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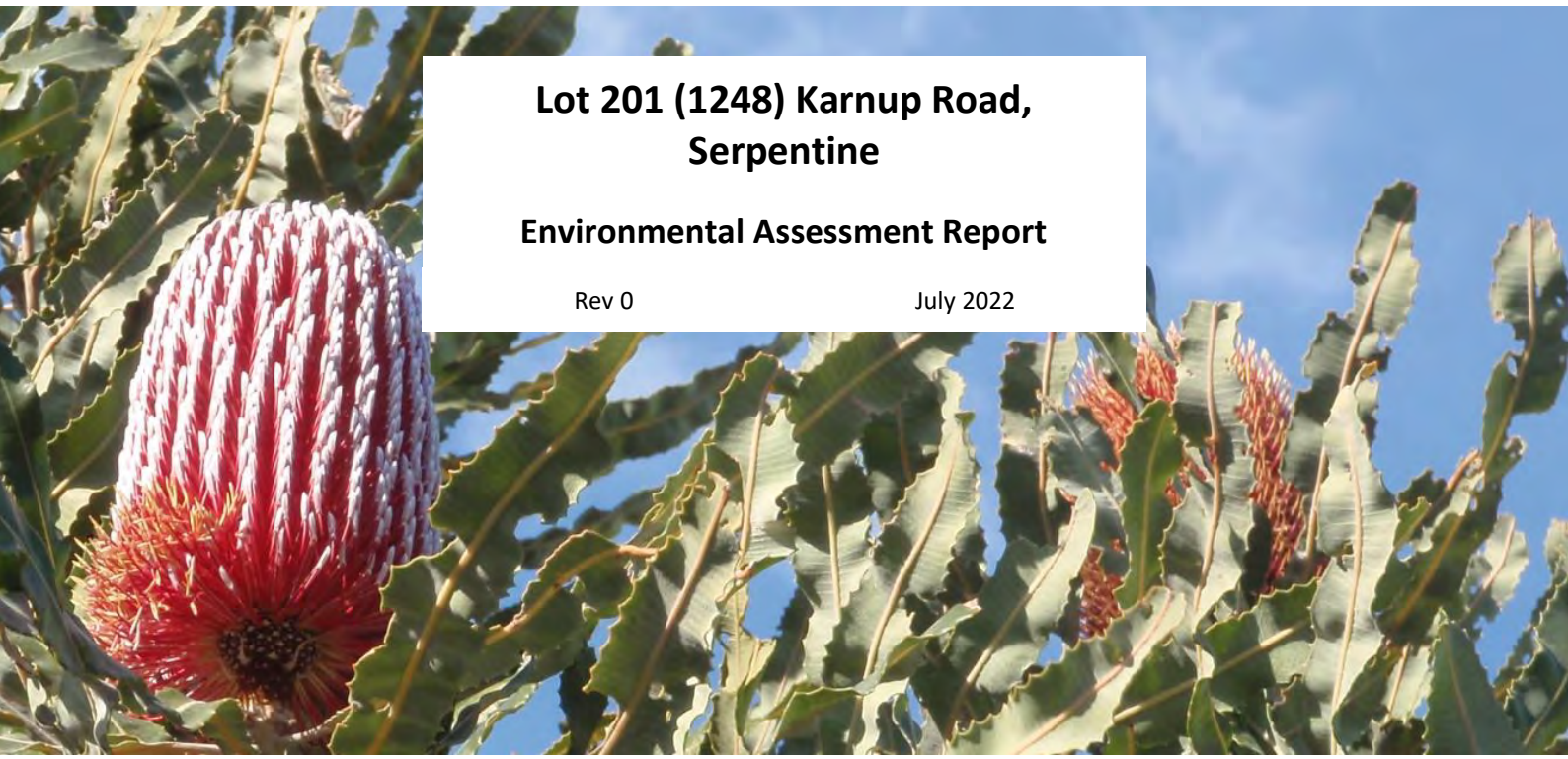

Lot 201 (1248) Karnup Road, Serpentine

Environmental Assessment Report

Rev 0 July 2022

CALIBRE | COMMITMENT | COLLABORATION

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This report was prepared for:
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1 Introduction

1.1 Proposed development

Bright Tank Brewing Co. is proposing to develop a brewery, bar and restaurant at Lot 201 Karnup Road, Serpentine (Figure 1). The site is approximately 43.2 ha and is located in the Shire of Serpentine-Jarrahdale (SoSJ), approximately 47 kilometres (km) from the Perth Central Business District. The site is currently being used for rural purposes as a beef grazing property (Figure 2).

The proposed development plan is presented in Figure 3 and comprises the following (Appendix 1) (TBB 2022):

- Main restaurant building located toward the rear (south) of the site, including an eatery, bar facility and shaded outdoor terrace dining area
- Commercial brewing facility with ancillary office space, attached to the southern side of the restaurant building
- An outdoor playground area extending from the western side of the restaurant
- A single two-way crossover to Karnup Road, with a 6m wide access driveway providing vehicular connection to the restaurant and brewery and pedestrian walkways and crossing
- An entry gate with feature signage at the Karnup Road entry point
- A vehicle loading bay located to the rear of the brewery
- 251 marked carparking bays (147 bays within a main carpark and 104 overflow spaces and two coach parking bays)
- Landscaping surrounding the areas adjacent to the restaurant, brewery and carparking areas.

1.2 Planning and environmental approval context

The site is zoned 'Rural' under the Metropolitan Region Scheme (MRS), and Shire of Serpentine-Jarrahdale's Town Planning Scheme No. 2 (TPS 2). The proposed development is consistent with the MRS and TPS 2.

A development application has been prepared and lodged to facilitate approval for the restaurant and brewery use on the site. Additionally, a Works Approval application for the brewery is being prepared and will be lodged with the Department of Water and Environmental Regulation (DWER) for approval.

The following documents have been prepared to support the development application and works approval application with DWER and should be read in conjunction with this report:

- Site and Soil Evaluation (Water Insight 2022a)
- Nutrient Irrigation Management Plan (Water Insight 2022b)
- Bushfire Management Plan (SBC 2021).

A Native Vegetation Clearing Referral (REF 9767/1) was submitted on 9 June 2022 and in accordance with Section 51DA(4) of the *Environmental Protection Act 1986* (EP Act), the Department of Water and Environmental Regulation (DWER) determined that a clearing permit was not required for the clearing associated with the proposed development (Appendix 2).

1.3 Purpose of this Report

This Environmental Assessment Report (EAR) is being prepared to support future development of the site by:

- identifying matters of environmental concern and potential impacts associated with future development
- demonstrating that the potential environmental impacts can be managed and have been adequately considered in the design of the development.

2 Environmental guidance and policies

The key policies and guidelines considered relevant to the proposed development are listed below and described in detail in the following sections.

2.1 State government

2.1.1 EPA Guidance Statement No. 33 – Environmental Guidance for Planning and Development

This guidance statement provides an overview of environmental protection processes and information, to assist land use planning and development in Western Australia. It provides specific information and guidance on (EPA 2008):

- Environmental protection processes in Western Australia including referral and environmental impact assessment procedures that apply to land use planning and development under the *Environmental Protection Act 1986*
- protecting a range of biophysical factors, to assist land use planning
- managing potential pollutants, waste and water (pollution management factors), to assist land use planning
- protecting aspects of the biophysical environment of cultural and social significance to the community (social surroundings factors), and the EPA's position on risk.

2.1.2 State Planning Policy 2.1 Peel Harvey Coastal Catchment

State Planning Policy 2.1 (SPP 2.1) – Peel Harvey Coastal Catchment seeks to ensure that land use changes within the Peel – Harvey Estuarine System likely to cause environmental damage to the estuary are brought under planning control and prevented (WAPC 1992).

The objectives of this policy are to (WAPC 1992):

- improve the social, economic, ecological, aesthetic, and recreational potential of the Peel-Harvey coastal plain catchment
- ensure that changes to land use within the catchment to the Peel-Harvey estuarine system are controlled so as to avoid and minimise environmental damage
- balance environmental protection with the economic viability of the primary sector
- increase high water-using vegetation cover within the Peel-Harvey coastal plain catchment
- reflect the environmental objectives in the draft *Environmental Protection Policy (Peel-Harvey Estuarine System) 1992*
- prevent land uses likely to result in excessive nutrient export into the drainage system.

A Nutrient and Irrigation Management Plan (NIMP) has been prepared by Water Insight (2022a) in accordance with SPP 2.1 and should be read in conjunction with this report.

2.1.3 State Planning Policy 2.9 Water Resources

State Planning Policy 2.9 (SPP 2.9) – Water Resources provides guidance in the planning, protection and management of surface and groundwater catchments, including consideration of availability of water and waterways management, wetlands, waterways, and estuaries and their buffers and implementation of total water cycle management principles in the land use planning system (WAPC 2006).

The objectives of this policy are to (WAPC 2006):

- protect, conserve and enhance water resources that are identified as having significant economic, social, cultural and/or environmental values
- assist in ensuring the availability of suitable water resources to maintain essential requirements for human and all other biological life with attention to maintaining or improving the quality and quantity of water resources
- promote and assist in the management and sustainable use of water resources.

A Nutrient and Irrigation Management Plan (NIMP) has been prepared by Water Insight (2022a) in accordance with SPP 2.9 and should be read in conjunction with this report.

2.1.4 State Planning Policy 3.7: Planning in Bushfire Prone Areas and Guidelines for Planning in Bushfire Prone Areas

State Planning Policy 3.7 (SPP 3.7) – Planning in Bushfire Prone Areas (WAPC 2015) and the associated Guidelines for Planning in Bushfire Prone Areas version 1.4 (WAPC 2021) have been developed to implement effective risk-based land use planning and development to preserve life and reduce the impact of bushfire on property and infrastructure (WAPC 2015).

SPP 3.7 applies to all strategic planning, subdivision and development applications in bushfire prone areas, and aims to support development through an assessment of bushfire hazard. The aims of SPP 3.7 are to (WAPC 2015):

- Avoid increases in the threat of bushfire to people, property and infrastructure
- Reduce vulnerability to bushfire through identification and consideration of bushfire risks
- Ensure higher order strategic planning documents, proposals, subdivision and development applications take into account bushfire protection requirements
- Achieve an appropriate balance between bushfire risk management measures, biodiversity conservation values, environmental protection and biodiversity management and landscape amenity, with consideration to climate change (WAPC, 2015).

The Guidelines for Planning in Bushfire Prone Areas (WAPC 2021) provides guidance on the implementation of SPP 3.7, and assist in:

- determining appropriate land use planning in relation to bushfire prone areas across Western Australia
- specifying the requirements to be met at each stage of the planning process
- ensuring that necessary bushfire protection measures are incorporated into development (WAPC 2021).

A Bushfire Management Plan (BMP) has been prepared by Smith Bushfire Consultants Pty Ltd in accordance with SPP 3.7 and bushfire guidelines and should be read in conjunction with this report.

2.1.5 Government Sewage Policy

The Government Sewerage Policy (GSP) establishes the requirement of sewage services through the planning and development of land in the State (GoWA 2019a). The policy's intent is to:

- promote reticulated sewerage as the preferred disposal method and that all new subdivision and development be connected to reticulated sewerage where available or considered necessary on health, environment or planning grounds.
- adopt a best practice approach to the provision of on-site sewage treatment and disposal, in instances where reticulated sewerage cannot be provided (GoWA 2019a).

The policy promotes sustainable use and development of land through the following objectives:

- to generally require connection of new subdivision and development to reticulated sewerage;
- to protect public health and amenity;
- to protect the environment and the State's water and land resources;
- to promote the efficient use of infrastructure and land;
- to minimise costs to the broader community including by ensuring an appropriate level and form of sewage servicing is provided; and
- to adopt the precautionary principle to on-site sewage disposal.

A site and Soil Evaluation (SSE) has been prepared by Water Insight (2022b) in accordance with the GSP and should be read in conjunction with this report.

2.2 Local government

2.2.1 Shire of Serpentine-Jarrahdale Town Planning Scheme No. 2

2.2.2 City of Rockingham Town Planning Scheme No. 2

The Shire of Serpentine-Jarrahdale Town Planning Scheme No 2 (TPS 2) details provisions for development within the Shire. TPS 2 details objectives for 'rural' zones as follows:

- To provide for lot sizes in the range of 1ha to 4ha
- To provide opportunities for a range of limited rural and related ancillary pursuits on rural residential lots where those activities will be consistent with the amenity of the locality and the conservation and landscape attributes of the land
- To set aside areas for the retention of vegetation and landform or other features which distinguish the land
- To provide a residential amenity with a rural character.

The proposed land use for a restaurant and brewery is consistent with the 'Rural' zone objectives under the TPS2.

2.2.3 Shire of Serpentine-Jarrahdale Local Planning Policies

The City of Rockingham has developed a number of Local Planning Policies which may have relevance to development at the site, including but not limited to the following:

- Local Planning Policy 2.4 – Water Sensitive Urban Design Guidelines
- Local Planning Policy 2.7 – Bio-Diversity Planning Policy

3 Site Characteristics

3.1 Climate

The site has a Mediterranean climate, which is characterised by hot dry summers and mild wet winters, typical of the Perth Swan Coastal Plan. Temperatures range from a mean maximum of 30.6°C in January to a mean minimum of 6.3°C in July, as recorded from 1965 to 2021 at Karnet weather station (Site No. 009111), located 10.6 km from Serpentine (BoM 2022). The mean annual rainfall at Karnet station, recorded between 1963 to 2021 is 1,150.3 mm. The annual total rainfall for 2021 was 1,307.1 mm

A summary of the climatic data for the nearest meteorological station (Karnet weather station) is presented in Plate 3-1 below.

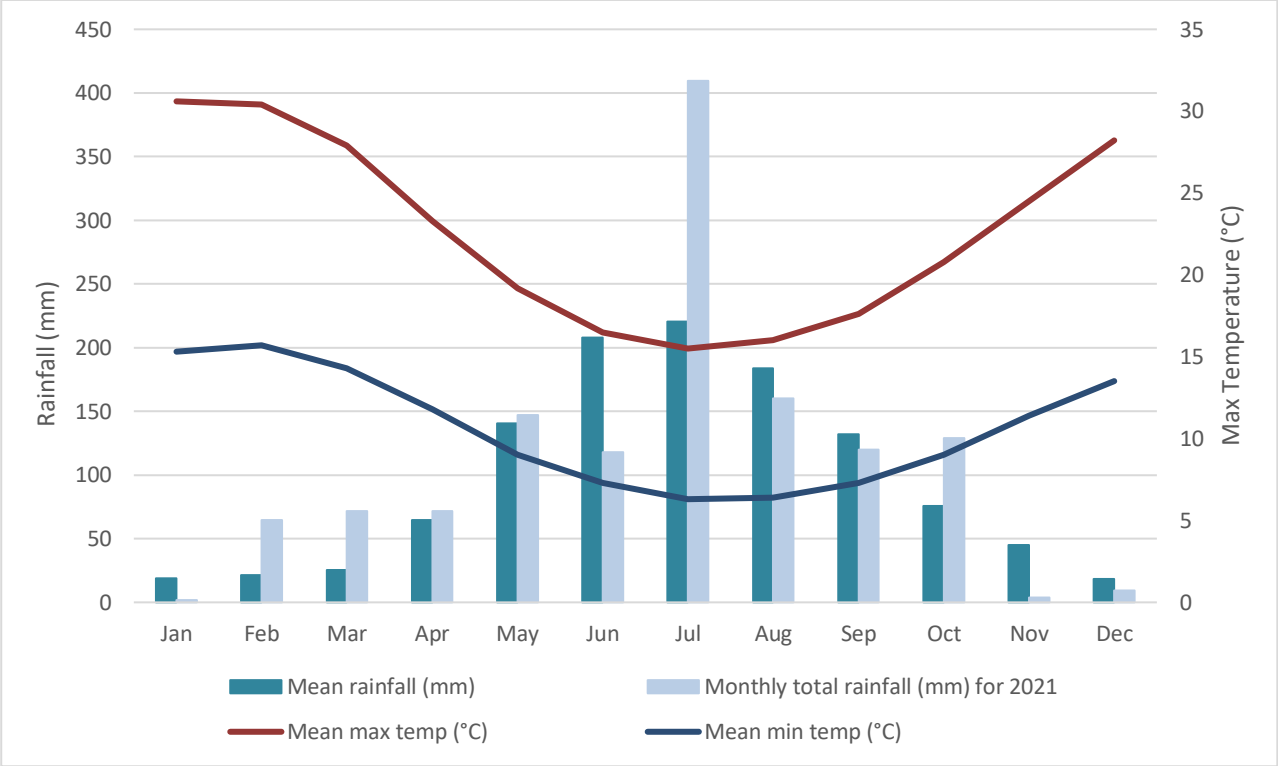

Plate 3-1: Climate data for Karnet weather station (BoM 2022)

3.2 Soils and topography

3.2.1 Geology and soils

Three geological units are represented at the site (Jordan 1986) (Figure 4):

- S8: SAND - white to pale grey at surface, yellow at depth; fine to medium-grained, moderately sorted sub-angular to subrounded minor heavy minerals, of eolian origin
- S10: SAND - as S8 over sandy clay to clayey sand of the Guildford Formation, of eolian origin
- Spc: CLAYEY PEATY SAND - grey to black, quartz sand with variable organic content; minor clays, of lacustrine origin.

The Spc is associated with the lower lying and wetland areas located in the south east corner of the site. The S10 is also associated with the lower lying areas of the site, whereas S8 is associated with the site's higher sand hills.

A geotechnical investigation was undertaken in August 2021 and a Geotechnical Site Classification report was prepared by STATS Australia.

The report concluded that the soil profiles encountered for all test pits were similar and comprised of Sand mixtures: fine to medium grained, dark grey, moist, loose, with grass/organics to a depth of 0.2 and 0.3 m and Sand mixtures: fine to medium grained, white, moist, loose as the second soil profile, with the exception of one test pit (located within the south east portion of the site and mapped as Spc), where the second soil profile typically comprised of Sand mixtures: fine to medium grained, yellow, moist, loose between a depth of 0.2 m to 2.3 m. (STATS Australia 2021)

3.2.2 Acid sulphate soils

The site is located in an area identified as having 'moderate to low' over most of the site and 'high to moderate' risk of containing acid sulphate soils within the south eastern portion of the site (Figure 5) (Landgate 2022).

3.2.3 Topography

The site's lower lying areas occur mostly along the western boundary at 25 metres Australian Height Datum (mAHD) to 26 m AHD, with the elevated areas associated with two sand hills located along the eastern (30 mAHD) and one sand hill located in south western (29 m AHD) portions of the site (Figure 4) (Landgate 2022).

3.3 Hydrology

3.3.1 Groundwater

The site is located within the Serpentine groundwater area and the Serpentine 3 subarea, and the Superficial Swan, Leederville and Cattamarra Coal Measures aquifers (DWER 2022).

Based on review of DWERs online Perth Groundwater Map, the minimum groundwater level at the site is approximately 24 mAHD in the north west and 26.8 mAHD in the south east (Water Insight 2022a). In relation to the maximum groundwater level contours, the Perth Groundwater Map does not extend into the site. Instead, the estimated maximum groundwater level was calculated to be 29 mAHD to 30 mAHD, which was derived by extrapolating the maximum groundwater level at the nearest DWER monitoring bore and comparing this data to the minimum groundwater contours shown at the same location on the Perth Groundwater Map (Water Insight 2022a).

3.3.2 Surface water and drainage

A Water Corporation drain is adjacent to the site's south east and western boundaries (Figure 6). This drain connects to a second Water Corporation drain located along Karnup Road and discharges to the Serpentine River approximately 2.6 km north of the site (Water Insight 2022a). There is no flood mapping available for the drain; however, it is expected to flood the low-lying areas adjacent to the drain in a 1% Annual Exceedance Probability (AEP) event (Water Insight 2022a).

A constructed drain is located in the centre of the site along with two dams which are located in the centre of the site and the south eastern corner of the site (Figure 6). The eastern extent of the central drain conveys stormwater into the central dam with the western extent of the drain conveying excess water off the site to the Water Corporation drain located along the site's western boundary (Water Insight 2022a). Based on aerial imagery, both dams appear to have part of a natural low lying wetland area which were excavated to create a permanent dam for stock watering (Water Insight 2022a).

The site's drainage is varied as the sand ridges are free draining, whereas the flat, lower lying Guildford formations, which correspond with the mapped resource enhancement wetlands on site (Figure 7), are prone to water logging (Water Insight 2022a).

3.3.3 Wetlands

The Department of Biodiversity, Conservation and Attractions (DBCA) geomorphic wetland dataset for the Swan Coastal Plain maps two resource enhancement wetland within the site, as well as a conservation category wetland along the northern boundary to the site (Table 3-1; Figure 7). The wetland management category definitions are provided in Table 3-2.

Table 3-1: Wetlands (Landgate 2022)

Wetland Name	Wetland Unique Feature ID	Landform	Wetland Type	Management Category	Total Area (ha)	Area on site (ha)
unnamed	15364	Basin	Dampland	Resource Enhancement	2,562.94	18.56
unnamed	7551	Basin	Sumpland	Resource Enhancement	8.99	4.01
unnamed	7403	Basin	Dampland	Conservation	19.07	0.14

Table 3-2: Wetland management categories (EPA 2008)

Management Category	General Description	Management Objective
Conservation	Wetlands which support a high level of attributes and functions	Highest priority wetlands. Objective is to preserve and protect the existing conservation values of the wetlands through various mechanisms including: • reservation in national parks, crown reserves and State-owned land, • protection under Environmental Protection Policies, and • wetland covenanting by landowners. No development or clearing is considered appropriate. These are the most valuable wetlands and any activity that may lead to further loss or degradation is inappropriate.
Resource Enhancement	Wetlands which may have been partially modified but still support substantial ecological attributes and functions	Priority wetlands. Ultimate objective is to manage, restore and protect towards improving their conservation value. These wetlands have the potential to be restored to Conservation category. This can be achieved by restoring wetland function, structure and biodiversity. Protection is recommended through a number of mechanisms.
Multiple Use	Wetlands with few remaining important attributes and functions	Use, development and management should be considered in the context of ecologically sustainable development and best management practice catchment planning through landcare.

It is worthwhile to note that based on the biological assessment undertaken by FVC (2021), the resource enhancement wetlands (UFI 15364 and 7551) mapped within the site are highly degraded and exhibit little ecological attributes that would grant it any significant value (see Section 3.4.4). Instead, these wetlands exhibit attributes that align closely with the multiple use management category (Table 3-2).

3.4 Vegetation and flora

Focused Vision Consulting Pty Ltd (FVC) undertook an ecological desktop and field assessment of the study area during spring 2021 (Appendix 3). The timing of the survey (early November) was considered optimal to conducting a biological assessment, as this was within the peak flowering period for the region and when vertebrate fauna activity is likely to be optimal (FVC 2021).

3.4.1 Bioregion

The site occurs within the Perth subregion of the Swan Coastal Plain region under the Interim Biogeographic Regionalisation of Australia (IBRA).

3.4.2 Vegetation complexes and associations

The National Objectives and Targets for Biodiversity Conservation 2001-2005 recognises that a retention of 30% or more of the pre-clearing extent of each ecological community is necessary if Australia's biological diversity is to be protected (ANECC 2000). However, State Planning Policy 2.8 – Bushland policy for the Perth Metropolitan Region (WAPC 2010) and EPA Guidance Statement 33 (EPA 2008) recognises the Perth Metropolitan Region as a 'constrained area' and establishes a target of 10% retention for vegetation complex.

Historically, the vegetation at the site would have been representative of the Southern River Complex – Open woodland of *Corymbia calophylla* (Marri) – *Eucalyptus marginata* (Jarrah) – *Banksia* species with fringing woodland of *Eucalyptus rudis* (Flooded Gum) – *Melaleuca rhaphiophylla* (Swamp Paperbark) along creek beds (Heddle et al. 1980). Approximately 18.43% of the Southern River vegetation complex remains within the Swan Coast Plain IBRA region (GoWA 2019b).

Three pockets of remnant vegetation within the north east and south east corners of the site (located outside the development footprint) are mapped as belonging to the Bassendean 1000 vegetation system, based on state-wide vegetation mapping by Beard et al. (2013) which is described as Mosaic: Medium forest; jarrah-marri / Low woodland; banksia / Low forest; teatree (*Melaleuca* spp.). Approximately 27.81% remains at the state, IBRA region and IBRA subregion scales (GoWA 2019c).

The above vegetation complex and association exceed the 10% target within constrained areas; however, it is worthwhile to note that due to the highly modified nature of the site, none of the defined vegetation units within the development footprint are considered to be representative of the Southern River Complex and Beard 1000 vegetation system.

3.4.3 Vegetation units and condition

The site supports one remnant vegetation unit, with the remainder of the site supporting pasture and various combinations of native and non-endemic species (mostly trees) in varying densities over some of the areas of pasture (FVC 2021).

The single remnant vegetation unit recorded and mapped within the south eastern corner of the site occupies 1.43 ha (3.24 % of the site) and is described as (FVC 2021):

- MpRc – Low Open Woodland of *Melaleuca preissii* over a Low Sparse Shrubland of *Regelia ciliata* over a Low Sparse Grassland of **Briza maxima*.

The species of parkland trees (and some shrubs and sedges) occurring over pasture (denoted in the vegetation mapping and reported data as '(P)') comprising areas of degraded (or poorer condition) vegetation within the study area are listed in Table 3-3 below and presented in Figure 8.

Table 3-3: Tree, shrub and sedge species occurring over Pasture (P) within the site (FVC 2021)

Abbreviation	Tree, shrub and sedge species	Riparian
Af	*Allocasuarina fraseriana*	No
Jk	*Juncus kraussii*	Yes
Cc	*Corymbia calophylla* (Marri)	No
Euc	*Eucalyptus* sp. (non-endemic/planted species)	No
Em	*Eucalyptus marginata* (Jarrah)	No
Er	*Eucalyptus rudis* (Flooded gum)	Yes
Kg	*Kunzea glabrescens*	Yes
Mp	*Melaleuca preissii*	Yes
Mr	*Melaleuca rhaphiophylla* (Swamp paperbark)	Yes
Pp	*Pinus pinaster*	No
Xo	*Xylomelum occidentale*	No
Xp	*Xanthorrhoea preissii* (Grass tree)	No

The vegetation condition of the site was found to range from Completely Degraded to Degraded, with the majority (approximately 95%) to be found in Completely Degraded condition (Figure 9) (FVC 2021). The site has been highly modified from historic clearing and a large proportion of the study area is devoid of remnant vegetation, and mainly comprises of isolated trees over pasture grasses and other weeds.

3.4.4 Wetland and riparian vegetation

Within the study area, riparian vegetation is represented within the remnant vegetation unit MpRc (Figure 8) (FVC 2021). Though highly degraded, a number of the isolated tree, shrub and sedge species present at the site are also typical of wetlands and considered riparian vegetation (*Juncus kraussii* (Jk), *Eucalyptus rudis* (Er), *Kunzea glabrescens* (Kg), *Melaleuca preissii* (Mp) and *Melaleuca rhaphiophylla* (Mr)) and presented in Figure 8 (FVC 2021).

The single mapped remnant vegetation unit, MpRc, is growing in association with the Resource Enhancement Wetland (UFI 7551) located in the south eastern corner of the site (Figure 7) (FVC 2021). Whereas no intact, remnant vegetation is growing in association with either of the Conservation Category Wetland (UFI 7403) located along the northern boundary of the site or the other Resource Enhancement Wetland (UFI 15364) mapped across the site (Figure 7) (FVC 2021).

3.4.5 Threatened and Priority Ecological Communities

Due to the highly modified nature of the site, none of the defined vegetation units are considered to be representative of any Threatened Ecological Community (TEC) or Priority Ecological Community (PEC).

3.4.6 Threatened and Priority Flora

The DBCA database, Western Australian Herbarium, NatureMap and Department of Agriculture, Water and Environment (DAWE) Protected Matters Search Tool (PMST) identified the potential for 15 significant flora species to occur within the area. Of these species, 12 are Threatened flora under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and State *Biodiversity Conservation Act 2016* (BC Act), one Priority 2 species, one Priority 3 species and one Priority 4 species (Appendix 3) (FVC 2021).

Based on the known distribution, current records, preferred habitat and habitat present within the study area, the following species may occur within the site (FVC 2021):

- *Synaphea* sp. Fairbridge Farm (D. Papenfus 696) – Critically Endangered
- *Synaphea* sp. Serpentine (G.R. Brand 103) – Critically Endangered
- *Drakaea elastica* – Critically Endangered
- *Verticordia plumosa* var. *ananeotes* – Critically Endangered
- *Synaphea* sp. Pinjarra Plain (A.S. George 17182) – Endangered
- *Drakaea micrantha* – Endangered
- *Johnsonia pubescens* subsp. *Cygnorum* – Priority 2
- *Eryngium pinnatifidum* subsp. *palustre* (G.J. Keighery 13459) – Priority 3
- *Verticordia lindleyi* subsp. *lindleyi* – Priority 4

It is worthwhile to note most of the species identified above were considered to have a possible occurrence due to some presence of those species to wetland or winter wet habitats; however, search traverses conducted during the spring assessment did not identify the presence of any species listed as Threatened or Priority flora within the site (FVC 2021).

A total of 19 flora species, from 17 genera and ten families was recorded during the field assessment. The dominant families were found to be Myrtaceae (eight taxa) and Poaceae (three taxa). The total includes 13 (68.42%) native species, six (31.58%) introduced (weed) species. (FVC 2021)

The low number of species recorded can be attributed to the previously cleared and highly modified nature of the site, and the ongoing land uses which appear to be stock grazing (FVC 2021).

3.5 Fauna

Focused Vision Consulting Pty Ltd (FVC) undertook an ecological desktop and field assessment of the study area during spring 2021 (Appendix 3). The timing of the survey (early November) was considered optimal to conducting a biological assessment, as this was within the peak flowering period for the region and when vertebrate fauna activity is likely to be optimal (FVC 2021).

3.5.1 Conservation significant fauna

The DBCA fauna database, NatureMap and Protected Maters Search Tool identified 28 significant fauna species as potentially occurring within the study area and of these, 12 are Threatened fauna pursuant to the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and State *Biodiversity Conservation Act 2016* (BC Act); two Critically Endangered, six Endangered and four Vulnerable species and eight of these species are listed as Marine or Migratory species (FVC 2021).

Based on currency of previous records, proximity to the site and suitability of the habitat provided within the site, of the 28 species identified from the desktop assessment, the following species are considered likely to occur within or occasionally utilise the site (FVC 2021):

- Forest Red-tailed Black-Cockatoo (*Calyptorhynchus banksii naso*) – Vulnerable
- Carnaby's Black-Cockatoo (*Calyptorhynchus latirostris*) – Endangered
- Baudin's Black-Cockatoo (*Calyptorhynchus baudinii*) – Endangered
- Carter’s Freshwater Mussel (*Westralunio carterii*) - Vulnerable
- Water-rat (*Hydromys chrysogaster*) – Priority 4
- Quenda (*Isoodon fusciventer*) – Priority 4
- South-western Brush-tailed Phascogale (*Phascogale tapoatafa*) – Conservation Dependent

- Peregrine Falcon (*Falco peregrinus*) – Other Specially Protected Fauna

Another species considered to potentially occur within the site

- Pacific Swift (*Apus pacificus*) – Marine/Migratory

Secondary evidence of the presence of forest red-tailed black cockatoos (*Calyptorhynchus banksii naso*), which is listed as Endangered under the State *Biodiversity Conservation Act 2016* (BC Act) and Federal (EPBC Act), was recorded from foraged Marri nuts on site; however, no direct or secondary evidence of the presence or activity of any other conservation significant vertebrate fauna species was observed during the field assessment.

3.5.2 Fauna habitat

The site was found to support the following three key fauna habitats (FVC 2021) (Figure 10):

1. Paperbark/Wetland/Shrubland

   Predominantly Paperbarks (Melaleuca spp.) of varying density, over pasture, or a degraded understorey of heath shrubs or wetland sedges. Growing in a rich, loamy clay substrate that is seasonally or perennially damp.

2. Parkland with sparse trees

   Various endemic and non-endemic trees, predominantly Eucalypts in varying densities, over pasture, in substrates that range from seasonally damp, loamy clay to damp or dry white sands.

3. Dams/Streams

   Open, brackish water, rich in tannins, seemingly deep in sections, associated with constructed of dams and drains (streams), with limited to no flow velocity.

Open pasture is also mapped on Figure 10 as a fauna habitat but is not considered to provide much, if any habitat value for native vertebrate fauna (FVC 2021).

3.5.3 Black cockatoo habitat

3.5.3.1 Foraging habitat

In accordance with Bamford Consulting Ecologist (BCE) methodology, each of the vegetation areas have been assigned a foraging quality value for each of the three Black Cockatoos, which is based on vegetation characteristics (out of six), context (out of three) and species presence (stocking rate) (one or zero), for a total score out of 10 (FVC 2021). The foraging habitat quality for Black Cockatoos has been mapped and presented in Figures 11a to 11c.

Most of the habitats defined and mapped with the site are of low to moderate, little or no foraging value for Black Cockatoos, with a total of (97%) of the site providing 'Low to moderate' (score of 3) or poorer quality foraging habitat for any of the Threatened species of Black-Cockatoo (FVC 2021).

The vegetation types that support Marri (Cc), Jarrah (Em) and Sheoak (Af) provide better quality foraging habitat for the various species of Black Cockatoo, with the highest quality foraging habitats being within areas mapped as Cc (P), CcEm (P) and CcEuc (P) (FVC 2021).

Vegetation type PpXp (P) also provides some of the higher quality foraging habitat due to the presence of Pines (*Pinus pinaster*), since Black-Cockatoos have adapted to foraging of pine cones due to foraging habitat loss (Higgins 1999; Saunders 1980).

3.5.3.2 Breeding habitat

The desktop assessment revealed that the study area lies within an unconfirmed (possible) Black-Cockatoo breeding area, and the nearest confirmed breeding site for Carnaby's Black Cockatoo occurring approximately 20 km north of the study area (FVC 2021).

A total of 26 trees were identified on site as potential breeding trees for Black Cockatoos, and of these (Figure 12) (FVC 2021):

- five contained potentially suitable hollows (but with no evidence of Black Cockatoo use)
- four contained hollows that are not of suitable size and/or near-vertical orientation
- 17 contained no hollows.

3.5.3.3 Roosting habitat

The desktop assessment identified no roosting sites (confirmed or unconfirmed) for Black Cockatoos, including buffers intersect with the site; however, a documented roost site for Black Cockatoos occurs approximately 1 km from the nearest edge of the site and a further four Black Cockatoo roosts occur within 5 km (FVC 2021).

Whilst, there are no known or confirmed roosting habitat with the site, the large trees present within the site may potentially provide suitable roosting habitat (Figure 12), although this is considered unlikely, since the location and extent of Black-Cockatoo roost sites in the Perth region is well understood and the birds are site faithful, so 'new' roosts are rare (FVC 2021).

3.6 Land use history

The site is not identified on the DWER Contaminated Sites database (Landgate 2022).

A review of historical land use on the basis of aerial photography (Landgate 2021). The site has largely only been used for rural/agricultural purposes, with changes/development evidenced as follows:

- **1953**: the site has been partially cleared with the remainder mostly unchanged. A manmade drain is evident across the site, and appears to run from north eastern corner from Karnup Road along the site's eastern boundary before, intersecting the site and then connecting to a larger drain which runs along the western boundary of the site.
- **1965**: most of the vegetation throughout the site has been cleared, with some scattered vegetation remaining in the northern and eastern portion of the site. A driveway has been constructed in the north eastern portion of the site, leading to a residence and shed / structure which have also been constructed. Planted trees along the driveway and around the residence. Powerline easement traversing the western portion of the site is evident.
- **1974**: site remains mostly unchanged, apart from two more shed / structure being constructed in close proximity to the residence.
- **1977 – 1989**: the site remains unchanged. The land seems to be used for agricultural purposes.
- **1995**: trees planed just north east of residence, appears to be a small orchard?
- **2000**: the two shed / structure (first evident in 1974 aerial imagery) are no longer evident. An additional structure has been constructed south of the residence, possibly septic / rainwater tank. Two dams are evident in the central and south eastern portion of the site.
- **2001**: large shed / structure has been constructed just south of the residence next to septic/rainwater tank. The land seems to be used for agricultural purposes.
- **2002 – 2004**: the site remains unchanged.
- **2005**: row of planted trees along the driveway cleared.
- **2008**: planted trees along driveway leading up to residence is evident.
- **2009 – 2021**: the site remains unchanged.

Plate 3-2: Aerial Photography - 19 December 2020

Plate 3-3: Aerial Photography - 24 December 2005

Plate 3-4: Aerial Photography - 26 January 2001

Plate 3-5: Aerial Photography - 6 February 1995

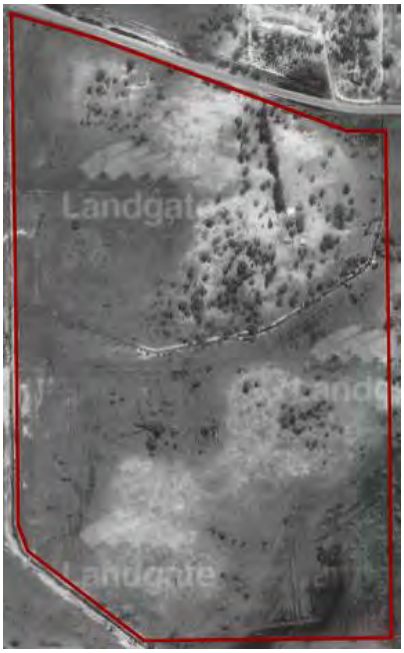

Plate 3-6: Aerial Photography - 6 September 1974

Plate 3-7: Aerial Photography - 27 November 1953

Source: Landgate 2021

3.6.1 Site visit

A site visit conducted by Coterra Environment in December 2021 confirmed:

- Location of proposed development is on top of a sand ridge that is mostly cleared of native vegetation with a patch of *Kunzea glabrescens* (Kg) and has little ecological attributes (Plate 3-8)
- Location of proposed access track intersects resource enhancement wetland (UFI 15364) is mostly pasture with patches of *Juncus kraussii* (Jk) and has little ecological attributes (Plate 3-9)

- On-site infrastructure comprises residence, two sheds, two dams and a central drain which traverses the site (Plate 3-10 and Plate 3-11).
- Powerline distribution poles (~33kV) are located on the western portion of the site (Plate 3-9) (that connects to a distribution network along Karnup Road
- Scattered native vegetation and planted trees was observed on site (Plate 3-12)
- The overall site condition was highly degraded due to rural land use activities (grazing) (Plate 3-13).

Plate 3-8: Proposed development area (patch of Kg)

Plate 3-9: Proposed access track (patches of Jk)

Plate 3-10: Central dam

Plate 3-11: Central drain

Plate 3-12: Scattered native vegetation and trees

Plate 3-13: Stock grazing on site

Source: Coterra 02/12/2021

3.7 Conservation Areas

Bush Forever Site No. 74 (Rapids Road Bushland, Peel Estate) is located approximately 320 m west of the site and Bush Forever Site No. 375 (Byford to Serpentine Rail/Road Reserves and Adjacent Bushland) is located approximately 1.5 km east of the site (Landgate 2022; DEP 2000). The site does not form part of any Bush Forever sites (Landgate 2022).

A portion of the site and surrounds are mapped as part of several Environmental Sensitive Areas (ESAs) that appear to be associated with the buffer zone for the conservation category wetlands adjacent to the northern and western boundaries of the site and a number of threatened ecological communities located approximately west and south west of the site (Figure 13). It is worthwhile to note that where the site is mapped as an ESA the area is highly degraded and mostly consists of pasture and weeds.

A regional ecological link passes through the site (Figure 13), and whilst the site is mostly comprised of isolated trees over pasture grasses and other weeds, the proposed retention of the only area of intact remnant vegetation (MpRc) in the south eastern portion of the site and native trees on site will assist with maintaining this regional ecological link.

3.8 Bushfire risk

The entire site is mapped as a Bushfire Prone Area under SPP 3.7, which triggers the requirement for the preparation of a Bushfire Management Plan.

A Bushfire Management Plan has been prepared by Smiths Bushfire Consulting Pty Ltd (SBC) and should be read in conjunction with this report.

3.9 Heritage

A search of the DPLH Aboriginal Heritage Enquiry System did not identify any known Aboriginal heritage sites or other heritage places within the site (DPLH 2022). The closest Aboriginal heritage site (within 2km of the site) include:

- Serpentine River (ID: 3582) – approximately 1.4 km east and 1.3 km north to the site buffer boundary.

A search of the Heritage Council inherit database did not identify the presence of any European heritage sites within the landholdings (DPLH 2021).

4 Potential Environmental Impacts and Management

4.1 Soils

4.1.1 Potential Impacts

The site is located in an area mapped as 'moderate to low' and 'moderate to high' risk ASS (Section 3.2.2). Disturbance to ASS has the potential to create an acidic environment, which may impact groundwater if not appropriately managed.

4.1.2 Management Measures

Given the location of the majority of the infrastructure and soil disturbance areas outside of the mapped high to moderate risk area, the proposed development appears unlikely to trigger the requirement for an ASS investigation and associated management during construction based on soil disturbance volumes.

However, once detailed engineering and construction details are available an ASS self-assessment form (WAPC 2020; Appendix 2 should be completed, and if there is potential for ASS to be impacted by the development, an ASS investigation should be undertaken. The ASS investigation and management plan should be undertaken in accordance with the following:

- Identification and Investigation of Acid Sulfate Soils and Acidic Landscapes (DER 2015a)
- Treatment and Management of Soils and Water in Acid Sulfate Soil Landscapes (DER 2015b).

These investigations and management plans, if required, could be undertaken as a condition of the Development Application approval.

4.2 Groundwater

4.2.1 Potential Impacts

The proposed development must be managed to avoid adverse impacts to groundwater. Furthermore, the site is in the Peel Harvey Catchment and a sewerage sensitive area.

4.2.2 Management Measures

The following documents have been prepared to support the development application and works approval application with DWER to ensure groundwater is appropriately managed:

- Site and Soil Evaluation (Water Insight 2022a)
- Nutrient Irrigation Management Plan (Water Insight 2022b).

The Site and Soil Evaluation confirm the site's suitability for onsite wastewater management and demonstrates the site can accommodate a suitable wastewater management system and not impact public health or the environment by implementing the following (Water Insight 2022a):

- Proposed tavern and brewery to be constructed on the most elevated area of the site which has the greatest clearance to groundwater.
- Transportable toilets will be hired to cater for large events, if required
- Minimum 100m buffer will be provided to the dams, Water Corporation and agricultural drains located on site and all wastewater infrastructure will be located outside all wetland areas.
- Installation of a secondary system with nutrient removal to treat wastewater to a higher standard which will include a land application area (Figure 14).

- Flatbed leach drains will dispose of the treated effluent as they require less space to infiltrate the effluent, when compared to surface or sub surface irrigation, and are able to be placed no greater than 15 cm below the surface to assist with achieving maximum clearance to groundwater.
- Soil amendment such as spearwood sand will be applied beneath the leach drains and will be provided where required to achieve a minimum 1.5m clearance to maximum groundwater levels.
- On site groundwater monitoring bores will installed to confirm the maximum groundwater level.
- An *Application to Construct or Install An Apparatus for the Treatment of Sewerage* will be submitted to the SoSJ prior to installation of the system.

4.3 Surface Water and Wetlands

4.3.1 Potential Impacts

Based on the proximity of the wetlands within and adjacent to the site, potential risks and pressures to surface water and wetlands from development include:

- Development may have the potential to increase nutrient loading to the sites surface and groundwater, influencing wetland nutrient balancing and ecology
- Clearing of vegetation associated with wetlands may have the potential to impact on wetland values
- Potential risk of ASS-related impacts to groundwater regime, if not managed appropriately during construction.

4.3.2 Management Measures

The biological assessment undertaken by FVC (2021), identified the resource enhancement wetlands (UFI 15364 and 7551) mapped within the site as being highly degraded and exhibiting little ecological attributes that would grant them any significant value (see Section 3.4.4). Instead, these wetlands exhibit attributes that align closely with the multiple use management category (Table 2).

The only mapped remnant vegetation unit (MpRc) recorded on site is growing in association with the Resource Enhancement Wetland (UFI 7551) located in the south eastern corner of the site (Figure 7) (FVC 2021). Whereas no intact, remnant vegetation is growing in association with either the Conservation Category Wetland (UFI 7403) located along the northern boundary of the site or the other Resource Enhancement Wetland (UFI 15364) mapped across the site (Figure 7) (FVC 2021).

Based on the above, it is proposed that a portion of the resource enhancement wetland (UFI 15364) (0.12 ha), of which 0.07 ha is mapped MpJk (P), is developed to provide an access track to the proposed development. However, it should be noted that the proposed development and access track has been placed on site to ensure existing intact remnant native vegetation and native trees (including *Melalueca* sp) are retained.

Given the highly degraded state of the resource enhancement wetland on site, the proponent is likely to pursue an application to reclassify the wetland multiple use.

Water Insight's (2022b) Nutrient Irrigation Management Plan will be implemented to ensure surface water is managed appropriately by:

- Irrigating the treated wastewater from the brewing process to land within the site boundary.
- Placing the irrigation areas (Figure 14) within the more elevated areas of the site where waterlogging is less likely to occur and away from existing drains, including the Water Corporation drain located along the site's western boundary. Additionally, the irrigation areas are only within portions of the site that are highly degraded and have no ecological values. That is, outside of the resource enhancement wetland areas and only within the areas mapped as Pasture by FVC (2021).
- Maintaining a 30 m buffer between watercourses and irrigation areas.

- Preventing runoff of irrigated wastewater through bunding the lower perimeter of each irrigation area.
- Wastewater will be recycled within the brewery during the months of April to September to reduce the nutrient and hydraulic loading to land when rainfall exceeds evapotranspiration.
- The reduced hydraulic loading shows the wastewater treatment system (P precipitation and DAF) will comply with both the Peel Harvey EPP nutrient application targets and the targets specified for Risk Category A sites in *Water Quality Protection Note – Nutrient Irrigation Management Plans* (DoW 2010).
- No irrigation will occur in June and July, when rainfall exceeds the rate of evaporation and infiltration, and waterlogging or ponding of water can occur.
- Any sludge or sediment collected in the wastewater treatment system will be disposed offsite, it will not be applied to land on site.
- Once constructed, the wastewater quality will be monitored, and the monthly wastewater loading will be calculated which will allow the proponents to adjust as required to both the wastewater management system and pasture and crop rotations grown on the irrigation areas.
- Detailing the planning and operational practices to be implemented on site to protect local water resources.
- Management of water from the brewing process.

A Stormwater Management Plan will be prepared as condition of the Development Application approval.

Furthermore, the development will require a licence to operate from DWER, which will include a stringent environmental monitoring program, including soil, groundwater and surface water monitoring to detect possible impacts the irrigation of treated wastewater to land may have on the soils on site and receiving environment. Annual compliance reports will also be prepared to demonstrate compliance with the licence. (Water Insight 2022b)

4.4 Vegetation

Existing vegetation within the proposed development footprint area is limited to:

- *Kunzea glabrescens* (Kg (P)) – Completely Degraded condition
- *Melaleuca preissii – Juncus kraussii* – Completely Degraded condition

4.4.1 Potential Impacts

Although vegetation is scattered throughout the site and is highly degraded and exhibits few ecological attributes, the development footprint has been positioned to avoid clearing of the only intact remnant vegetation on site (MpRc) and any native trees.

The extent of vegetation proposed to be cleared to facilitate development is 0.45 ha, and comprises the following:

- 0.38 ha of *Kunzea glabrescens* (Kg (P)) – Completely Degraded condition
- 0.07 ha of *Melaleuca preissii – Juncus kraussii* (MpJk (P))– Completely Degraded condition

4.4.2 Management Measures

Existing intact remnant native vegetation and trees (native and introduced species) will be retained where possible.

In addition, trees may be planted around the proposed development (Figure 3). These trees should be considered in the context of providing fauna habitat opportunities (Section 4.5) while not generating an additional bushfire risk through appropriate spacing and understorey design/management. In general, the following species are recommended to be considered (Section 4.6):

- *Corymbia calophylla*
- *Eucalyptus marginata*
- *Eucalyptus rudis*
- *Melaleuca rhaphiophylla*
- *Banksia attenuata*
- *Banksia menziesii*

These species represent the historical vegetation complex on the site, and nearby Bush Forever sites. In addition, they provide habitat opportunities for black cockatoo species (Groom 2011). Specific species should be determined for suitability by a Landscape Architect.

It is recommended weed and hygiene management actions are included with the Construction Management Plan (Section 4.8) to manage the potential spread of Declared Pest Plants, Arum Lily and Cape Tulip and other weeds present on site.

As the proposed development will result in 0.45 ha of riparian vegetation (*Kunzea glabrescens* and *Juncus kraussii*) being cleared, clearing exemptions under Regulation 5 Item 1 of *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* do not apply. Subsequently, A Native Vegetation Clearing Referral (REF 9767/1) was submitted on 9 June 2022 and in accordance with Section 51DA(4) of the EP Act, DWER determined that a clearing permit was not required for the clearing associated with the proposed development (Appendix 2).

4.5 Fauna

Existing fauna habitats within the proposed development footprint is limited to:

- Paperbark / Wetland / Shrubland

4.5.1 Potential Impacts

Potential impacts to fauna during vegetation clearing, should be considered and managed. Impacts to fauna from construction are associated with removal of habitat, and animal injury/fatality from the use of machinery.

The development footprint has been positioned to avoid direct impacts on Black Cockatoo foraging habitat, roosting habitat and potential breeding trees. The extent of fauna habitat proposed to be cleared to facilitate development is 0.45 ha of Paperbark / Wetland / Shrubland, which is highly modified and limited in ecological values. Therefore, the likely impact on fauna is considered to be minimal.

4.5.2 Management Measures

Given the limited fauna habitat values on site and that existing fauna habitat will be retained and potential impacts on fauna will be minimal, the preparation of a Fauna and Relocation Management Plan associated with the development is not recommended. However, some fauna management actions should still be included within the Construction Management Plan (Section 4.8), as follows:

- Clearing outside of the main avifauna breeding season is recommended, if possible.
- Prior to the commencement of clearing the clearing and construction boundary will be surveyed to ensure it is accurately located and demarcated.

- Potential fauna habitat trees with hollows should be tagged to ensure accidental damage does not occur.
- Clearing will be undertaken in the direction of retained vegetation in order to encourage any remaining fauna to move in this direction.
- Any vehicles on site will be restricted to the clearing and construction area footprint to minimise impact to vegetation beyond this boundary. Vehicle movements will be restricted to speeds of 30 km/hour
- If any fauna is located and/or injured, contact the Project Superintendent or Environmental Consultant for instructions. If these representatives cannot be reached, contact the DBCA Wildcare helpline (9474 9055).

4.6 Bushfire Management

Given the site is in a bush fire prone area (Section 3.7), a Bushfire Management Plan has been prepared by SBC (2021) for the site, in accordance with the following:

- *State Planning Policy 3.7 – Planning in Bushfire Prone Areas* (WAPC 2015)
- *Guidelines for Planning in Bushfire Prone Areas* (WAPC 2021).

The Bushfire Management Plan (SBC 2022) recommends the following actions in relation to the existing environment and the proposed development:

- Future buildings will be located in an area that is with a BAL rating of BAL-12.5 which aligns to the State's development criteria of being BAL-29 or less.
- A minimum 20 m Asset Protection Zone (APZ) will be established with any new buildings. It is worthwhile to note that a small patch of CcEm (Marri and Jarrah) (Figure 8), which is located south east of the proposed brewery building and within the 20 m APZ, can be maintained to the standard required for an APZ and not require clearing due to the degraded understorey, the trees being further than 10 m from the building and the canopy being less than 15 %.
- The private driveway to be constructed will be longer 50 m and meet the detailed requirements of the Guidelines.
- Firebreaks and fuel loads will continue to be maintained in accordance with the SoSJ Fire Control Notice
- Water tank(s) for commercial and fire fighting purposes that meet the SoSJs requirements.

4.7 Potential Contamination

4.7.1 Unexpected Finds

If, during earthworks, potential point sources of contamination are identified (i.e. asbestos or uncontrolled fill), the following Unexpected Finds Protocol should be included within the Construction Management Plan (Section 4.8) and enacted, as follows:

1. Stop Works.
2. An experienced contamination professional should be contacted for advice and potential investigation of point sources of contamination, in accordance with the DWER's Contamination Sites Management Series, including:
    - *Assessment and Management of Contaminated Sites* (DER 2014)

- Identification, Reporting and Classification of Contaminated Sites in Western Australia (DER 2017).

3. If contamination is confirmed to be present above guideline levels, management and remediation works should be undertaken to the satisfaction of DWER.

4.8 Construction Impacts

Construction activities need to be managed to minimise the impact to the receiving environment. Impacts can include:

- Dust generation from excavation activities
- Noise generation from machinery
- Uncontrolled sediment/surface water run-off during site works
- Inadvertent damage to trees marked for retention
- Inappropriate disposal of waste/wind-blown litter
- Weed and hygiene management
- Inadvertent access to areas beyond the development footprint.

All of these potential impacts are manageable through appropriate site management practices. A site Construction Management Plan could be required as a condition of the Development Application approval, which would detail specific management measures to avoid and/or mitigate these potential impacts prior site works commencing.

5 Conclusion

Based on review of the key environmental features of the site and surrounds, no environmental constraints have been identified which would prevent development as proposed.

A number of relevant environmental factors may trigger management requirements prior to and during construction. Assessment works in relation to these matters can be undertaken post-development approval, prior to works on site commencing.

The following further investigations and/or management plans may be required, as conditions to the development approval:

- ASS investigation and/or ASS and Dewatering Management Plan (if required)
- Construction Management Plan, including fauna management, weed hygiene management and Unexpected Finds Protocol
- Stormwater Management Plan.

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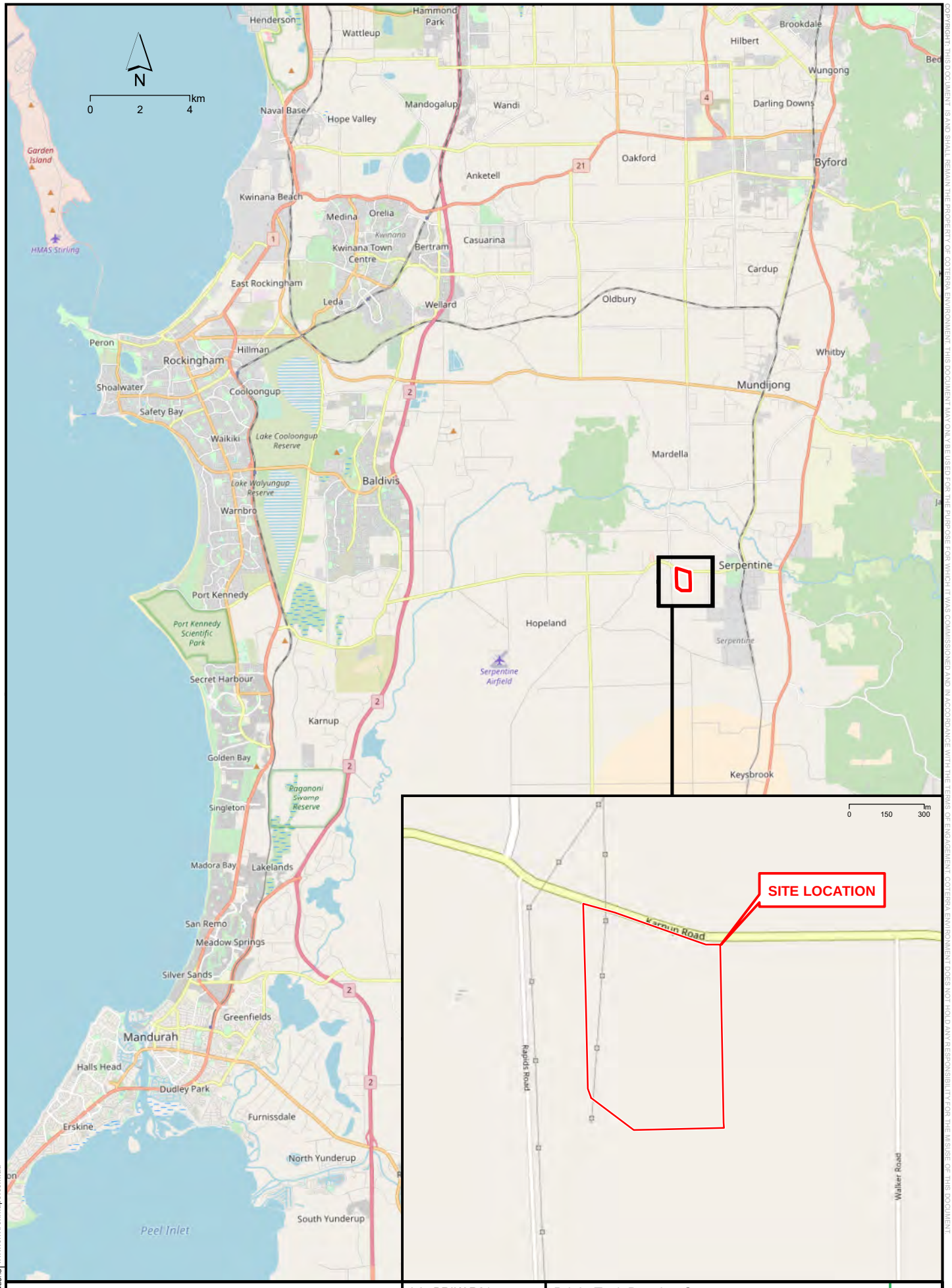

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Bright Tank Brewing Co.
ENVIRONMENTAL ASSESSMENT REPORT
LOT 201 KARNUP ROAD, SERPENTINE

SITE LOCATION

Figure 1

ENVIRONMAPS Environmental Mapping Solutions | t: 0406 590 006 | www.environmaps.com.au

C:\GIS\Jobs\CoTerra\BRIKAR01 - Lot 201 Karnup Road, Serpentine, EAR\Figures\BRIKAR01_F01 Site Location_211130.mxd

Source: Cadastre - Landgate, 2021
Orthophoto - NearMaps, 13.08.21

ENVIRONMAPS | t: 0406 590 006 | Environmental Mapping Solutions | www.environmaps.com.au

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ENVIRONMENTAL ASSESSMENT REPORT
LOT 201 KARNUP ROAD, SERPENTINE

AERIAL PHOTOGRAPH

Figure 2

C:\GIS\Jobs\CoTerra\BRIKAR01 - Lot 201 Karnup Road, Serpentine, EAR\Figures\BRIKAR01_F02 Aerial Photograph_211130.mxd

Karnup Rd

LEGEND

- Site Boundary
- Cadastre
- Proposed Development

N

0 12.5 25 50 75 100 m

Scale: 1:2,500 @ A3
GDA 1994 MGA Zone 50

Source: Cadastre - Landgate, 2021
Orthophoto - NearMaps, 13.08.21
Development - View Thru, 06.04.22

ENVIRONMAPS | t: 0406 590 006 | Environmental Mapping Solutions | www.environmaps.com.au

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Bright Tank Brewing Co.
ENVIRONMENTAL ASSESSMENT REPORT
LOT 201 KARNUP ROAD, SERPENTINE

DEVELOPMENT PLAN

Figure 3

Karnup Rd

Geology

- S8: SAND - white to pale grey at surface, yellow at depth; fine to medium-grained, moderately sorted sub-angular to sub-rounded minor heavy minerals, of eolian origin.
- S10: SAND - as S8 over sandy clay to clayey sand of the Guildford Formation, of eolian origin.
- Spc: CLAYEY PEATY SAND - grey to black, quartz sand with variable organic content; minor clays, of lacustrine origin.

Contour (mAHD)

S8 S10 Spc

LEGEND

- Site Boundary
- Cadastre
- Contour (mAHD)

N

0 12.5 25 50 75 100 m

Scale: 1:2,500 @ A3
GDA 1994 MGA Zone 50

Source: Topography - DWER
Cadastre - Landgate, 2021
Orthophoto - NearMaps, 13.08.21
Geology - DoIR: Geological Survey of W.A., 1999

ENVIRONMAPS Environmental Mapping Solutions t: 0406 590 006 www.environmaps.com.au

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LOT 201 KARNUP ROAD, SERPENTINE

SOILS AND TOPOGRAPHY

Figure 4

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Karnup Rd

LEGEND

Site Boundary

Cadastre

Acid Sulphate Soil Risk Mapping

High to Moderate Risk

Moderate to Low Risk

N

0 12.5 25 50 75 100 m

Scale: 1:2,500 @ A3

GDA 1994 MGA Zone 50

Source: ASS - DWER, 2021
Cadastre - Landgate, 2021
Orthophoto - NearMaps, 13.08.21

COTERRA ENVIRONMENT

Job: BRIKAR01
Doc: 005
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Bright Tank Brewing Co.
ENVIRONMENTAL ASSESSMENT REPORT
LOT 201 KARNUP ROAD, SERPENTINE

ACID SULPHATE SOIL MAPPING

Figure 5

C:\GIS\Jobs\CoTerra\BRIKAR01 - Lot 201 Karnup Road, Serpentine, EAR\Figures\BRIKAR01_F05 ASS Mapping_211130.mxd

Karnup Rd

WATER CORPORATION OPEN DRAIN

DAM

DAM

LEGEND

Site Boundary

Cadastre

Major Drain

N

0 12.5 25 50 75 100 m

Scale: 1:2,500 @ A3

GDA 1994 MGA Zone 50

Source: Hydro Features - DWER
Cadastre - Landgate, 2021
Orthophoto - NearMaps, 13.08.21

ENVIRONMAPS | t: 0406 590 006 | Environmental Mapping Solutions | www.environmaps.com.au

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Bright Tank Brewing Co.
ENVIRONMENTAL ASSESSMENT REPORT
LOT 201 KARNUP ROAD, SERPENTINE

HYDROLOGICAL FEATURES

Figure 6

C:\GIS\Jobs\CoTerra\BRIKAR01 - Lot 201 Karnup Road, Serpentine, EAR\Figures\BRIKAR01_F06 Hydrological Features_211130.mxd

UFI: 15364

UFI: 7403

Karnup Rd

UFI: 7586

UFI: 15364

UFI: 7551

LEGEND

- Site Boundary
- Cadastre
- Proposed Development

Wetland Mapping

- Conservation
- Resource Enhancement

N

0 12.5 25 50 75 100 m

Scale: 1:2,500 @ A3

GDA 1994 MGA Zone 50

Source: Wetlands - DPaW, 2022
Cadastre - Landgate, 2021
Orthophoto - NearMaps, 13.08.21

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www.environmaps.com.au

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Doc: 007
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Bright Tank Brewing Co.
ENVIRONMENTAL ASSESSMENT REPORT
LOT 201 KARNUP ROAD, SERPENTINE

WETLAND MAPPING

Figure 7

C:\GIS\Jobs\CoTerra\BRIKAR01 - Lot 201 Karnup Road, Serpentine, EAR\Figures\BRIKAR01_F07 Wetland Mapping_220422.mxd

N

0 12.5 25 50 75 100 m

Scale: 1:2,500 @ A3
GDA 1994 MGA Zone 50

Karnup Rd

EmXo (P)
CcEmEuc (P)
CcEmEuc (P)
PpXp (P)
Mp (P)
Euc (P)
Euc (P)
Jk (P)
Cc (P)
Planted
Cc (P)
Af (P)
CcMp (P)
CcEuc (P)
Er (P)
Pasture
Jk (P)
Open Water
CcMp (P)
Er (P)
MpJk (P)
Er (P)
Cc (P)
Cc (P)
Open Water
Jk (P)
CcEm (P)
MrMp (P)
MpRc
Kg (P)
Cc (P)
CcMr (P)

LEGEND

- Site Boundary
- Cadastre
- Proposed Development

Vegetation Units

- Af (P)
- Cc (P)
- CcEm (P)
- CcEmEuc (P)
- CcEuc (P)
- CcMp (P)
- CcMr (P)
- EmXo (P)
- Er (P)
- Euc (P)
- Jk (P)
- Kg (P)
- Mp (P)
- MpJk (P)
- MpRc
- MrMp (P)
- PpXp (P)
- Planted
- Pasture
- Open Water

Source: Vegetation - FVC, 2021
Cadastre - Landgate, 2021
Orthophoto - NearMaps, 13.08.21

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Bright Tank Brewing Co.
ENVIRONMENTAL ASSESSMENT REPORT
LOT 201 KARNUP ROAD, SERPENTINE

VEGETATION UNITS

Figure 8

C:\GIS\Jobs\CoTerra\BRIKAR01 - Lot 201 Karnup Road, Serpentine, EAR\Figures\BRIKAR01_F08 Vegetation Units_220422.mxd

N

0 12.5 25 50 75 100 m

Scale: 1:2,500 @ A3
GDA 1994 MGA Zone 50

Karnup Rd

D
CD
CD-D
CD
CD
CD
CD
CD
CD
CD
CD
CD
CD-D
D
CD
CD-D

LEGEND

- Site Boundary
- Cadastre
- Proposed Development

Vegetation Condition

- Degraded
- CD-Degraded
- Completely Degraded

Source: Vegetation - FVC, 2021
Cadastre - Landgate, 2021
Orthophoto - NearMaps, 13.08.21

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C:\GIS\Jobs\CoTerra\BRIKAR01 - Lot 201 Karnup Road, Serpentine, EAR\Figures\BRIKAR01_F09 Vegetation Condition_220422.mxd

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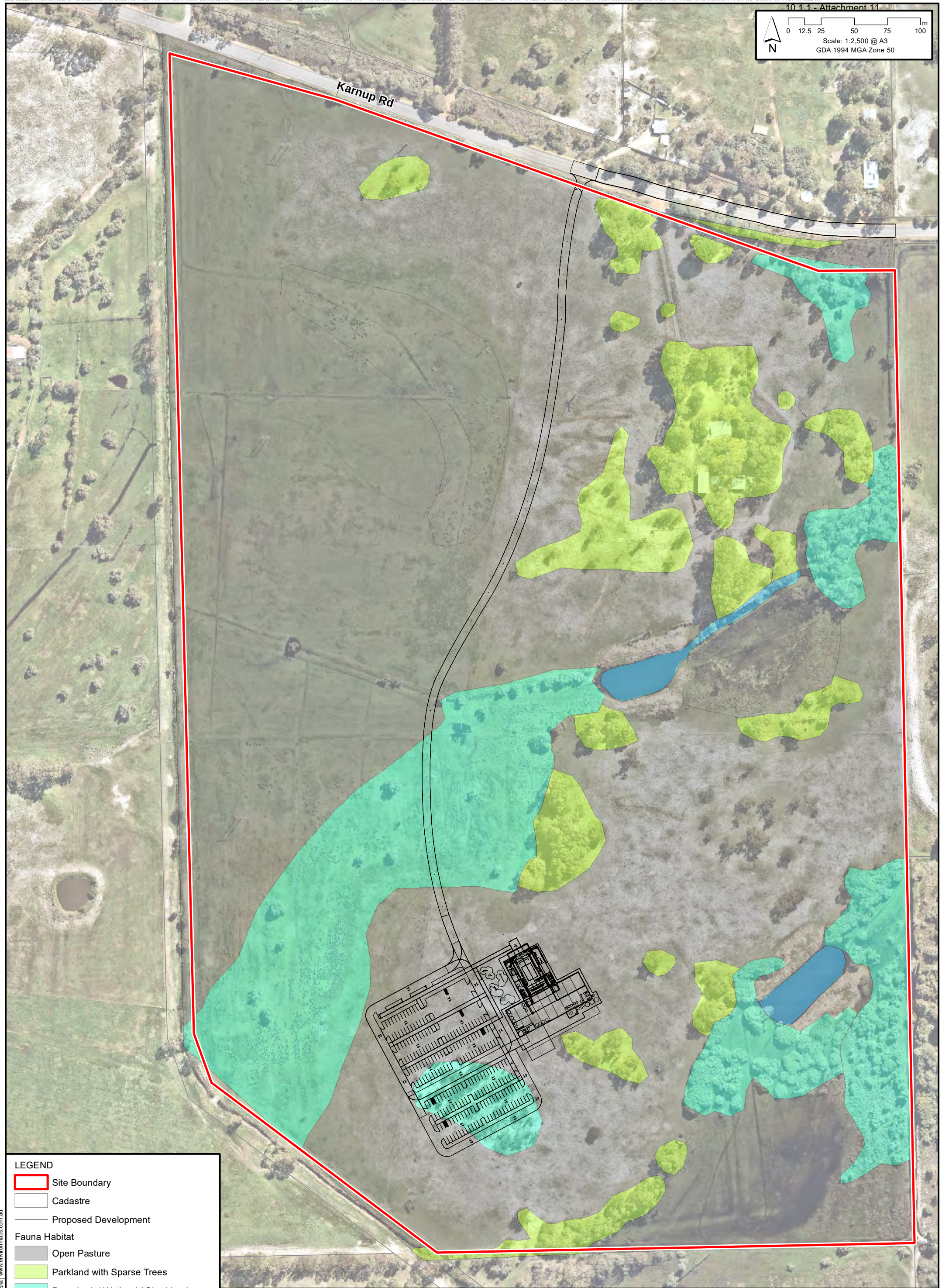
ENVIRONMENTAL ASSESSMENT REPORT
LOT 201 KARNUP ROAD, SERPENTINE

VEGETATION CONDITION

Figure 9



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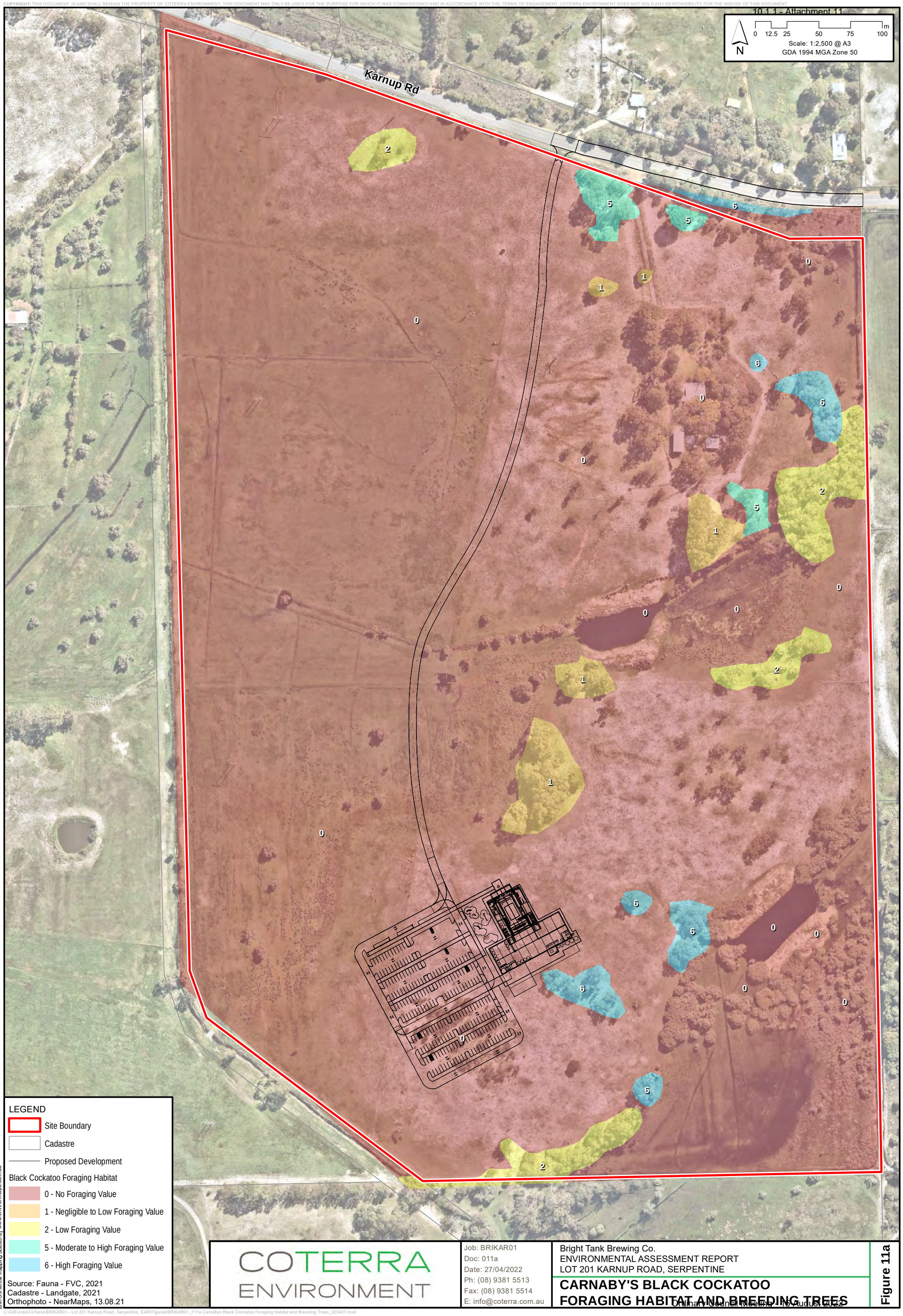
ENVIRONMENTAL ASSESSMENT REPORT
LOT 201 KARNUP ROAD, SERPENTINE

FAUNA HABITATS

Figure 10

C:\GIS\Jobs\CoTerra\BRIKAR01 - Lot 201 Karnup Road, Serpentine, EAR\Figures\BRIKAR01_F10 Fauna Habitats_220422.mxd



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Bright Tank Brewing Co.
ENVIRONMENTAL ASSESSMENT REPORT
LOT 201 KARNUP ROAD, SERPENTINE

CARNABY'S BLACK COCKATOO FORAGING HABITAT AND BREEDING TREES

Figure 11a

C:\GIS\Jobs\CoTerra\BRIKAR01 - Lot 201 Karnup Road, Serpentine, EAR\Figures\BRIKAR01_F11a Carnabys Black Cockatoo Foraging Habitat and Breeding Trees_220427.mxd

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Doc: 011b
Date: 22/04/2022
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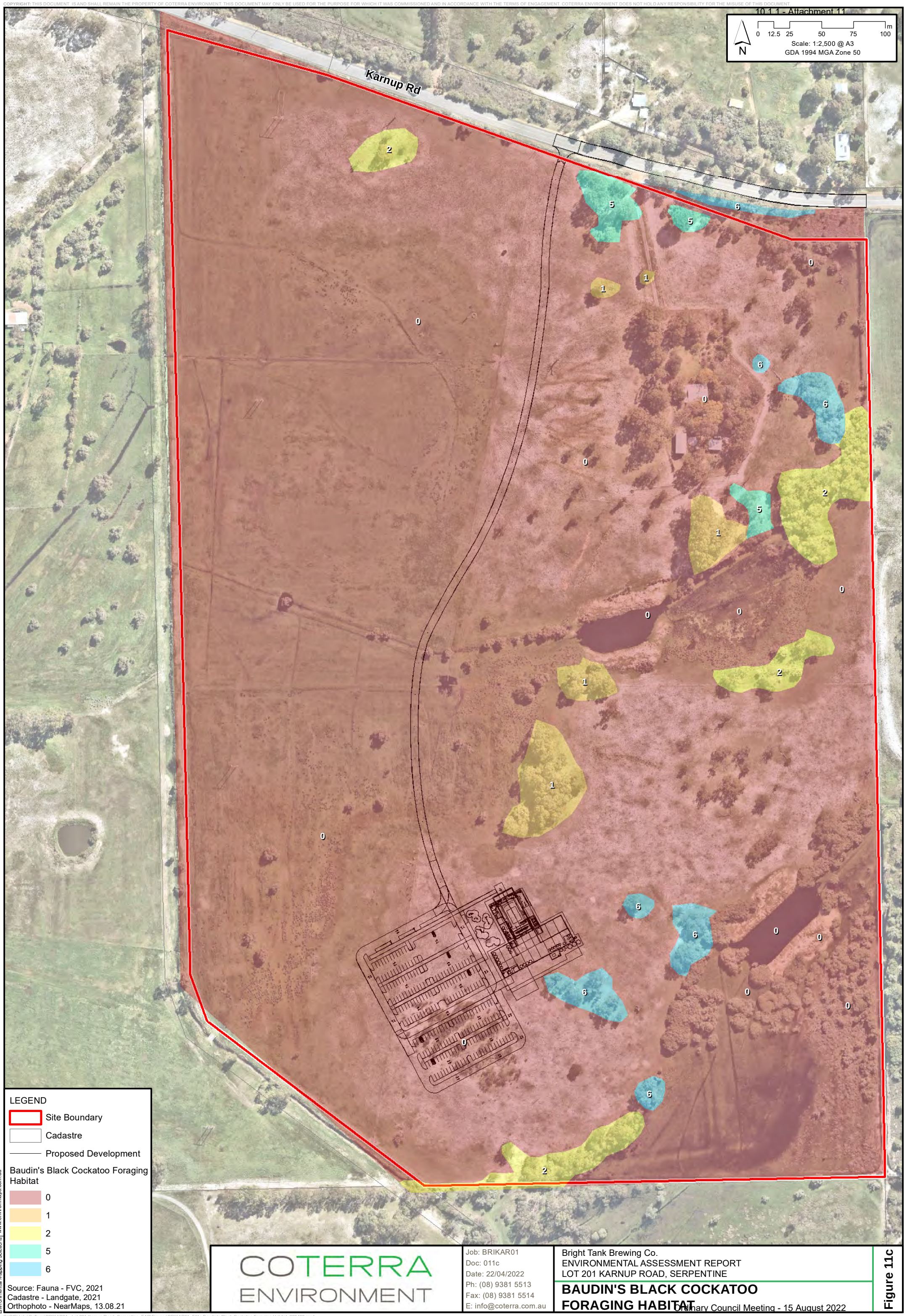
ENVIRONMENTAL ASSESSMENT REPORT
LOT 201 KARNUP ROAD, SERPENTINE

FOREST RED-TAILED BLACK COCKATOO FORAGING HABITAT

Figure 11b

C:\GIS\Jobs\CoTerra\BRIKAR01 - Lot 201 Karnup Road, Serpentine, EAR\Figures\BRIKAR01_F11b Forest Red-Tailed Black Cockatoo Foraging Habitat_220422.mxd



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Doc: 011c
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Bright Tank Brewing Co.
ENVIRONMENTAL ASSESSMENT REPORT
LOT 201 KARNUP ROAD, SERPENTINE

BAUDIN'S BLACK COCKATOO FORAGING HABITAT

Figure 11c

C:\GIS\Jobs\CoTerra\BRIKAR01 - Lot 201 Karnup Road, Serpentine, EAR\Figures\BRIKAR01_F11c Baudin's Black Cockatoo Foraging Habitat_220422.mxd

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ENVIRONMENTAL ASSESSMENT REPORT
LOT 201 KARNUP ROAD, SERPENTINE

POTENTIAL BLACK COCKATOO ROOSTING HABITAT AND BLACK COCKATOO BREEDING TREES

Figure 12

C:\GIS\Jobs\CoTerra\BRIKAR01 - Lot 201 Karnup Road, Serpentine, EAR\Figures\BRIKAR01_F12 Potential Black Cockatoo Roosting Habitat and BC Breeding Trees_220422.mxd

LEGEND
- Site Boundary
- Cadastre
- Ecological Linkages
- Environmentally Sensitive Area

N

0 25 50 100 150 200 m

Scale: 1:5,000 @ A3
GDA 1994 MGA Zone 50

Karnup Rd

Rapids Rd

Source: ESA - DWER
Cadastre - Landgate, 2021
Orthophoto - NearMaps, 13.08.21

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Bright Tank Brewing Co.
ENVIRONMENTAL ASSESSMENT REPORT
LOT 201 KARNUP ROAD, SERPENTINE

ENVIRONMENTAL SENSITIVE AREAS

Figure 13

C:\GIS\Jobs\CoTerra\BRIKAR01 - Lot 201 Karnup Road, Serpentine, EAR\Figures\BRIKAR01_F13 Environmental Sensitive Areas_220504.mxd

Karnup Rd

WATER CORPORATION OPEN DRAIN

LEGEND

- Site Boundary
- Cadastre
- Proposed Development
- Major Drain
- 100 m Water Corporation Open Drain Buffer
- Irrigation Area (10 ha)
- Land Application Area

N

0 12.5 25 50 75 100 m

Scale: 1:2,500 @ A3
GDA 1994 MGA Zone 50

MINIMUM 1.2 m BUFFER TO BUILDINGS NEAR THE LAND APPLICATION AREA. LOCATION IS INDICATIVE AND LIKELY TO CHANGE AT DETAILED DESIGN TO PREVENT CLEARING

Source: Cadastre - Landgate, 2021
Orthophoto - NearMaps, 13.08.21
Master Plan - View Thru, 06.04.22

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ENVIRONMENTAL ASSESSMENT REPORT
LOT 201 KARNUP ROAD, SERPENTINE

WASTEWATER LAND APPLICATION AREA AND IRRIGATION AREA

Figure 14

C:\GIS\Jobs\CoTerra\BRIKAR01 - Lot 201 Karnup Road, Serpentine, EAR\Figures\BRIKAR01_F14 Wastewater Land Application Area and Irrigation Area_220713.mxd

Appendix 1 Development Plan

1248 Karnup Road, Serpentine, WA

source: https://espatial.dplh.wa.gov.au/

site location plan

nts

north

to Perth // 45mins // 60km

via Kwinana Fwy // State Route 2

drawing register

		Issue Date:
	Day	6
	Month	4
	Year	22
DA//00	Site Location & Drawing Register	A
DA//01	Site Analysis Plan	A
DA//02	Site Layout Plan // Proposed	A
DA//03	Site Detail Plan // Proposed	A
DA//04	GF Venue Plan // Proposed	A
DA//05	FF Venue Plan // Proposed	A
DA//06	GF Brewery Plan // Proposed	A
DA//07	FF Brewery Plan // Proposed	A
DA//08	Elevations N & S // Proposed	A
DA//09	Elevations E & W // Proposed	A
DA//10	Sections // Proposed	A
DA//11	Perspective Views External	A

Issue:	**Recipients:**	
(DA)	Clients : Bright Tank Brewing Company	•
(DA)	Council : Serpentine Shire Council	•
(DA)	Engineer Traffic : P. Yapp - QTM	•
(DA)	Environmental : C. Choo - Coterra	•
(DA)	Acoustic : B. Farrell - Gabriels Hearne Farrell	•

BRIGHT TANK BREWING CO.

Development Application (DA)

address: 1248 Karnup Rd, Serpentine, WA 6125. LOT 201 DP 301718	title: Site Location & Drawing Register	date: 6/04/2022	scale: © VIEW//THRU
client: Bright Tank Brewing Co.	project: Proposed Brewery	drawn: JOB	dwg. no. DA//00

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HIGH WINDS AFTERNOON

PREVAILING NORTH EAST BREEZES summer

KARNUP ROAD

SITE ACCESS

LANDSCAPE OPPORTUNITY

LANDSCAPE OPPORTUNITY

WINTER JUN 21st

SUMMER DEC 21st

DAM

DAM

POTENTIAL AREA FOR BREWERY & VENUE SITING

LANDSCAPE OPPORTUNITY

PREVAILING WEST TO SOUTH//WEST WINTER BREEZES
exposure to cold winter winds

site analysis plan

scale : nts

plan reference key:

- site boundary
- water source
- views district
- site entry points
- sun path // summer
- sun path // winter

GEOGRAPHIC LOCATION	
Latitude:	-31.90°
Longitude:	115.30°
Timezone	GMT+08:00
DATE AND TIME	
Date:	21 Dec 2021
Time:	09:00
SOLAR INFORMATION	
Azi / Alt:	91.72° / 46.00°
Rise / Set:	05:10 / 19:24
Daylight:	14.14 Hrs

source: andrewmarsh.com

Development Application (DA)

address: 1248 Karnup Rd, Serpentine, WA 6125. LOT 201 DP 301718		title: Site Analysis Plan © VIEW//THRU	north	date: 6//04//2022	Rev. no.: A
client:	Bright Tank Brewing Co.	drawn by: JOB	scale: nts	dwg. no.: DA//01	issue: (DA)
project:	Proposed Brewery				

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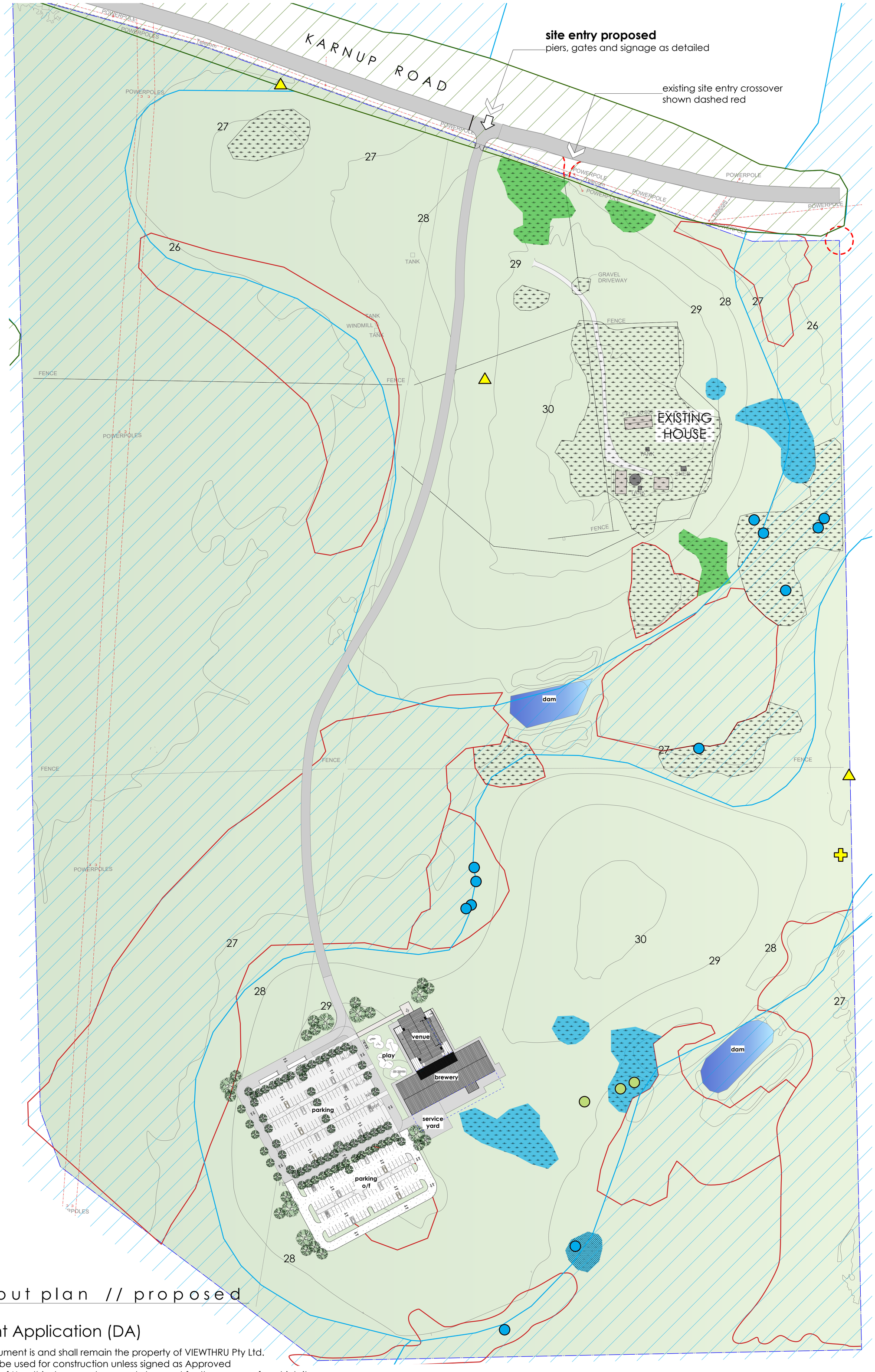

site layout plan // proposed

Scale: 1:1250

Development Application (DA)

address: 1248 Karnup Rd, Serpentine, WA 6125. LOT 201 DP 301718	title: Site Layout Plan // Proposed ©VIEW//THRU		north	date: 6//04//2022	Rev. no.: A
client: Bright Tank Brewing Co.	drawn by: JOB	scale: 1:100 @ A3		dwg. no.: DA//02	issue: (DA)
project: Proposed Brewery					

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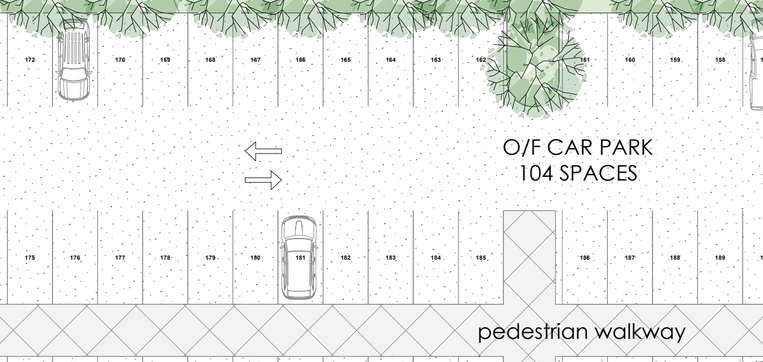
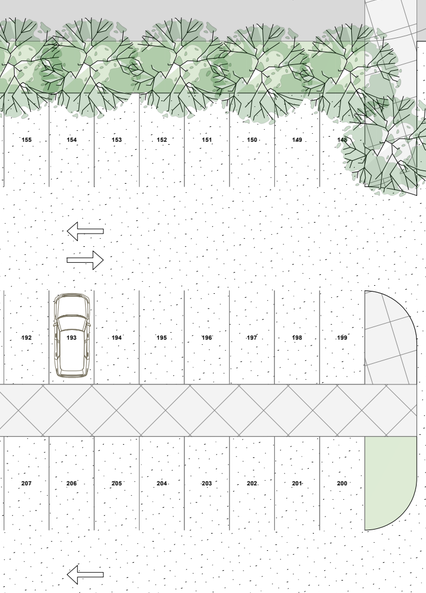
R 12000
R 9000
R 3000
15000
15000
6000
3000
coach bay
coach bay
pedestrian walkway
5400
2600
6000
bycycle bays
pedestrian walkway
3000
5400
6000
6000
MAIN CAR PARK
147 SPACES
6000
pedestrian walkway
motorcycle bays
motorcycle bays
VENUE
BREWERY
SERVICE YARD
R 9000
O/F CAR PARK
104 SPACES
pedestrian walkway

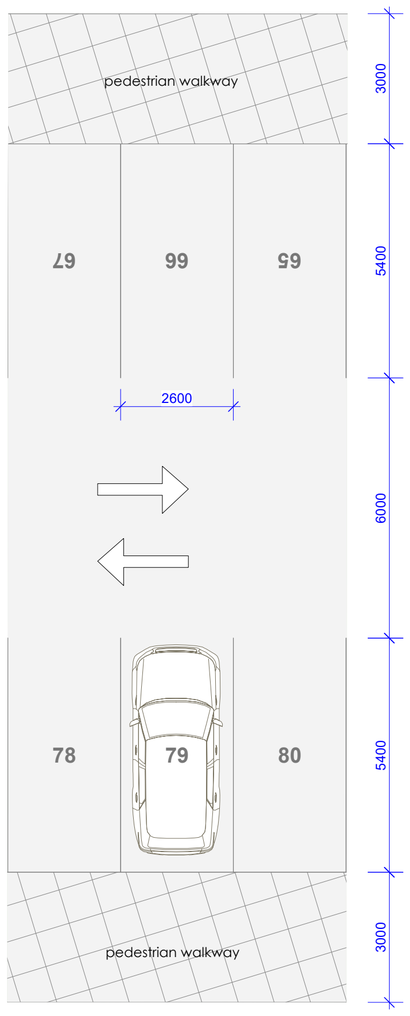
site detailed plan // proposed
Scale: 1:250



site entry detail
Scale: 1:100



typ. ACROD detail plan
Scale: 1:100



typ. parking detail plan
Scale: 1:100

Development Application (DA)

address: 1248 Karnup Rd, Serpentine, WA 6125. LOT 201 DP 301718	title: Site Detail Plan // Proposed ©VIEW//THRU		north	date: 6//04//2022	Rev. no.: A
client: Bright Tank Brewing Co.	drawn by: JOB	scale: 1:250 @ A1		dwg. no.: DA//03	issue: (DA)
project: Proposed Brewery					

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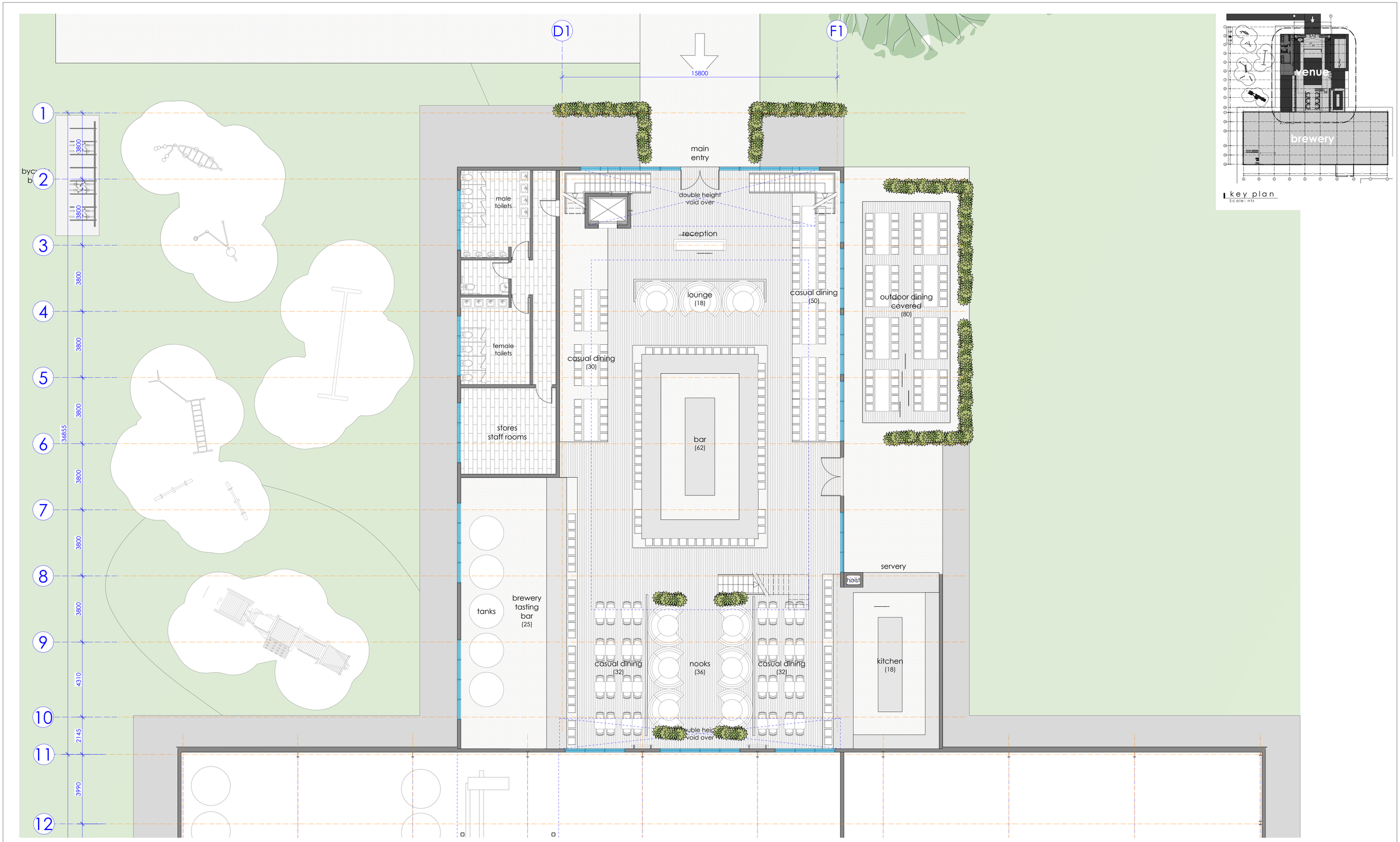

key plan
Scale: nts

venue // entry level plan proposed
Scale: 1:100

Development Application (DA)

north

address: 1248 Karnup Rd, Serpentine, WA 6125. LOT 201 DP 301718

client: Bright Tank Brewing Co.

project: Proposed Brewery

title: GF Venue Plan // Proposed

©VIEW//THRU

drawn by: JOB

scale: 1:100 @ A1

date: 6//04//2022

dwg. no.: **D A / / 0 4**

Rev. no.: **A**

issue: **(DA)**

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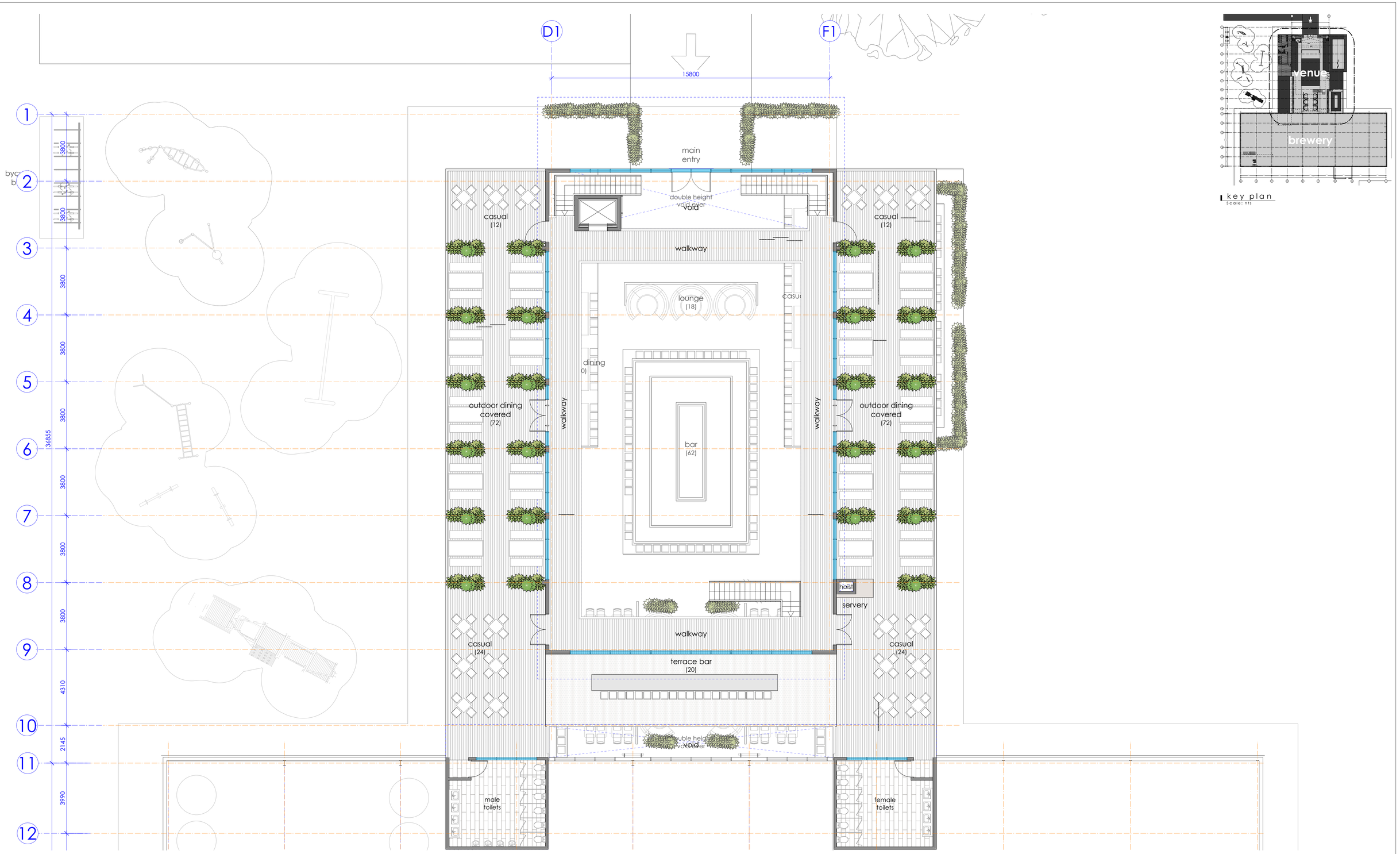

key plan
Scale: nts

venue // first floor plan proposed
Scale: 1:100

Development Application (DA)

north

address: 1248 Karnup Rd, Serpentine, WA 6125. LOT 201 DP 301718

client: Bright Tank Brewing Co.

project: Proposed Brewery

title: FF Venue Plan // Proposed

©VIEW//THRU

drawn by: JOB

scale: 1:100 @ A1

date: 6//04//2022

dwg. no.: D A / / 0 5

Rev. no.: A

issue: (DA)

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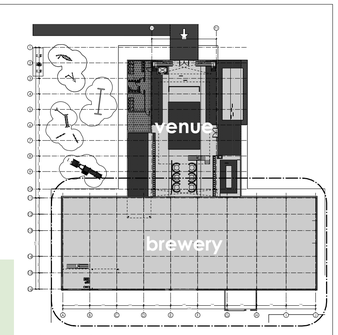
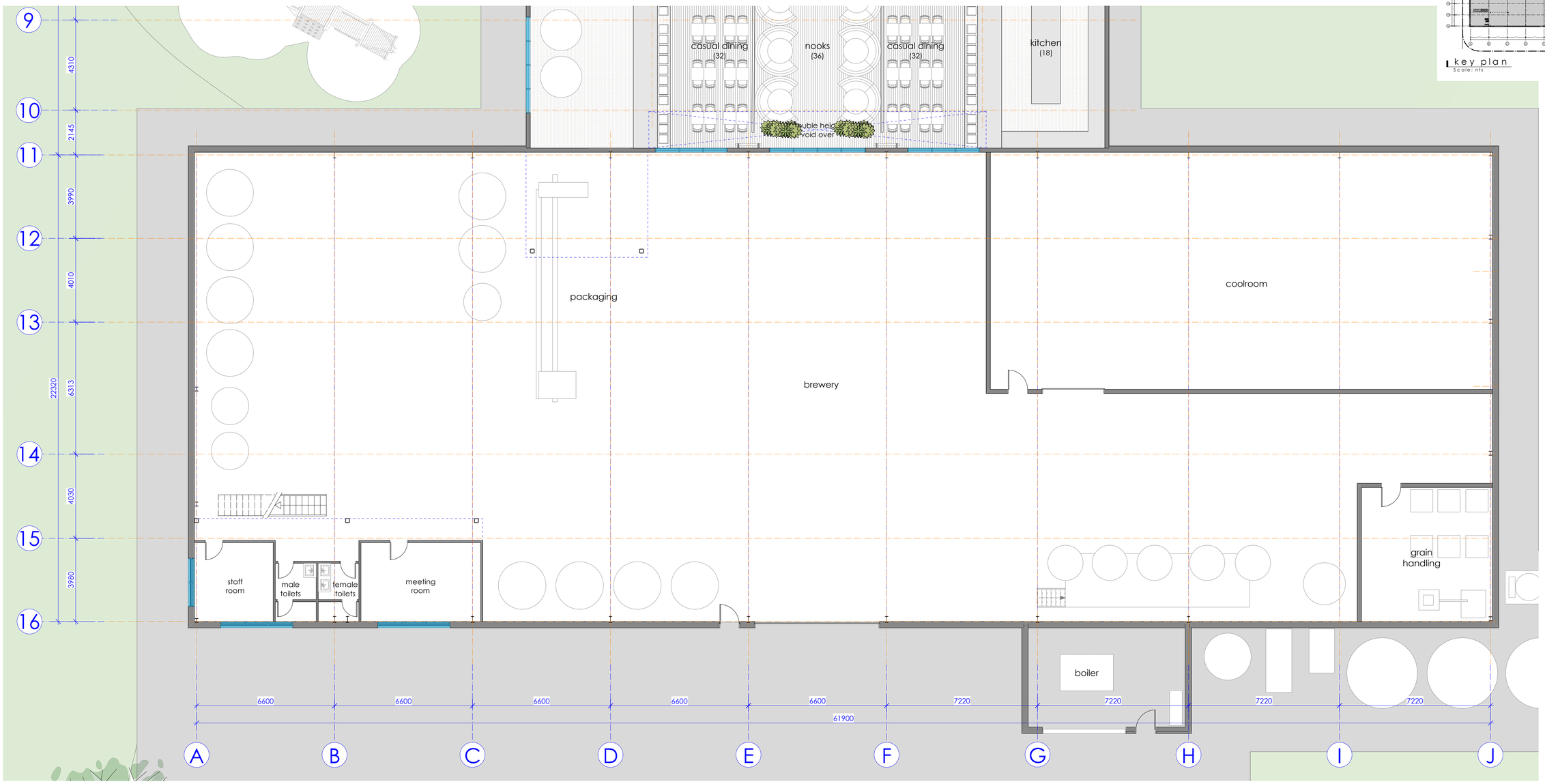


key plan
Scale: nts



brewery // entry level plan proposed
Scale: 1:100

Development Application (DA)

north

address: 1248 Karnup Rd, Serpentine, WA 6125. LOT 201 DP 301718	title: GF Brewery Plan // Proposed ©VIEW//THRU		date: 6//04//2022	Rev. no.: A
client: Bright Tank Brewing Co.	drawn by: JOB	scale: 1:100 @ A1	dwg. no.: D A / / 0 6	issue: (DA)
project: Proposed Brewery				

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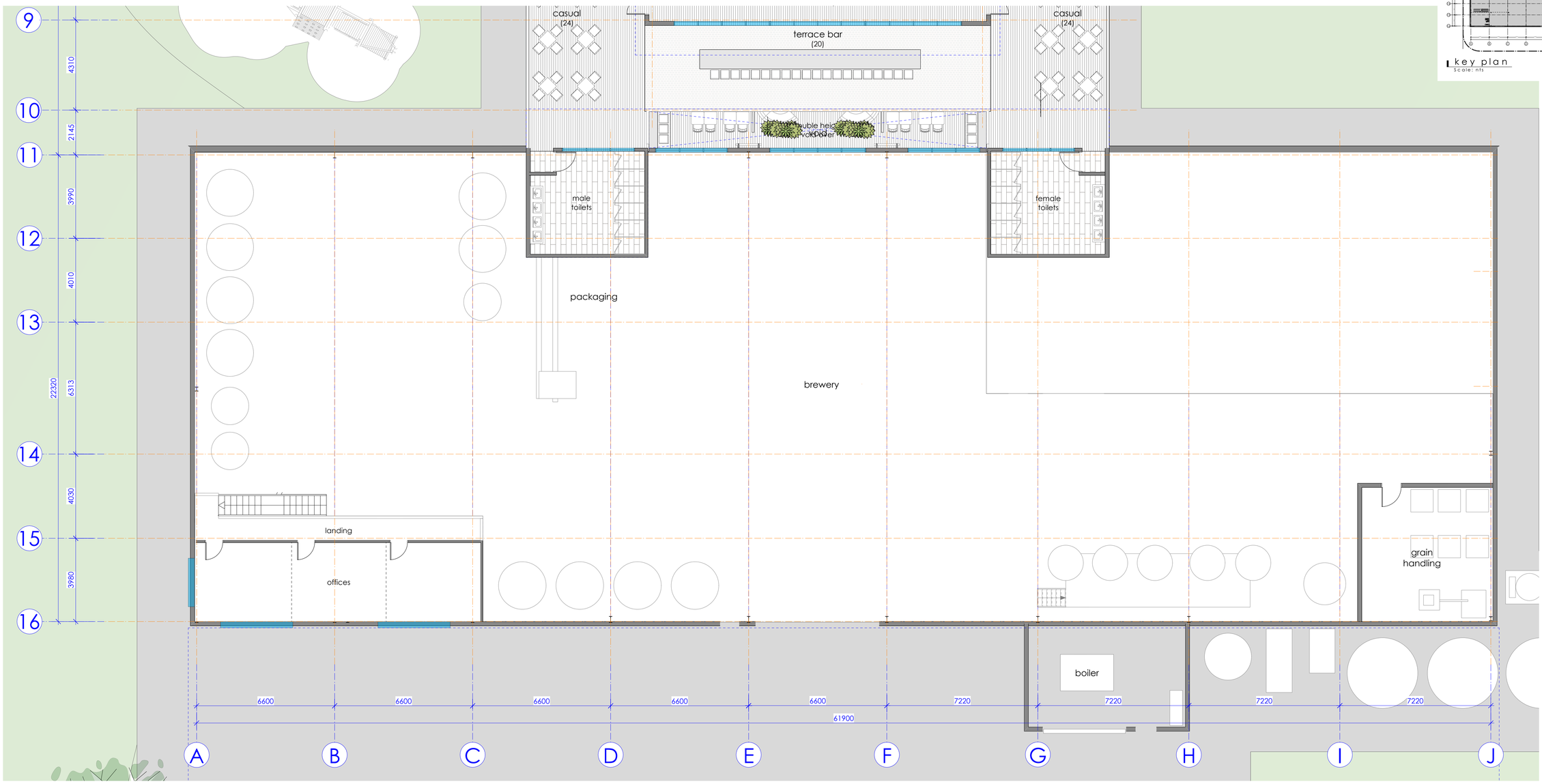

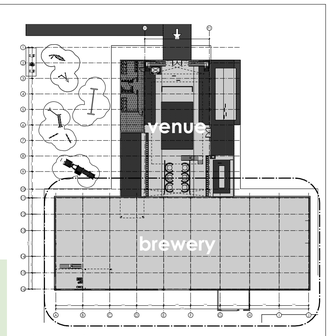

key plan
Scale: nts

brewery // first floor plan proposed
Scale: 1:100

Development Application (DA)

north

address: 1248 Karnup Rd, Serpentine, WA 6125. LOT 201 DP 301718	title: FF Brewery Plan // Proposed ©VIEW//THRU		date: 6//04//2022	Rev. no.: A
client: Bright Tank Brewing Co.	drawn by: JOB	scale: 1:100 @ A1	dwg. no.: D A / / 0 7	issue: (DA)
project: Proposed Brewery				

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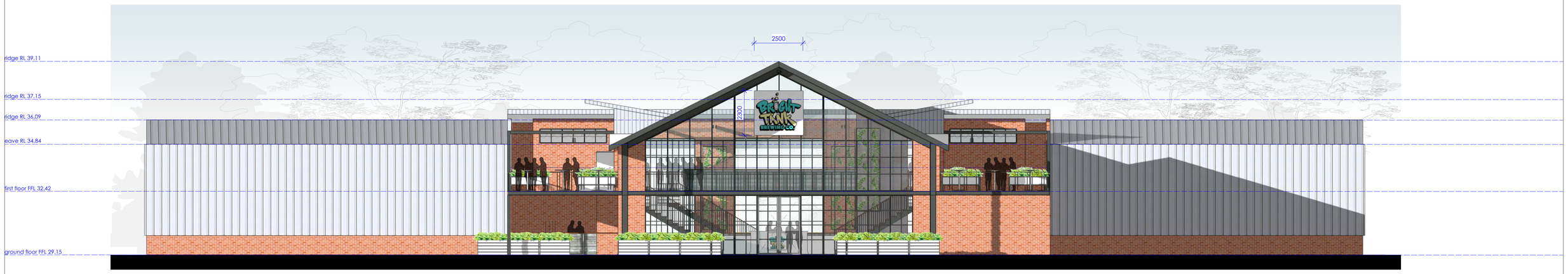

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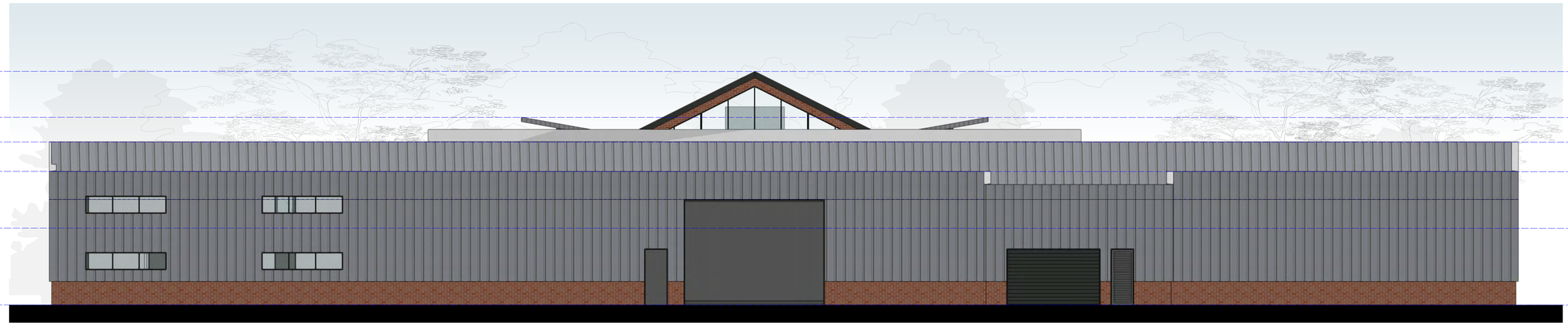


south elevation
Scale: 1:100

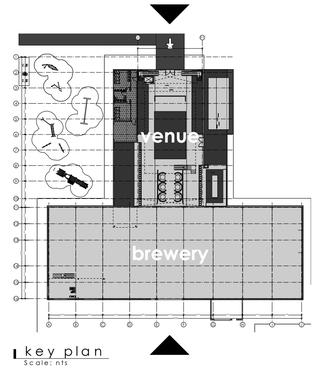
METAL ROOFING & CLADDING
Eg. Colorbond ' Monument Matt'

ALUMINIUM WINDOW AND DOOR FRAMES
Color - eg. Domino

WALLING & PAVING
recycled brick

DECKING
H/W Selection Natural Finish

external finishes
Scale: nts



key plan
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Development Application (DA)

address:
1248 Karnup Rd, Serpentine, WA 6125.
LOT 201 DP 301718

client: Bright Tank Brewing Co.

project: Proposed Brewery

title: Elevations N & S // Proposed

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scale: 1:100 @ A1

date: 6//04//2022

dwg. no.: **D A / / 0 8**

Rev. no.: **A**

issue: **(DA)**

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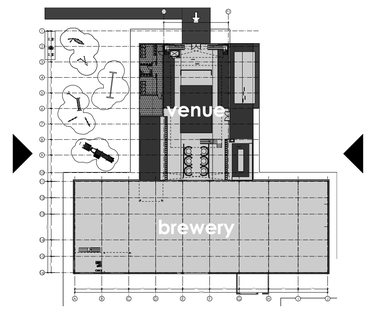
east elevation
Scale: 1:100

west elevation
Scale: 1:100



key plan
Scale: nts

Development Application (DA)

address:
1248 Karnup Rd, Serpentine, WA 6125.
LOT 201 DP 301718

client: Bright Tank Brewing Co.

project: Proposed Brewery

title: Elevations E & W // Proposed

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drawn by: JOB

scale: 1:100 @ A1

date: 6//04//2022

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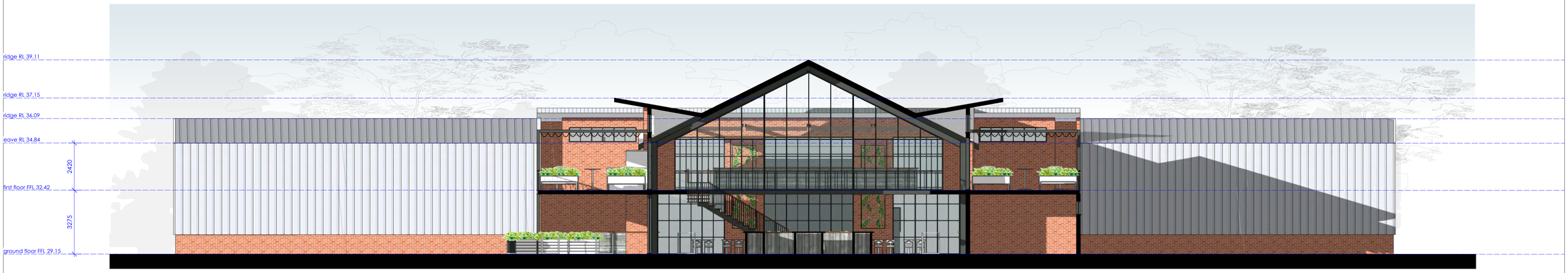

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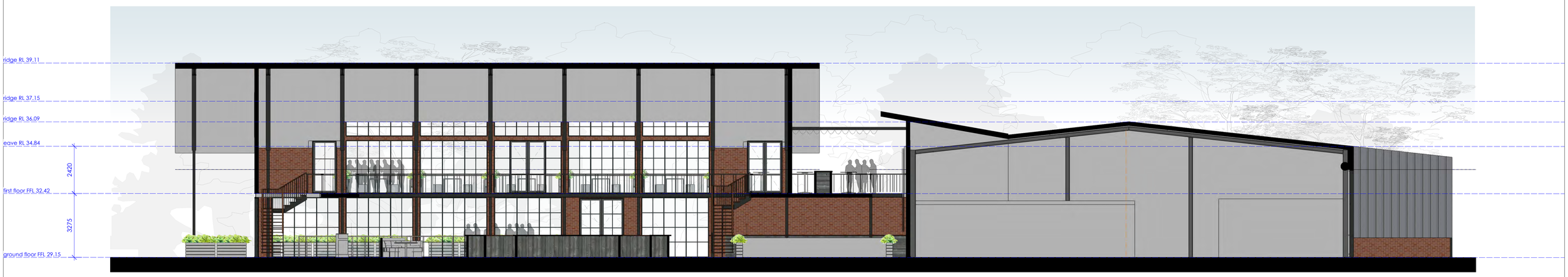
Scale: 1:100



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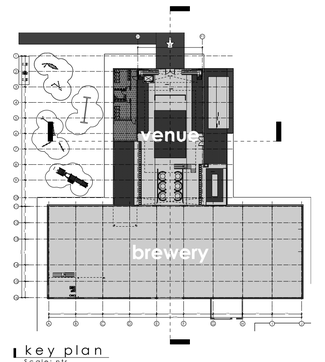

key plan
Scale: nts

Development Application (DA)

address:	1248 Karnup Rd, Serpentine, WA 6125. LOT 201 DP 301718
client:	Bright Tank Brewing Co.
project:	Proposed Brewery
title:	Sections // Proposed ©VIEW//THRU
drawn by:	JOB
scale:	1:100 @ A1
date:	6//04//2022
dwg. no.:	D A / / 1 0
Rev. no.:	A
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birdseye

entry

east

west

Development Application (DA)

address:
1248 Karnup Rd, Serpentine, WA 6125.
LOT 201 DP 301718

client: Bright Tank Brewing Co.

project: Proposed Brewery

title: Perspective Views External

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drawn by: JOB

scale: 1:100 @ A1

date: 6//04//2022

dwg. no.: **D A / / 1 1**

Rev. no.: **A**

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Appendix 2 Clearing Referral Determination Notice (11 July 2022)

Government of Western Australia
Department of Water and Environmental Regulation

CLEARING REFERRAL DETERMINATION NOTICE

Referral details

REF number:	REF 9767/1
Referral submitted by:	Bright Tank Property Pty Ltd
Purpose of proposed clearing:	Construction of a brewery, bar and restaurant
Location of proposed clearing:	Lot 201 on Deposited Plan 301718, Serpentine
Expiration date	11 July 2024

Referral determination

The Department of Water and Environmental Regulation has considered this referral and determined under section 51DA(3) of the *Environmental Protection Act 1986* (the EP Act) that:

- a clearing permit is not required for the proposed clearing of the areas hatched green on the attached map detailed in Schedule 1.

The reason for this determination is that the proposed clearing satisfies all of the criteria specified in section 51DA(4) of the EP Act. Specifically:

- the area proposed to be cleared (the area) is small relative to the total remaining native vegetation —
    - within the region in which the area is situated, and
    - of the ecological community of which the native vegetation proposed to be cleared forms part, and
- there are no known or likely significant environmental values identified within the area
- the state of scientific knowledge about native vegetation within the region in which the area is situated is adequate, and
- the are no issues that would arise as a result of the proposed clearing that are likely to require conditions to manage or mitigate effects on the environment.

Prime House, 8 Davidson Terrace Joondalup Western Australia 6027
Locked Bag 10 Joondalup DC WA 6919
Telephone: 08 6364 7000 Facsimile: 08 6364 7001
www.dwer.wa.gov.au

Please note that this determination is valid only until the expiration date specified above. After this date, you will need to submit a new clearing referral or apply for a clearing permit before undertaking further clearing of native vegetation.

Juraj Galba
A/SENIOR ENVIRONMENTAL OFFICER
NATIVE VEGETATION REGULATION

11 July 2022

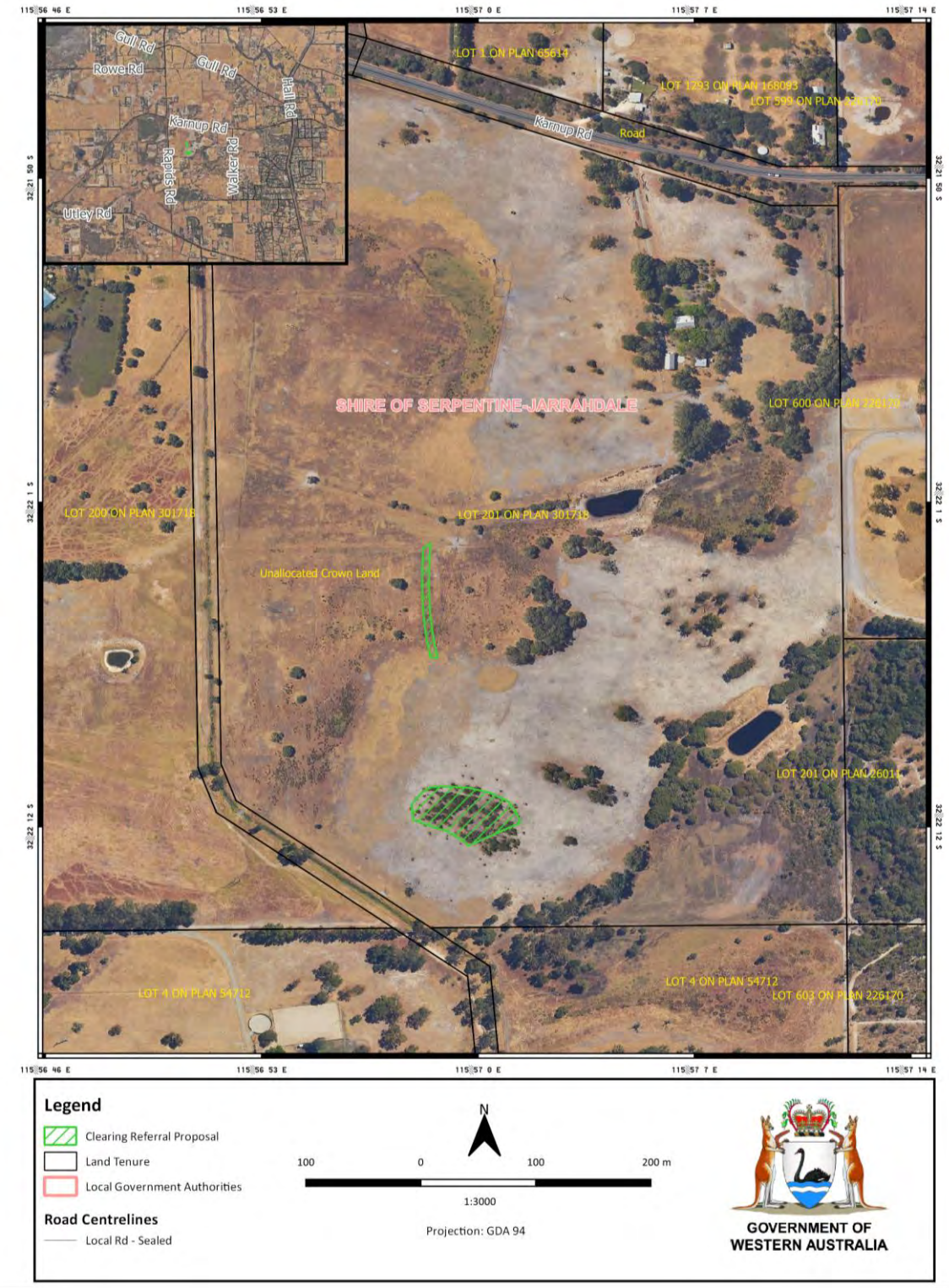
an officer delegated under section 20 of
the *Environmental Protection Act 1986*

Schedule 1: Map

Map

The area that does not require a clearing permit is shown in the map below.

Plan 9767/1



Appendix 3 Biological Assessment – 1248 Karnup Road, Serpentine (Focused Vision Consulting 2021)

BIOLOGICAL ASSESSMENT

LOT 1248 KARNUP ROAD, SERPENTINE

DECEMBER 2021

Focused Vision Consulting Pty Ltd
ABN 25 605 804 500

Please direct all inquiries to:
Focused Vision Consulting Pty Ltd
8/83 Mell Road, SPEARWOOD WA 6163
P: 08 6179 4111
E: admin@focusedvision.com.au

Document History

Rev.	Author	Reviewed	Approved	Date
A	Kellie Bauer-Simpson Principal Ecologist Louis Masarei Senior Zoologist Lisa Chappell Senior Botanist/Environmental Scientist	Lisa Chappell Senior Botanist/Environmental Scientist	Kellie Bauer-Simpson Principal Ecologist	09/12/2021

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EXECUTIVE SUMMARY

WaterInsight Pty Ltd (WaterInsight) and Coterra Environment (Coterra) are assisting a client with the development of a site in Serpentine for a proposed hospitality venue. Focused Vision Consulting Pty Ltd (FVC) was commissioned to undertake an ecological assessment of the study area. The scope of work required to be fulfilled was as follows:

- Undertake a desktop assessment to identify all biological features and constraints
- Undertake an overview inspection of the site for flora, vegetation and fauna habitat values with a targeted Black-Cockatoo habitat assessment
- Prepare a report compiling the findings of the desktop and field assessments.

The desktop and field assessments were completed during spring 2021 by experienced ecologists.

The results presented in this report will be used to avoid and minimise environmental impacts and support environmental approvals.

The key findings and conclusions arising from the ecological assessment within the study area are as follows:

- One remnant vegetation unit (MpRc), which occupies an area of 1.43 ha (3.24% of the study area) was recorded and mapped within the study area.
- Vegetation Unit MpRc is growing in is growing in association with a Resource Enhancement Wetland (REW) Sumpland, UFI 7551.
- No intact, remnant vegetation is growing in association with either of the Conservation Category Wetland (CCW) Damplands, UFI 7403 or UFI 7586, nor the REW, UFI 15364
- No Threatened flora listed under the BC Act or the EPBC Act, nor DBCA Priority listed flora were recorded.
- Two of the recorded weeds, **Zantadeschia aethiopica* (Arum Lily) and **Moraea flaccida* (Two-leaved Cape Tulip), are listed as Declared Pest [s22(2)] plants under the BAM Act (DPIRD 2020) throughout Western Australia and although no obligations are imposed on landholders to control their spread, best-practice hygiene measures should be implemented to avoid local exacerbation of infestations.
- None of the defined vegetation units are considered to be representative of any TEC or PEC identified from the desktop assessment.
- Based on the results of the field assessment, five vertebrate fauna species of significance are considered 'likely to occur' and one may 'potentially occur'. These species are:
    - Likely to occur:
        - Carnaby's Black-Cockatoo (*Calyptorhynchus latirostris*) – Endangered
        - Baudin's Black-Cockatoo (*Calyptorhynchus baudinii*) – Endangered
        - Quenda (*Isoodon fusciventer*) – Priority 4
        - Blue-billed Duck (*Oxyura australis*) – Priority 4
        - Rainbow Bee-eater (*Merops ornatus*) – Marine.
    - May potentially occur:
        - Pacific Swift (*Apus pacificus*) – Marine/Migratory.
- The study area was found to support three key fauna habitats (Paperbark/Wetland/Shrubland, Parkland with sparse trees and Dams/Streams), plus open pasture, which is considered to provide little, if any habitat value for native vertebrate fauna.

- The following Black-Cockatoo habitat is provided by the study area:
    - Foraging habitat:
        - 0.60 ha (1.38% of the study area) of 'High' (6) quality foraging habitat for Carnaby's Black-Cockatoos and Baudin's Black-Cockatoos, 'Moderate to High' (5) quality foraging habitat for Forest Red-tailed Black-Cockatoos, and 'Low to Moderate' (4) quality foraging habitat for Baudin's Black-Cockatoo, within Cc (P), CcEm (P) and PpXp (P)
        - 0.30 ha (0.67% of the study area) of 'Moderate to High' (5) quality foraging habitat for Carnaby's Black-Cockatoos and Baudin's Black-Cockatoos and 'Moderate' (4) quality foraging habitat for Forest Red-tailed Black-Cockatoos, within CcEmEuc (P) and CcEuc (P)
        - 0.61 ha (1.37% of the study area) of 'Low to Moderate' (4) quality foraging habitat for Forest Red-tailed Black-Cockatoos, within Af (P)
        - 42.73 ha (96.59%) of the study area recorded a Black-Cockatoo foraging habitat quality score of 3 'Low to Moderate' or lower, with 39.46 ha (89.20% of the study area) of this providing zero foraging habitat for any species of Black-Cockatoo.
    - Breeding habitat:
        - Twenty-six suitable trees of adequate DBH were recorded, comprising:
            - five trees with potentially suitable hollows, but with no evidence of Black-Cockatoo use
            - four trees with unsuitable hollows for Black-Cockatoo breeding
            - 17 trees without hollows, but with adequate DBH to potentially provide suitable Black-Cockatoo breeding hollows in the future.
    - Roosting habitat:
        - None known or confirmed within the study area, however, the large trees present may potentially provide suitable roosting habitat, although this is considered unlikely, since the location and extent of Black-Cockatoo roost sites in the Perth region is well understood and the birds are site faithful, so 'new' roosts are rare.

The following recommendations are suggested for the proposed future development of the study area:

- Design the development in a way that where possible, avoids the clearing of remnant native vegetation, including isolated trees, especially those that provide better-quality foraging, potential breeding and potential roosting habitat for Black-Cockatoos.
- If clearing avoidance of potential Black-Cockatoo breeding trees is not possible, carry out follow-up inspections of potentially suitable breeding hollows, via camera pole or other suitable means.
- Prepare and implement a weed hygiene plan for clearing and earthworks that manages the potential spread of Declared Pest plants, Arum Lily and Cape Tulip and other weeds present on site.

1 INTRODUCTION

1.1 BACKGROUND

WaterInsight Pty Ltd (WaterInsight) and Coterra Environment (Coterra) are assisting a client with the development of a site in Serpentine for a proposed hospitality venue. Focused Vision Consulting Pty Ltd (FVC) was commissioned to undertake a flora, vegetation and fauna assessment (including a targeted Black-Cockatoo habitat survey) of the study area. The outcome of the survey and information supplied in this ecological assessment report will be used to inform the environmental assessment and approvals process.

1.2 LOCATION

The study area is located at 1248 Karnup Road, Serpentine, within the Shire of Serpentine-Jarrahdale, approximately 48 kilometres (km) south, south-east of Perth. The study area occupies an area of approximately 44.24 hectares (ha) (**Figure 1**).

1.3 SCOPE OF WORK

The scope of work required to be fulfilled was as follows:

- Undertake a desktop assessment of the study area and surrounds to identify all biological features and constraints including presentation and review of data from the Department of Agriculture, Water and Environment (DAWE) Protected Matters Search Tool (PMST), DBCA's NatureMap and FloraBase, database searches from DBCA's Species & Communities Branch (Threatened and Priority flora/fauna/TECs and PECs)
- Undertake an overview inspection of the site for flora, vegetation and fauna habitat values with a targeted Black-Cockatoo habitat assessment
- Prepare a report compiling the findings of the desktop and field assessments.

0 50 100 150 200 m

GDA 94 / MGA Zone 50

Legend

Study Area

Figure 1 - Study Area

WIPL21001 06 December 2021

2 LEGISLATIVE CONTEXT

The biological assessments undertaken by FVC were conducted in accordance with the following legislation:

- Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)
- Western Australian *Environmental Protection Act 1986* (EP Act)
- Western Australian *Biodiversity Conservation Act 2016* (BC Act).

The assessments complied with requirements for environmental survey and reporting in Western Australia, as outlined in:

- EPA (2008) *Guidance Statement No. 33: Environmental Guidance for Planning and Development*
- EPA (2016a) *Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment*
- EPA (2016b) *Environmental Factor Guideline – Flora and Vegetation*
- EPA (2020) *Technical Guidance – Fauna Surveys for Environmental Impact Assessment*
- Department of Sustainability, Environment, Water, Population and Communities (DSEWPC) (2012) *EPBC Act referral guidelines for three threatened black cockatoo species: Carnaby's cockatoo (endangered) Calyptorhynchus latirostris,* Baudin's cockatoo (vulnerable) *Calyptorhynchus baudinii*, Forest red-tailed black cockatoo (vulnerable), *Calyptorhynchus banksii naso*.

Survey methodology guidance was also taken from:

- Commonwealth of Australia (2013) *Draft Survey Guidelines for Australia's threatened orchids*
- Department of the Environment and Energy (DEE) (2017) *Revised draft referral guideline for three threatened black cockatoo species: Carnaby's Cockatoo, Baudin's Cockatoo and the Forest Red-tailed Black Cockatoo*.

2.1 THREATENED AND PRIORITY FLORA

DBCA assigns conservation status to endemic plant species that are geographically restricted to few known populations or threatened by local processes. Allocating conservation status to plant species assists in protecting populations and conserving species from potential threats (DBCA 2018a).

The BC Act provides a statutory basis for the listing of threatened species, specially-protected species, TECs, critical habitat and key threatening processes (DBCA 2018a; DBCA 2018b). Whilst not awarded any statutory protection, DBCA also maintains the Priority flora list, for species of conservation concern (DBCA 2018a). Priority flora are given consideration in environmental impact assessments (EIAs) and in the assessment of clearing permit applications, in accordance with the ten clearing principles (EPA 2016b). Therefore, both Threatened and Priority flora are important focuses of surveys conducted to inform the EIA process, and their definitions are presented in **Table 1**.

Table 1 - Definitions of Threatened and Priority Flora Species

Conservation Code	Category
T	**Threatened Species** Listed by order of the Minister as Threatened in the category of critically endangered, endangered or vulnerable under section 19(1), or is a rediscovered species to be regarded as threatened species under section 26(2) of the *Biodiversity Conservation Act 2016* (BC Act). Threatened flora is that subset of 'Rare Flora' listed under schedules 1 to 3 of the Wildlife Conservation (Rare Flora) Notice for Threatened Flora.
P1	**Priority 1 – Poorly Known Species** Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.
P2	**Priority 2 – Poorly Known Species** Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.
P3	**Priority 3 – Poorly Known Species** Species that are known from several locations, and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of 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	**Priority 4 – Rare, Near Threatened and other species in need of monitoring** (a) Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection but could be if present circumstances change. These species are usually represented on conservation lands. (b) Near Threatened. Species that are considered to have been adequately surveyed and that are close to qualifying for Vulnerable but are not listed as Conservation Dependent. (c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.

Under the EPBC Act, actions that have, or are likely to have a significant impact on a matter of national environmental significance (MNES) require approval from the Federal Minister for the Environment.

Species at risk of extinction are recognised as Threatened at a Commonwealth level and classified under the IUCN categories (IUCN 2012) summarised in **Table 2**.

Table 2 - Categories of EPBC Act Threatened Flora Species (DAWE, 2020g)

Conservation Code	Category
Ex	**Extinct** Taxa not definitely located in the wild during the past 50 years
ExW	**Extinct in the Wild** Taxa known to survive only in captivity
CR	**Critically Endangered** Taxa facing an extremely high risk of extinction in the wild in the immediate future
EN	**Endangered** Taxa facing a very high risk of extinction in the wild in the near future
VU	**Vulnerable** Taxa facing a high risk of extinction in the wild in the medium-term future
CD	**Conservation Dependent** Taxa whose survival depends upon ongoing conservation measures. Without these measures, a conservation dependent taxon would be classified as Vulnerable or more severely threatened

Any species listed in State and Commonwealth legislation as being of conservation significance is said to be a significant species. This incorporates species that are endangered, vulnerable and rare or covered by international conventions. Significance is not limited to species covered by State and Commonwealth legislation and also includes species of local significance and species showing significant range extensions or at the edge of their known range.

2.2 THREATENED AND PRIORITY ECOLOGICAL COMMUNITIES

TECs are naturally occurring biological assemblages that occur in a particular type of habitat, which are subject to processes that threaten to destroy or significantly modify the assemblage across its range (DEC 2007).

The Minister may list an ecological community as a Threatened Ecological Community (TEC) in one of the following categories; Critically Endangered (CR), Endangered (EN) or Vulnerable (VU). The categories and the criteria for defining TECs have been described by English and Blyth (1997). A publicly available database, listing TECs within Western Australia is maintained by DBCA.

TECs in WA are protected under the BC Act and some are also protected under the Commonwealth EPBC Act. The TECs on the Commonwealth register are also listed on the Department of the Environment and Energy (DEE) website, and in the Protected Matters Database.

Additional to TECs, ecological communities that are considered potentially of conservation significance (and potentially TECs) that do not currently meet survey criteria or that are not adequately defined, are rare but not threatened, have been recently removed from the TEC list or require regular monitoring, are Priority Ecological Communities (PECs) (DEC 2013) and are required to be taken into consideration during environmental impact assessments (EPA 2016b).

2.3 LOCALLY OR REGIONALLY SIGNIFICANT VEGETATION

Vegetation may be locally or regionally significant in addition to significance according to statutory listings (Del Marco *et al*. 2004). Vegetation communities are referred to as locally significant where they:

- support populations of Priority flora species
- extend the geographic range of particular taxa from previously recorded locations
- are restricted to only one or a few locations
- occur as small, isolated communities
- exhibit unusually high structural and species diversity.

Vegetation communities are referred to as regionally significant where they:

- are limited to specific landform types
- are uncommon or restricted plant community types within the regional context
- are poorly retained in comparison to their pre-European extent (discussed further in the following section)
- support populations of threatened flora.

Vegetation communities are referred to as nationally significant where they:

- support populations of Threatened (EPBC listed) species
- support TECs listed as nationally (EPBC) significant.

Technical Guidance for Flora and Vegetation Surveys for Environmental Impact Assessment (EPA 2016a) also states that vegetation may be considered significant for a range of reasons, including but not limited to the following:

- being identified as TECs or PECs
- have a restricted distribution
- have a degree of historical impact from threatening processes
- have a role as a refuge
- provide an important function required to maintain ecological integrity of a significant ecosystem.

The Technical Guidance (EPA 2016a) also states that flora species may be considered significant for the following reasons:

- being identified as Threatened or Priority species
- being locally endemic or associated with a restricted habitat type (e.g. surface water or groundwater dependent ecosystems)
- supporting new species or anomalous features that indicate a potential new species
- being representative of the range of a species (particularly, at the extremes of range, recently discovered range extensions, or isolated outliers of the main range)
- supporting unusual species, including restricted subspecies, varieties or naturally occurring hybrids
- having relictual status, being representative of taxonomic groups that no longer occur widely in the broader landscape.

2.4 VEGETATION CLEARING, EXTENT AND STATUS

The objective of the EPA in relation to flora and vegetation is: *To protect flora and vegetation so that biological diversity and ecological integrity are maintained* (EPA 2016b). The EPA considers it is important that ecological communities are maintained above a threshold level of 30% of the original pre-clearing extent of each community (EPA 2008). A level of 30% of pre-clearing extent is the level below which species loss appears to accelerate exponentially at the ecosystem level (EPA 2008). From purely a biodiversity perspective, a level of 10% of the original extent of a vegetation association is regarded as being a level representing Endangered (EPA 2008).

2.5 INTRODUCED FLORA

Over 1,200 introduced (weed) species have been recognised to occur within Western Australia (EPA 2007). Weeds are non-indigenous plants that have been introduced either directly or indirectly through human activity. Weeds establish in natural ecosystems, adversely modifying natural processes, degrading the conservation values of the community and impacting on native fauna habitat. Weeds threaten the survival of many flora because of their rapid growth and the ability to out-compete native plants for available nutrients, water, space and sunlight.

2.5.1 Weeds of National Significance

Under the National Weed Strategy, there are currently 32 weed species listed as Weeds of National Significance (WoNS) (DAWE 2020f). Each weed was considered for inclusion based on the following criteria: invasive tendencies, impacts, potential for spread and socioeconomic and environmental values.

2.5.2 Declared Pest Plants

The Western Australian Organism List (WAOL) details organisms listed as Declared Pests, including pest plants, under the *Biosecurity and Agriculture Management Act 2007* (BAM Act) (DPIRD 2020).

Under the BAM Act, Declared Pests are listed under one of the following categories:

- C1 (exclusion), that applies to pests not established in Western Australia; control measures are to be taken to prevent their entry and establishment
- C2 (eradication), that applies to pests that are present in Western Australia but in low numbers or in limited areas where eradication is still a possibility
- C3 (management), that applies to established pests where it is not feasible or desirable to manage them in order to limit their damage.

2.5.3 Environmental Weeds

Introduced species have also been ranked by several attributes, including invasiveness, distribution and environmental impacts in the various regions in *An Environmental Weed Strategy* (CALM 1999). Those species meeting certain criteria are classified as environmental weeds. To advance the above categorisation, the Invasive Plant Prioritisation Process was developed in 2008 (DPaW 2013).

2.6 SIGNIFICANT FAUNA

Fauna species of conservation significance (CS) are recognised under three classes: those listed under legislation (CS1) (as listed in **Table 2** above and **Table 3** below), those listed as Priority by DBCA (CS2) (**Table 4**), and those that can be considered of local or other significance, but which have no formal listing (CS3).

Further to the Commonwealth level classifications applied to Threatened fauna, as summarised in **Table 2**, fauna species of State-level conservation concern are scheduled under the BC Act in accordance with the schedules listed in **Table 3**.

Table 3 – Categories of Fauna Scheduled Under the WA BC Act

Schedule	Category Description
Schedule 1 (S1)	Critically Endangered fauna
Schedule 2 (S2)	Endangered fauna
Schedule 3 (S3)	Vulnerable Migratory species listed under international treaties
Schedule 4 (S4)	Presumed extinct fauna
Schedule 5 (S5)	Migratory birds under international agreement
Schedule 6 (S6)	Conservation dependent fauna
Schedule 7 (S7)	Other specially protected fauna

Fauna species not listed under the BC Act, but for which there is some concern, are listed by DBCA as Priority species, in accordance with the categories listed in **Table 4**.

Table 4 - DBCA Priority Fauna Categories

Conservation Code	Category Description
Priority 1 (P1)	Taxa with few, poorly known populations on threatened lands
Priority 2 (P2)	Taxa with few, poorly known populations on conservation lands; or taxa with several, poorly known populations not on conservation lands
Priority 3 (P3)	Taxa with several, poorly known populations, some on conservation lands
Priority 4 (P4)	Taxa in need of monitoring
Priority 5 (P5)	Taxa which are considered to have been adequately surveyed, or for which sufficient knowledge is available, and which are considered not currently threatened or in need of special protection, but could be if present circumstances change

3 METHODOLOGY

The field assessment was completed during spring 2021 by Principal Ecologist, Kellie Bauer-Simpson, assisted by Technician, Will Bauer-Simpson. Data processing, mapping and reporting were completed by the field team, supported by the broader FVC team, in association with technical specialists where relevant input was required.

3.1 DESKTOP ASSESSMENT

The desktop assessment for Threatened and Priority flora, fauna and ecological communities incorporated a review of the DBCA databases (DBCA 2021a, 2021b, 2021d), NatureMap Species Report search results (**Appendix A**) and the Commonwealth Department of Agriculture, Water and the Environment (DAWE) Protected Matters Search Tool (PMST) (DAWE 2021a) for Matters of National Environmental Significance (MNES) (**Appendix B**) addressing the study area plus a 5 km buffer (desktop assessment area).

The desktop assessment formed the foundation of the field assessment and ensured that the field assessment was targeted to the areas of highest potential significance.

3.1.1 Flora and Vegetation

The following sources were consulted in addition to the desktop assessment searches:

- ESAs listed under *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*
- Declared Pests listed under the BAM Act
- DBCA Conservation Estates and Reserves.

This information was used to identify potential flora species, Threatened and Priority flora and ecological communities that could occur within the study area. The likelihood of all significant flora occurring within the study area was assessed based on known records, proximity to the study area, the age of records and the presence of suitable habitat. Based on this assessment each species was given a likelihood of occurrence category of 'likely', 'may' or 'unlikely' to occur.

The desktop assessment formed the foundation of the field survey and ensured that the assessment was targeted to the areas of highest potential significance.

3.1.2 Fauna

Database search results and information from the desktop assessment for the desktop assessment area were used to generate lists of significant fauna that are potentially occurring within the survey area (DBCA 2021d). The habitats recorded within the study area were then considered in consultation with this list to determine the likelihood of occurrence of each of the species in the list. This information provided guidance for preparations of the field assessment and provided the desktop assessment results for fauna as presented this report.

The desktop assessment also included review of available spatial data for known Black-Cockatoo habitats in the desktop assessment area (DBCA 2021e).

3.2 FIELD ASSESSMENT

3.2.1 Flora and Vegetation

Flora and vegetation data were collected in the field at suitable sampling points. Detailed data collection points (relevés) were to be recorded where remnant vegetation is present, which was at one location in the south-east of the study area. None of the vegetation was found to be in 'Good' or better condition, which would require quadrat sampling in accordance with the requirements for flora and vegetation assessments, as documented in EPA (2016a). In addition to the single recorded relevé, observations and opportunistic data collection were recorded continuously within and throughout the sstudy area. Field data was recorded using electronic tablets equipped with the mobile mapping software, Mappt™ and customised data collection forms, tailored to the collection of floristic data.

The following information is collected at each quadrat and relevé:

- observer
- date
- GPS location (MGA94)
- representative photograph
- soil type and colour
- topography
- vegetation condition/degradation/disturbances (e.g. grazing, weed invasion, fire)
- flora species observed, including average height and projected foliage cover of dominant species within each strata
- vegetation community, described in accordance with the National Vegetation Information System (NVIS) (DEH 2003)
- vegetation condition, assessed against the currently accepted scale (EPA 2016a); an adaptation of the Keighery (1994) condition scale.

The field assessment also included a targeted search for Threatened and Priority flora potentially supported by the study area. Habitat preferences for all target species were pre-determined during the desktop assessment, to enable targeted searching in the field. The entire study area was traversed utilising meandering transects to search for Threatened and Priority flora, in order to observed a large proportion of the study area. The location of any observed flora suspected to be Threatened or Priority were to be recorded using GPS and included in the report maps and spatial data layers provided.

The flora and vegetation data were collected from the combination of the relevé record and continuous opportunistic observations to contribute to the flora inventory for the study area. The vegetation units of the study area were defined by data collected from one relevé and opportunistically between, and how flora species present relates to other environmental features such as soil type and landscape position.

Vegetation condition was assessed using an adaptation of the Keighery (1994) scale, as described in EPA (2016a). Draft vegetation unit and condition mapping was prepared in shapefiles using Mappt™, whilst in the field, which formed the basis of the survey mapping. Draft mapping was then refined in desktop GIS software for presentation in this report.

3.2.2 Fauna Assessment

The field fauna assessment focused on habitat mapping, and a targeted survey for Black-cockatoos. The fauna habitat assessment was recorded and reported in accordance with:

- Environmental Protection Authority (EPA 2020) *Technical Guidance – Terrestrial Fauna Surveys for Environmental Impact Assessment*
- Department of Sustainability, Environment, Water, Population and Communities (DSEWPC) (2012) *EPBC Act referral guidelines for three threatened black cockatoo species: Carnaby's cockatoo (endangered)* Calyptorhynchus latirostris*, Baudin's cockatoo (vulnerable)* Calyptorhynchus baudinii, *Forest red-tailed black cockatoo (vulnerable)* Calyptorhynchus banksii naso
- Department of the Environment and Energy (DEE 2017) *Revised draft referral guideline for three threatened black cockatoo species: Carnaby's Cockatoo, Baudin's Cockatoo and the Forest Red-tailed Black Cockatoo*.

Fauna habitat characterisation and mapping combines vegetation types, the soils or other substrate with which they are associated, and the landform, into broad categories for ease of landscape scale analysis.

Fauna habitats within the study area were described based on site observations and in reference to mapped and described vegetation units. Site selection for fauna habitat mapping was based on providing optimal information by selecting vegetation in the best condition for the area for each habitat type and targeting likely conservation significant species habitat.

3.2.3 Targeted Black-Cockatoo Habitat Assessment

The Commonwealth DAWE provides guidelines for referral of actions that may result in impact to Black-Cockatoos (for assessment under the EPBC Act). The targeted Black-Cockatoo habitat assessment was conducted in accordance with the existing guidelines (DSEWPaC 2012) as well as the recently revised draft guidelines (DEE 2017), where appropriate. In addition, survey methodology followed the recommendations listed on the DEE's Species Profile and Threats Database (DAWE 2020c, 2020d, 2020e).

The Threatened species of Black-Cockatoos likely to occur within the study area are Carnaby's Black-Cockatoo (*Calyptorhynchus latirostris*), Forest Red-tailed Black-Cockatoo (*Calyptorhynchus banksii naso*) and Baudin's Black-Cockatoo (*Calyptorhynchus baudinii*).

The targeted survey for Black-Cockatoos and their habitat aimed to record any observed individuals either at the site or as an overfly observation, any evidence of their activity (e.g. chewed nuts), as well as habitat suitable for nesting/breeding, roosting or foraging. These habitats are described in **Table 5**. Suitable habitat was mapped, with areas rated and quantified, as discussed in the sections below.

Table 5 - Black-Cockatoo Habitats Surveyed

Habitat	Examples
Foraging habitat	Food source plants for Black-Cockatoos include Jarrah (*Eucalyptus marginata*), Marri (*Corymbia calophylla*), Proteaceous species such as *Banksia, Hakea* and *Grevillea*; *Allocasuarina*, and *Anigozanthos* and introduced species such as Pines (*Pinus* spp.) and Cape Lilac (*Melia azedarach*), but also *Erodium* spp. and various species grown for fruit, nuts and seeds which grow in native shrubland, heathland, woodland or forest and agricultural areas.
Night roosting habitat	These habitats include suitable trees (*Eucalyptus* or *Corymbia*) within or near riparian environments or natural or artificial water sources.
Breeding/nesting habitat	Any patch of woodland or forest that contains *Eucalyptus* or *Corymbia* trees with either a diameter at breast height of greater than 500 mm (or 300 mm for Salmon Gum and Wandoo) or with suitable nest hollows. More specifically, all individual trees observed to support suitable hollows within the study area.

3.2.3.1 Black-Cockatoo Foraging Habitat

Foraging habitat for Black-Cockatoos is given a score out of ten to indicate the quality of that foraging habitat for the species. The scoring system used (developed by FVC's specialist partner team, Bamford Consulting Ecologists (BCE), in consultation with (then) Department of Environment and Energy (DEE) (now, DAWE) is comprised of:

- a score out of six for vegetation composition, condition and structure in accordance with **Table 6**
- a score out of three for site context, in accordance with **Table 7**
- a score out of one for stocking rate (Black-Cockatoo species density).

The vegetation composition score is based on the presence, density/abundance, condition and proportions of food source plants for the relevant species of Black-Cockatoo. A selection of key examples applicable to each of the scores for the three Black-Cockatoo species is presented in **Table 6**.

Table 6 - Scoring System for the Assessment of Foraging Value of Vegetation for Relevant Species of Black-Cockatoo

Site Score	Description of Vegetation		
	Carnaby's Black-Cockatoo	**Baudin's Black-Cockatoo**	**Forest Red-tailed Black-Cockatoo**
0	No foraging value. No Proteaceae, eucalypts or other potential sources of food. Examples would be salt lakes and bare ground.	No foraging value. No eucalypts or other potential sources of food.	No foraging value. No eucalypts (i.e. Marri, Jarrah, Wandoo, Blackbutt or Karri) or other potential sources of food.
1	Negligible to low foraging value. Scattered specimens of known food plants but projected foliage cover of these <2%. Could include urban areas with scattered foraging trees. Blue Gum plantations are considered to have a score of 1 as foraging by Black-cockatoos has been reported but appears to be unusual.	Negligible to low foraging value. Scattered specimens of known food plants (e.g. Marri and Jarrah) but projected foliage cover of these <1%. Could include urban areas with scattered foraging trees.	Negligible to low foraging value. Scattered specimens of known food plants but projected foliage cover of these <1%. Could include urban areas with scattered foraging trees.
2	Low foraging value. Examples: • Shrubland in which species of foraging value, such as shrubby banksias, with <10% projected foliage cover. • Open eucalypt woodland/mallee of small-fruited species. • Paddocks with melons or other weeds (a short-term, seasonal food source).	Low foraging value. Example: • Woodland or forest with scattered specimens of known food plants (e.g. Marri, Jarrah, Sheoak) but projected foliage cover of these 1-<5%. Could include urban areas with scattered foraging trees.	Low foraging value. Examples: • Open eucalypt woodland (i.e. Marri, Jarrah, Wandoo, Blackbutt or Karri). Projected foliage cover of these 1-<5%. • Urban areas with scattered food plants such as Cape Lilac, *Eucalyptus caesia* and *Eucalyptus erythrocorys*.
3	Low to Moderate foraging value. Examples: • Shrubland in which species of foraging value, such as shrubby banksias, with 10-20% projected foliage cover. • Woodland with tree banksias 2-10% projected foliage cover. • Eucalypt woodland/mallee of small-fruited species; Marri, if present, <10% project foliage cover.	Low to Moderate foraging value. Examples: • Eucalypt woodland with known food plants (and in particular Marri) with a projected foliage cover of 5-<10%. • Parkland-cleared eucalypt woodland with projected foliage cover of known food plants of 10-<20% can be considered low-to-moderate because of poor long-term viability without management.	Low to Moderate foraging value. Examples: • Eucalypt woodland (i.e. Marri, Jarrah, Wandoo, and Blackbutt), if present, <10% project foliage cover.

Site Score	Description of Vegetation		
	Carnaby's Black-Cockatoo	**Baudin's Black-Cockatoo**	**Forest Red-tailed Black-Cockatoo**
4	Moderate foraging value. Examples: • Woodland with tree banksias 20-40% projected foliage cover. • Eucalypt woodland/forest with Marri 20-40% projected foliage cover.	Moderate foraging value. Examples: • Eucalypt woodland with known food plants (and in particular Marri) with a projected foliage cover of 10-<20%. • Parkland-cleared eucalypt woodland with projected foliage cover of known food plants of 20-<40% can be considered moderate because of poor long-term viability without management. • Areas of orchards and especially those with apples can be considered of moderate value.	Moderate foraging value. Examples: • Eucalypt woodland/forest (i.e. Marri, Jarrah, Wandoo, and Blackbutt) with 20-40% projected foliage cover.
5	Moderate to High foraging value. Example: • Banksia woodlands with tree banksias >40%. Vegetation condition moderate due to weed invasion and some tree deaths.	Moderate to High foraging value. Examples: • Eucalypt woodland with known food plants (and in particular Marri) with a projected foliage cover of 20-<40%. Parkland-cleared eucalypt woodland with projected foliage cover of known food plants of >40% can be considered moderate because of poor long-term viability without management.	Moderate to High foraging value. Example: • Eucalypt woodland/forest (i.e. Marri, Jarrah, Wandoo, and Blackbutt) with >40% projected foliage cover. Vegetation condition moderate due to weed invasion and some tree deaths.
6	High foraging value. Example: • Banksia woodlands of key species (e.g. *B. attenuata, B. menziesii*) with projected foliage cover >60%. Vegetation condition good with low weed invasion and low tree death to indicate it is robust and unlikely to decline in the medium term.	High foraging value. Example: • Eucalypt woodland/forest with a high proportion of Marri (>40% projected foliage cover). Vegetation condition good with low weed invasion and low tree death to indicate it is robust and unlikely to decline in the medium term.	High foraging value. Example: • Eucalypt woodland/forest (i.e. Marri, Jarrah, Wandoo, and Blackbutt) with >60% projected foliage cover. Vegetation condition good with low weed invasion and low tree death to indicate it is robust and unlikely to decline in the medium term.

Vegetation composition, condition and structure scores ≤2 are not further analysed for context and species presence (stocking rate) as such habitat is considered to be of negligible foraging value in the first place.

The site context score is species-specific as it depends upon factors such as the vegetation type and extent, and the presence of breeding birds. Scores for site context are guided by **Table 7**, noting that 'local area' is defined as within a 15 km radius of the centre point of the study area. To assign a score for site context, a maximum score of three is applied where foraging habitat is known, or the site is known to support breeding birds; or it can also be applied in fragmented landscapes where there is little foraging habitat remaining and thus what is left has a high contextual value.

Table 7 – Key to Black-Cockatoo Site Context Score for Foraging Habitat Quality

Site Context Score	% of Existing Native Vegetation within the 'Local Area' that the Study Site Represents	
	'Local' Breeding Known/Likely	'Local' Breeding Unlikely
3	> 5%	> 10%
2	1 - 5%	5 - 10%
1	0.1 - 1%	0.1 - 5%
0	< 0.1%	< 0.1%

The score for stocking rate/species density (0 or 1), is based upon the relevant Black-Cockatoo species being either abundant or not abundant and is species-specific. A score of 1 is applied where the species is seen or known to occur/reported regularly and/or there is abundant foraging evidence. 'Regularly' is when the species is seen at intervals of every few days or weeks for at least several months of the year. A score of 0 is applied when the species is recorded or reported very infrequently and there is little or no foraging evidence.

3.2.3.2 Black-Cockatoo Potential Breeding Habitat

Potential breeding habitat was assessed by examining each tree within the study area and determining whether each is suitable as a breeding tree, with or without hollows, with or without nesting evidence (for trees with hollows), or as potential future nesting trees (with a diameter at breast height of 500 mm or greater, or 300 mm or greater for Salmon Gum and Wandoo). Any identified trees were recorded and scored as per **Table 8**, which provides a ranking system to differentiate between trees of low, moderate and high potential as nest trees.

Table 8- Ranking System for Black-Cockatoo Nesting and Potential Nesting Trees

Rank	Description of Tree and Hollows/Activity
0	Tree large (DBH +/= 500 mm), but not tall, may be with thinner or branching trunks, so does not contain and no potential for hollows.
1	Active nest observed; adult (or immature) bird seen entering or emerging from hollow.
2	Hollow of suitable size and angle (i.e. near-vertical) visible with chew marks around entrance.
3	Potentially suitable hollow visible but no chew marks present; or potentially suitable hollow present (as suggested by structure of tree, such as large, vertical trunk broken off at a height of >10 m).
4	Tree with large hollows or broken branches that might contain large hollows, but hollows or potential hollows are not vertical or near-vertical; thus, a tree with or likely to have hollows of sufficient size but not to have hollows of the angle preferred by Black-Cockatoos.
5	Tree lacking large hollows or broken branches that might have large hollows; a tree with more or less intact branches and a spreading crown.
x	Where a hollow that is (otherwise) potentially suitable for Black-Cockatoo nesting has been colonised by feral HoneyBees (*Apis mellifera*), and therefore rendered unusable, the nest-tree rank is preceded by 'x' (e.g. x2, x3, x4).

Both the existing referral guidelines (DSEWPaC 2012) and the revised referral guidelines (DEE 2017) list certain tree species as typical and preferred breeding habitat for each of the three species of Black-Cockatoo, however, evidence suggests that Black-Cockatoos breed and nest in any trees that are sufficiently large and provide suitable hollows (Mike Bamford, pers. comm.). Therefore, all large Eucalypts within the study area were inspected for breeding habitat suitability and the presence of hollows. However, only those of species as listed in the referral guidelines would trigger the need for referral to the Commonwealth DAWE.

3.2.3.3 Black-Cockatoo Roosting Habitat

Tall trees within approximately 2 km of water sources are suitable Black-Cockatoo roosting habitat. Roosting habitat was assessed and mapped based on tall trees and their proximity to water sources, combined with knowledge or literature regarding known roost sites. A review of DBCA data for known roost sites (DBCA 2021e) was undertaken to assist in identifying whether the study area is known to support, or may support, roosting habitat.

3.3 DATA PROCESSING/ANALYSIS AND REPORTING

Following completion of desktop and field assessments, all information and collected field data were collated, ready for analysis and reporting.

Flora identifications were undertaken by Kellie Bauer-Simpson, following return from the field. Flora taxonomy and nomenclature followed current protocols of the WA Herbarium.

As per the recommendations of the EPA (2008), the nomenclature and taxonomic order presented in this report are based on the Western Australian Museum's (WAM) current (November 2020) version of *Checklist of the vertebrates of Western Australia* (WAM 2020).

Floristic data collected in the field was processed and vegetation descriptions for remnant vegetation were prepared in accordance with NVIS procedures to Level V detail. The resulting vegetation descriptions and key dominant species composition were assessed to determine if any of the defined vegetation units were considered to be potentially representative of the significant ecological communities resulting from the desktop assessment. Diagnosis of potential TEC vegetation within the study area was also carried out in direct reference to the relevant Conservation Advice and other available information.

Vegetation mapping was also used as a basis for fauna habitat mapping, and to score and map the quality of important fauna habitat.

All relevant data and results from the desktop and field assessments were collated or digitised in GIS, to enable the preparation of the suite of figures presented in this report.

All spatial data has been prepared as ESRI shapefiles that meet the protocols of Index of Biodiversity Surveys for Assessment (IBSA) initiative.

This report has been prepared by suitably qualified and experienced professionals, in accordance with relevant guidelines.

4 RESULTS AND DISCUSSION

4.1 DESKTOP ASSESSMENT

4.1.1 Threatened and Priority Flora

The DBCA TPFL database (DBCA 2021a), WA Herbarium, NatureMap (**Appendix A**) and DAWE PMST Report (**Appendix B**) identified 15 significant flora species that have the potential to occur within the desktop assessment area (**Table 9**). These species comprise 12 Threatened flora pursuant to the Commonwealth EPBC Act and State BC Act, one Priority 2 species, one Priority 3 species and one Priority 4 species (**Figure 2**).

Based on known distribution, current records, preferred habitat and the habitats provided within the study area, species were considered 'likely', 'may', 'possible' or 'unlikely to occur. It was considered nine species may occur within the study area. No species of Threatened flora, or flora species of Commonwealth-significance are considered likely to occur within the study area. The Priority flora species that may occur within the study area are listed in **Table 9**.

Table 9 – Threatened and Priority Flora Potentially Occurring within the Study Area

Species	EPBC Act Conservation Status	DBCA Conservation Status	Description	Preferred Habitat	Likelihood of Occurrence	Source of Record
Synaphea sp. Fairbridge Farm (D. Papenfus 696)	Critically Endangered	Critically Endangered	Dense, clumped shrub growing to 0.3 m high and 0.4 m wide. Produces yellow flowers in October.	Sandy with lateritic pebbles. Near winter-wet flats, in low woodland with weedy grasses.	May occur – Limited suitable habitat. Previously recorded 2 km from the study area.	EPBC PMST, DBCA
Synaphea sp. Serpentine (G.R. Brand 103)	Critically Endangered	Critically Endangered	Erect, compact shrub to 0.3 m high. Produces yellow flowers from September to October.	Grey, yellow or brown sandy clay-loam soils. Edge of wetlands, slopes and flats.	May occur - Suitable habitat may occur. Previously recorded 0.2 km from the study area.	EPBC PMST, DBCA, NatureMap
Drakaea elastica	Endangered	Critically Endangered	Tuberous, perennial herb growing to 0.1-0.3 m high with a single bright green, glossy, prostrate heart-shaped leaf. Produces distinctive flower with red and green-yellow parts from October to November.	Bare patches of white or grey sandy soils. Low-lying situations adjoining winter-wet swamps.	May occur - Suitable habitat may occur. Previously recorded 4.2 km from the study area.	EPBC PMST
Eucalyptus x *balanites*	Endangered	Critically Endangered	Mallee with rough flaky grey bark growing to 5-8 m high and 15 m wide. Produces white flowers from October to December or from January to February.	White-grey sand, brown sandy loam soils with lateritic gravel. Slopes.	Unlikely to occur. Suitable habitat unlikely. Previously recorded 21.2 km from the study area.	EPBC PMST, DBCA, NatureMap
Verticordia plumosa var. *ananeotes*	Endangered	Critically Endangered	Erect, sparsely branched shrub growing 0.3-0.5 m high. Produces pink-purple/white flowers from November to December.	Sandy loam. Seasonally inundated plains.	May occur - Suitable habitat may occur. Previously recorded 1.3 km from the study area.	EPBC PMST, DBCA
Synaphea sp. Pinjarra Plain (A.S. George 17182)	Endangered	Endangered	Erect, clumping shrub growing to 0.8 m high. Produces yellow flowers from September to November.	Sand, loam and clay soils sometimes with laterite. Winter wet depressions and flats.	May occur - Suitable habitat may occur. Previously recorded 2 km from the study area.	EPBC PMST, DBCA, NatureMap
Diuris purdiei	Endangered	Endangered	Tuberous, perennial orchid growing to 0.15-0.45 m high. Produces distinct flattened yellow flowers with brown blotches on their underside from September to October.	Grey-black sand, sandy clay moist soils. Winter-wet swamps.	Unlikely to occur - Suitable habitat unlikely. Previously recorded 7.6 km from the study area.	EPBC PMST, DBCA, NatureMap
Andersonia gracilis	Endangered	Vulnerable	Slender, erect or open straggly shrub growing to 0.1-0.5 m high. Produces pink to pale mauve flowers in ovoid oblong groups of 4-14 on terminal heads from September to November.	White-grey sand, sandy clay, gravelly loam soils. Winter wet areas, near swamps.	Unlikely to occur - Suitable habitat unlikely. Not previously recorded in the study area.	EPBC PMST

Species	EPBC Act Conservation Status	DBCA Conservation Status	Description	Preferred Habitat	Likelihood of Occurrence	Source of Record
Drakaea micrantha	Vulnerable	Endangered	Tuberous, perennial herb growing to 0.15-0.3 m high with a single silvery-grey, prostrate heart-shaped leaf. Produces distinct flowers with red and yellow parts from September to October.	Bare patches of white-grey sandy soils. Winter wet swamps, disturbed areas.	May occur - Suitable habitat may occur. Not previously recorded in the study area.	EPBC PMST
Diuris drummondii	Vulnerable	Vulnerable	Tuberous, perennial tall orchid growing to 0.5-1 m high. Produces 3-8 pale yellow flowers from November to January.	Brown sandy clay, moist peat soils. Low lying depressions, swamps.	Unlikely to occur - Suitable habitat unlikely. Not previously recorded in the study area.	EPBC PMST
Diuris micrantha	Vulnerable	Vulnerable	Tuberous, perennial orchid growing to 0.3-0.6 m high with a basal tuft of narrow, linear leaves. Produces up to 7 yellow flowers with red-brown markings from August to October.	Brown/black sandy clay-loam and clayey soils. Winter-wet depressions and swamps, in shallow water.	Unlikely to occur - Suitable habitat unlikely. Previously recorded 16.2 km from the study area.	EPBC PMST, DBCA
Morelotia australiensis (C.B.Clarke)	Vulnerable	Vulnerable	Tufted perennial grass-like sedge growing to 1 m high with cylindrical stems. Produces brown flowers following fire.	Grey sand over clay soil. Winter wet depressions, swamps, drainage lines and swamp margins.	Unlikely to occur - Suitable habitat unlikely. Not previously recorded in the study area.	EPBC PMST, NatureMap
Johnsonia pubescens subsp. *cygnorum*		Priority 2	Tufted, perennial, grass like herb (lily) growing to 0.25 m high. Produces greenish cream flowers from September to October.	Grey or yellow sand, sandy clayey soils. Gentle slopes and flats.	May occur - Previously recorded within the study area, however old historic record. Suitable habitat present.	DBCA, NatureMap
Eryngium pinnatifidum subsp. *palustre* (G.J. Keighery 13459)		Priority 3	Tuberous, perennial herb growing to 0.4 m high. Produces blue-pale blue flowers from September to November.	Sand, sandy loam, clay soils. Winter wet depression, claypans and flats.	May occur - Suitable habitat may occur. Previously recorded 0.7 km from study area.	DBCA, NatureMap
Verticordia lindleyi subsp. *lindleyi*		Priority 4	Erect shrub growing to 0.2 to 0.75 m high. Produces pink flowers with white fringes from November to January (also known from May).	Sand, sandy clay soils. Winter-wet depressions.	May occur - Suitable habitat may occur. Previously recorded 0.5 km from the study area.	DBCA, NatureMap

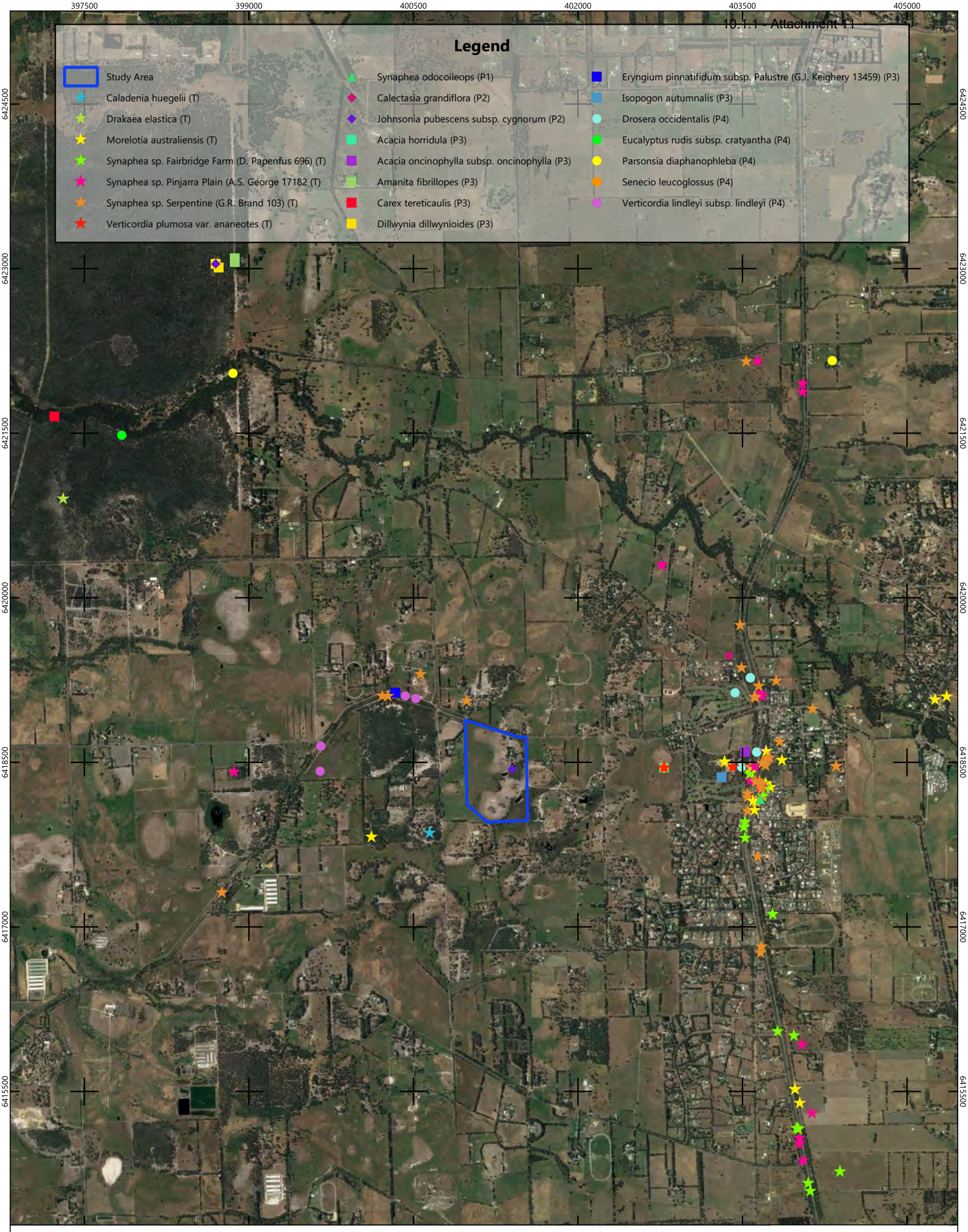


Figure 2 - Threatened and Priority Flora

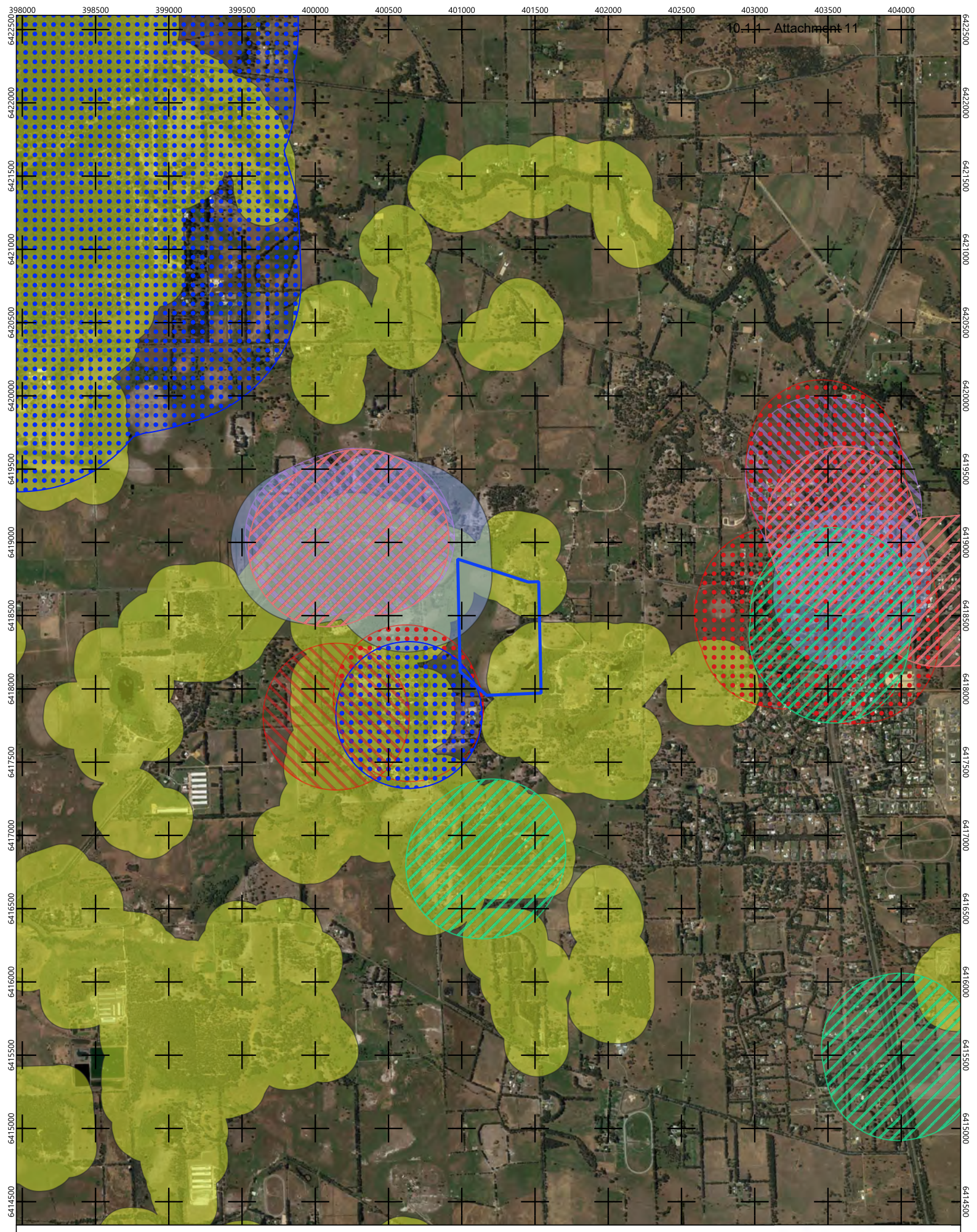
4.1.2 Threatened and Priority Ecological Communities

A review of the DBCA Threatened and Priority Ecological Communities (TECs and PECs) database (DBCA 2021b) and the EPBC PMST database (DAWE 2021a) identified 15 Threatened or Priority Ecological Communities that are known to occur within the desktop assessment area. This comprises 11 Commonwealth-listed TECs, eight of which are also State-listed TECs, plus an additional three State-listed TECs, one Priority 1 PEC and three Priority 3 PECs. The TECs and PECs known to occur in the desktop assessment area are described in **Table 10** and the known extent of the State-listed TECs and PECs returned from the DBCA database search is presented in **Figure 3**.

Table 10 – Summary of TECs and PECs Occurring Within the Desktop Assessment Area

Community ID	Community Name	EPBC Cons. Status	WA Cons. Status	Distance from Study Area
SCP10a	Shrublands on dry clay flats	Critically Endangered	Endangered	TEC boundary occurs 50 m west of the study area
SCP07	Herb rich saline shrublands in clay pans	Critically Endangered	Vulnerable	TEC buffer occurs within study area
SCP08	Herb rich shrublands in clay pans	Critically Endangered	Vulnerable	TEC boundary occur 1.7 km east of the study area
SCP09	Dense shrublands on clay flats	Critically Endangered	Vulnerable	Occurs 9 km north west of the study area
Tuart woodlands and forests of the SCP	Tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain	Critically Endangered	Priority 3	Occurs 9 km west of the study area
Mound Springs SCP	Communities of Tumulus Springs (Organic Mound Springs, Swan Coastal Plain)	Endangered	Critically Endangered	Occurs 9.4 km north west of the study area
SCP3a	*Corymbia calophylla - Kingia australis* woodlands on heavy soils, Swan Coastal Plain	Endangered	Critically Endangered	TEC boundary occurs 75 m west of the study area
SCP3c	*Corymbia calophylla - Xanthorrhoea preissii* woodlands and shrublands, Swan Coastal Plain	Endangered	Critically Endangered	TEC boundary occurs 400 m west of the study area
SCP20b	*Banksia attenuata* and/or *Eucalyptus marginata* woodlands of the eastern side of the Swan Coastal Plain	Endangered	Endangered	TEC buffer occurs within study area
Banksia WL SCP	*Banksia* Dominated Woodlands of the Swan Coastal Plain IBRA Region	Endangered	Priority 3	TEC previously recorded within the study area
SCP21c	Low lying Banksia attenuata woodlands or shrublands	Endangered	Priority 3	TEC buffer occurs within the study area
SCP02	Southern wet shrublands, Swan Coastal Plain		Endangered	Occurs 7.7 km north east of the study area
SCP15	Forests and woodlands of deep seasonal wetlands of the Swan Coastal Plain		Vulnerable	Occurs 8.6 km south west of the study area
SCP3b	*Corymbia calophylla - Eucalyptus marginata* woodlands on sandy clay soils of the southern Swan Coastal Plain		Vulnerable	Occurs 500 m south of the study area
Casuarina obesa association	*Casuarina obesa* Association		Priority 1	Occurs 6 km north of the study area

Of the 15 TECs or PECs identified to occur within the desktop assessment area, four Commonwealth-listed TECs or their buffers have been identified to occur within the study area. These communities are, Herb rich saline shrublands in claypans (SCP07), *Banksia attenuata* and/or *Eucalyptus marginata* woodlands of the eastern side of the Swan Coastal Plain (SCP20b), the Banksia woodlands TEC and Low-lying Banksia attenuata woodlands or shrublands (SCP21c) (**Table 10**).



0 0.375 0.75 1.125 1.5 km

GDA 94 / MGA Zone 50

Legend

- Study Area
- Banksia WL SCP
- SCP08
- SCP10a
- SCP20b
- SCP21c
- SCP3a
- SCP3b
- SCP3c

Figure 3 - Threatened and Priority Ecological Communities

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4.1.3 Wetlands

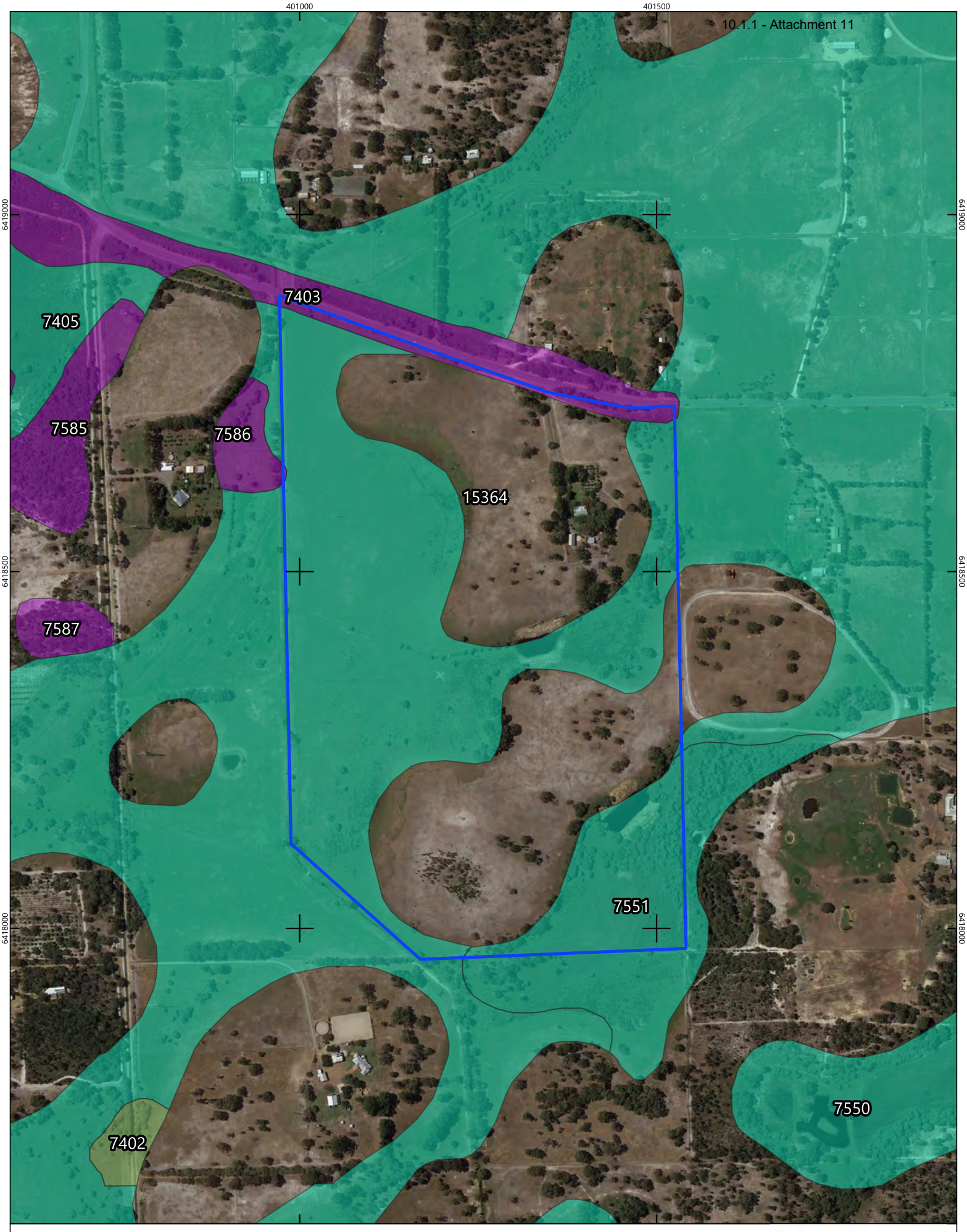
The Geomorphic Wetlands of the Swan Coastal Plain dataset displays the location, boundary, geomorphic classification (wetland type) and management category of wetlands on the Swan Coastal Plain. Wetland management categories are based on their ecological, hydrological and geomorphological significance, and the degree of disturbance that has occurred. The three Wetland Management Categories on the Swan Coastal Plain can be summarised as follows:

- Conservation Category (CC) – wetlands that support a high level of ecological attributes and functions (generally having intact vegetation and natural hydrological processes), or that have a reasonable level of functionality and are representative of wetland types that are rare or poorly protected.
- Resource Enhancement (RE) – wetlands that have been modified (degraded) but still support substantial ecological attributes (wetland dependant vegetation covering more than 10%) and functions (hydrological properties that support wetland dependent vegetation and associated fauna) and have some potential to be restored to CC quality. Typically, such wetlands still support some elements of the original native vegetation, and hydrological function.
- Multiple Use (MU) – wetlands that are assessed as possessing few remaining ecological attributes and functions. While such wetlands can still play an important role in regional or landscape ecosystem management, including water management, they are considered to have low intrinsic ecological value. Typically, they have very little or no native vegetation remaining (less than 10%).

According to the Geomorphic Wetlands of the Swan Coastal Plain dataset, four geomorphic wetlands occur within the bounds of the study area (**Table11**, **Figure 4**).

Table 11 – Summary of Geomorphic Wetlands occurring within the Study Area

UFI	Wetland Name	Wetland Classification	Wetland Evaluation
7403	Unknown	Dampland	Conservation
7586	Unknown	Dampland	Conservation
7551	Unknown	Sumpland	Resource Enhancement
15364	Unknown	Dampland	Resource Enhancement



0 75 150 225 300 m

GDA 94 / MGA Zone 50

Legend

- Study Area
- Conservation
- Multiple Use
- Resource Enhancement

Figure 4 - Geomorphic Wetlands of the Swan Coastal Plain

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4.1.4 Significant Fauna

The DBCA fauna database, NatureMap (**Appendix A**) and DEE PMST (**Appendix B**) identified 28 significant fauna species as potentially occurring within the study area. Of these, 12 are Threatened fauna pursuant to the Commonwealth EPBC Act; two Critically Endangered, six Endangered and four Vulnerable species and eight of these species are listed as Marine or Migratory species (**Table 12**). These species are also listed as Threatened fauna pursuant to the BC Act under the same categories (**Table 3**). Seven of the 28 species have been recorded within close (approximately 5 km or less) proximity to the study area. These species are:

- Carnaby's Black-Cockatoo (*Calyptorhynchus latirostris*) – Endangered
- Baudin's Black-Cockatoo (*Calyptorhynchus baudinii*) – Endangered
- Carter's Freshwater Mussel (*Westralunio carterii*) - Vulnerable
- Water-rat (*Hydromys chrysogaster*) – Priority 4
- Quenda (*Isoodon fusciventer*) – Priority 4
- South-western Brush-tailed Phascogale (*Phascogale tapoatafa*) – Conservation Dependent
- Peregrine Falcon (*Falco peregrinus*) – Other Specially Protected Fauna.

One species, Forest Red-tailed Black-Cockatoo (*Calyptorhynchus banksii naso*) was recorded within the study area (see **Table 12** and **Section 4.2.3**).

Marine and marine dependent bird species, such as the Australian Fairy Tern (*Sterna nereis*) and Greater Sand Plover (*Charadrius leshenaultii*), have been excluded as they are considered highly unlikely to occur within or significantly utilise the study area, since suitable marine or estuarine wetland habitat is not present.

Based on the proximity and currency of previous records and the suitability of habitat provided within the study area, of the 28 fauna species resulting from the desktop assessment, and in addition to the observed species (Forest Red-tailed Black-Cockatoo), five are considered 'likely to occur' within or occasionally utilise the study area. These species are:

- Carnaby's Black-Cockatoo (*Calyptorhynchus latirostris*) – Endangered
- Baudin's Black-Cockatoo (*Calyptorhynchus baudinii*) – Endangered
- Quenda (*Isoodon fusciventer*) – Priority 4
- Blue-billed Duck (*Oxyura australis*) – Priority 4
- Rainbow Bee-eater (*Merops ornatus*) – Marine.

One species is considered to 'potentially occur'. This species is:

- Pacific Swift (*Apus pacificus*) – Marine/Migratory.

The of previous recorded conservation-significant fauna resulting from the desktop assessment are summarised in **Table 12** and these previously recorded locations are presented in **Figure 5**.

Table 12 - Threatened and Priority Fauna Potentially Occurring within the Study Area

Species	EPBC Act Cons Status	WA Cons Status	Preferred Habitat	Likelihood of Occurrence	Source
Pseudocheirus occidentalis (Western Ringtail Possum)	Critically Endangered	Critically Endangered	Peppermint woodlands with high canopy continuity; jarrah/marri forests and woodland.	Unlikely – suitable habitat does not occur within the study area. Locally extinct.	PMST
Calidris ferruginea (Curlew Sandpiper)	Critically Endangered	Critically Endangered	Intertidal mudflats and the open muddy margins of freshwater wetlands.	Unlikely – suitable habitat does not occur within the study area.	PMST
Botaurus poiciloptilus (Australian bittern)	Endangered	Endangered	Permanent and seasonal freshwater wetlands, rarely estuarine habitats. Wetlands with tall, dense vegetation, particularly sedges/rushes/reeds.	Unlikely – suitable habitat unlikely to be provided by the study area.	PMST
Calyptorhynchus latirostris (Carnaby's Black-Cockatoo)	Endangered	Endangered	Seasonal in coastal and near coastal area. Foraging in proteaceous shrubland and heath.	Likely – suitable habitat occurs within the study area. Records of species within approximately 800 m.	DBCA NatureMap PMST
Calyptorhynchus baudinii (Baudin's Black-Cockatoo)	Endangered	Endangered	Mainly occurs in eucalypt forests, especially jarrah, marri and karri forest.	Likely – suitable habitat occurs within the study area. Records of species within approximately 1.8 km.	DBCA NatureMap PMST
Rostratula australis (Australian Painted Snipe)	Endangered	Endangered	Found in shallow inland wetlands that are either temporarily or permanently filled.	Unlikely – suitable habitat unlikely to be provided by the study area.	PMST
Myrmecobius fasciatus (Numbat, Walpurti)	Vulnerable	Vulnerable	Wild populations currently restricted to Eucalyptus woodlands.	Unlikely – suitable habitat unlikely to be provided by the study area.	DBCA
Bettongia penicillata (Woylie)	Vulnerable	Vulnerable	Once inhabited a wide range of habitats.	Unlikely – Locally extinct.	PMST
Calyptorhynchus banksii. naso (Forest Red-tailed Black-Cockatoo)	Vulnerable	Vulnerable	Eucalypt forests. Feeds on seeding Marri, Jarrah, Blackbutt, Karri, Sheoak and Snottygobble, also some ornamental eucalypts and introduced Cape Lilac.	Recorded – observed from secondary evidence (chewed Marri nuts), with suitable habitat throughout much of the study area. Existing records of species within approximately 1.8 km.	DBCA NatureMap PMST
Dasyurus geoffroii (Chuditch, Western Quoll)	Vulnerable	Vulnerable	Generalist, jarrah forest, eucalypt forest, mallee shrublands, woodland and desert.	Unlikely – most likely locally extinct.	DBCA NatureMap PMST

Species	EPBC Act Cons Status	WA Cons Status	Preferred Habitat	Likelihood of Occurrence	Source
Westralunio carteri (Carter's Freshwater Mussel)	Vulnerable	Vulnerable	Slow flowing freshwater waterways with stable and soft substrate.	Unlikely – suitable habitat unlikely to be provided by the study area.	DBCA NatureMap PMST
Setonix brachyurus (Quokka)	Vulnerable	Vulnerable	Mainland population requires dense heath groundcover.	Unlikely – suitable habitat unlikely to be provided by the study area.	PMST
Falco peregrinus (Peregrine Falcon)		Specially protected	Generalist, prefers coastal and inland cliffs or open woodlands.	Unlikely – suitable habitat unlikely to be provided by the study area.	DBCA NatureMap
Phascogale tapoatafa (South-western Brush tailed Phascogale, Wambenge)	Conservation Dependent	Conservation Dependent	Dry sclerophyll forests and open woodlands that contain hollow-bearing trees. Records are less common in high rainfall areas.	Unlikely – suitable habitat unlikely to be provided by the study area.	DBCA NatureMap
Idiosoma sigillatum (Swan Coastal Plain shield-backed trapdoor spider)		Priority 3	Jarrah/Marri woodland, semi-arid woodlands.	Unlikely – suitable habitat unlikely to be provided by the study area.	DBCA NatureMap
Geotria australis (Pouched Lamprey)		Priority 3	Return to freshwater to breed using significant freshwater waterways.	Unlikely – suitable habitat unlikely to be provided by the study area.	DBCA NatureMap
Hydromys chrysogaster (Water-rat, Rakali)		Priority 4	In the vicinity of permanent water, riparian vegetation, woody debris, rock ledges and wetland islands.	Unlikely – suitable habitat unlikely to be provided by the study area.	DBCA NatureMap
Isoodon fusciventer (Quenda, southwestern brown bandicoot)		Priority 4	Vegetation with dense cover to 1 m high, forest, woodland, wetlands.	Likely – suitable habitat occurs within the study area, Records of species approximately 2.9 km.	DBCA NatureMap
Oxyura australis (Blue-billed duck)		Priority 4	Well vegetated freshwater swamps, large dams and lakes, winters on more open water. Occasionally salt lakes and estuaries freshened by floodwaters.	Potentially occur – suitable habitat likely to occur within the study area.	DBCA NatureMap
Notamacropus eugenii (Tammar Wallaby)		Priority 4	Varied habitats though prefer areas with dense scrub or heath.	Unlikely – suitable habitat unlikely to be provided by the study area.	Naturemap
Falsistrellus mackenziei (Western False Pipistrelle, Western Falsistrelle)		Priority 4	Wet schlerophyll forests with high hollow prevalence.	Unlikely – suitable habitat unlikely to be provided by the study area.	Naturemap
Apus pacificus (Fork-tailed Swift)	Marine/ Migratory	Marine/Migratory	A predominantly aerial species that can occur over any habitat usually from October- April	Potentially occur – suitable habitat likely to occur within the study area.	PMST

Species	EPBC Act Cons Status	WA Cons Status	Preferred Habitat	Likelihood of Occurrence	Source
Merops ornatus (Rainbow Bee-eater)	Marine	Marine	Open timbered country, especially near water.	Likely – suitable habitat occurs within the study area.	PMST
Calidris ruficollis (Red-necked Stint)	Migratory	Migratory	Prefers tidal flats but can use other wetlands such as brackish or fresh inland wetlands with minimal vegetation and open shallow water, wet sand or mud.	Unlikely – suitable habitat unlikely to be provided by the study area.	DBCA
Actitis hypoleucos (Common Sandpiper)	Marine/Migratory	Marine/Migratory	Prefer mangrove lined creeks though can be found in wetlands featuring areas of mud and outcropping rocks.	Unlikely – suitable habitat unlikely to be provided by the study area.	PMST
Calidris acuminata (Sharp-tailed Sandpiper)	Marine/Migratory	Marine/Migratory	A variety of fresh to saline wetlands, damp unvegetated grasslands and tidal flats.	Unlikely – suitable habitat unlikely to be provided by the study area.	PMST
Calidris melanotus (Pectoral Sandpiper)	Marine/Migratory	Marine/Migratory	Shallows and edges of lightly grassed and otherwise unvegetated freshwater wetlands.	Unlikely – suitable habitat unlikely to be provided by the study area.	PMST
Tringa nebularia (Common Greenshank)	Marine/Migratory	Marine/Migratory	Utilises a variety of freshwater or coastal habitats where still shallow water or open mudflats are present	Unlikely – suitable habitat unlikely to be provided by the study area.	PMST

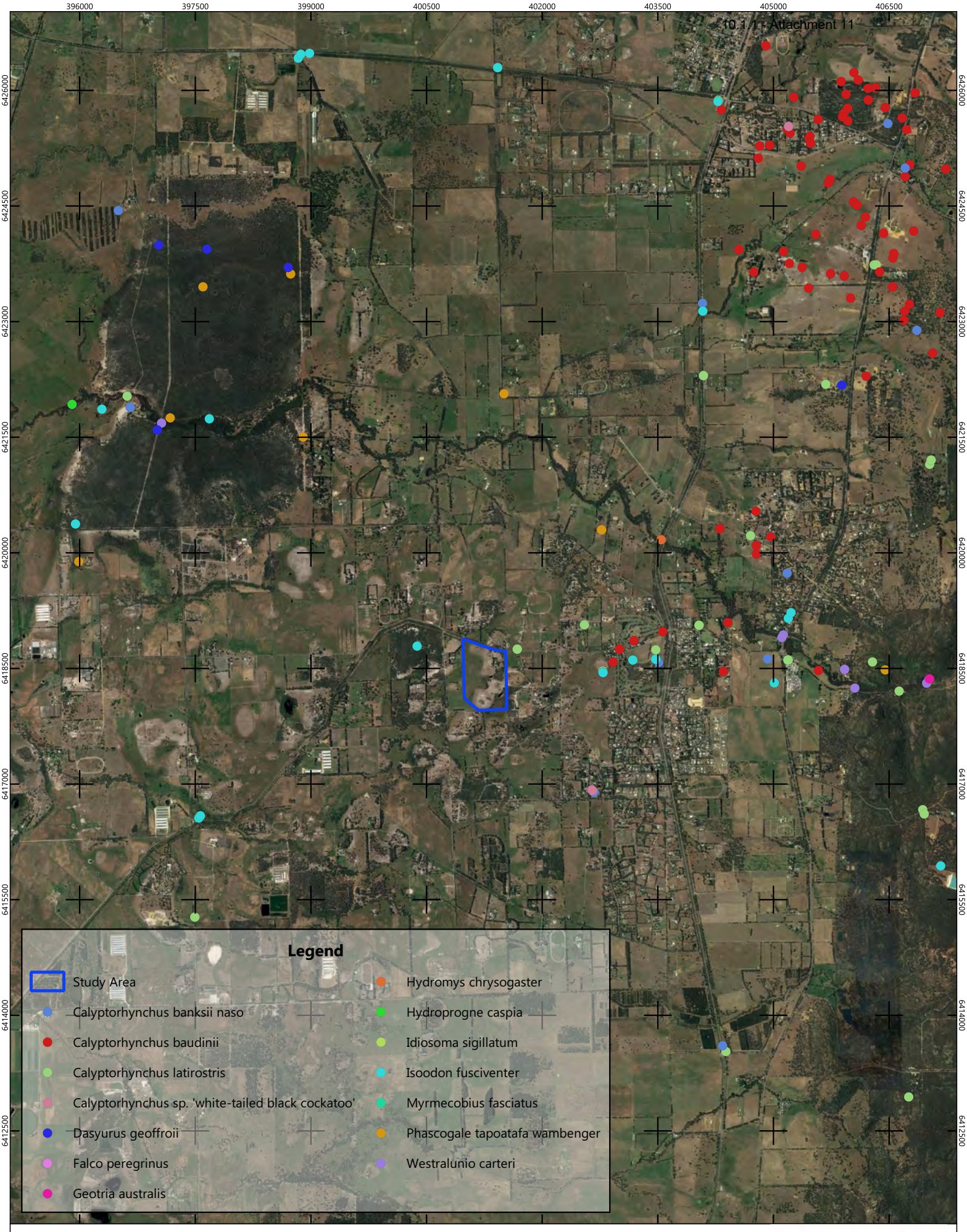

Figure 5 - Conservation Significant Fauna

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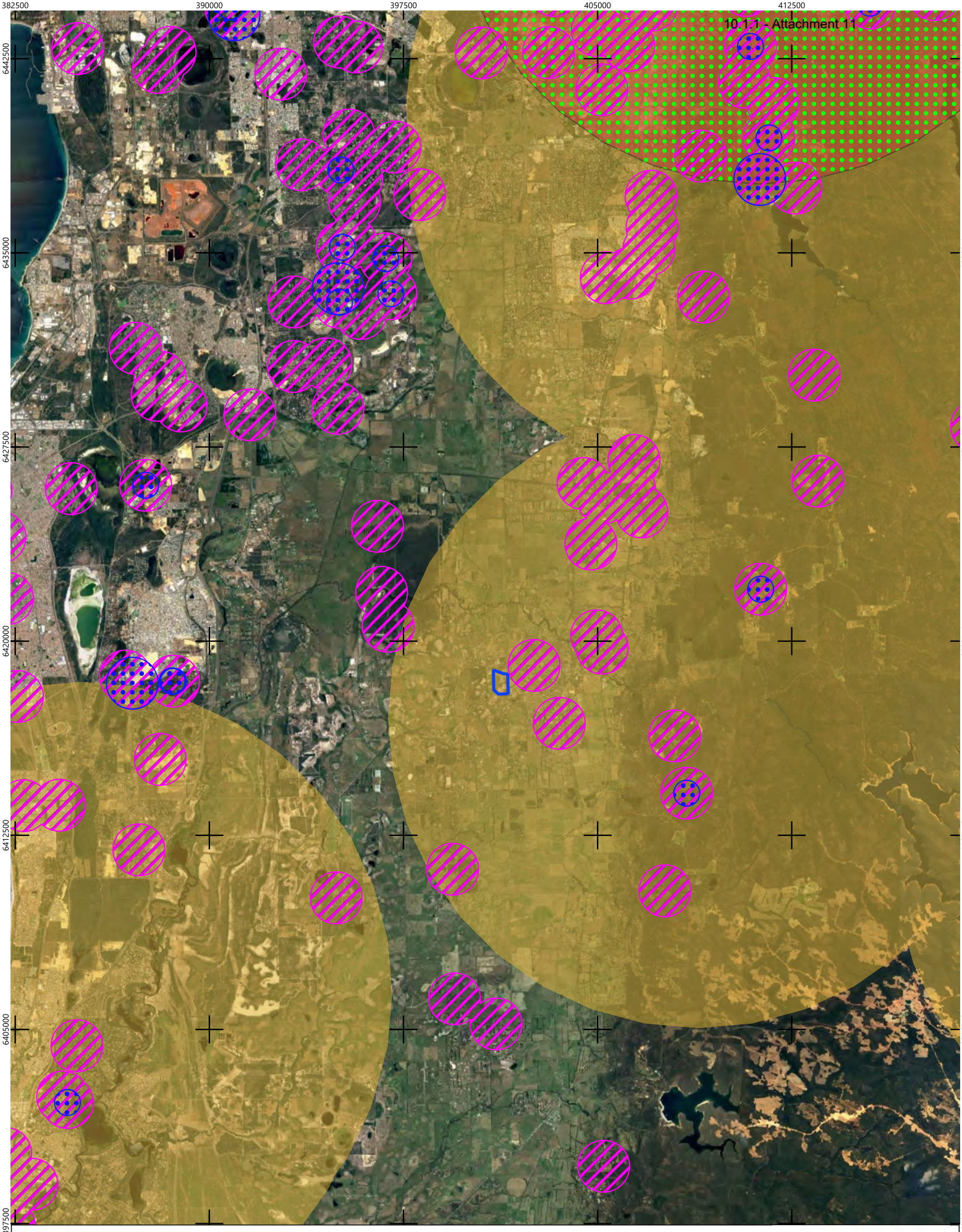
4.1.5 Black-Cockatoo Habitats

No known and confirmed breeding or roosting sites for Black-Cockatoos, nor their buffers intersect with the study area.

The desktop assessment revealed that the study area lies within the buffer of an unconfirmed Black-Cockatoo (possible) breeding area, with the centre of this buffered area approximately 7.4 km east of the study area. The edge of the buffer for the nearest confirmed breeding site for Carnaby's Black-Cockatoo occurs approximately 20 km north of the study area, with the centre of this area approximately 33 km away (**Figure 6**).

The edge of the buffer for the closest documented roost site for Black-Cockatoos occurs approximately 76 m east of the study area, with the centroid of this buffer approximately 1 km from the nearest edge of the study area, with a further four Black-Cockatoo roosts within 5 km of the centre of the study area, to the south-east, east and north-west. The centre of the nearest known roosts for Carnaby's Black-Cockatoos are approximately 7.9 km south-east, 10.3 km north-east and 12.4 km west of the boundary of the study area (**Figure 6**).



0 2.5 5 7.5 10 km

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Figure 6 - Known Black-Cockatoo Habitats

Legend

- Study Area
- Black-Cockatoo Roosting Site
- Carnabys Black-Cockatoo Unconfirmed Breeding Area
- Carnaby's Cockatoo Confirmed Roost Site
- Carnaby's Cockatoo Confirmed Breeding Area

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4.2 FIELD ASSESSMENT

The timing of the flora survey (early November) was considered optimal to conducting a biological assessment, as this is within the peak flowering period for the region, where vertebrate fauna activity is also likely optimal.

4.2.1 Flora

A total of 19 flora species, from 17 genera and ten families was recorded during the field assessment. The dominant families were found to be Myrtaceae (eight taxa) and Poaceae (three taxa). The total includes 13 (68.42%) native species, six (31.58%) introduced (weed) species. The full list of vascular flora species recorded within the study area is presented in **Appendix C** and data from the single recorded relevé is presented in **Appendix D**.

The desktop review identified the potential for 15 significant flora species to occur within the study area. Based on the field assessment, known distribution, current records, preferred habitat and habitat present within the study area, nine species may occur (**Table 9**). The majority of species that 'may' occur within the study area were considered to have a possible occurrence due to some presence of those species to wetland or winter wet habitats. Search traverses conducted during the spring assessment did not identify the presence of any species listed as Threatened or Priority flora within the study area.

None of the recorded flora are exhibiting an extension beyond their currently documented range, in accordance with records of the Western Australian Herbarium (WAH 1998-).

Although a targeted and thorough weed survey was not carried out across the entire study area none of the recorded weeds are listed as Weed of National Significance (WoNS). Two of the recorded weeds, **Zantadeschia aethiopica* (Arum Lily) and **Moraea flaccida* (Two-leaved Cape Tulip), are listed as Declared Pest plants under the *Biosecurity and Agricultural Management Act* (BAM Act) (Department of Primary Industries and Regional Development (DPIRD) 2020). Both weed species were recorded across the study area, with Cape Tulips abundant throughout and Arum Lilies present throughout much of the wetter areas associated with site drainage. No obligations are imposed on landholders to control the spread of these DP weeds, however, best-practice hygiene measures should be implemented to avoid local exacerbation of infestations.

The low number of species recorded can be attributed to the previously cleared and highly modified nature of study area, as well as being due to ongoing land uses, which appear to predominantly consist of stock grazing.

4.2.2 Vegetation Units

The survey area supports one remnant vegetation unit, with the remainder of the site supporting pasture and various combinations of native and non-endemic species (mostly trees) in varying densities over some of the areas of pasture.

The single remnant vegetation unit recorded and mapped within the study area occupies 1.43 ha (3.24 %) of the study area), is described in detail in **Appendix D** and is described in summary as:

> MpRc – Low Open Woodland of *Melaleuca preissii* over a Low Sparse Shrubland of *Regelia ciliata* over a Low Sparse Grassland of **Briza maxima.*

The species of parkland trees (and some shrubs and sedges) occurring over pasture (denoted in mapping and reported data as '(P)') comprising areas of degraded (or poorer condition) vegetation within the study area are listed in **Table 13**. The spatial extent of the varying vegetation across the study is presented in **Figure 7**.

Table 13 – Tree, Shrub and Sedge Species Occurring over Pasture (P) within the Study Area

Abbreviation (as a Prefix to '(P)')	Tree Species
Af	*Allocasuarina fraseriana*
Jk	*Juncus kraussii*
Cc	*Corymbia calophylla*
Euc	*Eucalyptus* sp. (non-endemic/planted species)
Em	*Eucalyptus marginata*
Er	*Eucalyptus rudis*
Kg	*Kunzea glabrescens*
Mp	*Melaleuca preissii*
Mr	*Melaleuca rhaphiophylla*
Pp	*Pinus pinaster*
Xo	*Xylomelum occidentale*
Xp	*Xanthorrhoea preissii*

Due to the highly modified nature of the study area, none of the defined vegetation units are considered to be representative of any TEC or PEC as identified from the desktop assessment.

4.2.1 Wetland and Riparian Vegetation

Within the study area, riparian vegetation is represented within the remnant vegetation unit MpRc. Additionally, a number of the isolated tree, shrub and sedge species are also typical of wetlands and considered riparian, and therefore, areas where they occur would be considered riparian vegetation, albeit it highly degraded. The species occurring in the study area that are considered riparian are listed in **Table 14** and the extent of riparian vegetation within the study area is presented in **Figure 8**.

Table 14 – Riparian Dominant Species within the Study Area

Abbreviation (as a Prefix to '(P)')	Tree Species	Riparian?
Af	*Allocasuarina fraseriana*	No
Jk	*Juncus kraussii*	Yes
Cc	*Corymbia calophylla*	No
Euc	*Eucalyptus* sp. (non-endemic/planted species)	No
Em	*Eucalyptus marginata*	No
Er	*Eucalyptus rudis*	Yes
Kg	*Kunzea glabrescens*	Yes
Mp	*Melaleuca preissii*	Yes
Mr	*Melaleuca rhaphiophylla*	Yes
Pp	*Pinus pinaster*	No
Xo	*Xylomelum occidentale*	No
Xp	*Xanthorrhoea preissii*	No

The single mapped remnant vegetation unit, MpRc, is growing in association with the Resource Enhancement Wetland (REW) Sumpland, UFI 7551. No intact, remnant vegetation is growing in association with either of the Conservation Category Wetland (CCW) Damplands, UFI 7403 or UFI 7586, nor the REW, UFI 15364.

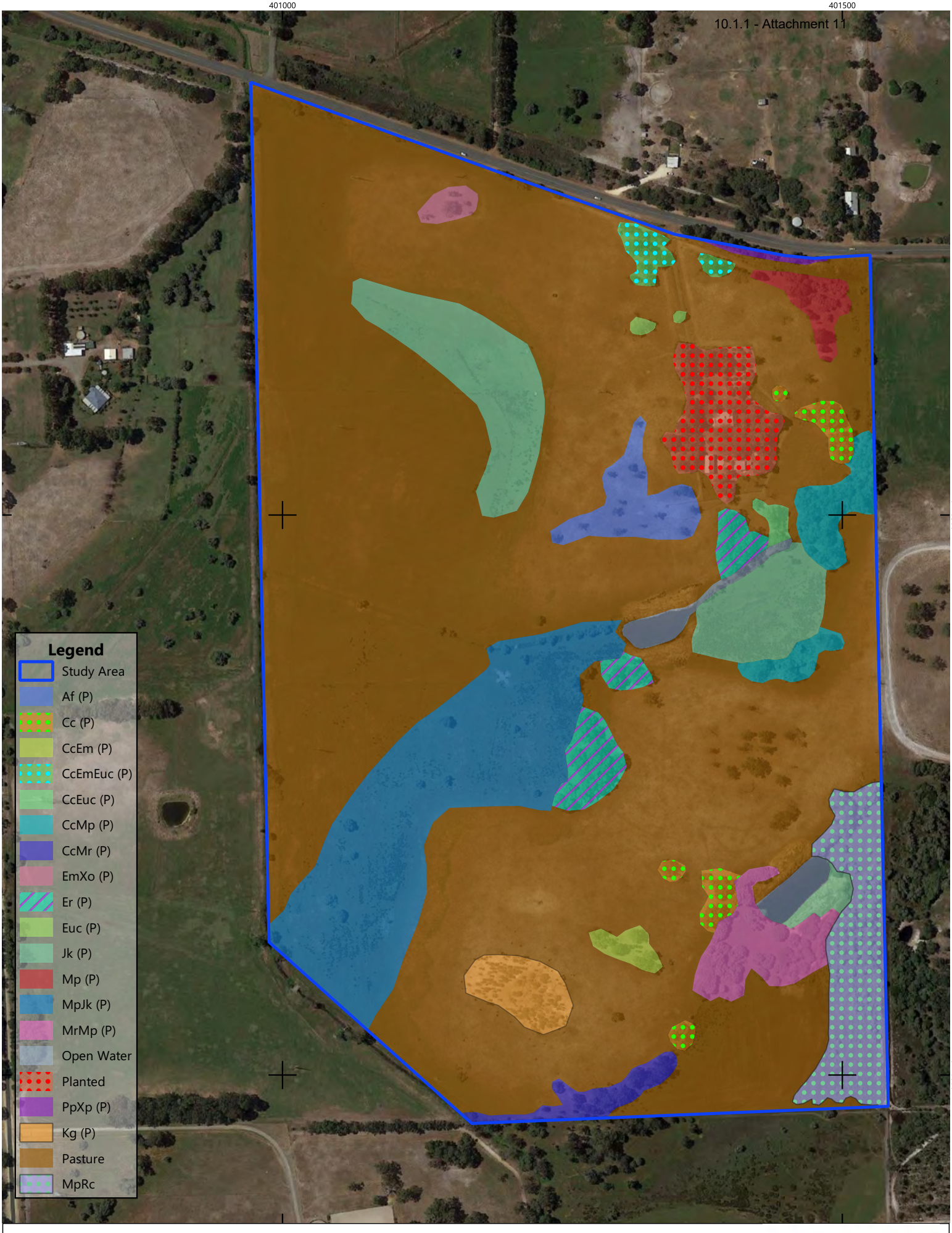

Figure 7 - Vegetation Units

0 0.05 0.1 0.15 0.2 km

GDA 94 / MGA Zone 50

Legend

Study Area

Riparian Vegetation

Figure 8 - Riparian Vegetation

4.2.2 Vegetation Condition

The vegetation condition of the study area was found to range from 'Degraded' to 'Completely Degraded', with the majority (95.44%) found to be in 'Completely Degraded' condition. The spatial extent of the varying vegetation condition across the study area is presented in **Figure 7** and the areas of each condition category are presented in **Table 15**. Areas of better-quality vegetation occur in the eastern portion of the study area, particularly towards the south-eastern corner. The study area has been highly modified from historic clearing and remains to due to ongoing stock grazing land uses. A large proportion of the study area is devoid of remnant vegetation comprises of isolated trees over pasture grasses and other weeds.

Table 15 - Vegetation Condition of the Study Area

Vegetation Condition Rating	Total Area (ha)	Proportion of Total Survey Area (%)
Degraded	0.49	1.10
Completely Degraded-Degraded	1.53	3.46
Completely Degraded	42.22	95.44
Total	**44.24**	**100**

Figure 9 - Vegetation Condition

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4.2.3 Significant Fauna

During the November field assessment, secondary evidence of the presence of Forest Red-tailed Black-cockatoos (*Calyptorhynchus banksii naso*) (Endangered) was recorded from foraged Marri nuts, as shown in **Plate 1**. The study area supports some areas of relatively good quality foraging habitat for Black-Cockatoos, as discussed in further detail in **Section 4.2.5.1**.

Plate 1 – Marri nuts observed in the Study Area showing the chew pattern characteristic of Forest Red-tailed Black-Cockatoo foraging

No direct nor secondary evidence of the presence or activity of any other conservation-significant vertebrate fauna species was observed during the field assessment.

4.2.4 Fauna Habitats

The survey area was found to support three key fauna habitats as summarised in **Table 15**. The spatial extent of the various fauna habitats within the survey area is presented in **Figure 10**.

The survey area was found to support three key fauna habitats, plus open pasture, which is not considered to provide much, if any habitat value for native vertebrate fauna. The fauna habitats of the study area are summarised in **Table 16**, which also lists the fauna species of conservation significance that they could support, and the spatial extent of these habitats across the study area is presented in **Figure 10**.

Table 16 - Summary of Fauna Habitats

Habitat/Description	Representative Photographs	Potentially Supported Significant Fauna	Area (ha)	% of Survey Area
Paperbark/Wetland/Shrubland Predominantly Paperbarks (*Melaleuca* spp.) of varying density, over pasture, or a degraded understorey of heath shrubs or wetland sedges. Growing in a rich, loamy clay substrate that is seasonally or perennially damp.	 	Quenda (*Isoodon fusciventer*) Pacific Swift (*Apus pacificus*)	7.04	15.91
Parkland with sparse trees Various endemic and non-endemic trees, predominantly Eucalypts in varying densities, over pasture, in substrates that range from seasonally damp, loamy clay to damp or dry white sands.		Carnaby's Black-Cockatoo (*Calyptorhynchus latirostris*) Baudin's Black-Cockatoo (*Calyptorhynchus baudinii*) – Rainbow Bee-eater (*Merops ornatus*)	3.87	8.74
Dams/Streams Open, brackish water, rich in tannins, seemingly deep in sections, associated with constructed of dams and drains (streams), with limited to no flow velocity.	 	Blue-billed Duck (*Oxyura australis*)	0.41	0.92
Open pasture Open, cleared pasture, lacking a tree, shrub or understorey layer, or with isolated trees and stags. Substrate ranges from seasonally damp, loamy clay to damp or dry white sands.	No representative photograph	Carnaby's Black-Cockatoo (*Calyptorhynchus latirostris*) Baudin's Black-Cockatoo (*Calyptorhynchus baudinii*) Pacific Swift (*Apus pacificus*)	32.93	74.43
		Total	**44.24**	**100**

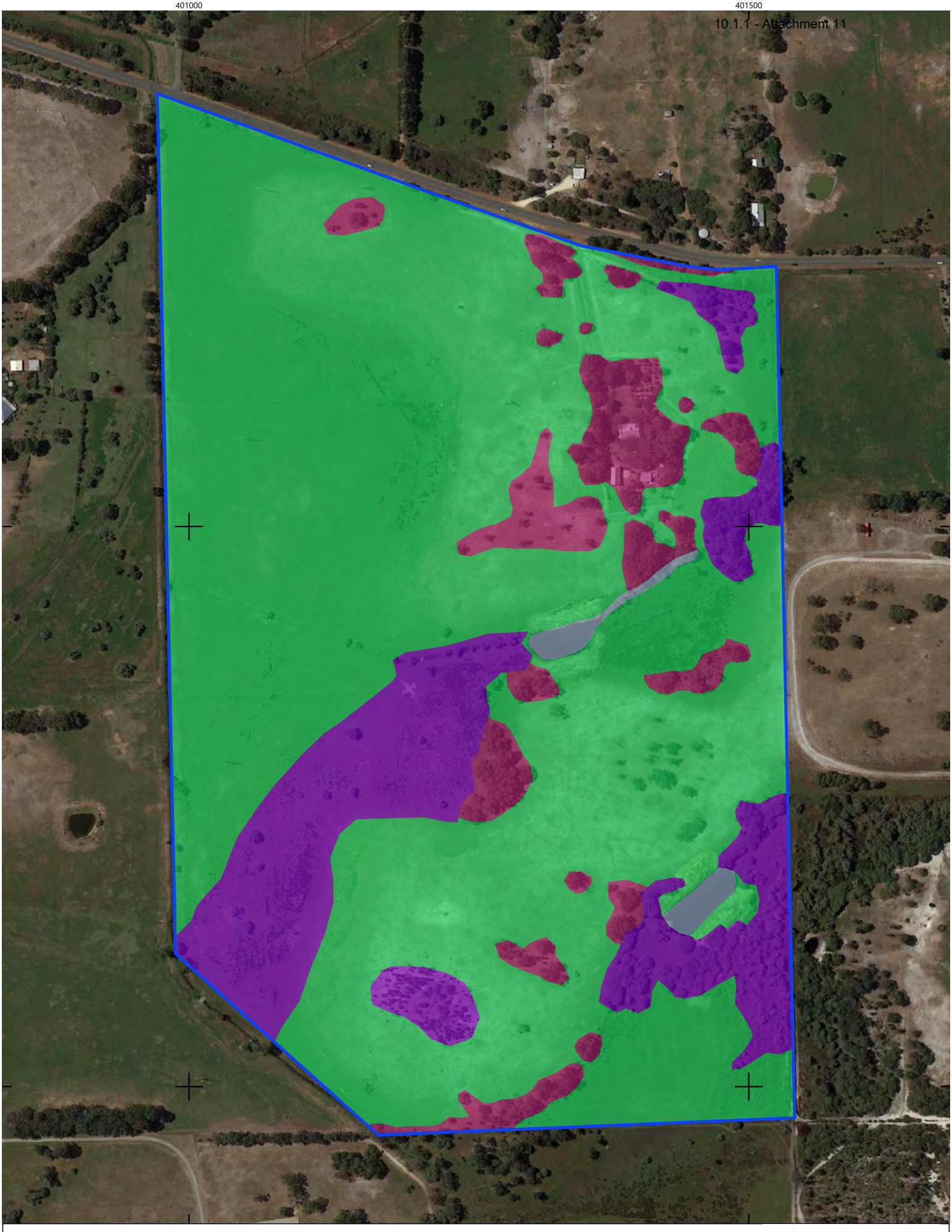

Figure 10 - Fauna Habitats

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4.2.5 Black-Cockatoo Habitat

4.2.5.1 Foraging Habitat

Rather than assigning Black-Cockatoo foraging quality scores to the four fauna habitats described and mapped within in the survey area, this had instead been carried out for the range of vegetation types, which have been mapped at a finer scale in terms of plant species compositions, which better quantifies foraging values, since the individual food source plants (or lack thereof) are able to be accounted for. Accordingly, each of the various vegetation areas have been assigned a foraging quality value in accordance with the BCE methodology for each of the species of Black-Cockatoos based on vegetation characteristics (out of six), context (out of three) and species presence (stocking rate) (one or zero), for a total score out of 10. Vegetation characteristic scores of ≤2 are not further analysed for context and species presence (stocking rate) as such habitat is considered to be of negligible foraging value. The results of this analysis are presented below in **Table 17** and summarised in **Table 18**.

Table 17 – Black-Cockatoo Foraging Habitat Quality for each Vegetation Type

Vegetation Type	Carnaby's Black-Cockatoo				Forest Red-tailed Black-Cockatoo				Baudin's Black-Cockatoo			
	Veg	Context	Stock-ing rate	Quality	Veg	Context	Stock-ing rate	Quality	Veg	Context	Stock-ing rate	Quality
Af (P)	0	NA	NA	**0**	3	0	1	**3**	0	NA	NA	**0**
Cc (P)	4	1	1	**6**	4	0	1	**5**	4	0	0	**4**
CcEm (P)	4	1	1	**6**	4	0	1	**5**	4	0	0	**4**
CcEmEuc (P)	3	1	1	**5**	3	0	1	**4**	3	0	0	**3**
CcEuc (P)	3	1	1	**5**	3	0	1	**4**	3	0	0	**3**
CcMp (P)	2	NA	NA	**2**	2	NA	NA	**2**	2	NA	NA	**2**
CcMr (P)	2	NA	NA	**2**	2	NA	NA	**2**	2	NA	NA	**2**
EmXo (P)	2	NA	NA	**2**	2	NA	NA	**2**	2	NA	NA	**2**
Er (P)	1	NA	NA	**1**	2	NA	NA	**2**	0	NA	NA	**0**
Euc (P)	1	NA	NA	**1**	2	NA	NA	**2**	0	NA	NA	**0**
Jk (P)	0	NA	NA	**0**	0	NA	NA	**0**	0	NA	NA	**0**
Kg (P)	0	NA	NA	**0**	0	NA	NA	**0**	0	NA	NA	**0**
Mp (P)	0	NA	NA	**0**	0	NA	NA	**0**	0	NA	NA	**0**
MpJk (P)	0	NA	NA	**0**	0	NA	NA	**0**	0	NA	NA	**0**
MrMp (P)	0	NA	NA	**0**	0	NA	NA	**0**	0	NA	NA	**0**
PpXp (P)	4	1	1	**6**	4	0	1	**5**	4	0	0	**4**
MpRc	0	NA	NA	**0**	0	NA	NA	**0**	0	NA	NA	**0**
Open Water	0	NA	NA	**0**	0	NA	NA	**0**	0	NA	NA	**0**
Pasture	0	NA	NA	**0**	0	NA	NA	**0**	0	NA	NA	**0**
Planted	0	NA	NA	**0**	0	NA	NA	**0**	0	NA	NA	**0**

Table 18 - Summary of Foraging Habitat Quality for Black-Cockatoos

Vegetation Type	Foraging Quality Scores			Area (ha)	% of Survey Area
	Carnaby's Black-Cockatoo	Forest Red-tailed Black-Cockatoo	Baudin's Black-Cockatoo		
Af (P)	0	4	0	0.61	1.37
Cc (P)	6	5	4	0.39	0.89
CcEm (P)	6	5	4	0.15	0.35
CcEmEuc (P)	5	4	3	0.22	0.49
CcEuc (P)	5	4	3	0.08	0.18
CcMp (P)	2	2	2	0.65	1.48
CcMr (P)	2	2	2	0.35	0.79
EmXo (P)	2	2	2	0.13	0.30
Er (P)	1	2	0	0.66	1.50
Euc (P)	1	2	0	0.04	0.09
Jk (P)	0	0	0	2.42	5.48
Kg (P)	0	0	0	0.46	1.04
Mp (P)	0	0	0	0.30	0.67
MpJk (P)	0	0	0	4.03	9.10
MrMp (P)	0	0	0	0.76	1.72
PpXp (P)	6	5	4	0.06	0.14
MpRc	0	0	0	1.43	3.24
Open Water	0	0	0	0.41	0.92
Pasture	0	0	0	30.11	68.06
Planted	0	0	0	0.97	2.19

Foraging Habitat Quality Scores:
0 = none/negligible; 1 = negligible to low; 2 = low; 3 = low to moderate; 4 = moderate; 5 = moderate to high; 6 = high 7+ = very high
*Vegetation characteristic scores ≤2 are not further analysed for context and stocking rate as these habitats are of negligible foraging value.

The majority of the habitats (vegetation types) defined and mapped with the survey area are of little or no foraging value for Black-Cockatoos, with scores of 0, 1 or 2 for vegetation characteristics, not allowing for further consideration of context and species presence (stocking rate). A total of (96.58% of the study area provides 'Low to moderate' (score of 3) or poorer quality foraging habitat for any of the Threatened species of Black-Cockatoo.

The vegetation types that support Marri (Cc), Jarrah (Em) and Sheoak (Af) provide better quality foraging habitat for the various species of Black-Cockatoo, since these species are native food source plants for the birds. The highest quality foraging habitats are within areas mapped as Cc (P), CcEm (P) and CcEuc (P). Vegetation type PpXp (P) also provides some of the higher quality foraging habitat due to the presence of Pines (*Pinua pinaster*), since Black-Cockatoos have adapted to foraging of pine cones due to foraging habitat loss (Higgins 1999; Saunders 1980). The foraging habitat quality for Black-Cockatoos is presented spatially in **Figure 11** series.

Figure 11a - Black-Cockatoo Foraging Habitat Quality (Carnaby's Black-Cockatoo)

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Figure 11b - Black-Cockatoo Foraging Habitat Quality (Forest Red-tailed Black-Cockatoo)

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0 50 100 150 200 m

GDA 94 / MGA Zone 50

Study Area

Legend

Foraging Quality

- 0 - No Foraging Value
- 2 - Low Foraging Value
- 3 - Low to Moderate Foraging Value
- 4 - Moderate to HIgh Foraging Value

Figure 11c - Black-Cockatoo Foraging Habitat Quality (Baudin's Black-Cockatoo)

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4.2.5.2 Breeding Habitat

The desktop assessment revealed that the study area lies within an unconfirmed (possible) Black-Cockatoo breeding area. The nearest confirmed breeding site for Carnaby's Black-Cockatoo occurs approximately 20 km north of the study area.

A total of 26 trees considered potential current or future breeding trees for Black-Cockatoos were recorded within the study area, as summarised in **Table 19** and detailed in **Table 20**. Of the total of 26 trees considered potential current or future breeding (i.e. suitable diameter at breast height (DBH)) trees for Black-Cockatoos, five were ranked category 3 (containing a potentially suitable hollow, but with no evidence of Black-Cockatoo use), four were ranked category 4 (hollows were observed, although these hollows are not of suitable size and/or near-vertical orientation for use by Black-Cockatoos) and 17 (65.38%) were ranked category 5 (sufficient DBH, no hollows). One of the category 3 trees (stag) was observed to have five hollows, one of which had evidence of bees and another, Pink and Grey Galahs, apparently nesting and therefore, it is considered unlikely that Black-Cockatoos would utilise any of these hollows for nesting. The remaining four trees with potentially suitable hollows would require closer inspection to check for evidence of use by Black-Cockatoos, although none was observed during the field assessment.

The location of the potential (and potential future) Black-Cockatoo breeding trees is presented in **Figure 12**.

Table 19 - Summary of Black-Cockatoo Potential Breeding Habitat

Species	Total No. Trees	Total Number in Tree Rank/Category				
		5 - Sufficient DBH, no hollows	4 – Hollow but unsuitable	3 - Potential hollow, no evidence	2 - Sufficient DBH, suitable hollow, evidence	1 – Active nest
Corymbia calophylla	19	15	4	0	0	0
Eucalyptus marginata	2	1	0	1	0	0
Stag	5	1	0	4	0	0
Total	**26**	**17**	**4**	**5**	**0**	**0**

Table 20 - Recorded Potential Black-Cockatoo Breeding Trees

Species	DBH (mm)	Tree Rank/Category	Easting (mE) Northing (mN)
Corymbia calophylla	550	5-Sufficient DBH No Hollows	401477mE 6418512mN
Corymbia calophylla	500	5-Sufficient DBH No Hollows	401285mE 6418281mN
Corymbia calophylla	500	5-Sufficient DBH No Hollows	401433mE 6418369mN
Corymbia calophylla	650	5-Sufficient DBH No Hollows	401279mE 6418263mN
Corymbia calophylla	650	5-Sufficient DBH No Hollows	401480mE 6418661mN
Corymbia calophylla	550	5-Sufficient DBH No Hollows	401491mE 6418474mN
Corymbia calophylla	600	5-Sufficient DBH No Hollows	401282mE 6418265mN
Corymbia calophylla	658	4-Unsuitable Hollows	401357mE 6418134mN
Corymbia calophylla	650	5-Sufficient DBH No Hollows	401513mE 6418516mN
Corymbia calophylla	550	5-Sufficient DBH No Hollows	401517mE 6418522mN
Corymbia calophylla	550	5-Sufficient DBH No Hollows	401351mE 6418039mN
Corymbia calophylla	500	5-Sufficient DBH No Hollows	401470mE 6418521mN
Corymbia calophylla	600	5-Sufficient DBH No Hollows	401499mE 6418571mN
Corymbia calophylla	550	5-Sufficient DBH No Hollows	401458mE 6418702mN
Corymbia calophylla	500	5-Sufficient DBH No Hollows	401304mE 6417983mN
Corymbia calophylla	700	4-Unsuitable Hollows	401390mE 6418148mN
Corymbia calophylla	500	5-Sufficient DBH No Hollows	401284mE 6418290mN
Corymbia calophylla	550	4-Unsuitable Hollows	401381mE 6418143mN
Corymbia calophylla	600	4-Unsuitable Hollows	401332mE 6418339mN
Eucalyptus marginata	550	5-Sufficient DBH No Hollows	401330mE 6418710mN
Eucalyptus marginata stag	750	3-Suitable Hollows no chew evidence	401528mE 6418299mN
Stag	550	3-Suitable Hollows no chew evidence	401533mE 6418352mN
Stag	500	3-Suitable Hollows no chew evidence	401273mE 6418277mN
Stag	900	3-Suitable Hollows no chew evidence	401291mE 6418615mN
Stag	500	5-Sufficient DBH No Hollows	401494mE 6418531mN
Stag	700	3-Suitable Hollows (5) no chew evidence, 1 hollow with bees, 1 hollow occupied by Pink and Grey Galahs	401155mE 6418811mN

0 50 100 150 200 m

GDA 94 / MGA Zone 50

Figure 12 - Black-Cockatoo Potential Breeding Habitat

Legend

Study Area

Species

Corymbia calophylla

Eucalyptus marginata

Stag

Rank Key

Tree Rank - 3

Tree Rank - 4

Tree Rank - 5

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4.2.5.3 Roosting Habitat

The results of the desktop assessment identified that no confirmed nor unconfirmed roosting sites for Black-Cockatoos, nor their buffers intersect with the study area. However, a documented roost site for Black-Cockatoos occurs approximately 1 km from the nearest edge of the study area and a further four Black-Cockatoo roosts occur within 5 km. Known roosts for Carnaby's Black-Cockatoos are approximately 7.9 km, 10.3 km and 12.4 km from the study area.

While no confirmed or unconfirmed roost sites occur within the study area, any large tree that are within 2 km of water could be considered a potential roost. Several tall trees are scattered throughout the study area and standing and flowing water occurs locally, including within the study area itself. The extent of tall trees that could provide suitable roosting habitat for Black-Cockatoos within the study area is shown in Figure

However, it is considered unlikely that Black-Cockatoos would roost within the survey area, immediately adjacent to a road, when sufficiently tall trees and known roosting habitat removed from this noise are present in the surrounding areas. Furthermore, the trees within study area are sparse, in low density or occur in narrow stands. Black-Cockatoos would favour trees that are part of a larger group, to accommodate large flocks, such as the better-quality roost sites that are known to support roosting that occur nearby, outside the study area.

Whilst any large trees within the project area could potentially be used for roosting by any of the Black-Cockatoo species, the roosting habitat within the study area and surrounds is considered to be well-defined. A decade long project targeting roosting sites used by Black-Cockatoos is ongoing, hence the abundance of roost site data in the region (Mike Bamford, pers. comm.). Black-Cockatoos are also known to have a high level of site fidelity to roosting trees, and it is apparent that preferred roosting sites support trees that are taller than their immediate neighbours, in an urban/peri-urban landscape, with the distance to water less important (Le Roux 2017). It follows that since the roost sites are well-defined for the study area and the surrounding region, understanding the suitability of trees for roosting is inconsequential, since these sites are known and Black-Cockatoos tend to be site-faithful and 'new' roosts are rare (Mike Bamford, pers. comm.).

Figure 13 - Potentially Suitable Black-Cockatoo Roosting Habitat

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5 CONCLUSIONS

The key findings and conclusions arising from the ecological assessment within the survey area are as follows:

- One remnant vegetation unit (MpRc), which occupies an area of 1.43 ha (3.24% of the study area) was recorded and mapped within the study area.
- Vegetation Unit MpRc is growing in is growing in association with a Resource Enhancement Wetland (REW) Sumpland, UFI 7551.
- No intact, remnant vegetation is growing in association with either of the Conservation Category Wetland (CCW) Damplands, UFI 7403 or UFI 7586, nor the REW, UFI 15364
- No Threatened flora listed under the BC Act or the EPBC Act, nor DBCA Priority listed flora were recorded.
- Two of the recorded weeds, **Zantadeschia aethiopica* (Arum Lily) and **Moraea flaccida* (Two-leaved Cape Tulip), are listed as Declared Pest [s22(2)] plants under the BAM Act (DPIRD 2020) throughout Western Australia and although no obligations are imposed on landholders to control their spread, best-practice hygiene measures should be implemented to avoid local exacerbation of infestations.
- None of the defined vegetation units are considered to be representative of any TEC or PEC identified from the desktop assessment.
- Based on the results of the field assessment, five vertebrate fauna species of significance are considered 'likely to occur' and one may 'potentially occur'. These species are:
    - Likely to occur:
        - Carnaby's Black-Cockatoo (*Calyptorhynchus latirostris*) – Endangered
        - Baudin's Black-Cockatoo (*Calyptorhynchus baudinii*) – Endangered
        - Quenda (*Isoodon fusciventer*) – Priority 4
        - Blue-billed Duck (*Oxyura australis*) – Priority 4
        - Rainbow Bee-eater (*Merops ornatus*) – Marine.
    - May potentially occur:
        - Pacific Swift (*Apus pacificus*) – Marine/Migratory.
- The study area was found to support three key fauna habitats (Paperbark/Wetland/Shrubland, Parkland with sparse trees and Dams/Streams), plus open pasture, which is considered to provide little, if any habitat value for native vertebrate fauna.
- The following Black-Cockatoo habitat is provided by the study area:
    - Foraging habitat:
        - 0.60 ha (1.38% of the study area) of 'High' (6) quality foraging habitat for Carnaby's Black-Cockatoos and Baudin's Black-Cockatoos, 'Moderate to High' (5) quality foraging habitat for Forest Red-tailed Black-Cockatoos, and 'Low to Moderate' (4) quality foraging habitat for Baudin's Black-Cockatoo, within Cc (P), CcEm (P) and PpXp (P)
        - 0.30 ha (0.67% of the study area) of 'Moderate to High' (5) quality foraging habitat for Carnaby's Black-Cockatoos and Baudin's Black-Cockatoos and 'Moderate' (4) quality foraging habitat for Forest Red-tailed Black-Cockatoos, within CcEmEuc (P) and CcEuc (P)
        - 0.61 ha (1.37% of the study area) of 'Low to Moderate' (4) quality foraging habitat for Forest Red-tailed Black-Cockatoos, within Af (P)
        - 42.73 ha (96.59%) of the study area recorded a Black-Cockatoo foraging habitat quality score of 3 'Low to Moderate' or lower, with 39.46 ha (89.20% of the study area) of this providing zero foraging habitat for any species of Black-Cockatoo.

- Breeding habitat:
  - Twenty-six suitable trees of adequate DBH were recorded, comprising:
    - five trees with potentially suitable hollows, but with no evidence of Black-Cockatoo use
    - four trees with unsuitable hollows for Black-Cockatoo breeding
    - 17 trees without hollows, but with adequate DBH to potentially provide suitable Black-Cockatoo breeding hollows in the future.
- Roosting habitat:
  - None known or confirmed within the survey area, however, the large trees present may potentially provide suitable roosting habitat, although this is considered unlikely, since the location and extent of Black-Cockatoo roost sites in the Perth region is well understood and the birds are site faithful, so 'new' roosts are rare.

The following recommendations are suggested for the proposed future development of the study area:

- Design the development in a way that where possible, avoids the clearing of remnant native vegetation, including isolated trees, especially those that provide better-quality foraging, potential breeding and potential roosting habitat for Black-Cockatoos.
- If clearing avoidance of potential Black-Cockatoo breeding trees is not possible, carry out follow-up inspections of potentially suitable breeding hollows, via camera pole or other suitable means.
- Prepare and implement a weed hygiene plan for clearing and earthworks that manages the potential spread of Declared Pest plants, Arum Lily and Cape Tulip and other weeds present on site.

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APPENDIX A - DBCA NATUREMAP SEARCH REPORT

NatureMap
Mapping Western Australia's biodiversity

NatureMap Species Report

Created By Guest user on 06/12/2021

Current Names Only Yes
Core Datasets Only Yes
Method 'By Circle'
Centre 115° 57' 16" E,32° 22' 09" S
Buffer 5km

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
1.		*? ?*			
2.	15429	*Acacia alata var. alata*			
3.	3294	*Acacia dentifera*			
4.	3373	*Acacia horridula*		P3	
5.	3382	*Acacia incrassata*			
6.	3383	*Acacia incurva*			
7.	3410	*Acacia lateriticola*			
8.	3454	*Acacia nervosa (Rib Wattle)*			
9.	3464	*Acacia obovata*			
10.	14129	*Acacia oncinophylla subsp. oncinophylla*		P3	
11.	3502	*Acacia pulchella (Prickly Moses)*			
12.	15483	*Acacia pulchella var. pulchella*			
13.	3541	*Acacia sessilis*			
14.	3557	*Acacia stenoptera (Narrow Winged Wattle)*			
15.	3574	*Acacia teretifolia*			
16.	3591	*Acacia urophylla*			
17.	24260	*Acanthiza apicalis (Broad-tailed Thornbill, Inland Thornbill)*			
18.	24261	*Acanthiza chrysorrhoa (Yellow-rumped Thornbill)*			
19.	24262	*Acanthiza inornata (Western Thornbill)*			
20.	1205	*Acanthocarpus canaliculatus*			
21.	1208	*Acanthocarpus preissii*			
22.	24560	*Acanthorhynchus superciliosus (Western Spinebill)*			
23.	25536	*Accipiter fasciatus (Brown Goshawk)*			
24.	25755	*Acrocephalus australis (Australian Reed Warbler)*			
25.	6205	*Actinotus leucocephalus (Flannel Flower)*			
26.	14970	*Adenanthos barbiger*			
27.	1790	*Adenanthos meisneri*			
28.	23474	*Agrostocrinum hirsutum*			
29.	1261	*Agrostocrinum scabrum (Blue Grass Lily)*			
30.	184	*Aira caryophyllea (Silvery Hairgrass)*	Y		
31.	1731	*Allocasuarina huegeliana (Rock Sheoak, Kwowl)*			
32.	1732	*Allocasuarina humilis (Dwarf Sheoak)*			
33.		*Allothereua maculata*			
34.	13380	*Amphibromus nervosus*			
35.	197	*Amphipogon debilis*			
36.	20184	*Amphipogon laguroides subsp. laguroides*			
37.	199	*Amphipogon strictus (Greybeard Grass)*			
38.	200	*Amphipogon turbinatus*			
39.		*Aname mainae*			
40.	24312	*Anas gracilis (Grey Teal)*			
41.	24315	*Anas rhynchotis (Australasian Shoveler)*			
42.	24316	*Anas superciliosa (Pacific Black Duck)*			
43.	6300	*Andersonia aristata (Rice Flower)*			
44.	6314	*Andersonia lehmanniana*			
45.	7833	*Angianthus preissianus*			
46.	1411	*Anigozanthos manglesii (Mangles Kangaroo Paw, Kurulbrang)*			
47.	1416	*Anigozanthos viridis (Green Kangaroo Paw, Kurulbardang)*			
48.	11566	*Anigozanthos viridis subsp. viridis*			
49.	24561	*Anthochaera carunculata (Red Wattlebird)*			
50.	24562	*Anthochaera lunulata (Western Little Wattlebird)*			
51.	12724	*Anthotium junciforme*			
52.	3688	*Aotus gracillima*			
53.	24285	*Aquila audax (Wedge-tailed Eagle)*			

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54.		*Arachnura higginsi*			
55.		*Araneus senicaudatus*			
56.	24340	*Ardea novaehollandiae (White-faced Heron)*			
57.	25566	*Artamus cinereus (Black-faced Woodswallow)*			
58.	24353	*Artamus cyanopterus (Dusky Woodswallow)*			
59.	20350	*Astartea affinis (West-coast Astartea)*			
60.	20249	*Astartea leptophylla (River-bank Astartea)*			
61.	6323	*Astroloma ciliatum (Candle Cranberry)*			
62.	6334	*Astroloma pallidum (Kick Bush)*			
63.		*Australotiphys barmutai*			
64.	17233	*Austrostipa campylachne*			
65.	17234	*Austrostipa compressa*			
66.	233	*Avena barbata (Bearded Oat)*	Y		
67.	24318	*Aythya australis (Hardhead)*			
68.	36441	*Babingtonia camphorosmae (Camphor Myrtle)*			
69.	1800	*Banksia attenuata (Slender Banksia, Piara)*			
70.	1852	*Banksia telmatiaea (Swamp Fox Banksia)*			
71.	32054	*Banksia undata var. undata*			
72.		*Barnardius zonarius*			
73.	745	*Baumea preissii*			
74.	1417	*Blancoa canescens (Winter Bell)*			
75.	11503	*Boronia crenulata subsp. crenulata var. crenulata*			
76.	11564	*Boronia ramosa subsp. ramosa*			
77.	1273	*Borya sphaerocephala (Pincushions)*			
78.	48782	*Bossiaea angustifolia*			
79.	3710	*Bossiaea eriocarpa (Common Brown Pea)*			
80.	3714	*Bossiaea ornata (Broad Leaved Brown Pea)*			
81.	3718	*Bossiaea rufa*			
82.		*Bostockia porosa*			
83.	8661	*Brachypodium distachyon (False Brome)*	Y		
84.	7871	*Brachyscome ciliaris*			
85.	244	*Briza maxima (Blowfly Grass)*	Y		
86.	245	*Briza minor (Shivery Grass)*	Y		
87.	250	*Bromus hordeaceus (Soft Brome)*	Y		
88.	12770	*Burchardia congesta*			
89.	1385	*Burchardia multiflora (Dwarf Burchardia)*			
90.	25716	*Cacatua sanguinea (Little Corella)*			
91.	25598	*Cacomantis flabelliformis (Fan-tailed Cuckoo)*			
92.	42307	*Cacomantis pallidus (Pallid Cuckoo)*			
93.	1276	*Caesia micrantha (Pale Grass Lily)*			
94.	1277	*Caesia occidentalis*			
95.	1590	*Caladenia ferruginea (Rusty Spider Orchid)*			
96.	1592	*Caladenia flava (Cowslip Orchid)*			
97.	1596	*Caladenia huegelii (Grand Spider Orchid)*		T	
98.	16365	*Calandrinia sp. Kenwick (G.J. Keighery 10905)*			
99.	1214	*Calectasia grandiflora (Blue Tinsel Lily)*			
100.	4717	*Callitriche stagnalis (Common Starwort)*	Y		
101.	36600	*Callitris pyramidalis (Swamp Cypress)*			
102.	5431	*Calothamnus torulosus*			
103.	25717	*Calyptorhynchus banksii (Red-tailed Black-Cockatoo)*			
104.	24731	*Calyptorhynchus banksii subsp. naso (Forest Red-tailed Black Cockatoo)*		T	
105.	24733	*Calyptorhynchus baudinii (Baudin's Cockatoo, White-tailed Long-billed Black Cockatoo)*		T	
106.	24734	*Calyptorhynchus latirostris (Carnaby's Cockatoo, White-tailed Short-billed Black Cockatoo)*		T	
107.	48400	*Calyptorhynchus sp. (white-tailed black cockatoo)*		T	
108.	5437	*Calytrix acutifolia*			
109.	2952	*Cassytha glabella (Tangled Dodder Laurel)*			
110.	2956	*Cassytha pomiformis (Dodder Laurel)*			
111.	6539	*Centaurium erythraea (Common Centaury)*	Y		
112.	1121	*Centrolepis aristata (Pointed Centrolepis)*			
113.	1134	*Centrolepis polygyna (Wiry Centrolepis)*			
114.		*Cercophonius sulcatus*			
115.	1280	*Chamaescilla corymbosa (Blue Squill)*			
116.	31	*Cheilanthes austrotenuifolia*			
117.	24321	*Chenonetta jubata (Australian Wood Duck, Wood Duck)*			
118.	33939	*Cherax cainii (Marron)*			
119.		*Cherax destructor*			
120.		*Cherax quinquecarinatus*			
121.	8971	*Chorizema cordatum*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
122.	3753	*Chorizema dicksonii (Yellow-eyed Flame Pea)*			
123.	41264	*Chrysothrix xanthina*			
124.	27688	*Cladonia ochrochlora*			
125.	25675	*Colluricincla harmonica (Grey Shrike-thrush)*			
126.	24399	*Columba livia (Domestic Pigeon)*	Y		
127.	4551	*Comesperma ciliatum*			
128.	4564	*Comesperma virgatum (Milkwort)*			
129.	1875	*Conospermum huegelii (Slender Smokebush)*			
130.	15611	*Conospermum stoechadis subsp. stoechadis (Common Smokebush)*			
131.	6349	*Conostephium preissii*			
132.	12109	*Conostylis aculeata subsp. preissii*			
133.	1454	*Conostylis setigera (Bristly Cottonhead)*			
134.	1455	*Conostylis setosa (White Cottonhead)*			
135.	25568	*Coracina novaehollandiae (Black-faced Cuckoo-shrike)*			
136.		*Cormocephalus aurantiipes*			
137.		*Cormocephalus turneri*			
138.	38874	*Cortinarius globuliformis*			
139.	25592	*Corvus coronoides (Australian Raven)*			
140.	17104	*Corymbia calophylla (Marri)*			
141.	7947	*Cotula turbinata (Funnel Weed)*	Y		
142.	25595	*Cracticus tibicen (Australian Magpie)*			
143.	24422	*Cracticus tibicen subsp. dorsalis (White-backed Magpie)*			
144.	25596	*Cracticus torquatus (Grey Butcherbird)*			
145.	13354	*Craspedia variabilis*			
146.	25398	*Crinia georgiana (Quacking Frog)*			
147.	25401	*Crinia pseudinsignifera (Bleating Froglet)*			
148.	35838	*Cristonia biloba subsp. biloba*			
149.	30893	*Cryptoblepharus buchananii*			
150.	24883	*Ctenophorus ornatus (Ornate Crevice-Dragon)*			
151.	25049	*Ctenotus labillardieri*			
152.	6663	*Cuscuta epithymum (Lesser Dodder, Greater Dodder)*	Y		
153.	768	*Cyathochaeta avenacea*			
154.	24322	*Cygnus atratus (Black Swan)*			
155.	815	*Cyperus tenellus (Tiny Flatsedge)*	Y		
156.	17692	*Cytogonidium leptocarpoides*			
157.	30901	*Dacelo novaeguineae (Laughing Kookaburra)*	Y		
158.	7420	*Dampiera alata (Winged-stem Dampiera)*			
159.	7454	*Dampiera linearis (Common Dampiera)*			
160.	25673	*Daphoenositta chrysoptera (Varied Sittella)*			
161.	5508	*Darwinia citriodora (Lemon-scented Darwinia)*			
162.	5531	*Darwinia thymoides*			
163.	1218	*Dasypogon bromeliifolius (Pineapple Bush)*			
164.	24092	*Dasyurus geoffroii (Chuditch, Western Quoll)*		T	
165.	6960	*Datura ferox (Fierce Thornapple)*	Y		
166.	6218	*Daucus glochidiatus (Australian Carrot)*			
167.	15656	*Daviesia brachyphylla*			
168.	3799	*Daviesia cordata (Bookleaf)*			
169.	16579	*Daviesia decipiens*			
170.	3815	*Daviesia horrida (Prickly Bitter-pea)*			
171.	3835	*Daviesia preissii*			
172.	15831	*Desmocladus castaneus*			
173.	17691	*Desmocladus fasciculatus*			
174.	11636	*Dianella revoluta var. divaricata*			
175.	306	*Dichelachne crinita (Longhair Plumegrass)*			
176.	1287	*Dichopogon capillipes*			
177.	17838	*Dielsia stenostachya*			
178.		*Dinocambala ingens*			
179.	1509	*Dioscorea hastifolia (Warrine, Wararn)*			
180.	24939	*Diplodactylus polyophthalmus*			
181.	18589	*Diplopeltis huegelii subsp. lehmannii*			
182.	12943	*Diuris brumalis*			
183.	4757	*Dodonaea ceratocarpa*			
184.	48751	*Drosera drummondii*			
185.	3095	*Drosera erythrorhiza (Red Ink Sundew)*			
186.	3106	*Drosera macrantha (Bridal Rainbow)*			
187.	3109	*Drosera menziesii (Pink Rainbow)*			
188.	3115	*Drosera occidentalis (Western Sundew)*		P4	
189.	8911	*Drosera rosulata*			
190.	49090	*Drosera sp. Branched styles (S.C. Coffey 193)*			
191.	3131	*Drosera stolonifera (Leafy Sundew)*			

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192.	25096	*Egernia kingii (King's Skink)*			
193.		*Egretta novaehollandiae*			
194.	349	*Ehrharta longiflora (Annual Veldt Grass)*	Y		
195.	25250	*Elapognathus coronatus (Crowned Snake)*			
196.	47937	*Elseyornis melanops (Black-fronted Dotterel)*			
197.	1643	*Elythranthera brunonis (Purple Enamel Orchid)*			
198.		*Eolophus roseicapillus*			
199.	24652	*Eopsaltria georgiana (White-breasted Robin)*			
200.	379	*Eragrostis elongata (Clustered Lovegrass)*			
201.	41801	*Eryngium pinnatifidum subsp. Palustre (G.J. Keighery 13459)*		P3	
202.	5616	*Eucalyptus decurva (Slender Mallee)*			
203.	5659	*Eucalyptus gomphocephala (Tuart, Duart)*			
204.	5688	*Eucalyptus laeliae (Darling Range Ghost Gum)*			
205.	5690	*Eucalyptus lane-poolei (Salmon White Gum)*			
206.	5708	*Eucalyptus marginata (Jarrah, Djara)*			
207.	13547	*Eucalyptus marginata subsp. marginata (Jarrah)*			
208.	5797	*Eucalyptus wandoo (Wandoo, Wondu)*			
209.	12906	*Eucalyptus wandoo subsp. wandoo*			
210.	3872	*Euchilopsis linearis (Swamp Pea)*			
211.		*Eucyrtops latior*			
212.	48579	*Euoplos inornatus (inornate trapdoor spider (northern Jarrah Forest))*		P3	
213.	4627	*Euphorbia helioscopia (Sun Spurge)*	Y		
214.	4648	*Euphorbia terracina (Geraldton Carnation Weed)*	Y		
215.	3880	*Eutaxia virgata*			
216.	25621	*Falco berigora (Brown Falcon)*			
217.	25622	*Falco cenchroides (Australian Kestrel, Nankeen Kestrel)*			
218.	25623	*Falco longipennis (Australian Hobby)*			
219.	25624	*Falco peregrinus (Peregrine Falcon)*		S	
220.	27746	*Flavoparmelia marchantii*			
221.	25727	*Fulica atra (Eurasian Coot)*			
222.	24761	*Fulica atra subsp. australis (Eurasian Coot)*			
223.	2969	*Fumaria capreolata (Whiteflower Fumitory)*	Y		
224.	31532	*Fumaria muralis subsp. muralis*	Y		
225.	34028	*Galaxias occidentalis (Western Minnow)*			
226.	7321	*Galium divaricatum*	Y		
227.	7323	*Galium murale (Small Goosegrass)*	Y		
228.	24763	*Gallinula tenebrosa subsp. tenebrosa (Dusky Moorhen)*			
229.	20513	*Gastrolobium dilatatum*			
230.	20473	*Gastrolobium ebracteolatum*			
231.	25404	*Geocrinia leai (Ticking Frog)*			
232.	25530	*Gerygone fusca (Western Gerygone)*			
233.	12624	*Gnephosis angianthoides*			
234.	3945	*Gompholobium aristatum*			
235.	10909	*Gompholobium confertum*			
236.	3950	*Gompholobium knightianum*			
237.	3951	*Gompholobium marginatum*			
238.	3954	*Gompholobium polymorphum*			
239.	29362	*Goodenia coerulea*			
240.	24443	*Grallina cyanoleuca (Magpie-lark)*			
241.	1964	*Grevillea bipinnatifida (Fuchsia Grevillea)*			
242.	19628	*Grevillea bipinnatifida subsp. bipinnatifida*			
243.	13429	*Grevillea diversifolia subsp. diversifolia*			
244.	1997	*Grevillea endlicheriana (Spindly Grevillea)*			
245.	2066	*Grevillea pilulifera (Woolly-flowered Grevillea)*			
246.	2122	*Grevillea wilsonii (Native Fuchsia)*			
247.	1465	*Haemodorum discolor*			
248.	1468	*Haemodorum laxum*			
249.	1472	*Haemodorum simplex*			
250.	1474	*Haemodorum sparsiflorum*			
251.	2137	*Hakea ceratophylla (Horned Leaf Hakea)*			
252.	2152	*Hakea cyclocarpa (Ramshorn)*			
253.	2166	*Hakea incrassata (Marble Hakea)*			
254.	2175	*Hakea lissocarpha (Honey Bush)*			
255.	2203	*Hakea ruscifolia (Candle Hakea)*			
256.	2206	*Hakea stenocarpa (Narrow-fruited Hakea)*			
257.	2212	*Hakea sulcata (Furrowed Hakea)*			
258.	2214	*Hakea trifurcata (Two-leaf Hakea)*			
259.	2215	*Hakea undulata (Wavy-leaved Hakea)*			
260.	32392	*Hedwigidium integrifolium*			
261.	25115	*Hemiergis initialis subsp. initialis*			

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262.	6856	*Hemigenia incana (Silky Hemigenia)*			
263.		*Henicops dentatus*			
264.	1293	*Hensmania turbinata*			
265.	5108	*Hibbertia acerosa (Needle Leaved Guinea Flower)*			
266.	5114	*Hibbertia commutata*			
267.	5135	*Hibbertia hypericoides (Yellow Buttercups)*			
268.	5148	*Hibbertia mylnei*			
269.	5150	*Hibbertia nymphaea*			
270.	5155	*Hibbertia pilosa (Hairy Guinea Flower)*			
271.	5169	*Hibbertia serrata (Serrate Leaved Guinea Flower)*			
272.	11481	*Hibbertia spicata subsp. spicata*			
273.	5173	*Hibbertia subvaginata*			
274.	47965	*Hieraaetus morphnoides (Little Eagle)*			
275.	24491	*Hirundo neoxena (Welcome Swallow)*			
276.	6222	*Homalosciadium homalocarpum*			
277.	3964	*Hovea chorizemifolia (Holly-leaved Hovea)*			
278.	3966	*Hovea pungens (Devil's Pins, Puyenak)*			
279.	3968	*Hovea trisperma (Common Hovea)*			
280.	12741	*Hyalosperma cotula*			
281.	12007	*Hybanthus floribundus subsp. floribundus*			
282.	6226	*Hydrocotyle callicarpa (Small Pennywort)*			
283.	24215	*Hydromys chrysogaster (Water-rat, Rakali)*		P4	
284.	5817	*Hypocalymma angustifolium (White Myrtle, Kudjid)*			
285.	8086	*Hypochaeris glabra (Smooth Catsear)*	Y		
286.	1070	*Hypolaena exsulca*			
287.		*Idiommata blackwalli*			
288.	20200	*Isolepis cernua var. setiformis*			
289.	917	*Isolepis marginata (Coarse Club-rush)*			
290.	919	*Isolepis oldfieldiana*			
291.		*Isometroides vescus*			
292.	48588	*Isoodon fusciventer (Quenda, southwestern brown bandicoot)*		P4	
293.		*Isopeda leishmanni*			
294.	2221	*Isopogon asper*			
295.	29775	*Isopogon drummondii*		P3	
296.	7396	*Isotoma hypocrateriformis (Woodbridge Poison)*			
297.	4018	*Jacksonia lehmannii*			
298.	4025	*Jacksonia restioides*			
299.	19272	*Johnsonia pubescens subsp. cygnorum*		P2	
300.	1180	*Juncus capitatus (Capitate Rush)*	Y		
301.	11922	*Juncus kraussii subsp. australiensis*			
302.	1195	*Juncus subsecundus (Finger Rush)*			
303.	1196	*Juncus usitatus (Common Rush)*	Y		
304.		*Karaops ellenae*			
305.	4037	*Kennedia coccinea (Coral Vine)*			
306.	4045	*Kennedia stirlingii (Bushy Kennedia)*			
307.	1221	*Kingia australis (Kingia, Pulonok)*			
308.	5835	*Kunzea micrantha*			
309.	17785	*Kunzea micrantha subsp. petiolata*			
310.	11289	*Labichea lanceolata subsp. lanceolata*			
311.	14083	*Lambertia multiflora var. darlingensis*			
312.	24511	*Larus novaehollandiae subsp. novaehollandiae (Silver Gull)*			
313.	17000	*Lasiopetalum pterocarpum*		T	
314.		*Latrodectus hasseltii*			
315.	11911	*Laxmannia ramosa subsp. ramosa*			
316.	1309	*Laxmannia squarrosa*			
317.	7568	*Lechenaultia biloba (Blue Leschenaultia)*			
318.	936	*Lepidosperma leptostachyum*			
319.	940	*Lepidosperma pubisquameum*			
320.	29141	*Lepidosperma sp. Gosnells (A. Markey 1145)*			
321.	29150	*Lepidosperma sp. Margaret River (B.J. Lepschi 1841)*			
322.	949	*Lepidosperma tuberculatum*			
323.	46375	*Leptocarpus decipiens*			
324.	2342	*Leptomeria cunninghamii*			
325.	6367	*Leucopogon capitellatus*			
326.	6436	*Leucopogon propinquus*			
327.	6439	*Leucopogon pulchellus (Beard-heath)*			
328.	7676	*Levenhookia pusilla (Midget Stylewort)*			
329.	7677	*Levenhookia stipitata (Common Stylewort)*			
330.	25661	*Lichmera indistincta (Brown Honeyeater)*			
331.	4363	*Linum trigynum (French Flax)*	Y		

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332.	9289	*Lobelia anceps (Angled Lobelia)*			
333.	7402	*Lobelia gibbosa (Tall Lobelia)*			
334.	7403	*Lobelia heterophylla (Wing-seeded Lobelia)*			
335.	478	*Lolium rigidum (Wimmera Ryegrass)*	Y		
336.	1222	*Lomandra brittanii*			
337.	1223	*Lomandra caespitosa (Tufted Mat Rush)*			
338.	1228	*Lomandra hermaphrodita*			
339.	1232	*Lomandra micrantha (Small-flower Mat-rush)*			
340.	14542	*Lomandra micrantha subsp. micrantha*			
341.	1234	*Lomandra nigricans*			
342.	1239	*Lomandra preissii*			
343.	1243	*Lomandra sericea (Silky Mat Rush)*			
344.	1244	*Lomandra sonderi*			
345.	4059	*Lotus angustissimus (Narrowleaf Trefoil)*	Y		
346.	8564	*Lotus subbiflorus*	Y		
347.	85	*Macrozamia riedlei (Zamia, Djiridji)*			
348.	25650	*Malurus elegans (Red-winged Fairy-wren)*			
349.	25654	*Malurus splendens (Splendid Fairy-wren)*			
350.	17636	*Marianthus coeruleopunctatus (Blue-spotted Marianthus)*			
351.	17630	*Marianthus tenuis*			
352.	18394	*Melaleuca parviceps*			
353.	5958	*Melaleuca radula (Graceful Honeymyrtle)*			
354.	5964	*Melaleuca seriata*			
355.	5983	*Melaleuca trichophylla*			
356.	13280	*Melaleuca viminea subsp. viminea*			
357.	24598	*Merops ornatus (Rainbow Bee-eater)*			
358.	955	*Mesomelaena pseudostygia*			
359.	11473	*Mesomelaena stygia subsp. stygia*			
360.	957	*Mesomelaena tetragona (Semaphore Sedge)*			
361.		*Microcarbo melanoleucos*			
362.	485	*Microlaena stipoides (Weeping Grass)*			
363.	11747	*Microlaena stipoides var. stipoides*			
364.	14344	*Millotia tenuifolia var. tenuifolia (Soft Millotia)*			
365.	4090	*Mirbelia dilatata (Holly-leaved Mirbelia)*			
366.	4091	*Mirbelia floribunda (Purple Mirbelia)*			
367.	4100	*Mirbelia spinosa*			
368.		*Nannoperca vittata*			
369.	24738	*Neophema elegans (Elegant Parrot)*			
370.		*Neosilurus hyrtlii*			
371.	492	*Neurachne alopecuroidea (Foxtail Mulga Grass)*			
372.	25252	*Notechis scutatus (Tiger Snake)*			
373.		*Nunciella aspera*			
374.	25564	*Nycticorax caledonicus (Rufous Night Heron)*			
375.		*Occiperipatoides gilesii*			
376.	24407	*Ocyphaps lophotes (Crested Pigeon)*			
377.	2365	*Olax benthamiana*			
378.	8143	*Olearia paucidentata (Autumn Scrub Daisy)*			
379.	38816	*Omphalotus nidiformis*			
380.	18254	*Opercularia apiciflora*			
381.	18255	*Opercularia vaginata (Dog Weed)*			
382.	11749	*Orthrosanthus laxus var. laxus (Morning Iris)*			
383.	24085	*Oryctolagus cuniculus (Rabbit)*	Y		
384.	4349	*Oxalis corniculata (Yellow Wood Sorrel)*	Y		
385.	4355	*Oxalis perennans*			
386.	25680	*Pachycephala rufiventris (Rufous Whistler)*			
387.	25253	*Parasuta gouldii*			
388.	25681	*Pardalotus punctatus (Spotted Pardalote)*			
389.	25682	*Pardalotus striatus (Striated Pardalote)*			
390.	7089	*Parentucellia latifolia (Common Bartsia)*	Y		
391.	27922	*Parmotrema chinense*			
392.	30458	*Parmotrema reticulatum*			
393.	6573	*Parsonsia diaphanophleba*		P4	
394.	1542	*Patersonia babianoides*			
395.	1550	*Patersonia occidentalis (Purple Flag, Koma)*			
396.	1551	*Patersonia pygmaea (Pygmy Patersonia)*			
397.	11550	*Patersonia umbrosa var. xanthina (Yellow Flags)*			
398.	24648	*Pelecanus conspicillatus (Australian Pelican)*			
399.	39058	*Perichaena depressa*			
400.	2273	*Persoonia saccata (Snottygobble)*			
401.	48061	*Petrochelidon nigricans (Tree Martin)*			

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402.	48066	*Petroica boodang (Scarlet Robin)*			
403.	2284	*Petrophile biloba (Granite Petrophile)*			
404.	2312	*Petrophile striata*			
405.	25698	*Phalacrocorax melanoleucos (Little Pied Cormorant)*			
406.	24667	*Phalacrocorax sulcirostris (Little Black Cormorant)*			
407.	24409	*Phaps chalcoptera (Common Bronzewing)*			
408.	48070	*Phascogale tapoatafa subsp. wambenger (South-western Brush-tailed Phascogale, Wambenger)*		S	
409.	18529	*Philotheca spicata (Pepper and Salt)*			
410.	1173	*Philydrella pygmaea (Butterfly Flowers)*			
411.	48071	*Phylidonyris niger (White-cheeked Honeyeater)*			
412.	24596	*Phylidonyris novaehollandiae (New Holland Honeyeater)*			
413.	4675	*Phyllanthus calycinus (False Boronia)*			
414.		*Phytophthora cinnamomi*			
415.	11667	*Pimelea brevistyla subsp. brevistyla*			
416.	5251	*Pimelea imbricata*			
417.	11402	*Pimelea imbricata var. piligera*			
418.	12041	*Pimelea suaveolens subsp. suaveolens*			
419.	8165	*Pithocarpa pulchella (Beautiful Pithocarpa)*			
420.	24841	*Platalea flavipes (Yellow-billed Spoonbill)*			
421.	25721	*Platycercus zonarius (Australian Ringneck, Ring-necked Parrot)*			
422.	6253	*Platysace filiformis*			
423.	573	*Poa drummondiana (Knotted Poa)*			
424.	8175	*Podolepis gracilis (Slender Podolepis)*			
425.	2419	*Polygonum aviculare (Wireweed)*	Y		
426.	25722	*Polytelis anthopeplus (Regent Parrot)*			
427.	4691	*Poranthera microphylla (Small Poranthera)*			
428.	24767	*Porphyrio porphyrio subsp. bellus (Purple Swamphen)*			
429.	1677	*Prasophyllum macrostachyum (Laughing Leek Orchid)*			
430.	25259	*Pseudonaja affinis subsp. affinis (Dugite)*			
431.	25433	*Pseudophryne guentheri (Crawling Toadlet)*			
432.	13255	*Pterochaeta paniculata*			
433.	24173	*Pteropus scapulatus (Little Red Flying-fox)*			
434.		*Purpureicephalus spurius*			
435.	6012	*Regelia ciliata*			
436.	48096	*Rhipidura albiscapa (Grey Fantail)*			
437.	25614	*Rhipidura leucophrys (Willie Wagtail)*			
438.	15035	*Rhodanthe corymbosa*			
439.	13234	*Rhodanthe manglesii*			
440.	1556	*Romulea rosea (Guildford Grass)*	Y		
441.	20506	*Rubus anglocandicans*	Y		
442.	23990	*Rubus ulmifolius var. ulmifolius*	Y		
443.	2433	*Rumex crispus (Curled Dock)*	Y		
444.	7602	*Scaevola calliptera*			
445.	7613	*Scaevola glandulifera (Viscid Hand-flower)*			
446.	6263	*Schoenolaena juncea*			
447.	978	*Schoenus brevisetis*			
448.	979	*Schoenus caespititius*			
449.	991	*Schoenus grammatophyllus*			
450.	1002	*Schoenus nanus (Tiny Bog Rush)*			
451.	17614	*Schoenus plumosus*			
452.	1013	*Schoenus sculptus (Gimlet Bog-rush)*			
453.	18164	*Schoenus sp. smooth culms (K.R. Newbey 7823)*			
454.	1023	*Schoenus tenellus*			
455.	1026	*Schoenus unispiculatus*			
456.	17409	*Schoenus variicellae*			
457.		*Scolopendra laeta*			
458.	8212	*Senecio leucoglossus*		P4	
459.	25534	*Sericornis frontalis (White-browed Scrubwren)*			
460.	8225	*Siloxerus humifusus (Procumbent Siloxerus)*			
461.	30948	*Smicrornis brevirostris (Weebill)*			
462.	8231	*Sonchus oleraceus (Common Sowthistle)*	Y		
463.	617	*Sorghum halepense (Johnson Grass)*	Y		
464.	1312	*Sowerbaea laxiflora (Purple Tassels)*			
465.	4207	*Sphaerolobium medium*			
466.	41623	*Sphaeromorphaea australis*	Y		
467.	4716	*Stachystemon vermicularis*			
468.	4733	*Stackhousia monogyna*			
469.	24645	*Stagonopleura oculata (Red-eared Firetail)*			
470.	39083	*Stemonitis fusca*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
471.	2316	*Stirlingia latifolia (Blueboy)*			
472.	25589	*Streptopelia chinensis (Spotted Turtle-Dove)*	Y		
473.	25590	*Streptopelia senegalensis (Laughing Turtle-Dove)*	Y		
474.	7693	*Stylidium brunonianum (Pink Fountain Triggerplant)*			
475.	7694	*Stylidium bulbiferum (Circus Triggerplant)*			
476.	7696	*Stylidium calcaratum (Book Triggerplant)*			
477.	7699	*Stylidium carnosum (Fleshy-leaved Triggerplant)*			
478.	7719	*Stylidium ecorne (Foot Triggerplant)*			
479.	7721	*Stylidium emarginatum (Biddy-four-legs)*			
480.	7736	*Stylidium hispidum (White Butterfly Triggerplant)*			
481.	7783	*Stylidium pycnostachyum (Downy Triggerplant)*			
482.	33106	*Stylidium recurvum*			
483.	7790	*Stylidium roseoalatum (Pink-wing Triggerplant)*			
484.	45594	*Stylidium tenue subsp. majusculum (Showy Fountain Triggerplant)*			
485.	23511	*Stylidium thesioides (Delicate Triggerplant)*			
486.	7806	*Stylidium utricularioides (Pink Fan Triggerplant)*			
487.	1260	*Stypandra glauca (Blind Grass)*			
488.	6476	*Styphelia tenuiflora (Common Pinheath)*			
489.	2323	*Synaphea gracillima*			
490.	16865	*Synaphea odocoileops*		P1	
491.	2324	*Synaphea petiolaris (Synaphea)*			
492.	18590	*Synaphea sp. Fairbridge Farm (D. Papenfus 696)*		T	
493.	30751	*Synaphea sp. Pinjarra Plain (A.S. George 17182)*		T	
494.	28354	*Synaphea sp. Serpentine (G.R. Brand 103)*		T	
495.	15532	*Synaphea spinulosa subsp. spinulosa*			
496.		*Synsphyronus mimulus*			
497.	25705	*Tachybaptus novaehollandiae (Australasian Grebe, Black-throated Grebe)*			
498.	24682	*Tachybaptus novaehollandiae subsp. novaehollandiae (Australasian Grebe, Black-throated Grebe)*			
499.	24331	*Tadorna tadornoides (Australian Shelduck, Mountain Duck)*			
500.		*Tandanus bostocki*			
501.	24167	*Tarsipes rostratus (Honey Possum, Noolbenger)*			
502.	20135	*Taxandria linearifolia*			
503.		*Tetragnatha maeandrata*			Y
504.	1033	*Tetraria australiensis*		T	
505.	1034	*Tetraria capillaris (Hair Sedge)*			
506.	1036	*Tetraria octandra*			
507.	667	*Tetrarrhena laevis (Forest Ricegrass)*			
508.	48342	*Tetratheca hirsuta subsp. hirsuta*			
509.	48341	*Tetratheca hirsuta subsp. viminea*			
510.	4536	*Tetratheca hispidissima*			
511.	4537	*Tetratheca nuda*			
512.	1705	*Thelymitra crinita (Blue Lady Orchid)*			
513.	1707	*Thelymitra flexuosa (Twisted Sun Orchid)*			
514.	11053	*Thelymitra macrophylla*			
515.	1715	*Thelymitra spiralis (Curlylocks)*			
516.	5080	*Thomasia foliosa*			
517.	24845	*Threskiornis spinicollis (Straw-necked Ibis)*			
518.	1328	*Thysanotus dichotomus (Branching Fringe Lily)*			
519.	1338	*Thysanotus manglesianus (Fringed Lily)*			
520.	1351	*Thysanotus sparteus*			
521.	1354	*Thysanotus tenellus*			
522.	1357	*Thysanotus thyrsoideus*			
523.	1358	*Thysanotus triandrus*			
524.	25519	*Tiliqua rugosa*			
525.	25207	*Tiliqua rugosa subsp. rugosa*			
526.	25549	*Todiramphus sanctus (Sacred Kingfisher)*			
527.	8248	*Tolpis barbata (Yellow Hawkweed)*	Y		
528.	19041	*Trachymene coerulea subsp. coerulea*			
529.	6280	*Trachymene pilosa (Native Parsnip)*			
530.	1482	*Tribonanthes brachypetala (Nodding Tiurndin)*			
531.	39098	*Trichia favoginea*			
532.	25521	*Trichosurus vulpecula (Common Brushtail Possum)*			
533.	24158	*Trichosurus vulpecula subsp. vulpecula (Common Brushtail Possum)*			
534.	1361	*Tricoryne elatior (Yellow Autumn Lily)*			
535.	4292	*Trifolium campestre (Hop Clover)*	Y		
536.	4304	*Trifolium ornithopodioides (Birdsfoot Fenugreek)*	Y		
537.	4737	*Tripterococcus brunonis (Winged Stackhousia)*			
538.	13479	*Trymalium ledifolium var. rosmarinifolium*			
539.	33418	*Trymalium odoratissimum subsp. odoratissimum*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
540.	24983	*Underwoodisaurus milii (Barking Gecko)*			
541.		*Urodacus novaehollandiae*			
542.		*Urodacus planimanus*			
543.		*Uromycladium tepperianum*			
544.	8255	*Ursinia anthemoides (Ursinia)*	Y		
545.	12411	*Verticordia densiflora var. cespitosa*			
546.	14714	*Verticordia lindleyi subsp. lindleyi*		P4	
547.	6107	*Verticordia pennigera*			
548.	12448	*Verticordia plumosa var. ananeotes*		T	
549.	12449	*Verticordia plumosa var. brachyphylla*			
550.	4325	*Viminaria juncea (Swishbush, Koweda)*			
551.	722	*Vulpia bromoides (Squirrel Tail Fescue)*	Y		
552.	724	*Vulpia myuros (Rat's Tail Fescue)*	Y		
553.	7389	*Wahlenbergia preissii*			
554.	18108	*Watsonia meriana var. bulbillifera*	Y		
555.	34113	*Westralunio carteri (Carter's Freshwater Mussel)*		T	
556.		*Wheenyoides cooki*			
557.	12072	*Wurmbea dioica subsp. alba*			
558.	1249	*Xanthorrhoea acanthostachya*			
559.	1253	*Xanthorrhoea gracilis (Graceful Grass Tree, Mimidi)*			
560.	1256	*Xanthorrhoea preissii (Grass tree, Palga)*			
561.	6284	*Xanthosia candida*			
562.	6289	*Xanthosia huegelii*			
563.	25765	*Zosterops lateralis (Grey-breasted White-eye, Silvereye)*			

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

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

APPENDIX B - EPBC PROTECTED MATTERS SEARCH REPORT

Australian Government
Department of Agriculture, Water and the Environment

EPBC Act Protected Matters Report

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

Report created: 06-Dec-2021

Summary

Matters of National Environment Significance

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

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance (Ramsar	1
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	5
Listed Threatened Species:	33
Listed Migratory Species:	9

Other Matters Protected by the EPBC Act

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

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

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

Commonwealth Lands:	2
Commonwealth Heritage Places:	None
Listed Marine Species:	14
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None
Habitat Critical to the Survival of Marine Turtles:	None

Extra Information

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

State and Territory Reserves:	5
Regional Forest Agreements:	None
Nationally Important Wetlands:	None
EPBC Act Referrals:	9
Key Ecological Features (Marine):	None
Biologically Important Areas:	None
Bioregional Assessments:	None
Geological and Bioregional Assessments:	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar Wetlands) [Resource Information]

Ramsar Site Name	Proximity	Buffer Status
Peel-yalgorup system	20 - 30km upstream from Ramsar site	In feature area

Listed Threatened Ecological Communities [Resource Information]

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

Community Name	Threatened Category	Presence Text	Buffer Status
Banksia Woodlands of the Swan Coastal Plain ecological community	Endangered	Community likely to occur within area	In feature area
Clay Pans of the Swan Coastal Plain	Critically Endangered	Community likely to occur within area	In feature area
Corymbia calophylla - Kingia australis woodlands on heavy soils of the Swan Coastal Plain	Endangered	Community known to occur within area	In feature area
Corymbia calophylla - Xanthorrhoea preissii woodlands and shrublands of the Swan Coastal Plain	Endangered	Community known to occur within area	In buffer area only
Tuart (Eucalyptus gomphocephala) Woodlands and Forests of the Swan Coastal Plain ecological community	Critically Endangered	Community may occur within area	In feature area

Listed Threatened Species [Resource Information]

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

Scientific Name	Threatened Category	Presence Text	Buffer Status
BIRD			
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat likely to occur within area	In feature area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
[Calyptorhynchus banksii naso](#) Forest Red-tailed Black-Cockatoo, Karrak [67034]	Vulnerable	Species or species habitat known to occur within area	In feature area
[Charadrius leschenaultii](#) Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat may occur within area	In feature area
[Falco hypoleucos](#) Grey Falcon [929]	Vulnerable	Species or species habitat may occur within area	In buffer area only
[Leipoa ocellata](#) Malleefowl [934]	Vulnerable	Species or species habitat likely to occur within area	In feature area
[Numenius madagascariensis](#) Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area	In feature area
[Rostratula australis](#) Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area	In feature area
[Zanda baudinii listed as Calyptorhynchus baudinii](#) Baudin's Black-Cockatoo, Long-billed Black-cockatoo [87736]	Endangered	Roosting known to occur within area	In feature area
[Zanda latirostris listed as Calyptorhynchus latirostris](#) Carnaby's Black Cockatoo, Short-billed Black-cockatoo [87737]	Endangered	Species or species habitat known to occur within area	In feature area
MAMMAL			
[Bettongia penicillata ogilbyi](#) Woylie [66844]	Endangered	Species or species habitat may occur within area	In buffer area only
[Dasyurus geoffroii](#) Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat known to occur within area	In feature area
[Pseudocheirus occidentalis](#) Western Ringtail Possum, Ngwayir, Womp, Woder, Ngoor, Ngoolangit [25911]	Critically Endangered	Species or species habitat likely to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
[Setonix brachyurus](#) Quokka [229]	Vulnerable	Species or species habitat likely to occur within area	In feature area
OTHER			
[Westralunio carteri](#) Carter's Freshwater Mussel, Freshwater Mussel [86266]	Vulnerable	Species or species habitat known to occur within area	In buffer area only
PLANT			
[Andersonia gracilis](#) Slender Andersonia [14470]	Endangered	Species or species habitat may occur within area	In feature area
[Anthocercis gracilis](#) Slender Tailflower [11103]	Vulnerable	Species or species habitat may occur within area	In buffer area only
[Caladenia huegelii](#) King Spider-orchid, Grand Spider-orchid, Rusty Spider-orchid [7309]	Endangered	Species or species habitat known to occur within area	In feature area
[Diuris drummondii](#) Tall Donkey Orchid [4365]	Vulnerable	Species or species habitat likely to occur within area	In feature area
[Diuris micrantha](#) Dwarf Bee-orchid [55082]	Vulnerable	Species or species habitat likely to occur within area	In feature area
[Diuris purdiei](#) Purdie's Donkey-orchid [12950]	Endangered	Species or species habitat likely to occur within area	In feature 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	In feature area
[Drakaea micrantha](#) Dwarf Hammer-orchid [56755]	Vulnerable	Species or species habitat likely to occur within area	In feature area
[Eleocharis keigheryi](#) Keighery's Eleocharis [64893]	Vulnerable	Species or species habitat may occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Eucalyptus x balanites			
Cadda Road Mallee, Cadda Mallee [87816]	Endangered	Species or species habitat may occur within area	In feature area
Lasiopetalum pterocarpum			
Wing-fruited Lasiopetalum [64922]	Endangered	Species or species habitat known to occur within area	In buffer area only
Lepidosperma rostratum			
Beaked Lepidosperma [14152]	Endangered	Species or species habitat may occur within area	In buffer area only
Synaphea sp. Fairbridge Farm (D. Papenfus 696)			
Selena's Synaphea [82881]	Critically Endangered	Species or species habitat known to occur within area	In feature area
Synaphea sp. Pinjarra Plain (A.S. George 17182)			
[86878]	Endangered	Species or species habitat known to occur within area	In feature area
Synaphea sp. Serpentine (G.R. Brand 103)			
[86879]	Critically Endangered	Species or species habitat known to occur within area	In feature area
Tetraria australiensis			
Southern Tetraria [10137]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
Thelymitra stellata			
Star Sun-orchid [7060]	Endangered	Species or species habitat may occur within area	In feature area
Verticordia plumosa var. ananeotes			
Tufted Plumed Featherflower [23871]	Endangered	Species or species habitat may occur within area	In feature area

Listed Migratory Species			[Resource Information]
Scientific Name	Threatened Category	Presence Text	Buffer Status
Migratory Marine Birds			
Apus pacificus			
Fork-tailed Swift [678]		Species or species habitat likely to occur within area	In feature area
Migratory Terrestrial Species			

Scientific Name	Threatened Category	Presence Text	Buffer Status
Motacilla cinerea			
Grey Wagtail [642]		Species or species habitat may occur within area	In feature area
Migratory Wetlands Species			
Actitis hypoleucos			
Common Sandpiper [59309]		Species or species habitat may occur within area	In feature area
Calidris acuminata			
Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area	In feature area
Calidris ferruginea			
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area	In feature area
Calidris melanotos			
Pectoral Sandpiper [858]		Species or species habitat may occur within area	In feature area
Charadrius leschenaultii			
Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat may occur within area	In feature area
Numenius madagascariensis			
Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area	In feature area
Tringa nebularia			
Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area	In buffer area only

Other Matters Protected by the EPBC Act

Commonwealth Lands [Resource Information]

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

Commonwealth Land Name	State	Buffer Status
Unknown		
Commonwealth Land - [50854]	WA	In buffer area only
Commonwealth Land - [51919]	WA	In buffer area only

Listed Marine Species			[Resource Information]
Scientific Name	Threatened Category	Presence Text	Buffer Status
Bird			
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area	In feature area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area overfly marine area	In feature area
Bubulcus ibis as Ardea ibis Cattle Egret [66521]		Species or species habitat may occur within area overfly marine area	In feature area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area	In feature area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area overfly marine area	In feature area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area overfly marine area	In feature area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat may occur within area	In feature area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area	In feature area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area overfly marine area	In feature area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area overfly marine area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Numenius madagascariensis			
Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area	In feature area
Rostratula australis as Rostratula benghalensis (sensu lato)			
Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area overfly marine area	In feature area
Thinornis cucullatus as Thinornis rubricollis			
Hooded Dotterel, Hooded Plover [87735]		Species or species habitat may occur within area overfly marine area	In buffer area only
Tringa nebularia			
Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area overfly marine area	In buffer area only

Extra Information

State and Territory Reserves			[Resource Information]
Protected Area Name	Reserve Type	State	Buffer Status
Lambkin	Nature Reserve	WA	In buffer area only
NTWA Bushland covenant (0076)	Conservation Covenant	WA	In buffer area only
Serpentine	National Park	WA	In buffer area only
Unnamed WA46587	Nature Reserve	WA	In buffer area only
Unnamed WA51784	Nature Reserve	WA	In buffer area only

EPBC Act Referrals				[Resource Information]
Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Controlled action				
Construction of Road and Extension of Utilities on Turner Street, Serpentine	2008/4670	Controlled Action	Post-Approval	In buffer area only
Natural Gas Pipeline Expansion	2006/2813	Controlled Action	Post-Approval	In buffer area only
Not controlled action				
'Looping 10' gas transmission pipeline from Kwinana to Hopelands	2005/2212	Not Controlled Action	Completed	In feature area

Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Not controlled action				
Development of a wholesale nursery	2012/6622	Not Controlled Action	Completed	In feature area
Eradication of the European House Borer, Perth metropolitan area, WA	2009/5027	Not Controlled Action	Completed	In buffer area only
Improving rabbit biocontrol: releasing another strain of RHDV, sthrn two thirds of Australia	2015/7522	Not Controlled Action	Completed	In feature area
INDIGO Central Submarine Telecommunications Cable	2017/8127	Not Controlled Action	Completed	In feature area
Serpentine Sports Reserve, Protection of Dieback Free Area	2008/4337	Not Controlled Action	Completed	In buffer area only
Not controlled action (particular manner)				
INDIGO Marine Cable Route Survey (INDIGO)	2017/7996	Not Controlled Action (Particular Manner)	Post-Approval	In feature area

Caveat

1 PURPOSE

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

The report contains the mapped locations of:

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

2 DISCLAIMER

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

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

3 DATA SOURCES

Threatened ecological communities

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

Threatened, migratory and marine species

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

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

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

4 LIMITATIONS

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

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

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

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

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

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

Acknowledgements

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

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

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

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

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APPENDIX C – SYSTEMATIC SPECIES LIST

FAMILY	SPECIES
Asteraceae	**Cotula coronopifolia*
Araceae	**Zantedeschia aethiopica* (DP)
Casuarinaceae	*Allocasuarina fraseriana*
Fabaceae	**Lotus* sp.
Juncaceae	*Juncus kraussii*
Myrtaceae	*Corymbia calophylla*
Myrtaceae	*Eremaea beaufortioides*
Myrtaceae	*Eucalyptus marginata*
Myrtaceae	*Eucalyptus rudis*
Myrtaceae	*Kunzea glabrescens*
Myrtaceae	*Melaleuca preissii*
Myrtaceae	*Melaleuca rhaphiophylla*
Myrtaceae	*Regelia ciliata*
Pinaceae	*Pinus pinaster*
Poaceae	**Briza maxima*
Poaceae	**Bromus arenarius*
Poaceae	**Lolium rigidum*
Proteaceae	*Xylomelum occidentale*
Xanthorrhoeaceae	*Xanthorrhoea preissii*

APPENDIX D – RELEVÉ DATA

Site BT01r

Date	9 November 2021
Botanist	Kellie Bauer-Simpson
Quadrat Size	Relevé
NW Corner Coordinates	401505mE 6418079mN
Vegetation Unit	MpRc – Low Open Woodland of *Melaleuca preissii* over a Low Sparse Shrubland of *Regelia ciliata* over a Low Sparse Grassland of **Briza maxima.*
Slope	Flat
Landform	Wetland
Soil Colour	Brown
Soil Type	Loamy clay
Litter	15%
Bare Ground	5%
Fire Age	>10 Years
Vegetation Condition	Degraded
Disturbances/Impacts	Weeds, histroic clearing and grazing

Species	Height (m)	% Cover
Melaleuca preissii	4	6
Regelia ciliata	1.5	25
**Briza maxima*	0.1	3
Eremaea beaufortioides		+
**Cotula coronopifolia*		+
**Lotus* sp.		+
**Bromus arenarius*		+
**Lolium rigidum*		+