# RECONNAISSANCE FLORA AND VEGETATION SURVEY REPORT

CBH Borden Expansion Area

Borden, WA 6338

Final

07/02/2023

BUSHFIRE | ENVIRONMENTAL | WATER | GIS

# DOCUMENT CONTROL

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## Executive Summary

Cooperative Bulk Handling ("the client") commissioned Bio Diverse Solutions as Environmental Consultants to undertake a spring reconnaissance flora and vegetation survey for an area of 49.5 ha at the CBH Borden Grain Receival Site in the Shire of Gnowangerup, forming the "survey area". The reconnaissance survey was required to provide environmental assessment data to support future environmental approvals for the expansion of the site. Current development proposals are not finalised and no plans were completed or provided to Bio Diverse Solutions at the time of this assessment.

Three vegetation units were identified within the survey area, namely *Allocasuarina fraseriana* Open Forest [AfOF], Mixed Eucalyptus Woodland [MEW] and *Acacia acuminata* Low Open Forest [AaLOF]. The condition of the vegetation units were 'Completely Degraded' or 'Degraded', largely due to disturbance from the adjacent road reserves and agricultural area and invasion of agricultural weeds. 40.3 ha of the 49.5 ha survey area was considered to be cleared, consisting of roads, CBH infrastructure or agricultural land. 153 species of flora were identified within the survey area, including 49 introduced or non-native species one which is classified as a 'Declared pest – s22(2) and Weed of National Significance (IPAC, 2017) under the *BAM Act 2007*; *Asparagus asparagoides* (bridal creeper). The likelihood of occurrence (LOO) assessment undertaken as part of the desktop assessment identified 19 species of Threatened and 72 species of Priority flora as occurring within 20 – 30 km of the survey area. Minor limitations were present on numerous species that have been assessed as 'Likely' or 'Possible', relating to lack of information on undescribed species, fire ephemeral species and autumn flowering species. No species of Priority or Threatened flora were identified within the survey area, with all species present listed as non-threatened and known to be locally common. Vegetation unit 2 (Mixed Eucalyptus Woodland) bore resemblance to a Threatened (TEC) and Priority (PEC) Ecological Community identified on the desktop assessment, 'Eucalyptus Woodlands of the Western Australian Wheatbelt (Wheatbelt Woodlands)'. Analysis indicated that it met Criteria 1 and 2 but did not meet the Criteria 3, 4 and 5 relating to the dominant overstorey species, the composition of the understorey and the condition of the vegetation, it was therefore not considered to be present within the survey area. No other vegetation units bore resemblance to TEC/PEC and there were no other TEC/PECs identified in the survey area.

# 1. Introduction, Scope and Background Information

Cooperative Bulk Handling (CBH), here in referred to as "the client" commissioned Bio Diverse Solutions as Environmental Consultants to undertake a spring reconnaissance flora and vegetation survey of the proposed CBH Borden expansion site in Borden. The purpose of the survey is to provide environmental assessment data to support future environmental approvals. Current development proposals are not finalised and no plans were completed or provided to Bio Diverse Solutions at the time of this assessment.

The scope of works include:

- Complete a desktop assessment of publicly available databases (including DBCA database searches) pertaining to the site for threatened flora and vegetation;
- Undertake a spring flora and vegetation survey across the survey area including targeted threatened flora survey, field GPS vegetation and flora and mapping of boundaries of vegetation community types and threatened and Priority flora (if present);
    - This shall include a likelihood of occurrence (LOO) assessment for all conservation significant flora species and ecological communities identified in desktop searches;
    - TPFL forms for new populations of Priority or threatened flora and ecological communities to be submitted to DBCA;
- Undertake any identification of flora species, including herbarium identification as required;
- Identification and mapping of the vegetation condition within the survey area using the EPA (2016) condition scale, including the location of any Weeds of National Significance (WoNS) or Declared Weeds;
- Undertake quadrant sampling in vegetation units where TEC/PEC is potentially present;
- Prepare IBSA data package as per EPA guidelines, and provide to client at completion of survey (as required to be submitted via the IBSA website by the client);
- Preparation of reconnaissance and targeted flora and vegetation survey report and memo, which will be aligned with the appropriate government agency legislation and guidelines; and
- Preparation of a standalone memo providing assessment of the 10 clearing principals and any recommendations and assessment of the impacts of the project(s).

## 1.1 Location and Development Proposal

The 'survey area' is defined as the 49.5 ha area situated within and adjacent to the CBH Borden receival site, located in the Shire of Gnowangerup (Figure 1). The following tenures were included in the survey area:

- CBH Borden receival site: Lot 150 Moir Street, Borden (CBH managed)
- Lot 361 Moir Street, Borden (CBH managed)
- Lot 111 Moir Street, Borden (CBH managed)
- Lot 112 Moir Street, Borden (CBH managed)
- Lot 92 Moir Street, Borden (CBH managed)
- Lot 500 (No. 4) Moir Street, Borden (CBH managed)
- Portion of Lot 9001 (No. 36) Magitup Road (private property)
- Moir Street road reserve (Shire of Gnowangerup managed)

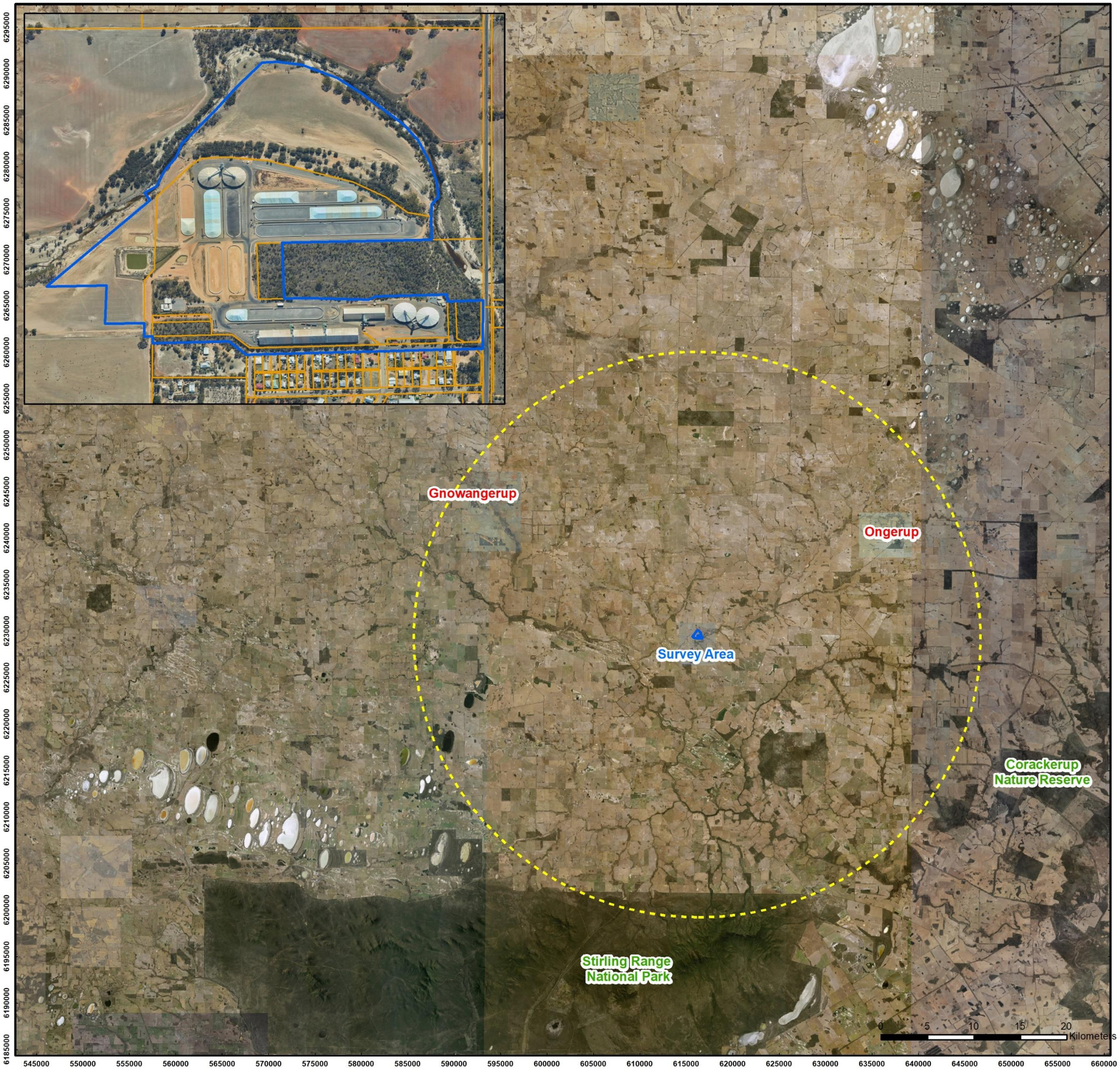
This site has been earmarked by Cooperative Bulk Handling for expansion of their grain storage facility, but development proposals have not been finalised and are only in draft stage, pending the information collected during this due diligence environmental assessment.

The "study area" consists of the 20-30 km radius around the survey area, used for indications of likelihood of occurrence of Threatened or Priority flora and ecological communities. It provides a broader local context and assessment of the survey area. This reconnaissance survey provides base-line data for determining what further surveys and environmental approvals may be required if proposed development includes clearing of native vegetation, such as further targeted or detailed surveys.

## 1.2 Alignment to Legislation, Guidelines and Policies

This survey and subsequent report is aligned to the following legislation, guidelines and policies:

- *Environmental Protection and Biodiversity Conservation Act 1999* (EP Act). Administered by the Australian Government of Department of Agriculture, Water and Environment (DAWE);
- *Biodiversity Conservation Act 2016* (BC Act). Administered by the Western Australian Department of Biodiversity, Conservation and Attractions (DBCA);
- *Environmental Protection Act 1986* (EP Act). Administered by the Western Australian Department of Water and Environmental Regulations;
- *Biosecurity and Agriculture Management Act 2007* (BAM Act);
- EPA (2016) Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment; and
- CoA (2013) Draft Survey guidelines for Australia's Threatened Orchids.

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Overview Map Scale 1:5,000,000

**Legend**

- Survey Area
- 30 km Study Area

Scale
1:400,000@ A3
GDA2020 MGA Zone 50

**Data Sources**
Aerial Imagery: WA Now, Landgate Subscription Imagery
Cadastre, Relief Contours and Roads: Landgate 2017
IRIS Road Network: Main Roads Western Australia 2017
Overview Map: World Topographic map service, ESRI 2012

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Borden Expansion Area
Lot 91 Moir Sreet
Borden, WA 6338

**Figure 1: Survey Area Locality**

| | *QA Check* | *Drawn by* |
|---|---|---|
| | **KPK** | **BMT** |
| *STATUS* | *FILE* | *DATE* |
| **FINAL** | **CBH0025** | **05/12/2022** |

## 1.3 Geology and soils

Database searches shows the survey area lies within the Upper Pallinup System (241Up). The Upper Pallinup System is described as *"Gently undulating rises in the Pallinup Zone with broad crests and upland plains. Grey shallow sandy duplex (some alkaline), shallow loamy duplex (some alkaline) and grey deep sandy duplex. Wandoo-York gum woodland (west) and mallee (east)"* (DPIRD, 2022a).

The Pallinup Zone (241) is described as "*Undulating rises on Archaean granitic rocks in the Upper Pallinup catchment. Shallow duplex soils, commonly with sodic and alkaline subsoils. Woodlands of York and Salmon gums, wandoo and yate dominate."* (DPIRD, 2022b). The soil type within the application area is mapped as the Upper Pallinup 3 subsystem (241Up_3) and Upper Pallinup 5 subsystem (241Up_5). The Upper Pallinup 3 subsystem is described as "*Lower to upper slopes and crests associated with shallow granite and dolerite. Soils are mainly grey sandy duplex soils (generally shallow) and minor areas of red duplex soils"* and the Upper Pallinup 5 subsystem is described as *"Narrow saline valley flats with minor areas of alkaline grey shallow sandy duplex soils, brown and pale deep sands"* (DPIRD, 2022c).

## 1.4 Climate

The closest open Bureau of Meteorology (BoM) site is Ongerup (010622). The average annual temperature in Ongerup ranges from 5.7–28.8°C. The average summer temperature ranges between 10.4-28.8°C, whilst average winter temperatures range between 5.7-16.2°C. The annual mean rainfall for Ongerup is 386.5 mm (BoM, 2022). On average the months of May – September are the months with the highest rainfall (Figure 2). There was higher than average rainfall recorded in the months of October 2021, and higher than average rain recorded in March, April, June, July, and August 2022 (Figure 2). The total rainfall in the year previous to the survey (October 2021 – September 2022) was 412.2 mm which is 25.7 mm above average and equates to 6.6% increase in average rainfall.

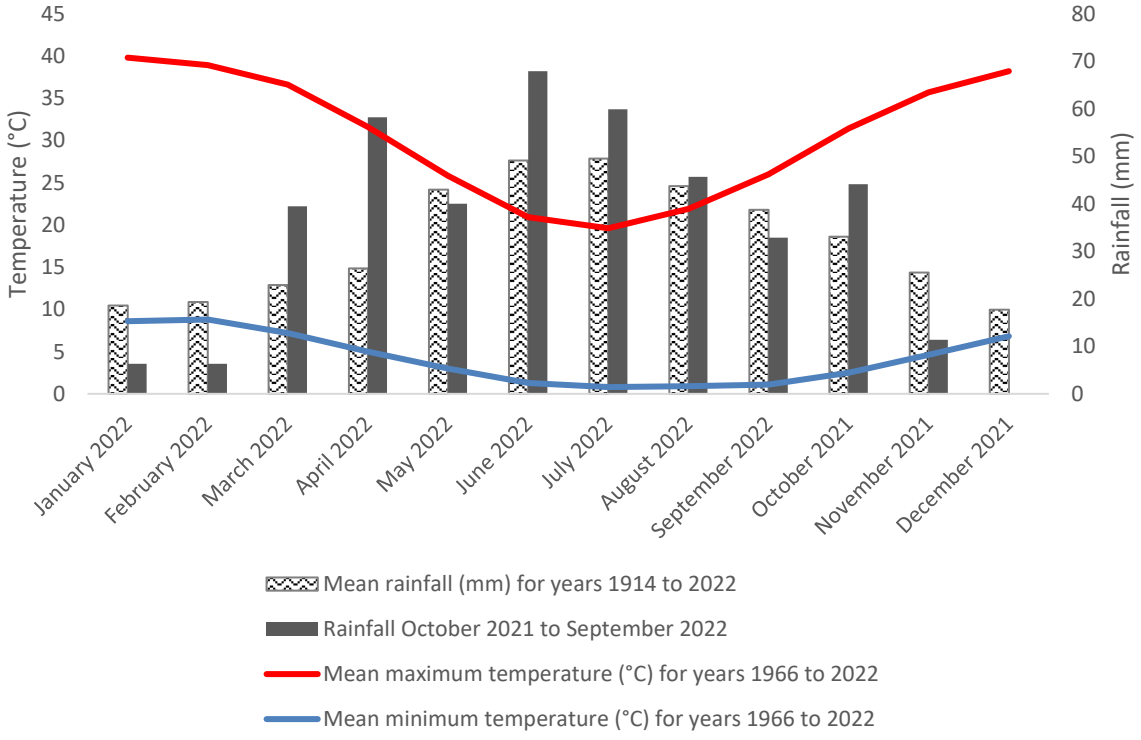


**Figure 2: Temperature and Rainfall Data for Ongerup BoM Weather Station No. 010622.**

## 1.5 Habitat Connectivity

Habitat connectivity assessments rely on a bioregional and landscape-scale approach to evaluate habitat for fauna movement and ecological linkage across a region. Habitat connectivity is largely reliant on remnant vegetation, recognising it plays a very

important role in developing corridors between protected areas to assist in achieving long-term biodiversity management outcomes (Wilkins *et al*. 2006). The survey area lies within a highly modified landscape consisting of agricultural properties. The Stirling Range National Park is located approximately 27 km south of the survey area and the Corackerup Nature Reserve is located approximately 34 km to the southeast. There are other small to large areas of remnant bushland located to the north, south, east and east of the survey area. The survey area is ultimately linked to these surrounding areas of vegetation through the existing road reserves, and vegetation within private property.

## 1.6 Water

The survey area does not lie within any Public Drinking Water Source areas (DWER, 2022). The Warperup Creek travels directly adjacent to the survey area, to the north. No RAMSAR wetlands, or significant wetlands are located within or near the survey area (DBCA, 2017). The survey area lies within the Pallinup (HZ22_P) Hydrological Zone (DPIRD, 2022d). The Pallinup zone is described as "*Undulating rises on Archaean granitic rocks in the Upper Pallinup catchment. Shallow duplex soils, commonly with sodic and alkaline subsoils. Woodlands of York and Salmon gums, wandoo and yate dominate.*" (DPIRD, 2022d). The survey area lies within the Beaufort Inlet-Pallinup River Hydrographic Catchment (DWER, 2018a) and within the Pallinup River Hydrographic Subcatchment (DWER, 2018b).

Standing water bodies and creeks were present in the southeast and in the vegetated section of the survey area.

## 1.7 Environmentally Sensitive Areas

The survey area does not contain any Environmentally Sensitive Areas (ESA), the nearest site lying approximately 2.8km to the south of the survey area (DWER, 2021).

## 1.8 Remnant Vegetation

The survey area lies within the Mallee Bioregion and Western Mallee (MAL02) subregion. Beecham and Danks (2001) describes the Mallee Bioregion as "*The Mallee bioregion is the south-eastern part of Yilgarn Craton. Its landscape is gently undulating, with partially occluded drainage. Mallee over myrtaceous-proteaceous heaths on duplex (sand over clay) soils are common. Melaleuca shrublands characterise alluvia, and Halosarcia low shrublands occur on saline alluvium. A mosaic of mixed eucalypt woodlands and mallee occur on calcareous earth plains and sandplains overlying Eocene limestone strata in the east. Landscape is fragmented with particular surface-types almost completely cleared as wheatfields."*

The vegetation has been mapped on a broad scale by J.S. Beard (Shepherd *et al.* 2002) in the 1970's, where a system was devised for state-wide mapping and vegetation classification based on geographic, geological, soil, climate structure, life form and vegetation characteristics (Sandiford and Barrett, 2010). Vegetation units were regarded as associations and were grouped into Vegetation Systems representing a particular pattern of association distribution within a given area. A GIS search of J.S. Beards (Beard *et al.* 2013) vegetation classification places the survey area within one System and Vegetation Association (DPIRD, 2019) Refer to Figure 10 in Appendix A:

- **System Association Name**: Pallinup
- **Vegetation Association Number:** 938
- **Structure Description:** Woodland other
- **Floristic Description:** Wheatbelt; York gum, salmon gum etc. *Eucalyptus loxophleba*, *E. salmonophloia*. Goldfields; gimlet, redwood etc. *E. salubris*, *E. oleosa*. Riverine; rivergum *E. camaldulensis*. Tropical; messmate, woolybush.
- **Remnant Vegetation by Beard Association Rarity in LGA:** 18.07% remaining (GoWA, 2019).
- **Remnant Vegetation by Beard Association Rarity in IBRA Region:** 14.59% remaining (GoWA, 2019).

## 1.9 Heritage

The survey is located within the Wagyl Kaip nation, and not located within a registered heritage site (DPLH, 2022). The closest registered heritage site (4476) is located approximately 130 m to the south of the survey area. It is recognised that there has been a large scale of loss of cultural knowledge and information, and the survey area may contain additional heritage values that are not recognised through DPLH (2022).


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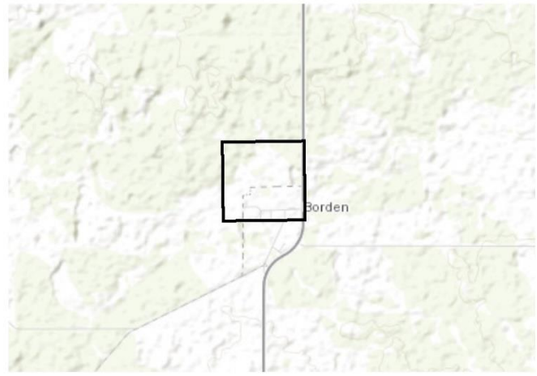


Overview Map Scale 1:100,000

**Legend**

- Survey Area
- Cadastre
- Geoscience Australia 250K Waterline

**Pre European Vegetation (DPIRD_006)**

- Pallinup, 938

Scale
1:3,750 @ A3
GDA2020 MGA Zone 50

**Data Sources**
Aerial Imagery: WA Now, Landgate Subscription Imagery
Cadastre, Relief Contours and Roads: Landgate 2017
IRIS Road Network: Main Roads Western Australia 2017
Overview Map: World Topographic map service, ESRI 2012

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**Figure 3: Desktop Data.**

| | *QA Check* | *Drawn by* |
|---|---|---|
| | **BMT** | **CvdM** |
| *STATUS* | *FILE* | *DATE* |
| **FINAL** | **CBH0025** | **05/12/2022** |

# 2. Methodology – Desktop Assessment

## 2.1. Threatened and Priority Flora and Ecological Communities

Desktop inventory of potential Threatened and Priority flora and ecological communities known to occur within 20-30 km of the survey area was undertaken using the following databases:

- 20 km Nature Map Database Search (combined data from DBCA, WA Museum and WA Herbarium; DBCA, 2007-; WAH 1998-);
- 20 km Protected matters search tool (DAWE 2022);
- 30 km Flora DBCA database records (DBCA, 2022a); and
- 20 km TEC/PEC DBCA database records (DBCA, 2022b).

The conservation significance of flora species has been assessed using data from the following sources:

- *Environment Protection and Biodiversity Conservation Act 1999* (*EPBC Act*). Administered by the Australian Government Department of Agriculture, Water and the Environment (DAWE);
- *Biodiversity Conservation Act 2016* (*BC Act*). Administered by the Western Australian Department of Biodiversity Conservation and Attractions (DBCA); and
- DBCA Priority and threatened ecological community list (DBCA, 2021). A non-legislative list maintained by DBCA for management purposes.

## 3. Methodology – Field Survey

The aim of this survey was to provide context and gather knowledge of the survey area. This type of survey aims to verify the desktop information obtained, and to characterise the flora and vegetation units present within the survey area.

A spring reconnaissance level flora and vegetation survey, including a targeted vegetation survey, was undertaken by Charlize van der Mescht (Ecologist / Environmental Consultant) of Bio Diverse Solutions and Karri Grant (Ecologist / Environmental Consultant) of Natural Area Consulting Management Services on the 17th and 18th of October 2022. The survey area was surveyed on foot using traverses, relevés and quadrats. The intent of the traverses was to identify and map the different vegetation units present within the survey area, their condition category and to undertake more intensive targeted surveys within suitable habitat for conservation significant species. The vegetation units occurring within the survey area were mapped and described using opportunistic mapping, relevés and quadrats. Vegetation units were formally described based on data collected within the relevé and quadrats. Vegetation units were distinguished through changes in structure, dominant taxa and cover characteristics, which is described in both Muirs (Muir, 1977) and NVIS (DoEE, 2017) Level 5 (sub-association) description methods.

Three relevés were systematically surveyed within representative vegetation types to enable analysis and categorisation across the ecological communities present (refer to Appendix D). The flora was systematically recorded within the relevés and collections of plant specimens were made where further identification was required, using Charlize van der Mescht's Regulation 62 Flora Taking Licence FB62000460. For species that were not flowering and where foliage or nuts / fruit couldn't be used for identification, potential habitat was used as an indication of the likelihood of species occurrence.

An assessment was completed during the field survey on whether vegetation units were likely to meet any TEC/PEC's identified as 'likely' or 'possible' to occur in the LOO. This predominately applied to Wheatbelt Woodland TEC/PEC and an assessment of ecological communities against criteria occurred. Where vegetation units bore resemblance to Wheatbelt Woodland TEC/PEC, more intensive sampling was conducted via quadrats to ecologically define communities within the survey area. This methodology is consistent with a Targeted Vegetation Survey. Non-permanent 10 x 10 m quadrats were sampled and analysed to identify if vegetation units met Wheatbelt Woodland TEC/PEC criteria (Table 6, Section 5.6; DoE, 2015b). This occurred in vegetation unit 2: Mixed Eucalyptus Woodland (refer to Section 5.6). Three quadrats were systematically sampled within this vegetation unit, with photos and GPS coordinates recorded on the north-western corners.

Information collected within each relevé and quadrat included:

- Location: coordinates of the relevé using a handheld GPS unit.
- Date and site code.
- Site description: landform, slope, soil colour and type and hydrology.
- Vegetation description: dominant and non-dominant species present within the different growth forms and percentage cover.
- Vegetation condition.

### 3.1. Survey Limitations and Constraints

An assessment of potential survey limitations was undertaken as per the EPA (2016) document *Technical Guidance Flora and Vegetation Surveys for Environmental Impact Assessment* (refer to Table 1 below). Limitations were primarily nil-minor in nature, and did not affect the validity of results presented in the reconnaissance survey. Minor limitations present included survey timing, lack of information on predominately undescribed, informal species, standing water limiting access and survey intensity for targeting orchid species.

Specifically, a random meandering traverse ensured that all areas within 5-10m of each other were covered. However, it is recognised that due to the complex nature of orchid phenology and physiology, more intensive survey transects and surveys over multiple time periods may be required (CoA, 2013). The survey was conducted at the appropriate time to detect the three orchid species identified in the desktop assessment.

Six species were identified in the likelihood of occurrence (LOO; Table 8, Appendix B) as 'Possible' to occur with very limited information present taxonomically, which was taken into account during identification, with precautionary principles applied to relevant genera. This was considered a minor limitation.

One species of lichen (P1 *Xanthoparmelia scabrosina*) was identified in the desktop assessment. This was outside the expertise of surveyors and was not accurately assessed during this survey. This presents a significant limitation for this species.

**Table 1: Assessment of potential survey limitations.**

| Limitation | Significance of limitation | Comment |
|---|---|---|
| Experience of personnel | Nil | Charlize van der Mescht has been with Bio Diverse Solutions since 2019 first as a Technical Assistant and now as an Ecologist / Environmental Consultant. Charlize has assisted Dr. Ellen Hickman and Katie White (Bio Diverse Solutions Botanists) on multiple reconnaissance and targeted flora and vegetation surveys during this time.<br>Karri Grant has over 4 years' experience at conducting targeted, reconnaissance and detailed flora surveys, and is competent in taxonomic identification and assessment of vegetation.<br>One species of lichen (P1 *Xanthoparmelia scabrosina*) was identified in the desktop assessment. This was outside the expertise of surveyors and was not accurately assessed during this survey. This presents a significant limitation for this species.<br>Katie White completed the technical review component of this report. Katie has over 5 years' experience at conducting targeted, reconnaissance and detailed flora surveys and is competent in taxonomic identification and assessment of vegetation. Additionally, she has conducted targeted flora surveys and worked alongside the DBCA Flora Conservation Officer for a large number of flora species listed on the 20-30 km desktop analysis.<br>Kylie Sadgrove provided field technical assistance. Kylie has over 5 years' experience at conducting targeted, reconnaissance and detailed flora surveys, and is competent in taxonomic identification and assessment of vegetation. |
| Survey timing | Minor | The client requested a spring flora and vegetation survey, consistent with peak flowering times for the majority of species in the area. Timing of survey occurred towards the end of the peak flowering period in this locale, and was undertaken on the 17th and 18th of October 2022.<br>Five species that were identified as 'Likely' or 'Possible' to occur in the LOO are not recorded as flowering in October. However, three species were flowering on the periphery of the survey period, in September, and it's therefore likely they had sparse early/late blooms or were distinctively budding. For these species, it is therefore a minor limitation. The other two species, namely P4 *Eucalyptus vesiculosa* and P4 *Banksia porrecta* were recorded as flowering in May and July to August, respectively. These species are both readily detectable without flowering, and no limitation is present.<br>Three orchid species were identified in the desktop assessment as 'Likely' or 'Possible' to occur. Information of flowering times was available for two of these species. *Thelymitra psammophila* is recorded as flowering between September and October, while *Caladenia bryceana* subsp. *bryceana* is recorded as flowering between August and October. No information was available on the flowering time of *Thelymitra* sp. Ongerup. The survey occurred in October which is an appropriate time to be surveying for these annual species (CoA, 2013). |
| Access restrictions | Minor | The vast majority of the survey area was easily traversable and no limitation in access was present.<br>Some access restrictions occurred during the survey, with standing water in a small area to the southeast of the lot not being traversable. This is not deemed to have significantly impacted the completeness of this survey. |

**Table 1 cont.**

| Limitation | Significance of limitation | Comment |
|---|---|---|
| Availability of contextual information | Minor | Publicly available desktop and background information was readily available to give a broad contextual understanding of the site. However, it is worth noting that database searches often rely on historical, outdated, understudied and under-resourced datasets and likely are not a comprehensive reflection of population status or presence of Priority or Threatened flora across the South Coast.<br>One species was identified in the LOO (Table 8, Appendix B) as 'Possible' to occur with very limited information present taxonomically. This primarily related to the undescribed, informal species P3 *Thelymitra sp.* Ongerup (S. Oborne 142) Due consideration was given and precautionary principles applied to any species in this genus during identification.<br>P1 *Xanthoparmelia scabrosina* is a lichen and was not surveyed for, as it is outside of the expertise of surveyors. |
| Survey effort and extent | Minor | 153 species were identified during the survey, and four relevé and three quadrat data sets were collected to gain as complete a picture as possible of flora species present at the site.<br>The area was sufficiently and lengthily searched for Threatened and Priority flora potentially present in the area. A random meandering traverse ensured that all areas within 5-10m of each other were covered.<br>Three orchid species were identified as 'Likely' or 'Possible' in the 20-30 km LOO; namely *Thelymitra psammophila* (T-VU), *Thelymitra* sp. Ongerup (S. Oborne 142; P3), and *Caladenia bryceana* subsp. *bryceana* (T-EN). Following the CoA (2013) *Draft Survey guidelines for Australia's Threatened Orchids,* it is recognised that due to the complex nature of orchid phenology and physiology, more intensive survey transects and surveys over multiple time periods may be required. See Appendix B, Table 8. |
| Disturbances that may affect results | Nil | Significant degradation occurred at the site with all vegetation units being in 'Degraded' or 'Completely Degraded' condition. The degradation has resulted in a high level of weed invasion and large areas of historical clearing. This may have affected the expression of species present, with a higher dominance of disturbance opportunists present. No obvious disturbance was present in the survey area.<br>Suitable habitat for species considered to have historically been possible to occur is mostly no longer present within the site, due to the extensive degradation across the site, resulting in a degraded or completely degraded condition across the survey area, in the areas that haven't been entirely cleared. It is also likely that if populations of species assessed as "possible" to occur were historically present at the site, the soil seed bank has been significantly impacted and compromised from disturbance through hooved grazers, off-site effects of chemical and fertiliser from surrounding agricultural use and the evident lengthy timeframe that the site has been disturbed. |

**Table 1 cont.**

| Limitation | Significance of limitation | Comment |
|---|---|---|
| Identification issues | Nil | The survey was undertaken on 17th and 18th of October 2022 during the peak flowering period for many south coast flora species to maximise ease of identifying them, however given that not all flora species flower during this time some species will be more difficult to observe in the field than others.<br>One cultivated species *Eucalyptus caesia* was still at a juvenile stage, therefore it was not possible to determine whether the species was the P4 subspecies. However, the individual was planted as part of the landscaping work so it is not considered endemic to the survey area directly and not of conservation significance in the context of native vegetation.<br>14 species were observed during the survey period that could not be identified to species level due to lack of distinguishing taxonomic features. All of these species were identified to family or genus level. Of the 14 species observed, six species were in the same family or genus as Threatened or Priority flora identified in the desktop assessment as being 'Possible' to occur. It was determined that none of these unidentified species are likely to be any of the Threatened/Priority species listed as 'Possible' to occur.<br>Of the 153 species, the vast majority contained sufficient taxonomic information for identification (such as nuts, fruit, leaf structure or flowers). It is estimated that 70% of species present were flowering. Numerous emerging annual herbs were present, most of which could be identified through the presence of flowers. For numerous Priority species listed on the 20-30 km LOO, there were similar non-threatened species present, with specific rationale provided in Table 8, Appendix B. |

# 4. Results – Desktop Assessment

## 4.1. Threatened and Priority Flora

The full species list compiled from all available data (Table 15 in Appendix D) is based on observations from a broader area than the survey area and is likely to include species that would not occur in the actual survey area due to a lack of suitable habitat. The data also includes very old records and in some cases the species in question may have become locally or regionally extinct. Conservation categories for Threatened and Priority flora are presented in Table 10 and 10 in Appendix C. Protected matters search tool database searches are provided in Appendix E.

As a result of the above-mentioned database searches 19 Threatened and 72 Priority flora species were identified within the study area (30 km buffer). Of these, 27 were assessed to be "Possible" to occur and two were assessed as "Likely" to occur. Refer to Table 8 in Appendix B for LOO analysis. Species that have previously been recorded within a 30 km radius of the survey area are shown in Figure 4.

Suitable habitat for species considered to have historically been possible to occur is mostly no longer present within the site, likely due to the extensive degradation across the site, resulting in a degraded or completely degraded condition across the survey area, in the areas that haven't been entirely cleared. It is also likely that if populations of species assessed as "possible" to occur were historically present at the site, the soil seed bank has been significantly impacted and compromised from disturbance through hooved grazers, off-site effects of chemical and fertiliser from surrounding agricultural use and the evident lengthy timeframe that the site has been disturbed.

Numerous limitations were present in detection of species identified within the desktop assessment, which are detailed in Table 1. A brief summary is provided below;

- Expertise of surveyors – P1 *Xanthoparmelia scabrosina* is a lichen and is outside of the expertise of surveyors and therefore could not be accurately surveyed for.
- Flowering time – P4 *Acacia declinata* was identified as 'Possible' to occur and is recorded as flowering in August to September, on the periphery of the survey period. This may represent a minor limitation, and it is recognised that detection of the species is possible without flowering.
- Flowering time – EN *Roycea pycnophylloides* was identified as 'Possible' to occur and is recorded as flowering in September, on the periphery of the survey period. This may represent a minor limitation, and it is recognised that detection of the species is possible without flowering.
- Flowering time – P3 *Calectasia obtusa* was identified as 'Possible' to occur and is recorded as flowering in August to September. This may represent a minor limitation, as it is recognised that this species is a cryptic and hard to detect without flowers. However, the survey was conducted on the periphery of the flowering period meaning some flowering material may still have been present at the time of the survey.
- Limitation information present on species – one species (P3 *Thelymitra sp. Ongerup* (S. Oborne 142)) was deemed as having a lack of information due to the undescribed, informal nature of the species. Due consideration was given and precautionary principles applied to any species in this genus during identification.

## 4.2. Threatened and Priority Ecological Communities

As a result of the database searches conducted, two Threatened (TEC) and Priority (PEC) Ecological Communities were identified within the study area (20 km buffer), 'Eucalyptus Woodlands of the Western Australian Wheatbelt (Wheatbelt Woodlands)' and 'Proteaceae Dominated Kwongkan Shrublands of the Southeast Coastal Floristic Province of Western Australia (Kwongkan)'. Of these, Wheatbelt Woodlands was assessed as 'likely' to occur and Kwongkan as "Possible" to occur. Further detail on both Wheatbelt Woodlands and Kwongkan are presented below.

TEC/PECs that have previously been recorded within a 20-30 km radius of the survey area are shown in Figure 4. Refer to Table 9 in Appendix B for LOO analysis. Conservation categories for Threatened and Priority ecological communities are presented in Table 12 and 13 in Appendix C. Protected matters search tool database searches are provided in Appendix E.

**Eucalypt Woodlands of the Western Australian Wheatbelt (Wheatbelt Woodlands)**

Wheatbelt Woodlands is listed as a Priority 3 (P3) Priority Ecological Community (PEC) under the *BC Act 2016* and an Endangered Threatened Ecological Community (TEC) under the *EPBC Act 1999*. The survey area lies within the Avon Wheatbelt IBRA Bioregion and Merredin IBRA subregion (AVW01), within the boundaries of the location criteria for Wheatbelt Woodlands. It is therefore a possibility that Wheatbelt Woodlands may be present within the survey area.

Wheatbelt Woodlands is comprised of Eucalypt woodlands that formerly were the most common type of vegetation across the wheatbelt landscape of south-western WA, inland between the Darling Range and western edge of the Goldfields. The woodlands are dominated by a complex mosaic of eucalypt species with a tree or mallet form over an understorey that is highly variable in structure and composition. Woodlands dominated by mallee forms or vegetation with a very sparse eucalypt tree canopy are not part of the ecological community (DoEE, 2015).

Wheatbelt Woodlands is recognised by the below key diagnostic features and minimum condition thresholds as outlined in the approved conservation advice guidelines (DoEE, 2015):

1) Occurs within the IBRA Avon Wheatbelt subregions Merredin (AVW01) and Katanning (AVW02), Western Mallee subregion (MAL02) and jarrah forest subregions Northern Jarrah Forest (JAF01) and Southern Jarrah Forest (JAF02) when adjacent to the Avon Wheatbelt.
2) Structure of the ecological community is a woodland, with minimum crown cover of tree canopy of mature woodland being 10% (crowns measured as if opaque).
3) Key species of the tree canopy are species of *Eucalyptus* identified in Table 2a of approved conservation guidelines (DoEE, 2015). These are species that typically have a single trunk. One or more tree species are dominant or co-dominant within the patch of the ecological community. If other species are present in the tree canopy, then these do not occur as dominant in the tree canopy.
4) Native understorey is present but is of variable composition, being a combination of grasses, other herbs and shrubs, as specified in Table A3 of Appendix B.

Condition thresholds for the ecological community are described in Table 2. General notes on the condition thresholds of the ecological community are outlined in the Approved Conservation Guidelines for Wheatbelt Woodlands (DoEE, 2015).

**Table 2: Condition thresholds for Wheatbelt Woodlands TEC diagnostic criteria**
Note: Condition is referenced to Keighery (1994) and Relative Conservation Value (RCV) is related to Roadside Conservation Committee (RCC, 2014).

| Category and comment | Cover of exotic plants (weeds) AND | Mature trees AND | Minimum patch size (non-roadside patches) OR | Minimum patch width (roadsides only) |
|---|---|---|---|---|
| A: patches likely to correspond to condition of Pristine / Excellent / Very Good or a High RCV. | Exotic plants account for 0 to 30% of total vegetation cover in the understorey layers i.e., below the tree canopy. | Mature trees may be present or absent. | >2ha | >5m |
| B: Patches likely to correspond to a condition of Good or a Medium-High RCV AND retains important habitat features. | Exotic plant species account for 30-50% of total vegetation cover in the understorey layers i.e., below the tree canopy. | Mature trees are present, >5 trees/ha. | >2ha | >5m |

**Table 2 cont.**

| Category and comment | Cover of exotic plants (weeds) AND | Mature trees AND | Minimum patch size (non-roadside patches) OR | Minimum patch width (roadsides only) |
|---|---|---|---|---|
| C: Patches likely to correspond to a condition of Good or a Medium-High RCV. | Exotic plant species account for 30-50% of total vegetation cover in the understorey layers i.e., below the tree canopy. | Mature trees either absent or <5 trees/ha. | >5ha | >5m |
| D: Patches likely to correspond to a condition of Degraded to Good or medium-low RCV BUT retains important habitat features. | Exotic plant species account for 50-70% of total vegetation cover in the understorey layers i.e., below the tree canopy. | Mature trees present at >5 trees/0.5ha. | >5ha | >5m |

**Proteaceae Dominated Kwongkan Shrublands of the Southeast Coastal Floristic Province of Western Australia (Kwongkan)**

Kwongkan is listed as Priority 3 (P3) PEC within WA under the *Biodiversity Conservation Act 2016* (BC Act) and as an Endangered Threatened Ecological Community (TEC) under the *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act). The survey area lies within the southeast botanical province of Western Australia (Hopper and Gioia, 2004), which is the geographical location of Kwongkan. It is defined and assessed in the conservation advice as generally Kwongkan shrubland, ranging from sparse to dense, thicket-forming, where Proteaceous species form a significant component (DoE, 2014). It is confined to the southeast botanical province of Western Australia (Hopper and Gioia, 2004) and primarily occurs on sandplains and marine plains and lower to upper slopes and ridges, as well as uplands across this region. Multiple other ecological communities are listed under the *BC Act 2016* that also meet criteria of Kwongkan TEC and should be considered when assessing whether Kwongkan is present.

Kwongkan is recognised by the below key diagnostic features and minimum condition thresholds outlined in Approved Conservation Advice Guidelines (DoE, 2014):

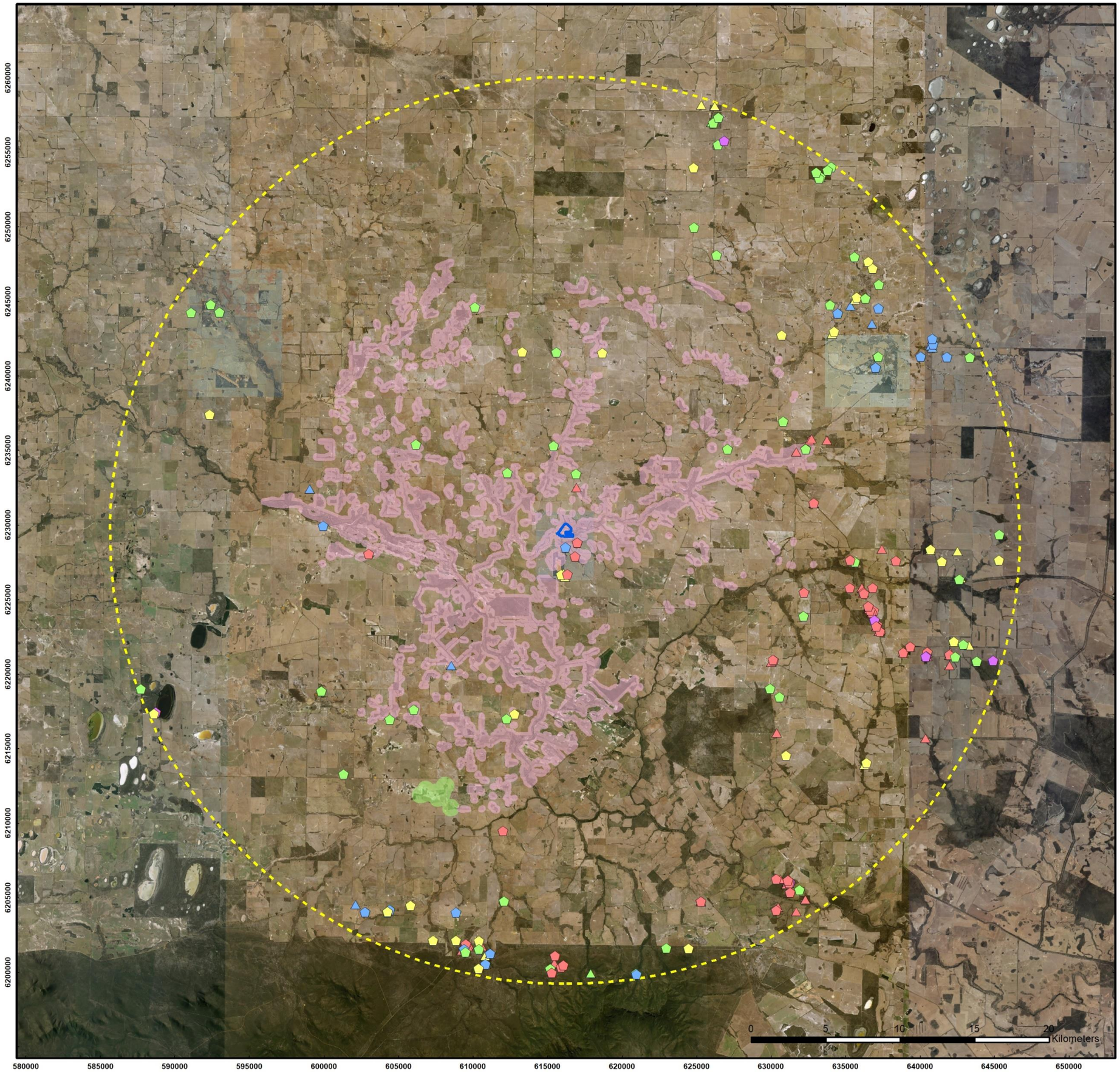
1) Occurs within the South Coastal Floristic Province (Hopper and Gioia, 2004); relating to south west phytogeographic boundaries. Includes Island of the Recherche Archipelago.
2) a) Characterised by Proteaceae species having 30% or greater cover of Proteaceae species across all layers of where shrubs occur (crowns measured as if opaque). OR;
   b) Two or more diagnostic Proteaceae species are present that are likely to form a significant vegetative component when regenerated. The use of diagnostic species is for situations in which the cover or Proteaceae species is reduced due to recent disturbance (e.g., fire).

Condition thresholds for the ecological community are described in Table 3.

**Table 3: Condition thresholds and minimum patch size analysis for Kwongkan PEC/TEC diagnostic criteria.**

| Condition category | Minimum patch size | Weeds | Dieback |
|---|---|---|---|
| High | 1 ha | <30% perennial weed cover | No known Dieback infestation |
| Moderate | 0.5 ha | <70% perennial weed cover | May be present or unknown |

The approved conservation advice, available spatial mapping for the ecological community, and description above indicates that this TEC/PEC could possibly occur within the survey area.

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Overview Map Scale 1:5,000,000

**Legend**

Survey Area

30 km Study Area

**Threatened and Priority Flora (FL_WAHerb)**

- P1
- P2
- P3
- P4
- T

**Threatened and Priority Flora (FL_TPFL)**

- P2
- P3
- P4
- T

**Priority and Threatened Ecological Communities**

**State Category, Commonwealth Category**

Priority 3, Critically Endangered

Priority 3, Endangered

**Data Sources**
Aerial Imagery: WA Now, Landgate Subscription Imagery
Cadastre, Relief Contours and Roads: Landgate 2017
IRIS Road Network: Main Roads Western Australia 2017
Overview Map: World Topographic map service, ESRI 2012

Scale
1:250,000 @ A3
GDA2020 MGA Zone 50

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Borden Expansion Area
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Borden, WA 6338

**Figure 4: Desktop Flora & TEC/PEC Data (DBCA, 2022a, b).**

| | *QA Check* | *Drawn by* |
|---|---|---|
| | **KPK** | **CvdM** |
| *STATUS* **FINAL** | *FILE* **CBH0025** | *DATE* **05/12/2022** |

# 5. Results – Field Survey

## 5.1. Flora Diversity

During the survey 153 flora species, consisting of 35 families and 95 genera were found. The most commonly occurring families were Asteraceae, Fabaceae, Myrtaceae, and Poaceae. The list includes 69 native species (refer to Table 15 Appendix D), 49 introduced / alien species and 35 cultivated species. The vegetation units identified across the survey area are described in Section 5.2. Refer to Figure 8 for vegetation mapping, and Appendix D for full species list.

Plant identification was undertaken through the most relevant, current and available taxonomic literature, keys and herbarium reference specimens available (AVH, n.d.; Barrett & Tay, 2016; Euclid, n.d.; French, 2012; JSTOR, 2000-; Maslin, 2018; WAH 1998-; Young, 2006; 2021). All resources used were the most current to knowledge. Nomenclature used through this report follows the most recent scientific names through the Western Australian Herbarium (WAH, 1998-).

## 5.2. Vegetation Units

Three vegetation units were identified during the survey period, vegetation descriptions can be found in the following sections, with relevé and quadrat data presented in Appendix D. Refer to Figures 5 – 7 for photographs of vegetation units and Figure 8 for extent. Please note only areas of intact native vegetation are described and mapped. Areas that have been cleared have not been described.

Cleared areas were also present throughout the survey area, occurring as CBH infrastructure, roads, or cleared paddock. A total of 40.3 ha of cleared area was present within the survey area. Minor, invasive herbs or agricultural grasses were often present within these bare areas. No native species were present within these cleared areas.

**1. Vegetation unit 1: *Allocasuarina fraseriana* Open Forest [AfOF]**

Vegetation unit 1 consists of a parkland cleared community, with only a native overstorey present (Figure 5). The mid- and understorey has likely been historically cleared and consists of invasive species or disturbance-opportunist natives. The overstorey is comprised of sheoak (*Allocasuarina fraseriana*) Open Forest while the understorey is dominated by invasive kikuyu (**Cenchrus clandestinus*) in the east of the survey area. In the north of the survey area the understorey is dominated by invasive barley grass (**Hordeum leporinum*) and annual veldt grass (**Ehrharta longiflora*). Overall, there is a low diversity of species within this vegetation unit. There was a patch of standing water within this vegetation unit, due to the poor drainage on the site. This restricted some access, but a large portion of the survey area was still able to be surveyed. No riparian vegetation was present around this waterbody with the system being in a degraded state. No Priority or Threatened flora were identified within Vegetation unit 1 and the ecological community did not bear any similarity to any PEC/TEC criteria.

Vegetation Description (NVIS; DoEE, 2017): U ^*Allocasuarina fraseriana*\^tree\7\c; G ^*Cenchrus clandestinus*\^grass\1\c.

Vegetation Description (Muirs, 1977): *Allocasuarina fraseriana* Open Forest, over *Cenchrus clandestinus* Grassland.

Area: 4.88 ha

Site description: Gently sloping site situated in a drainage depression, with dark brown sandy-loam soil which is seasonally wet.

Condition: Degraded.

Represented in R1, R4 (refer to Appendix D).

**Figure 5: *Allocasuarina fraseriana* Open Forest [AfOF] vegetation unit present within the survey area.**

### 2. Vegetation unit 2: Mixed Eucalyptus Woodland [MEW]

Vegetation unit 2 consisted of a mixed eucalyptus overstorey which had been planted within the survey area after historical clearing had taken place (Figure 6). The species planted were a cultivated mix of species endemic and non-endemic to the area. The mid- and understorey had likely also been historically cleared and consists of invasive species or disturbance-opportunist natives. The vegetation unit is characterised by a mixed eucalypt overstorey with flooded gum (*Eucalyptus rudis* subsp. *rudis*) being dominant in the south-eastern portion of the vegetation unit. The central, southern portion of the vegetation unit is a mix of eucalypts that have been historically planted, some endemic and some non-endemic to the area. The midstorey is characterised by tagasaste (**Chamaecytisus palmensis*), *Melaleuca hamulosa* and cultivated lesser bottlebrush (*Callistemon phoeniceus*). The weedy understorey is dominated by African love grass (**Eragrostis curvula*), great brome (**Bromus diandrus*) and kikuyu grass (**Cenchrus clandestinus*). Vegetation unit 2 has a high diversity of eucalypts due to the cultivated nature of the vegetation unit, but overall has a low diversity of species. This vegetation unit bore similarity to Wheatbelt Woodland PEC/TEC criteria but did not meet all the criteria. Quadrat analysis to determine if it does not meet Wheatbelt Woodland PEC/TEC is discussed in more detail in Section 5.6.

Vegetation Description (NVIS; DoEE, 2017): U ^ *Eucalyptus rudis* subsp. *rudis* \^tree\7\i;G *Eragrostis curvula, Bromus diandrus, Cenchrus clandestinus*\1\d.

Vegetation Description (Muirs, 1977): *Eucalyptus rudis* subsp. *rudis* Woodland, over *Eragrostis curvula, Bromus diandrus, Cenchrus clandestinus* Dense Grassland.

Area: 0.99 ha

Site description: Gently sloping site situated on a plain, with dark brown sandy-loam soil which is seasonally wet.

Condition: Degraded.

Represented in R2, Q1, Q2 and Q3 (refer to Appendix D).

**Figure 6: Mixed Eucalyptus Woodland [MEW] vegetation unit present within the survey area.**

### 3. Vegetation unit 3: *Acacia acuminata* Low Open Forest [AaLOF]

Vegetation unit 3 has likely been historically cleared and consists of invasive species or disturbance-opportunist natives (Figure 7). The vegetation unit is characterised by a dominant overstorey of jam wattle (*Acacia acuminata*) with scattered sheoak (*Allocasuarina fraseriana*) and occasional mixed eucalypts. The vegetation unit was generally lacking a mid-storey with a few scattered species present. The understorey was dominated by weedy herbs and grasses, namely, ursinia (**Ursinia anthemoides*), Guilford grass (**Romulea rosea*) and perennial veldt grass (**Ehrharta calycina*). No Priority or Threatened flora were identified within vegetation unit 3 and it did not bear any similarity to any PEC/TEC criteria.

Vegetation Description (NVIS; DoEE, 2017): U ^ *Acacia acuminata*\^tree\6\c; G *Ursinia anthemoides, Romulea rosea, Ehrharta calycina*\1\d.

Vegetation Description (Muirs, 1977): *Acacia acuminata* Low Open Forest, over *Ursinia anthemoides, Romulea rosea* Dense Herbs*, Ehrharta calycina* Low Grass.

Area: 3.24 ha.

Site description: Gently sloping site situated on a plain with light brown clay-sand soil which is well draining.
Condition: Degraded.
Represented in R3 (refer to Appendix D).

**Figure 7: *Acacia acuminata* Low Open Forest [AaLOF] vegetation unit present within the survey area.**

## 5.3. Vegetation Condition

The vegetation condition for the survey area (Table 4) has been mapped using the condition rating scale (adapted from Keighery 1994) outlined in *EPA Flora and Vegetation Survey Technical Guidance* (2016).

The vegetation across the survey area had been historically cleared with invasive species or disturbance-opportunist natives recolonising, as a result the vegetation ranged from 'Completely Degraded' to 'Degraded' condition throughout the survey area. These classification levels are related to degradation of structure and vegetation integrity by processes such as clearing, fire, weeds, grazing, Phytophthora Dieback and vehicle tracks. The 'AfOF' and 'AaLOF' units are classified as being in 'Degraded' and 'Completely Degraded' condition and the 'MEW' unit is in 'Degraded' condition.

**Table 4: Vegetation condition rating.**

| Vegetation type | Condition rating | Area (ha) |
|---|---|---|
| *Allocasuarina fraseriana* Open Forest [AfOF] | Degraded | 0.68 ha |
| | Completely Degraded | 4.20 ha |
| Mixed Eucalyptus Woodland [MEW] | Degraded | 0.95 ha |
| | Completely Degraded | 0.04 ha |
| *Acacia acuminata* Low Open Forest [AaLOF] | Degraded | 2.37 ha |
| | Completely Degraded | 0.87 ha |
| **Total** | | **9.11 ha** |



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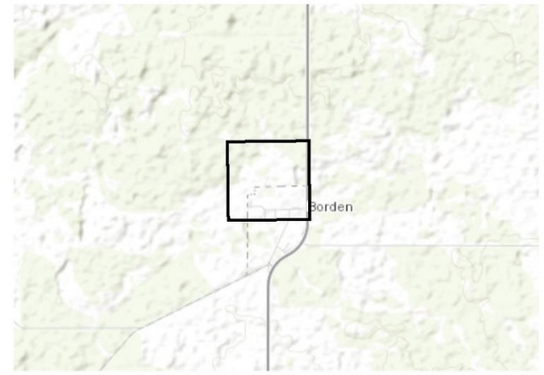


Overview Map Scale 1:100,000

**Legend**

- Survey Area
- Cadastre

**Releve and Quadrat Points**

- Quadrat
- Releve

**Vegetation Units**

- *Acacia acuminata* Low Forest [AaLF]
- *Allocasuarina fraseriana* Open Forest [AfOF]
- Mixed Eucalyptus Woodland [MEW]
- Paddock
- Planted Road Verge

**Vegetation Condition**

- Completely Degraded
- Degraded

Scale
1:3,750 @ A3
GDA20202 MGA Zone 50

**Data Sources**
Aerial Imagery: WA Now, Landgate Subscription Imagery
Cadastre, Relief Contours and Roads: Landgate 2017
IRIS Road Network: Main Roads Western Australia 2017
Overview Map: World Topographic map service, ESRI 2012

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Borden Expansion Area
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Borden, WA 6338

**Figure 8: Vegetation Units & Condition.**

| | *QA Check* | *Drawn by* |
|---|---|---|
| | **BMT** | **CvdM** |
| *STATUS* **FINAL** | *FILE* **CBH0025** | *DATE* **05/12/2022** |

## 5.4. Weeds and disturbance

Of the 153 flora species recorded within the survey area, 49 species are introduced. The full suite of weed species recorded is listed below in Table 5, with their corresponding ratings under the Australian Weed Strategy (IPAC, 2017), WA Weed Strategy (CALM, 1999) and the *BAM Act* (2007). The ratings given under the WA Weed Strategy relate to determining the significance of a weed, based on the criteria of invasiveness, impacts, potential for spread and socioeconomic and environmental values, and can be either 'High', 'Moderate', 'Mild', or 'Low' (CALM, 1999).

All species except bridal creeper (*Asparagus asparagoides*) are classed as 'Permitted – s11', while bridal creeper is classed as a 'Declared Pest – s22(2) under the *Biosecurity and Agriculture Management Act 2007* and a Weed of National Significance (IPAC, 2017). Under the Environmental Weeds Strategy for Western Australia (CALM, 1999) bridal creeper, Mediterranean turnip, Guildford grass, and perennial veldt grass are listed as 'High', while hottentot fig, iceplant, cape weed, spear thistle, smooth cats-ear, prickly lettuce, Jersey cudweed, common sowthistle, ursinia, budding club-rush, bugle lily, *Eucalyptus cladocalyx*, South African orchid, common bartsia, silvery hairgrass, bearded oat, blowfly grass, shivery grass, kikuyu grass, couch, barley grass and Wimmera ryegrass are rated as 'Moderate'. The remaining species are either rated 'Low', 'Mild' or are not listed (Table 5).

**Table 5: Weed species recorded from the survey area.**

| Family | Species | Vernacular | WA Weed Strategy rating (CALM 1999) | BAM Act (2007) | Weed of National Significance (IPAC, 2017) |
|---|---|---|---|---|---|
| Aizoaceae | *Carpobrotus edulis* | hottentot fig | Moderate | Permitted (s11) | No |
| Aizoaceae | *Disphyma crassifolium* | round-leaved pigface | - | Permitted (s11) | No |
| Aizoaceae | *Mesembryanthemum crystallinum* | iceplant | Moderate | Permitted (s11) | No |
| Asparagaceae | *Asparagus asparagoides* | bridal creeper | High | Declared Pest – s22(2) (Exempt) | Yes |
| Asteraceae | *Arctotheca calendula* | cape weed | Moderate | Permitted (s11) | No |
| Asteraceae | *Cirsium vulgare* | spear thistle | Moderate | Permitted (s11) | No |
| Asteraceae | *Erigeron sumatrensis* | | - | Permitted (s11) | No |
| Asteraceae | *Gazania linearis* | | Low | Permitted (s11) | No |
| Asteraceae | *Hypochaeris glabra* | smooth cats-ear | Moderate | Permitted (s11) | No |
| Asteraceae | *Lactuca serriola* | prickly lettuce | Moderate | Permitted (s11) | No |
| Asteraceae | *Osteospermum ecklonis* | Cape marguerite | Low | Permitted (s11) | No |
| Asteraceae | *Pseudognaphalium luteoalbum* | Jersey cudweed | Moderate | Permitted (s11) | No |
| Asteraceae | *Sonchus oleraceus* | common sowthistle | Moderate | Permitted (s11) | No |
| Asteraceae | *Taraxacum khatoonae* | dandelion | - | Permitted (s11) | No |

**Table 5 cont.**

| Family | Species | Vernacular | WA Weed Strategy rating (CALM 1999) | BAM Act (2007) | Weed of National Significance (IPAC, 2017) |
|---|---|---|---|---|---|
| Asteraceae | *Ursinia anthemoides* | ursinia | Moderate | Permitted (s11) | No |
| Brassicaceae | *Brassica tournefortii* | Mediterranean turnip | High | Permitted (s11) | No |
| Brassicaceae | *Raphanus raphanistrum* | wild radish | Mild | Permitted (s11) | No |
| Campanulaceae | *Monopsis debilis* | | Low | Permitted (s11) | No |
| Crassulaceae | *Crassula alata* | | Low | Permitted (s11) | No |
| Cyperaceae | *Isolepis prolifera* | Budding club-rush | Moderate | Permitted (s11) | No |
| Fabaceae | *Chamaecytisus palmensis* | tagasaste | Mild | Permitted (s11) | No |
| Fabaceae | *Medicago polymorpha* | burr medic | Mild | Permitted (s11) | No |
| Fabaceae | *Trifolium fragiferum* | strawberry clover | Low | Permitted (s11) | No |
| Fabaceae | *Trifolium angustifolium* | narrowleaf clover | Low | Permitted (s11) | No |
| Iridaceae | *Moraea setifolia* | | - | Permitted (s11) | No |
| Iridaceae | *Romulea rosea* | Guildford grass | High | Permitted (s11) | No |
| Iridaceae | *Watsonia meriana* var. *bulbillifera* | bugle lily | Moderate | Permitted (s11) | No |
| Lythraceae | *Lythrum hyssopifolia* | lesser loosestrife | TBA | Permitted (s11) | No |
| Myrtaceae | *Eucalyptus cladocalyx* | | Moderate | Permitted (s11) | No |
| Orchidaceae | *Disa bracteata* | South African orchid | Moderate | - | No |
| Orobanchaceae | *Parentucellia latifolia* | common bartsia | Moderate | Permitted (s11) | No |
| Oxalidaceae | *Oxalis pes-caprae* | soursob | Mild | Permitted (s11) | No |
| Plantaginaceae | *Plantago coronopus* | buckshorn plantain | Low | Permitted (s11) | No |
| Poaceae | *Aira caryophyllea* | silvery hairgrass | Moderate | Permitted (s11) | No |
| Poaceae | *Avena barbata* | bearded oat | Moderate | Permitted (s11) | No |
| Poaceae | *Briza maxima* | blowfly gras) | Moderate | Permitted (s11) | No |

**Table 5 cont.**

| Family | Species | Vernacular | WA Weed Strategy rating (CALM 1999) | BAM Act (2007) | Weed of National Significance (IPAC, 2017) |
|---|---|---|---|---|---|
| Poaceae | *Briza minor* | shivery grass | Moderate | Permitted (s11) | No |
| Poaceae | *Bromus hordeaceus* | soft brome | Low | Permitted (s11) | No |
| Poaceae | *Bromus diandrus* | great brome | High | Permitted (s11) | No |
| Poaceae | *Cenchrus clandestinus* | kikuyu grass | Moderate | Permitted (s11) | No |
| Poaceae | *Cynodon dactylon* | couch | Moderate | Permitted (s11) | No |
| Poaceae | *Ehrharta calycina* | perennial veldt grass | High | Permitted (s11) | No |
| Poaceae | *Ehrharta longiflora* | annual veldt grass | - | Permitted (s11) | No |
| Poaceae | *Eragrostis curvula* | African lovegrass | High | Permitted (s11) | No |
| Poaceae | *Hordeum leporinum* | barley grass | Moderate | Permitted (s11) | No |
| Poaceae | *Lolium rigidum* | Wimmera ryegrass | Moderate | Permitted (s11) | No |
| Polygonaceae | *Polygonum aviculare* | wireweed | Low | Permitted (s11) | No |
| Polygonaceae | *Rumex obtusifolius* | bitter dock | Low | Permitted (s11) | No |
| Primulaceae | *Lysimachia arvensis* | pimpernel | - | Permitted (s11) | No |

### 5.5. Presence of Priority or Threatened Flora

No Threatened or Priority flora were detected within the survey area. All native flora species present were considered to be non-threatened and common locally within the area. The survey was conducted outside of the flowering time of three species identified in the 20-30 km desktop assessment. Of these, both P4 *Acacia declinata* and EN *Roycea pycnophylloides* are able to be identified without flowers and were determined not to be present in the survey area. P3 *Calectasia obtusa* is recognised as cryptic and hard to detect without flowers. However, the survey was conducted on the periphery of the flowering time, meaning some flowering material may still have been present at the time of the survey. It is therefore said not to have been present within the survey area.

Limited information on the description and habitat preferences of P3 *Thelymitra* sp. Ongerup (S. Oborne 142) was available. One species of *Thelymitra* was detected but it was determined that it was the non-threatened *Thelymitra graminea.*

A juvenile *Eucalyptus caesia* plant was present within the survey area, which could not be identified to subspecies level. The species is either P4 *Eucalyptus caesia* subsp*. caesia* or P4 *Eucalyptus caesia* subsp. *magna,* but was too immature and lacked key taxonomic material to be identified to sub-species level. However, this individual is located within the cultivated road verge and is not considered a natural population within the survey area. *E. caesia* is widely planted as an ornamental species and is popular in revegetation, road verges and gardens. Because of this it is not considered a natural population.

Similarly, P4 *Eucalyptus kruseana* and P3 *Eucalyptus newbeyi* were identified in the cultivated road verge. These species naturally occur near Kalgoorlie and south Fitzgerald, respectively. Therefore, they are not endemic to the survey area and are planted as ornamental species. Because of this both are not considered to be natural populations.


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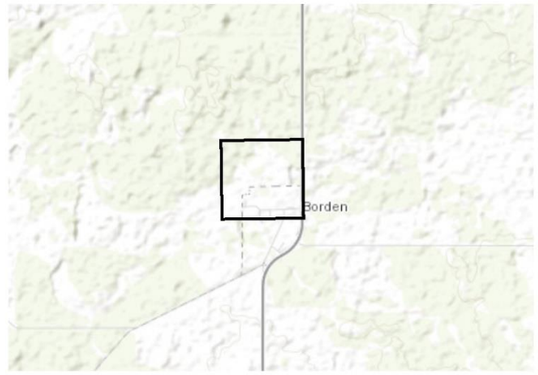


Overview Map Scale 1:100,000

**Legend**

- Survey Area
- Cadastre

**Vegetation Units**

- *Acacia acuminata* Low Forest
- *Allocasuarina fraseriana* Open Forest
- Mixed Eucalyptus Woodland
- Paddock
- Planted Road Verge

**Flora**

- *Asparagus asparagoides*, Declared Pest

Scale
1:3,750 @ A3
GDA2020 MGA Zone 50

**Data Sources**
Aerial Imagery: WA Now, Landgate Subscription Imagery
Cadastre, Relief Contours and Roads: Landgate 2017
IRIS Road Network: Main Roads Western Australia 2017
Overview Map: World Topographic map service, ESRI 2012

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Lot 91 Moir Sreet
Borden, WA 6338

**Figure 9: Flora Findings.**

| | *QA Check* | *Drawn by* |
|---|---|---|
| | **BMT** | **CvdM** |
| *STATUS* **FINAL** | *FILE* **CBH0025** | *DATE* **05/12/2022** |

## 5.6. Threatened and Priority Ecological Communities

The targeted ecological community component of the survey focused specifically on determining the presence of any Threatened (TEC) or Priority (PEC) Ecological Communities within the survey area through quadrat analysis.

One vegetation unit within the survey are bore similarity to a TEC / PEC identified on the LOO as 'Possible' to occur, namely 'Eucalyptus Woodlands of the Western Australian Wheatbelt (Wheatbelt Woodlands)' and vegetation unit 2: Mixed Eucalyptus Woodland [MEW]. Three quadrats (Appendix D) were sampled within Vegetation Unit 2: MEW to assess and analyse the quantitative and qualitative criteria and determine if present. Quadrat data is provided in Appendix D. Vegetation unit 2 consisted of a mixed eucalyptus overstorey which had been planted within the survey area after historical clearing had taken place. The species planted were a cultivated mix of species endemic and non-endemic to the area. The understorey was compromised entirely of introduced species. In summary, Vegetation unit 2 did not meet the criteria to be considered Wheatbelt Woodlands TEC/PEC. Quadrats 1 and 2 only met Criteria 1 and 2, while Quadrat 3 only met Criteria 1, 2 and 3. Criteria 4 and 5 were not met by any of the quadrats. Therefore, Vegetation Unit 2 [MEW] is not considered to be the Wheatbelt Woodlands TEC/PEC. Refer to Table 6 for rationale.

All other vegetation units present within the survey area did not bear resemblance to any TEC / PEC criteria.

**Table 6: Quadrat analysis of Vegetation Unit 2 [MEW] during the targeted survey, determining the presence of 'Eucalyptus Woodlands of the Western Australian Wheatbelt (Wheatbelt Woodlands)' Threatened (TEC) and Priority (PEC) Ecological Community.**

| Criteria | Description | Discussion | Meet Criteria |
|---|---|---|---|
| 1) | Occurs within the IBRA Avon Wheatbelt subregions Merredin (AVW01) and Katanning (AVW02), Western Mallee subregion (MAL02) and jarrah forest subregions Northern Jarrah Forest (JAF01) and Jarrah Forest (JAF02) when adjacent to the Avon Wheatbelt. | Confirmed that the survey area is located within Mallee Bioregion and Western Mallee (MAL02) subregion. | Yes – Q1, Q2 & Q3 |
| 2) | Structure of the ecological community is a woodland, with minimum crown cover of tree canopy of mature woodland being 10% (crowns measured as if opaque). | Q1, 2 & 3 all had a minimum crown cover of tree canopy of 10% of mature woodland. Specifically, *Eucalyptus utilis* had a cover of 10-30% for both Q1 and 2 and *Eucalyptus rudis* subsp. *rudis* had a cover of 10-30% for Q3. This exceeds the minimum of 10% required to meet the criteria and the vegetation unit is consistent with a woodland structure. | Yes – Q1, Q2 & Q3 |
| 3) | Key species of the tree canopy are species of Eucalyptus identified in Table 2a of approved conservation guidelines (DoEE, 2015). These are species that typically have a single trunk. One or more tree species are dominant or co-dominant within the patch of the ecological community. If other species are present in the tree canopy, then these do not occur as dominant in the tree canopy. | Q1 and 2 contained a high number of cultivated species not endemic to the area. For example, *Eucalyptus utilis,* the dominant species present within Q1 and Q2 does not naturally occur in Borden but has been planted as part of the revegetation of the road reserve. It is not identified as a key eucalyptus species in Table 2a of the approved conservation advice. *E. utilis* is considered a 'moort' opposed to 'tree', a key feature of eucalyptus species forming Wheatbelt Woodlands.<br>*Eucalyptus rudis* subsp. *rudis* is the dominant species present within Q3, which is identified as a key eucalypt species in Table 2a of the approved conservation advice. *E. rudis* subsp. *rudis* only occurred within locally occurring patches, with the species composition across the vegetation unit being more consistent with that of Q1 and Q2. It is also unknown whether the plants had been cultivated or were naturally occurring within the area. | Yes – Q3.<br>No – Q1 & Q2. |
| 4) | Native understorey is present but is of variable composition, being a combination of grasses, other herbs and shrubs, as specified in Table 2 of Section 4.2. | No native understorey is present in any of the quadrats, with the understorey being comprised fully of weed species including grasses such as **Ehrharta longiflora, *Ehrharta calycina, *Aira caryophyllea, *Lolium rigidum, *Briza maxima* and **Eragrostis curvula* and herbs such as **Hypochaeris glabra, *Bromus diandrus, *Ursinia anthemoides, *Crassula alata, *Asparagus asparagoides, *Oxalis pes-caprae* and **Arctotheca calendula.* | No - Q1, Q2 & Q3. |
| 5) | Patch Size and Condition Criteria (Table 2). | Table 2 identifies the specific condition and patch thresholds of Wheatbelt Woodlands TEC/PEC, with specific focus applied to the roadside minimum patch width required. The "patch" of Vegetation Unit 2: MEW is considered a roadside patch. However, exotic plant species account for >70% of total vegetation cover in the understorey layers. | No – Q1, Q2 & Q3. |

## 6. Discussion

The scope for this survey was to provide the client with information on any Threatened or Priority flora species that are potentially present within the survey area, as well as TEC/PEC, and to provide an assessment on vegetation types present and their general condition.

Three vegetation units were recorded during the survey, namely 1: *Allocasuarina fraseriana* Open Forest [AfOF], 2: Mixed Eucalyptus Woodland [MEW] and 3: *Acacia acuminata* Low Open Forest [AaLOF]. The condition of the vegetation units were 'Completely Degraded' or 'Degraded', due to historical clearing that allowed invasive species or disturbance-opportunist natives to dominate.

A total of 153 flora species were recorded, comprising 69 native species, 49 introduced species and 35 cultivated species. No Threatened or Priority flora was identified during the survey period. One introduced species of concern, the Declared Pest and Weed of National Significance, bridal creeper (*Asparagus asparagoides)* was detected across the survey area.

Two Threatened/Priority Ecological Communities were identified as 'Possible' to occur, namely '*Eucalyptus Woodlands of the Western Australian Wheatbelt (Wheatbelt Woodlands)'* and *'Proteaceae Dominated Kwongkan Shrublands of the Southeast Coastal Floristic Province of Western Australia (Kwongkan)'.* One vegetation unit identified in the survey area, bore similarity to the Wheatbelt Woodlands TEC/PEC, Vegetation unit 2: Mixed Eucalyptus Woodland [MEW]. Quadrat sampling and subsequent analysis occurred and it was determined to not meet the criteria due to the lack of dominant overstorey species that met the Wheatbelt Woodland description, the lack of native understorey species and the degraded nature of the vegetation.

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## 8. Appendices

Appendix A – Survey Effort Map

Appendix B – Conservation Significant Values Likelihood of Occurrence Analysis

Appendix C – Conservation Status Definitions and Condition Scale

Appendix D – Species Lists, Relevé and Quadrat Data

Appendix E - EPBC Act PMST reports

# Appendix A

Survey Effort Map


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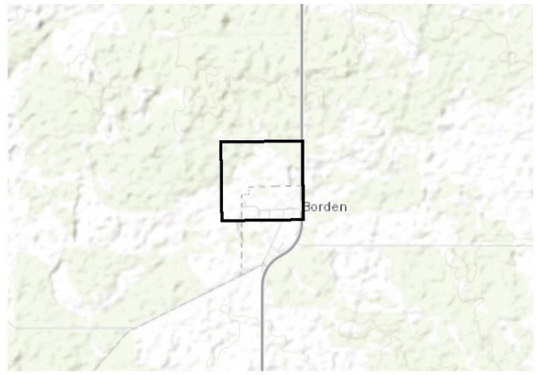


Overview Map Scale 1:100,000

**Legend**

- Survey Area
- Cadastre
- Survey Effort

Scale
1:3,750 @ A3
GDA2020 MGA Zone 50

**Data Sources**
Aerial Imagery: WA Now, Landgate Subscription Imagery
Cadastre, Relief Contours and Roads: Landgate 2017
IRIS Road Network: Main Roads Western Australia 2017
Overview Map: World Topographic map service, ESRI 2012

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Lot 91 Moir Sreet
Borden, WA 6338

**Figure 10: Survey Effort.**

| | *QA Check* | *Drawn by* |
|---|---|---|
| | **BMT** | **CvdM** |
| *STATUS* | *FILE* | *DATE* |
| **FINAL** | **CBH0025** | **05/12/2022** |

# Appendix B

Conservation Significant Values Likelihood of Occurrence Analysis

**Table 7: Criteria for assessing the likelihood of occurrence of conservation significant flora within a 30km radius of the survey area.**

| Likelihood | Criteria |
|---|---|
| Present | Species is recorded within the survey area. |
| Likely | Species has been previously recorded in close proximity and suitable habitat occurs within the survey area. |
| Possible | Species previously recorded within 10 km and suitable habitat occurs in the survey area. |
| Unlikely | The species has been recorded locally through database searches. However, suitable habitat for the species does not occur at the survey area or suitable habitat may occur but the species has a highly restricted distribution, is very rare and only known from a limited number of populations.<br><br>Species is unlikely to occur due to the site lacking critical habitat, only containing marginally suitable habitat, and/or the survey area is considerably degraded.<br><br>The species has not been recorded in the survey area despite adequate survey effort. |
| Highly Unlikely | No suitable habitat within the survey area or the survey area is outside the species' natural distribution. |

**Table 8: Potential Threatened and Priority flora located within 20 (NatureMap and PMST) to 30 (DBCA) km of the survey area and likelihood of occurrence analysis (post survey).**
NB - Species are sorted by likelihood of presence. Numerous resources specific to Threatened and Priority flora listed below were used in the likelihood assessment (Barrett et al. 2021; Barrett & Dixon, 2001; Briggs and Johnson, 2001; Brundrett, 2014; Brown, 2018; Euclid, n.d.; Hartley & Barrett, 2008; Hislop, 2012; Maslin, 2018-; Olde, 2020; WAH, 1998-).

| Family | Species | Vernacular | Status (WA) | Description- Species | Description - Habitat | Peak Flowering period | Likelihood Analysis - pre-survey assessment | Likelihood Analysis - Post survey outcomes |
|---|---|---|---|---|---|---|---|---|
| Parmeliaceae | *Xanthoparmelia scabrosina* | | P1 | Lichen | | | Outside expertise of surveyors. | Not surveyed for.<br>Outside expertise of surveyors. |
| Orchidaceae | *Thelymitra psammophila* | | T - VU | Tuberous, perennial, herb, 0.15-0.25 m high. Fl. Yellow. | Sandy clay, loam. | Sep to Oct | Likely. Located ~500m from survey area. | Unlikely – species not detected |
| Rhamnaceae | *Spyridium mucronatum* subsp. *recurvum* | | P3 | Erect or spreading shrub, 0.15-0.6 m high. Fl. white-cream-yellow. | Sandy & clayey soils. Plains. | Oct to Nov | Likely. Located ~500m from survey area. | Unlikely – species not detected |
| Fabaceae | *Acacia declinata* | | P4 | Dense, intricately branched, prostrate, pungent shrub, 0.2-0.4 m high. Fl. Yellow. | Loamy or sandy clay. | Aug to Sep | Possible. Located ~1.3km from survey area. | Unlikely – species not detected<br>Minor limitation on survey timing. Detection of species possible without flowering. |
| Iridaceae | *Orthrosanthus muelleri* | | P4 | Rhizomatous, tufted perennial, herb, 0.2-0.3 m high. Fl. Blue. | Sand. | Sep to Oct | Possible. Located ~2.5km from the survey area. | Unlikely – species not detected |
| Myrtaceae | *Verticordia coronata* | | P3 | Erect or spreading shrub, 0.15-0.5 m high. Fl. Yellow. | Clay loam, clay & sandy loam, sometimes gravelly. | Sep to Dec | Possible. Located ~3.5km from the survey area. | Unlikely – species not detected |
| Asparagaceae | *Thysanotus gageoides* | | P3 | Perennial, herb (with tuberous roots), to 0.2 m high. Fl. Purple. | Sand, clay, granite, sandstone, laterite. | Oct to Nov | Possible | Unlikely – species not detected |
| Chenopodiaceae | *Roycea pycnophylloides* | Saltmat | T-EN | Perennial, herb, forming densely branched, silvery mats to 1 m wide. | Sandy soils, clay. Saline flats. | Sep | Possible | Unlikely – species not detected<br>Minor limitation on survey timing. Detection of species possible without flowering. |
| Dasypogonaceae | *Calectasia obtusa* | | P3 | Erect, low herb, 0.25-0.4 m high, to 0.2; with aerial roots. Fl. Blue. | Sand, clay loam, gravel, laterite. Flats. | Aug to Sep | Possible | Unlikely – species not detected.<br>Species is cryptic to identify without flowering material. Survey was conducted on periphery of flowering period. Some material may have been available to detect species if species was present. Not detected |
| Ericaceae | *Andersonia setifolia* | | P3 | Decumbent to erect, cushion-forming shrub, 0.05-0.15 m high. Fl. red/white. | Sandy & gravelly soils. Hillslopes & breakaways. | Jun to Oct | Possible | Unlikely – species not detected |
| Ericaceae | *Sphenotoma drummondii* | | T-EN | Tufted shrub, 0.15-0.5 m high. Fl. White. | Stony or shallow soils over granite or quartzite. Steep rocky slopes, crevices of rocks. | Sep to Dec | Possible | Unlikely – species not detected |
| Fabaceae | *Acacia mutabilis* subsp. *rhynchophylla* | | P3 | Shrub, 0.5-1 m high. Fl. Yellow. | Gravelly sand, sandy loam or loam. | | Possible | Unlikely – species not detected |
| Fabaceae | *Chorizema carinatum* | | P3 | Erect or spreading shrub, 0.1-0.6 m high. Fl. Yellow. | Sand, sandy clay. | Oct to Dec | Possible | Unlikely – species not detected |
| Frankeniaceae | *Frankenia drummondii* | | P3 | Prostrate shrub. Fl. White. | Sand. Lake edges. | | Possible | Unlikely – species not detected |
| Haemodoraceae | *Conostylis misera* | Grass Conostylis | T-EN | Rhizomatous, tufted perennial, grass-like or herb, 0.05-0.18 m high. Fl. Yellow. | White or grey sand, sandy loam. Winter-wet flats. | Oct to Nov | Possible | Unlikely – species not detected |
| Lamiaceae | *Hemigenia platyphylla* | | P4 | Spreading shrub, 0.2-1.5 m high. Fl. blue-purple. | Sandy & loamy soils. Granite rocks, slopes. | Sep to Nov | Possible | Unlikely – species not detected |
| Malvaceae | *Lasiopetalum parvuliflorum* | | P3 | Erect, spreading shrub, 0.35-1 m high. Fl. green-cream. | Sand, gravelly loam. Along creeks, seasonal swamps. | Sep to Oct | Possible | Unlikely – species not detected |
| Myrtaceae | *Eucalyptus vesiculosa* | | P4 | (Mallee), to 3 m high, bark smooth, grey over rich coppery red. Fl. Pink. | Flat sites, slight rises. | May | Possible | Unlikely – species not detected<br>Minor limitation on survey timing. Detection of species possible without flowering. |
| Myrtaceae | *Rinzia longifolia* | | P3 | Prostrate shrub, 0.1-0.4 m high. Fl. pink/white. | Sand, clay. Low rises. | Aug to Nov | Possible | Unlikely – species not detected |
| Orchidaceae | *Caladenia bryceana* subsp. *bryceana* | | T - EN | Tuberous, perennial, herb, 0.05-0.1 m high. Fl. green-yellow. | Sand, loam. Adjacent to watercourses, winter-wet sites. | Aug to Oct | Possible | Unlikely – species not detected |

**Table 8 cont.**

| Family | Species | Vernacular | Status (WA) | Description- Species | Description - Habitat | Peak Flowering period | Likelihood Analysis - pre-survey assessment | Likelihood Analysis - Post survey outcomes |
|---|---|---|---|---|---|---|---|---|
| Proteaceae | *Banksia porrecta* | | P4 | Prostrate, sprawling, mat-forming, lignotuberous shrub, 0.2-0.35 m high, 0.6-4 m wide. Fl. white-cream. | White/grey sand, sandy loam. | Jul to Aug | Possible | Unlikely – species not detected<br>Minor limitation on survey timing. Detection of species possible without flowering. |
| Proteaceae | *Hakea brachyptera* | | P3 | Low, intricately branched shrub, 0.4-2.5 m high. Fl. White. | Sand, loam, clay. | | Possible | Unlikely – species not detected |
| Restionaceae | *Desmocladus biformis* | | P3 | Rhizomatous, densely tufted perennial, herb (sedge-like), 0.1-0.2 m high. | Sand, sandy clay, lateritic soils. Dry sites. | Sep to Oct | Possible | Unlikely – species not detected |
| Rhamnaceae | *Spyridium oligocephalum* | | P3 | Shrub, (0.3-)0.6-1.5 m high. Fl. white-cream. | Sandy soils. Sandplains. | Mar or Jul to Oct | Possible | Unlikely – species not detected |
| Stylidiaceae | *Stylidium diuroides* subsp. *nanum* | | P2 | Erect perennial, herb, 0.06-0.11 m high. Fl. cream-yellow. | Wet sand. | Oct | Possible | Unlikely – species not detected |
| Cyperaceae | *Tricostularia sandifordiana* | | P3 | Sedge to 0.9m high. Widely spreading rhizomes bearing distant culms and broadly flared leaf sheaths. | Low heath and *Banksia coccinea* shrubland on winter-wet white or grey sands on plains or gentle slopes, sometimes along drainage lines. | Nov to Dec | Possible | Unlikely – species not detected. Distribution not near survey area and lack of suitable habitat. |
| Ericaceae | *Leucopogon newbeyi* | | P3 | Erect shrub to 0.9 cm high. Inflorescence erect, terminal. White flowers. Narrow, revolute leaves, and brown bracts. | Restricted to narrow north-south band from Nyabing area to south of Ongerup. Low in the landscape as a component of Mallee Woodland, commonly associated with Melaleuca species. Sandy loam soils, with clay at depth. | June to Sep | Possible | Unlikely – species not detected |
| Myrtaceae | *Eucalyptus brandiana* | | P2 | Mallee to 5 m tall. Smoth grey to silvery grey and salmon bark. Large leaves. Large four-winged and pink fruits and flowers. | South coast on free draining soils. | Winter and Spring | Possible | Unlikely – species not detected |
| Orchidaceae | *Thelymitra* sp. Ongerup (S. Oborne 142) | | P3 | Bright orange flowers. | | | Possible | Unlikely – species not detected |
| Proteaceae | *Grevillea pieroniae* | | P2 | Erect to wispy shrub to 1.5 m high. White to cream flowers. Leaves secondary or tertiary division of lobes. | Creek lines and areas of impeded drainage in elevated terrain, comprising of marri-jarrah woodland and proteaceous heath-shrubland. Yellowish sandy loam or silt over laterite. | Mid-winter to Spring. | Possible | Unlikely – species not detected |
| Araliaceae | *Hydrocotyle muriculata* | | P1 | Low spreading to prostrate annual, herb. Fl. Yellow. | Margins of salt lakes & flats. | Sep | Unlikely | Unlikely – no suitable habitat |
| Asparagaceae | *Laxmannia grandiflora* subsp. *stirlingensis* | | P3 | Tall, slender, rambling, stilt-rooted perennial, herb, to 0.22 m high. Fl. White. | White sand, sandy clay. Winter-wet locations. | Sep to Nov | Unlikely | Unlikely – no suitable habitat |
| Brassicaceae | *Lepidium aschersonii* | | T-VU | Erect perennial, herb, 0.04-0.3 m high. | Clay. | | Unlikely | Unlikely – no suitable habitat |
| Casuarinaceae | *Allocasuarina anfractuosa* | | P1 | Monoecious, bushy shrub to c. 1.5 m high. | Broad hill crests or upper slopes in brown sandy loam on granite, often forming dense stands. | Aug | Unlikely | Unlikely – no suitable habitat |
| Chenopodiaceae | *Tecticornia uniflora* | | P4 | Prostrate perennial, herb, 0.01-0.03 m high, 0.8-1.5 m wide. | Clay, sandy clay, loam. Salt lakes & creeks. | | Unlikely | Unlikely – no suitable habitat |
| Dilleniaceae | *Hibbertia priceana* | | T - EN | Usually compact but sometimes sprawling, dwarf shrub, to 0.15 m high. Fl. Yellow. | Grey sandy clay with laterite gravel. Ridges. | Jun to Aug | Unlikely | Unlikely – no suitable habitat |
| Elaeocarpaceae | *Tetratheca pilata* | | P1 | Shrub (subshrub), 0.2-0.3 m high, with numerous stems. | Granite loam. Rocky outcrops. | | Unlikely | Unlikely – no suitable habitat |
| | | | | | | | | |

**Table 8 cont.**

| Family | Species | Vernacular | Status (WA) | Description- Species | Description - Habitat | Peak Flowering period | Likelihood Analysis - pre-survey assessment | Likelihood Analysis - Post survey outcomes |
|---|---|---|---|---|---|---|---|---|
| Ericaceae | *Andersonia echinocephala* | | P4 | Erect, rigid, semi-prickly shrub, 0.3-1.5 m high. Fl. white-cream. | Shallow skeletal rocky silty soils over quartzite or shalestone. Rocky slopes & summits. | Oct to Nov | Unlikely | Unlikely – no suitable habitat |
| Ericaceae | *Brachyloma mogin* | | P3 | Compact shrub, 0.4 m high. Fl. red/pink/white. | Grey clayey sand. Swamp flat. | Jun | Unlikely | Unlikely – no suitable habitat |
| Ericaceae | *Leucopogon acicularis* | | P2 | Erect, open shrub, 0.2-1 m high. Fl. White. | Sandy & clayey soils. Steep slopes. | Aug | Unlikely | Unlikely – no suitable habitat |
| Ericaceae | *Leucopogon bracteolaris* | | P2 | Shrub, 0.25-1 m high. Fl. White. | Stony sand, gravelly loam. | Feb or May or Jul or Oct | Unlikely | Unlikely – no suitable habitat |
| Ericaceae | *Leucopogon florulentus* | | P3 | Erect slender shrub, 0.3-0.8 m high. Fl. White. | White/grey or yellow sand, sandy clay, gravelly lateritic soils. Sandplains, gentle slopes. | Jun to Nov | Unlikely | Unlikely – no suitable habitat |
| Ericaceae | *Leucopogon gnaphalioides* | | T-EN | Slender or sprawling shrub, 0.25-1 m high. Fl. White. | Shallow rocky soils. Rocky slopes & plateaus. | Jul or Oct to Dec | Unlikely | Unlikely – no suitable habitat |
| Ericaceae | *Leucopogon* sp. Ongerup (A.S. George 16682) | | T - VU | An erect compact shrub, c. 60 cm high by 60 cm wide from a fire-sensitive rootstock. | Pale-brown sand clay loam and sandy loam soils with laterite gravel and quartz fragments on a laterite dry, pale yellow to white sand and sandy loam soil overlying laterite, some gravel on soil surface. Simple slope gentle ridge, overlying granite. | Jul to Aug | Unlikely | Unlikely – no suitable habitat |
| Ericaceae | *Sphenotoma* sp. Stirling Range (P.G. Wilson 4235) | | P4 | Shrub, 0.3-2 m high. Fl. White. | Skeletal soils over granite or quartzite. Rocky slopes & plateaus, gullies. | Aug to Dec | Unlikely | Unlikely – no suitable habitat |
| Ericaceae | *Styphelia disjuncta* | | T | Erect, compact shrubs to c. 60 cm high and 60 cm wide, branching from close to the base but with a fire-sensitive rootstock. | Grows in sand or sandy loam soils over laterite, and in association with species-rich heath or open mallee woodland. | Jun to Sep | Unlikely | Unlikely – no suitable habitat |
| Fabaceae | *Acacia awestoniana* | | T - CR | Spreading, viscid shrub, 2.4-3 m high, to 4 m wide. Fl. Yellow. | Loam, sandy clay loam. Lower slopes, along watercourses, flats. | Sep to Nov | Unlikely | Unlikely – no suitable habitat |
| Fabaceae | *Acacia keigheryi* | Keighery's Wattle | P3 | Diffuse or low domed shrub, 0.3-0.5 m tall. Yellow flowers. | Gentle slopes in often stony, gritty sand, sandy loam, sandy clay or clay over granite or gneiss in open Mallee woodland over heath scrub. | Aug to Oct | Unlikely | Unlikely – no suitable habitat |
| Fabaceae | *Acacia mutabilis* subsp. *incurva* | | P2 | Spreading shrub, 1.5-3 m high. Fl. Yellow. | Sandy loam, clayey loam. Undulating plains. | Aug to Sep | Unlikely | Unlikely – no suitable habitat |
| Fabaceae | *Acacia trulliformis* | | P4 | Spreading shrub, 0.9-2.2 m high. Fl. Yellow. | Sandy loam. | Sep | Unlikely | Unlikely – no suitable habitat |
| Fabaceae | *Bossiaea divaricata* | | P4 | Shrub, to 0.6 m high. | Sandy lateritic soils. | | Unlikely | Unlikely – no suitable habitat |
| Fabaceae | *Chorizema ulotropis* | | P4 | Sprawling, open, semi-prostrate shrub, to 0.45 m high. Fl. orange-yellow. | Moist to dry soils, white sand with gravel, laterite, granite. Outcrops, winter damp to dry areas, flats. | Jul to Sep | Unlikely | Unlikely – no suitable habitat |
| Fabaceae | *Daviesia mesophylla* | | P2 | Prostrate shrub. Fl. yellow & red. | Peaty or white sand. Rocky slopes. | Jan to May | Unlikely | Unlikely – no suitable habitat |
| Fabaceae | *Eutaxia nanophylla* | | P3 | Straggly, rounded shrub, to 0.35 m high. Fl. Yellow/orange/red. | Clayey sand, red clay, stoney clayey loam. Low-lying areas, damp flats, slopes, undulating plains, low stony ridges. | Oct to Nov | Unlikely | Unlikely – no suitable habitat |
| Fabaceae | *Gastrolobium crenulatum* | | P2 | Erect shrub, to 1.2 m high. Fl. Yellow/red. | Skeletal sediment. Mountain slopes. | Sep to Nov | Unlikely | Unlikely – no suitable habitat |
| Fabaceae | *Gastrolobium humile* | | T - EN | Low shrub. | Shallow soils over granite/ gneiss and occurs in a distinctive plant community. | Sep to Oct | Unlikely | Unlikely – no suitable habitat |

**Table 8 cont.**

| Family | Species | Vernacular | Status (WA) | Description- Species | Description - Habitat | Peak Flowering period | Likelihood Analysis - pre-survey assessment | Likelihood Analysis - Post survey outcomes |
|---|---|---|---|---|---|---|---|---|
| Fabaceae | *Gastrolobium leakeanum* | | P2 | Erect shrub, to 2 m high. Fl. red/orange-yellow. | Skeletal sandy soils. Mountain peaks. | Sep | Unlikely | Unlikely – no suitable habitat |
| Haloragaceae | *Gonocarpus rudis* | | P2 | Erect or sprawling perennial, herb or shrub, 0.1-0.3 m high. Fl. green-red. | Peaty sand. Seepages, roadsides. | | Unlikely | Unlikely – no suitable habitat |
| Juncaceae | *Juncus meianthus* | | P3 | Tufted perennial, herb, 0.05-0.2 m high, to 0.4 m wide. Fl. Brown. | Black sand, sandy clay. Creeks, seepage areas. | Nov to Dec or Jan | Unlikely | Unlikely – no suitable habitat |
| Malvaceae | *Commersonia rotundifolia* | | P3 | Shrub to 1.5 m high. Semi-erect. Cream flowers, white calyx with green base. Petals cream, ligule on green base, staminodes white. Dull green leaves. | Open Eucalyptus woodland and shrubs, with Eucalyptus platypus or other Mallee or Mallet species. Well drained grey brown loams. | Oct to Dec | Unlikely | Unlikely – no suitable habitat |
| Malvaceae | *Lasiopetalum dielsii* | | P2 | Spreading shrub, 0.5-1 m high. Fl. White. | Silty loam. Steep slopes. | Dec | Unlikely | Unlikely – no suitable habitat |
| Malvaceae | *Lasiopetalum fitzgibbonii* | | P3 | Erect, spreading shrub, 0.3-1.5 m high. Fl. blue-purple-pink. | Sand, clay loam, lateritic soils. Undulating plains, hills. | Sep to Nov | Unlikely | Unlikely – no suitable habitat |
| Malvaceae | *Lasiopetalum monticola* | | P3 | Erect slender or straggling shrub, 0.45-1.5 m high. Fl. white-cream-pink. | Rocky soils. Steep slopes, gullies. | Aug to Oct | Unlikely | Unlikely – no suitable habitat |
| Myrtaceae | *Baeckea* sp. Youndegin Hill (A.S. George 15772) | | P1 | Erect shrub, to 1.45 m high. Fl. White. | Yellow sand, red sandy clay, laterite. Along road verges. | Sep to Oct | Unlikely | Unlikely – no suitable habitat |
| Myrtaceae | *Calytrix pulchella* | | P3 | Shrub, 0.3-0.7(-1) m high. Fl. Pink. | Grey or white sand over laterite. Ridges, flats. | Aug to Nov | Unlikely | Unlikely – no suitable habitat |
| Myrtaceae | *Eucalyptus buprestium* x *marginata* | | P4 | (Mallee), 1.5-5 m high, bark rough, flaking & fibrous. Fl. | Loam or sand with gravel. Gradual slopes. | Mar to May | Unlikely | Unlikely – no suitable habitat |
| Myrtaceae | *Eucalyptus dissimulata* subsp. *dissimulata* | | P4 | (Mallee), 1.7-4 m high, bark smooth, grey. Fl. Cream. | White or yellow sand. Sandplains. | Dec | Unlikely | Unlikely – no suitable habitat |
| Myrtaceae | *Eucalyptus marginata* x *pachyloma* | | P4 | (Mallee), 1.5-5 m high, bark rough at the base. | Sandy loam or loam & gravel, sand & gravel. Plains, hills. | | Unlikely | Unlikely – no suitable habitat |
| Myrtaceae | *Eucalyptus* x *erectifolia* | | P4 | (Mallee), 1-4 m high, bark smooth, grey. Fl. White. | White sand, sandy loam & gravel. Hillslopes, sandplains. | Mar to May | Unlikely | Unlikely – no suitable habitat |
| Myrtaceae | *Melaleuca fissurata* | | P4 | Shrub, 0.5-2(-4) m high. Fl. white/yellow. | White/grey sand, sandy loam. Samphire flats, salt pans. | Jul to Aug | Unlikely | Unlikely – no suitable habitat |
| Myrtaceae | *Melaleuca polycephala* | | P3 | Spreading shrub, 0.6-0.9 m high. Fl. pink-purple. | Sandy clay, clay. | Sep to Nov | Unlikely | Unlikely – no suitable habitat |
| Myrtaceae | *Verticordia brevifolia* subsp. *brevifolia* | | P3 | Shrub, 0.2-0.4 m high. Fl. yellow/orange-red. | Gravelly loam & clay. Road verges. | Oct to Nov | Unlikely | Unlikely – no suitable habitat |
| Myrtaceae | *Verticordia brevifolia* subsp. *stirlingensis* | | P2 | Shrub, to 0.35 m high. Fl. Yellow. | Gravelly sandy loam. Road verges. | Oct | Unlikely | Unlikely – no suitable habitat |
| Myrtaceae | *Verticordia carinata* | | T - VU | Open, slender shrub, 0.8-1 m high. Fl. pink-red. | Grey sand over sandstone. | Mar to May | Unlikely | Unlikely – no suitable habitat |
| Polygonaceae | *Duma horrida* subsp. *Abdita* | Remote Thorny Lignum | T-CR | Divaricately to intricately branched, spreading erect shrub that grows to a height of 0.6–1.2 m. | Clay and silt depressions in seasonally inundated freshwater wetlands. | | Unlikely | Unlikely – no suitable habitat |
| Proteaceae | *Adenanthos pungens* subsp. *pungens* | | T-VU | Erect shrub, 0.5-3 m high. Fl. pink/red. | White/grey or pink sand, rocky soils, gypsum. Sand dunes, hillsides. | Aug to Nov | Unlikely | Unlikely – no suitable habitat |
| Proteaceae | *Banksia anatona* | Cactus Dryandra | T-CR | Upright, non-lignotuberous shrub, to 5 m high. Fl. Yellow. | Grey sand over gravelly shale, rocky silty clay loam. Lower slopes of ranges. | Jan to Mar | Unlikely | Unlikely – no suitable habitat |

**Table 8 cont.**

| Family | Species | Vernacular | Status (WA) | Description- Species | Description - Habitat | Peak Flowering period | Likelihood Analysis - pre-survey assessment | Likelihood Analysis - Post survey outcomes |
|---|---|---|---|---|---|---|---|---|
| Proteaceae | *Banksia hirta* | | P4 | Erect, prickly, non-lignotuberous shrub, 1-2.5 m high. Fl. Yellow. | Sandy clay over sandstone, gravelly loam. | May to Oct | Unlikely | Unlikely – no suitable habitat |
| Proteaceae | *Banksia laevigata* subsp. *laevigata* | | P4 | Non-lignotuberous shrub, 1-3.5 m high. Fl. green-yellow. | Rocky soils (spongolite, laterite). Hills, top of breakaways. | Sep to Dec | Unlikely | Unlikely – no suitable habitat |
| Proteaceae | *Banksia parva* | | P4 | Non-lignotuberous, erect, multi-stemmed, usually columnar shrubs to 1.5 m high. | Grows in sandy and gravelly loams and sands over laterite, in mallee-heath and shrublands with Eucalyptus pleurocarpa, E. incrassata, Allocasuarina huegeliana, Hakea varia, H. lissocarpha, H. marginata, Banksia nervosa, B. arctotidis, B. gardneri, B. armata, B. sphaerocarpa, B. drummondii, Regelia inops, and Xanthorrhoea platyphylla. | May to Jul | Unlikely | Unlikely – no suitable habitat |
| Proteaceae | *Banksia plumosa* subsp. *denticulata* | | P4 | Erect, dense, non-lignotuberous shrub, 0.6-1.2 m high. Fl. cream-yellow. | Rocky or gravelly sand. | May or Jul or Dec | Unlikely | Unlikely – no suitable habitat |
| Proteaceae | *Banksia pseudoplumosa* | | T - EN | Non-lignotuberous shrub, to 1.8 m high. | Gravelly soils. | Nov to Dec | Unlikely | Unlikely – no suitable habitat |
| Proteaceae | *Grevillea maxwellii* | | T - CR | Prostrate to spreading shrub, 0.2-1.2 m high, up to 2 m wide. Fl. Red. | Sandy clay or clay loam over granite. Hilltop. | May or Aug to Sep | Unlikely | Unlikely – no suitable habitat |
| Proteaceae | *Grevillea newbeyi* | | P3 | Bushy, intricately branched, spreading shrub, 0.6-1.5 m high. Fl. pink/pink-red-cream. | Clay loam, sandy gravelly soils. | Jan or Jun or Sep to Nov | Unlikely | Unlikely – no suitable habitat |
| Proteaceae | *Hakea oldfieldii* | | P3 | Open, straggling shrub, up to 2.5 m high. Fl. white-cream/yellow. | Red clay or sand over laterite. Seasonally wet flats. | Aug to Oct | Unlikely | Unlikely – no suitable habitat |
| Proteaceae | *Isopogon latifolius* | | P4 | Erect, much-branched, non-lignotuberous shrub, 0.9-3 m high. Fl. pink-red-purple. | Stony sandy soils on sandstone, quartzite or schistose rocks. Rocky slopes & summits of hills. | Aug to Dec | Unlikely | Unlikely – no suitable habitat |
| Proteaceae | *Persoonia brevirhachis* | | P3 | Erect, often spreading shrub, 0.3-2 m high. Fl. Yellow. | White or yellow sand, gravelly sandy soils. | Aug to Oct | Unlikely | Unlikely – no suitable habitat |
| Rhamnaceae | *Spyridium villosum* | | P2 | Low shrub, 0.1-0.4 m high. Fl. Cream. | Sand over sandstone. | Oct to Nov | Unlikely | Unlikely – no suitable habitat |
| Scrophulariaceae | *Eremophila veneta* | | P4 | Spreading or straggly shrub, 0.3-1.2 m high, to 1.8 m wide. Fl. green & yellow & purple. | Clay to loam, white/grey sand. Plains & flats, slopes. | Oct to Nov | Unlikely | Unlikely – no suitable habitat |
| Scrophulariaceae | *Myoporum cordifolium* | | T - EN | Spindly, erect shrub, 0.3-0.8 m high. Fl. white/white-pink. | Sandy loam or clay loam. Flat plains. | Jul to Nov | Unlikely | Unlikely – no suitable habitat |
| Stylidiaceae | *Stylidium lepidum* | | P3 | Spreading, rosetted perennial, herb, ca 0.05 m high, forming densely packed colonies. Fl. pink-orange. | Gravelly sand or loam, clay. Winter-wet depressions. | Oct to Nov | Unlikely | Unlikely – no suitable habitat |

**Table 9: Potential Threatened and Priority ecological communities located within 20 km of the survey area and likelihood of occurrence analysis (post survey).**

| Community Name | Status | Description | Pre-Survey Likelihood of Occurrence | Post-Survey Likelihood of Occurrence and Survey Outcome |
|---|---|---|---|---|
| Eucalyptus Woodlands of the Western Australian Wheatbelt | Priority 3 (WA)<br>CR (EPBC Act) | The ecological community defined and assessed as TEC/PEC 'Eucalyptus Woodland of the Western Australian Wheatbelt' is comprised of eucalypt woodlands that formerly were the most common type of vegetation across the wheatbelt landscape of south-western WA, inland between the Darling Range and western edge of the goldfields. The woodlands are dominated by a complex mosaic of eucalypt species with a tree or mallet form over an understorey that is highly variable in structure and composition. Woodlands dominated by mallee forms or vegetation with a very sparse Eucalypt tree canopy are not part of the ecological community (DoEE, 2015). | Likely | Not present in the survey area.<br><br>Vegetation unit 2: MEW bore similarities. Located in Mallee bioregion. Woodland structure with minimum crown cover of 10%. Only Q3 met key species criteria. Vegetation unit 2 did not meet native understorey criteria or condition criteria. Further discussed in Section 5.6 |
| Proteaceae Dominated Kwongkan Shrublands of the Southeast Coastal Floristic Province of Western Australia | Priority 3 (WA)<br>EN (EPBC Act) | Consists of predominantly obligate seeding proteaceous shrubland and heath (kwongkan) and mallee heath on sandplain, duplex sand/clay and gravels overlying Eocene sediments, quartzite, schist, Yilgarn and Albany Fraser granite and greenstone ranges. Its flora is characterised by high species diversity and a high degree of endemism, particularly in the Stirling Range, Fitzgerald River National Park, Ravensthorpe Range and Russell Ranges. Due to the high levels of endemism, there are few species that exist across the entire range of the dense, obligate seeding Proteaceae dominated shrublands and kwongkan of the Esperance Sandplains, however particular species have been identified as common dominant species in each of its ecodistricts (DoE, 2014). | Possible | Not present in the survey area |

# Appendix C

Conservation Status Definitions and Condition Scale

**Table 10: Conservation code definitions for flora listed as Threatened or specially protected.**
Threatened, Extinct and Specially Protected fauna or flora are species which have been adequately searched for and are deemed to be, in the wild, Threatened, extinct or in need of special protection, and have been gazetted as such.

| Threat Category | Definition |
|---|---|
| Threatened - Critically endangered species (CR) | Facing an extremely high risk of extinction in the wild in the immediate future |
| Threatened - Endangered species (EN) | Facing a very high risk of extinction in the wild in the near future |
| Threatened - Vulnerable species (VU) | Facing a high risk of extinction in the wild in the medium-term future |
| Threatened - Extinct (EX) | There is no reasonable doubt that the last member of the species has died |
| Threatened – Extinct in the wild (EW) | Species 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 |
| Specially protected species - Migratory species (MI) | Fauna that periodically or occasionally visit Australia or an external Territory or the exclusive economic zone; or the species is subject of an international agreement that relates to the protection of migratory species and that binds the Commonwealth;<br>Includes birds that are subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and The Republic of Korea (ROKAMBA), and fauna subject to the Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention), an environmental treaty under the United Nations Environment Program.<br>Migratory species listed under the BC Act are a subset of the migratory animals that are known to visit Western Australia, protected under the international agreements or treaties, excluding species that are listed as Threatened species. |
| Specially protected species – Conservation Dependent (CD) | Fauna of special conservation need being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened, |
| Specially protected species – Other specially protected species (OS) | Fauna otherwise in need of special protection to ensure their conservation |

**Table 11: Conservation code definitions for flora listed as Priority.**
Possibly Threatened species that do not meet survey criteria, or are otherwise data deficient, are added to the Priority Fauna or Priority Flora Lists under Priorities 1, 2 or 3.

| Threat Category | Definition |
|---|---|
| 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. |
| 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. |
| 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. |
| 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.<br>(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.<br>(c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy. |

**Table 12: Conservation code definitions for ecological communities listed as Threatened (TEC).**

| Threat Category | Definition |
|---|---|
| Presumed Totally Destroyed (PD) | An ecological community that has been adequately searched for but for which no representative occurrences have been located. The community has been found to be totally destroyed or so extensively modified throughout its range that no occurrence of it is likely to recover its species composition and/or structure in the foreseeable future. |
| Critically Endangered (CR) | An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or that was originally of limited distribution and is facing severe modification or destruction throughout its range in the immediate future, or is already severely degraded throughout its range but capable of being substantially restored or rehabilitated. |
| Endangered (EN) | An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or was originally of limited distribution and is in danger of significant modification throughout its range or severe modification or destruction over most of its range in the near future. |
| Vulnerable (VU) | An ecological community that has been adequately surveyed and is found to be declining and/or has declined in distribution and/or condition and whose ultimate security has not yet been assured and/or a community that is still widespread but is believed likely to move into a category of higher threat in the near future if threatening processes continue or begin operating throughout its range. |

**Table 13: Conservation code definitions for ecological communities listed as priority (PEC).**

Possible Threatened ecological communities that do not meet survey criteria or that are not adequately defined are added to the Priority Ecological Community List under priorities 1, 2 and 3.

| Threat Category | Definition |
|---|---|
| Priority One (P1) | Ecological communities that are known from very few occurrences with a very restricted distribution (generally ≤5 occurrences or a total area of ≤100ha), and appear to be under immediate threat. |
| Priority Two (P2) | Communities that are known from few occurrences with a restricted distribution (generally ≤10 occurrences or a total area of ≤200ha). At least some occurrences are not believed to be under immediate threat (within approximately 10 years) of destruction or degradation. |
| Priority Three (P3) | (i)Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation or:<br>(ii)communities known from a few widespread occurrences, which are either large or with significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat (within approximately 10 years), or;<br>(iii)communities made up of large, and/or widespread occurrences, that may or may not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, inappropriate fire regimes, clearing, hydrological change etc. |
| Priority Four (P4) | Ecological communities that are adequately known, rare but not Threatened or meet criteria for Near Threatened, or that have been recently removed from the Threatened list. These communities require regular monitoring. |
| Priority Five (P5) | Conservation Dependent ecological communities that are not Threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming Threatened within five years. |

**Table 14: Condition Rating Scale (adapted from Keighery 1994) outlined in EPA (2016a).**

| Vegetation Condition Rating | Description |
|---|---|
| Pristine | Pristine or nearly so, no obvious signs of disturbance or damage caused by human activities since European settlement. |
| Excellent | Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species. Damage to trees caused by fire, the presence of non-aggressive weeds and occasional vehicle tracks. |
| Very good | Vegetation structure altered, obvious signs of disturbance. Disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing. |
| Good | Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. Disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing. |
| Degraded | Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. Disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds at high density, partial clearing, dieback and grazing. |
| Completely Degraded | The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora comprising weed or crop species with isolated native trees and shrubs. |

# Appendix D

Species Lists, Relevé and Quadrat Data

**Table 15: Flora Species List recorded within survey area.**

| Family | Genus | Species | Vernacular | Cons code | Invasive | Comments |
|---|---|---|---|---|---|---|
| Aizoaceae | *Carpobrotus* | *edulis* | hottentot fig | | X | |
| Aizoaceae | *Disphyma* | *crassifolium* | round-leaved pigface | | X | |
| Aizoaceae | *Mesembryanthemum* | *crystallinum* | iceplant | | X | |
| Amaranthaceae | *Ptilotus* | *spathulatus* | | | | |
| Asparagaceae | *Asparagus* | *asparagoides* | bridal creeper | | X - DP, WoNS | |
| Asparagaceae | *Dichopogon* | sp. | | | | Not enough diagnostic features present. No potential T/P flora match. |
| Asparagaceae | *Lomandra* | *effusa* | scented matrush | | | |
| Asparagaceae | *Lomandra* | sp. | | | | No diagnostic features. No potential T/P flora match. |
| Asparagaceae | *Thysanotus* | *patersonii* | | | | |
| Asteraceae | *Arctotheca* | *calendula* | cape weed | | X | |
| Asteraceae | *Cirsium* | *vulgare* | spear thistle | | X | |
| Asteraceae | *Erigeron* | *sumatrensis* | | | X | |
| Asteraceae | *Gazania* | *linearis* | | | X | |
| Asteraceae | *Hypochaeris* | *glabra* | smooth cats-ear | | X | |
| Asteraceae | *Lactuca* | *serriola* | prickly lettuce | | X | |
| Asteraceae | *Osteospermum* | *ecklonis* | | | X | |
| Asteraceae | *Pseudognaphalium* | *luteoalbum* | jersey cudweed | | X | |
| Asteraceae | *Rhodanthe* | *chlorocephala* | | | Cultivated | |
| Asteraceae | *Senecio* | *serpens* | blue chalksticks | | Cultivated | |
| Asteraceae | *Sonchus* | *oleraceus* | common sowthistle | | X | |
| Asteraceae | *Taraxacum* | *khatoonae* | dandelion | | X | |
| Asteraceae | *Ursinia* | *anthemoides* | ursinia | | X | |
| Asteraceae | *Waitzia* | *acuminata* | orange immortelle | | | |
| Brassicaceae | *Brassica* | *tournefortii* | Mediterranean turnip | | X | |
| Brassicaceae | *Raphanus* | *raphanistrum* | wild radish | | X | |
| Campanulaceae | *Monopsis* | *debilis* | | | X | |
| Casuarinaceae | *Allocasuarina* | *fraseriana* | sheoak | | | |

**Table 15 cont.**

| Family | Genus | Species | Vernacular | Cons code | Invasive | Comments |
|---|---|---|---|---|---|---|
| Casuarinaceae | *Allocasuarina* | *huegeliana* | rock sheoak | | | |
| Chenopodiaceae | *Enchylaena* | *tomentosa* | barrier saltbush | | | |
| Chenopodiaceae | *Enchylaena* | *lanata* | | | | |
| Chenopodiaceae | *Rhagodia* | *drummondii* | | | | |
| Chenopodiaceae | *Rhagodia* | *preissii* | | | | |
| Chenopodiaceae | *Rhagodia* | *spinescens* | spiny saltbush | | Cultivated | |
| Crassulaceae | *Cotyledon* | *orbiculata* | | | X | |
| Crassulaceae | *Crassula* | *alata* | | | X | |
| Crassulaceae | *Crassula* | *colorata* var. *acuminata* | | | | |
| Cyperaceae | *Carex* | *testacea* | | | Cultivated | Name not in Florabase because they do not naturally occur, and are not a known weed species in Western Australia. |
| Cyperaceae | *Cyperaceae* | sp. | | | | Limited diagnostic features. Not likely to be P3 *Tricostularia sandifordiana.* Not geographically distributed near survey area. |
| Cyperaceae | *Cyperaceae* | sp. | | | | Not enough diagnostic features present. Not likely to be P3 *Tricostularia sandifordiana.* Not geographically distributed near survey area |
| Cyperaceae | *Ficinia* | *nodosa* | knotted club rush | | | |
| Cyperaceae | *Isolepis* | *prolifera* | budding club-rush | | X | |
| Cyperaceae | *Machaerina* | *juncea* | bare twigrush | | | |
| Dilleniaceae | *Hibbertia* | *scandens* | climbing guinea flower | | Cultivated | |
| Dilleniaceae | *Hibbertia* | *vestita* | hairy guinea-flower | | Cultivated | Name not in Florabase because they do not naturally occur, and are not a known weed species in Western Australia. |
| Ericaceae | Sp. | | | | | No diagnostic features. Not P3 *Andersonia setifolia,* P3 *Leucopogon newbeyi* or EN *Sphenotoma drummondii.* |
| Euphorbiaceae | *Ricinocarpos* | *pinifolius* | wedding bush | | Cultivated | |

**Table 15 cont.**

| Family | Genus | Species | Vernacular | Cons code | Invasive | Comments |
|---|---|---|---|---|---|---|
| Fabaceae | *Acacia* | *acuminata* | jam | | | |
| Fabaceae | *Acacia* | *cochlearis* | rigid wattle | | | |
| Fabaceae | *Acacia* | *consobrina* | | | | |
| Fabaceae | *Acacia* | *dodonaeifolia* | hop-bush wattle | | Cultivated | Name not in Florabase because they do not naturally occur, and are not a known weed species in Western Australia. |
| Fabaceae | *Acacia* | *glaucoptera* | flat wattle | | | |
| Fabaceae | *Acacia* | *mutabilis* subsp. *mutabilis* | | | | |
| Fabaceae | *Acacia* | *saligna* | orange wattle | | | |
| Fabaceae | *Acacia* | *erinacea* | | | | |
| Fabaceae | *Chamaecytisus* | *palmensis* | tagasaste | | X | |
| Fabaceae | *Daviesia* | *incrassata* | | | | |
| Fabaceae | *Medicago* | *polymorpha* | burr medic | | X | |
| Fabaceae | *Senna* | *artemisioides* | | | | |
| Fabaceae | *Trifolium* | *fragiferum* | strawberry clover | | X | |
| Fabaceae | *Trifolium* | *angustifolium* | narrowleaf clover | | X | |
| Goodeniaceae | *Dampiera* | *lavandulacea* | | | | |
| Haemodoraceae | *Anigozanthos* | *flavidus* | tall kangaroo paw | | Cultivated | |
| Haemodoraceae | *Anigozanthos* | sp. | | | | Limited diagnostic features.<br>No potential T/P flora match. |
| Haemodoraceae | *Conostylis* | *aculeata* | prickly conostylis | | | |
| Haemodoraceae | *Conostylis* | *candicans* | grey cottonhead | | Cultivated | |
| Haemodoraceae | *Conostylis* | sp. | | | | Not enough diagnostic features present.<br>Not *Conostylis misera.* |
| Hemerocallidaceae | *Chamaescilla* | *corymbosa* | blue squill | | | |
| Hemerocallidaceae | *Chamaescilla* | *spiralis* | | | | |
| Hemerocallidaceae | *Dianella* | *revoluta* | blueberry lily | | | |
| Hemerocallidaceae | *Stypandra* | *glauca* | blind grass | | | |
| Iridaceae | *Moraea* | *setifolia* | | | X | |
| Iridaceae | *Patersonia* | *occidentalis* | purple flag | | | |

**Table 15 cont.**

| Family | Genus | Species | Vernacular | Cons code | Invasive | Comments |
|---|---|---|---|---|---|---|
| Iridaceae | *Romulea* | *rosea* | Guildford grass | | X | |
| Iridaceae | *Watsonia* | *meriana* var. *bulbillifera* | bugle lily | | X | |
| Juncaceae | *Juncus* | *pallidus* | pale rush | | | |
| Juncaceae | *Juncus* | *radula* | | | | |
| Lamiaceae | *Westringia* | *brevifolia* | coastal rosemary | | | Name not in Florabase because they do not naturally occur, and are not a known weed species in Western Australia. |
| Lythraceae | *Lythrum* | *hyssopifolia* | lesser loosestrife | | X | |
| Montiaceae | *Calandrinia* | sp. | | | | Limited diagnostic features.<br>No potential T/P flora match. |
| Myrtaceae | *Callistemon* | *phoeniceus* | lesser bottlebrush | | Cultivated | |
| Myrtaceae | *Callistemon* | *viminalis* | little john | | Cultivated | |
| Myrtaceae | *Calothamnus* | *quadrifidus* | one-sided bottlebrush | | | |
| Myrtaceae | *Darwinia* | *citriodora* | lemon-scented darwinia | | Cultivated | |
| Myrtaceae | *Eucalyptus* | *caesia* | caesia | P4 | Cultivated | Subspecies could not be determined. Both subspecies are P4. Limited taxonomic features present due to juvenile state. However, this individual is located within the cultivated road verge and is not considered a natural population within the survey area. *E. caesia* is widely planted as an ornamental species and is popular in revegetation, road verges and gardens. Because of this it is not considered a natural population. |
| Myrtaceae | *Eucalyptus* | *calycogona* subsp. *calycogona* | square-fruited mallee | | Cultivated | Juvenile planted street tree |
| Myrtaceae | *Eucalyptus* | *cladocalyx* | | | Cultivated | |
| Myrtaceae | *Eucalyptus* | *flocktoniae* subsp. *flocktoniae* | flockton's mallee | | | |
| Myrtaceae | *Eucalyptus* | *forrestiana* | fuchsia gum | | Cultivated | |

**Table 15 cont.**

| Family | Genus | Species | Vernacular | Cons code | Invasive | Comments |
|---|---|---|---|---|---|---|
| Myrtaceae | *Eucalyptus* | *kruseana* | bookleaf mallee | P4 | Cultivated | Natural range in Kalgoorlie area. Individual is located within the cultivated road verge and is not considered a natural population within the survey area. Planted as an ornamental species. Because of this it is not considered a natural population. |
| Myrtaceae | *Eucalyptus* | *leucoxylon* subsp. *megalocarpa* | large fruited yellow gum | | Cultivated | |
| Myrtaceae | *Eucalyptus* | *leucoxylon* subsp. *leucoxylon* | yellow gum | | Cultivated | |
| Myrtaceae | *Eucalyptus* | *longicornis* | red morrel | | | |
| Myrtaceae | *Eucalyptus* | *megacornuta* | warted yate | | Cultivated | |
| Myrtaceae | *Eucalyptus* | *newbeyi* | Beaufort Inlet mallee | P3 | Cultivated | Considered to not be endemic to the survey area and cultivated species. |
| Myrtaceae | *Eucalyptus* | *occidentalis* | flat-topped yate | | | |
| Myrtaceae | *Eucalyptus* | *petiolaris* | | | Cultivated | |
| Myrtaceae | *Eucalyptus* | *platypus* subsp. *platypus* | moort | | | |
| Myrtaceae | *Eucalyptus* | *rudis subsp. rudis* | flooded gum | | | |
| Myrtaceae | *Eucalyptus* | sp. | | | Cultivated | Planted. Not enough diagnostic features present. Not *Eucalyptus brandiana* or *Eucalyptus vesiculosa.* |
| Myrtaceae | *Eucalyptus* | *torquata* | coral gum | | Cultivated | |
| Myrtaceae | *Eucalyptus* | *utilis* | coastal moort | | Cultivated | |
| Myrtaceae | *Melaleuca* | *hamata* | | | | |
| Myrtaceae | *Melaleuca* | *hamulosa* | | | | |
| Myrtaceae | *Melaleuca* | *lanceolata* | Rottnest teatree | | | |
| Myrtaceae | *Melaleuca* | *platycalyx* | | | | |
| Myrtaceae | *Melaleuca* | *quinquenervia* | | | Cultivated | |
| Myrtaceae | *Melaleuca* | *undulata* | hidden honey-myrtle | | | |
| Myrtaceae | *Scholtzia* | *involucrata* | spiked scholtzia | | Cultivated | |
| Myrtaceae | *Thryptomene* | sp. | | | | Limited diagnostic features. No potential T/P flora match. |

**Table 15 cont.**

| Family | Genus | Species | Vernacular | Cons code | Invasive | Comments |
|---|---|---|---|---|---|---|
| Myrtaceae | *Verticordia* | *plumosa* | plumed featherflower | | | |
| Orchidaceae | *Disa* | *bracteata* | | | X | |
| Orchidaceae | *Microtis* | *media* | tall mignonette orchid | | | |
| Orchidaceae | *Thelymitra* | *graminea* | | | | |
| Orobanchaceae | *Parentucellia* | *latifolia* | common bartsia | | X | |
| Oxalidaceae | *Oxalis* | *pes-caprae* | soursob | | X | |
| Plantaginaceae | *Plantago* | *coronopus* | buckshorn plantain | | X | |
| Poaceae | *Aira* | *caryophyllea* | silvery hairgrass | | X | |
| Poaceae | *Amphipogon* | *turbinatus* | | | | |
| Poaceae | *Austrostipa* | *exilis* | | | | |
| Poaceae | *Austrostipa* | *compressa* | | | | |
| Poaceae | *Avena* | *barbata* | bearded oat | | X | |
| Poaceae | *Briza* | *maxima* | blowfly grass | | X | |
| Poaceae | *Briza* | *minor* | shivery grass | | X | |
| Poaceae | *Bromus* | *hordeaceus* | soft brome | | X | |
| Poaceae | *Bromus* | *diandrus* | great brome | | X | |
| Poaceae | *Cenchrus* | *clandestinus* | kikuyu grass | | X | |
| Poaceae | *Cynodon* | *dactylon* | couch | | X | |
| Poaceae | *Ehrharta* | *calycina* | perennial veldt grass | | X | |
| Poaceae | *Ehrharta* | *longiflora* | annual veldt grass | | X | |
| Poaceae | *Eragrostis* | *curvula* | African lovegrass | | X | |
| Poaceae | *Hordeum* | *leporinum* | barley grass | | X | |
| Poaceae | *Lolium* | *rigidum* | Wimmera ryegrass | | X | |
| Poaceae | *Poaceae* | sp. | | | | No diagnostic features.<br>No potential T/P flora match. |
| Poaceae | *Rytidosperma* | *setaceum* | small-flowered wallaby-grass | | | |
| Poaceae | *Rytidosperma* | sp. | | | | No diagnostic features, evidence of herbivory. |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | | No potential T/P flora match. |
| Polygonaceae | *Polygonum* | *aviculare* | wireweed | | X | |

**Table 15 cont.**

| Family | Genus | Species | Vernacular | Cons code | Invasive | Comments |
|---|---|---|---|---|---|---|
| Polygonaceae | *Rumex* | *obtusifolius* | bitter dock | | X | |
| Primulaceae | *Lysimachia* | *arvensis* | pimpernel | | X | |
| Proteaceae | *Grevillea* | sp. | | | Cultivated | Hybrid |
| Proteaceae | *Grevillea* | *crithmifolia* | | | Cultivated | |
| Proteaceae | *Grevillea* | Red Dunset' | | | Cultivated | |
| Proteaceae | *Grevillea* | Robyn Gordon' | | | Cultivated | |
| Proteaceae | *Hakea* | *francisiana* | emu tree | | | |
| Proteaceae | *Hakea* | *laurina* | pincushion hakea | | | |
| Proteaceae | *Hakea* | *lissocarpha* | honey bush | | | |
| Proteaceae | *Hakea* | *prostrata* | harsh hakea | | | |
| Proteaceae | *Leucadendron* | sp. | | | Cultivated | Limited diagnostic features.<br>No potential T/P flora match. |
| Restionaceae | *Lepidobolus* | *preissianus* | | | | |
| Santalaceae | *Santalum* | *acuminatum* | quandong | | | |
| Scrophulariaceae | *Eremophila* | *glabra* | tar bush | | | |
| Scrophulariaceae | *Eremophila* | *glabra* 'Groundcover' | | | Cultivated | |
| Scrophulariaceae | *Eremophila* | hybrid sp. | | | Cultivated | |

| | | | | | |
|---|---|---|---|---|---|
| **Relevé** | R1 | **Veg Code** | *Allocasuarina fraseriana* Open Forest [AfOF] | **Date Surveyed** | 17/10/2022 |
| **Location** | Southeast in the survey area | | | | |
| **GPS (Lat, Long)** | -34.07046, 118.26406 | | | | |
| **Landform and Slope** | Drainage Depression, Gentle | | | | |
| **Soils** | Sandy-Loam, Dark Brown | | | | |
| **Hydrology** | Seasonal Wet | | | | |
| **Vegetation description** | (NVIS, DoEE, 2017): U ^*Allocasuarina fraseriana*\^tree\7\c; G ^*Cenchrus clandestinus*\^grass\1\c.<br><br>*(*Muirs, 1977*): Allocasuarina fraseriana* Open Forest, over *Cenchrus clandestinus* Grassland. | | | | |
| **Condition** | Degraded | | | | |
| **Comments** | - | | | | |

| **Life Form** | **Dominant Species** | **Other Species** | **Cover (%)** |
|---|---|---|---|
| Trees 10-30m | *Allocasuarina fraseriana* | *Eucalyptus rudis* subsp. *rudis* | 30-70% |
| Trees <10m | | *Allocasuarina huegeliana, Acacia saligna* | 10-30% |
| Shrub >2m | | **Chamaecytisus palmensis* | <10% |
| Shrub 1-2m | | *Hakea prostrata* | <10% |
| Herb | | **Oxalis pes-caprae, *Asparagus asparagoides* | <10% |
| Grass | **Cenchrus clandestinus* | **Ehrharta longiflora, *Ehrharta calycina, *Eragrostis curvula* | 30-70% |

| | | | | | |
|---|---|---|---|---|---|
| **Relevé** | R2 | **Veg Code** | Mixed Eucalyptus Woodland [MEW] | **Date Surveyed** | 17/10/2022 |
| **Location** | Southeast in the survey area | | | | |
| **GPS (Lat, Long)** | -34.070722, 118.264107 | | | | |
| **Landform and Slope** | Plain, Gentle | | | | |
| **Soils** | Sandy-Loam, Dark Brown | | | | |
| **Hydrology** | Seasonal Wet | | | | |
| **Vegetation description** | (NVIS, DoEE, 2017): U ^ *Eucalyptus rudis* subsp. *rudis* \^tree\7\i;G *Eragrostis curvula, Bromus diandrus, Cenchrus clandestinus*\1\d.<br><br>*(*Muirs, 1977*):* *Eucalyptus rudis* subsp. *rudis* Woodland, over *Eragrostis curvula, Bromus diandrus, Cenchrus clandestinus* Dense Grassland. | | | | |
| **Condition** | Degraded | | | | |
| **Comments** | - | | | | |

| **Life Form** | **Dominant Species** | **Other Species** | **Cover (%)** |
|---|---|---|---|
| Trees 10-30m | *Eucalyptus rudis* subsp. *rudis* | **Eucalyptus cladocalyx, Allocasuarina fraseriana, Eucalyptus forrestiana, Eucalyptus occidentalis, Eucalyptus longicornis* | 10-30% |
| Trees <10m | | *Acacia acuminata, Acacia dodonaeifolia, Eucalyptus torquata, Eucalyptus platypus* subsp. *platypus, Eucalyptus newbeyi, Eucalyptus megacornuta, Eucalyptus caesia* | 10-30% |
| Shrub >2m | | **Chamaecytisus palmensis, Melaleuca hamulosa, Callistemon phoeniceus* | <10% |
| Herb | | **Rumex obtusifolius, *Asparagus asparagoides, *Disphyma crassifolium* | <10% |
| Grass | **Eragrostis curvula, *Bromus diandrus, *Cenchrus clandestinus* | **Ehrharta calycina, *Ehrharta longiflora, *Briza maxima* | 30-70% |

| | | | | | |
|---|---|---|---|---|---|
| **Relevé** | R3 | **Veg Code** | Acacia acuminata Low Open Forest [AaLOF] | **Date Surveyed** | 17/10/2022 |
| **Location** | Southwest in the survey area | | | | |
| **GPS (Lat, Long)** | -34.070684, 118.256902 | | | | |
| **Landform and Slope** | Drainage Depression, Gentle | | | | |
| **Soils** | Sandy-Loam, Dark Brown | | | | |
| **Hydrology** | Seasonal Wet | | | | |
| **Vegetation description** | (NVIS, DoEE, 2017): U ^ *Acacia acuminata*\^tree\6\c;G *Ursinia anthemoides, Romulea rosea, Ehrharta calycina*\1\d.<br><br>*(*Muirs, 1977*):* *Acacia acuminata* Low Open Forest, over *Ursinia anthemoides, Romulea rosea* Herbs, *Ehrharta calycina* Dense Introduced Grassland and Herbland. | | | | |
| **Condition** | Degraded | | | | |
| **Comments** | - | | | | |

| **Life Form** | **Dominant Species** | **Other Species** | **Cover (%)** |
|---|---|---|---|
| Trees 10-30m | | *Eucalyptus longicornis, Eucalyptus occidentalis, Eucalyptus longicornis* | <10% |
| Trees <10m | *Acacia acuminata* | *Allocasuarina fraseriana, Santalum acuminatum* | 30-70% |
| Shrub >2m | | *Acacia saligna, Calothamnus quadrifidus, Hakea lissocarpha* | <10% |
| Shrub 1-2m | | *Rhagodia drummondii, Melaleuca undulata, Acacia consobrina, Melaleuca hamata* | <10% |
| Herb | **Ursinia anthemoides, *Romulea rosea* | **Hypochaeris glabra, *Taraxacum khatoonae, *Raphanus raphanistrum, *Medicago polymorpha, *Trifolium fragiferum, Thysanotus patersonii, *Mesembryanthemum crystallinum* | 30-70% |
| Grass | **Ehrharta calycina* | **Ehrharta longiflora, *Briza maxima, Austrostipa compressa, *Eragrostis curvula* | 30-70% |

| | | | | | |
|---|---|---|---|---|---|
| **Relevé** | R4 | **Veg Code** | *Allocasuarina fraseriana* Open Forest [AfOF] | **Date Surveyed** | 17/10/2022 |
| **Location** | Southeast in the survey area | | | | |
| **GPS (Lat, Long)** | -34.065821, 118.258118 | | | | |
| **Landform and Slope** | Drainage Depression, Gentle | | | | |
| **Soils** | Sandy-Loam, Dark Brown | | | | |
| **Hydrology** | Seasonal Wet | | | | |
| **Vegetation description** | (NVIS, DoEE, 2017): U ^*Allocasuarina fraseriana*\^tree\7\c; G ^*Cenchrus clandestinus*\^grass\1\c.<br><br>*(*Muirs, 1977*):* *Allocasuarina fraseriana* Forest, over *Cenchrus clandestinus* Grassland. | | | | |
| **Condition** | Completely Degraded | | | | |
| **Comments** | Access restricted by water body | | | | |

| **Life Form** | **Dominant Species** | **Other Species** | **Cover (%)** |
|---|---|---|---|
| Trees 10-30m | | *Eucalyptus longicornis* | <10% |
| Trees <10m | *Allocasuarina fraseriana* | *Acacia acuminata* | 30-70% |
| Shrub >2m | | *Acacia saligna* | <10% |
| Shrub 1-2m | | *Melaleuca hamulosa* | <10% |
| Sedge | | *Juncus radula, Juncus pallidus* | <10% |
| Herb | | **Hypochaeris glabra, *Cirsium vulgare, *Moraea setifolia, *Arctotheca calendula, *Sonchus oleraceus, *Romulea rosea, *Lythrum hyssopifolia, Crassula colorata* var. *acuminata, *Pseudognaphalium luteoalbum, *Plantago coronopus, *Oxalis pes-caprae, *Taraxacum khatoonae, *Trifolium angustifolium, *Silene gallica* | <10% |
| Grass | **Hordeum leporinum, *Ehrharta longiflora* | **Bromus diandrus, *Avena barbata, *Lolium rigidum, Austrostipa compressa, *Eragrostis curvula, *Ehrharta calycina, *Aira caryophyllea, *Bromus hordeaceus* | 30-70% |

| | | | | | |
|---|---|---|---|---|---|
| **Quadrat** | Q1 | **Veg Code** | 2: MEW | **Date Surveyed** | 18/10/2022 |
| **Location** | In the Moir Street road reserve in the south of the survey area. | | | | |
| **GPS (Lat, Long)** | -34.071109, 118.261425 | | | | |
| **Landform and Slope** | Plain, Gentle | | | | |
| **Soils** | Dark Brown Sand | | | | |
| **Hydrology** | Good drainage | | | | |
| **Vegetation description** | (NVIS, DoEE, 2017): U ^ *Eucalyptus rudis* subsp. *rudis* \^tree\7\i;G *Eragrostis curvula, Bromus diandrus, Cenchrus clandestinus*\1\d.<br><br>*(*Muirs, 1977*): Eucalyptus rudis* subsp. *rudis* Woodland, over *Eragrostis curvula, Bromus diandrus, Cenchrus clandestinus* Dense Grassland. | | | | |
| **Condition** | Completely Degraded | | | | |
| **Comments** | 5x20m | | | | |

| **Species Name** | **Form** | **Height (m)** | **Cover (%)** | **Flowering/Fruiting** |
|---|---|---|---|---|
| **Ehrharta longiflora* | G-grass | 0.2 | bi ≈0 | |
| **Eragrostis curvula* | G-grass | 0.3 | r <10% | |
| **Ehrharta calycina* | G-grass | 0.2 | bi ≈0 | |
| **Aira caryophyllea* | G-grass | 0.1 | bi ≈0 | |
| **Lolium rigidum* | G-grass | 0.1 | bi ≈0 | |
| **Hypochaeris glabra* | H-herb | 0.1 | bi ≈0 | |
| *Eucalyptus caesia* | T-tree | 3 | r <10% | FL/FR |
| *Callistemon viminalis* | S-shrub | 2 | r <10% | |
| *Darwinia citriodora* | S-shrub | 1.5 | r <10% | Flowering |
| *Eucalyptus megacornuta* | T-tree | 6 | r <10% | Flowering |
| *Allocasuarina huegeliana* | T-tree | 6 | r <10% | Fruiting |
| *Eucalyptus utilis* | T-tree | 6 | i 10-30% | |
| *Acacia acuminata* | T-tree | 9 | i 10-30% | |

| | | | | | |
|---|---|---|---|---|---|
| **Quadrat** | Q2 | **Veg Code** | 2: MEW | **Date Surveyed** | 18/10/2022 |
| **Location** | In the south-western portion of the vegetation unit. | | | | |
| **GPS (Lat, Long)** | -34.070988, 118.25828 | | | | |
| **Landform and Slope** | Plain, Gentle | | | | |
| **Soils** | Dark Brown Sand | | | | |
| **Hydrology** | Good drainage | | | | |
| **Vegetation description** | (NVIS, DoEE, 2017): U ^ *Eucalyptus rudis* subsp. *rudis* \^tree\7\i;G *Eragrostis curvula, Bromus diandrus, Cenchrus clandestinus*\1\d.<br><br>*(*Muirs, 1977*): Eucalyptus rudis* subsp. *rudis* Woodland, over *Eragrostis curvula, Bromus diandrus, Cenchrus clandestinus* Dense Grassland. | | | | |
| **Condition** | Degraded | | | | |
| **Comments** | 10x10m | | | | |

| **Species Name** | **Form** | **Height (m)** | **Cover (%)** | **Flowering/Fruiting** |
|---|---|---|---|---|
| **Hypochaeris glabra* | H-herb | 0.1 | bi ≈0 | |
| **Ehrharta longiflora* | G-grass | 0.1 | bi ≈0 | |
| **Ehrharta calycina* | G-grass | 0.3 | r <10% | |
| *Santalum acuminatum* | T-tree | 3 | r <10% | |
| **Bromus diandrus* | H-herb | 0.1 | bi ≈0 | |
| *Eucalyptus utilis* | T-tree | 3 | i 10-30% | |
| *Acacia acuminata* | T-tree | 5 | c 30-70% | |
| **Ursinia anthemoides* | H-herb | 0.2 | bi ≈0 | Flowering |
| **Crassula alata* | H-herb | 0.1 | bi ≈0 | |
| **Arctotheca calendula* | H-herb | 0.1 | bi ≈0 | Flowering |
| **Taraxacum khatoonae* | H-herb | 0.2 | bi ≈0 | |

| | | | | | |
|---|---|---|---|---|---|
| **Quadrat** | Q3 | **Veg Code** | 2: MEW | **Date Surveyed** | 18/10/2022 |
| **Location** | In the south-eastern portion of the vegetation unit. On the corner of Chester Pass Road and Moir Street. | | | | |
| **GPS (Lat, Long)** | -34.070823, 118.264182 | | | | |
| **Landform and Slope** | Plain, Gentle | | | | |
| **Soils** | Dark Brown Sand | | | | |
| **Hydrology** | Good drainage | | | | |
| **Vegetation description** | NVIS, DoEE, 2017): U ^ *Eucalyptus rudis* subsp. *rudis* \^tree\7\i;G *Eragrostis curvula, Bromus diandrus, Cenchrus clandestinus*\1\d.<br><br>*(*Muirs, 1977*): Eucalyptus rudis* subsp. *rudis* Woodland, over *Eragrostis curvula, Bromus diandrus, Cenchrus clandestinus* Dense Grassland. | | | | |
| **Condition** | Completely Degraded | | | | |
| **Comments** | 10x10 | | | | |

| **Species Name** | **Form** | **Height (m)** | **Cover (%)** | **Flowering/Fruiting** |
|---|---|---|---|---|
| **Ehrharta longiflora* | G-grass | 0.1 | i 10-30% | |
| **Bromus diandrus* | H-herb | 0.2 | i 10-30% | |
| **Ehrharta calycina* | G-grass | 0.3 | i 10-30% | |
| **Chamaecytisus palmensis* | T-tree | 3 | r <10% | |
| *Acacia acuminata* | T-tree | 6 | r <10% | |
| **Asparagus asparagoides* | H-herb | 0.1 | r <10% | |
| **Oxalis pes-caprae* | H-herb | 0.1 | bi ≈0 | |
| **Eragrostis curvula* | G-grass | 0.3 | bi ≈0 | |
| *Eucalyptus rudis* subsp. *rudis* | T-tree | 10 | i 10-30% | |
| **Eucalyptus cladocalyx* | T-tree | 15 | r <10% | |
| **Briza maxima* | G-grass | 0.1 | bi ≈0 | |

# Appendix E

EPBC Act PMST reports

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: 27-Sep-2022

# Summary

## Matters of National Environment Significance

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

| | |
|---|---|
| World Heritage Properties: | None |
| National Heritage Places: | None |
| Wetlands of International Importance (Ramsar | None |
| Great Barrier Reef Marine Park: | None |
| Commonwealth Marine Area: | None |
| Listed Threatened Ecological Communities: | 2 |
| Listed Threatened Species: | 25 |
| 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: | 5 |
| 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: | 2 |
| Regional Forest Agreements: | None |
| Nationally Important Wetlands: | None |
| EPBC Act Referrals: | 4 |
| Key Ecological Features (Marine): | None |
| Biologically Important Areas: | None |
| Bioregional Assessments: | None |
| Geological and Bioregional Assessments: | None |

# Details

## Matters of National Environmental Significance

### Listed Threatened Ecological Communities [ Resource Information ]

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

| Community Name | Threatened Category | Presence Text | Buffer Status |
|---|---|---|---|
| Eucalypt Woodlands of the Western Australian Wheatbelt | Critically Endangered | Community likely to occur within area | In feature area |
| Proteaceae Dominated Kwongkan Shrublands of the Southeast Coastal Floristic Province of Western Australia | Endangered | Community likely to occur within area | In buffer area only |

### 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<br>Australasian Bittern [1001] | Endangered | Species or species habitat may occur within area | In buffer area only |
| Calidris ferruginea<br>Curlew Sandpiper [856] | Critically Endangered | Species or species habitat may occur within area | In feature area |
| Calyptorhynchus banksii naso<br>Forest Red-tailed Black-Cockatoo, Karrak [67034] | Vulnerable | Species or species habitat may occur within area | In buffer area only |
| Falco hypoleucos<br>Grey Falcon [929] | Vulnerable | Species or species habitat likely to occur within area | In feature area |
| Leipoa ocellata<br>Malleefowl [934] | Vulnerable | Species or species habitat likely to occur within 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 |
| Pezoporus occidentalis | | | |
| Night Parrot [59350] | Endangered | Species or species habitat may 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 | | | |
| Dasyurus geoffroii | | | |
| Chuditch, Western Quoll [330] | Vulnerable | Species or species habitat likely to occur within area | In feature area |
| Parantechinus apicalis | | | |
| Dibbler [313] | Endangered | Species or species habitat likely to occur within area | In feature area |
| Phascogale calura | | | |
| Red-tailed Phascogale, Red-tailed Wambenger, Kenngoor [316] | Vulnerable | Species or species habitat likely to occur within area | In feature area |
| Setonix brachyurus | | | |
| Quokka [229] | Vulnerable | Species or species habitat may occur within area | In buffer area only |
| PLANT | | | |
| Adenanthos pungens subsp. pungens | | | |
| Spiky Adenanthos [19429] | Vulnerable | Species or species habitat may occur within area | In feature area |
| Banksia anatona | | | |
| Cactus Dryandra [82758] | Critically Endangered | Species or species habitat may occur within area | In buffer area only |
| Banksia pseudoplumosa | | | |
| False Plumed-Banksia [82760] | Endangered | Species or species habitat known to occur within area | In feature area |
| Caladenia bryceana subsp. bryceana | | | |
| Dwarf Spider-orchid [64503] | Endangered | Species or species habitat known to occur within area | In buffer area only |

| Scientific Name | Threatened Category | Presence Text | Buffer Status |
|---|---|---|---|
| Conostylis misera<br>Grass Conostylis [21320] | Endangered | Species or species habitat may occur within area | In buffer area only |
| Duma horrida subsp. abdita<br>Remote Thorny Lignum [87538] | Critically Endangered | Species or species habitat may occur within area | In feature area |
| Gastrolobium humile<br>[78418] | Endangered | Species or species habitat likely to occur within area | In buffer area only |
| Grevillea maxwellii<br>Maxwell's Grevillea [21745] | Endangered | Species or species habitat likely to occur within area | In buffer area only |
| Hibbertia priceana<br>[82694] | Critically Endangered | Species or species habitat known to occur within area | In buffer area only |
| Leucopogon sp. Ongerup (A.S. George 16682)<br>[85018] | Vulnerable | Species or species habitat known to occur within area | In buffer area only |
| Myoporum cordifolium<br>Jerramungup Myoporum [24223] | Vulnerable | Species or species habitat likely to occur within area | In buffer area only |
| Roycea pycnophylloides<br>Saltmat [21161] | Endangered | Species or species habitat likely to occur within area | In feature area |
| Thelymitra psammophila<br>Sandplain Sun-orchid [4908] | Vulnerable | Species or species habitat likely to occur within area | In feature area |

| Listed Migratory Species | | | [ Resource Information ] |
|---|---|---|---|
| Scientific Name | Threatened Category | Presence Text | Buffer Status |
| Migratory Marine Birds | | | |
| Apus pacificus<br>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 |
| Numenius madagascariensis | | | |
| Eastern Curlew, Far Eastern Curlew [847] | Critically Endangered | Species or species habitat may occur within area | In feature area |
| Pandion haliaetus | | | |
| Osprey [952] | | Species or species habitat likely to occur within area | In buffer area only |
| Tringa nebularia | | | |
| Common Greenshank, Greenshank [832] | | Species or species habitat may 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 - [52078] | WA | In buffer area only |
| Commonwealth Land - [52159] | WA | In buffer area only |

| Commonwealth Land Name | State | Buffer Status |
|---|---|---|
| Commonwealth Land - [52076] | WA | In buffer area only |
| Commonwealth Land - [52074] | WA | In buffer area only |
| Commonwealth Land - [51649] | WA | In feature area |

## Listed Marine Species [ Resource Information ]

| Scientific Name | Threatened Category | Presence Text | Buffer Status |
|---|---|---|---|
| **Bird** | | | |
| Actitis hypoleucos<br>Common Sandpiper [59309] | | Species or species habitat may occur within area | In feature area |
| Apus pacificus<br>Fork-tailed Swift [678] | | Species or species habitat likely to occur within area overfly marine area | In feature area |
| Bubulcus ibis as Ardea ibis<br>Cattle Egret [66521] | | Species or species habitat may occur within area overfly marine area | In feature area |
| Calidris acuminata<br>Sharp-tailed Sandpiper [874] | | Species or species habitat may occur within area | In feature area |
| Calidris ferruginea<br>Curlew Sandpiper [856] | Critically Endangered | Species or species habitat may occur within area overfly marine area | In feature area |
| Calidris melanotos<br>Pectoral Sandpiper [858] | | Species or species habitat may occur within area overfly marine area | In feature area |
| Chalcites osculans as Chrysococcyx osculans<br>Black-eared Cuckoo [83425] | | Species or species habitat likely to occur within area overfly marine area | In feature area |
| Haliaeetus leucogaster<br>White-bellied Sea-Eagle [943] | | Species or species habitat likely to occur within area | In feature area |

| Scientific Name | Threatened Category | Presence Text | Buffer Status |
|---|---|---|---|
| Merops ornatus<br>Rainbow Bee-eater [670] | | Species or species habitat may occur within area overfly marine area | In feature area |
| Motacilla cinerea<br>Grey Wagtail [642] | | Species or species habitat may occur within area overfly marine area | In feature area |
| Numenius madagascariensis<br>Eastern Curlew, Far Eastern Curlew [847] | Critically Endangered | Species or species habitat may occur within area | In feature area |
| Pandion haliaetus<br>Osprey [952] | | Species or species habitat likely to occur within area | In buffer area only |
| Thinornis cucullatus as Thinornis rubricollis<br>Hooded Plover, Hooded Dotterel [87735] | | Species or species habitat may occur within area overfly marine area | In buffer area only |
| Tringa nebularia<br>Common Greenshank, Greenshank [832] | | Species or species habitat may 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 |
|---|---|---|---|
| Chirelillup | Nature Reserve | WA | In buffer area only |
| Toompup | Nature Reserve | WA | In buffer area only |

### EPBC Act Referrals [ Resource Information ]

| Title of referral | Reference | Referral Outcome | Assessment Status | Buffer Status |
|---|---|---|---|---|
| Controlled action | | | | |
| Transmission Line Project | 2011/6066 | Controlled Action | Post-Approval | In buffer area only |
| Not controlled action | | | | |
| Improving rabbit biocontrol: releasing another strain of RHDV, sthrn two thirds of Australia | 2015/7522 | Not Controlled Action | Completed | In feature area |

| Title of referral | Reference | Referral Outcome | Assessment Status | Buffer Status |
|---|---|---|---|---|
| Not controlled action | | | | |
| INDIGO Central Submarine Telecommunications Cable | 2017/8127 | Not Controlled Action | Completed | In feature area |
| 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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