Appendix G: Biological Survey Report, Boallia

BIOLOGICAL SURVEY

POTENTIAL OFFSET SITE - LOT 2628 JACKA ROAD, BOALLIA

MAIN ROADS WESTERN AUSTRALIA

MARCH 2023

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Document History

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FIGURES

TABLES

EXECUTIVE SUMMARY

Main Roads Western Australia (Main Roads) required a detailed biological assessment, including a desktop assessment and field assessment for the potential offset site at Lot 2628 Jacka Road, Boallia (survey area). The desktop assessment area (study area) encompasses the survey area plus a 5 kilometre (km) radial buffer (**Figure 1**). The purpose of the biological assessment was to define key flora, vegetation, fauna, fauna habitats, and Black-Cockatoo habitat values. The biological assessment required an assessment of the State and Commonwealth listed *Banksia Woodlands of the Swan Coastal Plain* Threatened Ecological Community (TEC), and Black-Cockatoo foraging and roosting habitat and Suitable DBH Trees (i.e. trees with a diameter at breast height of ≥500 millimetres mm) for potential breeding habitat.

Focused Vision Consulting Pty Ltd (FVC) undertook a biological assessment of the survey area during spring 2022, which comprised a desktop assessment and a field assessment for flora, vegetation, ecological communities, targeted fauna surveys for relevant significant species and a targeted Black-Cockatoo habitat survey. All assessments and reporting have been conducted in accordance with relevant technical guidance and conservation advice.

The key findings and conclusions arising from the detailed biological assessment within the survey area were:

- The timing of the field surveys (November) was considered optimal for the identification of biological values, especially flowering flora and annual and ephemeral species.
- No Threatened flora listed under the *Biodiversity Conservation Act 2016* (BC Act) or under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) were recorded.
- Three Priority flora species were recorded; *Netrostylis* sp. Blackwood River (P3), *Acacia semitrullata* (P4) and *Hypolaena robusta* (P4) were recorded across four of the five mapped vegetation units.
- Based on the findings of desktop assessment, combined with field observations regarding habitat suitability, further to the three recorded Priority flora, it is considered that seven species of Threatened flora and 21 species of Priority flora may occur in the survey area.
- No Declared Pest (DP) plants or Weeds of National Significance (WoNS) listed under the *Biosecurity and Agriculture Management Act 2007* (BAM Act) were recorded within the survey area.
- Remnant vegetation of the survey area supports five vegetation units broadly characterised as Jarrah, Marri and Sheoak Woodlands, with vegetation unit EmTlMt being distinctly different due to the presence of a sedgeland midstorey associated with the Buayanyup River.
- The condition of the vegetation within the survey area was found to range from 'Excellent' to 'Completely Degraded'. The majority of the vegetation was observed to be in 'Excellent' condition, making up 77.85% (51 ha) of the survey area, with 0.04% (0.02 ha) considered to be in 'Degraded' condition.
- Potential Banksia woodlands of the Swan Coastal Plain TEC may occur within the survey area and further determination of the presence of this ecological community may be required.
- One fauna habitat was described and mapped within the survey area; Jarrah, Marri and Sheoak Woodlands, which is considered significant for fauna, also providing the best quality foraging habitat for all three Threatened Black-Cockatoo species, Western Ringtail Possum and South-western Brush-tailed Phascogale.
- Four fauna species of significance were recorded within the survey area; Baudin's Black-Cockatoo (*Zanda baudinii*), Carnaby's Black-Cockatoo *Zanda latirostris*), Forest Red-tailed Black-Cockatoo (*Calyptorhynchus banksii naso*) and Western Ringtail Possum (*Pseudocheirus occidentalis*).
- Based on the findings of desktop assessment, combined with field observations confirming habitat provided in the survey area, it is considered that ten significant fauna species may occur, either as residents (four species) or regular visitors (six species).

- Baudin's Black-Cockatoo, Carnaby's Black-Cockatoo, Forest Red-tailed Black Cockatoo and the Western Ringtail Possum are considered residents of the survey area.
- Muir's Corella, Peregrine Falcon, Chuditch, Western Falsistrelle, Quenda and the South-western Brush-tailed Phascogale are considered to be regular visitors of the survey area.
- The survey area supports 'High' quality foraging habitat for Carnaby's Black-Cockatoo and Forest Red-tailed Black-Cockatoo and 'Very High' quality foraging habitat for Baudin's Black-Cockatoo.
- A total of 3,187 Suitable DBH Trees relating to breeding habitat for Black-Cockatoos were identified within the survey area, of which 2,805 are rank 5 (no suitable hollows for Black-Cockatoos), 38 are rank 4 (have unsuitable hollows), 315 are rank 3 (potentially suitable hollow/s, but with no evidence of use) and 24 trees were found to be rank 2 (suitable hollow/s and evidence of use). No trees with active nests (Rank 1) were recorded.
- During the field assessment, four Black-Cockatoo night-roosts were positively identified in the north-west portion of the survey area, with one of these roost sites directly observed to support six individuals.

1 INTRODUCTION

1.1 BACKGROUND

Main Roads Western Australia (Main Roads) required a detailed biological assessment, including a desktop assessment and field assessment for the potential offset site at Lot 2628 Jacka Road, Boallia (survey area). The desktop study area (study area) encompasses the survey area plus a 5 kilometre (km) radial buffer (**Figure 1**). The purpose of the biological assessment was to define key flora, vegetation, fauna, fauna habitat and Black-Cockatoo habitat values. The biological assessment required an assessment of the State and Commonwealth listed *Banksia Woodlands of the Swan Coastal Plain* Threatened Ecological Community (TEC), and Black-Cockatoo foraging and roosting habitat and Suitable DBH Trees (i.e. trees with a diameter at breast height of ≥500 m) for potential breeding habitat.

1.2 LOCATION

The survey area is located within the locality of Boallia, approximately 200 km south-southwest of Perth and 21 km south-east of Busselton, within City of Busselton. The survey area encompasses 65.5 hectares (ha) within Lot 2628 and is bounded by Jacka Road to the west and Price Road to the south (**Figure 1**).

1.3 SCOPE OF WORK

Main Roads required a biological assessment to delineate key flora, vegetation, fauna, and Black-Cockatoo values for the survey area. A single-phase reconnaissance flora and vegetation survey and basic fauna survey were carried out in accordance with the Environmental Protection Authority (EPA) *Technical Guide Flora and Vegetation Surveys for Environment Impact Assessment* (EPA 2016c) and *Technical Guidance Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment* (EPA 2016d).

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

- Complete a desktop assessment to evaluate the study area prior to undertaking the field assessment.
- Conduct field assessments as per the latest EPA Guidance to verify / ground truth the desktop assessment findings through:
    - a reconnaissance vegetation and targeted flora survey
    - selective targeted surveys for Threatened and Priority flora species
    - a basic terrestrial vertebrate fauna survey
    - targeted fauna surveys for relevant significant fauna species: Black-Cockatoos, Western Ringtail Possums and South-Western Brush-tailed Phascogales.
- Report on the findings of the desktop and field assessments, with a particular focus on the presence or absence of Black-Cockatoo, Western Ringtail Possum and South-Western Brush-tailed Phascogale habitat, and other fauna habitat.

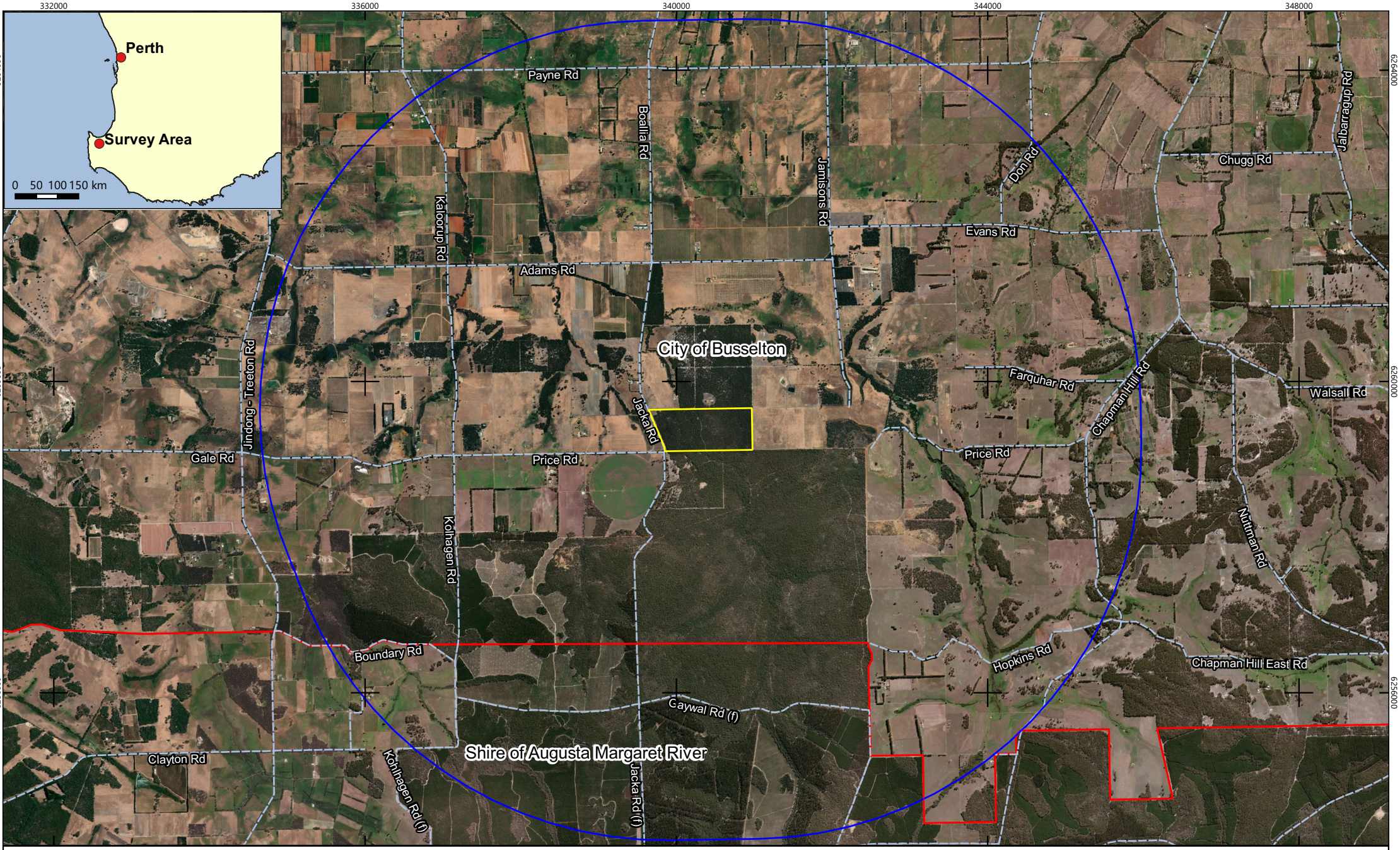

Figure 1 - Survey and Study Areas

FOCUSED VISION consulting

2 LEGISLATIVE CONTEXT

The biological assessments 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 – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment*
- Threatened Species Scientific Committee (DEE 2016) *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) *(s 266B) Approved Conservation Advice (incorporating listing advice) for the Banksia Woodlands of the Swan Coastal Plain ecological community*
- Department of Sustainability, Environment, Water, Population and Communities (DSEWPAC) (2011) *Survey guidelines for Australia's threatened mammals: Guidelines for detecting mammals listed as threatened under the Environment Protection and Biodiversity Conservation Act 1999 6.5*
- Department of Agriculture, Water and the Environment (DAWE) (2022) *Referral guideline for 3 WA threatened black cockatoo species*
- Department of Agriculture, Water and the Environment (Department of Environment 2013) *Referral guideline for 3 WA threatened black cockatoo species: Carnaby's Cockatoo, Baudin's Cockatoo and the Forest Red-tailed Black cockatoo*
- 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*.

Components of survey methodology guidance was also taken from:

- (Department of Environment 2013) *Survey guidelines for Australia's threatened orchid. Guidelines for detecting orchids listed as "threatened" under the Environmental Protection and Biodiversity Conservation Act 1999*
- Main Roads Western Australia (MRWA) (2017) *Threatened Ecological Community Banksia Woodlands of the Swan Coastal Plain Ecological Community Factsheet.*

2.1 THREATENED AND PRIORITY FLORA

The Department of Biodiversity, Conservation and Attractions (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.

Species that may potentially be threatened species but do not meet the requirements for listing under the BC Act due to insufficient survey effort or data deficiency are added to the Priority Flora lists under Priorities 1, 2 or 3. These priorities are ranked in order of prioritisation for survey and assessment of conservation status so they can be considered for potential listing. Priority 4 category is used for species that are adequately known, meet the criteria for near threatened, or rare but not threatened, or that have been recently removed from threatened species or conservation dependent lists. These species require regular monitoring. Priority status is based on the Western Australian distribution for the species unless the population is contiguous across state borders and then is defined by the distribution of known locations (DBCA 2020).

The BC Act provides a statutory basis for the listing of threatened species, specially protected species, TECs, critical habitat and key threatening processes (DBCA 2022a). Although not awarded any statutory protection, DBCA also maintains the Priority flora list, for species of conservation concern. 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 (DER 2014). 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 (DBCA 2020)

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 (Department of the Environment 2013).

Species at risk of extinction are recognised as Threatened at a Commonwealth level and are categorised according to the EPBC Act as summarised in **Table 2**.

Table 2 - Categories of EPBC Act Threatened Species (DBCA 2020)

Conservation Code	Category
EX	**Extinct** Species where "there is no reasonable doubt that the last member of the species has died", and listing is otherwise in accordance with the ministerial guidelines (section 24 of the BC Act).
EW	**Extinct in the Wild** Species that "is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; and it has not been recorded in its known habitat or expected habitat, at appropriate seasons, anywhere in its past range, despite surveys over a time frame appropriate to its life cycle and form", and listing is otherwise in accordance with the ministerial guidelines (section 25 of the BC Act). Currently there are no threatened fauna or threatened flora species listed as extinct in the wild. If listing of a species as extinct in the wild occurs, then a schedule will be added to the applicable notice.
CR	**Critically Endangered** Threatened species considered to be "facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with criteria set out in the ministerial guidelines". Listed as critically endangered under section 19(1)(a) of the BC Act in accordance with the criteria set out in section 20 and the ministerial guidelines. Published under schedule 1 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for critically endangered fauna or the Wildlife Conservation (Rare Flora) Notice 2018 for critically endangered flora.
EN	**Endangered** Threatened species considered to be "facing a very high risk of extinction in the wild in the near future, as determined in accordance with criteria set out in the ministerial guidelines". Listed as endangered under section 19(1)(b) of the BC Act in accordance with the criteria set out in section 21 and the ministerial guidelines. Published under schedule 2 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for endangered fauna or the Wildlife Conservation (Rare Flora) Notice 2018 for endangered flora.
VU	**Vulnerable** Threatened species considered to be "facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with criteria set out in the ministerial guidelines". Listed as vulnerable under section 19(1)(c) of the BC Act in accordance with the criteria set out in section 22 and the ministerial guidelines. Published under schedule 3 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for vulnerable fauna or the Wildlife Conservation (Rare Flora) Notice 2018 for vulnerable flora.
MI	**Migratory species** Fauna that periodically or occasionally visit Australia or an external Territory or the exclusive economic zone; of the species is subject of an international agreement that relates to the protection of migratory species and that binds the Commonwealth; and listing is otherwise in accordance with the ministerial guidelines (section 15 of the BC Act). Published as migratory birds protected under an international agreement under schedule 5 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018.
CD	**Species of special conservation interest (conservation dependent fauna)** Fauna of special conservation need being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened, and listing is otherwise in accordance with the ministerial guidelines (section 14 of the BC Act). Published as conservation dependent fauna under schedule 6 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018.

Any species listed in State and Commonwealth legislation as being of 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

Threatened 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 TEC in one of the following categories: Presumed Totally Destroyed (PD), 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 (WA) is maintained by DBCA.

TECs in WA are protected under the State 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 Climate Change, Energy, the Environment and Water (DCCEEW) website, and in the Protected Matters Database (DCCEEW 2023a; b).

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 considered PECs (Department of Environment and Conservation 2013) and are required to be taken into consideration during environmental impact assessments.

2.3 VEGETATION OF SIGNIFICANCE

Alongside and in addition to significance according to statutory listings, vegetation may be considered significant at a National, State, regional or local level.

2.3.1.1 Nationally Significant Vegetation

Vegetation communities may be considered to be of National significance where they support the following Commonwealth listed Matters of National Environmental Significance (MNES):

- populations of Threatened (EPBC listed) species
- TECs listed as nationally (EPBC) significant
- RAMSAR Wetlands of International Importance (Department of the Environment, Water, Heritage and the Arts 2013).

2.3.1.2 State Significant Vegetation

Vegetation communities may be considered to be of State significance where they:

- support State-listed Threatened flora, fauna and TECs afforded protection under the BC Act (Del Marco *et al.* 2004; EPA 2008)
- occur within the State-managed conservation estate (areas protected under the *Conservation and Land Management Act 1984*) or areas that have been formally recommended by DBCA for inclusion in the State conservation estate (EPA 2008).

2.3.1.3 Regionally Significant Vegetation

Vegetation communities may be considered to be of regional significance where they:

- support populations of Priority Flora or ecological communities (Western Australian Planning Commission 2000; EPA 2016b)
- are formally protected or recognised as Environmentally Sensitive Areas (ESAs), or under planning schemes for conservation, such as Bush Forever (Government of Western Australia 2005; EPA 2008)
- support conservation category wetlands including associated vegetation (Government of Western Australia 1997; Western Australian Planning Commission 2000)
- maintain important ecological processes (EPA 2016b)
- support high diversity of flora, fauna, communities, or community structure (Western Australian Planning Commission 2000)
- contain flora species exhibiting range extensions and undescribed species (EPA 2016b)
- have a restricted regional distribution (EPA 2016b)
- are represented by less than 30% of their pre-European extent (Commonwealth of Australia 2001).

2.3.2 Locally Significant Vegetation

Vegetation communities may be considered locally significant where they:

- occur as small, isolated communities (Western Australian Planning Commission 2000; Del Marco *et al.* 2004)
- have a restricted local extent (proportion) (EPA 2016b) and/or are locally restricted to only one or a few locations (Del Marco *et al.* 2004).

2.4 VEGETATION CLEARING, EXTENT AND STATUS

Clearing of native vegetation is regulated in WA under the EP Act and the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*. Any clearing of native vegetation is an offence, unless carried out under a clearing permit or if the clearing is for an exempt purpose (DER 2015). A clearing permit may be required under Part V of the EP Act, whereby permit applications to clear native vegetation must be assessed against the '10 Clearing Principles' as outlined in the regulations (DER 2014).

Where clearing of native vegetation is proposed to occur, there are several key criteria applied to the assessment of clearing permit applications, in the interests of biodiversity conservation (DER 2014).

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). This objective is documented in the EPA Factor Guideline - Flora and Vegetation (EPA 2016b). The EPA considers it is important that ecological communities are maintained above the threshold level of 30% of the original pre-clearing extent of the community in unconstrained areas and 10% within 'constrained' areas (EPA 2008).

2.5 ENVIRONMENTALLY SENSITIVE AREAS

Environmentally Sensitive Areas (ESAs) are areas that require special protection due to aspects such as landscape, fauna or historical value and are generally considered to be areas of high conservation value. ESAs are declared in the *Environmental Protection (Environmentally Sensitive Areas) Notice 2005*, which was gazetted on 8 April 2005 (Government of Western Australia 2005).

There are several types of ESAs relating to flora and vegetation, declared under Part V of the EP Act, which include:

- a defined wetland and the area within 50 m of that wetland
- the area covered by vegetation within 50 m of rare (Threatened) flora, to the extent where the vegetation is continuous with the vegetation within which the rare (Threatened) flora is located
- the area covered by a TEC
- Bush Forever sites (Western Australian Planning Commission 2000).

2.6 INTRODUCED FLORA

Over 1,200 introduced (weed) species have been recognised to occur within Western Australia (EPA 2007). Weeds are plants that are not indigenous to an area and have been introduced either directly or indirectly through human activity. They establish in natural ecosystems and adversely modify natural processes, have the potential to dominate and simplify the ecosystems and thus decrease habitat value provided for native fauna. Weeds pose a threat to many native flora species due to their ability to rapidly grow and out-compete for available water, space, sunlight, and nutrients (EPA 2007).

2.6.1 Weeds of National Significance

Under the National Weed Strategy, there are currently 32 weed species listed as Weeds of National Significance (WoNS) (Centre for Invasive Species Solutions 2022). Each weed listed was considered for inclusion based on the following criteria:

- invasive tendencies
- impacts
- potential for spread
- socioeconomic and environmental values.

2.6.2 Declared Pest Plants

The Western Australian Organism List (WAOL) details organisms listed as Declared Plants (DPs), including pest plants, under the *Biosecurity and Agriculture Management Act 2007* (BAM Act) (Department of Primary Industries and Regional Development 2022). Under the BAM Act, DPs 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 (DPIRD 2017).

2.6.3 Environmental Weeds

Introduced species have also been ranked by several attributes including invasiveness, distribution, and environmental impacts in the various regions in the *Environmental Weed Strategy* (Department of Conservation and Land Management 1999). To advance the above categorisation, the Invasive Plant Prioritisation Process for DBCA was developed in 2008 (Department of Parks and Wildlife 2013).

2.7 SIGNIFICANT FAUNA

Fauna species of 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).

Fauna species can be assigned one of three significance categories (Bamford Consulting Ecologists 2018):

- **Significance 1 (CS1)**: Species listed as Threatened under legislation, the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and State *Biodiversity Conservation Act 2016* (BC Act).
- **Significance 2 (CS2)**: Species listed as Priority by the DBCA.
- **Significance 3 (CS3)**: Species listed as locally significant because of local threats and declines as defined by the Western Australian Planning Commission (2000) as part of the Bush Forever plan.

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 (State of Western Australia 2018)

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 (DBCA 2020)

Conservation Code	Category Description
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.

3 EXISTING ENVIRONMENT

3.1 CLIMATE

The survey area experiences a Mediterranean climate which is characterised by hot dry summers and mild wet winters (Mitchell *et al.* 2002). Busselton Aero (site number 009603) is one of the Bureau of Meteorology's (BoM) meteorological recording stations located approximately 20 km from the study area, operating since 1997 (BoM 2022a). The site has recorded an average annual rainfall of 670.8 mm and annual mean maximum temperatures ranging from 16.9°C in winter to 30.2°C in summer (BoM 2022a) (**Figure 2**). In the months leading up to the November field assessment (October and September) temperature and rainfall was on par with the long-term average; however, the preceding winter months (July and August) recorded higher rainfall than the long-term average. Above average rainfall in late winter would provide optimal spring conditions for the growth of flora species, increasing the likelihood of annual species being present.

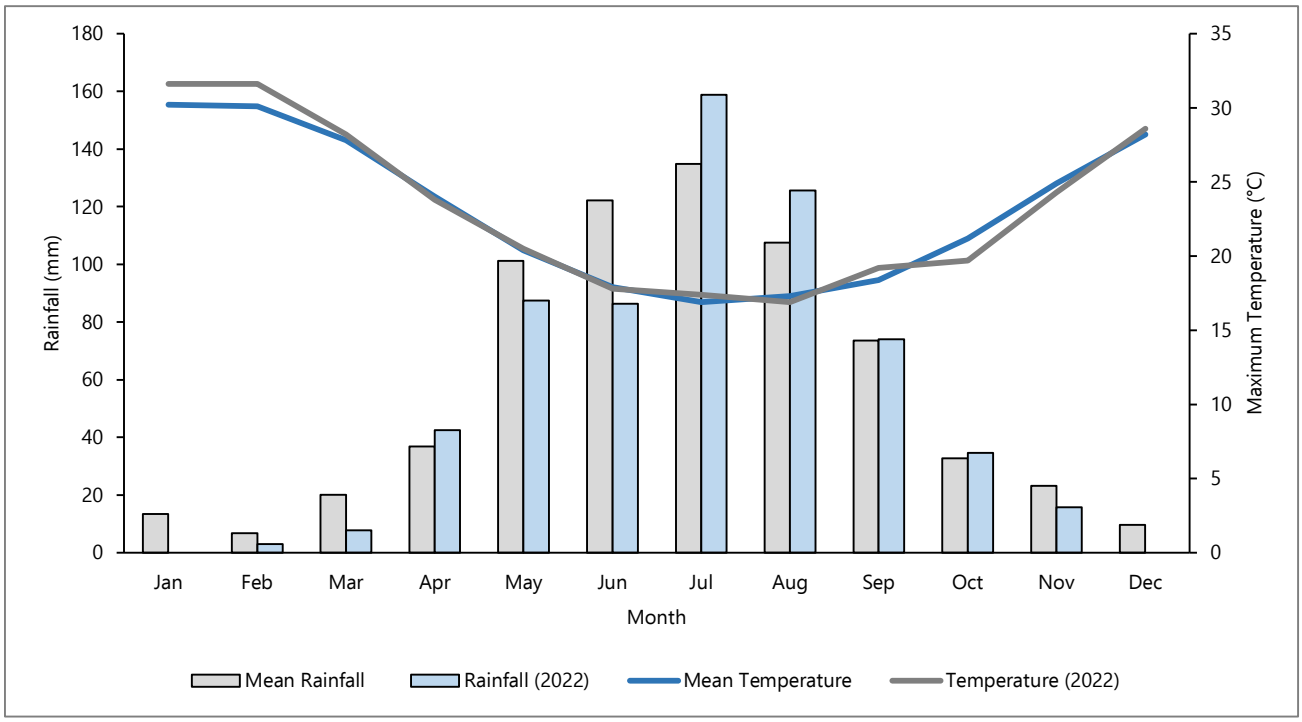

Figure 2 - Climate Data for Busselton Aero Weather Station 009603 (BoM 2022a)

3.2 IBRA REGION

There are 89 recognised Interim Biogeographic Regionalisation for Australia (IBRA) regions across Australia that have been defined based on climate, geology, landforms, and characteristic vegetation and fauna (DCCEEW 2022). The survey area lies within both the Swan Coastal Plain (SWA) IBRA region and the Jarrah Forest (JAF) IBRA region; at a finer scale, within the Perth subregion (SWA02) and Southern Jarrah Forest subregion (JAF02), representing the north and south the survey area, respectively (Hearn *et al.* 2002; Mitchell *et al.* 2002; McKenzie *et al.* 2003) (**Figure 3**).

The Swan Coastal Plain bioregion is a low lying coastal plain, mainly covered with Banksia and Tuart (*Eucalyptus gomphocephala*) woodlands on sandy soils. Swampy areas are dominated by paperbark, and outwash plains by *Casuarina obesa*. Melaleuca shrublands and *C. obesa* - Marri (*Corymbia calophylla*) woodlands are located extensively in the south, while Jarrah (*Eucalyptus marginata*) woodland dominates duricrusted Mesozoic sediments to the east (McKenzie *et al.* 2003).

The Jarrah Forest Bioregion is dominated by a duricrusted plateau of the Yilgarn Craton and characterised by Jarrah-Marri forest on laterite gravels and, in the eastern part, by Marri-Wandoo woodlands on clayey soils. *Agonis* spp. shrublands in the south are supported by eluvial and alluvial deposits. In areas of Mesozoic sediments, Jarrah forests and various species-rich shrublands occur in a mosaic pattern (McKenzie *et al.* 2003).

The Perth subregion (SWA02) is comprised of colluvial and aeolian sands, alluvial river flats, coastal limestone and heath and/or Tuart woodlands on limestone, Banksia and Jarrah - Banksia woodlands on Quaternary marine dunes of varying ages, Marri on colluvial and alluvial, and seasonal wetlands (McKenzie *et al.* 2003).

The Southern Jarrah Forest (JAF02) subregion is characterised by eluvial and alluvial deposits supporting Agonis shrublands, additionally Jarrah forests occur in a mosaic with a variety of species-rich shrublands in areas of Mesozoic sediments. Vegetation comprises Jarrah - Marri forest in the west grading to Marri and Wandoo woodlands in the east (Hearn *et al.* 2002).

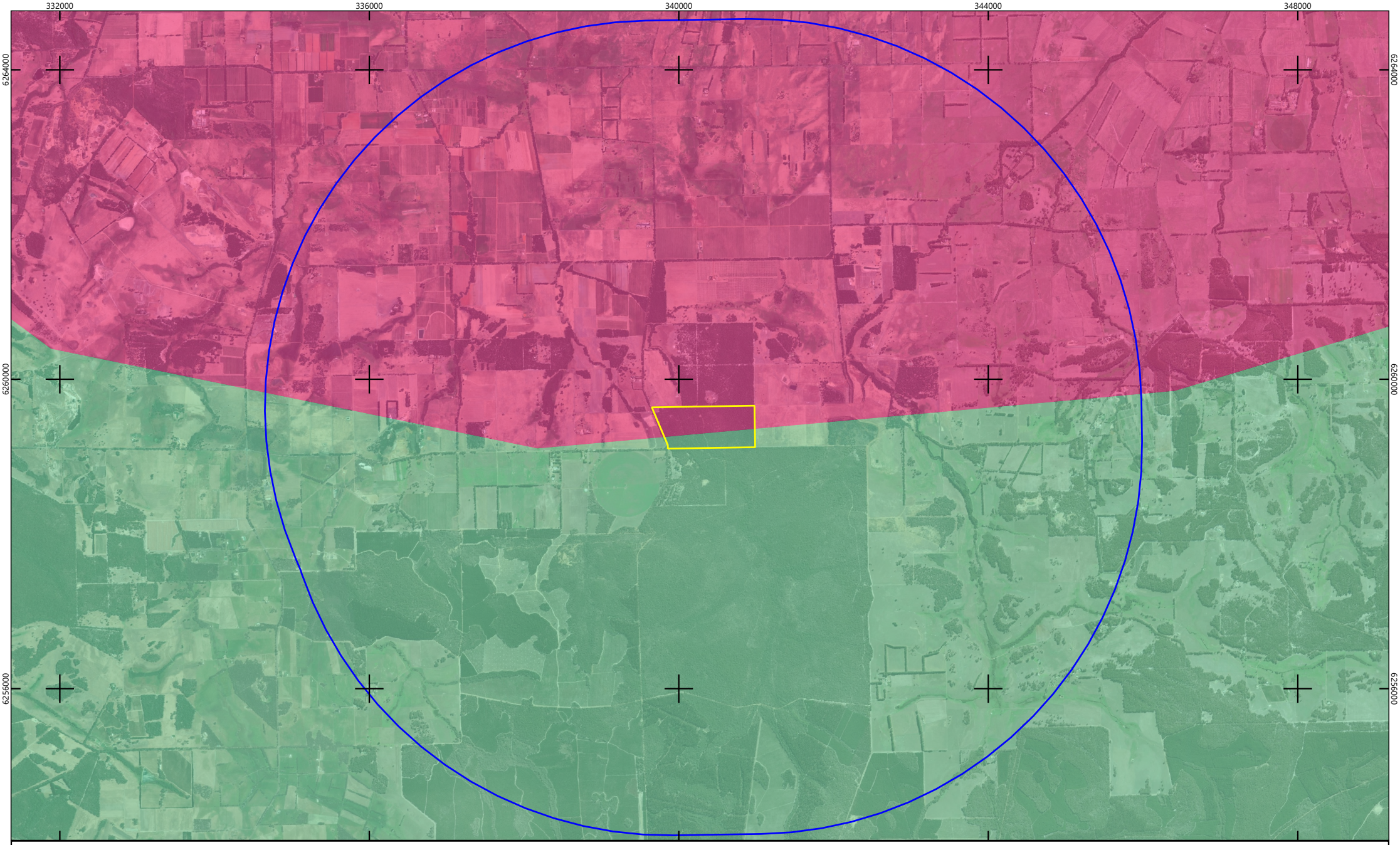

Figure 3 - IBRA Subregions

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3.3 SOILS

The survey area is situated on the Whicher Scarp System and is composed of sands and laterites from the Perth Sedimentary Basin that connects the granite scarps on the Darling Range and Leeuwin-Naturaliste Ridge (**Figure 4, Table 5**). A past landform stretching from Geraldton to Augusta is reflected in the deep sands of the Whicher Scarp and its associated restricted plant communities and flora. It contains more than 900 native species reflecting the flora of the Jarrah Forest, the south coast sands and wetlands, and the Swan Coastal Plain sands, in addition to many species that are specific to the Whicher Scarp. This area is recognised as a local biodiversity hotspot because of the richness of vegetation and flora, as well as endemism and geographical distinct species (EPA 2013).

Table 5 – Soil Systems within the Survey Area (Geoscience Australia 2021).

Soil System	Soil Unit	Unit Description
Whicher Scarp System	214Ws	Low scarp and raised platform, on the northern edge of the Donnybrook Sunkland. Sandy gravel and pale deep sands, loamy gravel and non-saline wet soils. Jarrah-Marri forest and woodland.

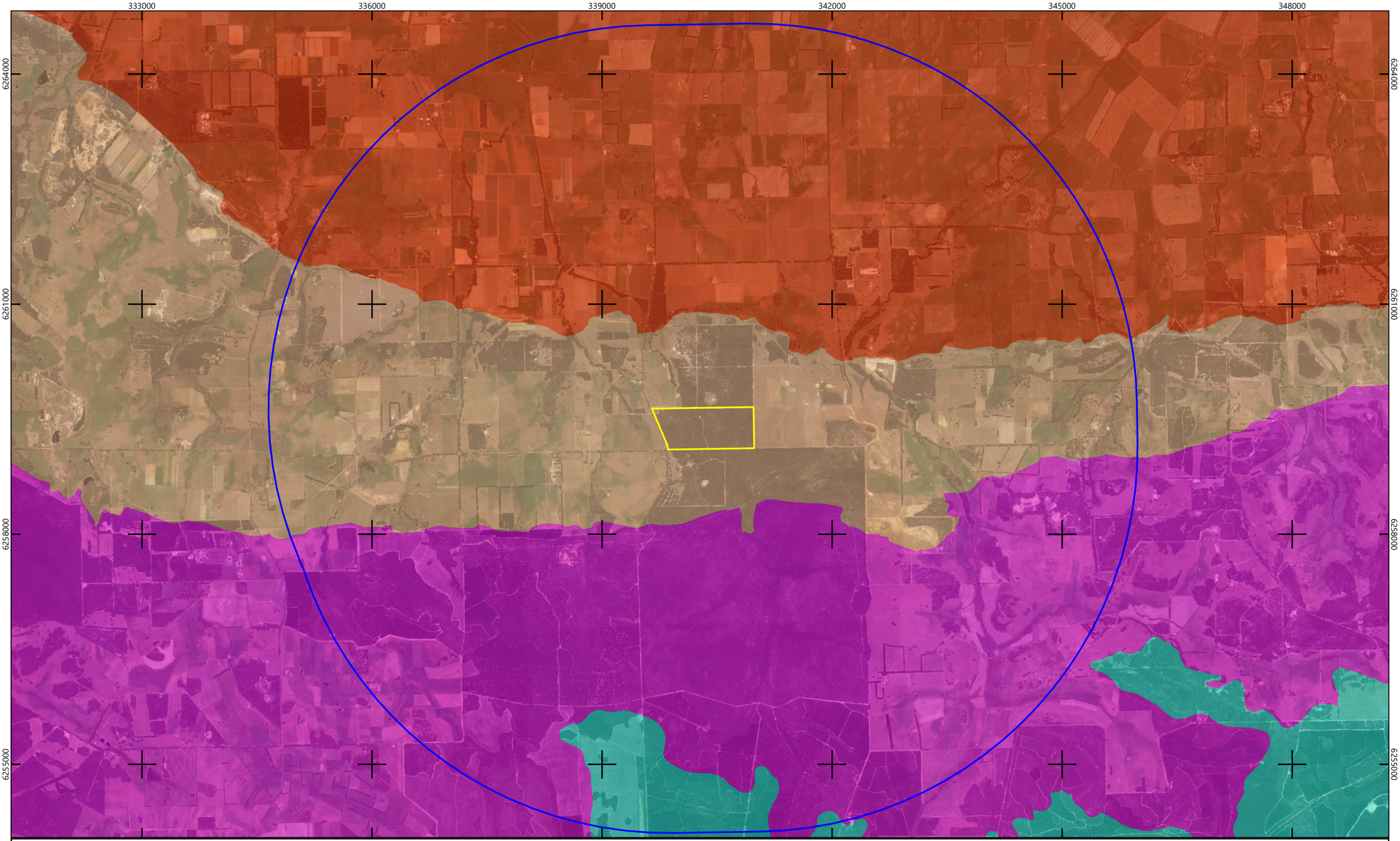

Figure 4 - Soils

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3.4 VEGETATION

EPA objectives in relation to flora and vegetation are to protect flora and vegetation so that biological diversity and ecological integrity are maintained (EPA 2016a). 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). Additionally, the National Objectives and Targets for Biodiversity Conservation 2001-2005 (Commonwealth of Australia 2001) recognise that the retention of at least 30% of the pre-clearing extent of each vegetation association is necessary for Australia's biological diversity to be protected (DER 2014). Species loss appears to accelerate exponentially at an ecosystem level when current extent falls below 30% of pre-clearing extent (EPA 2008). When only 10% or less of the original extent of a vegetation association remains, it is regarded as Endangered (EPA 2008), and any impacts or increased threats to these vegetation associations should be avoided, included clearing.

3.4.1 Pre-European Vegetation

Vegetation of the Jarrah Forest region has been broadly characterised by Beard (1975, 1990), and later re-assessed by Shepherd *et al.* (2002) into vegetation associations. Mapping depicted the native vegetation as it was presumed to be at the time of European settlement and is referred to as pre-European vegetation mapping. Two vegetation associations (1000 and 1181) are present within the survey area (**Figure 5**).

Vegetation association 1181 covers majority of the survey area (51.94 ha, 79.29%) and is described as supporting medium woodlands of *Eucalyptus marginata* and *Eucalyptus haematoxylon*. Vegetation association 1000, is restricted to the section of Boyanup River that runs through the survey area (13.57 ha, 20.71%). The remaining extent of these associations across relevant contexts are presented in **Table 6** (Beard 1975; DBCA 2019).

The remaining extents of the Beard vegetation associations (**Table 6**) all exceed 30% of their pre-European extent in all contexts, with the exception of vegetation association 1000 within the contexts of Western Australia, Swan Coastal Plain IBRA Region and Perth IBRA Subregion, where this association is represented by 27.81%, 26.41% and 26.41% of its pre-European extent, respectively.

Table 6 – Remaining Extent of Pre-European Vegetation within the Survey Area (Beard 1990; DBCA 2019)

Context	Vegetation Association	Pre–European Extent (ha)	Current Extent (ha)	Pre-European Extent Remaining (%)	Extent remaining in DBCA Managed Land (%)
Western Australia	1000	99,835.86	27,768.84	27.81	5.19
	1181	19,217.13	8,915.02	46.39	26.83
Swan Coastal Plain IBRA Region	1000	94,175.31	24,869.20	26.41	5.06
	1181	9,238.77	3,597.24	38.94	16.31
Jarrah Forest IBRA Region	1000	5,428.06	2,802.16	51.62	7.34
	1181	9,978.36	5,317.78	53.29	36.56
Perth IBRA Subregion	1000	94,175.31	24,869.20	26.41	5.06
	1181	9,238.77	3,597.24	38.94	16.31
Southern Jarrah Forest IBRA Subregion	1000	5,428.06	2,802.16	51.62	7.34
	1181	9,978.36	5,317.78	53.29	36.56
City of Busselton Local Government Area	1000	12,034.21	4,244.00	35.27	6.84
	1181	14,459.69	5,606.44	38.77	19.21

*Cells highlighted grey indicate where less than 30% of the pre-European extent remains

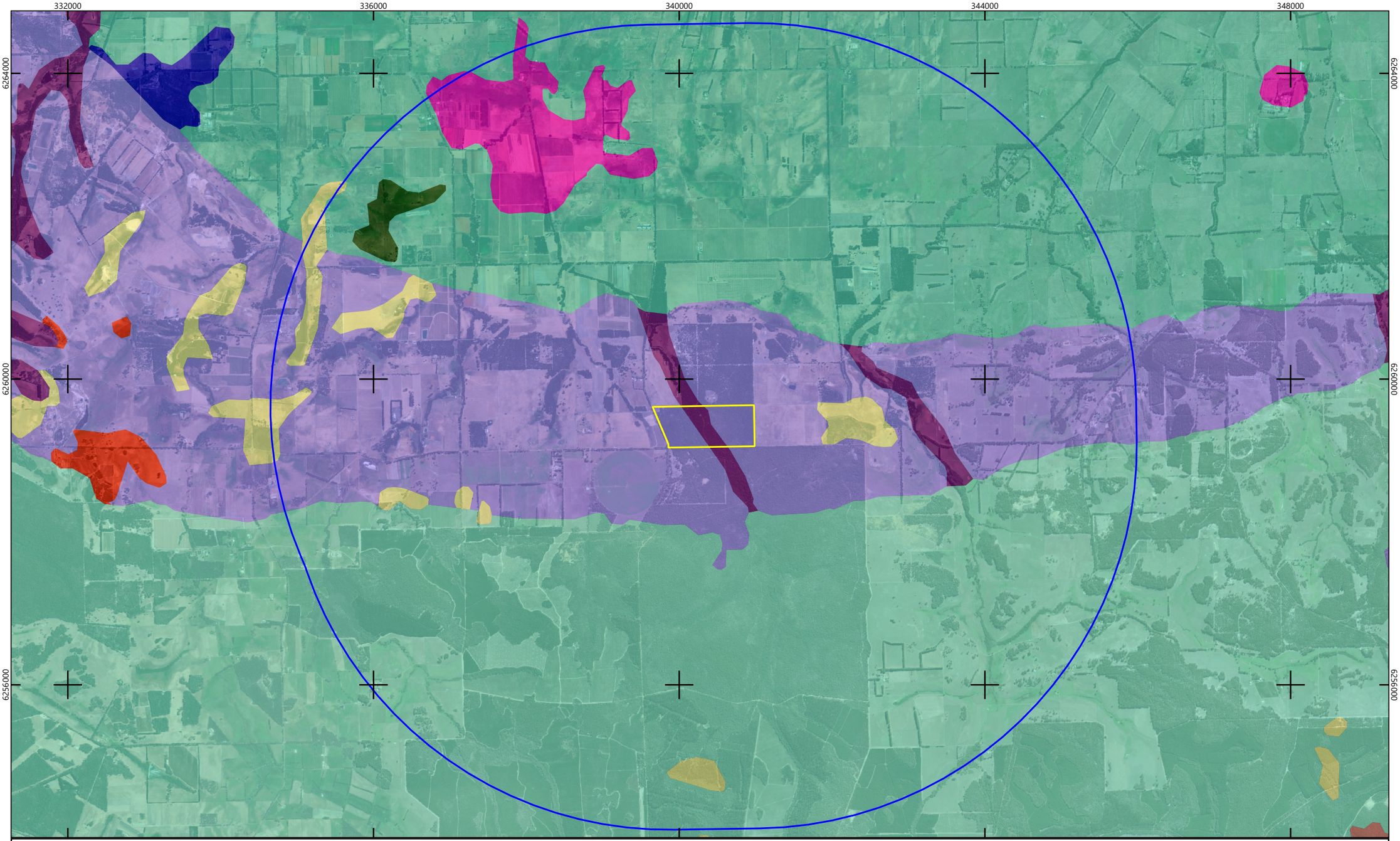

Figure 5 - Pre-European Vegetation

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3.4.2 Vegetation Complexes

Vegetation complexes defined by Heddle *et al.* (1980) and updated by Webb *et al.* (2016) within the survey area and are categorised based on vegetation in association with landforms and underlying geology.

One vegetation complex, Yelverton, occurs within the survey area (**Table 7**, **Figure 6**). The Yelverton complex broadly supports low open woodland of *Corymbia calophylla* and *Eucalyptus marginata* with *Allocasuarina fraseriana* and/or *Agonis flexuosa*.

The remaining extents of the Heddle *et al.* (1980) vegetation complex within the survey area (**Table 7**) across State and Local Government Area (LGA) contexts exceed 30% of the pre-European extent, represented by 37.29% and 33.86%, respectively.

Table 7 - Vegetation Complexes within the Survey Area (Government of Western Australia 2019)

Extent	Vegetation Complex	Pre–European Extent (ha)	Current Extent (ha)	Pre-European Extent Remaining (%)
Western Australia	Yelverton Complex	15,504.56	5,781.26	37.29
City of Busselton Local Government Area	Yelverton Complex	14,611.51	4,947.70	33.86

*Cells highlighted grey indicate where less than 30% of the pre-European extent remains

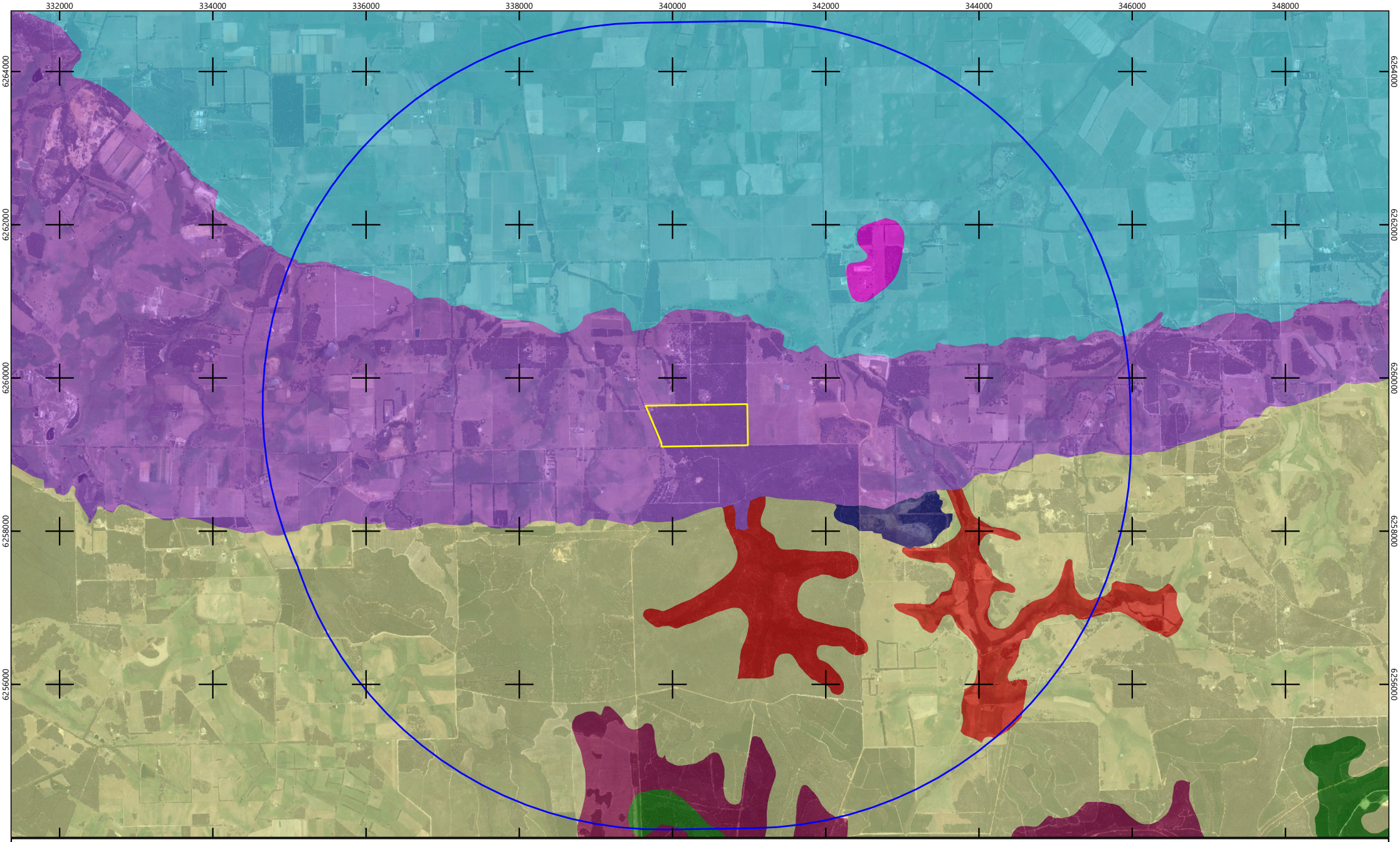

Figure 6 - Vegetation Complexes

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