Detailed Flora and Vegetation Assessment

Lot 783 Mitchell Drive, Lots 501, 502 and 504 Reef Drive and Lot 503 Seagrass Place, Gnarabup

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Executive Summary

5 Star Margaret River Pty Ltd engaged Emerge Associates to conduct a detailed assessment of the flora and vegetation values within Lot 783 Mitchell Drive, Lots 501, 502 and 504 Reef Drive, Lot 503 Seagrass Place and portions of adjacent public land in Gnarabup (referred to herein as the 'site').

As part of the assessment a desktop review of relevant background information was completed and a field survey was undertaken in September and October 2020. During the field survey an assessment was made on the type, condition and values of vegetation across the site.

Outcomes of the survey include the following:

- A total of 54 native and 28 non-native (weed) species were recorded in the site.
- No threatened or priority flora species were recorded within the site and none are considered likely to occur.
- Two plant communities were identified within the site: **MhScAlSg** and **non-native/cleared**.
- Plant community **MhScAlSg** comprises native heathland vegetation and extends over 12.38 ha (90% of the site).
- Plant community **non-native/cleared** extends over 1.35 ha (10% of the site).
- Most of the site comprises **MhScAlSg** vegetation in 'very good' condition (11.6 ha/84% of the site). The remainder of the **MhScAlSg** vegetation is in 'good' (0.21 ha/2% of the site), 'degraded' (0.51 ha/4% of the site) and 'degraded – completely degraded' (0.06 ha /<1% of the site).
- The **non-native/cleared** areas were mapped as being in 'completely degraded' condition (1.35 ha/10% of the site).
- No threatened or priority ecological communities were recorded in the site or considered likely to occur.
- The vegetation within the site contributes to broader ecological linkages but disturbance to the site would not disrupt these linkages.

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Table A1: Abbreviations – Organisations

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

Table A2: Abbreviations – General terms

General terms	
ESA	Environmentally sensitive area
IBRA	*Interim Biogeographic Regionalisation of Australia*
NVIS	National Vegetation Inventory System (ESCAVI 2003)
P1	Priority 1
P2	Priority 2
P3	Priority 3
P4	Priority 4
P5	Priority 5
PEC	Priority ecological community
T	Threatened
TEC	Threatened ecological communities

Table A3: Abbreviations –Legislation

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

Table A4: Abbreviations – Units of measurement

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

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1 Introduction

1.1 Project background

Emerge Associates (Emerge) were engaged by 5 Star Margaret River Pty Ltd to characterise the flora and vegetation values within multiple lots in Gnarabup. Specifically, this assessment was undertaken within Lot 783 Mitchell Drive, Lots 501, 502 and 504 Reef Drive, Lot 503 Seagrass Place (5 Star Margaret River Pty Ltd landholdings) and portions of the adjacent public land in Gnarabup including areas previously reserved for recreation purposes (collectively referred to herein as the 'site'). The site is located approximately eight kilometres (km) south west of Margaret River town in the south west of Western Australia within the Shire of Augusta Margaret River.

The site is approximately 13.73 hectares (ha) in size and is generally bounded by Wallcliffe Road to the east, Ocean View Road, Reef Road and Seagrass Place to the west and Breeze Cove to the south. The location and extent of the site is shown in **Figure 1**.

1.2 Purpose and scope of work

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

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

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

2 Environmental Context

2.1 Climate

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

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

An average of 1122.0 millimetres (mm) of rainfall is recorded annually from the Margaret River weather station (no. 9574), which is the closest weather station, located approximately 7 km north east of the site. The majority of this rainfall is received between the months of May and September. Mean maximum temperatures at the Witchcliffe weather station (no. 9746), which is the nearest active temperature recording station approximately 10 km south-east of the site, range from 16.4°C in July to 27.2°C in February, while mean minimum temperatures range from 8.2°C in July to 14.4°C in February (BoM 2021).

A total of 665.2 mm of rain was recorded from May to August 2020 prior to the survey, which is approximately 88% of the mean of 753.1 mm for this period (BoM 2021). The amount of rainfall recorded prior to the survey is similar to the mean and was considered to have been sufficient to promote the flowering and emergence of native flora.

2.2 Geomorphology and soils

Landform and soils influence fauna habitat and species at regional and local scales. The site lies in the Warren bioregion and subregion, as defined by the *Interim Biogeographic Regionalisation of Australia* (IBRA) (Environment Australia 2000). The Warren bioregion follows the coastline from Yallingup in the north-west to Albany in the south-east.

The Department of Primary Industries and Regional Development (DPIRD) has compiled data from various surveys to produce a soil landscape mapping dataset for Western Australia, which places the site within the 'Kilcarnup exposed dunes (organic) Phase' (DPIRD 2019). This soil landscape system is described as being steep dunes (gradients usually in excess of 20%) exposed to prevailing winds which come directly off the ocean. It has deep pale calcareous sands with brown topsoil (DPIRD 2019)

The locations of the soil landscapes mapped within and adjacent to the site are shown in **Figure 2**.

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

2.3 Topography

The elevation of the site ranges from 6 m in relation to the Australian height datum (mAHD) in the north eastern portion to 30 mAHD in the southern portion of the site (DPIRD 2020) (**Figure 2**).

2.4 Hydrology and wetlands

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

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

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

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

Examination of the Department of Water and Environmental Regulation (DWER) hydrography dataset (DWER 2018) shows no wetland or water related features within the site.

The Department of Biodiversity, Conservation and Attractions (DBCA) has developed the *Geomorphic Wetlands Leeuwin Naturaliste Ridge and Donnybrook to Nannup - Unreviewed* dataset (DBCA 2018b). This dataset maps geomorphic wetland features and classifies them based on their landform shape and water permanence.

A review of the *Geomorphic Wetlands Leeuwin Naturaliste Ridge and Donnybrook to Nannup - Unreviewed* dataset indicated that no wetland features occur within the site. The closest mapped wetland feature is located approximately 300 m north east of the site.

2.5 Regional vegetation

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

The site is contained within the Warren IBRA region and 'WAR01' subregion. The Warren subregion is characterised as comprising tall *Eucalyptus diversicolor* (karri) on deep loams or forest or *Eucalyptus marginata* (jarrah) to *Corymbia calophylla* (marri) on leached sands and extensive *Melaleuca* (paperbark) and sedge swamps in valleys (Beard 1990).

DBCA (2019) mapping shows the site as comprising 'Kilcarnup, KE' vegetation complex which is described as a 'tall shrubland to closed heath of *Agonis flexuosa* and *Spyridium globulosum* on exposed slopes of calcareous dunes'.

Studies have indicated that the loss of biodiversity caused by habitat fragmentation is significantly greater once a habitat type falls below 30% of its original extent (Miles 2001). The national objectives and targets for biodiversity conservation established an objective of retaining 30% of the original extent of each vegetation complex (Environment Australia 2001).

The 'Kilcarnup, KE' vegetation complex has 92.66% remaining, of which 63.01% is protected for conservation purposes (Government of Western Australia 2019). Therefore, the percentage of this complex protected for conservation lies above the 30% retention objective.

2.6 Historical land use

Review of historical images available from 2004 onwards shows that the majority of the site supported native vegetation in 2004, with some tracks and small cleared areas (WALIA 2021). Aerial imagery from 1 March 2012 shows that the site was subject to an intense fire referred to as 'Blackwood Fire 8' (Noetic Solutions 2012), with all native vegetation appearing to have been burnt, as shown in **Plate 1**. Since the fire the vegetation in the site has regrown and previous tracks/cleared areas have been maintained with minor clearing for access tracks having occurred.

Plate 1: Aerial imagery from 1 March 2012 showing evidence of fire within the site, with the general location of site shown by red outline

2.7 Conservation significant flora and vegetation

2.7.1 Threatened and priority flora

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

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

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

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

2.7.2 Threatened and priority ecological communities

An ecological community is a naturally occurring group of native plants, animals and other organisms that are interacting in a unique habitat. An ecological community's structure, composition and distribution are influenced by environmental factors such as soil type, position in the landscape, altitude, climate and water availability (DAWE 2020). 'Threatened ecological communities' (TECs) are ecological communities that are recognised as rare or under threat and therefore warrant special protection.

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

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

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

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

2.7.3 Local and regional significance

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

Key reasons that vegetation within a site may be significant are listed below:

- The site is part of or connected to a regional or National park.
- The vegetation within the site is associated with wetlands/water courses.
- The vegetation within the site has potential value as habitat for threatened or priority fauna species.

2.8 Weeds and pests

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

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

The Commonwealth government has further compiled a list of 32 *Weeds of National Significance* (WoNS) (DAWE 2020c). Whilst the WoNS list is non-statutory, many WoNS are also listed under the BAM Act. Further information on weeds and declared pests is provided in **Appendix A**.

2.9 Environmentally sensitive areas

'Environmentally sensitive areas' (ESAs) are prescribed under the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* and have been identified to protect native vegetation values of areas surrounding values such as significant wetlands, threatened flora, threatened communities and *Bush Forever* sites. Within an ESA none of the exemptions under the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* apply.

The north western portion of the site lies within an ESA which extends to the north and south along the coast. The location of this ESA is shown in **Figure 3**, however is not located within 5 Star Margaret River Pty Ltd landholding.

2.10 DBCA managed or legislated lands

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

No DBCA managed or legislated lands occur in the site. The *Legislated Lands and Waters* dataset shows the Ngari Capes Marine Park approximately 200 m west of the site and Leeuwin-Naturaliste National Park approximately 350 m east of the site, as shown in **Figure 3.**

2.11 Ecological linkages

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

The Perth Biodiversity Project, supported by the Western Australia Local Government Association (WALGA), have identified and mapped regional ecological linkages within the Perth Metropolitan Region (WALGA and PBP 2004). This study was extended beyond the Perth Metropolitan Region through the South West Biodiversity Project, resulting in the identification and mapping of the South West regional ecological linkages (Molloy *et al.* 2009).

There are no mapped ecological linkages within the site. One regional ecological linkage (no. 109) occurs approximately 900 m east of the site and extends to the north and south, as shown in **Figure 3.**

Review of aerial imagery indicates that the vegetation within the site is connected to extensive areas of native vegetation within the local area including that associated with mapped linkage no. 109.

2.12 Previous surveys

A flora, vegetation and fauna assessment was undertaken within the northern part of the site in 2015 (Ecosystem Solutions 2015). The previous assessment was undertaken within the northern portion of the site, bounded by Wallcliffe Road and Ocean View Road. A field survey was undertaken in July 2015 and the site was noted to have been 'significantly impacted' by bushfires which occurred in November 2011.

The site was mapped as comprising 'vegetation community 1' which is described as 'closed shrubland of *Scaevola crassifolia* and *Melaleuca huegelii* over low closed shrubland of *Acacia littorea* and *Tetragonia implexicoma* over open herbs of *Carpobrotus virescens* with climbers of *Muehlenbeckia adpressa*'. Using the Keighery (1994) scale the majority of the site was mapped as being in 'good' condition, with some areas in 'degraded – good', 'degraded' and 'completely degraded' condition.

No threatened or priority flora species were recorded within the survey area. However, it was indicated that *Caladenia excelsa*, which is listed as endangered under the EPBC Act and EP Act, would not have been visible at the time of the survey.

3 Methods

3.1 Desktop assessment

A search was conducted for threatened and priority flora that may occur or have been recorded within a 10 km radius of the site using the *Protected Matters Search Tool* (DAWE 2020a) and *NatureMap* (DBCA 2020). A search of DBCA's threatened and priority flora database was also conducted using a 30 km radius, as recommended by DBCA (reference no. 23-0920FL).

A search was also conducted for TECs and PECs that may occur or have been recorded within a 10 km radius of the site using the *Protected Matters Search Tool* (DAWE 2020a). A search of DBCA's threatened and priority ecological communities' database was also conducted using a 15 km radius, as recommended by DBCA (reference no. 03-1020EC).

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

3.2 Field survey

A botanist from Emerge visited the site on 16-17 September and 27-28 October 2020 to conduct the flora and vegetation field survey.

3.2.1 Flora and vegetation

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

Detailed sampling of the vegetation was undertaken using non-permanent quadrats. The quadrats were completed over an approximate 10 x 10 m area without the use of physical markers. The position of each sample was recorded with a hand-held GPS unit.

The data recorded within each sample included:

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

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

The suitability of habitat within the site for conservation significant species identified in the desktop assessment was assessed (refer **Section 3.1**). Where identified, areas of suitable habitat were traversed to search for conservation significant species.

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

Vegetation condition was assigned at each sample and changes in vegetation condition were also noted and mapped across the site. The condition of the vegetation was assessed using the Keighery (1994) scale (**Table 1**).

Table 1: Vegetation condition scale applied during the field assessment

Condition category	Definition (Keighery 1994)
Pristine	Pristine or nearly so, no obvious signs of disturbance.
Excellent	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.
Very good	Vegetation structure altered obvious signs of disturbance. For example, disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.
Good	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. For example, disturbance to vegetation structure caused by very frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback and grazing.
Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example, disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.
Completely degraded	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora comprising weed or crop species with isolated native trees or shrubs.

3.3 Mapping and analysis

3.3.1 Conservation significant flora and vegetation

Based on the information recorded during the field survey, an assessment of the likelihood of occurrence of threatened and priority flora species and communities within the site was undertaken using the categories outlined in **Table 2**.

Table 2: Likelihood of occurrence assessment categories and definitions

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

3.3.2 Plant community identification and description

The local plant communities within the site were identified from the sample data collected during the field survey. The vegetation was described according to the dominant species present using the structural formation descriptions of the *National Vegetation Inventory System* (NVIS) (ESCAVI 2003). The identified plant communities were mapped on aerial photography from the sample locations and boundaries were interpreted from aerial photography and notes taken in the field. Vegetation condition was mapped on aerial photography based on the locations and notes recorded during the field survey to define areas with differing condition.

3.3.3 Threatened and ecological communities

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

3.3.4 Species accumulation curve

A species accumulation curve was plotted from sample data by generating a trendline (log) in Microsoft Excel. The trendline was forecast to locate the asymptote of the curve (the point at which the curve flattens), which provides an indication of amount of sampling that would be required before it can be assumed few species remain undetected. PRIMER v6 also offers a range of estimators to predict minimum species richness (Clarke and Gorley 2006). Both the Jacknife1 and Chao2 non-parametric estimators are reported, as these are known to perform well in comparison to simulated and real data sets and are also recommended for small sample sizes (Gotelli and Colwell 2011). Comparison between actual and estimated species accumulation assists in evaluating the adequacy of sampling effort.

3.4 Survey limitations

It is important to note the specific constraints imposed on surveys and the degree to which these may have limited survey outcomes. An evaluation of the survey methodology against standard constraints outlined in the EPA document *Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA 2016) is provided in **Table 3**.

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

Constraint	Degree of limitation	Details
Availability of contextual information	No limitation	The broad scale contextual information described in **Section 2** is adequate to place the site and vegetation in context.
		A previous survey has been undertaken over part of the site and was reviewed during this assessment.
Experience level of personnel	No limitation	This flora and vegetation assessment was undertaken by a qualified botanist with over ten years of botanical experience in Western Australia. Technical review was undertaken by a senior environmental consultant with 18 years' experience in environmental science in Western Australia.
Suitability of timing	No limitation	The survey was conducted in September and October and thus within the main flowering season. High rainfall was recorded from May to August 2020 in the months preceding the site visit. Therefore, it is likely that many plant species would have been in flower and/or visible at the time of survey. The survey timing was considered adequate to allow the detection of species for which seasonal timing is critical.
Temporal coverage	No limitation	Comprehensive flora and vegetation assessments can require multiple visits, at different times of year, and over a period of a number of years, to enable observation of all species present. The site was visited twice in 2020 during the main flowering period. Therefore, according to the EPA guidelines this survey is considered to meet the requirements of a 'detailed' survey.
Spatial coverage and access	No limitation	Site coverage was comprehensive (track logged).
	No limitation	All parts of the site could be accessed as required. Some areas were too densely vegetated to traverse but this was not considered to be a limitation as the shrub species were consistent
Sampling intensity	No limitation	A total of 83 species were recorded, of which 21 were recorded from three sample locations and 62 were recorded opportunistically. Minimum species richness within site is estimated at between 27 (Jacknife1) and 28 (Chao2) species (refer species accumulation curve and estimates shown in **Plate 6**). The number of species recorded in the site is greater than the estimates which demonstrates that survey effort was adequate to prepare a comprehensive species inventory for the site.
Influence of disturbance	Minor limitation	A fire occurred across the whole site approximately eight years prior to the field survey. Whilst the vegetation has regrown there may be alterations to attributes such as vegetation structure and species composition that have not returned to pre-fire conditions. However, this was not considered to be a major constraint on the assessment.
	No limitation	Aside from fire, the main historical ground disturbance was due to clearing and maintenance of tracks. The disturbance history of the site was considered when undertaking field sampling.
Adequacy of resources	No limitation	All resources required to perform the survey were available.

4 Results

4.1 General site conditions

The site is undulating with rises in the northern, central and southern portions. Soils are brown to grey with some outcropping limestone.

The majority of the site supports dense native coastal shrubland (heathland) vegetation. Where the landform is elevated and more exposed, such as in the northern and central western portions, the shrub layer is lower. In more protected areas the shrubs are taller. Evidence of disturbance from the previous fire was recorded, such as dead wood on the ground and dead branches above existing vegetation.

Multiple unsealed tracks and one sealed path/boardwalk occur in the site. Vegetation regrowth and subsequent clearing appears to occur periodically within some of the unsealed paths.

4.2 Flora

4.2.1 Desktop assessment

The database search results identified a total of 16 threatened and 66 priority flora species occurring or potentially occurring within a 30 km radius of the site. Information on these species including their habitat preferences and flowering period is provided in **Appendix B**.

Based on background information available for the site, suitable habitat was considered to potentially occur within the site for one threatened flora species and eight priority flora species as shown in **Table 4**.

Table 4: Conservation significant flora species considered to have potential to occur in the site based on known habitat preferences

Species	Level of significance		Life strategy	Habitat	Flowering period
	State	EPBC Act			
Daviesia elongata	T	-	P	Sand, laterite.	Sep/Dec-Jan/Feb
Amperea micrantha	P2	-	P	Sandy soils.	Oct-Nov
Austrostipa mundula	P3	-	P	Grey sand over limestone.	Sept-Nov
Caladenia abbreviata	P3	-	PG	Sand dunes.	Nov-Dec
Banksia sessilis var. *cordata*	P4	-	P	White/grey sand. Coastal limestone.	Jul-Oct
Drosera fimbriata	P4	-	P	White sand, granite.	Sep-Oct
Eucalyptus calcicola subsp. *calcicola*	P4	-	P	Red-brown sand over limestone on coastal dunes, calcareous ridges, rocky outcrops.	May-Jun

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

Table 4: Conservation significant flora species considered to have potential to occur in the site based on known habitat preferences (continued)

Species	Level of significance		Life strategy	Habitat	Flowering period
	State	EPBC Act			
Franklandia triaristata	P4	-	P	White or grey sand.	Aug-Oct
Thysanotus glaucus	P4	-	P	White, grey or yellow sand, sandy gravel.	Oct-Mar

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

4.2.2 Species inventory

A total of 55 native and 28 non-native (weed) species were recorded within the site during the field survey, representing 42 families and 73 genera. The dominant families containing native taxa were Cyperaceae (five native taxa only), Fabaceae (four native taxa and two weed taxa) and Myrtaceae (five native taxa and one weed taxon). Of the species recorded 21 were recorded in sample locations and 62 were recorded opportunistically.

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

4.2.3 Threatened and priority flora

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

None of the threatened and priority flora species identified in the desktop assessment are considered likely to occur in the site due to lack of suitable habitat and/or because they were not recorded during the field survey. The likelihood of occurrence assessment is provided in **Appendix B**.

4.2.4 Locally and regionally significant flora

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

4.2.5 Declared pests

One species listed as a declared pest (C3) pursuant to the BAM Act, **Zantedeschia aethiopica* (arum lily), was recorded within the site. Few arum lily individuals were recorded scattered throughout the site.

No weeds of national significance (WoNS) were recorded.

4.3 Vegetation

4.3.1 Desktop assessment

The database search results identified four TECs and two PECs occurring or potentially occurring within a 15 km radius of the site. Information on these communities is provided in **Appendix D.**

Based geomorphology, soils and regional vegetation patterns, one PEC, *Melaleuca lanceolata* forests, Leeuwin Naturaliste Ridge (P2), was considered to have potential to occur in the site.

No TECs were considered to have potential to occur in the site.

4.3.2 Plant communities

A total of three locations were sampled using quadrats, as shown in **Figure 4**.

Two plant communities were identified within the site: **MhScAlSg** and **non-native/cleared.** Plant community **MhScAlSg** extends over the majority of the site (90%). This vegetation contains multiple native shrub species which occur as a mosaic of differing proportions and heights due to differences in landform and aspect.

The remainder of the site was mapped as **non-native/cleared** as it comprises weeds, tracks and bare soil with scattered native plants.

A description and the area of each plant community is provided in **Table 5** and representative photographs of each are provided in **Plate 2** to **Plate 5**. The location of each plant community is shown in **Figure 4**. Raw sample data is provided in **Appendix E.**

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

Plant community	Description	Area (ha)
MhScAlSg	Low closed heathland to tall closed heathland *Melaleuca huegelii, Scaevola crassifolia*, *Acacia littorea* and *Spyridium globulosum* with occasional shrubs *Agonis flexuosa*, *Thomasia triphylla*, *Melaleuca systena* and *Diplolaena dampieri* over isolated sedges *Lepidosperma squamatum* (**Plate 2** and **Plate 3**). Dead branches of *Melaleuca huegelii* tall shrubs occur within most of this community.	12.38
Non-native/cleared	Heavily disturbed areas comprising weeds such as **Pelargonium capitatum*, **Tetragonia decumbens*, **Bromus diandrus* and **Fumaria capreolata* with occasional native shrubs and forbs and areas of bare ground such as tracks (**Plate 4** and **Plate 5**).	1.35

*Plate 2: Plant community **MhScAlSg** in 'very good' condition (shrubland form)*

*Plate 3: Plant community **MhScAlSg** in 'very good' condition (tall shrubland form)*

*Plate 4: Plant community **non-native/cleared** in 'completely degraded' condition (with non-native vegetation)*

*Plate 5: Plant community **non-native/cleared** in 'completely degraded' condition (with bare ground)*

4.3.3 Vegetation condition

The majority of plant community **MhScAlSg** was mapped as being in 'very good' condition as it contains native species diversity and density expected of a coastal heathland community. The tall dead *M. huegelii* branches present in this vegetation indicated that the vegetation structure is altered, likely due to the previous fire (refer **Section 2.6**).

Small areas of **MhScAlSg** vegetation comprised lower native species diversity and/or cover and were mapped as being in 'good' or 'degraded' condition depending on cover and species present.

Non-native and cleared areas were mapped as being in 'completely degraded' condition as they consist of non-native species such as herbs and grasses with occasional native plants. Bare areas including tracks were also mapped as being in 'completely degraded' condition.

The extent of vegetation by condition category is detailed in **Table 6** and shown in **Figure 5**.

Table 6: Extent of vegetation condition categories within the site

Condition category (Gibson *et al.* 1994)	Size (ha)
Pristine	0
Excellent	0
Very good	11.6
Good	0.21
Degraded	0.51
Degraded – completely degraded	0.06
Completely degraded	1.35

4.3.4 Threatened and priority ecological communities

No TECs or PECs were recorded within the site. The *Melaleuca lanceolata* forests, Leeuwin Naturaliste Ridge PEC was not considered to occur due to the lack of *Melaleuca lanceolata* forest vegetation. The likelihood of occurrence assessment is provided as **Appendix D.**

4.3.5 Locally and regionally significant vegetation

The site supports vegetation which has the potential to provide habitat for threatened fauna, including western ringtail possum (Emerge Associates 2021).

The **MhScAlSg** vegetation in the site is contiguous with extensive areas of intact native vegetation outside of the site including Leeuwin-Naturaliste National Park.

4.4 Species richness

A total of 21 species were recorded from three samples. A species accumulation curve derived from sample data is presented in **Plate 6**. After three samples the curve is still increasing and has not reached its asymptote. This indicates that a proportion of species likely remain undetected by sampling.

Species richness was estimated in PRIMER v6 to be between 27 (Jacknife1) and 28 (Chao2). Based on the trend of the species accumulation curve approximately 30 to 40 samples would be required to capture that many species. Including the 62 additional species recorded opportunistically, a total of 83 species was recorded in the site. This indicates that greater than 100% of the estimated number of species was recorded. Therefore, the survey effort was considered to be adequate to prepare a comprehensive species inventory.

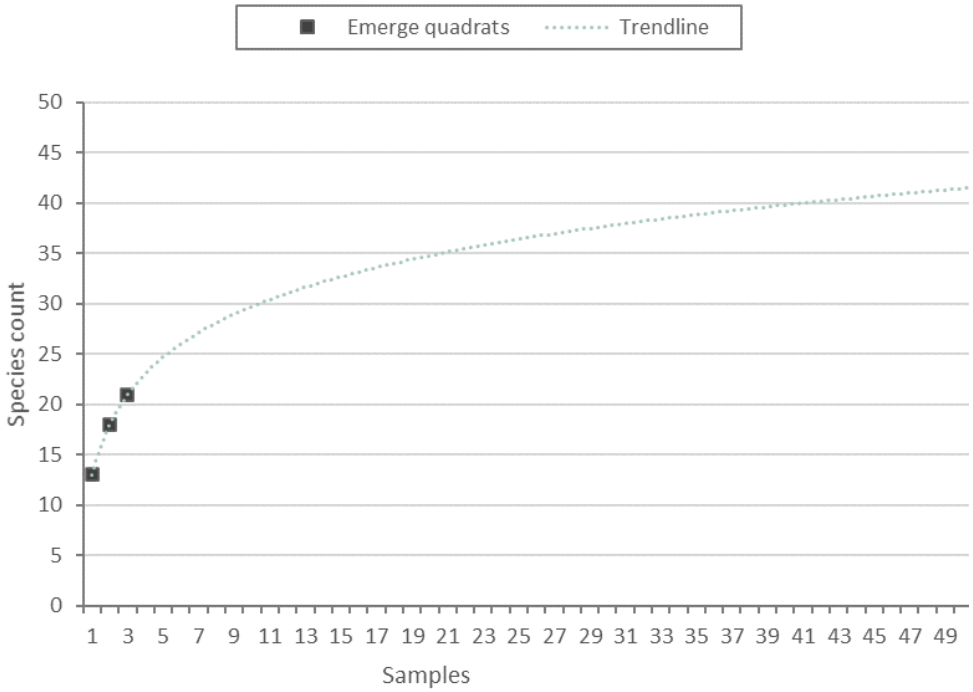

Plate 6: Species accumulation curve derived from sample data (y =7.2745ln(x) + 12.989, R^2 = 1)

5 Discussion

Intact native vegetation occurs across the majority of the site. The vegetation shows evidence of alteration from the previous fire but this is not considered to be a sign of degradation. The surrounding coastal area supports extensive areas of similar vegetation type and condition.

5.1 Threatened and priority flora

Prior to the survey, based on background information, one threatened and eight priority flora species were considered to potentially occur within the site but none were recorded. The field surveys in mid-September and late October were considered sufficient to determine that these species are unlikely to occur. This is because either suitable habitat does not occur or the species were not recorded during traverses within potentially suitable habitat. The timing of the surveys coincided with the main flowering period of most of the conservation significant flora identified in the desktop assessment and therefore they should have been visible, if present.

The orchid *Caladenia abbreviata* (P3) was considered to potentially occur in the site prior to the survey. This species flowers in late October to December and so may not have been flowering or visible at the time of the survey. The Western Australian Herbarium's *Florabase* website lists the habitat for this species as sand and sand dunes (Western Australian Herbarium 2021). However, other literature sources provide more detail and indicate that *C. abbreviata* occurs in 'areas of deep sandy soil amongst low shrubs in tall peppermint woodland' (Hoffman and Brown 1998) and 'open sandy clearings under tall peppermint and melaleuca species' (Brown *et al.* 2008). The dense heathland in the site does not match these descriptions and is therefore not considered to comprise suitable habitat for this species.

5.2 Plant communities

Plant community **MhScAlSg** comprises various structural forms and, on initial inspection, had potential to represent multiple plant communities. However, during sampling and traverses within the vegetation it was evident that a few species are consistently dominant across the site. Therefore, it was considered appropriate to classify the vegetation as one plant community. The structural forms are likely due to factors such as aspect, elevation and disturbance such as fire intensity.

5.3 Vegetation condition

The **MhScAlSg** vegetation generally comprises high cover of native species and low cover of weeds. However, the previous fire altered the vegetation structure and it has regrown into a heathland of varying height. Tall dead *M. huegelii* branches which extend above the current vegetation occur across the site and indicate the vegetation structure was different, and was likely to be taller prior to the fire. Therefore, most of the **MhScAlSg** vegetation was mapped as being in 'very good' rather than 'excellent' condition due to the alterations to structure. It is likely that, over time, the vegetation will continue to recover and improve in condition.

5.4 Threatened and priority ecological communities

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

Four of the six conservation significant communities identified within the desktop assessment are associated with caves and therefore do not apply to the site. The 'low shrublands on acidic grey-brown sands of the Gracetown soil-landscape system' PEC (P2) is associated with a particular soil-landscape system which does not occur within the site. The '*Melaleuca lanceolata* forests, Leeuwin Naturaliste Ridge' PEC (P2) has been recorded approximately 2.5 km north of the site. A small stand of *Melaleuca lanceolata* trees occurs in the southern portion of the site. However, these few trees are not considered to comprise a separate community and do not occur with understorey species typically associated with the PEC such as *Leucopogon propinquus* and *Suaeda australis*.

5.5 Local and regional significance

The site provides habitat for fauna species including conservation significant species such as western ringtail possum. However, a recent survey indicates that the vegetation within the site provides sub-optimal habitat for western ringtail possum and use of the site by western ringtail possum appears to be low and infrequent (Emerge Associates 2021).

The vegetation is contiguous with extensive areas of vegetation outside of the site which comprise similar or more intact native vegetation. The vegetation within the site contributes to broad ecological linkages but disturbance to the site would not disrupt these linkages.

6 Conclusions

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

One plant community, **MhScAlSg**, occurs across the majority (90%) of the site. The remainder of the site comprises non-native vegetation and cleared areas.

The **MhScAlSg** vegetation was mainly mapped as being in 'very good' condition, with small portions in 'good', 'degraded', 'degraded – completely degraded'. The non-native vegetation and cleared areas were mapped as being in 'completely degraded' condition.

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

The site is potential habitat for threatened fauna species such as western ringtail possum and the vegetation contributes to broader ecological linkages. A separate western ringtail possum survey has been undertaken, and disturbance to the site would not disturb or disrupt ecological linkages.

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Figures

Figure 1: Site Location

Project:	Detailed Flora and Vegetation Assessment - Lot 783 Mitchell Dr, Lots 501, 502 and 504 Reef Dr and Lot 503 Seagrass Pl, Gnarabup
Client:	5 Star Margaret River Pty Ltd

Plan Number:
EP20-008(06)--F39

Drawn:	GAR
Date:	16/03/2021
Checked:	RAW
Approved:	TAA
Date:	01/04/2021

N

0 50 100 150
Metres

Scale: 1:5,000@A4

GDA 1994 MGA Zone 50

emerge ASSOCIATES

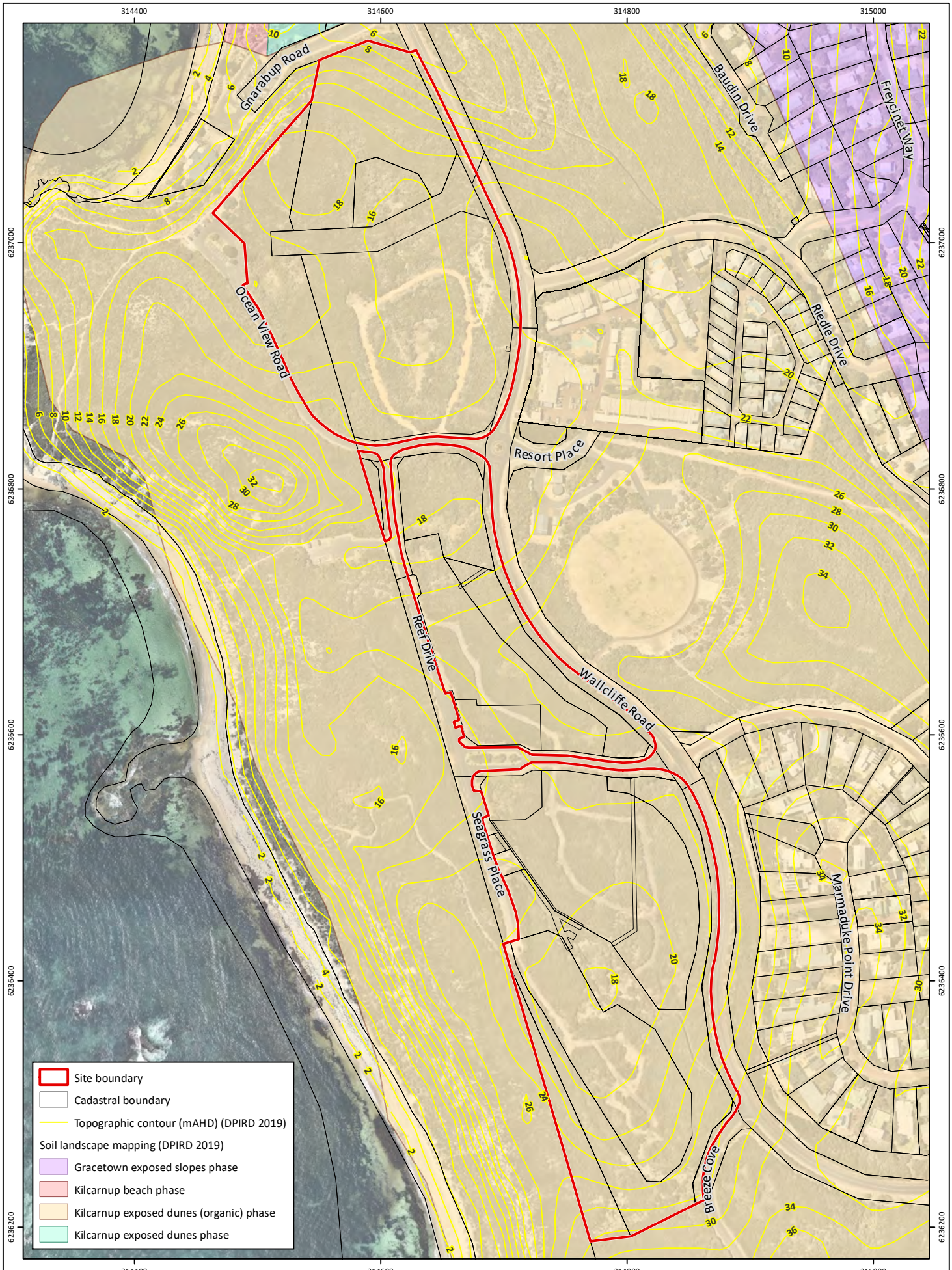

Figure 2: Soils and Topography

Project: Detailed Flora and Vegetation Assessment - Lot 783 Mitchell Dr, Lots 501, 502 and 504 Reef Dr and Lot 503 Seagrass Pl, Gnarabup

Client: 5 Star Margaret River Pty Ltd

Plan Number: EP20-008(06)--F40

Drawn:	GAR
Date:	16/03/2021
Checked:	RAW
Approved:	TAA
Date:	01/04/2021

N

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Metres

Scale: 1:4,000@A4

GDA 1994 MGA Zone 50

emerge ASSOCIATES

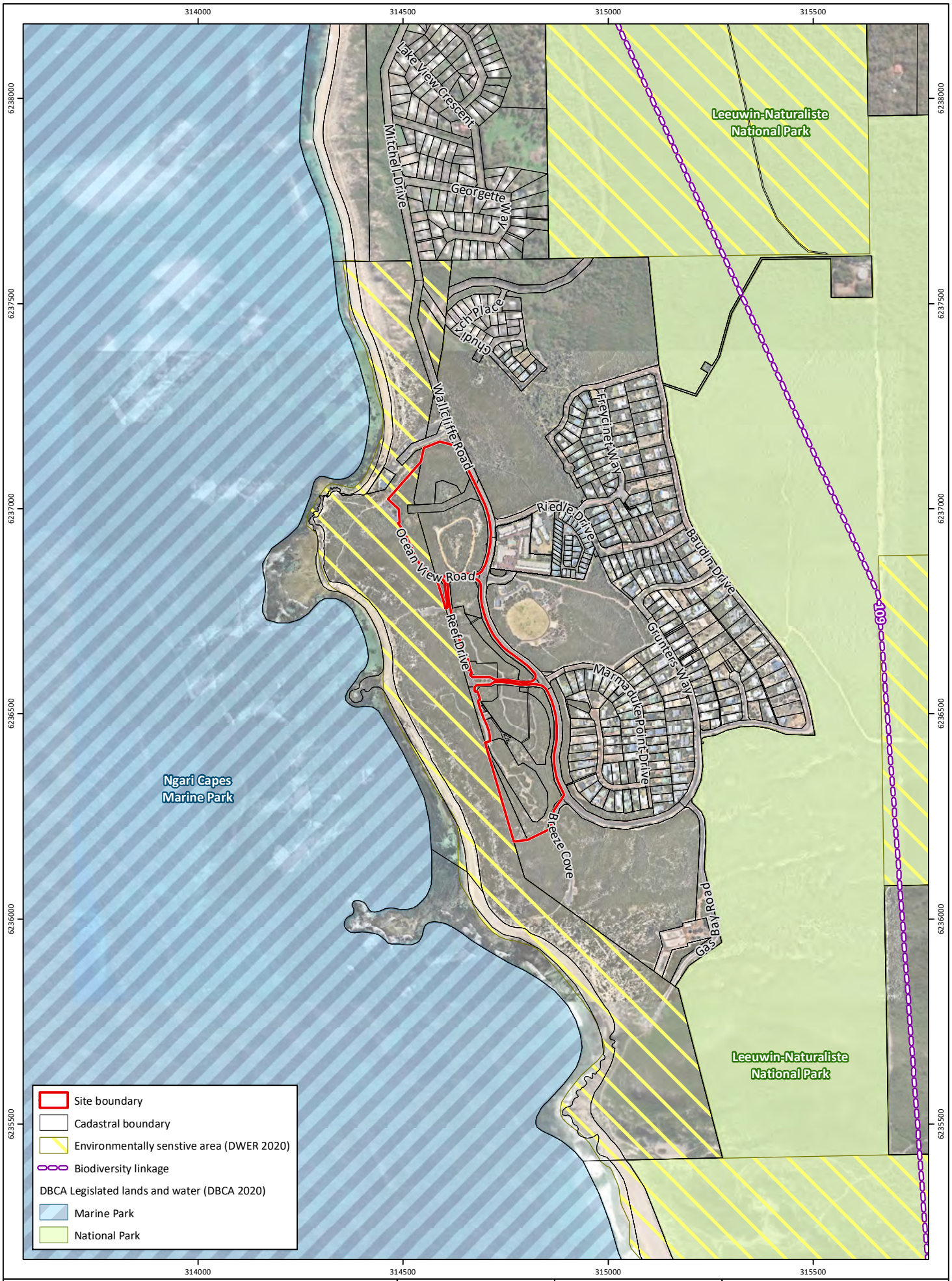

Figure 3: Environmental Features

Project:	Detailed Flora and Vegetation Assessment - Lot 783 Mitchell Dr, Lots 501, 502 and 504 Reef Dr and Lot 503 Seagrass Pl, Gnarabup
Client:	5 Star Margaret River Pty Ltd

Plan Number:
EP20-008(06)--F41

Drawn:	GAR
Date:	16/03/2021
Checked:	RAW
Approved:	TAA
Date:	01/04/2021

N

0 100 200 300
Metres

Scale: 1:12,000@A4

GDA 1994 MGA Zone 50

emerge ASSOCIATES

Figure 4: Plant Communities

Project: Detailed Flora and Vegetation Assessment - Lot 783 Mitchell Dr, Lots 501, 502 and 504 Reef Dr and Lot 503 Seagrass Pl, Gnarabup

Client: 5 Star Margaret River Pty Ltd

Plan Number: EP20-008(06)--F42

Drawn:	GAR
Date:	16/03/2021
Checked:	RAW
Approved:	TAA
Date:	01/04/2021

N

0 50 100

Metres

Scale: 1:4,000@A4

GDA 1994 MGA Zone 50

emerge ASSOCIATES

Figure 5: Vegetation Condition

Project:	Detailed Flora and Vegetation Assessment - Lot 783 Mitchell Dr, Lots 501, 502 and 504 Reef Dr and Lot 503 Seagrass Pl, Gnarabup
Client:	5 Star Margaret River Pty Ltd

Plan Number:
EP20-008(06)--F43

Drawn:	GAR
Date:	16/03/2021
Checked:	RAW
Approved:	TAA
Date:	01/04/2021

N

0 50 100
Metres

Scale: 1:4,000@A4

GDA 1994 MGA Zone 50

emerge ASSOCIATES

Appendix A

Additional Information

Conservation Significant Flora and Vegetation

Threatened and priority flora

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

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

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

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

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

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

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

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

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

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

Threatened and priority ecological communities

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

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

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

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

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

An ecological community that is under consideration for listing as a TEC, but does not yet meet survey criteria or has not been adequately defined may be listed as a 'priority ecological community' (PEC). PECs are categorised as priority category 1, 2 or 3 as described in **Table 3**. Ecological communities that are adequately known and are rare but not threatened, or meet criteria for 'near threatened', or that have been recently removed from the threatened list, are placed in 'priority 4'. These ecological communities require regular monitoring. Conservation dependent ecological communities are placed in 'priority 5' (DEC 2013). Listed PECs are published by DBCA (DBCA 2017).

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

Priority code	Description
P1	Priority One: Poorly known ecological communities Ecological communities that are known from very few occurrences with a very restricted distribution (generally ≤5 occurrences or a total area of ≤ 100ha). Occurrences are believed to be under threat either due to limited extent, or being on lands under immediate threat (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) or for which current threats exist. May include communities with occurrences on protected lands. Communities may be included if they are comparatively well-known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under immediate threat from known threatening processes across their range.
P2	Priority Two: Poorly known ecological communities Communities that are known from few occurrences with a restricted distribution (generally ≤10 occurrences or a total area of ≤200ha). At least some occurrences are not believed to be under immediate threat (within approximately 10 years) of destruction or degradation. Communities may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under threat from known threatening processes.
P3	Priority Three: Poorly known ecological communities (i) Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation or: (ii) communities known from a few widespread occurrences, which are either large or with significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat (within approximately 10 years), or; (iii) communities made up of large, and/or widespread occurrences, that may or may not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, inappropriate fire regimes, clearing, hydrological change etc. Communities may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and/or are not well defined, and known threatening processes exist that could affect them.
P4	Priority Four: Ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list. These communities require regular monitoring. (i) Rare. Ecological communities known from few occurrences that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These communities are usually represented on conservation lands. (ii) Near Threatened. Ecological communities that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for a higher threat category. (iii) Ecological communities that have been removed from the list of threatened communities during the past five years.
P5	Priority Five: Conservation Dependent ecological communities Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.

Weeds

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

Declared Pests

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

Under the BAM Act, all declared pests are assigned a legal status, as described in **Table 4**. Species assigned to the 'declared pest, prohibited - s12' category are placed in one of three control categories, as described in **Table 5**.

The *Biosecurity and Agriculture Management Regulations 2013* specify keeping categories for species assigned to the 'declared pest - s22(2)' category, which relate to the purposes of which species can be kept, as well as the entities that can keep them. The categories are described in **Table 6**.

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

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

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

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

Category	Description
C1	Exclusion Not established in Western Australia and control measures are to be taken, including border checks, in order to prevent them entering and establishing in the State.
C2	Eradication Present in Western Australia in low enough numbers or in sufficiently limited areas that their eradication is still a possibility.
C3	Management Established in Western Australia but it is feasible, or desirable, to manage them in order to limit their damage. Control measures can prevent a C3 pest from increasing in population size or density or moving from an area in which it is established into an area which currently is free of that pest.

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

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

References

General references

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

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

Online references

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

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

Appendix B

Conservation Significant Flora Species and likelihood of Occurrence Assessment

Species name	Level of significance		Life strategy	Habitat	Flowering period	Likelihood of occurrence
	WA	EPBC Act				
Caladenia lodgeana	CR	CR	PG	Seasonally moist to wet clay/sand soils on the margins of either low granite outcrops or ephemeral wetlands	Oct	Unlikely
Calectasia cyanea	CR	CR	P	Heathland on white sand or laterite gravel over laterite. Known only from one population near Albany.	Jun-Oct	Unlikely
Grevillea brachystylis subsp. grandis	CR	CR	P	Sand and loam with lateritic gravel.	Sep-Dec	Unlikely
Caladenia huegelii	CR	EN	PG	Well-drained, deep sandy soils in lush undergrowth in a variety of moisture levels.	Sep-early Nov	Unlikely
Gastrolobium papilio	CR	EN	P	Sandy clay over ironstone and laterite. Flat plains.	Oct-Dec	Unlikely
Lambertia orbifolia subsp. Scott River Plains (L.W. Sage 684)	EN	CR	P	Yellow-brown sandy clay, grey sand, sandy gravel, laterite. Along riverbanks, sand dunes, plains & ridges, seasonally-inundated areas.	Oct-Nov or Jan	Unlikely
Reedia spathacea	EN	CR	P	Low nutrient, anoxic and highly acidic wetlands usually over peat.	Nov (flowering is rare)	Unlikely
Boronia exilis	EN	EN	P	Seasonally wet heath or sedgelands on grey silty sand over ironstone. Restricted to Scott River area.	Sep	Unlikely
Banksia nivea subsp. uliginosa	EN	EN	P	Clay over laterite in thick scrub, in winter wet ironstones.	Aug-Sep	Unlikely
Caladenia excelsa	EN	EN	PG	Hilltops, slopes, swales and low plains in deep pale yellow, white or grey sandy soils among dense low shrubs in banksia, jarrah and marri woodlands	Sep-Oct	Unlikely
Caladenia hoffmanii	EN	EN	PG	Clay, loam, laterite, granite. Rocky outcrops and hillsides, ridges, swamps and gullies.	Aug-Oct	Unlikely

Species name	Level of significance		Life strategy	Habitat	Flowering period	Likelihood of occurrence
	WA	EPBC Act				
Sphenotoma drummondii	EN	E	P	Stony or shallow soils over granite or quartzite on steep rocky slopes, crevices of rocks.	Sep-Dec	Unlikely
Drakaea micrantha	EN	VU	PG	Open sandy patches often adjacent to winter-wet swamps.	Sept- early Oct	Unlikely
Lambertia echinata subsp. occidentalis	CR	T	P	White sandy soils over laterite, orange/brown-red clay over ironstone. Flats to foothills, winter-wet sites.	Feb, Apr or Dec	Unlikely
Andersonia ferricola	P1	-	P	White sand or red-brown loam over ironstone on seasonally wet flats.	Oct	Unlikely
Deyeuxia inaequalis	P1	-	A	Loam soils	Nov-Dec	Unlikely
Platychorda rivalis	P1	-	P	Peat, laterite on edges of swamps, valleys in sedgeland with tall shrubs.	Unknown	Unlikely
Synaphea macrophylla	P1	-	P	Gravelly loam with jarrah or marri woodland or forest	Oct	Unlikely
Synaphea sp. Redgate Road (J. Scott 16)	P1	-	P	Grey clay, litter. Winter-wet areas, wet areas along road verges and ditches.	Oct-Nov	Unlikely
Tetraria sp. Nannup (P.A. Jurjevich 1133)	P1	-	P	Sand and clay loam in valley flats and creeks	Undocumented (likely Mar-Nov)	Unlikely
Amperea micrantha	P2	-	P	Sandy soils.	Oct-Nov	Unlikely
Andersonia sp. Echidna (A.R. Annels ARA 5500)	P2	-	P	Brown laterite and sandy loam on slopes and flats.	Nov-Dec	Unlikely
Boronia sp. Leeuwin (J. Scott 235)	P2	-	P	Sand and peat with gravelly laterite in winter-wet depressions, swamps and watercourses.	Aug-Dec	Unlikely
Caladenia ambusta	P2	-	PG	Flat to gentle slopes in brown soil (limited information)	Nov	Unlikely
Caladenia nivalis	P2	-	PG	Sand, loam, granite on coastal granite outcrops.	Sep-Oct	Unlikely
Gastrolobium whicherense	P2	-	P	Red-grey sandy clay over quartzite on steep westerly slopes.	Oct	Unlikely

Species name	Level of significance		Life strategy	Habitat	Flowering period	Likelihood of occurrence
	WA	EPBC Act				
Hybanthus volubilis	P2	-	P	Clay or sandy clay on river banks.	Sep-Dec	Unlikely
Leptomeria furtiva	P2	-	P	Grey or black peaty sand in winter-wet flats.	Aug-Oct	Unlikely
Lepyrodia extensa	P2	-	P	Sand and sandy peat in seasonally inundated swamps.	Dec-Feb	Unlikely
Thysanotus sp. Badgingarra (E.A. Griffin 2511)	P2	-	P	Grey sand with lateritic gravel.	Dec	Unlikely
Xyris maxima	P2	-	P	Black peaty sand on drainage flats.	Nov-Dec/Jan	Unlikely
Acacia inops	P3	-	P	Black peaty sand, clay. Swamps, creeks.	Sep-early Nov	Unlikely
Actinotus repens	P3	-	P	Sand, clay or loam in wetlands or low lying areas in scrub, woodland or forest.	Dec-Mar	Unlikely
Austrostipa mundula	P3	-	P	Grey sand over limestone.	Sept-Nov	Unlikely
Boronia anceps	P3	-	P	White sand, gravelly laterite in seasonally swampy heaths.	Sep-Dec/Jan	Unlikely
Boronia capitata subsp. gracilis	P3	-	P	White/grey or black sand in winter-wet swamps, hillslopes.	Jun-Nov	Unlikely
Caladenia abbreviata	P3	-	PG	Sand dunes.	Nov-Dec	Unlikely
Calothamnus lateralis var. crassus	P3	-	P	Sand, clay or peat in swamps and winter-wet depressions.	Aug-Dec	Unlikely
Chamaescilla gibsonii	P3	-	P	Clay to sandy clay in winter-wet flats, shallow water-filled claypans.	Sep	Unlikely
Cyathochaeta teretifolia	P3	-	P	Grey sand, sandy clay in	Oct-Jan	Unlikely
Dampiera heteroptera	P3	-	P	Sandy soils, swampy areas.	Sep-Oct	Unlikely
Gastrolobium	P3	-	P	Clay loam. Along river banks or	Nov	Unlikely
Grevillea brachystylis subsp. brachystylis	P3	-	P	Black sand, sandy clay in swampy situations.	Aug-Nov	Unlikely
Grevillea bronwenae	P3	-	P	Grey sand over laterite, lateritic	Jun-Dec	Unlikely
Grevillea manglesioides subsp. ferricola	P3	-	P	Red sandy clay over ironstone on winter wet flats.	Oct	Unlikely
Hakea oldfieldii	P3	-	P	Red clay or sand over laterite	Aug-Oct	Unlikely

Species name	Level of significance		Life strategy	Habitat	Flowering period	Likelihood of occurrence
	WA	EPBC Act				
Isopogon formosus subsp. dasylepis	P3	-	P	Sand, sandy clay, gravelly sandy soils over laterite, often in swampy areas.	Jun-Dec	Unlikely
Johnsonia inconspicua	P3	-	P	White-grey or black sand. Low	Oct-Nov	Unlikely
Juncus meianthus	P3	-	P	Black sand, sandy clay. Creeks, seepage areas.	Nov-Dec/Jan	Unlikely
Lasiopetalum laxiflorum	P3	-	P	Sand and/or clay with laterite.	Sep-Dec	Unlikely
Leptinella drummondii	P3	-	A	Clay loam, mud along rivers.	Nov-Dec or	Unlikely
Lepyrodia heleocharoides	P3	-	P	Moist peaty sand. Dry or seasonally inundated heath or woodland, swamps.	Dec	Unlikely
Leucopogon wheelerae	P3	-	P	Grey/white sand and peaty sand in wetlands and winter wet areas.	Aug-Oct	Unlikely
Loxocarya magna	P3	-	P	Sand, loam, clay, ironstone in seasonally inundated or damp habitats.	Sep or Nov	Unlikely
Pimelea ciliata subsp. longituba	P3	-	P	Grey sand over clay, loam.	Oct-Dec	Unlikely
Pultenaea pinifolia	P3	-	P	Loam or clay. Floodplains, swampy areas.	Oct-Nov	Unlikely
Stylidium lowrieanum	P3	-	P	Sand or sandy loam over limestone. Eucalypt or Agonis woodland, forest.	Oct-Nov	Unlikely
Synaphea decumbens	P3	-	P	Sand over laterite.	Sep-Oct	Unlikely
Tetraria sp. Blackwood River (A.R. Annels 3043)	P3	-	P	Grey clay and loam in lakes, swamps and waterways.	Nov	Unlikely
Thysanotus cymosus	P3	-	P	Shrubland or woodland on clay, granitic or lateritic sand.	Sep-Oct	Unlikely
Acacia flagelliformis	P4	-	P	Sandy soils in winter-wet areas.	May-Sep	Unlikely
Acacia semitrullata	P4	-	P	White/grey sand, sometimes over laterite, clay sometimes in sandplains, swampy areas.	May-Oct	Unlikely
Acacia tayloriana	P4	-	P	Grey or yellow/orange sandy soils, lateritic gravel, clay loam. Winter-wet areas.	Jan	Unlikely

Species name	Level of significance		Life strategy	Habitat	Flowering period	Likelihood of occurrence
	WA	EPBC Act				
Astartea onycis	P4	-	P	Seasonally inundated swamps and low-lying areas on sandy clay, loam or peat	Nov-Mar	Unlikely
Banksia sessilis var. cordata	P4	-	P	White/grey sand. Coastal limestone.	Jul-Oct	Unlikely
Chamelaucium erythrochlorum	P4	-	P	Clay, loam and sandy soils in creeklines, slopes and ridges	Nov-Feb	Unlikely
Drosera fimbriata	P4	-	P	White sand, granite.	Sep-Oct	Unlikely
Eucalyptus calcicola subsp. calcicola	P4	-	P	Red-brown sand over limestone on coastal dunes, calcareous ridges, rocky outcrops.	May-Jun	Unlikely
Eucalyptus marginata x megacarpa	P4	-	P	Sandy loam. Interdunal areas.	Unknown	Unlikely
Eucalyptus rudis subsp. cratyantha	P4	-	P	Loam on flats and hillsides.	Jul-Sep	Unlikely
Franklandia triaristata	P4	-	P	White or grey sand.	Aug-Oct	Unlikely
Gahnia sclerioides	P4	-	P	Loam, sandy soils. Moist shaded situations.	Feb, Apr, Jun, Aug or Nov	Unlikely
Gonocarpus pusillus	P4	-	A	Grey sandy clay in winter-wet swamps.	Nov-Dec	Unlikely
Hypolaena robusta	P4	-	P	White sand. Sandplains.	Sep-Oct	Unlikely
Lambertia rariflora subsp. rariflora	P4	-	P	Red-brown clay soils, black organic loam, laterite near intermittent streams.	Feb-Mar or May	Unlikely
Melaleuca basicephala	P4	-	P	Black peaty sand, clay. Winter-wet flats, swamps.	Dec or Jan	Unlikely
Stylidium gloeophyllum	P4	-	P4	Sandy clay loam, granite in winter wet depressions or fringing outcrops. Grows with peppermint trees, mallees or in hakea shrubland with sedges.	Oct-Dec	Unlikely
Thysanotus glaucus	P4	-	P	White, grey or yellow sand, sandy gravel.	Oct-Mar	Unlikely
Thysanotus isantherus	P4	-	P	Hillsides, sand over granite.	Nov-Dec	Unlikely
Verticordia lehmannii	P4	-	P	Sandy clay in winter-wet flats.	Jan/Apr-Jun or Aug-Dec	Unlikely

Species name	Level of significance		Life strategy	Habitat	Flowering period	Likelihood of occurrence
	WA	EPBC Act				
Daviesia elongata	T	-	P	Sand, laterite.	Sep/Dec-Jan/Feb	Unlikely
Banksia squarrosa subsp. argillacea	VU	VU	P	White/grey sand, gravelly clay or loam predominantly in winter-wet areas over ironstone in open to tall shrubland.	Jun-Nov	Unlikely

Note: T=threatened, CR=critically endangered, EN=endangered, VU=vulnerable, P1=Priority 1, P2=Priority 2, P3=Priority 3, P4=Priority 4, P=perennial, PG=perennial geophyte, A=annual. Species considered to potentially occur within the site are shaded green

Appendix C

Species List

Family	Status	Species
Aizoaceae		
		Carpobrotus virescens
	*	*Tetragonia decumbens*
Araceae		
	*DP	*Zantedeschia aethiopica*
Asparagaceae		
		Acanthocarpus preissii
Asphodelaceae		
	*	*Trachyandra divaricata*
Asteraceae		
	*	*Arctotheca calendula*
		Gnaphalium indutum
		Olearia axillaris
	*	*Osteospermum ecklonis*
	*	*Senecio elegans*
		Senecio pinnatifolius var. maritimus
	*	*Sonchus oleraceus*
Brassicaceae		
	*	*Brassica tournefortii*
Campanulaceae		
		Isotoma scapigera
		Lobelia tenuior
Chenopodiaceae		
		Rhagodia baccata
		Threlkeldia diffusa
Crassulaceae		
		Crassula colorata
	*	*Crassula glomerata*
Cyperaceae		
		Carex thecata
		Ficinia nodosa
		Isolepis marginata
		Lepidosperma gladiatum
		Lepidosperma ?squamatum
Dilleniaceae		
		Hibbertia hypericoides
		Hibbertia serrata
Droseraceae		
		Drosera macrantha
Ericaceae		
		Acrotriche cordata
		Leucopogon parviflorus
Fabaceae		
		Acacia littorea
		Acacia saligna
		Hardenbergia comptoniana
	*	*Melilotus indicus*
		Templetonia retusa

Family	Status	Species
	*	*Trifolium dubium*
Gentianaceae		
	*	*Schenkia australis*
Geraniaceae		
	*	*Pelargonium capitatum*
	*	*Pelargonium sp.*
Goodeniaceae		
		Scaevola crassifolia
Haemodoraceae		
		Conostylis aculeata subsp. aculeata
Hemerocallidaceae		
		Dianella revoluta
		Tricoryne elatior
Lauraceae		
		Cassytha racemosa forma racemosa
Malvaceae		
		Thomasia triphylla
Myrtaceae		
		Agonis flexuosa
	*	*Eucalyptus utilis*
		Melaleuca huegelii
		Melaleuca lanceolata
		Melaleuca preissiana
		Melaleuca systena
Orchidaceae		
		Caladenia latifolia
Orobanchaceae		
	*	*Orobanche minor*
Oxalidaceae		
	*	*Oxalis pes-caprae*
Papaveraceae		
	*	*Fumaria capreolata*
Phyllanthaceae		
		Phyllanthus calycinus
		Poranthera microphylla
Pittosporaceae		
		Marianthus candidus
Poaceae		
		Austrostipa flavescens
	*	*Avena barbata*
	*	*Briza maxima*
	*	*Bromus diandrus*
	*	*Catapodium rigidum*
	*	*Ehrharta longiflora*
	*	*Lagurus ovatus*
		Poa sp.
		Rytidosperma occidentale
Polygalaceae		

Family	Status	Species
		Comesperma confertum
Polygonaceae		
		Muehlenbeckia adpressa
Primulaceae		
	*	*Lysimachia arvensis*
Ranunculaceae		
		Clematis pubescens
Restionaceae		
		Desmocladus flexuosus
Rhamnaceae		
		Spyridium globulosum
Rubiaceae		
	*	*Galium murale*
Rutaceae		
		Boronia alata
		Diplolaena dampieri
Santalaceae		
		Exocarpos sparteus
Sapindaceae		
		Dodonaea aptera
Scrophulariaceae		
	*	*Dischisma arenarium*
		Myoporum insulare
		Myoporum oppositifolium
	*	*Verbascum virgatum*
Stylidiaceae		
		Stylidium adnatum
Thymelaeaceae		
		Pimelea ferruginea

*=non-native, Pl=planted, DP=declared pest under BAM Act

Appendix D

Conservation Significant Communities and Likelihood of Occurrence Assessment

Code	Community name	TEC/ PEC	Level of significance		Likelihood of occurrence
			State	EPBC Act	
CAVES LEEUWIN02	Aquatic Root Mat Community Number 2 of Caves of the Leeuwin Naturaliste Ridge (Strongs Cave)	TEC	CR	EN	Does not occur
CAVES LEEUWIN03	Aquatic Root Mat Community Number 3 of Caves of the Leeuwin Naturaliste Ridge (Kudjal Yolgah and Budjur Mar Caves)	TEC	CR	EN	Does not occur
CAVES LEEUWIN04	Aquatic Root Mat Community 4 in Caves of the Leeuwin Naturaliste Ridge	TEC	CR	EN	Does not occur
Augusta-microbial	Rimstone Pools and Cave Structures Formed by Microbial Activity on Marine Shorelines (Augusta microbialites)	TEC	EN		Does not occur
Low shrublands (Gracetown)	Low shrublands on acidic grey-brown sands of the Gracetown soil-landscape system	PEC	P2		Does not occur
Melaleuca lanceolata forests	*Melaleuca lanceolata* forests, Leeuwin Naturaliste Ridge	PEC	P2		Does not occur

Note: TEC=threatened ecological community, PEC=priority ecological community, CR=critically endangered, EN=endangered, P2=priority 2

Appendix E

Sample Data

Vegetation Sample Data
Lot 783 Mitchell Drive, Lots 501, 502 and
504 Reef Drive and Lot 503 Seagrass Place, Gnarabup

Sample Name: Q1

Project no.: EP20-008
Date: 16/09/2020 **Status** Non-permanent
Author: RAW, Q1: Page 2 of 2

Quadrat and landform details

Sample type:	quadrat	Size:	10 m x 10 m
NW corner easting:	314549	NW corner northing:	6236952
Altitude (m):	16	Geographic datum/zone:	GDA94/Zone 50
Soil water content:	damp	Landform:	mid-slope
Time since fire:	> 5 yrs	Disturbance:	low - rabbits
Soil type/texture	sand/loam with organic layer	Bare ground (%):	0
Rocks (%) and type:	1%, limestone	Soil colour:	brown/
Litter:	100% (leaves,twigs,)	Vegetation condition:	very good

Sample Name: Q1

Project no.: EP20-008
Date: 16/09/2020 **Status** Non-permanent
Author: RAW, Q1: Page 2 of 2

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
	Acacia littorea	40
	Cassytha racemosa forma racemosa	opp
	Diplolaena dampieri	<1
	Exocarpos sparteus	opp
	Ficinia nodosa	opp
	Hibbertia hypericoides	<1
	Lepidosperma gladiatum	opp
	Leucopogon parviflorus	opp
	Melaleuca huegelii	10
	Melaleuca systena	<1
	Muehlenbeckia adpressa	opp
	Olearia axillaris	opp
	Pimelea ferruginea	<1
	Poa sp.	<1
	Rhagodia baccata	opp
	Scaevola crassifolia	10
	Spyridium globulosum	40
	Thomasia triphylla	opp

Sample Name: Q2

Project no.: EP20-008
Date: 16/09/2020 **Status** Non-permanent
Author: RAW, Q2: Page 2 of 2

Quadrat and landform details

Sample type:	quadrat	Size:	10 m x 10 m
NW corner easting:	314681	NW corner northing:	6236679
Altitude (m):	20	Geographic datum/zone:	GDA94/Zone 50
Soil water content:	damp	Landform:	hilltop
Time since fire:	> 5 yrs	Disturbance:	low -
Soil type/texture	sand/loam with organic layer	Bare ground (%):	0
Rocks (%) and type:	1%, limestone	Soil colour:	brown/
Litter:	100% (leaves,twigs,)	Vegetation condition:	very good

Sample Name: Q2

Project no.: EP20-008
Date: 16/09/2020 **Status** Non-permanent
Author: RAW, Q2: Page 2 of 2

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
	Acacia littorea	30
	Diplolaena dampieri	1
	Hibbertia hypericoides	<1
	Lepidosperma ?squamatum	5
	Melaleuca huegelii	10
	Melaleuca systena	5
	Olearia axillaris	<1
	Phyllanthus calycinus	<1
	Pimelea ferruginea	5
	Rhagodia baccata	<1
	Scaevola crassifolia	30
	Spyridium globulosum	10
	Thomasia triphylla	10
	Threlkeldia diffusa	opp

Sample Name: Q3

Project no.: EP20-008
Date: 17/09/2020 **Status** Non-permanent
Author: RAW, Q3: Page 2 of 2

Quadrat and landform details

Sample type:	quadrat	Size:	10 m x 10 m
NW corner easting:	314828	NW corner northing:	6236299
Altitude (m):	12	Geographic datum/zone:	GDA94/Zone 50
Soil water content:	damp	Landform:	hilltop
Time since fire:	> 5 yrs	Disturbance:	low -
Soil type/texture	sand/loam with organic layer	Bare ground (%):	0
Rocks (%) and type:	1%, limestone	Soil colour:	brown/
Litter:	100% (leaves,twigs,branches)	Vegetation condition:	very good

Sample Name: Q3

Project no.: EP20-008
Date: 17/09/2020 **Status** Non-permanent
Author: RAW, Q3: Page 2 of 2

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
	Acacia littorea	80
	Cassytha racemosa forma racemosa	1
	Diplolaena dampieri	5
	Melaleuca huegelii	5
	Rhagodia baccata	5
	Scaevola crassifolia	10
	Thomasia triphylla	10