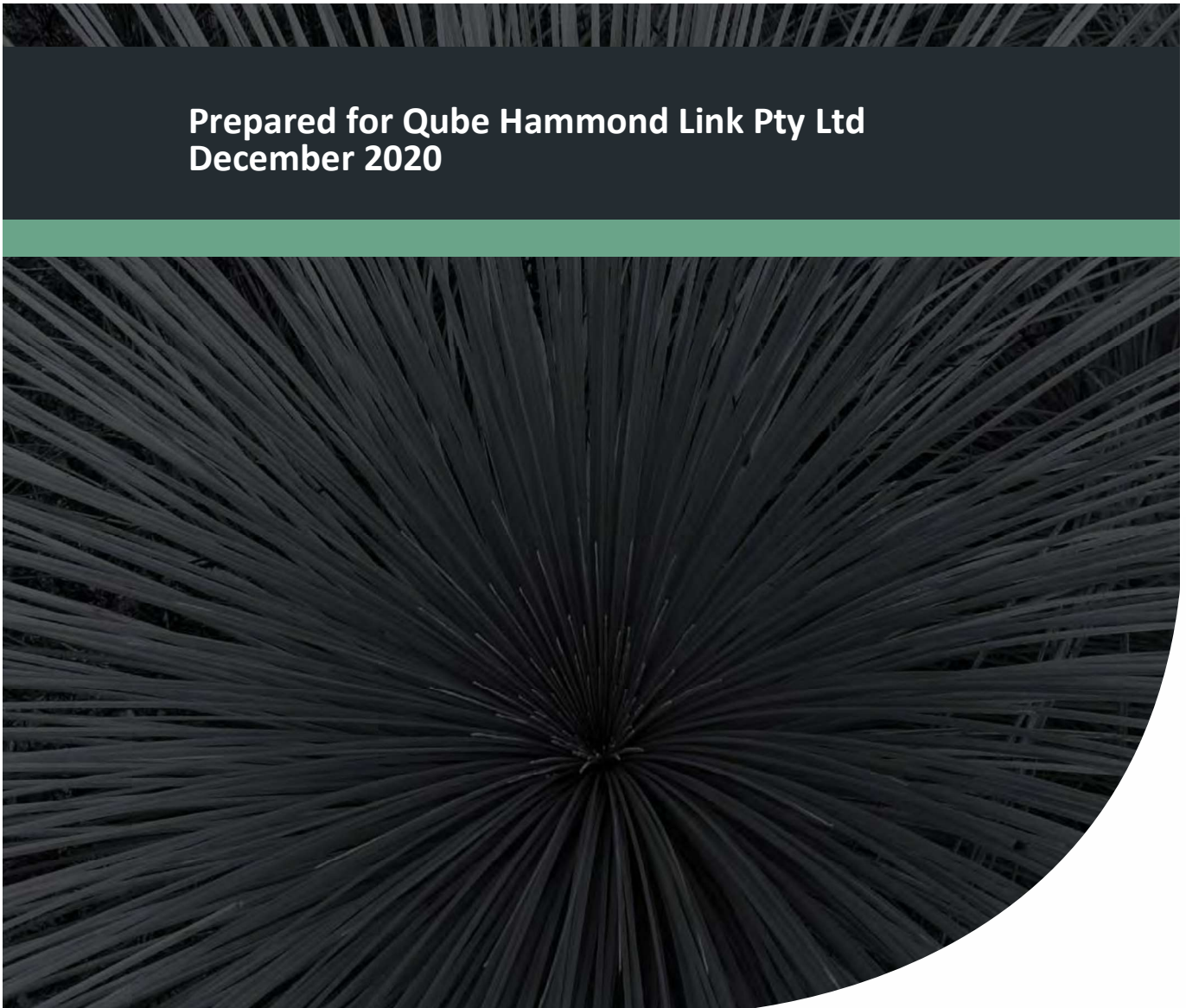


Spring Flora and Vegetation Assessment

Lots 76 and 107 Wattleup Road, Hammond Park

Project No: EP20-085(01)

**Prepared for Qube Hammond Link Pty Ltd
December 2020**



Spring Flora and Vegetation Assessment

Lots 76 and 107 Wattleup Road, Hammond Park



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Lots 76 and 107 Wattleup Road, Hammond Park



Executive Summary

Qube Hammond Link Pty Ltd engaged Emerge Associates (Emerge) to undertake a spring flora and vegetation survey within Lots 76 and 107 Wattleup Road in Hammond Park (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 on 18 August and 22 September 2020. During the survey targeted searches were conducted for 'threatened' and 'priority' flora and an assessment was made on the type, condition and values of vegetation across the site.

Outcomes of the survey include:

- Predominantly non-native vegetation is present across 3.34 hectares (ha) of the site including the southern portions of both lots. Remnant native vegetation is present across 4.75 ha of the site within Lots 76 and 107.
- No threatened or priority flora species were recorded or are considered likely to occur within the site due to lack of suitable habitat.
- The remnant native vegetation within the site was mapped as a single plant community (**BaBm**).
- The **BaBm** vegetation aligns closely with floristic community type (FCT) '28 -Spearwood *Banksia attenuata* or *Banksia attenuata* – *Eucalyptus* woodlands'.
- Native vegetation in the northern portion of the site is predominantly in 'excellent' condition and native vegetation in the central portions and north eastern portions of both lots is in 'very good' condition. An area of 'good' condition vegetation is present in the centre of Lot 107. The remainder of the vegetation is in 'degraded' or 'completely degraded' condition.
- Based on the relevant criteria, the remnant native vegetation within the site represents the 'Banksia Woodlands of the Swan Coastal Plain' threatened ecological community (TEC), which is listed under the *Environment Protection and Biodiversity Conservation Act 1999*. Approximately 4.75 ha of the banksia woodland TEC is present within the site. Given the presence of additional areas of 'banksia woodland' vegetation directly adjacent to the site, the **BaBm** vegetation within the site forms part of a much larger contiguous patch of the TEC.
- The remnant native vegetation represents the state listed priority ecological community (PEC) 'Banksia dominated woodlands of the Swan Coastal Plain IBRA region'. Approximately 4.58 ha of this PEC is present within the site.
- Native vegetation within the site provides a foraging resource for threatened species of black cockatoos.

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Abbreviation Tables

Table A1: Abbreviations – Organisations

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

Table A2: Abbreviations – General terms

General terms	
CCW	Conservation category wetland
ESA	Environmentally sensitive area
FCT	Floristic community type
IBRA	Interim Biogeographic Regionalisation of Australia
MUW	Multiple use wetland
NVIS	National Vegetation Inventory System (ESCAVI 2003)
P1	Priority 1
P2	Priority 2
P3	Priority 3
P4	Priority 4
P5	Priority 5
PEC	Priority ecological community
REW	Resource enhancement wetland
T	Threatened
TEC	Threatened ecological community
UFI	Unique feature identifier
WoNS	Weeds of National Significance

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Table A3: Abbreviations –Legislation

Legislation	
BAM Act	<i>Biosecurity and Agriculture Management Act 2007</i>
EP Act	<i>Environmental Protection Act 1986</i>
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
BC Act	<i>Biodiversity Conservation Act 2016</i>
BC Regs	<i>Biodiversity Conservation Regulations 2018</i>
CALM Act 1984	<i>Conservation and Land Management Act 1984</i>
LA Act	<i>Land Administration Act 1997</i>
SCRM Act	<i>Swan and Canning Rivers Management Act 2006</i>
WC Act	<i>Wildlife Conservation Act 1950</i>

Table A4: Abbreviations – planning

Planning terms	
MRS	Metropolitan region scheme
TPS	Town planning scheme

Table A5: Abbreviations – units of measurement

Units of measurement	
cm	Centimetre
ha	Hectare
m	Metre
m ²	Square metre
m AHD	m in relation to the Australian height datum
mm	Millimetre

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1 Introduction

1.1 Project background

Qube Hammond Link Pty Ltd (Qube) intends to develop Lots 76 and 107 Wattleup Road in Hammond Park for residential purposes. These lots (referred to herein as the 'site') are located approximately 24 kilometres (km) south of the Perth Central Business District within the City of Cockburn (CoC) and are zoned 'urban' under the Metropolitan Region Scheme (MRS) and 'development' under the CoC's Town Planning Scheme No.3. The site is also subject to the CoC's Southern Suburbs District Structure Plan – Stage 3.

The site is approximately 8.09 hectares (ha) in size and is bound by Wattleup Road to the south, Bush Forever Site 392 (Harry Waring Marsupial Reserve) to the north and recently cleared land to the east and west. The location and extent of the site is shown in **Figure 1**.

1.2 Purpose and scope of work

Emerge Associates (Emerge) were engaged by Qube to provide environmental consultancy services to support structure planning for the site. The purpose of this survey is to provide sufficient information on the flora and vegetation values within the site to inform this process.

The scope of work was specifically to undertake a flora and vegetation assessment to the standard required of a detailed survey in accordance with 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.
- Compilation of a comprehensive list of flora species recorded as part of the field survey.
- 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.
- Targeted searches for conservation significant flora species.
- Documentation of the desktop assessment, survey methodology and results into a report.

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2 Environmental Context

2.1 Climate

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

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

An average of 792.8 millimetres (mm) of rainfall is recorded annually from the Anketell weather station, which is the closest weather station, located approximately 7.3 km from the site. The majority of this rainfall is received between the months of May and September. Mean maximum temperatures at the Jandakot Aero weather station, which is the nearest temperature recording station approximately 9 km south-east of the site, range from 18.0° C in July to 31.6° C in February, while mean minimum temperatures range from 6.9° C in July and August to 17.2° C in February (BoM 2020).

A total of 480.1 mm of rain was recorded from May to September 2020 prior to the survey, which is approximately 80% of the mean of 598 mm for this period (BOM 2020). Although lower than the mean this amount of rainfall was considered to have been sufficient to promote the flowering and emergence of native flora.

2.2 Geomorphology and soils

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

The Swan Coastal Plain is approximately 500 km long and 20 to 30 km wide and is roughly bound by the Indian Ocean to the west and the Darling Scarp to the east. Broadly the Swan Coastal Plain consists of two sedimentary belts of different origin. Its eastern side has formed from the deposition of alluvial material washed down from the Darling Scarp, while its western side is comprised of three dune systems that run roughly parallel to the Indian Ocean coastline (Seddon 2004). These dune systems, referred to as Quindalup, Spearwood and Bassendean associations, represent a succession of coastal deposition that has occurred since the late Quaternary period (approximately two million years ago) (Kendrick *et al.* 1991) and, as a result, they contain soils at different stages of leaching and formation.

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Examination of broad scale soil mapping places the site within the Bassendean association but near the boundary of the Spearwood association (Churchward and McArthur 1980).

Finer scale mapping by (Gozzard 2011) places the site in the Spearwood dunes which was later confirmed during the field survey. The Spearwood association typically consists of a core of limestone overlain by yellow sand which is at an intermediate stage of leaching and formation. The soil types mapped within 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 45 metres in relation to the Australian Height Datum (m AHD) on the north eastern portion of the site to 28 m AHD on the south west corner of the site (DoW 2008) (**Figure 2**).

2.4 Hydrology and wetlands

Wetlands include “areas of seasonally, intermittently or permanently waterlogged soils or inundated land, whether natural or otherwise, fresh and saline, e.g. waterlogged soils, ponds, billabongs, lakes, swamps, tidal flats, estuaries, rivers and their tributaries” (Wetlands Advisory Committee 1977). Wetlands can further be recognised by the presence of vegetation associated with waterlogging or the presence of hydric soils such as peat, peaty sand or carbonate mud (Hill *et al.* 1996).

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

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

No Ramsar or listed ‘important wetlands’ are located within the site. The Ramsar listed wetland ‘Forrestdale and Thomsons Lakes’ is located approximately 1.3 km north of the site.

Examination of the Department of Water and Environmental Regulation (DWER) hydrography dataset (DWER 2018) shows that there are no hydrographic features within the site.

The Department of Biodiversity, Conservation and Attractions (DBCA) maintains the *Geomorphic Wetlands of the Swan Coastal Plain* dataset (DBCA 2020) which uses the geomorphic wetland classification system developed by Semeniuk (1987) and Semeniuk and Semeniuk (1995) to classify wetlands based on the landform shape and water permanence (hydro-period). The dataset also categorises geomorphic wetland features into specific wetland types and management categories to guide land use and conservation. Note that as this dataset was drafted at a regional scale the boundaries of mapped wetland features are often inconsistent with physical wetland boundaries.

A review of DPaW’s *Geomorphic Wetlands of the Swan Coastal Plain* dataset (DBCA 2020) indicated that no geomorphic wetlands occur within the site. Two small unnamed wetlands occur to the west of the site (conservation category and multiple use category), a series of wetlands occur to the north

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of the site within Bush Forever Site 392 (including conservation category Banganup Swamp). Wattleup Lake (resource enhancement category) occurs to the south-west of the site. The locations of geomorphic wetlands in the local area are shown in **Figure 2**.

2.5 Regional vegetation

Native vegetation is described and mapped at different scales in order to illustrate patterns in its distribution. At a continental scale the *Interim Biogeographic Regionalisation of Australia* (IBRA) divides the Swan Coastal Plain into two floristic subregions (Environment Australia 2000). The site is contained within the 'SWA02' or Perth subregion, which is characterised as mainly containing *Banksia* low woodland on leached sands with *Melaleuca* swamps where ill-drained; and woodland of *Eucalyptus gomphocephala* (tuart), *E. marginata* (jarrah) and *Corymbia calophylla* (marri) on less leached soils (Beard 1990). This subregion is recognised as a biodiversity hotspot and contains a wide variety of endemic flora and vegetation types.

Variations in native vegetation within the site can be further classified based on regional vegetation associations. Heddle *et al.* (1980) mapping shows the site as comprising the 'Bassendean central and south complex', but near the junction with the Spearwood association. 'Bassendean central and south complex' is described as vegetation ranging from woodland of *Eucalyptus marginata* - *Allocasuarina fraseriana* - *Banksia* spp. to low woodland of *Melaleuca* spp. and sedgeland on the moister sites. This complex was determined to have 26.9% remaining in 2018, of which 1.86% is under formal protection (Government of Western Australia 2019).

More recent Beard *et al.* (2013) mapping shows the site comprises vegetation association 'Spearwood 6'. This association is described as 'medium woodland; tuart and jarrah' (Beard *et al.* 2013). 'Spearwood 6' association has 23.7% of its pre-European extent remaining on the Swan Coastal Plain with 3.3% protected for conservation purposes (Government of Western Australia 2018).

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). However, a lower objective of 10% is applied in 'constrained urban areas' such as the Swan Coastal Plain (Ministry for Planning 1995). The percentage protected for conservation of the 'Bassendean central and south complex' and the 'Spearwood 6' association fall below the 30% and 10% retention objectives.

2.6 Historic land use

Review of historical images available from 1965 (WALIA 2016) onwards shows that Lot 107 and the southern portion of Lot 76 was completely cleared of remnant vegetation between 1965 and 1974, for grazing and agricultural (market garden and orchard) purposes. Vegetation was subsequently allowed to re-establish within portions of Lot 107 from 1985. The northern portion of Lot 76 appears not to have been subject to clearing. By 1979 vegetation had regenerated in the northern portion, a portion in the south-west corner and a narrow connecting strip of vegetation along the eastern side of Lot 107. Since then, no further vegetation clearing is evident from aerial imagery (WALIA 2007).

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2.7 Significant flora and vegetation

2.7.1 Threatened and priority flora

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

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

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

2.7.2 Threatened and priority ecological communities

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

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

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

A plant community that is under consideration for listing as a TEC in Western Australia but does not yet meet survey criteria or has not been adequately defined, may be listed as a 'priority ecological community' (PEC). Listing as a PEC is similarly considered during State approval processes. Further information on categories of TECs and PECs is provided in **Appendix A**.

2.7.3 Local and regional significance

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

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A key reason that vegetation within the site may be significant relates to its potential value as habitat for threatened or priority fauna species. While this flora and vegetation assessment does not provide an evaluation of the value of fauna habitat, the site has potential value to two threatened and one priority species:

- The site occurs within the known distribution of *Calyptorhynchus latirostris* (Carnaby's black cockatoo) and *Calyptorhynchus banksii naso* (forest red-tailed black cockatoo) (DoEE 2012) which are listed as 'endangered' and 'vulnerable' respectively under the EPBC Act. They are both also listed as 'endangered' under the *Wildlife Conservation Act 1950* (WC Act). Mapping data collated by the Department of Planning (DoP 2011) indicates that potential Carnaby's black cockatoo foraging habitat is located immediately north of the site within Bush Forever Site 392 (**Figure 2**). A confirmed Carnaby's black cockatoo roosting site occurs approximately 4.5 km to the south-east of the site and another approximately 3.8 km north-east of the site. These two black cockatoo species forage on the seeds of trees and shrubs such as *Eucalyptus* spp., *Banksia* spp., *Hakea* spp. and *Pinus* spp. They naturally rely on hollows that form in large mature eucalypt trees for nesting (DoEE 2016b, DoEE 2016c).
- *Isoodon fusciventer* (quenda) have been recorded within Bush Forever Site 392 (Government of WA 2000b) adjacent to the northern boundary of the site. This small native marsupial is listed as Priority 4 (P4) under the WC Act. Quenda are known to inhabit scrubby vegetation with dense cover up to 1 m high and often feed in adjacent woodland and in areas of pasture and cropland lying close to dense cover (DEC 2012). Therefore, habitat for this species could potentially occur within the site.

2.7.4 Weeds

The term 'weed' can refer to any plant that requires some form of action to reduce its effect on the economy, the environment, human health and amenity. Many non-native flora species and some native species are considered to be weeds.

A particularly invasive or detrimental weed species may be listed as a 'declared pest' pursuant to Western Australia's *Biosecurity and Agriculture Management Act 2007* (BAM Act), indicating that it warrants special management to limit its spread. At a National level, the Australian government has compiled a list of 32 *Weeds of National Significance* (WoNS) (DAWE 2020c). Whilst the WoNS list is non-statutory, many WoNS are also listed under the BAM Act. Further information on categories of declared pests is provided in **Appendix A**.

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

2.8 Bush Forever

The Government of Western Australia's *Bush Forever* policy is a strategic plan for conserving regionally significant bushland within the Swan Coastal Plain portion of the Perth Metropolitan Region. The objective of *Bush Forever* is to protect comprehensive representations of all original ecological communities by targeting a minimum of 10% of each vegetation complex for protection (Government of WA 2000). *Bush Forever* sites are representative of regional ecosystems and habitat and have a key role in the conservation of Perth's biodiversity.

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No *Bush Forever* sites occur within the site. Bush Forever Site 392 (Harry Waring Marsupial Reserve) is located directly north of the site. This reserve is managed by DBCA and covers an area of over 250 ha. The reserve protects conservation significant marsupials such as the quenda and is surrounded by a 'feral animal proof' perimeter fence. The location of Bush Forever Site 392 associated is shown in **Figure 2**.

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. However, exemptions under Schedule 6 of the EP Act still apply, which includes any clearing in accordance with a subdivision approval under the *Planning and Development Act 2005* (a recognised exemption under the Schedule 6 of the EP Act).

No ESAs are located within the site. One ESA occurs directly adjacent to the north and west of the site, associated with Bush Forever Site 392 (Harry Waring Marsupial Reserve) and three nearby wetlands including Wattleup Lake. The location of these ESAs is shown in **Figure 2**.

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.

Bush Forever 392 (Harry Waring Marsupial Reserve) incorporates three areas denoted as DBCA legislated lands and waters. R15556 and R29241 are nature reserves and R48291 is a conservation park under the CALM Act 1984 (DBCA 2017a).

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-

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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).

One ecological linkage (number 50) from the Perth Biodiversity Project (WALGA and PBP 2004) occurs in a small portion of the north eastern corner of the site. One additional ecological linkage (number 49) occurs approximately 500 m north-east of the site. These ecological linkages connect areas of *Bush Forever* and intact vegetation located in the wider local area.

2.12 Previous surveys

Emerge have previously completed surveys of Lot 107 as part of structure planning for the site under a different landowner. As part of this work a detailed survey was undertaken on 28 September 2016. During these surveys broad scale mapping of plant communities and vegetation condition was completed. Lot 76 has not been surveyed previously however during the survey of Lot 107 the vegetation was observed to be similar to the adjacent lot.

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3 Methods

3.1 Desktop assessment

A search was conducted for threatened and priority flora that may occur or have been recorded within a 15 km radius of the site using the *Protected Matters Search Tool* (DAWE 2020a), *NatureMap* (DBCA 2020) and DBCA's threatened and priority flora database (reference no. 12-0820FL).

A search was also conducted for TECs and PECs that may occur or have been recorded within a 5 km radius of the site using the *Protected Matters Search Tool* (DAWE 2020a), the *weed and native flora dataset* (Keighery *et al.* 2012) and DBCA's threatened and priority ecological communities' databases (reference no. 29-0820EC).

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 and an ecologist from Emerge visited the site on 18 August and 22 September 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 10 x 10 m quadrats. The quadrats were established using fence droppers bound by measuring tape.

A total of six locations were sampled. The position of each sample location was recorded with a hand-held GPS unit, as shown in **Figure 3**.

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.

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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 methods from Keighery (1994). For vegetation in the site containing *Banksia* spp., the condition scale provided in the conservation advice for the 'banksia Woodlands of the Swan Coastal Plain TEC' (TSSC 2016) was applied in addition to the Keighery scale (as shown in **Table 1**).

Table 1: Vegetation condition scale applied during the field assessment

Condition category	Definition (Keighery 1994)	Indicator (TSSC 2016)	
		Typical native vegetation composition	Typical weed cover
Pristine	Pristine or nearly so, no obvious signs of disturbance.	Native plant species diversity fully retained or almost so	Zero or close to
Excellent	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.	High native plant species diversity	Less than 10%
Very good	Vegetation structure altered obvious signs of disturbance. For example, disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing	Moderate native plant species diversity	5-20%
Good	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. For example, disturbance to vegetation structure caused by very frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback and grazing.	Low native plant species diversity	5-50%
Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example, disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.	Very low native plant species diversity	20-70%
Completely degraded	The structure of the vegetation is no longer intact, and the area is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora comprising weed or crop species with isolated native trees or shrubs.	Very low to no native species diversity	Greater than 70%

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3.3 Mapping and data 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 <u>or</u> the site contains suitable habitat for the species within which thorough targeted searches were completed and conclusion has been made that the species is unlikely to be present.

3.3.2 Plant community identification and description

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

3.3.3 Floristic community type assignment

The identified plant communities were then compared to the regional 'floristic community type' (FCT) dataset *A floristic survey of the southern Swan Coastal Plain* by Gibson *et al.* (1994). The sample data (presence/absence) was reconciled with Gibson *et al.* (1994) by standardising the names of taxa with those used in the earlier study. This was necessary due to changes in nomenclature in the intervening period. Taxa that were only identified to genus level were excluded, while some infra-species that have been identified since 1994 were reduced to species level. The combined dataset was then imported into the statistical analysis package PRIMER v6 (Clarke and Gorley 2006). As data from a localised survey is often spatially correlated, data for each sample was compared to Gibson *et al.* (1994) separately. This removed the influence of spatial correlation when assigning a FCT. Classification was then undertaken using a group-average hierarchical clustering technique using the Bray-Curtis distance measure (as described above for plant community determination).

Where the sample tended to cluster with a grouping of different FCTs, samples were assessed separately to differentiate between FCTs. Ultimately the cluster analysis, as well as contextual information relating to the soils, landforms and known locations of FCTs within the region, was considered in the final determination of an FCT for vegetation within the site.

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3.3.4 Threatened and priority ecological communities

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

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

3.3.5 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 Jackknife1 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.
	Limitation	Regarding assignment of FCTs, the authoritative Gibson <i>et al.</i> (1994) dataset was derived from a necessarily limited sample of vegetation from largely publicly owned land which is now more than 20 years out of date. Consequently, it is unknown to what degree official FCTs are an appropriate reference to biodiverse vegetation across the Swan Coastal Plain. Furthermore, Gibson <i>et al.</i> (1994) collected data in the spring main flowering period and in many cases sampled plots multiple times to provide a complete species list.
Experience level of personnel	No limitation	This flora and vegetation assessment was undertaken by a qualified botanist with ten years of botanical experience in Western Australia. Technical review was undertaken by a principal environmental consultant with 18 years' experience in environmental science in Western Australia.

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

Constraint	Degree of limitation	Details
Suitability of timing	No limitation	The survey was conducted in August and September and thus within the main flowering season. Relatively 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 multiple times in August and September 2020 and once in September 2016. The August site visits provided an insight into the vegetation condition and composition out of 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.
Sampling intensity	Minor limitation	A total of 133 species were recorded, of which 90 were recorded from six sample locations and 43 were recorded opportunistically. Minimum species richness within site is estimated at between 150 (Chao2) and 165 (Jackknife1) species (refer species accumulation curve and estimates shown in Plate 5). The number of species recorded in the site is between 87 and 96% of the estimated 150-165 species in the site and demonstrates that survey effort was adequate to prepare a near-comprehensive species inventory for the site.
Influence of disturbance	Minor limitation	Time since fire is greater than 40 years as interpreted from aerial imagery and therefore short lived species more common after fire may not have been visible.
	No limitation	Historical ground disturbance was evident in parts of the site and some native vegetation in the site is regrowth with minimal non-native species present. 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.

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4 Results

4.1 General site conditions

The site has a south-east facing aspect and gentle slope (5-15°). Surface soils are grey-brown and sandy with no rock cover. Native vegetation occurs in the northern half of Lot 76 and northern and south-west portion of Lot 107. The remaining areas are largely devoid of native vegetation and the southern half of Lot 76 is currently used as a residence and fruit orchard.

4.2 Flora

4.2.1 Desktop assessment

The database search results identified a total of 14 threatened and 41 priority flora species occurring or potentially occurring within a 10 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, one threatened flora species and 11 priority flora species were identified as potentially occurring within the site as shown in **Table 4**.

Table 4: Conservation significant flora species with habitat preferences considered to potentially occur in the site

Species	Level of significance		Life strategy	Habitat	Flowering period
	State	EPBC Act			
<i>Caladenia huegelii</i>	CR	E	PG	Well-drained, deep sandy soils in lush undergrowth in a variety of moisture levels.	Sep-early Nov
<i>Lachnagrostis nesomytica subsp. paralia</i>	P1	-	A/P	Calcareous sands. Coastal dunes and swales.	Unknown
<i>Acacia benthamii</i>	P2	-	P	Sand, typically on limestone breakaways	Aug – Sept
<i>Thelymitra variegata</i>	P2	-	P	Sandy clay, sand, laterite.	Jun-Sep
<i>Austrostipa mundula</i>	P3	-	P	Grey sand over limestone.	Sept-Nov
<i>Babingtonia urbana</i>	P3	-	P	Grey sand, lateritic gravel.	Jan-Mar
<i>Jacksonia gracillima</i>	P3	-	P	Sand, often adjacent to winter wet areas	Sep-Dec
<i>Pimelea calcicola</i>	P3	-	P	sand, limestone, coastal ridges	Sep-Nov
<i>Dodonaea hackettiana</i>	P4	-	P	Sand, outcropping limestone.	Jul-Oct
<i>Jacksonia sericea</i>	P4	-	P	Calcareous and sandy soils on Swan Coastal Plain	Dec-Feb
<i>Lepidium puberulum</i>	P4	-	A	Sandy soils.	Jul - Aug or Oct – Nov
<i>Thysanotus glaucus</i>	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.

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4.2.2 Species inventory

A total of 97 native and 36 non-native (weed) species were recorded within the site during the field survey, representing 47 families and 113 genera. The dominant families containing native taxa were Fabaceae (11 native taxa and one weed taxa), Orchidaceae (eight native taxa) and Proteaceae (seven native taxa and one weed taxa). The most common genera were *Stylidium* (with four taxa) and *Banksia* and *Lomandra* with three taxa each. Of the species recorded 90 were recorded in sample locations and 43 were recorded opportunistically.

A complete species list is provided in **Appendix D** and a species list by plant community matrix is provided in **Appendix E**.

4.2.3 Threatened and priority flora

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

The majority of the threatened and priority flora species identified in the desktop assessment are not considered to occur because they were not recorded during the field survey.

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

Two species, **Zantedeschia aethiopica* (arum lily) and **Lantana camara* (common lantana), listed as a declared pest (C3) pursuant to the BAM Act, were recorded within the site. Arum lily was found scattered in low numbers throughout the site. Common lantana was found planted along the driveway of Lot 76 and also scattered throughout the site.

Common lantana is also a weed of national significance (WoNS).

4.3 Vegetation

4.3.1 Desktop assessment

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

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

- 'Banksia woodlands of the Swan Coastal Plain' TEC which is listed as 'endangered' under EPBC Act.
- 'Banksia dominated woodlands of the Swan Coastal Plain IBRA region' PEC (P3).
- 'Northern Spearwood shrublands and woodlands' PEC (P3).

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4.3.2 Plant communities

One native plant community, **BaBm**, was identified within the site. This community extends over 4.75 ha. The remainder of the site (3.34 ha) was highly disturbed and was dominated by non-native vegetation with occasional 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 1** and **Plate 2**. The location of each plant community is shown in **Figure 3**. A matrix of species recorded within each plant community is provided in **Appendix E** and raw sample data in **Appendix F**.

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

Plant community	Description	Area (ha)
BaBm	Low woodland of occasional <i>Eucalyptus marginata</i> trees over scattered <i>Allocasuarina fraseriana</i> over <i>Banksia attenuata</i> and <i>Banksia menziesii</i> over open shrubland of <i>Jacksonia sternbergiana</i> , <i>Macrozamia riedlei</i> and <i>Xanthorrhoea preissii</i> over low shrubland of <i>Hibbertia hypericoides</i> , <i>Stirlingia latifolia</i> and open sedgeland of <i>Mesomelaena pseudostygia</i> and occasional introduced pasture weeds (Plate 1).	4.75
Predominantly non-native	Heavily disturbed areas comprising scattered native and planted trees and shrubs over closed grassland of scattered introduced pasture weeds such as <i>Ehrharta calycina</i> and <i>Bromus diandrus</i> (Plate 2).	3.34



Plate 1: Plant community **BaBm** in 'excellent' condition in Lot 76 (Q6).

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Plate 2: Plant community **BaBm** in 'very good' condition in Lot 107 (Q2).



Plate 3: Plant community **BaBm** in 'good' condition through the centre of Lot 107.

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Plate 4: Plant community **BaBm** in 'degraded' condition along the western edge of Lot 76.



Plate 5: **Predominantly non-native** vegetation in 'completely degraded' condition in Lot 76.

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4.3.3 Vegetation condition

The vegetation within the south-eastern corner of Lot 107 is ‘completely degraded’ and consists of introduced pasture grasses (**Plate 5**).

In contrast, the northern portions of both Lots contains native vegetation in ‘excellent’ and ‘very good’ condition (**Plate 1** and **Plate 2**). In Lot 76 the majority of the native vegetation is in ‘excellent’ condition, with some edges in ‘very good’ condition where weed cover is higher. In Lot 107 the ‘very good’ condition vegetation continues along the western boundary of the lot and an area of ‘excellent’ condition vegetation exists in the north-western corner. The vegetation in ‘excellent’ and ‘very good’ condition in the site contains high native species biodiversity, vegetation structure and low disturbance. Some weed species are present, though cover is low and dominated by less aggressive species.

An area of native vegetation in ‘good’ condition exists in the centre of Lot 107 (**Plate 3**). This vegetation has been subject to historical disturbance which has resulted in a more open structure with areas of bare ground. Native species diversity is low to moderate and signs of regeneration are present. Introduced pasture grasses are the dominant weeds in this area. A small linear strip of vegetation in ‘degraded’ condition is present on the boundaries of both lots (**Plate 4**). These areas along the fencelines have low native species diversity and high cover of introduced pasture grasses and introduced *Pelargonium capitatum* (rose pelargonium).

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

Table 6: Extent of vegetation condition categories within the site

Condition category (Keighery 1994)	Size (ha)
Pristine	0
Excellent	1.73
Very good	1.89
Good	0.97
Degraded	0.16
Completely degraded	3.34

4.3.4 Floristic community types

Plant community **BaBm** was determined to represent FCT 28 ‘Spearwood *Banksia attenuata* or *Banksia attenuata* – *Eucalyptus* woodlands’. This FCT is listed as ‘well reserved’ and ‘low risk’ by Gibson *et al.* (1994). All six quadrats grouped with FCT 28 in the cluster analysis. Quadrats 2, 3, 4 and 5 grouped with one Gibson *et al.* (1994) site (KING-2) representing FCT 28 with 48 to 59% similarity (**Table 7**). Quadrat 1 clustered with Gibson *et al.* (1994) sites NEER-3 and NEER-4 with 50% similarity. Quadrat 6 clustered with Gibson *et al.* (1994) site TRIG-4 with 42% similarity. All of these Gibson *et al.* (1994) sites represent occurrences of FCT 28. The relevant portions of the cluster dendrograms are provided in **Appendix G**.

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Table 7: Plant community and likely FCT represented within the site for each sample.

Plant Community	Quadrat	Most similar Gibson <i>et al.</i> (1994) sites	Similarity	Floristic community type (FCT)	Reservation and conservation status
BaBm	1	NEER-4 (FCT 28)	50%	FCT 28: Spearwood <i>Banksia attenuata</i> or <i>Banksia attenuata</i> – <i>Eucalyptus</i> woodlands	Well reserved and low risk (Gibson <i>et al.</i> 1994).
		NEER-3 (FCT 28)	50%		
	2	KING-2 (FCT 28)	48 %		
	3	KING-2 (FCT 28)	49%		
	4	KING-2 (FCT 28)	56%		
	5	KING-2 (FCT 28)	59%		
	6	TRIG-4 (FCT 28)	42%		

4.3.5 Threatened and priority ecological communities

The structure and composition of plant community **BaBm** indicates that it represents the ‘banksia woodlands of the Swan Coastal Plain’ TEC. This TEC (herein referred to as the banksia woodland TEC) is listed as ‘endangered’ under the EPBC Act. Whether a patch of vegetation is considered to represent the banksia woodland TEC depends on a number of diagnostic criteria including geographic location, soils, landform, structure, composition, condition and patch size (DoEE 2016). As outlined in **Table 8**, the majority of **BaBm** community in the site satisfies these criteria. In addition, FCT 28 is one of several FCTs directly associated with the banksia woodland TEC. All remaining areas of **BaBm** represent the banksia woodland TEC, with a total of 4.75 ha in parts of Lots 76 and 107, as outlined in **Table 8**.

The plant community **BaBm** also represents the ‘Banksia dominated woodlands of the Swan Coastal Plain IBRA region’ PEC (P3). All areas of **BaBm** community in good or better condition represent the PEC, totaling 4.58 ha.

No other TECs or PECs occur within the site.

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Table 8: Criteria for determining presence of *Banksia* Woodlands of the Swan Coastal Plain TEC adapted from (TSSC 2016)

Criteria	Requirements for meeting criteria	Site implications
1. Must meet key diagnostic characteristics	<p>A variety of factors relating to:</p> <ul style="list-style-type: none"> • Location • Soils • Structure • Composition 	<ul style="list-style-type: none"> • Site meets location and soils criteria. • The BaBm vegetation includes the key diagnostic feature of a tree layer of <i>Banksia attenuata</i> and <i>Banksia menziesii</i>. • The BaBm vegetation within site also meets structure and composition criterion. FCT 28 is identified as one of the FCTs comprising the banksia woodland TEC.
2. Must meet condition thresholds	<ul style="list-style-type: none"> • A patch should at least meet the 'good' condition category (see Table 1) 	<ul style="list-style-type: none"> • The BaBm vegetation is present in 'excellent', 'very good', 'good' and 'degraded' condition, which meets this criterion. The conservation advice indicates that a single patch may include areas of variable condition, meaning parts of the BaBm vegetation in 'degraded' condition may still be considered the TEC.
3. Must meet minimum patch size	<p>Minimum size of patch:</p> <ul style="list-style-type: none"> • Pristine=no minimum size • Excellent=0.5 ha • Very Good=1 ha • Good=2 ha 	<ul style="list-style-type: none"> • The BaBm vegetation in 'very good' condition (being the 'representative' condition category of the patch) comprises 1.87 ha and does independently meet this criterion. • The adjoining BaBm vegetation in 'excellent', 'good', and 'degraded' condition would be viewed as contiguous and part of the same patch. Therefore, the mapped 4.75 ha of BaBm vegetation within the site does comprise a patch of the TEC.
4. Must incorporate surrounding context	<ul style="list-style-type: none"> • Breaks (e.g. tracks) < 30 m do not separate vegetation into separate patches • Buffer zones may apply (20-50 m recommended from patch edge) • The site should be thoroughly sampled (2 surveys in same spring). • Survey timing should be appropriate. • Surrounding environment should be considered (e.g. connectivity, conservation values, fauna habitat) 	<ul style="list-style-type: none"> • Small scale tracks (<30 m wide) exist within the patch. • Land surrounding the patch is a combination of market garden, residential development, native vegetation and planted vegetation on the road verges. • This survey was conducted in August 2020 with spring and targeted searches conducted in September 2020. • Intact native vegetation that is likely to meet criteria as banksia woodland exists directly to the north and south of the site. All of these areas are within 30 m of the BaBm vegetation within the site and thus would also be considered as contiguous vegetation.

At the State level, there is no conservation advice for the 'banksia dominated woodlands of the Swan Coastal Plain IBRA region' PEC (P3) so it is unclear whether a condition threshold should be applied when identifying its presence. The DBCA has historically applied good condition as a threshold for the identification of PEC vegetation. Using good condition as a basis for identification, 4.59 ha of the **BaBm** vegetation is considered to represent the State 'banksia dominated woodlands of the Swan Coastal Plain IBRA region' PEC. The area of the banksia woodland PEC within the site is outlined in **Figure 5**.

No other TECs or PECs occur within the site.

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4.3.6 Locally and regionally significant vegetation

A small number of mature eucalypt trees (diameter at breast height larger than 500 mm) including *Corymbia calophylla* (marri) and *Eucalyptus marginata* (jarrah) are present in the site. Due to their size these trees have the potential to provide foraging, roosting and nesting habitat for black cockatoos (especially Carnaby's black cockatoo), along with other ecological services.

4.4 Species richness and sampling adequacy

A total of 90 species were recorded from six samples. A species accumulation curve derived from sample data is presented in **Plate 6**. After six 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 150 (Chao2) and 165 (Jackknife1). Based on the trend of the species accumulation curve approximately 50 samples would be required to capture that many species. Including the 43 additional species recorded opportunistically, a total of 133 species was recorded in the site. This indicates that between 87 and 96% of the estimated 150-165 species in the site were recorded. Considering the time spent sampling and searching the vegetation in the main flowering season, the survey effort was considered to be adequate to prepare a representative species inventory.

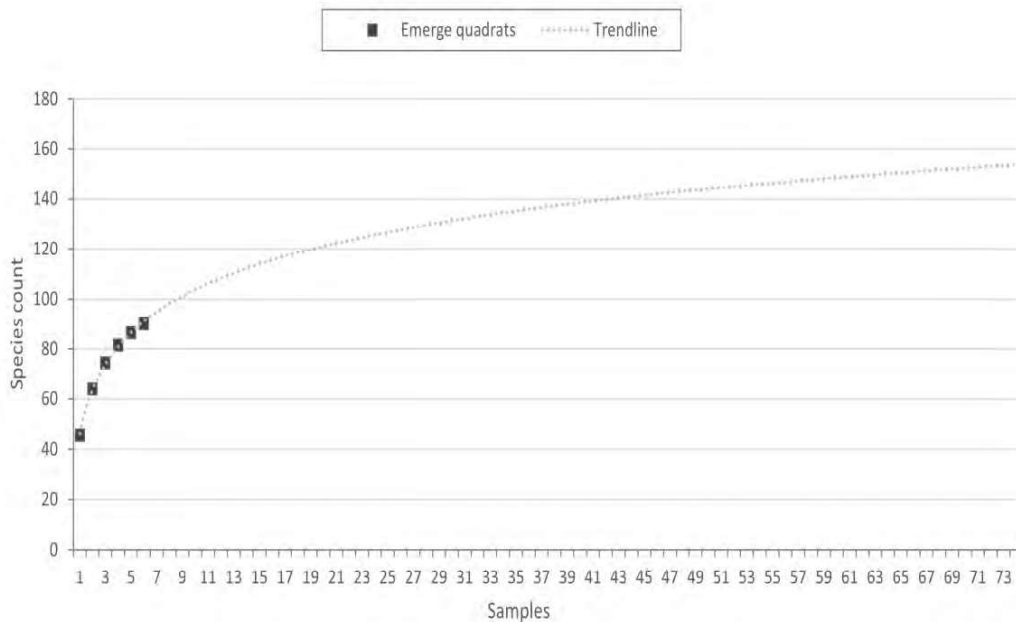


Plate 6: Species accumulation curve derived from sample data ($y = 24.979\ln(x) + 46.329$
 $R^2 = 0.998$)

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5 Discussion

Portions of the site have been cleared and are now dominated by non-native vegetation. The areas of native vegetation that do remain comprise a biodiverse and relatively intact patch of an upland banksia woodland community. Given the spring survey timing and intactness of the native vegetation where it remains, the survey is considered to provide an accurate representation of the flora and vegetation present.

No threatened or priority flora species were recorded. The absence of the larger perennial species such as *Dodonaea hackettiana* and *Jacksonia sericea* was relatively easy to confirm. However, species such as *Caladenia huegelii*, *Drakaea elastica* and *D. micrantha* can be cryptic and more difficult to detect. After considerable search effort within the flowering period, these species were not identified in the predominantly dry woodland type vegetation at the site. As many other orchids, geophytes and annuals were recorded it is considered that these threatened and priority flora species are unlikely to occur within the site.

Assigning condition using a categorical scale is always most difficult when vegetation qualities are close to the boundary between two categories. Categorical schemes may also invariably yield different results when applied by different assessors, because of differences in skill levels or personal bias. The method applied to assess vegetation condition was robust, as it combined the standard qualitative, categorical scheme of Keighery (1994), with the additional indicators for diversity and weed cover outlined in DoEE (2016).

The results of the FCT cluster analysis were conclusive, with all samples within plant community **BaBm** showing high similarity to Gibson *et al.* (1994) sites comprising FCT 28.

Due to the presence of *Banksia attenuata* and *B. menziesii* on deep sands, the **BaBm** community is considered to represent the State listed PEC 'banksia dominated woodlands of the Swan Coastal Plain IBRA region'. Conservation advice for PECs is less specific, but it is likely that only the area of **BaBm** vegetation in good or better condition would be considered to represent this PEC.

With regard to the Commonwealth banksia woodlands TEC, the **BaBm** vegetation includes the key diagnostic feature of a tree layer of *Banksia attenuata* and *B. menziesii*. The **BaBm** vegetation was also conclusively associated with 'FCT 28 - Spearwood *Banksia attenuata* or *Banksia attenuata* – *Eucalyptus woodlands*' which is one of three FCTs on Spearwood and Quindalup soil associations (super group 4) identified in banksia woodland TEC conservation advice (DoEE 2016). However, to be considered the banksia woodland TEC a patch of banksia vegetation must also meet thresholds for condition and minimum patch size (refer to **Table 1**). The conservation advice states that a patch may include areas of variable condition and that the condition that is most representative should be used to assign overall condition of a patch.

For the **BaBm** community, 1.73 ha was mapped as 'excellent' condition, 1.89 ha was mapped as 'very good' and 0.97 ha was mapped as good, while 0.16 ha was mapped as 'degraded'. As there are no breaks of 30 m or more to separate the areas of varying condition, these areas were understood as a single patch. Given the very good condition vegetation occupied the largest area, the whole patch was assessed as being in very good condition. The DoEE (2016) conservation advice states that a patch of banksia woodland vegetation in very good condition must be greater than 1 ha in size for it

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to be considered the TEC. Based on this, the **BaBm** vegetation within the site does meet the minimum patch size threshold.

Vegetation likely to comprise 'banksia woodland' is present in close proximity to the site, particularly to the north and south of the site (including much of the vegetation within the Harry Waring Marsupial Reserve). Thus, the **BaBm** vegetation comprises part of a larger patch of the banksia woodland TEC that extends outside of the site.

Plant communities **BaBm** contain a number of foraging species for black cockatoos (especially Carnaby's black cockatoo). In addition, a small number of mature *Corymbia ficifolia* and *Eucalyptus marginata* trees with a diameter at breast height larger than 500 mm are present within the site. Due to their size these trees have the potential to provide some foraging, roosting and nesting values for black cockatoos, along with other ecological services.

Spring Flora and Vegetation Assessment

Lots 76 and 107 Wattleup Road, Hammond Park



6 Conclusions

Predominantly non-native vegetation is present across 3.34 hectares (ha) of the site including the southern portions of both lots. Remnant native vegetation is present across 4.75 ha of the site within Lots 76 and 107. No threatened or priority flora species were recorded or are considered likely to occur within the site due to lack of suitable habitat.

The remnant native vegetation within the site was mapped as a single plant community (**BaBm**), in degraded to excellent condition, which aligns closely with floristic community type (FCT) '28 - Spearwood *Banksia attenuata* or *Banksia attenuata* – *Eucalyptus* woodlands'. The **BaBm** vegetation was found to represent the EPBC Act listed banksia woodland TEC. Approximately 4.75 ha of the banksia woodland TEC is present within the site. The **BaBm** plant community also represents the similar state listed PEC 'Banksia dominated woodlands of the Swan Coastal Plain IBRA region'. Approximately 4.58 ha of this PEC is present within the site.

Native vegetation within the site provides a foraging resource for threatened species of black cockatoos.

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Lots 76 and 107 Wattleup Road, Hammond Park



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Figures



Figure 1: Site Location

Figure 2: Environmental Features

Figure 3: Plant Communities

Figure 4: Vegetation Condition

Figure 5: Conservation Significant Values

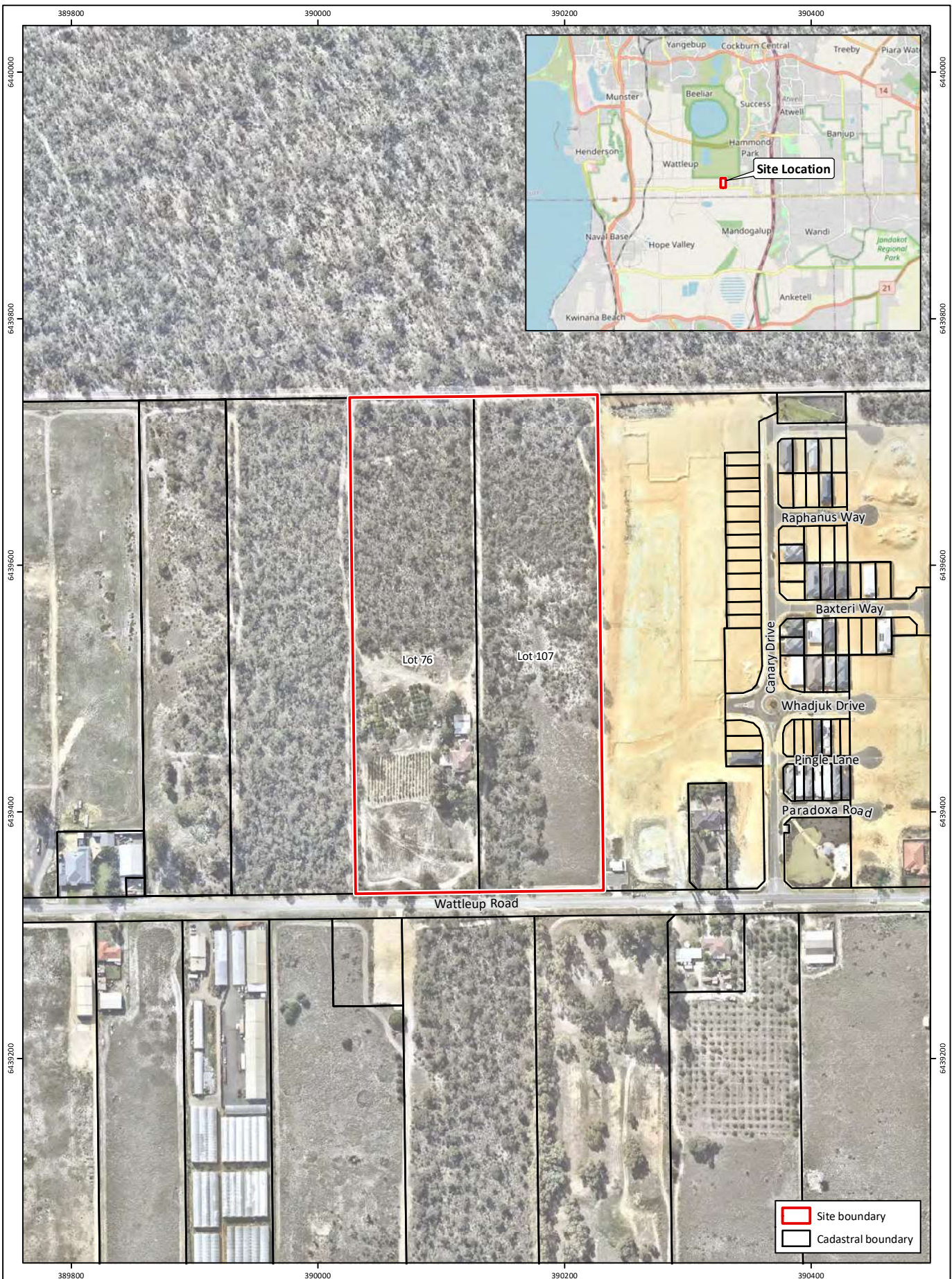


Figure 1: Site Location

Project: Detailed Flora and Vegetation Assessment
 Lots 76 and 107 Wattleup Road
Client: Qube Hammond Link Pty Ltd

Plan Number:
 EP20-085(01)-F01
Drawn: AFF
Date: 2/09/2020
Checked: SKP
Approved: TAA
Date: 18/11/2020



0 50 100
 Metres
 Scale: 1:4,000@A4
 GDA 1994 MGA Zone 50



While Emmerge Associates makes every attempt to ensure the accuracy and completeness of data, Emmerge accepts no responsibility for externally sourced data used.
 ©Landgate (2020). Nearmap Imagery date: 12/05/2020

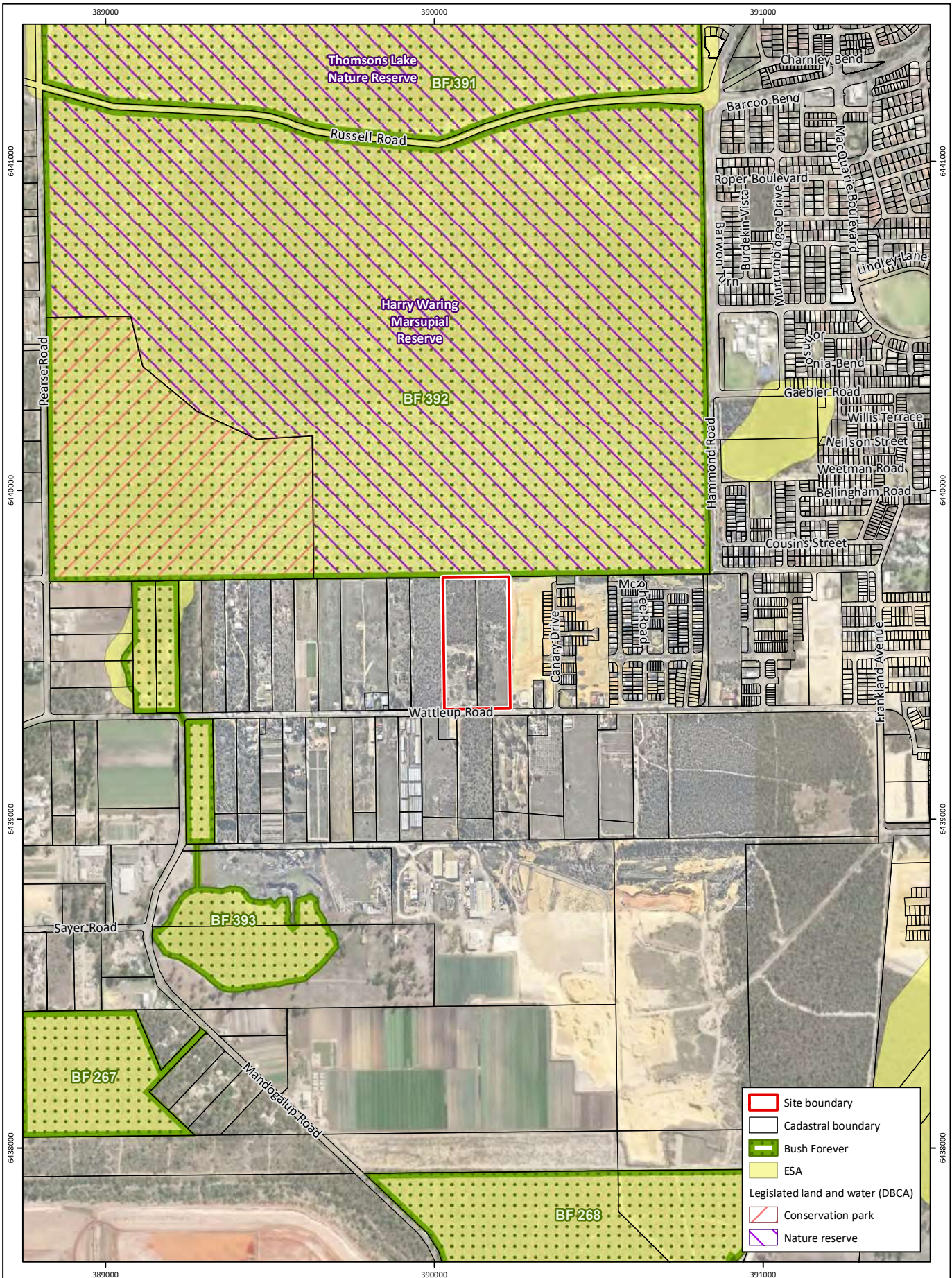


Figure 2: Environmental Features

Project: Detailed Flora and Vegetation Assessment
 Lots 76 and 107 Wattleup Road

Client: Qube Hammond Link Pty Ltd

Plan Number: EP20-085(01)-F02
 Drawn: AFF
 Date: 2/09/2020
 Checked: SKP
 Approved: TAA
 Date: 18/11/2020

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 Metres

Scale: 1:15,000@A4
 GDA 1994 MGA Zone 50



While Emerge Associates makes every attempt to ensure the accuracy and completeness of data, Emerge accepts no responsibility for externally sourced data used.
 ©Landgate (2020). Nearmap Imagery date: 12/05/2020

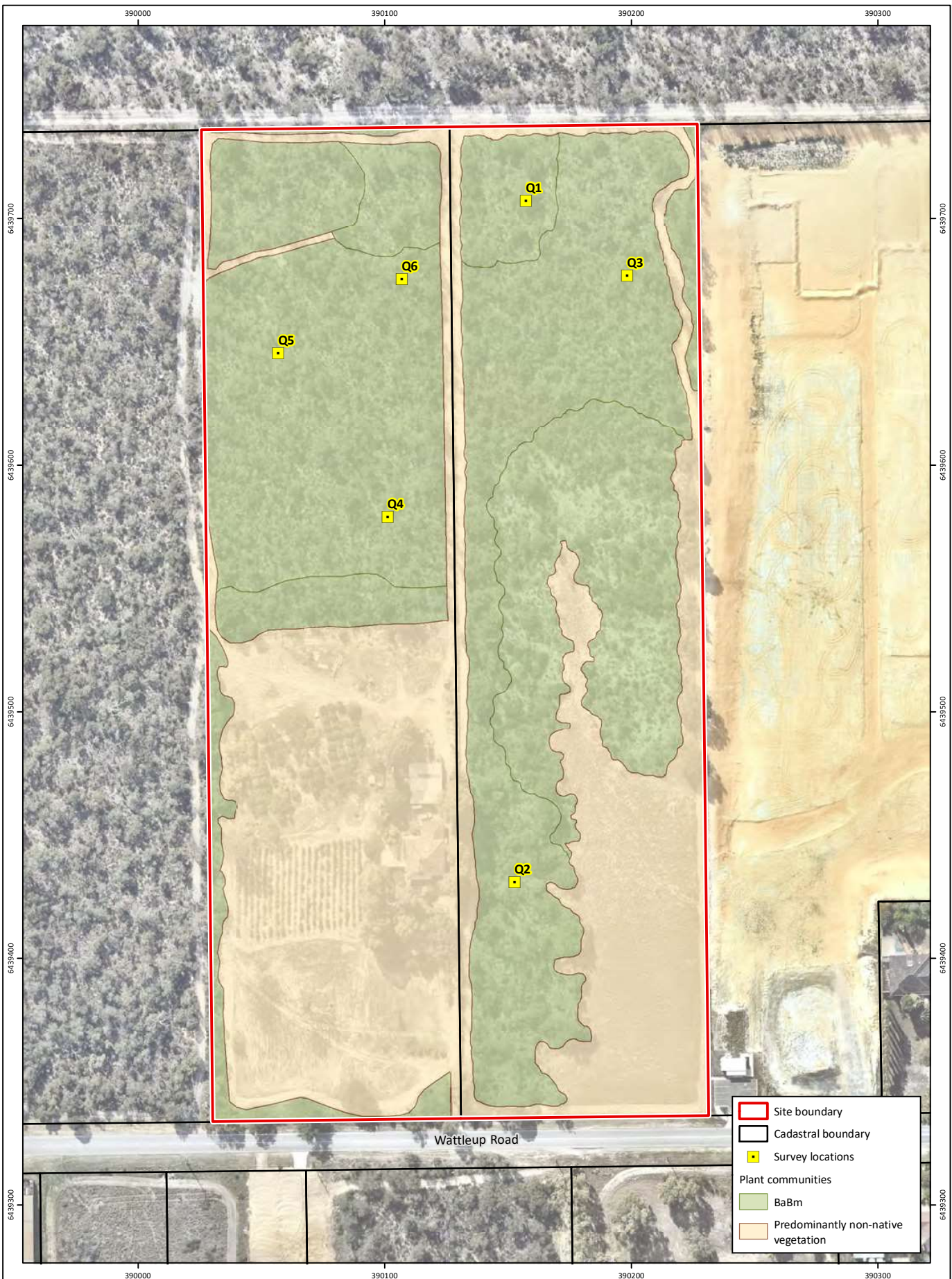


Figure 3: Plant Communities

Project: Detailed Flora and Vegetation Assessment
 Lots 76 and 107 Wattleup Road
Client: Qube Hammond Link Pty Ltd

Plan Number:
 EP20-085(01)-F03
Drawn: AFF
Date: 2/09/2020
Checked: SKP
Approved: TAA
Date: 18/11/2020

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 Metres
 Scale: 1:2,000@A4
 GDA 1994 MGA Zone 50





Figure 4: Vegetation Condition

Project: Detailed Flora and Vegetation Assessment
 Lots 76 and 107 Wattleup Road
Client: Qube Hammond Link Pty Ltd

Plan Number:
 EP20-085(01)-F04
 Drawn: AFF
 Date: 2/09/2020
 Checked: SKP
 Approved: TAA
 Date: 18/11/2020

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 Metres
 Scale: 1:2,000@A4
 GDA 1994 MGA Zone 50





Figure 5: Conservation Significant Values

Project: Detailed Flora and Vegetation Assessment
 Lots 76 and 107 Wattleup Road

Client: Qube Hammond Link Pty Ltd

Plan Number: EP20-085(01)-F05
 Drawn: AFF
 Date: 2/09/2020
 Checked: SKP
 Approved: TAA
 Date: 18/11/2020

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 Metres
 Scale: 1:4,000@A4
 GDA 1994 MGA Zone 50



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Appendix A

Additional Information



Conservation Significant Flora and Vegetation

Threatened and priority flora

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

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

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

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

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

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

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

Additional Background Information



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

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 ⁰	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 ⁰	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 ⁰	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 ⁰	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, ⁰on 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.

Additional Background Information



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

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

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

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

An ecological community that is under consideration for listing as a TEC, but does not yet meet survey criteria or has not been adequately defined may be listed as a 'priority ecological community' (PEC). PECs are categorised as priority category 1, 2 or 3 as described in **Table 3**. Ecological communities that are adequately known and are rare but not threatened, or meet criteria for 'near threatened', or that have been recently removed from the threatened list, are placed in 'priority 4'. These ecological communities require regular monitoring. Conservation dependent ecological communities are placed in 'priority 5' (DEC 2009). Listed PECs are published by DBCA (DBCA 2017b).

Additional Background Information



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

Priority code	Description
P1	<p>Priority One: Poorly known ecological communities</p> <p>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.</p>
P2	<p>Priority Two: Poorly known ecological communities</p> <p>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.</p>
P3	<p>Priority Three: Poorly known ecological communities</p> <p>(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:</p> <p>(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;</p> <p>(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.</p> <p>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.</p>
P4	<p>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.</p> <p>(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.</p> <p>(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.</p> <p>(iii) Ecological communities that have been removed from the list of threatened communities during the past five years.</p>
P5	<p>Priority Five: Conservation Dependent ecological communities</p> <p>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.</p>

Additional Background Information



Conservation Significant Fauna

Fauna species considered rare or under threat warrant special protection under Commonwealth and/or State legislation. At the Commonwealth level, fauna species can be listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Migratory birds may be recognised under international treaties including:

- *Japan Australia Migratory Bird Agreement 1981* (JAMBA)
- *China Australia Migratory Bird Agreement 1998* (CAMBA)
- *Republic of Korea-Australia Migratory Bird Agreement 2007* (ROKAMBA)
- *Bonn Convention 1979* (The Convention on the Conservation of Migratory Species of Wild Animals).

All migratory bird species listed in the annexes to these bilateral agreements are protected in Australia as ‘matters of national environmental significance’ (MNES) under the EPBC Act. Fauna species considered ‘threatened’ pursuant to Schedule 1 of the EPBC Act are assigned categories as outlined in **Table 4**.

Table 4: Definitions of conservation significant fauna species pursuant to the EPBC Act

Conservation Code	Category
X	Threatened Fauna –Extinct There is no reasonable doubt that the last member of the species has died.
EW [#]	Threatened Fauna –Extinct in the Wild Taxa which are known only to survive in cultivation, captivity or as a naturalised population outside its past range, or taxa which have not been recorded in its known and/or expected habitat despite appropriate exhaustive surveys.
CR [#]	Threatened Fauna – Critically Endangered Taxa which are considered to be facing an extremely high risk of extinction in the wild.
EN [#]	Threatened Fauna – Endangered Taxa which are considered to be facing a very high risk of extinction in the wild.
VU [#]	Threatened Fauna – Vulnerable Taxa which are considered to be facing a high risk of extinction in the wild.
Migratory [#]	Migratory Fauna All migratory species that are: (i) native species; and (ii) from time to time included in the appendices to the Bonn Convention; and (b) all migratory species from time to time included in annexes established under JAMBA, CAMBA and ROKAMBA; and All native species from time to time identified in a list established under, or an instrument made under, an international agreement approved by the Minister.
Ma	Marine Fauna Species in the list established under s248 of the EPBC Act

[#]matters of national environmental significance (MNES) under the EPBC Act

Additional Background Information



In Western Australia, fauna taxa may be classed as ‘threatened’, ‘extinct’, or ‘specially protected’ under the *Biodiversity Conservation Act 2016* (BC Act), which is enforced by Department of Biodiversity Conservation and Attractions (DBCA) (DBCA 2019). The definitions of these categories are provided in **Table 5**.

Table 5: Definitions of specially protected fauna schedules under the BC Act (DBCA 2019)

Category	Conservation Code	Definition
Threatened	CR	Critically endangered Threatened species considered to be facing an extremely high risk of extinction in the wild in the immediate future.
	EN	Endangered Threatened species considered to be facing a very high risk of extinction in the wild in the near future.
	VU	Vulnerable Threatened species considered to be facing a high risk of extinction in the wild in the medium-term future.
Extinct	EX	Extinct Species where there is no reasonable doubt that the last member of the species has died.
	EW	Extinct in the wild Species that is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; and it has not been recorded in its known habitat or expected habitat, at appropriate seasons, anywhere in its past range, despite surveys over a time frame appropriate to its life cycle and form. Note that no species are currently listed as EW.
Specially protected	MI	Migratory species Fauna that periodically or occasionally visit Australia or an external Territory or the exclusive economic zone; or the species is subject of an international agreement that relates to the protection of migratory species and that binds the Commonwealth Includes birds that subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and The Republic of Korea (ROKAMBA), and the Bonn Convention, relating to the protection of migratory birds.
	CD	Species of special conservation interest (conservation dependent fauna) Fauna of special conservation need being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened.
	OS	Other specially protected species Fauna otherwise in need of special protection to ensure their conservation.

Additional Background Information



Fauna species that may be threatened or near threatened but lack sufficient information to be legislatively listed may be added to the DBCA's *Priority Fauna List* (DBCA 2018c). Species listed under priorities 1-3 comprise possible threatened species that do not meet survey criteria or are otherwise data deficient. Species listed under priority 4 are those that are adequately known, are rare but not threatened, or meet criteria for near threatened, or that have been recently removed from the threatened species or other specially protected fauna lists for other than taxonomic reasons (DBCA 2019).

Priority fauna species are considered during State approval processes. Priority fauna categories and definitions are listed in **Table 6** (DBCA 2019).

Table 6: Definitions of priority fauna categories on DBCA's Priority Fauna List (DBCA 2019)

Conservation Code	Category
P1	<p>Priority 1 – Poorly known</p> <p>Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.</p>
P2	<p>Priority 2 – Poorly known</p> <p>Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.</p>
P3	<p>Priority 2 – Poorly known</p> <p>Species that are known from several locations and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.</p>
P4	<p>(a) Priority 4 – Rare species</p> <p>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.</p> <p>(b) Priority 4 – Near Threatened</p> <p>Species that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable.</p> <p>(c) Priority 4 – Other</p> <p>Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.</p>

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 7**. Species assigned to the ‘declared pest, prohibited - s12’ category are placed in one of three control categories, as described in **Table 8**.

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 9**.

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

Table 7: 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 8: 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

Additional Background Information



Category	Description
	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 9: 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.

Additional Background Information



Wetland Habitat

Geomorphic wetland types

On the Swan Coastal Plain DBCA (2017a) have used the geomorphic wetland classification system developed by Semeniuk (1987) and Semeniuk and Semeniuk (1995) to classify wetlands based on the landform shape and water permanence (hydro-period) as outlined in **Table 10**.

Table 10: Geomorphic Wetlands of the Swan Coastal Plain classification categories (DBCA 2017a)

Level of inundation	Geomorphology			
	Basin	Flat	Channel	Slope
Permanently inundated	Lake	-	River	-
Seasonally inundated	Sumpland	Floodplain	Creek	-
Seasonally waterlogged	Dampland	Palusplain	-	Paluslope

Wetland management categories

DBCA maintains the *Geomorphic Wetland of the Swan Coastal Plain* dataset (DBCA 2018a), which also categorises individual wetlands into specific management categories as described in **Table 11**.

Table 11: Geomorphic Wetlands of the Swan Coastal Plain classification categories (DBCA 2017a)

Management category	Description of wetland	Management objectives
Conservation (CCW)	Support high levels of attributes	Preserve wetland attributes and functions through reservation in national parks, crown reserves and state owned land. Protection provided under environmental protection policies.
Resource enhancement (REW)	Partly modified but still supporting substantial functions and attributes	Restore wetland through maintenance and enhancement of wetland functions and attributes. Protection via crown reserves, state or local government owned land, environmental protection policies and sustainable management on private properties.
Multiple use (MUW)	Few wetland attributes but still provide important hydrological functions	Use, development and management considered in the context of water, town and environmental planning through land care.

The management categories of wetland features are determined based on hydrological, biological and human use features. The DBCA document *A methodology for the evaluation of specific wetland types on the Swan Coastal Plain, Western Australia* (DBCA 2017a) details the methodology by which wetlands on the Swan Coastal Plain are assigned management categories based on a two tiered evaluation system, with preliminary and secondary evaluation stages. The preliminary evaluation aims to identify any features of conservation significance that would immediately place the wetland within the CCW management category. Examples of these significant features include presence on significant wetland lists, presence of TECs or PECs (Priority 1 and 2), presence of threatened flora and

Additional Background Information



over 90% of vegetation in good or better condition based on the Keighery (1994) scale. If such environmental values are identified the wetland would be categorised as CCW without further evaluation.

Should the preliminary evaluation indicate that no such features occur, the secondary evaluation and site assessment are then applied. In the secondary evaluation, an appropriate management category is determined through the assessment of a range of environmental attributes, functions and values.

Wetland reclassification

DBCA have a protocol for proposing changes to the wetland boundaries and management categories of the existing geomorphic wetland dataset (DEC 2007). The procedure involves a wetland desktop evaluation and site assessment which culminates in a recommended management category. Relevant information should be obtained in the optimal season for vegetation condition and water levels, which is usually spring (DEC 2007). In the case of larger wetlands that have undergone a degree of disturbance, a separate management category may be assigned to parts of the wetland in order to reflect the current values.

References

General references

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

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				
<i>Acacia benthamii</i>	P2	-	P	Sand, typically on limestone breakaways	Aug - Sept	Possible
<i>Acacia lasiocarpa</i> var. <i>bracteolata</i> long peduncle variant (G.J. Keighery 5026)	P1	-	P	Grey or black sand over clay in winter wet areas.	May-Aug	Unlikely
<i>Andersonia gracilis</i>	VU	E	P	Seasonally damp, black sandy clay flats near or on the margins of swamps.	Sep-Nov	Unlikely
<i>Aponogeton hexatepalus</i>	P4	-	P	Mud. Freshwater: ponds, rivers, claypans.	Jul-Oct	Unlikely
<i>Austrostipa jacobiana</i>	CR	CR	P	Grey sandy clay.	Nov-Jan	Unlikely
<i>Austrostipa mundula</i>	P3	-	P	Grey sand over limestone.	Sept-Nov	Possible
<i>Babingtonia urbana</i>	P3	-	P	Grey sand, lateritic gravel.	Jan-Mar	Possible
<i>Byblis gigantea</i>	P3	-	P	Sandy-peat swamps. Seasonally wet areas.	Sep-Jan	Unlikely
<i>Caladenia huegelii</i>	CR	E	PG	Well-drained, deep sandy soils in lush undergrowth in a variety of moisture levels.	Sep-early Nov	Possible
<i>Cyathochaeta teretifolia</i>	P3	-	P	Grey sand, sandy clay in swamps and creek edges.	Oct-Jan	Unlikely
<i>Dampiera triloba</i>	P3	-	P	Damp peat/loam soil.	Aug-Dec	Unlikely
<i>Diuris drummondii</i>	VU	V	PG	In low-lying depressions in peaty and sandy clay swamps.	Nov-Jan	Unlikely
<i>Diuris micrantha</i>	VU	V	PG	Dark grey-black sandy clay-loam in winter wet depressions or swamps. Often in shallow standing water.	Aug/Sep-early Oct	Unlikely
<i>Diuris purdiei</i>	EN	E	PG	Sand to sandy clay soils in areas subject to winter inundation.	late September to mid-October, but only after a summer or early autumn fire (Brown et al., 1998)	Unlikely
<i>Dodonaea hackettiana</i>	P4	-	P	Sand, outcropping limestone.	Jul-Oct	Possible

	WA	EPBC Act				
<i>Drakaea elastica</i>	CR	E	PG	Bare patches of sand within otherwise dense vegetation in low-lying areas alongside winter-wet swamps.	late Sep-Oct/Nov, survey Jul-Aug	Unlikely
<i>Drakaea micrantha</i>	EN	V	PG	Open sandy patches often adjacent to winter-wet swamps.	Sept- early Oct	Unlikely
<i>Drosera occidentalis</i>	P4	-	P	Flat, brown/white/yellow moist sand/clay/peat, often near swamps.	Oct-Dec/Jan	Unlikely
<i>Eleocharis keigheryi</i>	VU	V	P	Clay or sandy loam in freshwater creeks and transient waterbodies such as seasonally wet clay pans.	Aug-Dec	Unlikely
<i>Eremophila glabra subsp. chlorella</i>	EN	-	P	Sandy clay. Winter-wet depressions.	Jul-Nov	Unlikely
<i>Grevillea olivacea</i>	P4	0	P	White or grey sand. Coastal dunes, limestone rocks	Jun-Sep	Possible
<i>Hibbertia spicata subsp. leptotheca</i>	P3	-	P	Sand. Near-coastal limestone ridges, outcrops & cliffs	Jul-Oct	Possible
<i>Hydrocotyle striata</i>	P1	-	A	Sand and clay in springs and creeklines.	Nov	Unlikely
<i>Jacksonia gracillima</i>	P3	-	P	Sand, often adjacent to winter wet areas	Sep-Dec	Possible
<i>Jacksonia sericea</i>	P4	-	P	Calcareous and sandy soils on Swan Coastal Plain	Dec-Feb	Possible
<i>Kennedia becxiana</i>	P4	-	P	Sand or loam on granite hills and outcrops.	Sep-Dec	Unlikely
<i>Lachnagrostis nesomytica subsp. paralia</i>	P1	-	A/P	Calcareous sands. Coastal dunes and swales.	Unknown	Possible
<i>Lepidium puberulum</i>	P4	-	A	Sandy soils.	Jul - Aug or Oct - Nov	Possible
<i>Lepidosperma rostratum</i>	EN	E	P	Peaty sand and clay amongst low heath, in winter-wet swamps.	May-Jun (survey late Jun-Aug)	Unlikely
<i>Levenhookia preissii</i>	P1	-	A	Grey or black, peaty sand. Swamps	Sep-Dec/Jan	Unlikely
<i>Meionectes tenuifolia</i>	P3	-	P	Clay loam in seasonally wet areas.	Oct-Dec	Unlikely
<i>Microtis quadrata</i>	P4	-	PG	Sand, loam or peat in winter wet areas	Oct-Dec	Unlikely
<i>Ornduffia submersa</i>	P4	-	A	Sandy clay in inundated wetland/creek.	Aug-Nov	Unlikely

	WA	EPBC Act				
<i>Phlebocarya pilosissima</i> subsp. <i>pilosissima</i>	P3	-	P	White or grey sand, lateritic gravel.	Aug-Oct	Unlikely
<i>Pimelea calcicola</i>	P3	-	P	sand, limestone, coastal ridges	Sep-Nov	Possible
<i>Pithocarpa corymbulosa</i>	P3	-	P	Gravelly or sandy loam, amongst granite outcrops.	Jan-Apr	Unlikely
<i>Poranthera moorokatta</i>	P2	-	A	Sandy or clay soils. Dampland or low sandy dunes.	Oct or Feb	Unlikely
<i>Schoenus benthamii</i>	P3	-	P	White, grey sands, sandy clay in winter wet flats and swamps	Oct-Nov	Unlikely
<i>Schoenus capillifolius</i>	P3	-	A	Brown mud in claypans	Oct-Nov	Unlikely
<i>Schoenus pennisetis</i>	P3	-	A	Grey or peaty sand in swamps and winter-wet depressions.	Aug-Sep	Unlikely
<i>Stylidium aceratum</i>	P3	-	A	Sandy soils in swamp heathland.	Oct-Nov	Unlikely
<i>Stylidium ireneae</i>	P4	-	P	Sandy loam in valleys near creeklines.	Oct-Dec	Unlikely
<i>Stylidium longitubum</i>	P4	-	A	Seasonal wetlands.	Oct-Dec	Unlikely
<i>Stylidium paludicola</i>	P3	-	P	Peaty sand over clay. Winter wet habitats. Marri and Melaleuca woodland, Melaleuca shrubland	Oct-Dec	Unlikely
<i>Stylidium striatum</i>	P4	-	P	Brown clay over laterite on hill slopes.	Oct-Nov	Unlikely
<i>Styphelia filifolia</i>	P3	-	P	Brown over pale yellow sand.	Feb-Apr	Possible
<i>Synaphea</i> sp. Fairbridge Farm (D. Papenfus 696)	CR	CR	P	Low woodland on grey, clayey sand with lateritic pebbles (Pinjarra Plain) near winter wet	Sep-Nov	Unlikely
<i>Synaphea</i> sp. Serpentine (G.R. Brand 103)	CR	CR	P	Seasonally damp areas, loam - sand.	Sep-Oct	Unlikely
<i>Tetragonia</i> sp. Chandala (G.J. Keighery 17055)	P2	-	P	Black peat in swamps.	Sep-Feb	Unlikely
<i>Thelymitra dedmaniarum</i>	CR	E	PG	Red brown sandy loam with dolerite	Oct-Nov	Unlikely
<i>Thelymitra variegata</i>	P2	-	P	Sandy clay, sand, laterite.	Jun-Sep	Possible
<i>Tripterococcus</i> sp. <i>Brachylobus</i> (A.S. George 14234)	P4	-	P	Winter-wet areas on grey sand.	Oct-Feb	Unlikely
<i>Thysanotus glaucus</i>	P4	-	P	White, grey or yellow sand, sandy gravel.	Oct-Mar	Possible
<i>Verticordia lindleyi</i> subsp. <i>lindleyi</i>	P4	-	P	Sand and sandy clay in winter wet areas.	May or Nov-Jan	Unlikely

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

Appendix C

Conservation Significant Communities and Likelihood of
Occurrence Assessment



Code	Community name	TEC/PEC	Level of significance		Likelihood of occurrence
			State	EPBC Act	
Banksia WL SCP	Banksia Dominated Woodlands of the Swan Coastal Plain IBRA Region	PEC	P3		Likely
	Banksia woodlands of the Swan Coastal Plain ecological community	TEC		EN	Likely
SCP24	Northern Spearwood shrublands and woodlands	PEC	P3		Possible
Tuart woodlands	Tuart (<i>Eucalyptus gomphocephala</i>) woodlands and forests of the Swan Coastal Plain	TEC/PEC	P3	CR	Possible
SCP26a	Melaleuca huegelii - Melaleuca systema shrublands on limestone ridges (floristic community type 26a as originally described in Gibson et al. (1994))	TEC	EN		Unlikely
Mound Springs SCP	Communities of Tumulus Springs (Organic Mound Springs, Swan	TEC	CR	EN	Unlikely
SCP21c	Low lying Banksia attenuata woodlands or shrublands	TEC/PEC	P3	EN	Unlikely
SCP22	Banksia ilicifolia woodlands	TEC/PEC	P3	EN	Possible
Note: TEC=threatened ecological community, PEC=priority ecological community, CR=critically endangered, EN=endangered, VU=vulnerable, P3=priority 3					

Appendix D

Species List



Flora Species List - Lots 76 and 107 Wattleup Road, Wattleup

Note: * denotes introduced weed species, PI=planted, DP=declared pest under the BAM Act, WoNS=weed of National significance

Family	Status	Species
Aizoaceae	*	<i>Carpobrotus edulis</i>
Anacardiaceae	*, PI	<i>Schinus terebinifolius</i>
Anarthriaceae		<i>Lyginia imberbis</i>
Apiaceae		<i>Eryngium pinnatifidum subsp. pinnatifidum ms</i> <i>Xanthosia huegelii</i>
Araceae	*, DP	<i>Zantedeschia aethiopica</i>
Araliaceae		<i>Trachymene pilosa</i>
Araucariaceae	*, PI	<i>Araucaria heterophylla</i>
Areceaceae	*, PI *, PI	<i>Phoenix dactylifera</i> <i>Washingtonia sp.</i>
Asparagaceae		<i>Laxmannia squarrosa</i> <i>Lomandra caespitosa</i> <i>Lomandra nigricans</i> <i>Lomandra sericea</i> <i>Sowerbaea laxiflora</i> <i>Thysanotus manglesianus</i>
Asteraceae	* * * *	<i>Arctotheca calendula</i> <i>Hypochaeris glabra</i> <i>Hypochaeris radicata</i> <i>Lagenophora huegelii</i> <i>Monoculus monstrosus</i> <i>Podolepis gracilis</i> <i>Podotheca angustifolia</i> <i>Podotheca chrysantha</i> <i>Rhodanthe citrina</i>

Flora Species List - Lots 76 and 107 Wattleup Road, Wattleup

Note: * denotes introduced weed species, PI=planted, DP=declared pest under the BAM Act, WoNS=weed of National significance

Family	Status	Species
		<i>Senecio pinnatifolius</i> var. <i>latilobus</i>
		<i>Siloxerus humifusus</i>
	*	<i>Sonchus oleraceus</i>
	*	<i>Ursinia anthemoides</i>
Cactaceae		
	*	<i>Opuntia</i> sp.
Campanulaceae		
	*	<i>Wahlenbergia capensis</i>
Caryophyllaceae		
	*	<i>Silene gallica</i> var. <i>gallica</i>
Casuarinaceae		
		<i>Allocasuarina fraseriana</i>
Centrolepidaceae		
		<i>Centrolepis drummondiana</i>
Colchicaceae		
		<i>Burchardia congesta</i>
Crassulaceae		
		<i>Crassula colorata</i>
		<i>Crassula glomerata</i>
Cyperaceae		
		<i>Chaetospora curvifolia</i>
		<i>Isolepis marginata</i>
		<i>Lepidosperma scabrum</i>
		<i>Mesomelaena pseudostygia</i>
		<i>Schoenus clandestinus</i>
Dasygogonaceae		
		<i>Calectasia narragara</i>
		<i>Dasygogon bromeliifolius</i>
Dilleniaceae		
		<i>Hibbertia huegelii</i>
		<i>Hibbertia hypericoides</i>
Droseraceae		
		<i>Drosera erythrorhiza</i>
		<i>Drosera menziesii</i> subsp. <i>penicillaris</i>

Flora Species List - Lots 76 and 107 Wattleup Road, Wattleup

Note: * denotes introduced weed species, PI=planted, DP=declared pest under the BAM Act, WoNS=weed of National significance

Family	Status	Species
Ericaceae		<i>Conostephium pendulum</i> <i>Leucopogon conostephioides</i> <i>Styphelia pallida</i>
Fabaceae		<i>Acacia pulchella</i> <i>Acacia stenoptera</i> <i>Bossiaea eriocarpa</i> <i>Daviesia nudiflora</i> <i>Daviesia triflora</i> <i>Gastrolobium capitatum</i> <i>Gompholobium tomentosum</i> <i>Hardenbergia comptoniana</i> <i>Hovea trisperma</i> var. <i>trisperma</i> <i>Kennedia prostrata</i> <i>Jacksonia sternbergiana</i> * <i>Trifolium dubium</i>
Geraniaceae	*	<i>Pelargonium capitatum</i>
Goodeniaceae		<i>Dampiera linearis</i> <i>Scaevola canescens</i>
Haemodoraceae		<i>Anigozanthos humilis</i> subsp. <i>humilis</i> <i>Anigozanthos manglesii</i> subsp. <i>manglesii</i> <i>Conostylis aculeata</i> subsp. <i>aculeata</i> <i>Conostylis setigera</i> <i>Phlebocarya ciliata</i>
Hemerocallidaceae		<i>Dianella revoluta</i> var. <i>revoluta</i> <i>Tricoryne elatior</i>
Iridaceae	*	<i>Freesia alba</i> × <i>leichtlinii</i>
	*	<i>Gladiolus caryophyllaceus</i>
	*	<i>Patersonia occidentalis</i>
	*	<i>Romulea rosea</i>
Lauraceae	*, PI	<i>Persea americana</i>

Flora Species List - Lots 76 and 107 Wattleup Road, Wattleup

Note: * denotes introduced weed species, PI=planted, DP=declared pest under the BAM Act, WoNS=weed of National significance

Family	Status	Species
Loganiaceae		<i>Phyllangium paradoxum</i>
Macarthuriaceae		<i>Macarthuria australis</i>
Meliaceae	*, PI	<i>Melia azedarach</i>
Montiaceae		<i>Calandrinia corrigioloides</i>
Myrtaceae	*, PI	<i>Chamelaucium uncinatum</i>
	*, PI	<i>Corymbia ficifolia</i>
		<i>Eremaea asterocarpa</i> subsp. <i>asterocarpa</i>
	*, PI	<i>Eucalyptus camaldulensis</i>
		<i>Eucalyptus marginata</i>
		<i>Hypocalymma robustum</i>
		<i>Kunzea glabrescens</i>
		<i>Scholtzia involucrata</i>
Orchidaceae		<i>Caladenia flava</i> subsp. <i>flava</i>
		<i>Diuris corymbosa</i>
		<i>Diuris magnifica</i>
		<i>Eriochilus</i> sp.
		<i>Microtis media</i> subsp. <i>media</i>
		<i>Orchidaceae</i> sp.
		<i>Pterostylis vittata</i>
		<i>Pyrorchis nigricans</i>
Papaveraceae	*	<i>Fumaria capreolata</i>
Phyllanthaceae		<i>Phyllanthus calycinus</i>
		<i>Poranthera microphylla</i>
Poaceae		<i>Amphipogon turbinatus</i>
	*	<i>Avena barbata</i>
	*	<i>Briza maxima</i>
	*	<i>Briza minor</i>
	*	<i>Bromus diandrus</i>
	*	<i>Ehrharta calycina</i>

Flora Species List - Lots 76 and 107 Wattleup Road, Wattleup

Note: * denotes introduced weed species, PI=planted, DP=declared pest under the BAM Act, WoNS=weed of National significance

Family	Status	Species
	*	<i>Ehrharta longiflora</i> <i>Rytidosperma occidentale</i>
Primulaceae	*	<i>Lysimachia arvensis</i>
Proteaceae		<i>Adenanthos cygnorum</i> <i>Banksia attenuata</i> <i>Banksia menziesii</i> <i>Banksia nivea</i>
	*, PI	<i>Grevillea robusta</i> <i>Persoonia saccata</i> <i>Petrophile linearis</i> <i>Stirlingia latifolia</i>
Restionaceae		<i>Desmocladius flexuosus</i> <i>Hypolaena exsulca</i>
Rosaceae	*, PI	<i>Eriobotrya japonica</i>
Rubiaceae		<i>Opercularia vaginata</i>
Rutaceae		

Appendix E

Species x Plant Community Matrix



Flora Species x Plant Community Matrix - Lots 76 and 107 Wattleup Road, Wattleup

Species	Plant community and sample ID							Cleared Opps
	BaBm						Opps	
	Q1	Q2	Q3	Q4	Q5	Q6		
<i>Acacia pulchella</i>	X							
<i>Acacia stenoptera</i>	X	X		X	X			
<i>Adenanthos cygnorum</i>							X	X
<i>Allocasuarina fraseriana</i>	X		X	X		X		
<i>Amphipogon turbinatus</i>		X	X	X	X	X		
<i>Anigozanthus humilis</i>	X	X	X					
<i>Anigozanthus manglesii</i>							X	X
<i>Araucaria heterophylla</i>								X
<i>Arctotheca calendula</i>				X				
<i>Avena barbata</i>		X	X					
<i>Banksia attenuata</i>	X	X	X	X	X	X		
<i>Banksia menziesii</i>	X	X	X	X	X	X		
<i>Banksia nivea</i>				X				
<i>Bossiaea eriocarpa</i>	X	X						
<i>Briza maxima</i>	X	X	X	X	X	X		
<i>Briza minor</i>		X				X		
<i>Bromus diandrus</i>							X	X
<i>Burchardia congesta</i>	X	X	X	X	X	X		
<i>Caladenia flava subsp. flava</i>	X	X	X	X	X	X		
<i>Calandrinia corrigioloides</i>							X	
<i>Calectasia narragara</i>							X	
<i>Carpobrotus edulis</i>	X		X	X				
<i>Centrolepis ?drummondiana</i>	X							
<i>Chaetospora curvifolia</i>							X	
<i>Chamaescilla corymbosa</i>	X	X	X	X		X		
<i>Chamelaucium uncinatum</i>							X	X
<i>Citrus spp.</i>								X
<i>Conostephium pendulum</i>	X	X	X	X	X			
<i>Conostylis setigera</i>	X	X	X		X	X		

Flora Species x Plant Community Matrix - Lots 76 and 107 Wattleup Road, Wattleup

Species	Plant community and sample ID							Cleared Opps
	BaBm						Opps	
	Q1	Q2	Q3	Q4	Q5	Q6		
<i>Conostylis aculeata</i> subsp. <i>aculeata</i>	X	X	X	X	X	X		
<i>Corymbia ficifolia</i>							X	
<i>Crassula colorata</i>	X	X	X			X		
<i>Crassula glomerata</i>		X						
<i>Dampiera linearis</i>		X	X			X		
<i>Dasyopogon bromeliifolius</i>	X	X	X		X	X		
<i>Daviesia nudiflora</i>	X		X					
<i>Daviesia triflora</i>		X		X		X		
<i>Desmodcladus flexuosus</i>	X	X		X	X	X		
<i>Dianella revioluta</i> var. <i>revoluta</i>			X					
<i>Diuris corymbosa</i>							X	
<i>Diuris magnifica</i>	X	X	X					
<i>Drosera erythrorhiza</i>	X	X	X	X	X	X		
<i>Drosera menziesii</i> subsp. <i>penicillaris</i>		2	X		X	X		
<i>Ehrharta calycina</i>	X	X	X	X	X	X		X
<i>Ehrharta longiflora</i>		X	X					X
<i>Eremaea asterocarpa</i> subsp. <i>asterocarpa</i>							X	
<i>Eriobotrya japonica</i>								X
<i>Eriochilus</i> sp.				X				
<i>Eryngium pinnatifidum</i> subsp. <i>pinnatifidum</i> ms	X		X		X			
<i>Eucalyptus camaldulensis</i>								X
<i>Eucalyptus marginata</i>	X	X						
<i>Freesia alba</i> × <i>leichtlinii</i>					X			
<i>Fumaria capreolata</i>			X				X	X
<i>Gastrolobium capitatum</i>	X			X		X		
<i>Gladiolus caryophyllaceus</i>	X	X	X	X	X			
<i>Gompholobium tomentosum</i>	X	X	X	X	X	X		
<i>Grevillea robusta</i>								X
<i>Hardenbergia comptoniana</i>	X	X			X			

Flora Species x Plant Community Matrix - Lots 76 and 107 Wattleup Road, Wattleup

Species	Plant community and sample ID							Cleared Opps
	BaBm						Opps	
	Q1	Q2	Q3	Q4	Q5	Q6		
<i>Hibbertia huegelii</i>		X	X					
<i>Hibbertia hypericoides</i>	X	X	X	X	X	X		
<i>Hovea trisperma</i> var. <i>trisperma</i>			X	X	X	X		
<i>Hybanthus calycinus</i>	X		X					
<i>Hypocalymma robustum</i>		X	X	X	X	X		
<i>Hypochaeris glabra</i>		X		X	X	X		
<i>Hypochaeris radicata</i>	X		X					
<i>Hypolaena exsulca</i>		X						
<i>Isolepis marginata</i>	X							
<i>Jacksonia sternbergiana</i>	X		X		X	X		
<i>Kennedia prostrata</i>	X							
<i>Kunzea glabrescens</i>						X		
<i>Lagenophora huegelii</i>							X	
<i>Lantana camara</i>							X	X
<i>Laxmannia squarrosa</i>							X	
<i>Lepidosperma scabrum</i>					X	X		
<i>Leucopogon conostephioides</i>				X	X	X		
<i>Lomandra caespitosa</i>	X	X	X	X	X	X		
<i>Lomandra nigricans</i>					X	X		
<i>Lomandra sericea</i>		X		X				
<i>Lyginia imberbis</i>							X	
<i>Lysimachia arvensis</i>							X	
<i>Macarthuria australis</i>						X		
<i>Macrozamia riedlei</i>	X			X				
<i>Melia azedarach</i>								X
<i>Mesomelaena pseudostygia</i>	X	X	X	X	X	X		
<i>Microtis media</i> subsp. <i>media</i>	X		X					
<i>Monoculus monstrosus</i>							X	X
<i>Opercularia vaginata</i>	X	X						

Flora Species x Plant Community Matrix - Lots 76 and 107 Wattleup Road, Wattleup

Species	Plant community and sample ID							Cleared Opps
	BaBm						Opps	
	Q1	Q2	Q3	Q4	Q5	Q6		
<i>Opuntia sp.</i>								X
<i>Orchidaceae sp.</i>						X		
<i>Patersonia occidentalis</i>	X	X						
<i>Pelargonium capitatum</i>							X	X
<i>Persea americana</i>								X
<i>Persoonia saccata</i>							X	
<i>Petrophile linearis</i>	X	X		X		X		
<i>Philothea spicata</i>							X	
<i>Phlebocarya ciliata</i>		X						
<i>Phoenix dactylifera</i>								X
<i>Phyllangium paradoxum</i>			X					
<i>Phyllanthus calycinus</i>	X					X		
<i>Podolepis gracilis</i>	X		X	X		X		
<i>Podotheca angustifolia</i>	X		X	X	X			
<i>Podotheca chrysantha</i>	X							
<i>Poranthera microphylla</i>	X		X	X				
<i>Pterostylis vittata</i>			X	X	X	X		
<i>Pyrorchis nigricans</i>							X	
<i>Rhodanthe citrina</i>							X	
<i>Romulea rosea</i>							X	
<i>Rytidosperma occidentale</i>							X	
<i>Scaevola canescens</i>			X	X	X	X		
<i>Schinus terebinthifolius</i>							X	
<i>Schoenus clandestinus</i>	X		X	X	X	X		
<i>Scholtzia involucreta</i>	X		X		X			
<i>Senecio pinnatifolius var. latilobus</i>							X	
<i>Silene gallica var. gallica</i>							X	
<i>Siloxerus sp.</i>			X					
<i>Sonchus oleraceus</i>			X	X				

Flora Species x Plant Community Matrix - Lots 76 and 107 Wattleup Road, Wattleup

Species	Plant community and sample ID							Cleared Opps
	BaBm						Opps	
	Q1	Q2	Q3	Q4	Q5	Q6		
<i>Sowerbaea laxiflora</i>	X	X	X		X	X		
<i>Stirlingia latifolia</i>	X	X	X	X	X	X		
<i>Stylidium brunonianum subsp. brunonianum</i>	X		X	X	X	X		
<i>Stylidium piliferum</i>							X	
<i>Stylidium repens</i>	X					X		
<i>Stylidium schoenoides</i>							X	
<i>Styphelia pallida</i>	X		X			X		
<i>Thysanotus manglesianus</i>	X	X	X	X	X	X		
<i>Trachymene pilosa</i>	X	X	X	X	X	X		
<i>Tricoryne elatior</i>		X						
<i>Trifolium dubium</i>		X					X	
<i>Ursinia anthemoides</i>	X	X	X	X	X	X		
<i>Wahlenbergia capensis</i>							X	
<i>Washingtonia sp.</i>								X
<i>Xanthorrhoea brunonis</i>	X			X				
<i>Xanthorrhoea preissii</i>	X	X	X	X	X	X		
<i>Xanthosia huegelii</i>						X		
<i>Zantedeschia aethiopica</i>							X	

Appendix F

Sample Data



Sample Name: Q1

Project no.: EP20-085

Date: 18/08/2020, 22/09/2020

Author: SKP,

Status Permanent

Q1: Page 1 of 3

Quadrat and landform details

Sample type: quadrat	Size: 10 m x 10 m
NW corner easting: 390157.2007	NW corner northing: 6439707.443
Altitude (m): 36	Geographic datum/zone: GDA94/Zone 50
Soil water content: damp	Landform: mid-slope
Time since fire: > 5 yrs	Disturbance: low - weeds
Soil type/texture sand/	Bare ground (%): 10
Rocks (%) and type: No rocks	Soil colour: grey/brown
Litter: 40% (leaves,twigs,)	Vegetation condition: excellent-

Strata	Cover (%)	Height (m)
Upper:	30 to 70	<10
Mid:	30 to 70	<1
Ground layer 1:	10 to 30	>0.5
Ground layer 2:	10 to 30	<0.5

Vegetation description

low open forest *Banksia spp.*, *Eucalyptus marginata* and *Allocasuarina fraseriana* over tall shrubland *Xanthorrhoea spp.*, *Hibbertia hypericoides*, *Jacksonia sternbergiana* and *Stirlingia latifolia* over tall open sedgeland *Mesomelaena pseudostygi a* over low open herbland *Burchardia congesta* , *Lomandra caespitosa* and *Siloxerus humifusus*



Sample Name:

Q1

Project no.: EP20-085

Date: 18/08/2020, 22/09/2020

Status Permanent

Author: SKP,

Q1: Page 2 of 3

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
	<i>Acacia pulchella</i>	opp.
	<i>Acacia stenoptera</i>	opp.
	<i>Allocasuarina fraseriana</i>	1
	<i>Amphipogon turbinatus</i>	0.5
	<i>Anigozanthus humilis</i>	opp.
	<i>Banksia attenuata</i>	1
	<i>Banksia menziesii</i>	15
	<i>Bossiaea eriocarpa</i>	opp.
*	<i>Briza maxima</i>	0.5
	<i>Burchardia congesta</i>	0.5
	<i>Caladenia flava subsp. flava</i>	0.5
*	<i>Carpobrotus edulis</i>	0.5
	<i>Centrolepis drummondiana</i>	0.5
	<i>Chamaescilla corymbosa</i>	0.5
	<i>Conostephium pendulum</i>	0.5
	<i>Conostylis setigera</i>	opp.
	<i>Conostylis aculeata subsp. aculeata</i>	0.5
	<i>Crassula colorata</i>	0.5
	<i>Dasypogon bromeliifolius</i>	0.5
	<i>Daviesia nudiflora</i>	1
	<i>Desmocladus flexuosus</i>	0.5
	<i>Diuris magnifica</i>	0.5
	<i>Drosera erythrorhiza</i>	0.5
*	<i>Ehrharta calycina</i>	0.5
	<i>Eryngium pinnatifidum subsp. pinnatifidum ms</i>	0.5
	<i>Eucalyptus marginata</i>	20
	<i>Gastrolobium capitatum</i>	opp.
*	<i>Gladiolus caryophyllaceus</i>	0.5
	<i>Gompholobium tomentosum</i>	0.5
	<i>Hardenbergia comptoniana</i>	0.5
	<i>Hibbertia hypericoides</i>	10
	<i>Hybanthus calycinus</i>	opp.
*	<i>Hypochaeris radicata</i>	0.5
	<i>Isolepis marginata</i>	0.5
	<i>Jacksonia sternbergiana</i>	2
	<i>Kennedia prostrata</i>	opp.

Sample Name:

Q1

Project no.: EP20-085

Date: 18/08/2020, 22/09/2020

Status Permanent

Author: SKP,

Q1: Page 3 of 3

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
	<i>Laxmannia squarrosa</i>	0.5
	<i>Lomandra caespitosa</i>	1
	<i>Macrozamia riedlei</i>	opp.
	<i>Mesomelaena pseudostygia</i>	8
	<i>Microtis media subsp. media</i>	opp.
	<i>Opercularia vaginata</i>	opp.
	<i>Patersonia occidentalis</i>	0.5
	<i>Petrophile linearis</i>	0.5
	<i>Phyllanthus calycinus</i>	1
	<i>Podolepis gracilis</i>	opp.
	<i>Podotrochea angustifolia</i>	0.5
	<i>Podotrochea chrysantha</i>	0.5
	<i>Poranthera microphylla</i>	0.5
	<i>Poranthera microphylla</i>	0.5
	<i>Romulea rosea</i>	0.5
	<i>Schoenus clandestinus</i>	0.5
	<i>Scholtzia involucrata</i>	0.5
	<i>Siloxerus humifusus</i>	1
	<i>Sowerbaea laxiflora</i>	0.5
	<i>Stirlingia latifolia</i>	8
	<i>Stylidium brunonianum subsp. brunonianum</i>	0.5
	<i>Stylidium repens</i>	opp.
	<i>Styphelia pallida</i>	0.5
	<i>Thysanotus manglesianus</i>	0.5
	<i>Trachymene pilosa</i>	0.5
	<i>Tricoryne elatior</i>	0.5
	* <i>Ursinia anthemoides</i>	0.5
	<i>Xanthorrhoea brunonis</i>	0.5
	<i>Xanthorrhoea preissii</i>	2

Sample Name:

Q2

Project no.: EP20-085

Date: 18/08/2020, 22/09/2020

Author: SKP,

Status Permanent

Q2: Page 1 of 3

Quadrat and landform details

Sample type: quadrat	Size: 10 m x 10 m
NW corner easting: 390152.6522	NW corner northing: 6439430.887
Altitude (m): 0	Geographic datum/zone: GDA94/Zone 50
Soil water content: damp	Landform: flat
Time since fire: > 5 yrs	Disturbance: moderate - weeds, rabbits
Soil type/texture sand/	Bare ground (%): 12
Rocks (%) and type: No rocks	Soil colour: grey/brown
Litter: 10% (leaves,twigs,)	Vegetation condition: very good-

Strata	Cover (%)	Height (m)
Upper:	10 to 30	<10
Mid:	10 to 30	<1
Ground layer 1:	10 to 30	>0.5
Ground layer 2:	30 to 70	<0.5

Vegetation description

low open forest *Banksia spp.* and *Eucalyptus marginata* over tall shrubland *Xanthorrhoea preissii*, *Hibbertia hypericoides* over tall open sedgeland *Mesomelaena pseudostygi* a over low tussock grassland **Avena barbata* and **Ehrharta calycina* and herbland **Hypochaeris glabra*, *Phlebocarya ciliata* and *Lomandra spp.*



Sample Name:

Q2

Project no.: EP20-085

Date: 18/08/2020, 22/09/2020

Status Permanent

Author: SKP,

Q2: Page 2 of 3

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
	<i>Acacia stenoptera</i>	0.5
	<i>Amphipogon turbinatus</i>	0.5
	<i>Anigozanthus humilis</i>	0.5
*	<i>Avena barbata</i>	3
	<i>Banksia attenuata</i>	10
	<i>Banksia menziesii</i>	5
	<i>Bossiaea eriocarpa</i>	0.5
*	<i>Briza maxima</i>	0.5
*	<i>Briza minor</i>	0.5
	<i>Burchardia congesta</i>	0.5
	<i>Caladenia flava subsp. flava</i>	0.5
	<i>Chamaescilla corymbosa</i>	opp.
	<i>Conostephium pendulum</i>	0.5
	<i>Conostylis setigera</i>	0.5
	<i>Conostylis aculeata subsp. aculeata</i>	0.5
	<i>Crassula colorata</i>	0.5
*	<i>Crassula glomerata</i>	0.5
	<i>Dampiera linearis</i>	0.5
	<i>Dasyopogon bromeliifolius</i>	0.5
	<i>Daviesia triflora</i>	opp.
	<i>Desmocladus flexuosus</i>	0.5
	<i>Diuris magnifica</i>	opp.
	<i>Drosera erythrorhiza</i>	0.5
	<i>Drosera menziesii subsp. penicillaris</i>	0.5
	<i>Drosera menziesii subsp. penicillaris</i>	0.5
*	<i>Ehrharta calycina</i>	30
*	<i>Ehrharta longiflora</i>	0.5
	<i>Eucalyptus marginata</i>	5
*	<i>Gladiolus caryophyllaceus</i>	0.5
	<i>Gompholobium tomentosum</i>	0.5
	<i>Hardenbergia comptoniana</i>	0.5
	<i>Hibbertia huegelii</i>	0.5
	<i>Hibbertia hypericoides</i>	8
	<i>Hypocalymma robustum</i>	0.5
*	<i>Hypochaeris glabra</i>	10
	<i>Hypolaena exsulca</i>	1

Sample Name:

Q2

Project no.: EP20-085

Date: 18/08/2020, 22/09/2020

Status Permanent

Author: SKP,

Q2: Page 3 of 3

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
	<i>Lomandra caespitosa</i>	0.5
	<i>Lomandra sericea</i>	0.5
	<i>Mesomelaena pseudostygia</i>	25
	<i>Opercularia vaginata</i>	0.5
	<i>Patersonia occidentalis</i>	0.5
	<i>Petrophile linearis</i>	0.5
	<i>Phlebocarya ciliata</i>	1
	<i>Sowerbaea laxiflora</i>	0.5
	<i>Stirlingia latifolia</i>	0.5
	<i>Thysanotus manglesianus</i>	0.5
	<i>Trachymene pilosa</i>	0.5
	<i>Tricoryne elatior</i>	opp.
	* <i>Trifolium dubium</i>	0.5
	* <i>Ursinia anthemoides</i>	1
	<i>Xanthorrhoea preissii</i>	3

Sample Name:

Q3

Project no.: EP20-085

Date: 18/08/2020, 22/09/2020

Author: SKP,

Status Permanent

Q3: Page 1 of 3

Quadrat and landform details

Sample type: quadrat	Size: 10 m x 10 m
NW corner easting: 390198.361	NW corner northing: 6439676.956
Altitude (m): 0	Geographic datum/zone: GDA94/Zone 50
Soil water content: damp	Landform: mid-slope
Time since fire: > 5 yrs	Disturbance: low - weeds
Soil type/texture sand/	Bare ground (%): 12
Rocks (%) and type: No rocks	Soil colour: grey/brown
Litter: 25% (leaves,twigs,branches)	Vegetation condition: very good-

Strata	Cover (%)	Height (m)
Upper:	30 to 70	<10
Mid:	30 to 70	<1
Ground layer 1:	10 to 30	>0.5
Ground layer 2:	10 to 30	<0.5

Vegetation description

low open forest *Banksia* spp. over tall shrubland *Xanthorrhoea preissii*, *Jacksonia sternbergiana*, *Hibbertia hypericoides* and *Gompholobium tomentosum* over open sedgeland *Mesomelaena pseudostygi* a over low tussock grassland **Avena barbata* and **Ehrharta* spp. and low open mixed herbland *Chamaescilla corymbosa*, **Ursinia anthemoides*



Sample Name:

Q3

Project no.: EP20-085

Date: 18/08/2020, 22/09/2020

Status Permanent

Author: SKP,

Q3: Page 2 of 3

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
	<i>Allocasuarina fraseriana</i>	opp
	<i>Amphipogon turbinatus</i>	0.5
	<i>Anigozanthus humilis</i>	opp
*	<i>Avena barbata</i>	3
	<i>Banksia attenuata</i>	20
	<i>Banksia menziesii</i>	25
*	<i>Briza maxima</i>	0.5
	<i>Burchardia congesta</i>	0.5
	<i>Caladenia flava subsp. flava</i>	0.5
*	<i>Carpobrotus edulis</i>	0.5
	<i>Chamaescilla corymbosa</i>	0.5
	<i>Conostephium pendulum</i>	0.5
	<i>Conostylis setigera</i>	0.5
	<i>Conostylis aculeata subsp. aculeata</i>	0.5
	<i>Crassula colorata</i>	0.5
	<i>Dampiera linearis</i>	0.5
	<i>Dasyopogon bromeliifolius</i>	0.5
	<i>Daviesia nudiflora</i>	0.5
	<i>Dianella revioluta var. revoluta</i>	0.5
	<i>Diuris magnifica</i>	0.5
	<i>Drosera erythrorhiza</i>	0.5
	<i>Drosera menziesii subsp. penicillaris</i>	0.5
*	<i>Ehrharta calycina</i>	10
*	<i>Ehrharta longiflora</i>	0.5
	<i>Eryngium pinnatifidum subsp. pinnatifidum ms</i>	opp
*	<i>Fumaria capreolata</i>	0.5
*	<i>Gladiolus caryophyllaceus</i>	0.5
	<i>Gompholobium tomentosum</i>	1
	<i>Hibbertia huegelii</i>	0.5
	<i>Hibbertia hypericoides</i>	20
	<i>Hovea trisperma var. trisperma</i>	0.5
	<i>Hybanthus calycinus</i>	opp
	<i>Hypocalymma robustum</i>	0.5
*	<i>Hypochaeris radicata</i>	2
	<i>Jacksonia sternbergiana</i>	2
	<i>Lomandra caespitosa</i>	0.5

Sample Name:

Q3

Project no.: EP20-085

Date: 18/08/2020, 22/09/2020

Status Permanent

Author: SKP,

Q3: Page 3 of 3

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
	<i>Mesomelaena pseudostygia</i>	30
	<i>Microtis media subsp. media</i>	0.5
	<i>Phyllangium paradoxum</i>	0.5
	<i>Podolepis gracilis</i>	0.5
	<i>Podotheca angustifolia</i>	0.5
	<i>Poranthera microphylla</i>	0.5
	<i>Pterostylis vittata</i>	0.5
	<i>Scaevola canescens</i>	0.5
	<i>Schoenus clandestinus</i>	0.5
	<i>Scholtzia involucrata</i>	0.5
	<i>Siloxerus humifusus</i>	0.5
*	<i>Sonchus oleraceus</i>	0.5
	<i>Sowerbaea laxiflora</i>	0.5
	<i>Stirlingia latifolia</i>	0.5
	<i>Stylidium brunonianum subsp. brunonianum</i>	0.5
	<i>Styphelia pallida</i>	0.5
	<i>Thysanotus manglesianus</i>	0.5
	<i>Trachymene pilosa</i>	0.5
*	<i>Ursinia anthemoides</i>	1
	<i>Xanthorrhoea preissii</i>	10

Sample Name: Q4

Project no.: EP20-085

Date: 18/08/2020, 22/09/2020

Author: SKP,

Status Permanent

Q4: Page 1 of 3

Quadrat and landform details

Sample type: quadrat	Size: 10 m x 10 m
NW corner easting: 390101.1659	NW corner northing: 6439579.004
Altitude (m): 0	Geographic datum/zone: GDA94/Zone 50
Soil water content: damp	Landform: upper slope
Time since fire: > 5 yrs	Disturbance: low - weeds, rabbits, dead banksia
Soil type/texture sand/	Bare ground (%): 7
Rocks (%) and type: No rocks	Soil colour: grey/brown
Litter: 20% (leaves,branches,twigs)	Vegetation condition: very good-excellent

Strata	Cover (%)	Height (m)
Upper:	30 to 70	<10
Mid:	30 to 70	<1
Ground layer 1:	10 to 30	>0.5
Ground layer 2:	10 to 30	<0.5

Vegetation description

low open forest *Banksia* spp. over tall shrubland *Xanthorrhoea preissii*, *Macrozamia riedlei*, *Jacksonia sternbergiana*, *Hibbertia hypericoides* over open sedgeland *Mesomelaena pseudostygi* a over low tussock grassland **Avena barbata* and **Ehrharta* spp. and low open mixed herbland *Chamaescilla corymbosa*, **Ursinia anthemoides*



Sample Name:

Q4

Project no.: EP20-085

Date: 18/08/2020, 22/09/2020

Status Permanent

Author: SKP,

Q4: Page 2 of 3

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
	<i>Acacia stenoptera</i>	0.5
	<i>Allocasuarina fraseriana</i>	10
	<i>Amphipogon turbinatus</i>	0.5
* , PI	<i>Arctotheca calendula</i>	opp
	<i>Banksia attenuata</i>	20
	<i>Banksia menziesii</i>	2
	<i>Banksia nivea</i>	opp
*	<i>Briza maxima</i>	1
*	<i>Bromus diandrus</i>	opp
	<i>Burchardia congesta</i>	0.5
	<i>Caladenia flava subsp. flava</i>	0.5
*	<i>Carpobrotus edulis</i>	0.5
	<i>Chamaescilla corymbosa</i>	0.5
	<i>Conostephium pendulum</i>	1
	<i>Conostylis setigera</i>	0.5
	<i>Conostylis aculeata subsp. aculeata</i>	0.5
	<i>Daviesia triflora</i>	1
	<i>Desmocladus flexuosus</i>	0.5
	<i>Drosera erythrorhiza</i>	2
*	<i>Ehrharta calycina</i>	0.5
	<i>Eriochilus sp.</i>	0.5
	<i>Gastrolobium capitatum</i>	1
*	<i>Gladiolus caryophyllaceus</i>	1
	<i>Gompholobium tomentosum</i>	2
	<i>Hibbertia hypericoides</i>	7
	<i>Hovea trisperma var. trisperma</i>	0.5
	<i>Hypocalymma robustum</i>	1
*	<i>Hypochaeris glabra</i>	2
	<i>Leucopogon conostephioides</i>	0.5
	<i>Lomandra caespitosa</i>	0.5
	<i>Lomandra sericea</i>	0.5
	<i>Lyginia imberbis</i>	0.5
	<i>Macrozamia riedlei</i>	2
	<i>Mesomelaena pseudostygia</i>	8
	<i>Microtis media subsp. media</i>	0.5
	<i>Petrophile linearis</i>	0.5

Sample Name:

Q4

Project no.: EP20-085

Date: 18/08/2020, 22/09/2020

Status Permanent

Author: SKP,

Q4: Page 3 of 3

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
	<i>Podolepis gracilis</i>	0.5
	<i>Podotheca angustifolia</i>	1
	<i>Podotheca chrysantha</i>	0.5
	<i>Poranthera microphylla</i>	0.5
	<i>Pterostylis vittata</i>	0.5
*	<i>Romulea rosea</i>	0.5
	<i>Scaevola canescens</i>	0.5
	<i>Schoenus clandestinus</i>	0.5
*	<i>Sonchus oleraceus</i>	1
	<i>Sowerbaea laxiflora</i>	0.5
	<i>Stirlingia latifolia</i>	2
	<i>Stylidium brunonianum subsp. brunonianum</i>	0.5
	<i>Thysanotus manglesianus</i>	0.5
	<i>Trachymene pilosa</i>	1
*	<i>Ursinia anthemoides</i>	2
*	<i>Wahlenbergia capensis</i>	0.5
	<i>Xanthorrhoea brunonis</i>	3
	<i>Xanthorrhoea preissii</i>	10

Sample Name:

Q5

Project no.: EP20-085

Date: 18/08/2020, 22/09/2020

Author: SKP,

Status Permanent

Q5: Page 1 of 3

Quadrat and landform details

Sample type: quadrat	Size: 10 m x 10 m
NW corner easting: 390056.7866	NW corner northing: 6439645.488
Altitude (m): 0	Geographic datum/zone: GDA94/Zone 50
Soil water content: damp	Landform: upper slope
Time since fire: > 5 yrs	Disturbance: low - weeds occ
Soil type/texture sand/	Bare ground (%): 5
Rocks (%) and type: No rocks	Soil colour: grey/brown
Litter: 10% (leaves,twigs,)	Vegetation condition: excellent-

Strata	Cover (%)	Height (m)
Upper:	30 to 70	<10
Mid:	30 to 70	<1
Ground layer 1:	10 to 30	>0.5
Ground layer 2:	10 to 30	<0.5

Vegetation description

low open forest Banksia spp. over shrubland Xanthorrhoea preissii, Scholtzia involucreta, Hibbertia hypericoides and Gompholobium tomentosum over open sedgeland Mesomelaena pseudostygia low open herbland *Sowerbaea laxiflora*, *Drosera erythrorhiza*, **Gladiolus caryophyllaceus*, **Ursinia anthemoides*



Sample Name:

Q5

Project no.: EP20-085

Date: 18/08/2020, 22/09/2020

Status Permanent

Author: SKP,

Q5: Page 2 of 3

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
	<i>Acacia stenoptera</i>	opp
	<i>Amphipogon turbinatus</i>	1
	<i>Banksia attenuata</i>	25
	<i>Banksia menziesii</i>	opp
	* <i>Briza maxima</i>	1
	<i>Burchardia congesta</i>	1
	<i>Caladenia flava subsp. flava</i>	0.5
	<i>Conostephium pendulum</i>	1
	<i>Conostylis setigera</i>	0.5
	<i>Conostylis aculeata subsp. aculeata</i>	0.5
	<i>Dasypogon bromeliifolius</i>	1
	<i>Desmocladus flexuosus</i>	0.5
	<i>Drosera erythrorhiza</i>	3
	<i>Drosera menziesii subsp. penicillaris</i>	1
	* <i>Ehrharta calycina</i>	1
	<i>Eryngium pinnatifidum subsp. pinnatifidum ms</i>	0.5
	* <i>Freesia alba × leichtlinii</i>	1
	* <i>Gladiolus caryophyllaceus</i>	1
	<i>Gompholobium tomentosum</i>	1
	<i>Hardenbergia comptoniana</i>	3
	<i>Hibbertia hypericoides</i>	10
	<i>Hovea trisperma var. trisperma</i>	1
	<i>Hypocalymma robustum</i>	1
	* <i>Hypochoeris glabra</i>	1
	<i>Jacksonia sternbergiana</i>	0.5
	<i>Lepidosperma scabrum</i>	0.5
	<i>Leucopogon conostephioides</i>	1
	<i>Lomandra caespitosa</i>	0.5
	<i>Lomandra nigricans</i>	0.5
	<i>Mesomelaena pseudostygia</i>	10
	<i>Podotheca angustifolia</i>	0.5
	<i>Pterostylis vittata</i>	0.5
	<i>Scaevola canescens</i>	0.5
	<i>Schoenus clandestinus</i>	1
	<i>Scholtzia involucrata</i>	3
	<i>Sowerbaea laxiflora</i>	2

Sample Name:

Q5

Project no.: EP20-085

Date: 18/08/2020, 22/09/2020

Status Permanent

Author: SKP,

Q5: Page 3 of 3

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
	<i>Styliidium brunonianum subsp. brunonianum</i>	0.5
	<i>Thysanotus manglesianus</i>	0.5
	<i>Trachymene pilosa</i>	2
	* <i>Ursinia anthemoides</i>	1
	<i>Xanthorrhoea preissii</i>	2

Sample Name:

Q6

Project no.: EP20-085

Date: 18/08/2020, 22/09/2020

Author: SKP,

Status Permanent

Q6: Page 1 of 3

Quadrat and landform details

Sample type: quadrat	Size: 10 m x 10 m
NW corner easting: 390106.8139	NW corner northing: 6439675.632
Altitude (m): 0	Geographic datum/zone: GDA94/Zone 50
Soil water content: damp	Landform: mid-slope
Time since fire: > 5 yrs	Disturbance: low - weeds, rabbits, dead banksia
Soil type/texture sand/	Bare ground (%): 2
Rocks (%) and type: No rocks	Soil colour: brown/
Litter: 40% (leaves,twigs,branches)	Vegetation condition: excellent-

Strata	Cover (%)	Height (m)
Upper:	10 to 30	<10
Mid:	30 to 70	<1
Ground layer 1:	10 to 30	>0.5
Ground layer 2:	10 to 30	<0.5

Vegetation description

low woodland *Banksia* spp. and *Allocasuarina fraseriana* over shrubland *Xanthorrhoea preissii*, *Hibbertia hypericoides*, *Stirlingia latifolia* over open sedgeland *Mesomelaena pseudostygia* low open herbland *Sowerbaea laxiflora*, *Drosera erythrorhiza*, **Gladiolus caryophyllaceus*, **Ursinia anthemoides*



Sample Name:

Q6

Project no.: EP20-085

Date: 18/08/2020, 22/09/2020

Status Permanent

Author: SKP,

Q6: Page 2 of 3

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
	<i>Allocasuarina fraseriana</i>	15
	<i>Amphipogon turbinatus</i>	2
	<i>Banksia attenuata</i>	opp
	<i>Banksia menziesii</i>	10
	* <i>Briza maxima</i>	3
	* <i>Briza minor</i>	0.5
	<i>Burchardia congesta</i>	1
	<i>Caladenia flava subsp. flava</i>	0.5
	<i>Caladenia flava subsp. flava</i>	0.5
	<i>Chamaescilla corymbosa</i>	3
	<i>Conostylis setigera</i>	0.5
	<i>Conostylis aculeata subsp. aculeata</i>	0.5
	<i>Crassula colorata</i>	0.5
	<i>Dampiera linearis</i>	1
	<i>Dasyopogon bromeliifolius</i>	1
	<i>Daviesia triflora</i>	2
	<i>Desmocladus flexuosus</i>	1
	<i>Drosera erythrorhiza</i>	2
	<i>Drosera menziesii subsp. penicillaris</i>	1
	* <i>Ehrharta calycina</i>	4
	<i>Gastrolobium capitatum</i>	1
	<i>Gompholobium tomentosum</i>	1
	<i>Hibbertia hypericoides</i>	10
	<i>Hovea trisperma var. trisperma</i>	1
	<i>Hypocalymma robustum</i>	2
	* <i>Hypochaeris glabra</i>	1
	<i>Jacksonia sternbergiana</i>	opp
	<i>Kunzea glabrescens</i>	0.5
	<i>Lepidosperma scabrum</i>	0.5
	<i>Leucopogon conostephioides</i>	0.5
	<i>Lomandra caespitosa</i>	0.5
	<i>Lomandra nigricans</i>	0.5
	<i>Macarthuria australis</i>	opp
	<i>Mesomelaena pseudostygia</i>	10
	<i>Orchidaceae sp.</i>	0.5
	<i>Petrophile linearis</i>	0.5

Sample Name:

Q6

Project no.: EP20-085

Date: 18/08/2020, 22/09/2020

Status Permanent

Author: SKP,

Q6: Page 3 of 3

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
	<i>Phyllanthus calycinus</i>	0.5
	<i>Podolepis gracilis</i>	1
	<i>Pterostylis vittata</i>	0.5
	<i>Scaevola canescens</i>	2
	<i>Schoenus clandestinus</i>	0.5
	<i>Sowerbaea laxiflora</i>	1
	<i>Stirlingia latifolia</i>	2
	<i>Stylidium brunonianum subsp. brunonianum</i>	0.5
	<i>Stylidium repens</i>	0.5
	<i>Styphelia pallida</i>	0.5
	<i>Thysanotus manglesianus</i>	0.5
	<i>Trachymene pilosa</i>	1
	* <i>Ursinia anthemoides</i>	2
	<i>Xanthorrhoea preissii</i>	15
	<i>Xanthosia huegelii</i>	0.5

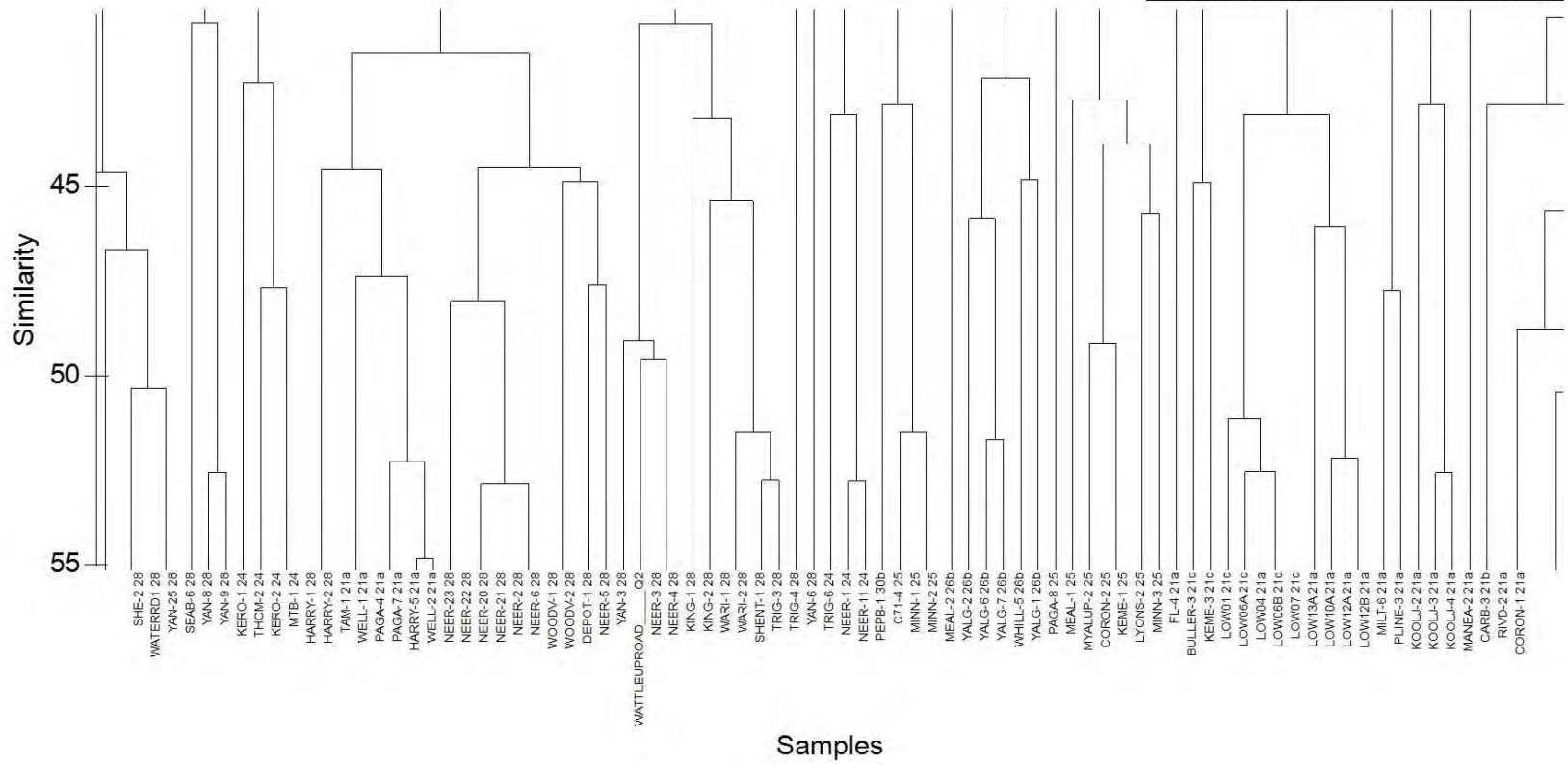
Appendix G

Cluster Dendrograms



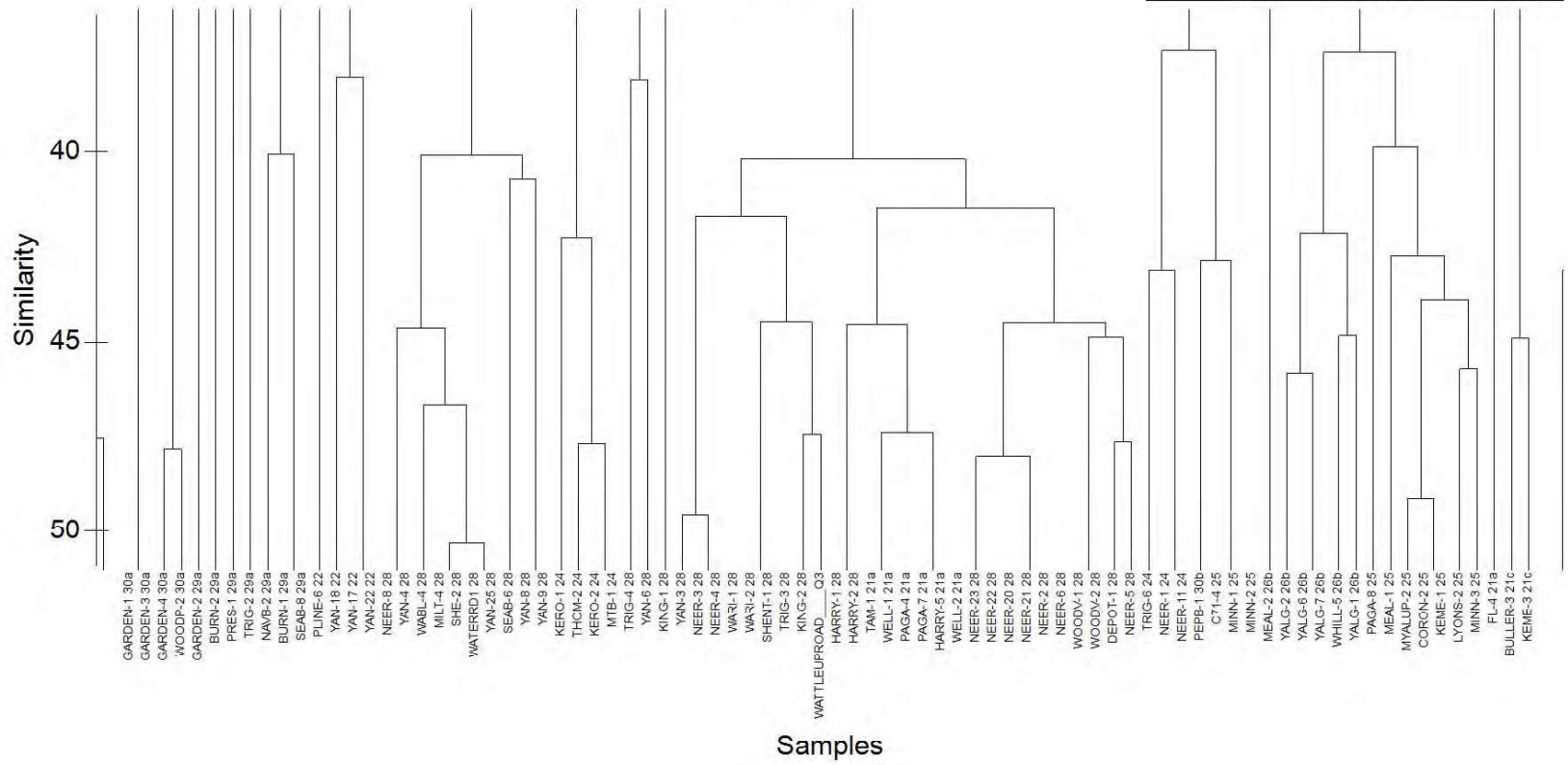
Group average

Resemblance: S17 Bray Curtis similarity



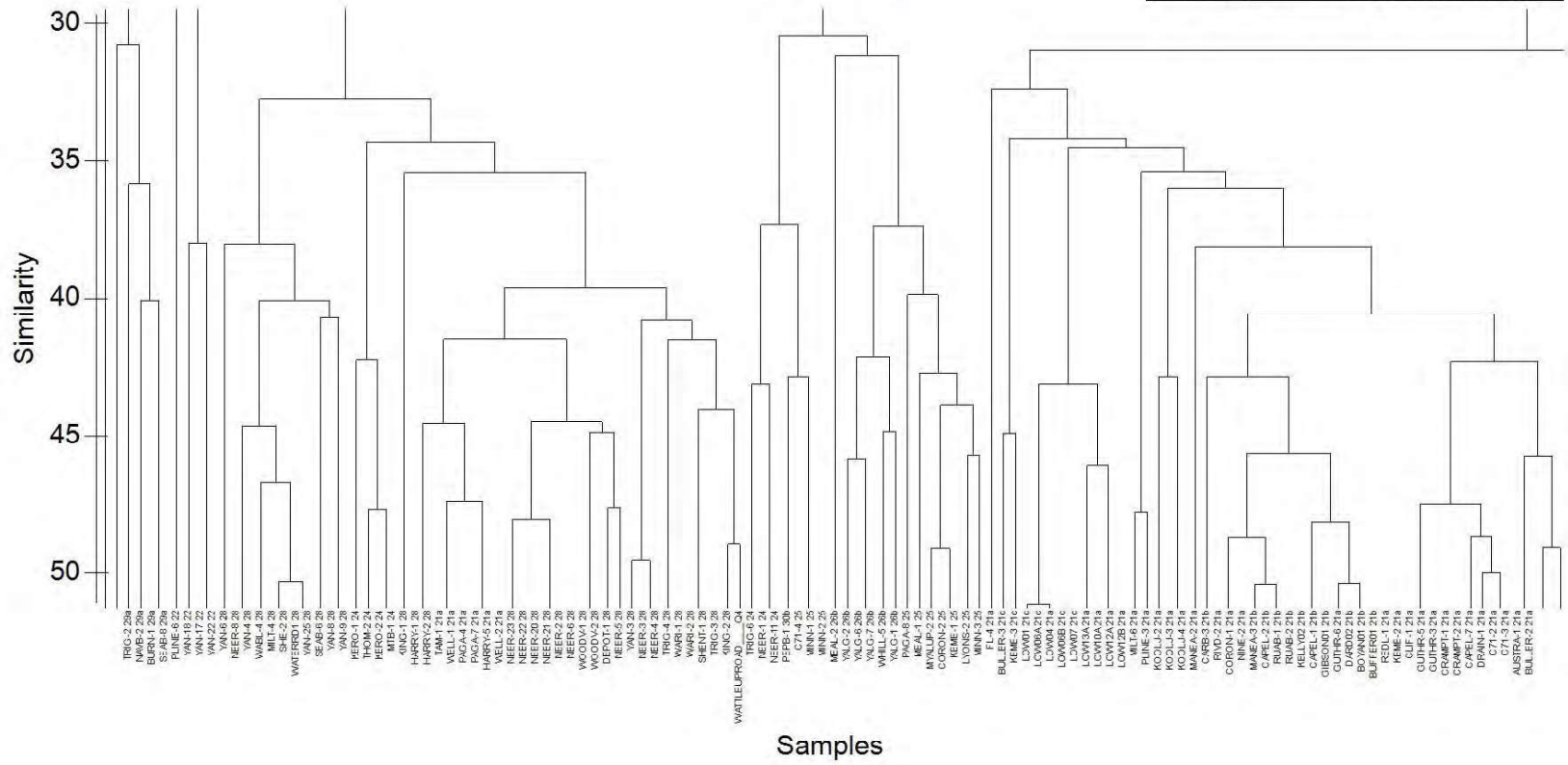
Group average

Resemblance: S17 Bray Curtis similarity



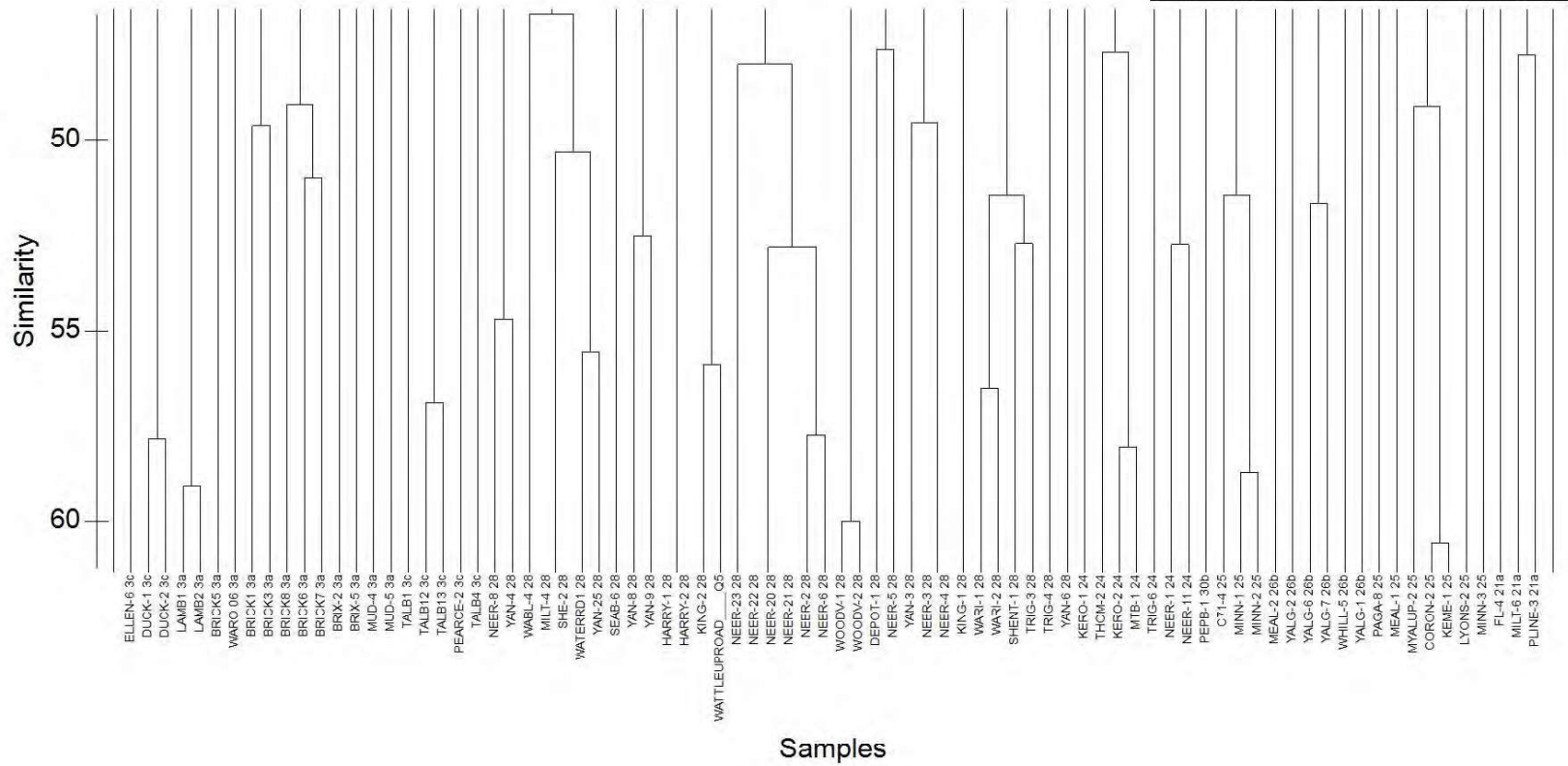
Group average

Resemblance: S17 Bray Curtis similarity



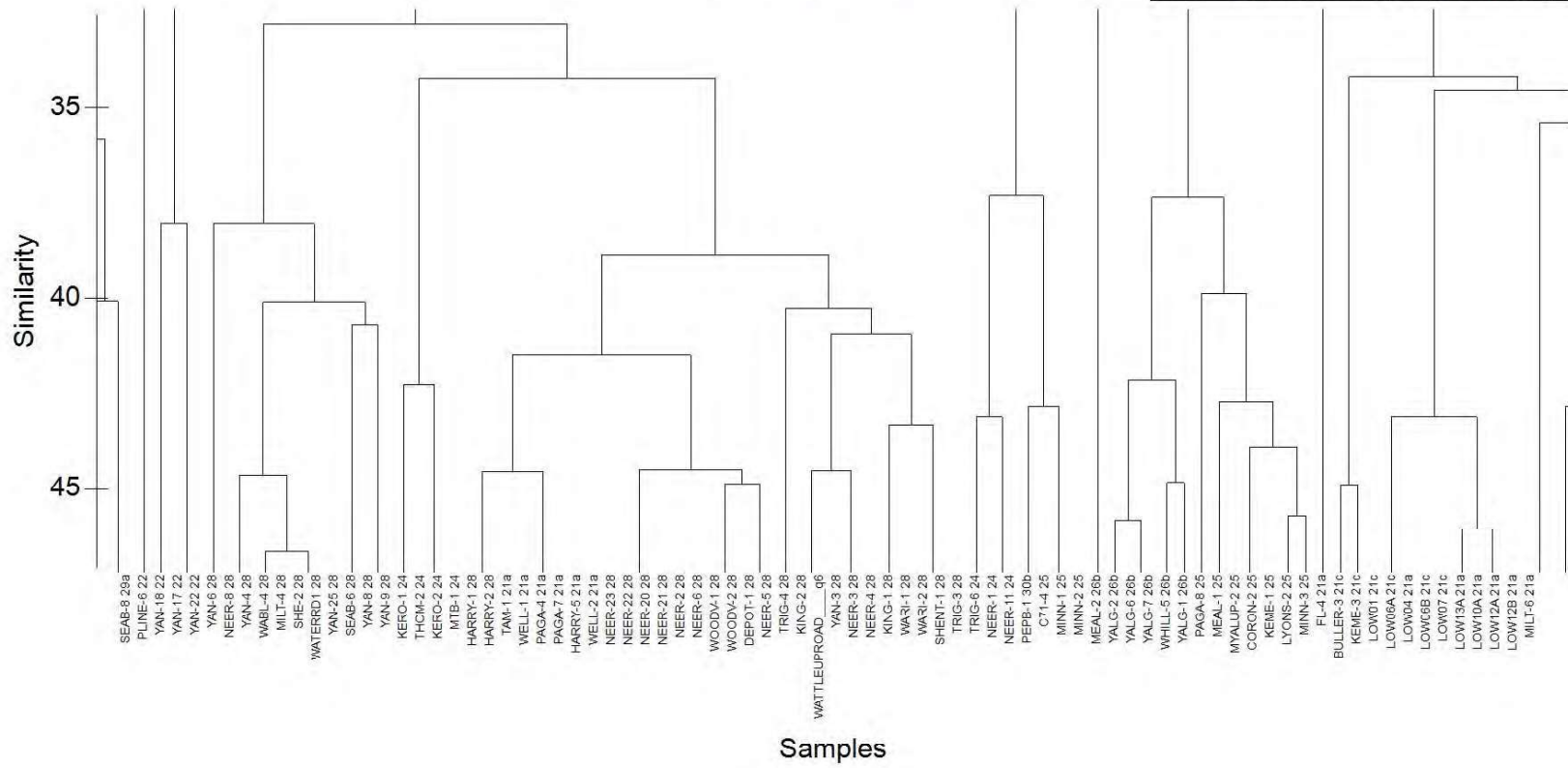
Group average

Resemblance: S17 Bray Curtis similarity



Group average

Resemblance: S17 Bray Curtis similarity



Group average

Resemblance: S17 Bray Curtis similarity

