

# Detailed Flora and Vegetation Assessment

Lot 15 Nicholson Road, Forrestdale

Project No: EP20-126(05)

**Prepared for Australian Islamic College (Perth) Inc  
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## Executive Summary

Australian Islamic College (Perth) Inc engaged Emerge Associates to conduct a detailed assessment to provide information on the flora and vegetation values within Lot 15 Nicholson Road in Forrestdale (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 16 November 2020, 11 March and 13 October 2021. During the field surveys an assessment was made on the type, condition and values of vegetation across the site. Targeted searches for conservation significant flora species were also undertaken within areas of potential habitat.

Outcomes of the survey include the following:

- Non-native vegetation is present across 10.1 ha of the site.
- Remnant native vegetation is present across 6.6 ha of the site in varying levels of condition.
- A total of 58 native and 40 non-native (weed) species were recorded in the site.
- No threatened or priority flora species were recorded within the site.
- One priority species, *Schoenus pennisetis* (P3) may occur within plant communities **Kg** and **KgMp**. Further survey between August and September would be required to confirm whether *S. pennisetis* occurs in the site.
- The vegetation within the site was classified into five plant communities: **BaBmSi**, **KgSi**, **KgMp**, **Kg** and non-native vegetation.
- Plant community **BaBmSi** was mapped as being in 'good' condition, whilst plant communities **KgSi**, **KgMp** and **Kg** were mapped as being in 'degraded' condition. The non-native vegetation was mapped as being in 'completely degraded' condition.
- Plant communities **BaBmSi**, **KgSi** and **Kg** were considered to represent 'floristic community type' (FCT) 21c 'low lying *Banksia attenuata* woodlands and shrublands'. Plant community **KgMp** was considered to represent FCT 11 'wet forests and woodlands'.
- A 0.6 ha patch of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) listed 'banksia woodlands of the Swan Coastal Plain' threatened ecological community (TEC) occurs in the south-eastern portion of the site. This patch also represents the State listed priority ecological community (PEC) of the same name.
- A 2.17 ha patch of the State listed PEC 'low-lying *Banksia attenuata* woodlands and shrublands' (P3) occurs in the north and south-east portions of the site.

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Conservation Significant Communities and Likelihood of Occurrence Assessment

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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
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	<i>Interim Biogeographic Regionalisation of Australia</i>
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 communities
UFI	Unique feature identifier



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*Table A3: Abbreviations –Legislation*

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

*Table A4: Abbreviations – Units of measurement*

Units of measurement	
cm	Centimetre
ha	Hectare
m	Metre
m <sup>2</sup>	square metre
m AHD	m in relation to the Australian height datum
mm	Millimetre

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## 1 Introduction

### 1.1 Project background

Emerge Associates (Emerge) were engaged by the Australia Islamic College (Perth) Inc to characterise the flora and vegetation values within Lot 15 Nicholson Road in Forrestdale. This lot, referred to herein as the 'site', is located approximately 25 kilometres (km) south of the Perth Central Business District within the City of Armadale.

The site is approximately 16.73 hectares (ha) in size and is bounded by native vegetation to the east, Oxley Road to the north, Nicholson Road to the west and rural land to the south. The location and extent of the site is shown in **Figure 1**.

### 1.2 Purpose and scope of work

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

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

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

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## 2 Environmental Context

### 2.1 Climate

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

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

An average of 816 millimetres (mm) of rainfall is recorded annually from the Forrestdale weather station (no. 9257), which is the closest weather station, located approximately 1 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 (no. 9172), which is the nearest temperature recording station approximately 8 km north-west of the site, range from 18.0°C in July to 31.6°C in February, while mean minimum temperatures range from 7.0°C in July and August to 17.2°C in February (BoM 2021).

Prior to the surveys, a total of 552 mm of rain was recorded from May to October 2020 and 813.6 mm was also recorded over the same period in 2021, which is approximately 82% and 119% of the mean of 681 mm for this period respectively (BoM 2021). This amount of rainfall (particularly in 2021) was 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 comprises the Pinjarra Plain which formed from the deposition of alluvial material washed down from the Darling Scarp, while its western side comprises 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 at the junction of the Bassendean (B) and Southern River (SR) associations (Churchward and McArthur 1980). The Bassendean association comprises sand plains with low dunes and occasional swamps with iron or humus podzols and areas of complex steep dunes. The Southern River association comprises sand plains with low dunes and many intervening swamps with iron and humus podzols, peats and clays.

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 25 m in relation to the Australian height datum (mAHD) in the central portion of the site to local high points at 30 mAHD in the northern and southern portions (DoW 2008) (**Figure 2**).

## 2.4 Hydrology and wetlands

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

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

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

No Ramsar or listed 'important wetlands' occur in the site. The Ramsar listed 'Forrestdale & Thomsons Lakes' (number 35) is located 500 m to the north east of the site. This Ramsar site is also listed as an important wetland. In addition, an 'important wetland' ('Gibbs Road Swamp System') is located directly to the north of the site and to the west of the site. The Gibbs Road Swamp System is an extensive, but fragmented wetland system covering approximately 750 ha between Armadale Road and Rowley Road.

Examination of the Department of Water and Environmental Regulation (DWER) hydrography dataset (DWER 2018) shows the following wetland or water related features occur within the site:

- Swamp – perennial ('unique feature identifiers' (UFIs) 418597 and 418598) (**Figure 2**).

The Department of Biodiversity, Conservation and Attractions (DBCA) has developed the *Geomorphic Wetlands of the Swan Coastal Plain* dataset (DBCA 2020). This dataset maps geomorphic wetland features and classifies them based on their landform shape and water permanence. Each feature is assigned to one of three management categories which guides land use and conservation.

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A review of the *Geomorphic Wetlands, Swan Coastal Plain* dataset indicated that one 'multiple use' category wetland feature (UFI 7236) occurs within the central portion of the site (DBCA 2020). Two 'conservation' category wetland features (UFIs 7233 and 7235) occur adjacent to the northern and eastern sides of the site respectively. Both UFI 7233 and 7235 are largely mapped as external to the site but both have small portions that overlap the site boundary. All three wetland features are classified as sumplands and are collectively named 'Forrestdale Sumpland'. The locations of the geomorphic wetlands in and closely associated with the site 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 Australia into floristic subregions (Environment Australia 2000).

The site is contained within the Swan Coastal Plain region and within the 'SWA02' or Perth subregion. The Perth subregion is characterised by mainly 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 can be further classified based on regional vegetation mapping.

Hedde *et al.* (1980) mapping shows most of the site as comprising the 'Southern River' complex, with a small portion in the south-west of the site mapped as comprising the 'Bassendean central and south complex'. The 'Southern River' complex is described as comprising open woodland of *Corymbia calophylla*, *Eucalyptus marginata* and *Banksia* spp. with fringing woodland of *Eucalyptus rudis* and *Melaleuca raphiophylla* along creek beds. The 'Bassendean central and south complex' comprises vegetation ranging from woodland of *Eucalyptus marginata*, *Allocasuarina fraseriana*, *Banksia* spp. to low woodland of *Melaleuca* spp. and sedgelands on the moister sites.

The 'Southern River' complex was determined to have 18.4% of its pre-European extent remaining, of which 1.2% is protected for conservation purposes (Government of Western Australia 2019).

The 'Bassendean central and south complex' was determined to have 26.8% of its pre-European extent remaining, of which 1.9% is protected for conservation purposes (Government of Western Australia 2019).

## 2.6 Historical land use

Review of historical images available from 1953 onwards shows that the majority of the site was cleared of native vegetation between 1953 and 1961, with areas of vegetation remaining in the eastern portion of the site (WALIA 2021).

The presence of wetland features within the site can be seen throughout the last 60 years but by 1991 these were almost entirely devoid of native vegetation. Some vegetation has since recolonised these areas, particularly near the eastern boundary of the site.

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### 2.7 Conservation significant flora and vegetation

#### 2.7.1 Threatened and priority flora

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

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

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

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

#### 2.7.2 Threatened and priority ecological communities

An ecological community is a naturally occurring group of native plants, animals and other organisms that are interacting in a unique habitat. An ecological community's structure, composition and distribution are influenced by environmental factors such as soil type, position in the landscape, altitude, climate and water availability (DAWE 2021b). '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.

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

### 2.7.3 Local and regional significance

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

Three key reasons that vegetation within the site may be significant are listed below:

- The site is in close proximity to Forrestdale Lake.
- The vegetation is associated with wetlands.
- The vegetation has potential value as habitat for threatened or priority fauna species including, in particular, black cockatoos listed as threatened under the EPBC Act and BC Act.

### 2.8 Weeds and pests

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

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

The Commonwealth government has further compiled a list of 32 *Weeds of National Significance* (WoNS) (DAWE 2021c). Whilst the WoNS list is non-statutory, many WoNS are also listed under the BAM Act. Further information on weeds and declared pests is provided in **Appendix A**.

### 2.9 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.

No *Bush Forever* sites occur within the site. Bush Forever Site 345 (Forrestdale Lake and Adjacent Bushland, Forrestdale) lies directly adjacent to the east and southern boundaries of the site. Bush Forever Site 344 (Dennis De Young Reserve and Gibbs Road Swamp Bushland, Banjup/Forrestdale) is located to the north-west of the site on the western side of Nicholson Road. Significant flora species are known to occur in both these sites. The locations of Bush Forever Sites 344 and 345 are shown in **Figure 3**.



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### 2.10 Ecological linkages

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

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

One biodiversity linkage (No. 52) occurs over the north-eastern corner of the site running east to west and intersects with another ecological linkage (No. 57) running north to south over Forrestdale Lake. These ecological linkages connect areas of *Bush Forever* and wetlands located in the wider local area. The location of the biodiversity linkage associated with the site is shown on **Figure 3**.

Review of aerial imagery indicates that the eastern portion of the site is connected to extensive areas of native vegetation within the wider local area.

### 2.11 Previous surveys

No previous surveys are known.

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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 10 km radius of the site using the *Protected Matters Search Tool* (DAWE 2021a), *NatureMap* (DBCA 2021) and DBCA's threatened and priority flora database (reference no. 26-0321FL).

A search was also conducted for TECs and PECs that may occur or have been recorded within a 10 km radius of the site using the *Protected Matters Search Tool* (DAWE 2021a), the *weed and native flora dataset* (Keighery *et al.* 2012) and DBCA's threatened and priority ecological communities' databases (reference no. 38-0321E).

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 16 November 2020, 11 March and 13 October 2021 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 a combination of non-permanent 10 x 10 m quadrats and relevés. The quadrats were established using fence droppers bound by measuring tape. The relevés were completed over an equivalent 10 x 10 m area without the use of physical markers and were included to provide a more rapid sample of patches of vegetation in poorer condition and/or of smaller size. The position of each sample was recorded with a hand-held GPS unit.

The data recorded within each sample included:

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

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

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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 the Keighery (1994) scale (**Table 1**). 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’ (DoEE 2016a) 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 (DoEE 2016a)	
		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 analysis

#### 3.3.1 Conservation significant flora and vegetation

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

Table 2: Likelihood of occurrence assessment categories and definitions

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

#### 3.3.2 Plant community identification and description

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

#### 3.3.3 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. The analysis included the compilation of a resemblance matrix containing the percentage similarity between all pairs of samples with groups defined using the Bray-Curtis distance measure. Subsequently, classification was undertaken using a group-average hierarchical clustering technique.

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

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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.

FCT analysis was not undertaken for samples located within disturbed vegetation with low native species diversity as the vegetation was considered unlikely to currently represent an FCT.

### 3.3.4 Threatened and ecological communities

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

### 3.3.5 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 <b>Section 2</b> is adequate to place the site and vegetation in context.
	Minor 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 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 senior botanist with 11 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	Limitation	The survey was conducted in March, October and November and thus both within and outside of the main flowering season. Moderate rainfall was recorded from May to October 2020 and high rainfall was recorded over the same period in 2021 preceding the site visits. 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 most species for which seasonal timing is critical.
Temporal coverage	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 in November 2020 and March and October 2021. The October and November site visits provided an insight into the vegetation condition and composition within 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 98 species were recorded, of which 41 were recorded from eight sample locations and 57 were recorded opportunistically. Minimum species richness within site is estimated at 54 species (refer species accumulation curve and estimates shown in <b>Plate 6</b> ). The number of species recorded in the site was considerably higher than the 54 species estimated to be within the site. Considering the degraded nature of the majority of the site, the survey effort was considered to be adequate to prepare a representative species inventory.
Influence of disturbance	Minor limitation	Time since fire is greater than 60 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 consists of sandy hills in the north and south and a lower lying depression running through the centre.

The majority of the site has been cleared and is currently under rural use. Remnant native vegetation occurs within the northern and eastern portions of the site.

### 4.2 Flora

#### 4.2.1 Desktop assessment

The database search results identified a total of 13 threatened and 39 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, suitable habitat was considered to potentially occur within the site for nine threatened flora species and 18 priority flora species as shown in **Table 4**.

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

Species	Level of significance		Life strategy	Habitat	Flowering period
	State	EPBC Act			
<i>Austrostipa jacobiana</i>	CR	-	P	Grey sandy clay.	Nov-Jan
<i>Caladenia huegelii</i>	CR	EN	PG	Well-drained, deep sandy soils in lush undergrowth in a variety of moisture levels.	Sep-early Nov
<i>Drakaea elastica</i>	CR	EN	PG	Bare patches of sand within otherwise dense vegetation in low-lying areas alongside winter-wet swamps. Typically in banksia woodland or thickets of <i>Kunzea glabrescens</i> .	Late Sep-Oct/Nov
<i>Synaphea</i> sp. Serpentine (G.R. Brand 103)	CR	CR	P	Seasonally damp areas, loam - sand.	Sep-Oct
<i>Diuris purdiei</i>	EN	EN	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

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

Species	Level of significance		Life strategy	Habitat	Flowering period
	State	EPBC Act			
<i>Drakaea micrantha</i>	EN	VU	PG	Open sandy patches often adjacent to winter-wet swamps.	Sept- early Oct
<i>Grevillea curviloba</i> subsp. <i>incurva</i>	EN	EN	P	Sand, sandy loam. Winter-wet heath.	Aug-Sep
<i>Synaphea</i> sp. Pinjarra Plain (A.S. George 17182)	EN	CR	P	White grey clayey sand on edges of seasonally inundated low lying areas.	Sep-Oct
<i>Diuris drummondii</i>	VU	VU	PG	In low-lying depressions in peaty and sandy clay swamps.	Nov-Jan
<i>Calectasia grandiflora</i>	P2	-	P	White, grey or yellow sand.	Jun-Nov
<i>Johnsonia pubescens</i> subsp. <i>cygnorum</i>	P2	-	P	Grey white yellow sands on flats and seasonally wet areas.	Sep
<i>Poranthera moorokatta</i>	P2	-	A	Sandy or clay soils. Dampland or low sandy dunes.	Oct or Feb
<i>Stenanthemum sublineare</i>	P2	-	P	White sand on coastal plains.	Oct-Dec
<i>Babingtonia urbana</i>	P3	-	P	Grey sand, lateritic gravel.	Jan-Mar
<i>Cyathochaeta teretifolia</i>	P3	-	P	Grey sand, sandy clay in swamps and creek edges.	Oct-Jan
<i>Eryngium pinnatifidum</i> subsp. <i>Palustre</i> (G.J. Keighery 13459)	P3	-	P	Grey brown sand or clay in winter wet flats.	Sep-Nov
<i>Jacksonia gracillima</i>	P3	-	P	Sand, often adjacent to winter wet areas	Sep-Dec
<i>Phlebocarya pilosissima</i> subsp. <i>pilosissima</i>	P3	-	P	White or grey sand, lateritic gravel.	Aug-Oct
<i>Schoenus benthamii</i>	P3	-	P	White, grey sands, sandy clay in winter wet flats and swamps	Oct-Nov
<i>Schoenus pennisetis</i>	P3	-	A	Grey or peaty sand in swamps and winter-wet depressions.	Aug-Sep
<i>Stylidium aceratum</i>	P3	-	A	Sandy soils in swamp heathland.	Oct-Nov
<i>Thysanotus anceps</i>	P3	-	P	White or grey sand, lateritic gravel, laterite.	Oct-Dec
<i>Drosera occidentalis</i>	P4	-	P	Flat, brown/white/yellow moist sand/clay/peat, often near swamps.	Oct-Dec/Jan
<i>Stylidium longitubum</i>	P4	-	A	Sandy clay, clay. Seasonal wetlands.	Oct-Dec



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

Species	Level of significance		Life strategy	Habitat	Flowering period
	State	EPBC Act			
<i>Thysanotus glaucus</i>	P4	-	P	White, grey or yellow sand, sandy gravel.	Oct-Mar
<i>Tripterococcus</i> sp. <i>Brachylobus</i> (A.S. George 14234)	P4	-	P	Winter-wet areas on grey sand.	Oct-Feb
<i>Verticordia lindleyi</i> subsp. <i>lindleyi</i>	P4	-	P	Sand and sandy clay in winter wet areas.	May or Nov-Jan

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

#### 4.2.2 Species inventory

A total of 48 native and 40 non-native (weed) species were recorded within the site during the field survey, representing 40 families and 82 genera. The dominant families containing native taxa were Myrtaceae (seven native taxa and four weed taxa), Fabaceae (six native taxa and two weed taxa), Orchidaceae and Asparagaceae (both with five native taxa and one weed taxa). The most common genera were *Eucalyptus* (two native taxa and three weed taxa) and *Acacia*, *Banksia* and *Lomandra* with three taxa each. Of the species recorded 41 were recorded in sample locations and 57 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 in the site due to lack of suitable habitat and/or because they were not recorded during the field survey.

The survey was unable to confirm the presence or absence of the priority flora species *Schoenus pennisetis* (P3) as this is an annual species that flowers outside of the survey period (August and September).

#### 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

Three species listed as a declared pest (C3) pursuant to the BAM Act were recorded within the site: \**Zantedeschia aethiopica* (arum lily), \**Asparagus asparagoides* (bridal creeper) and \**Solanum linnaeanum* (apple of Sodom).

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Bridal creeper is also listed as a weed of national significance (WoNS).

## 4.3 Vegetation

### 4.3.1 Desktop assessment

The database search results identified 16 TECs and six PECs occurring or potentially occurring within a 10 km radius of the site. Information on these communities is provided in **Appendix C**.

Based geomorphology, soils and regional vegetation patterns, one TEC and three 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).
- 'Low lying *Banksia attenuata* woodlands and shrublands' PEC (P3).
- '*Banksia ilicifolia* woodlands' PEC (P3).

### 4.3.2 Plant communities

A total of eight locations were sampled, comprised of one quadrat and seven relevés, as shown in **Figure 4**.

Five plant communities were identified within the site. Plant community **BaBmSi** exists in pockets in the northern and south-eastern portions of the site and extends over 2.17 ha. Plant community **Kg** occurs in the north-eastern corner of the site and extends over 0.98 ha. Plant community **KgMp** is present in the central eastern portion of the site and extends over 1.06 ha. Plant community **KgSi** occurs as multiple patches throughout the northern and eastern portions of the site and comprises 2.41 ha. The remainder of the site (10.11 ha) contains non-native vegetation with bare soil, weeds or planted non-native trees.

A description and the area of each plant community is provided in **Table 5** and representative photographs of each are provided in **Plate 1** to **Plate 5**. The location of each plant community is shown in **Figure 4**. 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)
<b>BaBmSi</b>	Low sparse to open woodland of <i>Banksia menziesii</i> , <i>B. attenuata</i> , <i>B. ilicifolia</i> , <i>Eucalyptus todtiana</i> and <i>Nuytsia floribunda</i> over sparse to open shrubland of <i>Kunzea glabrescens</i> , <i>Scholtzia involucreta</i> , <i>Acacia pulchella</i> var. <i>glaberrima</i> , <i>Macrozamia riedlei</i> and <i>Macarthuria australis</i> over sparse forbland of <i>Desmocladius flexuosus</i> , <i>Conostylis aculeata</i> , <i>Lyginia barbata</i> and <i>Lomandra</i> spp. and open grassland of <i>*Ehrharta calycina</i> and <i>*Briza maxima</i> ( <b>Plate 1</b> )	2.17
<b>Kg</b>	Tall shrubland to closed tall shrubland of <i>Kunzea glabrescens</i> over sparse low shrubland of <i>Brachyloma preissii</i> and <i>Acacia pulchella</i> var. <i>glaberrima</i> (or absent) and forbland (or absent) ( <b>Plate 2</b> ).	0.98

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Table 5: Description and extent of plant communities identified within the site (cont.)

Plant community	Description	Area (ha)
<b>KgMp</b>	Sparse woodland of <i>Melaleuca preissiana</i> over tall closed shrubland of <i>Kunzea glabrescens</i> over forbland of * <i>Hypochaeris</i> spp. and grassland of * <i>Cynodon dactylon</i> (or understorey layers absent) ( <b>Plate 3</b> ).	1.06
<b>KgSi</b>	Tall shrubland to closed tall shrubland of <i>Kunzea glabrescens</i> over shrubland to open shrubland of <i>Scholtzia involucreta</i> over sparse forbland <i>Conostylis aculeata</i> , <i>Lyginia barbata</i> and <i>Lomandra caespitosa</i> ( <b>Plate 4</b> ).	2.41
<b>Non-native</b>	Heavily disturbed areas comprising weeds with occasional native shrubs and forbs and planted vegetation ( <b>Plate 5</b> ).	10.11



Plate 1: Plant community **BaBmSi** in 'good' condition

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*Plate 2: Plant community **Kg** in 'degraded' condition*



*Plate 3: Plant community **KgMp** in 'degraded' condition*

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*Plate 4: Plant community KgSi in 'degraded' condition*



*Plate 5: Non-native vegetation in 'completely degraded' condition*

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### 4.3.3 Vegetation condition

The most intact native vegetation occurs in the northern and south-eastern portion of the site within the **BaBmSi** plant community. The **BaBmSi** vegetation was mapped as being in ‘good’ condition as it retains the basic structure expected of a banksia woodland community and has low to moderate native species diversity. Past disturbance throughout this vegetation is evident from historical aerial photography and on-ground through the presence of weeds, sparseness of the overstorey (particularly in the northern patches) and a low native species diversity.

Plant communities **Kg**, **KgMp** and **KgSi** were mapped as being in ‘degraded’ condition. This vegetation tended to have high weed cover, low species diversity and notable patches of sandy open ground present. Despite reasonable native cover in parts, this vegetation was mapped as being in ‘degraded’ condition due to the degree of disturbance and alteration of the vegetation structure.

The remainder of the site was mapped as being in ‘completely degraded’ condition as it consists of non-native species such as pasture grasses and planted trees. Sandy tracks within the site were also mapped as being in ‘completely degraded’ condition.

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

Table 6: Extent of vegetation condition categories within the site

Condition category (Gibson <i>et al.</i> 1994)	Size (ha)
Pristine	0
Excellent	0
Very good	0
Good	2.17
Degraded	4.45
Completely degraded	10.11

### 4.3.4 Floristic community types

Plant communities **BaBmSi**, **Kg** and **KgSi** were considered to represent FCT 21c ‘Low lying *Banksia attenuata* woodlands and shrublands’. This FCT is listed as ‘well reserved’ and ‘susceptible’ by Gibson *et al.* (1994). The majority of samples within these plant communities (R1, R2, R3, Q7 and R8) clustered with FCT 21c with 33-36% similarity (**Table 7**). Sample R4 clustered with FCT 6, indicating that weeds were influencing the analysis. The resemblance matrix showed the R4 data was most similar to Gibson *et al.* (1994) sites representing FCT 21c, FCT 5 and FCT 6 (**Table 7**).

Samples R5 and R6 from plant community **KgMp** clustered with FCT 14 ‘deeper wetlands on sandy soils’ with 19-21% similarity. However, the resemblance analysis indicated these samples were most similar to Gibson *et al.* (1994) site representing FCT 11 (**Table 7**). It is considered that **KgMp** is likely to be too degraded to assign an FCT with any level of certainty but is most likely to have once represented FCT 11 ‘wet forests and wetlands’.

The relevant portions of the cluster dendrograms are provided in **Appendix E**.

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

Plant community	Sample unit	Most similar Gibson <i>et al.</i> (1994) sites	Similarity (%)	Most likely floristic community type (FCT)	Reservation and conservation status (Gibson <i>et al.</i> 1994)
BaBmSi	R2	HYMUS04 (FCT 21c)	33	FCT 21c: Low-lying <i>Banksia attenuata</i> woodlands or shrublands	Well reserved Susceptible
		DEJONG-C (FCT 21c)	33		
	R3	HYMUS04 (FCT 21c)	33		
		DEJONG-C (FCT 21c)	33		
	Q7	HYMUS04 (FCT 21c)	36		
	R8	HYMUS04 (FCT 21c)	33		
		DEJONG-C (FCT 21c)	33		
	KgSi	R1	HYMUS04 (FCT 21c)		
DEJONG-C (FCT 21c)			34		
Kg	R4^	FL-6 (FCT 21c)	31		
		AUSTB-6 (FCT 5)	31		
		CARD4 (FCT 6)	30		
		FL-5 (FCT 21c)	30		
KgMp	R5^	MODO-3 (FCT 11)	30	FCT 11: Wet forests and wetlands	Well reserved Low risk
		BANK-1A (FCT 13)	25		
		HYMUS01 (FCT 11)	24		
	R6^	MILT-5 (FCT 14)	23		
		MODO-3 (FCT 11)	22		

Note: ^ shows highest percent similarity to individual Gibson *et al.* (1994) samples provided in the resemblance matrices rather than the similarity to a cluster of samples determined during the cluster analysis.

#### 4.3.5 Threatened and priority ecological communities

The following TECs and PECs were identified within the site:

- ‘Banksia woodlands of the Swan Coastal Plain’ TEC.
- ‘Banksia woodlands of the Swan Coastal Plain’ PEC.
- ‘Low lying *Banksia attenuata* woodlands and shrublands’ PEC.

The locations of the TECs and PECs within the site are shown in **Figure 6**.

The structure, composition and patch size of the south-eastern area of plant community **BaBmSi** indicates that it represents the Commonwealth listed ‘banksia woodlands of the Swan Coastal Plain’ TEC, as outlined in **Table 8** and shown on **Figure 6**. The northern two areas of plant community

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**BaBmSi** do not meet the patch size criteria to be considered as part of the ‘banksia woodlands of the Swan Coastal Plain’ TEC, as outlined in **Table 8**.

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

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"> <li>• Location</li> <li>• Soils</li> <li>• Structure</li> <li>• Composition</li> </ul>	<ul style="list-style-type: none"> <li>• Site meets location and soils criteria.</li> <li>• The <b>BaBmSi</b> vegetation includes the key diagnostic feature of a tree layer of <i>Banksia attenuata</i>, <i>Banksia menziesii</i> and <i>Banksia ilicifolia</i>.</li> <li>• The <b>KgSi</b> and <b>Kg</b> vegetation does <u>not</u> include the key diagnostic feature of a <i>Banksia</i> spp. tree layer.</li> <li>• The <b>BaBmSi</b> vegetation within site also meets structure and composition criterion. FCT 21c is identified as one of the FCTs comprising the banksia woodland TEC.</li> </ul>
2. Must meet condition thresholds	<ul style="list-style-type: none"> <li>• A patch should at least meet the ‘good’ condition category (see <b>Table 1</b>)</li> </ul>	<ul style="list-style-type: none"> <li>• The <b>BaBmSi</b> vegetation is present in ‘good’ condition, which meets this criterion.</li> </ul>
3. Must meet minimum patch size	<p>Minimum size of patch:</p> <ul style="list-style-type: none"> <li>• Pristine=no minimum size</li> <li>• Excellent=0.5 ha</li> <li>• Very Good=1 ha</li> <li>• Good=2 ha</li> </ul>	<ul style="list-style-type: none"> <li>• The <b>BaBmSi</b> vegetation in ‘good’ condition within the site comprises four areas ranging in size from 0.09 ha to 0.87 ha and none of these areas independently meet this criterion.</li> <li>• The northern two areas of the <b>BaBmSi</b> vegetation are separated by over 30 m from each other and any other banksia woodland and thus were assessed independently and do not meet the minimum size threshold.</li> <li>• The south-eastern patches of plant community <b>BaBmSi</b> are separated by less than 30 m and combine to form 0.6 ha. These are further connected by under 30 m to banksia woodland vegetation in the adjacent Lot 13 and Lot 303 (as shown on <b>Figure 6</b>). Given the estimated extent of Banksia woodland adjacent to the site is well over 2 ha, the south-eastern patches of <b>BaBmSi</b> vegetation are considered to comprise part of a larger patch of the TEC.</li> </ul>



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

Criteria	Requirements for meeting criteria	Site implications
4. Must incorporate surrounding context	<ul style="list-style-type: none"> <li>• Breaks (e.g. tracks) &lt; 30 m do not separate vegetation into separate patches</li> <li>• Buffer zones may apply (20-50 m recommended from patch edge)</li> <li>• The site should be thoroughly sampled (2 surveys in same spring).</li> <li>• Survey timing should be appropriate.</li> <li>• Surrounding environment should be considered (e.g. connectivity, conservation values, fauna habitat)</li> </ul>	<ul style="list-style-type: none"> <li>• Small scale tracks (&lt;30 m wide) exist within the patch.</li> <li>• Land surrounding the patch is a combination of agricultural and native vegetation.</li> <li>• This survey was conducted in March (outside of the main flowering season) with a reconnaissance survey also conducted in mid-November (late in the main flowering period).</li> <li>• The survey timing was appropriate however subsequent targeted survey in early spring would be required to confirm presence or absence of some species.</li> <li>• Intact native vegetation that is likely to meet criteria as banksia woodland exists in the south-east and is connected to some of the <b>BaBmSi</b> vegetation within the site (<b>Figure 6</b>).</li> </ul>
Result	The site supports 0.6 ha of the banksia woodlands of the Swan Coastal Plain TEC.	

DBCA's *Priority Ecological Community* list indicates that the description, area and condition thresholds that apply to the Commonwealth-listed TEC of the same name also apply to the 'banksia woodlands of the Swan Coastal Plain' PEC (DBCA 2020b). Therefore, a total of 0.6 ha of this PEC occurs within the site as shown in **Figure 6**.

There is no conservation advice for the State listed 'low-lying *Banksia attenuata* shrublands and woodlands' (PEC). However, DBCA has historically applied 'good' condition as a threshold for the identification of PEC vegetation. On this basis, 2.17 ha of the PEC exists within the site, as shown in **Figure 6**.

The likelihood of occurrence of other TECs and PECs is provided in **Appendix C**.

No other TECs or PECs occur within the site.

#### 4.3.6 Locally and regionally significant vegetation

Mature eucalypt trees (diameter at breast height larger than 500 mm) including *Eucalyptus todtiana* (pricklybark) are present in the site. These trees have the potential to provide foraging, roosting and nesting habitat for threatened black cockatoos, along with other ecological services.

#### 4.4 Species richness

A total of 41 species were recorded from eight samples. A species accumulation curve derived from sample data is presented in **Plate 6**. After eight samples the curve is still increasing and has not

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reached its asymptote. This indicates that a proportion of species likely remain undetected by sampling.

Species richness was estimated in PRIMER v6 to be 54 by both the Chao2 and Jackknife1 estimators. Based on the trend of the species accumulation curve approximately 20 samples would be required to capture that many species. Including the 57 additional species recorded opportunistically, a total of 84 species was recorded in the site. This is more than the 54 species estimated to be within the site. Considering the degraded nature of the majority of the site, the survey effort was considered to be adequate to prepare a representative species inventory.

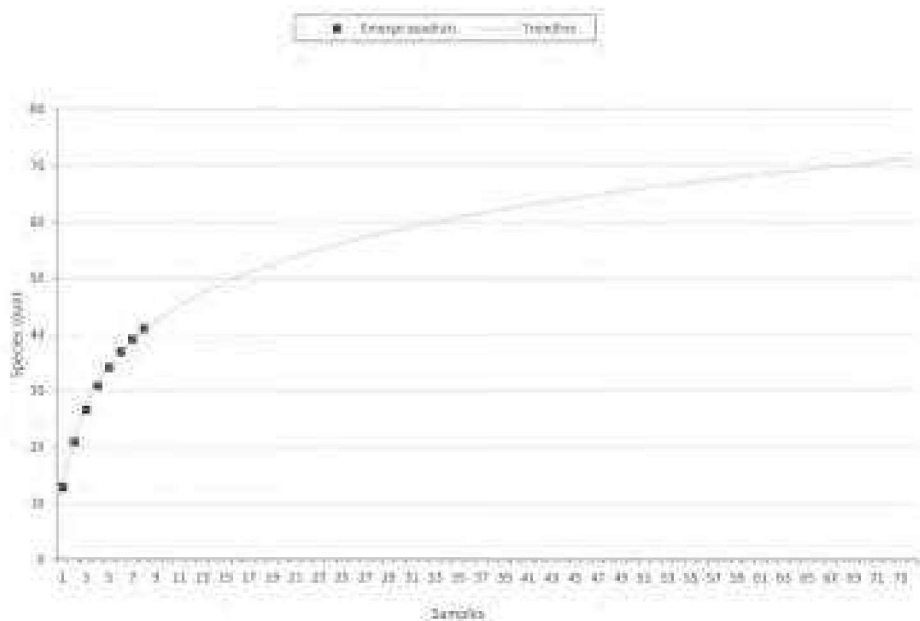


Plate 6: Species accumulation curve derived from sample data ( $y = 13.739\ln(x) + 12.073$   
 $R^2 = 0.9971$ )

## Detailed Flora and Vegetation Assessment

Lot 15 Nicholson Road, Forrestdale



### 5 Discussion

The vegetation within the site has been subject to significant past disturbance and approximately 87% of the site is in 'degraded' and 'completely degraded' condition.

The most intact native vegetation occurs in the northern and south-eastern portion of the site where the **BaBmSi** plant community is present. The **BaBmSi** vegetation extends over a small portion of the site (13%) and shows notable disturbances to vegetation structure.

#### 5.1 Threatened and priority flora

No threatened or priority flora species were recorded within the site. The absence of the larger perennial species that have potential to occur such as *Synaphea* sp. Serpentine (G.R. Brand 103), *Grevillea curviloba* subsp. *incurva* and *Calectasia grandiflora* was relatively easy to confirm. However, due to their size and seasonal lifeform, smaller annual or geophytic species such as *Caladenia huegelii*, *Drakaea elastica*, *D. micrantha*, *Diuris purdiei*, *Schoenus pennisetis* and *Poranthera moorokatta* can be more difficult to detect. Surveys for annual and geophytic species need to be undertaken during the species main flowering period or recommended survey period.

Two site visits were undertaken within the main flowering season, in October and November. As such, the majority of conservation significant species would have been detectable, if present. Notably five native orchid species were recorded in October 2021 and so the timing was appropriate to capture cryptic species such as orchids. One priority flora species with potential to occur in the site, *Schoenus pennisetis* (P3), is an annual herb that flowers from August to September. The survey was undertaken after the flowering season for this species and so it would not have been visible, if present. Although disturbed, plant communities **Kg** and **KgMp** may provide suitable habitat for *S. pennisetis*. Survey between August and September would be required to confirm whether *S. pennisetis* occurs in the site.

#### 5.2 Vegetation condition

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.

A vegetation condition score has the greatest implications when the condition of vegetation is close the boundary between 'good' and 'degraded'. This is because good condition is typically accepted as the threshold for conservation significance, while 'degraded' condition implies a low conservation requirement. Separating these two condition categories is further complicated by the fact that good condition is more correctly understood to mean 'average' condition. Applying the Keighery (1994) condition scale good condition vegetation can be expected to be significantly altered, with very obvious disturbance and the presence of aggressive weeds at high density. Therefore good does not literally mean "good" as the label implies.

## Detailed Flora and Vegetation Assessment

Lot 15 Nicholson Road, Forrestdale



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 (2016b). Nevertheless, the two northern areas of plant community **BaBmSi** showed characteristics of both ‘good’ and ‘degraded’ condition categories, and have been conservatively mapped as being in ‘good’ condition. These areas do not have particularly high weed cover, but have sparse overstorey and understorey species and a low level of native species diversity. Further survey during the growing and earlier flowering season may assist in the detection of additional annual and geophytic native and non-native species that may influence the final assessment of vegetation condition.

### 5.3 Floristic community type assignment

The results of the FCT cluster analysis were reasonably straightforward, with the samples within plant communities **BaBmSi** and **KgSi** clustering with moderate similarity (33-36%) to FCT 21c – ‘low lying *Banksia attenuata* woodlands or shrublands’. FCT 21c tends to occur on sands in wetter, lower lying areas of the Bassendean dune system on the Swan Coastal Plain (Gibson *et al.* 1994). This description aligns with the landform of plant communities **BaBmSi** and **KgSi**.

Whilst the samples in plant community **Kg** did not cluster with FCT 21c, it showed highest similarity to individual Gibson *et al.* (1994) sites were representing FCT 21c. Samples within the **KgMp** vegetation were less consistent, clustering with lower similarity (19-21%) to FCT 14. Highest similarities were to individual (Gibson *et al.* 1994) sites comprising FCTs 11, 13 and 14. FCTs 13 and 14 are not known to occur in the wider area. It is likely that the low number of native species recorded in the **KgMp** samples and the presence of dense *Kunzea glabrescens* has unduly influenced the results of the analysis. *K. glabrescens* often proliferates after disturbance such as vegetation clearing and thus its presence in high densities in most of the vegetation within the site is indicative historical disturbance. As such, FCT 11 is considered to be the most likely FCT for plant community **KgMp**.

Further survey earlier in the main flowering season may record additional flora species that were not visible during the current surveys and may provide more conclusive results when undertaking a statistical comparison to the Gibson *et al.* (1994) dataset.

Irrespective of the results of the FCT analysis, due to the presence of *Banksia ilicifolia* trees in a relatively low-lying area, it was also considered whether plant community **BaBmSi** could potentially represent FCT 22 ‘*Banksia ilicifolia* woodlands’, which is also a State listed PEC (P3). FCT 21c and FCT 22 are the only banksia woodland FCTs that tend to occur in more low lying areas and FCT 22 in particular tends to have a very open understorey (Gibson *et al.* 1994). The **BaBmSi** vegetation did not cluster with FCT 22, nor did any of the samples show high similarity to individual Gibson *et al.* (1994) sites representing FCT 22. Moreover, the presence of a number of native species that do not tend to occur within FCT 22, such as *Scholtzia involucreta*, *Desmocladius flexuosus*, *Conostylis aculeata* and *Macrozamia riedlei* indicates that it is not likely to represent this FCT.

## Detailed Flora and Vegetation Assessment

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### 5.4 Threatened and priority ecological communities

With regard to the Commonwealth banksia woodlands TEC, the **BaBmSi** vegetation includes the key diagnostic feature of a tree layer of *Banksia attenuata*, *B. menziesii* and *Banksia ilicifolia*. It was also determined to represent FCT 21c which is one of the regional FCTs identified as being associated with the TEC (DoEE 2016). 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 7**). 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 **BaBmSi** community, there are three separate areas of this community within the site. The area in the south-eastern corner comprises two smaller patches which are within 30 m of each other and combine to form a 0.6 ha patch in 'good' condition (with a narrow strip of 'completely degraded' vegetation separating them). It is also within 30 m (and thus contiguous) with an estimated 17.5 ha of banksia woodland within the adjacent lots, as shown on **Figure 6**. This area also connects to large areas of vegetation further north and east that may also contain *Banksia* spp. Given that sufficient banksia woodland was identified in close proximity to the site, the full extent of the wider patch of banksia woodland TEC has not been estimated beyond the two adjacent lots. Due to the contiguous banksia woodland, the south-eastern area of the **BaBmSi** within the site does meet the criteria to be considered as part of a larger patch of the banksia woodland TEC.

The northern patches of plant community **BaBmSi** do not individually meet size thresholds and are separated from each other by 36 m and thus would not be viewed as contiguous. They are also not connected to other banksia woodland vegetation outside of the site. Based on this, these two areas of **BaBmSi** vegetation do not represent the TEC.

On the basis that the south-eastern portion of the **BaBmSi** vegetation represents the Commonwealth TEC, it is also considered to represent the State listed PEC 'banksia woodlands of the Swan Coastal Plain'. Conservation advice for this PEC indicates that it is subject to the same criteria as the Commonwealth banksia woodland TEC.

The areas of the **Kg** and **KgSi** vegetation were also considered to represent FCT 21c, but do not include the key diagnostic feature of a tree layer of *Banksia* spp. Based on historical aerials and some of the vegetation currently present in the Oxley Road reserve and the adjacent Lot 13, these communities may have once contained *Banksia* spp. The northern portion of the site has been subject to multiple clearing events which has resulted in dense stands of the native *Kunzea glabrescens*. Due to the absence of *Banksia* spp. the **KgSi** and **Kg** vegetation is not considered to represent the Banksia woodland TEC or PEC.

Plant communities **BaBmSi**, **KgSi** and **Kg** are considered to represent FCT 21c – 'low lying *Banksia attenuata* woodlands or shrublands', which is a State listed PEC. Conservation advice for PECs is less specific, but it is likely that only the area of **BaBmSi** vegetation in good condition (2.17 ha) would be considered to represent this PEC.

## Detailed Flora and Vegetation Assessment

Lot 15 Nicholson Road, Forrestdale



### 5.5 Wetlands

The presence of a wetland landform throughout the central portion of the site was confirmed during the surveys, with this area being notably lower than the northern and portion portions of the site. However, the mapped MUW UFI 7236 running through the centre of the site is largely in 'completely degraded' condition and supports pasture weeds. The 'degraded' **KgMp** vegetation present within the mapped extent of MUW UFI 7236 largely comprises the native species *Kunzea glabrescens* and *Melaleuca preissiana*, which are both common species within wetlands of the Swan Coastal Plain. The small area of CCW UFI 7235 near the eastern edge of the site also supports part of plant community **KgMp** in degraded condition, which also extends further to the west of the mapped wetland boundary.

### 5.6 Local and regional significance

Plant communities **BaBmSi**, **KgSi** and **Kg** contain plants known to provide foraging habitat for threatened species of black cockatoo. In addition, a small number of mature *Eucalyptus todtiana* are present within the site as well as other *\*Eucalyptus* spp. trees with a diameter at breast height larger than 500 mm which have the potential to provide nesting values for black cockatoos, along with other ecological services.

## Detailed Flora and Vegetation Assessment

Lot 15 Nicholson Road, Forrestdale



### 6 Conclusions

Over half of the site is highly disturbed and modified, with approximately 10.11 ha of the site containing 'completely degraded', non-native vegetation. The remaining 6.62 ha of the site supports native vegetation in 'degraded' to 'good' condition.

No threatened or priority flora species were recorded within the site. One priority species, *Schoenus pennisetis* (P3) may occur within plant communities **Kg** and **KgMp**. Further survey between August and September would be required to confirm whether *S. pennisetis* occurs in the site.

The site contains five plant communities ranging from 'completely degraded' to 'good' condition.

A 0.6 ha patch of the EPBC Act listed banksia woodlands TEC occurs in the south-eastern portion of the site. This patch also represents the State listed PEC of the same name.

A 2.17 ha patch of the State listed PEC 'low-lying *Banksia attenuata* woodlands and shrublands' (P3) occurs in the north and south-east portions of the site.

# Detailed Flora and Vegetation Assessment

Lot 15 Nicholson Road, Forrestdale



## 7 References

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# Figures



*Figure 1: Site Location*

*Figure 2: Soils, Topography and Wetlands*

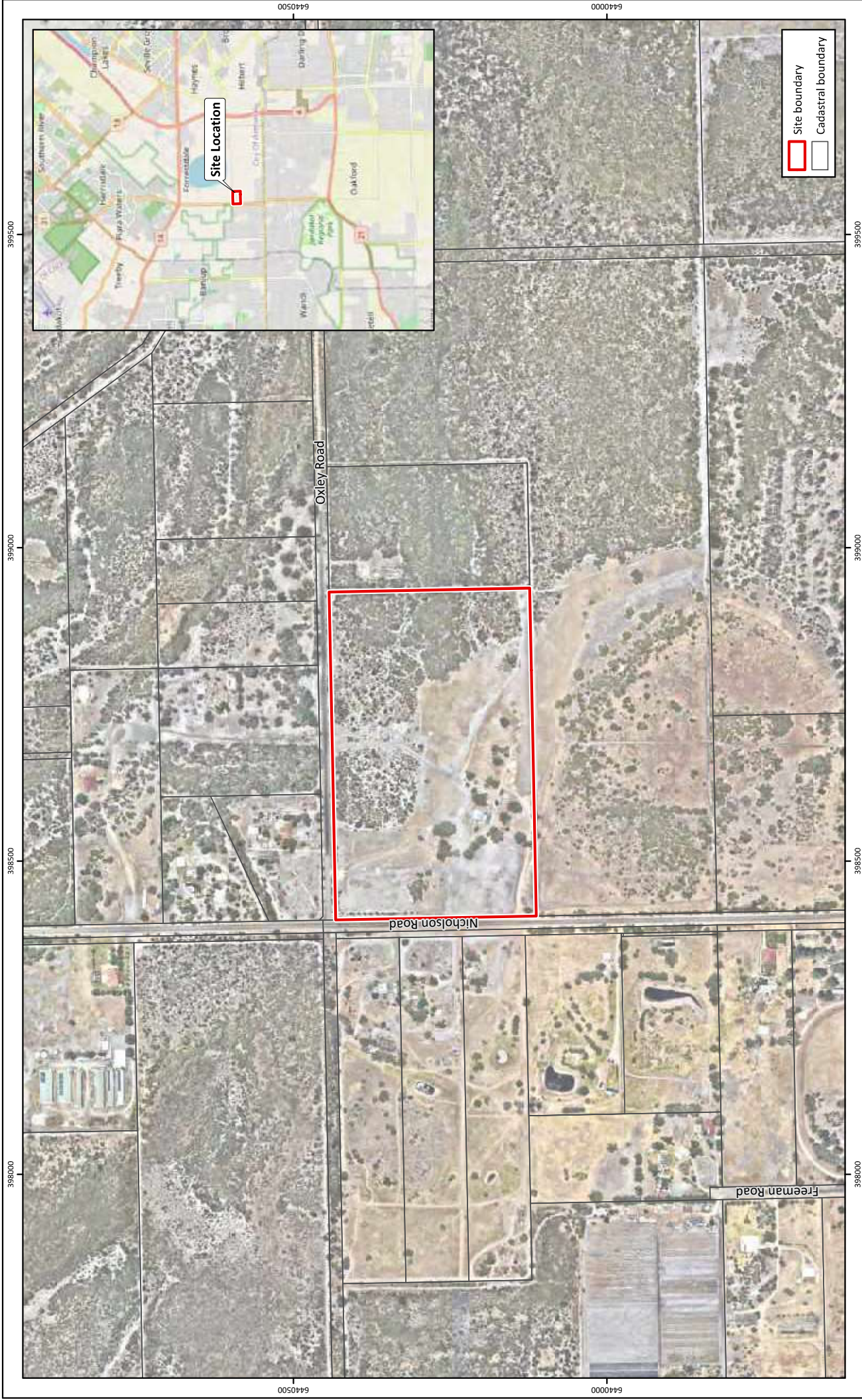
*Figure 3: Environmental Features*

*Figure 4: Plant Communities*

*Figure 5: Vegetation Condition*

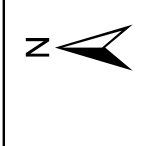
*Figure 6: Threatened and Priority Ecological Communities*





**Figure 1: Site Location**

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**Date:** 11/03/21  
**Checked:** SKP  
**Approved:** RAW  
**Date:** 10/05/2021



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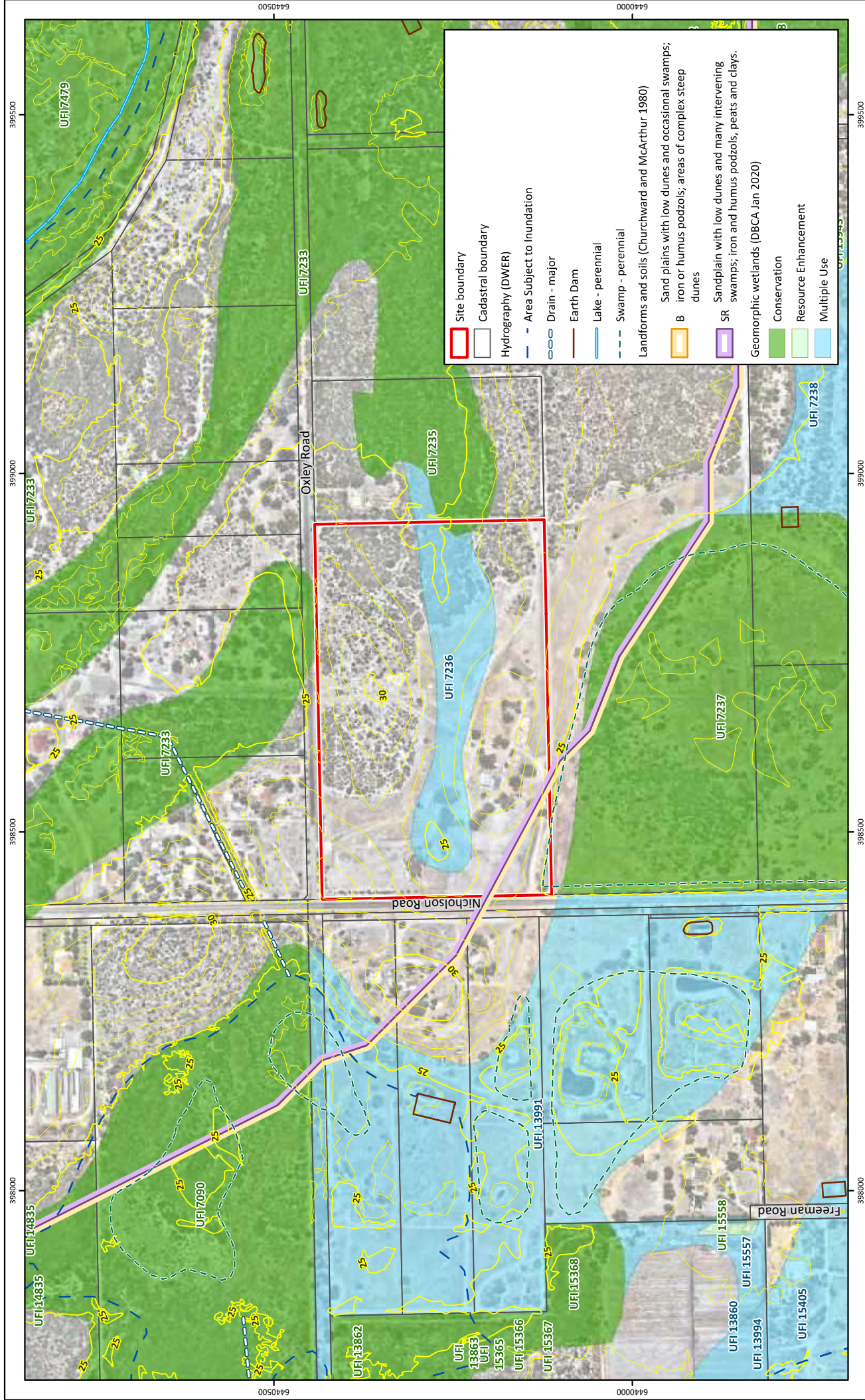
Site boundary  
 Cadastral boundary



**Project:** Detailed Flora and Vegetation Assessment  
 Lot 15 Nicholson Road, Forrestdale  
**Client:** Australian Islamic College (Perth) Inc.

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Plan Number:  
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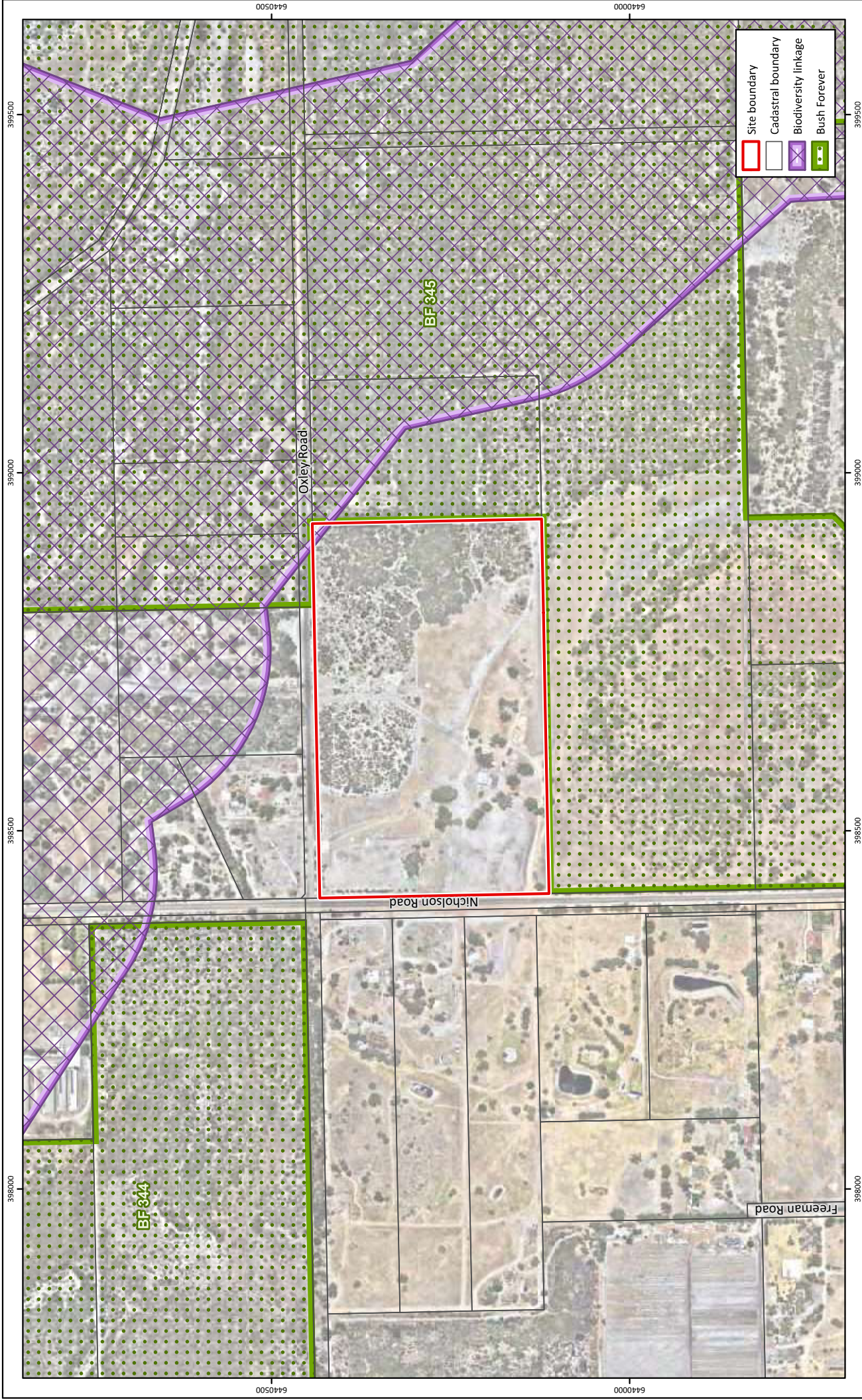
**Figure 2: Soils, Topography, and Wetlands**

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	Site boundary
	Cadastral boundary
	Biodiversity linkage
	Bush Forever



0 100 200  
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Scale: 1:7,000@A4  
GDA 1994 MGA Zone 50



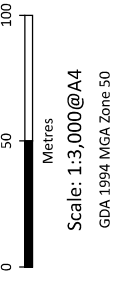
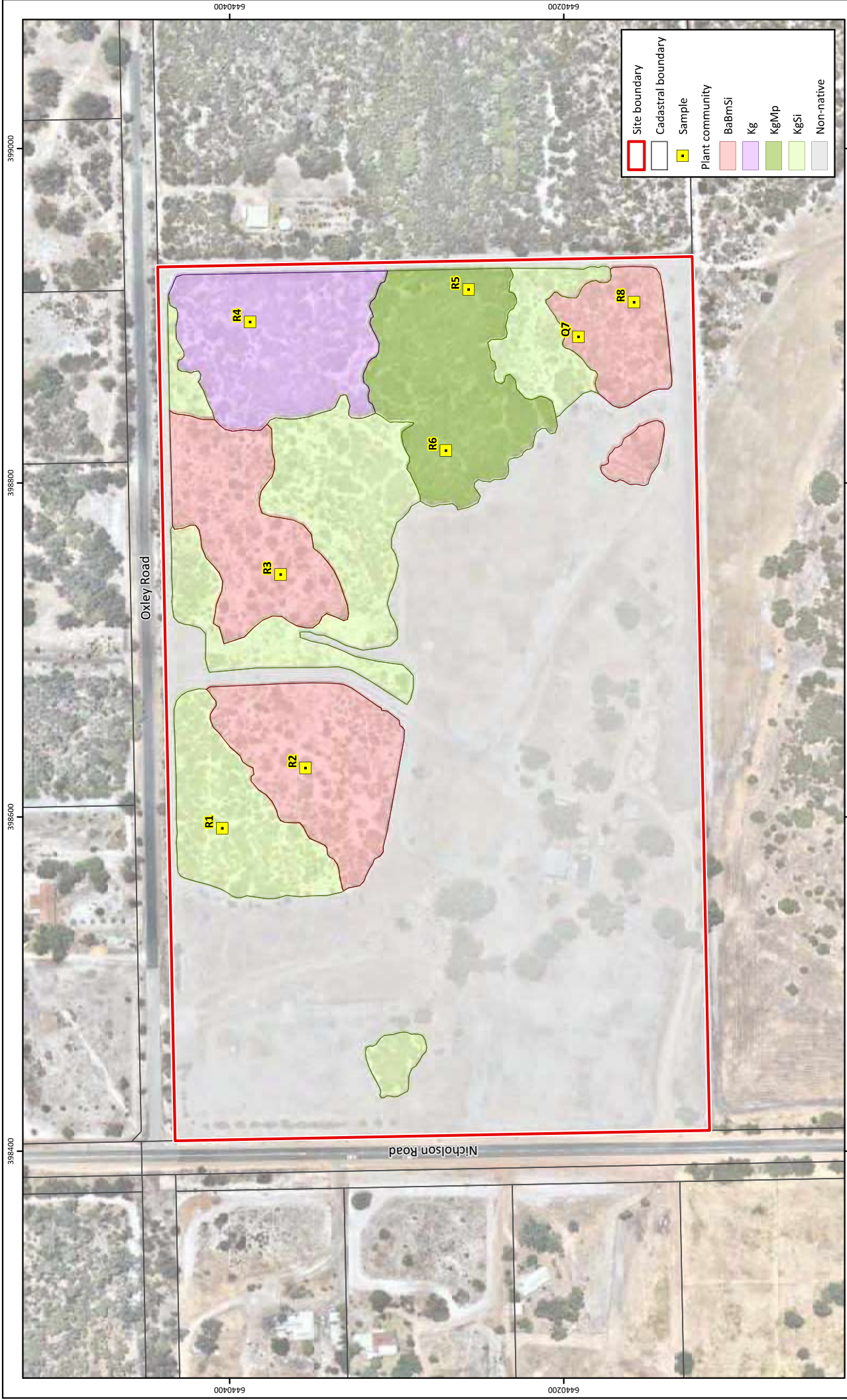
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EP20-126(05)-F08  
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Date: 11/03/21  
Checked: SKP  
Approved: RAW  
Date: 10/05/2021

**Figure 3: Environmental Features**

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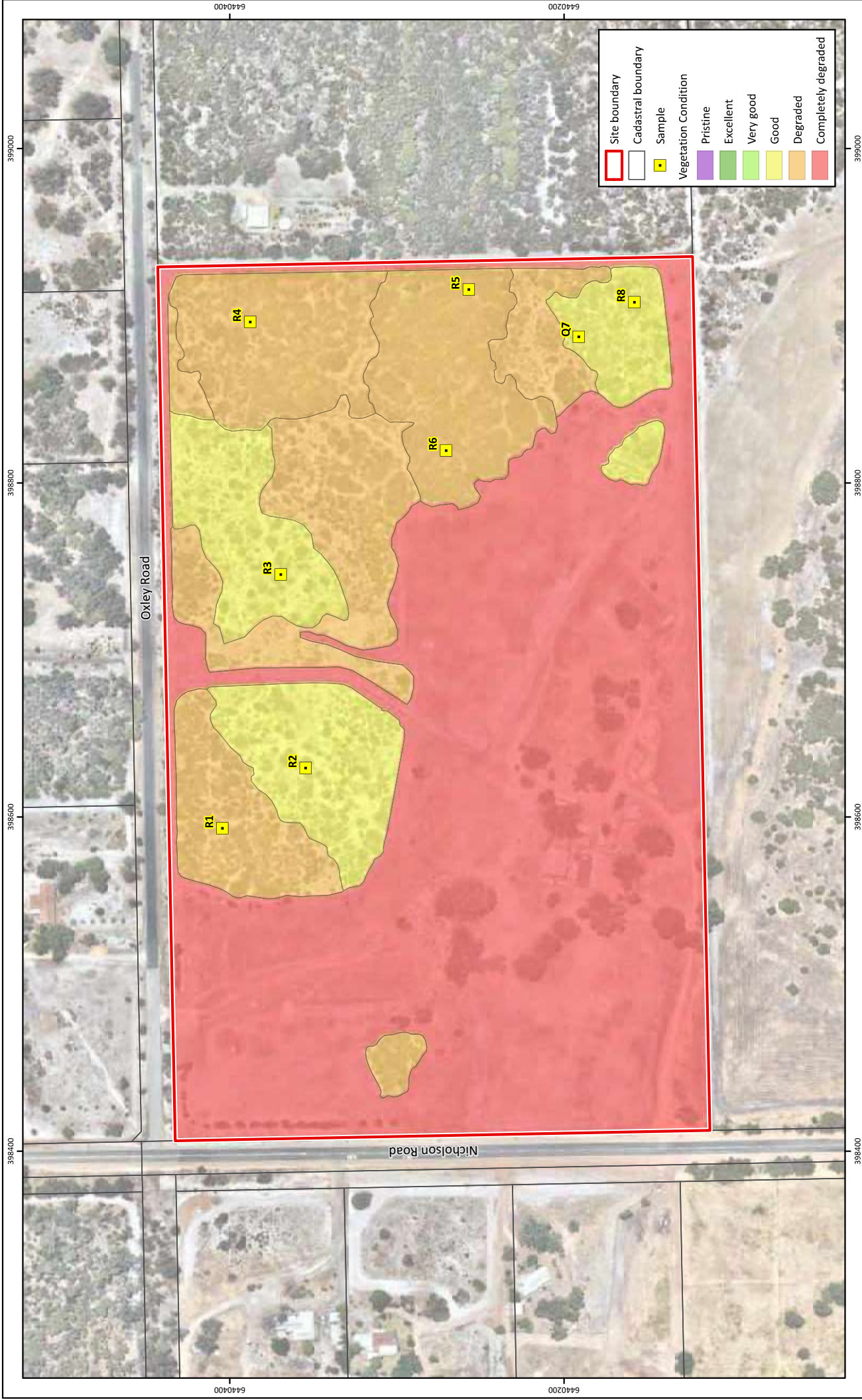
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 Approved: RAW  
 Date: 10/05/2021

**Figure 4: Plant Communities**

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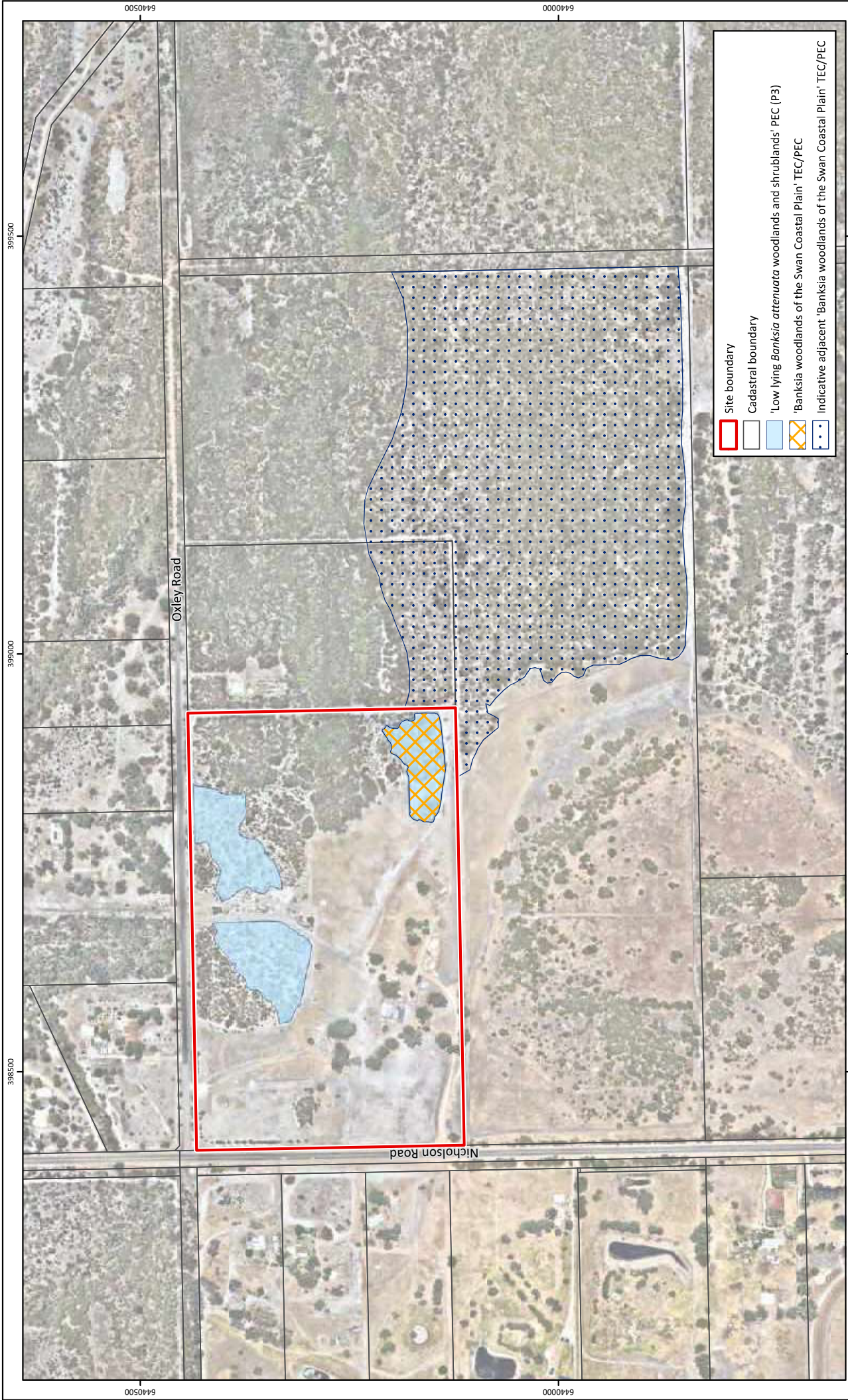
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**Date:** 10/05/2021

**Project:** Detailed Flora and Vegetation Assessment  
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**Figure 5: Vegetation Condition**

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Site boundary  
 Cadastral boundary  
 'Low lying *Banksia attenuata* woodlands and shrublands' PEC (P3)  
 'Banksia woodlands of the Swan Coastal Plain' TEC/PEC  
 Indicative adjacent 'Banksia woodlands of the Swan Coastal Plain' TEC/PEC



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 Metres  
 Scale: 1:6,000@A4  
 GDA 1994 MGA Zone 50

Plan Number: EP20-126(05)-F11  
 Drawn: AFF  
 Date: 11/03/21  
 Checked: SKP  
 Approved: RAW  
 Date: 10/05/2021

**Figure 6: Threatened and Priority Ecological Communities**  
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 Lot 15 Nicholson Road, Forrestdale  
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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 2018c). 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 2018c)

Conservation code	Description
EX <sup>†</sup>	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 <sup>†</sup>	Threatened Flora – Extant Taxa which are declared to be likely to become extinct or is rare, or otherwise in need of special protection.
CR <sup>^</sup>	Threatened Flora – Critically Endangered Taxa which are considered to be facing an extremely high risk of extinction in the wild.
EN <sup>^</sup>	Threatened Flora – Endangered Taxa which are considered to be facing a very high risk of extinction in the wild.
VU <sup>^</sup>	Threatened Flora – Vulnerable Taxa which are considered to be facing a high risk of extinction in the wild.
P1 <sup>□</sup>	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 <sup>□</sup>	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 <sup>□</sup>	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 <sup>□</sup>	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.

<sup>^</sup>pursuant to the EPBC Act, <sup>†</sup>pursuant to the BC Act, <sup>□</sup>on DBCA's *Priority Flora List*

### Threatened and priority ecological communities

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

## 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 2013). 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 <math>\leq 5</math> occurrences or a total area of <math>\leq 100</math>ha). 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 <math>\leq 10</math> occurrences or a total area of <math>\leq 200</math>ha). 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>

## Weeds

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

### Declared Pests

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

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

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

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

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

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

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

Category	Description
C1	Exclusion Not established in Western Australia and control measures are to be taken, including border checks, in order to prevent them entering and establishing in the State.
C2	Eradication Present in Western Australia in low enough numbers or in sufficiently limited areas that their eradication is still a possibility.
C3	Management Established in Western Australia but it is feasible, or desirable, to manage them in order to limit their

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

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



## 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 7**.

Table 7: 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 8**.

Table 8: 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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Keighery, B. 1994, *Bushland Plant Survey: A guide to plant community survey for the community*, Wildflower Society of WA (Inc), Nedlands.

Semeniuk, C. A. 1987, *Wetlands of the Darling System - a geomorphic approach to habitat classification*, Journal of the Royal Society of Western Australia, 69: 95-112.

Semeniuk, C. A. and Semeniuk, V. 1995, *A Geomorphic Approach to Global Classification for Inland Wetlands*, Vegetatio, 118(1/2): 103-124.

### Online references

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

## Additional Background Information



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

# Appendix B

Conservation Significant Flora Species and likelihood of  
Occurrence Assessment





Species name	Level of significance		Life strategy	Habitat	Flowering period	Likelihood of occurrence
	WA	EPBC Act				
<i>Austrostipa jacobsoniana</i>	CR	-	P	Grey sandy clay.	Nov-Jan	Unlikely
<i>Calectasia cyanea</i>	CR	CR	P	Heathland on white sand or laterite gravel over laterite. Known only from one population near Albany.	Jun-Oct	Unlikely
<i>Synaphea</i> sp. <i>Fairbridge Farm (D. Papenfus 696)</i>	CR	CR	P	Low woodland on grey, clayey sand with lateritic pebbles (Pinjarra Plain) near winter wet flats.	Sep-Nov	Unlikely
<i>Synaphea</i> sp. <i>Serpentine (G.R. Brand 103)</i>	CR	CR	P	Seasonally damp areas, loam - sand.	Sep-Oct	Unlikely
<i>Cataladenia huegelii</i>	CR	EN	PG	Well-drained, deep sandy soils in lush undergrowth in a variety of moisture levels.	Sep-early Nov	Unlikely
<i>Drakaea elastica</i>	CR	EN	PG	Bare patches of sand within otherwise dense vegetation in low-lying areas alongside winter-wet swamps. Typically in banksia woodland or thickets of <i>Kunzea glabrescens</i> .	late Sep-Oct/Nov, survey Jul-Aug	Unlikely
<i>Eucalyptus x balanites</i>	CR	EN	P	Light coloured sandy soils over laterite. Habitat consists of gently sloping heathlands; open mallee woodland over shrubland (Population 2) or heathland with emergent mallees (population 1)	Oct - Feb	Unlikely
<i>Synaphea</i> sp. <i>Pinjarra Plain (A.S. George 17182)</i>	EN	CR	P	White grey clayey sand on edges of seasonally inundated low lying areas.	Sep-Oct	Unlikely

Species name	Level of significance		Life strategy	Habitat	Flowering period	Likelihood of occurrence
	WA	EPBC Act				
<i>Diuris purdiei</i>	EN	EN	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>Grevillea curviloba subsp. incurva</i>	EN	EN	P	Sand, sandy loam. Winter-wet heath.	Aug-Sep	Unlikely
<i>Lepidosperma rostratum</i>	EN	EN	P	Peaty sand and clay amongst low heath, in winter-wet swamps.	May-Jun (survey late Jun-Aug)	Unlikely
<i>Thelymitra stellata</i>	EN	EN	PG	Sandy loam, clay or gravel over laterite or gravel.	Sep-Nov	Unlikely
<i>Drakea micrantha</i>	EN	VU	PG	Open sandy patches often adjacent to winter-wet swamps.	Sept- early Oct	Unlikely
<i>Calytrix simplex subsp. simplex</i>	P1	-	P	Swamps to well drained lateritic gravel slopes and flats.	(Dec-) Jan	Unlikely
<i>Drosera oreopodion</i>	P1	-	P	Clayey sand sometimes mixed with lateritic pebbles	Sep -Oct	Unlikely
<i>Ptilotus sericostachyus subsp. roseus</i>	P1	-	P	Unknown. Seem to be associated with wetlands/rivers.	Sep-Dec	Unlikely
<i>Thelymitra magnifica</i>	P1	-	PG	Gravelly soil on stony ridges.	Sep-Oct	Unlikely
<i>Acacia benthamii</i>	P2	-	P	Sand, typically on limestone breakaways	Aug - Sept	Unlikely
<i>Calectasia grandiflora</i>	P2	-	P	White, grey or yellow sand.	Jun-Nov	Unlikely
<i>Johnsonia pubescens subsp. cygnorum</i>	P2	-	P	Grey white yellow sands on flats and seasonally wet areas.	Sep	Unlikely
<i>Poranthera moorokatta</i>	P2	-	A	Sandy or clay soils. Dampland or low sandy dunes.	Oct or Feb	Unlikely



Species name	Level of significance		Life strategy	Habitat	Flowering period	Likelihood of occurrence
	WA	EPBC Act				
<i>Stenanthemum sublineare</i>	P2	-	P	White sand on coastal plains.	Oct-Dec	Unlikely
<i>Acacia horridula</i>	P3	-	P	Gravelly soils over granite, sand, rocky hillsides.	May-Aug	Unlikely
<i>Babingtonia urbana</i>	P3	-	P	Grey sand, lateritic gravel.	Jan-Mar	Unlikely
<i>Banksia kippistiana</i> var. <i>paenepeccata</i>	P3	-	P	Lateritic gravelly soils.	Oct-Nov	Unlikely
<i>Byblis gigantea</i>	P3	-	P	Sandy-peat swamps. Seasonally wet areas.	Sep-Jan	Unlikely
<i>Cyathochaeta teretifolia</i>	P3	-	P	Grey sand, sandy clay in swamps and creek edges.	Oct-Jan	Unlikely
<i>Eryngium pinnatifidum</i> subsp. <i>Palustre</i> (G.J. Keighery 13459)	P3	-	P	Grey brown sand or clay in winter wet flats.	Sep-Nov	Unlikely
<i>Jacksonia gracillima</i>	P3	-	P	Sand, often adjacent to winter wet areas	Sep-Dec	Unlikely
<i>Lasiopetalum glutinosum</i> subsp. <i>glutinosum</i>	P3	-	P	Brown clay loam on slopes	Sep-Dec	Unlikely
<i>Meionectes tenuifolia</i>	P3	-	P	Clay loam in seasonally wet areas.	Oct-Dec	Unlikely
<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 on coastal ridges.	Sep-Nov	Unlikely
<i>Pithocarpa corymbulosa</i>	P3	-	P	Gravelly or sandy loam, amongst granite outcrops.	Jan-Apr	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	Possible
<i>Stylidium aceratum</i>	P3	-	A	Sandy soils in swamp heathland.	Oct-Nov	Unlikely
<i>Stylidium paludicola</i>	P3	-	P	Peaty sand over clay. Winter wet habitats. Marri and Melaleuca woodland, Melaleuca shrubland	Oct-Dec	Unlikely
<i>Styphelia filifolia</i>	P3	-	P	Brown over pale yellow sand.	Feb-Apr	Unlikely
<i>Thysanotus anceps</i>	P3	-	P	White or grey sand, lateritic gravel, laterite.	Oct-Dec	Unlikely

Species name	Level of significance		Life strategy	Habitat	Flowering period	Likelihood of occurrence
	WA	EPBC Act				
<i>Acacia oncinophylla subsp. patulifolia</i>	P4	-	P	Granitic soils, occasionally on laterite.	Aug-Nov/Nov-Dec	Unlikely
<i>Aponogeton hexatepalus</i>	P4	-	P	Mud. Freshwater: ponds, rivers, claypans.	Jul-Oct	Unlikely
<i>Dodonaea hackettiana</i>	P4	-	P	Sand, outcropping limestone.	Jul-Oct	Unlikely
<i>Drosera occidentalis</i>	P4	-	P	Flat, brown/white/yellow moist sand/clay/peat, often near swamps.	Oct-Dec/Jan	Unlikely
<i>Jacksonia sericea</i>	P4	-	P	Calcareous and sandy soils on Swan Coastal Plain	Dec-Feb	Unlikely
<i>Kennedia beckxiana</i>	P4	-	P	Sand or loam on granite hills and outcrops.	Sep-Dec	Unlikely
<i>Ornduffia submersa</i>	P4	-	A	Sandy clay in inundated wetland/creek.	Aug-Nov	Unlikely
<i>Stylidium longitubum</i>	P4	-	A	Sandy clay, clay. Seasonal wetlands.	Oct-Dec	Unlikely
<i>Thysanotus glaucus</i>	P4	-	P	White, grey or yellow sand, sandy gravel.	Oct-Mar	Unlikely
<i>Tripterococcus sp. Brachylobus (A.S. George 14234)</i>	P4	-	P	Winter-wet areas on grey sand.	Oct-Feb	Unlikely
<i>Verticordia lindleyi subsp. 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 woodlands of the Swan Coastal Plain	TEC	-	EN	Recorded
Mound springs SCP	Communities of Tumulus Springs (Organic Mound Springs, Swan Coastal Plain)	TEC	CR	E	Does not occur
SCP3a	<i>Corymbia calophylla</i> - <i>Kingia australis</i> woodlands on heavy	TEC	CR	EN	Does not occur
SCP3b	<i>Corymbia calophylla</i> - <i>Eucalyptus marginata</i> woodlands on	TEC	VU	-	Does not occur
SCP3c	<i>Corymbia calophylla</i> - <i>Xanthorrhoea preissii</i> woodlands and shrublands, Swan Coastal Plain	TEC	CR	EN	Does not occur
SCP20b	<i>Banksia attenuata</i> and/or <i>Eucalyptus marginata</i> woodlands	TEC	EN	EN	Does not occur
SCP08	Claypans of the Swan Coastal Plain	TEC	-	CR	Does not occur
SCP09	Herb rich shrublands in clay pans	TEC	VU	CR	Does not occur
SCP10a	Dense shrublands on clay flats	TEC	VU	CR	Does not occur
SCP10a	Shrublands on dry clay flats	TEC	EN	CR	Does not occur
Tuart Woodlands	Tuart ( <i>Eucalyptus gomphocephala</i> ) woodlands and forests of the Swan Coastal Plain	TEC		CR	Does not occur
Muchea Limestone	Shrublands and woodlands on Muchea Limestone of the Swan Coastal Plain	TEC	EN	EN	Does not occur
Claypans with shrubs over herbs	Claypans with mid dense shrublands of <i>Melaleuca lateritia</i> over herbs	PEC	P1	-	Does not occur
	<i>Casuarina obesa</i> Association	PEC	P1	-	Does not occur
	Banksia woodlands of the Swan Coastal Plain	PEC	P3	-	Recorded
SCP21c	Low lying <i>Banksia attenuata</i> woodlands or shrublands	PEC	P3	-	Recorded
SCP22	<i>Banksia ilicifolia</i> woodlands	PEC	P3	-	Does not occur
SCP24	Northern Spearwood shrublands and woodlands	PEC	P3	-	Does not occur

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 - Lot 15 Nicholson Road Forrestdale

Note: \* denotes introduced weed species, PI = planted, DP = declared pest

Family	Status	Species
Aizoaceae	*	<i>Carpobrotus edulis</i>
Anacardiaceae	*, PI	<i>Schinus terebinthefolius</i>
Anarthriaceae		<i>Lyginia barbata</i>
Araceae	*, DP	<i>Zantedeschia aethiopica</i>
Araucariaceae	*, PI	<i>Araucaria heterophylla</i>
Asparagaceae	*, DP	<i>Asparagus asparagoides</i> <i>Laxmannia squarrosa</i> <i>Lomandra caespitosa</i> <i>Lomandra hermaphrodita</i> <i>Lomandra</i> sp. <i>Thysanotus manglesianus</i>
Asteraceae	*	<i>Arctotheca calendula</i>
	*	<i>Hypochaeris glabra</i>
	*	<i>Hypochaeris radicata</i>
	*	<i>Leontodon rhagadioloides</i>
	*	<i>Podotheca gnaphalioides</i>
	*	<i>Ursinia anthemoides</i>
Campanulaceae		<i>Lobelia tenuior</i>
Centrolepidaceae		<i>Centrolepis glabra</i>
Colchicaceae		<i>Burchardia congesta</i>
Commelinaceae		<i>Cartonema philydroides</i>
Crassulaceae		<i>Crassula colorata</i>
Cucurbitaceae	*	<i>Citrullus amarus</i>
Cyperaceae		<i>Chaetospora curvifolia</i> <i>Isolepis marginata</i>
Dilleniaceae		<i>Hibbertia subvaginata</i>
Droseraceae		<i>Drosera erythrorhiza</i>
Ericaceae		<i>Brachyloma preissii</i> <i>Styphelia conostephioides</i>

## Flora Species List - Lot 15 Nicholson Road Forrestdale

Note: \* denotes introduced weed species, PI = planted, DP = declared pest

Family	Status	Species
Fabaceae		<i>Acacia huegelii</i>
	*	<i>Acacia longifolia</i>
		<i>Acacia pulchella</i> var. <i>glaberrima</i>
		<i>Bossiaea eriocarpa</i>
		<i>Daviesia</i> sp.
		<i>Gompholobium tomentosum</i>
		<i>Jacksonia furcellata</i>
	*	<i>Lotus subbiflorus</i>
Goodeniaceae		<i>Lechenaultia floribunda</i>
Haemodoraceae		<i>Anigozanthos manglesii</i>
		<i>Conostylis aculeata</i> subsp. <i>aculeata</i>
		<i>Haemodorum spicatum</i>
Hemerocallidaceae		<i>Caesia micrantha</i>
		<i>Chamaescilla corymbosa</i>
		<i>Corynotheca micrantha</i>
		<i>Dianella revoluta</i>
Iridaceae		<i>Gladiolus caryophyllaceus</i>
	*	<i>Patersonia occidentalis</i>
		<i>Romulea</i> sp.
Lamiaceae		<i>Hemiandra pungens</i>
Loranthaceae		<i>Nuytsia floribunda</i>
Macarthuriaceae		<i>Macarthuria australis</i>
Malvaceae		<i>Brachychiton</i> sp.
	*, PI	
Meliaceae		<i>Melia azedarach</i>
	*, PI	
Moraceae		<i>Ficus carica</i>
	*, PI	
	*, PI	<i>Morus</i> sp.
Myrtaceae		<i>Astartea scoparia</i>
		<i>Calytrix flavescens</i>
	*, PI	<i>Corymbia ficifolia</i>
	*, PI	<i>Eucalyptus botryoides</i>
	*, PI	<i>Eucalyptus camaldulensis</i>
	*, PI	<i>Eucalyptus cladocalyx</i>
	PI	<i>Eucalyptus gomphocephala</i>
		<i>Eucalyptus todtiana</i>
		<i>Kunzea glabrescens</i>

## Flora Species List - Lot 15 Nicholson Road Forrestdale

Note: \* denotes introduced weed species, PI = planted, DP = declared pest

Family	Status	Species
Myrtaceae (cont.)		<i>Melaleuca preissiana</i> <i>Scholtzia involucrata</i>
Oleaceae		
	*, PI	<i>Olea europaea</i>
Orchidaceae		
	*	<i>Caladenia flava</i> <i>Disa bracteata</i> <i>Microtis media</i> <i>Pterostylis pyramidalis</i> <i>Pyrorchis nigricans</i> <i>Thelymitra crinita</i>
Orobanchaceae		
	*	<i>Orobanche minor</i>
Pinaceae		
	*, PI	<i>Pinus pinaster</i>
	*, PI	<i>Pinus radiata</i>
Poaceae		
	*	<i>Aira</i> sp. <i>Austrostipa compressa</i>
	*	<i>Avena barbata</i>
	*	<i>Briza maxima</i>
	*	<i>Cynodon dactylon</i>
	*	<i>Ehrharta calycina</i>
	*	<i>Eragrostis cilianensis</i>
	*	<i>Eragrostis curvula</i>
	*	<i>Lagurus ovatus</i>
	*	<i>Vulpia bromoides</i>
Polygonaceae		
	*	<i>Rumex crispus</i>
Proteaceae		
		<i>Adenanthos cygnorum</i> <i>Banksia attenuata</i> <i>Banksia ilicifolia</i> <i>Banksia menziesii</i>
Restionaceae		
		<i>Desmocladius flexuosus</i> <i>Hypolaena exsulca</i>
Solanaceae		
	*, DP	<i>Solanum linnaeanum</i>
	*	<i>Solanum nigrum</i>
Stylidiaceae		
		<i>Stylidium ?araeophyllum</i> <i>Stylidium repens</i>
Zamiaceae		
		<i>Macrozamia riedlei</i>



# Appendix E

Species x Plant Community Index





Flora Species x Plant Community Matrix - Lot 15 Nicholson Road Forrestdale

Species	Plant community				Opportunistic
	BaBmSi	Kg	KgMp	KgSi	
<i>Acacia huegelii</i>	X				
<i>Acacia longifolia</i>	X				
<i>Acacia pulchella</i> var. <i>glaberrima</i>	X	X			
<i>Adenanthos cygnorum</i>	X			X	
<i>Aira</i> sp.	X	X	X		
<i>Anigozanthos manglesii</i>	X				X
<i>Araucaria heterophylla</i>					X
<i>Arctotheca calendula</i>					X
<i>Asparagus asparagoides</i>	X		X		
<i>Astartea scoparia</i>			X		
<i>Austrostipa compressa</i>	X				
<i>Avena barbata</i>					X
<i>Banksia attenuata</i>	X				
<i>Banksia ilicifolia</i>	X				
<i>Banksia menziesii</i>	X				
<i>Bossiaea eriocarpa</i>	X				
<i>Brachychiton</i> sp.					X
<i>Brachyloma preissii</i>	X	X			
<i>Briza maxima</i>	X	X		X	
<i>Burchardia congesta</i>	X	X			
<i>Caesia micrantha</i>					X
<i>Caladenia flava</i>	X	X	X	X	X
<i>Calytrix flavescens</i>	X				
<i>Carpobrotus edulis</i>	X				
<i>Cartonema philydroides</i>					X
<i>Centrolepis glabra</i>	X				
<i>Chaetospora curvifolia</i>	X				
<i>Chamaescilla corymbosa</i>					X
<i>Citrullus amarus</i>					X
<i>Conostylis aculeata</i> subsp. <i>aculeata</i>	X	X		X	
<i>Corymbia ficifolia</i>					X
<i>Corynotheca micrantha</i>	X				
<i>Crassula colorata</i>		X			
<i>Cynodon dactylon</i>					X
<i>Daviesia</i> sp.	X				
<i>Desmocladius flexuosus</i>	X				
<i>Dianella revoluta</i>	X				X
<i>Disa bracteata</i>	X			X	
<i>Drosera erythrorhiza</i>	X			X	
<i>Ehrharta calycina</i>	X	X	X	X	
<i>Eragrostis cilianensis</i>					X
<i>Eragrostis curvula</i>					X
<i>Eucalyptus botryoides</i>					X
<i>Eucalyptus camaldulensis</i>					X
<i>Eucalyptus cladocalyx</i>					X
<i>Eucalyptus gomphocephala</i>					X
<i>Eucalyptus todtiana</i>	X				

Flora Species x Plant Community Matrix - Lot 15 Nicholson Road Forrestdale

Species	Plant community				Opportunistic
	BaBmSi	Kg	KgMp	KgSi	
<i>Ficus carica</i>					X
<i>Gladiolus caryophyllaceus</i>	X				
<i>Gompholobium tomentosum</i>	X	X			
<i>Haemodorum spicatum</i>	X				
<i>Hemiandra pungens</i>	X				
<i>Hibbertia subvaginata</i>	X				
<i>Hypochaeris glabra</i>			X		
<i>Hypochaeris radicata</i>			X		
<i>Hypolaena exsulca</i>		X		X	X
<i>Isolepis marginata</i>	X				
<i>Jacksonia furcellata</i>	X	X		X	
<i>Kunzea glabrescens</i>	X	X	X	X	
<i>Lagurus ovatus</i>				X	
<i>Laxmannia squarrosa</i>	X				
<i>Lechenaultia floribunda</i>	X				
<i>Leontodon rhagadioloides</i>	X				X
<i>Lobelia tenuior</i>	X				
<i>Lomandra caespitosa</i>	X			X	
<i>Lomandra hermaphrodita</i>	X			X	
<i>Lomandra sp.</i>	X				
<i>Lotus subbiflorus</i>	X			X	X
<i>Lyginia barbata</i>	X			X	
<i>Macarthuria australis</i>	X				
<i>Macrozamia riedlei</i>				X	
<i>Melaleuca preissiana</i>			X		
<i>Melia azedarach</i>					X
<i>Microtis media</i>	X	X	X	X	
<i>Morus sp.</i>					X
<i>Nuytsia floribunda</i>	X				
<i>Olea europaea</i>					X
<i>Orobanche minor</i>	X				
<i>Patersonia occidentalis</i>	X				
<i>Pinus pinaster</i>					X
<i>Pinus radiata</i>					X
<i>Podotheca gnaphalioides</i>	X	X		X	
<i>Pterostylis pyramidalis</i>		X	X		
<i>Pyrorchis nigricans</i>					X
<i>Romulea sp.</i>	X				
<i>Rumex crispus</i>					X
<i>Schinus terebinthefolius</i>					X
<i>Scholtzia involucrata</i>	X			X	
<i>Solanum linnaeanum</i>					X
<i>Solanum nigrum</i>					X
<i>Stylidium ?araeophyllum</i>	X				
<i>Stylidium repens</i>	X			X	
<i>Styphelia conostephioides</i>	X				
<i>Thelymitra crinita</i>			X		X



**Flora Species x Plant Community Matrix - Lot 15 Nicholson Road Forrestdale**

Species	Plant community				Opportunistic
	BaBmSi	Kg	KgMp	KgSi	
<i>Thysanotus sp.</i>	X				
<i>Ursinia anthemoides</i>	X	X			
<i>Vulpia bromoides</i>	X				
<i>Zantedeschia aethiopica</i>	X		X		



# Appendix F

Sample Data





**Sample Name:**

**R1**

**Project no.:** EP20-126

**Date:** 11.03.2021

**Author:** SKP,

**Status** Non-permanent

R1: Page 1 of 2

**Quadrat and landform details**

Sample type: releve

Size: other

NW corner easting: 398593.2629

NW corner northing: 6440404.494

Altitude (m): 27

Geographic datum/zone: GDA94/Zone 50

Soil water content: slightly damp

Landform: lower slope

Time since fire: no evidence

Disturbance: high - weeds, grazing

Soil type/texture sand/

Bare ground (%): 60

Rocks (%) and type: No rocks

Soil colour: white/brown

Litter: 5% (branches,twigs,leaves)

Vegetation condition: very good



**Sample Name:** R1

**Project no.:** EP20-126

**Date:** 11.03.2021

**Author:** SKP,

**Status** Non-permanent

R1: Page 2 of 2

## Species Data

\* denotes non-native species

Status	Confirmed name	Cover (%)
	<i>Adenanthos cygnorum</i>	1
*	<i>Briza maxima</i>	3
	<i>Conostylis aculeata subsp. aculeata</i>	0.5
*	<i>Ehrharta calycina</i>	7
	<i>Hypolaena exsulca</i>	2
	<i>Jacksonia furcellata</i>	3
	<i>Kunzea glabrescens</i>	30
*	<i>Lagurus ovatus</i>	1
	<i>Lomandra caespitosa</i>	0.5
	<i>Lomandra hermaphrodita</i>	0.5
	<i>Lyginia barbata</i>	0.5
	<i>Macrozamia riedlei</i>	0.5
	<i>Podotheca gnaphalioides</i>	0.5
	<i>Scholtzia involucreta</i>	15
	<i>Stylidium repens</i>	0.5

**Sample Name:**

**R2**

**Project no.:** EP20-126

**Date:** 16.11.2020, 11.03.2021

**Author:** SKP,TAA

**Status** Non-permanent

R2: Page 1 of 2

**Quadrat and landform details**

Sample type: releve

Size: other

NW corner easting: 398629.3119

NW corner northing: 6440354.633

Altitude (m): 28

Geographic datum/zone: GDA94/Zone 50

Soil water content: slightly damp

Landform: upper slope

Time since fire: no evidence

Disturbance: high - weeds, grazing

Soil type/texture sand/

Bare ground (%): 70

Rocks (%) and type: No rocks

Soil colour: white/brown

Litter: 5% (leaves,twigs,branches)

Vegetation condition: very good



**Sample Name:**

**R2**

**Project no.:** EP20-126

**Date:** 16.11.2020, 11.03.2021

**Status** Non-permanent

**Author:** SKP,TAA

R2: Page 2 of 2

**Species Data**

\* denotes non-native species

Status	Confirmed name	Cover (%)
	<i>Acacia pulchella</i> var. <i>glaberrima</i>	0.5
	<i>Adenanthos cygnorum</i>	2
	* <i>Aira</i> sp.	opp
	*, DP <i>Asparagus asparagoides</i>	0.5
	<i>Austrostipa</i> sp.	0.5
	<i>Banksia attenuata</i>	5
	<i>Banksia menziesii</i>	10
	* <i>Briza maxima</i>	5
	<i>Corynotheca micrantha</i>	1
	<i>Desmocladus flexuosus</i>	1
	* <i>Ehrharta calycina</i>	5
	<i>Jacksonia furcellata</i>	1
	<i>Lomandra caespitosa</i>	0.5
	<i>Lyginia barbata</i>	0.5
	<i>Macarthuria australis</i>	0.5
	<i>Macarthuria australis</i>	0.5
	<i>Nuytsia floribunda</i>	0.5
	<i>Podotrochea gnaphalioides</i>	0.5
	* <i>Romulea</i> sp.	1
	<i>Scholtzia involucrata</i>	5



**Sample Name:**

**R3**

**Project no.:** EP20-126

**Date:** 11.03.2021

**Author:** SKP,

**Status:** Non-permanent

R3: Page 1 of 2

**Quadrat and landform details**

Sample type: releve

Size: other

NW corner easting: 398745.055

NW corner northing: 6440369.647

Altitude (m): 30

Geographic datum/zone: GDA94/Zone 50

Soil water content: dry

Landform: upper slope

Time since fire: no evidence

Disturbance: high - weeds, grazing

Soil type/texture sand/

Bare ground (%): 40

Rocks (%) and type: No rocks

Soil colour: grey/brown

Litter: 10% (leaves,branches,twigs)

Vegetation condition: very good



**Sample Name:**

**R3**

**Project no.:** EP20-126

**Date:** 11.03.2021

**Author:** SKP,

**Status** Non-permanent

R3: Page 2 of 2

**Species Data**

\* denotes non-native species

Status	Confirmed name	Cover (%)
	? <i>Macarthuria australis</i>	0.5
	<i>Acacia huegelii</i>	0.5
	<i>Acacia pulchella</i> var. <i>glaberrima</i>	0.5
	<i>Adenanthos cygnorum</i>	3
	<i>Banksia attenuata</i>	20
	<i>Banksia menziesii</i>	10
*	<i>Briza maxima</i>	5
	<i>Calytrix flavescens</i>	opp
	<i>Conostylis aculeata</i> subsp. <i>aculeata</i>	0.5
	<i>Daviesia</i> sp.	1
*	<i>Ehrharta calycina</i>	15
	<i>Hemiandra pungens</i>	0.5
	<i>Kunzea glabrescens</i>	opp
	<i>Laxmannia squarrosa</i>	opp
	<i>Lobelia tenuior</i>	opp
	<i>Podotheca gnaphalioides</i>	1
*	<i>Romulea</i> sp.	0.5
	<i>Scholtzia involucrata</i>	20
	<i>Stylidium repens</i>	0.5

**Sample Name:**

**R4**

**Project no.:** EP20-126

**Date:** 11.03.2021

**Author:** SKP,

**Status** Non-permanent

R4: Page 1 of 2

**Quadrat and landform details**

Sample type: releve

Size: other

NW corner easting: 398896.2225

NW corner northing: 6440387.895

Altitude (m): 25

Geographic datum/zone: GDA94/Zone 50

Soil water content: slightly damp

Landform: lower slope

Time since fire: > 5 yrs

Disturbance: high - loss of u/s

Soil type/texture sand/ with organic layer

Bare ground (%): 5

Rocks (%) and type: No rocks

Soil colour: grey/brown

Litter: 10% (branches,leaves,twigs)

Vegetation condition: very good



**Sample Name:**

**R4**

**Project no.:** EP20-126

**Date:** 11.03.2021

**Author:** SKP,

**Status** Non-permanent

R4: Page 2 of 2

**Species Data**

\* denotes non-native species

Status	Confirmed name	Cover (%)
	<i>Acacia pulchella</i> var. <i>glaberrima</i>	0.5
*	<i>Aira</i> sp.	0.5
	<i>Brachyloma preissii</i>	0.5
*	<i>Briza maxima</i>	1
	<i>Burchardia congesta</i>	0.5
	<i>Conostylis aculeata</i> subsp. <i>aculeata</i>	0.5
	<i>Crassula colorata</i>	0.5
*	<i>Ehrharta calycina</i>	0.5
	<i>Gompholobium tomentosum</i>	0.5
	<i>Hypolaena exsulca</i>	0.5
	<i>Jacksonia furcellata</i>	0.5
	<i>Kunzea glabrescens</i>	75
	<i>Podotheca gnaphalioides</i>	0.5
*	<i>Ursinia anthemoides</i>	0.5

**Sample Name:**

**R5**

**Project no.:** EP20-126

**Date:** 11.03.2021

**Author:** SKP,

**Status:** Non-permanent

R5: Page 1 of 2

**Quadrat and landform details**

Sample type: releve

Size: other

NW corner easting: 398915.726

NW corner northing: 6440257.047

Altitude (m): 25

Geographic datum/zone: GDA94/Zone 50

Soil water content: slightly damp

Landform: depression

Time since fire: no evidence

Disturbance: high -

Soil type/texture sand/ with organic layer

Bare ground (%): 0

Rocks (%) and type: No rocks

Soil colour: brown/

Litter: 80% (leaves,branches,twigs)

Vegetation condition: very good



**Sample Name:**

**R5**

**Project no.:** EP20-126

**Date:** 11.03.2021

**Status** Non-permanent

**Author:** SKP,

R5: Page 2 of 2

## Species Data

\* denotes non-native species

Status	Confirmed name	Cover (%)
	*, DP <i>Asparagus asparagoides</i>	0.5
	<i>Astartea scoparia</i>	0.5
	* <i>Ehrharta calycina</i>	10
	<i>Kunzea glabrescens</i>	70
	<i>Melaleuca preissiana</i>	20

**Sample Name:**

**R6**

**Project no.:** EP20-126

**Date:** 16.11.2020, 11.03.2021

**Author:** SKP,TAA

**Status** Non-permanent

R6: Page 1 of 2

**Quadrat and landform details**

Sample type: releve

Size: other

NW corner easting: 398819.3128

NW corner northing: 6440270.609

Altitude (m): 24

Geographic datum/zone: GDA94/Zone 50

Soil water content: dry

Landform: depression

Time since fire: no evidence

Disturbance: high -

Soil type/texture sand/ with organic layer

Bare ground (%): 1

Rocks (%) and type: No rocks

Soil colour: brown/

Litter: 60% (leaves,branches,)

Vegetation condition: very good



**Sample Name:**

**R6**

**Project no.:** EP20-126

**Date:** 16.11.2020, 11.03.2021

**Status** Non-permanent

**Author:** SKP,TAA

R6: Page 2 of 2

## Species Data

\* denotes non-native species

Status	Confirmed name	Cover (%)
	* <i>Aira sp.</i>	0.5
	<i>Kunzea glabrescens</i>	90
	<i>Melaleuca preissiana</i>	5



**Sample Name:**

**Q7**

**Project no.:** EP20-126

**Date:** 16.11.2020, 11.03.2021

**Author:** SKP,TAA

**Status** Permanent

Q7: Page 1 of 2

**Quadrat and landform details**

Sample type: quadrat

Size: 10 m x 10 m

NW corner easting: 398887.4325

NW corner northing: 6440191.244

Altitude (m): 27

Geographic datum/zone: GDA94/Zone 50

Soil water content: dry

Landform: mid-slope

Time since fire: no evidence

Disturbance: moderate - weeds

Soil type/texture sand/

Bare ground (%): 5

Rocks (%) and type: No rocks

Soil colour: grey/brown

Litter: 70% (leaves,twigs,)

Vegetation condition: very good



**Sample Name:**

**Q7**

**Project no.:** EP20-126

**Date:** 16.11.2020, 11.03.2021

**Status** Non-permanent

**Author:** SKP,TAA

Q7: Page 2 of 2

## Species Data

\* denotes non-native species

Status	Confirmed name	Cover (%)
	* <i>Acacia longifolia</i>	opp
	<i>Banksia attenuata</i>	1
	<i>Banksia ilicifolia</i>	10
	<i>Banksia menziesii</i>	20
	<i>Brachyloma preissii</i>	1
	* <i>Briza maxima</i>	3
	<i>Burchardia congesta</i>	0.5
	<i>Desmocladius flexuosus</i>	0.5
	* <i>Ehrharta calycina</i>	3
	<i>Eucalyptus todtiana</i>	opp
	* <i>Gladiolus caryophyllaceus</i>	0.5
	<i>Gompholobium tomentosum</i>	1
	<i>Hibbertia subvaginata</i>	opp
	<i>Jacksonia furcellata</i>	opp
	<i>Kunzea glabrescens</i>	3
	<i>Lomandra hermaphrodita</i>	0.5
	<i>Podotheca gnaphalioides</i>	0.5
	* <i>Romulea sp.</i>	0.5
	<i>Scholtzia involucreta</i>	5
	<i>Stylidium ?araeophyllum</i>	opp
	<i>Thysanotus manglesianus</i>	opp
	* <i>Ursinia anthemoides</i>	0.5

**Sample Name:**

**R8**

**Project no.:** EP20-126

**Date:** 11.03.2021

**Author:** SKP,

**Status:** Non-permanent

R8: Page 1 of 2

**Quadrat and landform details**

Sample type: releve

Size: other

NW corner easting: 398908.0368

NW corner northing: 6440158.079

Altitude (m): 26

Geographic datum/zone: GDA94/Zone 50

Soil water content: dry

Landform: mid-slope

Time since fire: no evidence

Disturbance: moderate - weeds

Soil type/texture sand/ with organic layer

Bare ground (%): 20

Rocks (%) and type: No rocks

Soil colour: grey/brown

Litter: 70% (leaves,twigs,branches)

Vegetation condition: very good



**Sample Name:**

**R8**

**Project no.:** EP20-126

**Date:** 11.03.2021

**Author:** SKP,

**Status** Non-permanent

R8: Page 2 of 2

**Species Data**

\* denotes non-native species

Status	Confirmed name	Cover (%)
	<i>Banksia attenuata</i>	5
	<i>Banksia menziesii</i>	25
	<i>Brachyloma preissii</i>	3
*	<i>Briza maxima</i>	2
	<i>Burchardia congesta</i>	0.5
*	<i>Ehrharta calycina</i>	4
	<i>Eucalyptus todtiana</i>	opp
*	<i>Gladiolus caryophyllaceus</i>	0.5
	<i>Hypolaena exsulca</i>	opp
	<i>Kunzea glabrescens</i>	20
	<i>Lomandra sp.</i>	0.5
	<i>Patersonia occidentalis</i>	0.5
	<i>Podotheca gnaphalioides</i>	0.5
*	<i>Romulea sp.</i>	0.5
	<i>Scholtzia involucreta</i>	10
	<i>Stylidium repens</i>	0.5
*	<i>Ursinia anthemoides</i>	0.5

# Appendix G

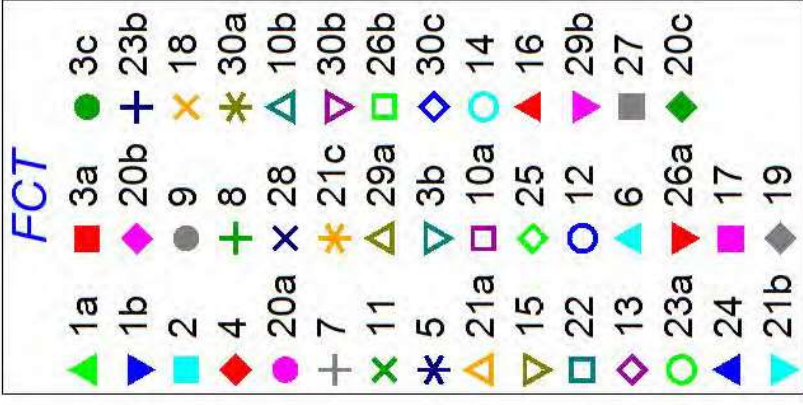
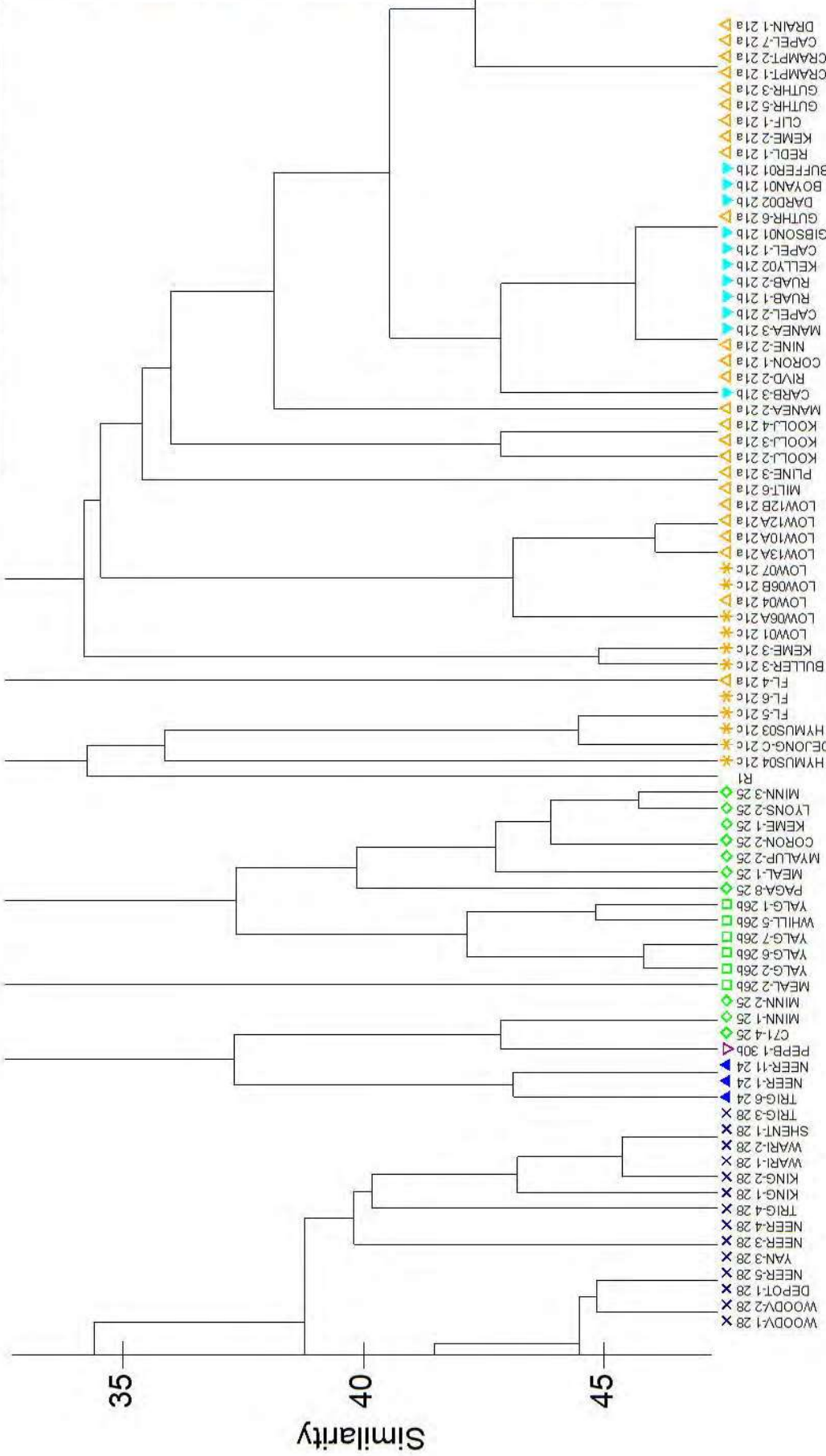
Cluster Dendrograms





Group average

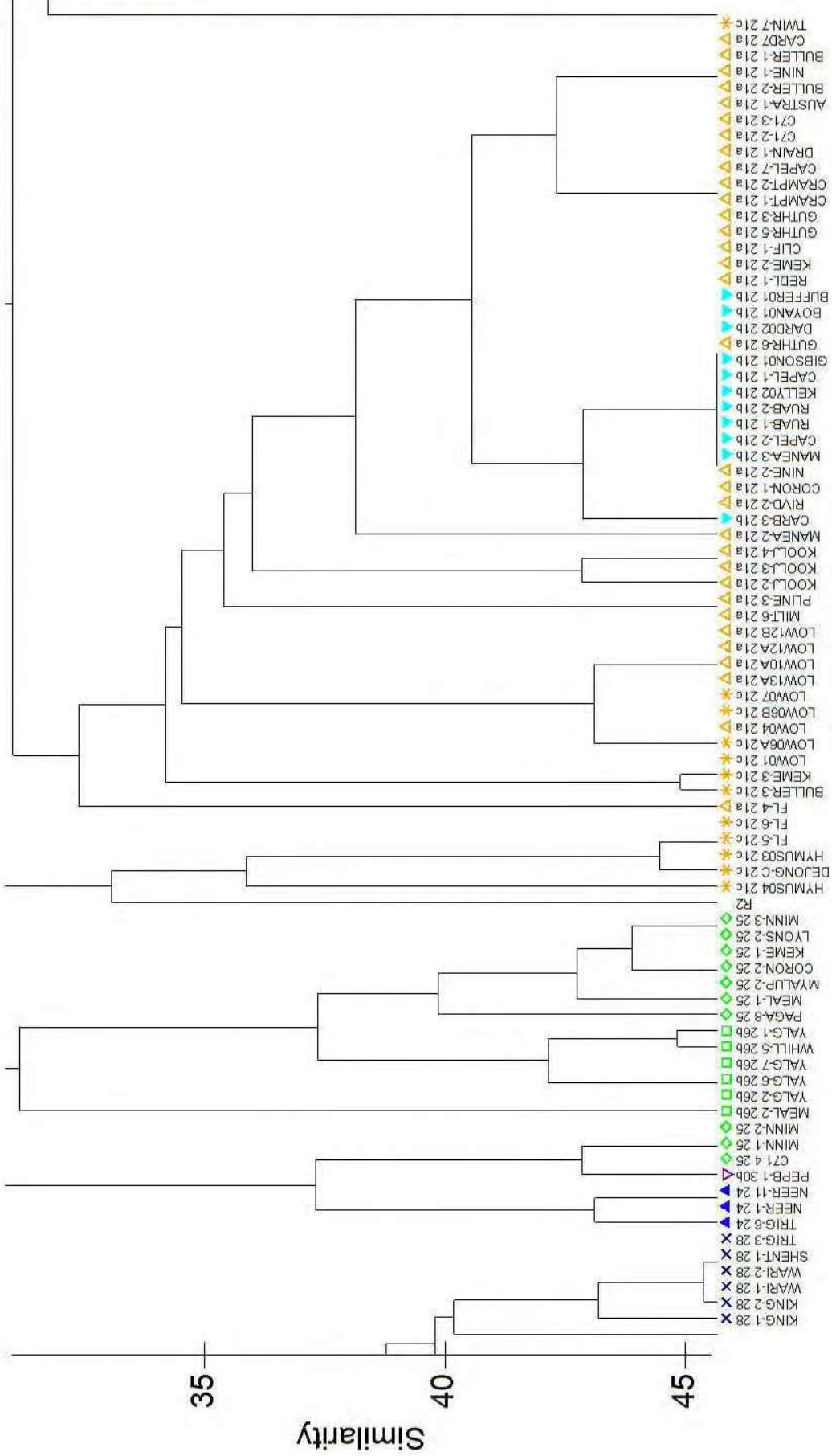
Resemblance: S17 Bray Curtis similarity



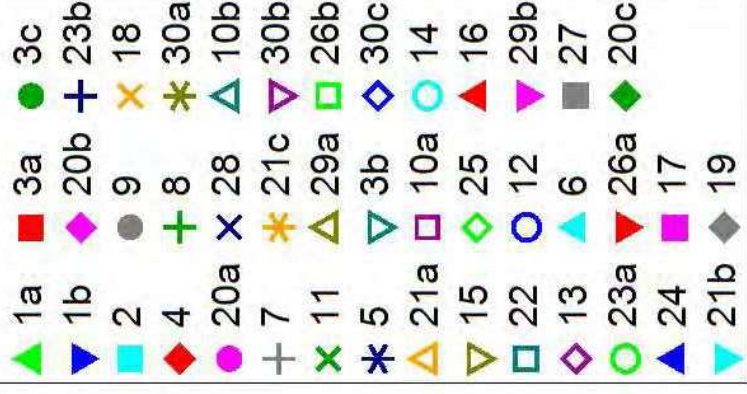
Samples

# Group average

Resemblance: S17 Bray Curtis similarity



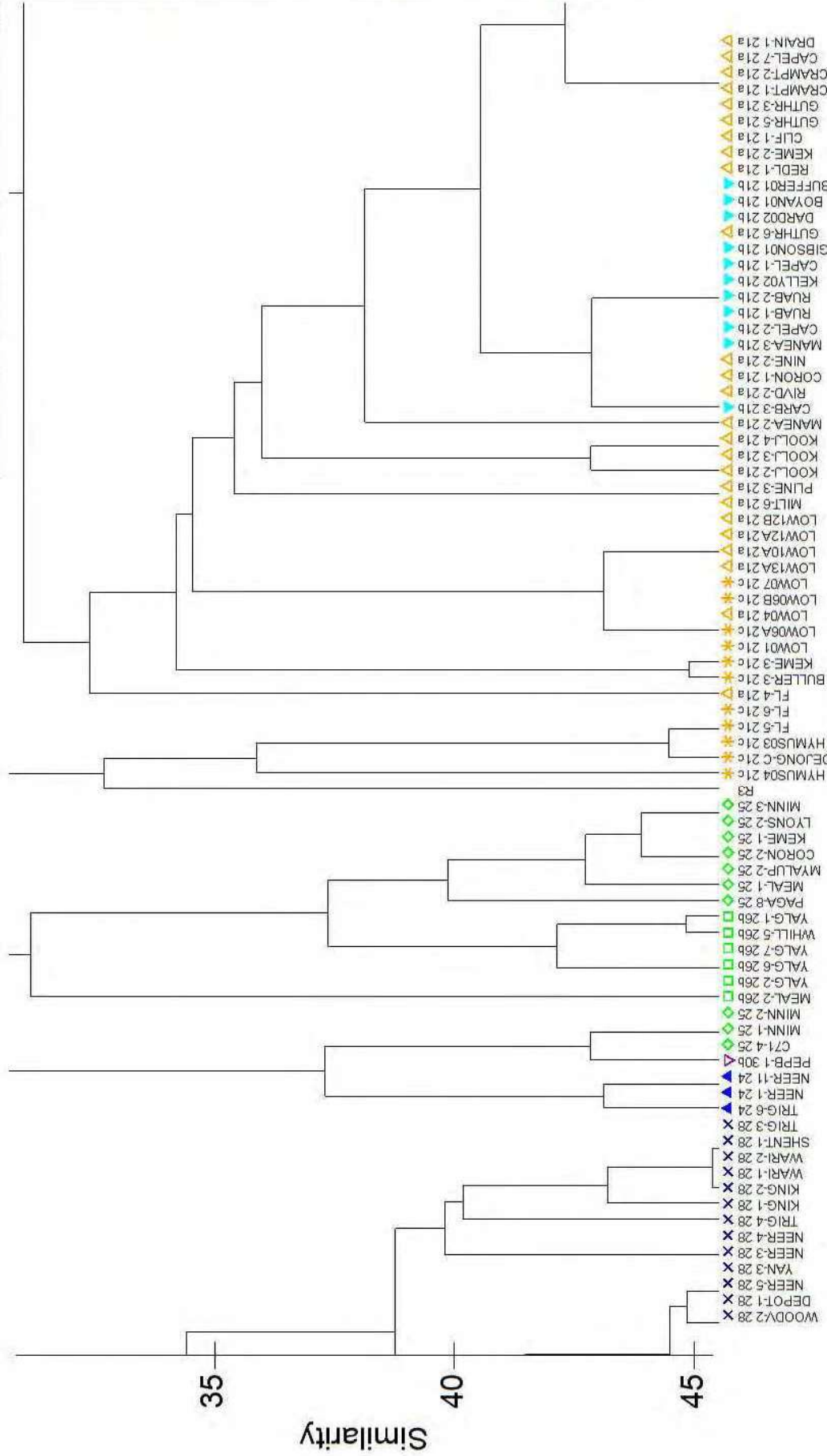
# FCT



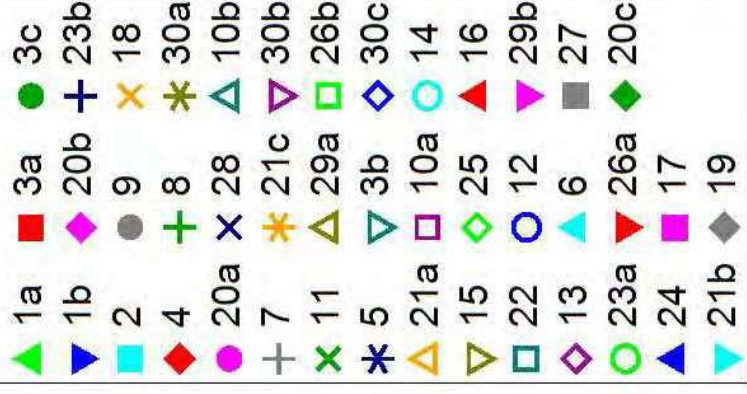


**Group average**

Resemblance: S17 Bray Curtis similarity



**FCT**

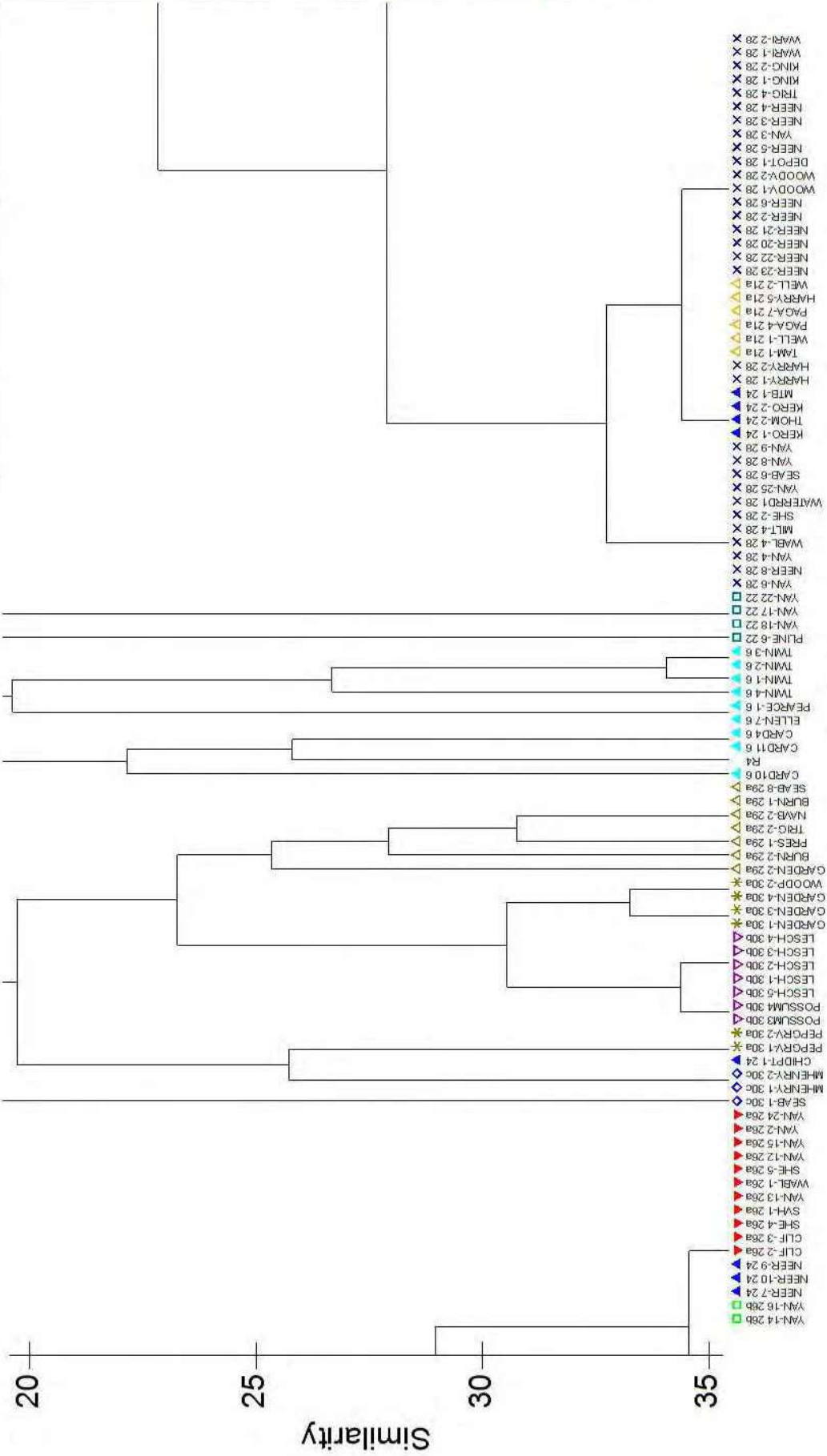


**Samples**

- WOODV2 28 X
- DEPOT1 28 X
- NEER5 28 X
- YAN3 28 X
- NEER3 28 X
- NEER4 28 X
- TRIG4 28 X
- KING1 28 X
- KING2 28 X
- WAR1 28 X
- WAR2 28 X
- SHENT1 28 X
- TRIG3 28 X
- TRIG6 24 X
- NEER11 24 X
- NEER1 24 X
- PEPB1 30b X
- C71 4 25 X
- MINN1 25 X
- MINN2 25 X
- MEAL2 26b X
- YALG2 26b X
- YALG6 26b X
- YALG7 26b X
- WHILL5 26b X
- YALG1 26b X
- PAGA 8 25 X
- MEAL1 25 X
- MVALUP2 25 X
- CORON2 25 X
- KEME1 25 X
- LYONS2 25 X
- MINN3 25 X
- R3
- HYMUS04 21c \*
- DEJONGC 21c \*
- HYMUS03 21c \*
- FL5 21c \*
- FL6 21c \*
- FL4 21a X
- BULLER3 21c X
- KEME3 21c \*
- LOW01 21c \*
- LOW06A 21c \*
- LOW06B 21c \*
- LOW04 21a \*
- LOW06A 21c \*
- LOW07 21c \*
- LOW13A 21a X
- LOW10A 21a X
- LOW12A 21a X
- LOW12B 21a X
- MILT6 21a X
- PLINE3 21a X
- KOOLJ2 21a X
- KOOLJ3 21a X
- KOOLJ4 21a X
- MANEA2 21a X
- CARB3 21b X
- RIVD2 21a X
- CORON1 21a X
- NINE2 21a X
- MANEA3 21b X
- CAPEL2 21b X
- RUAB2 21b X
- RUAB1 21b X
- KELLV02 21b X
- CAPEL1 21b X
- GIBSON1 21b X
- GUTHR6 21a X
- DARD02 21b X
- BOYAN01 21b X
- BUFFER01 21b X
- REDL1 21a X
- KEME2 21a X
- CLIF1 21a X
- GUTHR5 21a X
- GUTHR3 21a X
- GRAMPT1 21a X
- GRAMPT2 21a X
- CAPEL7 21a X
- DRAIN1 21a X

# Group average

Resemblance: S17 Bray Curtis similarity



**FCT**

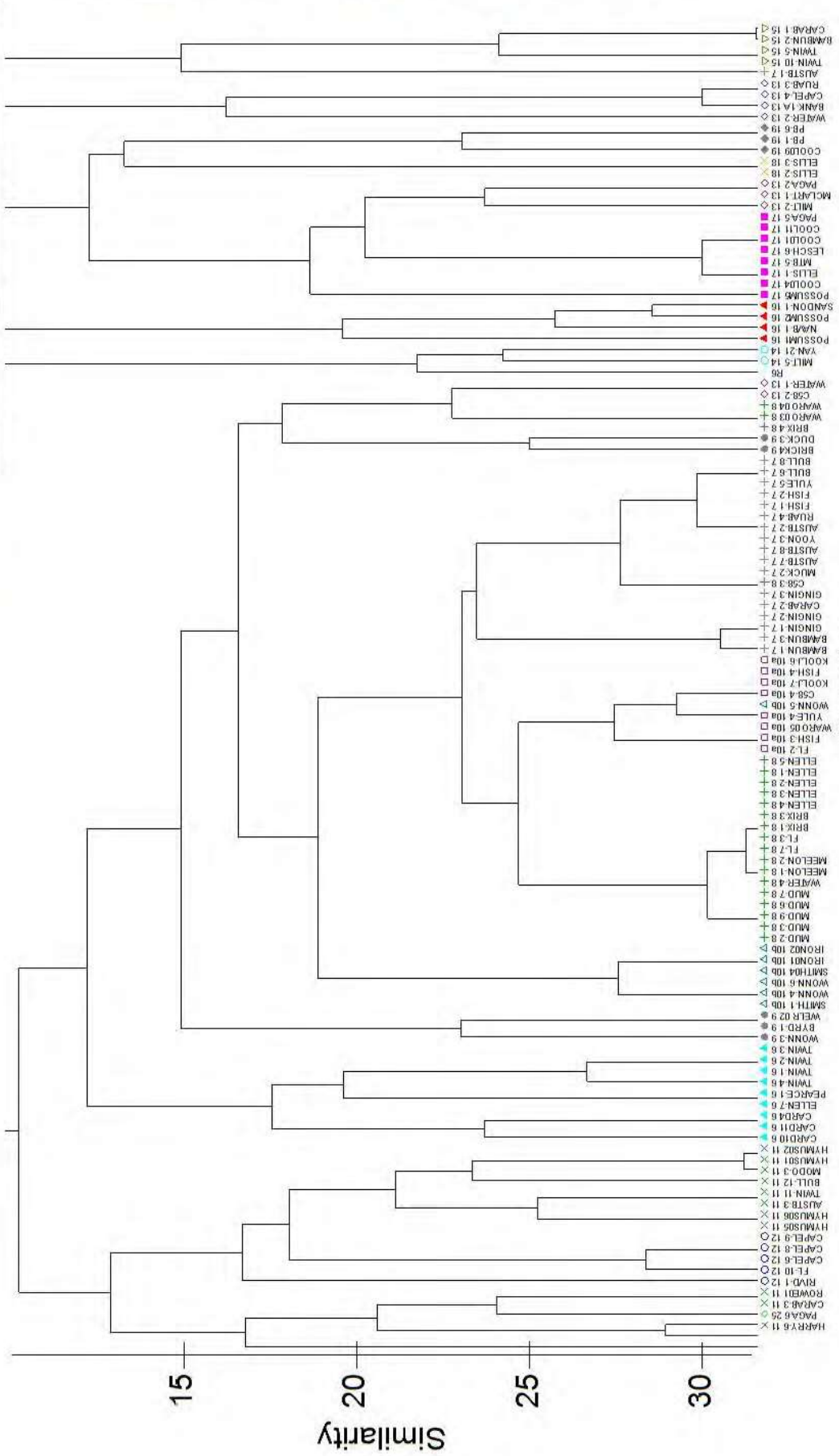
▲ 1a	■ 3a	● 3c
▼ 1b	◆ 20b	+ 23b
■ 2	● 9	× 18
◆ 4	+ 8	* 30a
× 20a	× 28	▲ 10b
+ 7	* 21c	▼ 30b
× 11	▲ 29a	□ 26b
* 5	▼ 3b	◇ 30c
▲ 21a	□ 10a	○ 14
▼ 15	◇ 25	▲ 16
□ 22	○ 12	▼ 29b
◇ 13	▲ 6	■ 27
○ 23a	▼ 26a	◆ 20c
▲ 24	■ 17	
▼ 21b	◆ 19	

Samples

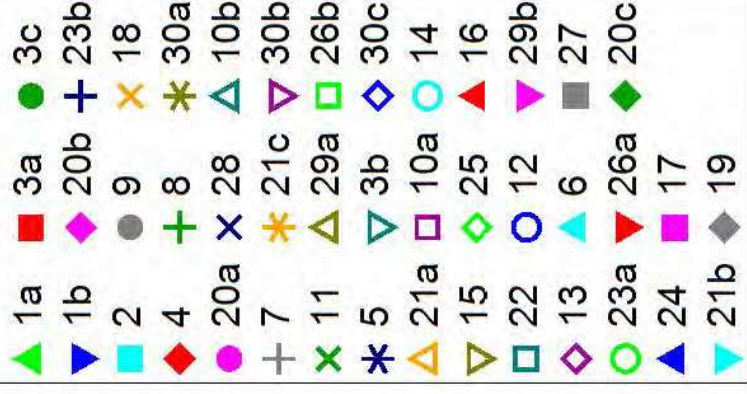


Group average

Resemblance: S17 Bray Curtis similarity



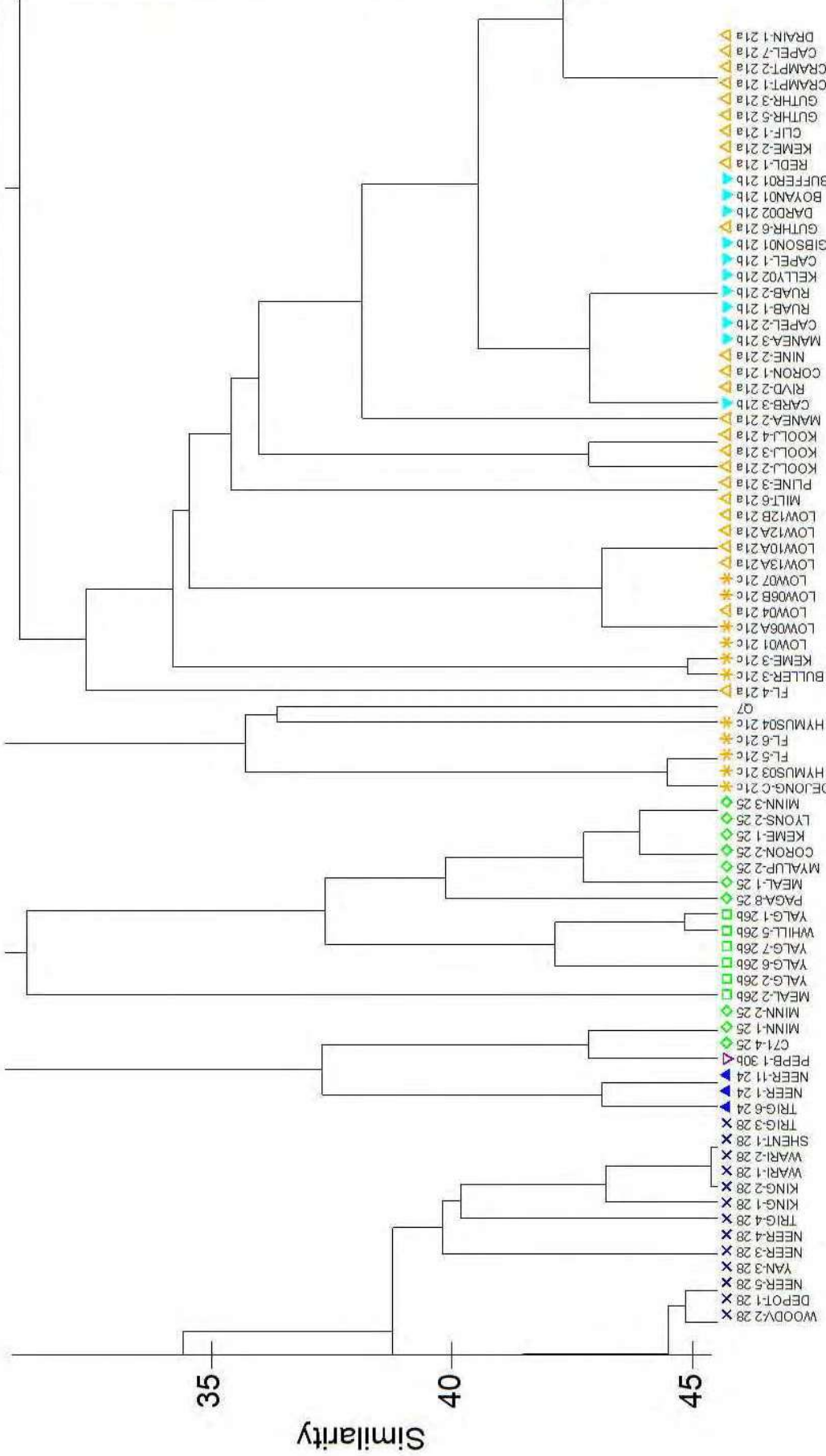
FCT



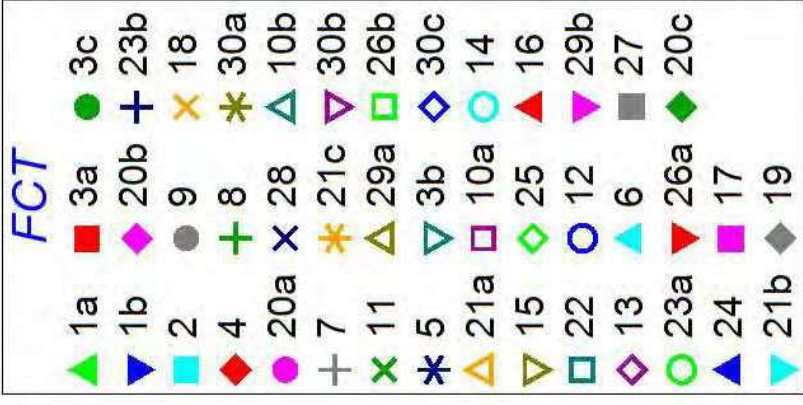
Samples

# Group average

Resemblance: S17 Bray Curtis similarity

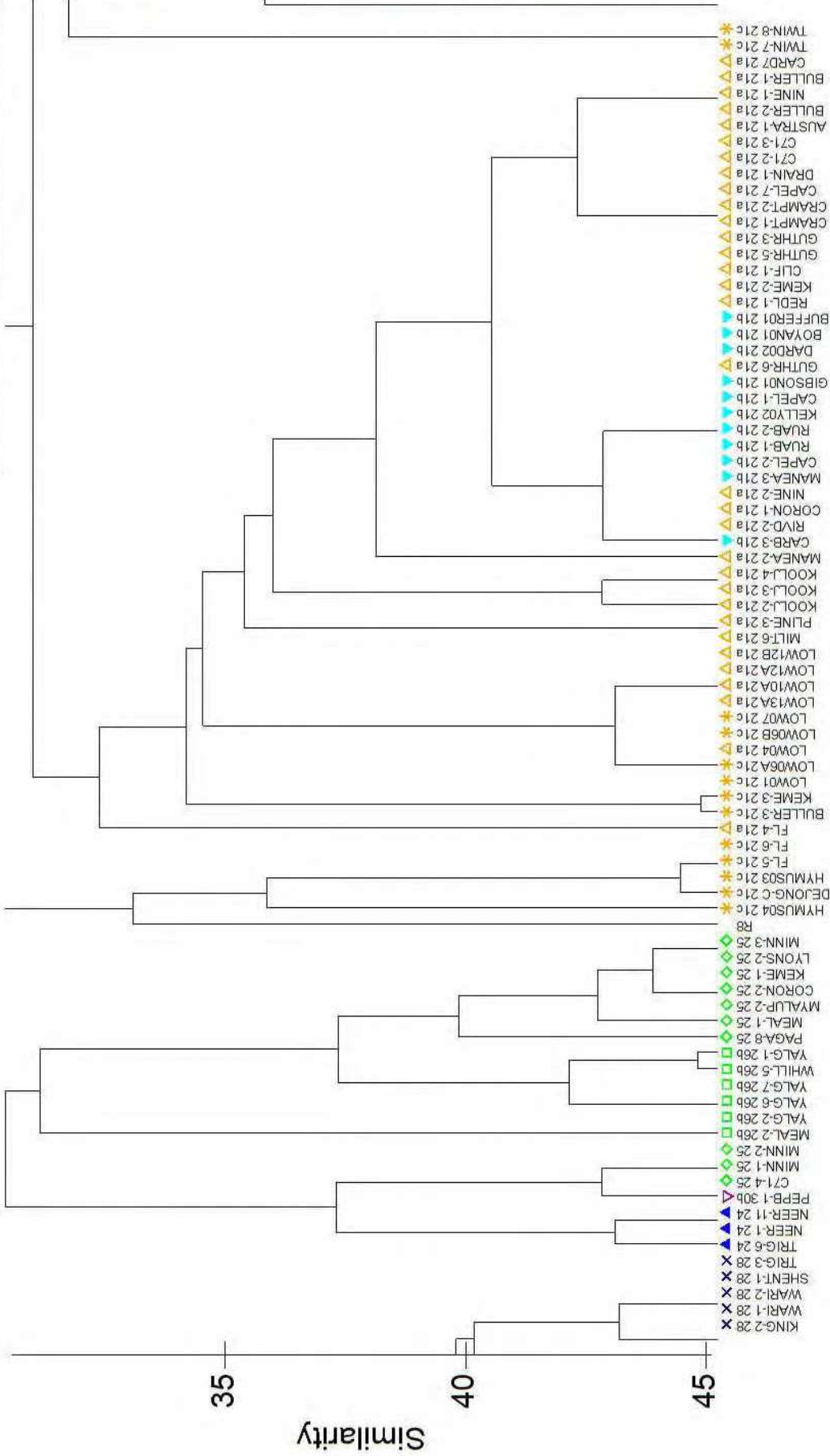


Samples



# Group average

Resemblance: S17 Bray Curtis similarity



# Samples

**FCT**

1a	3a	3c	2	9	18	4	8	30a	20a	28	10b	7	21c	30b	11	29a	26b	5	3b	30c	21a	10a	14	15	25	16	22	12	29b	13	6	27	23a	26a	20c	24	17	21b	19
▲	■	●	■	●	×	+	+	*	×	+	△	+	*	▽	×	△	□	*	▽	◇	△	□	○	▽	◇	▲	□	○	▽	◇	■	◆	▲	■	◆	▲	■	◆	