- **Early:** low numbers of sites with artefacts including steep scrapers and the use of Eocene fossiliferous chert. This period extended from the Pleistocene to 5,000 years BP.
- **Middle:** from 5,000 BP to 500 years ago. Sites usually found close to permanent water. Artefacts are made of quartz and chert and include backed blades, adzes, scrapers and flakes.
- **Late:** from 500 years ago. Sites cluster on the coastal plain. Bipolar cores and artefacts manufactured on quartz dominate assemblages.
- **Historic:** from 1829 onwards. Assemblages include artefacts made on post-contact material such as glass, pottery and ceramics.

The study suggested some initial patterning of site locations in the metropolitan area. Few sites were found on the coastal dunes or in the limestones west of the Spearwood Dunes. The majority of sites were found on elevated dunes or sandy ridges near the margins of creeks, swamps and wetlands associated with the Bassendean Sands. The wealth of natural resources associated with these environments was the focus of seasonal attention. Most sites were surface scatters of artefacts (commonly made of quartz), usually found in open sands near water sources.

Strawbridge (1988:34) developed a model of occupation for the Swan Coastal Plain on the basis of this research, which indicated that:

- Archaeological sites are likely to be situated on sandy well-drained dune ridges (the Bassendean Sands or thin Bassendean Sands over Guildford Formation);
- Archaeological sites are likely to be found within 350 m of a potential water source;
- Archaeological sites are unlikely to be located in low-lying, poorly drained or seasonally inundated areas; and

- Archaeological sites are unlikely to be located more than 350 m away from a potential water source.

The lakes and wetlands of the Swan Coastal Plain and the Swan River itself clearly provided an abundant supply of food and resources for the Noongar people. The records of the early settlers (Hammond 1933; Grey 1841) indicate that the chain of lakes which extended from Geraldton to Mandurah formed a major highway of movement for people along which a rich social and ceremonial life was enacted at the appropriate time of year.

Although few sites in the metropolitan area have been dated, most of them are located in the Swan Valley and Darling Scarp area (Walyunga, Helena Valley, and Brigadoon). Dates of between 32,000 and 38,000 years BP have been claimed for terraces on the Upper Swan River (Pearce and Barbetti 1981). A date of 9,930 years BP was obtained from Minim Cove on the Swan River (Clarke and Dortch 1977). More recent mid to late Holocene dates with a range of 6,000-1,000 years BP, have also been derived from the Bassendean Sands (Pearce 1977).

7 ABORIGINAL CULTURAL HERITAGE INQUIRY SYSTEM RESEARCH

A search of the Department of Planning, Lands and Heritage (DPLH) online Directory of Aboriginal Places; the Aboriginal Cultural Heritage Inquiry System (ACHIS) was conducted on the 19th of July, 2023. This search was used to provide contextual Aboriginal heritage information for inclusion and evaluation within the LSP desktop assessment area.

The research determined both the ethnographic and archaeological Aboriginal places within the project area and the nature and frequency of Aboriginal heritage surveys undertaken. In turn, the potential impact of the LSP upon these places and the likelihood of identifying additional places, values and heritage issues were assessed in preparation of this desktop research.

7.1 DPLH Aboriginal Cultural Heritage Inquiry System Results

Terminology

Access and Restrictions:

Boundary Reliable (Yes/No): Indicates whether the location and extent of the ACH boundary is considered reliable.

Boundary Restricted = No: ACH location is shown as accurately as the information submitted allows.

Boundary Restricted = Yes: To preserve confidentiality the exact location and extent of the place is not displayed on the map. However, the shaded region (generally with an area of at least 4km²) provides a general indication of where the ACH is located.

Culturally Sensitive = No: Availability of information that the Department of Planning, Lands and Heritage holds in relation to the ACH is not restricted in any way.

Culturally Sensitive = Yes: Some of the information that the Department of Planning, Lands and Heritage holds in relation to the ACH is restricted if it is considered culturally sensitive information. This information will only be made available if the Department of Planning, Lands and Heritage receives written approval from the people who provided the information.

Culturally Sensitive Nature:

- **No Gender / Initiation Restrictions:** *Anyone* can view the information.
- **Men only:** Only *males* can view restricted information.
- **Women only:** Only *females* can view restricted information.

Status:

- **ACH Directory:** Aboriginal cultural heritage place or cultural landscape.
- **Pending:** Aboriginal cultural heritage place or cultural landscape with information in a verification stage.
- **Historic:** Aboriginal heritage places determined to not meet the criteria of Section 5 of the Aboriginal Heritage Act 1972. Includes places that no longer exist as a result of land use activities with existing approvals.

ACH Type:

- **Cultural Landscape:** a group of areas interconnected through the tangible elements of Aboriginal culture heritage present.
- **Place:** an area in which tangible elements of Aboriginal cultural heritage are present.

Place Type: The type of Aboriginal cultural heritage place. For example, an artefact scatter place or engravings place.

Legacy Place Status: A status determined under the previous *Aboriginal Heritage Act 1972*:

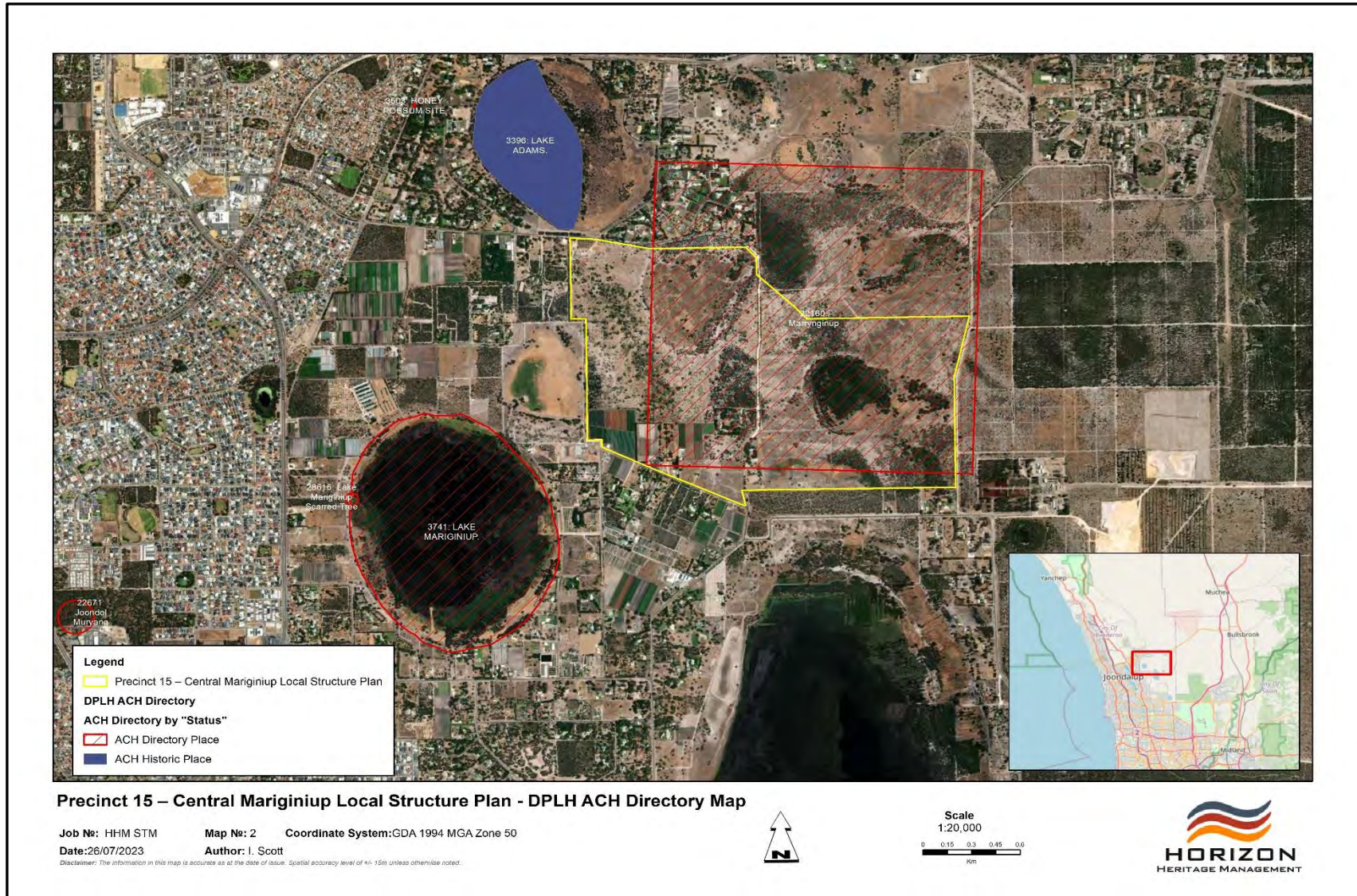
- **Registered Site:** the place was assessed as meeting Section 5 of the *Aboriginal Heritage Act 1972*.
- **Lodged:** Information was received in relation to the place, but an assessment was not completed to determine if it met section 5 of the *Aboriginal Heritage Act 1972*.
- **Stored Data/Not a Site:** The place was assessed as not meeting Section 5 of the *Aboriginal Heritage Act 1972*.

Legacy ID: This is the former unique number that the former Department of Aboriginal Sites assigned to the place.

There is one Place identified on the DPLH ACHIS (see Section 11) as potentially being located within the Precinct 15 Central Mariginup LSP desktop assessment area. 22160 Marrynginup has a large, closed polygon which restricts publicly displaying its reliable location and place boundary (see Map 4). Esandra Colbung (site custodian) gave Horizon Heritage permission to access and reveal the actual site boundary as administered under the ACHA for 22160 Marrynginup (see Maps 5 & 6).

The location of places on the ACHIS is sometimes unreliable. Many places were originally located prior to the availability of Global Positioning Systems. Conversion from imperial to metric mapping coordinates and the recording of coordinates via map grid to the nearest kilometre has introduced further possibilities for error. Also, human error with inputting or converting data accurately is another risk.

Map 4: 22160 Marraynginup restricted location boundary intersecting LSP area



(WARNING: Restricted Information on pages 30 -31)

DPLH ACHIS Results

The following Place has a restricted (public view) and actual boundary (as administered under the ACHA) which intersects with the Central Mariginup LSP desktop assessment area:

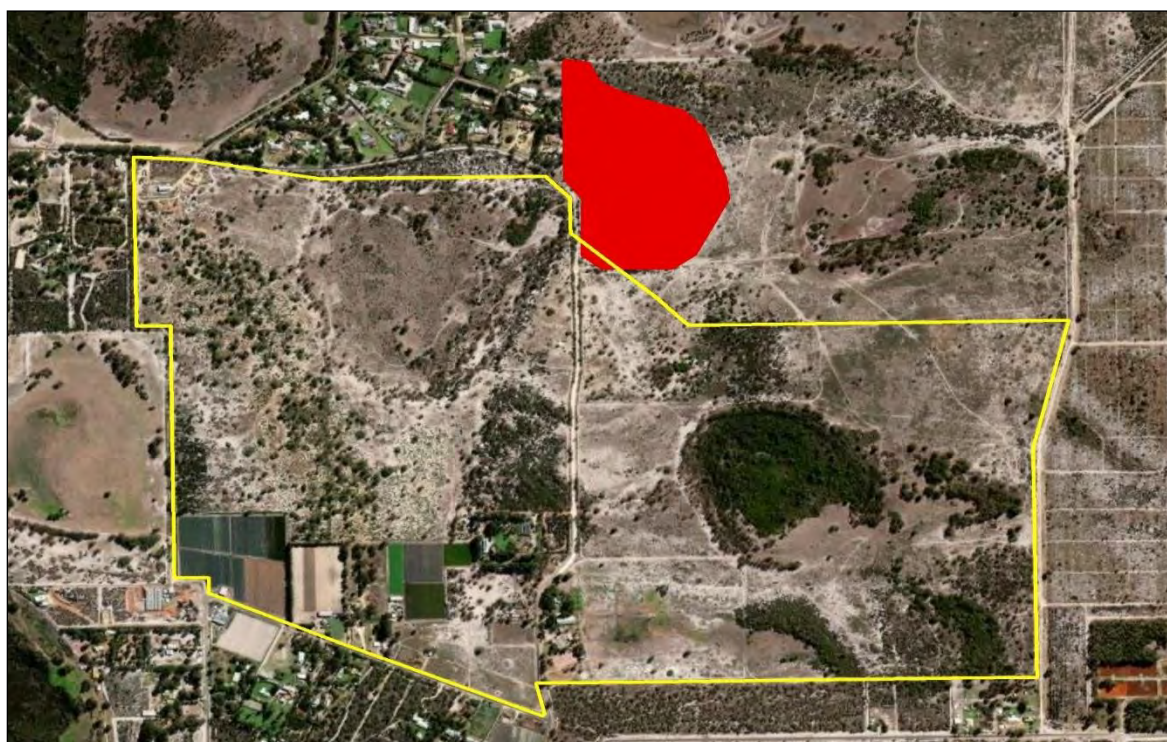
Table 2: Place within the LSP desktop assessment area

DPLH PLACE ID	PLACE NAME	PLACE TYPE	STATUS	LOCATION
22160	Marrynginup	Artefacts / Scatter, Ceremonial, Historical, Midden / Scatter, Modified Tree, Camp, Hunting Place, Meeting Place, Named Place, Natural Feature, Plant Resource, Water Source, Other: Healing Pits	CLOSED	Not available when location is restricted

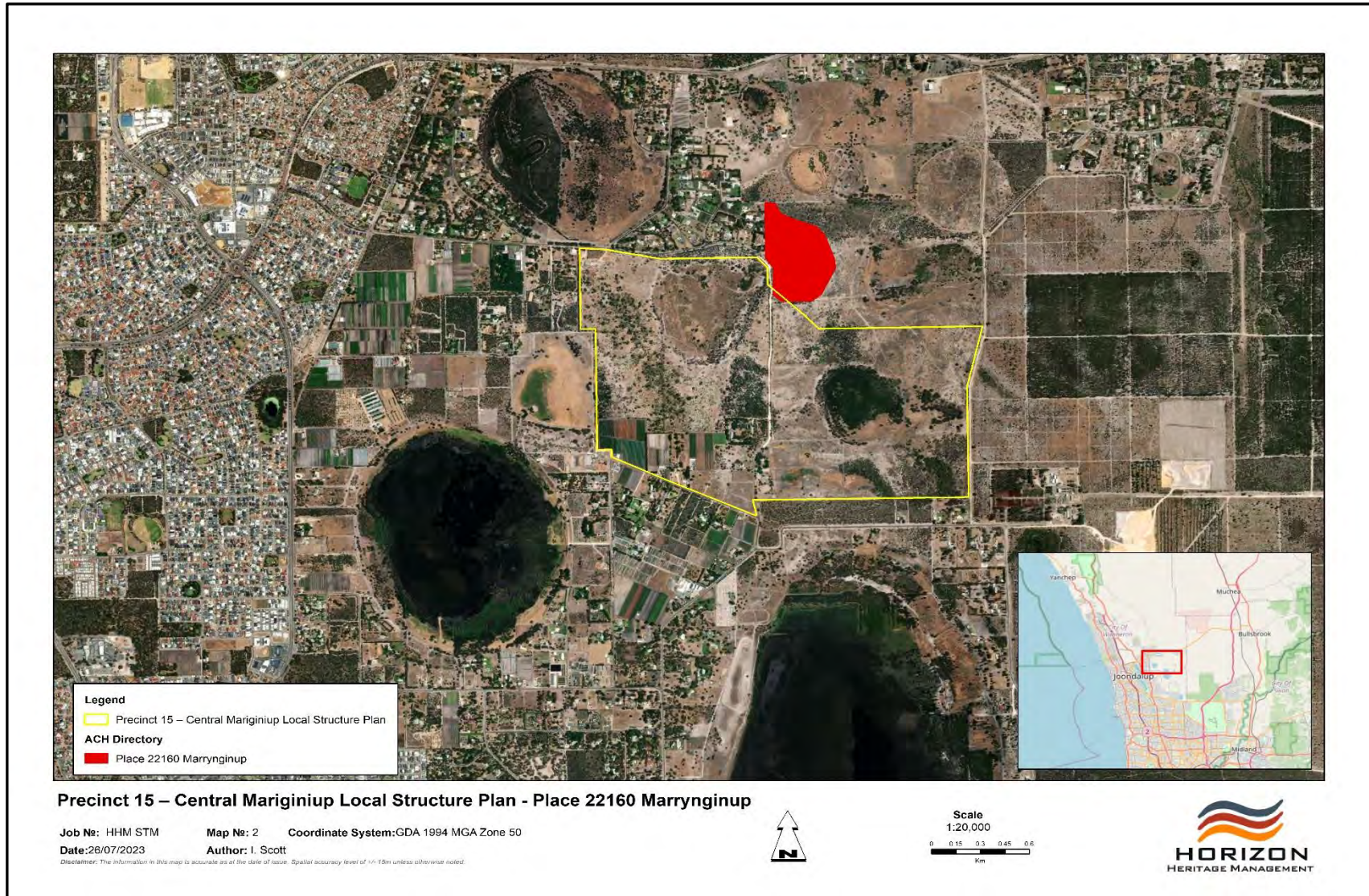
22160 Marrynginup

22160 Marrynginup is a very significant and sensitive area. Only basic site information will be used due to the closed restriction of the site information. The site is a healing area (flower baths) which is very important for Aboriginal spiritual health and cultural well-being. The original site informant Mr Ken Colbung (dec) stated that the continued maintenance of this bushland is essential to ensure the ongoing ceremonial use by Aboriginal Elders. The current custodian of the site is Esandra Colbung (daughter).

Map 5: 22160 Marrynginup ACH place boundary close up view



Map 6: 22160 Marrynginup ACH Place boundary as administered under the ACHA



DPLH ACH Directory Places

The eight ACH Directory (Aboriginal cultural heritage place or cultural landscape) Places detailed below have been chosen for inclusion in this desktop to demonstrate that important Aboriginal cultural places, features, and materials are still found within heavily developed and urbanised residential areas.

The following eight ACH Directory Places are located within proximity to the Precinct 15 Central Mariginiup LSP desktop assessment area:

Table 3: DPLH ACH Directory Places within proximity to the LSP desktop assessment area

DPLH PLACE ID	PLACE NAME	PLACE TYPE	STATUS	LOCATION
3741	Lake Mariginiup	Mythological, Hunting Place	ACH Directory	387858mE 6489483mN [Reliable]
3503	Honey Possum Site	Mythological	ACH Directory	387422mE 6493112mN [Reliable]
3657	Wanneroo Scarred Tree	Modified Tree, Other:	ACH Directory	386149mE 6486487mN [Reliable]
3316	Lake Joondalup West	Artefacts / Scatter	ACH Directory	383972mE 6488885mN [Reliable]
3740	Lake Joondalup	Mythological, Camp, Hunting Place	ACH Directory	384995mE 6486531mN [Reliable]
3532	Joondalup Caves	Mythological	ACH Directory	Not available when location is restricted
17498	Waugal Cave, Neil Hawkins Park	Modified Tree, Mythological, Water Source, Other: Cave	ACH Directory	384284mE 6487403mN [Reliable]
28616	Lake Mariginiup Scarred Tree	Modified Tree	ACH Directory	387238mE 6489695mN Zone 50 [Reliable]

3741 Lake Mariginiup

3741 Lake Mariginiup is protected under the ACHA. The ACHIS lists the place type as Mythological and Hunting Place. Wetlands across the Swan Coastal Plain are spiritually significant to the Whadjuk Noongar People as *Waugal* connections and were used extensively in traditional times. Many lakes and swamps were used as hunting (turtle and wildfowl) and gathering areas for flora and fauna.

Lake Mariginiup has mythological (*Waugal* association) and shows connection to the subterranean Gngangara mound. Lake Mariginiup was formed by the creative activities of the *Waugal* whose spiritual essence still exists there. The significance of water to Whadjuk Noongar People has been well documented in heritage surveys in the Perth Metropolitan area and broader south-west region, with numerous rivers (and often their tributaries), creeks, brooks, wetlands and swamps having been recorded as sites. Lake Mariginiup is a significant mythological, landscape and camping area to the Whadjuk Noongar People.

3503 Honey Possum Site

3503 Honey Possum Site is protected under the ACHA. The ACHIS lists the place type as Mythological. The site is a mythological storied place regarding the Honey Possum (noobenger) a tiny marsupial and associated with the banksia vegetation (10 hectares) where it lives.

3657 Wanneroo Scarred Tree

3657 Wanneroo Scarred Tree is protected under the ACHA. The ACHIS lists the place as a Modified Tree. The Wanneroo Scarred Tree is a Jarrah tree with two scars near its base. There was doubt as to whether the scars are from Aboriginal or non-Aboriginal origin.

3316 Lake Joondalup West

3316 Lake Joondalup West is protected under the ACHA. The ACHIS lists the place type as an Artefact Scatter. It was recorded by S Hallam in 1973 while undertaking the Swan Area Archaeological Survey. A total sample (salvage) of all 18 artefacts was undertaken at the time of recording, with the majority comprising quartz. Gary Quartermaine investigated the site in 1989 and reported 17 artefacts noted within 25 m of the lake shore and that they were likely uncovered by erosion since Hallam's collection from the site. Thus, the site has some potential for sub-surface cultural material.

3740 Lake Joondalup

3740 Lake Joondalup is protected under the ACHA. The ACHIS lists the place type as Mythological, Camp and Hunting Place. Lake Joondalup is a permanent lake in the northern suburb of Joondalup in Perth. It is known to have been a favoured Noongar camping area in traditional and more recent times. It was also a resource area where turtle and wildfowl were hunted.

Lake Joondalup was formed by the creative activities of the *Waugal* whose spiritual essence still exists there. The significance of water to Whadjuk Noongar People has been well documented in heritage surveys in the Perth Metropolitan area and broader south-west

region, with numerous rivers (and often their tributaries), creeks, brooks, wetlands and swamps having been recorded as sites. Lake Joondalup is a significant mythological, landscape and camping area to the Whadjuk Noongar People.

The area around Lake Joondalup was called Joondal (crayfish) and the area was a significant place mainly because there was plenty of food and covering for winter. A Noongar story is also associated with Malup Island within Lake Joondalup.

3532 Joondalup Caves

3532 Joondalup Caves is protected under the ACHA. The ACHIS lists the place type as Mythological. The caves lie 80 m west of Lake Joondalup and are believed to be the result of the Waugal and could connect to the ocean. The caves are within the Yellagona Regional Park. It was speculated that the deposit in the cave floor may contain cultural material.

17498 Waugal Cave, Neil Hawkins Park

17498 Waugal Cave, Neil Hawkins Park is protected under the ACHA. The ACHIS lists the place type as Mythological, Modified Tree, Water Source and Other: Cave. The cave is believed to be the result of the Waugal and could connect to the ocean.

28616 Lake Mariginiup Scarred Tree

28616 Lake Mariginiup Scarred Tree is protected under the ACHA. The ACHIS lists the place type as Modified Tree. The tree is an old eucalypt tree with an oval shaped scar on the trunk. The Aboriginal representatives present requested the tree be recorded although the archaeologists had doubts to its origin.

DPLH Historic Places

The following two Historic (Aboriginal heritage places determined to not meet the criteria of Section 5 of the Aboriginal Heritage Act 1972. Includes places that no longer exist because of land use activities with existing approvals) Places detailed below have been chosen for inclusion in this desktop to demonstrate that important Aboriginal cultural places, features and materials are still found within heavily developed and urbanised residential areas.

The following two Historic Places are located within a reasonable proximity to the Central Mariginiup LSP desktop assessment area:

Table 4: DPLH Historic Places within proximity to the LSP desktop assessment area

DPLH ID	PLACE NAME	PLACE TYPE	STATUS	LOCATION
3396	Lake Adams	Mythological, Hunting Place, Plant Resource, Water Source	Historic Stored Data / Not A Site	388348mE 6492052mN Zone 50 [Unreliable]

3514	Payne Road	Artefacts / Scatter	Historic Stored Data / Not A Site	395439mE 6491349mN [Reliable]
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3396 Lake Adams

3396 Lake Adams is a historic place under the ACHA. It was assessed under Section 5 of the old AHA and had a status as Stored Data / Not a Site. The ACHIS lists the place type as Mythological, Hunting Place, Plant Resource and Water Source. Lake Adams is associated with the Black Cockatoo Dreaming and was reported to have a plentiful supply of turtles and other fauna and flora resources.

3514 Payne Road

3514 Payne Road is a historic place under the ACHA. It was assessed under Section 5 of the old AHA and had a status as Stored Data / Not a Site. This place was a small low density quartz artefact scatter situated on the margins of a small swamp area within the Gngara Pine Plantation. The site dimensions are 20 x 40 m with only 3 quartz artefacts recorded. The site did have some potential for sub-surface cultural material.

DPLH Heritage Survey Reports:

No specific Aboriginal heritage surveys have been undertaken within the Precinct 15 Central Mariginiup LSP desktop assessment area. There are three heritage survey reports lodged with the DPLH which are considered relevant to the LPS desktop assessment area and are detailed below:

Table 5: DPLH Heritage Survey Reports

DPLH HSR ID	REPORT TITLE	AUTHOR
102670	Preliminary Report on the Survey of Aboriginal Areas of Significance in the Perth Metropolitan and Murray River Regions.	O'Connor, R., Bodney, C. and Little, L
104379	Final Report on the Project: Prehistoric Aboriginal Populations on the Swan Coastal Plain, WA.	Hallam, S. J
104505	Aboriginal Sites in the Perth Metropolitan Area: a Management Scheme.	Strawbridge, L

DPLH HSR 102670

O'Connor, R., Bodney, C. and Little, L. 1985 *Preliminary Report on the Survey of Aboriginal Areas of Significance in the Perth Metropolitan and Murray River Regions*. Unpublished report for the Department of Aboriginal Sites.

This report was part of a project to produce a management plan concerning Aboriginal sites in the Perth metropolitan region. The project involved an analysis of the existing body of archaeological data by Strawbridge (HSR 104505) and this report, which outlined the ethnographic survey. The ethnographic component discussed significant sites in terms of their

importance to Aboriginal groups today and/or their potential contribution to an understanding of Aboriginal culture. The aim of the project was to provide guidelines for development in the belief that aims of development and conservation of Aboriginal sites (archaeological and ethnographic) need not be directly opposed. This report discusses the mythology and significance of DPLH 3692 Bennett Brook: in toto and DPLH 3840 Bennett Brook: Camp Area, as well as details the location of DPLH 3744 Marshalls Paddock. It is closed due to the sensitive information contained about these and other ceremonial and mythological sites in the Perth metropolitan region.

DPLH HSR 104379

Hallam, S. J. 1986. *Final Report on the Project: Prehistoric Aboriginal Populations on the Swan Coastal Plain, WA*. Unpublished report for Australian Research Grants Scheme.

This study was funded under the Australian Research Grants Scheme. The objective of the study was to examine patterns of Aboriginal occupancy of the Swan River area 'as successive states within an ongoing system' (1986: 1) in particular, relating population to resources. To this end, rather than utilising a site-centred approach, patterns of occupancy over wide areas and their changes over time were emphasised. Based on lithological and typological criteria, Hallam divided the phases into four: Early, Middle, Late and Final. The Early phase was characterised by the presence of bryozoan chert marking a time before sea levels rose to their current levels (approximately 5,000 years ago). The Middle phase was determined by the presence of backed-blades which led to the Late phase marked by numerous, quartz-rich assemblages featuring all the technological characteristics. The Final phase is represented by the use of European materials such as glass and ceramic. As a result of the study, Hallam concluded that the coastal plain is 'extremely rich in sites' with the bulk of sites located around the lakes and swamps of the coastal sand plain. Environmental change over time impacted upon occupancy patterns in each phase.

DPLH HSR 104505

Strawbridge, L. 1988 *Aboriginal Sites in the Perth Metropolitan Area: a Management Scheme*. Unpublished report for the Department of Aboriginal Sites.

This report consists of the archaeological component of a study of the Aboriginal sites in the Perth Metropolitan area (the ethnographic component is O'Connor, *et. al.* 1985). The predictive model resulting from this study demonstrated that sites in the Perth area were most commonly located on sandy and well-drained dunes located on the Bassendean Sands, within approximately 350 m of water sources. Following a review of research on the Swan Coastal Plain, Strawbridge (1988) proposed a series of archaeological research questions relating to themes of site formation processes, site distribution and environmental changes, and changes in stone tool technology.

7.2 Summary Discussion

No Aboriginal heritage surveys have been conducted within the Precinct 15 Central Mariginiup LSP desktop assessment area. Numerous heritage surveys have been undertaken within the broader City of Wanneroo. The increased rate of urbanisation in the Perth area and connected developments has resulted in great disturbance to the original environmental

contexts. This directly affects the likelihood of locating further surface Aboriginal cultural material (archaeological). The natural environment has been heavily disturbed with vegetation clearing and the development of the broader City of Wanneroo area.

Despite this, an indication of potential Aboriginal heritage within the LSP area may be derived from looking at the local environment and ascertaining what sites have previously been reported from such land units, as well as what previous research conducted in the surrounding area has reported.

The rivers, pools and wetlands were a consistent source of food and water which also often linked campsites along walking tracks and places of mythological and spiritual significance. In the South West of Western Australia the Rainbow Serpent or *Waugal* is central to Noongar cultural beliefs. Noongars believe that the *Waugal* is both a creative force, shaping the landscape during *Nyittiny* (creation times) and a retributive force having the ability to harm, particularly against those who offend it by not carrying out their cultural responsibilities in protecting country, especially water sources. Creation time stories remain in the oral tradition of many Whadjuk Noongar families. It is these set of associations that concern contemporary Whadjuk Noongar people.

Lake Mariginiup (3741) as a natural feature, water source and mythological associations with the *Waugal* makes it a highly significant place. Its maintenance and protection is vital to help preserve Whadjuk cultural heritage values. The rivers, pools and wetland areas of the Perth metropolitan area was part of an extensive communication network that linked Aboriginal groups across the Swan Coastal Plain with other Noongar groups to the north (Yued), south (Gnaala Karla Boodja) and east (Ballardong).

Whadjuk Noongar people have concerns that their culture cannot continue if the natural environment is destroyed. Natural resources are integral to the maintenance, continuance, and transmission of Whadjuk Noongar culture. The Whadjuk Noongar's close connection with *boodja* (country) forms the foundation for much of their culture, spirituality, and identity.

Through ethnographic research Mariginiup was an important area for Aboriginal People both in prehistoric times through mythological sites and after colonisation as occupation areas. This area would have most likely been utilised by Whadjuk people to exploit the natural resources found in and around Lake Mariginiup. There is numerous ethnographic evidence that the broader area was also utilised as a camping area by families due to its proximity to wetlands and lakes.

The desktop research shows that the Mariginiup area is an important area for Aboriginal people both historically and in the present. Mariginiup is a very important mythological area to the Noongar people and a resource that provided both food and water and therefore an important area for camping and occupation. The area also became important historically as during the development of the Perth, Aboriginal people were forced out of the metropolitan area and into areas like the Wanneroo. The numerous lakes and wetlands (Little Mariginiup Lake, Lake Mariginiup, Jandabup Lake, Lake Adams, Little Dunbar Swamp, and Lake Joondalup) were areas in Wanneroo where Aboriginal people could live and conduct traditional practices. Previous reports have indicated that the broader areas all around

Mariginiup were used traditionally for camping and hunting. Numerous Noongar fringe camps have previously been identified within Wanneroo; potential remains for contemporary Whadjuk people to hold knowledge of any possible Whadjuk land use of the LSP desktop assessment area.

The archaeological results of this desktop assessment do not accurately reflect the historic and prehistoric Aboriginal occupation of the Mariginiup area and instead reflects the somewhat disturbed (rural land use) nature of the area. The types of archaeological sites that may have been in the area prior to its disturbance based on sites identified in similar but undisturbed areas would be small artefact scatters mainly consisting of quartz and possibly fossiliferous chert on the banks of the waterways or sand dune features. The results of the surveys tend to suggest that the area surrounding the LSP area was occupied on an ephemeral basis for task specific activities rather than long term habitation. Past Aboriginal usage of the broader area concentrated on the lakes and nearby wetlands. Remnant material from Noongar fringe camps could be in areas of less disturbance.

The waterways and lake systems and their surrounding land found in the broader City of Wanneroo area were exploited by the Whadjuk Noongar People in pre-contact times and by both Whadjuk Noongar People and Europeans in the years following contact. These places are associated with natural resource utilisation, and it has been suggested are often found near to or linked with traditional Noongar campsites. The lack of any major surface expression artefacts or stone tools is not surprising considering the development of the Wanneroo area.

Ethnographic surveys with Aboriginal groups in the Perth metropolitan region have shown the importance of the Wanneroo area. Some surveys have been conducted over significantly disturbed land and still the importance of the area is stressed by the Aboriginal people. The prospect of more development in the areas around lakes and wetlands is generally unwanted as this is an important place and damage to the water system could result in dire consequences for the Noongar people involved, including death or injury to themselves or family members. While the previous heritage survey reports suggest that Noongar people are unhappy about the developments in the broader area, as they feel that they cannot stop developments and therefore ask for several conditions to be honoured to minimise the impact to their sites. From the previous reports the most common conditions are minimise impacts on sites where possible, ensure no damage to waterways and banks, and the employment of monitors during ground clearance to identify sub-surface material and to ensure contractors stay away from certain sites or areas.

The Aboriginal heritage implications of the proposed Precinct 15 Central Mariginiup LSP area must be considered with representatives from the Whadjuk People both as a courtesy and to comply with state legislation. 22160 Marrynginup is an ACH directory Place and is afforded protection under the *Aboriginal Cultural Heritage Act (2021)*. Consultation with the Whadjuk People should be done early with any future development proposal to allow sufficient time to consider the heritage views of the Whadjuk People and to apply for consent under the *Aboriginal Cultural Heritage Act (2021)* if required.

8 LANDSCAPE FEATURES

Landscape features can often be predictors of areas of likely cultural activity. On the Swan Coastal Plain landscape features associated with water; like rivers, creeks, brooks, and wetlands are highly significant to Whadjuk People. They are a source of food and water, they were used as camping places and they have mythological heritage values; many Whadjuk People consider waterways to be spiritual repositories, particularly as they are associated with creation stories and are home to many living creatures and plant resources.

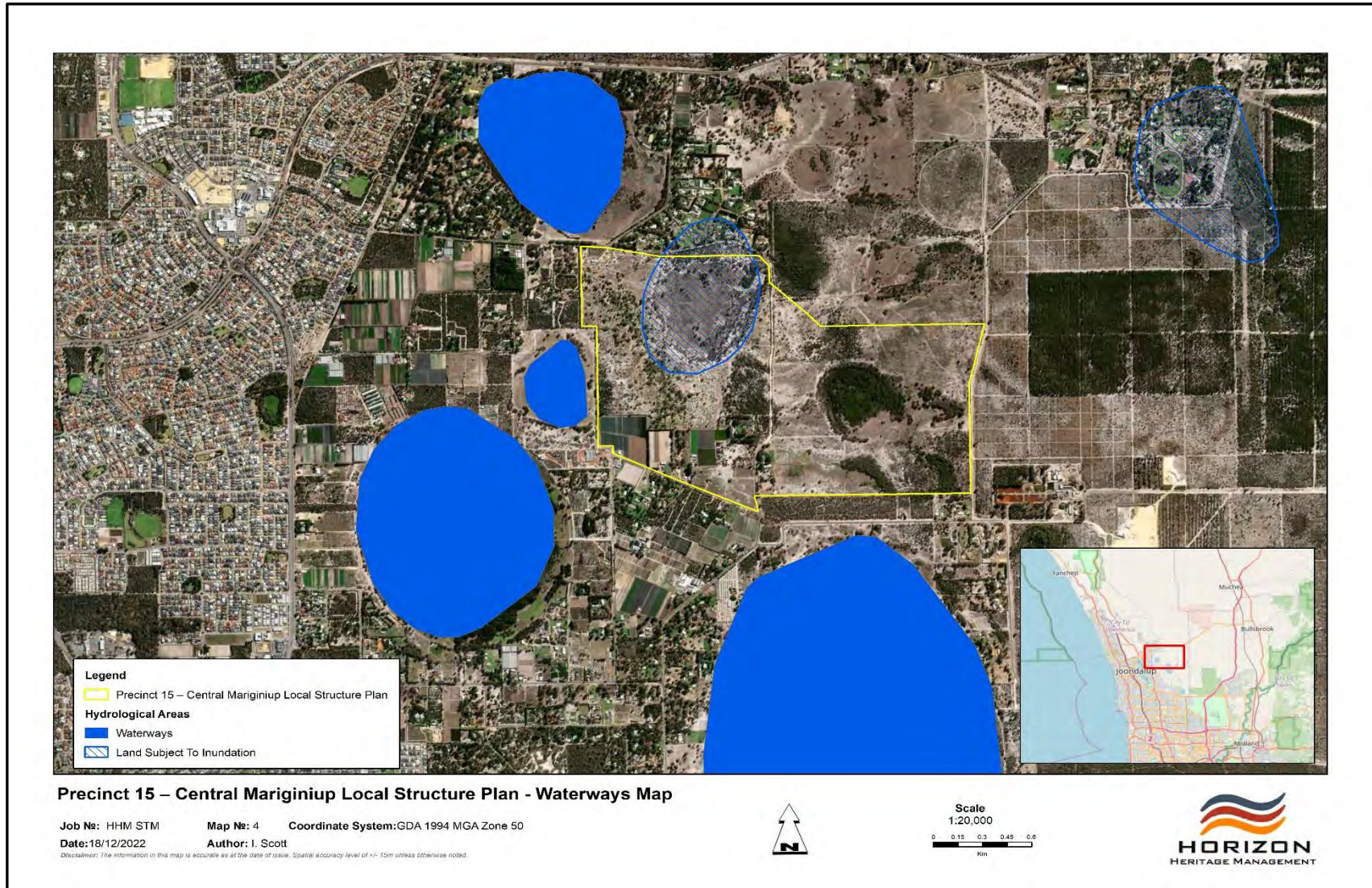
Aboriginal groups would travel along the reaches of waterways, hunting and gathering food while moving from camps in the Guildford area to Lake Gnangara, then beyond to the freshwater chain of wetlands that extend from Lake Goollelal to Yanchep.

The Precinct 15 Central Mariginiup LSP desktop assessment area is surrounded by a landscape that exhibits likely used landscape features that align with Aboriginal cultural features and associations. Most wetlands (like Mariginiup Lake and Little Mariginiup Lake) are of Aboriginal significance for the following reasons:

- they are interconnected,
- they are part of the Gnangara Mound (ground water),
- they are a source of food and water;
- they were used as camping and hunting places;
- they have mythological heritage values.

The LSP desktop assessment area although not formally recognised as having an official water body present within its boundary is subject to inundation of the land post heavy rainfall and does have several ephemeral looking swampy areas.

Map 7: Water Landscape Features within and nearby to the LSP area



9 DESKTOP CONCLUSIONS

Horizon Heritage Management makes the following conclusions:


- All Aboriginal heritage places are afforded protection under the *Aboriginal Cultural Heritage Act (2021)*.
- The key Aboriginal stakeholder group for the LSP desktop assessment area is the Whadjuk 'Noongar' People.
- Potentially important landscape features like swamps and wetlands connected with mythological associations are present within the LSP desktop assessment area.
- Important landscape features connected with resource utilisation and mythological associations are noted adjacent to the LSP desktop assessment area. Lake Adams is such a feature and is located along the northern boundary, Jandabup Lake is another such a feature and is located along the southern boundary. Further landscape features Little Mariginiup Lake and Mariginiup Lake are located immediately west and southwest.
- The ACH Directory Place 22160 Marrynginup has a closed and restricted boundary which intersects the LSP desktop assessment area and is afforded protection under the *Aboriginal Cultural Heritage Act (2021)*.
- The key Whadjuk Custodian for 22160 Marrynginup is Esandra Colbung. Her father (now deceased) was the original place informant.
- No specific Aboriginal heritage surveys (ethnographic or archaeological) have been undertaken within the LSP desktop assessment area.
- No known archaeological sites are within the LSP desktop assessment area. It is possible surface expressions of *in situ* cultural material (artefacts) could be present. Care should be taken in those areas with some potential to contain cultural material. These are around the margins of landscape features like lakes, swamps, wetlands, and any sand hill features that maybe within the LSP desktop assessment area.
- Numerous Noongar fringe camps have previously been identified within proximity of the numerous freshwater lakes found in the broader Wanneroo area, potential remains for contemporary Whadjuk People to hold knowledge of any possible Whadjuk land use of the LSP desktop assessment area.

10 RECOMMENDATIONS

Horizon Heritage Management makes the following recommendations:

1. Horizon Heritage Management recommends that any future development within the LSP area includes consultation with the Whadjuk Aboriginal Corporation and Aboriginal heritage ethnographic and archaeological heritage surveys with the Whadjuk People.
2. Horizon Heritage Management recommends that consultation is undertaken with Esandra Colbung (Whadjuk Site Custodian) for ACH Directory Place 22160 Marrynginup regarding the LSP desktop assessment area and this significant Aboriginal place.
3. Horizon Heritage Management recommends 22160 Marrynginup is an ACH Directory Place and is afforded protection under the *Aboriginal Cultural Heritage Act (2021)*. To use the land which Aboriginal Places are on the proponent/landowner must engage with the Whadjuk Aboriginal Corporation.
4. Horizon Heritage Management recommends an Aboriginal Cultural Heritage Management Plan (developed with input and consent from the Whadjuk People and endorsed by the new ACH Council) will likely be needed to satisfy the *Aboriginal Cultural Heritage Act (2021)*.

11 DPLH ACHIS RESULTS



Department of Planning,
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Aboriginal Cultural Heritage Inquiry System

List of Aboriginal Cultural Heritage (ACH) Directory

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Search Criteria

1 Aboriginal Cultural Heritage (ACH) Directory in Shapefile - Mariginiup_Site_Boundary_20221207

Disclaimer

The *Aboriginal Cultural Heritage Act 2021 (Act)* recognises, protects, conserves, and preserves Aboriginal cultural heritage (ACH), and recognises the fundamental importance of ACH to Aboriginal people and its role in Aboriginal communities past, present and future. The Act recognises the value of ACH to Aboriginal people as well as to the wider Western Australian community.

Aboriginal cultural heritage in Western Australia is protected, whether or not the ACH has been reported to the ACH Council or exists on the Directory.

The information provided is made available in good faith and is predominately based on the information provided to the Department of Planning, Lands and Heritage by third parties. The information is provided solely on the basis that readers will be responsible for making their own assessment as to the accuracy of the information. If you find any errors or omissions in our records, including our maps, it would be appreciated if you email the details to the Department at AboriginalHeritage@dplh.wa.gov.au and we will make every effort to rectify it as soon as possible.

South West Settlement ILUA Disclaimer

Your heritage enquiry is on land **within or adjacent to** the following Indigenous Land Use Agreement(s): Whadjuk People Indigenous Land Use Agreement.

On 8 June 2015, six identical Indigenous Land Use Agreements (ILUAs) were executed across the South West by the Western Australian Government and, respectively, the Yued, Whadjuk People, Gnaala Karla Booja, Ballardong People, South West Boorah #2 and Wagyl Kaip & Southern Noongar groups, and the South West Aboriginal Land and Sea Council (SWALSC).

The ILUAs bind the parties (including 'the State', which encompasses all State Government Departments and certain State Government agencies) to enter into a Noongar Standard Heritage Agreement (NSHA) when conducting Aboriginal Heritage Surveys in the ILUA areas, unless they have an existing heritage agreement. It is also intended that other State agencies and instrumentalities enter into the NSHA when conducting Aboriginal Heritage Surveys in the ILUA areas. It is recommended a NSHA is entered into, and an 'Activity Notice' issued under the NSHA, if there is a risk that an activity will 'impact' (i.e. by excavating, damaging, destroying or altering in any way) an Aboriginal heritage site. The Aboriginal Heritage Due Diligence Guidelines, which are referenced by the NSHA, provide guidance on how to assess the potential risk to Aboriginal heritage.

Likewise, from 8 June 2015 the Department of Mines, Industry Regulation and Safety (DMIRS) in granting Mineral, Petroleum and related Access Authority tenures within the South West Settlement ILUA areas, will place a condition on these tenures requiring a heritage agreement or a NSHA, before any rights can be exercised.

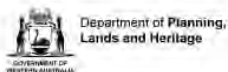
If you are a State Government Department, Agency or Instrumentality, or have a heritage condition placed on your mineral or petroleum title by DMIRS, you should seek advice as to the requirement to use the NSHA for your proposed activity. The full ILUA documents, maps of the ILUA areas and the NSHA template can be found at <https://www.wa.gov.au/organisation/departments-of-the-premier-and-cabinet/south-west-native-title-settlement>.

Further advice can also be sought from the Department of Planning, Lands and Heritage at AboriginalHeritage@dplh.wa.gov.au.

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Page 1



Aboriginal Cultural Heritage Inquiry System

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List of Aboriginal Cultural Heritage (ACH) Directory

Terminology

ID: Reported ACH is assigned a unique ID by the Department of Planning, Lands and Heritage using the format: ACH-00000001. For ACH places on the former Register the ID numbers remain unchanged and use the new format. For example the ACH ID of the place Swan River was previously '3538' and is now 'ACH-00003538'.

Access and Restrictions:

- **Boundary Reliable (Yes/No):** Indicates whether the location and extent of the ACH boundary is considered reliable.
- **Boundary Restricted = No:** ACH location is shown as accurately as the information submitted allows.
- **Boundary Restricted = Yes:** To preserve confidentiality the exact location and extent of the place is not displayed on the map. However, the shaded region (generally with an area of at least 4km²) provides a general indication of where the ACH is located. If you are a landowner and wish to find out more about the exact location of the place, please contact the Department of Planning, Lands and Heritage.
- **Culturally Sensitive = No:** Availability of information that the Department of Planning, Lands and Heritage holds in relation to the ACH is not restricted in any way.
- **Culturally Sensitive = Yes:** Some of the information that the Department of Planning, Lands and Heritage holds in relation to the ACH is restricted if it is considered culturally sensitive information. This information will only be made available if the Department of Planning, Lands and Heritage receives written approval from the people who provided the information. To request access please contact AboriginalHeritage@dmpr.wa.gov.au.
- **Culturally Sensitive Nature:**
 - **No Gender / Initiation Restrictions:** Anyone can view the information.
 - **Men only:** Only *males* can view restricted information.
 - **Women only:** Only *females* can view restricted information.

Status:

- **ACH Directory:** Aboriginal cultural heritage place or cultural landscape.
- **Pending:** Aboriginal cultural heritage place or cultural landscape with information in a verification stage.
- **Historic:** Aboriginal heritage places determined to not meet the criteria of Section 5 of the Aboriginal Heritage Act 1972. Includes places that no longer exist as a result of land use activities with existing approvals.

ACH Type:

- **Cultural Landscape:** a group of areas interconnected through the tangible elements of Aboriginal culture heritage present.
- **Place:** an area in which tangible elements of Aboriginal cultural heritage are present.

Place Type: The type of Aboriginal cultural heritage place. For example an artefact scatter place or engravings place.

Legacy Place Status: A status determined under the previous *Aboriginal Heritage Act 1972*.

- **Registered Site:** the place was assessed as meeting Section 5 of the *Aboriginal Heritage Act 1972*.
- **Lodged:** Information was received in relation to the place, but an assessment was not completed to determine if it met section 5 of the *Aboriginal Heritage Act 1972*.
- **Stored Data/Not a Site:** The place was assessed as not meeting Section 5 of the *Aboriginal Heritage Act 1972*.

Legacy ID: This is the former unique number that the former Department of Aboriginal Sites assigned to the place.

Coordinates

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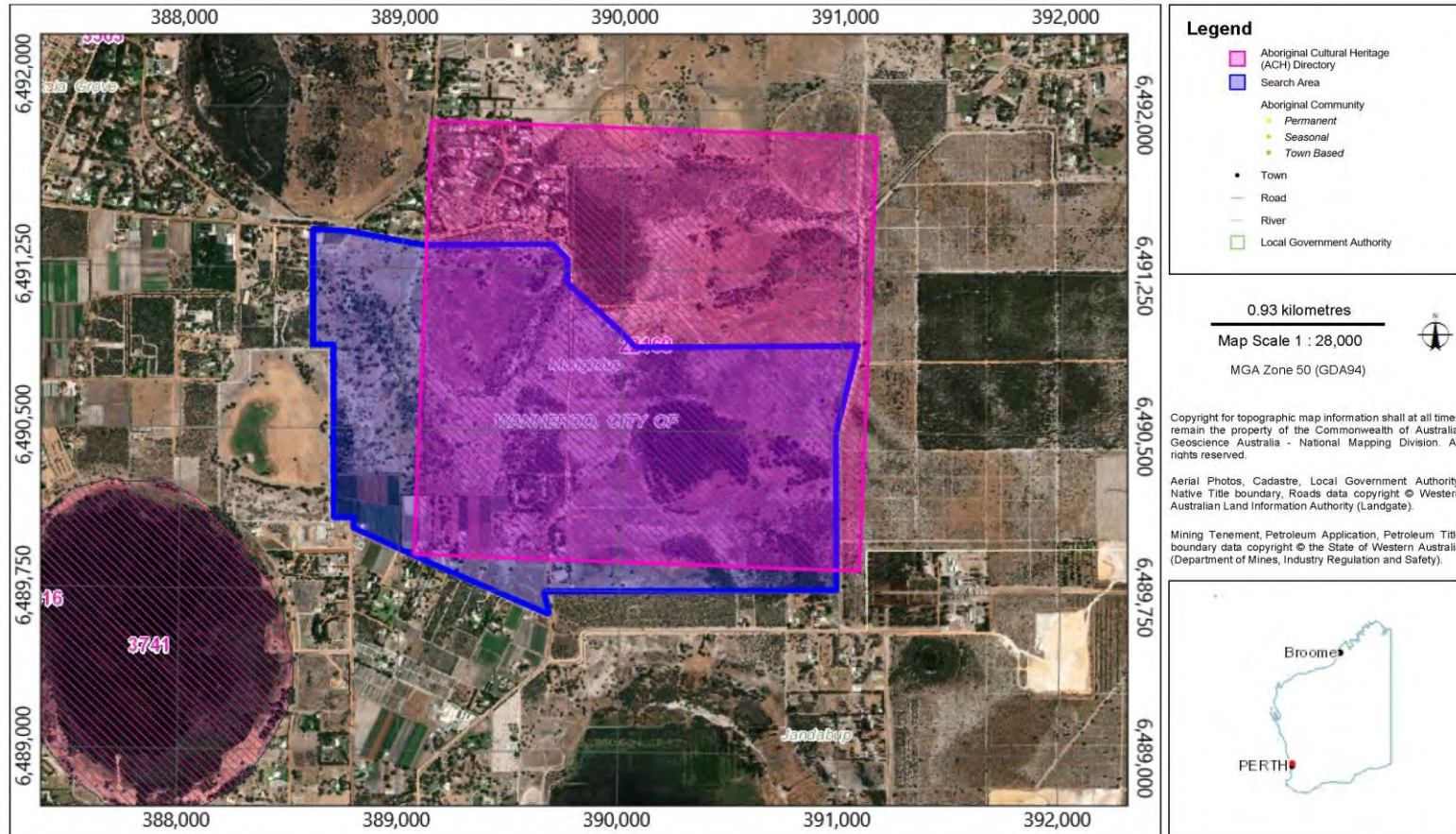
ID	Name	Boundary Restricted	Boundary Reliable	Culturally Sensitive	Culturally Sensitive Nature	Status	ACH Type	Place Type	Knowledge Holders	Legacy Place Status	Legacy ID
22160	Marrynginup	Yes	Yes	Yes	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Camp; Ritual / Ceremonial; Historical; Hunting Place; Meeting Place; Midden; Modified Tree; Landscape / Seascape Feature; Other; Plant Resource; Water Source	*Registered Knowledge Holder names available from DPLH	Lodged	



Aboriginal Cultural Heritage Inquiry System

Map of Aboriginal Cultural Heritage (ACH) Directory

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12 REFERENCES

- Aboriginal Heritage Act 1972* Abbreviated version available from: <www.dplh.wa.gov.au>.
- Aplin, Graeme, Foster, S.G. and McKernan, Michael 1987 *Australians: Events and Places*, Broadway: Fairfax, Syme & Weldon Assocs.
- Armstrong, Francis 1836 *Perth Gazette*, Vol. XX, 5 November, p. 797.
- Bates, Daisy. 1985 *The Native Tribes of Western Australia* (ed. Isobel White), National Library of Australia, Canberra.
- Bates, Daisy 2004 *My Natives and I (Incorporating The Passing of the Aborigines: A Lifetime spent among the Natives of Australia)*, ed. P.J. Bridge, Victoria Park: Hesperian Press.
- Beard, J. 1981 *Vegetation Survey of Western Australia: 1:1,000,000 series Swan*. Perth: University of Western Australia Press.
- Bindon, P. and R. Chadwick. 1992 *A Nyoongar Wordlist from the South-West of Western Australia*. Perth: Western Australian Museum.
- Biskup, Peter. 1973 *Not slaves not citizens: The Aboriginal Problem in Western Australia 1898-1954*, University of Queensland Press, St. Lucia.
- Bropho, Robert. 1980 *Fringedweller*, Alternative Publishing Co-operative Ltd., Sydney.
- Carter, Bevan and Lynda Nutter (eds.) 2005 *Nyungah Land: Records of Invasion and Theft of Aboriginal Land on the Swan River 1829-1850*, Swan Valley Nyungah Community, Guildford.
- Clarke, J. and C. Dortch. 1977 *A 10,000 Year BP Radiocarbon Date for Archaeological Finds within a Soil of the Spearwood Dune System, Mosman Park, WA*. Search 8:36-38.
- Colbung, Ken 2006 'Waitj Dreaming,' in Hill, Sandra (ed.) 2006 *Indigenous Consultation Report, Draft Report, Indigenous Heritage Public Art Project, Leighton Marshalling Yards Redevelopment (Stage 1)*, Public Art Commission, pp. 10-13.
- Costello, V. 2002-3 'Glistening Attraction: Yellagonga Regional Park, *Landscape*, vol. 19, no. 2.
- Curr, E.M. (ed.) 1886 *The Australian Race*, 4 vols, Melb: J. Ferres, Govt. Printer, Vols. 1 & 2 pub.
- Curr, E.M. (ed.) 1887 *The Australian Race*, 4 vols, Melb: J. Ferres, Govt. Printer, Vols. 3 & 4 pub.
- Corunna, Albert 2006 'The Waugal,' in Hill, Sandra (ed.) 2006 *Indigenous Consultation Report, Draft Report, Indigenous Heritage Public Art Project, Leighton Marshalling Yards Redevelopment (Stage 1)*, Public Art Commission, pp. 18-19.

Douglas, WH. 1973 'The language of south-western Australia,' *Journal of the Royal Society of Western Australia*, Vol. 56, Parts 1 and 2, pp 48-50.

Flood, Josephine. 1995 *Archaeology of the Dreamtime: The story of prehistoric Australia and its people*, Angus and Robertson, Sydney.

Green, Neville 1984 *Broken Spears*, Focus Education Series, Perth, WA.

Grey, G. 1841 *Journals of two expeditions of discovery in North-West and Western Australia, during the years 1837, 38 and 39*. London: T. and W. Boone.

Haebich, A. (1992) *For Their Own Good: Aborigines and Government in the South West of Western Australia 1900 to 1904*, Nedlands: UWA Press.

Hallam, Sylvia and Tilbrook, Lois (eds.) 1990 *Aborigines of the Southwest Region 1829-1840, The Bicentennial Dictionary of Western Australians Volume VIII*, The University of Western Australia Press, Nedlands.

Hallam, S. J. 1986. *Final Report on the Project: Prehistoric Aboriginal Populations on the Swan Coastal Plain, WA*.

Hammond, J. 1993 *Winjan's people: the story of the South-West Australian Aborigines*. Perth: Imperial Print.

Gentilli, J. 1989 *Climate of the Jarrah Forrest*. The Jarrah Forrest: 23-40.

Green, Neville 1979 *Nyungar, the People*, Perth: Creative research in association with Mt Lawley College, South Perth, WA.

Green, Neville 1979 'Aboriginal and Settler Conflict in Western Australia, 1826-1852' in *The Push from the Bush: A Bulletin of Social History Devoted to the Year of Grace 1938*, No. 3, May, pp. 70-94.

Green, Neville 1984 *Broken Spears*, Perth, WA: Focus Education Series.

Green, Neville and Tilbrook, Lois (eds.) 1989 *Aborigines of New Norcia 1845-1914, The Bicentennial Dictionary of Western Australians Volume VII*, Nedlands: The University of Western Australia Press.

Grey, Sir G. 1841 *Journals of two expeditions of discovery in North-West and Western Australia, during the years 1837, 38 and 39*, London: T. and W. Boone, 2v.

Hallam, S. J. 1971 'Roof markings in the "Orchestra Shell" cave, Wanneroo, near Perth, Western Australia,' *Mankind*, vol . 8, no. 2, pp. 90-103.

Hallam, Sylvia 1975 *Fire and Hearth: a study of Aboriginal usage and European usurpation in south-western Australia*, Canberra: Australian Institute of Aboriginal Studies.

Hallam, S. J. (1998) 'Wanneroo, Joondalup, Yanchep, the Aborigines', Appendix 6.1 in Kauler

The Cultural Significance of Aboriginal Sites in the Wanneroo Area. Unpublished Report.

Hallam, Sylvia and Tilbrook, Lois (eds.) 1990 *Aborigines of the Southwest Region 1829-1840, The Bicentennial Dictionary of Western Australians Volume VIII*, Nedlands: The University of Western Australia Press.

Hasluck, Alexandra 1961 'Yagan the Patriot,' in *The Western Australian Historical Society Incorporated Journal and Proceedings*, Vol. V, Part VII, pp. 33-39.

Hill, Sandra (ed.) 2006 Indigenous Consultation Report, Draft Report, Indigenous Heritage Public Art Project, Leighton Marshalling Yards Redevelopment (Stage 1), Public Art Commission.

Horton, David (gen. ed.) 1994 *The Encyclopaedia of Aboriginal Australia: Aboriginal and Torres Strait Islander History, Society and Culture*, Volume 1, A-L, Canberra: Aboriginal Studies Press.

Howie-Willis, Ian 1994 'Nyungar,' in Horton, David (gen. ed.) *The Encyclopaedia of Aboriginal Australia: Aboriginal and Torres Strait Islander History, Society and Culture*, Volume 2, M-Z, Canberra: Aboriginal Studies Press, p. 814.

Howie-Willis, Ian 1994 'Yagan,' in Horton, David (gen. ed.) *The Encyclopaedia of Aboriginal Australia: Aboriginal and Torres Strait Islander History, Society and Culture*, Volume 2, M-Z, Canberra: Aboriginal Studies Press, pp. 1213-1214.

Howie-Willis, Ian 1994 'Southwest Region,' in Horton, David (gen. ed.) *The Encyclopaedia of Aboriginal Australia: Aboriginal and Torres Strait Islander History, Society and Culture*, Volume 2, M-Z, Canberra: Aboriginal Studies Press, pp. 1010-1012.

Jutson, J.T. 1950 *The Physiology (Geomorphology) of Western Australia*, Perth: Government Printer.

Kauler, Lily Bhavna (1997–98) *Final Report: Cultural Significance of Aboriginal Sites in the Wanneroo Area.* Prepared for Elder Harry Nannup of Aboriginal Community College, Gnangara.

Landgate 2022 'Mariginiup' Western Australian Land Information Authority.
<https://www0.landgate.wa.gov.au/maps-and-imagery/wa-geographic-names/name-history/historical-suburb-names#Mariginiup> [Accessed 06 December 2022].

Landor, E. W. 1847 *The bushman; or, life in a new country.* London: Richard Bentley.

Low, G. 1971 *Definition of two new Quaternary formations in the Perth Basin.* Western Australia Geological Survey Annual Report 1970 (1971): 33–34.

McArthur, W. M. and Bettenay, E. 1960 *The development and distribution of the soils of the Swan coastal plain, Western Australia*, Melbourne: C.S.I.R.O (Soil Publication No. 16).

McDonald, Edward, Bryn Coldrick and Linda Villiers 2005 *Study of Groundwater-Related Aboriginal Cultural Values on the Gnangara Mound, Western Australia*, for Department of Environment, October, Estill & Associates.

McPherson, A. and A. Jones. 2006 *Appendix D: Perth Basin Geology Review and Site Class Assessment*. Perth Basin Geology.

Moore, George Fletcher 1884 *Diary of Ten Years Eventful Life of an Early Settler in Western Australia; and also A Descriptive Vocabulary of the Language of the Aborigines*, London: Walbrook. Facsimile edition, with an introduction by C. T. Stannage, University of Western Australia Press, 1978.

Mulvaney, John & Kamminga, Johan 1999 *Prehistory of Australia*, St Leonards: Allen & Unwin.

Oates, W.J and Oates, Lynette F. 1970 *A Revised Linguistic Survey of Australia*, Canberra: Australian Institute of Aboriginal Studies.

O'Connor, R., Bodney, C. and Little, L. 1985 *Preliminary Report on the Survey of Aboriginal Areas of Significance in the Perth Metropolitan and Murray River Regions*. Unpublished report for the Department of Aboriginal Sites.

Pearce, R. 1977 *The relationship of chert artefacts at Walyunga in southwest Australia to Holocene sea levels*. Search 10(8): 375-7.

Pearce, R. and M. Barbetti. 1981 *A 38,000 year old site at Upper Swan, Western Australia*. Archaeology in Oceania 16:173-78.

Playford, P., Cockbain, A. and G. Low. 1976 *Geology of the Perth Basin, Western Australia*. Perth: Geological Survey of Western Australia.

Seddon, G. 1972 *Sense of Place*. Perth: University of Western Australia Press.

Strawbridge, L. 1988 *Aboriginal Sites in the Perth Metropolitan Area: a Management Scheme*. Unpublished report for the Department of Aboriginal Sites.

Thieberger, N. 1993 *Handbook of Western Australian Aboriginal Languages South of the Kimberley Region*. Canberra: Pacific Linguistics, Australian National University.

Tindale, Norman 1974 *Aboriginal Tribes of Australia: Their Terrain, Environmental Controls, Distribution, Limits, and Proper Names*, ANU Press, Canberra.

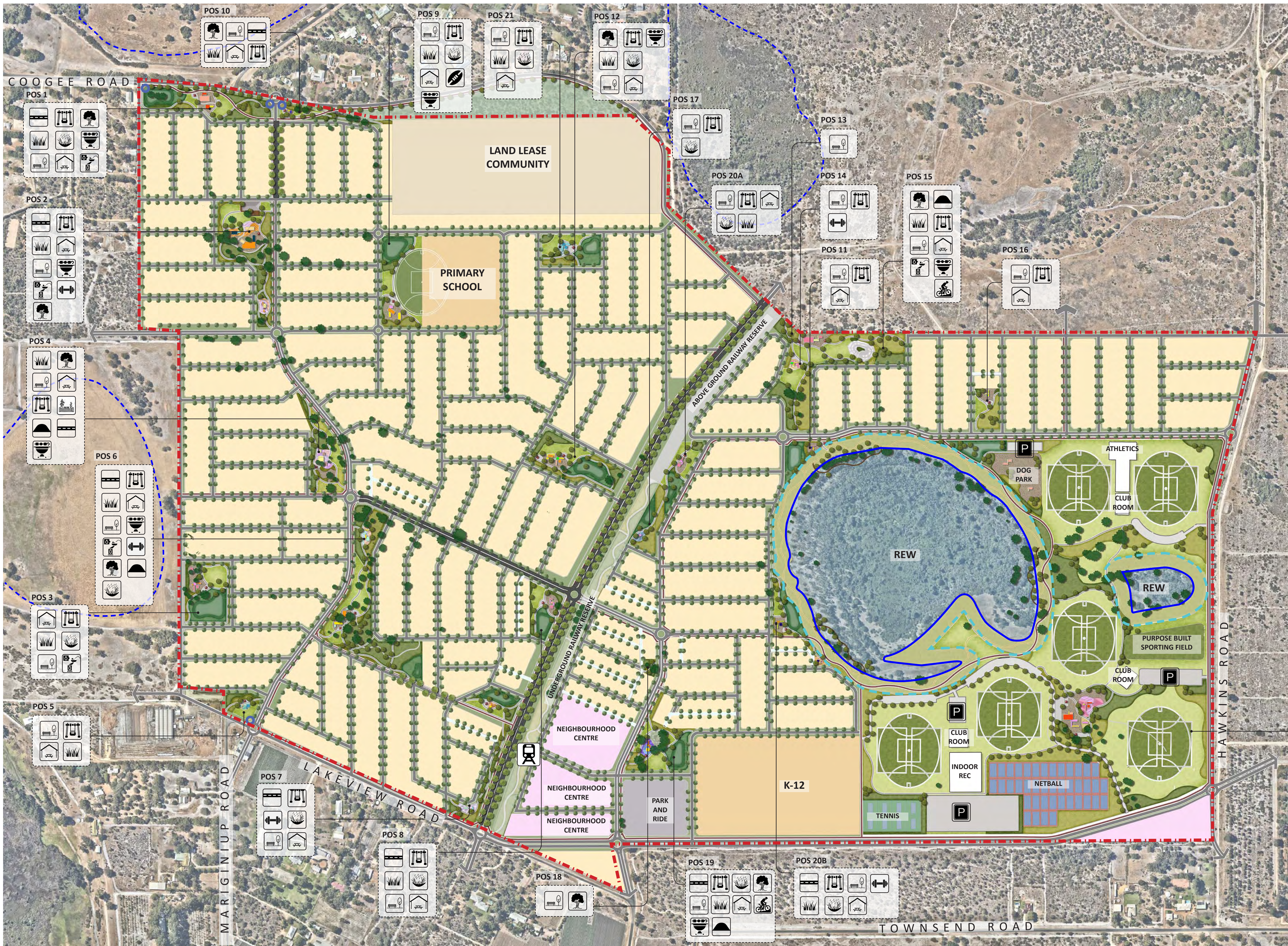
Tilbrook, Lois 1983 *Nyungar Tradition: Glimpses of Aborigines of South-Western Australia 1829-1914*, Nedlands: University of Western Australia Press.

Wilkes, Richard 2006 'The Battle between Waugal and Younduk,' in Hill, Sandra (ed.) 2006 Indigenous Consultation Report, Draft Report, Indigenous Heritage Public Art Project, Leighton Marshalling Yards Redevelopment (Stage 1), Public Art Commission, pp. 14-15.

Appendix F

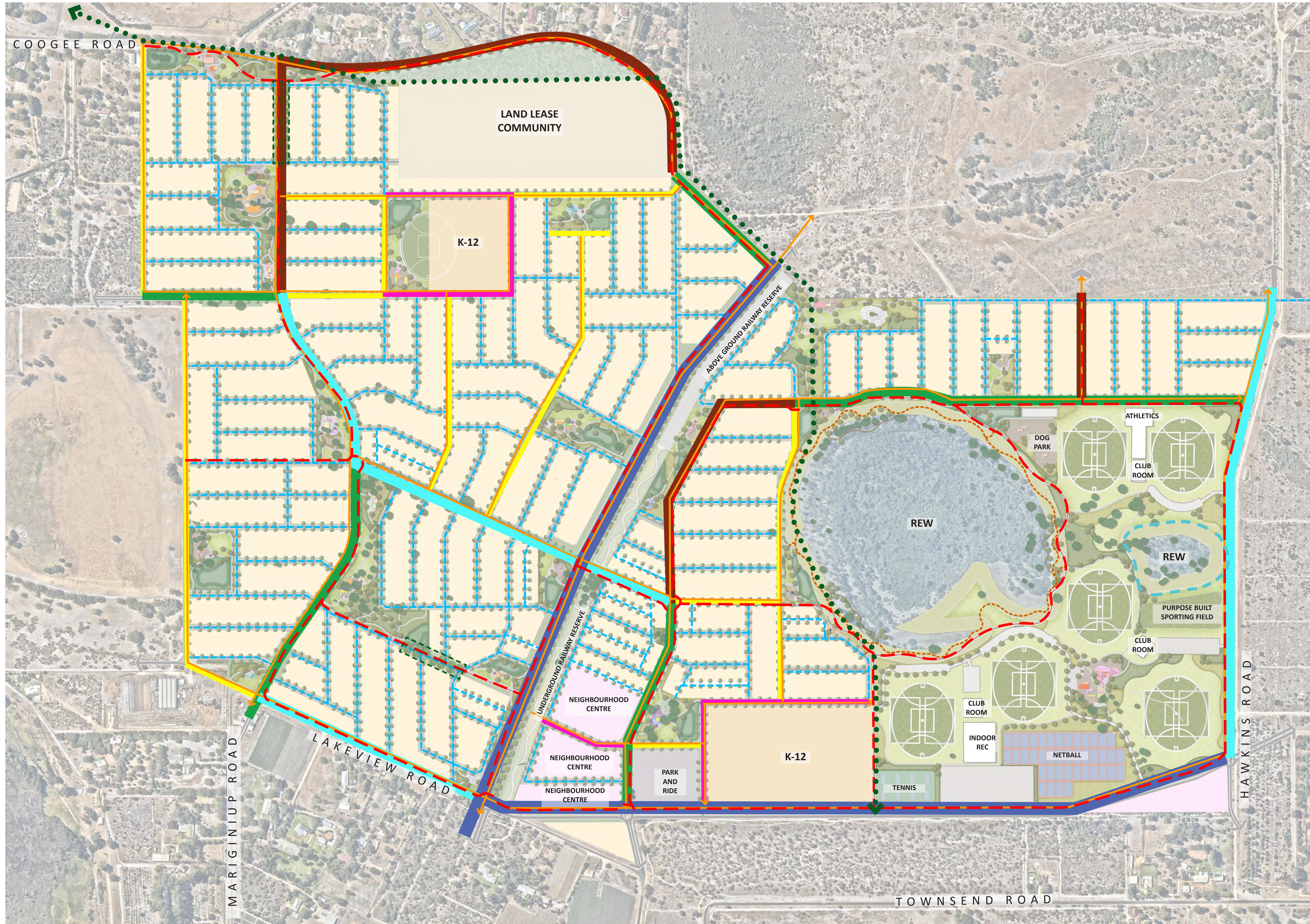
Landscape Masterplan (Emerge Associates 2023)



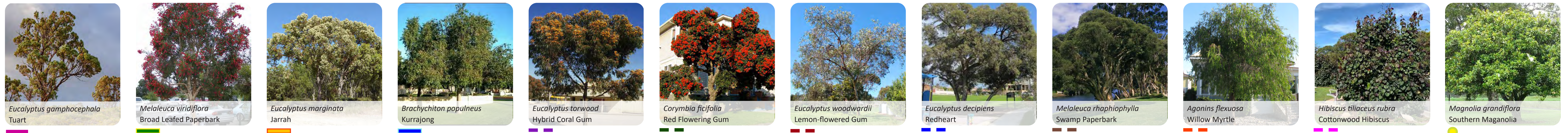
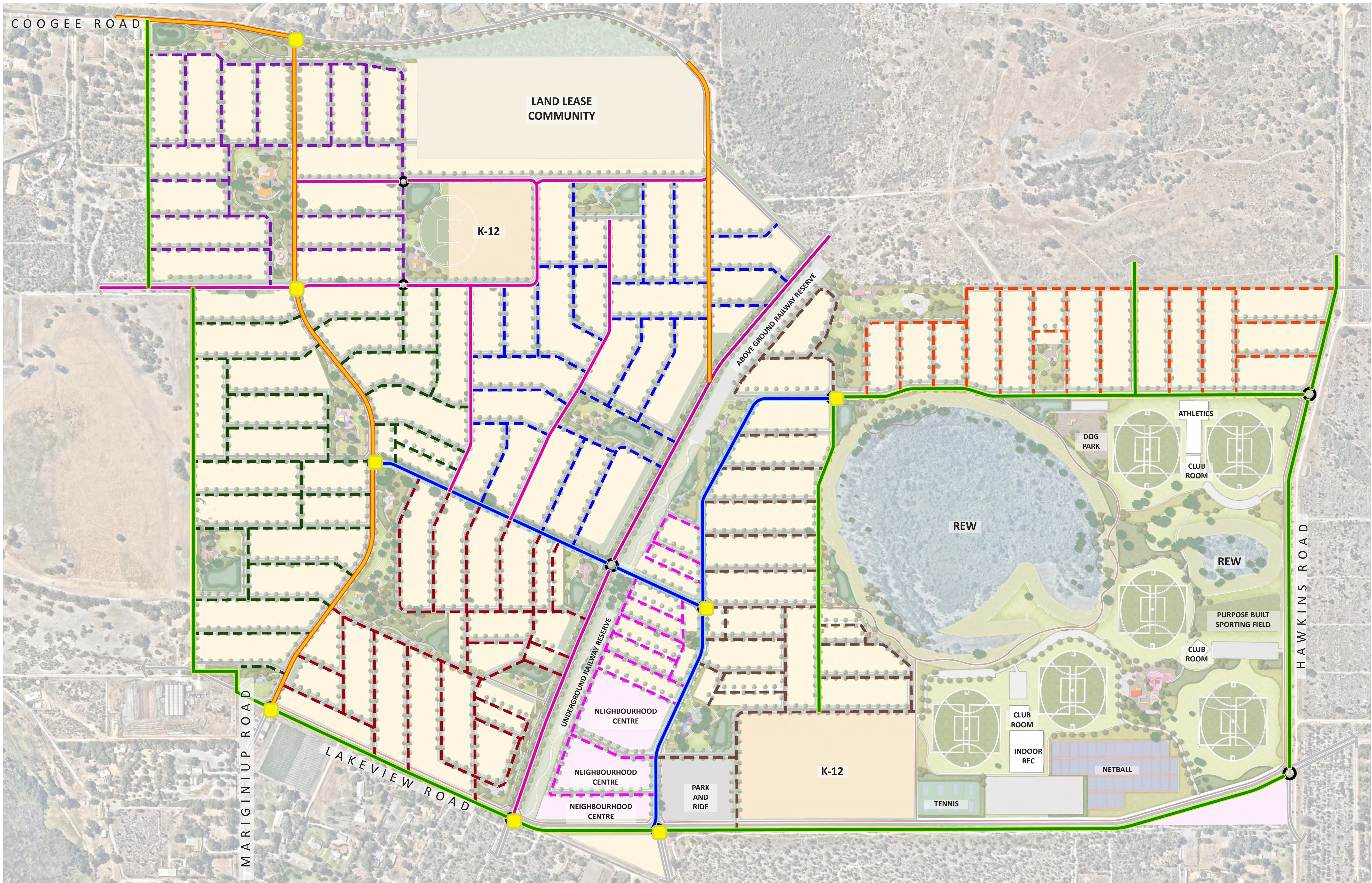


- LEGEND**
- EXISTING LARGE TREE
 - OPEN TURF
 - FITNESS AREA
 - BOARDWALK
 - BASIN & SWALES
 - DUAL USE PATH
 - PLAYING FIELD
 - CARPARK
 - PLAYGROUND
 - PARK SHELTER
 - BBQ
 - PICNIC SETTING
 - DOG PARK
 - CRUSHED LIMESTONE TRACK
 - DRINK FOUNTAIN
 - BENCH SEAT
 - BMX BIKE TRACK
 - COMMUNITY GARDEN
 - FUTURE TRAIN STATION
 - TURF MOUND
 - EXTENT OF WORK
 - REW
 - REW BUFFER
 - CCW
 - ENTRY SIGNAGE
 - EXISTING TREES
 - PROPOSED PLANTING
 - PROPOSED TURF
 - PROPOSED REVEGETATION/ UNIRRIGATED TUBESTOCK

- REGIONAL SPORTING COMPLEX**
- CRUSHED LIMESTONE TRACK
 - DRINK FOUNTAIN
 - BENCH SEAT
 - BMX BIKE TRACK
 - COMMUNITY GARDEN
 - FUTURE TRAIN STATION
 - TURF MOUND
 - EXTENT OF WORK
 - REW
 - REW BUFFER
 - CCW
 - ENTRY SIGNAGE
 - EXISTING TREES
 - PROPOSED PLANTING
 - PROPOSED TURF
 - PROPOSED REVEGETATION/ UNIRRIGATED TUBESTOCK

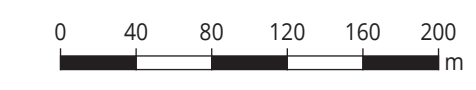


LEGEND	
	Road Integrator A
	Road Integrator B
	Neighbourhood Connector A
	Neighbourhood Connector A
	Access Street A
	Access Street B
	Access Street D
	Pedestrian Footpath
	Crushed limestone/trail
	Dual Use Path
	Parkland Link
	Green Street



MARIGINIUP- Stockland
LANDSCAPE STREET TREE MASTERPLAN

DWG MAR01_DES
REV B
DATE 2023-08-09
SCALE 1:4000 @ A1

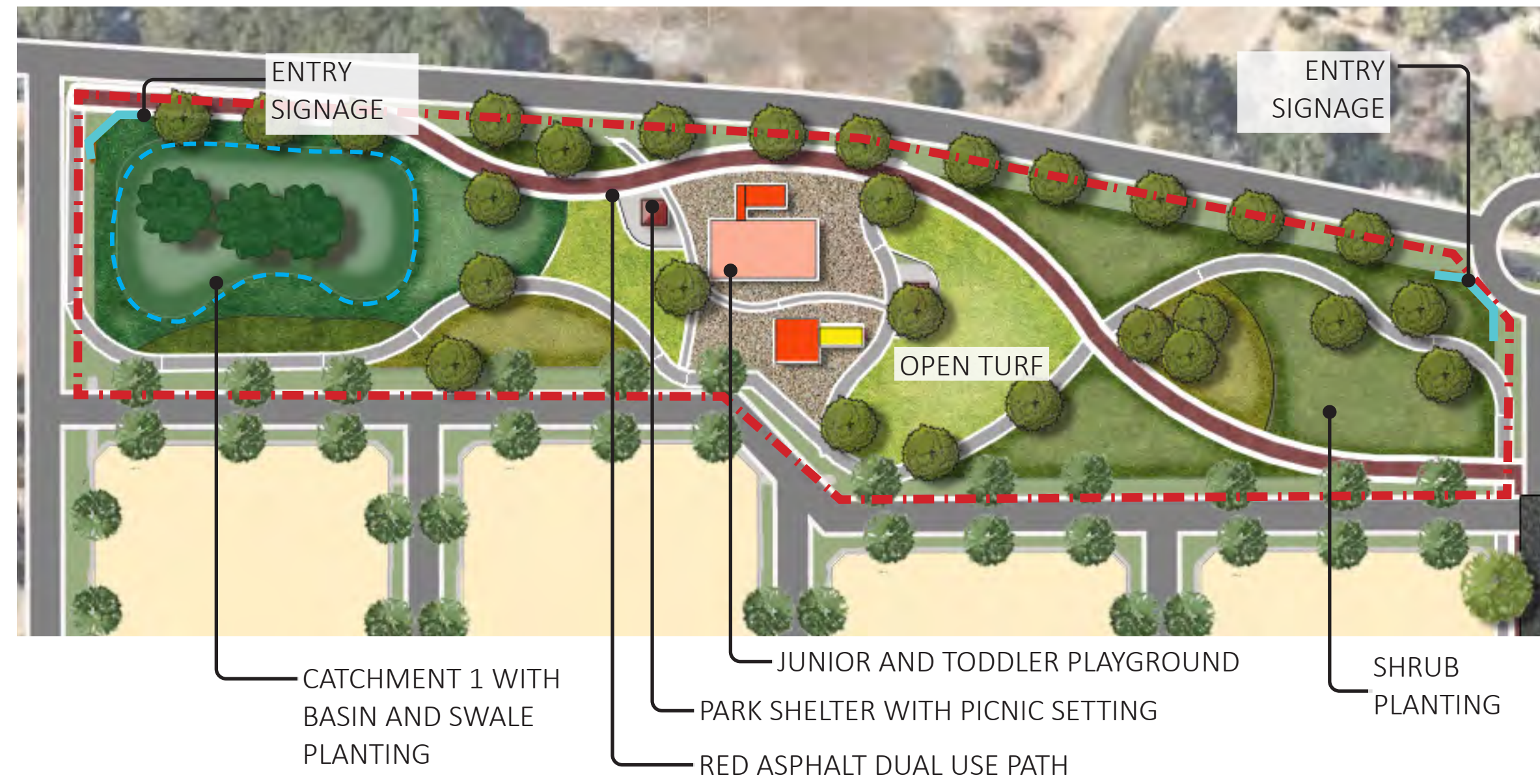


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POS 1 CONCEPT



DRAINAGE LEGEND - CATCHMENT 1

FIRST 15mm BRA DETAILS

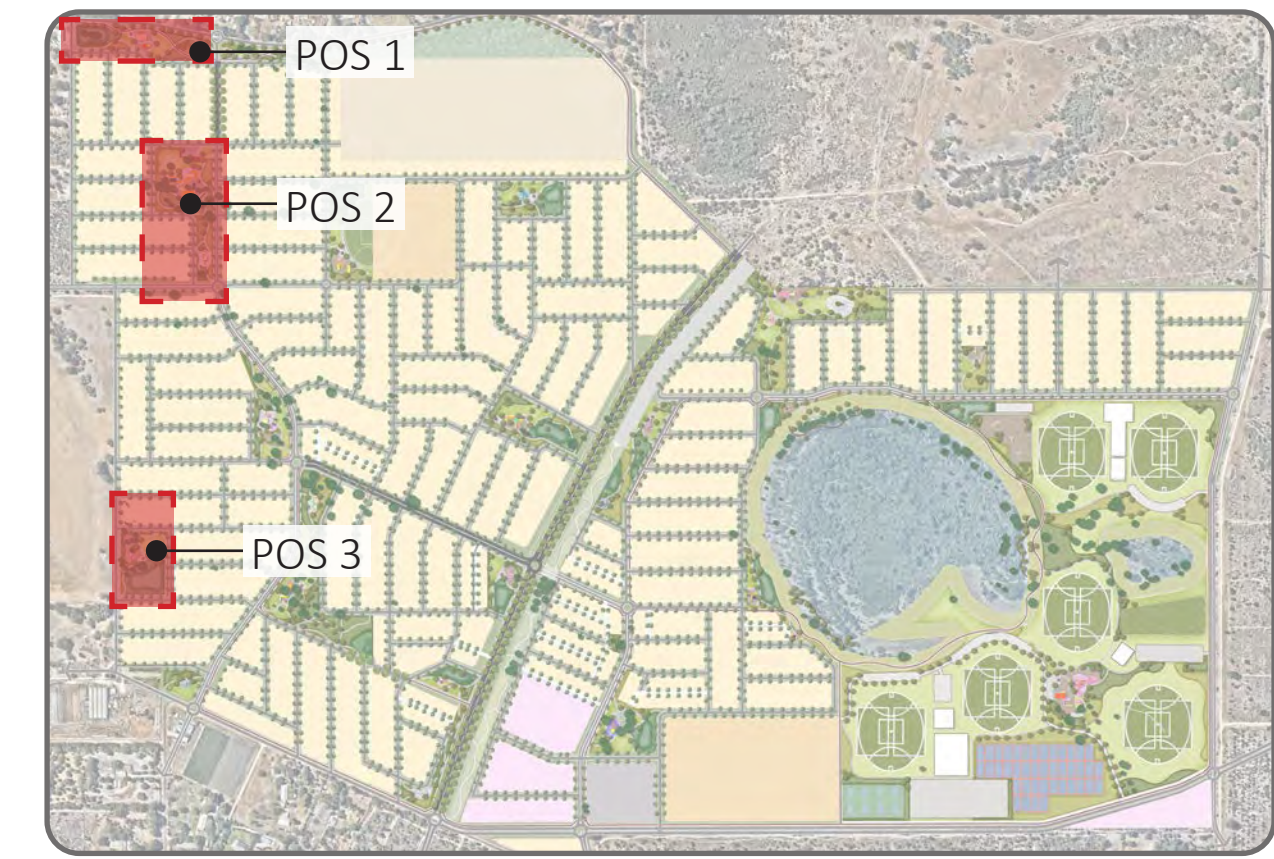
Depth(m):	0.30
Base Area(m ²):	1600
Top Area(mAHD):	1747
Slope:	1:3

- POS TYPOLOGY**
- Neighborhood Park
- SIZE**
- 1.43 ha + Verge

- CONCEPT**
- D.U.P on northern side of the POS to provide connection to road integrators
 - Existing trees to be retained
 - Shrub revegetation under existing vegetation
 - Provide a pedestrian link through estate
 - Significant trees to be retained where possible
 - Picnic area with shelter, picnic setting and BBQ area
 - Playground to provide activity space
 - Open turf to provide activity area to residents
 - Provide entry signage
 - Drainage basin as per LWMS

- ENVIRONMENTAL CONSIDERATIONS**
- Existing trees and vegetation to be retained where possible.
 - Low fuel planting to minimise the threat area intensity for bushfire prone areas
 - Water-wise native planting and planting
 - Source local materials where possible to minimise transport requirements and provide local employment.
 - Consider long-term maintenance requirements.
 - Provide a buffer to the adjacent road

- FUNCTIONS / MATERIALS**
- Existing trees to be retained
 - Open turf area for outdoor activity
 - Shelter with table settings and BBQ will provide opportunity for socialisation
 - Playground for kids
 - Connected path to open space perimeter, with connections to the broader path network.
 - Entry signage to convey directions and enhance the character of the estate



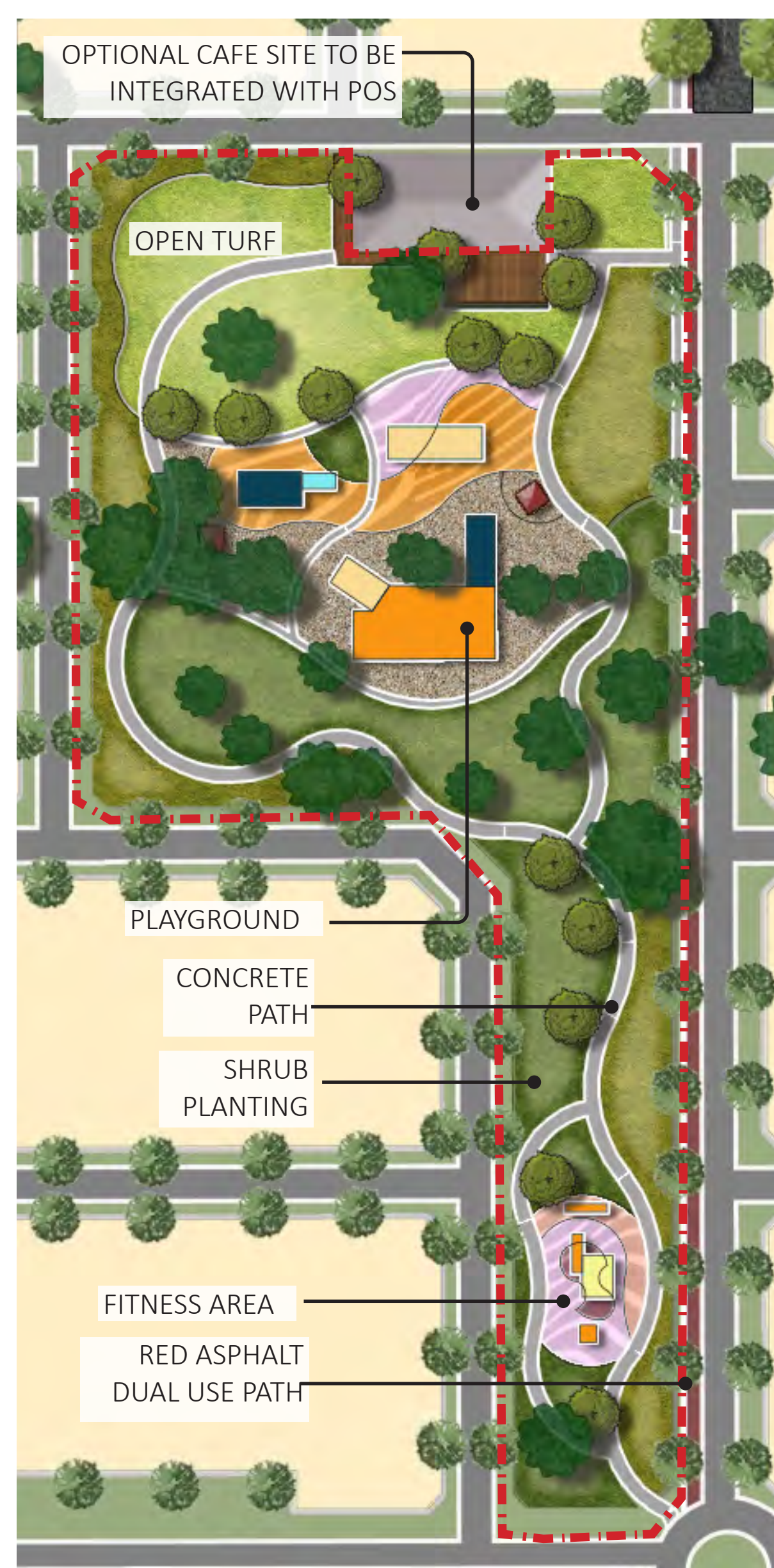
LOCATION PLAN



LEGEND

- TURF
- SHRUB PLANTING (AMENITY)
- LOW FUEL PLANTING
- BASIN
- LOT
- DUAL USE PATH
- FOOTPATH
- MULCH ONLY
- STREET TREES
- EXISTING TREES
- PROPOSED TREES
- CRUSHED LIMESTONE PATH
- BOARDWALK
- REVEGETATION
- EXTENT OF WORK
- REW
- REW BUFFER

POS 2 CONCEPT



- POS TYPOLOGY**
- Neighborhood Park
- SIZE**
- 2.02 ha + Verge

- CONCEPT**
- D.U.P on eastern side of the POS to provide connection to road integrators
 - Existing trees to be retained
 - Shrub revegetation under existing vegetation
 - Provide a pedestrian link through estate
 - Significant trees to be retained where possible
 - Picnic area with shelter, picnic setting and BBQ area
 - Playground to provide activity space
 - Open turf to provide activity area to residents
 - Provide fitness area for residents

- ENVIRONMENTAL CONSIDERATIONS**
- Existing trees and vegetation to be retained where possible.
 - Low fuel planting to minimise the threat area intensity for bushfire prone areas
 - Water-wise native planting and planting
 - Source local materials where possible to minimise transport requirements and provide local employment.
 - Consider long-term maintenance requirements.

- FUNCTIONS / MATERIALS**
- Existing trees to be retained
 - Open turf area for outdoor activity
 - Shelter with table settings and BBQ will provide opportunity for socialisation
 - Playground for kids
 - Connected path to open space perimeter, with connections to the broader path network.
 - Outdoor exercise area provide fitness opportunities for the residents

POS 3 CONCEPT



DRAINAGE LEGEND - CATCHMENT 3

FIRST 15mm BRA DETAILS

Depth(m):	0.30
Base Area(m ²):	2500
Top Area(mAHD):	2683
Slope:	1:3

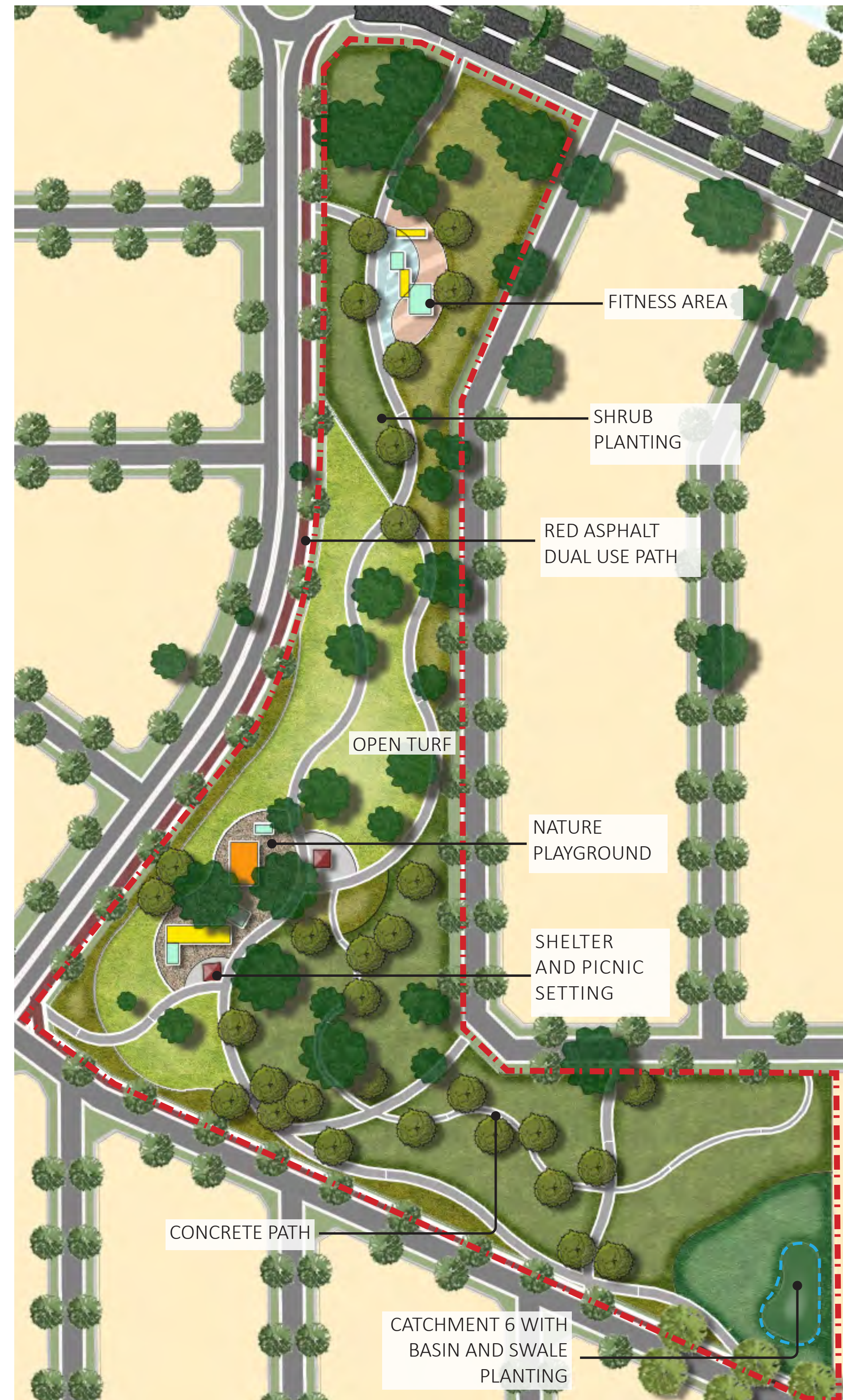
- POS TYPOLOGY**
- Neighborhood Park
- SIZE**
- 1.3 ha + Verge

- CONCEPT**
- Concrete footpath to provide connection to road integrators
 - Existing trees to be retained
 - Shrub revegetation under existing vegetation
 - Provide a pedestrian link through estate
 - Provide Dog park with agility equipment
 - Significant trees to be retained where possible
 - Picnic area with shelter and picnic setting
 - playground to provide activity space
 - Open turf to provide activity area to residents
 - Drainage basin as per LWMS

- ENVIRONMENTAL CONSIDERATIONS**
- Existing trees and vegetation to be retained where possible.
 - Low fuel planting to minimise the threat area intensity for bushfire prone areas
 - Water-wise native planting and planting
 - Source local materials where possible to minimise transport requirements and provide local employment.
 - Consider long-term maintenance requirements.
 - Provide a buffer to the adjacent road

- FUNCTIONS / MATERIALS**
- Existing trees to be retained
 - Open turf area for outdoor activity
 - Shelter and picnic settings
 - Nature Playground for kids
 - Dog park for Dog agility play opportunities for residents
 - Connected path to open space perimeter, with connections to the broader path network.

POS 6 CONCEPT



DRAINAGE LEGEND - CATCHMENT 6

FIRST 15mm BRA DETAILS

Depth(m):	0.30
Base Area(m ²):	289
Top Area(mAHD):	353
Slope	1:3

POS TYPOLOGY

- Neighborhood Park

SIZE

- 2.94 ha + Verge

CONCEPT

- D.U.P on western side of the POS to provide connection to road integrators
- Existing trees to be retained
- Shrub revegetation under existing vegetation
- Provide a pedestrian link through estate
- Significant trees to be retained where possible
- Picnic area with shelter, picnic setting and BBQ area
- Playground to provide activity space
- Open turf to provide activity area to residents
- Provide fitness area
- Drainage basin as per LWMS

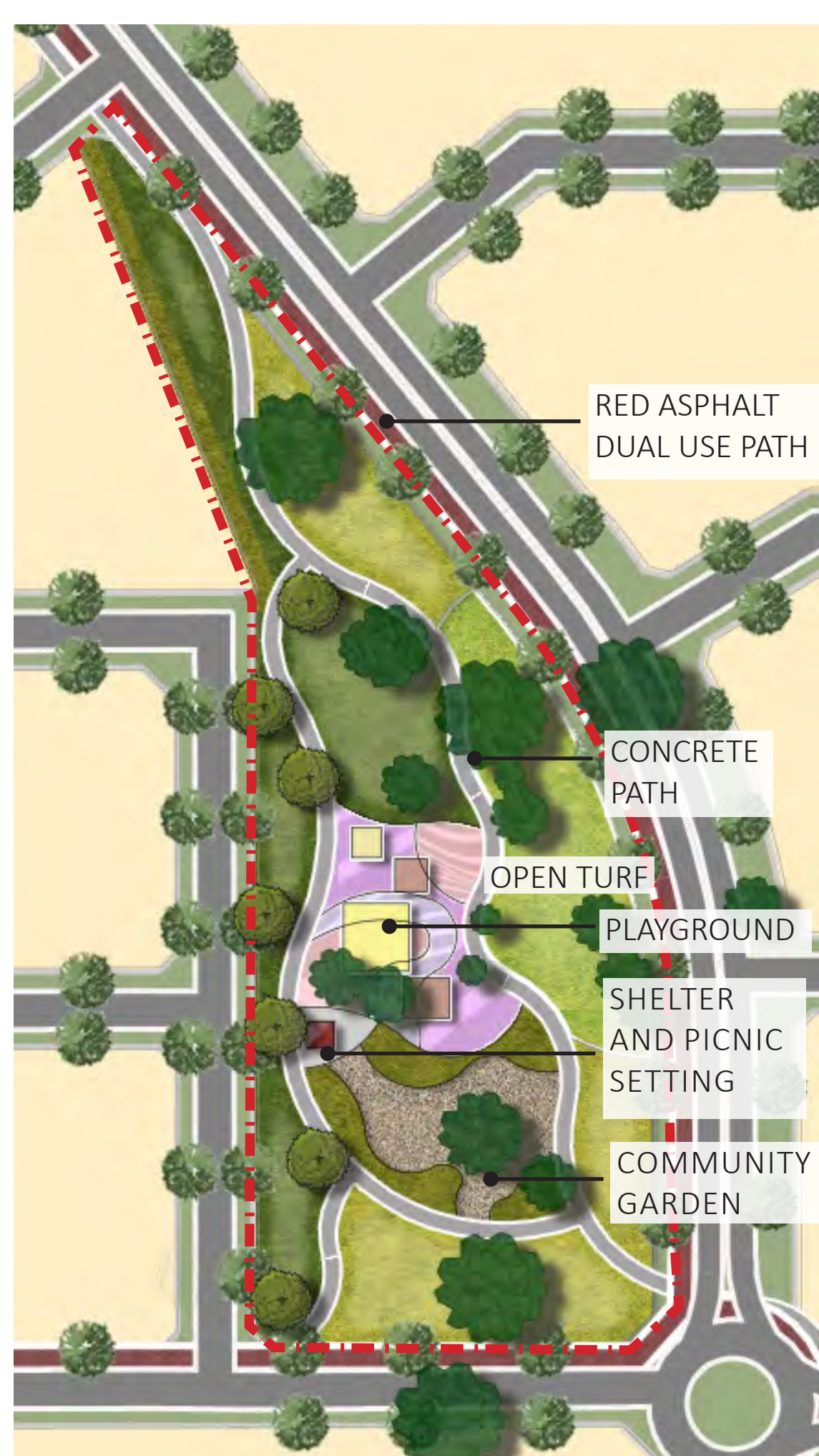
ENVIRONMENTAL CONSIDERATIONS

- Existing trees and vegetation to be retained where possible.
- Low fuel planting to minimise the threat area intensity for bushfire prone areas
- Water-wise native planting and planting
- Source local materials where possible to minimise transport requirements and provide local employment.
- Consider long-term maintenance requirements.
- Provide a buffer to the adjacent road

FUNCTIONS / MATERIALS

- Existing trees to be retained
- Open turf area for outdoor activity
- Shelter with table settings and BBQ will provide opportunity for socialisation
- Playground for kids
- Outdoor exercise area provide fitness oppotunities for the residents
- Connected path to open space perimeter, with connections to the broader path network.

POS 4 CONCEPT



POS TYPOLOGY

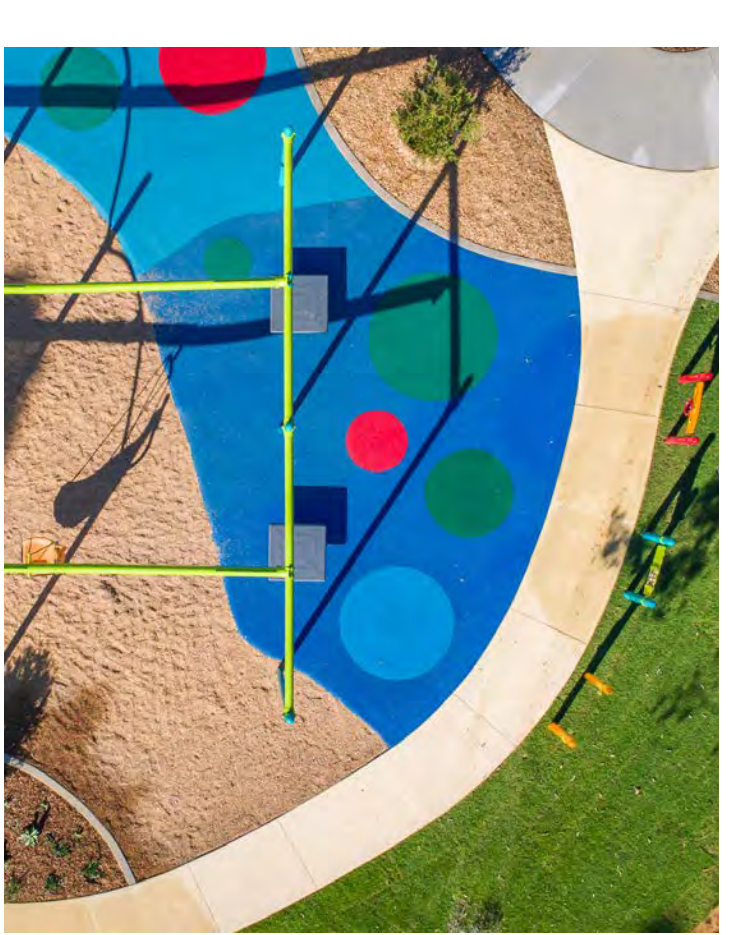
- Neighborhood Park

SIZE

- 1.13 ha + Verge

CONCEPT

- D.U.P on eastern side of the POS to provide connection to road integrators
- Existing trees to be retained
- Shrub vegetation under existing vegetation
- Provide a pedestrian link through estate
- Significant trees to be retained where possible
- Picnic area with shelter, picnic setting and BBQ area
- playground to provide activity space
- Open turf to provide activity area to residents
- Provide fitness area for residents

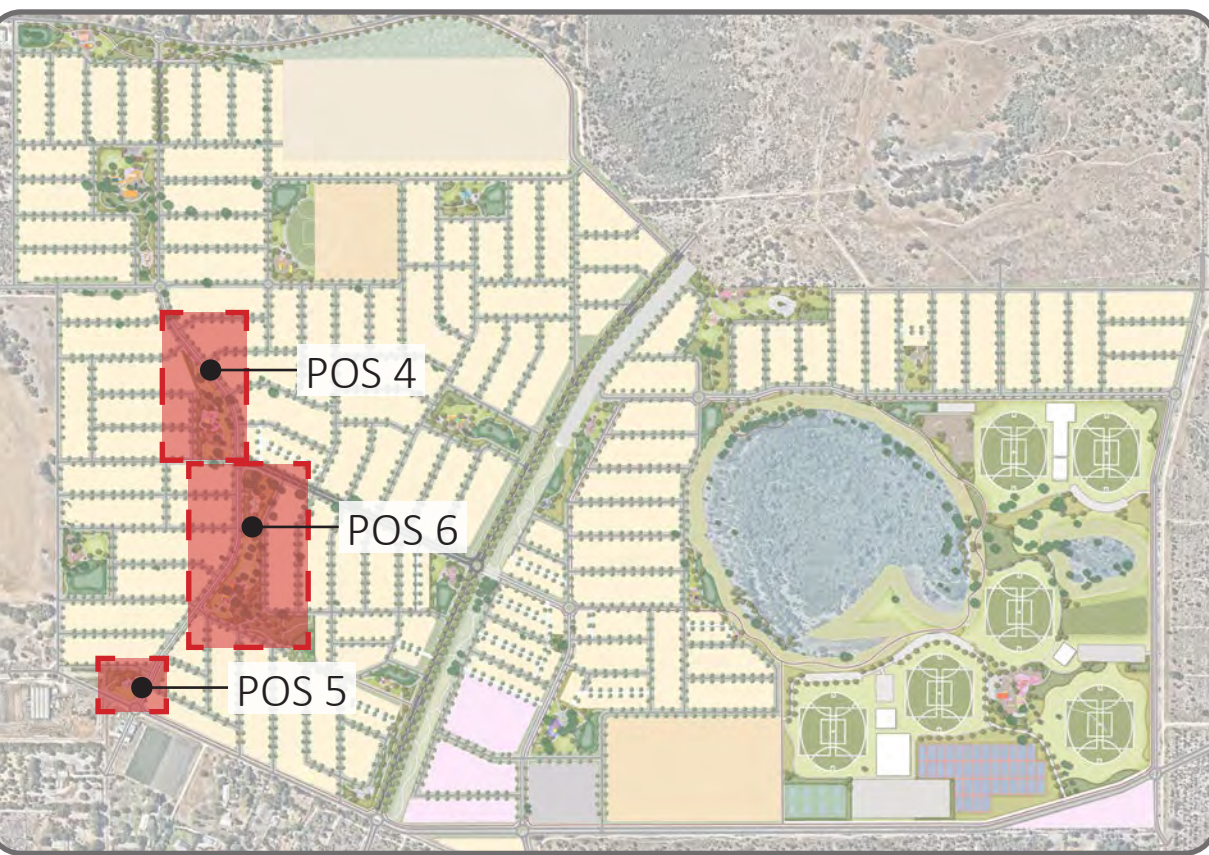


ENVIRONMENTAL CONSIDERATIONS

- Existing trees and vegetation to be retained where possible.
- Low fuel planting to minimise the threat area intensity for bushfire prone areas
- Water-wise native planting and planting
- Source local materials where possible to minimise transport requirements and provide local employment.
- Consider long-term maintenance requirements.

FUNCTIONS / MATERIALS

- Existing trees to be retained
- Open turf area for outdoor activity
- Shelter with table settings and BBQ will provide opportunity for socialisation
- Playground for kids
- Connected path to open space perimeter, with connections to the broader path network.
- Community garden with recycled materials to provide family activity opportunity for residents



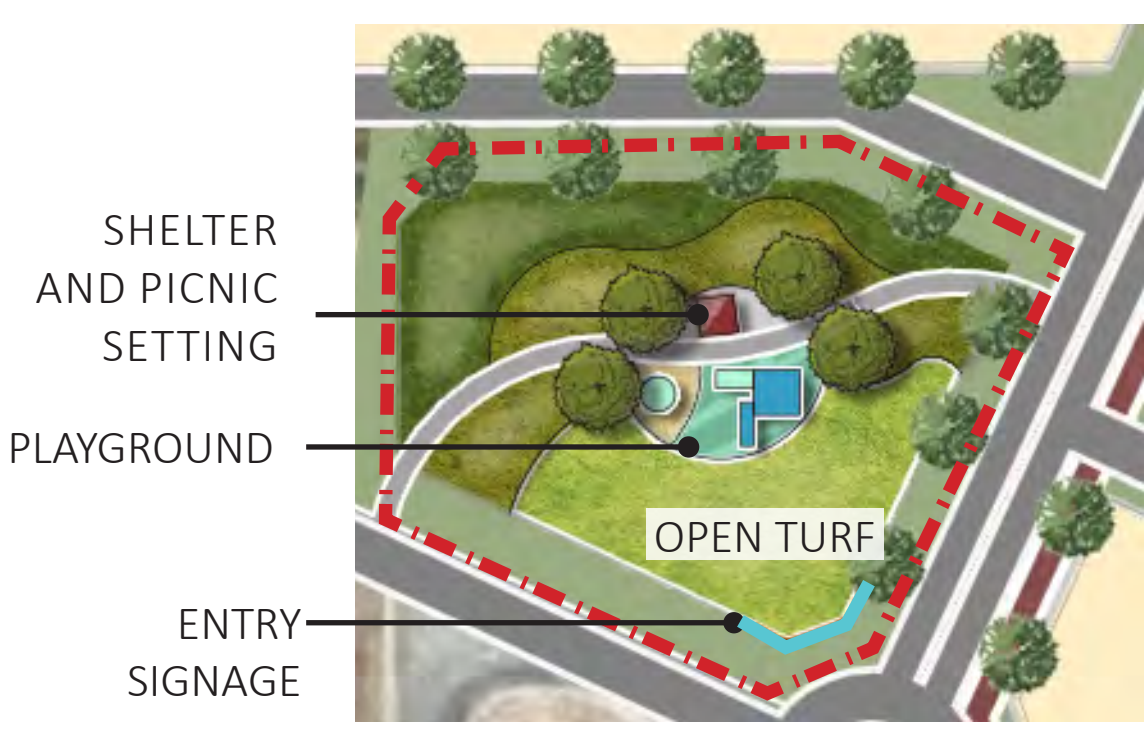
LOCATION PLAN

LEGEND

- TURF
- SHRUB PLANTING (AMENITY)
- LOW FUEL PLANTING
- BASIN
- LOT
- DUAL USE PATH
- FOOTPATH
- MULCH ONLY
- STREET TREES
- EXISTING TREES
- PROPOSED TREES
- CRUSHED LIMESTONE PATH
- BOARDWALK
- REVEGETATION
- EXTENT OF WORK
- REW
- REW BUFFER



POS 5 CONCEPT



POS TYPOLOGY

- Pocket Park

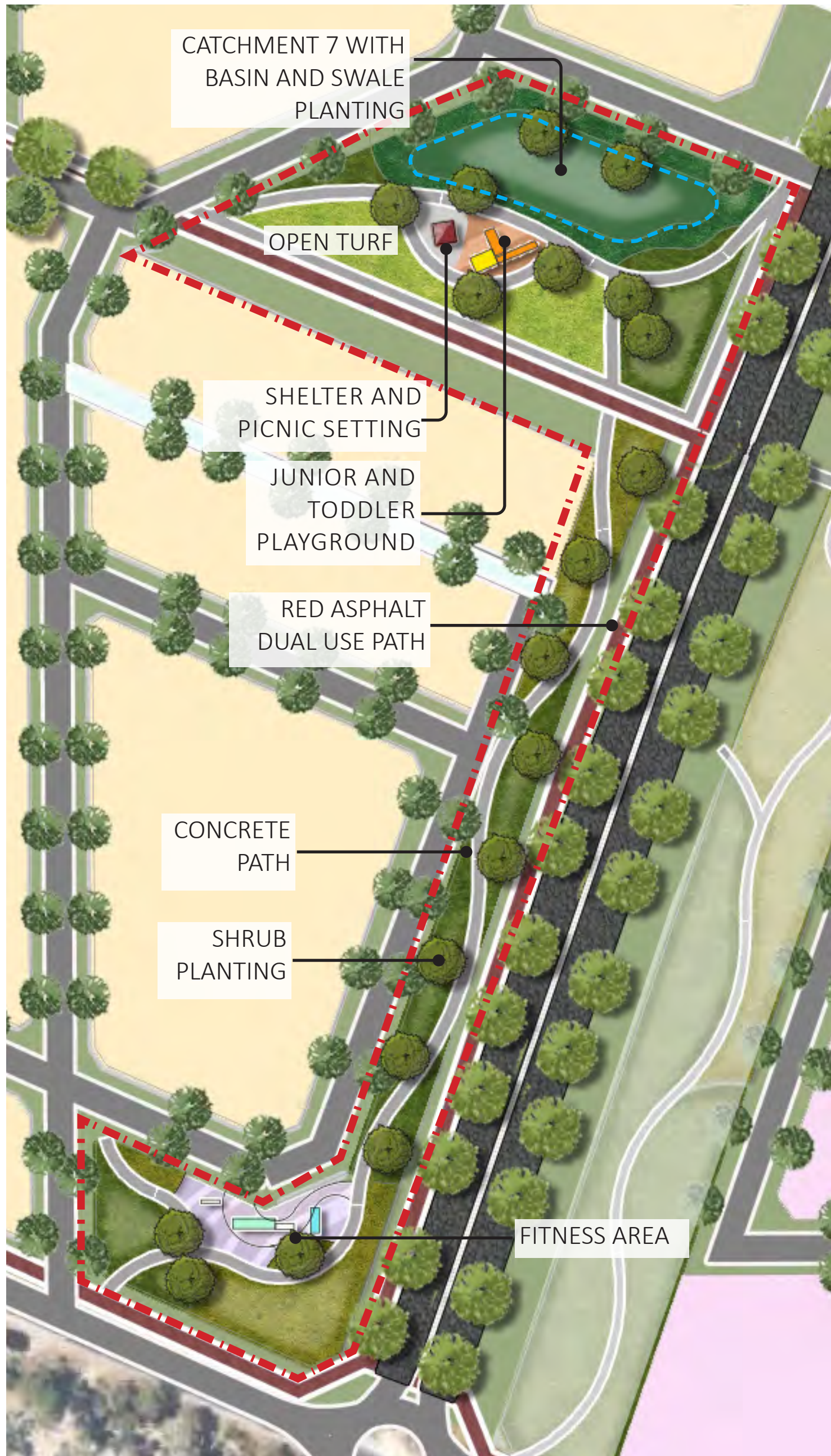
SIZE

- 3,658 m² + Verge

CONCEPT

- Playground for kids
- Shelter and picnic settings
- Plantings to provide buffer to external road
- Small turf area to provide open space
- Provide a pedestrian link through estate from the road
- Entry signage to convey directions and enhance the character of the estate

POS 7 CONCEPT



DRAINAGE LEGEND - CATCHMENT 7

FIRST 15mm BRA DETAILS	
Depth(m):	0.30
Base Area(m ²):	961
Top Area(mAHD):	1076
Slope	1:3

POS TYPOLOGY

- Neighborhood Park
- 1.17 ha + Verge

CONCEPT

- D.U.P most side of the POS to provide connection to road integrators
- Shrub vegetation to provide buffer along main integrator
- Provide a pedestrian link through estate
- Picnic area with shelter and picnic setting
- playground to provide activity space
- Open turf to provide activity area to residents
- Provide fitness area for residents
- Drainage basin as per LWMS

ENVIRONMENTAL CONSIDERATIONS

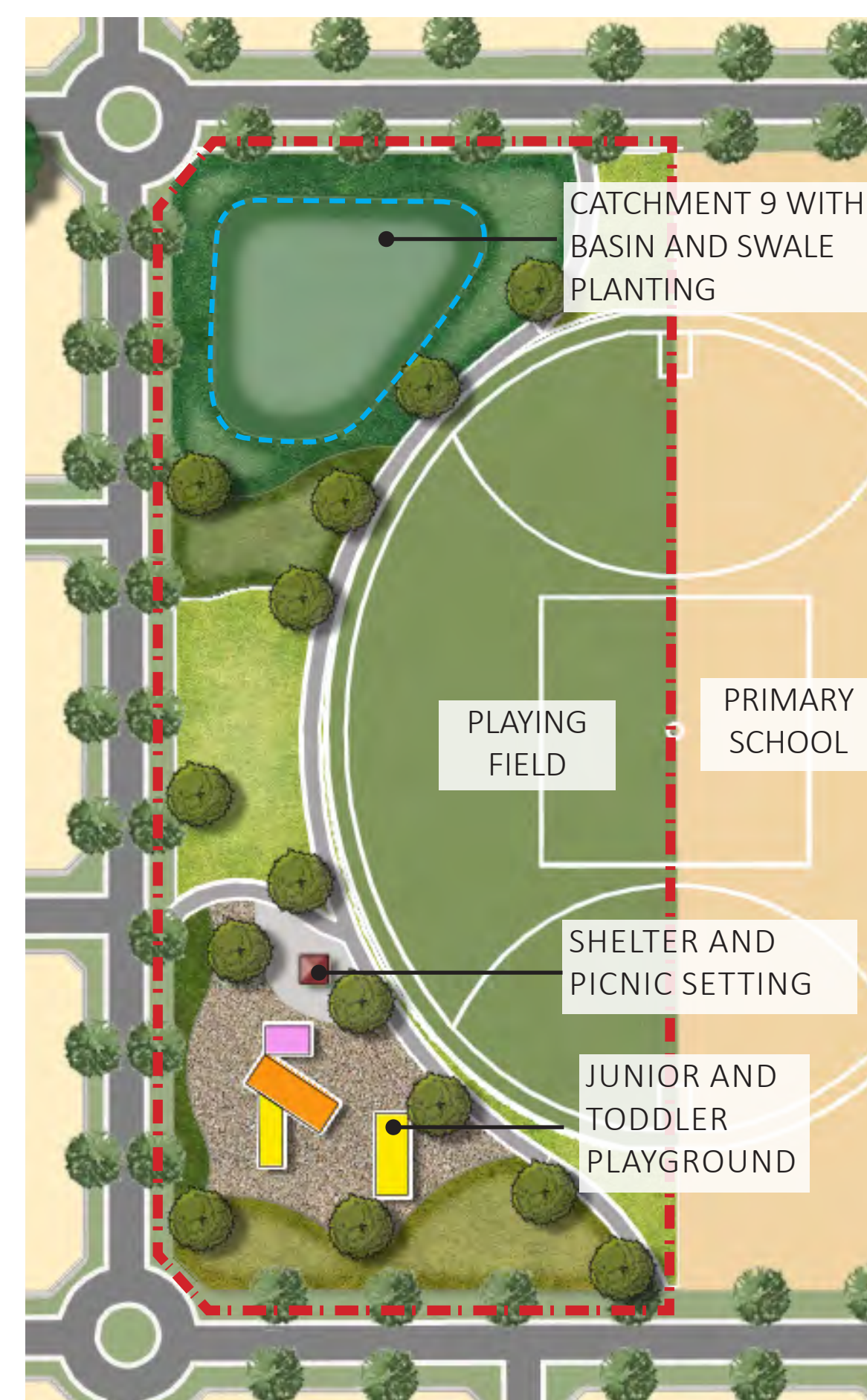
- Low fuel planting to minimise the threat area intensity for bushfire prone areas
- Water-wise native planting and planting
- Source local materials where possible to minimise transport requirements and provide local employment.
- Consider long-term maintenance requirements.
- Provide a buffer to the adjacent road

FUNCTIONS / MATERIALS

- Open turf area for outdoor activity
- Shelter and picnic settings
- Playground for kids
- Fitness area for residents
- Connected path to open space perimeter, with connections to the broader path network and DUP
- Outdoor exercise area provide fitness opportunities for the residents



POS 9 CONCEPT



DRAINAGE LEGEND - CATCHMENT 9

FIRST 15mm BRA DETAILS	
Depth(m):	0.30
Base Area(m ²):	1521
Top Area(mAHD):	1665
Slope	1:3

POS 8 CONCEPT



DRAINAGE LEGEND - CATCHMENT 8

FIRST 15mm BRA DETAILS	
Depth(m):	0.30
Base Area(m ²):	1024
Top Area(mAHD):	1142
Slope	1:3



POS TYPOLOGY

- Neighbourhood Park
- 1.81 ha + Verge

CONCEPT

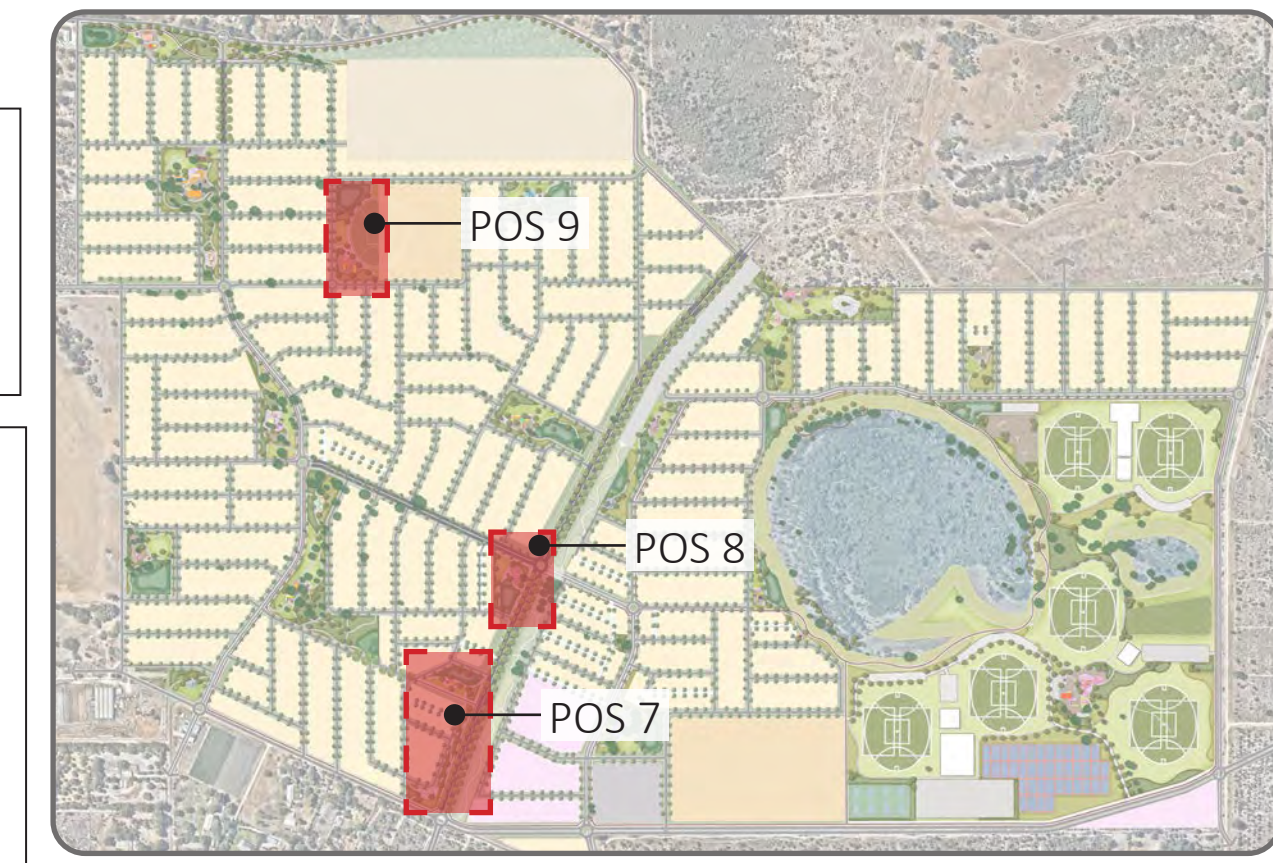
- Concrete footpath to provide connection to road integrators
- Picnic area with shelter, picnic setting and BBQ area
- playground to provide activity space
- Open turf to provide activity area
- Provide Playing field to share with Primary School
- Drainage basin as per LWMS

ENVIRONMENTAL CONSIDERATIONS

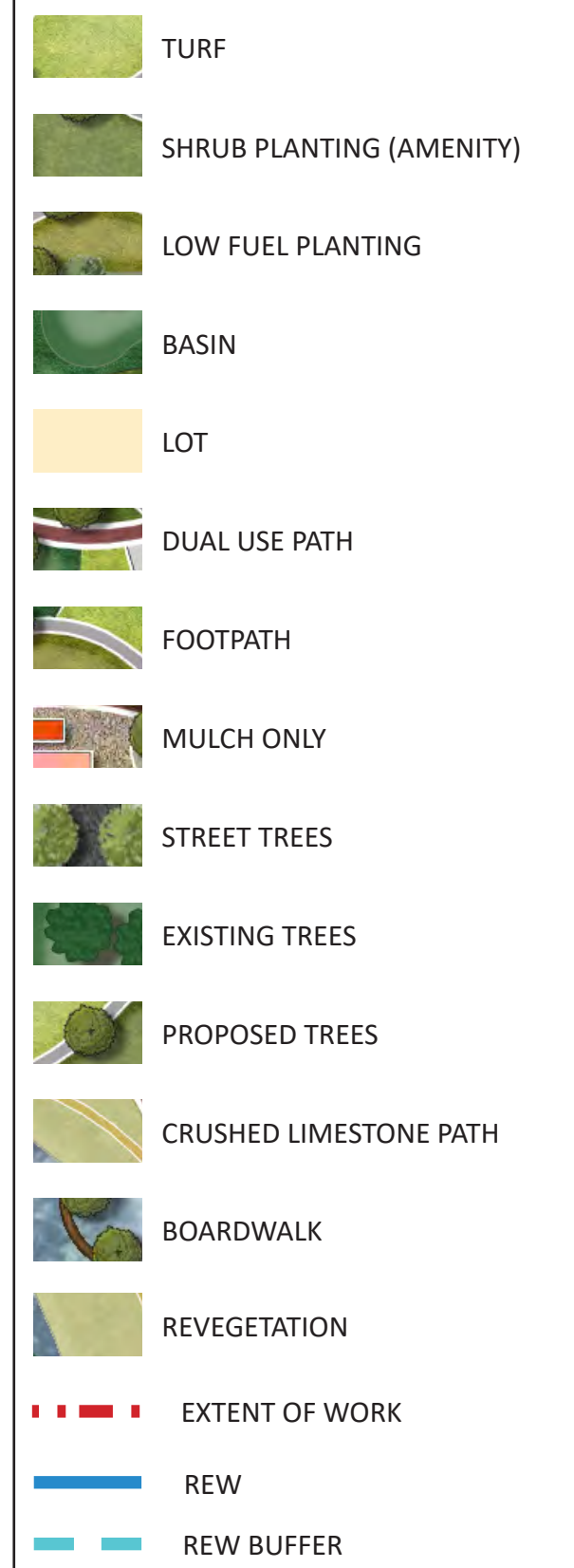
- Low fuel planting to minimise the threat area intensity for bushfire prone areas
- Water-wise native planting and planting
- Source local materials where possible to minimise transport requirements and provide local employment.
- Consider long-term maintenance requirements.
- Provide a buffer to the adjacent road

FUNCTIONS / MATERIALS

- Open turf area for playing field and outdoor activity
- Shelter with table settings and BBQ will provide opportunity for socialisation
- Playground for kids
- Connected path to open space



LOCATION PLAN



CONCEPT

- Concrete footpath to provide connection to road integrators and DUP
- Picnic area with shelter and picnic setting
- playground to provide activity space
- Open turf to provide activity area
- Significant trees to be retained where possible
- Drainage basin as per LWMS

FUNCTIONS / MATERIALS

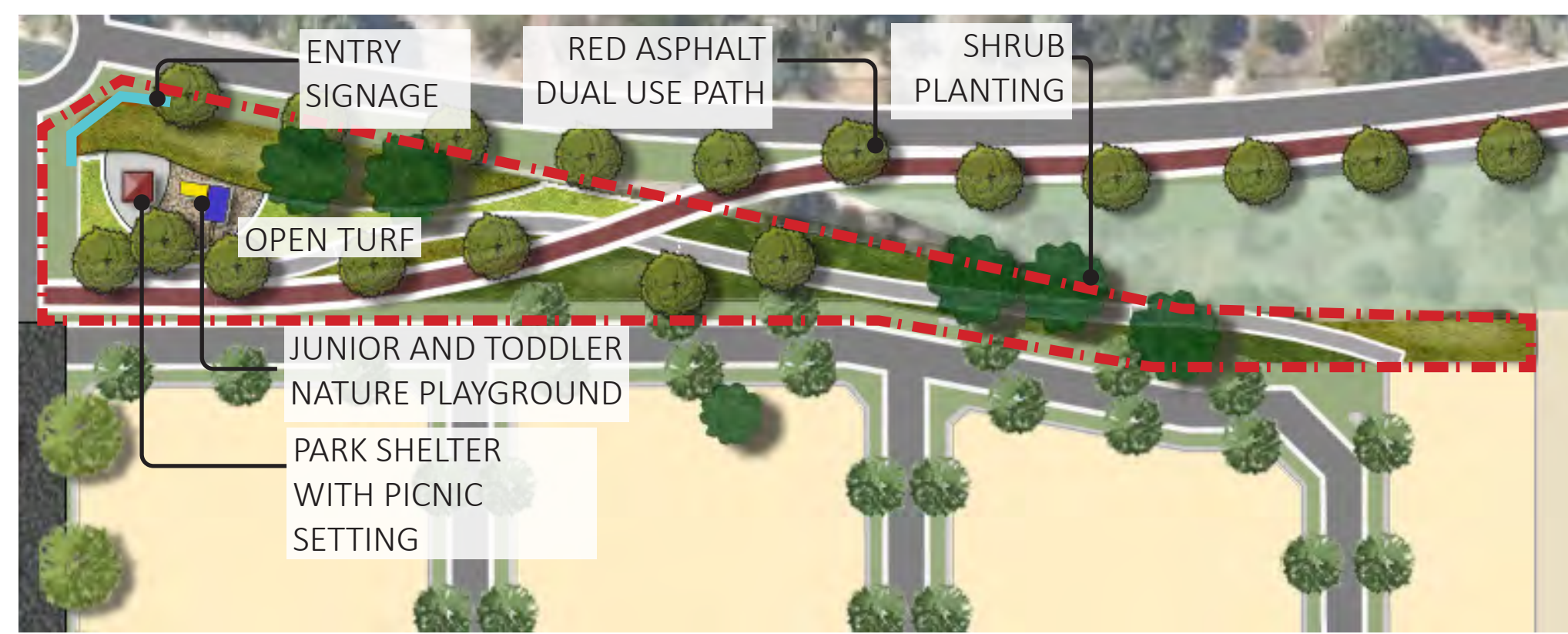
- Open turf area for playing field and outdoor activity
- Shelter and picnic settings
- Playground for kids
- Connected path to open space

ENVIRONMENTAL CONSIDERATIONS

- Low fuel planting to minimise the threat area intensity for bushfire prone areas
- Water-wise native planting and planting
- Source local materials where possible to minimise transport requirements and provide local employment.
- Consider long-term maintenance requirements.
- Provide a buffer to the adjacent road



POS 10 CONCEPT



POS TYPOLOGY

- Pocket Park
- SIZE**
- .4231 ha + Verge

CONCEPT

- D.U.P on northern side of the POS to provide connection to road integrators
- Shrub vegetation to provide buffer along main integrator
- Provide a pedestrian link through estate
- Significant trees to be retained where possible
- Picnic area with shelter and picnic setting
- playground to provide activity space
- Open turf to provide activity area to residents
- Provide entry signage

ENVIRONMENTAL CONSIDERATIONS

- Existing trees and vegetation to be retained where possible.
- Low fuel planting to minimise the threat area intensity for bushfire prone areas
- Water-wise native planting and planting
- Source local materials where possible to minimise transport requirements and provide local employment.
- Consider long-term maintenance requirements.
- Provide a buffer to the adjacent road

FUNCTIONS / MATERIALS

- Existing trees to be retained
- Open turf area for outdoor activity
- Shelter and picnic settings
- Playground for kids
- Entry signage to convey directions and enhance the character of the estate
- Connected path to open space perimeter, with connections to the broader path network.



POS 13 CONCEPT

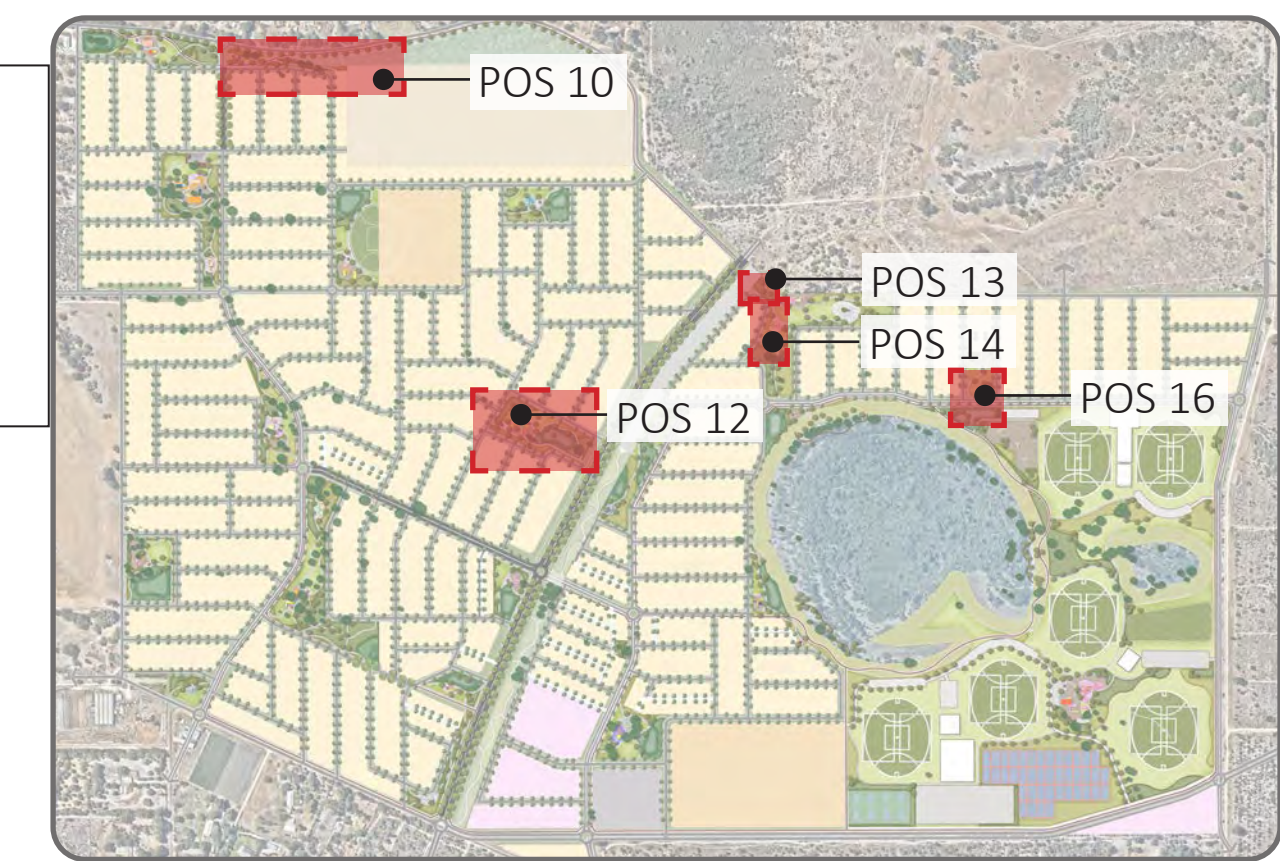


POS TYPOLOGY

- Pocket Park
- SIZE**
- 1,488 m² + Verge

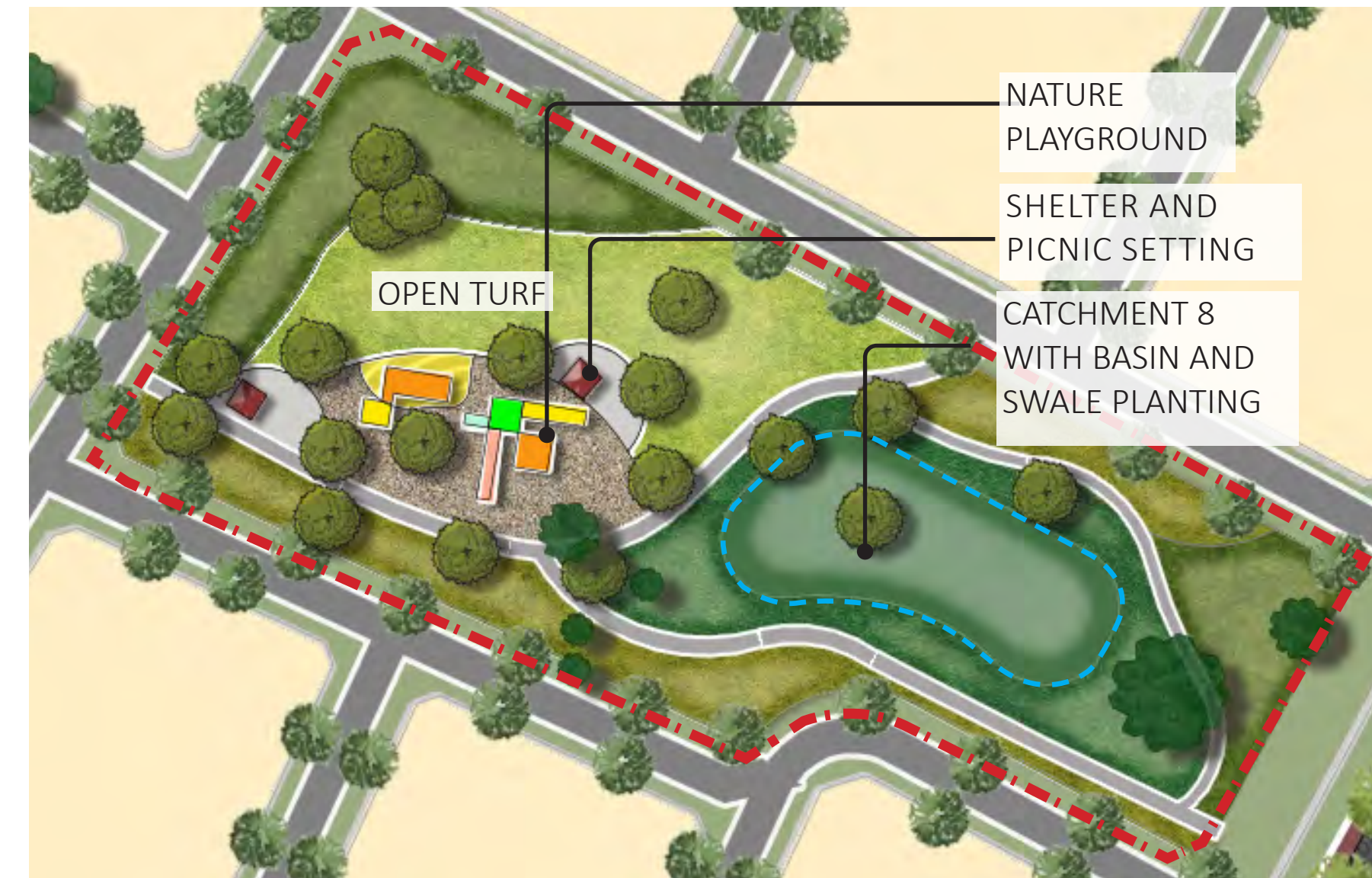
CONCEPT

- Plantings to provide buffer to external road
- Provide a pedestrian link through estate and



LOCATION PLAN

POS 12 CONCEPT



DRAINAGE LEGEND - CATCHMENT 12

FIRST 15mm BRA DETAILS	
Depth(m):	0.30
Base Area(m ²):	1521
Top Area(mAHD):	1665
Slope	1:3

POS TYPOLOGY

- Neighborhood Park
- SIZE**
- 1.4 ha + Verge

CONCEPT

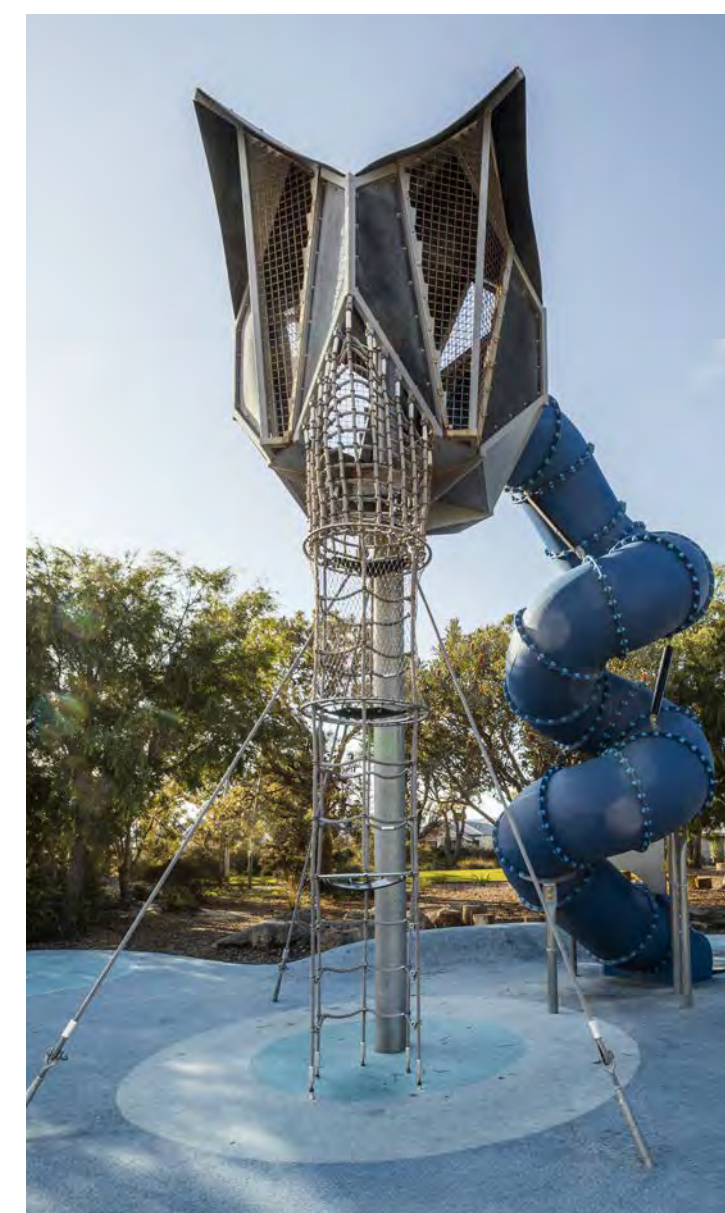
- D.U.P near eastern side of the POS to provide connection to road integrators
- Significant trees to be retained where possible
- Shrub vegetation
- Provide a pedestrian link through estate
- Picnic area with shelter, picnic setting and BBQ area
- All ages playground to provide activity space
- Open turf to provide activity area to residents
- Drainage basin as per LWMS

ENVIRONMENTAL CONSIDERATIONS

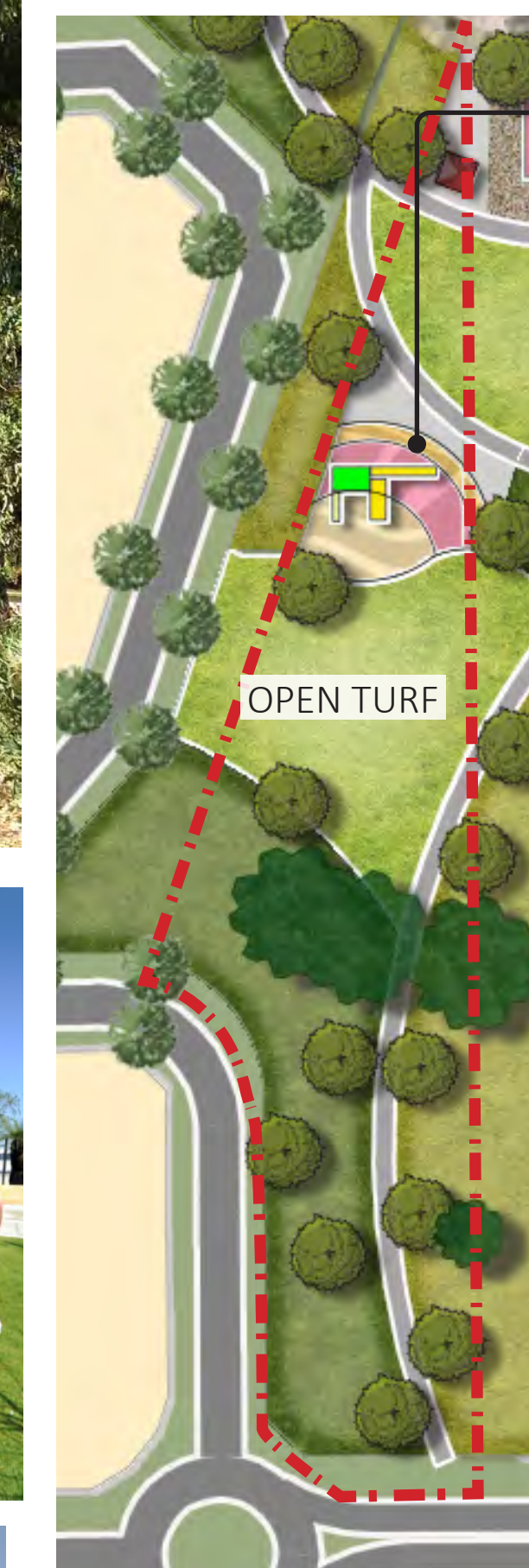
- Existing trees and vegetation to be retained where possible.
- Low fuel planting to minimise the threat area intensity for bushfire prone areas
- Water-wise native planting and planting
- Source local materials where possible to minimise transport requirements and provide local employment.
- Consider long-term maintenance requirements.
- Provide a buffer to the adjacent road

FUNCTIONS / MATERIALS

- Existing trees to be retained
- Open turf area for outdoor activity
- Shelter with table settings and BBQ will provide opportunity for socialisation
- Playground for all ages
- Connected path to open space with connections to the broader path



POS 14 CONCEPT



FITNESS AREA

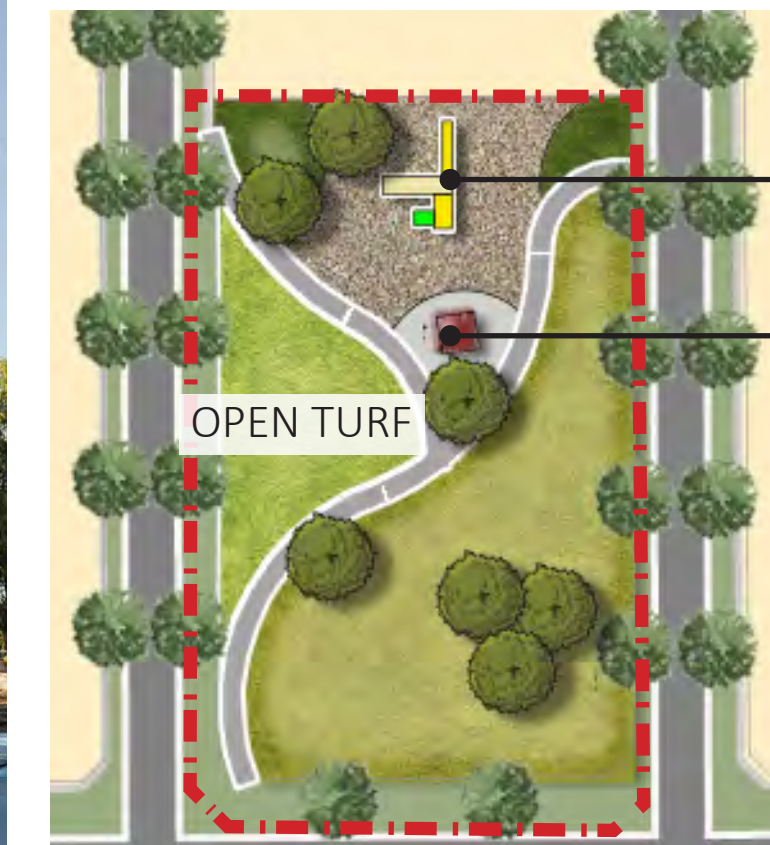
POS TYPOLOGY

- Local Park
- SIZE**
- 5,686 m² + Verge

CONCEPT

- Shelter and picnic settings
- Plantings to provide buffer to external road
- Small turf area to be part of connecting POS turf area to provide a wider open space
- Significant trees to be retained where possible
- Outdoor exercise area provide fitness opportunities for the residents
- Provide a pedestrian link through estate from the road through connecting POS

POS 16 CONCEPT



JUNIOR AND TODDLER PLAYGROUND

PARK SHELTER WITH PICNIC SETTING

POS TYPOLOGY

- Pocket Park
- SIZE**
- 4,941 m² + Verge

CONCEPT

- Plantings to provide buffer to external road
- Small Playground for kids
- Provide a pedestrian link through estate and from the road
- Drainage basin as per LWMS



POS 15 CONCEPT



POS TYPOLOGY

- Neighbourhood Park

SIZE

- 1.92 ha + Verge

CONCEPT

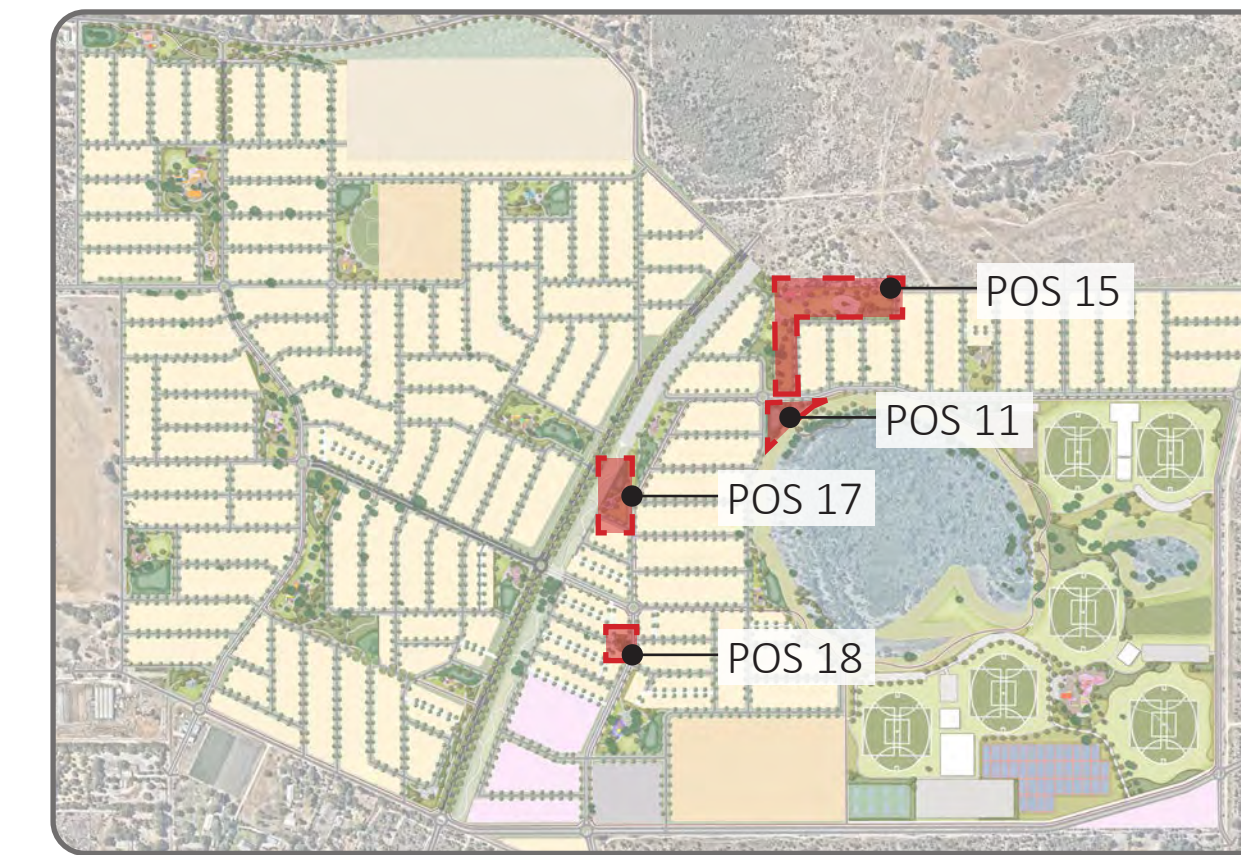
- Concrete footpath to provide a pedestrian link through estate and connecting the POS to road integrators
- Shrub vegetation to provide as a buffer to adjacent road
- Picnic area with shelter, picnic setting and BBQ area
- All ages playground to provide activity space
- Provide pump track
- Open turf to provide activity area to residents
- Turf mounding to create a unique landscape topography
- Drainage basin as per LWMS

ENVIRONMENTAL CONSIDERATIONS

- Existing trees and vegetation to be retained where possible.
- Low fuel planting to minimise the threat area intensity for bushfire prone areas
- Water-wise native planting and planting
- Source local materials where possible to minimise transport requirements and provide local employment.
- Consider long-term maintenance requirements.
- Provide a buffer to the adjacent road

FUNCTIONS / MATERIALS

- Existing trees to be retained
- Open turf area for outdoor activity
- Shelter with table settings and BBQ will provide opportunity for socialisation
- All age Nature Playground for kids
- Pump track will create exercise and play opportunity as well as socialisation
- Connected path to open space perimeter, with connections to the broader path network.
- Provide a pedestrian link through estate and connecting POS from the road



LOCATION PLAN

	TURF
	SHRUB PLANTING (AMENITY)
	LOW FUEL PLANTING
	BASIN
	LOT
	DUAL USE PATH
	FOOTPATH
	MULCH ONLY
	STREET TREES
	EXISTING TREES
	PROPOSED TREES
	CRUSHED LIMESTONE PATH
	BOARDWALK
	REVEGETATION
	EXTENT OF WORK
	REW
	REW BUFFER



POS 11 CONCEPT



DRAINAGE LEGEND - CATCHMENT 11

FIRST 15mm BRA DETAILS

Depth(m):	0.30
Base Area(m ²):	1089
Top Area(mAHD):	1211
Slope:	1:3

POS TYPOLOGY

- Pocket Park
- 4,941 m² + Verge

CONCEPT

- Plantings to provide buffer to external road
- Small Playground for kids
- Provide a pedestrian link through estate and from the road
- Drainage basin as per LWMS



POS 17 CONCEPT



DRAINAGE LEGEND - CATCHMENT 17

FIRST 15mm BRA DETAILS

Depth(m):	0.30
Base Area(m ²):	576
Top Area(mAHD):	666
Slope:	1:3

POS TYPOLOGY

- Pocket Park
- 4,480 m² + Verge

CONCEPT

- Plantings to provide buffer to external road
- Small Playground for kids
- Provide a pedestrian link through estate and connecting POS from the road
- Drainage basin as per LWMS



POS 18 CONCEPT

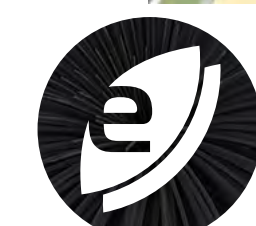


POS TYPOLOGY

- Pocket Park
- 1,020 m² + Verge

CONCEPT

- Plantings to provide buffer to external road
- Significant trees to be retained where possible
- Provide a pedestrian link through estate from the road



POS 19 CONCEPT



DRAINAGE LEGEND - CATCHMENT 19

FIRST 15mm BRA DETAILS	
Depth(m):	0.30
Base Area(m ²):	1089
Top Area(mAHD):	1211
Slope	1:3

POS TYPOLOGY

- Neighbourhood Park
- 1.28 ha + Verge

CONCEPT

- D.U.P on western side of the POS to provide connection to road integrators
- Concrete footpath to provide connection to road integrators
- Shrub vegetation to provide buffer from adjacent road
- Provide a pedestrian link through estate from neighbourhood centre
- Opportunity of BMX bike tracks to be implemented in existing tree canopy at where is appropriate
- Open turf to provide activity area to residents
- Turf mounding to create a unique landscape topography
- Significant trees to be retained where possible
- Picnic area with shelter, picnic setting and BBQ area
- Playground to provide activity space
- Drainage basin as per LWMS

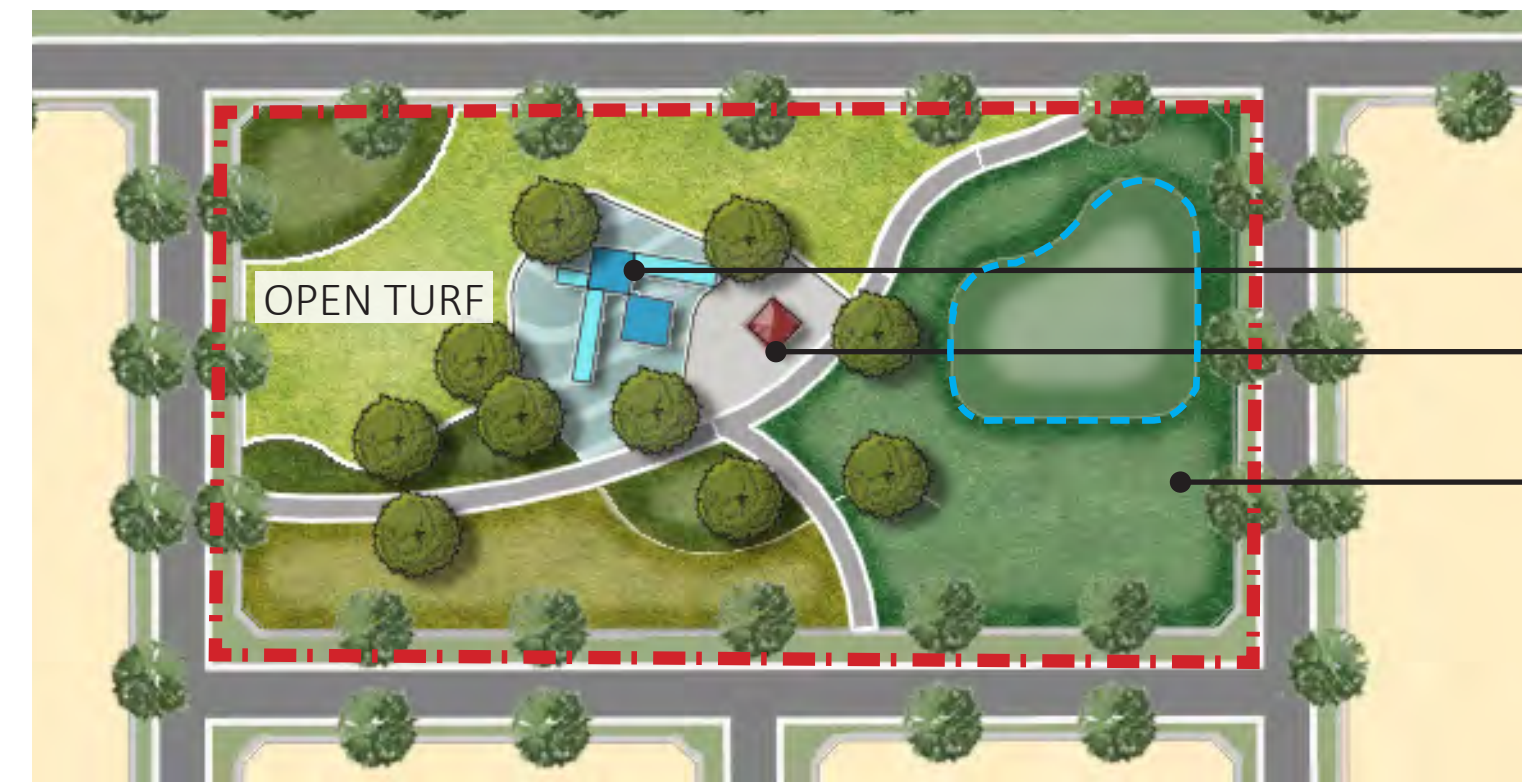
FUNCTIONS / MATERIALS

- Playground for kids
- Turf mounding to create unique landscape topography
- Pump track will create exercise and play opportunity as well as socialisation
- Shelter with table settings and BBQ will provide opportunity for socialisation
- Existing trees to be retained
- Open turf area for outdoor activity
- Connected path and pedestrian link to open space perimeter, with connections to the neighbourhood centre, school and train station

ENVIRONMENTAL CONSIDERATIONS

- Existing trees and vegetation to be retained where possible.
- Low fuel planting to minimise the threat area intensity for bushfire prone areas
- Water-wise native planting and planting
- Source local materials where possible to minimise transport requirements and provide local employment.
- Consider long-term maintenance requirements.
- Provide a buffer to the adjacent road

POS 21 CONCEPT



- JUNIOR AND TODDLER PLAYGROUND
- PARK SHELTER WITH PICNIC SETTING
- CATCHMENT 21 WITH BASIN AND SWALE PLANTING

DRAINAGE LEGEND - CATCHMENT 21

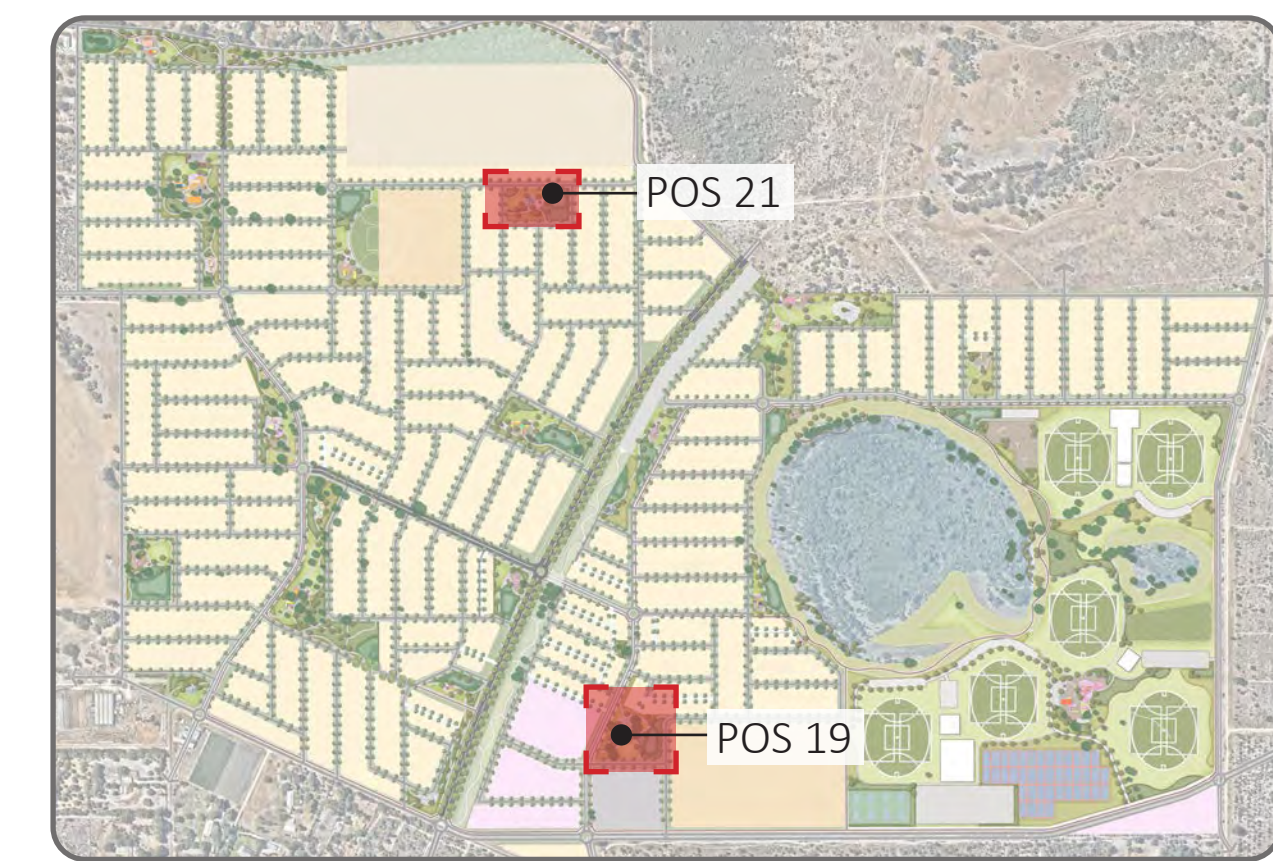
FIRST 15mm BRA DETAILS	
Depth(m):	0.30
Base Area(m ²):	676
Top Area(mAHD):	773
Slope	1:3

POS TYPOLOGY

- Local Park
- .9 ha + Verge

FUNCTIONS / MATERIALS

- Existing trees to be retained
- Open turf area for outdoor activity
- Shelter and picnic settings
- Playground for kids
- Connected path to open space perimeter, with connections to the broader path network.



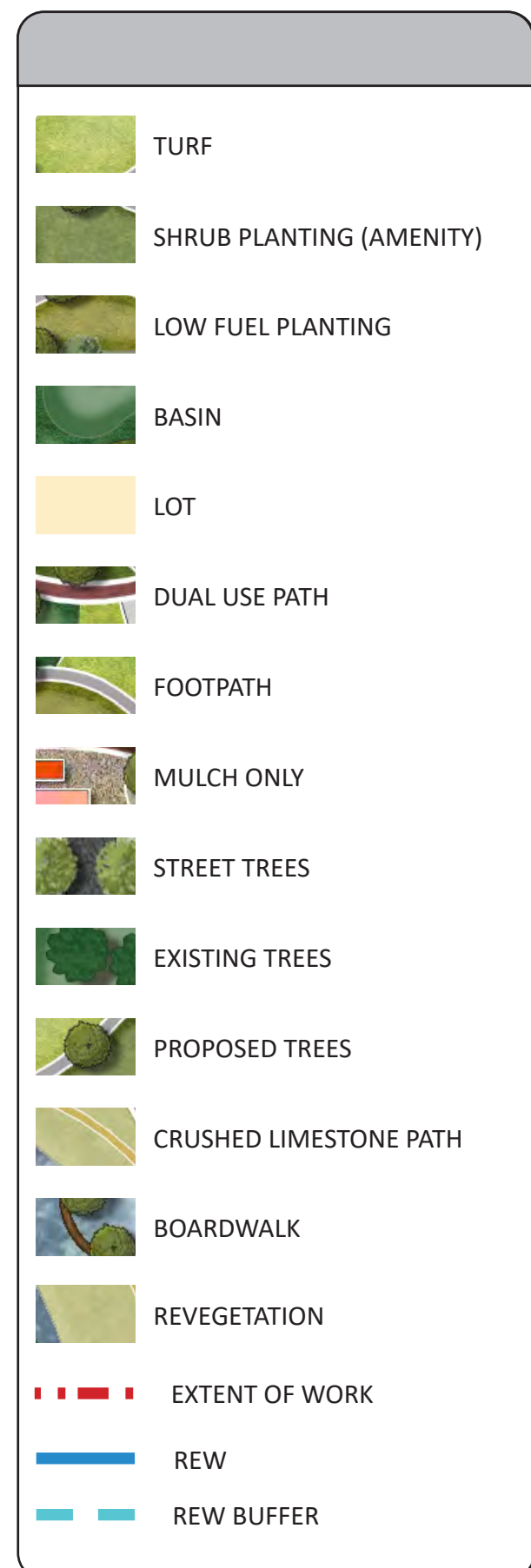
LOCATION PLAN

CONCEPT

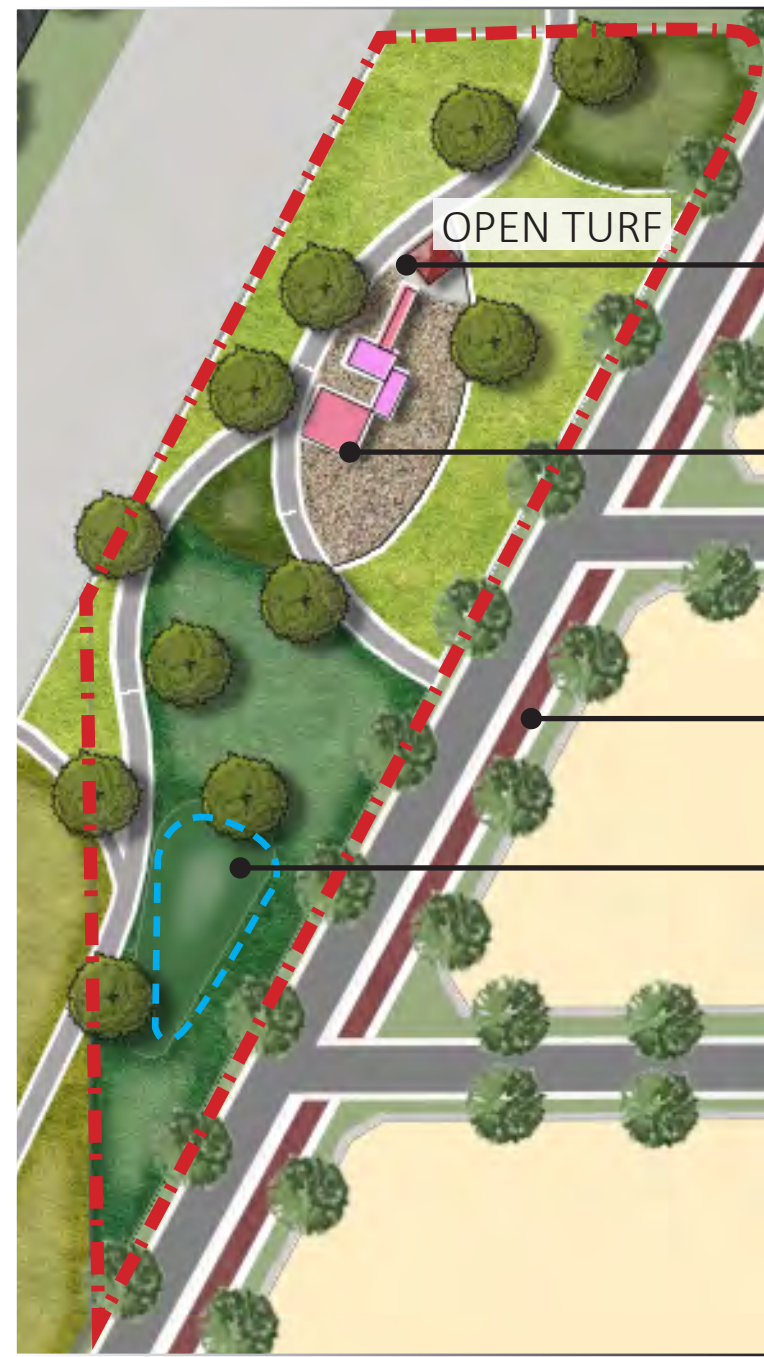
- Shrub vegetation to provide as buffer to adjacent road
- Provide a pedestrian link through estate
- Significant trees to be retained where possible
- Picnic area with shelter and picnic setting
- playground to provide activity space
- Open turf to provide activity area to residents
- Drainage basin as per LWMS

ENVIRONMENTAL CONSIDERATIONS

- Existing trees and vegetation to be retained where possible.
- Low fuel planting to minimise the threat area intensity for bushfire prone areas
- Water-wise native planting and planting
- Source local materials where possible to minimise transport requirements and provide local employment.
- Consider long-term maintenance requirements.
- Provide a buffer to the adjacent road



POS 20A CONCEPT



- PARK SHELTER WITH PICNIC SETTING
- JUNIOR AND TODDLER PLAYGROUND
- RED ASPHALT DUAL USE PATH
- CATCHMENT 20A WITH BASIN AND SWALE PLANTING

CONCEPT

- Shrub vegetation to provide buffer to adjacent road
- Provide a pedestrian link through estate and connecting POS from the road
- Picnic area with shelter and picnic setting
- Playground to provide activity space
- Open turf to provide activity area to residents
- Drainage basin as per LWMS

ENVIRONMENTAL CONSIDERATIONS

- Low fuel planting to minimise the threat area intensity for bushfire prone areas
- Water-wise native planting and planting
- Source local materials where possible to minimise transport requirements and provide local employment.
- Consider long-term maintenance requirements.
- Provide a buffer to the adjacent road

DRAINAGE LEGEND - CATCHMENT 20A

FIRST 15mm BRA DETAILS

Depth(m):	0.30
Base Area(m ²)	289
Top Area(mAHD):	353
Slope	1:3

POS TYPOLOGY

- Local Park

SIZE

- .6329 ha + Verge

FUNCTIONS / MATERIALS

- Open turf area for outdoor activity
- Shelter and picnic settings
- Playground for kids
- Connected path to open space perimeter, with connections to the broader path network.



- CATCHMENT 20B WITH BASIN AND SWALE PLANTING
- JUNIOR AND TODDLER PLAYGROUND
- PARK SHELTER WITH PICNIC SETTING
- RED ASPHALT DUAL USE PATH

DRAINAGE LEGEND - CATCHMENT 20B

FIRST 15mm BRA DETAILS

Depth(m):	0.30
Base Area(m ²)	1225
Top Area(mAHD):	1354
Slope	1:3

POS TYPOLOGY

- Local Park

SIZE

- .8273 ha + Verge

FUNCTIONS / MATERIALS

- Open turf area for outdoor activity
- Shelter and picnic settings
- Playground for kids
- Outdoor exercise area provide fitness opportunities for the residents
- Connected path to open space perimeter, with connections to the broader path network and DUP

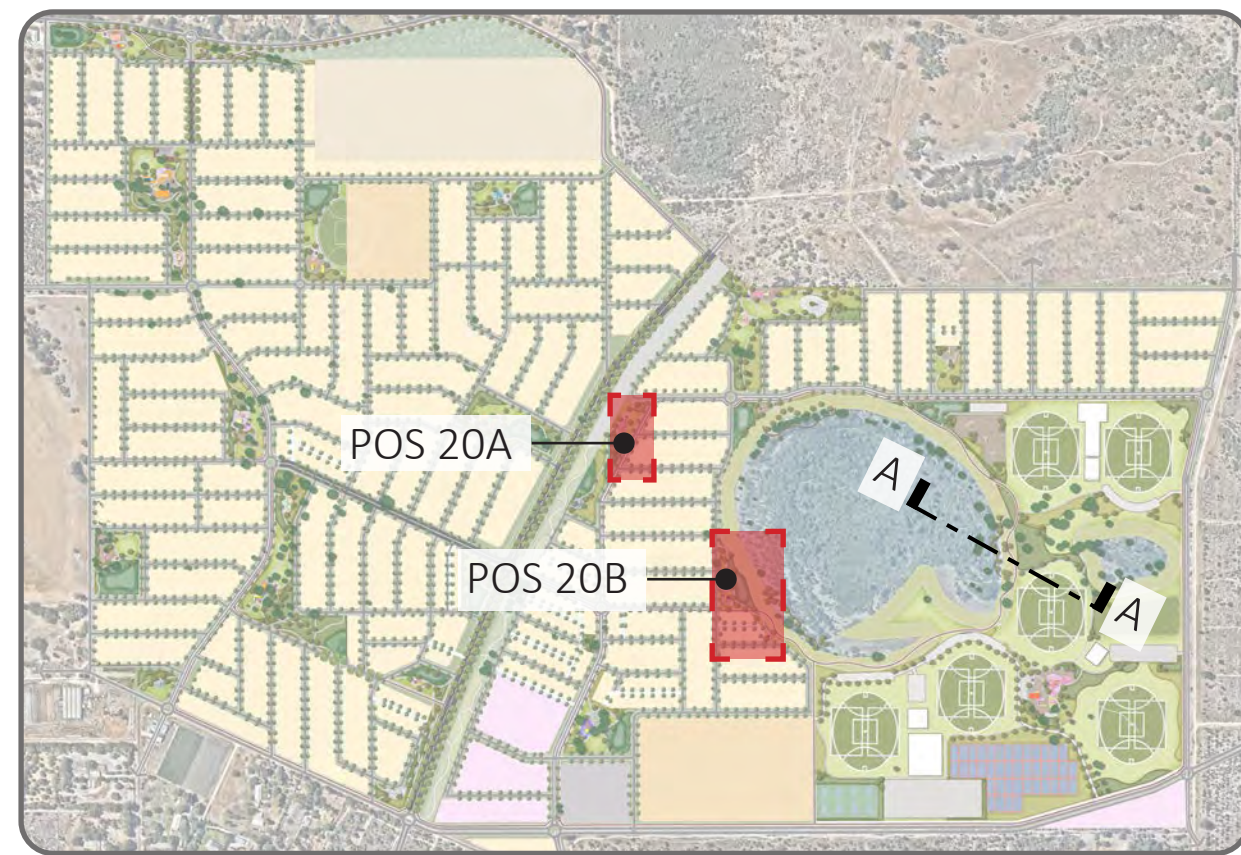


CONCEPT

- D.U.P on southern side of the POS to provide connection to road integrators
- Provide fitness area for residents
- Shrub vegetation to provide buffer to adjacent road
- Provide a pedestrian link through estate and REW
- Picnic area with shelter and picnic setting
- playground to provide activity space
- Open turf to provide activity area to residents
- Drainage basin as per LWMS

ENVIRONMENTAL CONSIDERATIONS

- Low fuel planting to minimise the threat area intensity for bushfire prone areas
- Water-wise native planting and planting
- Source local materials where possible to minimise transport requirements and provide local employment.
- Consider long-term maintenance requirements.



LOCATION PLAN

LEGEND

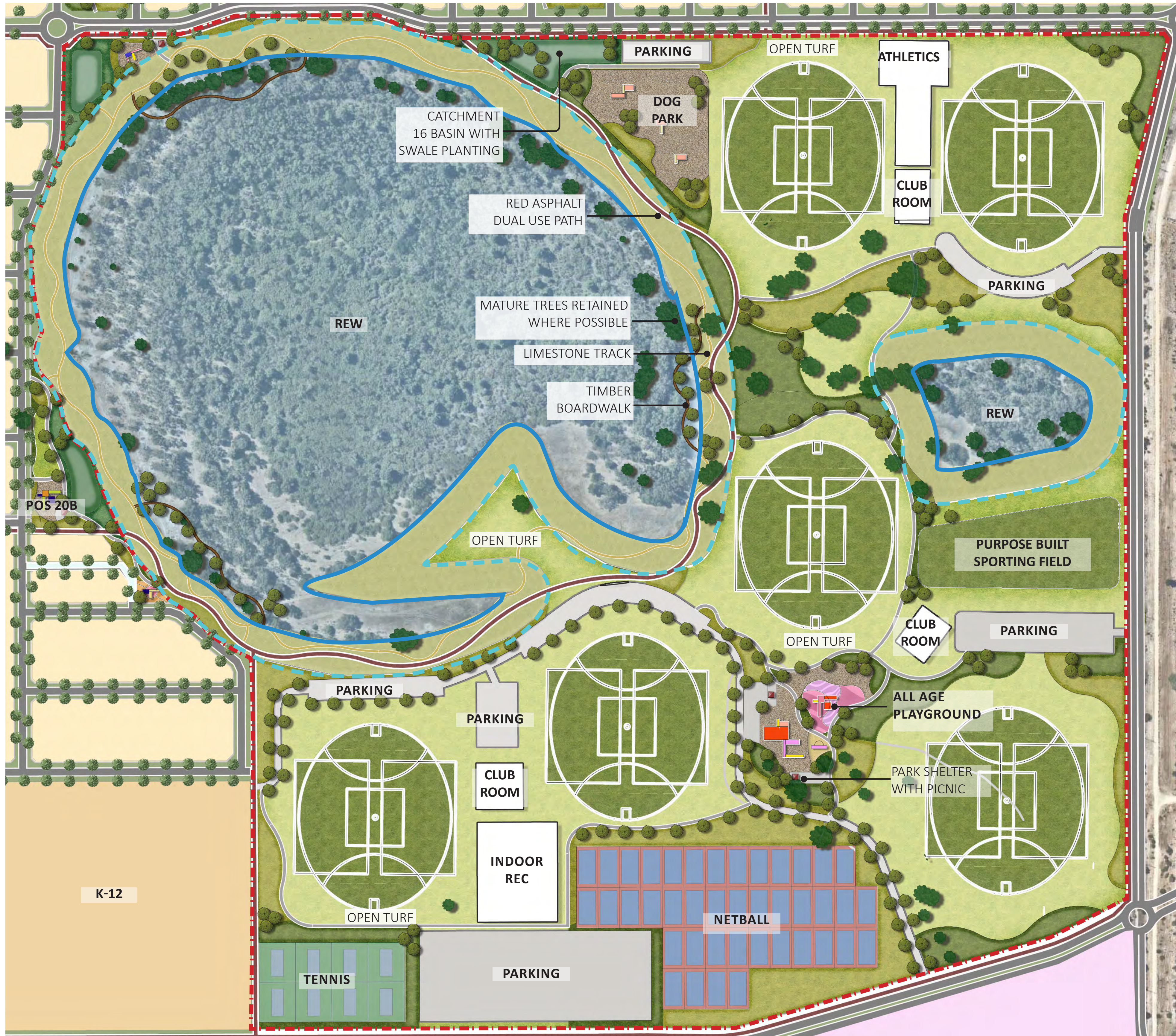
- TURF
- SHRUB PLANTING (AMENITY)
- LOW FUEL PLANTING
- BASIN
- LOT
- DUAL USE PATH
- FOOTPATH
- MULCH ONLY
- STREET TREES
- EXISTING TREES
- PROPOSED TREES
- CRUSHED LIMESTONE PATH
- BOARDWALK
- REW
- REVEGETATION
- EXTENT OF WORK
- REW
- REW BUFFER

REGIONAL POS SECTION



SECTION A-A

SCALE 1 : 200 @ A1



POS TYPOLOGY

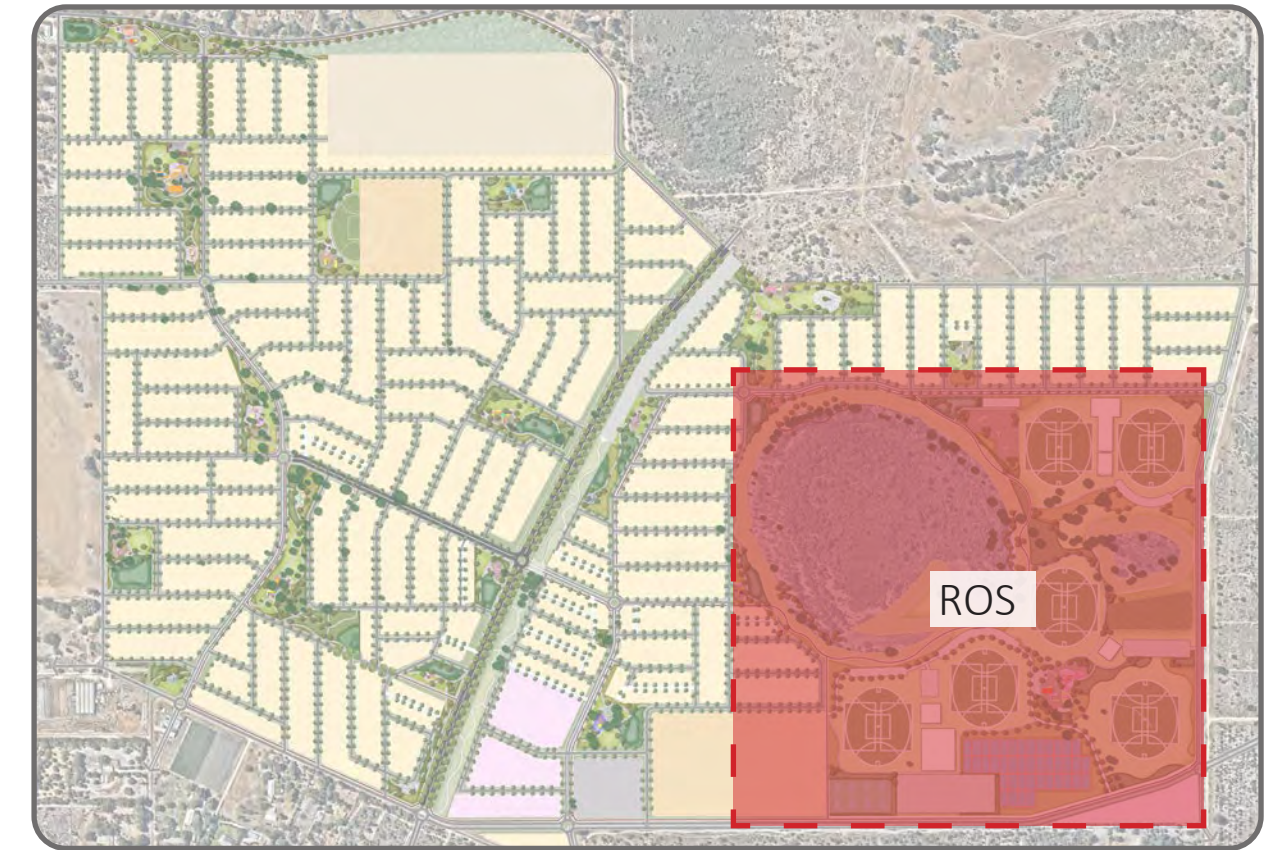
- Sports POS

SIZE

- 47.423 ha + Verge

- CONCEPT POS 7**
- Playing field to provide with senior 6xAFL oval, 2
 - Dual use path to provide cyclists and pedestrian with connection to wetland area
 - Connected path to open space perimeter, with connections to the broader path network and DUP
 - Provide a pedestrian link through estate, REW and road integrators
 - All age playground to provide play space
 - Fitness area to provide exercise space
 - 2x Shelter with picnic settings to provide BBQ area
 - Shrub vegetation to provide buffer to adjacent road
 - Open turf to provide activity area to residents
 - Mounded turf to create good views to the playing field as well as to provide opportunities for sitting, laying, and gathering
 - Large area of existing vegetation & significant trees to be retained and protected
 - Dog park with agilities to be included in the POS
 - Drainage basin as per LWMS design

- ENVIRONMENTAL CONSIDERATIONS**
- Large area of existing vegetation to be retained and protected for local flora and fauna habitat
 - Revegetation planting around REW buffers to enhance local flora and fauna habitat. Palette aligns with spring survey results
 - Significant existing trees to be retained in open space where possible
 - Water-wise native planting.
 - Consider long-term maintenance requirements.
 - Source local materials where possible to minimise transport requirements and provide local employment.
 - Dirt and crushed limestone track/path in existing vegetation area instead of



LOCATION PLAN

FUNCTIONS / MATERIALS

- Significant existing trees to be retained
- Playing field including 6x AFL Senior oval
- Open turf area for outdoor activity
- Mounded turf to create good views
- Shelter with table settings and BBQ will provide opportunity for socialisation
- All-age playground for all people
- Dog park for dog agility play opportunity for residents
- Turf mounding to create unique landscape topography
- Boardwalk to provided good view above drainage basin
- Limestone path in shrub planting
- Outdoor exercise area provide fitness opportunities for the residents
- Connected path to open space perimeter, with connections to the broader path network and DUP

LEGEND

- TURF
- SHRUB PLANTING (AMENITY)
- LOW FUEL PLANTING
- BASIN
- LOT
- DUAL USE PATH
- FOOTPATH
- MULCH ONLY
- STREET TREES
- EXISTING TREES
- PROPOSED TREES
- CRUSHED LIMESTONE PATH
- BOARDWALK
- REW
- REVEGETATION
- EXTENT OF WORK
- REW
- REW BUFFER



DRAINAGE LEGEND - CATCHMENT 16

FIRST 15mm BRA DETAILS

Depth(m):	0.30
Base Area(m ²):	2401
Top Area(mAHD):	2582
Slope	1:3



STREET TREE PLANTINGS



Eucalyptus gomphocephala



Jacaranda mimosifolia



Olea europaea (Swan Hill)



Melaleuca leucadendron



Agonis flexuosa



Callistemon 'KPS'



Corymbia calophylla



Eucalyptus gomphocephala



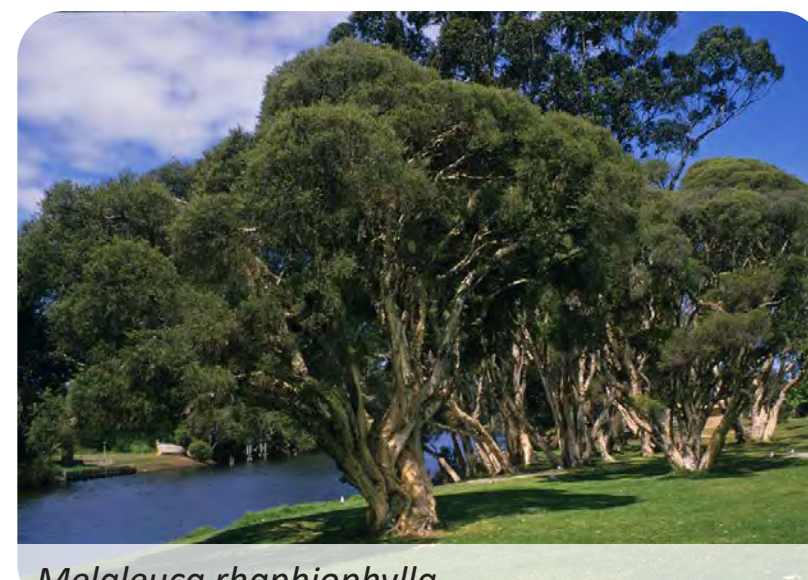
Eucalyptus rudis



Eucalyptus todtiana



Eucalyptus marginata



Melaleuca raphiophylla

SHRUB PLANTING



Acacia lasiocarpa



Conostylis aculeata ssp. preissii



Dianella revoluta



Dampiera linearis



Eremophila maculata



Grevillea crithmifolia



Grevillea thelemanniana



Hemiandra pungens



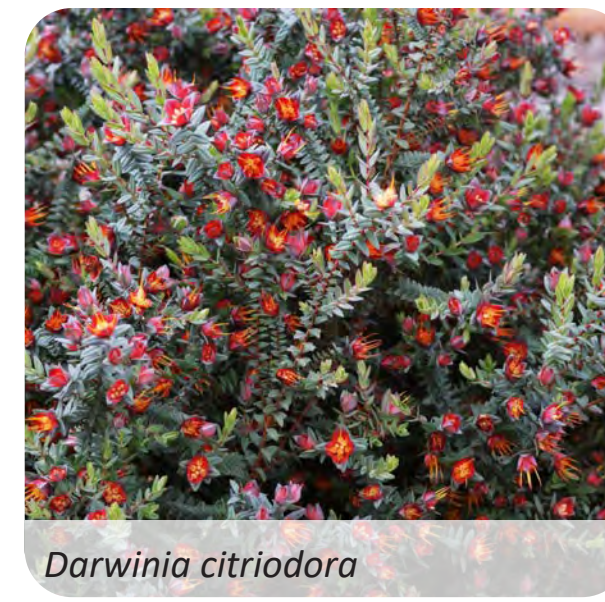
Patersonia occidentalis



Olearia axillaris



Rhagodia baccata



Darwinia citriodora



Dianella cassia blue



Eremophila glabra



Lepidosperma calcicola



Lepidosperma gladiatum



Lomandra longifolia



Meeboldina scariosa

REVEGETATION PLANTING



Anigozanthos manglesii



Adenanthos cygnorum



Adenanthos cygnorum



Acacia pulchella



Beaufortia squarrosa



Baumea juncea



Banksia grandis



Calothamnus sanguineus



Darwinia citriodora



Eucalyptus rudis



Hypocalymma angustifolium



Juncus pallidus



Jacksonia sternbergiana



Kunzea glabrescens



Kennedia prostrata



Regelia inops



Verticordia densiflora

LOW FUEL PLANTING



Anigozanthos manglesii



Austrostipa compressa



Conostylis aculeata



Dampiera linearis



Juncus pallidus



Kennedia prostrata



Kunzea recurva



Melaleuca thymoides



Patersonia occidentalis

Environmental Assessment Report

Precinct 15 Structure Plan

