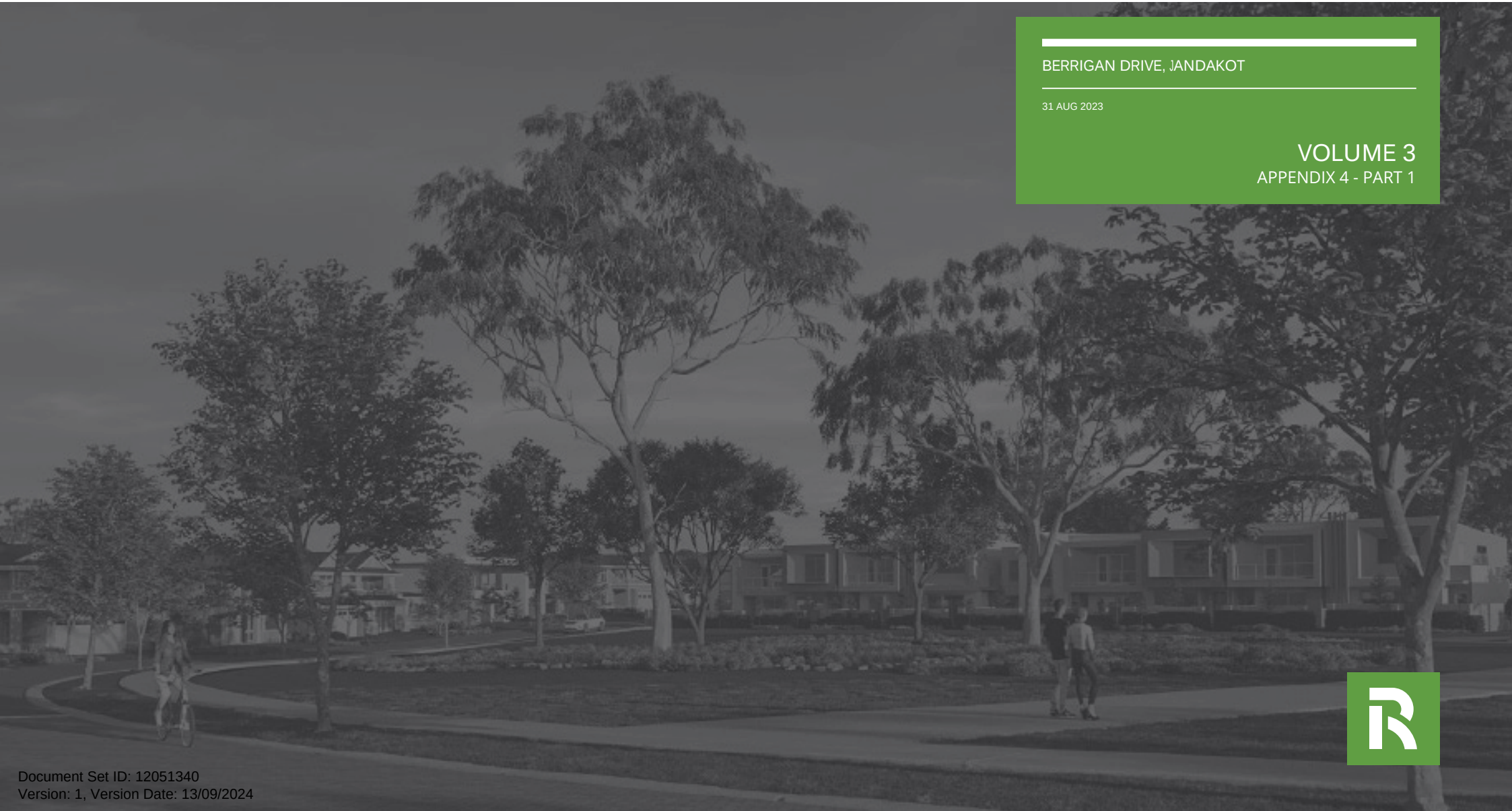
GLEN IRIS ESTATE

STRUCTURE PLAN



BERRIGAN DRIVE, JANDAKOT

31 AUG 2023

VOLUME 3
APPENDIX 4 - PART 1

GLEN IRIS ESTATE

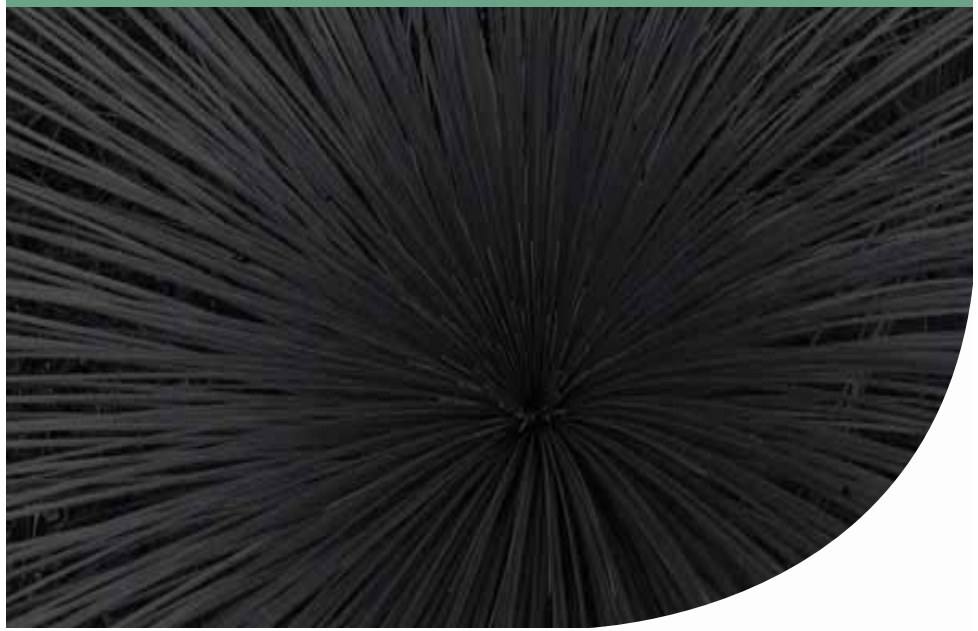
APPENDIX 4
ENVIRONMENTAL ASSESSMENT REPORT

Environmental Assessment and Management Strategy: Local Structure Plan

Former Glen Iris Golf Course

Project No: EP20-009(09)

Prepared for Acumen Development Solutions on behalf of Eastcourt Property Group
August 2023



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Executive Summary

This *Environmental Assessment and Management Strategy* (EAMS) has been prepared on behalf of ECP Acquisitions 6 Pty Ltd (the proponent), an entity related to Eastcourt Property Group, to support a Local Structure Plan (LSP) for the residential development of the former Glen Iris Golf Course. Located within the City of Cockburn (CoC), the proposed LSP includes Lots 6 and 7 Glen Iris Drive, Lots 3, 509 and 512 Dean Road and Lot 139 Imlah Court in Jandakot (an area herein referred to as 'the site'), encompassing an area of approximately 53.7 hectares (ha). The site is surrounded by residential and rural residential properties and the Yangebup freight rail line to the north, residential development and Kwinana Freeway to the west, Jandakot Airport to the north-east, commercial and industrial units to the south-east, and residential and mixed business zoned land to the south.

The site is currently zoned 'Development' under the CoC Town Planning Scheme (TPS) No.3 and 'Urban' under the Metropolitan Region Scheme (MRS). The site was operated as a golf course until it was permanently closed in March 2020 and then sold to Eastcourt Property Group who intends to redevelop the site as a residential estate.

Environmental context

Desktop research and site-specific investigations did not identify any restricted landforms or unique geological features within the site. Mapping released by the Department of Water and Environmental Regulation (DWER) identifies the site has a 'moderate to low' risk of Acid Sulfate Soils (ASS) occurring within 3 m of the natural soil surface, but a 'high to moderate' risk of ASS occurring beyond 3 m of the natural soil surface.

Based on a detailed flora and vegetation assessment undertaken by Emerge Associates across 2020 and 2021, four plant communities were identified scattered in patches across the site. The dominant plant communities were identified as planted trees and shrubs and turf and bare ground covering the majority of the site (98.5%) and classified as being in mainly 'Degraded to Completely Degraded' condition. Vegetation mapped as in 'Very Good' or 'Good' condition comprises 1.3% of the site's extent. None of the vegetation communities were considered representative of any State or Commonwealth listed threatened ecological community or state priority ecological community. No conservation significant flora species were identified during the site-specific investigations, including during the surveys in Winter and Spring 2021.

A total of 15 native, three introduced, and two conservation significant fauna species were recorded during site-specific surveys. The conservation significant species recorded were Carnaby's black cockatoo, listed as a protected matter under the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) and quenda, listed as Priority 4 species at the state level.

The overall quality of the black cockatoo habitat on the site was scored as five (5) out of ten (10) for Forest red-tailed black cockatoos (FRTBC) and three (3) out of ten (10) for Carnaby's black cockatoo (CBC). This score was determined considering factors such as the presence of 11 potential black cockatoo habitat trees (none with suitable nesting hollows) within the site, the absence of known or suspected roosting activity, and the limited extent and low feeding resource value of the foraging habitat.

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The presence of quendas was confirmed within the site, with three suitable habitats identified; however, the majority of the site was identified as unsuitable for this species, with more suitable habitat identified in the surrounding areas where more intact remnant vegetation occurs.

Noise mitigation in the form of quiet house design would be required in proximity to Kwinana Freeway and Berrigan Drive. The rail noise levels would comply within site without any mitigation being required. The central and southern portions of the site are subject to aircraft noise from Jandakot Airport and fall within Australian Noise Exposure Forecast (ANEF) 20 to 25 contours. Residential development is acceptable within these contours, subject to internal noise level meeting the criteria contained in AS2021 and application of the CoC's *Local Planning Policy 1.12: Noise Attenuation* over the entire Jandakot Frame Area that includes the site.

There is 'Industrial' zoned land and industrial development/operations to the south of the site, with the uses within 500 m of the site largely comprising smaller depots, work yards and storage yards, with the exception being Fremantle Steel Group's steel fabrication facilities being located approximately 200 m from the nearest portion of the site. A search of the DWER Licences and Works Approvals database for the CoC does not indicate that there are any existing prescribed premises within 500 m of the site. Given the nature of the uses (currently and likely into the future) it is expected that noise would be the primary consideration in relation to the site, and there is no reason to expect that there would be significant dust or odour emissions, or higher levels of risk that would be of concern or require larger separations that would preclude residential development within the site. Any new industrial uses in the future within the industrial zoned land to the south would need to give appropriate consideration to the existing residential dwellings situated on Imlah Court, which are situated closer to the industrial area than the site. These existing residential dwellings immediately to the south of Imlah Court would provide a noise compliance threshold on industrial uses to the south and are located closer to these existing industrial uses than the site. Built form noise mitigation requirements associated with Jandakot Airport (to address AS2021 and the City of Cockburn's *Local Planning Policy 1.12: Noise Attenuation*) and the ability to provide interface treatments (i.e., solid fencing) along Imlah Court and Princep Road would ensure that any noise impacts were minimised and acceptable for any new sensitive uses within the site.

Local Structure Plan response

Based on the environmental values or attributes identified, this EAMS sets out how the LSP has responded and where required provides an environmental management framework to guide the development of the site through future subdivision and development. The principal responses are:

- Flora and Vegetation: Some areas of vegetation in 'Very Good' and 'Good' condition will be retained within the 10.15 ha of public open space (POS) and 2.6 ha of landscape interfaces that will be spread across the site. While some vegetation clearing will be required to implement the LSP this is primarily limited to isolated and disturbed patches generally comprised of non-native vegetation in 'Degraded' and 'Completely Degraded condition. POS areas can be planted with native vegetation and would then be likely to have higher ecological value than the majority of the site in its current state.
- Native fauna: Impacts on native fauna will be minimal given the site's limited habitat values and condition. The proposed LSP would allow for the retention of some of the site's black

cockatoo foraging habitat and up to ten (10) of the identified black cockatoo habitat trees will be retained subject to detailed engineering and earthworks design and approval from the City of Cockburn.

- Hydrology – stormwater and groundwater: The current hydrological functions of the site will be managed through the application of the *Better Urban Water Management Framework* (implemented through the standard planning process), as detailed in the Local Water Management Strategy (LWMS) prepared to support the LSP. It is anticipated that the site's future irrigation will use 60-70% less groundwater than required to maintain the golf course. The redevelopment will also remove the risk to groundwater quality posed by the golf course's use of fertilisers and other chemicals.
- Bushfire management: Bushfire hazards can be suitably managed through the provision of appropriate setbacks to achieve a bushfire attack level (BAL) of BAL-29 or less and constructing dwellings in accordance with *Australian Standard 3959-2019 Construction of buildings in bushfire prone areas*. Appropriate mitigation measures for bushfire can be resolved in further detail at the time of subdivision and would not compromise any proposed vegetation retention or enhancement opportunities.

The EAMS concludes that the proposed urban development can be suitably managed through the standard planning process to remove the likelihood of it giving rise to significant adverse environmental impacts. As such, there are no significant environmental issues or constraints within the site to the extent that it would preclude the site from redeveloped for urban land uses.

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List of Abbreviations

Table A1: Abbreviations – General terms

General terms	
AHD	Australian Height Datum
ANEF	Australian Noise Exposure Forecast
ASS	Acid Sulfate Soil
EAMS	Environmental Assessment and Management Strategy
ESA	Environmentally Sensitive Area
ha	Hectares
km	Kilometres
LWMS	Local Water Management Strategy
MNES	Matters of National Environmental Significance
PEC	Priority Ecological Community
PDWSA	Public Drinking Water Source Area
TEC	Threatened Ecological Community
UWMP	Urban Water Management Plan
WoNS	Weeds of National Significance

Table A2: Abbreviations – Legislation and policies

Legislation and policies	
BC Act	Biodiversity Conservation Act 2016
EP Act	Environmental Protection Act 1986
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999
TPS No. 3	Town Planning Scheme No. 3

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Table A3: Abbreviations – Organisations

Organisations	
CoC	City of Cockburn
DAWE	Department of Agriculture, Water and the Environment
DBCA	Department of Biodiversity Conservation and Attractions
DoEE	Department of Environment and Energy (now known as the Department of Agriculture, Water and the Environment)
DoW	Department of Water (now known as Department of Water and Environmental Regulation)
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	
LSP	Local Structure Plan
MRS	Metropolitan Region Scheme
TPS	Town Planning Scheme

1 Introduction

1.1 Background

ECP Acquisitions 6 Pty Ltd (a company related to Eastcourt Property Group) proposes to develop the former Glen Iris Golf Course into a residential estate and is progressing the preparation of a local structure plan (LSP), provided in Appendix A. The former golf course comprises Lots 6 and 7 Glen Iris Drive, Lots 3, 509 and 512 Dean Road and Lot 139 Imlah Court in Jandakot (herein referred to as 'the site') within the City of Cockburn (CoC). The site is located approximately 16 kilometres (km) South of the Perth Central Business District. The site is zoned 'Urban' under the Metropolitan Region Scheme (MRS) and 'Development' forming part of Development Area 45 under the CoC *Town Planning Scheme No. 3* (TPS No.3). The existing TPS No. 3 zones within and the surroundings of the site are illustrated below in Plate 1.

The site is approximately 53.7 hectares (ha) in size, as shown in Figure 1, and is surrounded by residential and rural residential properties and the Yangebup freight rail line to the north, the Kwinana Freeway and residential development to the west, Jandakot Airport and areas zoned 'Resource' (currently rural-residential development) to the east, industrial development to the south-east, and residential and mixed business to the south as shown below in Plate 1.

Plate 1: City of Cockburn TPS No. 3 zones and reserves within and surrounding the site (DPLH 2023)

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1.2 Purpose of this report

Emerge Associates (Emerge) was engaged by ECP Acquisitions 6 Pty Ltd to prepare an Environmental Assessment and Management Strategy (EAMS) to support the preparation of the LSP (see Appendix A) to guide the future urban development of former Glen Iris Golf Course. This EAMS provides an assessment of the potential environmental impacts that could arise from future residential development and outlines a strategy for environmental management within the site to be implemented during the future planning and development processes.

The EAMS is the principal supporting environmental document for the LSP preparation process, providing a synthesis of information regarding the environmental values and attributes of the site. It is consistent with the Western Australian Planning Commission's (WAPC) *Structure Plan Framework* (WAPC 2015b) and:

- Identifies and assesses the existing environmental values and attributes of the site (Section 2)
- Discusses the land use planning context and the proposed LSP (Section 3)
- Discusses how the LSP design responds to the existing environment and outlines the proposed future environmental management strategy (Section 4)
- Describes how the environmental management strategy will be implemented (Section 4)
- Summarises the LSP's response to the site's existing environmental values and attributes (Section 5).

1.3 Assessment scope

Emerge was engaged to undertake a range of environmental investigations and assessments across the site to support the EAMS, and additional investigations were conducted by others including an Acoustic Assessment, Geotechnical Investigations, Bushfire Management Plan and a Local Water Management Strategy, as outlined in Table 1 below. This EAMS has incorporated the outcomes of these investigations and assessments to provide an overarching environmental assessment. It further documents the existing environmental attributes and values and ensures that significant attributes and values can be accommodated within the LSP and future development stages.

Table 1: Environmental investigations, assessments and strategies undertaken/prepared to support the LSP

Component	Purpose	Relevant EAMS section/s
Detailed Flora and Vegetation Assessment (Emerge)	To assess and document the existing flora and vegetation values within the site	Section 2.2.1 Appendix C
Basic 1 Fauna and Targeted Black Cockatoo Assessment (Emerge)	To assess and document the existing terrestrial vertebrate and avian fauna habitat values and known species occurrences within the site.	Section 2.2.6 Appendix E
Arboricultural Assessment (Emerge)	To provide information on attributes of all large trees (DBH > 300mm) within the site to inform tree retention.	Section 4.3.2 Appendix F
Geotechnical Investigation Report (CMW Geosciences)	To provide recommendations with respect to geotechnical aspects of the proposed development including site prepration and earthworks, site classification, suitable foundation parameters, drainage, and indentification of geohazards and risks to the proposed development.	Section 2.1.2 and 2.6.2 Accompanies the LSP
Local Water Management Strategy (Hyd2o)	To address stormwater management of the site including areas outside the LSP area and provide an overall assessment of the existing water management system of the area and how it will be modified and integrated with the new development to improve water sensitive urban design outcomes as a result of the proposed land use change.	Section 2.3 and 4.5 Accompanies the LSP
Acoustic Assessment (Herring Storer Acoustics)	To investigate and provide any recommendations regarding noise impacts to the proposed development from surrounding land uses.	Section 2.6.3 and 4.7 Appendix G
Bushfire Management Plan	To investigate and provide any recommendations regarding bushfire risk and associated mitigation requirements	Accompanies the LSP

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2 Existing Environment

The outcomes of previously completed investigations, in addition to further site-specific targeted 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 further detail below.

2.1 Landform and soils

2.1.1 Topography

The site's elevation ranges from 25 m Australian Height Datum (m AHD) in the southern portion to 40 m AHD in the northern portion of the site (DoW 2008), as shown in Figure 2.

2.1.2 Landform, soils and geology

Landform and soils influence vegetation types at regional and local scales. The site occurs on the Swan Coastal Plain, the geomorphic unit that characterises much of the Perth metropolitan area.

Examinations of broad-scale soil mapping place the site within the Bassendean soil association (BSA) (Churchward and McArthur 1980). The BSA comprises sand plains with low dunes and occasional swamps, iron or humus podzols, and complex steep dunes. It was confirmed during Emerge's field surveys that the site is located on Bassendean sands which typically are very light grey at surface, yellow at depth, fine to medium-grained, sub-rounded quartz and moderately well sorted of eolian origin (Purdie *et al.* 2004).

Desktop research and the Emerge field surveys did not identify any restricted landforms or unique geological features at the site.

In November and December 2020, a geotechnical investigation was carried out under the direction of CMW Geosciences Pty Ltd to provide further information on the ground conditions and provide recommendations with respect to geotechnical aspects of the proposed future residential development of the site (CMW Geosciences 2021). 55 test pits were excavated to depths of up to 2.2 m to investigate the underlying soil conditions, facilitate sampling for laboratory testing, and to assess excavatability and inform earthworks recommendations. These investigations generally confirmed the regional soil and landform mapping.

2.1.3 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 are 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 2021). A review of the DWER mapping suggests that the entire 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.

2.2 Biodiversity and natural area assets

2.2.1 Flora and vegetation

2.2.1.1 Historical context

Historical aerial images available from 1953 and onwards show that the northern and southern portions of the site, separated by Berrigan Drive, were subject to vegetation clearing at different timeframes, as shown in Plate 2 to Plate 5. The northern area of the site consisted of native vegetation until construction of the central part of the golf course commenced, which is visible in aerial imagery from 1965 shown in Plate 3. By 1995 the remainder of the vegetation on the northern area was cleared for further golf course construction, shown in Plate 4 and Plate 5. Scattered remnant native trees appear to have been retained between the course fairways, however most of the vegetation has been cleared for golf course construction. The southern portion of the site, except for two patches near the southern boundary, was completely cleared of native vegetation for the golf course in the early 1990s. The vegetation on the site is therefore highly disturbed and sits within an artificial landscape setting.

Plate 2: 1953 Glen Iris Golf Course historical aerial imagery.

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Plate 3: 1965 Glen Iris Golf Course historical aerial imagery.

Plate 4: 1985 Glen Iris Golf Course historical aerial imagery.

Plate 5: 1995 Glen Iris Golf Course historical aerial imagery.

2.2.1.2 Regional context

Variations in native vegetation within the site can be classified based on regional vegetation associations. Heddle et al. (Heddle *et al.* 1980) mapping shows the site as comprising the 'Bassendean central and south' complex, described as vegetation ranging from woodland *Eucalyptus marginata – Allocasuarina fraseriana*-Banksia spp. to low woodland of *Melaleuca* spp. and sedgelands on the moister sites. This complex was determined to have 26.87% remaining as of 2019 (Government of Western Australia 2019).

2.2.1.3 Site-specific investigations

Ecologists from Emerge visited the site on 11 March 2020, and then again on 19 August, 9 September and 7 and 28 October 2021 to conduct the flora and vegetation assessment, as documented in Appendix C. As part of the survey, an assessment was made of the type, condition, values of vegetation across the site, and weed mapping was undertaking. The details of the survey for flora and vegetation are summarised in the sections below. To support this assessment and inform the consideration of tree retention within the LSP's layout, an Arboriculture Assessment was also completed in early 2021, as contained in Appendix G.

2.2.1.4 Plant communities

Based on the findings from the survey, four plant communities were recorded in the site, as described below in Table 2 and shown in Figure 3.

Plant community TdSt exists as multiple small patches on the edges of artificial lakes and is considered to be likely planted or a combination of planted and naturally generated vegetation. Plant

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community EmB exists as scattered patches in the northern, central, and southwestern parts of the site. Plant communities planted trees and shrubs and turf and bare ground exist across the site and were likely previously installed for the site's historical use as a golf course.

The reminder of the site supports multiple artificial lakes, buildings and hardstand comprising an area of approximately 2.3 ha in size.

Table 2: Plant communities present within the site

Plant community	Description	Area (ha)
EmB	Woodland to open woodland *Eucalyptus marginata* subsp. *marginata*, *Banksia attenuata* and *Banksia menziesii* over mixed shrubland *Xanthorrhoea preissii*, *Allocasuarina humilis* and *Hibbertia hypericoides* over open sedgeland *Mesomelaena pseudostygia* over non-native grassland **Ehrharta calycina.*	1.9
TdSt	Closed sedgeland *Typha domingensis*, *Schoenoplectus tabernaemontani*, **Cortaderia selloana* and *Baumea* sp..	0.2
Planted trees and shrubs	Predominantly scattered non-native planted trees and shrubs such as **Corymbia* spp., **Eucalyptus* spp., *Melaleuca* spp. and *Grevillea* spp. with occasional native plants.	13.6
Turf and bare ground	Closed non-native grassland (turf) and bare ground.	35.7
	Total	51.4[1]

Note 1: Excludes areas of infrastructure and open water (2.3 ha).

2.2.1.5 Vegetation condition

The condition of the vegetation across the site was determined to range from 'Completely Degraded' to 'Very Good'. The majority (95.8%) of the site was mapped as being in 'Completely Degraded' condition predominantly due to the former use of the site, mainly consisting of Turf and bare ground. Approximately 1.30% of vegetation was mapped as 'Very Good'' condition with the remaining plant communities (2.86%) considered 'Good-Degraded' and 'Good' (Table 3). The mapped extent of the vegetation condition classes across the site is shown in Figure 4.

Table 3: Extend of vegetation condition categories within the site

Condition category (Keighery 1994)	Size (ha)
Pristine	0
Excellent	0
Very good	0.43
Very good – good	0
Good	0.69
Good – degraded	0.22
Degraded	0.8
Completely degraded	49.25

2.2.1.6 Threatened and Priority Ecological Communities

Threatened Ecological Communities (TECs) are recognised as rare or under threat and therefore warrant special protection. Selected TECs are afforded statutory protection at a Commonwealth level under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). TECs listed under the EPBC Act are categorised as either 'critically endangered', 'endangered' or 'vulnerable'.

At the state level, the *Biodiversity Conservation Act 2016* (BC Act) provides for direct statutory acknowledgement and protection for TECs. DBCA have recently advised that 65 TECs previously nominated for the listing of TECs under the BC Act have now been officially listed by order of the Minister for Environment under section 27 of the BC Act as either 'critically endangered', 'endangered' or 'vulnerable' (Government 2023). 'Modification' in relation to an occurrence of a TEC under Section 44 of the BC Act are required to be referred to DBCA and granted authorisation under Section 45 of the BC Act by the Minister.

Known locations of TECs and PECs within 10 km of the site were searched for using the publicly available *Protected Matters Search Tool* (DAWE 2021), and NatureMap (DBCA 2020b). These search results identified 10 TECs and two PECs as occurring or potentially occurring within a 5-10 km radius of the site.

The structure and composition of plant community EmB indicates that it had the potential to represent the EPBC Act listed TEC 'Banksia Woodland of the Swan Coastal Plain' (BWTEC) and the previously state listed PEC 'Banksia dominated woodlands of the Swan Coastal Plain IBRA region'. However, the EmB vegetation community does not satisfy the criteria to be considered a patch of BWTEC due to the small size of the patches. Since the EmB vegetation community does not represent the BWTEC it also does not represent a PEC.

The remainder of the site was not identified as being representative of any other State or Commonwealth listed TECs or PECs.

2.2.1.7 Threatened and priority 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.

During the detailed flora and vegetation assessment, which has involved survey across multiple dates including in Winter and Spring 2021, there were no threatened or priority flora species identified within the site, and none are likely to occur in the site.

2.2.1.8 Locally and regionally significant flora

No locally or regionally significant flora species have been identified within the site.

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2.2.1.9 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. A particularly invasive or detrimental weed species may be listed as a 'declared pest' pursuant to the state *Biosecurity and Agriculture Management Act 2007* (BAM Act), indicating that it warrants special management to limit its spread. At a National level, the Australian government has compiled a list of 32 Weeds of National Significance (WoNS) (DoEE 2019c).

As part of the flora and vegetation assessment, mapping of weed species was undertaken within the site. The weed cover within the site was widespread, with moderate-high coverage across the site, particularly in the areas subject to historical disturbance. The areas within the site classified as turf and bare ground are also consistent with widespread weed cover.

No species listed as a declared pest pursuant to BAM Act or weed of national significance were recorded within the site during the site assessments.

2.2.2 Dieback

Opportunistic observations of signs of Phytophthora dieback were noted (if present) and the location(s) recorded with a hand-held GPS unit. Signs of dieback assessed include where sensitive species were noticeably dead, dying, or absent, particularly where other less sensitive species were not. Sensitive species were identified from literature and sources such as Dieback Working Group (2021).

No signs of Phytophthora dieback were observed within the site.

2.2.3 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 sites represent regional ecosystems and habitat and have a vital role in conserving Perth's biodiversity.

No Bush Forever site occurs within the site. A number of Bush Forever sites occur to the east and west of the site.

2.2.4 Ecological linkages

Ecological linkages are linear landscape elements that allow the movement of fauna, flora and genetic material between areas of remnant habitat.

Based on mapping undertaken as part of the Perth Biodiversity Project (PBP), there are no mapped regional ecological linkages within the site. One biodiversity ecological linkage (No.48) is located approximately 0.8 km to the north of the site and extends to the west and east. The extent to which the site could contribute to any local ecological linkage is limited due to the lack of remnant vegetation, whereas areas to the east and south of the site that do still support native remnant vegetation would provide a local ecological linkage function.

2.2.5 Environmentally Sensitive Areas

'Environmentally sensitive areas' (ESAs) are prescribed under the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* and have been identified to protect native vegetation values of areas surrounding values such as significant wetlands, threatened flora, threatened communities and *Bush Forever* sites.

No ESAs are present within or near the site. Multiple ESAs occur to the east and west of the site.

2.2.6 Terrestrial fauna

2.2.6.1 Site-specific surveys and investigations

An ecologist from Emerge visited the site on 11 March, between 10:30 am to 4:30 pm, and 28 May 2020, between 2:00 pm to 6:00 pm, to determine the fauna values associated with the site. A fauna list was compiled, and fauna habitat values were described, with particular reference to 'threatened' and 'priority' fauna species with potential to occur within the site, see Appendix D. In addition, following concerns raised by local residents regarding quenda, camera traps were installed during April 2021 to monitor for their presence.

2.2.6.2 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 federal 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 *Biodiversity Conservation Act 2016* (BC Act). In addition to this, the Department of Biodiversity Conservation and Attractions (DBCA) maintains a list of priority fauna species which, while not considered threatened under the BC Act and therefore not protected directly, elicit some concern over their long-term survival.

A total of 15 native, three introduced and two conservation significant fauna species were recorded within the site during site-specific surveys.

The conservation significant species recorded were:

- Carnaby's black cockatoo listed as 'endangered' under the EPBC Act

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- Quenda, listed as Priority 4 at state level.

Based on the results of the fauna survey and the camera trap monitoring, these two fauna species of conservation significance were positively identified as utilising the site for some purpose, as described below:

Calyptorhynchus latirostris (Carnaby's black cockatoo [CBC]), see Appendix E

- Approximately 20 CBC were recorded perching in trees during the site assessment on 11 March 2020 within the central portion of the site.
- No signs of foraging or night roosting were recorded or observed, however the native woodland and planted trees and shrubs plant communities support plants known to be suitable foraging habitat for CBC.
- The site contains trees suitable for breeding or roosting habitat by black cockatoos, however currently there are no suitable hollows and no evidence that the site is used for roosting.
- The site is located outside the CBC's breeding range.
- There were no signs of roosting during the field visits (which included a dusk visit) and there are no records in the BirdLife Australia datasets indicating that black cockatoos use this site. The Birdlife Australia roost dataset is acknowledged as being a key reference for known roosting locations for black cockatoos on the Swan Coastal Plain portion of the Perth metropolitan area.

Isoodon fusciventer (quenda)

- Diggings of quenda were found and recorded in the southern portion of the site within dense understorey vegetation within the planted trees and shrubs, and riparian habitats.
- The site contains three habitats suitable to support quenda: Native Woodland, Riparian (not inundated), planted trees and shrubs (where understory vegetation is present and dense).
- The camera trapping undertaken in April 2021 confirmed the presence of quenda on the site.

In addition, 45 further species of conservation significance have the potential to occur on the site, however the majority of these are birds that may only use the site intermittently if at all, including forest red-tailed black cockatoo (FRTBC) which are 'likely' to occur due to potential habitat present at the site. No direct or indirect record of FRTBC was made during the site survey.

2.2.6.3 Fauna Habitat

According to the most dominant flora species, fauna habitats were identified from observations made during the site survey. The identified fauna habitats were then mapped on aerial images with boundaries interpreted from aerial photography, plant communities and notes taken in the field.

Five fauna habitats were recorded in the site. Native woodland is present as scattered patches and has the highest fauna habitat values due to the presence of native trees, shrubs and ground cover and contains microhabitats such as logs, rocks, and leaf litter. The riparian and water habitats provide value for aquatic fauna species and those associated with riparian areas. The planted trees and shrubs habitat mainly provides habitat for avian species as the majority is devoid of any understorey vegetation. The turf and bare ground habitat extends over a large portion of the site

and has minimal habitat values for native fauna species. A description of the habitat and the corresponding area is provided in Table 4.

Table 4: Fauna habitats identified within the site

Fauna habitat classification	Description	Area (ha)
Native woodland	Woodland to open woodland Eucalyptus marginata subsp. marginata, Banksia attenuata and Banksia menziesii over mixed shrubland Xanthorrhoea preissii, Allocasuarina humilis and Hibbertia hypericoides over open sedgeland Mesomelaena pseudostygia over non-native grassland *Ehrharta calycina.	1.9
Riparian	Closed sedgeland *Typha domingensis*, *Schoenoplectus tabernaemontani*, **Cortaderia selloana* and *Baumea* sp. (likely planted or a combination of planted and naturally regenerated).	0.2
Water	Water in artificial lakes of varying depth.	1.4
Planted trees and shrubs	Predominantly scattered non-native planted trees and shubs such as **Corymbia* spp., **Eucalyptus* spp., *Melaleuca* spp. and *Grevillea* spp. with occasional native plants.	13.6
Turf and bare ground	Closed non-native grassland (turf) and bare ground.	35.7
Total		52.8

2.2.6.4 Black cockatoo habitat

During the 'Targeted Black Cockatoo Assessment' a total of 11 black cockatoo habitat trees were recorded within the site. All the habitat trees were *Eucalyptus marginata* (jarrah), with each determined not to be suitable for black cockatoo breeding due to the absence of hollows.

Foraging habitat was also identified during the site assessment predominantly comprised of Banksia *attenuata* (candlestick banksia), Banksia *menziesii* (firewood banksia), *Eucalyptus patens* (Swan River blackbutt), jarrah, marri, *Melia azedarach* (Cape lilac) and *Tipuana tipu* (tipuana). A total of 4.76 ha of foraging habitat was mapped within the site for Carnaby's black cockatoo (CBC), as shown in Figure 5, and 4.88 ha for forest red-tailed black cockatoo (FRTBC), shown in Figure 6. The foraging habitat for both species of black cockatoo is comprised of vegetation providing a high, moderate or low value feeding resource, see Appendix E, with the vast majority of the vegetation being in the low resource category, as shown in Figure 5 and Figure 6.

The overall black cockatoo habitat quality score for the site, which evaluates the site's foraging, roosting, and breeding habitat, was determined to be five (5) out of ten (10) for the FRTBC representing a 'moderate' score and three out of ten for the CBC representing a 'low' score.

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2.3 Hydrology

2.3.1 Groundwater

Information on the regional groundwater resources obtained from the Department of Water (DoW) Water Register (DoW 2015) 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).

The Department of Water and Environmental Regulation (DWER) Water Information Reporting Tool (DoW 2015) includes groundwater and surface water monitoring information from bores and wells across the state. The current water table at the northern portion of the site is 18 m from ground level with the base of the aquifer 59 m below surface level. The southern part of the site has a water table of 4 m from ground level with the base of the aquifer 47 m below surface level.

2.3.2 Surface water

There are no surface water bodies present within the site.

The site does not connect to any arterial drainage scheme, and all stormwater generated on site is infiltrated. The site currently provides stormwater storage and infiltration areas for adjacent developed areas that drain into the site, including 18 bubble up pit outlets.

2.3.3 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).

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 the site.

DBCA maintains the Geomorphic Wetlands of the Swan Coastal Plain dataset (DBCA 2020a), which categorises geomorphic wetland features into specific management categories to guide land use and conservation.

A review of the dataset indicated that no wetlands with conservation values (i.e. Conservation or Resource Enhancement management category) occur within or near the site, as shown in Figure 2. There are a number of Multiple Use management category wetlands in close proximity to the site, but these support limited values, and have been partially developed in the past.

2.3.4 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. PDWSAs provide drinking water to local populations and can be vulnerable to contamination from a range of land uses. Once an area is identified as a PDWSA, consideration needs to be given to the intended land use and associated activities to ensure that they are appropriate in meeting the PDWA's water protection quality objectives.

Parts of the site are located within a Priority 3 (P3) PDWSA, the '*Jandakot Underground Water Pollution Control Area'* (UWPCA). A review of *the Land use compatibility tables for public drinking water source areas* (DoW 2016) indicates that land zoned for urban purposes is an acceptable use within a P3 PDWSA.

The site's past use as a golf course posed potential risks to groundwater quality through the transmission of nutrients, pesticides, and chemicals (Water Corporation 2006). The historical use of fertilizers on the site posed a significant risk, as the site is located within the wellhead protection zone of a number of public drinking water supply bores. Human activity and litter were other potential hazards identified by the Water Corporation (2006).

2.4 Heritage

2.4.1 Aboriginal cultural heritage

DPLH maintain the Aboriginal Cultural Heritage Inquiry System (ACHIS), which is a directory containing locations and information about Aboriginal Cultural Heritage (ACH) in Western Australia.

A search of any occurring ACH within the site and immediate proximity was undertaken with no ACH Directory or Historic Places identified within the site on the ACHIS.

2.4.2 Non-Indigenous heritage

A desktop search of the Australian Heritage Database (Department of the Environment 2019), the State Heritage Office database (Heritage Council 2019) and the City of Cockburn Local Government Inventory and Heritage List (City of Cockburn 2021), indicated there are no registered heritage sites located within, or in proximity to the site.

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2.5 Bushfire

Portions of the site are identified within a 'bushfire prone area' on the state-wide Map of Bush Fire Prone Areas as prepared by the Office of Bushfire Risk Management (OBRM 2019), see Plate 6. Strategic planning proposals, including Local Structure Plans, require a bushfire hazard level assessment under the Guidelines for Planning in Bushfire Prone Areas Version 1.4 (the Guidelines) (WAPC and DFES 2017; DPLH & WAPC 2021).

A Bushfire Management Plan (BMP) (eco logical Australia 2021) has been prepared to support the LSP. The BMP includes an assessment of vegetation within and surrounding the site to determine applicable bushfire hazards, in accordance with *Australian Standard 3959:2018 Construction of buildings in bushfire-prone areas* (AS 3959), and an assessment of the bushfire protection criteria outlined in the Guidelines.

Plate 6: Bushfire prone areas.

2.6 Other land use considerations

2.6.1 Historical and existing land uses

A review of historical images available from 1953 (WALIA 2020) onwards shows that the northern and southern portions of the site, separated by Berrigan Drive, have been subject to vegetation clearing at different times, see Plate 2 to Plate 5 in Section 2.2.1.1.

The northern portion of the site supported native vegetation until construction of the central part of the Glen Iris Golf Course commenced, which is first visible in imagery from 1965. The remainder of

the northern portion of the site was cleared of native vegetation by 1995 for further golf course construction. Scattered remnant native trees appear to have been retained between the golf course fairway, but most vegetation was cleared during the construction of the golf course.

The southern portion of the site supported native vegetation until construction of the golf course commenced, which is first visible in imagery from 1995. The entire southern portion of the site, except two areas near the south boundary, was completely cleared of native vegetation for the golf course.

2.6.2 Potential site contamination

A review of the DWER Contaminated Sites Database indicates that the site is not registered as a contaminated site pursuant to the Contaminated Sites Act 2003. A 'Remediated for restricted use' site is located adjacent on the south-east portion of the site.

Residual construction and demolition debris may be present across the site at the locations of former buildings. During site investigations by CMW Geosciences, segments of suspected asbestos containing materials (ACM) in the form of fractured cement pipe were found in the upper 0.5 m of soil in three locations in an area along the western boundary of the central precinct adjacent to Hartwell Parade (CMW Geosciences 2021). Such occurrences are not uncommon, being a legacy of the ACM pipework previously used by the Water Corporation, some of which is still actively used for water supply. The proponent will remove this ACM before any further development commences.

2.6.3 Surrounding land uses

The central and southern portions of the site are within the predicted Australian Noise Exposure Forecast (ANEF) 20 to 25 contour for Jandakot Airport, as shown in Figure 2. The ANEF system is a tool used to illustrate the impact of aircraft noise in an area using visual contours and provides guidance on the acceptability of new development sites within each of the ANEF zones.

An acoustic assessment has been undertaken by Herring Storer Acoustics (Herring Storer Acoustics 2021) to support the LSP process and the proposed redevelopment of the site. The acoustic assessment report, provided in Appendix G, provides high level acoustic advice and informs on the potential noise impacts on future residential development caused by road traffic (Kwinana Freeway and Berrigan Drive), rail traffic (Yangebup freight rail line and future Thornlie-Cockburn passenger rail line), aircraft associated with Jandakot Airport, and industrial activities to the south of the site on Prinsep Road.

The acoustic assessment indicates that road noise emissions would result in several future lots in three separate areas within the site to require quiet house design in proximity to Kwinana Freeway and Berrigan Drive Rail noise from both the Yangebup Freight Line and the Thornlie rail line would be compliant without requiring any mitigation.

Based on the guidance within *SPP 5.3 Land Use Planning in the Vicinity of Jandakot Airport*, the majority of the northern portion of the site is not adversely impacted by aircraft noise. An area of the central and southern portion of the site is within the ANEF 20 to 25 contour. As a consequence, development approvals for future residential development on lots within this area will be

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conditioned such that the internal noise levels from aircraft noise events are to meet the criteria in AS2021 (*Australian Standard 2021 Acoustics-Aircraft noise intrusion-building siting and construction*). These lots will also require notifications on titles for aircraft noise. The City of Cockburn's *Local Planning Policy 1.12: Noise Attenuation* will also apply for the Jandakot Frame Area, that includes the site.

Industrial land uses to the south of the site would raise some noise impact considerations, however the location of existing residential premises located on Imlah Court are located at closer proximity to the industrial premises than any proposed development would be within the site. Therefore, expectations are that compliance with regulatory criterial contained in the *Environmental Protection (Noise) Regulations 1997* would be achieved for the existing situations at these locations. Notwithstanding this, considerations of any potential for noise impact from this area has been undertaken for the proposed future residential development of the site. Noise amelioration in forms of noise walls (on Prinsep Road), upgraded building designs (as per SPP 5.3) and building setbacks (50 m) of lots have been considered for future residential development. The implementation of the noise amelioration, noise levels can be managed regardless of compliance with the regulatory criteria.

3 The Proposal

3.1 Historical planning context

A request to initiate a Town planning scheme (TPS) amendment was lodged with the City of Cockburn in October 2021.

Subsequent the scheme amendment request having been received and initiated by the responsible authority; it was formally referred to the EPA under Section 48A of the *Environmental Protection Act 1986* (EP Act) in December 2021. On 20 April 2022, the EPA considered that the proposed scheme amendment should not be formally assessed under Part IV Division 3 of the EP Act, therefore for the purposes of Part IV of the EP Act, the scheme is defined as an assessed scheme. Notwithstanding this, the EPA provided advice and recommendations pursuant to Section 48A(1)(a) on the environmental issues raised by the scheme amendment. The formal decision by the EPA is attached in Appendix H and a summary of the advice and recommendations provided below:

Flora and Vegetation and Terrestrial Fauna:

'In addition to structure planning provisions, it is recommended the scheme provisions are modified to include reference to future development being required to prioritise black cockatoo habitat for retention.'

'Consistent with DBCA advice, it is recommended that through future stages of planning, vegetation containing black cockatoo habitat is set aside in public open space and enhanced through the planting of black cockatoo habitat species to mitigate the impacts from the development. Planting should be designed to reduce the risk to fauna of vehicle strike.'

Social Surrounds:

'There is 'Industrial' zoned land and industrial development/operations to the south of the site.

Future residential development associated with the amendment may be subject to dust, noise and odour impacts from industrial land use.

EPA's Guidance Statement No. 3 Separation Distances between Industrial and Sensitive Land Uses should be considered in managing potential impacts to surrounding land uses prior to progressing urban development.'

Inland Waters:

'Parts of the amendment area are located within the 'Jandakot Underground Water Pollution Control Area', a Priority 3 (P3) Priority Drinking Water Source Area (PDWSA), and within Wellhead Protection Zones (WPZ).

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Future stages of planning should consider Water Quality Protection Note (WQPN) 25 Land use compatibility tables for public drinking water source areas (DWER 2021) and State Planning Policy (SPP) 2.3 Jandakot Groundwater Protection (WAPC 2017).

Future development should demonstrate best practice water management, consistent with Better Urban Water Management (WAPC 2008). Future water management plans should be prepared in consultation with Department of Water and Environmental Regulation to support local structure planning and subdivision, and should ensure that pre development hydrology is maintained post development, and that post development water quality.'

The TPS was formally amended in June 2023 and the site is now zoned 'Development' under the current CoC *Town Planning Scheme No. 3* (TPS No.3).

3.2 Local planning framework

As part of the formal TPS No.3 amendment, a number of provision insertions were made within the scheme text, some of which specify future environmental requirements as part of the LSP implementation. The TPS No.3 provisions are:

- An approved Structure Plan together with all approved amendments shall be give due regard in the assessment of applications for subdivision and development in accordance with clause 27(1) of the Deemed Provisions.
- The Structure Plan is to provide an appropriate mix of residential and compatible land uses.
- Public open space and the use of wider, landscaped road reservations shall be arranged to:
  - Promote the retention of significant mature trees and provide an amount of public open space beyond minimum standards in recognition of the character of the area and the former use as a private recreational space;
  - Retain where practicable an appropriate, amount of black cockatoo habitat, in consultation with the Department of Biodiversity, Conservation and Attractions;
  - Provide for future active recreational needs of the community; and
  - Provide an appropriate interface to surrounding landholdings.
- Future subdivision and development of the DA 45 area is limited to a maximum of 250 dwellings (by no later than 2026), until such time as a new traffic-light controlled intersection on Berrigan Drive is approved by Main Roads Western Australia and constructed at the subdivider/developer's expense.

3.3 Local Structure Plan

The Local Structure Plan (LSP) will provide a framework for the provision of future land use, subdivisions and development within the site. An indicative subdivision concept to support the LSP is provided in Appendix A. The Subdivision concept identifies the following land uses within the proposed LSP:

- Development of low to medium density residential lots.

- Public open space areas divided between the northern, central and southern portion of the site and covering 10.15 ha) of the site, which will retain native vegetation.
- Landscaped interfaces to act as buffers to existing residential areas surrounding the site, covering approximately 2.6 ha of the site.
- Conservation areas
- An integrated local road network.
- A local centre.

Specific LSP spatial considerations in response to identified environmental values include:

- Retention of native vegetation and potential black cockatoo habitat trees within POS and conservation areas.
- Landscape interfaces between existing residential areas and new development by retaining existing vegetation and mature trees.

A landscape strategy has also been prepared to demonstrate the intended open space and landscape treatment outcomes, which is included as Appendix B.

3.4 Future planning approvals process

3.4.1 Subdivision and development

Subject to the approval and endorsement of the LSP by the CoC and the WAPC, urban development of the site will be progressed through subdivision and/or development approvals during future planning stages.

In is anticipated that future subdivision approvals for the staged urban 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 subdivision lots are issued. Other components of redevelopment may be progressed through development approval, for example, forward bulk earthworks or other non-subdivisional works; in which case a Native Vegetation Clearing Permits may be required in accordance with Part V of the EP Act.

All environmental impacts associated with the implementation of urban subdivision and development works across the site have been considered by the EPA under Section 48A of the EP Act during their assessment of the TPS 3 scheme amendment.

Section 38 of the EP Act enables any person to refer a proposal likely to have a significant impact on the environment to the EPA, who then decide whether or not to assess the proposal. Notwithstanding this, 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 were considered by the EPA under Section 48A of the EP Act (at the TPS No.3 scheme amendment stage),

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it is not required that the implementation of urban development works within the site would be referred under Section 38 of the EP Act.

4 Environmental Assessment and Management Strategies

This section outlines the spatial response of the LSP to the environmental attributes and values associated with the site and the environmental management considerations that will be required as part of future subdivision and development. Only those environmental values and attributes that require specific consideration based on their presence within the site, and/or applicable legislation and policy requirements have been assessed.

An assessment of the TPS amendment (and subsequent development of the site) against the EPA's environmental factors has been provided within the *Environmental Assessment Report* (Emerge Associates 2021), which supported the scheme amendment. The LSP raises no additional environmental considerations of relevance to the EPA; hence, this assessment has not been repeated in this EAMS.

4.1 Scope of Assessment

Environmental issues that are required to be included within this EAMS are listed below:

- Acid Sulfate Soils
- Flora and Vegetation
- Fauna
- Hydrology
- Bushfire Management
- Noise.

The EAMS identifies the policy framework for each impact, including the site context, management objectives, the considerations of the impact within the LSP and potential future management strategies.

4.2 Acid Sulfate Soils

4.2.1 Policy framework, site context and management objectives

DWER, through the WAPC, ensures ASS are adequately managed during the land use planning and development process. The objective of the DWER's ASS policy framework is to manage ASS appropriately to prevent the release of metals, nutrients and acidity into the soil and groundwater system that may adversely affect the natural and built environment and human health.

The principal management objective for acid sulfate soils within the site is to ensure that any future development that may disturb acid sulfate soils is appropriately managed to avoid environmental impacts.

Where relevant, the WAPC includes a standard condition relating to ASS management on subdivision applications (model subdivision condition EN8, (WAPC and DPLH 2019)) which states:

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An acid sulphate soils self-assessment form and, if required as a result of the self-assessment an acid sulphate soils report and an acid sulphate soils management plan shall be submitted to and approved by the Department of Water and Environmental Regulation (DWER) before any subdivision works or development are commenced.

Where an acid sulphate soils management plan is required to be submitted, all subdivision works shall be carried out in accordance with the approved management plan (Department of Water and Environmental Regulation).

4.2.2 Structure plan layout considerations for acid sulfate soils

During Geotechnical investigations (CMW Geosciences 2021), ground conditions for site preparations and earthworks were identified. It is not anticipated that bulk earth works below a depth of 1 m will be required throughout development, hence it is highly unlikely that any earthworks will cause disturbance of ASS. Therefore, ASS management does not require any spatial consideration within the LSP.

4.2.3 Future acid sulfate soils management requirements

As earthworks will not likely occur below 3 m, there is limited likelihood of encountering ASS; hence no specific management measures are required. Should earthworks extend beyond 3 m below natural ground into areas with a 'high to moderate' risk of ASS, an ASS self-assessment will be undertaken, and this will indicate what further investigation and management might be required.

4.3 Flora and vegetation

4.3.1 Policy framework, site context and management objectives

In the context of environmental impact assessments, the EPA's objective for flora and vegetation is '*to protect flora and vegetation so that biological diversity and ecological integrity are maintained*'. Where a proposal may potentially impact upon flora and vegetation values, the following mitigation hierarchy should be applied to minimise potential impacts:

1. Avoid impacts
2. Minimise impacts
3. Offset impacts

The majority of the site (95.8%) is mapped as being in 'completely degraded' condition due to the site's former use as a golf course consisting of predominantly 69.4% 'closed non-native grassland (turf) and bare ground'. The areas of vegetation in 'very good –good' and 'good' condition are quite scarce, comprising an area of approximately 1.12 ha.

4.3.2 Structure plan considerations for flora and vegetation

The majority of flora and vegetation within the site does not hold any conservation significance; however, the retention of the native environmental values within the site was an important design consideration throughout the LSP design process. The implementation of the LSP will require the clearing of isolated and disturbed patches of native vegetation, generally in a 'completely degraded' condition. Patches of the Banksia dominated vegetation community (EmB) and a significant number of the existing trees will be retained in areas of public open space, conservation areas and landscape interfaces. The findings of the Arboricultural Assessment influenced decisions about tree retention and the LSP layout. The extent of proposed vegetation and tree retention is illustrated in Figure 7 and Figure 8.

Native Woodland Community EmB comprises the highest vegetation value and condition within the site. 1.04 ha (53%) of native woodland is to be retained within the POS areas and approximately 0.9 ha cleared due to engineering constraints/requirements. In particular 95% of the patch of EmB vegetation in 'Very Good' condition has been included within POS.

The planted trees and shrubs community covers approximately 26.4% of the site and is not of any conservation significance due to its 'Completely Degraded' condition and non-native planted vegetation. Notwithstanding, 5.86 ha of this community will be retained within the landscaped interfaces between existing housing and future residential development. The earthworks and engineering necessary to implement the LSP will result in the removal of approximately 700 of the identified trees and the retention of 539 trees.

4.3.3 Future management requirements

The POS and conservation areas within LSP have been located to enable the retention and future management of parts of the site's native woodland vegetation. Furthermore, the LSP incorporates landscaped interfaces to existing residential areas, allowing for further retention of existing vegetation. A landscaping plan will be prepared for the POS and conservation areas and will address fencing, weed control, revegetation works, fauna management and landscape treatments.

The condition of the native vegetation within the POS areas is likely to improve due to appropriate management, which may involve planting additional native species, increasing the total vegetation diversity. The number of trees within the site will ultimately increase, with two street trees proposed for each new home, and additional trees planted within the POS areas, at least a minimum of 1000 new trees the species of which will be endemic and native to the site.

A landscaping plan will be prepared for the POS and buffer areas and will address fencing, weed control, revegetation works and landscape treatments, generally in accordance with the landscape strategy provided in Appendix B.

Where native vegetation is required to be cleared within the site, this will likely be undertaken in accordance with a subdivision approval and associated authorised subdivision works, and in accordance with a Construction Environmental Management Plan.

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4.4 Fauna

4.4.1 Policy framework, site context and management objectives

In the context of environmental impact assessment, the EPA's objective for terrestrial fauna is *'to protect fauna so that biological diversity and ecological integrity are maintained'*. The application of the mitigation hierarchy should be applied to avoid or minimise impacts to terrestrial fauna where possible.

The EPBC Act also provides protection for listed 'threatened' species, including black cockatoos. Any proposed action which is considered likely to result in a 'significant' impact upon these species, identified by DAWE as Matters of National Environmental Significance (MNES), should be referred to the Department (now the Department of Climate Change, Energy, the Environment and Water).

Five fauna habitats were recorded in the site as outlined in Section 2.2.6.3. Native Woodland is present as scattered patches and was found to have the highest fauna habitat value due to the presence of native trees, shrubs and groundcover. The dense understorey and ground cover within the Native Woodland vegetation community make it suitable quenda habitat. Riparian vegetation community furthermore provides suitable quenda habitat due to the thick ground cover. However, most of the planted trees and shrubs community do not provide any suitable habitat for quenda lacking the dense understorey vegetation and cover for the species.

The site provides 4.76 ha of foraging habitat for Carnaby's black cockatoos (CBC) and 4.88 ha for forest red-tailed black cockatoo (FRTBC), of which the majority provides a low foraging resource, see Appendix E. Surveys identified 11 habitat trees for black cockatoos, though none contain suitable breeding hollows. Areas surrounding the site to the north, east, south-east, especially Bibra Lake Reserve less than 2 km north-west of the site, are identified as a suitable feeding habitat for black cockatoos (DBCA 2017a).

4.4.2 Structure plan considerations for fauna

The LSP has principally focussed on retaining the Native Woodland habitat, that provides foraging habitat for CBC and FRTBC, and quenda habitat. Up to 10 of the black cockatoo habitat trees will be retained (subject to agreement with the City of Cockburn), see Figure 8, subject to detailed engineering and earthworks design. The potential clearing of habitat trees is unlikely to cause any adverse impacts on black cockatoos given the more suitable habitat surrounding the site.

Revegetation of the POS areas within the site, using local native plant species, will provide additional fauna habitat within these areas.

4.4.3 Future management requirements

A preliminary self-assessment against the *Matters of National Environmental Significance Significant Impact Guidelines* (DotE 2013) was undertaken to determine the likelihood of whether future subdivision or development approval applications will require referral pursuant to the EPBC Act. It was concluded that due the limited extent of quality foraging habitat for black cockatoo species, and the absence of any trees with suitable breeding hollows on the site, future development is highly unlikely to significantly impact any species of black cockatoo. Hence a referral pursuant to the EPBC Act is presently deemed unnecessary.

Once detailed designs have been progressed to the stage that they can support a subdivision or development application, sufficient certainty will be available to confirm the extent of any impact to black cockatoo species. Using this information, the self-assessment in accordance with the *Matters of National Environmental Significance Significant Impact Guidelines* will be reviewed to determine if the confirmed impact extent raises any issues that will alter the current view that any impact to black cockatoo species will not be significant.

A landscaping plan will be prepared for the POS and buffer areas and will address fencing, weed control, revegetation works, fauna management and landscape treatments, generally in accordance with the landscape strategy provided in Appendix B. Additionally, a fauna relocation management plan will be prepared to accommodate for the site's quenda population, which is anticipated to be implemented as a condition of future subdivision approvals.

Where fauna habitat is required to be cleared within the site, this will likely be undertaken in accordance with a subdivision approval and associated authorised subdivision works, and in accordance with a Construction Environmental Management Plan.

4.5 Hydrology

4.5.1 Management objectives

In the context of environmental impact assessment, the EPA's objective for inland waters is *'to maintain the hydrological regimes and quality of groundwater and surface water so that environmental values are protected'.*

In addition, the *State Water Strategy for Western Australia* (Government of WA 2003) and *Better Urban Water Management* (WAPC 2008) endorses the promotion of integrated water cycle management and application of water sensitive urban design (WSUD) principles to provide improvements in the management of stormwater and to increase the efficient use of other existing water supplies.

There are no surface water bodies or natural wetlands within the site, however, parts of the site are located within a Priority 3 Public Drinking Water Source Area (PDWSA), the *Jandakot Underground Water Pollution Control Area.* Land used for urban purposes, including residential development, is acceptable within a Priority 3 PDWSA.

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Environmental Assessment and Management Strategy: Local Structure Plan
Former Glen Iris Golf Course

The principal management objective for hydrology within the site is to ensure that the post-development environmental flows and/or hydrological cycles are improved or maintained to pre-development conditions, especially regarding groundwater sources, the PDWSA and water pollution control area.

4.5.2 Structure plan layout considerations for hydrology

A Local Water Management Strategy (LWMS) has been prepared (Hyd2o Hydrology 2020) to support the LSP, in accordance with the requirements of state and local planning policies. The LSP provides an opportunity for the overall improvement of the local water environmental by reducing nutrient runoff and the use of irrigation bore water abstraction from the local superficial aquifer, by between 60-70%.

The LWMS addresses the site's stormwater management, including areas outside of the LSP area that currently discharge stormwater into the site. The LWMS provides a comprehensive assessment of the existing water management system of the site and how it will be modified and integrated with the new development to improve the WSUD outcomes. The LWMS provides a complete water cycle management approach to the proposed development and the stormwater management system has been designed in accordance with the objectives and principles of *Better Urban Water Management* (BUWM) (WAPC 2008), see summary below, and in consultation with stakeholders such as the City of Cockburn and DWER.

LWMS summary:

- The stormwater management system will consist of a series of in lot soakwells, road drainage pits, piped drainage, overland flows paths, swales and distributed bioretention and flood storage areas within the POS areas and road reserves for water quality treatment and major event management.
- Pipe networks, and associated maintenance, will be minimised through the implementation of many small-scale local catchments to treat and infiltrate stormwater runoff at the source.
- Underground storage will be required in some areas due to constraints provided via the level of existing pipes inverts entering the site from external catchments.
- Water quality will be managed within POS areas through the biofiltration treatment of runoff generated by the first 15mm of rainfall prior to infiltration.
- Development levels will have suitable clearance above groundwater and 1% AEP flood levels.
- Soakwells within lots sized to retain and infiltrate first 15mm rainfall.
- Water-wise landscaping will be implemented to retain stormwater and minimise runoff.
- Use of cut/fill across the site to minimise import fill and establish levels to meet the design criteria of clearance above groundwater and the 1% AEP level in POS infiltration areas.
- Groundwater quality is expected to improve relative to the current mean total nitrogen values, which ranging from 0.70 mg/L to 9.30 mg/L, exceeding the guideline limit of 1.2 mg/L. These elevated levels are likely due to fertiliser application on the former golf course.

4.5.3 Future management requirements

The LWMS provides for the environmental management framework for groundwater and stormwater within the site.

The predevelopment groundwater and stormwater monitoring program is set to be completed by the end of winter 2021, with the final results to develop water quality targets. All future planning stages are to be consistent with BUWM, including preparation of Urban Water Management Plans (UWMPs). Furthermore, the staging of stormwater is set to be detailed in the relevant UWMP's and implemented to ensure critical hydrological performance criteria are maintained during the staged redevelopment.

Generally, a UWMP will address the following considerations:

- The detailed drainage design including the size, location and design of POS areas, integrating major and minor flood management capability.
- Imported fill specifications and requirements, including management of groundwater levels and proposed cut/fill levels.
- Implementation of water conservation strategies, including the provision of POS irrigation water use distribution details.
- Non-structural water quality improvement measures.
- Management and maintenance requirements.
- Construction period management strategy.
- Monitoring and evaluation program.
- Status of groundwater abstraction license.

4.6 Bushfire management

4.6.1 Policy framework, site context and management objectives

State Planning Policy 3.7 Planning in Bushfire Prone Areas (WAPC 2015a) requires that a bushfire management plan accompany any local structure plan that occurs partly or wholly within a bushfire prone area. A Bushfire Management Plan (BMP) (eco logical Australia 2021) has been prepared to support the LSP.

4.6.2 Structure plan considerations for bushfire management

The majority of the on-site vegetation is proposed to be cleared to enable urban development, which will be set amongst landscaped buffers, managed Public Open Space (POS) and various easements. The BMP concludes that the current on-site vegetation will not be a bushfire hazard issue post-development, since these hazards can be managed through a staged clearing process, adequate separation of future built assets from bushfire classified vegetation, and ongoing fuel management that can be undertaken in and around individual development stages.

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4.6.3 Future bushfire management requirements

The BMP considers that the bushfire hazards within and adjacent to the site and the associated bushfire risk is readily manageable through standard management responses and compliance with acceptable solutions outlined in the Guidelines. These responses will be detailed in further BMPs prepared to support future subdivision or development applications. Bushfire management requirements are not expected to affect vegetation retention or enhancement opportunities that have been considered as part of formulating the current structure plan,

4.7 Acoustic Impacts

4.7.1 Policy framework, site context and management objectives

The site is located within a developed area with urban residential development to the west adjacent to Kwinana Freeway, Jandakot Airport located 1.6 km to the east, and industrial development to the south of the site past Berrigan Drive and Jandakot Road, and such is likely to be impacted by transport noise. *SPP 5.4 Road and Rail Noise* (DPLH 2019) recognises that excessive noise has the potential to affect the health and amenity of a community, as well as the wellbeing of individuals. SPP 5.4 aims to protect people from unreasonable levels of transport noise by establishing a standardised set of criteria to be used in the assessment of development proposals.

The site is located approximately 1.6 km west of Jandakot Airport and thus subject to the provisions of state planning policy in relation to aircraft noise, *SPP 5.3 Land Use Planning in the Vicinity of Jandakot Airport* (WAPC 2017). The central and southern portions of the site are within the predicted Australian Noise Exposure Forecast (ANEF) 20 to 25 contour for Jandakot Airport, see Figure 2. The ANEF system is a tool used to illustrate the impact of aircraft noise in an area using visual contours and provides guidance on the acceptability of new development sites within each of the ANEF zones.

4.7.2 Structure plan layout considerations for noise

Noise insulation is not mandatory for residential development within the 20 to 25 ANEF; however, some areas may experience maximum aircraft noise levels in excess of the Indoor Design Sound Levels specified in *Australian Standard 2021:2015 Acoustics: Aircraft Noise Intrusion – Building Siting and Construction* (AS 2021:2015) and noise insulation is recommended in such cases. Additionally where land is zoned for residential purposes or to permit residential development, the maximum dwelling density should generally be limited to R20 and a notice on title advertising of the potential for noise nuisance is required as a condition of any subdivision or planning approval within the noise exposure zone (WAPC 2017).

The road traffic noise assessment indicates that noise levels will exceed the target in three areas of the site based on the future traffic volumes on Kwinana Freeway and Berrigan Drive, and some future lots would require quiet house designs in the form of quiet house packages. The lots in these areas will also require notification on titles of the freeway noise impact. Rail noise from the Yangebup Freight line and the Thornlie rail line have been assessed as being below the night time noise target; hence no responses is required.

4.7.3 Future management requirements

The noise assessment of the site (Storer 2023) has not identified the need for any physical management measures e.g. noise barriers. However, future residential lots within the areas exceeding the road noise target and those in the central and southern portions of the site located within the ANEF 20 to 25 contours require notification on titles of the freeway noise impact, and potential aircraft noise, respectively. Furthermore, the design of dwellings on lots within the ANEF 20 to 25 contours must be designed to achieve internal noise levels (for aircraft noise events) that meet the criteria contained in AS2021. A "deemed to satisfy construction" has been provided in the noise assessment report including recommendations and requirements for glazing, walls, roof, and ceiling.

It is expected that the built form treatments to respond to aircraft noise and interface treatments (i.e., solid fencing) will adequately mitigate any noise emissions from industrial uses to the south given the presence of existing residential dwellings (i.e., noise sensitive premises) to the south of the site which are closer to the industrial uses.

The acoustic assessment report is provided in Appendix G.

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Environmental Assessment and Management Strategy: Local Structure Plan
Former Glen Iris Golf Course

5 Implementation Framework

A summary of how the LSP responds to the environmental values and attributes within the site is provided in Table 5. The table also outlines the proposed and potential future management measures required for the subdivision and development process.

Table 5: Environmental management framework implementation table

Factor	Structure plan phase (completed)	Subdivision phase	Part of development works
Acid sulfate soils	• Consider ASS Risk mapping as prepared by DWER. No spatial response in LSP required.	• If required, completion of ASS self-assessment and preparation of an Acid Sulfate Soil and Dewatering Management Plan.	• Implementation of an Acid Sulfate Soil and Dewatering Management Plan, as required.
Native vegetation	• Assessment of flora and vegetation values and preliminary consideration of potential retention opportunities. • Retention of native vegetation in POS area.	• Preparation of landscaping plan for the POS areas. • Preparation of a Construction Environmental Mangagement Plan.	• Implementation of plans.
Native fauna	• Assessment of fauna habitat and preliminary consideration of potential retention opportunities. • Retention of potential black cockatoo habitat trees within POS areas.	• Preparation of landscaping plan for the POS areas. • Preparation of a Construction Environmental Mangagement Plan to provide measures to minimise impacts to fauna during construction works. • Preparation of a fauna relocation management plan to accommodate for the site's quenda population, which is anticipated to be implemented as a condition of future subdivision approvals.	• Implementation of plans.
Hydrology and stormwater management	• Preparation of a Local Water Management Strategy. • POS areas to provide adequate stormwater biofiltration via a system of swales.	• Preparation of Urban Water Management Plans.	• Implementation of the plans.
Heritage	• Preliminary desktop investigations into heritage sites.	• N/A	• N/A
Bushfire risk	• Preparation of a Bushfire Management Plan. • Provision of public open space and road reserves to accommodate appropriate setbacks. • Determining a spatial layout that reduces the bushfire hazard to future development.	• Complete detailed BAL assessment to support dwelling construction.	• Dwellings within 100 m of bushfire threat to demonstrate compliance with AS 3959. • Notifications placed on titles of lots subject to a bushfire risk.

Factor	Structure plan phase (completed)	Subdivision phase	Part of development works
Site contamination	• Removal of ACM (water pipes).	• N/A	• N/A
Noise	• Preparation of a Noise Impact Assessment • Determine noise implications from road and aircraft.	• Preparation of a Construction Environmental Mangagement Plan to provide measures to minimise noise impacts during construction works.	• Implementation of plans. • Notifications placed on titles of lots subjected to elevated levels of road or aircraft noise.

6 Conclusion

This *Environmental Assessment and Management Strategy* (EAMS) has been prepared to support a Local Structure Plan (LSP) for the former Glen Iris Golf Course redevelopment.

The EAMS provides a synthesis of information regarding the environmental values and attributes of the site, obtained from a range of sources such as local and regional reports, databases, mapping and site-specific investigations. The following documents provide support to this EAMS:

- *Detailed Flora and Vegetation Assessment, Former Glen Iris Golf Course* (Emerge Associates 2021), see Appendix C.
- *Basic 1 Fauna Assessment, Former Glen Iris Golf Course* (Emerge Associates 2021), see Appendix D.
- Targeted Black Cockatoo Assessment, Former Glen Iris Golf Course (Emerge Associates 2021), see Appendix E
- *Arboricultural Assessment, Former Glen Iris Golf Course* (Emerge Associates 2021), see Appendix F.
- *Local Water Management Strategy, Glen Iris, Jandakot (Hyd2o Hydrology 2021)*
- *Bushfire Management Plan* (eco logical Australia 2021)
- *Acoustic Assessment (Storer 2023)*, see Appendix G.

The environmental attributes and values identified within the site have been outlined in Section 2 of this document, and consideration of potential impacts on environmental values have been outlined within Section 4.

Listed below is a summary of the principal spatial responses.

- Native Vegetation: areas of the native woodland vegetation community will be retained within areas of Public Open Space and landscape buffers. Up to 10 of the 11 black cockatoo breeding habitat trees will also be retained.
- Hydrology: The current hydrological functions of the site will be maintained by applying the Better Urban Water Management Framework (implemented through the standard planning process), as detailed in the LSP's Local Water Management Strategy (LWMS). The LSP and the future use of the site are likely to improve the overall quality of local groundwater through the removal of potentially pollution activities associated with the golf course, e.g., the use of fertilizers.
- Bushfire risks: Appropriate setbacks and vegetation management measures will be employed to ensure that residential dwellings are subject to no more than BAL-29.

The EAMS has found that the implementation of the proposed LSP can be suitably managed through the standard planning processes to remove the likelihood of it giving rise to significant adverse environmental impacts.

7 References

7.1 Legislation

Biodiversity Conservation Act 2016

Contaminated Sites Act 2003

Environmental Protection Act 1986

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Environmental Assessment and Management Strategy: Local Structure Plan
Former Glen Iris Golf Course

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Figures

Figure 1: Site Location

Project: Environmental Assessment and Management Strategy
Former Glen Iris Golf Course
Client: ECP Acquisitions 6 Pty Ltd

Plan Number: EP20-009(09)--F26
Drawn: GAR
Date: 01/04/2021
Checked: PPS
Approved: ALB
Date: 04/06/2021

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Metres
Scale: 1:10,000@A4
GDA 1994 MGA Zone 50

emerge ASSOCIATES

While Emerge Associates makes every attempt to ensure the accuracy and completeness of data, Emerge accepts no responsibility for externally sourced data used

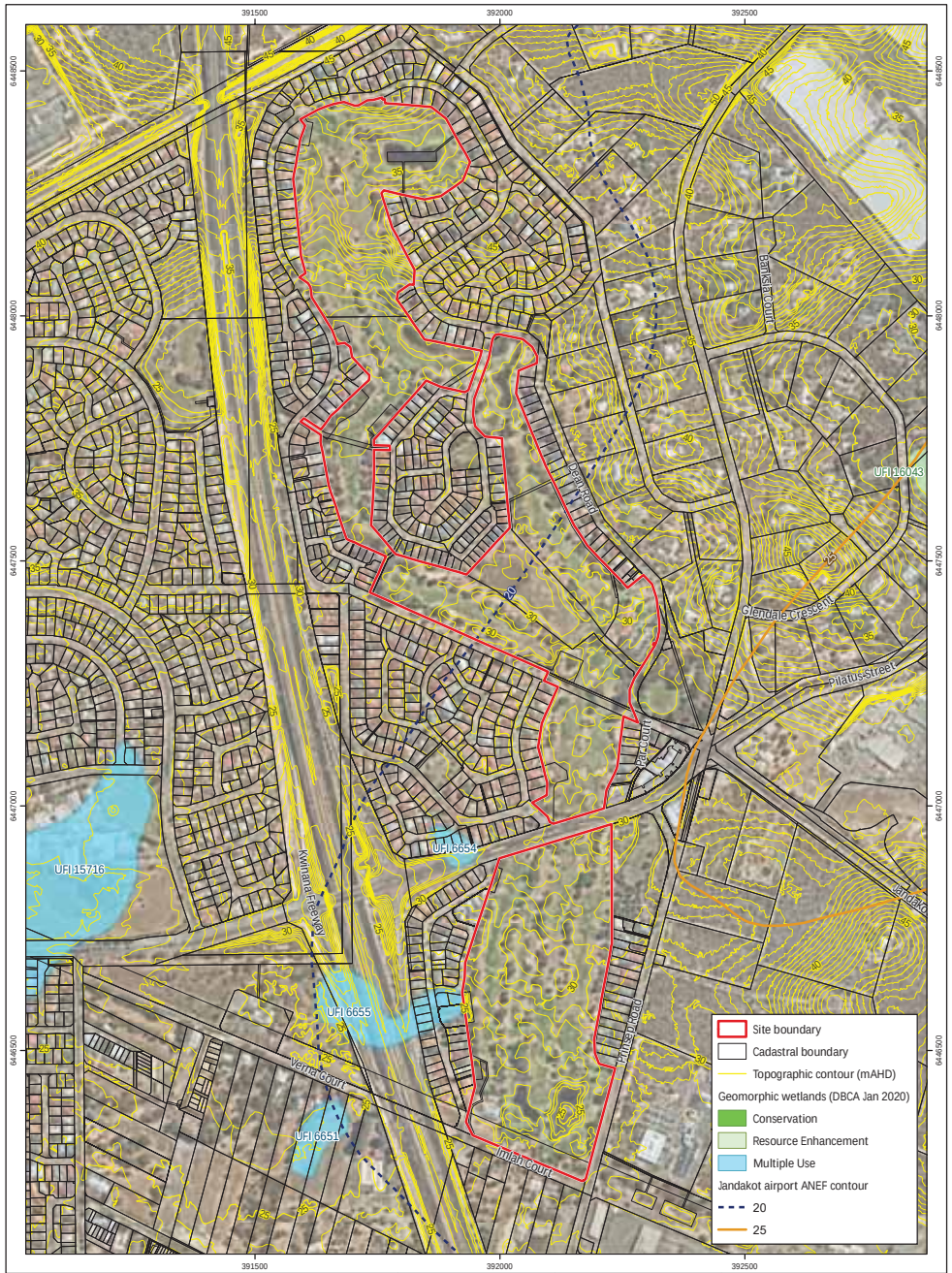

Figure 2: Environmental Features

Project: Environmental Assessment and Management Strategy
Former Glen Iris Golf Course
Client: ECP Acquisitions 6 Pty Ltd

Plan Number: EP20-009(09)--F27
Drawn: GAR
Date: 04/06/2021
Checked: PPS
Approved: ALB
Date: 04/06/2021

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GDA 1994 MGA Zone 50

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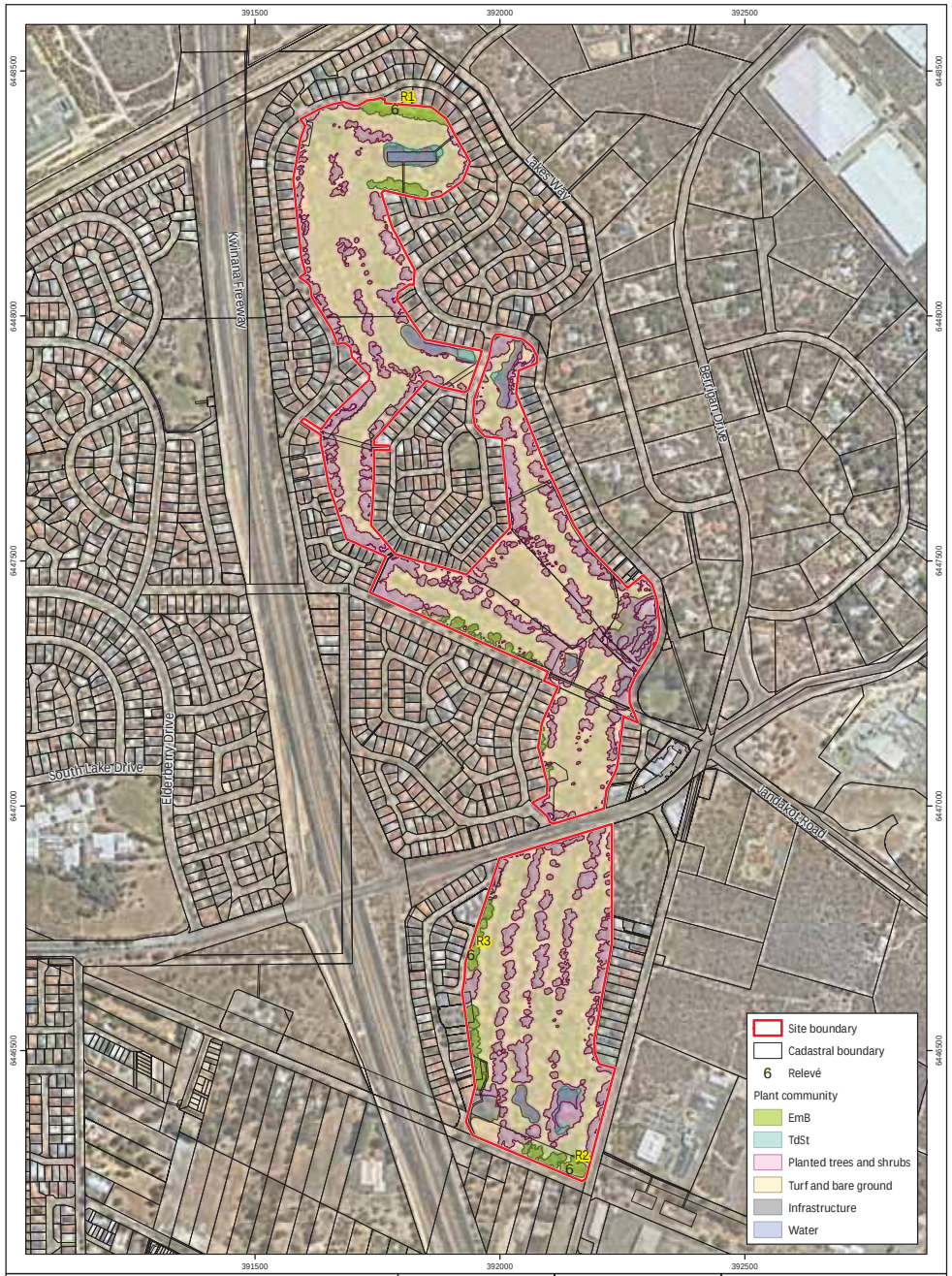

Figure 3: Plant Communities

Project: Environmental Assessment and Management Strategy
Former Glen Iris Golf Course
Client: ECP Acquisitions 6 Pty Ltd

Plan Number: EP20-009(09)--F28a
Drawn: GAR
Date: 17/09/2021
Checked: JDH
Approved: JDH
Date: 17/09/2021

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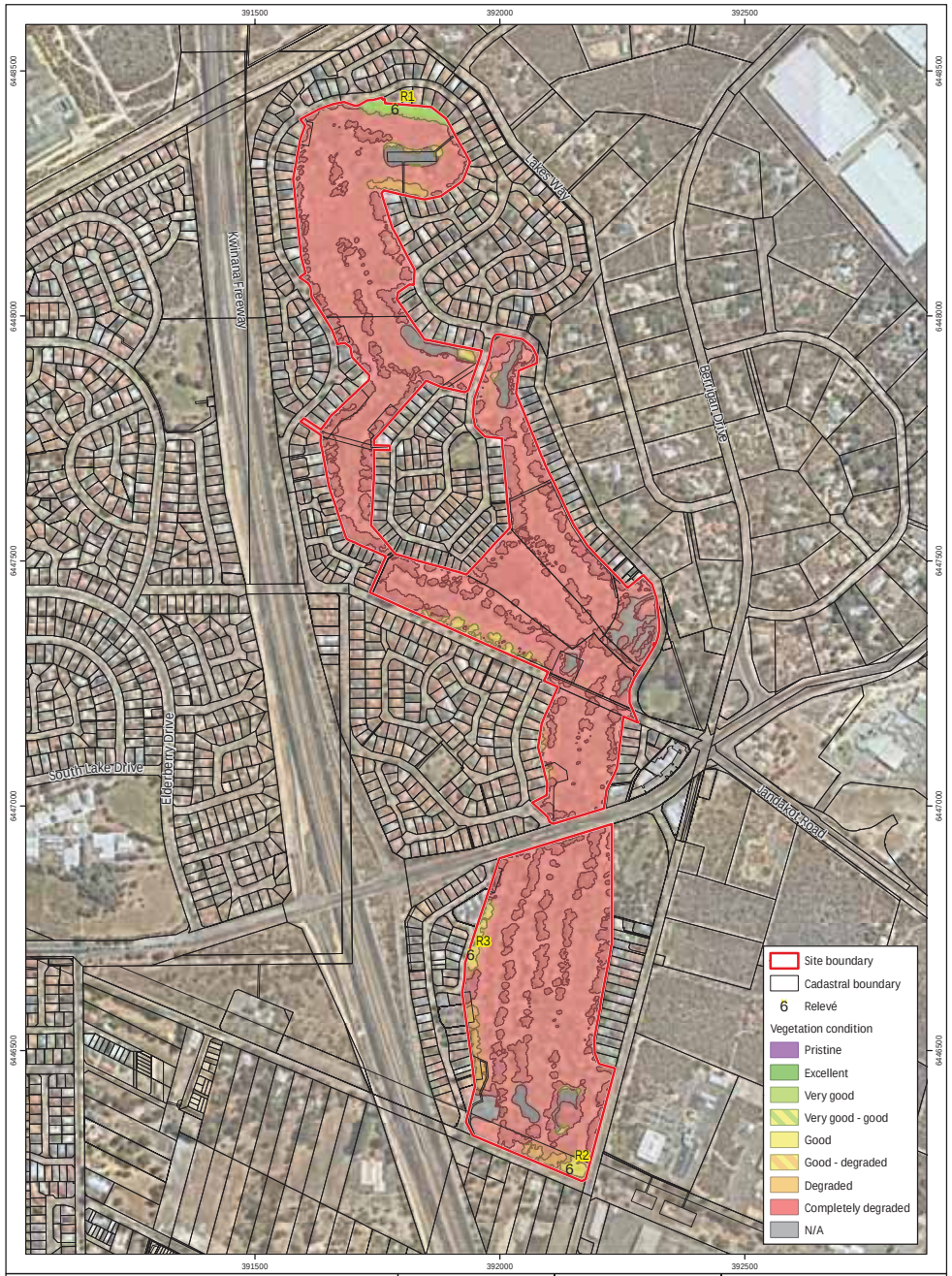

Figure 4: Vegetation Condition

Project: Environmental Assessment and Management Strategy
Former Glen Iris Golf Course
Client: ECP Acquisitions 6 Pty Ltd

Plan Number: EP20-009(09)--F50
Drawn: GAR
Date: 17/09/2021
Checked: JDH
Approved: JDH
Date: 17/09/2021

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GDA 1994 MGA Zone 50

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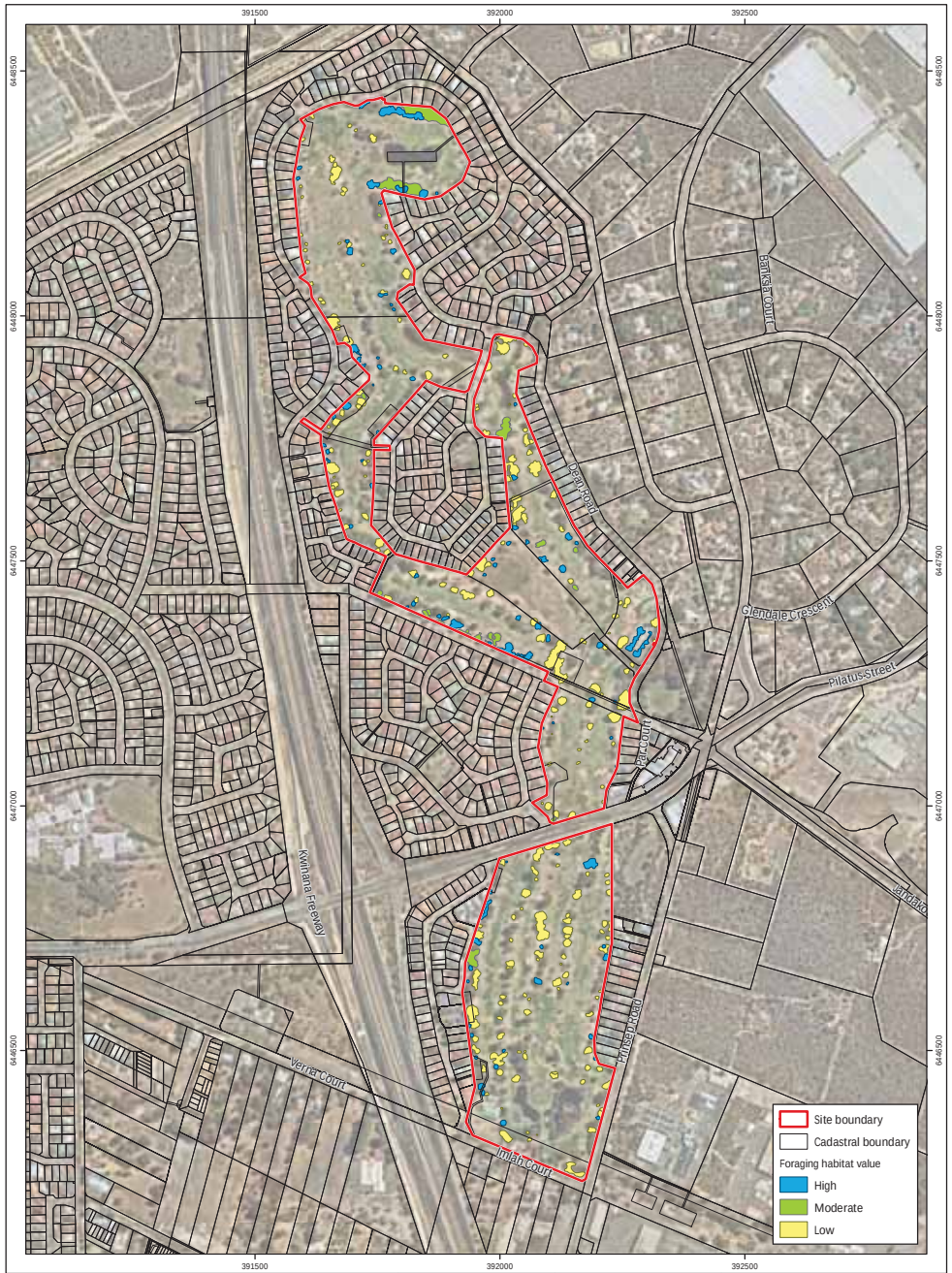

Figure 5: Potential Carnaby's Cockatoo Foraging Habitat

Project: Environmental Assessment and Management Strategy
Former Glen Iris Golf Course
Client: ECP Acquisitions 6 Pty Ltd

Plan Number: EP20-009(09)--F38b
Drawn: GAR
Date: 17/09/2021
Checked: JDH
Approved: JDH
Date: 17/09/2021

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GDA 1994 MGA Zone 50

emerge ASSOCIATES

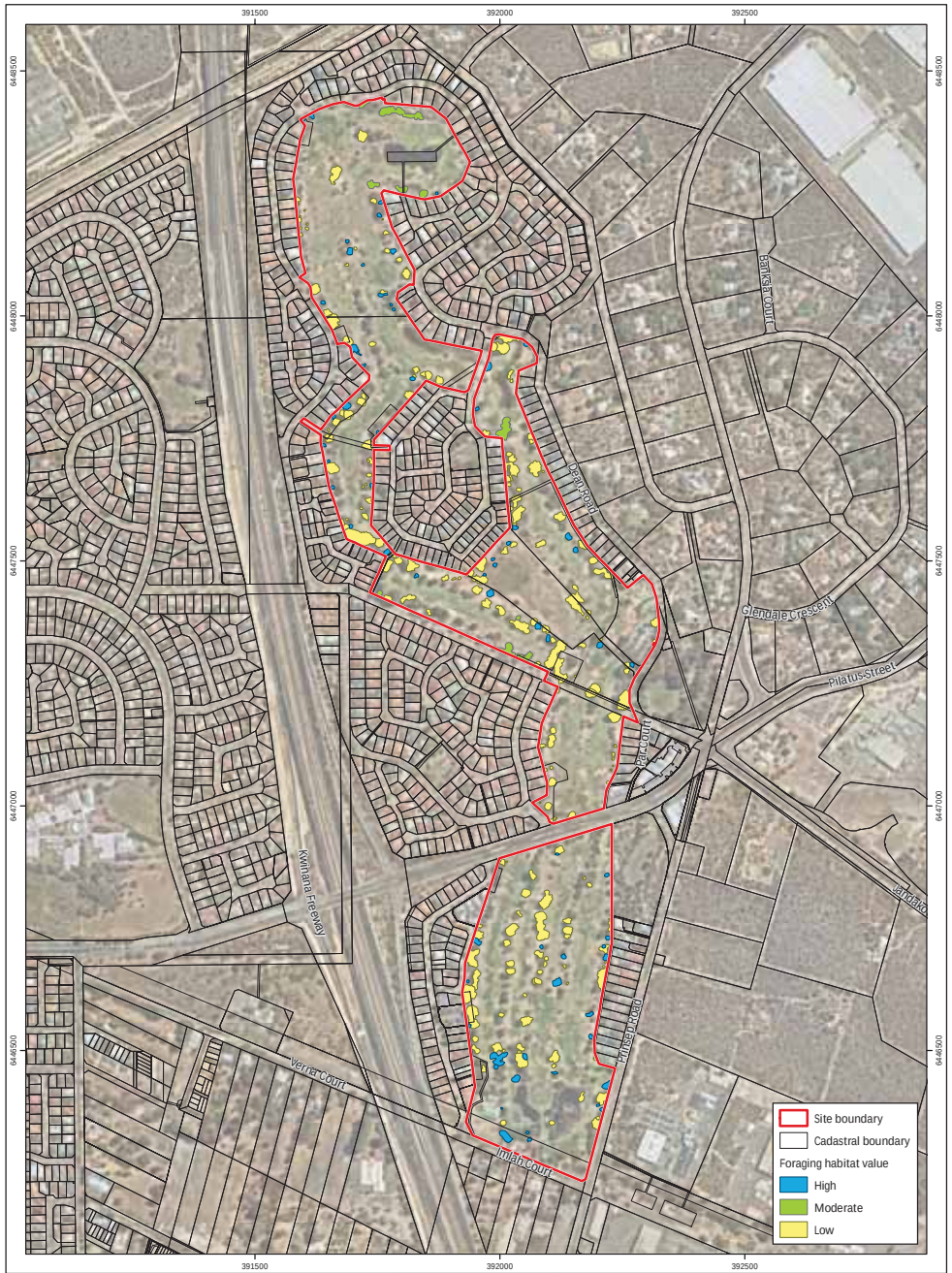

Figure 6: Potential Forest Red-tailed Black Cockatoo Foraging Habitat

Project: Environmental Assessment and Management Strategy
Former Glen Iris Golf Course
Client: ECP Acquisitions 6 Pty Ltd

Plan Number: EP20-009(09)--F39b
Drawn: GAR
Date: 17/09/2021
Checked: JDH
Approved: JDH
Date: 17/09/2021

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GDA 1994 MGA Zone 50

emerge ASSOCIATES

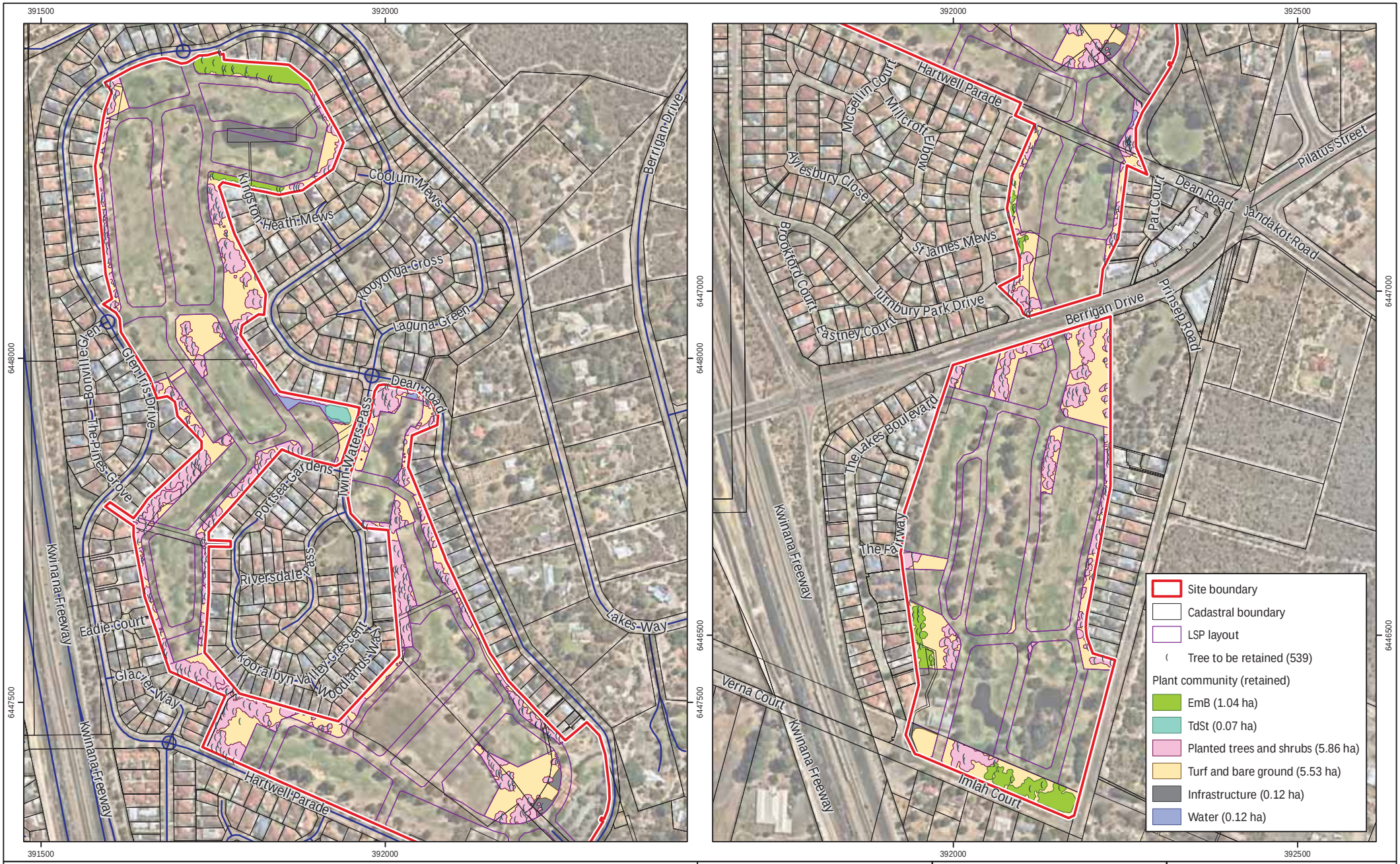

Figure 7: Vegetation and Tree Retention

Project: Environmental Assessment and Management Strategy
Former Glen Iris Golf Course
Client: ECP Acquisitions 6 Pty Ltd

Plan Number: EP20-009(09)--F20c
Drawn: GAR
Date: 05/07/2023
Checked: PPS
Approved: JDH
Date: 30/08/2023

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GDA 1994 MGA Zone 50

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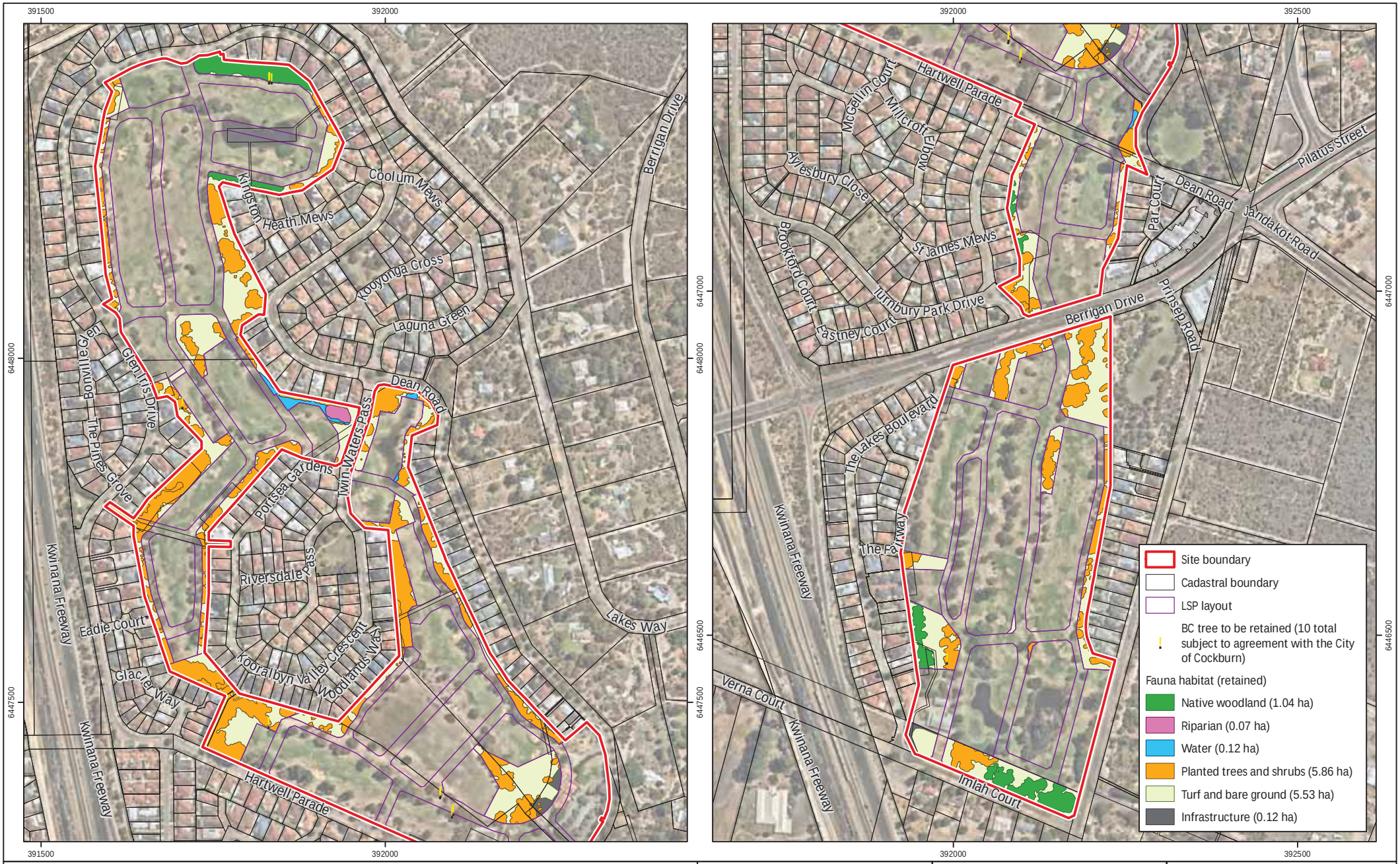


Figure 8: Fauna Habitat Retention

Project:	Environmental Assessment and Management Strategy Former Glen Iris Golf Course
Client:	ECP Acquisitions 6 Pty Ltd

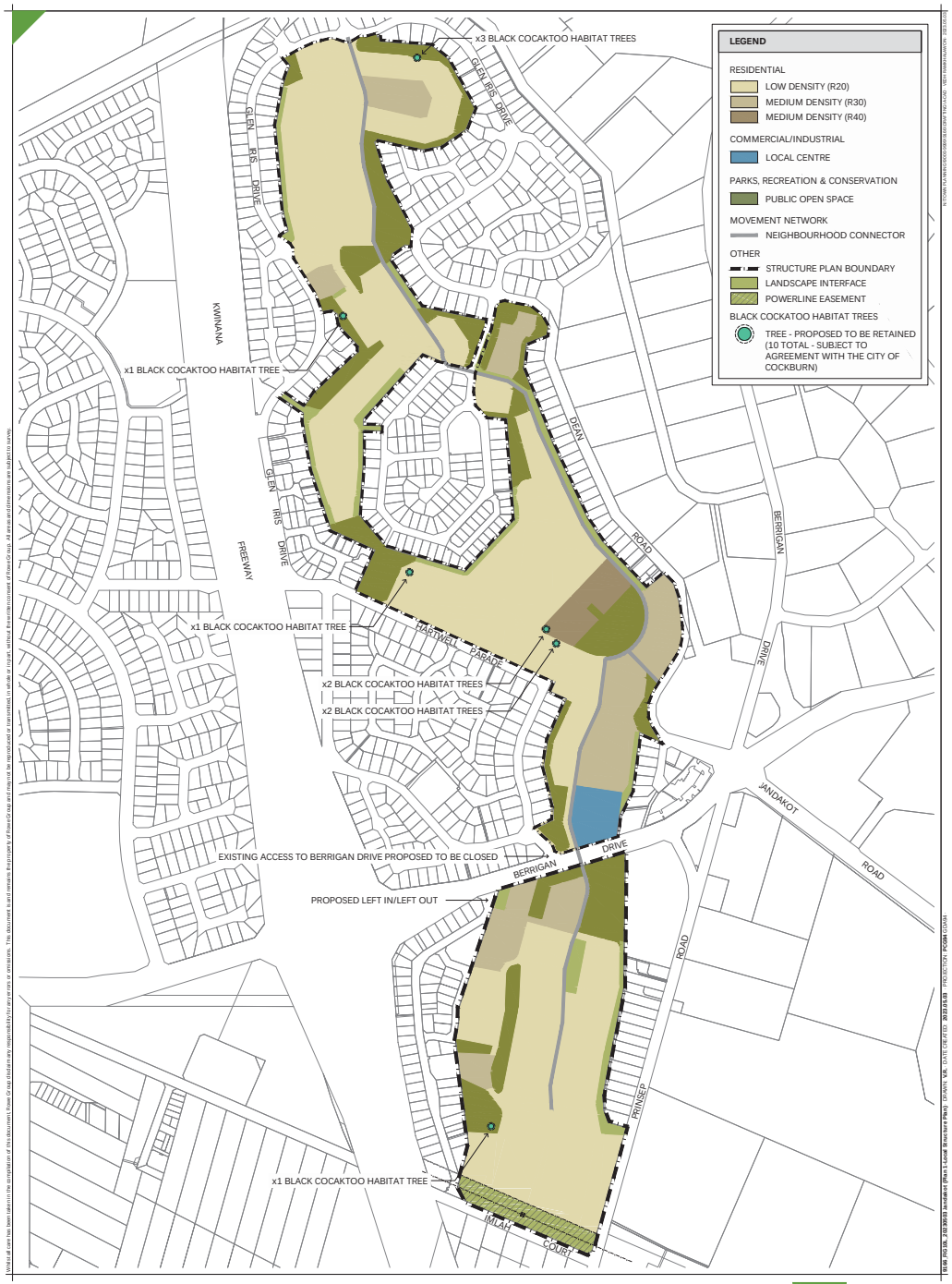
Plan Number:	EP20-009(09)--F51a
Drawn:	GAR
Date:	05/07/2023
Checked:	PPS
Approved:	JDH
Date:	30/08/2023

0 100 200 300
Metres
Scale: 1:7,250@A4
GDA 1994 MGA Zone 50

emerge ASSOCIATES

Appendix A

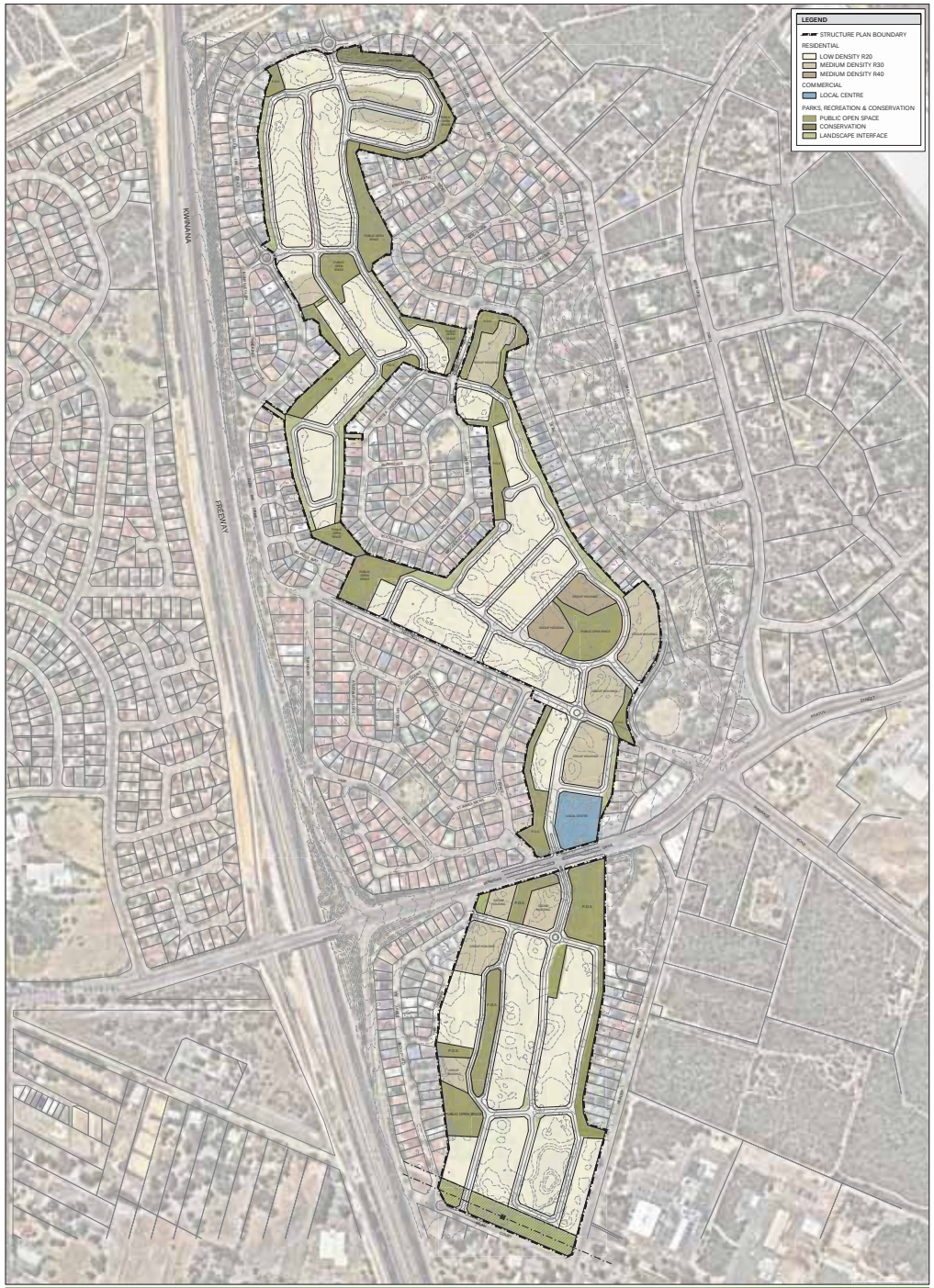
Local Structure Plan and Indicative Subdivision Concept
(Rowe Group Design 2023)



PLAN 1 - LOCAL STRUCTURE PLAN
GLEN IRIS DRIVE
JANDAKOT

SCALE @ A3: 1:6000
9166-FIG-10-L

ROWE GROUP DESIGN



INDICATIVE SUBDIVISION CONCEPT
GLEN IRIS ESTATE
JANDAKOT

SCALE @ A1: 1:3000
9166-CON-12-A

ROWE GROUP DESIGN

Appendix B

Landscape Strategy (Emerge Associates 2023)

Glen Iris Estate

Landscape Strategy for Local Structure Plan
Eastcourt

July 2023

emerge ASSOCIATES

Contents

REVISION	DATE	ISSUE OR AMENDMENT	BY	REVIEWED
A	June 2021	Issued for approval	CN	CN
B	Sept 2021	Issued for approval	CN	CN
C	March 2022	Issued for Text Update to page19	CN	CN
D	April 2022	Issued for Text Update to page 5	CN	CN
E	July 2023	Structure Plan Modifications	XZ	SM

1.1 General

The proposed redevelopment of the former Glen Iris golf course has created the need for a planning design to create residential housing including the provision of considerable areas of landscaped open space in a generally somewhat constrained space. The redevelopment includes planning for between 550 and 600 residential dwellings of varying densities in areas between the existing residential uses adjoining and surrounding the site. The use of landscaped open space is critical in providing for the needs of new and providing additional amenity to all existing residents. The project broadly consists of north, central and southern residential precincts.

It was noted during the extensive community consultation phase of the design process that the opportunity exists for a more diversified and broader accessible open space network than the previous fenced and single use golf course. The planning layout and landscape design have worked together to maximise the access and usability of the open space areas as a broader green link network with the aim of connecting precincts both within the new development and with the existing development surrounding the site.

1.2 Landscape Approach

The nature of the project as an infill redevelopment offers the opportunity to both create new existing open space precincts in its own contemporary style and also to be complimentary and mindful of the retention and expression of the sites existing older character. The overall intent of the landscaped open space design is encompassed below:

- To reflect and respond to the key existing landscape elements and character of the site in order to maintain visual continuity between existing and new precincts wherever reasonably possible. This includes built form and landscape treatments within streetscapes and open space.
- To provide safe external environment for the quiet enjoyment of the residents, guests and the general public.
- To best cater for the lifestyle needs and aesthetic desires of the existing residential community within the bounds of the capacity of the development to do so.
- To best cater for the lifestyle needs and expected desires of the new future residential community in reference to their anticipated demographics.
- To provide integrated public access that links with the existing residential, street and path network with a strong sense of movement opportunity, options and legibility as part of a broader open space green link strategy.
- To retain mature trees where ever reasonable and practical to do so within the bounds of the projects delivery and approval requirements.
- To provide a more environmentally sustainable outcome than the prior land use as a golf course, inclusive of the use of sustainable design practices as applied to new works.
- To consider habitat retention and creation in various methods including vegetation retention and replanting.

- To clearly define various landscape design typologies as applicable to all areas of open space to assist in the provision of facilities and legibility.
- To manage fire risk in a creative and aesthetic manner while meeting required standards and obligations.
- To respond to the local colour palette with either matching or complimentary colours and textures with the aim of visually minimizing visual impacts and blending where possible.

1.3 Private Realm Strategy

The project's private realm consists of landscaped open space within private residential lots in both front and rear yards. In the case of higher density strata development areas, the open space consists of common areas for access and the use of those strata residents as well as private open space to balconies and courtyards in accordance with R-Code requirements.

It is envisaged that landscape guidelines will be provided to residents as part of their purchase process to assist them in making informed landscape choices around design, aesthetics, sustainability and maintenance. In all cases the private realm will be under the care and control of the individual resident or the strata body.

1.4 Public Realm Strategy

Generally the public realm includes primarily the landscaped open space and path network within the proposed development and its linkages to the existing adjacent and surrounding open spaces networks and streetscapes. The landscape design aims to:

- Provide clear, direct, safe and compliant access around and through the proposed development
- Positioned to ensure the retention of a significant number of existing mature trees in new parks and linear interface buffers adjoining existing residences.
- Be designed and installed to integrate and manage fire risk to the required areas of the landscape treatment
- Provide open usable informal grass recreation space for new and existing residents visitors and the general public.
- Provide shaded seating as a point of refuge on the pedestrian and cycle networks
- Provide suitably sized central play facility befitting the character and history of the site.
- Provide small informal play area for general public use.
- Provide shady endemic native and exotic trees for respite.
- Provide signage elements for clarity of pedestrian and cycle movement.
- To cater for a range of demographics, user groups and skill levels.

Braithwaite Park, Emerge Associates

Newhaven, Emerge Associates

Secret Harbour, Emerge Associates

1.5 Changing Demographics

The demographics of the existing Glen Iris locality is generally characterized as a mature suburb with a large proportion of long standing residents. There is a lower than average number of children or adolescents and young people living in the locality. It is understood that grandchildren are somewhat present when visiting the existing residents. The anticipated demographics of new residents is younger than the existing Glen Iris age cohort. New residents will bring a range of children ranging in ages from school age children to older teens as part of a general second and third home buyer profile. It is not currently expected that first home buyers will be significantly present within the new development based on proximity, lot size and anticipated pricing structures.

1.6 Open Space Distribution

The proposed open space typologies are arranged to provide a range of experiences and also a range of facilities within both vehicular and walking proximity to all new and existing residents of Glen Iris and Jandakot generally. The landscape plans attached identify the open space distribution and strategy.

1.7 Open Space Typologies

Broadly the open space areas within the project consist of set landscape and use typologies. These typologies are determined by a number of factors including size of the open space, grade / levels and grade within the open space, the amount and location of gravity surface runoff, tree retention ability, habitat retention and creation, usable and safe walkable linkages.

The four open space typologies include:

1. Focal open space

The proposed design consists of four distributed larger open space areas suitable for community gathering and active informal recreation. These four parks are distributed reasonably evenly throughout the proposed redevelopment. These parks cater for a range of informal active recreation uses and a mix of passive recreation uses. These larger areas of open space have the ability to cater for tree retention and larger areas of surface runoff drainage storage and management.

2. Access open space

The proposed design consists of a series of access open space areas. These open space areas are characterized by providing a strong open space link between other open space typologies. In so doing, these open spaces provide a critical role in creation of a continuous green link option for pedestrian and cycle movement around the redevelopment. The linear nature of these open space links allows for the retention of vegetation, while the width of these open spaces enables the inclusion of series of public facilities accessible for existing and new residents.

3. Pocket park open space

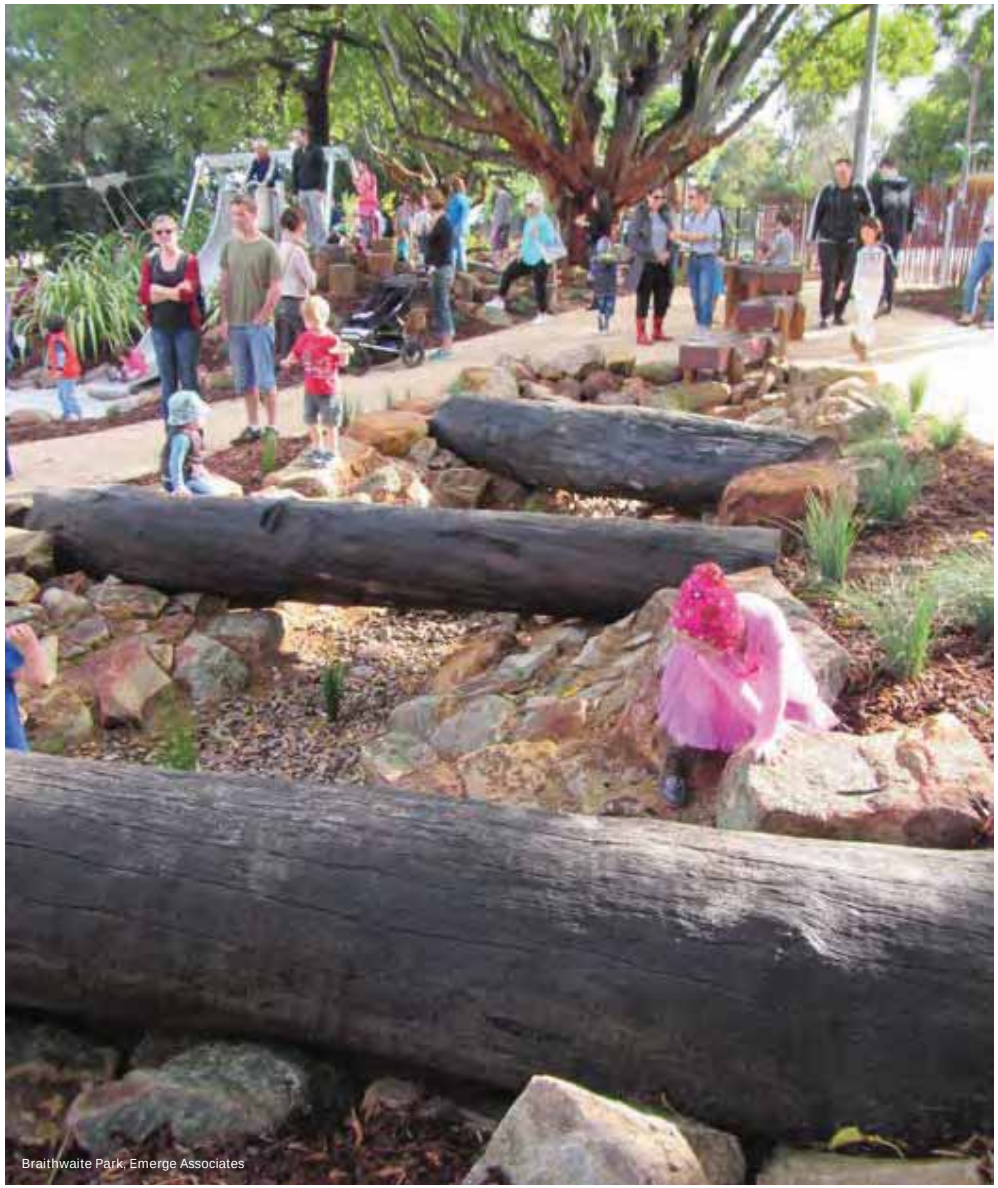
The proposed design locates a number of smaller open space areas set within the residential zone. These smaller open space areas are located to provide a range of localized incidental benefits including visual softening among the residential zone, walkability rest and respite via shade and seating, and in some cases specific associated needs such as low point drainage management and existing landmark specimen tree retention.

4. Buffer and linking open space

The proposal consists of a series of linear open space links. The nature of these open space areas ranges from road reserves with a widened verge to one side, to narrow buffers suitable to cater for a linking path and low planting between existing and new residences. The internal function of these spaces is to act as an access link.

Bibra Lake Regional Playground, Emerge Associates

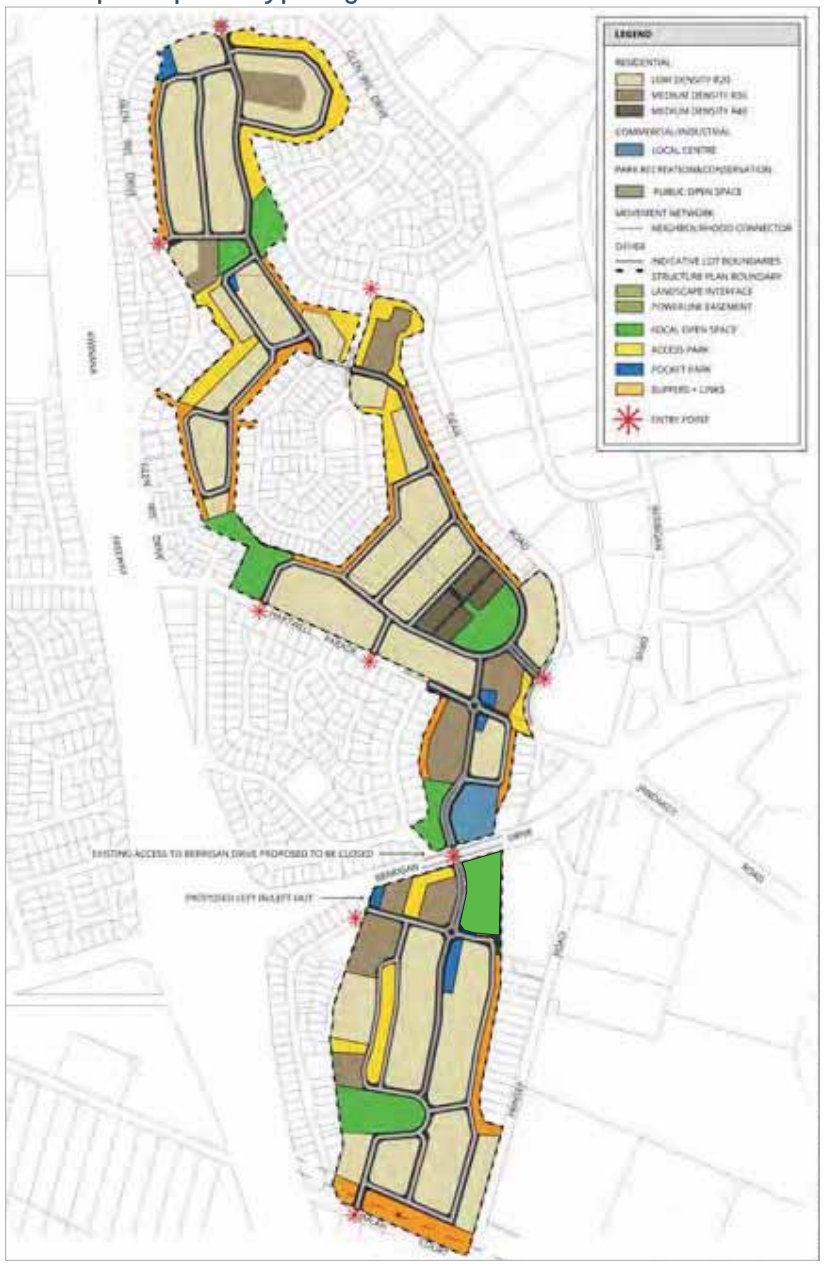
Bibra Lake Regional Playground, Emerge Associates



Braithwaite Park, Emerge Associates

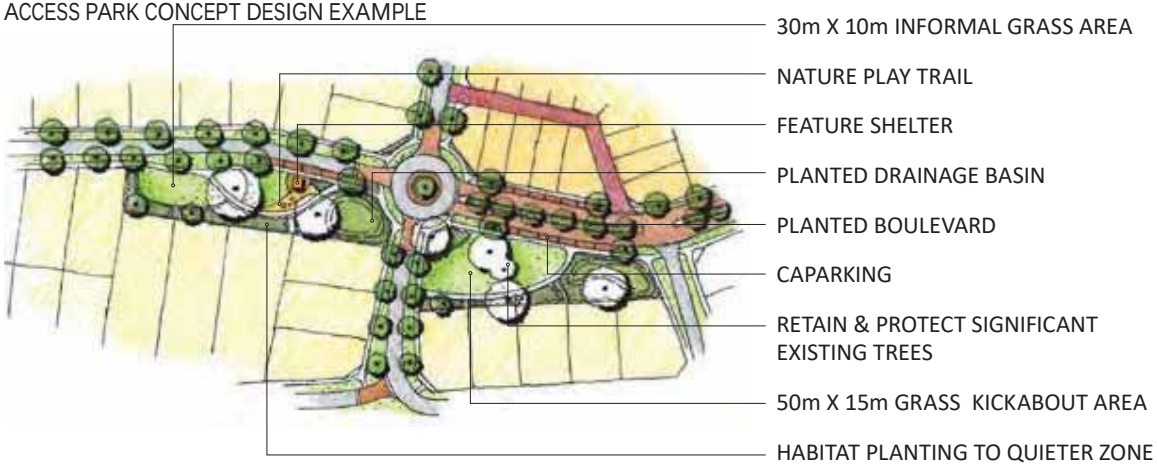
Evermore Heights, Emerge Associates

1.8 Open Space Typologies Visual

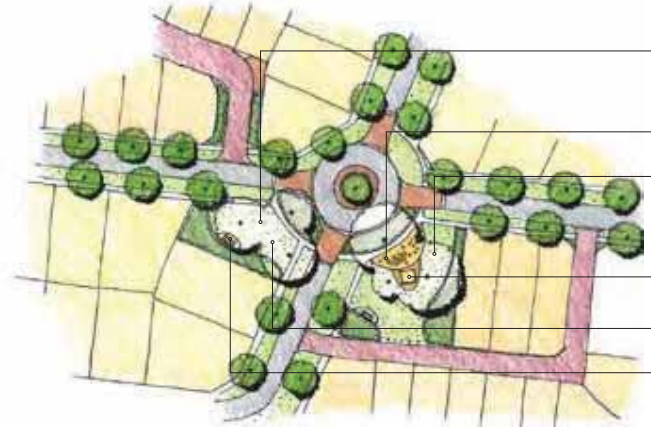


FOCAL OPEN SPACE CONCEPT DESIGN EXAMPLE

ACCESS PARK CONCEPT DESIGN EXAMPLE



POCKET PARK CONCEPT DESIGN EXAMPLE



RETAIN & PROTECT SIGNIFICANT EXISTING TREES

NATURE PLAY TRAIL

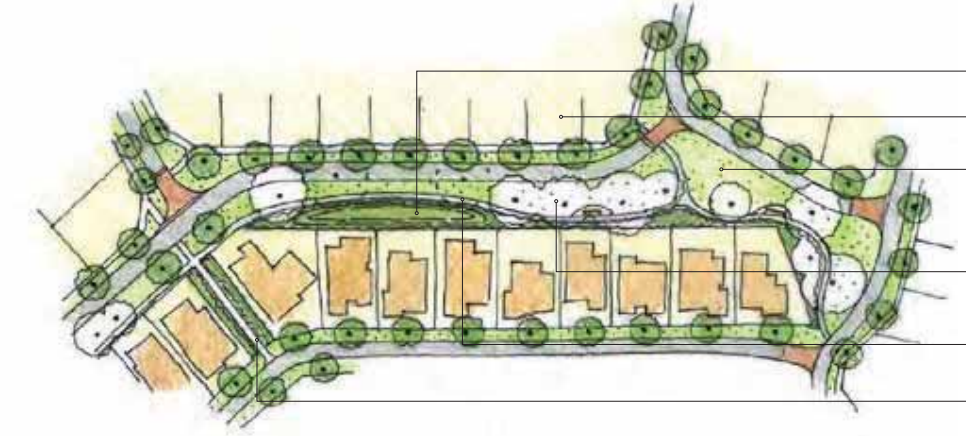
INFORMAL GRASS AREA

FEATURE SHELTER

SHADY GRASS AREA

BENCH SEAT

LANDSCAPE BUFFER WITH ROAD FRONTAGE CONCEPT DESIGN EXAMPLE



PLANTED DRAINAGE BASIN

NEW RESIDENCES

OPEN GRASS AREA

RETAIN & PROTECT SIGNIFICANT EXISTING TREES

PEDESTRIAN FOOTPATH

RIGHT OF WAY PEDESTRIAN CONNECTION

LANDSCAPE BUFFER WITHOUT ROAD FRONTAGE CONCEPT DESIGN EXAMPLE

NEW RESIDENCES

ACTIVE OPEN SPACE

PEDESTRIAN FOOTPATH SET AMONGST LOW SHRUB PLANTNG & GRASS

LIGHTING SET AT LOW PHYSICAL LEVEL

SHADY TREES AT REGULAR INTERVALS

EXISTING RESIDENCES

Glen Iris Estate

1.9 Landscape Masterplan

Glen Iris Estate

1.10 Functional Layout Masterplan

1.11 Public Facilities

The development proposes to build upon existing public facilities whilst catering for new residents via a range of new publicly accessible facilities. The extensive community consultation process and discussions with the City of Cockburn technical staff have identified a number of desirable public facilities including:

1. Informal larger play areas disbursed through the focal parks to cater for informal recreation activities eg: informal touch football, ball games, unstructured training, frisbee, kite flying, dog exercise and the like.
2. Defined personal training areas. It is envisaged that areas set aside for small gatherings of residents and visitors to allow for use/hiring for personal training and bootcamp type events. This is intended to cater for a variety of local age groups and skill levels. The landscape design can provide definition to these areas via small level changes and path and wall layouts.
3. 3. Playground facilities – it is noted that the need for a major regional facility is already catered for externally to the development area. It is proposed that a mid order play facility is located within the development to cater for the expected increase in local use and change in demographics. The aim is to design play elements that complement the existing retained play elements within Glen Iris rather than copy them, this will better provide a range of user experiences.
4. 4. Smaller play elements generally associated with nature play items located in discrete locations along the green links as part of a broader play trail running through the proposed development. This caters for smaller residential local precincts and also acts as a combined whole with each nature play area having a different type of play offering to those retained play elements currently in the Glen Iris.
5. Shelter structures with picnic settings to select locations where residents are encouraged to stop and stay for a while. These are generally associated with play elements and view axis lines from adjacent roads.
6. Electric BBQs are proposed to a couple of select locations as part of a social gathering and mixing initiative catering for smaller family groups and family scaled events.
7. Fitness elements are proposed as part of the broader green link design approach. This is in response to community feedback gained from the community consultation process.
8. Walking trails are proposed to occur through the green link network and are to be denoted via signage and colour coded elements to identify trails of various lengths and difficulty to suit a variety of users (eg: 1km, 3km, 5km, 7km). It is envisaged these trails will form a key tool in encouraging greater social interaction between existing and new residents.
9. Cycle trails are proposed to meander through the proposed development primarily on a path system with suitable signage and in some locations this may also occur partly onto the road system where low vehicle flow is to occur.
10. Dog walking trails and facilities are proposed to be included generally in alignment with the walking trails. These may include rest points in shade, taps and fixed dog bowls and discrete areas containing dog agility elements as part of a broader walking network.
11. A hard surface ball court is proposed to provide an active focus for teens. The final location of these facilities will be subject to detail design to mitigate noise impacts to adjacent residents but also to maintain clear and open view lines for passive surveillance.
12. Embayment carparking is proposed adjacent to the larger areas of open space and along certain streets. The car bays will cater for local visitors and a variety of social events and informal activities.
13. Street furniture is proposed to occur to defined set locations for the comfort of open space users. This will be inclusive of seating, table settings, drink fountains, select bollards and the like.
14. Public art is proposed to occur either as a larger landmark element on key view lines or as smaller discrete art elements to be discovered as part of the green link approach perhaps set into paving or on to low walls and the like.
15. A 3 phase power outlet is proposed for the larger open community gathering grass space to cater for possible periodic larger scaled community events.

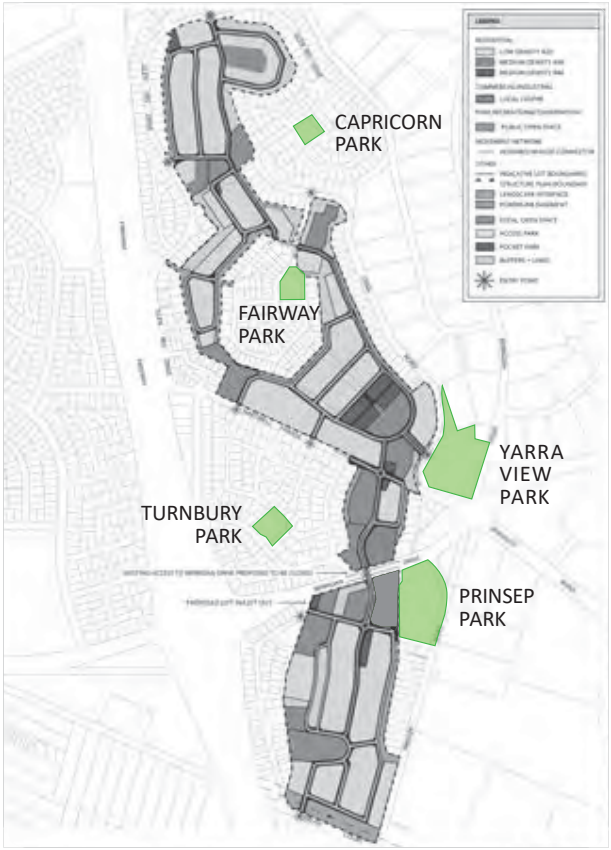
Dalyellup Beach, Emerge Associates

Evermore Heights, Emerge Associates

Osprey Waters, Emerge Associates

1.12 Existing Open Space Facilities

Glen Iris has 5 existing parks that form part of the current local urban layout that are well used and loved by the local community. Each has differing sizes and facilities catering for the local population and visiting public as summarised below. It is not proposed that any reduction in the existing public open space areas is to occur. The new open space network aims to be complimentary to the existing parks and their facilities.



A. Prinsep Park

This is a large neighbourhood scale park with minimal facilities. There is a large open grass kickabout area centrally located to the park bounded by clumps of taller native trees and stands of native bushland shrub vegetation forming bushland. The park appears to be well maintained but somewhat underutilised for its scale with limited public facilities. A simple path system and a shelter and table setting front onto the central grass area. Access into the park is currently difficult as it occurs mainly off major roads and intersections bounding the park.

It is noted that officers from the City of Cockburn have indicated there is the current need for a formal oval playing surface somewhere in the Glen Iris area as part of a broader growing need within Jandakot and Treeby. One possible option suggested by the City is its inclusion by reimagining the existing Prinsep Park on the corner of Berrigan Drive and Prinsep Road given the parks size can cater for an oval. Should the City wish to pursue this option it will be subject to a separate application process led by the City and is not part of the proponents proposal.

B. Yarra View Park

This is a large neighbourhood scale park with numerous facilities including a dedicated carpark for approx 20 cars. Existing native mature trees are located internally within the park with mature exotic street trees located to street edges. There is a large grass kick about area that doubles as a drainage overflow basin. There are 2 off lead fenced dog agility areas that exist with gate access and a variety of dog agility elements that cater for local and visiting dog walkers.

An existing off the shelf plastic playground is set in a sand base which caters for a variety of play and user ages from 4 to 10. Individual standalone small play elements exist in grass outside of the main play area for 2 – 4 year old users. Bench seating is set into the park near existing path system and there is a picnic shelter and table setting overlooking the usable grass area. There is a partly fenced basketball court in a raised area within the park that caters for teens.

C. Turnbury Park

This is a local scale park that is well maintained with central open grass kickabout area and numerous exotic shade trees set in grass. A central off the shelf plastic playground currently caters for 2-10 years of age and includes an off the shelf climbing wall and swings. A small basketball half court caters for teens as active semi formal play. There is a BBQ located in the park but no table setting. There is bench seating located under trees overlooking the grass area.

A large feature brick arbor at the main entry point adds formality and shade but has no particular usability or shaded seating. Hedge planting along the road edge limits some views from Turnbury Park Drive. The park has its own bore. Residents directly side onto the park and view over park inclusive of areas of detailed exotic shrub planting in a domestic character and scale.





D. Fairway Park

Generally the park consists of a central open grass kickabout area bounded by a variety of shrubs and hedges interspersed with a variety of mature native and exotic nature trees. A children's play area caters for toddlers and young children in a fairy garden character inclusive of off the shelf play items and with a small amount of specialised themed equipment for imagination play with a seesaw all set in a white picket fence. The park contains a bore and is well maintained and is overlooked by adjacent residences and bounded in part by a residential scaled road system.



E. Capricorn Park

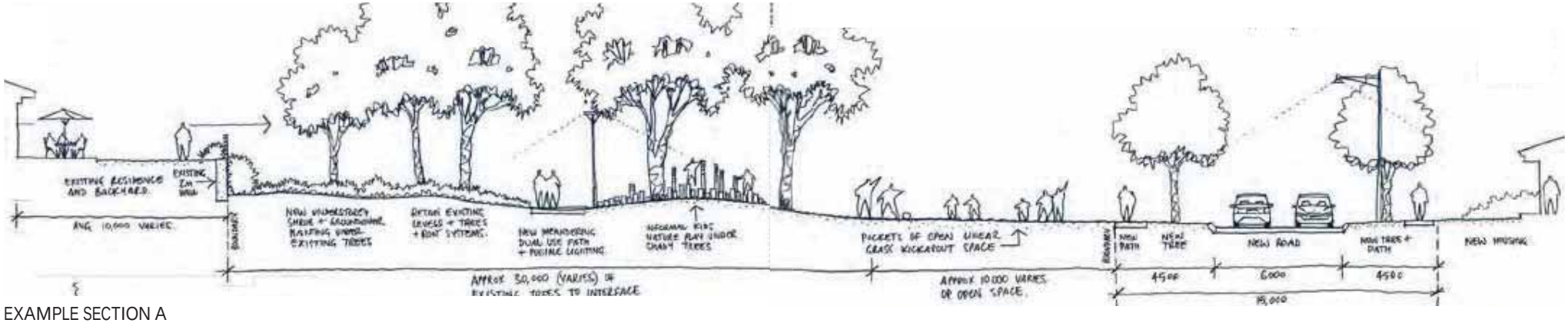
The park is located on a hilltop location with views to the surrounding area. Pockets of retained mature native vegetation inclusive of mature native trees exist with mature exotic trees located along adjacent street edges. A meandering concrete path is set into pockets of sloped grass set among native planting beds. An off the shelf playground set in a sand surface is nestled into bushland adjacent to residents side boundary fence with a single solar light located nearby. The playground appears well maintained and caters for children 2 - 10yrs and generally the park is in good condition. The park has low passive surveillance and is not particularly safe with limited street visibility. No seating is evident within the park.



Glen Iris Estate


Sunrise, Emerge Associates

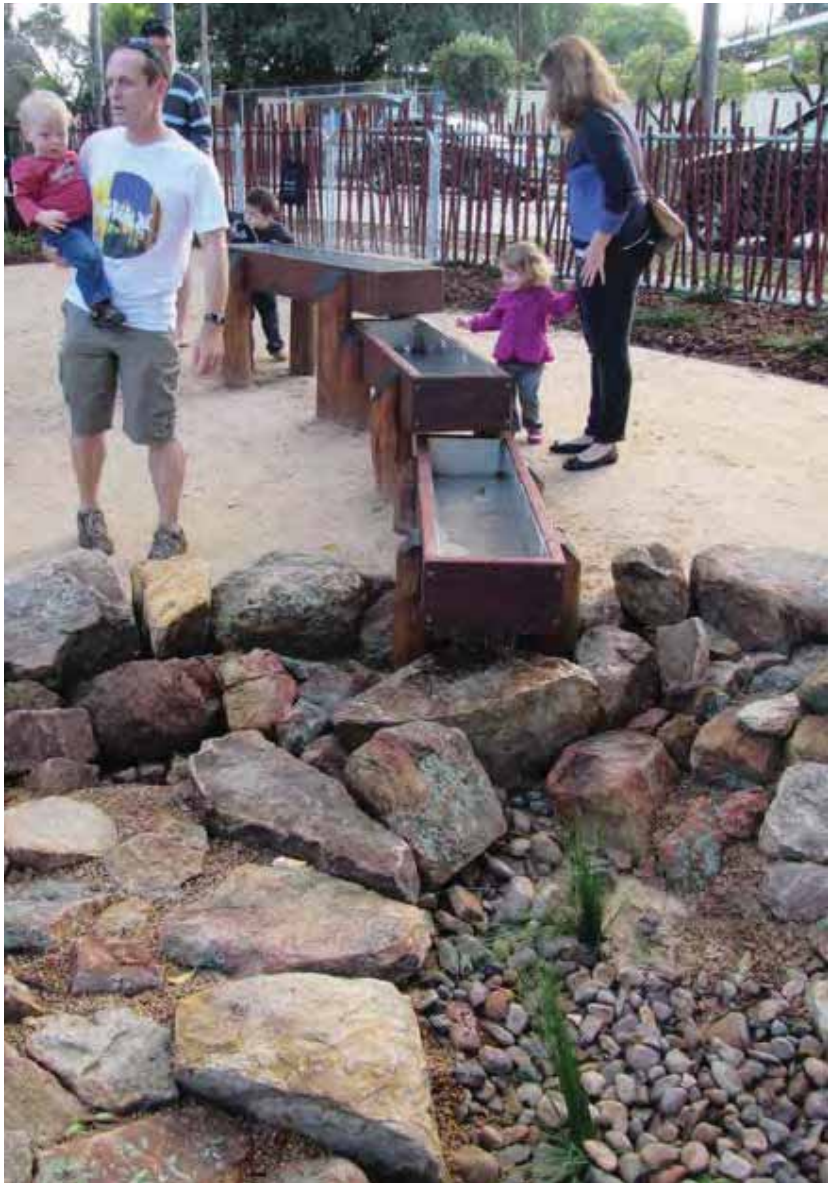

Brighton, Emerge Associates



EXAMPLE SECTION A

Braithwaite Park, Emerge Associates

Spire, Emerge Associates



Braithwaite Park, Emerge Associates

Allara, Emerge Associates

1.13 Interface to Existing Residences

The former golf course was directly backed onto by existing one and two storey residential housing. Some of the adjoining existing residential land is elevated above the subject site. In all instances, private rear fences along the boundary interface generated the safety and security necessary for the respective residence. Under the proposed development approvch the edge treatment between the existing residences and the new development will be managed in a variety of ways including:

- Upgrading to the existing rear wall and fencing where suitable and necessary subject to need, levels and impact with the work to be managed by the developer at 50/50 shared expense in consultation with individual affected adjoining landowners.
- The creation of new walling and/or fencing where suitable and necessary subject to levels and the impact of any alterations proposed by the development.

The design of the interface may be managed in a variety of ways including but not limited to:

- The backing of new housing directly onto the rear of the existing residence creating a typical residential rear boundary interface.
- The creation of a road and streetscape to the rear boundary of the existing residence.
- The creation of open space to the rear boundary of the existing residence.
- The creation of an access and buffer strip to the rear boundary of the existing residence.

1.14 CPTED & Passive Surveillance Approach

The landscape design of open space and streetscapes will take into consideration various crime prevention through environmental design (CPTED) principles. Noting the extent of open space and the connected nature of the path system, passive surveillance over the open space areas is a key part of the developments safety and security approach. The design of the open space landscape treatments combined with orientation of the open space to roads, paths and new and existing residences enables passive surveillance over parks.

The height of rear boundary fencing and possible semi permeable detailing enables interaction. In addition the use of level changes where required allows for some overlooking of open space areas. The location of trees, furnishings, and play elements will be arranged to not impede views to smaller open space areas.

Shrub planting will typically be lower shrubs and groundcovers to minimize the ability for hiding. The location of key facilities will be set ion key view lines from adjacent streets inclusive of car headlights illuminating various elements. The use of lighting has been described elsewhere within this document.

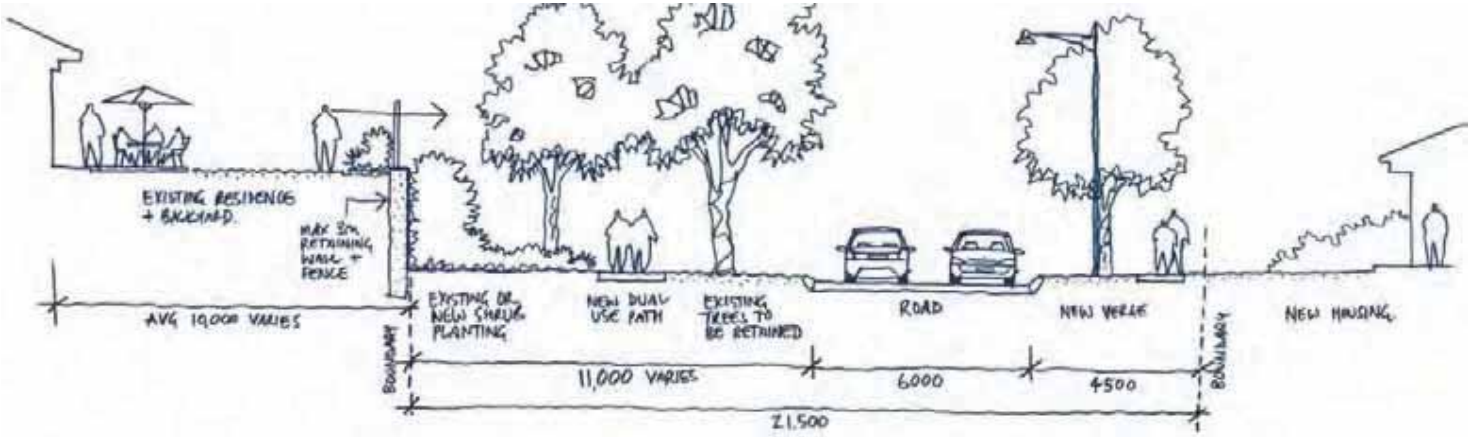
1.15 Existing Adjacent Public Open Space Upgrades

The Glen Iris precinct has a number of existing parks throughout the existing residential areas that are well used and loved by the local community. It is not proposed that any reduction in the existing public open space areas is to occur.

Osprey Waters, Emerge Associates


The Sanctuary, Emerge Associates


The Sanctuary, Emerge Associates



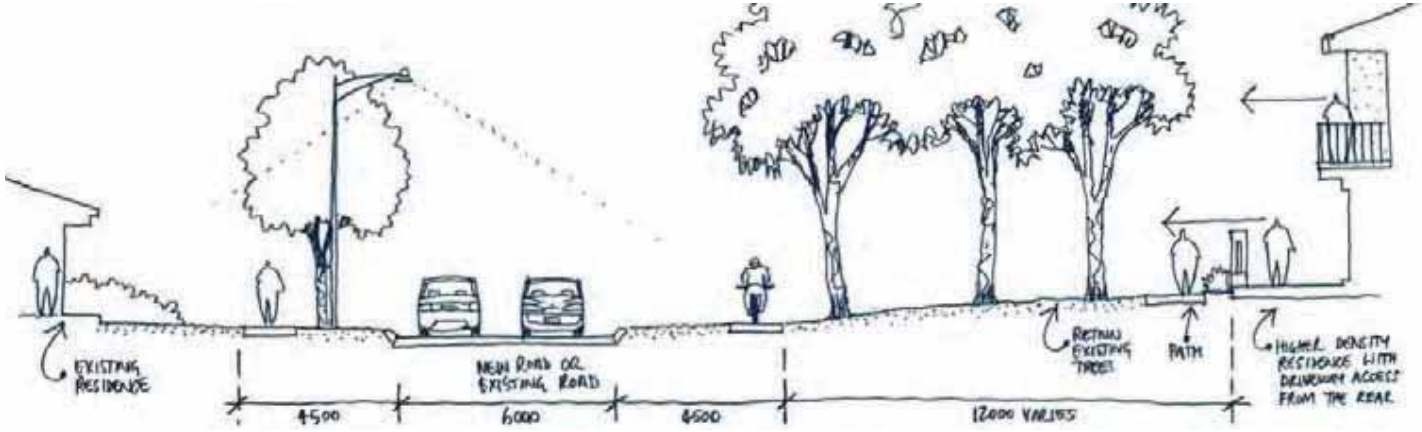
EXAMPLE SECTION B

Glen Iris Estate


The Sanctuary, Emerge Associates

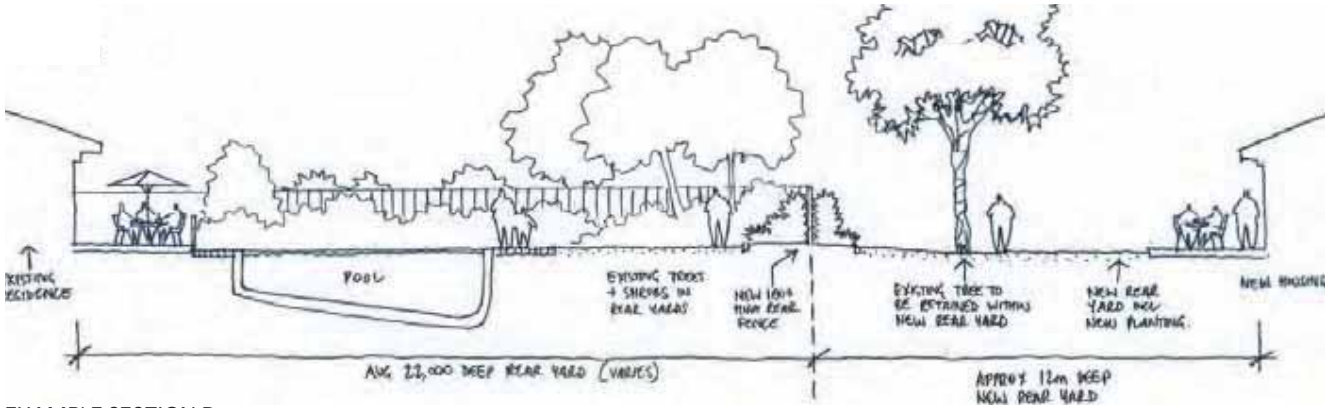

Heritage Park, Emerge Associates


Shoreline, Emerge Associates



EXAMPLE SECTION C

Lakeway, Claremont



EXAMPLE SECTION D

Lakeway, Claremont

1.16 Streetscapes

Road Hierarchy

The proposed road network will consist of a variety of typologies to better define planning legibility to the user, including:

- A series of entry points into the proposed development that will aim to define the edge of the new works without being completely divorced from the character, colour and finish of the existing Glen Iris residential area.
- Collector roads. These will distribute traffic into and out of the proposed development, these will have defined larger future tree stock to recreate the meandering shady drive as the most travelled roads. The opportunity for drainage management exists based on the generally wider road verges.
- Residential streets landscape type 1: These streets are generally longer and more direct in their layout and will have a series of tree species befitting this street type.
- Residential streets landscape type 2: These are smaller shorter residential streets which act as much more localized road element in some cases as cul-de-sacs.

In all cases the provision of shade and canopy cover is paramount and in keeping with urban green canopy coverage aims and the reduction of the urban heat island effect wherever possible.

Existing Streets

The existing streetscapes in Glen Iris are one of its key defining character and landscape features. The intention is to retain the existing streetscapes as is, and to aim to replicate elements of this avenue approach in the proposed streets where possible. It is proposed that in the order of 500 existing mature trees will be retained within the proposed open space areas, and more than 1,000 new trees will be planted across the new development in open space and streetscape areas. This is in addition to the trees to be retained within existing streetscapes in and around the surrounds of the site.

Widened Road Reserves

Select streets are proposed to have an offset road carriageway and a widened verge to cater for a widened 2.5m dual use footpath and a shady double tree avenue either side of the path, which will act as a key part of the broader safe and secure green link movement network through the proposed development. This enables access to occur off street and can cater for visitors carparking in select locations in addition to flush kerbing and drainage swales in select locations - subject to future detail design.

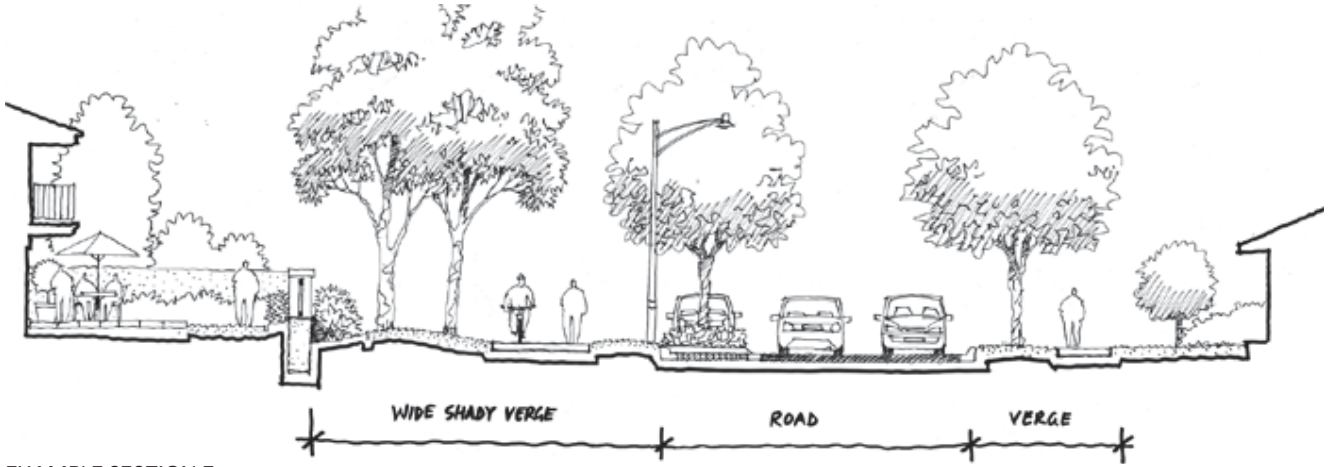
New Roads

New road design will cater for street tree planting and the broader safe and secure green link network. Street tree planting will be selective and will be variable to bring a variable character to different streets.

Traffic Calming

In locations of longer lengths of straight residential roads the inclusion of traffic calming may be employed to assist in slowing traffic speeds and allowing crossing points are suitable locations and allow for additional landscape softening. Locations of traffic calming will need to pay due regard to driveways and lot access and footpath road crossings.


Bushmead

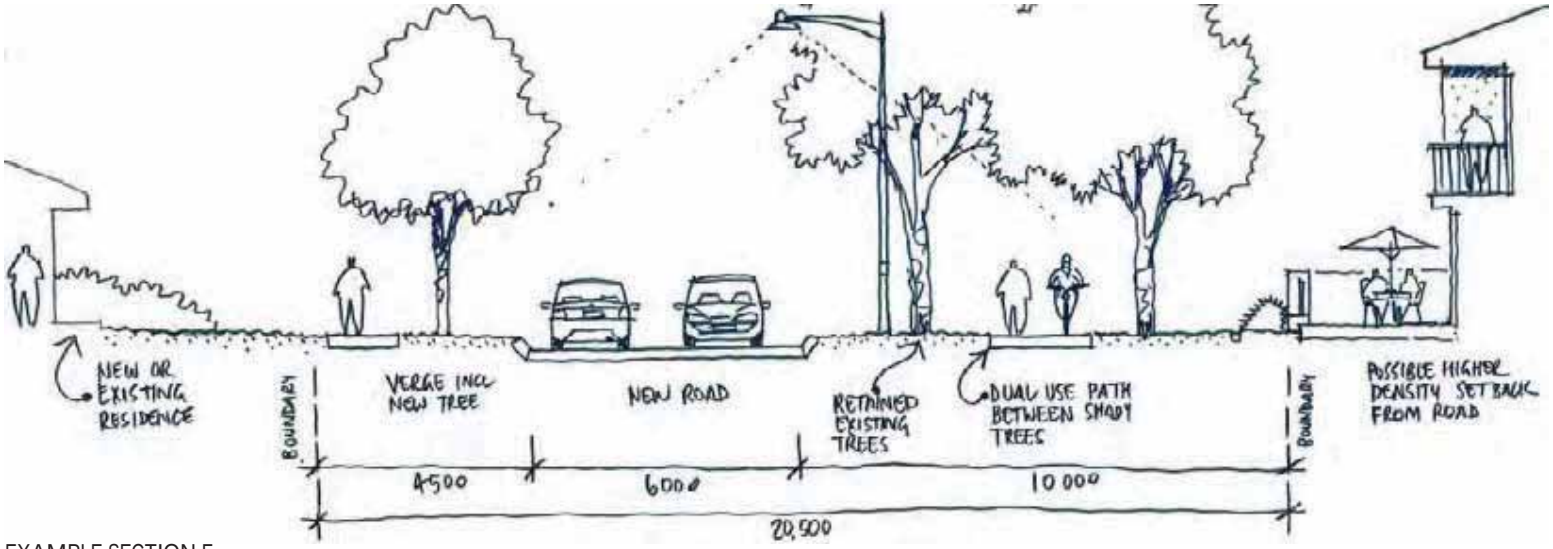


EXAMPLE SECTION E

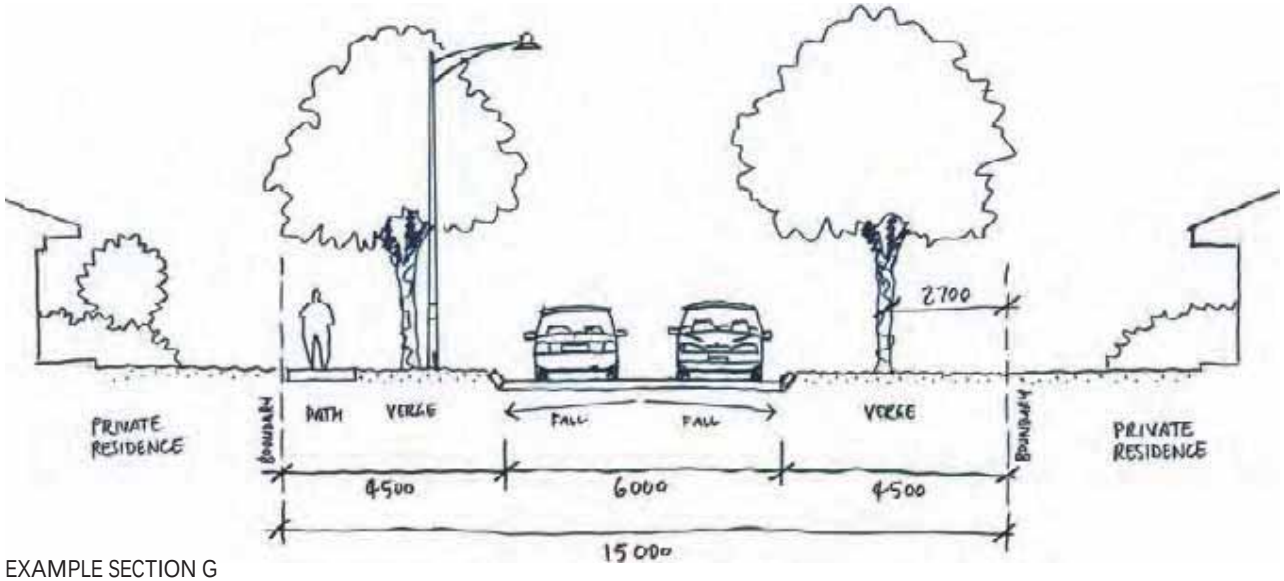
Jacob's Ridge, Queensland

Lakeway, Claremont

Newhaven, Emerge Associates



EXAMPLE SECTION F



EXAMPLE SECTION G


Honeywood, Emerge Associates


Lakeway, Claremont

1.17 Tree and Plant Species

An indicative plant list and select imagery has been included within the attached drawings in support of the proposal. While the list is subject to refinement in consultation with the City of Cockburn, it clearly defines the plant species approach and intent. Planting will consist of a mix of mature stock for specific uses and high profile location purposes, and smaller nursery hardened off stock for mass planting purposes.

The planting strategy consists of the following three principal approaches:

a. Retained trees. The retention of existing trees from the golf course rough areas in between the various former fairways is proposed. This creates instant visual effect, retains shade and habitat and maintains an element of the site's former use.

b. Transplanted trees. The preparation and transplanting of existing trees is possible based on the diversity of species currently located on the site. Existing transplantable trees include but are not limited to: Norfolk Island Pines, Plane trees, Palms of various species, Cape lilacs (subject to approval), WA Peppermints, Liquidambers, casuarinas, ficus species, melaleuca species and grass trees.

c. New tree planting. The proposed development intends on undertaking a new tree planting regime for streetscapes and parkland areas. The final extent and species mix will be subject to approvals and availability. In addition to planting in public areas, the planting of trees is also encouraged in the private realm noting the generally larger sized residential lots proposed for this development.

The new planting selections are aimed at achieving the below criteria:

- Being of local character.
- Preferably being endemic and native to the site area.
- Not being invasive by habit and not containing any declared weed species.
- Being hardy to local soils, wind and salt tolerant and with lower water needs.
- Where required and suitable, being of low fire fuel creation and load as a key part of fire management to the margins of the development.
- Promoting the local ecosystem as habitat for a range of endemic fauna.
- Being of a series of attractive and contrasting foliage, colour and form to enable design based planting and displaying the diversity of the local environment.
- Having a selection of species that ideally enable some to be seasonally flowering at all times of the year.
- Being of suitable form and habit to promote shade where suitable and to either open or screen select views.
- Being of species that are readily commercially accessible and available for future replenishment.









Verge Planting


Scaevola ‘Purple Fanfare’


Melaleuca incana ‘Nana’


Adenanthos cuneatus ‘Coral Carpet’


Hemiandra pungens


Grevillea obtusifolia prostrate


Westringia mundi


Eremophila glabra


Myoporum parvifolium purpurea


Lomandra tanika

Feature Planting


Grevillea obtusifolia prostrate


Beaufortia squarrosa orange


Westringia fruticosa ‘Smokey’


Scaevola ‘Purple Fanfare’


Hemiandra pungens purpurea


Lomandra tanika

Broad Planting



Adenanthos sericea



Pimelia ferruginea



Eremophila nivea ‘Spring Mist’



Grevillea olivacea



Grevilea olivacea



Dampiera linearis



Acacia lasiocarpa



Acacia saligna ‘Green Mulch’



Acacia pulchella



Hemiandra pungens purpurea



Chamelaucium unicnatum



Calothamnus quadrifidus



Hypocalymma angustifolium



Thryptomene baeckeacea



Grevillea thelemanniana



Beaufortia squarrosa orange



Westringia fruticosa ‘Jervis Gem’



Adenanthos cuneatus



Ricinocarpus ‘Bridal Star’



Callistemon phoeniceus

1.18 Habitat Approach

The former fenced golf course created the opportunity for native fauna to use the area as part of a broader habitat area with access to shelter, shade, food and water and some degree of protection. The conclusion of the golf course use may alter aspects of this until such time as the new open space can be created and established. The City has indicated its support for the creation of a series of smaller habitat zones within the proposals open space areas that encourage the survival and retention of native fauna in the area. The final locations will be determined based on existing vegetation, suitable seclusion from humans.

Avian fauna will be able to access the site and use its existing retained trees as it always has done, albeit noting that works may see some degree of disturbance. Ultimately new tree planting will rise to provide generational change to the existing tree stock currently providing habitat. The retention of trees individually, in clumps and in avenues, encourages the retention of existing fauna.

Ground dwelling native fauna will have access to the site noting that construction will occur in stages allowing fauna to adjust to newly created open space areas as the environment transitions over time. As the landscaped areas are installed and mature over time, it is envisaged that native fauna will return to the site from adjacent bushland areas. The proposed retention of two smaller areas of existing banksia bushland provides some continuity for habitat and cover for native fauna.

The landscape design aims to provide areas suitable for fauna to reside and move through the development over time. This will be accomplished by planting types and densities, continuous cover, pockets of refuge for example logs and rocks to lesser used areas of open space, planted drainage basins with infrequent domestic animal and human use. Education of the local existing and new community around risks to native fauna and what individuals can do to promote preservation. An item possibly worthy of examination as part of future detail design is the creation of defined native fauna refuge zones with controlled suitably sized access that limits domestic animal access.

1.19 Sustainability Approach

The landscape approach will have embedded within it a series of sustainable initiatives to be further refined at the detail design stage. These include, but are not limited to:

- Tree retention above and beyond that typical for greenfield development within parks and streetscapes.
- Transplanting of existing mature tree stock saving from destruction and retaining habitat and creating instant shade.
- Larger percentage of open space (22.9% total proposed green space) beyond that typical for greenfield development.
- A variety of storm water management initiative, techniques and inclusions to provide at source recharge including possible subsurface storage tanks.
- Planted detention basins inclusive of nutrient stripping capability in place of sumps.
- A major reduction in the existing long term groundwater draw and licensing needs for public open space maintenance, and significant reduction in the use of fertilizers and herbicides and pesticides.
- Removal of existing lined lakes and their groundwater top up resulting from evaporation and use by the former golf course for irrigation purposes.
- Relocation of native fauna (as may either be temporary or permanent)
- A variety of water wise initiatives applied to the public and private realm inclusive of a new, more efficient irrigation system.
- Retention of two small pockets of existing Banksia woodland.
- Reuse of timber removed from the site as both nature play elements and in mulch and possible select public art elements.
- Preference for use of low embodied energy materials where possible and suitable.
- Use of select LED /and solar lighting where possible and suitable.
- Creation of possible fauna habitat opportunities within open space and retention of trees suitable for avian fauna.
- A maintenance minimisation in design approach to limit cost and time impacts.
- A series of maintenance initiatives to reduce pesticides, herbicides and chemical use generally.
- The aim of creating a continuous tree canopy coverage to limit urban heat island effect and maximise green canopy coverage.
- Use of predominantly native shrub and groundcover vegetation endemic to the Swan coastal plain.

1.20 Wayfinding & Signage Approach

Wayfinding

The design of the development is proposed to be undertaken to encourage intuitive orientation and movement through the development. This is to be undertaken through the use of materials and colours to define particular movement routes, visibility to key features and elements, open viewsheds to desirable destinations and screened viewsheds to assist in directing users and promote privacy where necessary. The design of the path system is aimed at promoting connectivity through the development in an expanded, safe and efficient manner.

Signage

Signage to the development will be unified in its materials and form. Signage is proposed to be located at key decision points including points of arrival, intersections of roads and paths and at reinforcement locations along longer paths.

Signage is proposed to consist of:

- Directional signage to facilitate efficient movement within the precinct.
- Educational signage relating to the local area its habitat, features and history.
- Orientation signage pertaining to direction and distances to local places of interest inclusive of information pertaining to users' fitness and outdoor activities.

1.21 Landscape Materials & Furnishings

Landscape materials will be common to the proposed development area to bring design and character unity to the precinct while also marking quality of the new development area. External landscape materials will be generally selected to be complimentary to the local character in texture, colour and style. The attraction of the local area is intended to be reflected in the materials used. In all instances materials will be robust and fit for purpose with consideration on durability, longevity and maintenance minimization over the longer term inclusive of minimized replacement, local availability and all relevant warranties and guarantees.

Furnishings will all be off the shelf proprietary elements available locally inclusive of parts, replacements, and all suitable guarantees and warranties.

The proposed range of landscape includes:

- Stone paving finish to select higher use and feature areas and to select dry stacked look limestone feature walls befitting of a more handcrafted finish.
- A mix of exposed aggregate and plain concrete finishes to select areas.
- A mix of fencing materials fit for purpose.
- Off form concrete to select feature walls and stairs.
- Metal frames decking and structures with a variety of materials panels and finishes.
- Stabilised gravel paving to select lower use paths.
- Galvanised metal finish to select landscape elements.
- Natural loose gravel paths to select private access points.
- Natural treated timber materials for nature play elements.
- Red asphalt for select paths and higher use road areas.
- A combination of large stone, concrete and steel and/or plastic garden edging.
- Minimal timber to reduce maintenance and extend longevity.
- Low fuel mulches including sand, gravels, select organic mulches to defined areas.

1.22 Landscape Lighting Strategy

Lighting to the landscaped areas will be kept to the minimum necessary to enable safe access to select key routes and areas. The intention is that lighting is subtle but effective, directed rather than broad. There is proposed to be minimal light overspill and light pollution generated by the development.

In the main, landscape lighting will be solar and/or LED or similar low electricity use equivalent and will typically be lower directed lighting to signage, doorways, roads and key paths and access routes as opposed to lighting to all access routes. Street lighting will be managed by the civil design package.

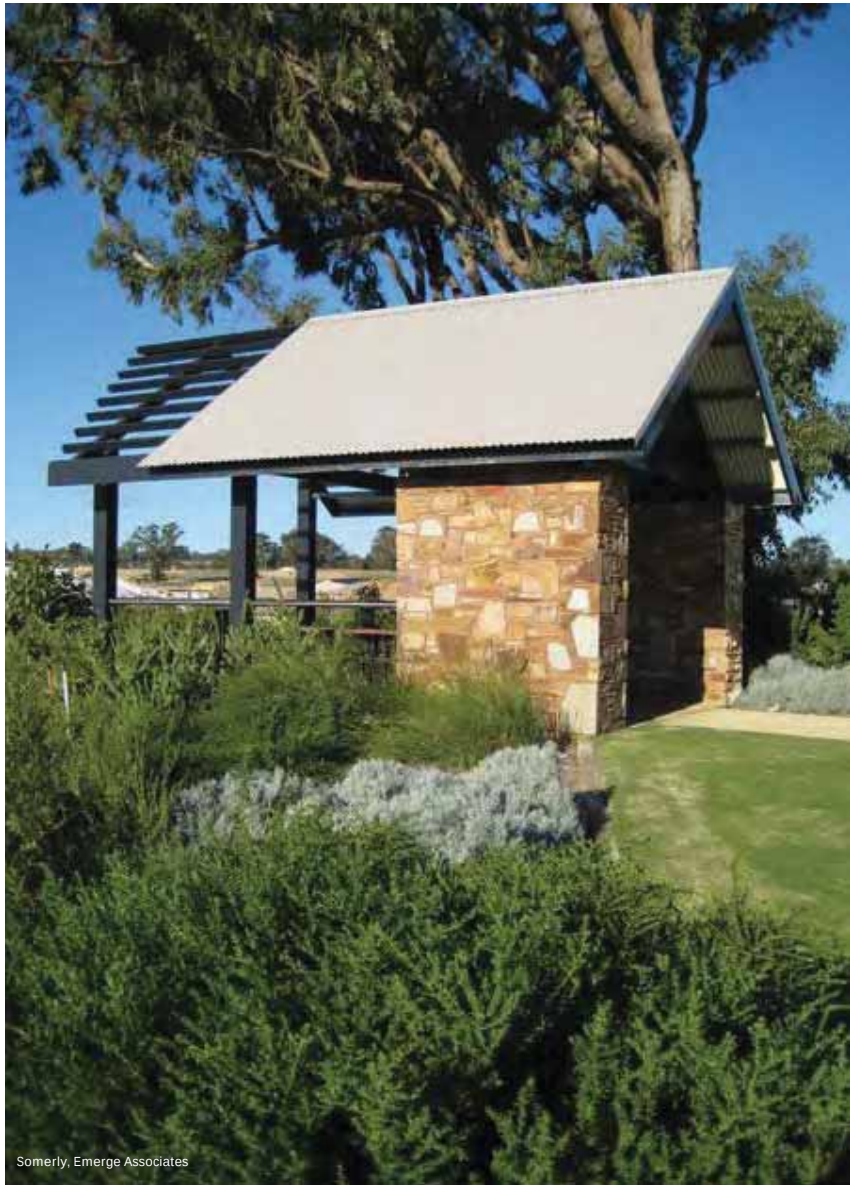
1.23 Bushfire Risk Management Landscape Response

The fire setback zone occurs around most of the margins of the development where they abut a bushland fire threat. Two small areas of existing banksia bushland are proposed to be retained within the design. The resulting landscape design will respond to the projects BAL line in these two smaller defined locations and will employ the use of compliant fire management techniques to meet fire management obligations.

The landscape response will include, but not be limited to, the below in all selected effected fire management zone areas:

- Use of endemic plants and native species identified by the Department of Fire and Emergency Services (DFES) as being low fire fuel species.
- Selection, arrangement and spacing of shrub planting to meet low fire risk principles and requirements.
- Selection, arrangement and spacing of trees to meet low fire risk principles and requirements.
- Use of noncombustible and low combustible landscape materials within the fire setback zone including hard paving, gravels as paths and mulches in select areas, limited organic material, rocks and boulders.
- Provision of access for fire and emergency vehicles.
- Incorporation of a fire setback zone management and maintenance approach inclusive of removal of necessary vegetative fuel and debris at standard required intervals.


The Sanctuary, Emerge Associates


Somerly, Emerge Associates

- Proposed inclusion of irrigation to fire zones for use in advance of fire emergency. Should fire management may require fire mitigation measures in addition to setbacks, the installation of irrigation sprays to defined locations can assist in the suppression of fire prone material and flames within the fire buffer zone.

1.24 Irrigation Strategy

The former golf course has a large irrigation allocation suitable for the preparation and maintenance of healthy greens and fairways over a larger area than that proposed for the new development. This irrigation allocation remains in place.

With the removal of the golf course it is anticipated that the use of ground water will significantly decline. Initial expectations are in the vicinity of up to a 70% reduction in water usage which may be on-sold, traded and / or returned to the groundwater aquifer.

The exiting irrigation system will be removed and replaced with a new integrated irrigation system designed and installed to meet the standards of the City of Cockburn. This may include a system of sprays, drippers and bubblers to suit various circumstances and planting regimes. The existing bores are expected to be reviewed and reworked to maximise water extraction efficiency and to meet new standards. Additional bores may also be considered/ required to better distribute extraction and more efficiently cater for water distribution. Ultimately the groundwater licence and infrastructure required for the new parks will be transferred to the City.

The irrigation water source is proposed to be from the existing (or new) bore system and will be separately metered. The irrigation system will have a range of inbuilt sustainable measures including, but not limited to, rain gauges, water use monitoring, partial drip systems and hydro zoning as part of the design process, inclusive of manual override to respond to periods of excessive rain or lengthy dry periods. Conscious of continuing staged house and road construction, there is also the opportunity to consider a mainline loop system with reverse flow or to be linked to a variety of bores in order to maintain water flow irrespective of any possible future break.

Individual residences may apply for a domestic bore or uitilise mains scheme water as suitable and will be separately metered accordingly. The individual on lot and verge irrigation system will be under the care and control of the resident. In the main, the planting species palette will be local endemic species / native species requiring less water than existing system.

1.25 Landscape Surface Drainage Strategy

Generally the site has a good drainage infiltration rates and good soil permeability reducing the need for extensive drainage and water storage infrastructure. Where possible, the development will opt for at source drainage solutions to distribute drainage throughout. Landscape zones will include planted basins at key low point locations within the development and also will utilize the existing drainage basins where possible. Overflow onto adjacent grass areas may occur to cater for defined irregular larger storm events.

The residential lots and the medium density sites will seek to manage their drainage and infiltration within their lot or strata area. Where open space areas are somewhat limited in space to cater for surface drainage management, underground storage solutions are proposed in accordance with relevant standards and subject to detail design, to ensure maximum open space areas are available for the community.

Roads and paths will be generally graded to sheet drain inclusive of a mix of infiltration basins, raingardens in select locations and swales where suitable. Final drainage design will be subject to detail engineering design. The streetscapes will seek to have flush kerbing in select locations adjacent to grass swales or planted swales inclusive of defined rain gardens to select locations.


Harvest Lakes, Emerge Associates


Vivente, Emerge Associates

1.26 Maintenance Strategy

In all cases, a maintenance regime will be in place inclusive of general maintenance minimization through design practices and will aim to use sustainable maintenance practices. This includes, but is not limited to, defined edges and borders, minimal and preferably alternate approaches to pesticides, controlled and minimized fertilizer use.

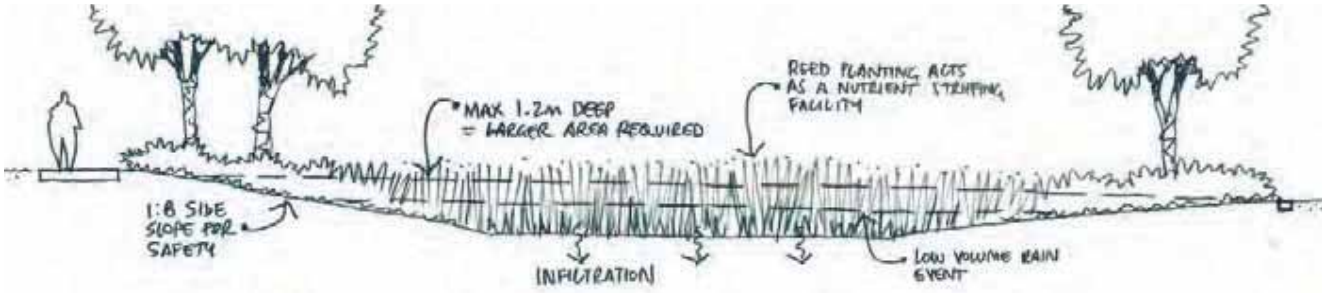
Planted revegetation areas and managed vegetation zones will include a maintenance regime as part of its bushfire management obligations. This will include but is not limited to required periodic removal of natural fuel, review of planting densities to ensure continued compliance with fire regulations and checking and testing of irrigation sprays.

Maintenance will be undertaken via general access to all public accessible areas. Light maintenance vehicles can access all public areas and can adjoin all private areas within the development. This will occur initially via the road system and then by careful access over landscaped grass areas and select areas of the pedestrian path system. Use of removable bollards will limit and control unauthorize access to link areas between roads.

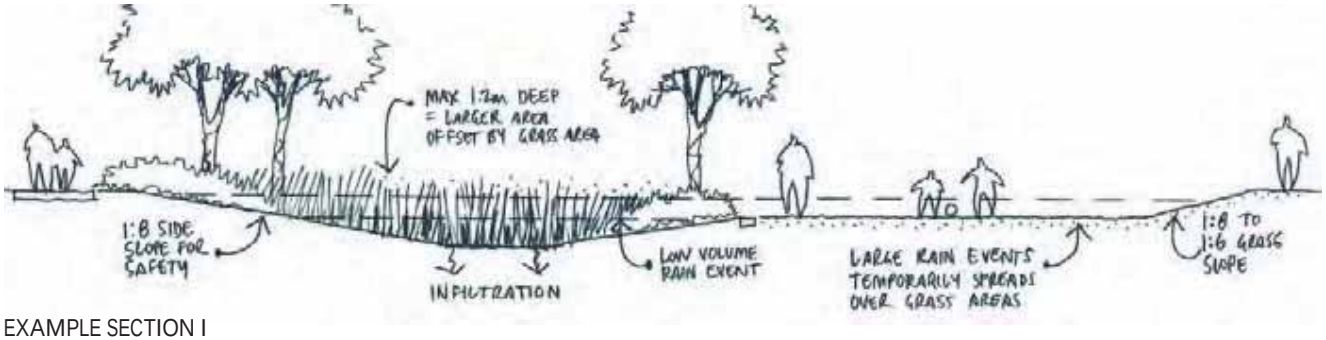
Maintenance will be managed by the development for the first 2 years minimum. The 2 year maintenance timeframe may be extended in certain locations at the developers discretion in liaison with the City.

The increased volume of open space will see additional expenditure occur as necessary in order to maintain the increase in area of open space. This additional cost is somewhat offset by the content of the additional open space (which will mainly be linear widened streetscape areas)

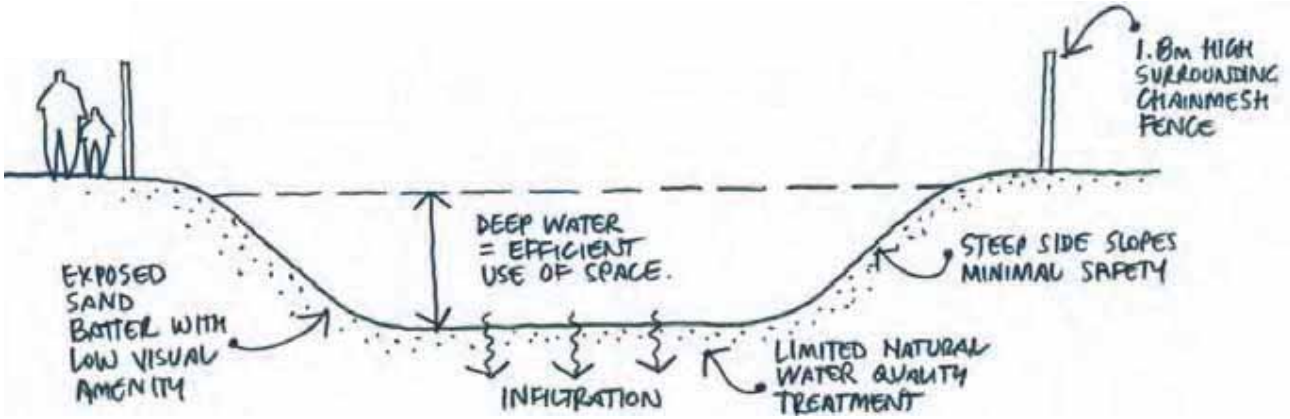

The Sanctuary, Emerge Associates



EXAMPLE SECTION H



EXAMPLE SECTION I



EXAMPLE SECTION J

which will not generally be complex in layout, detail design or material selection thus minimising maintenance costs.

The proponent has been advised by the City that the City's current typical maintenance rate is approximately $2.00/m2. Preliminary calculations indicates that the likely maintenance cost for the proposed design is approximately $2.50/m2 average.

The additional maintenance required to deliver the proposed design may be met by either:

a. The City agreeing to undertake additional maintenance based on the larger volume of open space in response to the existing residents requests and concerns as identified through the community consultation process and the resulting proposed masterplan.

b. The City agreeing to a special area rate to be applied to the new residential lots in addition to their usual rates in order to meet the additional costs over and above Council typical expenditure. This arrangement would be disclosed to the purchasers of new lots at the time of sale and written into the sale contract annexures. This arrangement requires confirmation that the City's expenditure of these funds occurs within the Glen Iris precinct.

Providence, Emerge Associates

Appendix C

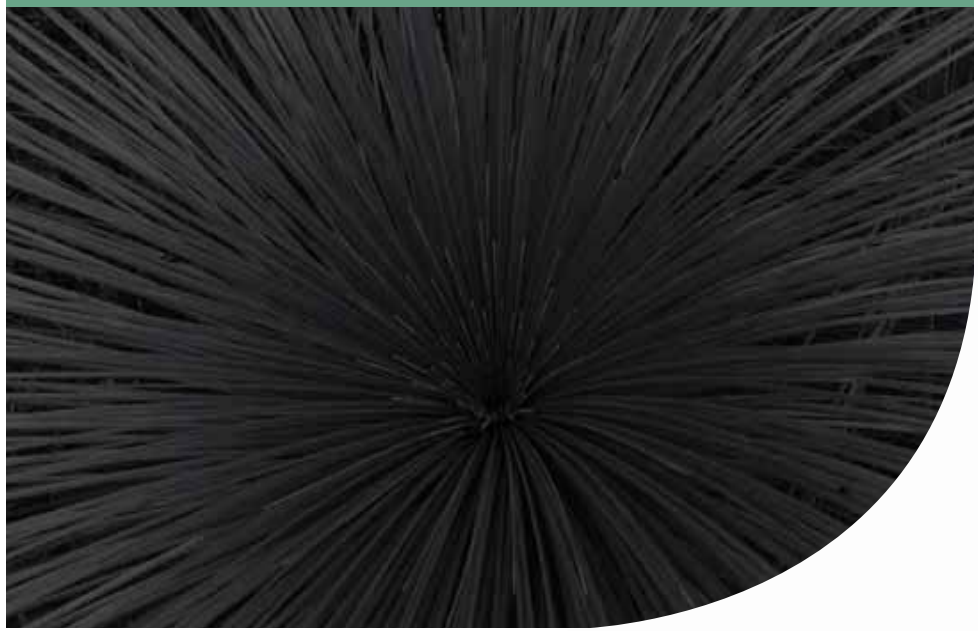
Detailed Flora and Vegetation Assessment

Detailed Flora and Vegetation Assessment

Former Glen Iris Golf Course

Project No: EP20-009(03)

Prepared for ECP Acquisitions 6 Pty Ltd
October 2021



Document Control

Doc name:	Detailed Flora and Vegetation Assessment Former Glen Iris Golf Course				
Doc no.:	EP20-009(03)--002D RAW				
Version	Date	Author		Reviewer	
1	June 2020	Rachel Weber	RAW	Tom Atkinson	TAA
	Report prepared for client review				
A	April 2021	Rachel Weber	RAW	Tom Atkinson	TAA
	Minor updates to reflect change in site boundary				
B	June 2021	Rachel Weber	RAW	Tom Atkinson	TAA
	Minor updates to numeric decimal places				
C	September 2021	Sarah Paul	SKP	Tom Atkinson	TAA
	Updated to include targeted spring surveys for conservation significant species				
D	October 2021	Sarah Paul	SKP	Rachel Weber	RAW
	Updated to include additional targeted spring surveys for conservation significant species				

Executive Summary

Emerge Associates (Emerge) were engaged by ECP Acquisitions 6 Pty Ltd to conduct a 'detailed' and 'targeted' level assessment within the former Glen Iris Golf Course (referred to herein as the 'site') to provide information on the flora and vegetation values.

As part of the assessment a desktop review of relevant background information was completed, and site surveys were undertaken on 11 March 2020, 19 August, 9 September, 7 and 28 October 2021. Outcomes of the flora and vegetation assessment include the following:

- A total of 80 native and 51 non-native (weed) species were recorded in the site.
- Four plant communities were recorded within the site:
  - Plant community EmB extends over 1.9 ha (4% of the site) and comprises remnant native vegetation in 'very good', 'good' and 'degraded' condition. This vegetation occurs as scattered patches and is considered likely to represent floristic community type (FCT) 23a 'Central *Banksia attenuata – B. menziesii* woodlands'.
  - Plant community TdSt extends over 0.2 ha (<1% of the site) and comprises riparian vegetation that is likely planted or a combination of planted and naturally regenerated and was mapped as being in 'good – degraded' condition.
  - Plant community planted trees and shrubs extends over 13.6 ha (25% of the site) and comprises predominantly scattered non-native species in 'completely degraded' condition.
  - Plant community turf and bare ground extends over 35.7 ha (66% of the site) and comprises the previous golf fairway and bare ground in 'completely degraded' condition.
- The remainder of the site comprises artificial lakes, buildings and hardstand which extend over 2.3 ha (4% of the site) and were not assigned to a vegetation condition category.
- No threatened or priority flora species were recorded within the site and none are considered likely to occur.
- No threatened or priority ecological communities occur within the site and none are considered likely to occur.

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Detailed Flora and Vegetation Assessment
Former Glen Iris Golf Course

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Abbreviation Tables

Table A1: Abbreviations – Organisations

Organisations	
EPA	Environmental Protection Authority
DBCA	Department of Biodiversity, Conservation and Attractions
DoW	Department of Water (now DWER)
DWER	Department of Water and Environmental Regulation
WALGA	Western Australia Local Government Association

Table A2: Abbreviations – General terms

General terms	
ESA	Environmentally sensitive area
FCT	Floristic community type
IBRA	Interim Biogeographic Regionalisation of Australia
MUW	Multiple use wetland
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 community
UFI	Unique feature identifier

Table A3: Abbreviations –Legislation

Legislation	
BAM Act	*Biosecurity and Agriculture Management Act 2007*
EP Act	*Environmental Protection Act 1986*
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
BC Act	*Biodiversity Conservation Act 2016*
BC Regs	*Biodiversity Conservation Regulations 2018*

Table A4: Abbreviations – planning

Planning terms	
MRS	Metropolitan region scheme

Table A5: 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

ECP Acquisitions 6 Pty Ltd intends to develop the former privately run Glen Iris Golf Course into a residential estate. The former Glen Iris Golf Course comprises Lots 6 and 7 Glen Iris Drive, Lots 3, 509 and 512 Dean Road and Lot 139 Imlah Court in Jandakot (referred to herein as the 'site').

The site is located approximately 16 kilometres (km) south of the Perth Central Business District within the City of Cockburn and is zoned 'urban' under the *Metropolitan Region Scheme* (MRS) and 'development contribution area 13 special use 1', 'development contribution area 13 special use 6', 'development contribution area 13 residential-R40' under the City of Cockburn *Town Planning Scheme No. 3*.

The site is approximately 53.7 hectares (ha) in size and is surrounded by residential subdivision, with a railway to the north and Kwinana Freeway to the west. The site comprises two areas separated by Berrigan Drive. The location and extent of the site is shown in Figure 1.

1.2 Purpose and scope of work

Emerge Associates (Emerge) were engaged by Acumen Development Solutions, on behalf of ECP Acquisitions 6 Pty Ltd, to provide environmental consultancy services to support the planning process for the site. The purpose of this survey is to provide sufficient information on the flora and vegetation values within the site to inform this process.

The scope of work was specifically to undertake a flora and vegetation assessment to the standard required of a detailed and a targeted survey with reference to the Environmental Protection Authority's (EPA's) *Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA 2016).

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.
- Compilation of a comprehensive list of flora species recorded as part of the field survey.
- Mapping of conservation significant flora and vegetation, plant communities and vegetation condition.
- Identification of potential habitat for conservation significant flora and vegetation and likelihood of occurrence.
- Targeted searches for conservation significant flora within areas of suitable 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 types of vegetation that grow in a region and the life cycles of the flora present. It is therefore 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 719.6 millimetres (mm) of rainfall is recorded annually from the Jandakot Aero weather station, which is the closest weather station, located approximately 2 km east of the site. The majority of this rainfall is received between the months of May and September. Mean maximum temperatures at the Jandakot Aero weather station range from 18.0ºC in July to 31.6ºC in February, while mean minimum temperatures range from 6.9ºC in July to 17.2ºC in February (BoM 2020).

A total of 600.6 mm of rain was recorded between May and August 2021 prior to the surveys which is higher than the combined long-term average of 558.5 mm for the same months (BOM 2021). This high 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 has formed from the deposition of alluvial material washed down from the Darling Scarp, while its western side is comprised of 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 broad scale soil mapping places the site within the Bassendean soil 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.

Finer scale mapping by (Gozzard 2011) also places the site in Bassendean sand (S8) which was later confirmed during the field survey. The Bassendean sands typically very light grey at surface, yellow at depth, fine to medium-grained, sub-rounded quartz, moderately well sorted of eolian origin (Purdie *et al.* 2004).

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

2.3 Topography

The elevation of the site ranges from 25 m in relation to the Australian height datum (mAHD) in the southern portion to 40 mAHD in the northern portion of the site (DoW 2008) (Figure 2).

2.4 Hydrology and 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).

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 that no wetland or water related features are mapped within the site.

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). The Department of Biodiversity, Conservation and Attractions (DBCA) maintains the *Geomorphic Wetlands of the Swan Coastal Plain* dataset (DBCA 2020a), which further categorises geomorphic wetland features into specific management categories to guide land use and conservation. Note that as this dataset was drafted at a regional scale the boundaries of mapped wetland features are often inconsistent with physical wetland boundaries.

A review of the *Geomorphic Wetlands, Swan Coastal Plain* dataset (DBCA 2020a) indicated that no wetland features are mapped within the site. Two 'multiple use' category wetland features (UFIs 6654 and 6655) occur adjacent to the south-western portion of the site.

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The locations of the geomorphic wetlands surrounding the site are shown in Figure 2.

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 the Swan Coastal Plain into two floristic subregions (Environment Australia 2000). 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 flora and vegetation types.

Variations in native vegetation within the site can be further classified based on regional vegetation associations. Heddle *et al.* (1980) mapping shows the majority of the site as comprising the 'Bassendean central and south' complex, which is described as vegetation ranging from woodland of *Eucalyptus marginata - Allocasuarina fraseriana - Banksia* spp. to low woodland of *Melaleuca* spp. and sedgelands on the moister sites. This complex was determined to have 26.87% remaining in 2019, of which 2.15% is under formal protection (Government of Western Australia 2019).

2.6 Historic land use

Review of historical images available from 1953 (WALIA 2020) onwards shows that the northern and southern portions of the site, separated by Berrigan Drive, have been subject to vegetation clearing at different times.

The northern portion of the site supported native vegetation until construction of the central part of the Glen Iris Golf Course commenced, which is first visible in imagery from 1965. The remainder of the northern portion of the site was cleared of native vegetation by 1995 for further golf course construction. Scattered remnant native trees appear to have been retained between the golf course fairway but the majority of the vegetation was cleared during construction of the golf course.

The southern portion of the site supported native vegetation until construction of the golf course commenced, which is first visible in imagery from 1995. The entirety of the southern portion of the site, except two areas near the southern boundary, were completely cleared of native vegetation for the golf course.

The Glen Iris Golf Course was formally closed by the previous owners in March 2020 and has been in caretaker and maintenance ever since.

2.7 Significant flora and vegetation

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.

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 (DoEE 2019b). 'Threatened ecological communities' (TECs) 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*.

A plant 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.

2.7.3 Local and regional significance

Flora species and ecological communities may be significant for a number of reasons irrespective of whether they have special protection under policy or legislation.

Two reasons that vegetation within the site may be significant are listed below:

- The vegetation within the site has potential value as habitat for threatened or priority fauna species including, in particular, Carnaby's black cockatoo and the forest red-tailed black cockatoo, which are listed as 'vulnerable' under the EPBC Act and 'endangered' under the BC Act.

- The vegetation supports flora species Listed in *Bush Forever* 'significant flora' list for the Bassendean dunes (Government of WA 2000).

2.7.4 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. Many non-native flora species and some native species are considered to be weeds.

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. At a National level, the Australian government has compiled a list of 32 *Weeds of National Significance* (WoNS) (DoEE 2019c). Whilst the WoNS list is non-statuatory, many WoNS are also listed under the BAM Act. Further information on categories of declared pests is provided in Appendix A.

Due to historical disturbance weed species are expected to be present at the site.

2.8 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.

No *Bush Forever* sites occur within the site. Multiple *Bush Forever* sites occur to the east and west of the site.

2.9 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).

There are no mapped ecological linkages within the site. One biodiversity ecological linkage (no. 48) is located approximately 800 m to the north of the site and extends to the west and east.

2.10 Previous surveys

No previous flora and vegetation surveys are known to have been undertaken within the site.

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3 Methods

3.1 Desktop assessment

3.1.1 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 2020a) and *NatureMap* (DBCA 2020).

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 2020a) and the *Weed and Native Flora Dataset* (Keighery *et al.* 2012).

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

An ecologist from Emerge visited the site on 11 March 2020, 19 August, 9 September, 7 and 28 October 2021 to conduct the flora and vegetation field surveys.

3.2.1 Flora and vegetation

The site was traversed on foot and the composition and condition of vegetation was recorded.

Detailed sampling of the vegetation was undertaken using non-permanent relevés. Each relevé was completed over an approximately 10 x 10 m area. A total of three relevés were sampled and the position of each sample location was recorded with a hand-held GPS unit, as shown in Figure 3. The data recorded within each relevé 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, degree of disturbance and species present).

Additional plant taxa not observed within samples were recorded opportunistically as the ecologist traversed the site. Photographs were taken throughout the field visit to show particular site conditions.

The suitability of habitat within the site for conservation significant species identified in the desktop assessment was assessed (refer Section 3.1). Areas of suitable habitat were searched for conservation significant species as required.

All plant specimens collected during the field survey were dried, pressed and then named in accordance with requirements of the Western Australian Herbarium. 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.

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 methods from Keighery (1994). 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' (TSSC 2016) was applied in addition to the Keighery scale (as shown in Table 1).

Table 1: Vegetation condition scale applied during the field assessment

Condition category	Definition (Keighery 1994)	Indicator (TSSC 2016)	
		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%
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 data analysis

3.3.1 Likelihood of occurrence of conservation significant flora and vegetation

Information on the habitat preferences of threatened and priority flora species and communities identified from database searches was reviewed. Based on existing conditions such as plant community, vegetation condition, land use and disturbance, 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 2.

Table 2: 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 local 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) (ESCAVI 2003). The identified plant communities were mapped on aerial photography from the sample locations and boundaries were interpreted from aerial photography and notes taken in the field. Vegetation condition was mapped on aerial photography based on the locations and notes recorded during the field survey to define areas with differing condition.

3.3.3 Floristic community type assignment

Where possible, each plant community was assigned a 'floristic community type' (FCT), as defined by Gibson *et al.* (1994). This was determined by comparing the flora species recorded within each sample to those in the regional datasets *A floristic survey of the southern Swan Coastal Plain* Gibson *et al.* (Gibson *et al.* 1994) and *Weed and Native Flora Data for the Swan Coastal Plain* (Keighery *et al.* 2012). No statistical FCT analysis was undertaken due to the high level of disturbance across most of the site and small size of vegetation patches in better quality.

Ultimately the flora species present and contextual information relating to the soils, landforms and known locations of FCTs within the region were used to determine the appropriate FCT for vegetation within the site.

3.3.4 Threatened and priority ecological communities

Areas of native vegetation potentially representing a TEC were assessed against key diagnostic characteristics and, if available, size and/or vegetation condition thresholds provided in the following document:

- *Approved Conservation Advice (incorporating listing advice) for the Banksia Woodlands of the Swan Coastal Plain ecological community (TSSC 2016).*

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 3.

Table 3: 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.
		No previous relevant surveys are known to have been undertaken within the site.
	No limitation	Regarding assignment of FCTs, the authoritative Gibson *et al.* (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. In lieu of an alternative and as recommended by DBCA, the Gibson *et al.* (1994) dataset was used to assign an FCT where possible. Comparison of species in the patches of vegetation in better condition with the Gibson *et al.* (1994) dataset, in combination with soils, landforms and known locations of FCTs within the region, was sufficient to assign an FCT.
Experience level of personnel	No limitation	This flora and vegetation assessment was undertaken by qualified botanists with 6-11 years of botanical experience in Western Australia. Technical review was undertaken by a senior environmental consultant with 18 years' experience in environmental science in Western Australia.
Suitability of timing	No limitation	The survey was conducted in March 2020 and August, September and October 2021 and thus within the main flowering season. High rainfall was recorded from May to August 2021 in the months preceding the site visits. Therefore, it is likely that most plant species would have been in flower and/or visible at the time of survey. The degraded nature of most 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. Nevertheless, some orchid species were recorded and able to be identified to species level. No unidentified specimens were collected. The survey timing was considered adequate to allow the detection of all species for which seasonal timing is critical.
Temporal coverage	No limitation	Comprehensive flora and vegetation assessments can require multiple visits, at different times of year, and over a period of multiple, to enable observation of all species present. The portions of the site containing native vegetation were visited five times over two years and three seasons.

Table 3: Evaluation of survey methodology against standard constraints outlined in EPA (2016) (continued)

Constraint	Degree of limitation	Details
Spatial coverage and access	No limitation	Site coverage was comprehensive (track logged).
	No limitation	All parts of the site could be accessed as required.
Sampling intensity	No limitation	A total of 131 species were recorded, comprising 80 native and 51 non-native species. These species were recorded from three sample locations and opportunistic observations across the site. Considering the high level of disturbance within the majority of the site and the small size of the areas of remnant native vegetation, the number of native species recorded was considered sufficient to classify the vegetation for the purposes of this assessment.
Influence of disturbance	Minor limitation	Time since fire is greater than 60 years as interpreted form aerial imagery and therefore species reliant on fire to emerge may not have been visible. However, this was not considered a limitation in regards to determining the presence of threatened or priority flora species.
	No limitation	Historical ground disturbance was evident in the majority 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.

4 Results

4.1 General site conditions

The site is gently undulating and comprises sandy white-grey soils. The site was recently used as a golf course and the fairways and lakes were irrigated at the time of the survey.

The site has been highly modified for its use as a golf course and is dominated by non-native vegetation and unvegetated areas. Small areas of remnant native vegetation occur as scattered patches of varying quality.

4.2 Flora

4.2.1 Desktop assessment

The database search results identified a total of 16 threatened and 34 priority flora species occurring or potentially occurring within a 10 km radius of the site. Information on these species including their habitat preferences is provided in Appendix B.

Based on background information available for the site, two threatened flora species and five priority flora species were identified as having potential to occur within the site as shown in Table 4.

Table 4: 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			
Caladenia huegelii	CR	E	PG	Well-drained, deep sandy soils in lush undergrowth in a variety of moisture levels.	Sep-early Nov
Macarthuria keigheryi	E	E	P	Low-lying winter-wet damp grey/white sands in open patches.	Sep-Dec, Feb-Mar
Stenanthemum sublineare	P2	-	P	White sand on coastal plains.	Oct-Dec
Thelymitra variegata	P2	-	PG	Sandy clay, sand, laterite.	Jun-Sep
Phlebocarya pilosissima subsp. *pilosissima*	P3	-	P	White or grey sand, lateritic gravel.	Aug-Oct
Styphelia filifolia	P3	-	P	Brown over pale yellow sand.	Feb-Apr
Jacksonia sericea	P4	-	P	Calcareous and sandy soils on Swan Coastal Plain	Dec-Feb

4.2.2 Species inventory

A total of 80 native and 51 non-native (weed) species were recorded within the site during the field survey, representing 45 families and 103 genera. The dominant families containing native taxa were

Myrtaceae (15 native taxa and 13 weed taxa) and Fabaceae (12 native taxa and four weed taxa). A complete species list is provided in Appendix C.

4.2.3 Threatened and priority flora

No occurrences of threatened or priority flora species were recorded within the site.

The EmB vegetation described in Section 4.3.2 comprises suitable habitat for the threatened and priority flora species identified in Table 4. Targeted searches were undertaken for these species during the optimal survey period and they were not recorded. Therefore, no threatened or priority flora species are considered likely to occur in the site.

The likelihood of occurrence assessment is provided in Appendix B.

4.2.4 Locally and regionally significant flora

No locally or regionally significant flora species were recorded within the site.

4.2.5 Declared pests

No species listed as declared pests pursuant to the BAM Act or weeds of national significance (WoNS) were recorded in the site.

4.3 Vegetation

4.3.1 Desktop assessment

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

Based geomorphology, soils and regional vegetation patterns, the following one TEC and three PECs were considered to have potential to occur in the site:

- 'Banksia woodlands of the Swan Coastal Plain' TEC which is listed as 'endangered' under EPBC Act.
- 'Banksia woodlands of the Swan Coastal Plain' PEC (P3)
- '*Banksia ilicifolia* woodlands, southern Swan Coastal Plain' PEC (P3)
- 'Northern Spearwood shrublands and woodlands' PEC (P3).

4.3.2 Plant communities

Four plant communities were identified within the site. Plant community EmB exists as scattered patches in the northern, central and south-western portions of the site. Plant community TdSt exists as multiple small patches on the edges of artificial lakes and is considered to be likely planted or a combination of planted and naturally generated vegetation. Plant communities planted trees and shrubs and turf and bare ground exist across the site and were likely previously installed for the sites' historic use as a golf course.

The remainder of the site supports multiple artificial lakes, buildings and hardstand (2.3 ha).

A description and the area of each plant community is provided in Table 5, representative photographs of each are provided in Plate 1 to Plate 4 and raw sample data is provided in Appendix E. The location of each plant community is shown in Figure 3.

Table 5: Description and extent of plant communities identified within the site

Plant community	Description	Area (ha)
EmB	Woodland to open woodland *Eucalyptus marginata* subsp. *marginata*, *Banksia attenuata* and *Banksia menziesii* over mixed shrubland *Xanthorrhoea preissii*, *Allocasuarina humilis* and *Hibbertia hypericoides* over open sedgeland *Mesomelaena pseudostygia* over non-native grassland **Ehrharta calycina* (Plate 1).	1.9
TdSt	Closed sedgeland *Typha domingensis*, *Schoenoplectus tabernaemontani*, **Cortaderia selloana* and *Baumea* sp. (Plate 2).	0.2
Planted trees and shrubs	Predominantly scattered non-native planted trees and shrubs such as **Corymbia* spp., **Eucalyptus* spp., *Melaleuca* spp. and *Grevillea* spp. with occasional native plants (Plate 3).	13.6
Turf and bare ground	Closed non-native grassland (turf) and bare ground (Plate 4).	35.7

Plate 1: Plant community EmB in 'very good' condition

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Plate 2: Plant community TdSt in 'good – degraded' condition

Plate 3: Planted trees and shrubs in 'completely degraded' condition

Plate 4: Turf and bare ground in 'completely degraded' condition

4.3.3 Vegetation condition

Plant community EmB comprises the most intact native vegetation within the site. Some of the EmB vegetation was mapped as being in 'very good' condition as they supported the general structure expected of a banksia woodland community and had moderate native species diversity. The remainder of the EmB vegetation was mapped as being in 'good' and 'degraded' condition where it was more disturbed with an altered structure, lower native species diversity and higher weed cover.

Plant community TdSt was mapped as being in 'good – degraded' condition as it comprises a combination of native and non-native species that only exist in the site due to the presence of the artificial lakes created for the previous golf course.

The planted trees and shrubs and the turf and bare ground communities were mapped as being in 'completely degraded' condition as they are dominated by non-native species or comprise unvegetated areas. The remainder of the site, which comprises artificial lakes, buildings and hardstand, were not assigned a condition category (2.3 ha).

The extent of vegetation by condition category is detailed in Table 6 and shown in Figure 4.

Table 6: Extent of vegetation condition categories within the site

Condition category (Keighery 1994)	Size (ha)
Pristine	0
Excellent	0
Very good	0.43
Good	0.69
Good – degraded	0.22
Degraded	0.80
Completely degraded	49.25

4.3.4 Floristic community types

Plant community EmB was determined to likely represent FCT 23a 'Central *Banksia attenuata – B. menziesii* woodlands'. This FCT is listed as 'well reserved' and 'low risk' by Gibson *et al.* (1994).

The other plant communities in the site were considered too degraded to assign to an FCT.

4.3.5 Threatened and priority ecological communities

The structure and composition of plant community EmB indicates that it has the potential to represent the Commonwealth listed TEC 'banksia woodlands of the Swan Coastal Plain' and the State listed PEC of the same name (P3).

The above TEC, herein referred to as the 'banksia woodland TEC', is listed as 'endangered' under the EPBC Act. Whether a patch of vegetation is considered to represent the banksia woodland TEC depends on a number of diagnostic criteria including geographic location, soils, landform, structure, composition, condition and patch size (DoEE 2016).

As outlined in Table 7, the EmB vegetation does not satisfy the criteria to be considered a patch of the 'banksia woodland TEC' due to the small size of the patches.

Table 7: Criteria for determining presence of Banksia Woodlands of the Swan Coastal Plain TEC adapted from (TSSC 2016)

Criteria	Requirements for meeting criteria	Site implications
1. Must meet key diagnostic characteristics	A variety of factors relating to: • Location • Soils • Structure • Composition	• Site meets location and soils criteria. • The EmB vegetation includes the key diagnostic feature of a tree layer of *Banksia attenuata*, *Banksia menziesii* and *Banksia ilicifolia*. • The EmB vegetation within site also meets structure and composition criterion. It is likely to represent FCT 23a which is identified as one of the FCTs comprising the banksia woodland TEC.
2. Must meet condition thresholds	• A patch should at least meet the 'good' condition category (see Table 1)	• The EmB vegetation is present in 'very good', 'good' and 'degraded' condition, which meets this criterion. The conservation advice indicates that a single patch may include areas of variable condition, meaning the 'degraded' condition may still be considered the TEC. • The patches of EmB vegetation that are adjacent to each other would be considered part of the same patch. Therefore, six 'patches' of EmB vegetation exist within the site.
3. Must meet minimum patch size	Minimum size of patch: • Pristine=no minimum size • Excellent=0.5 ha • Very Good=1 ha • Good=2 ha	• The six patches of EmB vegetation are each less than 1 ha in size and do not meet this criterion.
4. Must incorporate surrounding context	• 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)	• The patches of EmB vegetation are isolated from other banksia woodland and no relevant surrounding context considerations apply.
Result	The site does not support any vegetation that represents the banksia woodland 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 2020b). Since the EmB vegetation does not represent the banksia woodland TEC it also does not represent the PEC.

No other TECs or PECs occur within the site.

4.3.6 Locally and regionally significant vegetation

Plant communities EmB and planted trees and shrubs contain multiple foraging species for threatened species of black cockatoo. In addition, a small number of mature *Corymbia calophylla*, *Eucalyptus marginata* and **Eucalyptus* sp. trees with a diameter at breast height larger than 500 mm are also present within plant communities EmB and planted trees and shrubs. Due to their size these

trees have the potential to provide some value as foraging, roosting and breeding habitat values for black cockatoos, along with other ecological services.

5 Discussion

The site has been highly modified and approximately 92% supports vegetation in 'completely degraded' condition. Native vegetation exists as scattered patches that extend over approximately 4% of the site. The remaining 4% of the site comprises artificial lakes, buildings and hardstand. The highest quality vegetation exists within plant community EmB.

5.1 Threatened and priority flora

Based on the desktop assessment, it was considered that two threatened and five priority flora species had potential to occur within the site. If these species were to occur it was most likely that they would have been found within the EmB vegetation, which, while disturbed, is the most intact remnant vegetation in the site.

Intensive targeted searches were undertaken in August, September and October 2021 across the EmB vegetation and none of the identified threatened or priority flora species were recorded. The absence of the larger perennial species such as *Jacksonia gracillima*, *Verticordia lindleyi* subsp. *lindleyi* and *Andersonia gracilis* was relatively easy to confirm. However, due to their size and seasonal lifeform, smaller annual or geophytic species such as *Drakaea elastica*, *Thelymitra variegata* and *Caladenia huegelii* can be more difficult to detect. Intensive targeted searches were carried out in August, September and October 2021 to search for *Drakaea elastica*, *Thelymitra variegata* and *Caladenia huegelii*. The searches were conducted during the main growing and flowering period for these species and so they would have been visible, if present. Since these species were not recorded the surveys are considered sufficient to conclude that they do not occur in the site.

5.2 Vegetation condition

A vegetation condition score has the greatest implications when the condition of vegetation is close the boundary between 'good' and 'degraded'. This is because good condition is typically accepted as the threshold for conservation significance, while 'degraded' condition implies a low conservation requirement. Separating these two condition categories is further complicated by the fact that good condition is more correctly understood to mean 'average' condition. Applying the Keighery (1994) condition scale good condition vegetation can be expected to be significantly altered, with very obvious disturbance and the presence of aggressive weeds at high density. Therefore, good does not literally mean "good" as the label implies.

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 (2016).

Compound condition categories were applied where the patch of vegetation supported a mosaic of small areas in differing condition and at fine-scale unsuitable for mapping.

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5.3 Floristic community type assignment

Although no statistical FCT analysis was undertaken, the flora species within the EmB vegetation are similar to those recorded within Gibson *et al.* (1994) sites that represent FCT 23a. A total of 15 Gibson *et al.* (1994) and Keighery *et al.* (2012) samples that represent FCT 23a occur within approximately four kilometres of the site and the soils and landform within the site also align with that described for FCT 23a.

5.4 Threatened and priority ecological communities

Arriving at the conclusion that the EmB vegetation does not represent the banksia woodland TEC/PEC was straightforward as the small patches of this vegetation do not meet defined size thresholds.

5.5 Wetlands

The two mapped multiple use wetlands located adjacent to the south-western portion of the site comprise residential lots and extend over portions of the Kwinana Freeway (UFI 6655) and Berrigan Drive (UFI 6654) (Figure 2). Neither of these mapped wetlands contain any native wetland vegetation in proximity to the site.

5.6 Local and regional significance

Suitable habitat for threatened species of black cockatoo were opportunistically recorded within the site. A separate fauna assessment has been undertaken to determine the fauna habitat within the site and whether other fauna species of conservation significance are likely to occur (Emerge Associates 2021).

6 Conclusions

Over 95% of the site has been highly disturbed and modified from its remnant state, with approximately 2.3 ha supporting artificial lakes, buildings and hardstand and 49.2 ha supporting non-native vegetation (planted trees and shrubs and turf and bare ground) in 'completely degraded' condition. The remainder of the site supports remnant native vegetation (1.9 ha) and riparian vegetation that is likely planted or a combination of planted and naturally regenerated (0.2 ha).

No threatened or priority flora species were recorded within the site and none are considered likely to occur.

No TECs or PECs occur within the site and none are considered likely to occur.

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Figures

Figure 1: Site Location

Project: Detailed Flora and Vegetation Assessment
Former Glen Iris Golf Course
Client: ECP Acquisitions 6 Pty Ltd

Plan Number: EP20-009(03)--F02
Drawn: RAW
Date: 18/05/2020
Checked: RAW
Approved: TAA
Date: 16/06/2020

0 100 200
Metres
Scale: 1:10,000@A4
GDA 1994 MGA Zone 50

emerge ASSOCIATES

While Emerge Associates makes every attempt to ensure the accuracy and completeness of data, Emerge accepts no responsibility for externally sourced data used

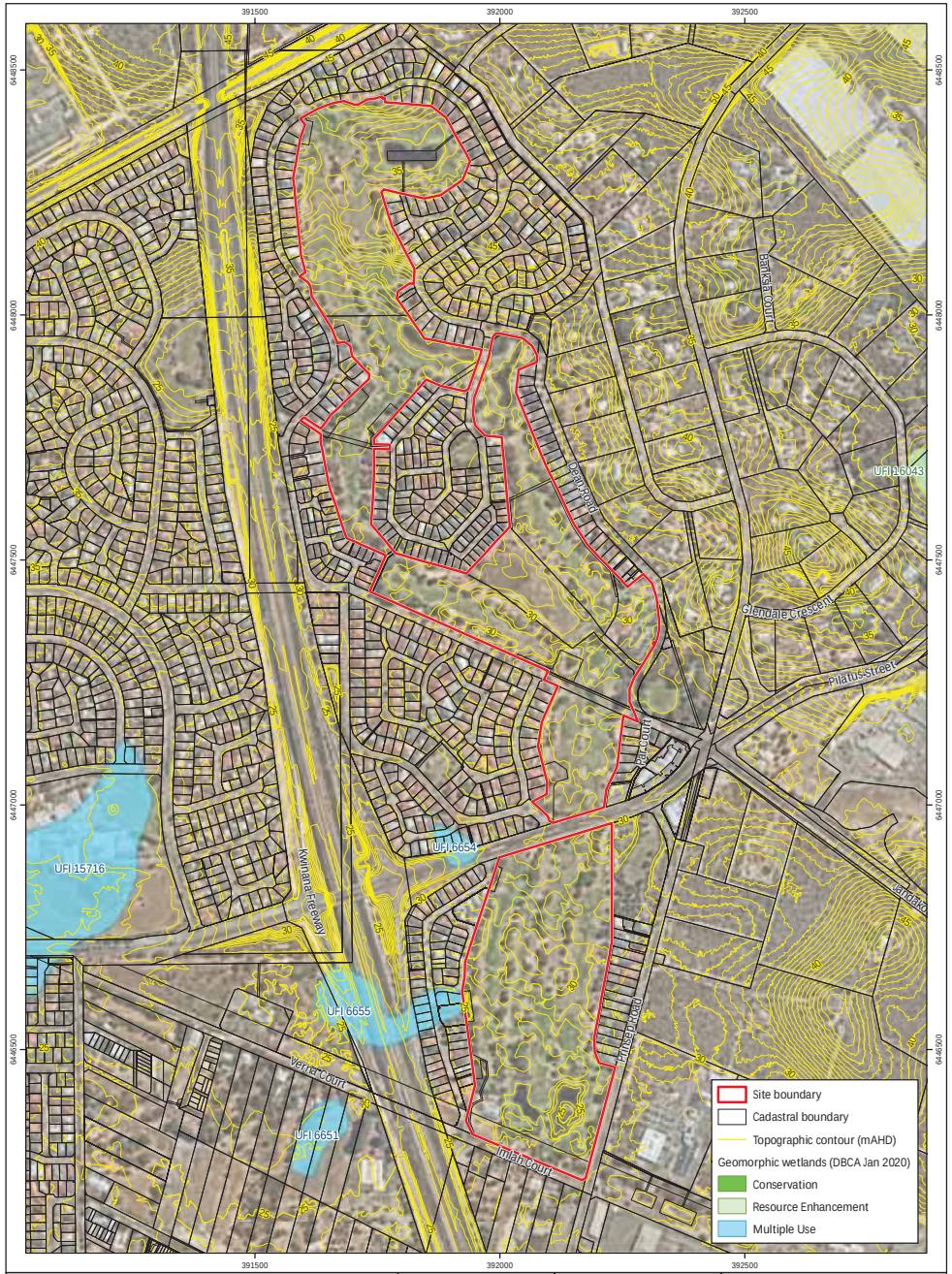

Figure 2: Environmental Features

Project: Detailed Flora and Vegetation Assessment
Former Glen Iris Golf Course
Client: ECP Acquisitions 6 Pty Ltd

Plan Number: EP20-009(03)--F03
Drawn: RAW
Date: 18/05/2020
Checked: RAW
Approved: TAA
Date: 16/06/2020

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Metres
Scale: 1:10,000@A4
GDA 1994 MGA Zone 50

emerge ASSOCIATES

While Emerge Associates makes every attempt to ensure the accuracy and completeness of data, Emerge accepts no responsibility for externally sourced data used

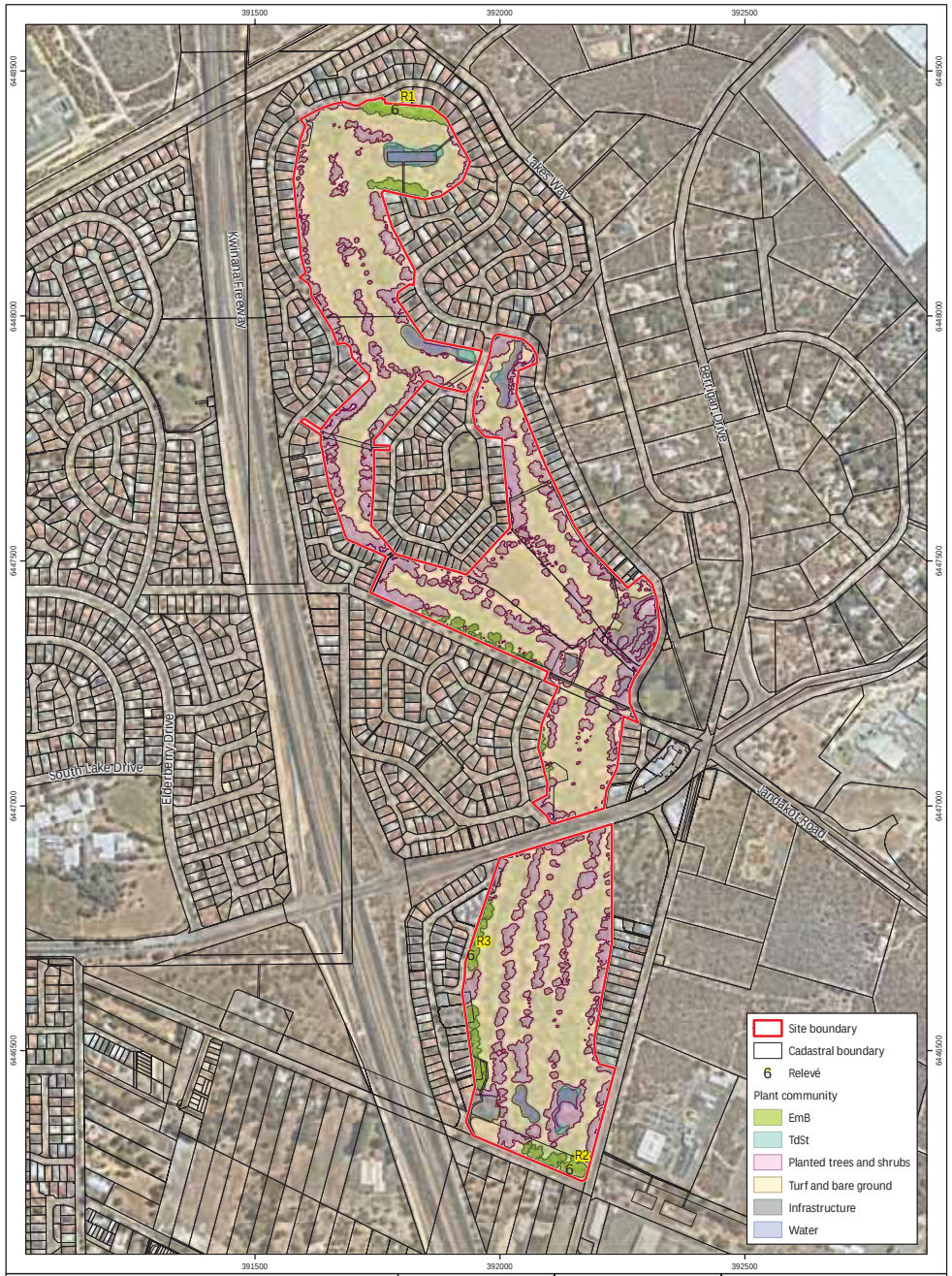

Figure 3: Plant Communities

Project: Detailed Flora and Vegetation Assessment
Former Glen Iris Golf Course
Client: ECP Acquisitions 6 Pty Ltd

Plan Number: EP20-009(03)--F04a
Drawn: GAR
Date: 14/09/2021
Checked: SKP
Approved: TAA
Date: 15/09/2021

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Metres
Scale: 1:10,000@A4
GDA 1994 MGA Zone 50

emerge ASSOCIATES

While Emerge Associates makes every attempt to ensure the accuracy and completeness of data, Emerge accepts no responsibility for externally sourced data used

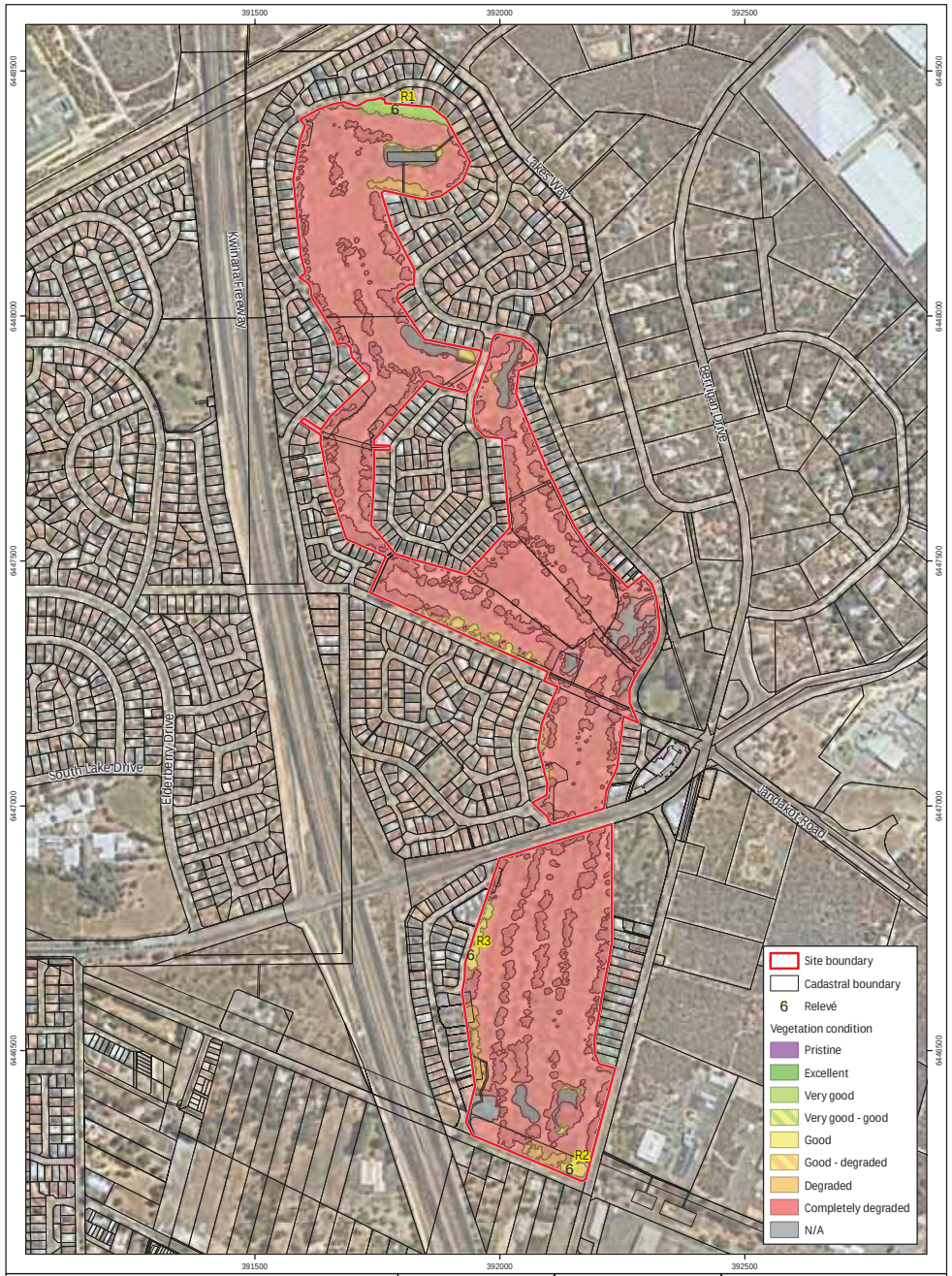

Figure 4: Vegetation Condition

Project: Detailed Flora and Vegetation Assessment
Former Glen Iris Golf Course
Client: ECP Acquisitions 6 Pty Ltd

Plan Number: EP20-009(03)--F05a
Drawn: GAR
Date: 14/09/2021
Checked: SKP
Approved: TAA
Date: 15/09/2021

0 100 200
Metres
Scale: 1:10,000@A4
GDA 1994 MGA Zone 50

emerge ASSOCIATES

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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.

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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.

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).

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

Priority code	Description
P1	Priority One: Poorly known ecological communities 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.
P2	Priority Two: Poorly known ecological communities 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.
P3	Priority Three: Poorly known ecological communities (i) Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation or: (ii) communities known from a few widespread occurrences, which are either large or with significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat (within approximately 10 years), or; (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. 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.
P4	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. (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. (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. (iii) Ecological communities that have been removed from the list of threatened communities during the past five years.
P5	Priority Five: Conservation Dependent ecological communities Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.

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 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 (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

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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 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 7.

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 8.

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

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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.

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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				
Synaphea 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
Synaphea 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
Andersonia gracilis	V	E	P	Seasonally damp, black sandy clay flats near or on the margins of swamps.	Sep-Nov	Unlikely
Caladenia huegelii	CR	E	PG	Well-drained, deep sandy soils in lush undergrowth in a variety of moisture levels.	Sep-early Nov	Unlikely
Diuris purdiei	E	E	PG	Sand to sandy clay soils in areas subject to winter inundation.	late Sep-mid-Oct, only after a summer or early autumn fire	Unlikely
Drakaea elastica	CR	E	PG	Bare patches of sand within otherwise dense vegetation in low-lying areas alongside winter-wet swamps.	Late Sep-Oct/Nove (survey Jul-Aug)	Unlikely
Eucalyptus x balanites	CR	E	P	Light coloured sandy soils over laterite. Habitat consists of gently sloping heathlands; open mallee woodland over shrubland (Population 2) or heathland with emergent mallees (population 1)	Oct - Feb	Unlikely
Grevillea curviloba subsp. incurva	EN	E	P	Sand, sandy loam. Winter-wet heath.	Aug-Sep	Unlikely
Lepidosperma rostratum	EN	E	P	Peaty sand and clay amongst low heath, in winter-wet swamps.	May-Jun (survey late Jun-Aug)	Unlikely
Macarthuria keigheryi	E	E	P	Low-lying winter-wet damp gey/white sands in open patches.	Sep-Dec, Feb-Mar	Unlikely
Thelymitra dedmaniarum	CR	E	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				
Thelymitra stellata	E	E	PG	Sandy loam, clay or gravel over laterite or gravel.	Sep-Nov	Unlikely
Diuris drummondii	V	V	PG	In low-lying depressions in peaty and sandy clay swamps.	Nov-Jan	Unlikely
Diuris micrantha	V	V	PG	Dark grey-black sandly clay-loam in winter wet depressions or swamps. Often in shallow standing water.	Aug/Sep-early Oct	Unlikely
Drakaea micrantha	E	V	PG	Open sandy patches often adjacent to winter-wet swamps.	Sept- early Oct	Unlikely
Eleocharis keigheryi	V	V	P	Clay or sandy loam in freshwater creeks and transient waterbodies such as seasonally wet clay pans.	Aug-Dec	Unlikely
Austrostipa jacobsiana	CR	-	P	Grey sandy clay.	Nov-Jan	Unlikely
Eremophila glabra subsp. chlorella	EN	-	P	Sandy clay. Winter-wet depressions.	Jul-Nov	Unlikely
Acacia lasiocarpa var. bracteolata long peduncle variant (G.J. Keighery 5026)	P1	-	P	Grey or black sand over clay in winter wet areas.	May-Aug	Unlikely
Hydrocotyle striata	P1	-	A	Sand and clay in springs and creeklines.	Nov	Unlikely
Acacia benthamii	P2	-	P	Sand, typically on limestone breakaways	Aug - Sept	Unlikely
Poranthera moorokatta	P2	-	A	Sandy or clay soils. Dampland or low sandy dunes.	Oct or Feb	Unlikely
Stenanthemum sublineare	P2	-	P	White sand on coastal plains.	Oct-Dec	Unlikely
Thelymitra variegata	P2	-	P	Sandy clay, sand, laterite.	Jun-Sep	Unlikely
Thysanotus sp. Badgingarra (E.A. Griffin 2511)	P2	-	P	Grey sand with lateritic gravel.	Dec	Unlikely
Angianthus micropodioides	P3	-	A	Saline sandy soils on edge of rivers, depressions and clay pans.	Nov-Dec or Jan-Feb	Unlikely
Byblis gigantea	P3	-	P	Sandy-peat swamps. Seasonally wet areas.	Sep-Jan	Unlikely
Cyathochaeta teretifolia	P3	-	P	Grey sand, sandy clay in swamps and creek edges.	Oct-Jan	Unlikely
Dampiera triloba	P3	-	P	Damp peat/loam soil.	Aug-Dec	Unlikely
Dillwynia dillwynioides	P3	-	P	Winter wet depressions on sandy soils	Aug - Dec	Unlikely

Species name	Level of significance		Life strategy	Habitat	Flowering period	Likelihood of occurrence
	WA	EPBC Act				
Jacksonia gracillima	P3	-	P	Sand, often adjacent to winter wet areas	Sep-Dec	Unlikely
Phlebocarya pilosissima subsp. pilosissima	P3	-	P	White or grey sand, lateritic gravel.	Aug-Oct	Unlikely
Pimelea calcicola	P3	-	P	sand, limestone, coastal ridges	Sep-Nov	Unlikely
Schoenus benthamii	P3	-	P	White, grey ands, sandy clay in winter wet flats and swamps	Oct-Nov	Unlikely
Schoenus capillifolius	P3	-	A	Brown mud in claypans	Oct-Nov	Unlikely
Schoenus pennisetis	P3	-	A	Grey or peaty sand in swamps and winter-wet depressions.	Aug-Sep	Unlikely
Stylidium aceratum	P3	-	A	Sandy soils in swamp heathland.	Oct-Nov	Unlikely
Stylidium paludicola	P3	-	P	Peaty sand over clay. Winter wet habitats. Marri and Melaleuca woodland, Melaleuca shrubland	Oct-Dec	Unlikely
Styphelia filifolia	P3	-	P	Brown over pale yellow sand.	Feb-Apr	Unlikely
Aponogeton hexatepalus	P4	-	P	Mud. Freshwater: ponds, rivers, claypans.	Jul-Oct	Unlikely
Dodonaea	P4	-	P	Sand, outcropping limestone.	Jul-Oct	Unlikely
Drosera occidentalis	P4	-	P	Flat, brown/white/yellow moist	Oct-	Unlikely
Hydrocotyle	P4	-	A	Floating in swamps.	Aug-Oct	Unlikely
Jacksonia sericea	P4	-	P	Calcareous and sandy soils on Swan Coastal Plain	Dec-Feb	Unlikely
Kennedia beckxiana	P4	-	P	Sand or loam on granite hills and	Sep-Dec	Unlikely
Microtis quadrata	P4	-	PG	Sand, loam or peat in winter wet areas	Oct-Dec	Unlikely
Ornduffia submersa	P4	-	A	Sandy clay in inundated	Aug-Nov	Unlikely
Stylidium longitubum	P4	-	A	Seasonal wetlands.	Oct-Dec	Unlikely
Tripterococcus sp.	P4	-	P	Winter-wet areas on grey sand.	Oct-Feb	Unlikely
Verticordia lindleyi subsp. lindleyi	P4	-	P	Sand and sandy clay in winter wet areas.	May or Nov-Jan	Unlikely

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 considered to potentially occur within the site are shaded green

Appendix C

Flora Species List

Family	Status	Species
Aizoaceae		
	*	*Carpobrotus edulis*
Anacardiaceae		
	*	*Schinus terebinthifolia*
Anarthriaceae		
		Lyginia imberbis
Apocynaceae		
		?Alyxia buxifolia
	*	*Nerium oleander*
Arecaceae		
	*	*Washingtonia filifera*
Asparagaceae		
		Lomandra caespitosa
		Lomandra hermaphrodita
		Sowerbaea laxiflora
Asteraceae		
	*	*Conyza bonariensis*
	*	*Hypochaeris ?glabra*
	*	*Lactuca seriata*
	*	*Sonchus oleraceus*
	*	*Ursinia anthemoides*
Casuarinaceae		
		Allocasuarina fraseriana
		Allocasuarina humilis
Chenopodiaceae		
		Rhagodia baccata subsp. baccata
Colchicaceae		
		Burchardia congesta
Convolvulaceae		
	*	*Ipomoea cairica*
Cupressaceae		
		Callitris preissii
Cyperaceae		
		Baumea sp.
	*	*Cyperus congestus*
		Lepidosperma sp.
		Mesomelaena pseudostygia
		?Schoenus sp.
		Schoenoplectus tabernaemontani
Dasypogonaceae		
		Dasypogon bromeliifolius
Dilleniaceae		
		Hibbertia huegelii
		Hibbertia hypericoides
Droseraceae		
		Drosera erythrorhiza
		Drosera menziesii

Family	Status	Species
Ericaceae		
		Conostephium pendulum
		Leucopogon sp.
		Styphelia propinqua
Fabaceae		
	*	*Acacia baileyana*
	*	*Acacia longifolia*
		Acacia pulchella
		Acacia rostellifera
		Acacia saligna
		Acacia stenoptera
		Bossiaea eriocarpa
		Daviesia nudiflora
		Daviesia triflora
		Gastrolobium capitatum
		Gompholobium tomentosum
		Hardenbergia comptoniana
		Jacksonia furcellata
		Jacksonia sternbergiana
	*	*Robinia sp.*
	*	*Trifolium sp.*
Geraniaceae		
	*	*Pelargonium capitatum*
Goodeniaceae		
		Dampiera linearis
		Lechenaultia biloba
		Scaevola canescens
		Scaevola repens
Haemodoraceae		
		Conostylis aculeata
		Conostylis setigera
		Phlebocarya ciliata
Hemerocallidaceae		
		Arnocrinum preissii
		Corynotheca micrantha var. micrantha
		Tricoryne elatior
Iridaceae		
	*	*Gladiolus caryophyllaceus*
	*	*Patersonia occidentalis*
Juncaceae		
		Juncus pallidus
Lamiaceae		
	*	*Salvia rosmarinus*
Loranthaceae		
		Nuytsia floribunda
Malvaceae		
	*	*Lagunaria patersonia*
Meliaceae		

Family	Status	Species
	*	*Melia azedarach*
Myrtaceae		
		Agonis flexuosa
		?Calytrix sp
		Corymbia calophylla
	*Pl	*Corymbia citriodora*
	*Pl	*Corymbia ficifolia*
	*Pl	*Corymbia maculata*
		Eremaea pauciflora
	*Pl	*Eucalyptus caesia*
	*Pl	*Eucalyptus camaldulensis*
		Eucalyptus gomphocephala var. gomphocephala
	*Pl	*Eucalyptus grandis*
		Eucalyptus marginata subsp. marginata
	*Pl	*Eucalyptus sideroxylon*
	*Pl	*Eucalyptus sp. 1*
	*Pl	*Eucalyptus sp. 2*
		Eucalyptus todtiana
	*Pl	*Eucalyptus utilis*
		Hypocalymma angustifolium
		Hypocalymma robustum
		Kunzea glabrescens
	*	*Leptospermum laevigatum*
	*Pl	*Lophostemon confertus*
	*Pl	*Melaleuca sp.*
		?Melaleuca systena
		Melaleuca thymoides
		Regelia ciliata
		Regelia inops
		Scholtzia involucrata
Nyctaginaceae		
	*	*Bougainvillea sp.*
Oleaceae		
	*Pl	*Olea europaea subsp. europaea*
Orchidaceae		
		Caladenia latifolia
		Microtis media
Pinaceae		
	*Pl	*Pinus sp.*
Poaceae		
	*	*Avena barbata*
	*	*Briza maxima*
	*	*Bromus diandrus*
	*	*Cenchrus clandestinus*
	*	*Cortaderia selloana*
	*	*Cynodon dactylon*
	*	*Ehrharta calycina*
	*	*Eragrostis curvula*

Family	Status	Species
	*	*Lagurus ovatus*
	*	*Paspalum dilatatum*
	*	*Sporobolus africanus*
Portulacaceae		
		Portulaca oleracea
Proteaceae		
		Adenanthos cygnorum
		Banksia attenuata
		Banksia ilicifolia
		Banksia menziesii
	*Pl	*Grevillea sp.*
		Persoonia saccata
		Petrophile linearis
	*Pl	*Protea sp.*
		Stirlingia latifolia
Restionaceae		
		Desmocladus flexuosus
		Hypolaena exsulca
Santalaceae		
		Exocarpos sparteus
Simaroubaceae		
	*	*Ailanthus altissima*
Thymelaeaceae		
		Pimelea suaveolens
Typhaceae		
		Typha domingensis
Violaceae		
		Hybanthus calycinus
Xanthorrhoeaceae		
		Xanthorrhoea preissii
Zamiaceae		
		Macrozamia fraseri

Note: * denotes non-native species, Pl denotes planted

Appendix D

Conservation Significant Communities and Likelihood of Occurrence Assessment

Conservation significant communities known or likely to occur within 10 km of the site
Former Glen Iris Golf Course

Code	Community name	TEC/PEC	Level of significance	
			State	EPBC Act
	Clay pans of the Swan Coastal Plain	TEC	VU/EN	CR
	Tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain	TEC	-	CR
SCP22	*Banksia ilicifolia* woodlands, southern Swan Coastal Plain	TEC/PEC	P3	EN (Banksia woodlands of the Swan Coastal Plain)
SCP24	Northern Spearwood shrublands and woodlands	TEC/PEC	P3	
	Banksia woodlands of the Swan Coastal Plain	TEC/PEC	P3	EN
	Subtropical and temperate coastal saltmarsh	TEC	-	VU

Note: TEC=threatened ecological community, PEC=priority ecological community, CR=critically endangered, EN=endangered, VU=vulnerable, P3=priority 3

Appendix E

Sample Data

Sample Name: R1

Project no.: EP20-009
Date: 11/03/2020, 19/08/21, 9/9/21 Status Non-permanent
Author: TAA,SKP R1: Page 2 of 3

Quadrat and landform details

Sample type:	releve	Size:	other
NW corner easting:	391786	NW corner northing:	6448422
Altitude (m):	N/A	Geographic datum/zone:	GDA94/Zone 50
Soil water content:	dry	Landform:	flat
Time since fire:	> 5 yrs	Disturbance:	moderate - weeds
Soil type/texture	sand/	Bare ground (%):	10
Rocks (%) and type:	No rocks	Soil colour:	brown/white
Litter:	30% (leaves,branches,)	Vegetation condition:	very good

Vegetation Sample Data
Former Glen Iris Golf Course

Sample Name: R1

Project no.: EP20-009
Date: 11/03/2020, 19/08/21, 9/9/21 Status Non-permanent
Author: TAA,SKP R1: Page 2 of 3

Species Data
* denotes non-native species

Status	Confirmed name
	Acacia pulchella
	Acacia stenoptera
	Allocasuarina humilis
	Banksia attenuata
	Banksia menziesii
*	*Carpobrotus edulis*
	Conostephium pendulum
	Conostylis ?aculeata
	Dampiera linearis
	Daviesia nudiflora
	Desmocladus flexuosus
*	*Ehrharta calycina*
*	*Eragrostis curvula*
	Eucalyptus marginata subsp. marginata
	Gastrolobium capitatum
	Gompholobium tomentosum
*Pl	*Grevillea sp.*
	Hardenbergia comptoniana
	Hibbertia hypericoides
	Jacksonia furcellata
	Jacksonia sternbergiana
	Lepidosperma sp.
*	*Leptospermum laevigatum*
	Lyginia imberbis
	Mesomelaena pseudostygia
*	*Nerium oleander*
	Patersonia occidentalis
*	*Pelargonium capitatum*
	Petrophile linearis
	Phlebocarya ciliata
	Scaevola canescens
	Stirlingia latifolia
	Xanthorrhoea preissii
	Pimelea ?suaveolens subsp. suaveolens
	Tricoryne elatior

Sample Name: R1

Project no.: EP20-009
Date: 11/03/2020, 19/08/21, 9/9/21 Status Non-permanent
Author: TAA,SKP R1: Page 3 of 3

Conostylis setigera
Hybanthus calycinus
Sowerbaea laxiflora
Drosera menziesii
Hypocalymma robustum
Lomandra caespitosa

* = non-native, Pl=planted

Sample Name: R2

Project no.: EP20-009
Date: 11/03/2020, 19/08/21, 9/9/21 Status Non-permanent
Author: TAA,SKP R2: Page 2 of 2

Quadrat and landform details

Sample type:	releve	Size:	other
NW corner easting:	392142	NW corner northing:	6446258
Altitude (m):	N/A	Geographic datum/zone:	GDA94/Zone 50
Soil water content:	dry	Landform:	flat
Time since fire:	no evidence	Disturbance:	moderate - weeds
Soil type/texture	sand/	Bare ground (%):	30
Rocks (%) and type:	No rocks	Soil colour:	brown/white
Litter:	15% (leaves,twigs,)	Vegetation condition:	very good

Sample Name: R2

Project no.: EP20-009
Date: 11/03/2020, 19/08/21, 9/9/21 Status Non-permanent
Author: TAA,SKP R2: Page 2 of 2

Species Data
* denotes non-native species

Status	Confirmed name
*	*Acacia longifolia*
	Allocasuarina fraseriana
	Burchardia congesta
*	*Cynodon dactylon*
	Dasypogon bromeliifolius
*	*Ehrharta calycina*
	Hypolaena exsulca
	Kunzea glabrescens
*	*Lagurus ovatus*
	Lyginia imberbis
	Melaleuca thymoides
	Scholtzia involucrata
	Xanthorrhoea preissii

* = non-native

Sample Name: R3

Project no.: EP20-009
Date: 11/03/2020, 19/08/21, 9/9/21 Status Non-permanent
Author: TAA,SKP R3: Page 2 of 2

Quadrat and landform details

Sample type:	releve	Size:	other
NW corner easting:	391941	NW corner northing:	6446696
Altitude (m):	N/A	Geographic datum/zone:	GDA94/Zone 50
Soil water content:	dry	Landform:	flat
Time since fire:	> 5 yrs	Disturbance:	moderate - weeds
Soil type/texture	sand/	Bare ground (%):	20
Rocks (%) and type:	No rocks	Soil colour:	brown/white
Litter:	20% (leaves,branches,)	Vegetation condition:	very good

Vegetation Sample Data
Former Glen Iris Golf Course

Sample Name: R3

Project no.: EP20-009
Date: 11/03/2020, 19/08/21, 9/9/21 Status Non-permanent
Author: TAA,SKP R3: Page 2 of 2

Species Data
* denotes non-native species

Status	Confirmed name
	Adenanthos cygnorum
	Allocasuarina humilis
	Banksia attenuata
	Banksia menziesii
	Callitris preissii
*	*Carpobrotus edulis*
	Conostephium pendulum
	Daviesia nudiflora
	Daviesia triflora
*	*Ehrharta calycina*
*Pl	*Eucalyptus caesia*
	Eucalyptus marginata subsp. marginata
	Gastrolobium capitatum
	Gompholobium tomentosum
	Hibbertia hypericoides
	Hypocalymma angustifolium
	Jacksonia furcellata
	Lomandra hermaphrodita
	Lyginia imberbis
	Macrozamia fraseri
	Mesomelaena pseudostygia
	Patersonia occidentalis
*	*Pelargonium capitatum*
	Persoonia saccata
	Scaevola repens
	Scholtzia involucrata
	Stirlingia latifolia
	Styphelia propinqua
	Caladenia latifolia
	Hypocalymma robustum

* = non-native, Pl=planted

Appendix D

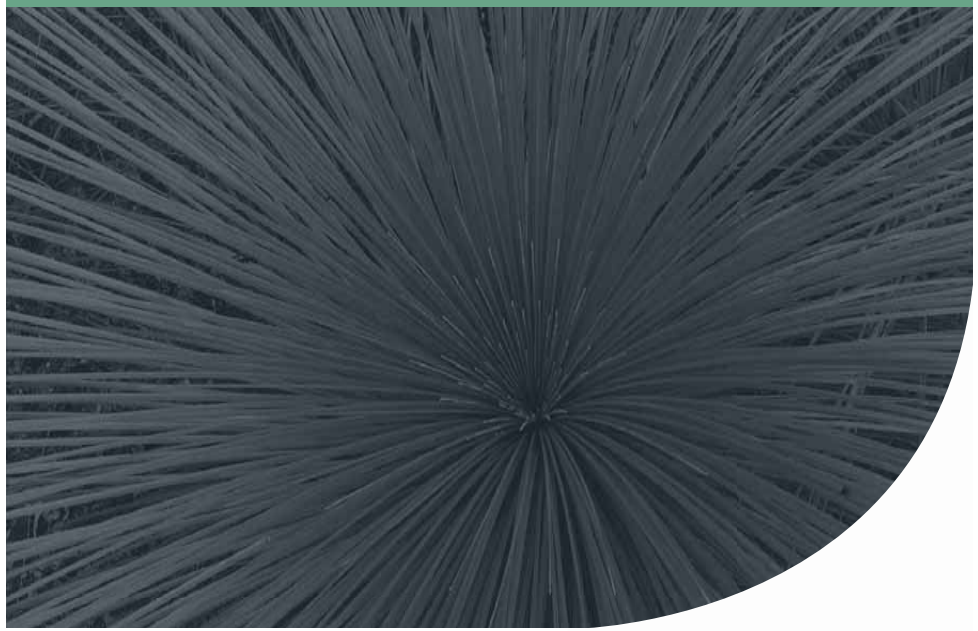
Basic Fauna Assessment

Level 1 Fauna Assessment

Former Glen Iris Golf Course

Project No: EP20-009(04)

Prepared for ECP Acquisitions 6 Pty Ltd
June 2021



Document Control

Doc name:	Level 1 Fauna Assessment Former Glen Iris Golf Course				
Doc no.:	EP20-009(04)--004B RAW				
Version	Date	Author		Reviewer	
1	June 2020	Rachel Weber	RAW	Tom Atkinson	TAA
	Initial report submitted for client review				
A	April 2021	Melanie Schubert	MS	Rachel Weber	RAW
	Minor updates to reflect change in site boundary				
B	June 2021	Rachel Weber	RAW	Tom Atkinson	TAA
	Minor updates to numeric decimal places				

Executive Summary

ECP Acquisitions 6 Pty Ltd intends to develop the former Glen Iris Golf Course into a residential estate (referred to herein as 'the site'). Emerge were engaged to conduct a 'level 1' fauna assessment to provide information on the fauna values within the site to inform the development.

As part of the assessment a desktop review of relevant background information was completed and a site survey was undertaken on 11 March and 28 May 2020. During the survey an assessment was made on the type and conservation significance of fauna habitat across the site.

Outcomes of the level 1 fauna assessment include the following:

- Five fauna habitats were recorded in the site:
  - The native woodland habitat has the highest fauna habitat values but extends over a small portion of the site (4%) and occurs as scattered patches.
  - The riparian and water habitats, although artificial, also provide habitat for native fauna and occur as small patches (3% of the site).
  - The planted trees and shrubs habitat provides varying habitat values according to the plant species and density and extends over 25% of the site.
  - The remainder of the site (68%) supports turf, bare ground and infrastructure which provide low habitat values for native fauna.
- A total of 15 native and three introduced fauna species were recorded in the site, including Carnaby's cockatoo (threatened under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*) and quenda (Priority 4 in Western Australia).
- The native woodland and planted trees and shrubs habitats support plants known to be foraged by threatened species of black cockatoos including Carnaby's cockatoo. These habitats may also support trees suitable for use by black cockatoos as breeding or roosting habitat. A targeted assessment would be required to confirm the black cockatoo habitat values within the site.
- The portions of the native woodland, planted trees and shrubs and riparian habitats with dense understorey vegetation provide suitable habitat for quenda.
- An additional 45 species of conservation significance have potential to occur in the site. The majority of these species are birds which may only use the site intermittently, if at all. The native woodland habitat also provides a relatively small area of potential habitat for two invertebrates and two reptiles of conservation significance.

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Former Glen Iris Golf Course

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Abbreviation Tables

Table A1: Abbreviations – Organisations

Organisations	
EPA	Environmental Protection Authority
DBCA	Department of Biodiversity, Conservation and Attractions
DAWE	Department of Agriculture, Water and the Environment
WA Museum	Western Australian Museum

Table A2: Abbreviations – General terms

General terms	
T	Threatened
EN	Endangered
EX	Extinct
VU	Vulnerable
MI	Migratory
HT	Habitat tree
P1	Priority 1
P2	Priority 2
P3	Priority 3
P4	Priority 4
P5	Priority 5

Table A3: Abbreviations –Legislation

Legislation	
BAM Act	*Biosecurity and Agriculture Management Act 2007*
EP Act	*Environmental Protection Act 1986*
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
BC Act	*Biodiversity Conservation Act 2016*
BC Regs	*Biodiversity Conservation Regulations 2018*

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Table A4: Abbreviations – planning

Planning terms	
MRS	Metropolitan Region Scheme

Table A5: Abbreviations – units of measurement

Units of measurement	
cm	Centimetre
ha	Hectare
km	Kilometre
m	Metre

1 Introduction

1.1 Project background

ECP Acquisitions 6 Pty Ltd intends to develop the former Glen Iris Golf Course into a residential estate. The former Glen Iris Golf Course comprises Lots 6 and 7 Glen Iris Drive, Lots 3, 509 and 512 Dean Road and Lot 139 Imlah Court in Jandakot (referred to herein as the 'site').

The site is located approximately 16 kilometres (km) south of the Perth Central Business District within the City of Cockburn and is zoned 'urban' under the Metropolitan Region Scheme (MRS) and 'development contribution area 13 special use 1', 'development contribution area 13 special use 6', 'development contribution area 13 residential-R40' under the City of Cockburn *Town Planning Scheme No. 3.*

The site is approximately 53.7 hectares (ha) in size and is surrounded by residential subdivision, with a railway to the north and Kwinana Freeway to the west. The site comprises two areas separated by Berrigan Drive. The location and extent of the site is shown in Figure 1.

1.2 Purpose and scope of work

Emerge Associates (Emerge) were engaged by Acumen Development Solutions, on behalf of ECP Acquisitions 6 Pty Ltd, to provide environmental consultancy services to support the planning process for the site. The purpose of this survey is to provide sufficient information on the fauna values within the site to inform this process.

The scope of work was specifically to conduct a fauna assessment to the standard required of a 'level 1' fauna survey with reference to the Environmental Protection Authority's (EPA's) *Technical Guidance – Terrestrial fauna Surveys* (EPA 2016).

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

- Desktop review of background information regarding fauna species relevant to the site and surrounds.
- Compilation of a list of fauna species opportunistically recorded as part of the field survey.
- Identification of potential habitat for conservation significant fauna species and likelihood of occurrence.
- Documentation of the desktop assessment, survey methodology and results into a report.

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2 Environmental Context

2.1 Significant fauna

2.1.1 Threatened fauna species

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 taxon listed under the EPBC Act requires approval from the Commonwealth Minister for the Environment.

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.

2.1.2 Priority fauna species

Fauna species that do not currently meet the criteria for listing as threatened but are potentially rare or threatened may be added to the Department of Biodiversity, Conservation and Attractions (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.

2.1.3 Migratory fauna species

Migratory fauna species that migrate to Australia and its external territories, or pass though or over Australian waters during their annual migrations warrant special protection 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 significant impact on a taxon listed under the EPBC Act requires approval from the Commonwealth Minister for the Environment.

In Western Australia migratory fauna taxa may be listed as 'specially protected species' and classed as 'migratory' under the *Biodiversity Conservation Act 2016* (BC Act). Further information on migratory species is provided in Appendix A.

2.1.4 Specially protected fauna species

In Western Australia, fauna species that are of special conservation interest, including migratory species, cetaceans, species subject to international agreement or species otherwise in need of special protection, may be listed as 'specially protected' under the BC Act.

2.1.5 Pest fauna species

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. Many non-native fauna species and some fauna species native to Australia but not Western Australia are considered to be pest fauna.

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. Further information on categories of declared pests is provided in Appendix A.

2.2 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.

No *Bush Forever* sites occur within the site. Multiple *Bush Forever* sites occur to the east and west of the site.

2.3 Ecological linkages

Ecological linkages are linear landscape elements that allow the movement of fauna, flora and genetic material between areas of remnant habitat. The movement of fauna and the exchange of genetic material between vegetation remnants improve 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). This study was extended beyond the Perth Metropolitan Region through the South West Biodiversity Project, resulting in the identification and mapping of the South West regional ecological linkages (Molloy *et al.* 2009).

There are no mapped ecological linkages within the site. One biodiversity ecological linkage (No. 48) is located approximately 800 m to the north of the site and extends to the west and east.

2.4 Previous surveys

No previous fauna surveys are known to have been undertaken within the site.

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3 Methods

3.1 Desktop assessment

3.1.1 Database searches

A search was conducted for fauna species that may occur or have been recorded within a 10 km radius of the site using the *Protected Matters Search Tool* (DAWE 2020) and *NatureMap* (DBCA 2020).

A total number of species with potential to occur within the site 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*.

3.1.2 Likelihood of occurrence

Information on habitat preferences and distribution of threatened and priority vertebrate fauna species identified in database searches was reviewed. This was assessed against the general site conditions and fauna habitat types recorded during the field survey.

An assessment of the likelihood of occurrence of threatened and priority fauna species within the site was undertaken and each was assigned to one of the following categories:

- Recorded: The species in question was positively identified as being present within the site during the field survey or from recent literature records.
- Likely: Potentially suitable habitat for the species in question was identified during the field survey and the site lies within the known distribution of the species.
- Possible: Potentially suitable habitat for the species in question was identified but of marginal quality and/or extent. The site lies within or close to the known distribution of the species.
- Unlikely: The site lies outside of the known distribution of the species in question and/or no suitable habitat was identified within the site.

3.2 Field survey

An ecologist from Emerge visited the site on the 11 March 2020 during the day from approximately 10:30 am to 4:30 pm to conduct the level 1 fauna survey field survey.

Another ecologist from Emerge also visited the site on 28 May 2020 during the day from approximately 2:00 pm to 6:00 pm to conduct an additional assessment of the fauna in the artificial lakes within the site.

3.2.1 Level 1 fauna

During both surveys transects were traversed across the site and the characteristics of fauna habitat and presence of fauna species was recorded. Microhabitats such as logs, rocks and leaf litter were investigated and secondary evidence of species presence such as tracks, scats, skeletal remains, foraging evidence or calls was also noted.

A vertebrate fauna list was compiled and fauna habitat values were described, with particular reference to 'threatened' and 'priority' fauna species with potential to occur within the site. Taxonomy and nomenclature for vertebrate fauna species was taken from the *Western Australian Museum Checklist of the Terrestrial Vertebrate Fauna of Western Australia* (Western Australian Museum 2019). Literature listed in Appendix A represent the main publications used to identify fauna species and habitats within the site.

3.3 Data analysis, presentation mapping

3.3.1 Fauna habitat

Fauna habitats were described according to the dominant flora species and vegetation type present, as determined from observations made during the field survey and information provided in the *Reconnaissance Flora and Vegetation Assessment* for the site (Emerge Associates 2020). The identified fauna habitats were mapped on aerial photography with the boundaries interpreted from aerial photography, Emerge Associates (2020) plant communities and notes taken in the field.

Information on specific habitat requirements for conservation significant vertebrate fauna species with potential to occur within the site were compiled as part of the desktop assessment. This information was compared to the fauna habitats identified within the site to determine whether any conservation significant fauna species are considered to have potential to utilise the site.

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 – Terrestrial Fauna Surveys* (EPA 2016) is provided in Table 1.

Table 1: Evaluation of survey methodology against standard constraints outlined in EPA Technical Guidance – Terrestrial Fauna Surveys (EPA 2016)

Constraint	Degree of limitation	Details
Level of survey	No limitation	A level 1 survey (desktop study and field survey) was considered adequate given the relatively low habitat values within the site and the generally good availability of fauna information for the region.
Scope	No limitation	The survey focused on vertebrate fauna and habitat values, with particular focus on 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.

Table 1: Evaluation of survey methodology against standard constraints outlined in EPA Technical Guidance – Terrestrial Fauna Surveys (EPA 2016) (continued)

Constraint	Degree of limitation	Details
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	Minor limitation	The field surveys were undertaken by two qualified ecologists with three years' and 18 years' experience in environmental science. The report was authored by a qualified ecologist with over nine years' experience. Technical review was undertaken by a senior environmental consultant with 18 years' experience in environmental science in Western Australia.
Suitability of timing	Slight limitation	Survey timing is not considered to be of great importance for Level 1 assessments.
Completeness	No limitation	The desktop assessment and field survey components were completed.
Spatial coverage and access	No limitation	Site coverage was comprehensive (track logged).
	No limitation	All parts of the site could be accessed as required.
Survey intensity	No limitation	The intensity of the survey was adequate given the size of the site and the relatively low habitat value present.
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.

4 Results

4.1 General site conditions

The site is gently undulating and comprises sandy white-grey soils. The fairways within the site were irrigated at the time of the survey. Seven artificial lakes occur within the site that were also sustained by irrigation at the time of the survey.

The site has been highly modified for use as a golf course and is dominated by non-native vegetation and unvegetated areas, with native vegetation present as individuals or small scattered patches. The artificial lakes are surrounded by either turf, riparian vegetation or planted trees and shrubs.

4.2 Fauna habitat

Historical disturbance has significantly compromised habitat values within the site. The majority of the native vegetation has been removed and vegetation now predominantly comprises cleared area, dominated by non-native and weed species with scattered or patches of native and non-native trees and shrubs.

Five fauna habitats were recorded in the site. Native woodland is present as scattered patches and has the highest fauna habitat values due to the presence of native trees, shrubs and ground cover and contains microhabitats such as logs, rocks and leaf litter. The riparian and water habitats provide value for aquatic fauna species and those associated with riparian areas. The planted trees and shrubs habitat mainly provides habitat for avian species as the majority is devoid of understorey vegetation. The turf and bare ground habitat extends over a large portion of the site and has minimal habitat values for native fauna species.

The remainder of the site is not considered to provide fauna habitat as it comprises infrastructure such as buildings and hardstand (0.9 ha).

A description and the area of each habitat is provided in Table 2 and representative photographs of each are provided in Plate 1 to Plate 5 . The location of each habitat is shown in Figure 3.

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Table 2: Fauna habitats identified within the site

Fauna habitat classification	Description	Area (ha)
Native woodland	Woodland to open woodland *Eucalyptus marginata* subsp. *marginata*, *Banksia attenuata* and *Banksia menziesii* over mixed shrubland *Xanthorrhoea preissii*, *Allocasuarina humilis* and *Hibbertia hypericoides* over open sedgeland *Mesomelaena pseudostygia* over non-native grassland **Ehrharta calycina* (Plate 1).	1.9
Riparian	Closed sedgeland *Typha domingensis*, *Schoenoplectus tabernaemontani*, **Cortaderia selloana* and *Baumea* sp. (likely planted or a combination of planted and naturally regenerated) (Plate 2).	0.2
Water	Water in artificial lakes of varying depth (Plate 3).	1.4
Planted trees and shrubs	Predominantly scattered non-native planted trees and shrubs such as **Corymbia* spp., **Eucalyptus* spp., *Melaleuca* spp. and *Grevillea* spp. with occasional native plants (Plate 4).	13.6
Turf and bare ground	Closed non-native grassland (turf) and bare ground (Plate 5).	35.7

Plate 1: Native woodland habitat

Plate 2: Riparian habitat

Plate 3: Water habitat

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Plate 4: Planted trees and shrubs habitat

Plate 5: Turf and bare ground habitat

4.3 Fauna

4.3.1 Desktop assessment

A total of 560[1] fauna species were identified from database searches as occurring or potentially occurring within 10 km of the site, as listed in Appendix B.

Of these, 92 species are of conservation significance, comprising 38 threatened, 14 priority, 39 migratory fauna and one other specially protected species as listed in Appendix C.

4.3.2 Species inventory

A total of 15 native and three introduced fauna species were recorded in the site, including two fauna species of conservation significance which is described in Section 4.3.3.

Two of the introduced fauna species, **Cherax destructor* (yabby) and **Cyprinus rubrofuscus* (koi fish), were recorded on 28 May 2020 within or adjacent to the artificial lakes. Scats of the other introduced fauna species, **Oryctolagus cuniculus* (rabbit) were recorded across the site during both surveys.

A complete species list is provided in Appendix D.

4.3.3 Conservation significant fauna

Two fauna species of conservation significance were recorded in the site: Carnaby's cockatoo which is listed as endangered under the EPBC Act and quenda which is listed as P4 in WA.

Approximately 20 individuals of Carnaby's cockatoo were recorded perching in trees on the 11 March 2020 in the central portion of the site. No signs of foraging or night roosting were opportunistically recorded in the site. The native woodland and planted trees and shrubs habitats support plants known to be foraged by threatened species of black cockatoos including Carnaby's cockatoo. These habitats may also support trees suitable for use as breeding or roosting habitat by black cockatoos.

Diggings of quenda (P4) were recorded in the south eastern portion of the site within the planted trees and shrubs and riparian habitats, within dense understorey vegetation. The following three mapped habitats may comprise suitable habitat for quenda:

- native woodland
- riparian (where it is not inundated)
- planted trees and shrubs (where understorey vegetation is present and dense).

A total of 48 fauna species of conservation significance were considered to have potential to occur in the site, as shown in Table 3. This comprises the two recorded species, one that is considered likely to occur and 45 considered to possibly occur.

The remaining conservation significant fauna species identified in Section 4.3.1 are not considered to occur in the site due to lack of suitable habitat or because the site lies outside of the species known distribution. The likelihood of occurrence assessment for these species is provided in Appendix B.

[1] Includes native and non-native species

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Table 3: Conservation significant fauna species which have potential to occur within the site

Species name	Common name	Level of significance		Habitat	Likelihood of occurrence
		BC Act	EPBC Act		
Birds					
Actitis hypoleucos	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 wherelow perches are available (Johnstone & Storr 1998).	Possible (marginal habitat present)
Apus pacificus	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 above the site, potential foraging habitat present)
Ardea alba	Eastern great egret	-	MA	Shallows of rivers, estuaries; tidal mudflats, freshwater wetlands; sewage ponds, irrigation areas and larger dams (Pizzey & Knight 2012).	Possible (potential habitat present)
Ardea ibis	Cattle egret	-	MA	Stock paddocks, pastures, croplands, garbage tips, wetlands, tidal mudflats, drains (Pizzey & Knight 2012).	Possible (potential habitat present)
Botaurus poiciloptilus	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.	Possible (marginal habitat present)
Calidris acuminata	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.	Possible (marginal habitat present)

Table 3: Conservation significant fauna species which have potential to occur within the site (continued)

Species name	Common name	Level of significance		Habitat	Likelihood of occurrence
		BC Act	EPBC Act		
Calidris melanotos	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).	Possible (marginal habitat present)
Calidris ruficollis	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).	Possible (marginal habitat present)
Calidris subminuta	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.	Possible (marginal habitat present)
Calyptorhynchus banksii naso	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 azdarach and Eucalyptus spp. trees.	Likely (potential habitat present)
Calyptorhynchus latirostris	Carnaby's cockatoo	EN	EN	Mainly proteaceous scrubs and heaths and adjacent eucalypt woodlands and forests; also plantations of Pinus spp. Attracted to seeding Banksia spp., Dryandra spp., Hakea spp., Eucalyptus spp., Corymbia calophylla, Grevillea spp., and Allocasuarina spp. (Johnstone and Storr 1998).	Recorded (suitable habitat present)
Charadrius bicinctus	Double-banded plover	MI	MI	Wide beaches, tidal mudflats, saltmarsh, wide and sparsely vegetated margins of shallow saline and freshwater wetlands, paddocks with sparse vegetation, ploughed fields, airfields.	Possible (potential habitat present)

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Table 3: Conservation significant fauna species which have potential to occur within the site (continued)

Species name	Common name	Level of significance		Habitat	Likelihood of occurrence
		BC Act	EPBC Act		
Charadrius dubius	Little ringed plover	MI	MI	Open, muddy or sandy shores of lakes, swamps, tidal areas, sewage ponds or farm dams. Rare but regular summer migrant to Australia (Pizzey & Knight 2012).	Possible (potential habitat present)
Charadrius leschenaultii	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).	Possible (potential habitat present)
Charadrius ruficapillus	Red-capped plover	-	MA	Broad, sandy and shelly beaches; bare margins of saline wetlands and lakes, inland and coastal; saltmarsh; tidal mudflats and sandflats; adjacent dunes; occasionally shallow freshwater wetlands, inland and coastal (Pizzey & Knight 2012).	Possible (potential habitat present)
Chlidonias leucopterus	White-winged black tern	MI	MI	Vegetated and open wetlands, brackish and saline lakes, saltfields, irrigated lands, sewage ponds and occasionally offshore.	Possible (potential habitat present)
Falco peregrinus	Peregrine falcon	OS	-	Mainly found around cliffs along coasts, rivers, ranges and around wooded watercourses and lakes (Johnstone and Storr 1998).	Possible (marginal habitat present)
Gallinago hardwickii	Latham's snipe	MI	MI	Soft, wet ground or shallow water with tussocks and other green or dead growth, wet parts of paddocks, seepage below dams, irrigated areas, scrub or open woodlandfrom sea level to alpine bogs over 2000 m, samphire on saltmarshes and mangrove fringes. Rare visitor to Western Australia.	Possible (potential habitat present)
Gallinago megala	Swinhoe's snipe	MI	MI	Wet, grassy ground; edges of reedy swamps (Pizzey & Knight 2012).	Possible (potential habitat present)

Table 3: Conservation significant fauna species which have potential to occur within the site (continued)

Species name	Common name	Level of significance		Habitat	Likelihood of occurrence
		BC Act	EPBC Act		
Gallinago stenura	Pin-tailed snipe	MI	MI	Boggy edges of vegetated wetlands; sewage and other ponds; stubbles, grasslands with shrubs, pastures (Pizzey & Knight 2012).	Possible (potential habitat present)
Gelochelidon nilotica	Gull-billed tern	MI	MI	Beaches, mudflats; fresh, brackish wetlands, including far inland; grasslands, crops, ploughed fields, airfields (Pizzey & Knight 2012).	Possible (potential habitat present)
Himantopus himantopus	Black-winged stilt	-	MA	Freshwater and saltwater marshes, mudflats, and the shallow edges of lakes and rivers (Birdlife Australia 2019).	Possible (potential habitat present)
Ixobrychus dubius	Australian little bittern	P4	-	Dense vegetation surrounding/within freshwater pools, swamps and lagoons, well screened with trees. Shelters in dense beds of Typha spp., Baumea spp. and tall rushes in freshwater swamps around lakes and along rivers (Johnstone and Storr 1998).	Possible (marginal habitat present)
Limosa limosa	Black-tailed godwit	MI	MI	Tidal mudflats, estuaries, sewage ponds, shallow river margins, brackish or saline inland lakes, flooded pastures, airfields (Pizzey & Knight 2012).	Possible (potential habitat present)
Merops ornatus	Rainbow bee-eater	-	MA	Open woodlands with sandy, loamy soil; sandridges, sandpits, riverbanks, road cuttings, beaches, dunes, cliffs, mangroves, rainforest, woodlands and golf courses (Pizzey & Knight 2012).	Possible (potential habitat present)
Numenius minutus	Little curlew	MI	MI	Dry grasslands, floodplains, margins of drying swamps; tidal mudflats, airfields, playing fields, crops, commercial saltfields, sewage ponds (Pizzey & Knight 2012).	Possible (potential habitat present)
Numenius phaeopus	Whimbrel	MI	MI	Estuaries, mangroves, tidal flats, coral cays, exposed reefs, flooded paddocks, sewage ponds, bare grasslands, sportsgrounds and lawns.	Possible (potential habitat present)

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Table 3: Conservation significant fauna species which have potential to occur within the site (continued)

Species name	Common name	Level of significance		Habitat	Likelihood of occurrence
		BC Act	EPBC Act		
Oxyura australis	Blue-billed duck	P4	-	Mainly deeper freshwater swamps and lakes; occasionally saltlakes and estuaries freshened by flood waters (Johnstone and Storr 1998a).	Possible (marginal habitat present)
Phalaropus lobatus	Red-necked phalarope	MI	MI	Shallow pools in commercial saltfields, tidal mudflats, beaches, saltmarshes, freshwater wetlands.	Possible (marginal habitat present)
Philomachus pugnax	Ruff	MI	MI	Fresh, brackish and saline wetlands; tidal mudflats, saltfields, sewage ponds (Pizzey & Knight 2012).	Possible (marginal habitat present)
Plegadis falcinellus	Glossy Ibis	MI	MI	Shallow and adjacent flats of freshwater lakes and swamps, also river pools, flooded samphire and sewage ponds.	Possible (marginal habitat present)
Pluvialis fulva	Pacific golden plover	MI	MI	Estuaries, mudflats, saltmarshes, mangroves; rocky reefs and stranded seaweed on ocean shores; margins of shallow open inland swamps; sewage ponds, short-grass paddocks, sportsgrounds, airfields, ploughed land (Pizzey & Knight 2012).	Possible (potential habitat present)
Recurvirostra novaehollandiae	Red-necked avocet	-	MA	Estuaries, tidal mudflats; fresh, brackish and salt swamps and lakes; claypans, commercial saltfields and sewage ponds (Pizzey & Knight 2012).	Possible (marginal habitat present)
Rostratula australis	Australian painted snipe	EN	EN	Mainly shallow terrestrial freshwater (occasionally brackish) wetlands, including temporary and permanent lakes, swamps and claypans (Marchant and Higgins 1993).	Possible (marginal habitat present)
Thalassarche cauta cauta	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).	Possible (marginal habitat present)

Table 3: Conservation significant fauna species which have potential to occur within the site (continued)

Species name	Common name	Level of significance		Habitat	Likelihood of occurrence
		BC Act	EPBC Act		
Thinornis rubricollis	Hooded plover	P4	VU	Margins and shallows of saltlakes, sandy and seaweedy beaches and estuaries; also dams (Johnstone & Storr 1998).	Possible (marginal habitat present)
Tringa glareola	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.	Possible (potential habitat present)
Tringa nebularia	Common greenshank	MI	MI	Shallow fresh waters (claypans, lagoons, swamps, river pools, dams and sewage ponds) and salt waters (estuaries, mangrove creeks, lakes, samphire flats, reef flats and saltwork ponds).	Possible (potential habitat present)
Tringa stagnatilis	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.	Possible (potential habitat present)
Tringa totanus	Common redshank	MI	MI	Sheltered coastal wetlands such as bays, river estuaries, lagoons, inlets and saltmarsh (with bare open flats and banks of mud or sand). Also found around saltlakes, freshwater lagoons, artificial wetlands and saltworks and sewage farms (Higgins & Davies 1996).	Possible (marginal habitat present)
Tyto novaehollandiae novaehollandiae	Australian masked owl	P3	-	Forests, open woodlands, farmlands with large trees. E.g. river red gums, adjacent cleared country, timbered watercourses, paperbark woodlands and caves (Pizzey & Knight 2012).	Possible (marginal habitat present)
Invertebrates					
Idiosoma sigillatum	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, multiple records nearby)

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Table 3: Conservation significant fauna species which have potential to occur within the site (continued)

Species name	Common name	Level of significance		Habitat	Likelihood of occurrence
		BC Act	EPBC Act		
Synemon gratiosa	Graceful sunmoth	P4	-	Coastal heathland on Quindalup dunes where it is restricted to secondary sand dunes due to the abundance of the preferred host plant Lomandra maritima. Banksia woodland on Spearwood and Bassendean dunes, where the second known host plant L. hermaphrodita is widespread (DEC 2011).	Possible (hostplant recorded)
Throscodectes xiphos	Stylet bush cricket	P1	-	Species poorly understood and documented. Known from Jandacot area, where it was originally collected in the axial leaf bases of grass trees (Xanthorrhoea preissei) (Invertebrate Solutions 2019).	Possible (suitable habitat present, single record nearby, poor knowledge of species)
Mammals					
Hydromys chrysogaster	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).	Possible (marginal habitat present)
Isoodon fusciventer	Quenda	P4	-	Dense scrubby, often swampy, vegetation with dense cover up to one metre high (DEC 2012a)	Recorded (suitable habitat present)
Reptiles					
Lerista lineata	Perth slider	P3	-	Sandy coastal heath and low scrubland. Banksia spp. woodland, Eucalyptus gomphocephala open woodland over deep sands, and coastal dunes immediately adjacent to the beach (Wilson and Swan 2017).	Possible (potential habitat present)
Neelaps calonotos	Black-striped snake	P3	-	Coastal and near-coastal dunes, sandplains supporting heathlands and Banksia spp. woodlands (Bush et al. 2002).	Possible (potential habitat present)

4.3.1 Declared pests

One of the introduced fauna species recorded, **Oryctolagus cuniculus* (rabbit), is listed as a declared pest (C3) pursuant to the BAM Act.

5 Discussion

5.1 Fauna habitat values

Over half of the site (68%) supports turf, bare ground and infrastructure which provide low habitat values for native fauna. The native woodland habitat provides the highest habitat values but extends over a small portion of the site (4%) and occurs as scattered patches. The riparian and water habitats, although artificial, also provide habitat for native fauna and occur as small patches (3% of the site). The remainder of the site supports planted trees and shrubs which provide varying habitat values according to the plant species and density. The majority of the planted trees and shrubs habitat lacks understorey vegetation and would mainly provide habitat for common avian species.

The 15 native and three introduced fauna taxa recorded within the site are common and widespread on the Swan Coastal Plain region, although two of them are of conservation significance as detailed in Section 5.2.

5.2 Conservation significant fauna

Threatened Carnaby's cockatoo were recorded in the site and another threatened black cockatoo, forest red-tailed black cockatoo, is considered likely to occur in the site. The native woodland and planted trees and shrubs habitats support plants known to be foraged by threatened species of black cockatoos including Carnaby's cockatoo and forest red-tailed black cockatoo. These habitats may also support trees suitable for use by black cockatoos as breeding or roosting habitat. Further targeted assessment would be required to confirm the black cockatoo habitat values within the site.

Quenda (P4) diggings were recorded in the site and the native woodland, planted trees and shrubs and riparian habitats are considered to provide suitable habitat for quenda. Quenda inhabit dense scrub/shrub vegetation and therefore only parts of the above habitats with a dense understorey vegetation are considered likely to support this species (DEC 2012). The planted trees and shrubs habitat largely lacks understorey and as such the native woodland and riparian habitats would provide the highest habitat value to quenda in the site.

An additional 45 species of conservation significance have potential to occur in the site. However, the majority of these species are birds which may only use the site intermittently, if at all. The native woodland habitat also provides a relatively small area of potential habitat for two invertebrates and two reptiles of conservation significance.

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6 Conclusions

The majority of the site supports turf, bare ground and infrastructure which provides low habitat values for native fauna. The native woodland habitat provides the highest relative value but, as this habitat extends over a small portion of the site (4%) and occurs as scattered patches, the importance of this habitat to native fauna is likely limited. Although artificial, the riparian and water habitats also provide habitat for native fauna. The remainder of the site supports planted trees and shrubs which provide varying habitat values depending on plant species and density.

The 15 native and three introduced fauna taxa recorded within the site are all common and widespread across the Swan Coastal Plain region. Two of them are of conservation significance.

Two fauna species of conservation significance were recorded within the site: Carnaby's cockatoo (threatened) and quenda (P4). One other threatened species, forest red-tailed black cockatoo, is considered likely to occur in the site. A targeted assessment would be required to confirm the black cockatoo habitat values within the site.

An additional 45 species of conservation significance have potential to occur in the site. The majority of these species are birds which may only use the site intermittently, if at all. The native woodland habitat also provides a relatively small area of potential habitat for two invertebrates and two reptiles of conservation significance.

7 References

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Figures

Figure 1: Site Location

Project: Level 1 Fauna Assessment
Former Glen Iris Golf Course
Client: ECP Acquisitions 6 Pty Ltd

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Drawn: GAR
Date: 29/03/2021
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Date: 29/03/2021

0 100 200
Metres
Scale: 1:10,000@A4
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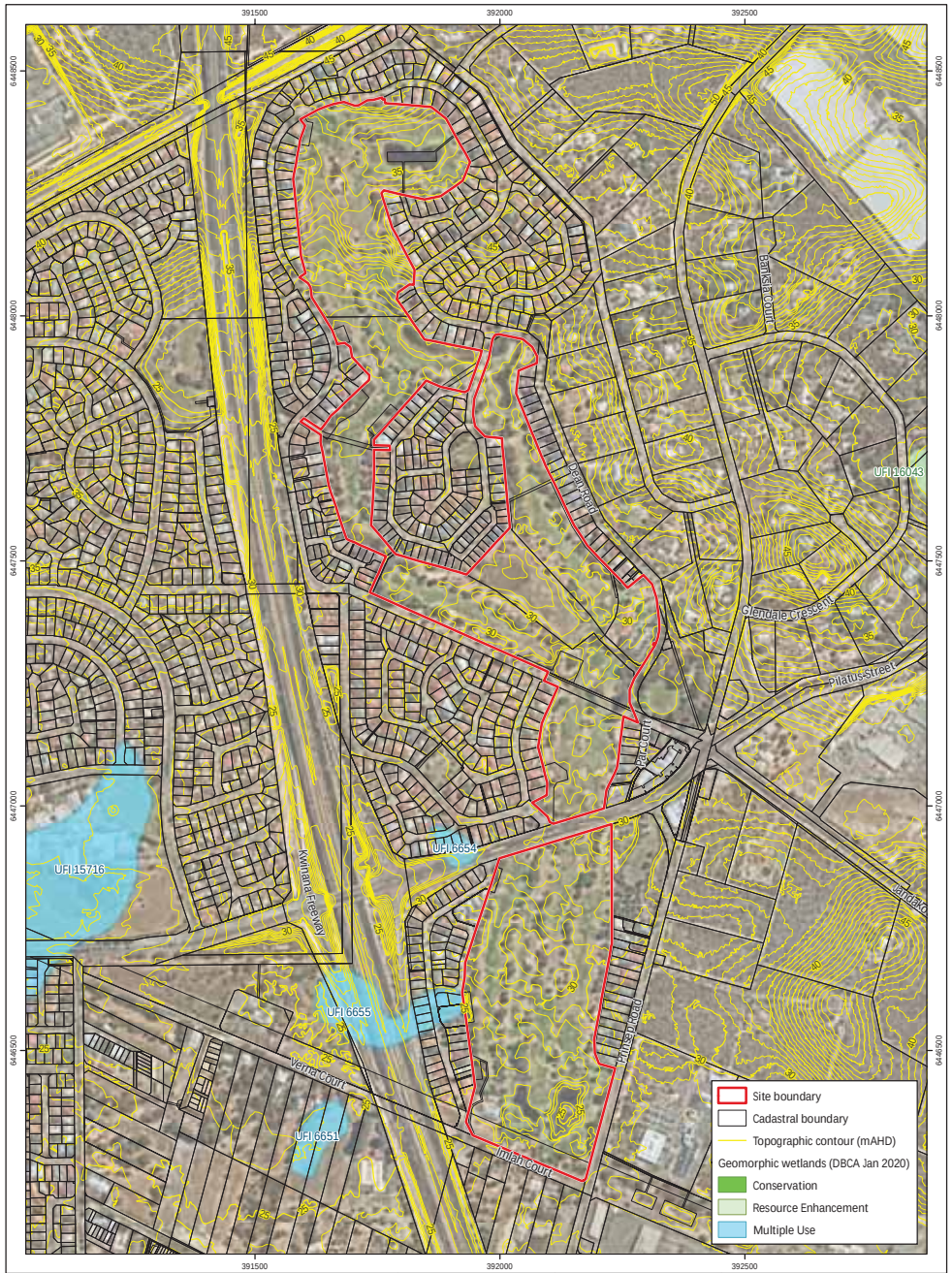

Figure 2: Environmental Features

Project: Level 1 Fauna Assessment
Former Glen Iris Golf Course
Client: ECP Acquisitions 6 Pty Ltd

Plan Number: EP20-009(04)--F08a
Drawn: GAR
Date: 29/03/2021
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0 100 200
Metres
Scale: 1:10,000@A4
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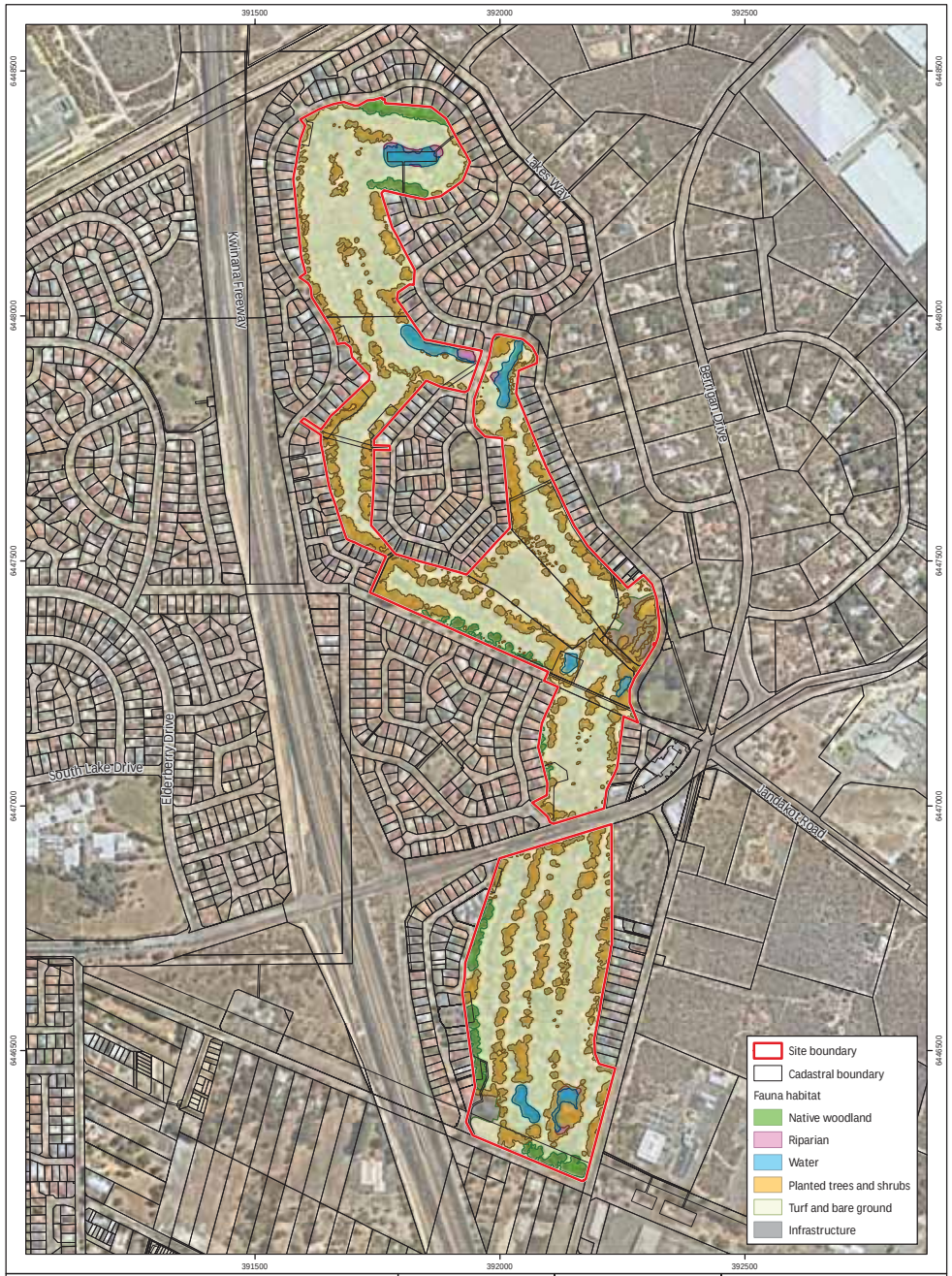

Figure 3: Fauna Habitat

Project: Level 1 Fauna Assessment
Former Glen Iris Golf Course
Client: ECP Acquisitions 6 Pty Ltd

Plan Number: EP20-009(04)--F09a
Drawn: GAR
Date: 29/03/2021
Checked: RAW
Approved: TAA
Date: 29/03/2021

0 100 200
Metres
Scale: 1:10,000@A4
GDA 1994 MGA Zone 50

emerge ASSOCIATES

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). Migratory birds may be 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).

All migratory bird species listed in the annexes to these bilateral agreements are protected in Australia as 'matters of national environmental significance' (MNES) under the EPBC Act. Fauna species considered 'threatened' pursuant to Schedule 1 of the EPBC Act are assigned categories as outlined in Table 1.

Table 1: Definitions of conservation significant fauna species pursuant to the EPBC Act

Conservation Code	Category
X	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

Version: EMRG_FReport_Appendix (V011)
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 2019). The definitions of these categories are provided in Table 2.

Table 2: Definitions of specially protected fauna schedules under the BC Act (DBCA 2019)

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.

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 2018). 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 2019).

Priority fauna species are considered during State approval processes. Priority fauna categories and definitions are listed in Table 3 (DBCA 2019).

Table 3: Definitions of priority fauna categories on DBCA's Priority Fauna List (DBCA 2019)

Conservation Code	Category
P1	Priority 1 – Poorly known 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.
P2	Priority 2 – Poorly known 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.
P3	Priority 3 – Poorly known 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.
P4	(a) Priority 4 – Rare species Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These species are usually represented on conservation lands. (b) Priority 4 – Near Threatened 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. (c) Priority 4 – Other Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.

Version: EMRG_FReport_Appendix (V011)
Additional Background Information

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.

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.

Version: EMRG_FReport_Appendix (V011)
Additional Background Information

References

General references

Department of Biodiversity, Conservation and Attractions (DBCA) 2018, *Threatened and Priority Fauna List 15 February 2018*, Perth.

Department of Biodiversity Conservation and Attractions (DBCA) 2019, *Conservation Codes for Western Australian Flora and Fauna - last updated 3 January 2019*.

Appendix B

Database Search Results

Australian Government
Department of the Environment and Energy

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

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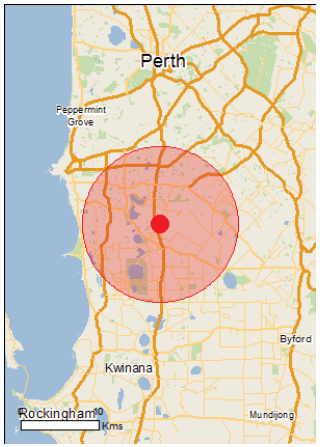

This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2010

Coordinates
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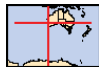

Summary

Matters of National Environmental Significance

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

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	2
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	4
Listed Threatened Species:	54
Listed Migratory Species:	54

Other Matters Protected by the EPBC Act

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

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

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

Commonwealth Land:	1
Commonwealth Heritage Places:	None
Listed Marine Species:	63
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

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

State and Territory Reserves:	15
Regional Forest Agreements:	None
Invasive Species:	42
Nationally Important Wetlands:	4
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar) [Resource Information]

Name	Proximity
Forrestdale and thomsons lakes	Within Ramsar site
Peel-yalgorup system	30 - 40km upstream

Listed Threatened Ecological Communities [Resource Information]

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

Name	Status	Type of Presence
Banksia Woodlands of the Swan Coastal Plain ecological community	Endangered	Community likely to occur within area
Clay Pans of the Swan Coastal Plain	Critically Endangered	Community likely to occur within area
Subtropical and Temperate Coastal Saltmarsh	Vulnerable	Community likely to occur within area
Tuart (Eucalyptus gomphocephala) Woodlands and Forests of the Swan Coastal Plain ecological community	Critically Endangered	Community likely to occur within area

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Anous tenuirostris melanops Australian Lesser Noddy [26000]	Vulnerable	Species or species habitat may occur within area
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Foraging, feeding or related behaviour known to occur within area
Calyptorhynchus banksii naso Forest Red-tailed Black-Cockatoo, Karrak [67034]	Vulnerable	Species or species habitat known to occur within area
Calyptorhynchus baudinii Baudin's Cockatoo, Long-billed Black-Cockatoo [769]	Endangered	Roosting known to occur within area
Calyptorhynchus latirostris Carnaby's Cockatoo, Short-billed Black-Cockatoo [59523]	Endangered	Species or species habitat known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Foraging, feeding or related behaviour known to occur within area
Diomedea amsterdamensis Amsterdam Albatross [64405]	Endangered	Species or species habitat may occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Species or species habitat likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Species or species habitat likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Species or species habitat likely to occur within area
Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species habitat likely to occur within area
Limosa lapponica baueri Bar-tailed Godwit (baueri), Western Alaskan Bar-tailed Godwit [86380]	Vulnerable	Species or species habitat known to occur within area
Limosa lapponica menzbieri Northern Siberian Bar-tailed Godwit, Bar-tailed Godwit (menzbieri) [86432]	Critically Endangered	Species or species habitat may occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Pachyptila turtur subantarctica Fairy Prion (southern) [64445]	Vulnerable	Species or species habitat known to occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat known to occur within area
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Species or species habitat known to occur within area
Thalassarche cauta cauta Shy Albatross [82345]	Vulnerable	Species or species habitat likely to occur within area
Thalassarche cauta steadi White-capped Albatross [82344]	Vulnerable	Species or species habitat likely to occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area

Name	Status	Type of Presence
Thalassarche melanophris		
Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Insects		
Neopasiphae simplicior		
A native bee [66821]	Critically Endangered	Species or species habitat likely to occur within area
Mammals		
Dasyurus geoffroii		
Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat likely to occur within area
Neophoca cinerea		
Australian Sea-lion, Australian Sea Lion [22]	Vulnerable	Species or species habitat known to occur within area
Pseudocheirus occidentalis		
Western Ringtail Possum, Ngwayir, Womp, Woder, Ngoor, Ngoolangit [25911]	Critically Endangered	Species or species habitat likely to occur within area
Other		
Westralunio carteri		
Carter's Freshwater Mussel, Freshwater Mussel [86266]	Vulnerable	Species or species habitat may occur within area
Plants		
Andersonia gracilis		
Slender Andersonia [14470]	Endangered	Species or species habitat may occur within area
Austrostipa jacobsiana		
[87809]	Critically Endangered	Species or species habitat may occur within area
Caladenia huegelii		
King Spider-orchid, Grand Spider-orchid, Rusty Spider-orchid [7309]	Endangered	Species or species habitat known to occur within area
Diuris drummondii		
Tall Donkey Orchid [4365]	Vulnerable	Species or species habitat known to occur within area
Diuris micrantha		
Dwarf Bee-orchid [55082]	Vulnerable	Species or species habitat known to occur within area
Diuris purdiei		
Purdie's Donkey-orchid [12950]	Endangered	Species or species habitat known to occur within area
Drakaea elastica		
Glossy-leafed Hammer Orchid, Glossy-leaved Hammer Orchid, Warty Hammer Orchid [16753]	Endangered	Species or species habitat known to occur within area
Drakaea micrantha		
Dwarf Hammer-orchid [56755]	Vulnerable	Species or species habitat known to occur within area
Eleocharis keigheryi		
Keighery's Eleocharis [64893]	Vulnerable	Species or species habitat may occur within area
Eremophila glabra subsp. chlorella		
[84927]	Endangered	Species or species habitat likely to occur within area
Eucalyptus x balanites		
Cadda Road Mallee, Cadda Mallee [87816]	Endangered	Species or species habitat may occur within area

Name	Status	Type of Presence
Grevillea curviloba subsp. incurva		
Narrow curved-leaf Grevillea [64909]	Endangered	Species or species habitat may occur within area
Lepidosperma rostratum		
Beaked Lepidosperma [14152]	Endangered	Species or species habitat likely to occur within area
Macarthuria keigheryi		
Keighery's Macarthuria [64930]	Endangered	Species or species habitat likely to occur within area
Synaphea sp. Fairbridge Farm (D. Papenfus 696)		
Selena's Synaphea [82881]	Critically Endangered	Species or species habitat likely to occur within area
Synaphea sp. Serpentine (G.R. Brand 103)		
[86879]	Critically Endangered	Species or species habitat may occur within area
Thelymitra dedmaniarum		
Cinnamon Sun Orchid [65105]	Endangered	Species or species habitat may occur within area
Thelymitra stellata		
Star Sun-orchid [7060]	Endangered	Species or species habitat may occur within area
Reptiles		
Caretta caretta		
Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas		
Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea		
Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
Natator depressus		
Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Anous stolidus		
Common Noddy [825]		Species or species habitat likely to occur within area
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardenna carneipes		
Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Species or species habitat likely to occur within area
Diomedea amsterdamensis		
Amsterdam Albatross [64405]	Endangered	Species or species habitat may occur within area
Diomedea epomophora		
Southern Royal Albatross [89221]	Vulnerable	Species or species habitat likely to occur within area
Diomedea exulans		
Wandering Albatross [89223]	Vulnerable	Species or species habitat likely to occur

Name	Threatened	Type of Presence within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Species or species habitat likely to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Sterna dougallii Roseate Tern [817]		Foraging, feeding or related behaviour likely to occur within area
Thalassarche cauta Shy Albatross [89224]	Vulnerable*	Species or species habitat likely to occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable*	Species or species habitat likely to occur within area
Migratory Marine Species		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
Lamna nasus Porbeagle, Mackerel Shark [83288]		Species or species habitat may occur within area
Manta alfredi Reef Manta Ray, Coastal Manta Ray, Inshore Manta Ray, Prince Alfred's Ray, Resident Manta Ray [84994]		Species or species habitat may occur within area
Manta birostris Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray [84995]		Species or species habitat may occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Migratory Terrestrial Species		
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Arenaria interpres Ruddy Turnstone [872]		Foraging, feeding or related behaviour known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Roosting known to occur within area
Calidris alba Sanderling [875]		Foraging, feeding or related behaviour known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat known to occur within area
Calidris ruficollis Red-necked Stint [860]		Roosting known to occur within area
Calidris subminuta Long-toed Stint [861]		Roosting known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Foraging, feeding or related behaviour known to occur within area
Charadrius bicinctus Double-banded Plover [895]		Foraging, feeding or related behaviour known to occur within area
Charadrius dubius Little Ringed Plover [896]		Roosting known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Foraging, feeding or related behaviour known to occur within area
Gallinago megala Swinhoe's Snipe [864]		Roosting likely to occur within area
Gallinago stenura Pin-tailed Snipe [841]		Roosting likely to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]		Roosting known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Numenius minutus Little Curlew, Little Whimbrel [848]		Roosting likely to occur within area
Numenius phaeopus Whimbrel [849]		Foraging, feeding or related behaviour known to occur within area

Name	Threatened	Type of Presence
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Phalaropus lobatus Red-necked Phalarope [838]		Foraging, feeding or related behaviour known to occur within area
Philomachus pugnax Ruff (Reeve) [850]		Roosting known to occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Foraging, feeding or related behaviour known to occur within area
Pluvialis squatarola Grey Plover [865]		Foraging, feeding or related behaviour known to occur within area
Tringa brevipes Grey-tailed Tattler [851]		Foraging, feeding or related behaviour known to occur within area
Tringa glareola Wood Sandpiper [829]		Roosting known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Roosting known to occur within area
Tringa totanus Common Redshank, Redshank [835]		Foraging, feeding or related behaviour known to occur within area
Xenus cinereus Terek Sandpiper [59300]		Foraging, feeding or related behaviour known to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land [Resource Information]

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

Name
Commonwealth Land -

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Anous stolidus Common Noddy [825]		Species or species habitat likely to occur within area
Anous tenuirostris melanops Australian Lesser Noddy [26000]	Vulnerable	Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Breeding known to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Arenaria interpres Ruddy Turnstone [872]		Foraging, feeding or related behaviour known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Roosting known to occur within area
Calidris alba Sanderling [875]		Foraging, feeding or related behaviour known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat known to occur within area
Calidris ruficollis Red-necked Stint [860]		Roosting known to occur within area
Calidris subminuta Long-toed Stint [861]		Roosting known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Foraging, feeding or related behaviour known to occur within area
Charadrius bicinctus Double-banded Plover [895]		Foraging, feeding or related behaviour known to occur within area
Charadrius dubius Little Ringed Plover [896]		Roosting known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Foraging, feeding or related behaviour known to occur within area
Charadrius ruficapillus Red-capped Plover [881]		Roosting known to occur within area
Diomedea amsterdamensis Amsterdam Albatross [64405]	Endangered	Species or species habitat may occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Species or species habitat likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Species or species habitat likely to occur within area

Name	Threatened	Type of Presence
Diomedea sanfordi		
Northern Royal Albatross [64456]	Endangered	Species or species habitat likely to occur within area
Gallinago megala		
Swinhoe's Snipe [864]		Roosting likely to occur within area
Gallinago stenura		
Pin-tailed Snipe [841]		Roosting likely to occur within area
Haliaeetus leucogaster		
White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Heteroscelus brevipes		
Grey-tailed Tattler [59311]		Foraging, feeding or related behaviour known to occur within area
Himantopus himantopus		
Pied Stilt, Black-winged Stilt [870]		Roosting known to occur within area
Limosa lapponica		
Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Limosa limosa		
Black-tailed Godwit [845]		Roosting known to occur within area
Macronectes giganteus		
Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli		
Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Merops ornatus		
Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea		
Grey Wagtail [642]		Species or species habitat may occur within area
Numenius madagascariensis		
Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Numenius minutus		
Little Curlew, Little Whimbrel [848]		Roosting likely to occur within area
Numenius phaeopus		
Whimbrel [849]		Foraging, feeding or related behaviour known to occur within area
Pachyptila turtur		
Fairy Prion [1066]		Species or species habitat known to occur within area
Pandion haliaetus		
Osprey [952]		Breeding known to occur within area
Phalaropus lobatus		
Red-necked Phalarope [838]		Foraging, feeding or related behaviour known to occur within area
Philomachus pugnax		
Ruff (Reeve) [850]		Roosting known to occur within area
Pluvialis fulva		
Pacific Golden Plover [25545]		Foraging, feeding or related behaviour known to occur within area

Name	Threatened	Type of Presence
Pluvialis squatarola		
Grey Plover [865]		Foraging, feeding or related behaviour known to occur within area
Puffinus carneipes		
Flesh-footed Shearwater, Fleshy-footed Shearwater [1043]		Species or species habitat likely to occur within area
Recurvirostra novaehollandiae		
Red-necked Avocet [871]		Roosting known to occur within area
Rostratula benghalensis (sensu lato)		
Painted Snipe [889]	Endangered*	Species or species habitat known to occur within area
Sterna dougallii		
Roseate Tern [817]		Foraging, feeding or related behaviour likely to occur within area
Thalassarche cauta		
Shy Albatross [89224]	Vulnerable*	Species or species habitat likely to occur within area
Thalassarche impavida		
Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris		
Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche steadi		
White-capped Albatross [64462]	Vulnerable*	Species or species habitat likely to occur within area
Thinornis rubricollis		
Hooded Plover [59510]		Species or species habitat known to occur within area
Tringa glareola		
Wood Sandpiper [829]		Roosting known to occur within area
Tringa nebularia		
Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
Tringa stagnatilis		
Marsh Sandpiper, Little Greenshank [833]		Roosting known to occur within area
Tringa totanus		
Common Redshank, Redshank [835]		Foraging, feeding or related behaviour known to occur within area
Xenus cinereus		
Terek Sandpiper [59300]		Foraging, feeding or related behaviour known to occur within area
Mammals		
Neophoca cinerea		
Australian Sea-lion, Australian Sea Lion [22]	Vulnerable	Species or species habitat known to occur within area
Reptiles		
Caretta caretta		
Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas		
Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea		
Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or

Name	Threatened	Type of Presence
		related behaviour known to occur within area
Natator depressus		
Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area

Extra Information

State and Territory Reserves [Resource Information]

Name	State
Alfred Cove	WA
Balannup Lake	WA
Canning River	WA
Forrestdale Lake	WA
Gibbs Road	WA
Harry Waring Marsupial Reserve	WA
Piara	WA
Swan River	WA
Thomsons Lake	WA
Unnamed WA39752	WA
Unnamed WA44414	WA
Unnamed WA48291	WA
Unnamed WA49362	WA
Unnamed WA49363	WA
Unnamed WA49561	WA

Invasive Species [Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Acridotheres tristis		
Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Anas platyrhynchos		
Mallard [974]		Species or species habitat likely to occur within area
Carduelis carduelis		
European Goldfinch [403]		Species or species habitat likely to occur within area
Columba livia		
Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Passer domesticus		
House Sparrow [405]		Species or species habitat likely to occur within area
Passer montanus		
Eurasian Tree Sparrow [406]		Species or species habitat likely to occur within area
Streptopelia chinensis		
Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Streptopelia senegalensis		
Laughing Turtle-dove, Laughing Dove [781]		Species or species habitat likely to occur within area
Sturnus vulgaris		
Common Starling [389]		Species or species habitat likely to occur within area
Turdus merula		
Common Blackbird, Eurasian Blackbird [596]		Species or species habitat likely to occur within area
Mammals		
Bos taurus		
Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris		
Domestic Dog [82654]		Species or species habitat likely to occur within area
Felis catus		
Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Funambulus pennantii		
Northern Palm Squirrel, Five-striped Palm Squirrel [129]		Species or species habitat likely to occur within area
Mus musculus		
House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus		
Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus norvegicus		
Brown Rat, Norway Rat [83]		Species or species habitat likely to occur within area
Rattus rattus		
Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Vulpes vulpes		
Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Anredera cordifolia		
Madeira Vine, Jalap, Lamb's-tail, Mignonette Vine, Anredera, Gulf Madeiravine, Heartleaf Madeiravine, Potato Vine [2643]		Species or species habitat likely to occur within area
Asparagus aethiopicus		
Asparagus Fern, Ground Asparagus, Basket Fern, Sprengi's Fern, Bushy Asparagus, Emerald Asparagus [62425]		Species or species habitat likely to occur within area
Asparagus asparagoides		
Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Asparagus plumosus		
Climbing Asparagus-fern [48993]		Species or species habitat likely to occur within area
Brachiaria mutica		
Para Grass [5879]		Species or species habitat may occur within

Name	Status	Type of Presence
		area
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat may occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area
Chrysanthemoides monilifera subsp. monilifera Boneseed [16905]		Species or species habitat likely to occur within area
Genista linifolia Flax-leaved Broom, Mediterranean Broom, Flax Broom [2800]		Species or species habitat likely to occur within area
Genista monspessulana Montpellier Broom, Cape Broom, Canary Broom, Common Broom, French Broom, Soft Broom [20126]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Olea europaea Olive, Common Olive [9160]		Species or species habitat may occur within area
Opuntia spp. Prickly Pears [82753]		Species or species habitat likely to occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Sagittaria platyphylla Delta Arrowhead, Arrowhead, Slender Arrowhead [68483]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
Solanum elaeagnifolium Silver Nightshade, Silver-leaved Nightshade, White Horse Nettle, Silver-leaf Nightshade, Tomato Weed, White Nightshade, Bull-nettle, Prairie-berry, Satansbos, Silver-leaf Bitter-apple, Silverleaf-nettle, Trompillo [12323]		Species or species habitat likely to occur within area
Tamarix aphylla Athel Pine, Athel Tree, Tamarisk, Athel Tamarisk, Athel Tamarix, Desert Tamarisk, Flowering Cypress, Salt Cedar [16018]		Species or species habitat likely to occur within area
Reptiles		

Name	Status	Type of Presence
Hemidactylus frenatus Asian House Gecko [1708]		Species or species habitat likely to occur within area

Nationally Important Wetlands	[Resource Information]
Name	State
Booragoon Swamp	WA
Gibbs Road Swamp System	WA
Swan-Canning Estuary	WA
Thomsons Lake	WA

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

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

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

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

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

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

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

Coordinates

-32.10414 115.85615

Acknowledgements

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

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

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

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

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NatureMap Species Report

Created By Guest user on 16/06/2020

Kingdom Animalia
Current Names Only Yes
Core Datasets Only Yes
Method 'By Circle'
Centre 115° 51' 22" E,32° 06' 15" S
Buffer 10km

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
1.	24559	*Acanthagenys rufogularis (Spiny-cheeked Honeyeater)*			
2.	24260	*Acanthiza apicalis (Broad-tailed Thornbill, Inland Thornbill)*			
3.	24261	*Acanthiza chrysorrhoa (Yellow-rumped Thornbill)*			
4.	24262	*Acanthiza inornata (Western Thornbill)*			
5.	24560	*Acanthorhynchus superciliosus (Western Spinebill)*			
6.	25535	*Accipiter cirrocephalus (Collared Sparrowhawk)*			
7.	25536	*Accipiter fasciatus (Brown Goshawk)*			
8.	24283	*Accipiter fasciatus subsp. didimus (Brown Goshawk)*			
9.	24282	*Accipiter fasciatus subsp. fasciatus (Brown Goshawk)*			
10.		*Acentrogobius bifrenatus*			
11.		*Acercella falcipes*			
12.	42368	*Acritoscincus trilineatus (Western Three-lined Skink)*			
13.	25755	*Acrocephalus australis (Australian Reed Warbler)*			
14.	24831	*Acrocephalus australis subsp. gouldi (Australian Reed Warbler)*			
15.	41323	*Actitis hypoleucos (Common Sandpiper)*		IA	
16.	25544	*Aegotheles cristatus (Australian Owlet-nightjar)*			
17.		*Afurcagobius suppositus*			
18.		*Akamptogonus novarae*			
19.		*Aldrichetta forsteri*			
20.		*Allothereua maculata*			
21.		*Aname mainae*			
22.		*Aname tepperi*			
23.	24310	*Anas castanea (Chestnut Teal)*			
24.	24312	*Anas gracilis (Grey Teal)*			
25.	24313	*Anas platyrhynchos (Mallard)*			
26.		*Anas platyrhynchos subsp. domesticus*			
27.	24315	*Anas rhynchotis (Australasian Shoveler)*			
28.	24316	*Anas superciliosa (Pacific Black Duck)*			
29.	47414	*Anhinga novaehollandiae (Australasian Darter)*			
30.	44629	*Anilios australis*			
31.		*Anoplocapros lenticularis*			
32.	24506	*Anous tenuirostris subsp. melanops (Australian Lesser Noddy)*		T	
33.		*Anser anser*			
34.	24561	*Anthochaera carunculata (Red Wattlebird)*			
35.	24562	*Anthochaera lunulata (Western Little Wattlebird)*			
36.		*Aploactisoma milesii*			
37.		*Apogon rueppellii*			
38.	24991	*Aprasia repens (Sand-plain Worm-lizard)*			
39.	25554	*Apus pacificus (Fork-tailed Swift, Pacific Swift)*		IA	
40.	24285	*Aquila audax (Wedge-tailed Eagle)*			
41.		*Arachnura higginsi*			
42.		*Araneus cyphoxis*			
43.		*Araneus eburneiventris*			
44.		*Araneus senicaudatus*			
45.	24337	*Ardea garzetta subsp. nigripes (Little Egret)*			
46.	25558	*Ardea ibis (Cattle Egret)*			
47.	25559	*Ardea intermedia (Intermediate Egret)*			
48.	41324	*Ardea modesta (great egret, white egret)*			
49.	24340	*Ardea novaehollandiae (White-faced Heron)*			
50.	24341	*Ardea pacifica (White-necked Heron)*			
51.	25560	*Ardea sacra (Eastern Reef Egret, Eastern Reef Heron)*			
52.	25736	*Arenaria interpres (Ruddy Turnstone)*		IA	

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
53.		*Arenigobius bifrenatus*			
54.		*Argiope protensa*			
55.		*Argiope trifasciata*			
56.		*Arkys walckenaeri*			
57.	25566	*Artamus cinereus (Black-faced Woodswallow)*			
58.	24352	*Artamus cinereus subsp. melanops (Black-faced Woodswallow)*			
59.	24353	*Artamus cyanopterus (Dusky Woodswallow)*			
60.		*Artema atlanta*			
61.		*Artoria flavimana*			
62.		*Artoria linnaei*			
63.		*Artoria taeniifera*			
64.		*Artoriopsis eccentrica*			
65.		*Artoriopsis expolita*			
66.		*Artoriopsis joergi*			
67.		*Atherinomorus vaigiensis*			
68.		*Atherinosoma wallacei*			
69.		*Aurecocrypta lugubris*			
70.		*Austracantha minax*			
71.	47713	*Austronomus australis (White-striped Free-tailed Bat)*			
72.	24318	*Aythya australis (Hardhead)*			
73.		*Backobourkia heroine*			
74.		*Badumna insignis*			
75.		*Ballarra longipalpus*			
76.		*Barnardius zonarius*			
77.	24319	*Biziura lobata (Musk Duck)*			
78.	24345	*Botaurus poiciloptilus (Australasian Bittern)*		T	
79.	42380	*Brachyurophis fasciolatus subsp. fasciolatus (Narrow-banded Shovel-nosed Snake)*			
80.	42381	*Brachyurophis semifasciatus (Southern Shovel-nosed Snake)*			
81.	25713	*Cacatua galerita (Sulphur-crested Cockatoo)*			
82.	25714	*Cacatua pastinator (Western Long-billed Corella)*			
83.	25715	*Cacatua roseicapilla (Galah)*			
84.	25716	*Cacatua sanguinea (Little Corella)*			
85.	24729	*Cacatua tenuirostris (Eastern Long-billed Corella)*	Y		
86.	25598	*Cacomantis flabelliformis (Fan-tailed Cuckoo)*			
87.	24427	*Cacomantis flabelliformis subsp. flabelliformis (Fan-tailed Cuckoo)*			
88.	42307	*Cacomantis pallidus (Pallid Cuckoo)*			
89.	24779	*Calidris acuminata (Sharp-tailed Sandpiper)*		IA	
90.	24780	*Calidris alba (Sanderling)*		IA	
91.	25738	*Calidris canutus (Red Knot, knot)*		IA	
92.	24784	*Calidris ferruginea (Curlew Sandpiper)*		T	
93.	24786	*Calidris melanotos (Pectoral Sandpiper)*		IA	
94.	24787	*Calidris minuta (Little Stint)*			
95.	24788	*Calidris ruficollis (Red-necked Stint)*		IA	
96.		*Calidris sp.*			
97.	24789	*Calidris subminuta (Long-toed Stint)*		IA	
98.	24790	*Calidris tenuirostris (Great Knot)*		T	
99.	25717	*Calyptorhynchus banksii (Red-tailed Black-Cockatoo)*			
100.	24731	*Calyptorhynchus banksii subsp. naso (Forest Red-tailed Black Cockatoo)*		T	
101.	24733	*Calyptorhynchus baudinii (Baudin's Cockatoo, White-tailed Long-billed Black Cockatoo)*		T	
102.	24734	*Calyptorhynchus latirostris (Carnaby's Cockatoo, White-tailed Short-billed Black Cockatoo)*		T	
103.	48400	*Calyptorhynchus sp. (white-tailed black cockatoo)*		T	
104.		*Carassius auratus*			
105.	34031	*Carcharodon carcharias (Great White Shark)*		T	
106.	25335	*Caretta caretta (Loggerhead Turtle)*		T	
107.		*Cercophonius sulcatus*			
108.	24186	*Chalinolobus gouldii (Gould's Wattled Bat)*			
109.	24187	*Chalinolobus morio (Chocolate Wattled Bat)*			
110.	25574	*Charadrius dubius (Little Ringed Plover)*		IA	
111.	25575	*Charadrius leschenaultii (Greater Sand Plover)*		T	
112.	24377	*Charadrius ruficapillus (Red-capped Plover)*			
113.		*Cheilodactylus gibbosus*			
114.	43380	*Chelodina colliei (South-western Snake-necked Turtle)*			
115.	24321	*Chenonetta jubata (Australian Wood Duck, Wood Duck)*			
116.	47909	*Cheramoeca leucosterna (White-backed Swallow)*			
117.	33939	*Cherax cainii (Marron)*			
118.		*Cherax destructor*			
119.		*Cherax preissii*			
120.		*Cherax quinquecarinatus*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
121.		*Cherax sp.*			
122.	41332	*Chlidonias leucopterus (White-winged Black Tern, white-winged tern)*		IA	
123.	24980	*Christinus marmoratus (Marbled Gecko)*			
124.		*Chroicocephalus novaehollandiae*			
125.	25601	*Chrysococcyx lucidus (Shining Bronze Cuckoo)*			
126.	24432	*Chrysococcyx lucidus subsp. plagosus (Shining Bronze Cuckoo)*			
127.	24288	*Circus approximans (Swamp Harrier)*			
128.	24289	*Circus assimilis (Spotted Harrier)*			
129.	24774	*Cladorhynchus leucocephalus (Banded Stilt)*			
130.		*Clynotis albobarbatus*			
131.		*Cnidoglanis macrocephalus*			
132.	25675	*Colluricincla harmonica (Grey Shrike-thrush)*			
133.	24399	*Columba livia (Domestic Pigeon)*	Y		
134.	25568	*Coracina novaehollandiae (Black-faced Cuckoo-shrike)*			
135.	24362	*Coracina novaehollandiae subsp. novaehollandiae (Black-faced Cuckoo-shrike)*			
136.		*Cormocephalus aurantiipes*			
137.		*Cormocephalus novaehollandiae*			
138.		*Cormocephalus rubriceps*			
139.	24416	*Corvus bennetti (Little Crow)*			
140.	25592	*Corvus coronoides (Australian Raven)*			
141.	24417	*Corvus coronoides subsp. perplexus (Australian Raven)*			
142.	24671	*Coturnix pectoralis (Stubble Quail)*			
143.	25701	*Coturnix ypsilophora (Brown Quail)*			
144.	24673	*Coturnix ypsilophora subsp. australis (Brown Quail)*			
145.	24420	*Cracticus nigrogularis (Pied Butcherbird)*			
146.	25595	*Cracticus tibicen (Australian Magpie)*			
147.	24422	*Cracticus tibicen subsp. dorsalis (White-backed Magpie)*			
148.	24423	*Cracticus tibicen subsp. tibicen (Black-backed Magpie)*			
149.	25596	*Cracticus torquatus (Grey Butcherbird)*			
150.	24424	*Cracticus torquatus subsp. torquatus (Grey Butcherbird)*			
151.		*Craterocephalus mugiloides*			
152.	25398	*Crinia georgiana (Quacking Frog)*			
153.	25399	*Crinia glauerti (Clicking Frog)*			
154.	25400	*Crinia insignifera (Squelching Froglet)*			
155.	25401	*Crinia pseudinsignifera (Bleating Froglet)*			
156.		*Cristiceps sp.*			
157.		*Crustulina bicruciata*			
158.	30893	*Cryptoblepharus buchananii*			
159.	25020	*Cryptoblepharus plagiocephalus*			
160.		*Cryptoerithus quobba*			
161.	30899	*Ctenophorus adelaidensis (Southern Heath Dragon, Western Heath Dragon)*			
162.	25027	*Ctenotus australis*			
163.	25039	*Ctenotus fallens*			
164.	25040	*Ctenotus gemmula (Jewelled South-west Ctenotus (Swan Coastal Plain subpop P3), skink)*			
165.	25047	*Ctenotus impar*			
166.		*Cyclosa trilobata*			
167.	24322	*Cygnus atratus (Black Swan)*			
168.	24323	*Cygnus olor (Mute Swan)*	Y		
169.		*Cyrtophora parnasia*			
170.	30901	*Dacelo novaeguineae (Laughing Kookaburra)*	Y		
171.		*Dactylopus dactylopus*			
172.		*Daphnia carinata*			
173.	25673	*Daphoenositta chrysoptera (Varied Sittella)*			
174.	24092	*Dasyurus geoffroii (Chuditch, Western Quoll)*		T	
175.		*Delena cancerides*			
176.	25766	*Delma fraseri (Fraser's Legless Lizard)*			
177.	24999	*Delma grayii*			
178.	25468	*Demansia psammophis (Yellow-faced Whipsnake)*			
179.	25296	*Demansia psammophis subsp. reticulata (Yellow-faced Whipsnake)*			
180.	24324	*Dendrocygna arcuata (Wandering Whistling Duck, Chestnut Whistling Duck)*			
181.	25346	*Dermochelys coriacea (Leatherback Turtle)*		T	
182.	25607	*Dicaeum hirundinaceum (Mistletoebird)*			
183.		*Dingosa serrata*			
184.	30836	*Diomedea exulans subsp. exulans (Snowy Albatross)*		T	
185.	44654	*Diplodactylus lateroides (Speckled Stone Gecko)*			
186.	24470	*Dromaius novaehollandiae (Emu)*			
187.	25096	*Egernia kingii (King's Skink)*			
188.	25100	*Egernia napoleonis*			
189.		*Egretta garzetta*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
190.		*Egretta novaehollandiae*			
191.		*Elanus axillaris*			
192.	25540	*Elanus caeruleus (Black-shouldered Kite)*			
193.	24290	*Elanus caeruleus subsp. axillaris (Australian Black-shouldered Kite)*			
194.	25250	*Elapognathus coronatus (Crowned Snake)*			
195.	47937	*Elseyornis melanops (Black-fronted Dotterel)*			
196.		*Eodelena convexa*			
197.		*Eodelena lapidicola*			
198.		*Eolophus roseicapillus*			
199.		*Epinephelus sp.*			
200.	24567	*Epthianura albifrons (White-fronted Chat)*			
201.		*Eriophora biapicata*			
202.		*Ero aphana*			
203.		*Erythracarus decoris*			
204.	24379	*Erythrogonys cinctus (Red-kneed Dotterel)*			
205.		*Ethmostigmus rubripes*			
206.	24368	*Eurostopodus argus (Spotted Nightjar)*			
207.	25591	*Eurystomus orientalis (Dollarbird)*			
208.	25621	*Falco berigora (Brown Falcon)*			
209.	24471	*Falco berigora subsp. berigora (Brown Falcon)*			
210.	25622	*Falco cenchroides (Australian Kestrel, Nankeen Kestrel)*			
211.	25623	*Falco longipennis (Australian Hobby)*			
212.	25624	*Falco peregrinus (Peregrine Falcon)*		S	
213.	24189	*Falsistrellus mackenziei (Western False Pipistrelle, Western Falsistrelle)*		P4	
214.	24041	*Felis catus (Cat)*	Y		
215.	25727	*Fulica atra (Eurasian Coot)*			
216.	24761	*Fulica atra subsp. australis (Eurasian Coot)*			
217.	30916	*Funambulus pennanti (Indian Palm Squirrel)*	Y		
218.		*Galaxias maculatus*			
219.	24791	*Gallinago hardwickii (Latham's Snipe, Japanese snipe)*		IA	
220.	24793	*Gallinago stenura (Pin-tailed Snipe)*		IA	
221.	25729	*Gallinula tenebrosa (Dusky Moorhen)*			
222.	24763	*Gallinula tenebrosa subsp. tenebrosa (Dusky Moorhen)*			
223.	25730	*Gallirallus philippensis (Buff-banded Rail)*			
224.	42314	*Gavicalis virescens (Singing Honeyeater)*			
225.		*Gea theridioides*			
226.	24959	*Gehyra variegata*			
227.	47954	*Gelochelidon nilotica (Gull-billed Tern)*		IA	
228.		*Geogarypus taylori*			
229.	24401	*Geopelia cuneata (Diamond Dove)*			
230.	25530	*Gerygone fusca (Western Gerygone)*			
231.	24271	*Gerygone fusca subsp. fusca (Western Gerygone)*			
232.	47962	*Glyciphila melanops (Tawny-crowned Honeyeater)*			
233.	24443	*Grallina cyanoleuca (Magpie-lark)*			
234.		*Gymnapistes marmoratus*			
235.	25627	*Haematopus fuliginosus (Sooty Oystercatcher)*			
236.	24487	*Haematopus longirostris (Pied Oystercatcher)*			
237.	24293	*Haliaeetus leucogaster (White-bellied Sea-Eagle)*			
238.	24295	*Haliastur sphenurus (Whistling Kite)*			
239.	25410	*Heleioporus eyrei (Moaning Frog)*			
240.	25119	*Hemiergis quadrilineata*			
241.		*Henicops dentatus*			
242.	24961	*Heteronotia binoei (Bynoe's Gecko)*			
243.	47965	*Hieraaetus morphnoides (Little Eagle)*			
244.	25734	*Himantopus himantopus (Black-winged Stilt)*			
245.	24775	*Himantopus himantopus subsp. leucocephalus (Black-winged Stilt)*			
246.		*Hippocampus elongatus*			
247.	24491	*Hirundo neoxena (Welcome Swallow)*			
248.		*Hogna crispipes*			
249.		*Holconia westralia*			
250.	24215	*Hydromys chrysogaster (Water-rat, Rakali)*		P4	
251.	25366	*Hydrophis elegans (Elegant Seasnake, Bar-bellied Seasnake)*			
252.	42410	*Hydrophis ornatus (Ornate Reef Seasnake, Sea Snake)*			
253.	43384	*Hydrophis platurus (Yellow-bellied Seasnake)*			
254.	48587	*Hydroprogne caspia (Caspian Tern)*		IA	
255.		*Hyperlophus vittatus*			
256.		*Hyporhamphus regularis*			
257.		*Idiommata blackwalli*			
258.		*Idiosoma hirsutum*			
259.	48935	*Idiosoma sigillatum (Swan Coastal Plain shield-backed trapdoor spider)*		P3	

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260.	48588	*Isoodon fusciventer (Quenda, southwestern brown bandicoot)*		P4	
261.		*Isopeda leishmanni*			
262.	47975	*Ixobrychus dubius (Australian Little Bittern)*		P4	
263.		*Ixodes australiensis*			
264.		*Kangarosa ludwigi*			
265.		*Kangarosa properipes*			
266.		*Lampona brevipes*			
267.		*Lampona cylindrata*			
268.	25637	*Larus novaehollandiae (Silver Gull)*			
269.	24511	*Larus novaehollandiae subsp. novaehollandiae (Silver Gull)*			
270.	25638	*Larus pacificus (Pacific Gull)*			
271.		*Latrodectus hasseltii*			
272.	33982	*Leioproctus contrarius (a short-tongued bee)*		P3	
273.	25128	*Lerista christinae*			
274.	25131	*Lerista distinguenda*			
275.	25133	*Lerista elegans*			
276.	25147	*Lerista lineata (Perth Slider, Lined Skink)*		P3	
277.		*Leucauge dromedaria*			Y
278.	25005	*Lialis burtonis*			
279.	25661	*Lichmera indistincta (Brown Honeyeater)*			
280.	24582	*Lichmera indistincta subsp. indistincta (Brown Honeyeater)*			
281.	25415	*Limnodynastes dorsalis (Western Banjo Frog)*			
282.	30932	*Limosa lapponica (Bar-tailed Godwit)*		IA	
283.	25741	*Limosa limosa (Black-tailed Godwit)*		IA	
284.	24797	*Limosa limosa subsp. melanuroides (Black-tailed Godwit)*		IA	
285.	25378	*Litoria adelaidensis (Slender Tree Frog)*			
286.	25388	*Litoria moorei (Motorbike Frog)*			
287.	25683	*Lonchura castaneothorax (Chestnut-breasted Mannikin)*			
288.		*Longepi woodman*			
289.		*Lophoictinia isura*			
290.		*Lycosa ariadnae*			
291.		*Lycosa australicola*			
292.		*Lycosa gilberta*			
293.		*Lycosa lacertosa*			
294.	24132	*Macropus fuliginosus (Western Grey Kangaroo)*			
295.	24326	*Malacorhynchus membranaceus (Pink-eared Duck)*			
296.	25651	*Malurus lamberti (Variegated Fairy-wren)*			
297.	25654	*Malurus splendens (Splendid Fairy-wren)*			
298.	24583	*Manorina flavigula (Yellow-throated Miner)*			
299.		*Maratus pavonis*			
300.	25758	*Megalurus gramineus (Little Grassbird)*			
301.	47997	*Melanodryas cucullata (Hooded Robin)*			
302.	25663	*Melithreptus brevirostris (Brown-headed Honeyeater)*			
303.	24587	*Melithreptus chloropsis (Western White-naped Honeyeater)*			
304.	24736	*Melopsittacus undulatus (Budgerigar)*			
305.	25184	*Menetia greyii*			
306.	24598	*Merops ornatus (Rainbow Bee-eater)*			
307.		*Microcarbo melanoleucos*			
308.	25693	*Microeca fascinans (Jacky Winter)*			
309.	25542	*Milvus migrans (Black Kite)*			
310.		*Missulena granulosa*			
311.		*Missulena occatoria*			
312.		*Mituliodon tarantulinus*			
313.		*Mitzoruga insularis*			
314.		*Molycria vokes*			
315.	25191	*Morethia lineoocellata*			
316.	25192	*Morethia obscura*			
317.	48008	*Morus serrator (Australasian Gannet)*			
318.		*Mugil cephalus*			
319.	24223	*Mus musculus (House Mouse)*	Y		
320.	24042	*Mustela putorius (European Polecat, Ferret)*	Y		
321.		*Myandra bicincta*			
322.	25610	*Myiagra inquieta (Restless Flycatcher)*			
323.	25420	*Myobatrachus gouldii (Turtle Frog)*			
324.	24146	*Myrmecobius fasciatus (Numbat, Walpurti)*		T	
325.		*Nanometa gentilis*			
326.	25248	*Neelaps bimaculatus (Black-naped Snake)*			
327.	25249	*Neelaps calonotos (Black-striped Snake, black-striped burrowing snake)*		P3	
328.	33984	*Neopasiphae simplicior (a short-tongued bee)*		T	
329.	24738	*Neophema elegans (Elegant Parrot)*			

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330.	24739	*Neophema petrophila (Rock Parrot)*			
331.		*Nephila edulis*			
332.		*Nicodamus mainae*			
333.	25747	*Ninox connivens (Barking Owl)*			
334.	48024	*Notamacropus eugenii subsp. derbianus (Tammar Wallaby, Tammar)*		P4	
335.	48022	*Notamacropus irma (Western Brush Wallaby)*		P4	
336.	25252	*Notechis scutatus (Tiger Snake)*			
337.		*Notiasemus glauerti*			
338.	24798	*Numenius madagascariensis (Eastern Curlew)*		T	
339.	25742	*Numenius phaeopus (Whimbrel)*		IA	
340.	25564	*Nycticorax caledonicus (Rufous Night Heron)*			
341.	24194	*Nyctophilus geoffroyi (Lesser Long-eared Bat)*			
342.	24742	*Nymphicus hollandicus (Cockatiel)*			
343.		*Ocrisiona leucocomis*			
344.	24407	*Ocyphaps lophotes (Crested Pigeon)*			
345.		*Oecobius navus*			
346.		*Ommatoiulus moreleti*			
347.		*Ommatoiulus moreletii*			
348.		*Ophisurus serpens*			
349.	24085	*Oryctolagus cuniculus (Rabbit)*	Y		
350.	24328	*Oxyura australis (Blue-billed Duck)*		P4	
351.	25680	*Pachycephala rufiventris (Rufous Whistler)*			
352.	24624	*Pachycephala rufiventris subsp. rufiventris (Rufous Whistler)*			
353.	24692	*Pachyptila belcheri (Slender-billed Prion)*			
354.	48591	*Pandion cristatus (Osprey, Eastern Osprey)*		IA	
355.		*Papillogobius punctatus*			
356.		*Paralamyctes cammooensis*			Y
357.	25253	*Parasuta gouldii*			
358.	25255	*Parasuta nigriceps*			
359.	25681	*Pardalotus punctatus (Spotted Pardalote)*			
360.	25682	*Pardalotus striatus (Striated Pardalote)*			
361.		*Pediana occidentalis*			
362.		*Pegasus volitans*			
363.		*Pelates sexlineatus*			
364.	24648	*Pelecanus conspicillatus (Australian Pelican)*			
365.	48060	*Petrochelidon ariel (Fairy Martin)*			
366.	48061	*Petrochelidon nigricans (Tree Martin)*			
367.	48066	*Petroica boodang (Scarlet Robin)*			
368.	24659	*Petroica goodenovii (Red-capped Robin)*			
369.	24663	*Phaethon rubricauda (Red-tailed Tropicbird)*		P4	
370.	25697	*Phalacrocorax carbo (Great Cormorant)*			
371.	24665	*Phalacrocorax fuscescens (Black-faced Cormorant)*			
372.	25698	*Phalacrocorax melanoleucos (Little Pied Cormorant)*			
373.	24666	*Phalacrocorax melanoleucos subsp. melanoleucos (Little Pied Cormorant)*			
374.	24667	*Phalacrocorax sulcirostris (Little Black Cormorant)*			
375.	25699	*Phalacrocorax varius (Pied Cormorant)*			
376.		*Phalloceros harpagos*			Y
377.	24409	*Phaps chalcoptera (Common Bronzewing)*			
378.	25587	*Phaps elegans (Brush Bronzewing)*			
379.		*Phenasteron longiconductor*			
380.	24802	*Philomachus pugnax (Ruff, reeve)*		IA	
381.		*Pholcus phalangioides*			
382.	48071	*Phylidonyris niger (White-cheeked Honeyeater)*			
383.	24596	*Phylidonyris novaehollandiae (New Holland Honeyeater)*			
384.		*Pinkfloydia harveii*			
385.		*Piona cumberlandensis*			
386.	24841	*Platalea flavipes (Yellow-billed Spoonbill)*			
387.	24842	*Platalea regia (Royal Spoonbill)*			
388.	25720	*Platycercus icterotis (Western Rosella)*			
389.	24747	*Platycercus spurius (Red-capped Parrot)*			
390.	25721	*Platycercus zonarius (Australian Ringneck, Ring-necked Parrot)*			
391.	24750	*Platycercus zonarius subsp. semitorquatus (Twenty-eight Parrot)*			
392.	24843	*Plegadis falcinellus (Glossy Ibis)*		IA	
393.	25509	*Pletholax gracilis (Keeled Legless Lizard)*			
394.	25007	*Pletholax gracilis subsp. gracilis (Keeled Legless Lizard)*			
395.	24382	*Pluvialis fulva (Pacific Golden Plover)*		IA	
396.	24383	*Pluvialis squatarola (Grey Plover)*		IA	
397.	25703	*Podargus strigoides (Tawny Frogmouth)*			
398.	24679	*Podargus strigoides subsp. brachypterus (Tawny Frogmouth)*			
399.	25704	*Podiceps cristatus (Great Crested Grebe)*			

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400.		*Podykipus collinus*			
401.	25510	*Pogona minor (Dwarf Bearded Dragon)*			
402.	24907	*Pogona minor subsp. minor (Dwarf Bearded Dragon)*			
403.	24681	*Poliocephalus poliocephalus (Hoary-headed Grebe)*			
404.		*Poltys laciniosus*			
405.	25722	*Polytelis anthopeplus (Regent Parrot)*			
406.	25731	*Porphyrio porphyrio (Purple Swamphen)*			
407.	24767	*Porphyrio porphyrio subsp. bellus (Purple Swamphen)*			
408.	24769	*Porzana fluminea (Australian Spotted Crake)*			
409.	25732	*Porzana pusilla (Baillon's Crake)*			
410.	24770	*Porzana pusilla subsp. palustris (Baillon's Crake)*			
411.	24771	*Porzana tabuensis (Spotless Crake)*			
412.		*Priolepis nuchifasciata*			
413.		*Prionosternum scutatum*			
414.		*Pseudolampona woodman*			
415.	25511	*Pseudonaja affinis (Dugite)*			
416.	25259	*Pseudonaja affinis subsp. affinis (Dugite)*			
417.	42416	*Pseudonaja mengdeni (Western Brown Snake)*			
418.	25433	*Pseudophryne guentheri (Crawling Toadlet)*			
419.	48085	*Psittacula krameri (Indian Ringnecked Parrot, Rose-ringed Parakeet)*	Y		
420.	24703	*Pterodroma lessonii (White-headed Petrel)*			
421.		*Pterygotrigla polyommata*			
422.	24711	*Puffinus assimilis subsp. assimilis (Little Shearwater)*			
423.	42344	*Purnella albifrons (White-fronted Honeyeater)*			
424.		*Purpureicephalus spurius*			
425.	25008	*Pygopus lepidopodus (Common Scaly Foot)*			
426.	24243	*Rattus fuscipes (Western Bush Rat)*			
427.	24244	*Rattus norvegicus (Brown Rat)*	Y		
428.	24245	*Rattus rattus (Black Rat)*	Y		
429.		*Raveniella arenacea*			
430.		*Raveniella cirrata*			
431.		*Raveniella peckorum*			
432.		*Raveniella subcirrata*			
433.	24776	*Recurvirostra novaehollandiae (Red-necked Avocet)*			
434.	48096	*Rhipidura albiscapa (Grey Fantail)*			
435.	25614	*Rhipidura leucophrys (Willie Wagtail)*			
436.	24454	*Rhipidura leucophrys subsp. leucophrys (Willie Wagtail)*			
437.	48237	*Rostratula australis (Australian Painted Snipe)*		T	
438.		*Scolopendra laeta*			
439.		*Scomberoides lysan*			
440.	25534	*Sericornis frontalis (White-browed Scrubwren)*			
441.		*Servaea melaina*			
442.	24145	*Setonix brachyurus (Quokka)*		T	
443.		*Sillago burrus*			
444.		*Simaetha tenuior*			
445.	25266	*Simoselaps bertholdi (Jan's Banded Snake)*			
446.		*Smeringopus natalensis*			
447.	30948	*Smicrornis brevirostris (Weebill)*			
448.		*Solaenodolichopus pruvoti*			
449.		*Steatoda capensis*			
450.	24526	*Sterna hirundo subsp. hirundo (Common Tern)*		IA	Y
451.	24528	*Sterna hybrida subsp. javanica (Whiskered Tern)*			
452.	48594	*Sternula nereis (Fairy Tern)*			
453.	48595	*Sternula nereis subsp. nereis (Fairy Tern)*		T	
454.	24329	*Stictonetta naevosa (Freckled Duck)*			
455.		*Stigmatopora argus*			
456.	25597	*Strepera versicolor (Grey Currawong)*			
457.	25589	*Streptopelia chinensis (Spotted Turtle-Dove)*	Y		
458.	25590	*Streptopelia senegalensis (Laughing Turtle-Dove)*	Y		
459.	30950	*Streptopelia senegalensis subsp. senegalensis (Laughing Turtle-Dove)*	Y		
460.	25518	*Strophurus spinigerus*			
461.	24942	*Strophurus spinigerus subsp. spinigerus*			
462.	24946	*Strophurus strophurus*			
463.		*Supunna funerea*			
464.		*Supunna picta*			
465.	33992	*Synemon gratiosa (Graceful Sunmoth)*		P4	
466.		*Synothele michaelseni*			
467.		*Synothele rastelloides*			
468.	25705	*Tachybaptus novaehollandiae (Australasian Grebe, Black-throated Grebe)*			
469.	24682	*Tachybaptus novaehollandiae subsp. novaehollandiae (Australasian Grebe, Black-*			

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		throated Grebe)			
470.	24207	*Tachyglossus aculeatus (Short-beaked Echidna)*			
471.	25552	*Tadorna radjah (Radjah Shelduck)*			
472.	24331	*Tadorna tadornoides (Australian Shelduck, Mountain Duck)*			
473.		*Tamopsis darlingtoniana*			
474.	24167	*Tarsipes rostratus (Honey Possum, Noolbenger)*			
475.		*Tasmanicosa leuckartii*			
476.		*Tetragnatha demissa*			
477.		*Tetragnatha nitens*			
478.	48597	*Thalasseus bergii (Crested Tern)*		IA	
479.	48135	*Thinornis rubricollis (Hooded Plover, Hooded Dotterel)*		P4	
480.	48136	*Threskiornis moluccus (Australian White Ibis)*			
481.	24845	*Threskiornis spinicollis (Straw-necked Ibis)*			
482.	33994	*Throscodectes xiphos (Stylet Bush Cricket, Stylet Throsco (Jandakot))*		P1	Y
483.	25203	*Tiliqua occipitalis (Western Bluetongue)*			
484.	25519	*Tiliqua rugosa*			
485.	25204	*Tiliqua rugosa subsp. aspera*			
486.	25207	*Tiliqua rugosa subsp. rugosa*			
487.		*Tinytrema yarra*			
488.	25549	*Todiramphus sanctus (Sacred Kingfisher)*			
489.	24309	*Todiramphus sanctus subsp. sanctus (Sacred Kingfisher)*			
490.		*Torquigener pleurogramma*			
491.	48141	*Tribonyx ventralis (Black-tailed Native-hen)*			
492.	25723	*Trichoglossus haematodus (Rainbow Lorikeet)*			
493.	24755	*Trichoglossus haematodus subsp. moluccanus (Rainbow Lorikeet)*	Y		
494.	24754	*Trichoglossus haematodus subsp. rubritorquis (Red-collared Lorikeet)*			
495.	25521	*Trichosurus vulpecula (Common Brushtail Possum)*			
496.	24158	*Trichosurus vulpecula subsp. vulpecula (Common Brushtail Possum)*			
497.	24803	*Tringa brevipes (Grey-tailed Tattler)*		P4	
498.	24806	*Tringa glareola (Wood Sandpiper)*		IA	
499.	24808	*Tringa nebularia (Common Greenshank, greenshank)*		IA	
500.	24809	*Tringa stagnatilis (Marsh Sandpiper, little greenshank)*		IA	
501.	48147	*Turnix varius (Painted Button-quail)*			
502.	24851	*Turnix velox (Little Button-quail)*			
503.	24852	*Tyto alba subsp. delicatula (Barn Owl)*			
504.	24855	*Tyto novaehollandiae subsp. novaehollandiae (Masked Owl (southwest))*		P3	
505.		*Urocampus carinirostris*			
506.		*Urodacus novaehollandiae*			
507.	25577	*Vanellus miles (Masked Lapwing)*			
508.	24386	*Vanellus tricolor (Banded Lapwing)*			
509.	25218	*Varanus gouldii (Bungarra or Sand Monitor)*			
510.	25225	*Varanus rosenbergi (Heath Monitor)*			
511.		*Venator immansueta*			
512.		*Venatrix pullastra*			
513.	24206	*Vespadelus regulus (Southern Forest Bat)*			
514.	24040	*Vulpes vulpes (Red Fox)*	Y		
515.	34113	*Westralunio carteri (Carter's Freshwater Mussel)*		T	
516.		*Westrarchaea sinuosa*			
517.	41351	*Xenus cinereus (Terek Sandpiper)*		IA	
518.		*Zachria flavicoma*			
519.	25765	*Zosterops lateralis (Grey-breasted White-eye, Silvereye)*			

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

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

Appendix C

Conservation Significant Species and Likelihood of Occurrence Assessment

Species name	Common name	Level of significance		Habitat	Likelihood of occurrence
		WA	EPBC Act		
Birds					
Actitis hypoleucos	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 wherelow perches are available (Johnstone & Storr 1998).	Possible (marginal habitat present)
Anous stolidus	Common noddy	MI	MI	Tropical and subtropical seas, cayes, reefs, buoys and piles (Pizzey & Knight 2012).	Unlikely (no suitable habitat)
Anous tenuirostris melanops	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)
Apus pacificus	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 opportunitcally occur above the site, potential foraging habitat present)
Ardea alba	Eastern great egret	-	MA	Shallows of rivers, estuaries; tidal mudflats, freshwater wetlands; sewage ponds, irrigation areas and larger dams (Pizzey & Knight 2012).	Possible (potential habitat present)

Species name	Common name	Level of significance		Habitat	Likelihood of occurrence
		WA	EPBC Act		
Ardea ibis	Cattle egret	-	MA	Stock paddocks, pastures, croplands, garbage tips, wetlands, tidal mudflats, drains (Pizzey & Knight 2012).	Possible (potential habitat present)
Ardenna carneipes	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)
Arenaria interpres	Ruddy turnstone	MI	MI	Tidal mud and reef flats, sheltered rocky coasts, stony and seaweedy beaches and sandpits, dry coral ridges (Abrolhos) and pebbly shores of near-coastal saltlakes (including saltwork ponds) (Johnstone and Storr 1998).	Unlikely (no suitable habitat)
Botaurus poiciloptilus	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.	Possible (marginal habitat present)
Calidris acuminata	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.	Possible (marginal habitat present)
Calidris alba	Sanderling	MI	MI	Mainly steeply shelving sandy beaches exposed to ocean swell. Also sandy inlets, estuarine sandbanks and near-coastal saltlakes (including saltwork ponds) (Johnstone & Storr 1998).	Unlikely (no suitable habitat)

Species name	Common name	Level of significance		Habitat	Likelihood of occurrence
		WA	EPBC Act		
Calidris canutus	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)
Calidris ferruginea	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)
Calidris melanotos	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).	Possible (marginal habitat present)
Calidris ruficollis	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).	Possible (marginal habitat present)
Calidris subminuta	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.	Possible (marginal habitat present)
Calidris tenuirostris	Great knot	CR	CR (MI)	Mud or sand flats in estuaries and on sheltered coasts. Also near-coastal saltlakes, including saltwork ponds.	Unlikely (no suitable habitat)

Species name	Common name	Level of significance		Habitat	Likelihood of occurrence
		WA	EPBC Act		
Calyptorhynchus banksii naso	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 azdarach and Eucalyptus spp. trees.	Likely (potential habitat present)
Calyptorhynchus baudinii	Baudin's cockatoo	EN	EN	Mainly eucalypt forests. Attracted to seeding Corymbia calophylla, Banksia spp., Hakea spp., and to fruiting apples and pears (Johnstone and Storr 1998).	Unlikely (outside of modelled distribution, limited foraging habitat)
Calyptorhynchus latirostris	Carnaby's cockatoo	EN	EN	Mainly proteaceous scrubs and heaths and adjacent eucalypt woodlands and forests; also plantations of Pinus spp. Attracted to seeding Banksia spp., Dryandra spp., Hakea spp., Eucalyptus spp., Corymbia calophylla, Grevillea spp., and Allocasuarina spp. (Johnstone and Storr 1998).	Recorded (potential habitat present)
Charadrius bicinctus	Double-banded plover	MI	MI	Wide beaches, tidal mudflats, saltmarsh, wide and sparsely vegetated margins of shallow saline and freshwater wetlands, paddocks with sparse vegetation, ploughed fields, airfields.	Possible (potential habitat present)

Species name	Common name	Level of significance		Habitat	Likelihood of occurrence
		WA	EPBC Act		
Charadrius dubius	Little ringed plover	MI	MI	Open, muddy or sandy shores of lakes, swamps, tidal areas, sewage ponds or farm dams. Rare but regular summer migrant to Australia (Pizzey & Knight 2012).	Possible (potential habitat present)
Charadrius leschenaultii	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).	Possible (potential habitat present)
Charadrius mongolus	Lesser sand plover	EN	EN (MI)	Sandy beaches and tidal estuarine flats. Also near-coastal saltlakes, including saltwork ponds (Johnstone & Storr 1998).	Unlikely (no suitable habitat)
Charadrius ruficapillus	Red-capped plover	-	MA	Broad, sandy and shelly beaches; bare margins of saline wetlands and lakes, inland and coastal; saltmarsh; tidal mudflats and sandflats; adjacent dunes; occasionally shallow freshwater wetlands, inland and coastal (Pizzey & Knight 2012).	Possible (potential habitat present)
Chlidonias leucopterus	White-winged black tern	MI	MI	Vegetated and open wetlands, brackish and saline lakes, saltfields, irrigated lands, sewage ponds and occasionally offshore.	Possible (potential habitat present)

Species name	Common name	Level of significance		Habitat	Likelihood of occurrence
		WA	EPBC Act		
Diomedea amsterdamensis	Amsterdam 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)
Diomedea epomophora	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)
Diomedea exulans	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)
Diomedea sanfordi	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)
Falco peregrinus	Peregrine falcon	OS	-	Mainly found around cliffs along coasts, rivers, ranges and around wooded watercourses and lakes (Johnstone and Storr 1998).	Possible (marginal habitat present)

Species name	Common name	Level of significance		Habitat	Likelihood of occurrence
		WA	EPBC Act		
Gallinago hardwickii	Latham's snipe	MI	MI	Soft, wet ground or shallow water with tussocks and other green or dead growth, wet parts of paddocks, seepage below dams, irrigated areas, scrub or open woodlandfrom sea level to alpine bogs over 2000 m, samphire on saltmarshes and mangrove fringes. Rare visitor to Western Australia.	Possible (potential habitat present)
Gallinago megala	Swinhoe's snipe	MI	MI	Wet, grassy ground; edges of reedy swamps (Pizzey & Knight 2012).	Possible (potential habitat present)
Gallinago stenura	Pin-tailed snipe	MI	MI	Boggy edges of vegetated wetlands; sewage and other ponds; stubbles, grasslands with shrubs, pastures (Pizzey & Knight 2012).	Possible (potential habitat present)
Gelochelidon nilotica	Gull-billed tern	MI	MI	Beaches, mudflats; fresh, brackish wetlands, including far inland; grasslands, crops, ploughed fields, airfields (Pizzey & Knight 2012).	Possible (potential habitat present)
Haliaeetus leucogaster	White-bellied sea-eagle	-	MA	Coasts, islands, estuaries, inlets, large rivers, inland lakes and reservoirs (Pizzey & Knight 2012).	Unlikely (no suitable habitat)
Heteroscelus brevipes	Grey-tailed tattler	P4 (M	MI	Tidal mud and reef flats, sheltered rocky coasts, stony and seaweedy beaches and sandpits, dry coral ridges (Abrolhos) and pebbly shores of near-coastal saltlakes (including saltwork ponds) (Johnstone and Storr 1998).	Unlikely (no suitable habitat)

Species name	Common name	Level of significance		Habitat	Likelihood of occurrence
		WA	EPBC Act		
Himantopus himantopus	Black-winged stilt	-	MA	Freshwater and saltwater marshes, mudflats, and the shallow edges of lakes and rivers (Birdlife Australia 2019).	Possible (potential habitat present)
Hydroprogne caspia	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)
Ixobrychus dubius	Australian little bittern	P4	-	Dense vegetation surrounding/within freshwater pools, swamps and lagoons, well screened with trees. Shelters in dense beds of Typha spp., Baumea spp. and tall rushes in freshwater swamps around lakes and along rivers (Johnstone and Storr 1998).	Possible (marginal habitat present)
Leipoa ocellata	Mallefowl	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 (locally extinct, no suitable habitat)
Limosa lapponica	Bar-tailed godwit	MI (&	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)

Species name	Common name	Level of significance		Habitat	Likelihood of occurrence
		WA	EPBC Act		
Limosa lapponica baueri	Bar-tailed godwit	VU	VU	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)
Limosa lapponica menzbieri	Bar-tailed godwit	CR	CR	Mainly coastal habitats such as large intertidal sandflats, banks, mudflats, estuaries, inlets, harbours, coastal lagoons and bays. Has also been recorded in coastal sewage farms and saltworks, saltlakes and brackish wetlands near coasts, sandy ocean beaches, rock platforms, and coral reef-flats (Higgins and Davies 1996).	Unlikely (no suitable habitat)
Limosa limosa	Black-tailed godwit	MI	MI	Tidal mudflats, estuaries, sewage ponds, shallow river margins, brackish or saline inland lakes, flooded pastures, airfields (Pizzey & Knight 2012).	Possible (potential habitat present)
Macronectes giganteus	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)
Macronectes halli	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)

Species name	Common name	Level of significance		Habitat	Likelihood of occurrence
		WA	EPBC Act		
Merops ornatus	Rainbow bee-eater	-	MA	Open woodlands with sandy, loamy soil; sandridges, sandpits, riverbanks, road cuttings, beaches, dunes, cliffs, mangroves, rainforest, woodlands and golf courses (Pizzey & Knight 2012).	Possible (potential habitat present)
Motacilla cinerea	Grey wagtail	MI	MI	Mainly banks and rocks in fast-running fresh water habitats: rivers, creeks, streams and around waterfalls, both in forest and open country.	Unlikely (no suitable habitat)
Numenius madagascariensis	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)
Numenius minutus	Little curlew	MI	MI	Dry grasslands, floodplains, margins of drying swamps; tidal mudflats, airfields, playing fields, crops, commercial saltfields, sewage ponds (Pizzey & Knight 2012).	Possible (potential habitat present)
Numenius phaeopus	Whimbrel	MI	MI	Estuaries, mangroves, tidal flats, coral cays, exposed reefs, flooded paddocks, sewage ponds, bare grasslands, sportsgrounds and lawns.	Possible (potential habitat present)
Oxyura australis	Blue-billed duck	P4	-	Mainly deeper freshwater swamps and lakes; occasionally saltlakes and estuaries freshened by flood waters (Johnstone and Storr 1998a).	Possible (marginal habitat present)

Species name	Common name	Level of significance		Habitat	Likelihood of occurrence
		WA	EPBC Act		
Pachyptila turtur subantarctica	Fairy prion	-	VU	Breeds on subantarctic islands and is presumed to frequent subtropical waters during non-breeding period (TSSC 2015).	Unlikely (no suitable habitat)
Pandion cristatus	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)
Phaethon rubricauda	Red-tailed tropicbird	P4 (M	MI	Spend most of their lives at sea and rarely venture near land. This bird is normally found in tropical and subtropical seas around northern Australia. Though rarely seen in colder areas, a few pairs breed on Sugarloaf Rock, south of Cape Naturaliste (DPAW 2017b).	Unlikely (no suitable habitat)
Phalaropus lobatus	Red-necked phalarope	MI	MI	Shallow pools in commercial saltfields, tidal mudflats, beaches, saltmarshes, freshwater wetlands.	Possible (marginal habitat present)
Philomachus pugnax	Ruff	MI	MI	Fresh, brackish and saline wetlands; tidal mudflats, saltfields, sewage ponds (Pizzey & Knight 2012).	Possible (marginal habitat present)
Plegadis falcinellus	Glossy Ibis	MI	MI	Shallow and adjacent flats of freshwater lakes and swamps, also river pools, flooded samphire and sewage ponds.	Possible (marginal habitat present)

Species name	Common name	Level of significance		Habitat	Likelihood of occurrence
		WA	EPBC Act		
Pluvialis fulva	Pacific golden plover	MI	MI	Estuaries, mudflats, saltmarshes, mangroves; rocky reefs and stranded seaweed on ocean shores; margins of shallow open inland swamps; sewage ponds, short-grass paddocks, sportsgrounds, airfields, ploughed land (Pizzey & Knight 2012).	Possible (potential habitat present)
Pluvialis squatarola	Grey Plover	MI	MI	Mudflats, saltmarsh, tidal reefs and estuaries, rarely inland (Pizzey and Knight 2012).	Unlikely (no suitable habitat)
Puffinus carneipes	Flesh-footed shearwater	MI	MI	Marine species that breeds on islands off south coast from near Cape Leeuwin (Johnstone and Storr 1998).	Unlikely (no suitable habitat)
Recurvirostra novaehollandiae	Red-necked avocet	-	MA	Estuaries, tidal mudflats; fresh, brackish and salt swamps and lakes; claypans, commercial saltfields and sewage ponds (Pizzey & Knight 2012).	Possible (marginal habitat present)
Rostratula australis	Australian painted snipe	EN	EN	Mainly shallow terrestrial freshwater (occasionally brackish) wetlands, including temporary and permanent lakes, swamps and claypans (Marchant and Higgins 1993).	Possible (marginal habitat present)
Rostratula benghalensis	Painted snipe	-	EN	Well vegetated shallows and margins of wetlands, dams, sewerage ponds, wet pastures, marshy areas, irrigation systems, lignum, tea tree scrub, open timber. Requires dense low cover (Morcombe 2004).	Unlikely (no suitable habitat)

Species name	Common name	Level of significance		Habitat	Likelihood of occurrence
		WA	EPBC Act		
Sterna dougallii	Roseate tern	MI	MI	Offshore waters, islands, coral reefs, sand cays, beaches, tidal inlets (Pizzey & Knight 2012).	Unlikely (no suitable habitat)
Sterna hirundo hirundo	n/a	MI	MI	Offshore waters, beaches, reefs, bays, estuaries, sandflats, saltfields, sewage ponds, freshwater wetlands.	Unlikely (no suitable habitat)
Sternula nereis nereis	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)
Thalassarche cauta cauta	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).	Possible (marginal habitat present)
Thalassarche cauta steadi	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)
Thalassarche impavida	Campbell albatross	VU	VU (MI)	Scarce visitor to south western and western seas. Breeds on Campbell island.	Unlikely (no suitable habitat)
Thalassarche melanophris	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)

Species name	Common name	Level of significance		Habitat	Likelihood of occurrence
		WA	EPBC Act		
Thalassarche steadi	White-capped albatross	VU	VU (MI)	Marine species that occurs in subantarctic and subtropical waters. It reaches tropical areas associated with the cool Humboldt Current off South America (Marchant & Higgins 1990). The species has been noted in shelf-waters around breeding islands and over adjacent rises. During the non-breeding season, birds have been observed over continental shelves around continents. The species occurs both inshore and offshore (Marchant 1977) and enters harbours and bays (Jehl 1973). Birds gather to scavenge at commercial fishing grounds.	Unlikely (no suitable habitat)
Thalasseus bergii	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)
Thinornis rubricollis	Hooded plover	P4	VU	Margins and shallows of saltlakes, sandy and seaweedy beaches and estuaries; also dams (Johnstone & Storr 1998).	Possible (marginal habitat present)
Tringa brevipes	Grey-tailed tattler	P4 (M	MI	Tidal mud and reef flats, sheltered rocky coasts, stony and seaweedy beaches and sandpits, dry coral ridges (Abrolhos) and pebbly shores of near-coastal saltlakes (including saltwork ponds) (Johnstone and Storr 1998).	Unlikely (no suitable habitat)

Species name	Common name	Level of significance		Habitat	Likelihood of occurrence
		WA	EPBC Act		
Tringa glareola	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.	Possible (potential habitat present)
Tringa nebularia	Common greenshank	MI	MI	Shallow fresh waters (claypans, lagoons, swamps, river pools, dams and sewage ponds) and salt waters (estuaries, mangrove creeks, lakes, samphire flats, reef flats and saltwork ponds).	Possible (potential habitat present)
Tringa stagnatilis	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.	Possible (potential habitat present)
Tringa totanus	Common redshank	MI	MI	Sheltered coastal wetlands such as bays, river estuaries, lagoons, inlets and saltmarsh (with bare open flats and banks of mud or sand). Also found around saltlakes, freshwater lagoons, artificial wetlands and saltworks and sewage farms (Higgins & Davies 1996).	Possible (marginal habitat present)
Tyto novaehollandiae novaehollandiae	Australian masked owl	P3	-	Forests, open woodlands, farmlands with large trees. E.g. river red gums, adjacent cleared country, timbered watercourses, paperbark woodlands and caves (Pizzey & Knight 2012).	Possible (marginal habitat present)

Species name	Common name	Level of significance		Habitat	Likelihood of occurrence
		WA	EPBC Act		
Xenus cinereus	Terek sandpiper	MI	MI	Tidal mudflats, estuaries; shores and reefs of islands; coastal swamps, commercial saltfields (Pizzey & Knight 2012).	Unlikely (no suitable habitat)
Invertebrates					
Idiosoma sigillatum	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. multiple records nearby.)
Synemon gratiosa	Graceful sunmoth	P4	-	Coastal heathland on Quindalup dunes where it is restricted to secondary sand dunes due to the abundance of the preferred host plant Lomandra maritima. Banksia woodland on Spearwood and Bassendean dunes, where the second known host plant L. hermaphrodita is widespread (DEC 2011).	Possible (hostplant recorded)
Throscodectes xiphos	Stylet bush cricket	P1	-	Species poorly understood and documented. Known from Jandacot area, where it was originally collected in the axial leaf bases of grass trees (*Xanthorrhoea preissei*) (Invertebrate Solutions 2019).	Possible (suitable habitat present, single record narby, poor knowledge of species exists.)
Leioproctus contrarius	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 stenosepala (Bamford 2003).	Unlikely (hostplants not recorded, one record in the wider area)

Species name	Common name	Level of significance		Habitat	Likelihood of occurrence
		WA	EPBC Act		
Westralunio carteri	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. Salinity tolerance quite low (Morgan et al. 2011).	Unlikely (no suitable habitat)
Neopasiphae simplicior	a short-tongued bee	EN	CR	This species of native bee has been collected on flowers of Goodenia filiformis, Lobelia tenuior, Angianthus preissianus and Velleia sp. (Houston 2000).	Unlikely (hostplants not recorded. one record in the wider area)
Mammals					
Hydromys chrysogaster	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).	Possible (marginal habitat present)
Isoodon fusciventer	Quenda	P4	-	Dense scrubby, often swampy, vegetation with dense cover up to one metre high (DEC 2012a)	Recorded (potential habitat present)
Falsistrellus mackenziei	Western false pipistrelle	P4	-	High rainfall forests dominated by jarrah, karri, marri, and tuart. Occupies hollow logs for breeding and resting (Van Dyck and Strahan 2008). Also known to utilise Banksia woodland on the Swan Coastal Plain (Hosken and O'Shea 1995).	Unlikely (no suitable habitat)

Species name	Common name	Level of significance		Habitat	Likelihood of occurrence
		WA	EPBC Act		
Notamacropus eugenii derbianus	Tammar wallaby	P4	-	Dry sclerophyll forest, Banksia spp. woodlands and shrublands, typically favouring dense low vegetation that provides dense cover (Christensen and Strahan 1983).	Unlikely (no suitable habitat)
Notamacropus irma	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).	Unlikely (no suitable habitat)
Dasyurus geoffroii	Chuditch	VU	VU	Wide range of habitats from woodlands, dry sclerophyll forests, riparian vegetation, beaches and deserts. Appears to utilise native vegetation along road sides in the wheatbelt (DEC 2012b).	Unlikely (no suitable habitat, now mostly restircted to darling scarp)
Myrmecobius fasciatus	Numbat	EN	EN	Generally dominated by Eucalyptus spp. that provide hollow logs and branches for shelter and termites for food (van Dyck & Strahan 2008).	Unlikely (no suitable habitat, locally extinct)
Pseudocheirus occidentalis	Western ringtail possum	CR	CR	On the Swan Coastal Plain in Agonis flexuosa woodlands and Agonis flexuosa/ Eucalyptus gomphocephala forests. Also Eucalyptus marginata forests (DBCA 2017).	Unlikely (locally extinct, no suitable habitat)
Setonix brachyurus	Quokka	VU	VU	On the mainland mostly dense streamside vegetation or shrubland and heath areas, particularly around swamps (Cronin 2007).	Unlikely (locally extinct, no suitable habitat)
Reptiles					

Species name	Common name	Level of significance		Habitat	Likelihood of occurrence
		WA	EPBC Act		
Lerista lineata	Perth slider	P3	-	Sandy coastal heath and low scrubland. Banksia spp. woodland, Eucalyptus gomphocephala open woodland over deep sands, and coastal dunes immediately adjacent to the beach (Wilson and Swan 2017).	Possible (potential habitat present)
Neelaps calonotos	Black-striped snake	P3	-	Coastal and near-coastal dunes, sandplains supporting heathlands and Banksia spp. woodlands (Bush et al. 2002).	Possible (potential habitat present)

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.

Appendix D

Species List

Fauna List
Former Glen Iris Golf Course

Category	Status	Species name	Common name	Record type
Birds				
		Anthochaera carunculata	Red wattlebird	Sight
	EN	*Calyptorhynchus latirostris*	Carnaby's cockatoo	Sight
		Chenonetta jubata	Australian wood duck	Sight
		Corvus coronoides	Australian raven	Sight
		Cracticus tibicen	Australian magpie	Sight
		Fulica atra	Eurasian coot	Sight
		Grallina cyanoleuca	Magpie-lark	Call
		Phaps chalcoptera	Common bronzewing	Sight
		Phylidonyris novaehollandiae	New Holland honeyeater	Sight
		Rhipidura leucophrys	Willie wagtail	Sight
		Threskiornis spinicollis	Straw-necked ibis	Sight
		Trichoglossus haematodus	Rainbow lorikeet	Call
		Zosterops lateralis	Grey-breasted white-eye	Call
Crustacean				
	*	*Cherax destructor*	Yabby	Shell
Fish				
	*	*Cyprinus rubrofuscus*	Koi fish	Sight
Mammals				
	P4	*Isoodon fusciventer*	Quenda	Diggings
	*DP	*Oryctolagus cuniculus*	Rabbit	Scat, diggings
Reptiles				
		Chelodina colliei	Snake-necked turtle	Sight

Note: * denotes introduced fauna species, DP=declared pest under the BAM Act, EN=Endangered under the EPBC Act, P4=Priority 4 in WA

Appendix E

Targeted Black Cockatoo Assessment

Targeted Black Cockatoo Assessment

Former Glen Iris Golf Course

Project No: EP20-009(13)

Prepared for ECP Acquisitions 6 Pty Ltd
June 2021

Document Control

Doc name:	Targeted Black Cockatoo Assessment Former Glen Iris Golf Course				
Doc no.:	EP20-009(13)--009B TAA				
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1	March 2021	Melanie Schubert	MS	Rachel Weber	RAW
	Submitted for client review				
A	April 2021	Melanie Schubert	MS	Rachel Weber	RAW
	Minor updates to reflect change in site boundary				
B	June 2021	Tom Atkinson	TAA	Rachel Weber	RAW
	Updated for agency submission				

Executive Summary

ECP Acquisitions 6 Pty Ltd engaged Emerge Associates (Emerge) to conduct a 'targeted' threatened black cockatoo assessment in the former Glen Iris Golf Course which comprises Lots 6 and 7 Glen Iris Drive, Lots 3, 509 and 512 Dean Road and Lot 139 Imlah Court in Jandakot (referred to herein as the 'site').

As part of the assessment a desktop assessment of relevant background information was completed and a field survey was undertaken across the site on 11 March and 12 November 2020. During the field survey an assessment of habitat for threatened black cockatoo species was completed.

Outcomes of the survey include the following:

- The site occurs within the modelled distribution of Carnaby's cockatoo and forest red-tailed black cockatoo, but outside of the modelled distribution of Baudin's cockatoo. The site is also within the breeding range of forest red-tailed black cockatoo. Therefore, the habitat in the site is most relevant to Carnaby's cockatoo and forest red-tailed black cockatoo.
- Carnaby's cockatoo were recorded in the site. Both Carnaby's cockatoo and forest red-tailed black cockatoo are likely to occur within the site.
- Forest red-tailed black cockatoo nests have been recorded within 6 km of the site at Bibra Lake and Murdoch, with the most recent breeding record occurring in spring 2020 (BirdLife Australia 2021). The site contains 11 habitat trees of which none contain hollows suitable for use by black cockatoos for breeding. Therefore, the site does not currently provide breeding habitat for forest red-tailed black cockatoo black cockatoo.
- White-tailed black cockatoo (likely Carnaby's cockatoo) and forest red-tailed black cockatoo roosts have been recorded at 42 locations within 12 km of the site (BirdLife Australia 2021). No roosts or evidence of roosting by any species of black cockatoo was recorded within the site. Tall native and non-native trees within the site represent suitable roosting habitat.
- Extensive areas of native and non-native vegetation that provides foraging habitat for Carnaby's cockatoo and forest red-tailed black cockatoo occurs immediately adjacent to the site and in the wider area. A total of 4.76 ha of foraging habitat for Carnaby's cockatoo was mapped within the site of which 0.96 ha (20%) provides a high value resource, 0.16 ha (14%) provides a moderate value resource and 3.13 ha (66%) provides a low value resource. A total of 4.88 ha of foraging habitat for forest red-tailed black cockatoo was mapped in the site of which 0.59 ha (12%) provides a high value resource, 0.39 ha (8%) provides a moderate value resource and 3.90 ha (80%) provides a low value resource.
- Overall habitat quality was scored at three out of ten (low quality) for Carnaby's cockatoo with foraging habitat being the highest scoring component. Overall black cockatoo habitat quality was scored at five out of ten (moderate quality) for forest red-tailed black cockatoo with foraging habitat being the highest scoring component.

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Abbreviation Tables

Table A1: Abbreviations – Organisations

Organisations	
EPA	Environmental Protection Authority
DBCA	Department of Biodiversity, Conservation and Attractions
DPaW	Department of Parks and Wildlife (now DBCA)
DAWE	Department of Agriculture, Water and the Environment
WA Museum	Western Australian Museum

Table A2: Abbreviations – General terms

General terms	
EN	Endangered
VU	Vulnerable

Table A3: Abbreviations – Legislation

Legislation	
BC Act	*Biodiversity Conservation Act 2016*
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*

Table A4: Abbreviations – units of measurement

Units of measurement	
DBH	Diameter at breast height
cm	Centimetre
ha	Hectare
km	Kilometre
m	Metre

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1 Introduction

1.1 Project background

Emerge Associates (Emerge) were engaged by ECP Acquisitions 6 Pty Ltd to characterise the black cockatoo habitat values within the former Glen Iris Golf Course which comprises Lots 6 and 7 Glen Iris Drive, Lots 3, 509 and 512 Dean Road and Lot 139 Imlah Court in Jandakot (referred to herein as the 'site'). These lots are located approximately 6 kilometres (km) south of the Perth Central Business District within the City of Cockburn.

The site is approximately 53.7 hectares (ha) in size and is surrounded by residential subdivision, with a railway to the north and Kwinana Freeway to the west. The site comprises two areas separated by Berrigan Drive. The location and extent of the site is shown in Figure 1.

1.2 Purpose and scope of work

The scope of work was specifically to conduct a terrestrial vertebrate fauna assessment to the standard required of 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 (DSEWPaC 2012b).

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

- Desktop assessment of relevant background information pertaining to the site and surrounds, including database and literature searches for black cockatoos.
- Field survey to identify potential habitat for species of black cockatoo.
- An assessment of the quality of black cockatoo habitat within the site.
- Mapping of black cockatoo habitat.
- Documentation of the desktop assessment, survey methodology and results into a report.

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2 Background

2.1 Environmental Context

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 has formed from the deposition of alluvial material washed down from the Darling Scarp, while its western side is comprised of 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.

Soil mapping by Gozzard (2011) places the site in the Bassendean dunes which are 'old, low hills of quartz sand with numerous interdunal swamps and lakes'.

Vegetation mapping by Heddle *et al.* (1980) indicates the site lies within the 'Bassendean complex - central and south' which is described as supporting 'woodland of *Eucalyptus marginata - Allocasuarina fraseriana - Banksia* spp. to low woodland of *Melaleuca* spp. and sedgelands on the moister sites' (Beard 1990).

2.2 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 taxon listed 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.

2.3 Black cockatoos

Three threatened species of black cockatoo occur in the south-west of WA (referred to herein collectively as 'black cockatoos'):

- *Calyptorhynchus latirostris* (Carnaby's cockatoo) which is listed as 'endangered' under the EPBC Act and the BC Act.
- *Calyptorhynchus baudinii* (Baudin's 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 (DSEWPaC 2012a). 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) (DSEWPaC 2012a). Breeding habitat is also generally expected to be located within 7 km of food and water resources (Saunders 1990).
- During the day and most often overnight black cockatoos congregate in a tree or group of trees to rest. '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 (DSEWPaC 2012a). They are often located within 6 km of water and food resources, with additional foraging ranges within 12 km (Shah 2006; DSEWPaC 2012a; Le Roux 2017). 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 plants 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 cockatoo breeding from August/September to February/March and Carnaby's cockatoo breeding from July/August to January/February (DSEWPaC 2012a). Forest red-tailed black cockatoo breeds in October/November but may breed in March/April if there is good autumn rainfall (DSEWPaC 2012a). 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).

2.4 Previous surveys

No previous black cockatoo surveys are known to have been undertaken within the site.

Emerge have previously completed a Level 1 fauna assessment within the site (Emerge Associates 2020a).

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3 Methods

3.1 Desktop assessment

A search was conducted for records of black cockatoos and potential black cockatoo habitat mapping occurring within 10 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

A zoologist and an ecologist from Emerge visited the site on 11 March and 12 November 2020 during the day to conduct the field survey.

Transects were traversed across the site and 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 secondary evidence of breeding, roosting and foraging activity such as chew marks, branch clippings, droppings, moulted feathers and chewed fruit were conducted.

3.2.1 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 such that they could contain a suitable hollow. These trees were not recorded as habitat trees as the likelihood they would ever form a suitable hollow was low.

Habitat trees were individually identified, and the attributes outlined in Table 1 were recorded for each tree.

Table 1: Attributes recorded for each habitat tree in the site

Attribute	Description
Tag	Unique identifier on a metal tag was nailed to tree
Image	Trees were individually photographed
GPS location	The location was recorded using a handheld GPS unit
Tree species	Species and common name were identified
Diameter at breast height (DBH) (cm)	DBH was measured at breast height (1.3 metres) 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, feathers or the presence of birds within the hollow.

All recorded habitat trees were assigned to a category listed in Table 2.

Table 2: Habitat tree categories

Category	Specifications
Nest	The tree contains a hollow used by black cockatoos for breeding as confirmed by records of black cockatoos, their eggs or fledglings or other evidence of recent nesting activity by black cockatoos
Potential nest	The tree contains one or more hollows that are suitable for use by black cockatoos as breeding habitat as confirmed by internal hollow inspection^ and evidence of use by an unidentified bird such as feathers, chew marks or nest material has been recorded within a hollow
Suitable hollow(s)	The tree contains one or more hollows that are suitable for use by black cockatoos as breeding habitat as confirmed by internal hollow inspection^
Potentially suitable hollow(s)	The tree contains or is suspected to contain one or more hollows that have the potential to be suitable for use by black cockatoos when either viewed from the ground or following an internal hollow inspection that was inconclusive^
No suitable hollow(s)	The tree does not contain hollow(s) that have the potential to be suitable for use by black cockatoos when viewed from the ground or contains hollows that were determined to be unsuitable for use by black cockatoos by internal inspection^

^Hollow determined to be suitable for use as breeding habitat by black cockatoos as listed above in Section 3.2.1.

3.2.2 Roosting habitat

The site was assessed for the presence of active or historical roosts and its potential to provide roosting habitat for black cockatoos.

During the field survey the site was searched for secondary evidence of roosting activity, such as branch clippings, droppings or moulted feathers. No dusk roost survey was undertaken as no signs indicative of roosting were recorded (refer Section 4.5). Groups of tall native and non-native trees, if present, were assumed to provide potential roosting habitat.

3.2.3 Foraging habitat

Foraging habitat was identified by comparing the vegetation within the site to literature on plant species known to provide food consumed by black cockatoos (Davies 1966; Saunders 1980; Johnstone and Storr 1998; Johnstone and Kirkby 1999; Groom 2011; Johnstone *et al.* 2011; DSEWPaC 2012a).

Foraging habitat was classified as providing a 'high', 'moderate' or 'low' value resource based on the proportion of 'primary' or 'secondary' food plants. 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. Each patch of foraging habitat was assigned a percentage cover of primary and secondary food plants based on the preferences of each black cockatoo species. 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. Classification of foraging habitat was completed such that the proportion of non-food plants was minimised as far as practicable. A list of plant species classified as primary or secondary food plants is provided as Appendix B.

Evidence of black cockatoo foraging, such as chewed fruits, was searched for within the site and allocated to a species where possible. The locations of black cockatoo foraging evidence within the site were recorded using a hand-held GPS unit.

3.3 Data analysis, presentation and mapping

Habitat trees were classified according to the scheme outlined in Table 2 and mapped on aerial imagery. A complete summary of the recorded attributes of habitat trees was compiled in a tabular format.

Foraging habitat was described according to the dominant flora species or vegetation type present and mapped on aerial photography with the boundaries interpreted from aerial photography and notes taken in the field. The value of each patch of foraging habitat was mapped for each species of black cockatoo likely to occur in the site. The proportions of high, moderate and low value foraging habitat mapped within the site are reported in Section 4.6.

3.3.1 Overall black cockatoo habitat quality

As part of environmental impact assessment and offset calculation, the Department of Agriculture, Water and the Environment (DAWE) requires that a score out of ten is provided for the overall quality of back cockatoo habitat (DAWE 2020). DAWE does not provide a methodology for scoring 'overall black cockatoo habitat quality' but instead specifies that an assessment of quality should be undertaken by an experienced technical expert (DSEWPaC 2012b).

Emerge have developed a method to provide a systematic assessment of overall black cockatoo habitat quality. The method assesses and scores the condition, context and stocking rate of breeding, roosting and foraging habitat separately and then provides an overall quality score out of ten based on the highest score determined for these categories of habitat. The assessment methodology is detailed in Appendix C.

3.4 Nomenclature and sources of information

Taxonomy and nomenclature of scientific and common names for fauna species follow the *Western Australian Museum* (WAM) *Checklist of the Terrestrial Vertebrate Fauna of Western Australia* (WAM 2020). Where common names were not provided by the Western Australian Museum (2019); (WAM 2020), these have been derived from other sources. 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 3.

Table 3: 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 targeted black cockatoo habitat survey was undertaken. The level of survey and survey effort are considered adequate to assess the black cockatoo habitat values within the site.
Scope	No limitation	The survey focused on black cockatoo habitat within the site.
Proportion of fauna identified, recorded and/or collected.	No limitation	The survey focused on identifying habitat for species of black cockatoo rather. One of the two species of black cockatoo known to occur in the vicinity of the site was recorded during the survey. Habitat was reviewed across the entire site. All habitat trees and all potentially suitable hollows were assessed. The extent of foraging habitat was resolved such that the proportion of non-food plants within mapped habitat was less than 25%.
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 and previous surveys to place habitat in context.
The proportion of the task achieved and further work which might be needed.	No limitation	The targeted black cockatoo assessment was achieved in its entirety.
Experience level of personnel	No limitation	The field survey was led by and the report authored by a qualified zoologist with over three years' experience. Technical review was undertaken by an ecologist with over ten years' experience in in environmental science in Western Australia.

Table 3: 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
Suitability of timing, weather and season	No limitation	Survey timing is not of great importance for a black cockatoo habitat assessment (with exception of detecting active nests). Nevertheless, the survey was undertaken within the main breeding season for all three species of black cockatoo (refer to Section 2.3).
Completeness	No limitation	The desktop assessment, field survey and targeted black cockatoo habitat assessment was completed comprehensively.
Spatial coverage and access	No limitation	Site coverage was comprehensive (track logged).
	No limitation	All parts of the site could be accessed as required.
Survey intensity	No limitation	The intensity of the survey was adequate given the size of the site.
Influence of disturbance	No limitation	The western portion of the site is modified due to historical disturbance associated with quarrying activities. 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. In response this assessment applies an internally developed methodology that is considered to provide a systematic and balanced characterisation of black cockatoo habitat.

4 Results

4.1 Desktop assessment

The results of the desktop assessment are summarised in Table 4, Table 5 and Table 6, and shown in Figure 2. Detailed information on each dataset considered as part of the desktop review is provided in Appendix A.

Table 4: Summary of black cockatoo background review

Category		Site context	Source
Species distribution		• Site is not within the modelled distribution of Baudin's cockatoo. • Site is within the modelled distribution of Carnaby's cockatoo but not within its breeding range. • Site is within the modelled distribution of forest red-tailed black cockatoo and within its known breeding range.	(DoEE 2016a, c, b)
Breeding sites		• No nesting records occur within the site. • Breeding of forest red-tailed black cockatoo has been recorded within 6 km of the site in Bibra Lake and Murdoch, with the most recent breeding in spring 2020.	BirdLife Australia database search (2021)
Carnaby's cockatoo breeding areas (12 km radius surrounding breeding sites)		• No confirmed or possible breeding areas intersect the site.	(Glossop *et al.* 2011)
Important bird areas for Carnaby's cockatoo		• None within the site. • None within 12 km of the site	(DPaW 2013)
Roost site		• None within the site. • 42 roost sites within 12 km of the site (see Table 5 and Table 6): o 18 associated with white-tailed^ black cockatoos only o 11 associated with forest red-tailed black cockatoos only o 13 associated with white^ and red-tailed black cockatoos	BirdLife Australia database search (2021), Peck *et al.* (2019)
Foraging habitat	White-tailed black cockatoo^	• No native foraging habitat mapped within the site. • Multiple parcels of potential native foraging habitat are mapped within the wider local area of the site. Extensive areas of potential native foraging habitat are mapped on the Darling Scarp approximately 16 km east of the site.	(Emerge Associates 2020b)
	White-tailed black cockatoo^	• No pine plantations are mapped within 12 km of the site	(Forest Products Commission 2020)
	Forest red-tailed black cockatoo	• No native foraging habitat mapped within the site. • Multiple parcels of potential native foraging habitat are mapped within the wider local area of the site. Extensive areas of potential native foraging habitat are mapped on the Darling Scarp approximately 16 km east of the site.	(Emerge Associates 2020c)

^Carnaby's and/or Baudin's cockatoo

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Table 5: White-tailed black cockatoos recorded in roosts within 12 km of the site (Birdlife Australia (2021); (Peck et al. 2019)

Roost ID	Year and number of individuals									
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
ARMCHAR001	NS	NS	NS	NS	NS	NS	NS	0	3	0
ARMFORR001	NS	NS	NS	0	0	18	0	0	NS	0
ARMHARR001	NS	0	0	NS	0	1	3	0	0	0
CANFERR001	NS	NS	NS	5	0	0	0	0	0	NS
CANWILR001	0	0	0	0	68	0	0	0	0	0
COCBANR001	NS	NS	NS	NS	NS	45	NS	0	20	0
COCBANR002	NS	NS	NS	NS	53	NS	0	0	0	0
COCBANR003	NS	NS	NS	NS	NS	NS	NS	6	16	0
COCCOOR005	NS	NS	NS	NS	NS	NS	NS	38	0	0
COCHAMR001	0	169	215	0	168	68	101	0	0	0
COCHAMR002	NS	NS	NS	NS	NS	263	194	0	369	506
COCMUNR003	NS	NS	NS	NS	NS	NS	0	0	0	3
COCSPER001	0	2	NS	323	NS	0	0	40	0	NS
COCSPER002	NS	5	0	NS	NS	0	24	0	NS	NS
GOSCNVR001	0	19	NS	NS	0	0	0	0	NS	80
GOSCNVR002	NS	NS	26	52	0	0	151	0	0	0
GOSSOUR002	NS	NS	NS	NS	NS	NS	50	0	0	0
KWIWANR001	63	0	0	1	0	0	0	0	0	NS
KWIWANR002	NS	NS	NS	0	0	0	0	5	0	0
KWIWANR004	NS	NS	NS	NS	NS	NS	NS	73	0	0
MELBATR001	8	0	0	0	0	0	0	0	0	0
MELKARR002	0	0	0	NS	0	55	0	0	0	0
MELLEER001	0	0	12	0	70	0	0	0	15	2
MELMURR001	700	60	142	127	234	24	78	0	227	249
MELWINR001	NS	56	81	70	41	0	21	0	0	12
MELWINR003	117	130	NS	NS	NS	0	7	54	64	108

Table 5: White-tailed black cockatoos recorded in roosts within 12 km of the site (Birdlife Australia (2021); (Peck et al. 2019) (continued)

Roost ID	Year and number of individuals									
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
MELWINR004	0	0	0	0	2	0	0	0	0	NS
SEROAKR004	45	3	0	0	50	0	26	2	33	NS
SEROAKR007	NS	NS	NS	NS	NS	NS	NS	2	0	NS
SOUCOMR001	408	645	558	301	402	460	242	289	470	563
SOUSALR001	12	0	0	0	5	0	0	0	2	0

NS = not surveyed

Table 6: Forest red-tailed black cockatoos recorded in roosts within 12 km of the site (Birdlife Australia (2021); (Peck et al. 2019)

Roost ID	Year and number of individuals					
	2014	2015	2016	2017	2018	2019
ARMCHAR001	NS	NS	NS	11	16	0
CANRIVR001	NS	NS	6	11	7	16
CANROSR001	NS	NS	0	0	14	2
CANWILR001	4	7	7	5	16	82
COCBANR001	NS	0	NS	6	17	0
COCBANR002	3	NS	32	24	109	15
COCCOCR001	NS	NS	NS	NS	15	102
COCCOOR001	NS	13	0	0	8	0
COCCOOR003	NS	NS	57	6	71	33
COCMUNR001	92	NS	73	0	365	259
COCMUNR003	NS	NS	38	0	108	0
COCSPER003	NS	NS	NS	35	12	0
FREWHIR001	0	NS	0	38	29	28
GOSCNVR001	2	0	0	0	NS	0
GOSCNVR002	0	4	0	0	0	0
GOSGOSR004	19	NS	31	32	79	0

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Table 6: Forest red-tailed black cockatoos recorded in roosts within 12 km of the site (Birdlife Australia (2021); (Peck et al. 2019) (continued)

Roost ID	Year and number of individuals					
	2014	2015	2016	2017	2018	2019
GOSSOUR002	NS	NS	0	36	208	15
MELLEER001	0	0	11	25	5	0
MELMURR001	199	33	125	209	441	214
MELWINR003	NS	0	0	0	1	0
MOSMOSR001	0	0	0	0	0	3
SOUCOMR001	0	0	0	0	0	1
SOUSALR001	2	0	0	0	8	0
VICWATR002	NS	NS	0	45	85	51

NS = not surveyed

4.2 General site conditions

The site is gently undulating and comprises sandy white-grey soils. Seven artificial lakes occur within the site that were sustained by irrigation at the time of the first survey day. During the second survey, only the southernmost lake contained water.

The site has been highly modified for use as a golf course and is dominated by non-native vegetation and unvegetated areas, with native vegetation present as individuals or small scattered patches. The artificial lakes are surrounded by either turf, riparian vegetation or planted trees and shrubs.

4.3 Species inventory

Approximately 20 Carnaby's cockatoo individuals were observed perching and foraging within trees in the central portion of the site during the day on 11 March 2020.

4.4 Breeding habitat

A total of 11 black cockatoo habitat trees were recorded within the site as shown in Figure 3.

All of the habitat trees were *Eucalyptus marginata* (jarrah). Two habitat trees were initially assessed to potentially contain suitable hollows based on the initial inspection from ground level. An internal hollow inspection determined that these hollows were not suitable for use by black cockatoos for breeding.

A summary of the habitat trees recorded within the site is provided in Table 7 and an inventory in Appendix D.

Table 7: Habitat trees recorded within the site

Category	No. trees	No. suitable hollows
Confirmed nest	0	-
Potential nest	0	-
Suitable hollow(s)	0	-
Potentially suitable hollow(s)	0	-
No suitable hollow(s)	11	0
Total	11	0

4.5 Roosting habitat

No roosts or secondary evidence of roosting were observed within the site during the survey. Native and non-native trees within the site have the potential to provide roosting habitat for black cockatoos.

4.6 Foraging habitat

A total of 4.76 ha of foraging habitat was mapped within the site for Carnaby's cockatoo and 4.88 ha for forest red-tailed black cockatoo as detailed in Table 9 and shown in Figure 4 and Figure 5. The foraging habitat occurs as scattered native trees and generally linear patches of native and non-native trees. The extent of foraging habitat by value category is detailed in Table 9.

Table 8: Foraging habitat quality

Foraging value	Black cockatoo species and foraging habitat area (ha)^	
	Carnaby's	Forest red-tailed
High	0.96 (20%)	0.59 (12%)
Moderate	0.67 (14%)	0.39 (8%)
Low	3.13 (66%)	3.90 (80%)
Total	4.76	4.88

^As the site is located outside of the range of Baudin's cockatoo foraging value for this species was not reported.

Primary food plants include *Banksia attenuata* (candlestick banksia), *Banksia menziesii* (firewood banksia) and **Tipuana tipu* (tipuana) whose fruits are consumed by Carnaby's cockatoo, jarrah and marri whose fruits are consumed by both Carnaby's cockatoo and forest red-tailed black cockatoo and **Melia azedarach* (Cape lilac) whose fruits are consumed by forest red-tailed black cockatoo. Secondary food plants include a range of species including *Allocasuarina fraseriana* (sheoak), *Casuarina obesa* (swamp sheoak), *Xanthorrhoea preissii* (grass tree), but predominantly comprise non-native eucalypt trees (**Eucalyptus* spp.).

A summary of dominant food plants within foraging habitat within the site is provided in Table 8.

Table 9: Dominant primary and secondary black cockatoo foraging plants recorded within the site

Common name	Black cockatoo species and foraging habitat category	
	Carnaby's	Forest red-tailed
Candlestick banksia	Primary	Non-food
*Cape lilac	Secondary	Primary
**Eucalyptus* spp.	Secondary	Secondary
Firewood banksia	Primary	Non-food
Grass tree	Secondary	Non-food
Jarrah	Primary	Primary
Marri	Primary	Primary
Sheoak	Non-food	Secondary
Swan River blackbutt	Primary	Primary
*Swamp sheoak	Secondary	Non-food
*Tipuana	Primary	Non-food

*Denotes non-native species.

4.7 Overall quality

Overall habitat quality for Carnaby's cockatoo within the site scored three out of ten (low quality). The overall habitat quality for forest red-tailed black cockatoo scored five out of ten (moderate quality).

The outcome of the overall black cockatoo habitat quality assessment is provided in Table 10 and summarised in Table 11. The full results of the quality assessment are provided in Appendix E.

Table 10: Overall habitat quality assessment scores

Habitat category	Black cockatoo species and score	
	Carnaby's	Forest red-tailed
Breeding	N/A#	3
Roosting	1	1
Foraging	3	5
Overall Score	3	5

#No breeding habitat score was assigned as the site is located outside of the species breeding range. No habitat score was assigned for Baudin's cockatoo as the site is located outside of the species distribution range.

Table 11: Summary of attributes contributing to black cockatoo habitat quality scores

Habitat category	Quality component category	Black cockatoo species and attributes	
		Carnaby's	Forest red-tailed
Breeding	Site condition	N/A – site is located outside of its breeding range	The site supports habitat trees without suitable hollows.
	Site context		Three confirmed forest red-tailed black cockatoo nests occur within 6 km of the site and 2,236 ha of potential forest red-tailed foraging habitat is mapped within 6 km of the site.
	Species stocking rate		N/A – no evidence of breeding was recorded within the site.
Roosting	Site condition	The site supports potential roosting habitat.	The site supports potential roosting habitat.
	Site context	The site is located more than 1 km from a large white-tailed black cockatoo roost and more than 500 m from a small white-tailed black cockatoo roost.	The site is located more than 1 km from a large roost and more than 500 m from a small roost.
	Species stocking rate	N/A - no evidence of roosting was recorded within the site.	N/A - no evidence of roosting was recorded within the site.
Foraging	Site condition	The site supports foraging habitat that comprises 66% low value, 14% moderate value and 20% high value.	The site supports foraging habitat that comprises 80% low value, 8% moderate value and 12% high value.
	Site context	The site is located more than 6 km from a white-tailed black cockatoo nest.	Confirmed forest red-tailed black cockatoo nest sites occur within 6 km of the site, indicating the foraging habitat within the site may be used by the birds utilising the breeding sites.
	Species stocking rate	Limited evidence of Carnaby's cockatoo foraging was recorded. Nevertheless, it is likely that the species would forage in the site.	No evidence of foraging by forest red-tailed black cockatoos was recorded. Nevertheless, it is likely that the species would forage in the site.

5 Discussion

Carnaby's cockatoo was observed foraging in trees within the site. A record for Carnaby's cockatoo was not surprising as this species is routinely sighted across the Swan Coastal Plain and foraging habitat occurs within the site and local area.

No record of forest red-tailed black cockatoo was made during the two site visits. It is likely that forest red-tailed black cockatoo would also occur in the site as this species is similarly common within its range. Chance observation of highly mobile species like black cockatoos could require frequent surveillance. Given foraging evidence or other signs of presence may not persist in the environment for particular long periods, or necessarily be noted by surveyors on a given day, the lack of records for forest red-tailed black cockatoo should not be taken of indication that the species would not occur.

5.1 Breeding habitat

As the 11 habitat trees recorded in the site do not 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 and other large trees within the site have the potential to form suitable hollows in the future. However, it will likely take many tens of years 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 Carnaby's cockatoo and Baudin's cockatoo, the potential for the future formation of breeding habitat is most relevant to forest red-tailed black cockatoo.

5.2 Roosting habitat

No signs of roosting were observed during the field survey and the BirdLife Australia dataset does not include any roost records in the site. Therefore, there is no reason to suspect that roosting currently occurs in the site. Nevertheless, the site contains tall trees and a water source that, in combination, comprise roosting habitat which could be used by black cockatoos.

5.3 Foraging habitat

The foraging habitat within the site was predominantly classified as providing low value to Carnaby's cockatoo and forest tailed black cockatoo. This is due to the high cover of secondary food plants, in particularly non-native eucalypts. While there are records of the consumption of non-native eucalypts by Carnaby's cockatoo and forest tailed black cockatoo (Groom 2011; DoEE 2017), these plants are arguably not as important food sources compared to primary food plants.

White-tailed black cockatoo (likely Carnaby's cockatoo) roosts occur within 6 km of the site and forest red-tailed black cockatoo roosts and nest sites occur within 6 km of the site. The foraging habitat within the site may be used by birds utilising the roosts and nesting in the local area. However, extensive areas of native and non-native vegetation that are dominated by primary food

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plants for Carnaby's cockatoo and forest red-tailed black cockatoo occur immediately adjacent to the site and in the wider area and would provide a larger and higher value foraging resource.

5.4 Overall quality

Developing an objective scoring system for relative and to some extent subjective concept like quality can be challenging. An ecological concept like habitat may have multiple attributes, which may be independent, interdependent or contrasting with other attributes and which vary in relevance in response to the changing species requirements or environmental conditions. Consequently, overall 'quality' must be assessed holistically to be properly understood.

The three conventional categories of black cockatoo habitat are intrinsically linked in that breeding and roosting activity is directly related to the availability of foraging and watering resources surrounding nests or roosts (Saunders 1990; Shah 2006; Le Roux 2017). Black cockatoos can also move over large distances within their range to access breeding and foraging habitat and will not necessarily return to the same locations within a year or across years (Saunders 1980; Johnstone and Kirkby 2008; Johnstone *et al.* 2017; Peck *et al.* 2019). Therefore, evaluating the overall quality of black cockatoo habitat requires acknowledgement of the interrelationships between the three habitat categories and the potential for use more than one category of habitat to be relevant to a site.

The method used in the assessment of overall quality selects the highest score of the three habitat categories to represent overall habitat quality (refer Appendix C). Adopting the highest score from a habitat category within a site avoids over or under estimating habitat quality because the most important value always drives, or is reflected in, the overall score.

Foraging habitat was the highest scoring category of habitat within the site for both Carnaby's cockatoo and forest red-tailed black cockatoos as the site does not currently provide breeding habitat and while roost habitat is present, roosting is not suspected to occur.

The foraging habitat within the site was further dominated by lower value secondary food plants. As there were no significant contextual factors to increase quality for Carnaby's cockatoo, a score of three (low quality) was applied. However, forest red-tailed black cockatoo nests are recorded within 6 km of the site. A nearby nest is considered to increase the quality of foraging habitat (from an impact assessment perspective) as it indicates foraging resource is within range of a nest such that it could contribute to support breeding activity. Accordingly, the overall quality of forest red-tailed black cockatoo foraging was scored five out of ten (moderate quality).

6 Conclusions

The site occurs within the modelled distribution of Carnaby's cockatoo and forest red-tailed black cockatoo, but outside of the modelled distribution of Baudin's cockatoo. The site is also within the breeding range of forest red-tailed black cockatoo. Therefore, the habitat in the site is most relevant to Carnaby's cockatoo and forest red-tailed black cockatoo.

Carnaby's cockatoo were recorded in the site. Both Carnaby's cockatoo and forest red-tailed black cockatoo are likely to occur within the site.

Forest red-tailed black cockatoo nests have been recorded within 6 km of the site at Bibra Lake and Murdoch, with the most recent breeding record occurring in spring 2020 (BirdLife Australia 2021). The site contains 11 habitat trees of which none contain hollows suitable for use by black cockatoos for breeding. Therefore, the site does not currently provide breeding habitat for forest red-tailed black cockatoo black cockatoo.

White-tailed black cockatoo (likely Carnaby's cockatoo) and forest red-tailed black cockatoo roosts have been recorded at 42 locations within 12 km of the site (BirdLife Australia 2021). No roosts or evidence of roosting by any species of black cockatoo was recorded within the site. Tall native and non-native trees within the site represent suitable roosting habitat.

Extensive areas of native and non-native vegetation that provide foraging habitat for Carnaby's cockatoo and forest red-tailed black cockatoo occurs immediately adjacent to the site and in the wider area.

A total of 4.76 ha of foraging habitat for Carnaby's cockatoo was mapped within the site of which 0.96 ha (20%) provides a high value resource, 0.67 ha (14%) provides a moderate value resource and 3.13 ha (66%) provides a low value resource.

A total of 4.88 ha of foraging habitat for forest red-tailed black cockatoo was mapped in the site of which 0.59 ha (12%) provides a high value resource, 0.39 ha (8%) provides a moderate value resource and 3.90 ha (80%) provides a low value resource.

Overall habitat quality was scored at three out of ten (low) for Carnaby's cockatoo with foraging habitat being the highest scoring component.

Overall black cockatoo habitat quality was scored at five out of ten (moderate) for forest red-tailed black cockatoo foraging habitat being the highest scoring component.

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Figures

Figure 1: Site Location

Project: Targeted Black Cockatoo Assessment
Former Glen Iris Golf Course
Client: ECP Acquisitions 6 Pty Ltd

Plan Number: EP20-009(13)--F14
Drawn: GAR
Date: 03/03/2021
Checked: MS
Approved: RAW
Date: 18/03/2021

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Metres
Scale: 1:10,000@A4
GDA 1994 MGA Zone 50

emerge ASSOCIATES

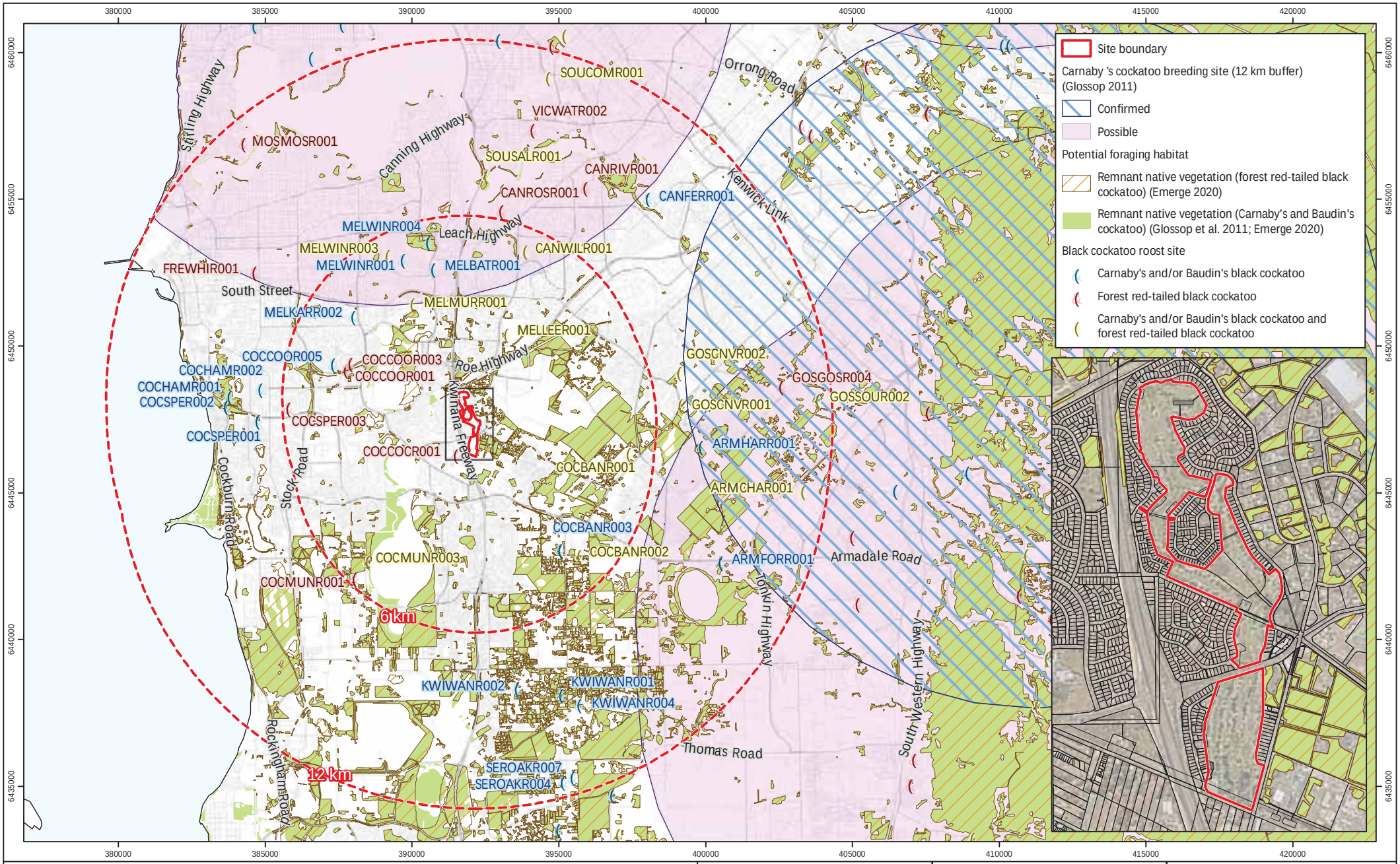

Figure 2: Black Cockatoo Habitat Context

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Client: ECP Acquisitions 6 Pty Ltd

Plan Number: EP20-009(13)--F15
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Checked: MS
Approved: RAW
Date: 18/03/2021

Figure 3: Black Cockatoo Habitat Trees

Project: Targeted Black Cockatoo Assessment
Former Glen Iris Golf Course
Client: ECP Acquisitions 6 Pty Ltd

Plan Number: EP20-009(13)--F16
Drawn: GAR
Date: 03/03/2021
Checked: MS
Approved: RAW
Date: 18/03/2021

0 100 200 300
Metres
Scale: 1:10,000@A4
GDA 1994 MGA Zone 50

emerge ASSOCIATES

While Emerge Associates makes every attempt to ensure the accuracy and completeness of data, Emerge accepts no responsibility for externally sourced data used

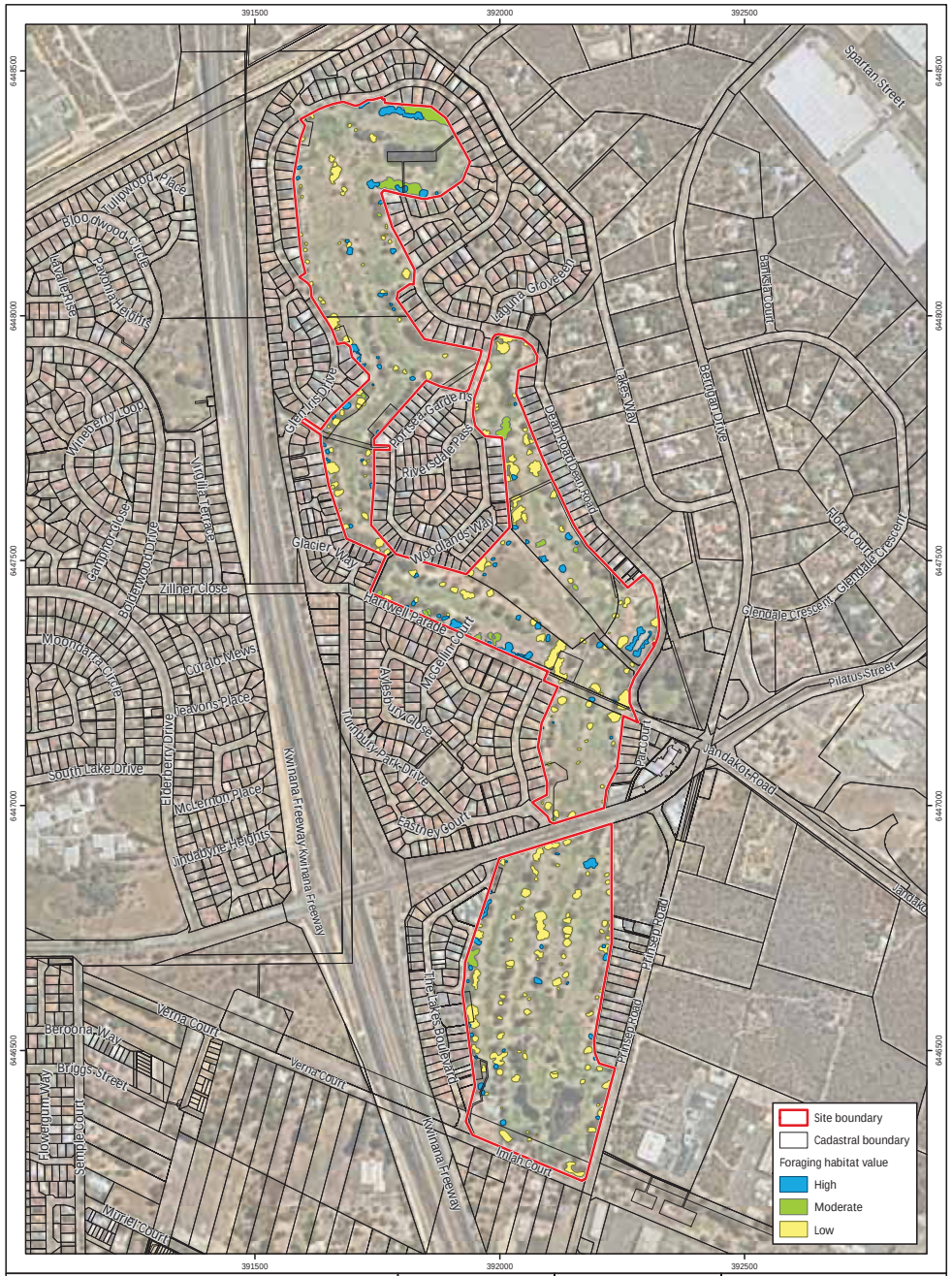

Figure 4: Carnaby's Cockatoo Foraging Habitat

Project: Targeted Black Cockatoo Assessment
Former Glen Iris Golf Course
Client: ECP Acquisitions 6 Pty Ltd

Plan Number: EP20-009(13)--F17a
Drawn: RAW
Date: 21/06/2021
Checked: RAW
Approved: TAA
Date: 21/06/2021

0 100 200 300
Metres
Scale: 1:10,000@A4
GDA 1994 MGA Zone 50

emerge ASSOCIATES

While Emerge Associates makes every attempt to ensure the accuracy and completeness of data, Emerge accepts no responsibility for externally sourced data used

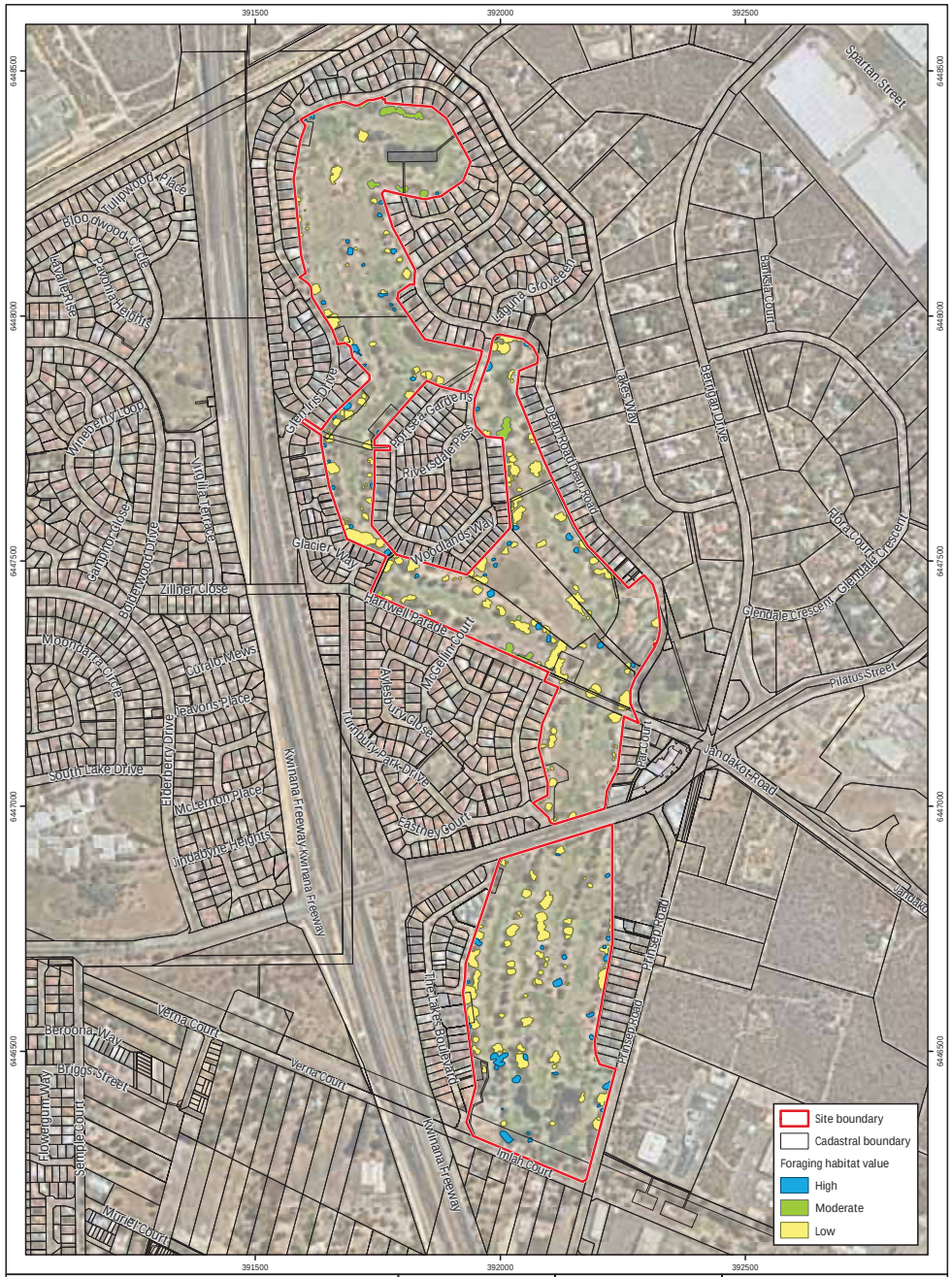

Figure 5: Forest Red-tailed Black Cockatoo Foraging Habitat		Plan Number: EP20-009(13)--F18a Drawn: RAW Date: 21/06/2021 Checked: RAW Approved: TAA Date: 21/06/2021	0 100 200 300 Metres Scale: 1:10,000@A4 GDA 1994 MGA Zone 50
Project: Targeted Black Cockatoo Assessment Former Glen Iris Golf Course Client: ECP Acquisitions 6 Pty Ltd			emerge ASSOCIATES

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
X	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

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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.

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 2018). 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	Priority 1 – Poorly known 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.
P2	Priority 2 – Poorly known 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.
P3	Priority 3 – Poorly known 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.
P4	(a) Priority 4 – Rare species Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These species are usually represented on conservation lands. (b) Priority 4 – Near Threatened 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. (c) Priority 4 – Other Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.

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Black cockatoos

Three threatened species of black cockatoo occur on the Swan Coastal Plain (referred to herein collectively as 'black cockatoos'):

- *Calyptorhynchus latirostris* (Carnaby's cockatoo) which is listed as 'endangered' under the EPBC Act and the BC Act.
- *Calyptorhynchus baudinii* (Baudin's 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 cockatoo, Carnaby's 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 cockatoo and 'breeding range' and 'non-breeding range' for Carnaby's 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 2017) and in small populations on the Swan Coastal Plain within the Baldivis, 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 cockatoo habitat on the Swan Coastal Plain and Jarrah Forest regions (Glossop *et al.* 2011). This dataset includes mapping of Carnaby's 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 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 cockatoo breeding and that many nesting sites are not known.

While this dataset only applies to Carnaby's cockatoo, the information it contains is also applicable for Baudin's cockatoo and forest red-tailed black cockatoo as they have similar breeding habitat requirements. That is, breeding sites that are suitable for Carnaby's cockatoo may also be suitable for

Baudin's 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 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 cockatoo recovery plan also identifies 13 'important bird areas' for Carnaby's 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 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 cockatoo. Note that this dataset does not include observations or point records of Carnaby's cockatoo feeding. This dataset represents areas of vegetation that may potentially provide foraging habitat for Carnaby's cockatoo.

Given this dataset was created in 2011 and in order to account for clearing of native vegetation that has occurred since this time, Emerge have updated this dataset using the current native vegetation extent as provided by DPIRD (2019a) to only show potential foraging habitat that currently exists (Emerge Associates 2020a).

Pine plantations also provide an important food source for Carnaby's cockatoo, but were not included in the Glossop et al. (2011) dataset. Mapping of pine plantations is available from the Forest Products Commission (Forest Products Commission 2020).

The Glossop et al. (2011) dataset is broadly applicable to other black cockatoos as many plant species that are foraged upon by Carnaby's cockatoo are also consumed by Baudins' cockatoo (e.g. fruit of *Banksia* spp., *Corymbia calophylla* (marri) and *Eucalyptus marginata* (jarrah)) and forest red-tailed black cockatoo (e.g. jarrah and marri fruit). However, using the Glossop et al. (2011) potential foraging habitat dataset for forest red-tailed cockatoos likely overestimates available foraging habitat as it includes multiple plant species that are not consumed by this species (e.g. *Banksia* spp.), and to a lesser extent the foraging value is also over-estimated for Baudin's cockatoo.

Emerge Associates (2020b) have used a similar methodology to Glossop et al. (2011) to define potential foraging habitat for forest-red tailed cockatoos. Specifically, DBCA (2019b) regional vegetation complex mapping has been used to determine which areas of remnant vegetation

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support plant species known to be foraged upon by forest red-tailed cockatoos, including *Allocasuarina fraseriana* (sheoak), *Corymbia calophylla* (marri), *Eucalyptus gomphocephala* (tuart) and *Eucalyptus marginata* (jarrah). Where these vegetation complexes intersect remnant vegetation mapped by DPIRD (2019b) they were considered to represent potential foraging habitat for forest red-tailed cockatoos.

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General references

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Appendix B

Black Cockatoo Foraging Plants

		Foraging category as assigned by Emerge			
Species name	Common name	CBC	BBC	FRTBC	Literature references
Acacia baileyana	Cootamundra wattle	Secondary			Groom 2011
Acacia pentadenia	Karri wattle	Secondary			Groom 2011
Acacia saligna	Orange wattle	Secondary			Groom 2011
Agonis flexuosa	Peppermint tree	Secondary			Groom 2011
Allocasuarina fraseriana	Sheoak		Secondary	Secondary	Johnstone & Storr 1998; Johnstone et al. 2010; Johnstone 2017; DoEE 2017
Allocasuarina spp.		Secondary		Secondary	Johnstone et al. 2010; Groom 2011; DSEWPaC 2012; DoEE 2017
Anigozanthos flavidus	Tall kangaroo paw		Secondary		Johnstone et al. 2010; DSEWPaC 2012; DoEE 2017
Araucaria heterophylla	Norfolk island pine	Secondary			Groom 2011; DoEE 2017
Banksia ashbyi	Ashby's banksia	Primary	Secondary		Saunders 1980; Groom 2011; DoEE 2017
Banksia attenuata	Slender banksia	Primary	Secondary		Saunders 1980; Johnstone et al. 2010; Groom 2011; DoEE 2017
Banksia baxteri	Baxter's banksia	Primary	Secondary		Johnstone et al. 2010; Groom 2011; DoEE 2017
Banksia carlinoides	Pink dryandra	Primary	Secondary		Johnstone et al. 2010; Groom 2011; DoEE 2017
Banksia coccinea	Scarlet banksia	Primary	Secondary		Johnstone et al. 2010; Groom 2011; DoEE 2017
Banksia dallanneyi	Couch honeypot dryandra	Primary	Secondary		Groom 2011; DoEE 2017
Banksia ericifolia	Heath-leaved banksia	Primary	Secondary		Johnstone et al. 2010; Groom 2011; DoEE 2017
Banksia fraseri		Primary	Secondary		Johnstone et al. 2010; Groom 2011; DoEE 2017
Banksia gardneri	Prostrate banksia	Primary	Secondary		Groom 2011; DoEE 2017
Banksia grandis	Bull banksia	Primary	Secondary		Saunders 1980; Johnstone & Storr 1998; Johnstone et al. 2010; Groom 2011; DoEE 2017
Banksia hookeriana	Hooker's banksia	Primary	Secondary		Johnstone et al. 2010; Groom 2011; DoEE 2017
Banksia ilicifolia	Holly banksia	Primary	Secondary		Johnstone et al. 2010; Groom 2011; Johnstone & Storr 1998; DoEE 2017
Banksia kippistiana		Primary	Secondary		Groom 2011; DoEE 2017
Banksia leptophylla		Primary	Secondary		Groom 2011; DoEE 2017
Banksia lindleyana	Porcupine banksia	Primary	Secondary		Johnstone et al. 2010; DoEE 2017

		Foraging category as assigned by Emerge			
Species name	Common name	CBC	BBC	FRTBC	Literature references
Banksia littoralis	Swamp banksia	Primary	Secondary		Saunders 1980; Groom 2011Johnstone & Storr 1998; Johnstone et al. 2010; DoEE 2017
Banksia menziesii	Firewood banksia	Primary	Secondary		Saunders 1980; Johnstone et al. 2010; Groom 2011; DoEE 2017
Banksia mucronulata	Swordfish dryandra	Primary	Secondary		Groom 2011; DoEE 2017
Banksia nivea	Honeypot dryandra	Primary	Secondary		Saunders 1980; Groom 2011; DoEE 2017
Banksia nobilis	Golden dryandra	Primary	Secondary		Saunders 1980; Groom 2011; DoEE 2017
Banksia praemorsa	Cut-leaf banksia	Primary	Secondary		Saunders 1980; Johnstone et al. 2010; Groom 2011; DoEE 2017
Banksia prionotes	Acorn banksia	Primary	Secondary		Johnstone et al. 2010; Groom 2011; DoEE 2017
Banksia prolata		Primary	Secondary		Johnstone et al. 2010; DoEE 2017
Banksia quercifolia	Oak-leaved banksia	Primary	Secondary		Johnstone & Storr 1998; Johnstone et al. 2010; Groom 2011; DoEE 2017
Banksia sessilis	Parrot bush	Primary	Secondary		Saunders 1980; Johnstone & Storr 1998; Johnstone et al. 2010; Groom 2011; DoEE 2017
Banksia speciosa	Showy banksia	Primary	Secondary		Johnstone et al. 2010; Groom 2011; DoEE 2017
Banksia spp.		Primary	Secondary		Saunders 1979; DSEWPaC 2012; DoEE 2017
Banksia squarrosa	Pingle	Primary	Secondary		Johnstone et al. 2010; Groom 2011; DoEE 2017
Banksia tricuspis	Pine banksia	Primary	Secondary		Groom 2011; DoEE 2017
Banksia undata	Urchin dryandra	Primary	Secondary		Groom 2011; DoEE 2017
Banksia verticillata	Granite banksia	Primary	Secondary		Saunders 1980; Groom 2011; DoEE 2017
Brassica campestris	Canola	Secondary			Groom 2011; DoEE 2017
Callistemon spp.		Secondary	Secondary		Johnstone et al. 2010; DoEE 2017
Callistemon viminalis	Captain cook bottlebrush	Secondary			Groom 2011
Callitris sp.		Secondary			Johnstone et al. 2010; Groom 2011
Carya illnoinensis	Pecan	Primary	Secondary		Johnstone et al. 2010; Groom 2011; Groom 2014; DoEE 2017
Casuarina cunninghamiana	River sheoak	Secondary			Groom 2011
Citrullus lanatus	Pie or afghan melon	Secondary			Johnstone et al. 2010; Groom 2011

Species name	Common name	Foraging category as assigned by Emerge			Literature references
		CBC	BBC	FRTBC	
Corymbia calophylla	Marri	Primary	Primary	Primary	Johnstone & Storr 1998; Johnstone & Kirkby 1999; Johnstone et al. 2010; DSEWPaC 2012; DoEE 2017; Johnstone 2017; Saunders 1979; Johnstone & Kirkby 2008
Corymbia citriodora	Lemon scented gum	Secondary	Secondary	Secondary	Johnstone et al. 2010; DSEWPaC 2012; Groom 2011; Johnstone 2017
Corymbia ficifolia	Red flowering gum	Secondary			Groom 2011
Corymbia haematoxylon	Mountain marri	Secondary		Secondary	Groom 2011; DoEE 2012; DoEE 2017
Corymbia maculata	Spotted gum	-	-	-	-
Darwinia citriodora	Lemon-scented darwinia	Secondary	Secondary		Groom 2011; Johnstone et al. 2010
Diospryros sp.	Sweet persimmon	Secondary	Secondary		Johnstone et al. 2010; Groom 2011; DSEWPaC 2012; DoEE 2017
Eremophila glabra	Tarbush	Secondary			Groom 2011
Erodium aureum		Secondary			Groom 2011
Erodium botrys	Long storksbill	Secondary	Secondary		Groom 2011; Johnstone & Storr 1998; Johnstone et al. 2010
Erodium spp.		Secondary	Secondary		Johnstone et al. 2010; DoEE 2017
Eucalyptus accedens	Powderbark	-	-	-	-
Eucalyptus caesia	Silver princess	Secondary		Secondary	Johnstone et al. 2010; Groom 2011; DSEWPaC 2012; DoEE 2017; Johnstone 2017
Eucalyptus camaldulensis	River red gum			Secondary	DoEE 2012; DoEE 2017
Eucalyptus decipiens	Red heart/moit			Secondary	Johnstone 2017
Eucalyptus diversicolor	Karri			Primary	Johnstone et al. 2010; DSEWPaC 2012; DoEE 2017; Johnstone & Storr 1998
Eucalyptus erythrocorys	Illyarrie	Secondary		Secondary	DSEWPaC 2012; DoEE 2017; Johnstone 2017, Johnstone et al. 2010
Eucalyptus globulus	Tasmanian blue gum	-	-	-	-
Eucalyptus gomphocephala	Tuart	Secondary		Secondary	Johnstone et al. 2010; Groom 2011; DSEWPaC 2012; DoEE 2017
Eucalyptus grandis	Flooded gum, rose gum			Secondary	DoEE 2012; DoEE 2017

Species name	Common name	Foraging category as assigned by Emerge			Literature references
		CBC	BBC	FRTBC	
Eucalyptus lehmannii	Bushy yate			Secondary	Johnstone 2017
Eucalyptus leucoxylon	Yellow gum	Secondary			Groom 2014
Eucalyptus longicornis	Red morrell	-	-	-	-
Eucalyptus loxophleba	York gum	Secondary			Johnstone et al. 2010; Groom 2011; DSEWPaC 2012; DoEE 2017
Eucalyptus marginata	Jarrah	Primary	Secondary	Primary	Saunders 1980; Johnstone et al. 2010; Groom 2011; DSEWPaC 2012; DoEE 2017; Johnstone & Storr 1998; Johnstone & Kirkby 1999; Johnstone 2017
Eucalyptus megacarpa	Bullich	-	-	-	-
Eucalyptus occidentalis	Swamp yate	-	-	-	-
Eucalyptus patens	Blackbutt	Primary		Primary	Johnstone & Storr 1998; Johnstone & Kirkby 1999; Johnstone et al. 2010; DSEWPaC 2012; DoEE 2017; Johnstone 2017; Groom 2011
Eucalyptus pleurocarpa	Tallerack	Secondary			Groom 2011
Eucalyptus preissiana	Bell-fruited mallee	Secondary			Groom 2011
Eucalyptus robusta	Swamp mahogany	Secondary			Johnstone et al. 2010; Groom 2011
Eucalyptus rudis	Flooded gum	-	-	-	-
Eucalyptus salmonophloia	Salmon gum	Primary			Johnstone et al. 2010; Groom 2011; DSEWPaC 2012; DSEWPaC 2012; DoEE 2017
Eucalyptus salubris	Gimlet	-	-	-	-
Eucalyptus staeri	Albany blackbutt			Secondary	Johnstone & Storr 1998
Eucalyptus todtiana	Coastal blackbutt	Secondary			Saunders 1980; Johnstone et al. 2010; Groom 2011; Johnstone & Kirkby 2008
Eucalyptus wandoo	Wandoo	Primary	Secondary	Primary	Saunders 1980; Johnstone et al. 2010; Groom 2011; DSEWPaC 2012; DoEE 2017
Ficus sp.	Fig	Secondary			Groom 2011
Grevillea armigera	Prickly toothbrushes	Primary			Groom 2011
Grevillea bipinnatifida	Fuschia grevillea	Primary			Groom 2011

Species name	Common name	Foraging category as assigned by Emerge			Literature references
		CBC	BBC	FRTBC	
Grevillea hookeriana	Red toothbrushes	Primary			Groom 2011
Grevillea hookeriana subsp. apic	Black toothbrushes	Primary			Groom 2011
Grevillea paniculata	Kerosene bush	Primary			Groom 2011
Grevillea paradoxa	Bottlebrush grevillea	Primary			Groom 2011
Grevillea petrophiloides	Pink poker	Primary			Groom 2011
Grevillea robusta	Silky oak	Primary			Johnstone et al. 2010; Groom 2011
Grevillea spp.		Primary			Saunders 1979; Johnstone et al. 2010; DSEWPaC 2012; DoEE 2017
Grevillea wilsonii	Native fuchsia		Secondary		Johnstone et al. 2010
Hakea auriculata		Primary			Saunders 1980; Groom 2011
Hakea candolleana		Primary			Groom 2011
Hakea circumalata	Coastal hakea	Primary			Groom 2011
Hakea commutata		Primary			Groom 2011
Hakea conchifolia	Shell-leaved hakea	Primary			Groom 2011
Hakea costata	Ribbed hakea	Primary			Groom 2011
Hakea cristata	Snail hakea	Primary	Secondary		Groom 2011; Johnstone et al. 2010
Hakea cucullata	Snail hakea	Primary			Groom 2011
Hakea cyclocarpa	Ramshorn	Primary			Saunders 1980; Groom 2011
Hakea eneabba		Primary			Groom 2011
Hakea erinacea	Hedgehog hakea	Primary	Secondary		Johnstone et al. 2010; Groom 2011
Hakea falcata	Sickle hakea	Primary			Groom 2011
Hakea flabellifolia	Fan-leaved hakea	Primary			Groom 2011
Hakea gilbertii		Primary			Saunders 1980; Groom 2011
Hakea incrassata	Golfball or marble hakea	Primary			Johnstone et al. 2010; Groom 2011
Hakea lasiantha	Woolly flowered hakea	Primary			Johnstone et al. 2010; Groom 2011
Hakea lasianthoides		Primary	Secondary		Johnstone et al. 2010; Groom 2011
Hakea laurina	Pin-cushion hakea	Primary			Johnstone et al. 2010; Groom 2011
Hakea lissocarpha	Honeybush	Primary	Secondary		Saunders 1980; Johnstone et al. 2010; Groom 2011
Hakea marginata			Secondary		Johnstone et al. 2010

Species name	Common name	Foraging category as assigned by Emerge			Literature references
		CBC	BBC	FRTBC	
Hakea megalosperma	Lesueur hakea	Primary			Groom 2011
Hakea multilineata	Grass leaf hakea	Primary			Groom 2011
Hakea neospathulata		Primary			Groom 2011
Hakea obliqua	Needles and corks	Primary			Saunders 1980; Groom 2011
Hakea oleifolia	Dungyn	Primary			Groom 2011
Hakea pandanicarpa subsp. crassifolia	Thick-leaved hakea	Primary			Groom 2011
Hakea petiolaris	Sea urchin hakea	Primary			Groom 2011
Hakea polyanthema		Primary			Groom 2011
Hakea preissii	Needle tree	Primary			Groom 2011
Hakea prostrata	Harsh hakea	Primary	Secondary		Saunders 1980; Johnstone et al. 2010; Groom 2011
Hakea psilorrhyncha		Primary			Groom 2011
Hakea ruscifolia	Candle hakea	Primary	Secondary		Saunders 1980; Groom 2011; Johnstone et al. 2010
Hakea scoparia	Kangaroo bush	Primary			Groom 2011
Hakea smilacifolia		Primary			Groom 2011
Hakea spp.		Primary	Secondary		Saunders 1979; DSEWPaC 2012; DoEE 2017
Hakea stenocarpa	Narrow-fruited hakea	Primary	Secondary		Johnstone et al. 2010; Groom 2011
Hakea sulcata	Furrowed hakea	Primary			Groom 2011
Hakea trifurcata	Two-leaved hakea	Primary	Secondary		Saunders 1980; Johnstone et al. 2010; Groom 2011
Hakea undulata	Wavy-leaved hakea	Primary	Secondary		Saunders 1980; Johnstone et al. 2010; Groom 2011
Hakea varia	Variable-leaved hakea	Primary	Secondary		Saunders 1980; Groom 2011
Harpephyllum caffrum	Kaffir plum			Secondary	Johnstone 2017
Helianthus annuus	Sunflower	Secondary			Johnstone et al. 2010; Groom 2011
Hibiscus sp.	Hibiscus	Secondary			Groom 2011
Isopogon scabriusculus		Secondary			Groom 2011
Jacaranda mimosifolia	Jacaranda	Secondary	Secondary		Johnstone et al. 2010; Groom 2011

Species name	Common name	Foraging category as assigned by Emerge			Literature references
		CBC	BBC	FRTBC	
Jacksonia furcellata	Grey stinkwood	Secondary			Groom 2011
Kingia australis	Kingia		Secondary		Johnstone et al. 2010
Lambertia inermis	Chittick	Secondary			Johnstone & Storr 1998; Groom 2011
Lambertia multiflora	Many-flowered honeysuckle	Secondary			Saunders 1980; Groom 2011
Liquidamber styraciflua	Liquid amber	Primary		Secondary	Johnstone et al. 2010; Groom 2011; Groom 2014; Personal observation
Lupinus sp.	Lupin	Secondary			Saunders 1980; Groom 2011
Macadamia integrifolia	Macadamia	Primary	Secondary		Johnstone et al. 2010; Grooms 2011; Groom 2014
Malus domestica	Apple	Secondary	Secondary		Johnstone et al. 2010; Johnstone & Storr 1998; DSEWPaC 2012; DoEE 2017; Groom 2011
Melaleuca leuropoma		Secondary			Saunders 1980; Groom 2011
Melia azedarach	Cape lilac or white cedar	Secondary		Primary	Johnstone et al. 2010; Groom 2011
Mesomeleana spp.		Secondary			Johnstone et al. 2010; Groom 2011
Olea europea	Olive			Secondary	Johnstone 2017
Persoonia longifolia	Snottygobble			Secondary	Johnstone & Storr 1998; Johnstone & Kirkby 1999; Johnstone et al. 2010; DSEWPaC 2012; DoEE 2017
Pinus canariensis	Canary island pine	Primary			Johnstone et al. 2010; Groom 2011
Pinus caribea	Caribbean pine	Primary			Johnstone et al. 2010; Groom 2011
Pinus pinaster	Pinaster or maritime pine	Primary			Groom 2011
Pinus radiata	Radiata pine	Primary	Secondary		Johnstone et al. 2010; Groom 2011
Pinus spp.		Primary	Secondary		Johnstone & Storr 1998; Saunders 1979; Johnstone et al. 2010; DSEWPaC 2012; DoEE 2017
Protea 'Pink Ice'		Secondary			Groom 2011
Protea repens		Secondary			Groom 2011
Protea spp.		Secondary			Johnstone et al. 2010

Species name	Common name	Foraging category as assigned by Emerge			Literature references
		CBC	BBC	FRTBC	
Prunus amygdalus	Almond tree	Secondary			Johnstone & Storr 1998; Johnstone et al. 2010; Groom 2011; DoEE 2017
Pyrus communis	European pear		Secondary		Johnstone & Storr 1998; Johnstone et al. 2010; DSEWPaC 2012; DoEE 2017
Quercus spp.	Oak		Secondary		Johnstone et al. 2010
Raphanus raphanistrum	Wild radish	Secondary			Groom 2011; DoEE 2017
Reedia spathacea			Secondary		Johnstone et al. 2010
Rumex hypogaeus	Doublegee	Secondary			Saunders 1980
Stenocarpus sinuatus		Secondary			Johnstone et al. 2010
Syzygium smithii	Lilly pilly	Secondary			Groom 2014
Tipuana tipu	Tipu or rosewood tree	Primary			Groom 2011, Groom 2014
Xanthorrhoea preissii	Grass tree	Secondary	Secondary		Groom 2011; Johnstone et al. 2010
Xylomelum occidentale	Woody pear	Secondary			Groom 2014

CBC=Carnaby's cockatoo, BBC=Baudin's cockatoo and FRTBC=Forest red-tailed black cockatoo

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Appendix C

Black Cockatoo Habitat Quality Assessment (Emerge 2021)

Introduction

As part of environmental impact assessment and offset calculation, the Department of Agriculture, Water and the Environment (DAWE) requires that a score out of ten is provided for the overall quality of back cockatoo habitat within a site (DAWE 2020). DAWE does not provide a methodology for scoring habitat quality, specifying instead that an assessment of quality should be undertaken by an experienced technical expert (DSEWPaC 2012).

Emerge Associates (Emerge) have developed this method to provide a systematic assessment of overall black cockatoo habitat quality. Black cockatoo habitat is conventionally separated into breeding, roosting and foraging categories. Our method assesses and scores the quality of breeding, roosting and foraging habitat separately and then provides an overall quality score (out of ten) based on the highest score determined for the respective habitat categories.

Methodology

The International Organization for Standardization defines 'quality' as the "*degree to which a set of inherent characteristics fulfils requirements*" (ISO 9000 2020). Developing an objective scoring system for quality is therefore challenging, as quality is both relative and, to some extent, subjective. An ecological value like habitat may also have a wide range of characteristics, with varying relevance to the requirements of a species and that may be independent, interdependent or contrasting with other characteristics, such that habitat quality must be assessed holistically to be properly understood.

The three categories of black cockatoo habitat are intrinsically linked in that breeding and roosting activity is directly related to the availability of foraging and watering resources surrounding nests or roosts (Saunders 1990; Shah 2006; Le Roux 2017). Black cockatoos can also move over large distances within their range to access breeding and foraging habitat and will not necessarily return to the same locations within a year or across years (Saunders 1980; Johnstone and Kirkby 2008; Johnstone *et al.* 2017; Peck *et al.* 2019). Therefore, evaluating the overall quality of black cockatoo habitat requires acknowledgement of the relationships between the different habitat categories and the potential for use of all habitats within a site, given the condition of each habitat, the sites' location and the history of use of habitat within a site by black cockatoos.

While breeding, roosting and foraging habitat are interrelated, we suggest that the different habitat categories should not be scored cumulatively as this can overestimate quality. That is, if a site contains multiple categories of habitat it does not necessarily contain greater quality habitat. For example, a site that contains a roost is not necessarily of higher overall quality if it also contains breeding habitat.

Alternatively, averaging the scores from all three habitat categories can act to underestimate habitat, since certain types of habitat are recorded less frequently than others and therefore their absence would act to devalue quality. For example, the likelihood of recording a roost is generally low compared to recording foraging or breeding habitat but a site that lacks a roost is not necessarily of lower overall quality.

EMERGE_BC_Quality_Appendix (V007)
Black Cockatoo Habitat Quality Assessment

Hence, our scoring system selects the highest habitat category score to represent overall habitat quality. Adopting the highest score from any habitat category within a site avoids over or under estimating habitat quality because the most important value always drives, or is reflected in, the overall score.

To provide a score for each habitat category, the following three 'quality components' are considered as recommended by DAWE (DAWE 2020):

- Site condition which is the "*condition of a site in relation to the ecological requirements of a threatened species or ecological community. This includes considerations such as vegetation condition and structure, the diversity of habitat species present, and the number of relevant habitat features*".
- Site context which is the "*relative importance of a site in terms of its position in the landscape, taking into account the connectivity needs of a threatened species or ecological community. This includes considerations such as movement patterns of the species, the proximity of the site in relation to other areas of suitable habitat, and the role of the site in relation to the overall population or extent of a species or community*".
- Species stocking rate which is the "*usage and/or density of a species at a particular site…It includes considerations such as survey data for a site in regards to a particular species population or, in the case of a threatened ecological community this may be a number of different populations. It also includes consideration of the role of the site population in regards to the overall species population viability or community extent*".

A habitat quality assessment should aim to combine current information on the status of black cockatoos and habitat characteristics within a site with the best available information regarding the status of black cockatoo populations and black cockatoo habitat within areas surrounding a site. Black cockatoo habitat assessments for a given site don't typically allow scope for physical survey of areas surrounding a site and so the ability to obtain new information is usually limited to that which can be obtained within a site. Therefore, we considered that, when assessing the above components, site condition is best defined from a current survey, site context is best defined from literature and relevant databases (Glossop *et al.* 2011; DPaW 2013; DoEE 2016a, c, b; Peck *et al.* 2019) and information on species stocking rate is best obtained from a combination of current survey, previous survey or databases (Glossop *et al.* 2011; DPaW 2013; DoEE 2016a, c, b; Peck *et al.* 2019).

Method

The *Habitat Scoring Tool* provided as Plate 1 is an *Excel* spreadsheet document that is used to determine a quality score for each habitat category component by answering queries about habitat within and surrounding the site. The *Habitat Scoring Tool* shows the attributes measured within each habitat category and quality component. An overall score from one to ten is assigned for each species, with 1-3 being low, 4-6 being moderate, 7 being moderate – high and 8-10 being high.

The highest score of 10 is reserved for habitat that has an active nest(s) as it provides the best confirmation that the site and/or surrounding area provides sufficient resources and is therefore worthy of a higher quality score. Foraging habitat scores a maximum total of eight as it is an essential

requirement for black cockatoos, particularly to support breeding. Roosting habitat scores a maximum total of seven as it is more transient than the other habitat components.

A quality score is calculated for each habitat category by summing maximum scores for each query. Because maximum scores are selected, multiple answers may be provided for any query where appropriate without exaggerating the quality score. For key confirmed habitat such as roosts or nests, the scoring tool ensures that relevant, higher scores are achieved irrespective of whether all preceding queries have been answered positively (for example a roost always scores 8 irrespective of whether other quality criteria have been met).

The highest score from any of the three habitat categories is then adopted as the overall score for black cockatoo habitat quality within the site.

Black Cockatoo Habitat Quality Assessment - Scoring Tool (Baudin's cockatoo)
<insert site name>

		Query		Answer	Weighting	Site score	Sum
Breeding habitat	Site condition	1.1	The site contains habitat trees with either:				
			no suitable hollow(s)	y	1.0	1.0	
			suitable hollow(s)	n	4.0	0.0	1.0
			suitable hollow(s) that have signs of use by black cockatoos	n	5.0	0.0	
	Site context	1.2	The site contains habitat trees and is located within 6 km of a black cockatoo nest(s) (active, historical or potential)	y	1.0	1.0	
		1.3	The site contains habitat trees and is located within 6 km of either:				1.0
			>2,000 ha of native vegetation that provides foraging habitat	y	1.0	1.0	
			>10,000 ha of native vegetation that provides foraging habitat	n	2.0	0.0	
	Species stocking rate	1.4	The site contains habitat tree(s) that support(s) an active nest(s)	n	Maximum score (10)	0.0	0.0
						Score out of a maximum of 10	3
Roosting habitat	Site condition	2.1	The site contains trees suitable for roosting and a water source or a water source exists nearby	y	1.0	1.0	1.0
	Site context	2.2	The site is located within 1 km of a large roost (≥150 individuals) or 500 m of a small roost (< 150 individuals)(used within last 5 years)	n	3.0	0.0	0.0
	Species stocking rate	2.3	The site contains a roost (used within last 5 years)	n	7.0	0.0	0.0
						Score out of a maximum of 7	1
Foraging habitat	Site condition	3.1	Within the site the proportion of foraging habitat that is:				
			low value	90%	1.0	0.9	
			moderate value	1%	3.0	0.0	1.4
			high value	10%	5.0	0.5	
	Site context	3.2	The site is located within 6 km of a nest(s) (active, historical or potential)	y	2.0	2.0	2.0
	Species stocking rate	3.4	The site is likely to support foraging by the species	y	1.0	1.0	1.0
						Score out of a maximum of 8	4

SUMMARY		
Habitat category	**Score**	**Habitat quality**
Breeding	3	Low
Roosting	1	Low
Foraging	4	Moderate
Overall habitat quality score	**4**	Moderate

Note:
1. Within the breeding category, a score of 10 applies if an active nest(s) occurs within the site, regardless of the answer to other queries in this category
2. Within the roosting category, a score of 7 applies if a roost occurs within the site, regardless of the answer to other queries in this category.
3. The overall habitat quality score consists of the highest score from each habitat category.

Plate 1: Black Cockatoo Habitat Scoring Tool (Baudin's cockatoo example)

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Appendix D

Black Cockatoo Habitat Tree Data

Tag No.	Easting	Northing	DBH (cm)	Species	Category	Notes
1	391990	6446466	75	Eucalyptus marginata	No suitable hollow(s)	
2	392097	6447344	67	Eucalyptus marginata	No suitable hollow(s)	
3	392099	6447344	61	Eucalyptus marginata	No suitable hollow(s)	
4	391830	6447470	68	Eucalyptus marginata	No suitable hollow(s)	
5	392080	6447370	89	Eucalyptus marginata	No suitable hollow(s)	
6	392079	6447368	86	Eucalyptus marginata	No suitable hollow(s)	
7	391737	6448274	105	Eucalyptus marginata	No suitable hollow(s)	Internal hollow inspection undertaken but hollow(s) not suitable for black cockatoos
8	391836	6448409	81	Eucalyptus marginata	No suitable hollow(s)	
9	391835	6448406	58	Eucalyptus marginata	No suitable hollow(s)	
10	391831	6448405	87	Eucalyptus marginata	No suitable hollow(s)	Internal hollow inspection undertaken but hollow(s) not suitable for black cockatoos
11	391705	6447935	93	Eucalyptus marginata	No suitable hollow(s)	

Appendix E

Overall Habitat Quality Assessment

Black Cockatoo Habitat Quality Assessment - Scoring Tool (Carnaby's cockatoo)
Former Glen Iris Golf Course

		Query		Answer	Weighting	Site score	Sum
Breeding habitat	Site condition	1.1	The site contains habitat trees with either:				
			no suitable hollow(s)	N/A	1.0	0.0	0.0
			suitable hollow(s)	N/A	4.0	0.0	
			suitable hollow(s) that have signs of use by black cockatoos	N/A	5.0	0.0	
	Site context	1.2	The site contains habitat trees and is located within 6 km of a black cockatoo nest(s) (active, historical or potential)	N/A	1.0	0.0	0.0
		1.3	The site contains habitat trees and is located within 6 km of either:				
			>2,000 ha of native vegetation that provides foraging habitat	N/A	1.0	0.0	
			>10,000 ha of native vegetation that provides foraging habitat	N/A	2.0	0.0	
	Species stocking rate	1.4	The site contains habitat tree(s) that support(s) an active nest(s)	N/A	Maximum score (10)	0.0	0.0
						Score out of a maximum of 10	0
Roosting habitat	Site condition	2.1	The site contains trees suitable for roosting and a water source or a water source exists nearby	y	1.0	1.0	1.0
	Site context	2.2	The site is located within 1 km of a large roost (≥150 individuals) or 500 m of a small roost (< 150 individuals)(used within last 5 years)	n	3.0	0.0	0.0
	Species stocking rate	2.3	The site contains a roost (used within last 5 years)	n	7.0	0.0	0.0
						Score out of a maximum of 7	1
Foraging habitat	Site condition	3.1	Within the site the proportion of foraging habitat that is:				
			low value	66%	1.0	0.7	2.1
			moderate value	14%	3.0	0.4	
			high value	20%	5.0	1.0	
	Site context	3.2	The site is located within 6 km of a nest(s) (active, historical or potential)	n	2.0	0.0	0.0
	Species stocking rate	3.4	The site is likely to support foraging by the species	y	1.0	1.0	1.0
						Score out of a maximum of 8	3

SUMMARY		
Habitat category	Score	Habitat quality
Breeding	N/A	N/A
Roosting	1	Low
Foraging	3	Moderate
Overall habitat quality score	3	Moderate

Note:
1. Within the breeding category, a score of 10 applies if an active nest(s) occurs within the site, regardless of the answer to other queries in this category
2. Within the roosting category, a score of 7 applies if a roost occurs within the site, regardless of the answer to other queries in this category.
3. The overall habitat quality score consists of the highest score from each habitat category.

Black Cockatoo Habitat Quality Assessment - Scoring Tool (forest red-tailed black cockatoo)
Former Glen Iris Golf Course

		Query		Answer	Weighting	Site score	Sum
Breeding habitat	Site condition	1.1	The site contains habitat trees with either:				
			no suitable hollow(s)	y	1.0	1.0	1.0
			suitable hollow(s)	n	4.0	0.0	
			suitable hollow(s) that have signs of use by black cockatoos	n	5.0	0.0	
	Site context	1.2	The site contains habitat trees and is located within 6 km of a black cockatoo nest(s) (active, historical or potential)	y	1.0	1.0	2.0
		1.3	The site contains habitat trees and is located within 6 km of either:				
			>2,000 ha of native vegetation that provides foraging habitat	y	1.0	1.0	
			>10,000 ha of native vegetation that provides foraging habitat	n	2.0	0.0	
	Species stocking rate	1.4	The site contains habitat tree(s) that support(s) an active nest(s)	n	Maximum score (10)	0.0	0.0
						Score out of a maximum of 10	3
Roosting habitat	Site condition	2.1	The site contains trees suitable for roosting and a water source or a water source exists nearby	y	1.0	1.0	1.0
	Site context	2.2	The site is located within 1 km of a large roost (≥150 individuals) or 500 m of a small roost (< 150 individuals)(used within last 5 years)	n	3.0	0.0	0.0
	Species stocking rate	2.3	The site contains a roost (used within last 5 years)	n	7.0	0.0	0.0
						Score out of a maximum of 7	1
Foraging habitat	Site condition	3.1	Within the site the proportion of foraging habitat that is:				
			low value	80%	1.0	0.8	1.6
			moderate value	8%	3.0	0.2	
			high value	12%	5.0	0.6	
	Site context	3.2	The site is located within 6 km of a nest(s) (active, historical or potential)	y	2.0	2.0	2.0
	Species stocking rate	3.4	The site is likely to support foraging by the species	y	1.0	1.0	1.0
						Score out of a maximum of 8	5

SUMMARY		
Habitat category	Score	Habitat quality
Breeding	3	Low
Roosting	1	Low
Foraging	5	Moderate
Overall habitat quality score	5	Moderate

Note:
1. Within the breeding category, a score of 10 applies if an active nest(s) occurs within the site, regardless of the answer to other queries in this category
2. Within the roosting category, a score of 7 applies if a roost occurs within the site, regardless of the answer to other queries in this category.
3. The overall habitat quality score consists of the highest score from each habitat category.

Appendix F

Arboricultural Assessment

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17 September 2021

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Dear Jarrod

ARBORICULTURAL ASSESSMENT – FORMER GLEN IRIS GOLF COURSE

1 INTRODUCTION

Acumen Development Solutions, on behalf of ECP Acquisitions 6 Pty Ltd, engaged Emerge Associates (Emerge) to conduct an arboricultural assessment within the former Glen Iris Golf Course, which comprises Lots 6 and 7 Glen Iris Drive, Lots 3, 509 and 512 Dean Road and Lot 139 Imlah Court, Jandakot (referred to herein as the 'site').

A separate assessment was previously undertaken to map black cockatoo habitat trees[1] (Emerge Associates 2021). The purpose of this arboricultural assessment was to provide information on attributes of all large trees within the site to inform tree retention.

The location of the site is shown in Figure 1.

2 METHODS

2.1 Field survey

The field survey was completed by subcontracted qualified arborist from Arborite[2].

The survey was completed by the arborist over multiple dates in January and February 2021. During the survey the site was traversed on foot. The arborist recorded the attributes outlined in Table 1 for all trees with a trunk diameter at breast height (DBH) of 30 centimetres (cm) or greater , including habitat trees previously assessed by Emerge Associates (2021). In some instances, a single location was recorded for groups of similar juvenile or semi-mature trees (with DBH ≥30 cm).

[1] Native eucalypts with a trunk 'diameter at breast height' (DBH) of ≥50 centimetres (cm).
[2] David Cuddihy, Graduate Certificate Arboriculture (Australian Qualifications Framework (AQF) Level 8)

Table 1: Attributes assessed for each tree

Attribute	Notes
Unique id	Aluminium tag number
Spatial location	XY coordinates using GPS receiver ± 5m^
Image	Oblique digital photograph (12 megapixel or greater)
Species name	Using WA herbarium nomenclature
Common name	Using WA herbarium nomenclature
Height	1-5 m, 1-10 m, 10-15 m, 15-20 m, 20-25 m, 25 +m
Canopy spread (width)	1-5 m, 1-10 m, 10-15 m, 15-20 m
Trunk diameter	Diameter at breast height (DBH) (cm)
Health	Excellent, good, average, poor, dead
Age	Juvenile, semi-mature, mature
Useful life expectancy	25+ years, 15-25 years, 5-15 years, <5 years
Retention value	Low, medium, high
Notes	Safety concerns, tree defects, pruning requirements, further ecologist/arborist assessment recommended etc.

2.2 Health

Tree health was determined by the arborist according to scheme outlined in Table 2.

Table 2: Tree health rating descriptions

Tree Health Rating	Description
Excellent	Tree with >90% of original canopy present. Less than 5% epicormic growth and deadwood. No history of failures or pruning wounds. Well-formed canopy.
Good	Tree with 75-90% of original canopy present. Epicormic growth less than 10% of remaining canopy. Some dead branchlets, minor limb failures and pruning wounds. Minor canopy imbalance.
Average	Tree with 50– 75% of original canopy present Some epicormic growth. Some major dead stems and major deadwood up to 30%. History of larger limb failure and canopy imbalance.
Poor	Major canopy die-back with major stems deceased. Structurally unsound, history of large limb failure. Hazardous tree.
Dead	Tree dead or transient. Less than 5 years useful life expectancy.

2.3 Useful life expectancy

Useful life expectancy (ULE) is an estimate of the number of years a tree is expected to remain alive. ULE is a method of assessing the relative importance of individual trees and the amenity value that can be realised for the remaining duration of the trees' lifespan. In conjunction with landscape significance, ULE helps making informed decisions on the retention value of trees on site.

ULE was determined by the arborist who considered the age of the tree, the average life span of the species and any local environmental modifying factors that may influence life span.

2.4 Retention value

There is always a compromise between retaining trees on a development site and the economic imperatives of land development. Establishing priorities for the retention of trees is an important part of the planning process if amenity is to be sustained in the long term.

Retention value was classified 'high', 'medium', 'low' and 'very low' by the arborist. Arborite's method for classifying retention value contrasts ULE with landscape significance, as outlined in Table 3. Landscape significance of trees was determined by the arborist using the criteria outlined in Table 4.

Table 3: Tree retention matrix

Useful life expectancy (ULE)	Landscape significance						
	1	2	3	4	5	6	7
Long - Greater than 25 years	High						
Medium - 15 to 25 years			Medium				
Short - 5 to 15 years				Low			
Transient - Less than 5 years					Very low		
Dead or potentially hazardous							

Table 4: Criteria for rating landscape significance of trees

Significance rating	Criteria
1 - Significant	• The subject tree is listed as a heritage Item with a local, state or national level of significance. • The subject tree forms part of the curtilage of a Heritage Item and has a known or documented association with that item. • The subject tree is a commemorative planting having been planted by an important historical person (s) or to commemorate an important historical event. • The subject tree is scheduled as a threatened species. • The tree is a locally indigenous species, representative of the original vegetation of the area and is known as an important food, shelter or nesting tree for endangered or threatened fauna species. • The subject tree is a remnant tree, being a tree in existence prior to development of the area. • The subject tree has a very large live crown size exceeding 300 m² with normal to dense foliage cover, is located in a visually prominent in the landscape, exhibits very good form and habit typical of the species and makes a significant contribution to the amenity and visual character of the area by creating a sense of place or creating a sense of identity. • The tree is visually prominent in view from surrounding areas, being a landmark or visible from a considerable distance.
2 - Very high	• The tree has a strong historical association with a heritage item. (building/structure/artifact/garden etc) within or adjacent the property and/or exemplifies a particular era or style of landscape design associated with the original development of the site. • The subject tree is listed on a local Significant Tree Register. • The tree is a locally-indigenous species and representative of the original vegetation of the area and the tree is located within a defined biodiversity corridor or has known wildlife habitat value. • The subject tree has a very large live crown size exceeding 200 m²; a crown density exceeding 70% Crown Cover (normal-dense), is a very good representative of the species in terms of its form and branching habit or is aesthetically distinctive and makes a positive contribution to the visual character and the amenity of the area.
3- High	• The tree has a suspected historical association with a heritage item or landscape supported by anecdotal or visual evidence. • The tree is a locally-indigenous species and representative of the original vegetation of the area. • The subject tree has a large live crown size exceeding 100 m². • The tree is a good representative of the species in terms of its form and branching habit with minor deviations from normal (e.g. crown distortion/suppression) with a crown density of at least 70% Crown Cover (normal). • The subject tree is visible from the street and surrounding properties and makes a positive contribution to the visual character and the amenity of the area.
4 - Moderate	• The subject tree has a medium live crown size exceeding 40 m². • The tree is a fair representative of the species, exhibiting moderate deviations from typical form (distortion/suppression etc) with a crown density of more than 50% Crown Cover (thinning to normal). • The tree makes a fair contribution to the visual character and amenity of the area.

Table 4: Criteria for rating landscape significance of trees (continued)

Significance rating	Criteria
4 - Moderate	• The tree is visible from surrounding properties, but is not visually prominent – view may be partially obscured by other vegetation or built forms. • The tree has no known or suspected historical association.
5- Low	• The subject tree has a small live crown size of less than 40 m² and can be replaced within the short term with new tree planting. • The tree is a poor representative of the species, showing significant deviations from the typical form and branching habit with a crown density of less than 50% Crown Cover (sparse). • The subject tree is not visible from surrounding properties (visibility obscured) and makes a negligible contribution or has a negative impact on the amenity and visual character of the area.
6 - Very low	• The subject tree is listed as an environment weed in the relevant Local Government Area, being invasive, or a nuisance species. • The subject tree is scheduled as exempt (not protected) under the provisions of the local Council's due to its species, nuisance or position relative to buildings or other structures.
7 - Insignificant	• The tree is a declared pest or environmental weed.

2.5 Spatial location

Following the survey, the spatial location of high and medium retention value trees was updated using data supplied by project surveyors MNG.

3 RESULTS

A total of 1,215 trees were recorded within the site, comprising 80 species and 26 unidentified trees. (including one 'unknown' category which was not assigned species). Nine species are native to the local area and 72 species are non-native[3]. The unidentified trees are also non-native. The locations of native and non-native trees within the site are shown in Figure 2.

A summary of the ten most common species in the site is provided in Table 5.

Table 5: Ten most common tree species in the site

Species name	Common name	No. individuals
**Eucalyptus camaldulensis*	River red-gum	158
**Corymbia maculata*	Spotted gum	106
**Eucalyptus grandis*	Rose gum	102
**Eucalyptus leucoxylon*	Yellow gum	72
**Eucalyptus* sp.	Gum	59
**Eucalyptus cladocalyx*	Sugar gum	56
**Eucalyptus citriodora*	Lemon-scented gum	42
Banksia attenuata	Slender banksia	41
**Acacia* sp.	Wattle	36
**Ficus microcarpa*	Chinese banyan	36

Ninety-seven (97) trees were classified as having 'high' retention value, 375 were classified as having 'medium' retention value and the remaining 743 trees were classified as having 'low' retention value. The

[3] Non-native species denoted by an asterisk ('*') in text and raw data.

retention value of each tree is shown in Figure 3. Note only three of the retention value categories outlined in Section 2.4 were applied (that is no trees were classified as having a very low retention value).

The data recorded for each tree is provided as Attachment 1.

Summary and closing

We trust that this letter provides sufficient details on the trees within the site. Should you have any questions regarding the content of this letter, please do not hesitate to contact the undersigned.

Yours sincerely
Emerge Associates

Tom Atkinson
PRINCIPAL ENVIRONMENTAL CONSULTANT

cc: nil

Encl: Figure 1: Site Location
Figure 2: Tree Species
Figure 3: Retention Value
Attachment 1: Tree Inventory Data and Photos

References

Emerge Associates 2021, *Targeted Black Cockatoo Assessment - Former Glen Iris Golf Course*, EP20-009(13)--009A MS, Version A.

Figures

Figure 1: Site Location

Project: Arboricultural Assessment
Former Glen Iris Golf Course
Client: ECP Acquisitions 6 Pty Ltd

Plan Number: EP20-009(12)--F21
Drawn: GAR
Date: 07/04/2021
Checked: RAW
Approved: ALB
Date: 03/06/2021

0 100 200 300
Metres
Scale: 1:10,000@A4
GDA 1994 MGA Zone 50

emerge ASSOCIATES

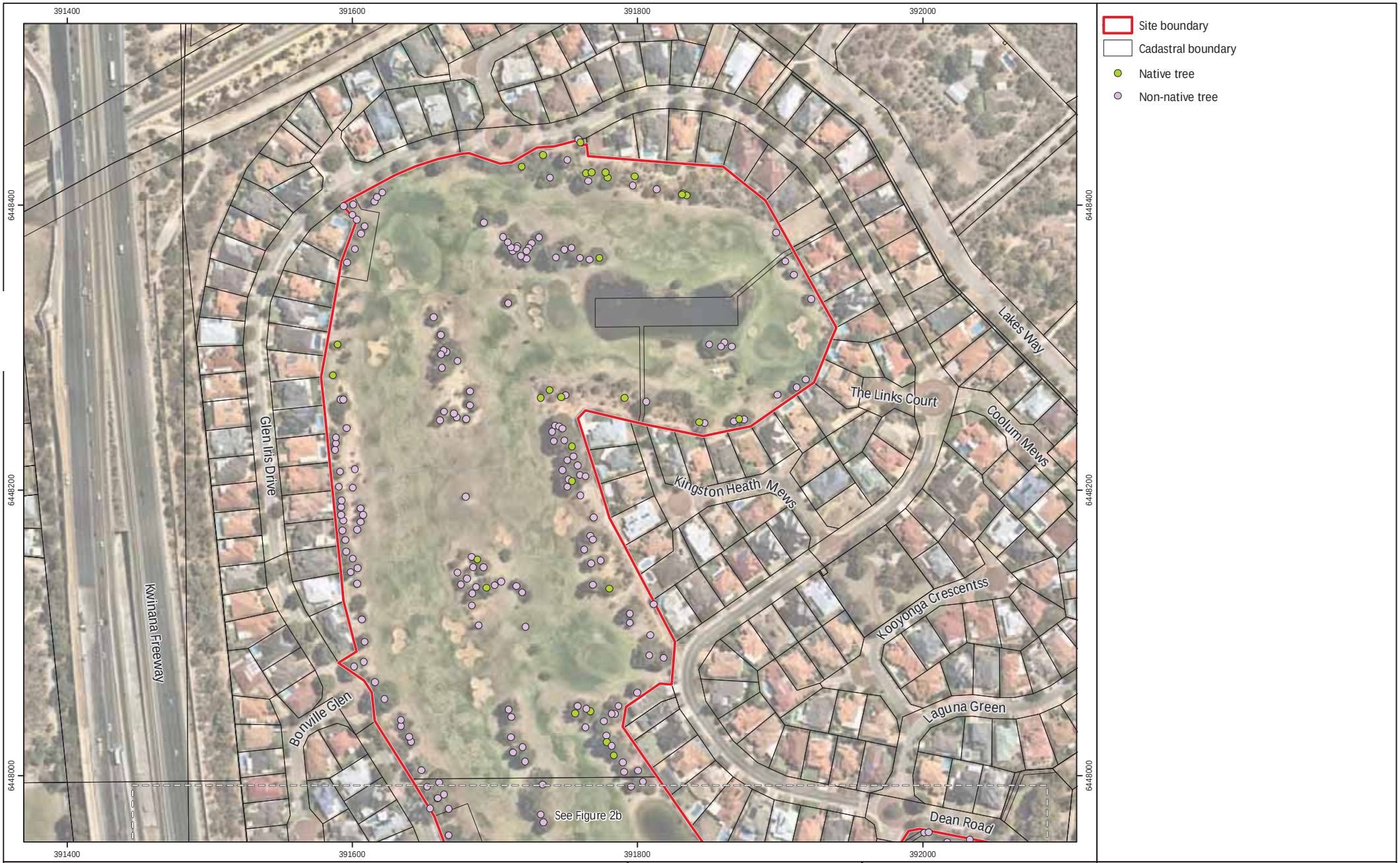

Figure 2a: Trees

Project: Arboricultural Assessment
Former Glen Iris Golf Course
Client: ECP Acquisitions 6 Pty Ltd

Plan Number: EP20-009(12)--F24
Drawn: GAR
Date: 07/04/2021
Checked: RAW
Approved: ALB
Date: 03/06/2021

0 50 100 150
Metres
Scale: 1:3,500@A4
GDA 1994 MGA Zone 50

emerge ASSOCIATES

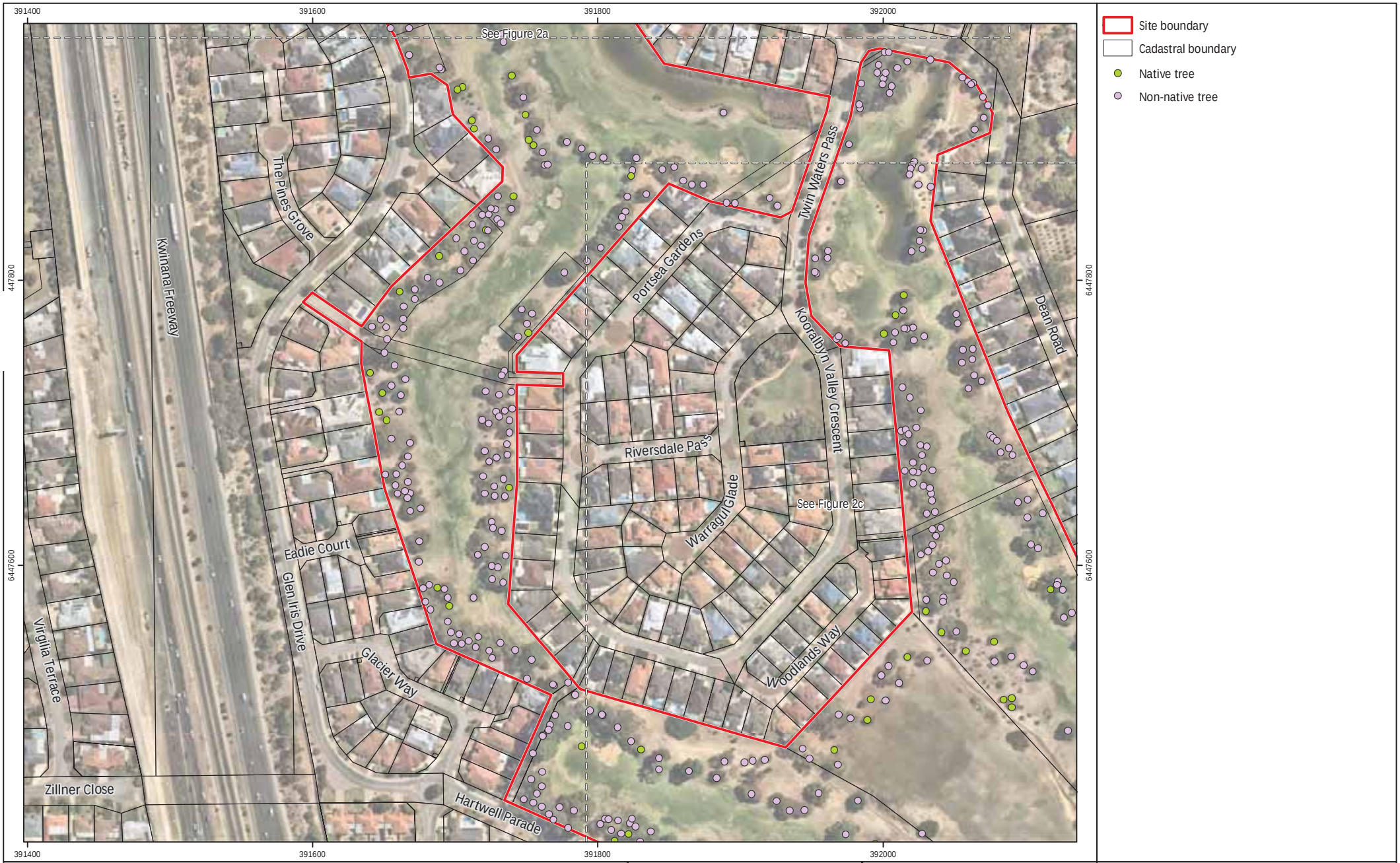

Figure 2b: Trees

Project: Arboricultural Assessment
Former Glen Iris Golf Course
Client: ECP Acquisitions 6 Pty Ltd

Plan Number: EP20-009(12)--F24
Drawn: GAR
Date: 07/04/2021
Checked: RAW
Approved: ALB
Date: 03/06/2021

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Metres
Scale: 1:3,500@A4
GDA 1994 MGA Zone 50

emerge ASSOCIATES

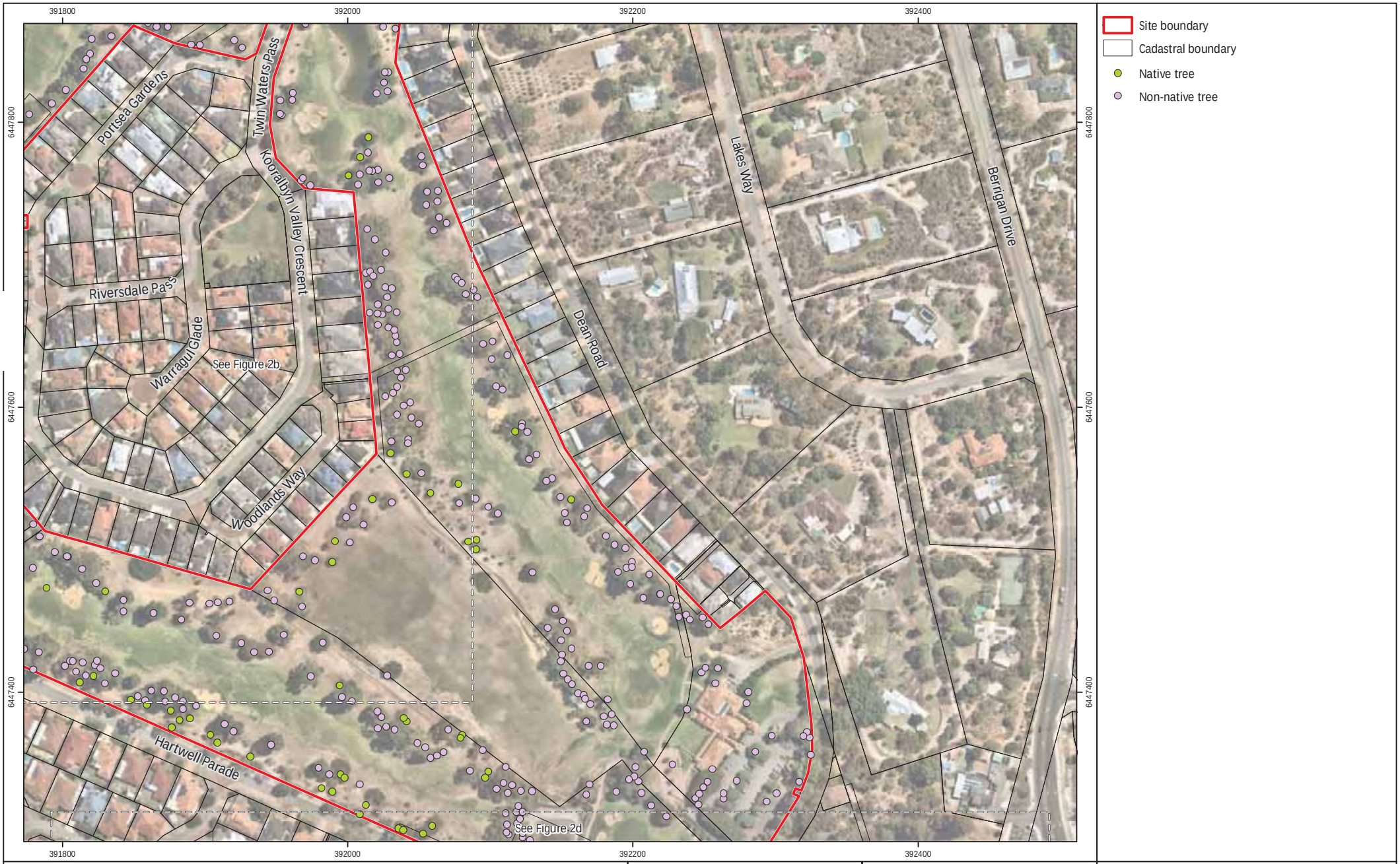

Figure 2c: Trees

Project: Arboricultural Assessment
Former Glen Iris Golf Course
Client: ECP Acquisitions 6 Pty Ltd

Plan Number: EP20-009(12)--F24
Drawn: GAR
Date: 07/04/2021
Checked: RAW
Approved: ALB
Date: 03/06/2021

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Metres
Scale: 1:3,500@A4
GDA 1994 MGA Zone 50

emerge ASSOCIATES

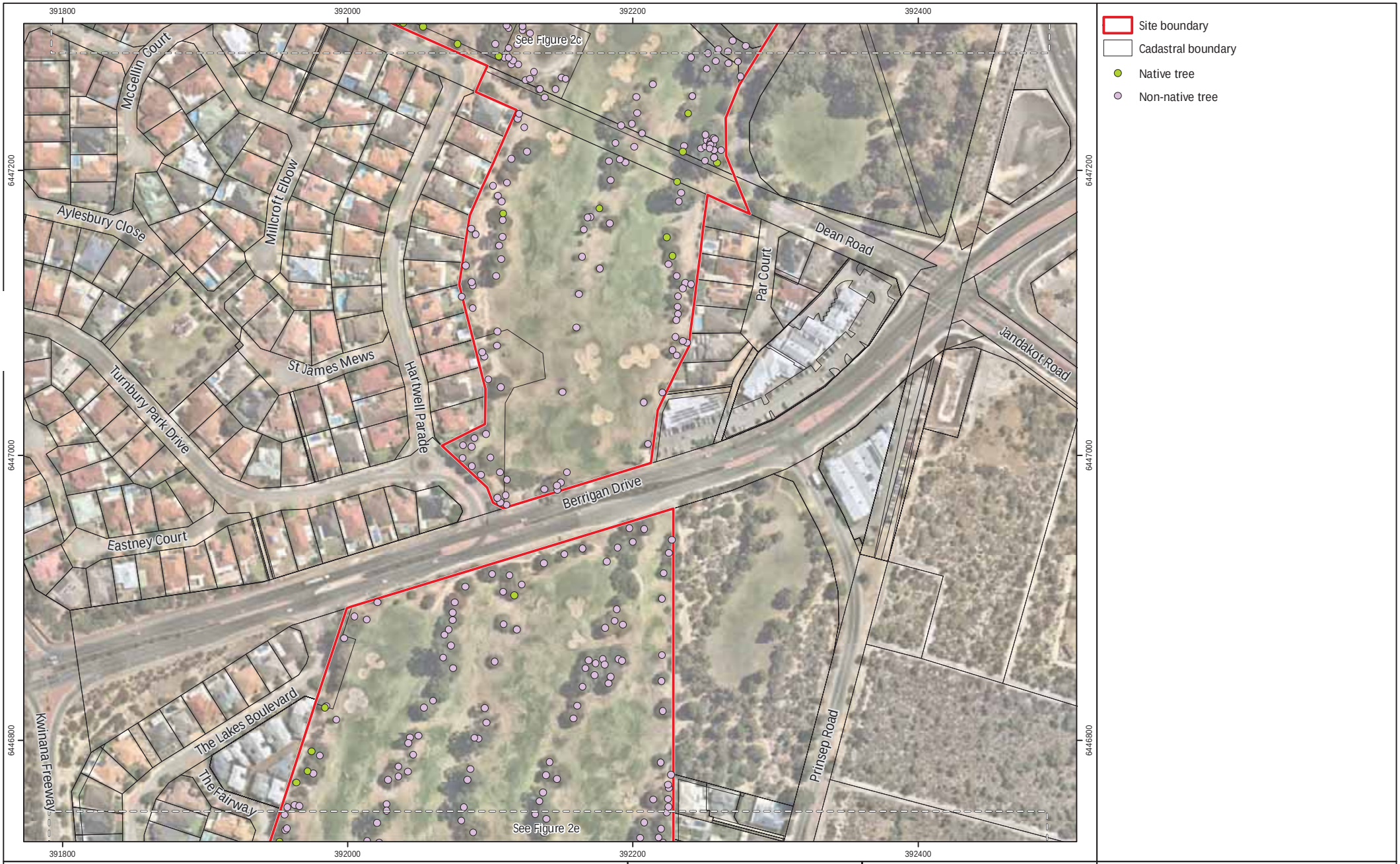

Figure 2d: Trees

Project: Arboricultural Assessment
Former Glen Iris Golf Course
Client: ECP Acquisitions 6 Pty Ltd

Plan Number: EP20-009(12)--F24
Drawn: GAR
Date: 07/04/2021
Checked: RAW
Approved: ALB
Date: 03/06/2021

0 50 100 150
Metres
Scale: 1:3,500@A4
GDA 1994 MGA Zone 50

emerge ASSOCIATES

Figure 2e: Trees

Project: Arboricultural Assessment
Former Glen Iris Golf Course
Client: ECP Acquisitions 6 Pty Ltd

Plan Number: EP20-009(12)--F24
Drawn: GAR
Date: 07/04/2021
Checked: RAW
Approved: ALB
Date: 03/06/2021

0 50 100 150
Metres
Scale: 1:3,500@A4
GDA 1994 MGA Zone 50

emerge ASSOCIATES

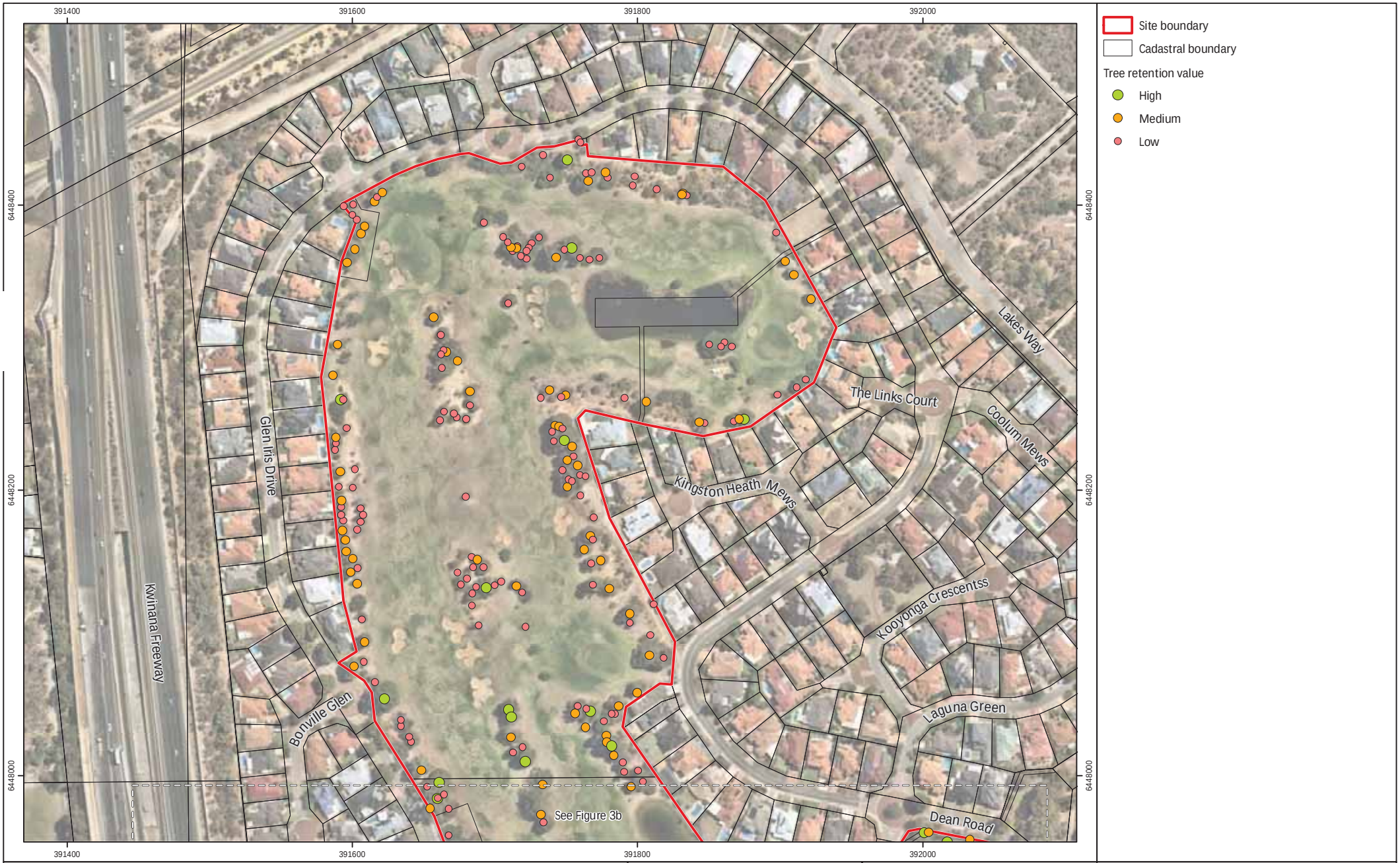

Figure 3a: Tree Retention Value

Project: Arboricultural Assessment
Former Glen Iris Golf Course
Client: ECP Acquisitions 6 Pty Ltd

Plan Number: EP20-009(12)--F23
Drawn: GAR
Date: 07/04/2021
Checked: RAW
Approved: ALB
Date: 03/06/2021

0 50 100 150
Metres
Scale: 1:3,500@A4
GDA 1994 MGA Zone 50

emerge ASSOCIATES

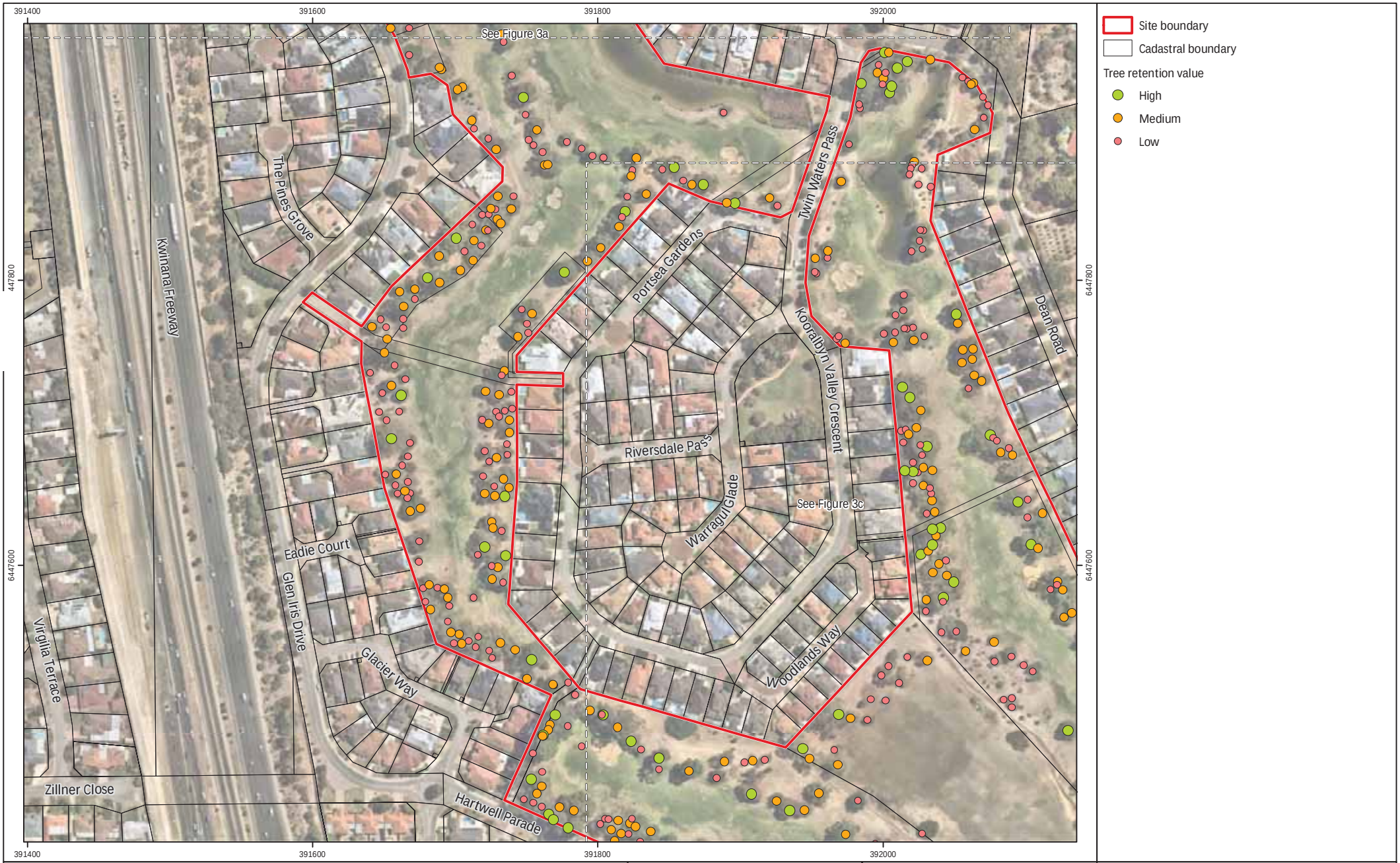

Figure 3b: Tree Retention Value

Project: Arboricultural Assessment
Former Glen Iris Golf Course
Client: ECP Acquisitions 6 Pty Ltd

Plan Number: EP20-009(12)--F23
Drawn: GAR
Date: 07/04/2021
Checked: RAW
Approved: ALB
Date: 03/06/2021

0 50 100 150
Metres
Scale: 1:3,500@A4
GDA 1994 MGA Zone 50

emerge ASSOCIATES

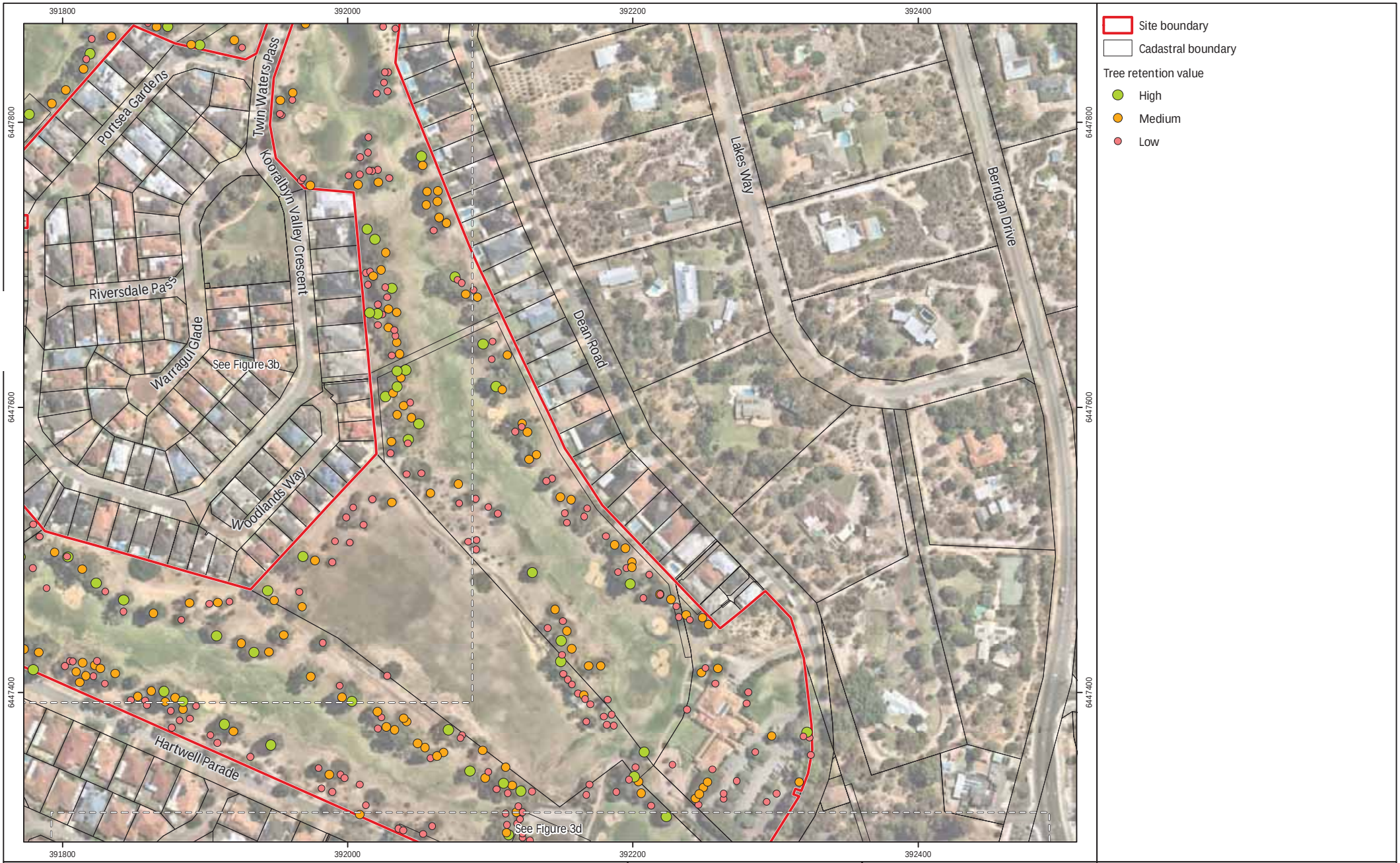

Figure 3c: Tree Retention Value

Project:	Arboricultural Assessment Former Glen Iris Golf Course
Client:	ECP Acquisitions 6 Pty Ltd

Plan Number:	EP20-009(12)--F23
Drawn:	GAR
Date:	07/04/2021
Checked:	RAW
Approved:	ALB
Date:	03/06/2021

0 50 100 150
Metres
Scale: 1:3,500@A4
GDA 1994 MGA Zone 50

emerge ASSOCIATES

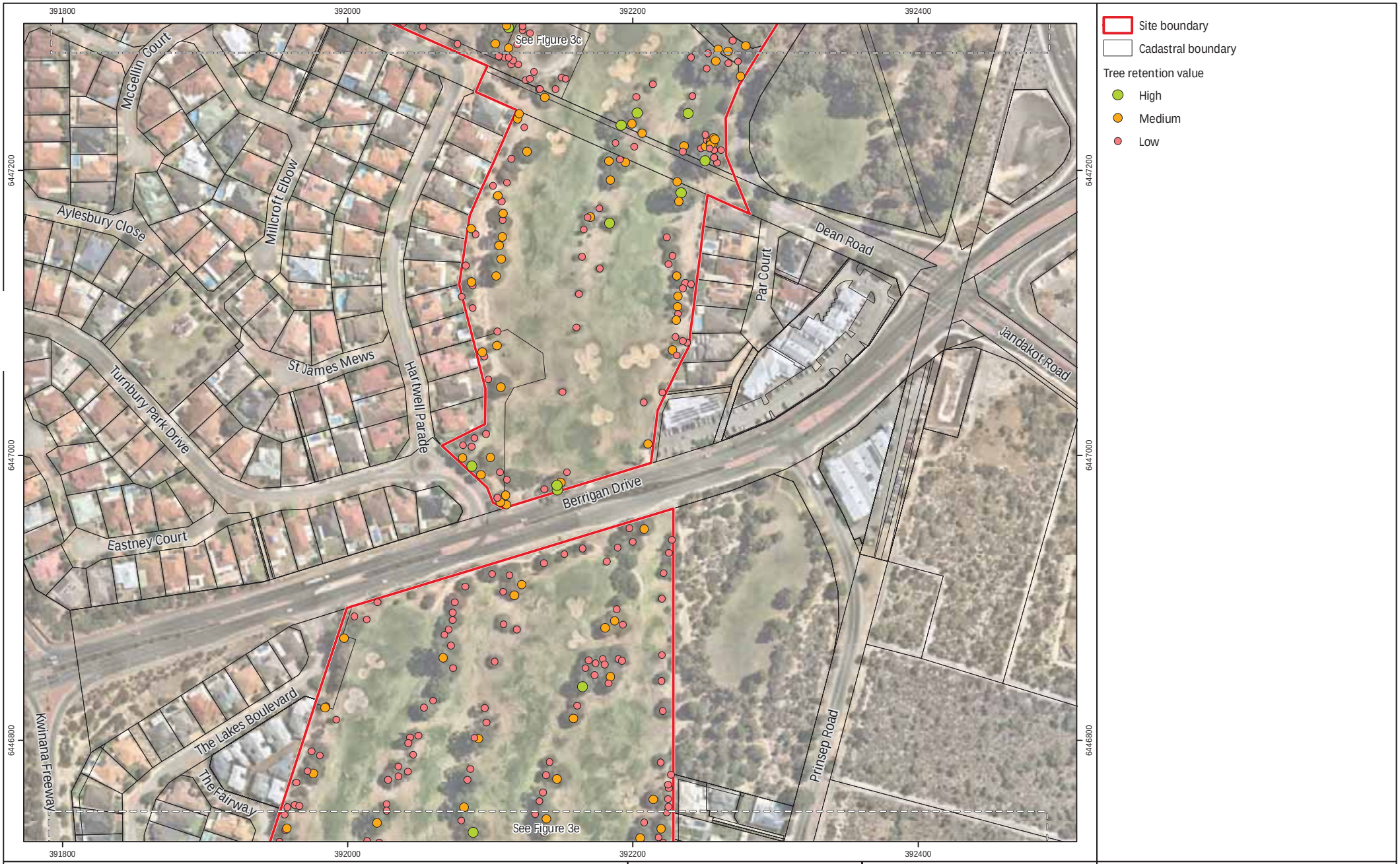

Figure 3d: Tree Retention Value

Project: Arboricultural Assessment
Former Glen Iris Golf Course
Client: ECP Acquisitions 6 Pty Ltd

Plan Number: EP20-009(12)--F23
Drawn: GAR
Date: 07/04/2021
Checked: RAW
Approved: ALB
Date: 03/06/2021

0 50 100 150
Metres
Scale: 1:3,500@A4
GDA 1994 MGA Zone 50

emerge ASSOCIATES

Figure 3e: Tree Retention Value

Project: Arboricultural Assessment
Former Glen Iris Golf Course
Client: ECP Acquisitions 6 Pty Ltd

Plan Number: EP20-009(12)--F23
Drawn: GAR
Date: 07/04/2021
Checked: RAW
Approved: ALB
Date: 03/06/2021

0 50 100 150
Metres
Scale: 1:3,500@A4
GDA 1994 MGA Zone 50

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