



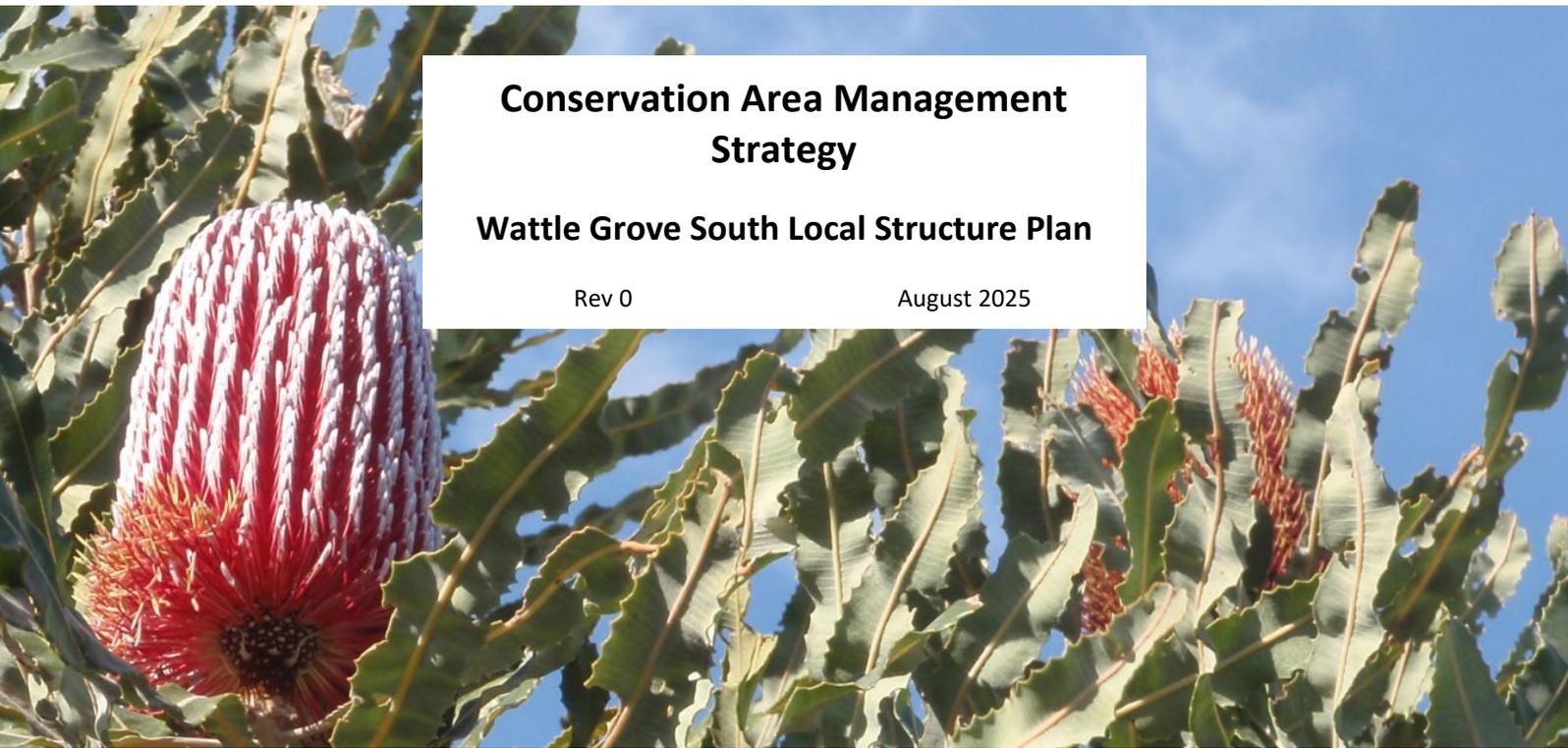
COTERRA  
ENVIRONMENT

**Conservation Area Management  
Strategy**

**Wattle Grove South Local Structure Plan**

Rev 0

August 2025



CALIBRE | COMMITMENT | COLLABORATION

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# 1 Introduction

## 1.1 Project Overview

The Wattle Grove South Local Structure Plan area ('the site') extends over approximately 126 hectares (ha) and is 16 kilometres (km) south-east of the Perth Central Business District (CBD) (Figure 1) (Appendix 1). The site is located within the area bound by Welshpool Road East and Crystal Brook Road to the north-east, and Tonkin Highway to the west, within the City of Kalamunda in the locality of Wattle Grove (Figure 2).

The landholdings within the site are currently undergoing a rezoning under the Perth Metropolitan Region Scheme (MRS), (MRS Amendment 1388/57 – Wattle Grove South), with the proposed rezoning changing the site from Rural to Urban under the MRS, along with a concurrent rezoning to Urban Development under the City of Kalamunda Local Planning Scheme No. 3 (LPS 3).

## 1.2 Environmental Assessment

The MRS Amendment was assessed by the Environmental Protection Authority (EPA) at the level of Environmental Review under Division 3, Part IV of the *Environmental Protection Act 1986* (EP Act)

The MRS Amendment underwent a formal environmental impact assessment, which was done in accordance with the EPAs Instructions for the Environmental Review (Assessment No. 2335) and resulted in a suite of environmental investigations, technical studies and Environmental Review documentation being prepared for public review and the EPA's assessment.

Concerning the site's significant ecological values, and to ensure the EPAs objectives for Flora and Vegetation, and Terrestrial Fauna could be met and that the proposed rezoning will not result in significant residual impacts on significant flora and vegetation (including threatened ecological communities and threatened/priority flora), and fauna habitat (including black cockatoo habitat), the EPAs mitigation hierarchy of avoid, minimise and rehabilitate was applied as part of the environmental assessment of the MRS amendment. This resulted in the following environmental outcomes being achieved and potential impacts being:

1. **Avoided** by retaining areas of remnant vegetation containing threatened ecological communities, threatened/priority flora and black cockatoo habitat and placing them within Conservation Areas (i.e. Conservation POS).
2. **Minimised** by preparing and implementing a Conservation Area Management Strategy at the local structure plan stage to establish the objectives and information required for each Conservation Area Management Plan during the future urban subdivision or development of the site.
3. **Rehabilitated** by managing Conservation Areas containing threatened ecological communities, threatened/priority flora, and black cockatoo habitat and restoring threatened ecological communities and black cockatoo habitat in degraded condition so that the vegetation condition rating of good or better is achieved.

### 1.2.1 Environmental Conditions (MRS Amendment 1388/57)

The EPA published its report and recommendations on 30 July 2025 (EPA Assessment Report 1788) and advised the Minister for the Environment that the MRS Amendment may be implemented subject to the Environmental Conditions (as they relate to inland waters, flora and vegetation, and terrestrial fauna) being undertaken (Appendix 2) to achieve the following:

#### Environmental Outcomes (condition 3):

- Avoid disturbance to the following environmental values within retention areas, including:



- *Banksia attenuata* woodlands over species rich dense shrublands (FCT 20a)
- Shrublands and Woodlands of the Eastern Swan Coastal Plain (FCT 20c)
- Viable populations of Threatened flora (*Conospermum undulatum*) and Priority 3 flora (*Isopogon autumnalis*)
- Medium to high quality black cockatoo foraging habitat
- Potential nesting trees
- Avoid disturbance to black cockatoo known nesting trees and roosting sites within the site.
- Tree retention and replacement to ensure canopy coverage across the site and habitat connectivity between retention areas retained black cockatoo habitat.
- Minimise adverse impacts on the Greater Brixton Street Wetlands from urban development of the Amendment Area, including impacts to the wetlands' persistency, hydrological regime, water quality, ecological integrity and ecological function.

#### Conservation Area Management (condition 4):

- Prior to future subdivision or development of areas which include or part of a retention area, the condition requires preparation of a Conservation Area Management Plan, which is consistent with the environmental outcomes set out in condition 3.
- The management plan will provide for appropriate fencing, monitoring of Threatened Ecological Communities (TECs) and threatened flora, restoration of degraded TECs, buffers to threatened flora, weed and pathogen control, and development within the retention area is for the purposes for conservation or incidental.

### 1.3 Conservation Areas

As a part of the site's future urban development, and in accordance with the Environmental Conditions, Conservation Areas have been identified within the site for future conservation to protect the site's highest environmental values, which include:

- Remnant vegetation (BaEpPf, BmXpEc and EmMpLp) in Good or better condition.
- Probable FCT 20a *Banksia attenuata* woodlands over species rich dense shrublands – State TEC listed as Critically Endangered (*Biodiversity Conservation Act 2016* [BC Act]).
- Probable FCT 20c Shrublands and Woodlands of the eastern side of the Swan Coastal Plain State TEC listed as Critically Endangered (BC Act) and Federal TEC listed as Endangered (*Environment Protection and Biodiversity Conservation Act 1999* [EPBC Act]).
- Banksia Woodlands of the Swan Coastal Plain ecological community – Federal TEC listed as Endangered (EPBC Act) and State Priority 3 (DBCAs listing).
- Occurrences of TECs that are in degraded condition and have potential to be restored to Good or better condition.
- Viable populations of *Conospermum undulatum* – Threatened flora listed as Vulnerable (BC Act and EPBC Act)
- Viable populations of *Isopogon autumnalis* – State Priority 3 (DBCAs listing)
- Medium to high quality foraging habitat for:
  - Carnaby's cockatoo (*Zanda latirostris*) – Endangered
  - Baudin's cockatoo (*Zanda baudinii*) – Endangered (BC Act and EPBC Act)

- Forest Red-tailed black cockatoo (*Calyptorhynchus banksii naso*) – Vulnerable (BC Act and EPBC Act)
- High quality vegetation which provides habitat for other conservation significant fauna (e.g., *Isoodon fusciventer*; Quenda).

Regarding the creation of these Conservation Areas, the Local Structure Plan (Appendix 1) has designated these areas as Public Open Space - Conservation and Public Open Space - Potential Conservation. Further investigation and site studies will be required prior to subdivision to:

- confirm the presence and extent of threatened ecological communities (including occurrences that are degraded that can be restored to achieve a condition rating of good or better), viable populations of threatened flora (including buffers that may be required) and medium to high quality black cockatoo foraging habitat and potential nesting trees
- inform the final boundary and delineation of these Conservation Areas, particularly for the areas designated Public Open Space – Potential Conservation, where site access has been limited and the presence and/or absence of these environmental values is still unknown.

Depending on the extent of the proposed variations to the Structure Plan, the Western Australian Planning Commission and the City of Kalamunda may require a proponent to also amend this Structure Plan prior to the determination of the subdivision application.

Sections 5.2.1, 5.2.2, 5.2.3 and 5.2.6 outline the management actions required to undertake these studies and define the final boundary of these Conservation Areas.

## 1.4 Objective

The objective of this Conservation Area Management Strategy (CAMS) is to provide a framework and facilitate on ground management to protect, maintain and enhance the environmental values of the Conservation Areas as urban subdivision and development of the site progresses.

## 1.5 Purpose and Scope

The purpose and scope of this CAMS is to inform the:

- design and creation of future Conservation Areas at subdivision and/or development stage
- development of the Conservation Area Management Plan (CAMP) for each Conservation Area within the site.

The CAMS aims to:

- establish the objectives, targets and environment outcomes to be achieved
- establish the information that each CAMP will be required to provide (i.e. baseline surveys, etc) to confirm the environmental values to be protected (baseline ecological surveys) and the key threats (i.e. weed and pathogen surveys, etc) to be managed within the Conservation Area
- address the potential impacts and identify the mitigation measures to be implemented through the CAMP during the subdivision and/or development stage
- detail how the Conservation Areas will be protected, and significant environmental values will be maintained and enhanced
- detail monitoring, evaluation and response mechanisms to be implemented.

The background and technical content presented in this document has been compiled from the Environmental Review for MRS Amendment (1388/57) (Coterra et al. 2024) and updated with detailed project information developed during the local structure planning process.

## 1.6 Land Use Planning Process

The following sets out the land use planning process that will be applied to facilitate future urban development and creation of the Conservation Public Open Space areas:

- Site will be concurrently rezoned to Urban under the MRS and Residential Development under LPS 3.
- Local Structure Plan has been prepared to facilitate development of the urban area to:
  - address the relevant Environmental Conditions of the Ministerial Statement for MRS Amendment 1388/57 (Appendix 2)
  - outline the Part 1 implementation provisions so that landowners and developers are aware of their obligations when pursuing the redevelopment of the land.
- Subdivision or development, will address the Environmental Conditions of the Ministerial Statement for MRS Amendment 1388/57 (i.e. preparation of conservation area management plan) as well as any relevant subdivision conditions (e.g. preparation of construction environmental management plan as a condition of subdivision).

## 1.7 Wattle Grove South Local Structure Plan

The Wattle Grove South Local Structure Plan has been developed for the site and comprises the following attributes (Appendix 1):

- Precincts (A, B, C, D, E and F)
- Residential
- Light Industry
- Public Purpose – Primary School
- Public Open Space – Conservation (as per the Environmental Conditions of MRS Amendment 1388/57)
- Public Open Space – Potential Conservation (as per the Environmental Conditions of MRS Amendment 1388/57)
- Public Open Space - Recreation

Concerning the Conservation and Potential Conservation areas, the Local Structure Plan notes that these areas will be investigated further and determined by proponents as part of Local Structure Plan Amendments.

## 2 Legislation, Policies and Guidance

The following legislation, policy and guidelines have been utilised in preparation of this CAMS.

### 2.1 Commonwealth

- *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)
- Referral Guidelines for 3 WA Threatened Black Cockatoo Species (DAWE 2022)
- EPBC Referral Guidance – Banksia Woodlands of the Swan Coastal Plain ecological community

### 2.2 State

- *Biodiversity Conservation Act 2016* (BC Act)
- *Environmental Protection Act 1986* (EP Act)
- *Planning and Development Act 2005* (PD Act)
- State Planning Policy 2.8 – Bushland Policy for the Perth Metropolitan Region (WAPC 2010)
- State Planning Policy 3.7 Planning in Bushfire Prone Areas (WAPC 2024)

### 2.3 Local

- Local Biodiversity Strategy 2023 – 2043 (City of Kalamunda 2023a)
- Urban Forest Strategy 2023 – 2043 (City of Kalamunda 2023b)
- Public Open Space Strategy (City of Kalamunda 2018a)
- Local Planning Policy 32 – Public Open Space (City of Kalamunda 2018b)

### 2.4 Conservation Advice and Recovery Plans

- Carnaby's Cockatoo (*Calyptorhynchus latirostris*) Recovery Plan. Department of Parks and Wildlife, Perth, Western Australia (DPaW 2013)
- Approved Conservation Advice for *Calyptorhynchus banksii naso* (Forest Red-tailed Black Cockatoo) (DWEHA 2009)
- Conservation Advice *Calyptorhynchus baudinii* Baudin's Cockatoo (TSSC 2018)
- Forest Black Cockatoo (Baudin's Cockatoo *Calyptorhynchus baudinii* and Forest Red-tailed Black Cockatoo *Calyptorhynchus banksii naso*) Recovery Plan (DEC 2008)
- Approved Conservation Advice (incorporating listing advice) for the Banksia Woodlands of the Swan Coastal Plain ecological community (TSSC 2016)
- Waxy-leaved smokebush (*Conospermum undulatum*) recovery plan (DEC 2009)
- Approved Conservation Advice for Shrublands and Woodlands of the eastern Swan Coastal Plain (DCCEEW 2017)



## 3 Existing Environment

### 3.1 Regional and Local Context

#### 3.1.1 Swan Coastal Plain

The Interim Biogeographic Regionalisation for Australia (IBRA) describe a system of 85 'biogeographic regions' (bioregions) and 405 subregions covering the entirety of the Australian continent (DCCEEW 2022). Bioregions are defined on the basis of climate, geology, landforms, vegetation and fauna.

The site is located within the Perth subregion (SWA02) of the Swan Coastal Plain bioregion of Western Australia, which is described by Mitchell et al. (2002) as:

'The Swan Coastal Plain is a low lying coastal plain, mainly covered with woodlands. It is dominated by Banksia or Tuart on sandy soils, *Casuarina obesa* on outwash plains, and paperbark in swampy areas. In the east, the plain rises to duricrusted Mesozoic sediments dominated by Jarrah woodland. The climate is Warm Mediterranean. Three phases of marine sand dune development provide relief. The outwash plains, once dominated by *Casuarina obesa*-marri woodlands and Melaleuca shrublands, are extensive only in the south.'

The Perth subregion is composed of colluvial and aeolian sands, alluvial river flats, coastal limestone. Heath and/or Tuart woodlands on limestone, Banksia and Jarrah-Banksia woodlands on Quaternary marine dunes of various ages, Marri on colluvial and alluvial. Rainfall ranges between 600 and 1000 mm annually and the climate is Mediterranean. The subregional area is 1,333,901 ha.

#### 3.1.2 Regional climate

The climate of the Swan Coastal Plain subregion is Mediterranean with wet winters and dry hot summers. The mean maximum temperatures range from 18.0°C in July to 31.8°C in January (Hyd2o 2024).

Based on Bureau of Meteorology Station 009172 (Jandakot Aero), the long-term average annual rainfall since 1973 has been 818 mm (BOM, 2025). Since 2000, the average annual rainfall has declined to 758 mm, a reduction of 7%. Most of the rainfall occurs between the months of May and September (Hyd2o 2024).

#### 3.1.3 Topography

Regional topographic contour mapping indicates that the site is relatively flat to undulating, with elevation ranging from 22 m Australian Height Datum (AHD) in the north of the site to 36 m AHD in the south (Figure 3).

#### 3.1.4 Geology

##### 3.1.4.1 Regional geology

The Swan Coastal Plain comprises five major geomorphologic systems that lie parallel to the coast: the Quindalup Dunes, Spearwood Dunes, Bassendean Dunes, Pinjarra Plain and Ridge Hill Shelf (Churchward and McArthur 1980; Gibson et al. 1994). Each major system is further subdivided into detailed geomorphologic units (Churchward and McArthur 1980; Semeniuk et al. 1990; Gibson et al 1994).

##### 3.1.4.2 Local geology

The local geological formations within the site are defined below:

- The dominant geological unit consist of the Yoganup Formation which extends eastwards from the Darling Scarp.
- Portions of the western and north-western boundary of the site is underlain by thin Bassendean Sand over sandy clay to clayey sand of the Guildford Formation. These sands and clays are interfingering

making the geology heterogeneous. Guildford Formation, which is predominantly of fluvial origin and consists of clayey-sands and clays with lenses of coarse sands particularly at the base (Davidson 1995).

- The base of the superficial formations is between 0 m AHD to 8 m AHD, sloping downwards to the west.
- Based on ground surface elevations the superficial formations are about 20 m to 35 m thick.
- The superficial formations are underlain by the Kardinya Shale.

Table 3-1 provides a summary of the surface geological units within the site (Figure 3).

**Table 3-1: Surface geological units within the site**

Unit	Description	Equivalent regional geological unit
S8	Sand – white to pale grey at surface, yellow at depth, fine to medium-grained, moderately sorted, subangular to subrounded, minor heavy minerals, of eolian origin.	Bassendean Sand (Qpb)
S10	Sand – S8 (sand) over sandy clay to clayey sandy of the Guildford Formation, of eolian origin.	Thin Bassendean Sand over Guildford Formation (Qpb/Qpa)
S12	Sand – structureless, yellow, fine-grained, subangular, and medium to coarse grained subrounded to rounded quartz, feldspar and heavy minerals common, minor silt and clay, of colluvial origin.	Yoganup Formation (Qpr)
Mgs2	Gravelly silt – strong brown, tough, common pebbles of fine to coarse-grained, sub-rounded granite, some dolerite and rare sandstone (SS), variable sand content.	Colluvium (Qc)
Ms4	Sandy silt – cream to pale brown, angular to rounded sand, low cohesion, of alluvial origin.	Alluvium (Qha)

Source: Jordan, 1986

### 3.1.5 Hydrology

#### 3.1.5.1 Groundwater

Local water monitoring data shows that the groundwater depth ranges from 4 m to 20 m below natural surface, the seasonal fluctuation in water table varies across the site, and the presence of a distinct groundwater mound centred over the former turf located on the western boundary of the site.

The groundwater used for turf irrigation was drawn predominantly from the Leederville Aquifer, which is below the Superficial Aquifer. There is limited movement of groundwater between the two Aquifers due to the presence of the Kardinya Shale which acts as a barrier. As a result of the former turf farm irrigation practices and geological factors, the groundwater drawn from the Leederville Aquifer and used for irrigation then infiltrated and accumulated in the Superficial Aquifer, resulting in groundwater mounding in the Superficial Aquifer over the long term.

Additionally, the geology along the western and north-western boundary of the site is predominately sand over clayey sand and clay sediments associated with the Bassendean Sands and Guildford Formations. Based on the soil permeability and geophysical studies undertaken within and adjacent to the site, the presence of non-contiguous Guildford Formation clayey soil forms a hydraulic barrier which strongly influence local groundwater flow, with the seasonal groundwater flows confirming a radial flow direction (i.e., flowing north-west to flowing south-east) from the mound and limiting groundwater flow in a westerly direction.

Cessation of the turf farm is likely to affect groundwater levels locally, with recent groundwater monitoring in proximity of the mound confirms water levels have reduced.

### 3.1.5.2 Surface Water

The site is within the catchment of Yule Brook, and is located between the Yule Brook Main Drain (approximately 200 m to the north) and Bickley Brook Main Drain (approximately 1.8 km to the south), which are both external to the site.

Post seasonal rain events, overland water within the site flows in a north-westerly direction following the topographical gradient. The surface water flow (if it is not infiltrated in the Yoganup Formation sandy soil profile) is intercepted by open roadside drains located along Boundary Road, Brentwood Road and Victoria Road and piped drains within private landholdings. The roadside drains are located above the groundwater table (Hyd2o 2024). These drains direct the surface water in a westerly to south-westerly direction towards three culvert outlets, positioned under Tonkin Highway, located at the western ends of Brentwood Road, Victoria Road and Boundary Road.

Please refer to LWMS for further detail on the site's hydrological conditions.

### 3.1.5.3 Geomorphic Wetlands

The wetlands on the Swan Coastal Plain have been evaluated and assigned a management category, providing guidance on how they should be managed and protected (EPA 2008):

- Conservation (CCW) – Wetlands that support a high level of attributes and functions. These wetlands are afforded the highest level of priority and protection.
- Resource Enhancement (REW) – Wetlands which may have been partially modified but still support substantial ecological attributes and functions. These wetlands are afforded priority with an emphasis on retention and rehabilitation.
- Multiple Use (MUW) – Wetlands with few remaining important attributes and functions. Land use, development and management of such wetlands should be considered in the context of ecologically sustainable development.

Within the site are two REWs (UFI 8037 and 15257), which were evaluated by Pentium Water (2024) as part of the MRS amendment process, and confirmed that both wetlands are in Completely Degraded condition or in the case of REW UFI 8037 within Tonkin Highway reserve, DBNGP easement and the former turf farm has been completed infilled and cleared of all native vegetation. Furthermore, DBCA's preliminary advice on the proposed Wattle Grove south MRS amendment, and specific to the two REWs within the site is summarised below (WAPC 2021):

- The portion of REW (UFI 15257) has been significantly modified from the construction of Tonkin Highway, the Water Corporation pipeline and DBNGP easements.
- REW (UFI 8037) has been cleared and filled (from the turf farm land use) and no longer exists.
- The environmental values of the two REWs (UFI 8037 and UFI 15257), using available regional scale data are commensurate with a MUW.

Concerning the Conservation Areas, there are no geomorphic wetlands mapped within these areas.

In proximity to the site, are the Greater Brixton Street Wetlands (GBSW) in Kenwick, which is approximately 100 m west of the site at the closest point and separated by Tonkin Highway (Figure 4). The GBSW are of international, national and regional environmental significance and are one of the most important wetlands on the Swan Coastal Plain, with biodiversity attributed to the unique geological, geomorphic and hydrological characteristics (EPA 2022). The extent of the GBSW includes the combined boundaries of A Directory of Important Wetlands in Australia (DIWA) (Brixton Street Swamps) and Bush Forever Site 387. The GBSW are also included on the Register of the National Estate.



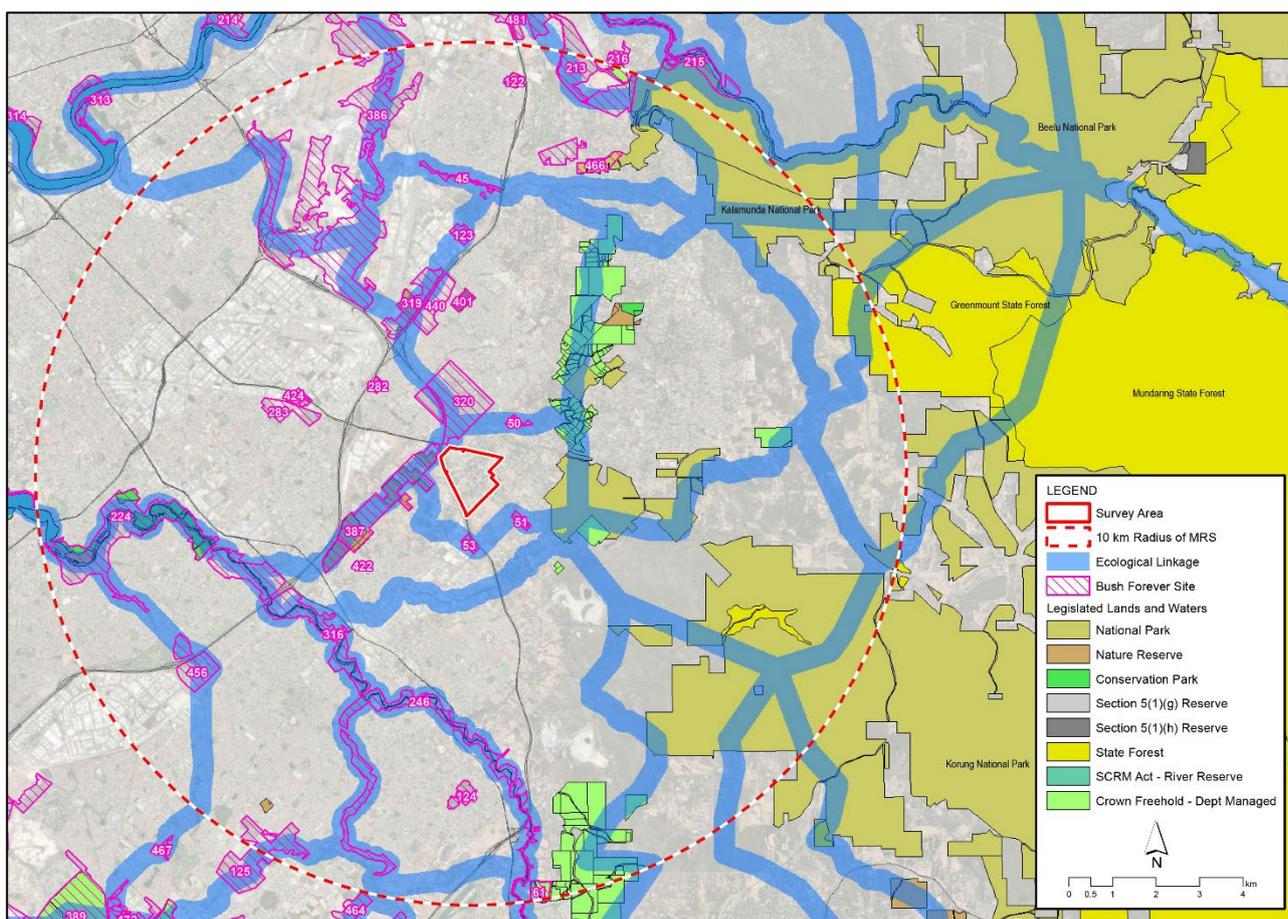
The GBSW are characterised by outstanding and unique botanical diversity, with over 650 plant species recorded, including locally restricted species and distinct vegetation communities supporting conservation significant fauna, attributed to the specialised plant adaptations to the complex soils, chemistry and hydrology of the site (EPA 2022). The wetlands, located at the base of the Darling Scarp, are supported by Crystal Brook and Yule Brook and other surface and sub-surface water inputs. The area supports naturally vegetated wetlands that are rare or no longer exist elsewhere, and it is one of the largest consolidated wetland areas of high conservation value on the Swan Coastal Plain (EPA 2022).

### 3.1.6 Conservation Areas and Bush Forever

*State Planning Policy 2.8: Bushland Policy for the Perth Metropolitan Region (SPP 2.8)* aims to provide a policy and implementation framework that ensures bushland protection and management matters throughout the Perth Metropolitan Region are adequately addressed and integrated with broader land use planning and decision-making (WAPC 2010). In accordance with SPP 2.8, scheme amendments and development proposals must recognise regionally significant bushland and outline methods by which they will avoid, minimise, and offset any likely adverse impacts on regionally significant bushland. SPP 2.8 predominantly deals with two distinct subjects, Bush Forever areas and local bushland.

There are no DBCA managed lands within the site, with the nearest conservation reserve being the GBSW, which is approximately 100 m west of the site boundary (Plate 3-1).

No Bush Forever sites occur within the site (Plate 3-1). The closest points of the nearest Bush Forever sites are approximately 100 m to the west on the opposite side of Tonkin Highway (Site 387, the Greater Brixton Street Wetlands) and approximately 90 m to the north-west on the opposite side of Welshpool Road East (Site 320, Hartfield Road Bushland) (Plate 3-1).



**Plate 3-1: Conservation areas and regional ecological linkages**

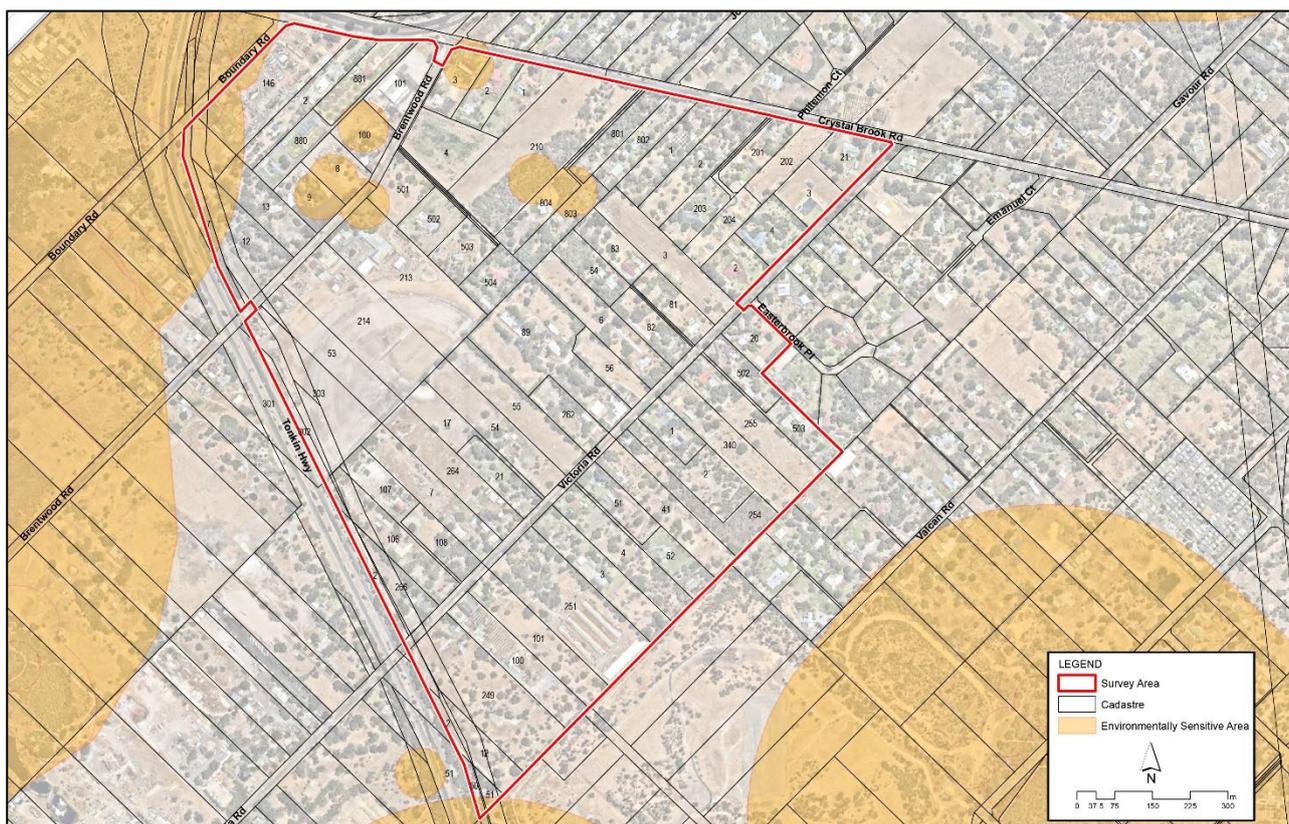
### 3.1.7 Regional Ecological Linkages

Ecological corridors have been identified in the Perth metropolitan region to limit the effects of fragmentation across areas of remnant bushland. In relation to the site, there is one regional ecological linkage located along the north-western perimeter of the site (Link ID: 40), which connects the GBSW and the Hartfield Road Bushland (Molloy, et.al. 2009). The small portion of the regional ecological linkage which falls within the site (specifically within portions of Lot 146 Welshpool Road East and Lot 12 Brentwood Road) has been extensively cleared of native vegetation and filled. An approved commercial landscape supply yard occurs within Lot 146 Welshpool Road East. Plate 3-1 illustrates the regional ecological linkages in proximity to the site.

### 3.1.8 Environmentally Sensitive Areas

Environmentally sensitive areas (ESAs) are declared by the Minister for Environment under Section 15b of the EP Act. ESAs are classes or areas of native vegetation where a number of the exemptions for clearing vegetation under the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* do not apply.

Eight ESAs are mapped within the site according to the dataset available through DWER (2025) Environment Online (Plate 3-2).



**Plate 3-2: ESAs within the site (DWER 2025)**

Each ESA is described in Table 3-2. Many of the ESAs mapped within the site are associated with the locations of historically recorded declared rare flora; however, based on surveys undertaken by AECOM (2020) many of these areas have since been cleared and the Threatened flora associated with the ESA boundary appear to be no longer present.

**Table 3-2: Summary of ESAs within the site**

Object ID	ESA purpose	Comment
8712	Within 50 m of CCW	Associated within the small area of mapped CCW on Lot 501 external to the site that is within/adjacent the proposed Tonkin Highway/Welshpool Road East intersection upgrade. Further, Lot 501 has historically been significantly altered including clearing of native vegetation and infilling of wetland areas to establish transport corridors and the construction (and maintenance) of DBGNP and Water Corporation pipeline easements.
17271	Within 50 m of CCW and associated with TEC	Associated with the small area of mapped CCW on Lot 501 external to the site. This CCW is within/adjacent to the proposed Tonkin Highway/Welshpool Road East intersection upgrade. Lot 501 has historically been significantly altered including clearing of native vegetation and infilling of wetland areas to establish transport corridors and the construction (and maintenance) of DBNGP and Water Corporation pipeline easement. ESA is also associated with an inferred TEC associated with GBSW. The association between this wetland (or Lot 501) and the GBSW has been severed with the construction of the four lane Tonkin Highway and the construction (and maintenance) of DBNGP and Water Corporation pipeline easement. This CCW is located over 100 m from the GBSW separated by Tonkin Highway.
10050	Associated with TEC	Associated with the TEC located within the mapped GBSW area which is located on the western side of Tonkin Highway and is more than 100 m west of the site however, a buffer area to the TEC falls within the north west corner of the site. Portions of this mapped ESA within the site have been significantly altered through historical clearing and associated semi-rural land uses which includes livestock paddocks and residential dwellings.
10045	Associated with TEC	Associated with the TEC located on the western side of Tonkin Highway and is more than 400 m south of the site; however, a buffer area to the TEC slightly falls within the southernmost corner of the site.
11904	Threatened or Rare Flora	Associated with the historic records of a <i>Conospermum undulatum</i> in this location. This area has been significantly altered through historical clearing and associated semi-rural land uses which includes livestock paddocks and residential dwellings. There is no evidence of this flora being present at this location (within the site) from the AECOM (2020) flora and vegetation.
11907		
11908		
11905	Threatened or Rare Flora	Associated with the historic record of a <i>Conospermum undulatum</i> in this location. Remnant vegetation in the immediate area has been identified as locally significant vegetation and is proposed to be retained.

### 3.1.9 Local Natural Areas

The City of Kalamunda (2023a) Local Biodiversity Strategy refers to Local Natural Areas (LNAs) as areas containing endemic species or ecological communities in a relatively natural state and are inferred as potentially having high biodiversity values. It also recognises LNAs as native vegetation, vegetated or open wetlands (lakes and swamps) and waterways (rivers, streams, creeks and estuaries), and seeks to retain, protect, manage, enhance and rehabilitate LNAs to improve the quality and quantity of biodiversity values (City of Kalamunda 2023a).

The City of Kalamunda (2023a) Local Biodiversity Strategy has mapped a number of LNAs within the site as shown in Plate 3-3. LNAs are natural areas held outside of the State's conservation estate and have formed the primary focus of the Local Biodiversity Strategy.



### Plate 3-3: Local Biodiversity Strategy LNA (City of Kalamunda 2023a)

The Local Biodiversity Strategy has allocated the LNAs within the site as having an ‘I Management Category’, which is for LNA on varied rural lots (of any size) and on Rural Conservation and Rural Landscape Interest on blocks less than 6 ha. LNAs within this management category have the following recommended planning conservation action:

- Any future development / subdivision should be within the provisions of the Scheme and the proposed Local Planning Policy for Biodiversity Conservation (e.g. High Conservation Value LNAs to be retained as Local Open Space for conservation).

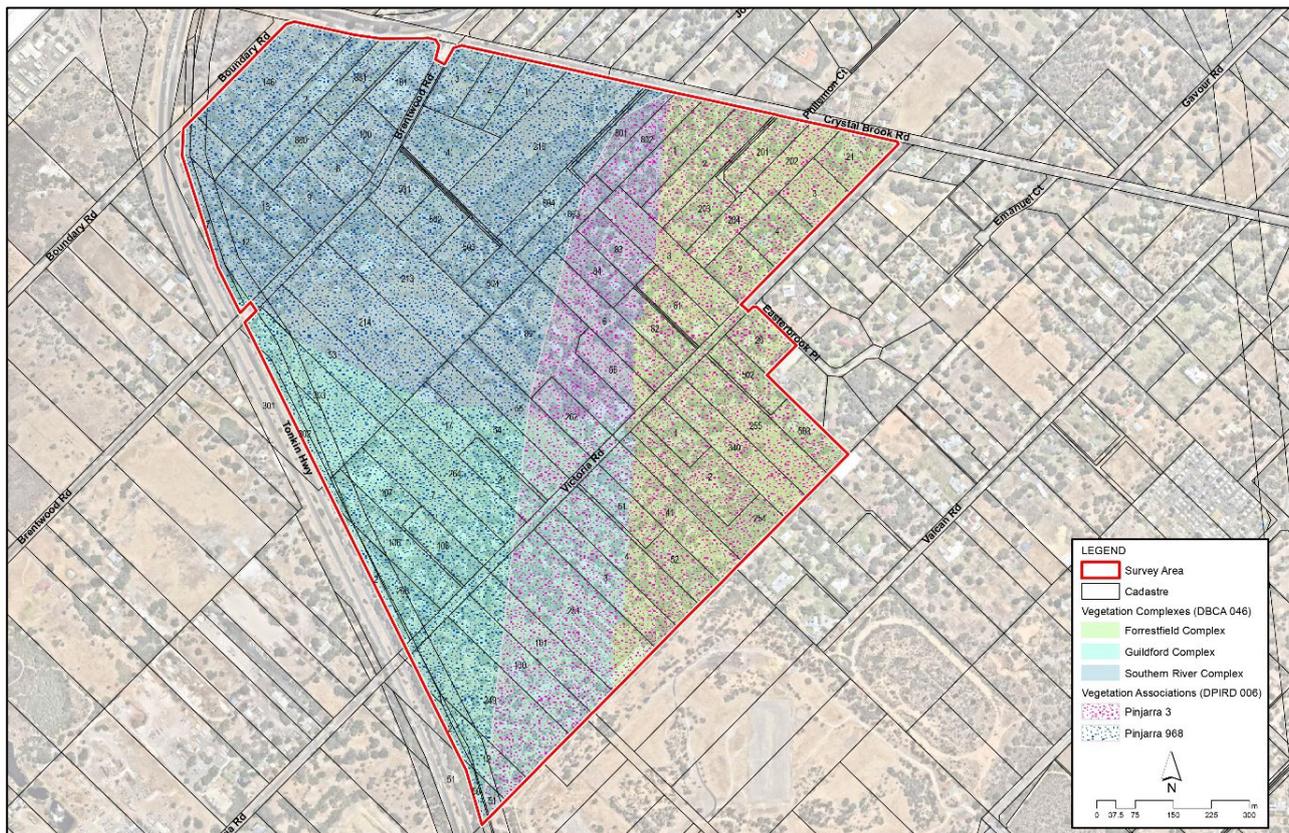
As an outcome of the MRS Amendment process, future residential development of the site will result in retention and protection of all intact remnant vegetation which fall within the areas identified as LNAs, as well as some areas of remnant vegetation that have not been identified as LNA. Based on the surveys undertaken by AECOM (2020) and JBS&G (2024), it is worthwhile to note that the remaining areas of LNAs outside of those mapped as remnant vegetation within the site contain scattered trees (refer to Section 3.2.2).

## 3.2 Vegetation

### 3.2.1 Vegetation associations and complexes

Vegetation occurring within the region was initially mapped at a broad scale (1:1000 000) by Beard during the 1970s. This dataset formed the basis of several regional mapping systems, including the biogeographic region dataset for Western Australia (available via [data.gov.au](https://data.gov.au)) and the physiographic regions defined by Beard (1975). The vegetation for the site has been identified as belonging to two sub-associations of the Pinjarra vegetation system (Beard et al. 2013), as shown in Plate 3-4.

Most of the Pinjarra vegetation system on the Swan Coastal Plain has been historically cleared, and of the two sub-associations of the Pinjarra system that are representative of the site, there is only 10,583 ha in total remaining on the Swan Coastal Plain, which accounts for only 7% of the pre-European extent of these two sub-associations, in aggregate (GoWA 2019a).



**Plate 3-4: Vegetation associations and complexes**

This is largely consistent with the extent of pre-European vegetation clearing that has historically occurred within the site. The area has been significantly cleared and now consists primarily of lawns/paddocks, planted trees and garden beds, with intact remnant native vegetation (in Good or better condition) making up approximately 2.9% of the site.

Vegetation complex mapping of the Swan Coastal Plain was completed by Heddle et al. (1980) and considers soils, landforms and floristics. The site straddles the Forreestfield, Guildford, and Southern River Complexes on the Ridge Hill Shelf, fluvial deposits (deposited by watercourses) and aeolian deposits (wind-driven deposits) as shown on Plate 3-4.

The Forreestfield Complex is dominated by open forest or woodland of Marri (*Corymbia calophylla*), Wandoo (*Eucalyptus wandoo*) and Jarrah (*Eucalyptus marginata*) on heavier, gravelly soils, as well as Jarrah, Marri, and Sheoak (*Allocasuarina* spp.) on sandier soils. The Guildford Complex is dominated by open forest to woodland of Marri, Wandoo, and Jarrah, with areas of just Wandoo. The Southern River Complex is an open woodland of Marri, Jarrah, and Banksia. Woodlands of flooded gum (*Eucalyptus rudis*) and Swamp Paperbark (*Melaleuca raphiophylla*) occur in wet areas in all three complexes (Heddle et al. 1980).

Most of the Guildford Complex has been historically cleared with less than 10% remaining on the Swan Coastal Plain and within the Perth Metropolitan Region (GoWA 2019b), which again is largely consistent with the pre-European vegetation clearing that has taken place within the site. However, it is worthwhile to note that there is no intact remnant vegetation within the area mapped as Guildford Complex.

### 3.2.2 Vegetation Communities

Six native vegetation communities were described and mapped by AECOM (2020) for the broader Wattle Grove South area. Five vegetation communities (representing three native vegetation and two highly modified or planted) have been mapped consistent with those identified in the AECOM (2020) survey. Areas

not subject to a site survey were extrapolated by JBS&G (2024) (Appendix 3) based on adjacent ecological values, review of aerial imagery and where possible visual assessment from adjoining lots and road reserves.

Three native vegetation communities occur within the Conservation Areas. These communities fall into the broad category of Banksia Woodlands and *Eucalyptus marginata* Woodlands (AECOM 2020). The native vegetation communities within the site and the Conservation Areas are mapped in Figure 5 and presented in Table 3-3.

**Table 3-3: Vegetation community descriptions**

Description (ACEOM 2020)	Photograph (AECOM 2020)
<b>Remnant native vegetation</b>	
<p>BaEpPf Banksia Woodland <i>Banksia attenuata</i>, <i>Banksia menziesii</i> and <i>Eucalyptus todtiana</i> low open woodland over <i>Eremaea pauciflora</i> var. <i>pauciflora</i>, <i>Hibbertia hypericoides</i> and <i>Allocasuarina humilis</i> low shrubland over <i>Phlebocarya filifolia</i>, <i>Mesomelaena pseudostygia</i> and <i>Lepidosperma leptostachyum</i> low sedgeland. Supports the Threatened <i>Conospermum undulatum</i> and Priority 3 <i>Isopogon autumnalis</i>.</p>	
<p>BmXpEc Banksia Woodland <i>Banksia menziesii</i>, <i>Allocasuarina fraseriana</i> and <i>Eucalyptus todtiana</i> low open woodland over <i>Xanthorrhoea preissii</i>, <i>Eremaea pauciflora</i> var. <i>pauciflora</i> and <i>Stirlingia latifolia</i> low open shrubland over <i>Ehrharta calycina</i>*, <i>Dasypogon bromeliifolius</i> and <i>Anigozanthos manglesii</i> subsp. <i>manglesii</i> mixed grass and forbland.</p>	
<p>EmMpLp <i>Eucalyptus marginata</i> Woodland <i>Eucalyptus marginata</i> subsp. <i>marginata</i> and <i>Allocasuarina fraseriana</i> mid open forest over <i>Mesomelaena pseudostygia</i> and <i>Tetraria octandra</i> low sedgeland with <i>Lomandra preissii</i>, <i>Tricoryne elatior</i> and <i>Dampiera linearis</i> low open forbland.</p>	
<b>Highly modified vegetation</b>	
<p>Planted Planted and maintained gardens Condition considered Completely Degraded</p>	<p>NA</p>
<p>Trees Scattered trees Includes scattered trees (both native and introduced). Condition considered Completely Degraded.</p>	<p>NA</p>



It is worthwhile to note native vegetation on Lots 8 and 9 Brentwood Road was cleared following the surveys undertaken by AECOM (2020) and JBS&G (2024), which mapped the vegetation as BmXpEc and ranged from Degraded to Very Good condition. Figure 5 reflects the recent clearing and illustrates the current and remaining extent of BmXpEc.

Table 3-4 presents the extent of these vegetation communities to be retained in Conservation.

**Table 3-4: Vegetation community and extents in Conservation Areas**

Vegetation community	Extent within Site	Conservation	Potential Future Conservation	Total area and percentage (Conservation and Potential Future Conservation)
BaEpPf	4.23 ha	3.41 ha	0.74 ha	4.15 ha (98% of BaEpPf area)
BmXpEx	0.28 ha	0.15 ha	0.05 ha	0.20 ha (71% of BmXpEx area)
EmMpLp	0.05 ha	0.05 ha	0.0 ha	0.05 ha (100% of EmMpLp area)
<b>Total</b>	<b>4.56 ha</b>	<b>3.61 ha</b>	<b>0.79 ha</b>	<b>4.40 ha (96% of total remnant vegetation area)</b>

### 3.2.3 Vegetation Condition

Vegetation condition within the site and the Conservation Areas varies from Excellent to Completely Degraded (Figure 6 and Table 3-5). As previously advised, and due to the recently clearing on Lots 8 and 9, the areas provided in the table below will have a minor variation to the areas presented in JBS&G (2024) ecological memo.

Vegetation condition mapped within the site as being in Good or better condition is 3.61 ha, all of which will be retained in Conservation (Figure 6).

**Table 3-5: Vegetation condition and extents in Conservation Areas**

Vegetation condition	Extent within site	Conservation	Potential Future Conservation	Total area (Conservation and Potential Future Conservation)
<b>Remnant Native Vegetation</b>				
Excellent	3.41 ha	3.41 ha	0.00 ha	3.41 ha
Very Good	0.05 ha	0.05 ha	0.00 ha	0.05 ha
Good	0.15 ha	0.15 ha	0.00 ha	0.15 ha
Degraded	0.13 ha	0.00 ha	0.05 ha	0.05 ha
Completely Degraded	0.82 ha	0.00 ha	0.74 ha	0.74 ha
<b>Total</b>	<b>4.56 ha</b>	<b>3.61 ha</b>	<b>0.79 ha</b>	<b>4.40 ha</b>

### 3.2.4 Floristic Community Types

An FCT analysis was undertaken by Plantecology (2024) (Appendix 4) in accordance with DBCA (2023) Methods for Survey and Identification of Western Australian Threatened Ecological Communities. The FCT assignment used the Gibson et al. (1994) and Keighery et al. (2012) datasets, and assignment was done by minimum dissimilarity between the AECOM and JBS&G plot data and plots from two regional datasets (nearest neighbour) (Plantecology 2024).



The FCT analysis incorporated relevant quadrats from the broader AECOM (2020) study area. Although some of the quadrats themselves were outside of the site and within the wider Wattle Grove area, using these quadrats enabled a better and more robust analysis of FCT. All but one of these quadrats were surveyed by AECOM (2020), with the other quadrat surveyed by JBS&G (2024).

Within the Conservation Areas, the probable FCTs assigned from the analysis undertaken by Plantecology (2024) include:

- FCT 20a *Banksia attenuata* woodlands over species rich dense shrublands State TEC – Critically Endangered (BC Act)
- FCT 20c Shrublands and woodlands of the eastern side of the Swan Coastal Plain State TEC – Critically Endangered (BC Act) and Federal TEC – Endangered (EPBC Act)

Regarding, the remaining patch of vegetation (BmXpEc) mapped within Lot 8, which is 0.05 ha in extent and is in Degraded condition, a targeted survey and FCT analysis of the flora and vegetation within this patch will be undertaken in accordance with DBCA (2023) Methods for Survey and Identification of Western Australian Threatened Ecological Communities, prior to any future subdivision application being lodged over this patch of vegetation to verify if it represents FCT 20c Shrublands and woodlands of the eastern side of the Swan Coastal Plain and therefore, requires retention and rehabilitation in accordance with the Environmental Conditions (Appendix 2).

### 3.2.5 Threatened Ecological communities

Native vegetation was mapped over 4.56 ha within the site. The FCT analysis undertaken by Plantecology (2024) (Appendix 4) and the Banksia Woodlands Assessment undertaken by JBS&G (2024) (Appendix 3) was used to determine the presence of any conservation-significant ecological communities within the four major vegetation patches (Figure 5) occurring within the site and the Conservation Areas. Three of these include TECs (Patches 1, 2 and 4), and another one (Patch 3) previously included TEC vegetation that has been recently cleared (Figure 7)

- Patch 1, contains:
  - 1.8 ha of Banksia Woodland – BaEpPf across Lots 254 and Lot 2 Victoria Road
  - BaEpPf is assigned as probably being FCT 20a *Banksia attenuata* woodlands over species rich dense shrublands State TEC – Critically Endangered (BC Act)
  - Banksia Woodlands of the Swan Coastal Plain TEC
  - Supports occurrences of threatened flora species *Conospermum undulatum* (Vulnerable) and priority flora *Isopogon autumnalis* (Priority 3).
- Patch 2, contains:
  - 0.35 ha of Banksia Woodland – BaEpPf
  - BaEpPf is assigned as probably being FCT 20a *Banksia attenuata* woodlands over species rich dense shrublands State TEC – Critically Endangered (BC Act)
  - Banksia Woodlands of the Swan Coastal Plain TEC
  - Supports occurrences of threatened flora species *Conospermum undulatum* (Vulnerable) and priority flora *Isopogon autumnalis* (Priority 3).
- Patch 3, previously contained:
  - 0.05 ha of Banksia Woodland – BmXpEc, use to comprise of approximately 0.3 ha of BmXpEc
  - BmXpEc assigned as probably being FCT 20c Shrublands and woodlands of the eastern side of the Swan Coastal Plain State TEC – Critically Endangered (BC Act) and Federal TEC – Endangered (EPBC Act)



- Patch 4, contains:
  - 2.07 ha of Banksia Woodland – BaEpPf
  - BaEpPf is assigned as probably being FCT 20a *Banksia attenuata* woodlands over species rich dense shrublands State TEC – Critically Endangered (BC Act)
  - Banksia Woodlands of the Swan Coastal Plain TEC
  - Supports occurrences of threatened flora species *Conospermum undulatum* (Vulnerable) and priority flora *Isopogon autumnalis* (Priority 3).

### 3.3 Flora

#### 3.3.1 Conservation Significant Flora

AECOM undertook an ecological spring survey, incorporating flora and vegetation in October 2019 (AECOM 2020). The survey recorded data from twelve quadrats and eight relevés, covering a broader area of the Wattle Grove locality than the site. The result of this survey has been augmented by the further survey work undertaken by JBS&G (2024) as part of the MRS amendment for the site.

AECOM (2020) recorded 165 native vascular flora taxa from the broader survey area and 21 introduced flora taxa, many of which are not expected to occur within the site. This also included two conservation significant flora taxa, concentrated in two localised areas, within the site and Conservation Areas (Figure 8):

- *Conospermum undulatum* (T)
- *Isopogon autumnalis* (P3), previously named *Isopogon drummondii*.

The AECOM field survey was undertaken at an appropriate time to identify conservation significant orchid species if present, however, the survey only gained access to approximately 50% of lots and recognised that there is potential for conservation significant flora taxa to have been missed if present. JBS&G conducted flora and vegetation surveys, incorporating both previously surveyed and unsurveyed lots within the site. JBS&G recorded observations of conservation significant flora from the boundary of Lots 210 and 801. Observations of Lot 210 and Lot 801 noted the presence of *Conospermum undulatum* (T) and *Isopogon autumnalis* (P3).

#### 3.3.2 Introduced Flora

Two Declared Pest plants were identified by AECOM (2020) as occurring within the broader survey area, *\*Asparagus asparagoides* (bridal creeper) and *\*Rubus ulmifolius* (blackberry). AECOM (2020) did not include a location for these weed species, so it is not known whether AECOM identified them as occurring within the site. JBS&G (2024) recorded *\*Asparagus asparagoides* (bridal creeper) on Lot 254 Victoria Road, and also noted that Lot 801 is a significant source of weeds invading remnant vegetation on Lot 210, including but not limited to *\*Leptospermum laevigatum*. Plantecology (2025) recorded *\*Gomphocarpus fruticosus* (Narrowleaf cottonbush) on Lot 54 Victoria Road.

### 3.4 Terrestrial Fauna

#### 3.4.1 Fauna habitats

The AECOM (2020) survey broadly defined and mapped six fauna habitats within the wider area of Wattle Grove South area. Of these, only four of these habitats were mapped within the site, including:

- Banksia Woodlands
- Eucalypt Woodlands
- Scattered Trees

- Planted and Maintained Gardens

These survey results were further confirmed by JBS&Gs surveys undertaken in 2021 and 2022 (JBS&G 2024).

Fauna habitat within the site has been highly modified through historical and ongoing land uses, which have resulted in the clearing of the majority of native vegetation. The small areas of remnant vegetation that remain within the site provide the greatest significant fauna habitat and comprise mostly Banksia Woodlands, which exists in four distinct patches, as well as one very small patch of Eucalyptus Woodland in Very Good condition (Figure 9). The fauna habitat types that have been recorded within the site and the Conservation Areas are presented in Table 3-6.

**Table 3-6: Fauna habitat descriptions (AECOM 2020)**

Fauna habitat	Description
<p>Banksia Woodland</p>	<p>This habitat generally comprises a low open woodland of Banksia and Eucalyptus over a low open shrubland on loamy, sandy brown soil.</p> <p>The habitat is generally considered high quality due to the presence of Banksia, its complexity and limited disturbance levels. Habitat quality is reduced where areas are significantly degraded due to impacts from clearing and edge effects.</p> <p>Fauna habitat characteristics include:</p> <ul style="list-style-type: none"> <li>• Dense understorey common</li> <li>• Logs of various sizes are common.</li> <li>• Fine and coarse leaf litter common to abundant</li> <li>• Bare ground occasionally present</li> <li>• Absence of stones and boulders</li> <li>• Large mature trees in occasional abundance (hollows absent).</li> </ul>  <p>Conservation significant species with potential to utilise habitat:</p> <ul style="list-style-type: none"> <li>• Generally good quality foraging habitat for Carnaby’s cockatoo and Baudin’s cockatoo</li> <li>• Low to moderate quality foraging habitat for the Forest Red-tailed black cockatoo</li> <li>• Contains occasional breeding tree for black cockatoos</li> <li>• Habitat for Quenda</li> </ul>
<p>Eucalypt Woodland</p>	<p>This habitat typically contains a Eucalypt woodland / open forest over a low shrubland over sandy brown soils. This habitat is variable throughout the survey area though generally contains a Eucalyptus woodland / open forest over a low shrubland over sandy brown soils.</p> <p>This habitat is considered high to moderate (depending on degree of degradation) quality due to the structural complexity and disturbance levels.</p> <p>Significant habitat characteristics include:</p> <ul style="list-style-type: none"> <li>• presence of large mature eucalypts</li> <li>• dense understorey occasionally present</li> <li>• logs of various sizes in variable abundance</li> <li>• fine and coarse leaf litter common</li> <li>• bare ground occasionally present</li> <li>• absence of stones and boulders</li> <li>• large hollows occasionally present, small hollows common</li> <li>• soils of areas at base of Darling scarp contained pea-gravel.</li> </ul>  <p>Conservation significant species with potential to utilise habitat:</p>

Fauna habitat	Description
	<ul style="list-style-type: none"> <li>• Potential foraging, breeding and roosting habitat for:                             <ul style="list-style-type: none"> <li>▪ Forest Red-tailed black cockatoo</li> <li>▪ Carnaby’s cockatoo</li> <li>▪ Baudin’s cockatoo.</li> </ul> </li> <li>• Habitat for Quenda</li> </ul>
<p>Planted and Maintained Gardens</p>	<p>Highly variable habitat including areas of planted and maintained native and introduced vegetation.</p> <p>The habitat is considered low to moderate quality due to disturbance levels and limited habitat complexity.</p> <p>Significant habitat characteristics include:</p> <ul style="list-style-type: none"> <li>• mature trees rare</li> <li>• variability of understorey, with areas of dense understorey generally absent</li> <li>• general lack of hollows</li> <li>• bare sandy ground abundant</li> <li>• absence of stones, boulders and rock crevices.</li> </ul>  <p>Conservation significant species with potential to utilise habitat:</p> <ul style="list-style-type: none"> <li>• Potential foraging, breeding and roosting habitat for:                             <ul style="list-style-type: none"> <li>▪ Forest Red-tailed black cockatoo</li> <li>▪ Carnaby’s cockatoo</li> <li>▪ Baudin’s cockatoo.</li> </ul> </li> <li>• Habitat for Quenda</li> </ul>
<p>Scattered Trees</p>	<p>This habitat is varied and contains large mature native and non-native eucalypt trees, as well as other introduced species such as Cape Lilac and Jacaranda. Trees were generally recorded over cleared areas.</p> <p>The significant fauna habitat characteristics include:</p> <ul style="list-style-type: none"> <li>• presence of large mature trees</li> <li>• absence of dense understorey</li> <li>• small hollows are common, large hollows are rare</li> <li>• logs of all sizes are rare to occasionally present</li> <li>• coarse and fine litter are present but generally only under trees.</li> <li>• bare sandy ground abundant</li> <li>• absence of stones, boulders and rock crevices.</li> </ul>  <p>Conservation significant species with potential to utilise habitat:</p> <ul style="list-style-type: none"> <li>• Potential foraging, breeding and roosting habitat for:                             <ul style="list-style-type: none"> <li>▪ Forest Red-tailed black cockatoo</li> <li>▪ Carnaby’s cockatoo</li> <li>▪ Baudin’s cockatoo.</li> </ul> </li> <li>• Marginal habitat for Quenda</li> </ul>

Fauna habitat	Description	
Cleared	<p>Generally, consists of areas which have been cleared (e.g. paddocks) and now comprise bare soil and / or weeds (may contain the occasional shrub/tree), or hardstand areas (e.g. roads).</p> <p>Habitat is considered very low quality.</p> <p>Conservation significant species with potential to utilise habitat:</p> <ul style="list-style-type: none"> <li>This habitat may contain the occasional individual foraging tree/shrub for black cockatoos.</li> </ul>	

Regarding the clearing that has taken place on Lots 8 and 9 Brentwood Road and the mapping discrepancy identified on Lot 2 Victoria Road, Table 3-8 and Figure 9 reflects the updated fauna habitat areas for Banksia Woodland and Eucalyptus Woodland as a result of this clearing and revision to the mapping.

**Table 3-7: Fauna habitats and extents in Conservation Areas**

Fauna habitat (vegetation communities)	Extent within Site	Conservation	Potential Future Conservation	Total area and percentage (Conservation and Potential Future Conservation)
Banksia Woodlands (BaEpPf)	4.23 ha	3.41 ha	0.74 ha	4.15 ha (98%)
Banksia Woodlands (BmXpEc)	0.28 ha	0.15 ha	0.05 ha	0.20 ha (71%)
Eucalypt Woodlands (EmMpLp)	0.05 ha	0.05 ha	0.0 ha	0.05 ha (100%)
<b>Total</b>	<b>4.56 ha</b>	<b>3.61 ha</b>	<b>0.79 ha</b>	<b>4.40 ha (96%)</b>

### 3.4.2 Fauna Assemblage

Fifty-one vertebrate fauna species were recorded within the site or in adjacent areas during the AECOM (2020) field survey. This comprised 36 bird, 11 mammal, one amphibian and three reptile species.

### 3.4.3 Conservation Significant Fauna

Five of the 51 recorded vertebrate fauna species are identified as having some conservation significance, including three birds and one mammal, summarised as follows:

- Forest Red-Tailed black cockatoo *Calyptorhynchus banksii* (listed as Vulnerable under the EPBC Act and the BC Act).
- Carnaby's cockatoo *Zandi latirostris* (listed as Endangered under the EPBC Act and the BC Act).
- Quenda *Isoodon fusciventer* (listed as Priority 4 by DBCA) (refer to Figure 9 for locations of Quenda diggings and scat recorded within the site).
- Rainbow Bee-Eater *Merops ornatus* (listed as Marine under the EPBC Act).

Whilst not observed during the survey, an additional conservation significant fauna species is also considered to have the potential to utilise the habitats within the survey area:

- Baudin's cockatoo *Zandi baudinii* (listed as Endangered under the BC Act and the EPBC Act).

### 3.4.4 Black Cockatoo Habitat

#### 3.4.4.1 Foraging Habitat

The site contains both native and introduced vegetation, of varying quality, some of which may be suitable for foraging for all three black cockatoo species, as described in Table 3-6. The suitability of this habitat for foraging varies, depending on the type of habitat and its condition.

Phoenix Environmental (2024) utilised the data collected by AECOM (2020) and JBS&G (2024), which included site surveys undertaken by AECOM in 2019 and JBS&G in 2021 and 2022 and determined the foraging habitat value using the BCE (2021) scoring system for all three black cockatoos within the site and the Conservation Areas.

At the time of the surveys undertaken by AECOM (2020) and JBS&G (2024), there were no records of fire and therefore, is unlikely to have impacted forage species coverage scores (Phoenix Environmental 2024).

The BCE (2021) scoring system provides a foraging value score that reflects the significance of vegetation as foraging habitat for black cockatoos and a numerical value that is designed to assess potential impact significance and offset requirements. The foraging value of the vegetation is dependent on the following components:

- Site condition – a score out of six is determined based on the vegetation composition, condition and structure.
- Site context – a score out of three is determined for the context of the site, which is a function of site size, availability of nearby habitat and breeding area, as well as consideration of connectivity to access foraging sites.
- Species stocking rate – a score out of one is determined based on upon the black cockatoo species being either abundant or not-abundant (i.e. a score of 1 is used when the species is reported regularly and/or there is abundant foraging evidence and a score of 0 is used when the species is recorded or reported very infrequently, and there is little or no foraging evidence).

Determining the total score out of 10, which may require moderation for context and species density with respect to the site condition (vegetation) score. Moderation also includes consideration of pine plantations as a special case for foraging value

Site condition is scored out of 6 and is the biggest factor in the overall score. Site condition varied between species of black cockatoo and vegetation communities, with higher scores being attributed to those vegetation communities/habitats with a higher density of foraging species (Phoenix Environmental 2024).

The site context was assigned by Phoenix Environmental (2024) as 3 to all polygons, given:

- Carnaby's cockatoo: local breeding is also known and 32.9% of native vegetation remains within 15 km of the MRS amendment area.
- Baudin's cockatoo: no local breeding is known or likely, but 32.9% of native vegetation remains within 15 km of the MRS amendment area
- Forest Red-tailed black cockatoo: no local breeding is known or likely, but 32.9% of native vegetation remains within 15 km of the MRS amendment area.

The following stocking rates were calculated by Phoenix Environmental as:

- Carnaby's cockatoo: stocking rate = 1 as observed feeding and multiple recent and historic evidence of feeding activity were recorded (i.e. AECOM 2020; DBCA 2023; JBS&G 2024 and here).
- Baudin's cockatoo: stocking rate = 0 as no feeding was directly observed, nor was recent or historical evidence found and desktop records are also absent within 15 km of the MRS amendment area



- Forest Red-tailed black cockatoo: stocking rate = 1 as observed feeding and multiple recent and historic evidence of feeding activity were recorded (i.e. AECOM 2020; DBCA 2023; JBS&G 2024 and here).

The moderation values were applied to parts of the habitat polygons that did not record any known forage species (native or introduced) (Phoenix Environmental 2024).

The resultant foraging habitat scores for all three black cockatoos according to the vegetation communities is presented in Table 3-9. Areas that have been subject to clearing or development have been mapped as ‘Cleared’, and include the recent clearing on Lots 8 and 9. As a result, the areas provided in the table below will have a minor variation to the areas presented in Phoenix Environmental's (2024) black cockatoo habitat assessment (Appendix 5).

**Table 3-8: Black cockatoo foraging habitat value per BCE 2021 scoring method**

Vegetation community	Rating*	Carnaby's cockatoo		Baudin's cockatoo		Forest Red-tailed black cockatoo	
		Score	Sum area (ha)	Score	Sum area (ha)	Score	Sum area (ha)
BaEpPf	Low	-	0	2	0.82	3	0.82
	Medium	6	0.82	5	1.34	-	0
	High	8	3.41	7	2.07	8	3.41
BmXpEc	High	-	0	7	0.15 (pre clearing 0.29)	7	0 (pre clearing 0.05)
		8	0.15 (pre clearing 0.29)	-	0	8	0.15 (pre clearing 0.24)
EmMpLp	Low	2	0.08	3	0.08	3	0.08
	High	8	0.05	7	0.05	8	0.05
Trees	Low	2	20.43	2	21.62	2	20.61
		3	5.84	3	4.48	3	6.30
	Medium	5	0.59	5	0.81	-	0
		6	0.05	-	0	-	0
Planted	Low	2	2.80	3	2.80	2	2.80
Cleared	Low	2	91.37 (pre clearing 91.23)	2	91.37 (pre clearing 91.23)	2	91.37 (pre clearing 91.23)
<b>Total area (ha)</b>		<b>125.59</b>		<b>125.59</b>		<b>125.59</b>	

**\* Relative Rating**

- Low value habitat (red) is 1 to 3 out of 10
- Medium value habitat (yellow) is 4 to 6 out of 10
- High value habitat (green) is 7 to 10 out of 10

The spatial distribution of the foraging habitat value across the site and the Conservation Areas is shown in Figure 10 (Carnaby's cockatoo), Figure 11 (Forest Red-tailed black cockatoo) and Figure 12 (Baudin's cockatoo).

Based on the density of suitable foraging species, most of the site (ranging from 95.96% for Carnaby's cockatoo to 97.01% for Forest Red-tailed black cockatoo) is comprised of low foraging habitat value for all three Black cockatoos (Table 3-10). The Banksia Woodland (BaEpPf and BmXpEc) and Eucalyptus Woodland (EmMpLp) scored the highest at either 7 or 8 out of 10. There were some discrete areas that were of medium foraging habitat value for Carnaby's cockatoo (located on Lot 801 and Lot 2) and Baudin's cockatoo (located on Lots 84, 504, 803 and 804).

**Table 3-9: Foraging habitat value per black cockatoo species in Conservation**

Rating	Score	Carnaby’s cockatoo			Baudin’s cockatoo			Forest Red-tailed black cockatoo		
		Extent in Site	Conservation	Potential Conservation	Extent in Site	Conservation	Potential Conservation	Extent in Site	Conservation	Potential Conservation
Low	2	114.68 ha (91.32%)	-	0.05 ha (0.04%)	113.81 ha (90.63%)	-	0.79 ha (0.63%)	114.78 ha (91.39%)	-	0.05 ha (0.04%)
	3	5.84 ha (4.65%)	-	-	7.36 ha (5.79%)	-	-	7.20 ha (5.73%)	-	0.74 ha (0.59%)
Subtotal		120.52 ha (95.97%)	-	-	121.17 ha (96.48%)	-	-	121.97 ha (97.12%)	0.60 ha (0.48%)	-
Medium	5	0.59 ha (0.47%)	-	-	2.15 ha (1.71%)	1.34 ha (1.06%)	-	-	-	-
	6	0.87 ha (0.69%)	-	0.74 ha (0.59%)	-	-	-	-	-	-
Subtotal		1.46 ha (1.16%)	-	-	2.15 ha (1.71%)	1.34 ha (1.06%)	-	-	-	-
High	7	-	-	-	2.27 ha (1.81%)	2.27 ha (1.81%)	-	-	-	-
	8	3.61 ha (2.88%)	3.61 ha (2.87%)	-	-	-	-	3.61 ha (2.87%)	3.61 ha (2.87%)	-
Subtotal		3.61 ha (2.88%)	3.61 ha (2.87%)	-	2.27 ha (1.81%)	2.27 ha (1.81%)	-	3.61 ha (2.87%)	3.61 ha (2.87%)	-
Total		125.59 ha (100%)	3.61 ha (2.87%)	0.79 ha (0.63%)	125.59 ha (100%)	3.61 ha (2.87%)	0.79 ha (0.63%)	125.58 ha (100%)	3.61 ha (2.87%)	0.79 ha (0.63%)



Given the results of the habitat assessment, Phoenix Environmental (2024) recommended that all of the high-quality TEC remnant vegetation present within the site is retained to support local breeding, roosting and foraging for Carnaby's cockatoo and Forest Red-tailed black cockatoo as the remaining areas offer little value to those species.

Table 3-10 lists the foraging habitat score for each black cockatoo species and those that will be retained in the Conservation areas. The table highlights that all areas containing high quality foraging habitat for all three black cockatoos will be retained for conservation.

#### **3.4.4.2 Potential Breeding Habitat**

Potential nesting trees, in the context of black cockatoos, are defined by DAWE (2022) as native trees of suitable species with a diameter at breast height (DBH) greater than 500 mm (or >300 mm for Salmon Gum and Wandoo). Trees with a DBH greater than 500 mm (or >300 mm for Salmon Gum and Wandoo) are large enough to potentially contain hollows suitable for nesting black cockatoos or have the potential to develop suitable hollows over the next 50 years.

Based on the AECOM (2020) and JBS&G (2024) surveys, and the more recent Phoenix Environmental (2025) survey, a total 158 potential nesting trees have been recorded within the site (Figure 13).

The majority of potential nesting trees are scattered in areas of degraded habitat or cleared land/paddocks and consist of native trees known to support breeding such as Jarrah, Marri, Tuart and Flooded Gums (Phoenix Environmental 2024).

##### **3.4.4.2.1 Tree hollow inspection**

As part of Phoenix Environmental (2024) analysis of the black cockatoo data collected from the site surveys by AECOM (2020) and JBS&G (2020), seven potential nesting trees were identified as requiring re-inspection to confirm location and suitability of hollows as nests for black cockatoos (Appendix 5). Phoenix Environmental (2024) inspected the seven potential nesting trees on 19 January 2024 with a GoPro pole camera and recorded tree species, DBH, number of hollows present, hollow heights present, hollow height and orientation, hollow suitability (e.g. size of entrance, condition of outside of the hollow), and evidence of use (Phoenix Environmental 2024). None of the inspected trees are suitable for black cockatoo nesting (Phoenix Environmental 2024).

In order to be suitable for black cockatoos, hollow entrances need to be at least 100 mm in diameter. Hollows in Jarrah tend to be smaller than those found in Marri, consequently black cockatoos, particularly Forest Red-tailed black cockatoos, breed predominantly in Marri, in the Jarrah-Marri forest of the south-west (Whitford 2002; Johnstone et al 2013). On the Swan Coastal Plain most black cockatoo breeding records, particularly for Carnaby's cockatoo, are in Tuart (Johnstone and Kirkby 2011).

Given the semi-urban nature of the local environment and the outcome of the hollow inspection undertaken by Phoenix Environmental (2024), it is unlikely that the site represents breeding habitat for any of the 3 black cockatoo species especially in the absence of confirmed or historic breeding observations and the absence of any trees with suitable hollows.

The site does contain small areas of high-quality foraging habitat, as well as water sources and roosting site in close proximity, and so whilst the site could be considered high quality future breeding habitat, the site comprises semi-rural residential land that has been heavily developed and highly modified (Phoenix Environmental 2024). Subsequently, numerous potential nesting trees have been lost over the past few years due to age and condition and therefore, in the consideration of the current land use, it is considered highly unlikely that the current crop of trees will still be standing in 50 to 100 years, which is when they may begin to develop larger hollows suitable for breeding (Phoenix Environmental 2024).

#### **3.4.4.3 Potential Roosting Habitat**

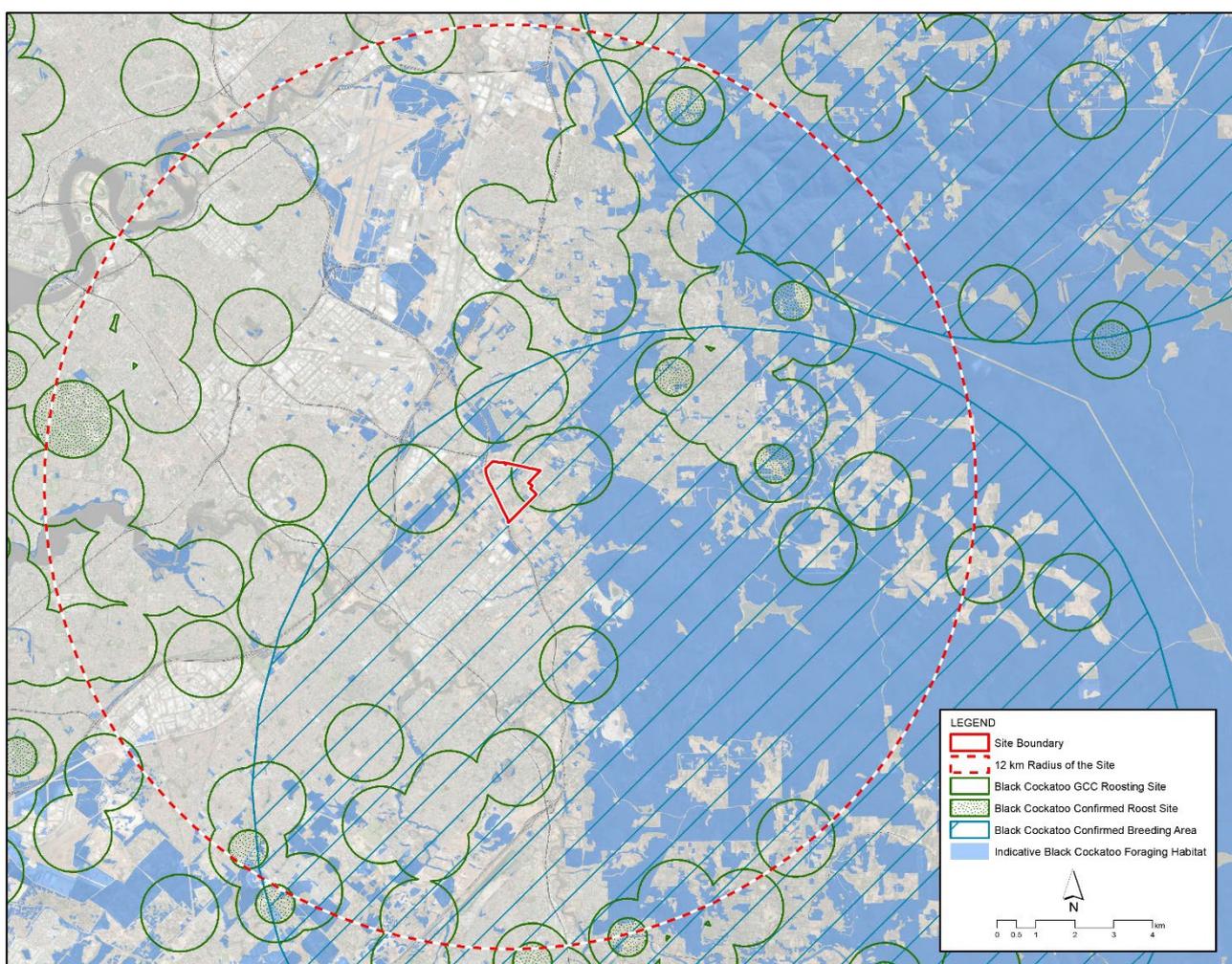
Carnaby's and Baudin's cockatoos roost in or near riparian environments or near other permanent water sources, generally within any tall trees, but particularly Flat-topped Yate, Salmon Gum, Wandoo, Marri, Karri,

Blackbutt, Tuart, introduced Eucalypts and introduced Pines. The Forest Red-tailed black cockatoo prefers the edges of forests for roosting, within any tall trees, but particularly tall Jarrah, Marri, Blackbutt, Tuart and introduced Eucalypt trees (DotEE 2017).

Within 12 km of the MRS amendment area, there are 50 confirmed roosting sites (23 Forest Red-tailed black cockatoo roosting sites, 7 White tailed black cockatoo roosting sites and 20 White-tailed and Forest Red-tailed roosting sites) and 10 unconfirmed roosting sites (Plate 3-5) (Birdlife 2024, as cited in Phoenix Environmental 2024).

Located 250 m east from the MRS amendment area is an unconfirmed roosting site (KALWATR001), which means roosting black cockatoos have been provided but there has been no positive count recorded during any of the Great Cocky Count census (Birdlife 2024, as cited in Phoenix Environmental 2024). The following 2 roosting sites occur to the east and are within 1 km of the MRS amendment area (Phoenix Environmental 2024):

- Confirmed site (KALWATR002) is located 850 m east of the MRS amendment area and is known to support FRTBC roosting of up to 150 individuals (Great Cocky Count Census 2016 2018) (DBCA 2023), with lower numbers recorded in subsequent years (2019 – 23, 2021 – 87, 2022 – 0 and 2023 – 35).
- Unconfirmed site (KALWATR001) is located 250 m east of the MRS amendment area. An unconfirmed black cockatoo roosting site is where roosting has been reported but there has been no positive count recorded during any of the Great Cocky Count census (Birdlife 2024, as cited in Phoenix Environmental 2024).



**Plate 3-5: Black cockatoo roosting and breeding sites (within 12 km)**



The habitat assessment undertaken by AECOM (2020) determined that 29.8 ha of suitable roosting habitat was present, consisting of remnant native vegetation, planted gardens and scattered trees; however, these have been found to be of largely low value (Phoenix Environmental 2024).

Numerous surveys have been undertaken within the site since 2019, as well as numerous sites in close proximity are part of annual black cockatoo monitoring, and to date no roosting sites for black cockatoo species have been identified within the site (Plate 3-5). So, while there may be suitable roosting habitat, it does not appear to be used as such, at least not for the last decade (Phoenix Environmental 2024).

## 4 Conservation Areas

### 4.1 Environmental objective

To protect, maintain and enhance the quality and ecological function of the conservation significant ecological communities and flora, and black cockatoo habitat for the long term.

### 4.2 Environmental values

#### 4.2.1 Threatened Ecological Communities

##### 4.2.1.1 *Banksia attenuata* woodlands over species rich dense shrublands (FCT 20a)

This community occurs on sands at the base of the Darling Scarp between Chittering and Gosnells. It is very species rich and is usually dominated *Banksia attenuata* (occasionally *Eucalyptus marginata*) *Bossiaea eriocarpa*, *Conostephium pendulum*, *Hibbertia huegelii*, *H. hypericoides*, *Petrophile linearis*, *Scaevola repens*, *Stirlingia latifolia*, *Mesomelaena pseudostygia* and *Alexgeorgea nitens* being common in the understorey. The introduced bulbous weed *Gladiolus caryophyllaceus* is also common in the community (DPaW 2016).

This community is listed as Critically Endangered under the State BC Act, and is listed as sub-community under the *Banksia* Woodlands of the Swan Coastal Plain ecological community (Section 4.2.1.3), which is listed as Endangered under the Federal EPBC Act.

##### 4.2.1.1.1 *Recovery Plan for Banksia attenuata* woodlands over species rich dense shrublands (FCT 20a)

The objective of the interim recovery plan is 'to maintain and maintain or improve the overall condition of the *Banksia attenuata* woodlands over species rich dense shrublands in the known locations' (DPaW 2016).

Table 4-1 identifies the relevant recovery actions for FCT 20a that have guided the preparation of this CAMS and future management actions to be implemented through the CAMP for each Conservation Area containing FCT 20a, and to ensure conservation measures proposed will achieve the overall objective of the Recovery Plan and contribute towards increasing the occurrences of FCT 20a within the conservation estate.

**Table 4-1: Relevance to the interim recovery plan for FCT 20a**

Recovery action (DPaW 2016)	Relevance to site and future conservation
Liaise with stakeholders to implement recovery	As part of the CAMS and subsequent CAMP (to be prepared and implemented at subdivision/development stage), liaison will be undertaken with DBCA and the City of Kalamunda to ensure the management actions will ensure FCT 20a is adequately protected within the Conservation Areas.
Seek to minimise further clearing of the community	Implementation of the Local Structure Plan and the Environmental Conditions (Appendix 2) will result in all occurrences of FCT 20a being retained and protected within the Conservation Areas. Thereby, minimising the further clearing of the community.
Verify occurrences as required	All 3 remaining areas of intact remnant vegetation (in Good or better condition) within the MRS amendment area have been surveyed and the probable FCT 20a has been assigned using DBCA (2024) Methods for survey and identification of Western Australian threatened ecological communities.
Continue to monitor the extent and boundaries of occurrences	Where occurrences of FCT 20a are retained within the Conservation Areas, regular monitoring and annual reporting via the CAMP will be undertaken. Annual reporting will include annual monitoring of condition to ensure the occurrences are being maintained and not declining in condition.



Recovery action (DPaW 2016)	Relevance to site and future conservation
Implement weed control and rehabilitation as required	<p>The CAMP will include and implement weed control measures within the Conservation Area, and in line with the following protocol:</p> <ol style="list-style-type: none"> <li>1. Determine which weeds are present and develop a prioritised weed control program</li> <li>2. Select appropriate herbicides</li> <li>3. Control invasive weeds by hand removal or spot spraying as the herb layer is an integral part of this plant community and care will be taken to minimise disturbance of native herbs</li> </ol> <p>The CAMP will also include a rehabilitation program that will be tailored to increase the extent as well as improve the overall condition of the FCT 20a within the Conservation Areas.</p>
Develop and implement a fire management strategy	<p>The CAMP will include appropriate bushfire management measures to be implemented within the Conservation Areas. Furthermore, site specific Bushfire Management Plans will be required as part of local structure planning, subdivision and/or development.</p>
Implement disease hygiene procedures	<p>The CAMP will establish and implement hygiene procedures to prevent introduction of pathogens within the Conservation Area.</p>
Seek long term protection of the community for conservation	<p>Implementation of the Local Structure Plan and the Environmental Conditions (Appendix 2) will result in all occurrences of FCT 20a being retained and protected within the Conservation Areas. Further, implementation of the CAMP will facilitate their on-ground management and thereby, ensure their conservation for the long term.</p>

#### 4.2.1.2 Shrublands and Woodlands of the Eastern Swan Coastal Plain (FCT 20c)

This community occurs mainly on the transitional soils of the Ridge Hill, on the Swan Coastal Plain adjacent to the Darling Scarp, and extends marginally onto the alluvial clays deposited on the eastern fringe of the Swan Coastal Plain. This community has been recorded between Stratton and Maddington (DBCA 2023).

The flora of this community reflects the transitional landform and soil zone between the Scarp and the Swan Coastal Plain, and comprises a shrubland or woodland of *Banksia attenuata* (slender banksia) and *Banksia menziesii* (firewood banksia), sometimes with *Allocasuarina fraseriana* (western sheoak), over a shrub layer that can include the species *Adenanthos cygnorum* (woolybush), *Hibbertia huegelii*, *Scaevola repens* var. *repens* (fan flower), *Allocasuarina humilis* (dwarf sheoak), *Bossiaea eriocarpa* (common brown pea), *Hibbertia hypericoides* (yellow buttercups) and *Stirlingia latifolia* (blueboy). A suite of herbs usually occur within this community, including *Conostylis aurea* (golden conostylis), *Trachymene pilosa* (native parsnip), *Lomandra hermaphrodita*, *Burchardia congesta* (milkmaids) and *Patersonia occidentalis* (purple flag), and the sedges *Mesomelaena pseudostygia* (semaphore sedge) and *Lyginia barbata* (DBCA 2023).

This community is listed as Critically Endangered under the State BC Act and Endangered under the Federal EPBC Act.

##### 4.2.1.2.1 Approved Conservation Advice for Shrublands and Woodlands of the eastern Swan Coastal Plain

The objective of this conservation advice is ‘to mitigate the risk of extinction (or collapse) of the Shrublands and Woodlands of the eastern Swan Coastal Plain ecological community, and help recover its biodiversity and function’ (TSSC 2017).

The advice outlines the following four key approaches to achieving this objective:

- Protect the ecological community to prevent further loss of extent and condition
- Restore the ecological community within its original range by active abatement of threats, regeneration and revegetation, and other conservation initiatives



- Communication – Engage with and support people to increase understanding of the value and function of the ecological community and encourage their efforts in its protection and recovery
- Research and monitoring to improve our understanding of the ecological community and methods for restoration and protection over the long-term.

The above key approaches have guided the preparation of this CAMS and future management actions to be implemented through the CAMP for any Conservation Area containing Shrublands and Woodlands of the eastern Swan Coastal Plain. Thereby, ensuring the management actions proposed will contribute to the long-term protection and restoration of any occurrences of Shrublands and Woodlands of the eastern Swan Coastal Plain within the Conservation Areas.

**4.2.1.2.2 Interim Recovery Plan for the Eastern Shrublands and Woodlands (Community type 20C) 2006-2011**

The objective of the interim recovery plan is ‘To maintain or improve the overall condition of the ‘shrublands and woodlands of the eastern side of the Swan Coastal Plain’ and reduce the level of threat with the aim of downgrading it from Critically Endangered to Endangered’ (DEC 2006).

Table 4-2 identifies the relevant recovery actions for FCT 20c that have guided the preparation of this CAMS and future management actions to be implemented through the CAMP for any Conservation Area containing FCT 20c, and to ensure conservation measures proposed will achieve the overall objective of the Recovery Plan and contribute towards increasing the occurrences of FCT 20c within the conservation estate.

**Table 4-2: Relevance to the interim recovery plan for FCT 20c**

Recovery action (DPaW 2016)	Relevance to site and future conservation
Liaise with stakeholders to implement interim recovery plan	As part of the CAMS and subsequent CAMP (to be prepared and implemented at subdivision/development stage), liaison will be undertaken with DBCA and the City of Kalamunda to ensure the management actions will ensure FCT 20a is adequately protected within the Conservation Areas.
Monitor the extent and boundaries of the community	Where occurrences of FCT 20c are retained within the Conservation Areas, regular monitoring and annual reporting via the CAMP will be undertaken. Annual reporting will include annual monitoring of condition to ensure the occurrences are being maintained and not declining in condition.
Develop and implement fire management strategy	The CAMP will include appropriate bushfire management measures to be implemented within the Conservation Areas. Furthermore, site specific Bushfire Management Plans will be required as part of local structure planning, subdivision and/or development.
Monitor dieback and determine priority areas for dieback treatment	The CAMP will include the requirement for baseline dieback assessment and mapping to be undertaken within the Conservation Area, to identify priority areas for dieback treatment. If dieback is found to be present, annual reporting will include annual monitoring of dieback within the Conservation Area.
Implement dieback treatments	The CAMP will establish and implement hygiene procedures to prevent introduction of pathogens within the Conservation Areas.
Assess and monitor weed populations	The CAMP will include the requirement to undertake a baseline weed survey and annual weed monitoring as part of the annual reporting requirements for the CAMP.
Implement weed control, replanting and rehabilitation where necessary	The CAMP will include and implement weed control measures within the Conservation Area, and in line with the following protocol: <ol style="list-style-type: none"> <li>1. Determine which weeds are present and develop a prioritised weed control program</li> <li>2. Select appropriate herbicides</li> </ol>



Recovery action (DPaW 2016)	Relevance to site and future conservation
	<p>3. Control invasive weeds by hand removal or spot spraying as the herb layer is an integral part of this plant community and care will be taken to minimise disturbance of native herbs</p> <p>If required, the CAMP will also include a revegetation program that will be tailored to increase the extent as well as improve the overall condition of the FCT 20c within the Conservation Areas.</p>
Ensure fences are constructed and maintained.	The CAMP will include the requirement to provide install, monitor and maintain access appropriate fencing around the Conservation Areas.

#### 4.2.1.3 Banksia Woodlands of the Swan Coastal Plain ecological community

The ecological community is a woodland associated with the Swan Coastal Plain of southwest Western Australia, and is largely restricted to the Perth (SWA02) and Dandaragon (SWA01) subregions of the Swan Coastal Plain IBRA bioregion; however, it does also extend into immediately adjacent areas on the Whicher and Darling escarpments (which lie within the HAF01 and JAF02 subregions of the Jarrah Forest IBRA bioregion), to the south and east where pockets of Banksia Woodland may also occur (TSSC 2016).

A key diagnostic feature is a prominent tree layer of Banksia, with scattered eucalypts and other tree species often present among or emerging above the Banksia canopy. The understorey is a species rich mix of sclerophyllous shrubs, graminoids and forbs. The ecological community is characterised by a high endemism and considerable localised variation in species composition across its range (TSSC 2016).

This community is listed as Endangered under the Federal EPBC Act, and at a State level it is listed by DBCA as Priority 3.

##### 4.2.1.3.1 *Approved conservation advice for the Banksia Woodlands of the Swan Coastal Plain*

The conservation objective of this advice is to ‘mitigate the risk of extinction of the Banksia Woodlands of the Swan Coastal Plain ecological community and help recover its biodiversity and function’ (TSSC 2016).

The advice outlines three key actions to achieve this conservation objective being:

- Protect the ecological community to prevent further loss of extent and condition.
- Restore the ecological community within its original range by active abatement of threats, revegetation and other conservation initiatives.
- Communicate with and support researchers, land use planners, landholders, land managers, community members, including the Indigenous community, and others to increase understanding of the value and function of the ecological community and encourage their efforts in its protection and recovery.

The above key actions have guided the preparation of this CAMS and future management actions to be implemented through the CAMP for each Conservation Area containing Banksia Woodlands of the Swan Coastal Plain ecological community. Thereby, ensuring the management actions proposed will contribute to the long-term protection and restoration of the Banksia Woodlands of the Swan Coastal Plain TEC within the Conservation Areas.

## 4.2.2 Conservation Significant Flora

### 4.2.2.1 *Conospermum undulatum* (T)

*Conospermum undulatum* (waxy-leaved smokebush) is an erect shrub which grows to 1.5 m height and is characterised by its fibrous, longitudinally fissured stems and wide leaves with wavy margins. It is listed as Vulnerable under the BC Act and EPBC Act and is ranked as Vulnerable (VU) under World Conservation Union (IUCN 1994) Red List criterion B1+2c, with its main threats being listed as further land clearing, poor habitat quality, road and firebreak maintenance, inappropriate fire regimes, weeds, recreational activities and rabbit grazing (DEC 2009). *Conospermum undulatum* is recorded from 25 historical populations, comprising 83 subpopulations. However, only 20 populations currently contain extant plants (DEC 2009). It occurs on sand and sandy clay soils, often over laterite, on flat or gently sloping sites between the Swan and Canning Rivers. A few records are from slightly swampy habitat. Habitat critical to the survival of *Conospermum undulatum* includes the area of occupancy of important populations and areas of similar habitat surrounding important populations (DEC 2009). Important populations of *Conospermum undulatum* are listed in the species' recovery plan.

#### 4.2.2.1.1 Recovery plan for *Conospermum undulatum*

The objective of the recovery plan is to maintain or improve the conservation status of *Conospermum undulatum* during the term of this plan by abating identified threats to populations (DEC 2009).

Table 4-3 identifies the relevant recovery actions for *Conospermum undulatum* that have guided the preparation of this CAMS and future management actions to be implemented through the CAMP for each Conservation Area containing *Conospermum undulatum*, and to ensure conservation measures proposed will achieve the overall objective of the Recovery Plan and contribute towards improving its conservation status.

**Table 4-3: Relevance to the Recovery Plan for *Conospermum undulatum***

Recovery action (DEC 2009)	Relevance to site and future conservation
Monitor populations	Where populations of <i>Conospermum undulatum</i> within the Conservation Areas are retained, regular monitoring and annual reporting via the CAMP will record occurrences of the species and whether they are being maintained / improved and are not declining.
Liaise with relevant land managers regarding management of bushland containing <i>Conospermum undulatum</i>	As part of the CAMS and subsequent CAMP/s (to be prepared and implemented at subdivision/development stage), liaison will be undertaken with DBCA and the City of Kalamunda to ensure the management actions will ensure the populations of <i>Conospermum undulatum</i> are adequately protected within the Conservation Areas.
Fence subpopulations	Fencing the Conservation Area or populations of <i>Conospermum undulatum</i> will be included as part of the on-ground management for each Conservation Area, where required.
Undertake weed control	The CAMP will include and implement weed control measures within the Conservation Area, and in line with the following protocol: <ol style="list-style-type: none"> <li>Determine which weeds are present and develop a prioritised weed control program</li> <li>Select appropriate herbicides</li> <li>Control invasive weeds by hand removal or spot spraying around <i>Conospermum undulatum</i> plants when weeds first emerge</li> </ol>
Develop and implement a rabbit control strategy	The CAMP will include and implement pest control measures, including rabbit control within the Conservation Area.



Recovery action (DEC 2009)	Relevance to site and future conservation
Assess development applications for lands containing <i>Conospermum undulatum</i>	The Environmental Management Framework sets out the future requirements for Local Structure Plan, subdivision and development applications which will ensure DBCA continue to assess future proposals for lands for lands containing <i>Conospermum undulatum</i> and participate in environmental impact assessment and statutory planning processes.
Increase area of <i>Conospermum undulatum</i> in the conservation estate	Implementation of the Local Structure Plan and the Environmental Conditions (Appendix 2) will result in occurrences of <i>Conospermum undulatum</i> being retained and protected within the Conservation Areas. Thereby, leading to the area of <i>Conospermum undulatum</i> in the conservation estate being increased.
Conduct further surveys	Past surveys undertaken by AECOM (2020) and JBS&G (2024) have recorded several populations of <i>Conospermum undulatum</i> within the site. Flora surveys will be undertaken over areas that have not be previously surveyed.
Develop and implement a fire management strategy	The CAMP will include appropriate bushfire management measures to be implemented within the Conservation Areas. Furthermore, site specific Bushfire Management Plans will be required as part of local structure planning, subdivision and/or development.
Promote awareness	The CAMP will include the requirement for educational signage to be installed providing information on the species and the importance of its conservation, in consultation with DBCA

#### 4.2.2.2 *Isopogon autumnalis* (P3)

*Isopogon autumnalis* is an erect shrub growing to 1 m height with cream-yellow flowers and mostly terete leaves (Rye and MacFarlane 2019). It is listed as a Priority 3 taxon by DBCA. It is known from a large range extending from the southern Lesueur Sandplains through the Swan Coastal Plain and Dandaragan Plateau to the Northern Jarrah Forrest. It prefers white, grey or yellow sand, often over laterite. It was previously known as *Isopogon drummondii* but was renamed in 2019 due to lack of a type specimen and descriptions being based on cultivated specimens (Rye and MacFarlane 2019). Variants of the taxon with larger leaves were transferred to *Isopogon sphaerocephalus*.

#### 4.2.3 Black cockatoos

##### 4.2.3.1 Carnaby's cockatoo

Carnaby's cockatoo (*Zanda latirostris*) is listed as Endangered under the EPBC Act (Federal) and Endangered under the BC Act (State). The species is endemic to the south-west of Western Australia, extending from the Murchison River to Esperance, and inland to Coorow, Kellerberrin and Lake Cronin. This black cockatoo has a white patch on its cheek, white bands on its tail and a strong curved bill. Carnaby's cockatoo is a seasonal visitor to the Swan Coastal Plain, which provides important foraging and roosting habitat during the non-breeding season.

Carnaby's cockatoo feeds on seeds, nuts and flowers of a variety of native and exotic plants. Feed plants include the various proteaceous species (e.g. Banksia, Grevillea and Hakea), Marri (*Corymbia calophylla*), Jarrah (*Eucalyptus marginata*), and seeds from the cones of Pine (*Pinus* sp.) trees. Cockatoo flocks follow vegetation corridors and actively avoid cleared and open areas when moving between roosting, water and food resources. Habitat fragmentation increases the distances cockatoos need to travel between resources. Proximity of foraging habitat and water has been demonstrated to be critical to support roosting and breeding sites (Le Roux 2017).

Carnaby's cockatoo displays strong pair bonds and nest in the hollows of live or dead mature Eucalypts including Salmon Gum (*Eucalyptus salmonophloia*), York Gum (*Eucalyptus loxophleba* subsp. *loxophleba*), Flooded Gum (*Eucalyptus rudis*), Karri (*Eucalyptus diversicolor*), Wandoo (*Eucalyptus wandoo*), Tuart

(*Eucalyptus gomphocephala*) and Marri (*Corymbia calophylla*), (DSEWPaC 2012). Nest hollows generally range from 2.5-12 m above ground, size of entrance from 23-30 cm and depth of hollows from 1-2.5 m (Johnstone and Storr 1998).

Carnaby's cockatoo has undergone a dramatic decline of approximately 50 percent in the past 45 years, with the main contributing factors the clearing of core breeding habitat in the Wheatbelt, the deterioration of nesting hollows and clearing of foraging habitat.

Breeding habitat for this species occurs in the Wheatbelt, Jarrah Forest and South Coast regions, and the species is expanding its current breeding range with small patches of breeding habitat now being utilised across the Swan Coastal Plain. After breeding, Carnaby's cockatoo disperse to the higher rainfall coastal areas of the south-west of Western Australia to feed in late December to July. Breeding has been recorded from early July to mid-December.

#### 4.2.3.1.1 Recovery plan for Carnaby's cockatoo

The objective of the recovery plan is to stop further decline in the distribution and abundance of Carnaby's cockatoo by protecting the birds throughout their life stages and enhancing habitat critical for survival throughout their breeding and non-breeding range, ensuring that the reproductive capacity of the species remains stable or increases (DPaW 2013).

Table 4-4 identifies the relevant recovery actions for Carnaby's cockatoo that have guided the preparation of this CAMS and future management actions to be implemented through the CAMP for each Conservation Area containing black cockatoo habitat, and to ensure the conservation measures proposed will achieve the overall objective of the Recovery Plan and contribute towards protecting and enhancing habitat critical for their survival.

**Table 4-4: Relevance to the recovery plan for Carnaby's cockatoo**

Recovery action (DPaW 2013)	Relevance to site and future conservation
Protect and management important habitat	<p>Implementation of the Local Structure Plan and the Environmental Conditions (Appendix 2) will result in:</p> <ul style="list-style-type: none"> <li>• Medium to high quality foraging habitat for Carnaby's cockatoo (<i>Zanda latirostris</i>), Forest Red-tailed black cockatoo (<i>Calyptorhynchus banksii naso</i>) and Baudin's cockatoo (<i>Zanda baudinii</i>) being retained and protected within the Conservation Areas via the CAMP.</li> <li>• Potential nesting trees being retained and protected within the Conservation Areas via the CAMP</li> </ul> <p>Thereby, ensuring future protection and management of their habitat within the Conservation Areas.</p>
Undertake regular monitoring	Regular monitoring and annual reporting will be undertaken via the CAMP. Annual reporting will include annual monitoring of habitat condition to ensure the occurrences are being maintained and not declining in condition.
Manage other impacts	<p>The CAMP will address, monitor and implement management measures to reduce the following potential impacts on black cockatoo habitat within the Conservation areas:</p> <ul style="list-style-type: none"> <li>• Fauna and pest management</li> <li>• Weed and pathogen control</li> <li>• Bushfire management</li> <li>• Fencing and access control</li> </ul>
Engage with broader community	The CAMP will include the requirement for educational signage to be installed providing information on the species and the importance of its conservation, in consultation with DBCA.

#### 4.2.3.2 Forest Red-tailed black cockatoo

The Forest Red-tailed black cockatoo (*Calyptorhynchus banksii naso*) is listed as Vulnerable under the EPBC Act (Federal) and Vulnerable under the BC Act (State). The species is endemic to the south-west humid and semi-humid zones of Western Australia, where it inhabits dense Jarrah, Karri and Marri forests which receive more than 600 mm average annual rainfall (DSEWPaC 2012). It has a pair of black central tail feathers and a bright red, orange or yellow barring on the tail.

This species predominantly feeds in eucalypt forests, preferring Marri (*Corymbia calophylla*) and Jarrah (*Eucalyptus marginata*) seeds, but also feeding on Blackbutt (*Eucalyptus patens*), Albany Blackbutt (*Eucalyptus staeri*), Karri (*Eucalyptus diversicolor*), Sheoak (*Allocasuarina* sp.) and Snottygobble (*Persoonia longifolia*) (Johnstone and Kirkby 2016).

Forest Red-tailed black cockatoo are monogamous and pairs nest in tree hollows from 6.5 to 33 m above ground. Most nests are in very large and very old, mature Marri (Johnstone, Kirkby and Sarti 2013), though they will nest in other Eucalypts such as Tuart (Johnstone and Kirkby 2016). Breeding habitat for this species occurs in the eastern margins of the Jarrah forests of the Wheatbelt, and within the Jarrah Forest regions. The Forest Red-tailed black cockatoo is also expanding its current breeding range with small patches of breeding habitat now being utilised across the Swan Coastal Plain.

##### 4.2.3.2.1 Conservation advice for Forest Red-tailed black cockatoo

The Approved Conservation Advice for Forest Red-tailed black cockatoo identifies various research priorities, regional priority and threat abatement actions to support the recovery of Forest Red-tailed black cockatoo (DEWHA 2009).

The following relevant regional priority actions were identified to be:

- Monitor the progress of recovery, including the effectiveness of management actions and the need to adapt them if necessary
- Determine and implement ways to manage forests for the conservation of the subspecies.

The above regional priority actions have guided the preparation of the CAMS and future management actions to be implemented through the CAMP for each Conservation Area containing black cockatoo habitat. Thereby, ensuring the management actions proposed will contribute to the long-term conservation of black cockatoo habitat.

It is worthwhile to note that the Recovery Plan for Forest Red-tailed black cockatoo has been revoked and is no longer in effect.

#### 4.2.3.3 Baudin's cockatoo

Baudin's cockatoo (*Zanda baudinii*) is listed as Endangered under the EPBC Act (Federal) and the BC Act (State). The species is distributed throughout the south-western humid and subhumid zones of Western Australia, from the northern Darling Range and adjacent far east of the Swan Coastal Plain (south of the Swan River), south to Bunbury and across to Albany (Johnstone and Storr 1998). It is a large black cockatoo with rectangular white patches in the tail. Males have a pink eye ring, the female a dark eye ring.

Baudin's cockatoo forages primarily in Eucalypt forest, where it feeds on seeds, flowers, nectar and buds from Marri (*Corymbia calophylla*), and seeds of Eucalyptus and proteaceous species (e.g. Banksia and Hakea), as well as orchard fruits and Pines (*Pinus* sp). It also takes insect larvae and insects (including beetle, wasp and moth larvae) from under bark and in wood of live and dead trees, from galls and from flower spikes of Xanthorrhoea and the pith of *Anigozanthos flavidus* (Johnstone and Kirkby 2008).

This black cockatoo primarily nests in tree hollows in live or dead Karri (*Eucalyptus diversicolor*), Marri (*Corymbia calophylla*), Wandoo (*Eucalyptus wandoo*) and Tuart (*Eucalyptus gomphocephala*) (DSEWPac 2012). Baudin's cockatoo nests in spring in the deep south-west of Western Australia.

#### **4.2.3.3.1 Conservation advice for Baudin's cockatoo**

The reason for the conservation assessment and advice was 'to change the listing status of Baudin's cockatoo to Endangered' (TSSC 2018).

The relevant conservation and management priorities are identified to be (TSSC 2018):

- Ensure land managers are aware of the species' occurrence and provide appropriate mitigation measures against habitat clearing
- Undertake habitat restoration by revegetating suitable areas with key tree species
- Fire must be managed to ensure that prevailing fire regimes do not disrupt the life cycle of Baudin's cockatoo, that they support rather than degrade the species habitat, and that they do not promote invasion of exotic species
- Implement best practice and adaptive management actions to reduce the spread of phytopathogens, manage and contain infested areas, and protect non-infested areas across the Baudin's cockatoo distribution
- Monitor the progress of conservation actions, including the effectiveness of management actions and adapt them if necessary to contribute to the species' recovery

The above priority actions have guided the preparation of the CAMS and future management actions to be implemented through the CAMP for each Conservation Area containing black cockatoo habitat. Thereby, ensuring the management actions proposed will contribute to the long-term conservation of black cockatoo habitat.

It is worthwhile to note that the Recovery Plan for Baudin's cockatoo has been revoked and is no longer in effect.

## 5 Management

### 5.1 Key threats and management issues

The key threats and management issues to threatened ecological communities, conservation significant flora, and black cockatoo habitat contained in the Conservation Areas are (Figure 14):

- Uncontrolled access within the Conservation Areas may result in vandalism or damage to native vegetation as a result of waste discharge or soil contamination.
- Introduction and/or spread of weed species and pathogens leading to reduced flora species and system diversity.
- Poor management and/or supervision during works associated future urban development may lead to the loss of threatened ecological communities, conservation significant flora, and black cockatoo habitat outside of clearing boundaries.
- Poor management and/or supervision during works associated with future urban development may lead to the loss of habitat for threatened fauna and migratory species.
- Works associated with future urban development have the potential to cause bush fires in the surrounding environment leading to damage or death to local flora, fauna and/or communities.
- Uncontrolled release of waste may result in pollution to the Conservation Areas.

### 5.2 Management provisions

The following sets out the management provisions that will be used to inform the preparation of the future CAMP for each Conservation Area as urban subdivision or development progresses.

#### 5.2.1 Delineation and access management

Defining and delineating the final boundary of the Conservation Areas is critical to protecting the quality and ecological function of the threatened ecological communities and conservation significant flora, and black cockatoo habitat for the long term. The detrimental consequences of not adequately delineating each Conservation Area can lead to degrading processes such as:

- unapproved clearing
- uncontrolled vehicle and pedestrian access
- increase in the risk of weed and pathogens
- uncontrolled waste and pollution
- vandalism (including arson).

In accordance with the requirements of the Environmental Conditions (Appendix 2), and to guide the preparation and implementation of the CAMP, delineation and access management actions are presented in Table 5-1.



**Table 5-1: Delineation and access management actions**

Management Action	Target	Timing	Responsibility	Environmental Outcome
<b>Preparation of CAMP</b>				
Confirm final Conservation Area boundary by undertaking studies to confirm presence and extent of significant ecological attributes set out in the Environmental Conditions (Appendix 2).  Note: see sections 5.2.2, 5.2.3 and 5.2.6 for further detail on studies to be undertaken.	To ensure final boundary of Conservation Area retains the significant ecological attributes set out in the Environmental Conditions (Appendix 2).	During detailed subdivision design and preparation of each CAMP.	Environmental consultant/ Developer	Will ensure the long-term protection and management of the Conservation Area and its significant ecological attributes.
Define location and type of fencing, gates and signage to be installed around the Conservation Area.	To prevent unauthorised vehicle and pedestrian access to the Conservation Area.	During preparation of CAMP.	Environmental consultant/ Developer	
<b>Potential management provisions to be included CAMP</b>				
Clearly demarcate the boundary of the Conservation Area with star pickets and/or flagging at minimum	To ensure no clearing of vegetation within the Conservation Area.	Prior to clearing commencing within the subdivision / development area	Construction contractor	Will ensure the long-term protection and management of the Conservation Area and prevent its significant ecological attributes being degraded as a result of unapproved clearing and unmitigated vehicle and pedestrian access.
Install and maintain appropriate fencing around the periphery of the Conservation Area and lockable gates at appropriate locations to enable vehicle access when required.	To prevent unauthorised vehicle and pedestrian access to the Conservation Area.	During clearing and post construction until handover	Construction contractor	
Install and maintain signage on periphery fencing detailing access and presence of the Conservation Area.	Increase awareness that the Conservation Area is a restricted access reserve containing significant vegetation and discourage unauthorised access	As periphery fencing is installed during clearing and post construction until handover	Construction contractor	



## 5.2.2 Threatened ecological communities

To ensure the overall maintenance or improvement of TECs within the Conservation Areas, the following management and recovery actions (where applicable) should be incorporated into each CAMP and implemented as urban subdivision and development progresses:

- Conduct baseline vegetation assessments to confirm, map and assess the current condition and extent of occurrences of TEC/s.
- Liaise with key stakeholders (i.e. DBCA and City of Kalamunda)
- Where appropriate, include a rehabilitation program that is tailored to increase the extent (within degraded areas) as well as maintain and/or enhance (where practicable) the condition of the TEC/s within the Conservation Areas.
- Continue to monitor the extent and boundaries of occurrences of TEC/s.
- Implement weed and pathogen control measures within the Conservation Area
- Develop and implement bushfire management measures
- Develop pest management measures within the Conservation Area.

These actions aim to protect, restore, and enhance the ecological integrity of TECs, which are often highly vulnerable to environmental pressures and the key threats identified in Section 5.1.

In accordance with the requirements of Environmental Conditions (Appendix 2), and to guide the preparation and implementation of the CAMP, TEC management actions are presented in Table 5-2.

**Table 5-2: TECs management actions**

Management Action	Target	Timing	Responsibility	Environmental Outcome
<b>Preparation of CAMP</b>				
Conduct baseline vegetation assessments to confirm, map and assess the current condition and extent of occurrences of TEC/s	To ensure known occurrences are maintained or improved within the Conservation Area.	During preparation of each CAMP.	Environmental consultant/ Developer	Will ensure the long-term protection, management and rehabilitation (if required) of TECs in the Conservation Areas.
If required, following baseline assessment, include a rehabilitation program that is tailored to increase the extent (within degraded areas) as well as maintain and/or enhance (where practicable) the condition of the TEC/s within the Conservation Areas. Rehabilitation program to include: <ul style="list-style-type: none"> <li>• completion criteria for: <ul style="list-style-type: none"> <li>▪ vegetation condition</li> <li>▪ flora diversity</li> <li>▪ weeds, diversity and cover.</li> </ul> </li> </ul>	To ensure known degraded occurrences of TECs that are in 'degraded' condition are restored to achieve a condition rating of 'good' or better, in accordance with Keighery 1994	During preparation of CAMP.	Environmental consultant/ Revegetation contractor/ Developer	



Management Action	Target	Timing	Responsibility	Environmental Outcome
<ul style="list-style-type: none"> <li>• revegetation measures (i.e. topsoil and native seed collection, etc)</li> <li>• corrective actions</li> <li>• Timing, monitoring and responsibility.</li> </ul>				
Liaise with key stakeholders (i.e. DBCA and City of Kalamunda).	To ensure management actions are appropriate and adequate.	During preparation of CAMP.	Environmental consultant/	
<b>Potential management provisions to be included CAMP</b>				
Install and maintain signage on periphery fencing detailing access and presence of TEC in the Conservation Area	Increase awareness that the Conservation Area is a restricted access reserve containing TECs and discourage unauthorised access	Post construction until handover	Developer	Will ensure the long-term protection and management of the Conservation Area and prevent its significant ecological attributes being degraded as a result of unapproved clearing and unmitigated vehicle and pedestrian access.
Monitor the extent and boundaries of occurrences of TEC/s.	To ensure known occurrences of TECs are maintained or improved within Conservation Areas.	Annually (post construction) and for remaining duration of Management Plan implementation until handover	Environmental consultant/ Developer	
If revegetation is being undertaken, confirm boundary of rehabilitation area.	Prior to revegetation, confirm revegetation location is suitable to reduce risk of stock not establishing or causing disruption to currently present ecosystem.	Prior to revegetation commencing	Revegetation contractor	Will ensure the long-term protection, management and rehabilitation (if required) of TECs in the Conservation Areas.
Implement revegetation measures and monitoring schedule to align with completion criteria.	Completion criteria are achieved within desired timeframe.	Throughout program until handover	Revegetation contractor / Construction contractor	



### 5.2.3 Threatened flora

To ensure the total number of conservation-significant flora is maintained or increased within a Conservation Area, the following management and recovery actions (where applicable) should be incorporated into each CAMP and implemented as urban subdivision and development progresses:

- Conduct targeted baseline threatened flora surveys within the Conservation Areas
- Liaise with key stakeholders (i.e. DBCA and City of Kalamunda)
- Continue to monitor the extent and of occurrences of conservation significant flora within the Conservation Areas
- Implement weed and pathogen control measures within the Conservation Area
- Develop and implement bushfire management measures
- Develop pest management measures within the Conservation Areas.

In accordance with the requirements of the Environmental Conditions (Appendix 2), and to guide the preparation and implementation of the CAMP, conservation significant flora management actions are presented in Table 5-3.

**Table 5-3: Conservation significant flora management actions**

Management Action	Target	Timing	Responsibility	Environmental Outcome
<b>Preparation of CAMP</b>				
Conduct targeted baseline threatened flora surveys to record occurrences within the Conservation Area.	To ensure populations of threatened flora are maintained or increased within the Conservation Area.	Prior to preparation of CAMP.	Environmental consultant/ Developer	Will ensure the long-term protection and management of populations of threatened flora in Conservation Areas.
Following baseline threatened flora survey, define appropriate buffers to threatened flora to be established and maintained within the Conservation Area.	To ensure populations of threatened flora are maintained or increased within the Conservation Area.	Prior to subdivision design During preparation of CAMP	Environmental consultant/ Developer	
If required, following baseline assessment, include a rehabilitation program that is tailored to maintain or increase the populations of threatened flora (where practicable) within the Conservation Areas. Rehabilitation program to include: <ul style="list-style-type: none"> <li>• completion criteria for: <ul style="list-style-type: none"> <li>▪ occurrences of threatened flora</li> <li>▪ weeds, diversity and cover</li> </ul> </li> <li>• response actions</li> <li>• Timing, monitoring and responsibility.</li> </ul>	To ensure populations of threatened flora are maintained or increased within the Conservation Area.	Prior to subdivision design During preparation of CAMP	Environmental consultant/ Developer	



Management Action	Target	Timing	Responsibility	Environmental Outcome
Liaise with key stakeholders (i.e. DBCA and City of Kalamunda).	To ensure management actions are appropriate and adequate.	During preparation of CAMP.	Environmental consultant/ Developer	
<b>Potential management provisions to be included CAMP</b>				
Install and maintain signage on periphery fencing detailing access and presence of conservation significant flora in the Conservation Area.	Increase awareness that the Conservation Area is a restricted access reserve containing conservation significant flora and discourage unauthorised access	Post construction until handover	Developer	Will ensure the long-term protection and management of populations of threatened flora and prevent species decline as a result of threatening process such as weed and/or pest invasion, unapproved clearing, unmitigated vehicle and pedestrian access.
If required, establish and maintain buffers to threatened flora within the Conservation Area.	To ensure populations of threatened flora are maintained or increased within the Conservation Area.	Prior to clearing Post construction until handover	Environmental consultant/ Developer	
Monitor the populations of threatened flora.	To ensure populations of threatened flora are maintained or increased within the Conservation Area	Annually (post construction) and for remaining duration of Management Plan implementation until handover	Environmental consultant/ Developer	



## 5.2.4 Waste management

The increased urbanisation of the site is likely to result in increased waste disposal within the Conservation Areas, which can have detrimental impacts on flora and fauna through the introduction of weeds and dieback, contamination of soils and physically endangering native fauna.

To guide the preparation and implementation of the CAMP, conservation significant flora management actions are presented in Table 5-4.

**Table 5-4: Waste management actions**

Management Action	Target	Timing	Responsibility	Environmental Outcome
<b>Preparation of CAMP</b>				
Conduct inspection to identify presence and type of waste located within the Conservation Area.	To prevent the buildup of waste within the Conservation Area.	Prior to preparation of CAMP.	Environmental consultant/ Developer	Will ensure the long-term protection and management of significant environmental values within the Conservation Area.
Liaise with key stakeholders (i.e. DBCA and City of Kalamunda)	To ensure management actions are appropriate and adequate.	During preparation of CAMP.	Environmental consultant/ Developer	
If required, based on the results of the inspection, develop a waste management program.	To ensure the appropriate removal of waste from the Conservation Area.	During preparation of CAMP	Environmental consultant/ Developer	
<b>Potential management provisions to be included CAMP</b>				
Chemical, hydrocarbon and other hazardous waste material must be stored at minimum 50 m from the boundary of the Conservation Area.	To prevent spills impacting native vegetation and fauna habitat within the Conservation Area.	During clearing and construction	Construction contractor	Implementation of waste management measures to ensure significant ecological values within the Conservation Area are protected in the long term by: <ul style="list-style-type: none"> <li>reducing weeds within the Conservation Area</li> <li>preventing any new weeds and pathogens being introduced into the Conservation Area.</li> </ul>
Temporary installation of shade cloth on Conservation Area fencing .	To restrict wind-blown material entering the Conservation Area.	During clearing and construction	Construction contractor	
Portable ablution blocks must be stored at minimum 50 m from the boundary of the Conservation Area.	To prevent spills impacting native vegetation and fauna habitat within the Conservation Area.	During clearing and construction.	Construction contractor	
Undertake a waste removal program within the Conservation Area, following the outcome of baseline inspection and thereafter, following monitoring events.	To prevent the buildup of waste within the Conservation Area.	As required based on the results of monitoring until handover	Developer/ Construction contractor	



### 5.2.5 Weed and pathogen management

To minimise the potential introduction and spread of weeds and pathogens (i.e. dieback) to vegetation within the Conservation Area, appropriate management measures will developed to inform the preparation of the CAMP and implemented as urban subdivision and development progresses.

In accordance with the requirements of the Environmental Conditions (Appendix 2), and to guide the preparation and implementation of the CAMP, weed and pathogen management actions are presented in Table 5-5.

**Table 5-5: Weed and pathogen management actions**

Management Action	Target	Timing	Responsibility	Environmental Outcome
<b>Preparation of CAMP</b>				
Conduct baseline weed and pathogen surveys and mapping within the Conservation Areas.	To minimise the spread of existing weed species and pathogens, and the introduction of new weed species and pathogens in the Conservation Area.	Prior to preparation of CAMP.	Environmental consultant/ Developer	Will ensure the long-term protection and management of significant ecological values in the Conservation Area.
If required, based on the results of the baseline weed and pathogen surveys, develop a weed and pathogen control program. Weed and/or pathogen control program to include: <ul style="list-style-type: none"> <li>• Weed control techniques</li> <li>• Pathogen management and hygiene measures</li> <li>• Completion criteria</li> <li>• Timing, roles and responsibilities.</li> </ul>		During preparation of CAMP	Environmental consultant/ Developer	
Liaise with key stakeholders (i.e. DBCA and City of Kalamunda)	To ensure management actions are appropriate and adequate.	During preparation of CAMP	Environmental consultant/ Developer	
<b>Potential management provisions to be included CAMP</b>				
Prior to entering the Conservation Area, all vehicles and machinery are to be free of mud and soil that may have been brought onto site from outside of the subdivision / development area.	To prevent the introduction of new weed species and pathogens into the Conservation Area.	For the duration of the CAMPs implementation until handover	All personnel	Implementation of weed and dieback measures to ensure significant ecological values within the Conservation Area are protected in the long term by: <ul style="list-style-type: none"> <li>• reducing weeds within the Conservation Area</li> <li>• preventing any new weeds and</li> </ul>
Prior to clearing around the periphery of the Conservation Area, all vehicles and machinery are to be free of mud and soil that may have been brought onto site from outside of the subdivision / development area.	To prevent the introduction of new weed species and pathogens into the Conservation Area.	During clearing adjacent to the Conservation Area	All personnel	



Management Action	Target	Timing	Responsibility	Environmental Outcome
If required, undertake weed pathogen control program and appoint experienced contractor to manage weeds within the Conservation Area.	To ensure weed densities do not increase to a level above the maximum target cover.	Annually (post construction) and for remaining duration of Management Plan implementation until handover	Environmental consultant/ Developer	pathogens being introduced into the Conservation Area.
Topsoil from clearing activities to be retained and appropriately stockpiled within the subdivision / development area.	To prevent the introduction of new weed species and pathogens into the Conservation Area.	During clearing and excavation	Construction contractor/ Revegetation contractor	
Any seedlings used as part of revegetation activities are to be free of soil that may contain dieback or weeds (i.e., plants must be supplied by a NIASA accredited nursery).	To prevent the introduction of new weed species and pathogens into the Conservation Area.	During revegetation	Revegetation contractor	



## 5.2.6 Fauna and pest management

To protect and maintain the significant environmental values within the Conservation Areas, and reduce the impacts of invasive or pest species that threaten endemic fauna survival within the Conservation Areas, the following pest management controls should be incorporated into CAMP and implemented as urban subdivision and development progresses:

- Develop fauna and pest management measures to increase habitat quality and availability within the Conservation Area.
- Develop management measures to enhance black cockatoo habitat within the Conservation Area.
- Reduce access for pest species to Conservation Areas.

To guide the preparation and implementation of the CAMP, fauna and pest management actions are presented in Table 5-6.

**Table 5-6: Fauna and pest management actions**

Management Action	Target	Timing	Responsibility	Environmental Outcome
<b>Preparation of CAMP</b>				
Conduct baseline fauna habitat and black cockatoo habitat assessment within the Conservation Area.	To ensure overall fauna habitat and black cockatoo habitat is maintained or enhanced within the Conservation Area.	Prior to preparation of CAMP.	Environmental consultant/ Developer	To ensure overall fauna habitat and black cockatoo habitat is maintained or enhanced within the Conservation Area.
Following baseline survey, develop management measures to maintain or enhance black cockatoo habitat within the Conservation Area.	Increase available foraging habitat for black cockatoos.	During preparation of CAMP.	Environmental consultant/ Developer	
Following baseline survey, develop fauna and pest management measures to maintain or enhance habitat quality and availability within the Conservation Area.	To mitigate impacts of herbivory on conservation significant flora and revegetation activities.	During preparation of CAMP.	Environmental consultant/ Developer	To reduce the impacts of feral species on endemic fauna survival.
Liaise with key stakeholders (i.e. DBCA and City of Kalamunda)	To ensure management actions are appropriate and adequate.	During preparation of CAMP.	Environmental consultant/ Developer	To ensure overall fauna habitat and black cockatoo habitat is maintained or enhanced within the Conservation Area.
<b>Potential management provisions to be included CAMP</b>				
Undertake pest fauna control / removal (if required).	To mitigate impacts of herbivory on conservation significant flora and revegetation activities. Reduce/remove pest species present within the Conservation Area.	Post construction until handover	Developer	Will ensure the long-term protection and management of conservation significant flora and prevent species decline as a result of threatening process



Management Action	Target	Timing	Responsibility	Environmental Outcome
Translocation of hollow bearing logs into the Conservation Area.	To increase the availability and quality of native fauna habitat. To ensure populations of conservation significant flora are maintained or increased within the Conservation Area	Post construction	Environmental consultant/ Developer	such as weed and/or pest invasion, unapproved clearing, unmitigated vehicle and pedestrian access.
Revegetation and landscaping within the Conservation Area with suitable endemic native species will be undertaken to provide foraging habitat for black cockatoos.	To maintain or increase available foraging habitat for black cockatoos.	During revegetation until handover	Revegetation consultant/ Landscape consultant	
Install educational signage regarding black cockatoo species ecology and habitat within the Conservation Area.	To reduce impacts of increased human activity within the MRS amendment area on black cockatoos.	Post construction	Developer	
Install and maintain conservation fencing to protect vegetation from herbivory and endemic fauna from feral animals.	To reduce the potential harm of feral animals within the Conservation Area to native flora and fauna.	Post construction until handover	Developer	

### 5.2.7 Bushfire management

Urban subdivision and development of the site may increase the risk of fire within the Conservation Areas through:

- The operation of equipment and machinery
- Handling and storage of flammable liquids
- Inappropriate storage of waste materials including cigarette butts
- The presence of vegetation stockpiles which can act as fuel sources

To guide the preparation and implementation of the CAMP, fauna and pest management actions are presented in Table 5-7.

**Table 5-7: Bushfire management actions**

Management Action	Target	Timing	Responsibility	Environmental Outcome
<b>Potential management provisions to be included CAMP</b>				
Store all flammable materials as specified by manufacturer's instruction at minimum 50 m from boundary of the Conservation Area.	To minimise the risk of fire within the Conservation Area.	During clearing and construction	Construction contractor	Ensures maintenance of natural bushfire cycles, promoting species natural regeneration cycles and limiting the destruction of species beyond levels where establishment can occur.
Prohibit vehicle movements within the Conservation Area during increased fire risk or total bans.	To minimise the risk of fire within the Conservation Area.	For the duration of the CAMPs implementation until handover	All personnel	
Vegetation stockpiles to be stored at minimum 50 m from boundary of the Conservation Area.	To minimise the risk of fire within the Conservation Area.	During clearing and construction	All personnel	
Undertake vegetation clearing in line with requirements under the City of Kalamunda Fire Hazard Reduction Notice.	Bushfire risk is not exacerbated with increased housing density requirements.	Ongoing until handover	Construction contractor	Reduces potential risk of bushfire frequency occurring beyond natural cycles.

## 6 Monitoring and assessment

To guide the preparation of the CAMP, the following monitoring actions have been developed for inclusion within the CAMP to ensure assessment of the effectiveness of the management actions.

**Table 6-1: Monitoring actions**

Parameter	Timing / frequency	Location	Purpose	Responsibility
<b>Delineation and access management</b>				
Condition of delineation and access infrastructure (i.e. fencing, gates, access tracks, signage, etc.)	<ul style="list-style-type: none"> <li>Pre clearing site inspection</li> <li>Monthly site inspections (during construction)</li> <li>Quarterly site inspection (post construction) and for remainder of Management Plan implementation until handover</li> </ul>	Perimeter of Conservation Area, where delineation and access infrastructure has been installed.	To ensure that delineation and access infrastructure is in good condition and there has been no unauthorised access into the Conservation Area	Construction contractor
<b>Threatened ecological communities</b>				
Monitor the extent and boundaries of occurrences of TEC/s.	<ul style="list-style-type: none"> <li>Pre clearing site inspection</li> <li>Annual monitoring (post construction) and for remaining duration of Management Plan implementation until handover</li> </ul>	Known occurrences of TEC/s within the Conservation Area.	To ensure known occurrences of TECs are maintained or improved within the Conservation Area.	Environmental consultant/ Developer
If revegetation is required, annual revegetation monitoring to assess: <ul style="list-style-type: none"> <li>Weed species and percentage cover</li> <li>Native species and percentage cover</li> <li>Evidence of threatening processes (such as herbivory)</li> </ul>	<ul style="list-style-type: none"> <li>Annually in Spring following initial planting works until handover</li> </ul>	Throughout revegetation area	To assess the efficacy of revegetation activities.	Environmental consultant/ Developer
<b>Threatened flora</b>				
Monitor the populations of threatened flora.	<ul style="list-style-type: none"> <li>Pre clearing site inspection</li> <li>Annual monitoring (post construction) and for remaining duration of Management Plan implementation until handover</li> </ul>	Known populations of threatened flora within the Conservation Area.	To ensure populations of threatened flora are maintained or increased within the Conservation Area.	Environmental consultant/ Developer
<b>Waste management</b>				
Monitor and assess volume of waste within Conservation Area.	<ul style="list-style-type: none"> <li>Pre clearing site inspection</li> <li>Monthly site inspections (during construction)</li> <li>Annual monitoring (post construction) and for</li> </ul>	Within 30 meters of the perimeter of the Conservation	To minimise volume of waste deposited within the Conservation Area.	Environmental consultant/ Developer



Parameter	Timing / frequency	Location	Purpose	Responsibility
	remaining duration of Management Plan implementation until handover	Area until handover		
<b>Weed and pathogen management</b>				
Monitor and assess pathogen extent (if present) and weed distribution, species and density / cover.	<ul style="list-style-type: none"> <li>Pre clearing site inspection</li> <li>Annual monitoring (post construction) and for remaining duration of Management Plan implementation until handover</li> </ul>	Conservation Area	Ensure effective weed and pathogen control is undertaken and that weed densities do not increase above established % cover.	Environmental consultant/ Developer
<b>Fauna and pest management</b>				
Evidence / presence of pests / feral animals and associated damage to native vegetation / fauna / black cockatoo habitat.	<ul style="list-style-type: none"> <li>Pre clearing site inspection</li> <li>Annual monitoring (post construction) and for remaining duration of Management Plan implementation until handover</li> </ul>	Conservation area	To determine the presence of pests / feral animals within the Conservation Area and whether damage is occurring to native vegetation or fauna as a result.	Environmental consultant/ Developer
Monitor black cockatoo habitat	<ul style="list-style-type: none"> <li>Pre clearing site inspection</li> <li>Annual monitoring (post construction) and for remaining duration of Management Plan implementation until handover</li> </ul>	Black cockatoo habitat within the Conservation Area	To ensure overall fauna habitat and black cockatoo habitat is maintained or enhanced within the Conservation Area.	Environmental consultant/ Developer



## 7 Response actions

The CAMP will develop appropriate trigger criteria and response actions to be initiated if monitoring indicates the management measures are not successful or effective.

To guide the preparation of the CAMP, the following trigger criteria and response actions have been developed for inclusion within the CAMP; however, given each Conservation Area will have different ecological values, vegetation condition, black cockatoo habitat quality scores, weed/pathogen extent, etc, it is anticipated that the CAMP will develop specific trigger criteria and response actions to be initiated for each Conservation Area.

**Table 7-1: Response actions**

Parameter	Trigger criteria	Response Action	Responsibility
Delineation and access	Damage has been reporting to delineation infrastructure, including fencing, gates or signage	<ol style="list-style-type: none"> <li>1. Determine cause of damage</li> <li>2. Prevent recurrence of damage where possible</li> <li>3. Take necessary steps to repair damaged infrastructure</li> </ol>	Construction contractor/ Developer
	Unauthorised vehicle / personnel reported within the Conservation Area	<ol style="list-style-type: none"> <li>1. Determine how access was gained and if possible, the likely time of access</li> <li>2. Implement remedy, which may include repairing damaged infrastructure or the installation of additional signage</li> </ol>	Construction contractor/ Developer
Threatened ecological communities	Annual monitoring indicates current extent of TEC trending towards decline in vegetation condition.	<ol style="list-style-type: none"> <li>1. Determine cause of decline by reviewing degree of infrastructure/development disturbance, site condition, climatic factors and other factors (i.e. fire, storm, insect activity, pests, etc).</li> <li>2. Undertake preventative measures, which may include a pest animal control program, improving access infrastructure, etc.</li> </ol>	Environmental consultant/ Developer
	Clearing of TEC beyond area of the development and within Conservation Area.	<ol style="list-style-type: none"> <li>1. Stop works (temporary)</li> <li>2. Record environmental incident</li> <li>3. Investigate cause</li> <li>4. Update environmental training of personnel (if appropriate)</li> <li>5. Undertake remedial / rehabilitation works within impact area.</li> </ol>	Environmental consultant/ Revegetation contractor
Revegetation	Annual revegetation monitoring indicates that less than established number of native plant species are represented within the revegetation area	<ol style="list-style-type: none"> <li>1. Assess likely reason for lower plant species representation</li> <li>2. Undertake infill planting / seeding with additional species as required.</li> <li>3. Liaise with DBCA/DWER to agree an alternative approach should this be required.</li> </ol>	Environmental consultant/ Revegetation contractor
	Annual revegetation monitoring indicates that native plant species are not achieving established % cover of the revegetation area	<ol style="list-style-type: none"> <li>1. Determine cause of deficient coverage.</li> <li>2. Undertake infill planting / seeding as required</li> <li>3. Liaise with DBCA/DWER to agree an alternative approach should this be required.</li> </ol>	Environmental consultant/ Revegetation contractor
	Annual revegetation monitoring indicates herbivory	<ol style="list-style-type: none"> <li>1. Determine scale and extent of herbivory observed.</li> </ol>	Environmental consultant/



Parameter	Trigger criteria	Response Action	Responsibility
	as the primary cause of plant mortality within the revegetation area	2. Undertake preventative measures, which may include the installation of exclusion fencing, tree guards, or the implementation of a pest animal control program.	Revegetation contractor
Threatened flora	Annual monitoring indicates populations of threatened flora is trending towards decline.	1. Determine cause of decline by reviewing degree of infrastructure/development disturbance, site condition, climatic factors and other factors (i.e. fire, storm, insect activity, pests, etc). 2. Undertake preventative measures, which may include a pest animal control program, improving access infrastructure, etc.	Environmental consultant/ Revegetation contractor
	Clearing of threatened flora beyond area of the development and within the Conservation Area.	1. Stop works (temporary) 2. Record environmental incident 3. Investigate cause 4. Update environmental training of personnel (if appropriate) 5. Undertake remedial / rehabilitation works within impact area.	Environmental consultant/ Revegetation contractor
Weed and pathogen management	Identification of a “Declared Pest” weed species within the Conservation Area (e.g. <i>Zantedeschia aethiopica</i> )	1. Undertake weed control as required, with the objective of eradicating all identified Declared Pests from the Conservation Area.	Environmental consultant/ Revegetation contractor
	Monitoring indicates that weed densities are over established % cover	1. Develop a weed control program and appoint an experienced contractor to manage weeds within the Conservation Area, with the objective of reducing weed cover to below established % cover.	Environmental consultant/ Revegetation contractor
	Vehicles which have not been inspected for mud and soil access in the Conservation Area.	1. The vehicle must be stopped and inspected for mud and soil. If the vehicle is deemed to be clean it can continue to be used within the Conservation Area. 2. If a build-up of mud and soil is identified, then the vehicle must be removed offsite for cleaning.	Environmental consultant/ Revegetation contractor
Fauna and pests	Evidence of damage by animals (i.e. herbivory) to established % cover of monitoring sites	1. Investigate cause 2. Undertake intervention or remediation works if required (move bins, fencing, trapping, baiting or hive removal). 3. Monitor success of works.	Environmental consultant/ Developer
	Evidence of feral predators observed within or surrounding the Conservation Area .		
Bushfire	Fire incident within the Conservation Area.	1. Investigate cause 2. Consult with local fire authorities in relation to improvements in fire mitigation measures 3. Amend and update figure mitigation measures following consultation 4. Communicate outcomes to all contractors	Construction contractor/ Environmental consultant/ Developer



## 8 Reporting

A report summarising the results of all monitoring will be prepared annually, for provision to the Project Manager. This monitoring report is also to be submitted to the City of Kalamunda, DBCA, DWER or EPA upon request. The report may be used as evidence of legal compliance or non-compliance and must be correct and auditable. The annual monitoring report will include at minimum:

- Methodology employed during monitoring
- Monitoring results
- Assessment of revegetation against completion criteria
- Details of any response actions implemented
- Recommendations for changes to the CAMP if required.



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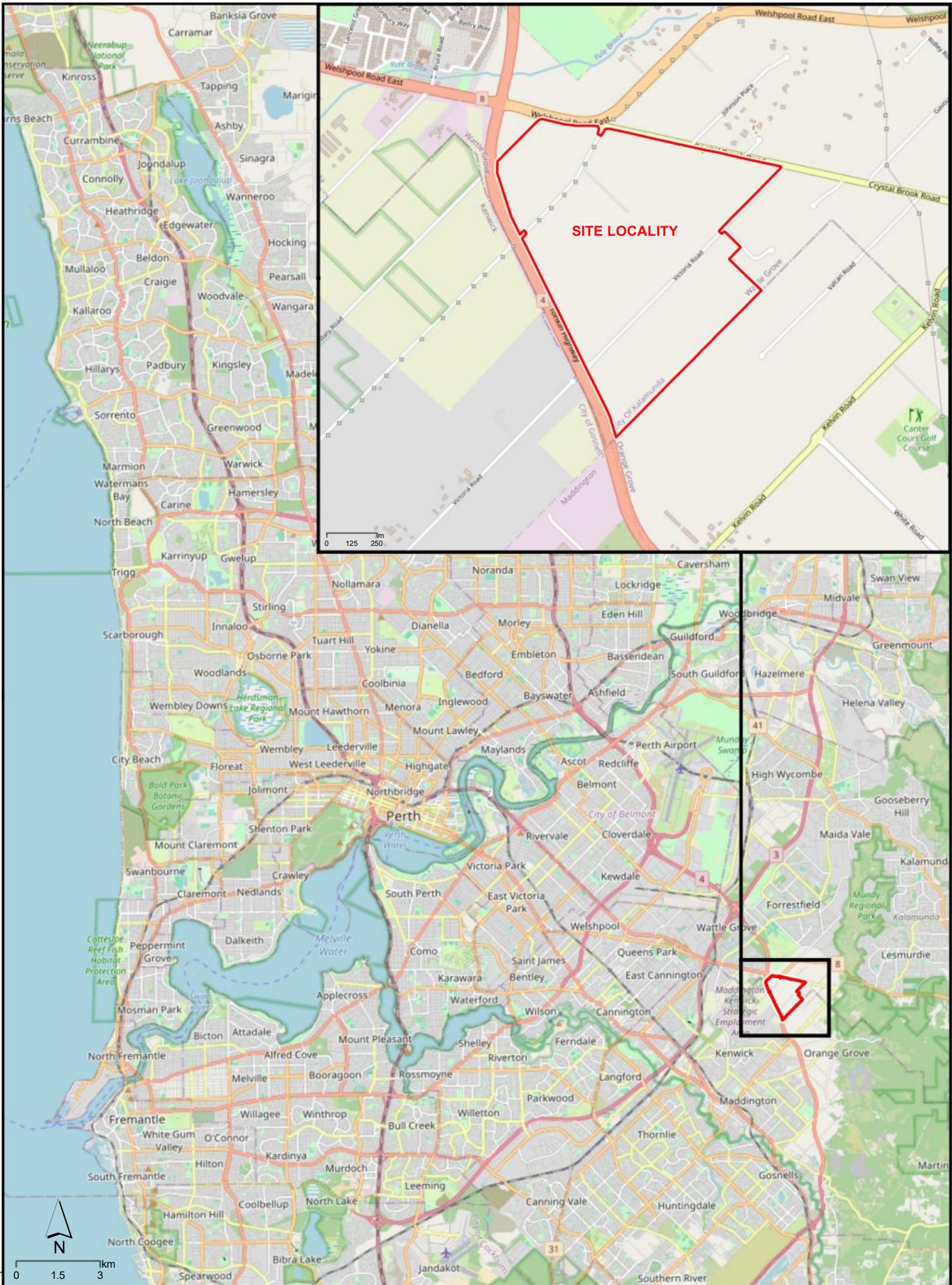
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## Figures

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**LEGEND**

- Local Structure Plan Area
- Cadastre

N

0 25 50 100 150 200 m

Scale: 1:6,000 @ A3  
GDA2020 MGA Zone 50

ENVIRONMAPS | T: 0406 590 006  
Environmental Mapping Solutions | www.environmaps.com.au

Source: Cadastre - Landgate  
Orthophoto - NearMaps, 17.03.25

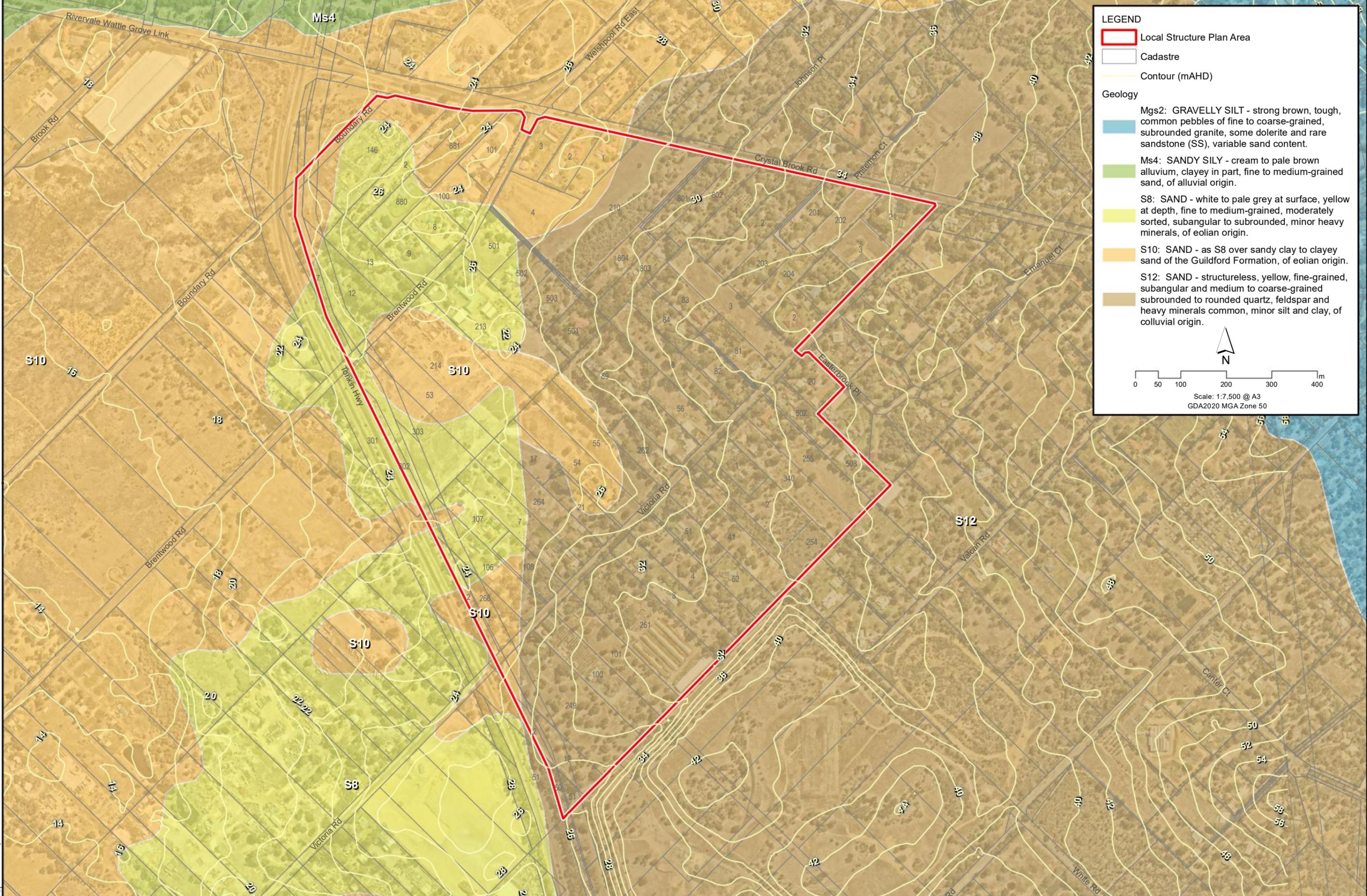
**COTERRA**  
ENVIRONMENT

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Hesperia  
ENVIRONMENTAL ASSESSMENT REPORT  
WATTLE GROVE SOUTH LOCAL STRUCTURE PLAN

**AERIAL PHOTOGRAPH**

**Figure 2**



**LEGEND**

- Local Structure Plan Area
- Cadastre
- Contour (mAHD)

**Geology**

- Mgs2: GRAVELLY SILT - strong brown, tough, common pebbles of fine to coarse-grained, subrounded granite, some dolerite and rare sandstone (SS), variable sand content.
- Ms4: SANDY SILY - cream to pale brown alluvium, clayey in part, fine to medium-grained sand, of alluvial origin.
- S8: SAND - white to pale grey at surface, yellow at depth, fine to medium-grained, moderately sorted, subangular to subrounded, minor heavy minerals, of eolian origin.
- S10: SAND - as S8 over sandy clay to clayey sand of the Guildford Formation, of eolian origin.
- S12: SAND - structureless, yellow, fine-grained, subangular and medium to coarse-grained subrounded to rounded quartz, feldspar and heavy minerals common, minor silt and clay, of colluvial origin.



Scale: 1:7,500 @ A3  
GDA2020 MGA Zone 50

ENVIRONMAPS | 0406 590 006  
Environmental Mapping Solutions | www.environmaps.com.au

Source: Cadastre - Landgate  
Orthophoto - NearMaps, 17.03.25  
Geology and Topography - DPIRD

	Job: HESWAT02 Doc: 003 Date: 27/06/2025 Ph: (08) 9381 5513 Fax: (08) 9381 5514 E: info@coterra.com.au	Hesperia ENVIRONMENTAL ASSESSMENT REPORT WATTLE GROVE SOUTH LOCAL STRUCTURE PLAN <hr/> <b>TOPOGRAPHY AND SOILS</b>	Figure 3
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**LEGEND**

- Local Structure Plan Area
- Cadastre
- Major Tributary

**Wetland Mapping**

- Conservation
- Resource Enhancement
- Multiple Use

N

0 50 100 200 300 400 m

Scale: 1:7,500 @ A3  
GDA2020 MGA Zone 50

ENVIRONMAPS | t: 0406 590 006  
Environmental Mapping Solutions | www.environmentmaps.com.au

Source: Cadastre - Landgate  
Orthophoto - NearMaps, 17.03.25  
Wetlands - DBCA | Hydrography - DWER

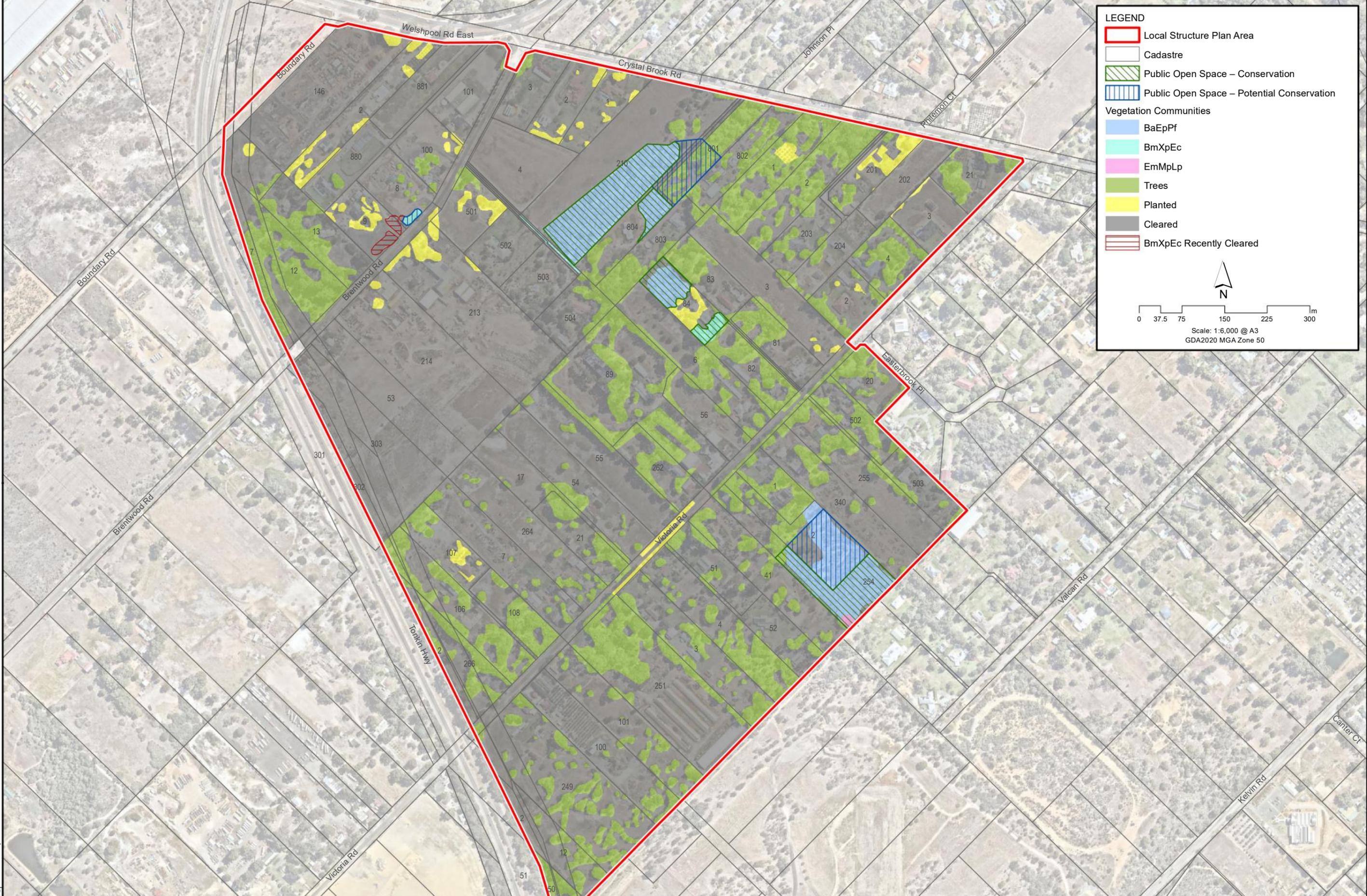
**COTERRA**  
ENVIRONMENT

Job: HESWAT02  
Doc: 004  
Date: 27/06/2025  
Ph: (08) 9381 5513  
Fax: (08) 9381 5514  
E: info@coterra.com.au

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WATTLE GROVE SOUTH LOCAL STRUCTURE PLAN

**WETLAND MAPPING**

**Figure 4**



**LEGEND**

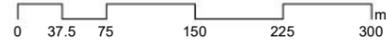
- Local Structure Plan Area
- Cadastre
- Public Open Space – Conservation
- Public Open Space – Potential Conservation

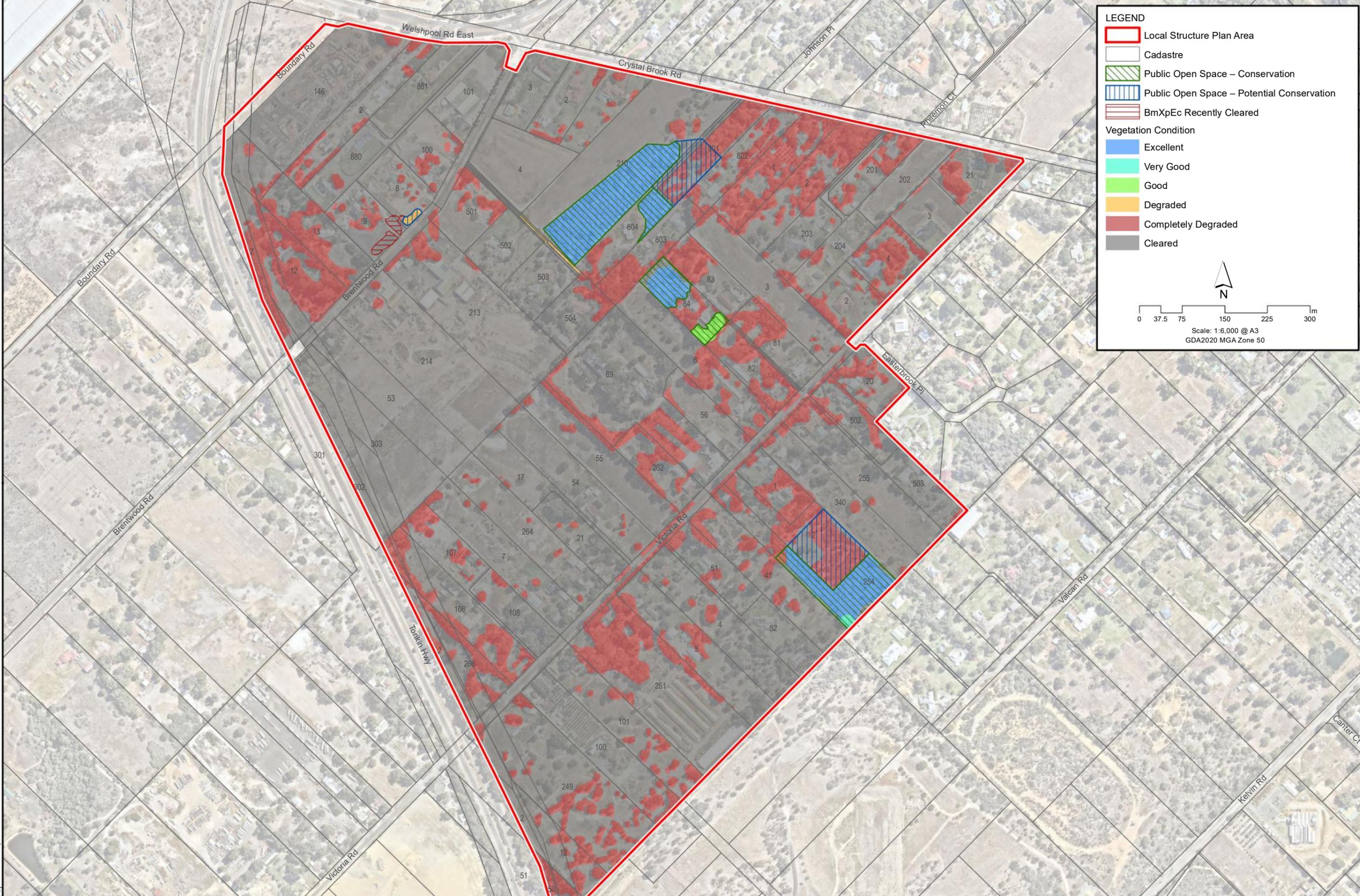
**Vegetation Communities**

- BaEpPf
- BmXpEc
- EmMpLp
- Trees
- Planted
- Cleared
- BmXpEc Recently Cleared



Scale: 1:6,000 @ A3  
GDA2020 MGA Zone 50





**LEGEND**

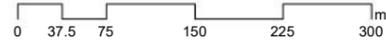
- Local Structure Plan Area
- Cadastre
- Public Open Space – Conservation
- Public Open Space – Potential Conservation
- BmXpEc Recently Cleared

**Vegetation Condition**

- Excellent
- Very Good
- Good
- Degraded
- Completely Degraded
- Cleared

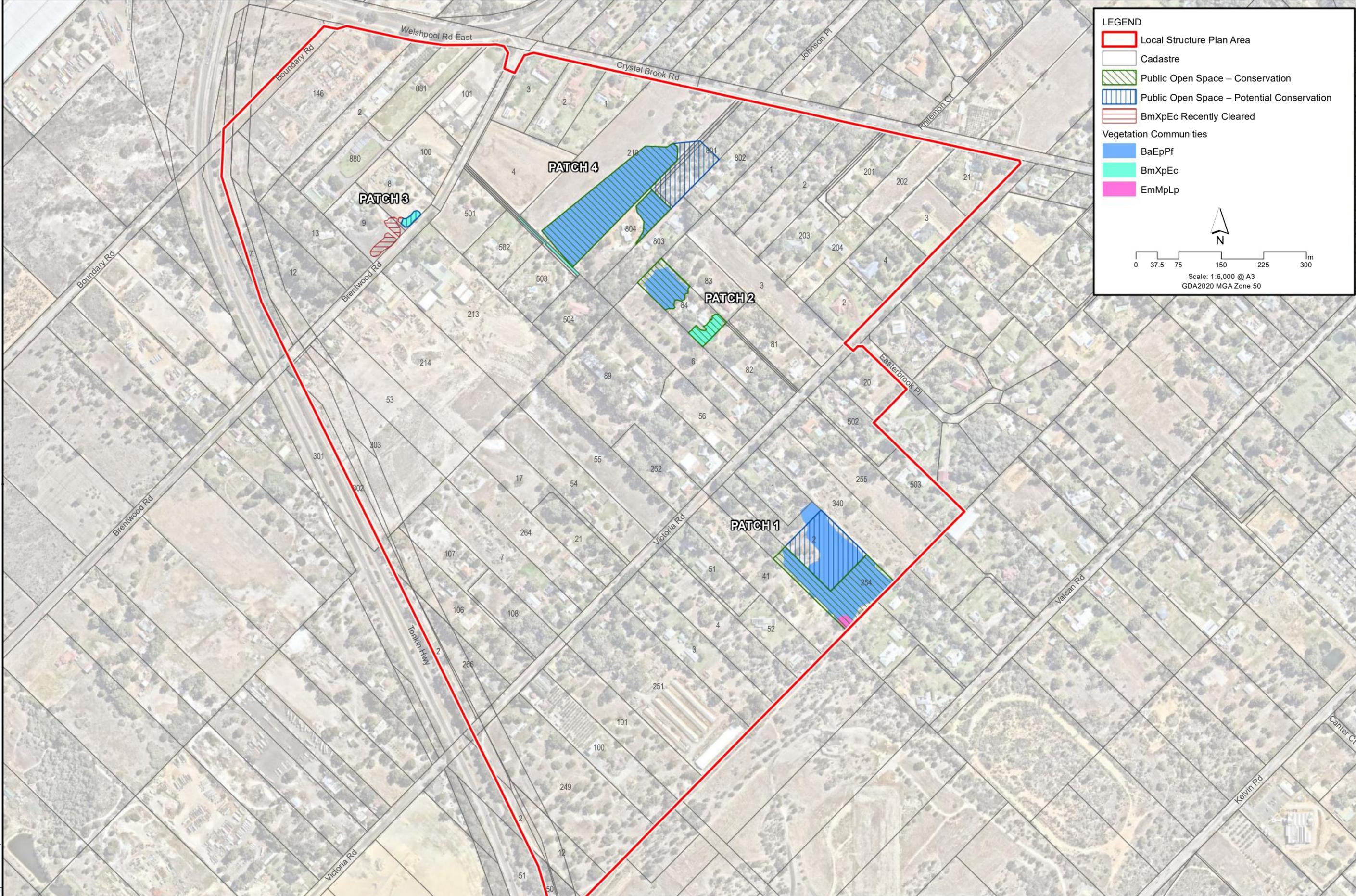


N



0 37.5 75 150 225 300 m

Scale: 1:6,000 @ A3  
GDA2020 MGA Zone 50



**LEGEND**

- Local Structure Plan Area
- Cadastre
- Public Open Space – Conservation
- Public Open Space – Potential Conservation
- BmXpEc Recently Cleared

**Vegetation Communities**

- BaEpPf
- BmXpEc
- EmMpLp

N

0 37.5 75 150 225 300 m

Scale: 1:6,000 @ A3  
GDA2020 MGA Zone 50

ENVIRONMAPS | t: 0406 590 006  
Environmental Mapping Solutions | www.environmaps.com.au

Source: Cadastre - Landgate  
Orthophoto - NearMaps, 17.03.25

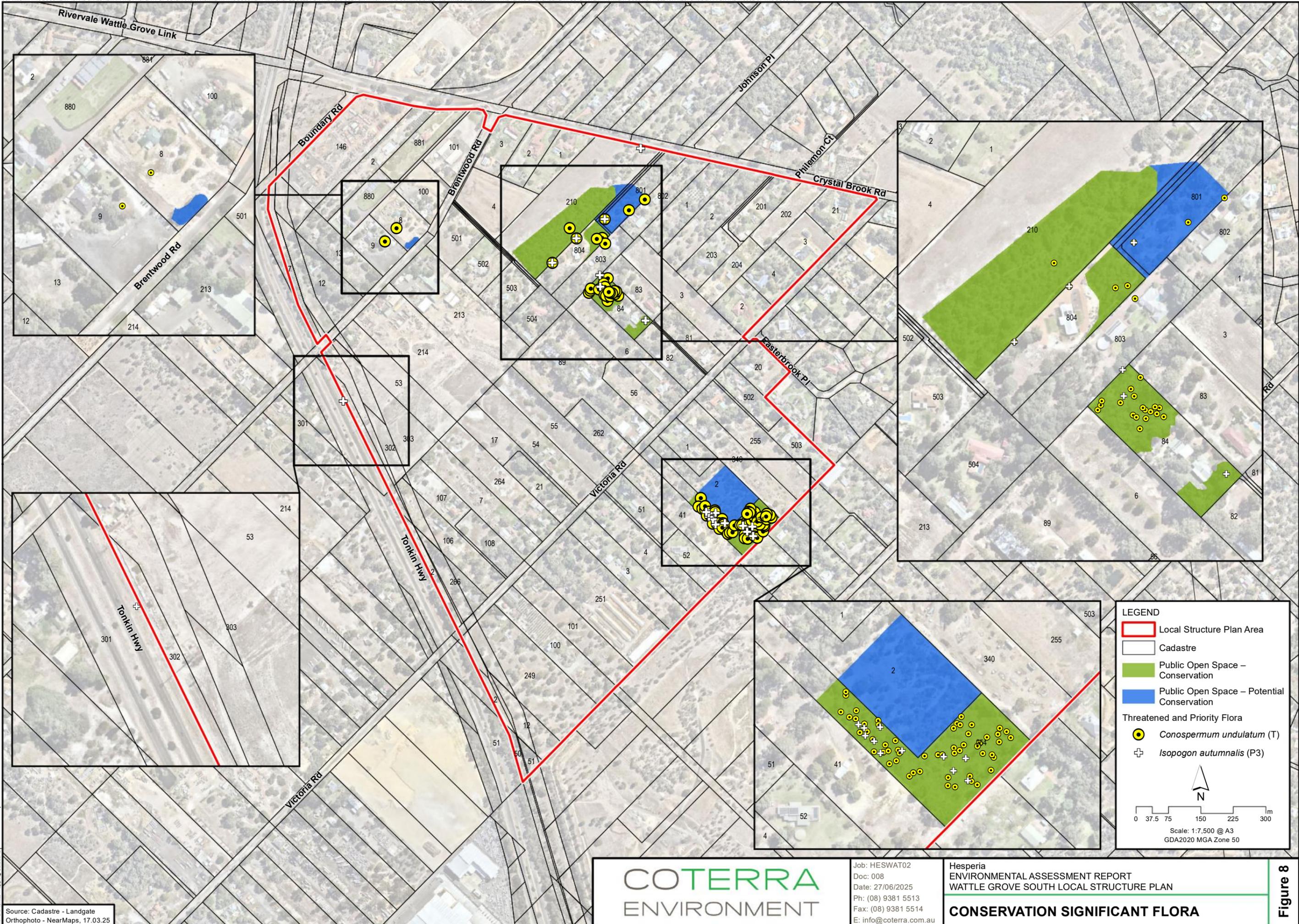
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**CONSERVATION SIGNIFICANT VEGETATION**

**Figure 7**



ENVIRONMAPS | t: 0406 590 006  
 Environmental Mapping Solutions | www.environmaps.com.au

Source: Cadastre - Landgate  
 Orthophoto - NearMaps, 17.03.25

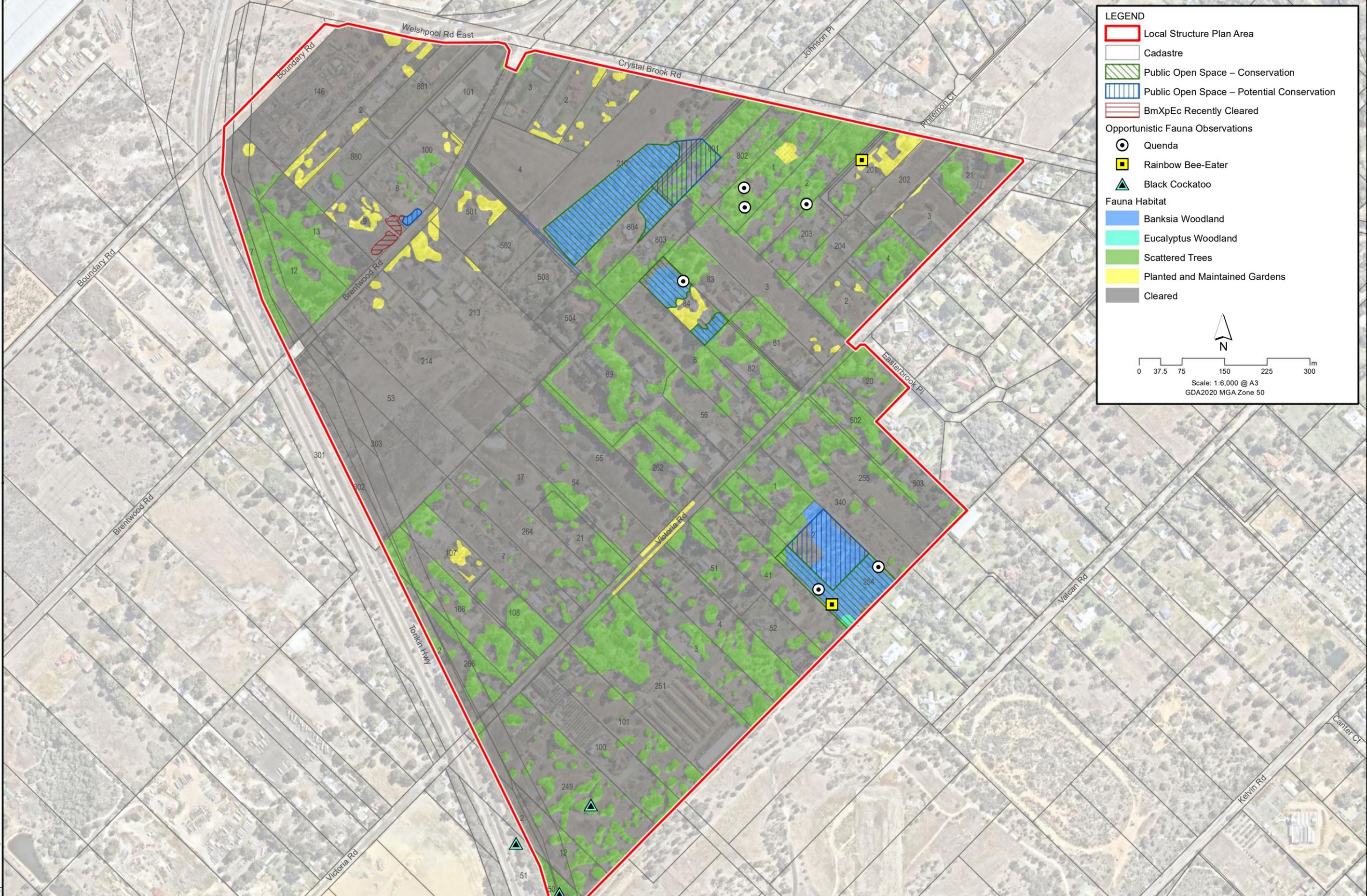
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**CONSERVATION SIGNIFICANT FLORA**

**Figure 8**



**LEGEND**

- Local Structure Plan Area
- Cadastre
- Public Open Space – Conservation
- Public Open Space – Potential Conservation
- BmXpEc Recently Cleared

**Opportunistic Fauna Observations**

- Quenda
- Rainbow Bee-Eater
- ▲ Black Cockatoo

**Fauna Habitat**

- Banksia Woodland
- Eucalyptus Woodland
- Scattered Trees
- Planted and Maintained Gardens
- Cleared

N  
 0 37.5 75 150 225 300 m  
 Scale: 1:6,000 @ A3  
 GDA2020 MGA Zone 50

ENVIRONMAPS | t: 0406 590 006  
Environmental Mapping Solutions | www.environmaps.com.au

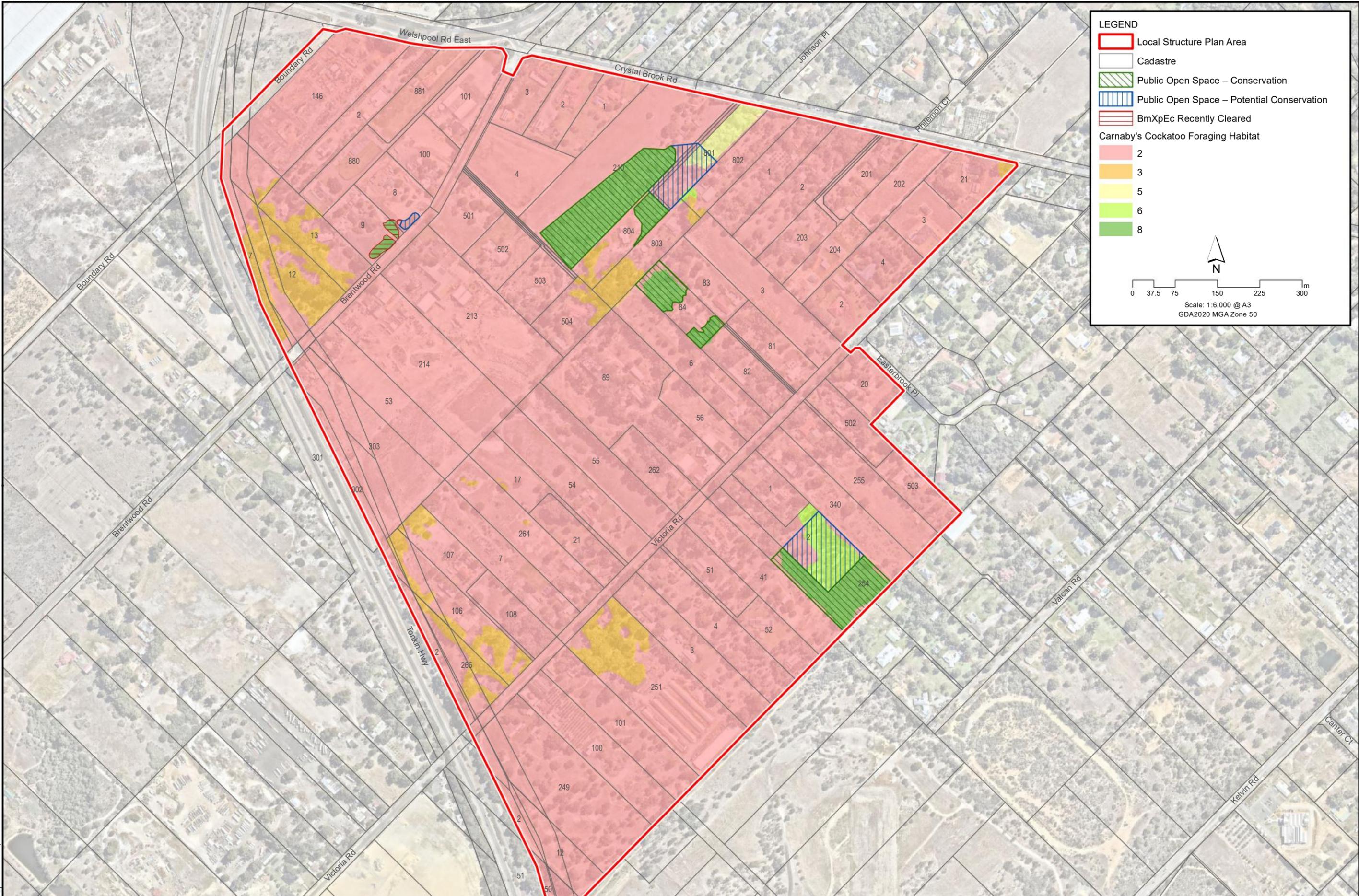
Source: Cadastre - Landgate  
Orthophoto - NearMaps, 17.03.25

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**FAUNA HABITAT**

**Figure 9**



**LEGEND**

- Local Structure Plan Area
- Cadastre
- Public Open Space – Conservation
- Public Open Space – Potential Conservation
- BmXpEc Recently Cleared

**Carnaby's Cockatoo Foraging Habitat**

- 2
- 3
- 5
- 6
- 8

N

Scale: 1:6,000 @ A3  
GDA2020 MGA Zone 50

ENVIRONMAPS | t: 0406 590 006  
Environmental Mapping Solutions | www.environmaps.com.au

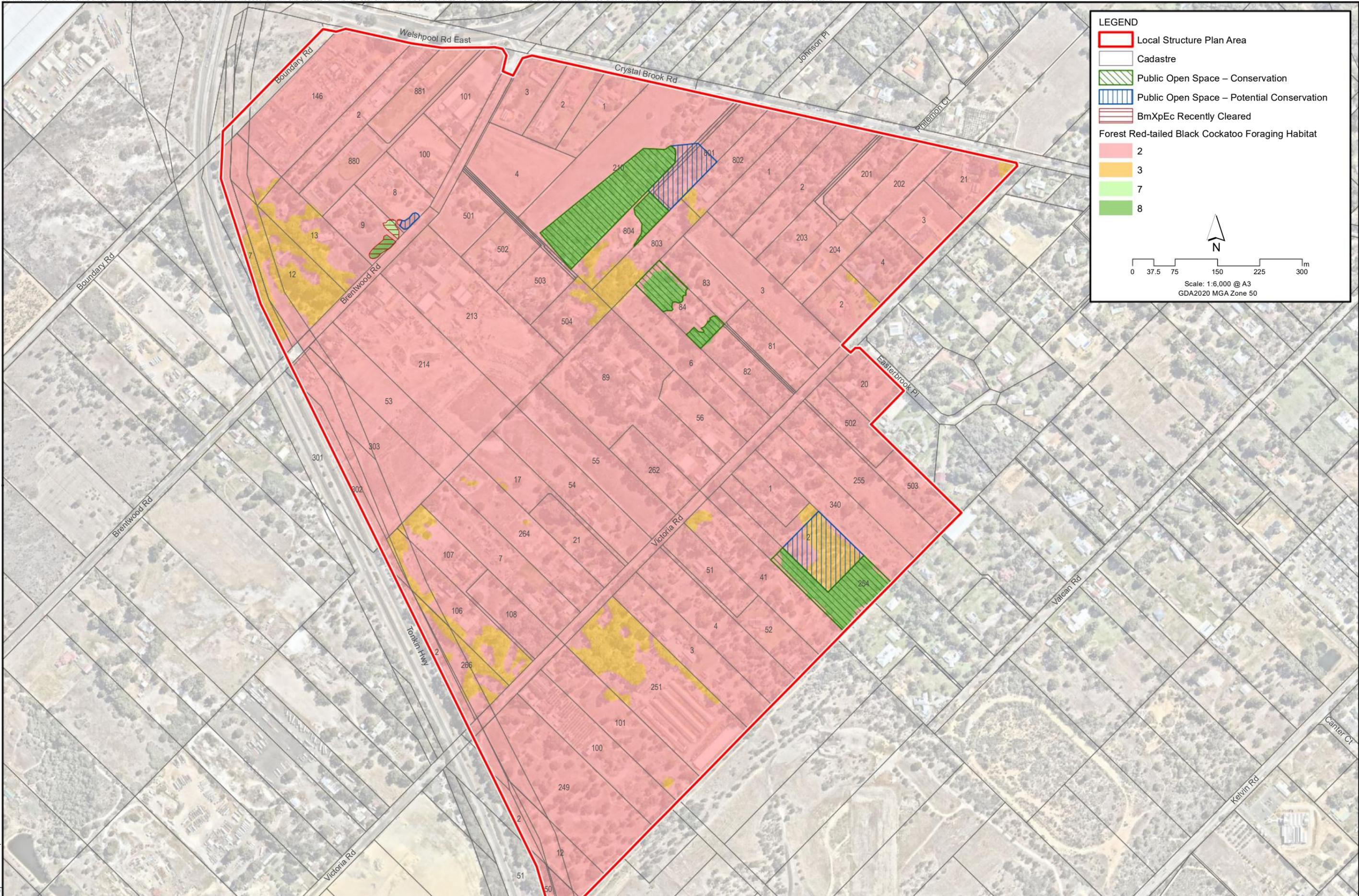
Source: Cadastre - Landgate  
Orthophoto - NearMaps, 17.03.25

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**CARNABY'S COCKATOO FORAGING HABITAT**

**Figure 10**



**LEGEND**

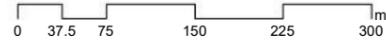
- Local Structure Plan Area
- Cadastre
- Public Open Space – Conservation
- Public Open Space – Potential Conservation
- BmXpEc Recently Cleared

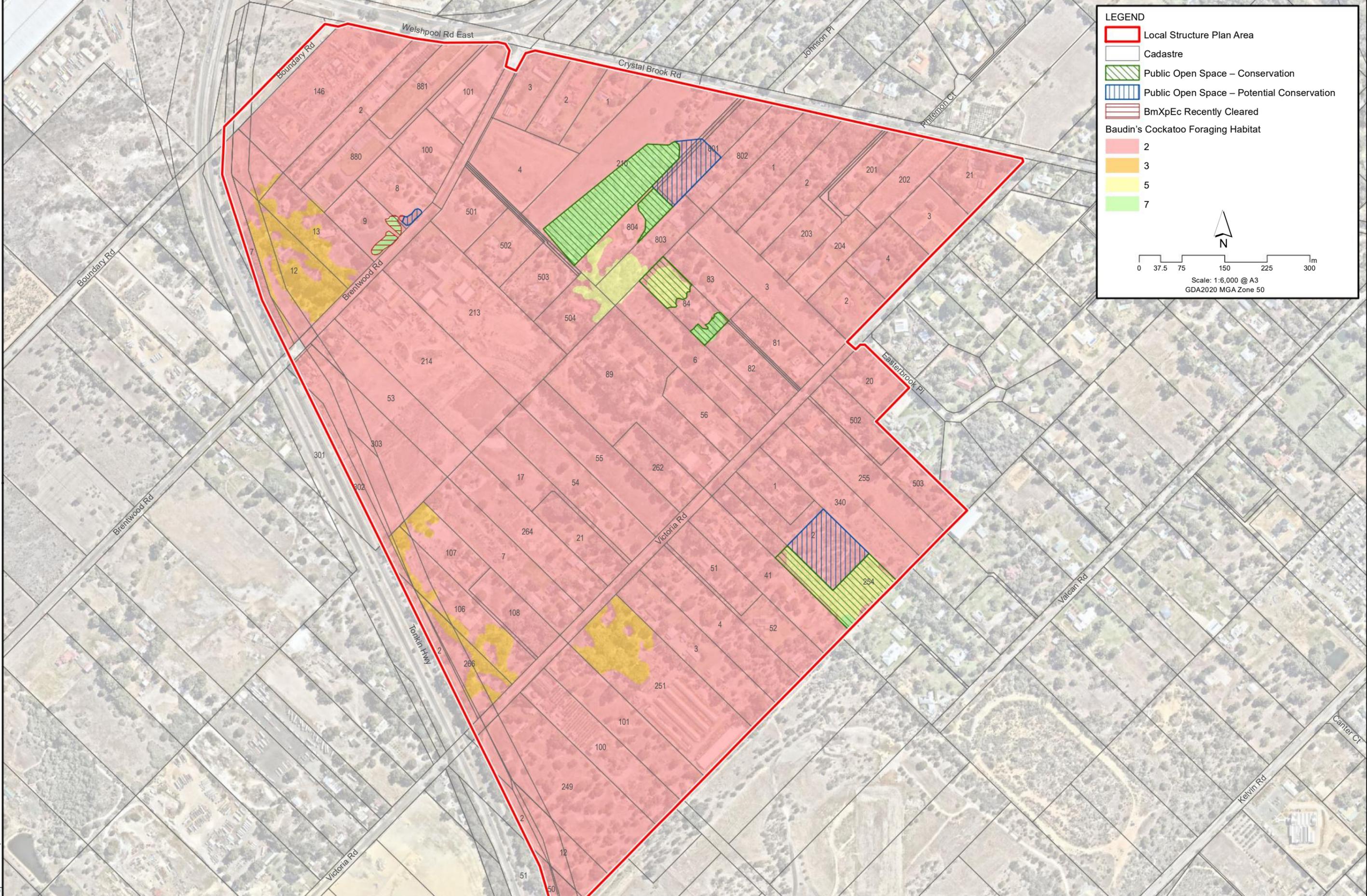
**Forest Red-tailed Black Cockatoo Foraging Habitat**

- 2
- 3
- 7
- 8



Scale: 1:6,000 @ A3  
GDA2020 MGA Zone 50





**LEGEND**

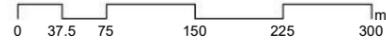
- Local Structure Plan Area
- Cadastre
- Public Open Space – Conservation
- Public Open Space – Potential Conservation
- BmXpEc Recently Cleared

**Baudin's Cockatoo Foraging Habitat**

- 2
- 3
- 5
- 7

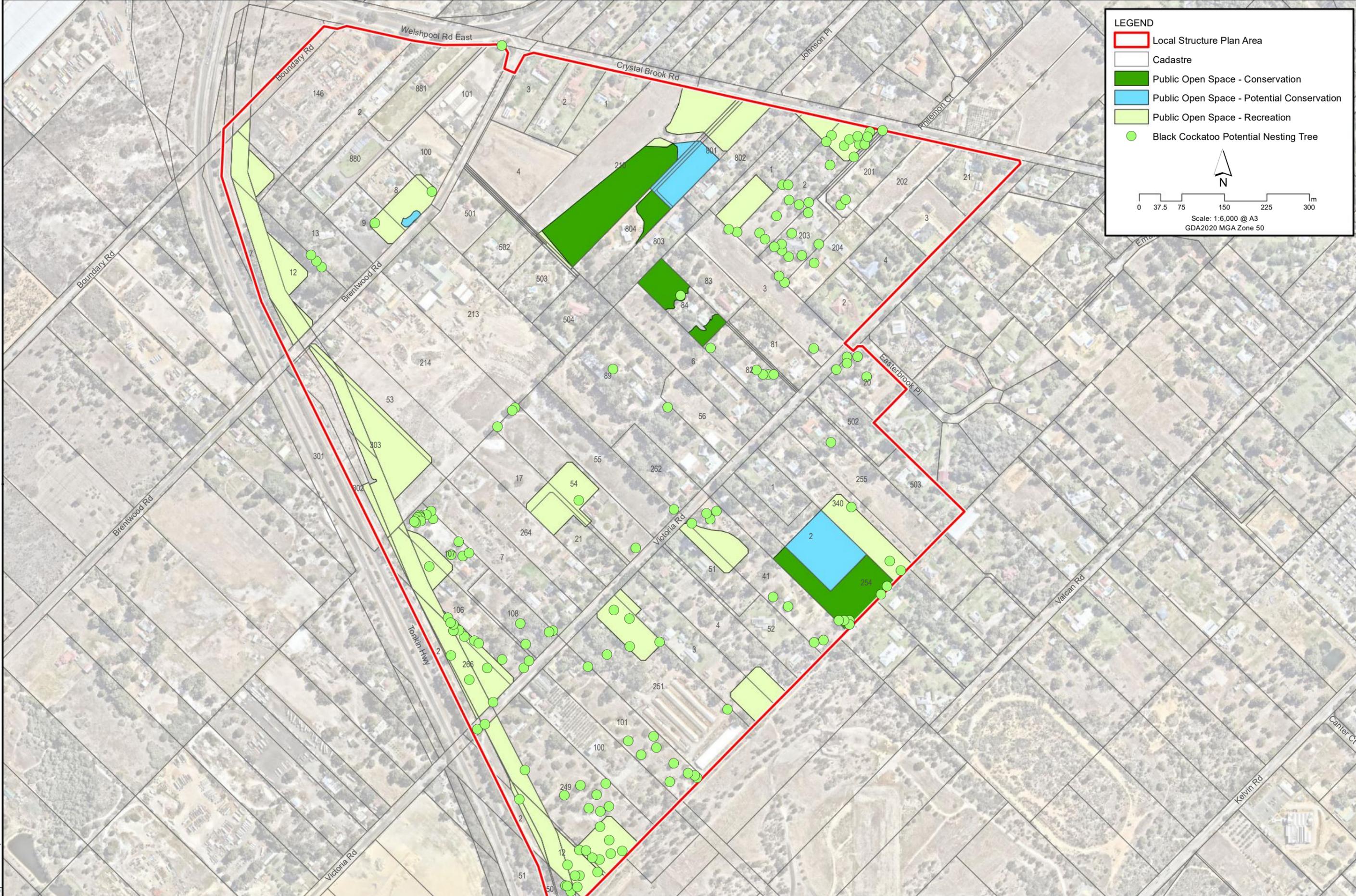


N



0 37.5 75 150 225 300 m

Scale: 1:6,000 @ A3  
GDA2020 MGA Zone 50



**LEGEND**

- Local Structure Plan Area
- Cadastre
- Public Open Space - Conservation
- Public Open Space - Potential Conservation
- Public Open Space - Recreation
- Black Cockatoo Potential Nesting Tree



Scale: 1:6,000 @ A3  
GDA2020 MGA Zone 50

ENVIRONMAPS | t: 0406 590 006  
Environmental Mapping Solutions | www.environmaps.com.au

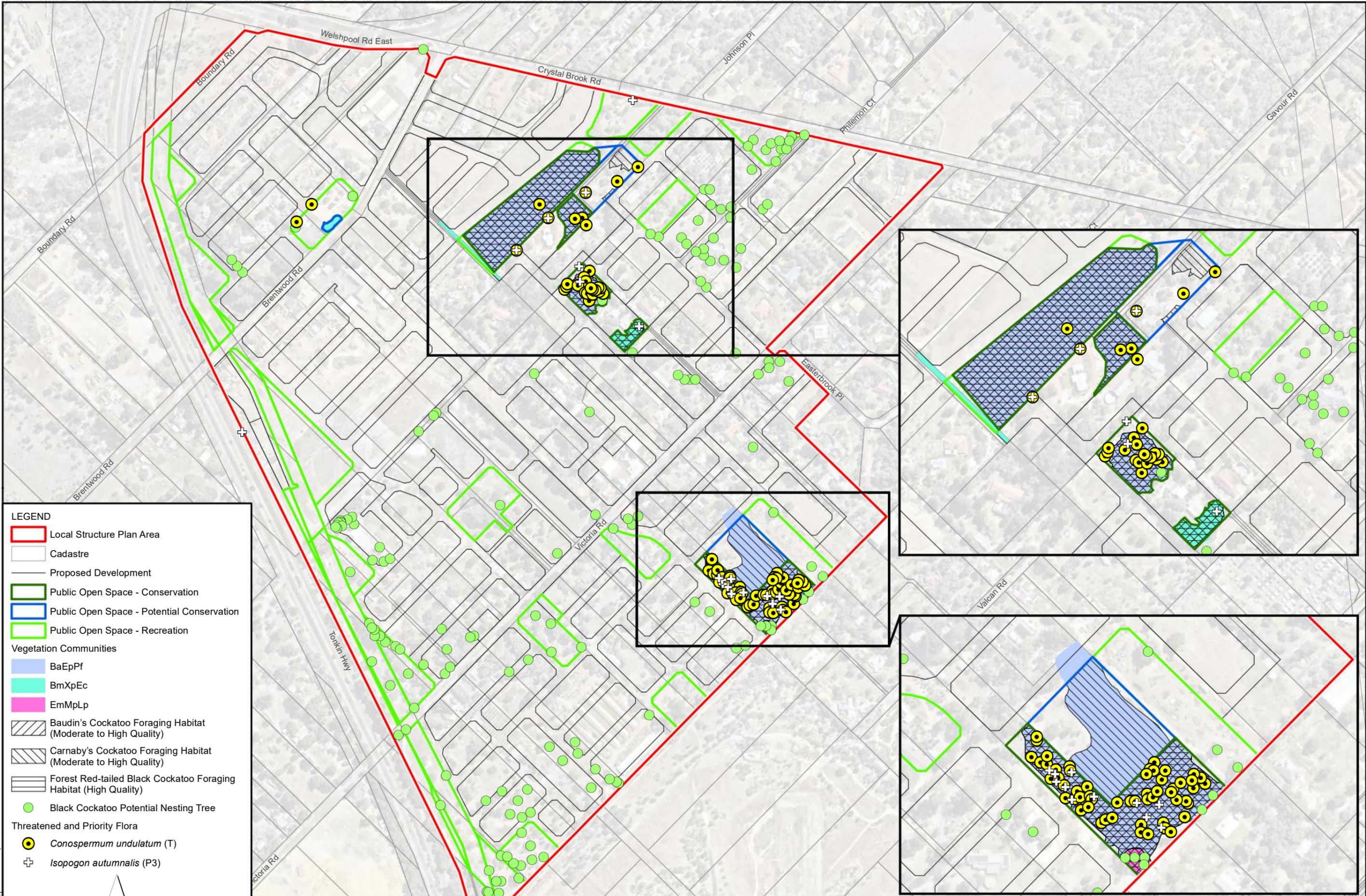
Source: Cadastre - Landgate  
Orthophoto - NearMaps, 17.03.25

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**BLACK COCKATOO  
POTENTIAL NESTING TREES**

**Figure 13**



**LEGEND**

- Local Structure Plan Area
- Cadastre
- Proposed Development
- Public Open Space - Conservation
- Public Open Space - Potential Conservation
- Public Open Space - Recreation

**Vegetation Communities**

- BaEpPf
- BmXpEc
- EmMplp

**Foraging Habitats**

- Baudin's Cockatoo Foraging Habitat (Moderate to High Quality)
- Carnaby's Cockatoo Foraging Habitat (Moderate to High Quality)
- Forest Red-tailed Black Cockatoo Foraging Habitat (High Quality)

**Threatened and Priority Flora**

- Black Cockatoo Potential Nesting Tree
- *Conospermum undulatum* (T)
- + *Isopogon autumnalis* (P3)

N

Scale: 1:6,000 @ A3  
GDA2020 MGA Zone 50

Source: Cadastre - Landgate | Orthophoto - NearMaps, 17.03.25

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**KEY ENVIRONMENTAL FEATURES**

**Figure 14**



## **Appendix 1      Local Structure Plan**

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- Legend**
- Local Structure Plan & MRS Amendment Boundary
  - Precinct Boundaries
  - High Pressure Gas Pipeline Easement
  - Water Corporation Land
  - Resource Enhancement Wetland  
(DBCA advice to WAPC 26 August 2021 indicates values commensurate with Multiple Use Wetland, UFI 6037 and portion of UFI 15257) subject to reclassification with DBCA)
  - Residential R20 - R40
  - Residential R80
  - Light Industry
  - Public Purpose - Primary School
  - Public Open Space - Conservation  
(As per EPA Assessment Report 1788)
  - Public Open Space - Potential Conservation  
(As per EPA Assessment Report 1788 - See Note 1)
  - Public Open Space - Recreation
  - Existing Road
  - Neighbourhood Connector A (22m)
  - Neighbourhood Connector B (20m)
  - Access Road (18m)
  - Access Road (15m)
  - Access Road (12m)
  - Lane (6m)
  - Potential Neighbourhood Activity Centre
  - Intersection: Full Movement
  - Intersection: Left In/Left Out

- Notes**
- 1 Conservation and Potential Conservation areas to be investigated further and determined by proponents as part of Local Structure Plan Amendments.
  - 2 Landowners are not forced to redevelop their land. It is their individual choice whether they wish to proceed to develop or remain as-is.
  - 3 The location of Public Open Space can potentially be modified by a proponent as part of their final design solution, subject to justification being provided through a Structure Plan amendment and/or subdivision application.
  - 4 Upgrades to Welshpool Road intersection will be required in the future in accordance with the Transport Impact Assessment (PTG 2025) - proposed roundabout, subject to detailed design with City of Kalamunda and Main Roads WA.
  - 5 Opportunity for Neighbourhood Activity Centre in Precinct A - subject to further investigations undertaken by Precinct A landowners.





## Appendix 2 Environmental Conditions

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# Appendix A: Recommended conditions

## STATEMENT THAT A SCHEME MAY BE IMPLEMENTED (*Environmental Protection Act 1986*)

### METROPOLITAN REGION SCHEME AMENDMENT 1388/57 – WATTLE GROVE (SOUTH) URBAN PRECINCT

**Scheme Purpose:** The Metropolitan Region Scheme (MRS) Amendment proposed to rezone land in Wattle Grove South from the 'Rural' zone to the 'Urban' zone. The proposed 'Urban' zone will facilitate future residential development, areas of public open space and retention areas (conservation of environmental values) following a Local Planning Scheme (LPS) amendment, structure planning and subdivision and development approval.

**Responsible Authority:** Western Australian Planning Commission (WAPC)  
Australian Company Number (ACN) 35 482 341 493

**Responsible Authority address:** Gordon Stephenson House, 140 William St, Perth WA 6000

**Assessment number:** 2335

**Report of the Environmental Protection Authority:** 1788

**Introduction:** Subject to the following conditions being incorporated into the Metropolitan Region Scheme (MRS), the Amendment to which the above Report 1788 of the Environmental Protection Authority (EPA) relates may be implemented.

## ENVIRONMENTAL CONDITIONS FOR MRS AMENDMENT 1388/57

### Environmental outcomes

1. Within the **Amendment Area**, it is an objective of this scheme that **subdivision and development** is consistent with the achievement of the environmental outcomes in condition 3.
2. The **Responsible Authority** must act consistently with:
  - (1) the requirements of **Ministerial Statement XXX**; and
  - (2) the achievement of the environmental outcomes in condition 3;when exercising powers under this scheme or when determining an application to **subdivide** land in the **Amendment Area**.
3. The environmental outcomes are:
  - (1) Avoid disturbance to the following environmental values within **retention areas** (Figure 1), except when undertaking **low impact activities**:
    - (a) Banksia attenuata woodlands over species rich dense shrublands (**FCT 20a**);
    - (b) Shrublands and Woodlands of the Eastern Swan Coastal Plain (**FCT 20c**);
    - (c) **Viable populations** of *Conospermum undulatum*;
    - (d) **Viable populations** of *Isopogon autumnalis*;
    - (e) **medium to high quality foraging habitat** for carnaby's cockatoo (*Zanda latirostris*) and baudin's cockatoo (*Zanda baudinii*); and
    - (f) **potential nesting trees**.
  - (2) Avoid disturbance to black cockatoo **known nesting trees** and **roosting sites** within the **Amendment Area**.
  - (3) Retain trees or, where retention is not practicable, replace trees in the **Amendment Area** to:
    - (a) achieve a generally even distribution of trees across parts of the **Amendment Area** that are not within **retention areas**; and
    - (b) to create connectivity between **retention areas** and retained black cockatoo habitat.
  - (4) Avoid or where not practicable, minimise adverse impacts to the **Greater Brixton Street Wetlands** from urban development of the **Amendment Area**, including impacts to the wetlands' persistency, hydrological regime, water quality, ecological integrity and ecological function.

### Conservation Area Management Plans

4. The Responsible Authority must not approve any subdivision (other than minor subdivision) or development for land that includes all or part of a retention area unless it is satisfied, after consulting with DWER, DBCA and the local government, that:

- (1) a Conservation Area Management Plan has been prepared for the **retention area**; and
- (2) the Conservation Area Management Plan is consistent with the achievement of the environmental outcomes in condition 3 and:
  - (a) provides for the installation and maintenance of appropriate fencing around the periphery of the **retention area**;
  - (b) provides for the monitoring of occurrences of **Threatened Ecological Community (TECs)** and populations of **threatened** flora; and
  - (c) identifies actions that will be implemented to ensure that:
    - (i) occurrences of **TECs** that are in 'degraded' condition are restored to achieve a condition rating of 'good' or better, in accordance with **Keighery 1994**;
    - (ii) populations of **threatened** flora are maintained or increased;
    - (iii) buffers to **threatened** flora are established and maintained;
    - (iv) the spread of existing weed species and pathogens, and the introduction of new weed species and pathogens, is minimised;
  - (d) provides that the only **development** to occur within the **retention area** is to be **development** for the purposes of conservation or incidental purposes; and
- (3) satisfactory arrangements have or will be made for the implementation of the Conservation Area Management Plan.

### **Black cockatoos**

5. The **Responsible Authority** must not approve any **subdivision** (other than **minor subdivision**) or **development** for any land in the **Amendment Area** that is **unsurveyed land** unless it is satisfied that a **black cockatoo** survey that meets the requirements of **DWER** has been carried out for that **unsurveyed land**.
6. The **Responsible Authority** must not approve any **subdivision** or **development** for any land in the **Amendment Area**, if the subdivision or development is likely to impact a **potential nesting tree** unless it is satisfied, after consulting with **DWER**, that:
  - (1) an assessment has been carried out to determine the number of **potential nesting trees** likely to be impacted;
  - (2) the number of **potential nesting trees** likely to be impacted has been quantified; and
  - (3) at least twice the number of **potential nesting trees** likely to be impacted will be replaced by planting within the **Amendment Area**.

### **Tree canopy**

7. The **Responsible Authority** must not approve any **subdivision** (other than **minor subdivision**) or **development** for any land in the **Amendment Area** unless it is satisfied that:

- (1) a Tree Canopy Retention and Landscape Management Plan for the land has been prepared, having regard to any urban forest strategy adopted by the City of Kalamunda; and
  - (2) the Tree Canopy Retention and Landscape Management Plan is consistent with the achievement of the environmental outcomes in condition 3 and:
    - (a) identifies the location, species, size and structural health of any trees to be retained;
    - (b) identifies the location, species, number, planting size, mature height and spread of trees to be planted;
    - (c) identifies the planting schedule for the trees to be planted; and
    - (d) estimates the percentage of canopy coverage expected to be achieved through implementation of the plan; and
  - (3) satisfactory arrangements have or will be made for the implementation of the Tree Canopy Retention and Landscape Management Plan,
- unless the **Responsible Authority** considers that a plan, or a plan that meets all the requirements in condition 7(2), is not required.

### Water management

8. The **Responsible Authority** must not approve any **subdivision** (other than **minor subdivision**) or **development** unless it is satisfied, after consulting with **DWER** and the local government, that:
  - (1) an **Urban Water Management Plan (UWMP)** has been prepared; and
  - (2) the **UWMP** is:
    - (a) consistent with the achievement of the environmental outcome in condition 3(4); and
    - (b) is informed by the **results of any pre development monitoring program**; and
  - (3) satisfactory arrangements have or will be made for the implementation of the **UWMP**,

unless the **Responsible Authority** considers, after consulting with **DWER**, that a **UWMP**, or a **UWMP** that meets the requirements in condition 8(2), is not required.

### Reporting

9. The **Responsible Authority** must submit an environmental performance report which is inclusive of all **subdivisions** within the **Amendment Area** to **DWER** within three months after the end of the **Initial Report Year** and subsequently within three months after the end of each **Report Period** or by such later date as **DWER** confirms in writing, until **DWER** confirms in writing that reports no longer need to be submitted under this condition.
10. An environmental performance report must:
  - (1) identify any **structure plan** approved by the **Responsible Authority** for all or part of the **Amendment Area**; and
  - (2) demonstrate, in relation to the preceding **Report Period** how the **Responsible Authority** has acted consistently with the requirements of **Ministerial Statement XXX** and the achievement of the environmental

outcomes in condition 3 when exercising powers under this scheme or when determining an application to **subdivide** land in the **Amendment Area**.

## **Definitions**

- 11.** Defined terms in these conditions have the meaning set out in Table 1 of **Ministerial Statement XXX**.

Hon Matthew Swinbourn MLA  
**MINISTER FOR ENVIRONMENT**

<b>Responsible Minister consulted under section 48F(1):</b>
Minister for Planning

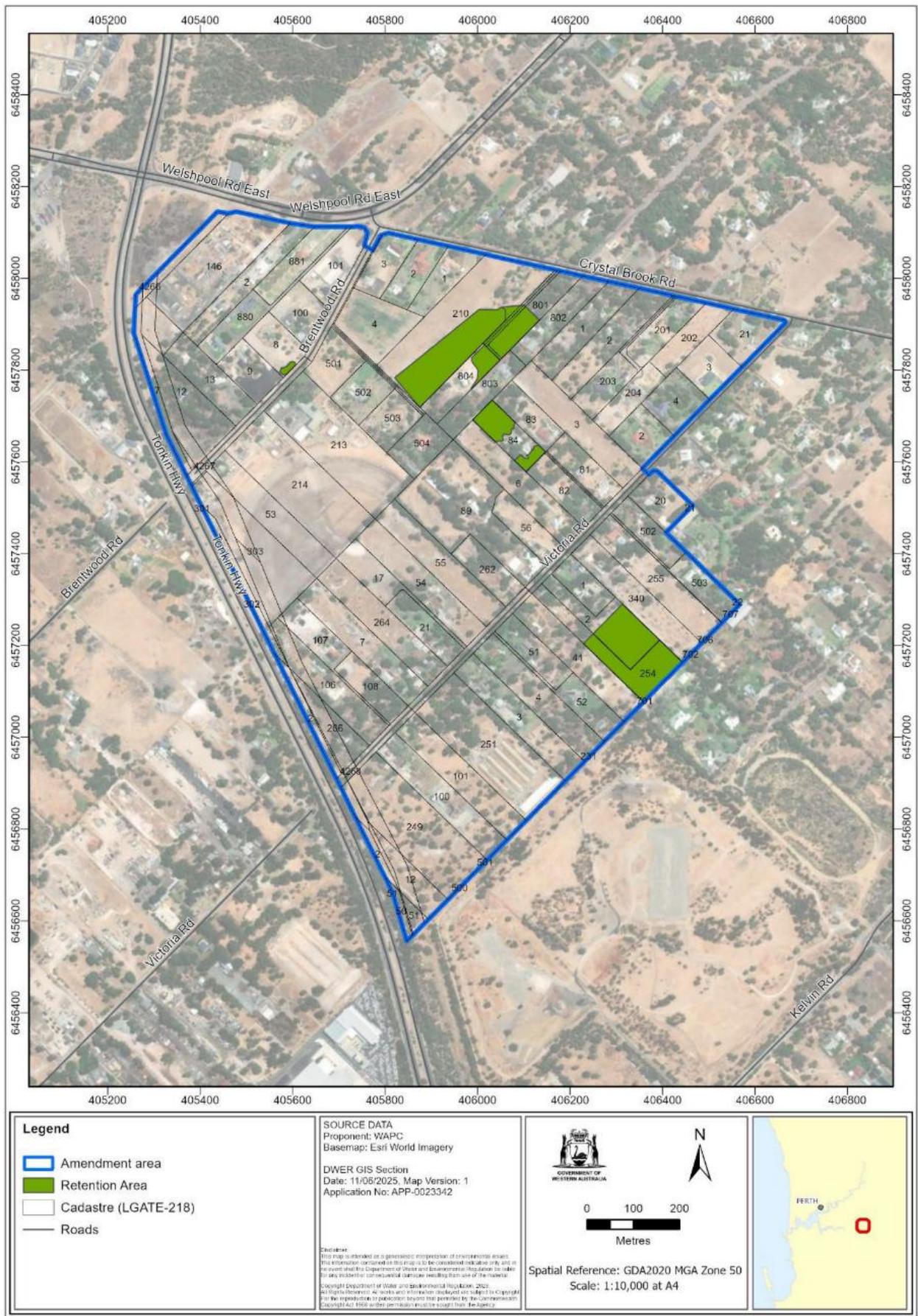
**Table 1: Definitions**

Acronym or abbreviation	Definition or term
<b>Adverse impacts</b>	<p>Negative change that is neither trivial nor negligible that could result in a reduction in health, diversity or abundance of the receptor/s being impacted, or a reduction in environmental value. Adverse impacts can arise from direct or indirect impacts, or other impacts from the implementation of the scheme.</p> <p>In relation to flora and vegetation and terrestrial fauna, includes but is not limited to change in hydrology, altered fire regime and edge effects.</p>
<b>Amendment</b>	MRS Amendment 1388/57
<b>Amendment area</b>	The land subject of MRS Amendment 1388/57. As depicted on Figure 1
<b>Black cockatoo</b>	Includes carnaby's cockatoo ( <i>Zanda latirostris</i> ), forest red-tailed black cockatoo ( <i>Calyptorhynchus banksii naso</i> ) and baudin's cockatoo ( <i>Zanda baudinii</i> ).
<b>Buffer</b>	Adequate area adjacent to the environmental value important for protecting its integrity and providing protection from direct disturbance, to reduce the risk of significant adverse impact.
<b>DBCA</b>	Department of Biodiversity, Conservation and Attractions
<b>Development</b>	As defined in the <i>Planning and Development Act 2005</i>
<b>Disturb/ disturbance</b>	<p>Directly has or materially contributes to the disturbance effect on health, diversity or abundance of the receptor/s being impacted or on an environmental value.</p> <p>In relation to flora, vegetation, or fauna habitat, includes to result in death, destruction, removal, severing or doing substantial damage to.</p> <p>In relation to fauna, includes to have the effect of altering the natural behaviour of fauna to its detriment.</p> <p>In relation to inland waters, includes to have the effect of altering hydrological regimes or water quality to the detriment of the environmental values supported by or dependent on surface water and/or groundwater.</p>
<b>DWER</b>	Department of Water and Environmental Regulation
<b>Environmental Review Document (ERD)</b>	Coterra Environment, Pentium Water, Hyd2o, Emerge Associates, Phoenix Environmental Services, JBS&G, EPCAD Pty Ltd, Element, CLE Town Planning + Design, MBS Environmental, GBG Group, Douglas Partners, Bennelongia Environmental Consultants 2024, Environmental Review Metropolitan Region Scheme Amendment 1388/57 – Wattle Grove South. EPA Assessment No: 2335. Rev 4 (September).

<b>FCT</b>	Floristic Community Type
<b>Greater Brixton Street Wetlands (GBSW)</b>	As depicted in Figure 1 of the EPA 2022. Environmental values and pressures for the Greater Brixton Street Wetlands on the Swan Coastal Plain Advice in accordance with section 16(j) of the <i>Environmental Protection Act 1986, EPA, WA</i> .
<b>Initial Report Year</b>	The 12 month period commencing on the date the first <b>subdivision</b> within the <b>Amendment Area</b> is first approved.
<b>Keighery 1994</b>	Keighery, B.J. (1994). Bushland Plant Survey: a Guide to Plant Community Survey for the Community. Wildflower Society of WA (Inc.), Nedlands, Western Australia
<b>Known nesting trees</b>	Trees (live or dead but still standing) which contains a hollow where black cockatoo breeding has been recorded or which demonstrates evidence of breeding (i.e. showing evidence of use through scratches, chew marks or feathers).
<b>Low impact activities</b>	Activities involving minimal disturbance of ground or vegetation, including revegetation, rehabilitation monitoring of fauna, vegetation or water, or management activities associated with feral fauna control or weed control.
<b>Medium to High quality foraging habitat</b>	As defined in Table 7-10 of <b>Environmental Review Document (ERD)</b> .
<b>Ministerial Statement XXX</b>	Statement that a Scheme may be Implemented No. XXX published on XXX 2025.
<b>Minor subdivision</b>	Subdivision of a minor nature that does not involve any subdivision works and does not impede the achievement of the environmental outcomes in <b>Ministerial Statement XXX</b> .
<b>MRS Amendment Area</b>	The land the subject of MRS Amendment 1388/57, as shown in Figure 1.
<b>Potential nesting trees</b>	Trees that have a Diameter at Breast Height greater than 300mm but do not currently have hollows.

<b>Recovery plan</b>	Plans that outline the actions that are needed to help threatened species or ecological communities survive and 'recover' to a healthy level, including: <ul style="list-style-type: none"> <li>• Department of Parks and Wildlife (2016). <i>Banksia attenuata</i> woodlands over species rich dense shrublands (Swan Coastal Plain community type 20a – Gibson et al. 1994). Interim Recovery Plan No. 359. Parks and Wildlife, Kensington, Western Australia.</li> <li>• Department of Environment and Conservation (2009). Wavy-leaved smokebush (<i>Conospermum undulatum</i>) Recovery Plan. Commonwealth Department of the Environment, Water, Heritage and the Arts, Canberra.</li> </ul>
<b>Report Period</b>	The 36 month period commencing on the date of conclusion of the <b>Initial Report Year</b> , and every subsequent 36 month period.
<b>Responsible authority</b>	Western Australian Planning Commission (WAPC)
<b>Results of any pre development monitoring program</b>	Any results of pre development monitoring associated with implementation of: <ul style="list-style-type: none"> <li>• Hyd2o 2024, WATTLE GROVE SOUTH District Water Management Strategy. Ref: H22076Bv8, 19 July 2024, or any subsequent District Water Management Strategy that includes the <b>Amendment Area</b>; and</li> <li>• any local water management strategy prepared for the relevant land.</li> </ul>
<b>Retention area(s)</b>	Retention area(s) as shown in Figure 1
<b>Roosting site</b>	Habitat that contains one, or a group of, known or potential roosting trees as defined in Department of Agriculture, Water and the Environment (DAWE) 2022, Referral guideline for 3 WA threatened black cockatoo species Carnaby's Cockatoo, Baudin's Cockatoo and the Forest Red-tailed Black cockatoo, Department of Agriculture, Water and the Environment, Canberra.
<b>Structure Plan</b>	As defined in the <i>Planning and Development (Local Planning Scheme) Regulations 2015</i>
<b>Subdivide/Subdivision(s)</b>	Division or amalgamation of lots as approved by the WAPC under the <i>Strata Titles Act 1985 / Planning and Development Act 2005</i>
<b>Threatened</b>	Listed by order of the Minister as Threatened in the category of critically endangered, endangered or vulnerable under section 19(1), or a rediscovered species to be regarded as threatened species under section 26(2) of the <i>Biodiversity Conservation Act 2016 (WA)</i> .
<b>Threatened Ecological Community (TEC)</b>	A Threatened Ecological Community is a vegetation community which is found to fit into one of the following categories; "presumed totally destroyed", "critically endangered", "endangered" or "vulnerable" under the <i>Biodiversity Conservation Act 2016 (WA)</i> and/or <i>Environment Protection and Biodiversity Conservation Act 1999 (Cth)</i> .
<b>Unsurveyed Land</b>	Areas depicted as "Unsurveyed Areas" in Figure 2.

<p><b>Urban Water Management Plan (UWMP)</b></p>	<p>Water management document prepared in accordance with the relevant guideline and informed by any local water management strategy, to support a land-use planning proposal at the <b>subdivision</b> or <b>development</b> stage. <i>Better Urban Water Management (WAPC 2008); Urban water management plans – Guidelines for preparing plans and for complying with subdivision conditions (DoW 2008).</i></p>
<p><b>Viable populations</b></p>	<p>The viability of a population (including in relation to species function, habitat requirements and buffers, and population stability) is to be determined in consultation with <b>DBCA</b> consistently with any relevant <b>recovery plan</b>.</p>



**Figure 1: Amendment area and retention area**

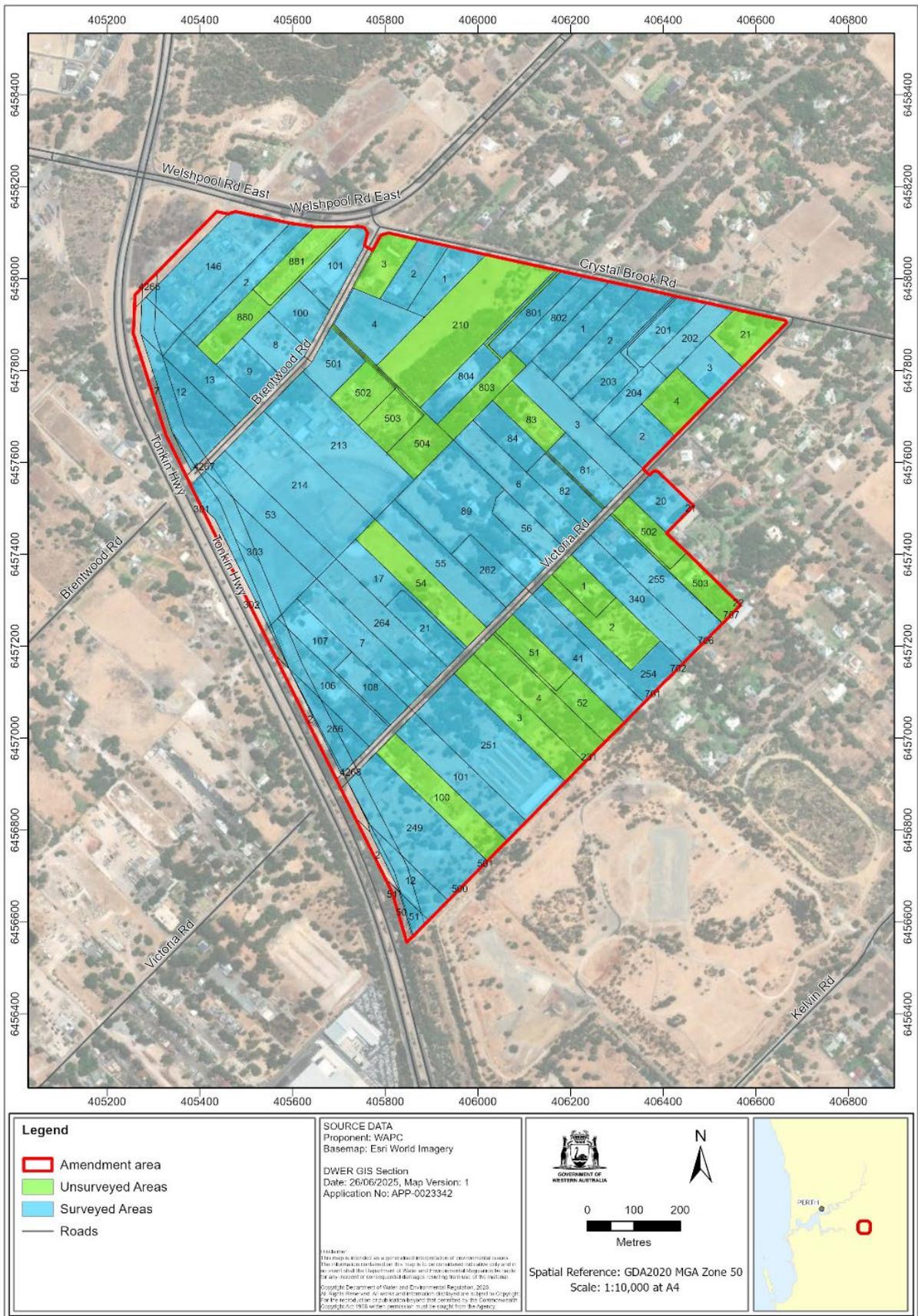


Figure 2: Unsurveyed areas (source: ERD)



## **Appendix 3      Ecological Memo (JBS&G 2024)**

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# Wattle Grove South MRS Amendment Area Ecological Survey Effort

Hesperia Property Pty Ltd for Western Australian Planning Commission

Technical Memo

JBS&G 60309 | 157,603

19 February 2024





**We acknowledge the Traditional Custodians of Country throughout Australia and their connections to land, sea and community.**

We pay respect to Elders past and present and in the spirit of reconciliation, we commit to working together for our shared future.

Caring for Country The Journey of JBS&G  
Artist: Patrick Caruso, Eastern Arrernte

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## 1. Purpose and Scope

This memorandum provides a summary of the ecological survey effort undertaken for the Metropolitan Region Scheme (MRS) Amendment 1388/57 – Wattle Grove South.

The Western Australian Planning Commission (WAPC) is proposing to rezone approximately 126 ha of 'Rural' zoned land to 'Urban' under the MRS. The MRS amendment area is located within Wattle Grove, bound by Welshpool Road East and Crystal Brook Road to the north, and Tonkin Highway to the west. The MRS amendment area is approximately 30 km east of the Perth Central Business District (CBD) and is located within the City of Kalamunda. The MRS amendment area covers a total of 126 ha and is comprised of 77 lots.

This memo provides an overview of the following flora, vegetation and fauna surveys and assessments that have been undertaken within the MRS amendment area:

- 360 Environmental (2018) – desktop assessment (Appendix A);
- AECOM (2020) – desktop and detailed field surveys (Appendix B); and
- JBS&G – various surveys in 2021 and 2022 (Appendices C to F).

These surveys and assessments are intended to inform the environmental impact assessment of MRS Amendment 1388/57 and will inform the environmental management framework that will be further referenced in the Environmental Review Document.

## 1.1 Survey overview

The majority of the MRS amendment area (Figure 1-1) has been previously surveyed by AECOM (2020) as part of the City of Kalamunda's preparation of a concept plan for the wider Crystal Brook (Wattle Grove South) investigation area. Additional targeted survey work was undertaken by JBS&G between 2021 and 2022 to provide supplementary ecological data for the MRS amendment area not covered by previous survey effort or to provide further targeted surveys. The majority of the MRS amendment area, being 69 of the 77 lots (representing approximately 92% by area), has been subject to some form of ecological assessment. Thirteen of the lots were surveyed based on observations made from the fence line of road and adjacent lots and detailed aerial photography. Eight privately owned lots were unable to be surveyed due to limited access.

The fauna, flora and vegetation survey effort within the MRS amendment area is summarised below and depicted in Figure 1-2.

### Summary of ecological survey within the MRS amendment area

360 Environmental (2018) and AECOM (2020) have previously undertaken desktop assessments of the MRS amendment area as part of a consideration of the broader Wattle Grove (South) locality. AECOM (2020) also conducted site survey's and assessment for flora, vegetation and fauna.

Five further supplementary surveys of the MRS amendment area were completed by JBS&G during 2021 and 2022:

- Tree survey (February 2021): Habitat tree survey of various lots and the Victoria Road reserve.
- Targeted flora survey (August 2021): *Drakea elastica* on Lot 254 Victoria Road;
- Supplementary vegetation and flora assessment (October 2021): Various lots;
- Reconnaissance vegetation and flora assessment (January 2022) (Appendix F): Various lots, including from lot boundaries; and
- Further reconnaissance vegetation and flora assessment of targeted lots (October 2022).

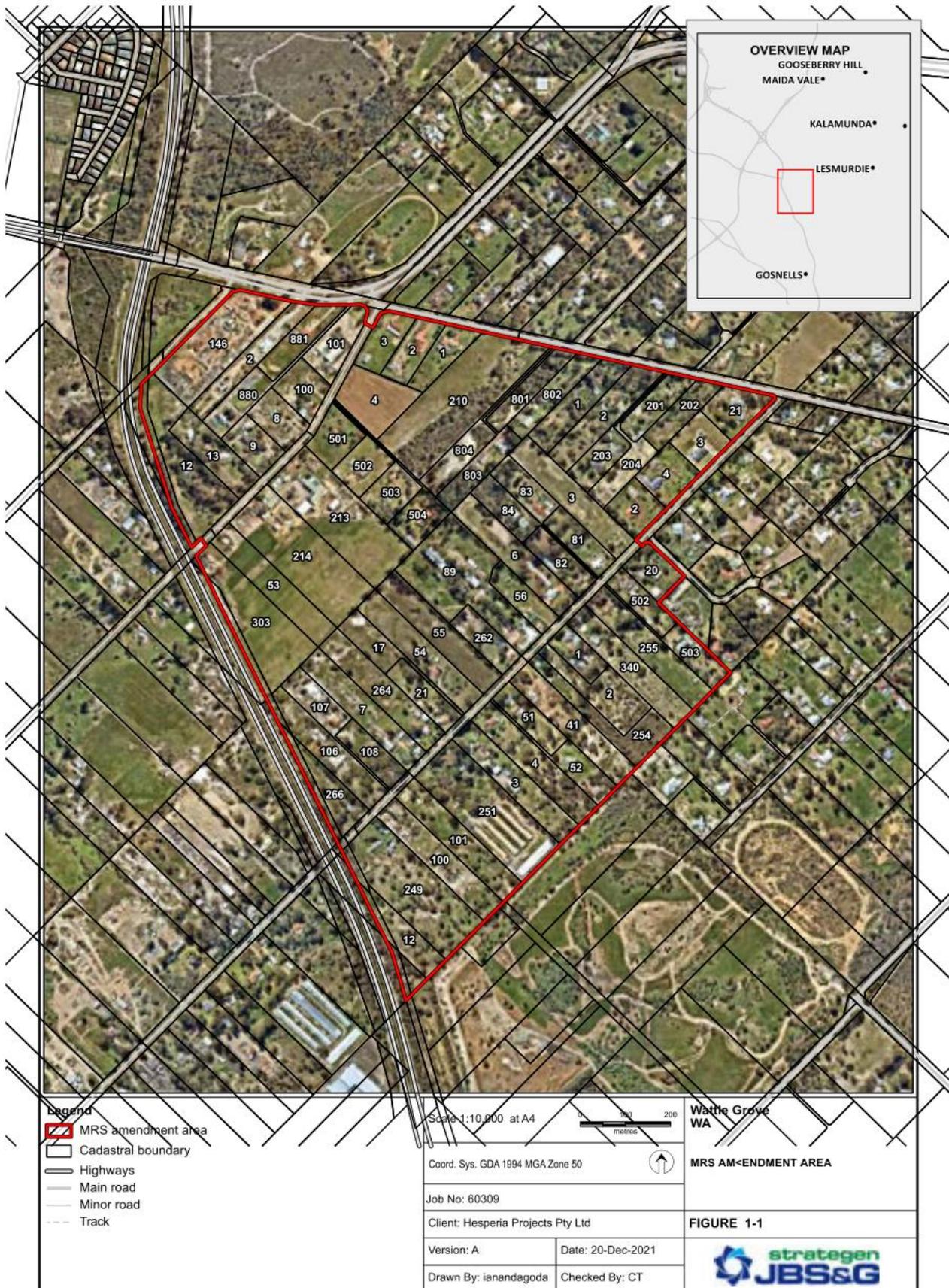


Figure 1-1 MRS Amendment Area

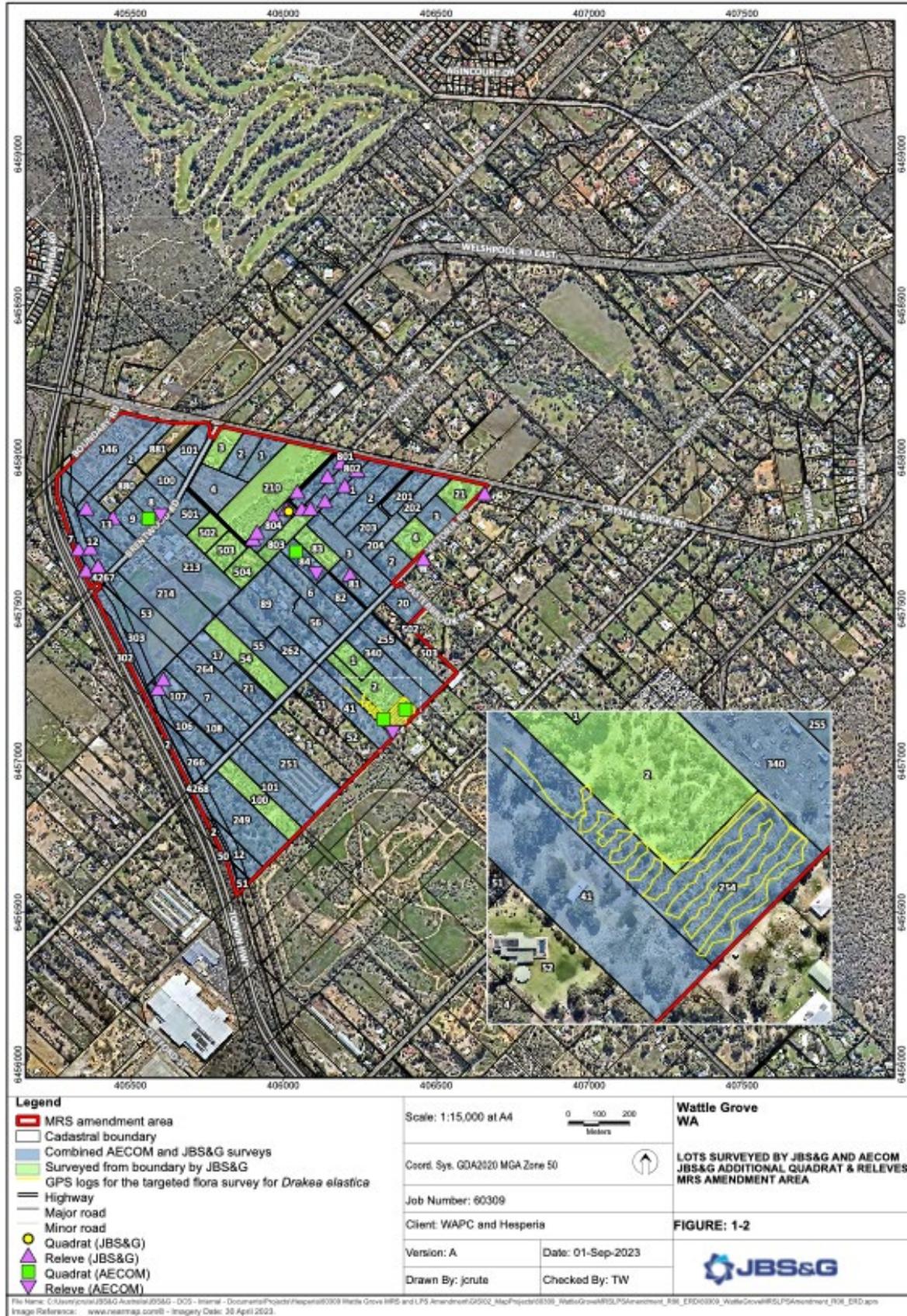


Figure 1-2: Lots surveyed by AECOM and JBS&G within MRS amendment area

## 2. Desktop Assessments

### 2.1.1 Conservation Significant Flora

360 Environmental (2018) and AECOM (2020) undertook desktop assessments for the Wattle Grove (South) locality. Further desktop assessments were undertaken in September 2023 by JBS&G to verify the validity of the previous searches, with new database requests submitted to the Department of Biodiversity, Conservation and Attractions (DBCAs) for both the Threatened and Priority Flora Database and the Western Australian Herbarium Database. A total of 83 flora taxa of conservation significance were identified by the searches, with 60 potentially occurring within a 5 km buffer of the MRS amendment area. A 10 km buffer was requested; however, DBCAs determined that a 5 km buffer was appropriate for the MRS amendment area, based on the number of records available in the general area and the range of local species, and that this flexibility caters for complexity, ensuring meaningful results.

The potential for these plants to occur within the site was assessed and based on general habitat requirements and distribution. Twenty Threatened and 61 Priority flora species were considered to have the potential to occur within the site (Table 2-1). The JBS&G 2023 database search results are presented in Table 2-1.

Further, two conservation significant flora taxa were identified by AECOM (2020) to have been historically recorded within the site:

- *Conospermum undulatum* (T) – listed under the *Federal Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the *State Biodiversity Conservation Act 2016* (BC Act)
- *Isopogon autumnalis* (P3), previously named *Isopogon drummondii* – listed under the Department of Biodiversity Conservation and Attractions' (DBCAs) Priority flora lists

**Table 2-1: Threatened and Priority flora potentially occurring within 5 km of MRS amendment area**

Species (Common name (if applicable))	Conservation status		Potential to occur (based on desktop assessment)
	EPBC Act	BC Act	
<i>Grevillea thelemanniana</i> (Spider Net Grevillea)	Critically Endangered	Critically Endangered	Possible
<i>Ptilotus pyramidatus</i>	Critically Endangered	Critically Endangered	Unknown
<i>Synaphea</i> sp. Fairbridge Farm (D. Papenfus 696)	Critically Endangered	Critically Endangered	Likely
<i>Caladenia huegelii</i> (Grand Spider Orchid)	Endangered	Critically Endangered	Unknown
<i>Drakaea elastica</i> (Glossy-leaved Hammer Orchid)	Endangered	Critically Endangered	Likely
<i>Calytrix breviseta</i> subsp. <i>Breviseta</i>	Endangered	Critically Endangered	Likely
<i>Thelymitra magnifica</i> (Crystal Brook Star Orchid)	-	Critically Endangered	Likely
<i>Andersonia gracilis</i>	Endangered	Vulnerable	Possible
<i>Austrostipa bronwenae</i>	Endangered	Endangered	Likely
<i>Banksia mimica</i> (Summer Honeypot)	Endangered	Vulnerable	Possible
<i>Darwinia apiculata</i> (Scarp Darwinia)	Endangered	Endangered	Possible
<i>Diuris purdiei</i> (Purdie's Donkey Orchid)	Endangered	Endangered	Unknown
<i>Eremophila glabra</i> subsp. <i>Chlorella</i>	Endangered	Endangered	Likely
<i>Macarthuria keigheryi</i>	Endangered	Endangered	Possible
<i>Lepidosperma rostratum</i>	Endangered	Endangered	Likely
<i>Thelymitra stellata</i> (Star Orchid)	Endangered	Endangered	Likely
<i>Acacia anomala</i> (Grass Wattle)	Vulnerable	Vulnerable	Possible

Species (Common name (if applicable))	Conservation status		Potential to occur (based on desktop assessment)
	EPBC Act	BC Act	
<i>Acacia aphylla</i> (Leafless Rock Wattle)	Vulnerable	Vulnerable	Possible
<i>Anthocercis gracilis</i> (Slender Tailflower)	Vulnerable	Vulnerable	Possible
<i>Conospermum undulatum</i>	Vulnerable	Vulnerable	Confirmed
<i>Eleocharis keigheryi</i>	Vulnerable	Vulnerable	Possible
<i>Morelotia australiensis</i>		Vulnerable	Unlikely
<i>Goodenia arthrotricha</i>	Endangered	Endangered	Possible
<i>Grevillea curviloba</i>	Endangered	Endangered	Possible
<i>Diuris drummondii</i> (Tall Donkey Orchid)	Vulnerable	Threatened	Unlikely
<i>Schoenus</i> sp. Beaufort (G.J. Keighery 6291)	-	P1	Possible
<i>Boronia humifusa</i>	-	P1	Possible
<i>Lepyrodia curvescens</i>	-	P2	Possible
<i>Schoenus loliaceus</i>	-	P2	Possible
<i>Comesperma griffinii</i>	-	P2	Likely
<i>Platysace ramosissima</i>	-	P3	Possible
<i>Schoenus benthamii</i>	-	P3	Possible
<i>Schoenus capillifolius</i>	-	P3	Possible
<i>Schoenus pennisetis</i>	-	P3	Possible
<i>Schoenus</i> sp. Waroona (G.J. Keighery 12235)	-	P3	Possible
<i>Stylidium aceratum</i>	-	P3	Possible
<i>Styphelia filifolia</i>	-	P3	Unknown
<i>Thysanotus anceps</i>	-	P3	Possible
<i>Isopogon autumnalis</i> (Previously <i>Isopogon drummondii</i> )	-	P3	Confirmed
<i>Isotropis cuneifolia</i> subsp. <i>Glabra</i>	-	P3	Possible
<i>Allocauarina grevilleoides</i>	-	P3	Possible
<i>Jacksonia gracillima</i>	-	P3	Possible
<i>Lasiopetalum glutinosum</i> subsp. <i>Glutinosum</i>	-	P3	Unlikely
<i>Meionectes tenuifolia</i>	-	P3	Possible
<i>Myriophyllum echinatum</i>	-	P3	Possible
<i>Babingtonia urbana</i> (Coastal Plain Babingtonia)	-	P3	Unlikely
<i>Banksia pteridifolia</i> subsp. <i>Vernalis</i>	-	P3	Unlikely
<i>Byblis gigantea</i> (Rainbow Plant)	-	P3	Unlikely
<i>Chamaescilla gibsonii</i>	-	P3	Possible
<i>Comesperma rhadinocarpum</i> (Slender-fruited Comesperma)	-	P3	Unknown
<i>Asteridea gracilis</i>	-	P3	Possible
<i>Beaufortia purpurea</i> (Purple Beaufortia)	-	P3	Possible
<i>Eryngium pinnatifidum</i> subsp. Palustre (G.J. Keighery 13459)	-	P3	Likely
<i>Carex tereticaulis</i>	-	P3	Possible
<i>Eryngium</i> sp. <i>Subdecumbens</i> (G.J. Keighery 5390)	-	P3	Likely
<i>Haemodorum loratum</i>	-	P3	Likely
<i>Halgania corymbosa</i>	-	P3	Possible
<i>Acacia horridula</i>	-	P3	Likely
<i>Schoenus natans</i> (Floating Bog-rush)	-	P4	Possible
<i>Lasiopetalum bracteatum</i>	-	P4	Likely
<i>Cyanicula ixioides</i> subsp. <i>Ixioides</i>	-	P4	Unknown

Species (Common name (if applicable))	Conservation status		Potential to occur (based on desktop assessment)
	EPBC Act	BC Act	
<i>Senecio leucoglossus</i>	-	P4	Possible
<i>Stylidium longitubum</i> (Jumping Jacks)	-	P4	Possible
<i>Stylidium striatum</i> (Fan-leaved Triggerplant)	-	P4	Possible
<i>Verticordia lindleyi</i> subsp. <i>Lindleyi</i>	-	P4	Likely
<i>Ornduffia submersa</i>	-	P4	Unknown
<i>Acacia oncinophylla</i> subsp. <i>Patulifolia</i>	-	P4	Likely
<i>Drosera occidentalis</i> (Western Sundew)	-	P4	Unknown
<i>Calothamnus accedens</i>	-	P4	Possible
<i>Aponogeton hexatepalus</i>	-	P4	Possible
<i>Bolboschoenus fluviatilis</i>	-	P3	Unlikely
<i>Calandrinia uncinella</i>	-	P1	Possible
<i>Calectasia grandiflora</i>	-	P2	Possible
<i>Commersonia</i> sp. <i>Lesmurdie</i> (A.A. <i>Mitchell 11429</i> )	-	P2	Unlikely
<i>Cyanothamnus tenuis</i>	-	P4	Unlikely
<i>Diuris brevis</i>	-	P2	Possible
<i>Hydrocotyle lemnoides</i>	-	P4	Possible
<i>Johnsonia pubescens</i> subsp. <i>Cygnorum</i>	-	P2	Possible
<i>Pimelea rara</i>	-	P4	Unlikely
<i>Pithocarpa corymbulosa</i>	-	P3	Unlikely
<i>Rytidosperma racemosum</i> var. <i>racemosum</i>	-	P2	Possible
<i>Thysanotus cymosus</i>	-	P3	Unlikely

### 2.1.2 Threatened and Priority Ecological Communities

The BC Act defines an ecological community as a naturally occurring assemblage of organisms that occurs in a particular habitat. In most instances on the Swan Coastal Plain, an ecological community has been determined based on their floristic community type (FCT) and some Commonwealth listed Threatened Ecological Communities (TECs) may correspond with more than one FCT at a State level.

The number of TECs and Priority Ecological Communities (PECs) identified as potentially occurring within the MRS amendment area reflects the unique landforms that occur in a highly fragmented environment at the base of the Darling Scarp. This area is influenced by the Scarp and the Swan Coastal Plain and supports a mix of Banksia and Eucalyptus woodlands, Heath shrublands and wetlands.

The 2023 desktop assessment identified 6 TECs listed under the EPBC Act and 11 TECs listed under the BC Act and 3 PECs listed by the DBCA as having a likely or greater chance of occurrence in the MRS amendment area (See Table 2-2). Of these, the Commonwealth-listed Banksia Woodlands of the Swan Coastal Plain TEC (which is listed as Priority 3 by the DBCA) and 2 State-listed TECs have been identified as occurring in discrete areas within the MRS amendment area.

**Table 2-2 Threatened and Priority Ecological Communities identified in the desktop assessment**

Community	Conservation Code		Presence in the MRS amendment area
	State (WA)	EPBC Act (Cth)	
Banksia Woodlands of the Swan Coastal Plain Incorporating the State listed TECs and PECs:	P3	E	Present (See section 3.1.4)
<ul style="list-style-type: none"> <li>• <i>Banksia attenuata</i> woodlands over species rich dense shrublands (FCT/SCP 20a)</li> <li>• <i>Banksia attenuata</i> and/or <i>Eucalyptus marginata</i> woodlands of the eastern side of the Swan Coastal Plain (FCT/SCP 20b)</li> <li>• Low lying <i>Banksia attenuata</i> woodlands or shrublands (FCT/SCP 21c)</li> </ul>	CR CR P3		<ul style="list-style-type: none"> <li>• Present (See section 3.1.4)</li> <li>• Present (See section 3.1.4)</li> <li>• Absent</li> </ul>
SCP20c Shrublands and Woodlands of the Eastern Swan Coastal Plain (FCT20c)	CR	E	Absent
Clay Pans of the Swan Coastal Plain Incorporating the State listed TECs:		CE	Absent
<ul style="list-style-type: none"> <li>• Herb rich saline shrublands in clay pans (FCT/SCP 07)</li> <li>• Herb rich shrublands in clay pans (FCT/SCP 08)</li> <li>• Shrublands on dry clay flats. (FCT/SCP 10a)</li> </ul>	EN EN EN		<ul style="list-style-type: none"> <li>• Absent</li> <li>• Absent</li> <li>• Absent</li> </ul>
SCP 3a <i>Corymbia calophylla</i> – <i>Kingia australis</i> Woodlands on Heavy Soils of the Swan Coastal Plain (FCT/SCP 3a)	CR	E	Absent
SCP3b <i>Corymbia calophylla</i> – <i>Eucalyptus marginata</i> Woodlands on Sandy Clay Soils of the southern Swan Coastal Plain (FCT/SCP 3b)	EN	-	Absent
SCP3c <i>Corymbia calophylla</i> – <i>Xanthorrhoea preissii</i> Woodlands and Shrublands, Swan Coastal Plain (FCT/SCP 3c)	EN	E	Absent
Central Northern Darling Scarp Granite Shrubland Community	P4	-	Absent
SCP02 Southern Wet Shrublands, Swan Coastal Plain (FCT/SCP 02)	CR	-	Absent
Muchea Limestone – Shrublands and Woodlands on Muchea Limestone of the Swan Coastal Plain	EN	E	Absent

Conservation Codes	State (WA)	Federal
Endangered	EN	E
Critically Endangered	CR	CE
Vulnerable	VU	V
Priority (rated in order of significance from 1 to 4)	P	Not applicable

### 2.1.3 Conservation Significant Fauna

Conservation significant fauna database searches were conducted using a 10 km buffer surrounding the MRS amendment area using the EPBC Act Protected Matters Search Tool (PMST) and the DBCA Threatened, Specially Protected, and Priority Fauna database by AECOM (2020) and JBS&G in 2022. An additional database search was conducted in September 2023 by JBS&G to verify the validity of the previous searches.

The 2023 desktop assessment identified a total of 33 fauna taxa of conservation significance as potentially occurring within a 10 km buffer of the MRS amendment area (Table 2-3). The majority of these taxa are associated with wetland (and other discrete) habitats that are within a 10km radius but do not occur within the MRS amendment area. The EPBC Protected Matters Search identified five fauna species listed as Marine under the EPBC Act which only pertains to Commonwealth Land.

As such, of the 33 conservation significant fauna taxa identified in the desktop assessment, up to 7 species are considered to have the potential to occur based on presence of suitable habitat within the MRS amendment area, including 3 species (black cockatoo) listed under both the BC and EPBC Act. The likelihood for each species to occur within the MRS amendment area is provided in Table 2-3.

As the site is predominantly cleared of native vegetation and used for rural purposes, the site does not provide large areas of intact or connected habitat. The surrounding environment (external to the MRS amendment area) is also predominantly cleared and consists of rural land uses containing limited native vegetation. Large areas of intact vegetation are located east of the site, within the Lesmurdie Falls National Park, which is considered to provide higher quality fauna habitat. The Greater Brixton Street Wetlands, located to the west of the site and physically separated by Tonkin Highway, also provides higher quality fauna habitat. There are some discrete areas of good (and better) quality remnant vegetation and scattered trees located within the MRS amendment area. An assessment of the likelihood for each species to occur included consideration of the habitat types within the MRS amendment area.

**Table 2-3: Threatened and Priority Fauna potentially occurring within 10 km of the MRS amendment area**

Scientific Name	Common Name	Conservation Status		Likelihood of occurrence within the MRS Amendment Area
		State (WA)	Federal	
<i>Leioproctus douglasiellus</i>	a short-tongued bee	EN	CR	Unlikely
<i>Neopasiphae simplicior</i>	a short-tongued bee	EN	CR	Unlikely
<i>Glossurocolletes bilobatus</i>	a short-tongued bee (southwest)	P2		Possible
<i>Zanda baudinii</i>	Baudin's cockatoo	EN	EN	Possible
<i>Neelaps calonotos</i>	black-striped snake, black-striped burrowing snake	P3		Unlikely
<i>Oxyura australis</i>	blue-billed duck	P4		Unlikely
<i>Zanda latirostris</i>	Carnaby's cockatoo	EN	EN	Likely
<i>Westralunio carteri</i>	Carter's freshwater mussel	VU	VU	Unlikely
<i>Hydroprogne caspia</i>	Caspian tern	MI	MI	Unlikely
<i>Australotomurus morbidus</i>	cemetery springtail, Guildford springtail	P3		Unlikely
<i>Dasyurus geoffroii</i>	chuditch, western quoll	VU	VU	Unlikely
<i>Tringa nebularia</i>	common greenshank	MI	MI	Unlikely
<i>Actitis hypoleucos</i>	common sandpiper	MI	MI	Unlikely
<i>Thalasseus bergii</i>	crested tern	MI	MI	Unlikely
<i>Calyptorhynchus banksii naso</i>	forest red-tailed black cockatoo	VU	VU	Likely
<i>Plegadis falcinellus</i>	glossy ibis	MI	MI	Unlikely
<i>Kawanaphila pachomai</i>	grey vernal katydid (southwest)	P1		Unlikely
<i>Tringa stagnatilis</i>	marsh sandpiper, Little greenshank	MI	MI	Unlikely
<i>Myrmecobius fasciatus</i>	numbat, walpurti	EN	EN	Unlikely
<i>Pandion haliaetus</i>	osprey	MI	MI	Unlikely
<i>Falco peregrinus</i>	peregrine falcon	OS		Unlikely
<i>Lerista lineata</i>	Perth slider, lined skink	P3		Unlikely
<i>Isoodon fusciventer</i>	quenda, southwestern brown bandicoot	P4		Likely
<i>Setonix brachyurus</i>	quokka	VU	VU	Unlikely
<i>Acanthophis antarcticus</i>	southern death adder	P3		Unlikely
<i>Phascogale tapoatafa wambenger</i>	south-western brush-tailed phascogale, wambenger	CD		Unknown
<i>Idiosoma sigillatum</i>	Swan Coastal Plain shield-backed trapdoor spider	P3		Possible
<i>Hydromys chrysogaster</i>	water-rat, rakali	P4		Unlikely
<i>Notamacropus irma</i>	western brush wallaby	P4		Unlikely
<i>Platycercus icterotis xanthogenys</i>	western rosella (inland)	P4		Possible
<i>Pseudemydura umbrina</i>	western swamp tortoise	CR	CR	Unlikely
<i>Tringa glareola</i>	wood sandpiper	MI	MI	Unlikely
<i>Bettongia penicillata ogilbyi</i>	woylie, brush-tailed bettong	CR	EN	Unlikely

**Conservation Codes**

Endangered  
Critically Endangered  
Vulnerable

**State (WA)**

EN  
CR  
VU

**Federal**

E  
CE  
V

Priority (rated in order of significance from 1 to 4)

P

Not applicable

## 3. Field Survey Results and Discussion

### 3.1 Flora and Vegetation

#### 3.1.1 Vegetation Communities

Six native vegetation communities were described and mapped by AECOM (2020) for the broader Wattle Grove South area. Of these, three occur within the MRS amendment area. These communities fall into two broad categories of Banksia Woodland and *E. marginata* Woodland (AECOM 2020). Vegetation descriptions for those communities present in the MRS amendment area are provided in Table 3-1 and shown Figure 3-1. The delineation of vegetation communities was supported by cluster analysis of floristic data. The cluster outcomes as identified using AECOMs quadrat and relevé data (Q09, Q06, Q13, R12, R14 and R05) (AECOM 2020) and the single quadrat data collected by JBS&G in 2022 (S01) are provided below. The quadrat and relevé data sheets are provided in Appendix C.

**Table 3-1: Vegetation Community Descriptions**

Description	Additional Details	Photograph
<p><b>BmXpEc</b>  <b>Banksia Woodland</b>  <i>Banksia menziesii</i>, <i>Allocasuarina fraseriana</i> and <i>Eucalyptus todtiana</i> low open woodland over <i>Xanthorrhoea preissii</i>, <i>Eremaea pauciflora</i> var. <i>pauciflora</i> and <i>Stirlingia latifolia</i> low open shrubland over <i>Ehrharta calycina</i>*, <i>Dasyogon bromeliifolius</i> and <i>Anigozanthos manglesii</i> subsp. <i>manglesii</i> mixed grass and forbland (AECOM 2020).  Represents Federal TEC Banksia Woodlands of the SCP and WA TEC <i>B. attenuata</i> and/or <i>E. marginata</i> woodlands of the eastern SCP (SCP20b) (AECOM 2020).</p>	<p>Survey effort:  Q09 (AECOM quadrat)  R12 (AECOM relevé)  R14 (AECOM relevé)</p> <p>Species richness: 80 native and 12 weed species (AECOM 2020).</p>	 <p>Source: AECOM 2020</p>
<p><b>BaEpPf</b>  <b>Banksia Woodland</b>  <i>Banksia attenuata</i>, <i>Banksia menziesii</i> and <i>Eucalyptus todtiana</i> low open woodland over <i>Eremaea pauciflora</i> var. <i>pauciflora</i>, <i>Hibbertia hypericoides</i> and <i>Allocasuarina humilis</i> low shrubland over <i>Phlebocarya filifolia</i>, <i>Mesomelaena pseudostygia</i> and <i>Lepidosperma leptostachyum</i> low sedgeland (AECOM 2020).  Represents Federal TEC Banksia Woodlands of the SCP. One patch also represents the WA TEC <i>Banksia attenuata</i> woodlands over species rich dense shrublands (SCP20a). Supports the Threatened <i>Conospermum undulatum</i> and Priority 3 <i>Isopogon drummondii</i> (AECOM 2020).</p>	<p>Survey effort:  Q6 (AECOM quadrat)  Q13 (AECOM quadrat)  S01 (JBS&amp;G relevé)</p> <p>Species richness: 88 native and 7 weed species.</p>	 <p>Source: AECOM 2020</p>
<p><b>EmMpLp</b>  <b><i>E. marginata</i> Woodland</b>  <i>Eucalyptus marginata</i> subsp. <i>marginata</i> and <i>Allocasuarina fraseriana</i> mid open forest over <i>Mesomelaena pseudostygia</i> and <i>Tetraria octandra</i> low sedgeland with <i>Lomandra preissii</i>, <i>Tricoryne elatior</i> and <i>Dampiera linearis</i> low open forbland (AECOM 2020).  Larger patch of this community surveyed in wider Wattle Grove South survey area (but outside of MRS amendment area) represents WA TEC <i>B. attenuata</i> and/or <i>E. marginata</i> woodlands of the eastern SCP (SCP20b) (AECOM 2020).</p>	<p>Survey effort:  R05 (AECOM relevé)</p>	 <p>Source: AECOM 2020</p>
<p><b>Significantly Altered</b>  Includes planted, gardens, scattered trees (both native and introduced). Condition considered Completely Degraded.</p>	N/A	N/A

Of the mapped vegetation communities, three represent remnant native vegetation while the remaining two represent highly modified or planted vegetation communities. Areas previously subject to clearing or development have been identified as 'Cleared'. Areas not subject to a site assessment have been extrapolated based on adjacent environmental values, review of aerial imagery and where possible, visual assessment from adjoining lots and road reserves. The area each vegetation community occupies within the site is provided in Table 3.3.

**Table 3-2: Vegetation Communities**

Vegetation Community	Area (ha)	Percentage Total (%)
<b>Remnant Native Vegetation</b>		
BaEpPf	4.23	3.37
BmXpEc	0.42	0.34
EmMpLp	0.13	0.10
<b>Total Remnant Native Vegetation</b>	<b>4.70</b>	<b>3.73</b>
<b>Highly Modified Vegetation</b>		
Planted	2.80	2.23
Scattered Trees	26.90	21.42
<b>Other</b>		
Cleared	91.10	72.54
<b>Grand Total</b>	<b>125.58</b>	<b>100</b>

### 3.1.2 Vegetation Condition

Vegetation condition within the MRS amendment area varied from 'Excellent' to 'Completely Degraded' and is described in Table 3-3 and shown in Figure 3-2. The condition map reflects the current land use which comprises numerous landholdings and contains a mixture of land uses including residential and rural living, composite business along Welshpool and Brentwood Roads and horticulture (including turf farm). The turf farm located across Lots 303, 53, 214 and 213, south of Brentwood Road, has discontinued operations in the last 6 months. There is a former poultry farm located at Lot 251 within the south-east portion of the site, that ceased operations over a decade ago. The Dampier to Bunbury natural gas pipeline (DBNGP) also runs along the western edge of the site adjacent to Tonkin Highway. The majority of rural residences comprise cleared paddocks, grasslands (lawn) and maintained gardens.

**Table 3-3: Vegetation Condition within the Amendment Area**

Vegetation Condition	Area (ha)	Percentage Total (%)
Excellent	3.41	2.71
Very Good	0.1	0.08
Good	0.24	0.19
Degraded	0.13	0.10
Completely Degraded	24.95	19.87
Cleared	96.74	77.04
<b>Total</b>	<b>125.58</b>	<b>100</b>



Figure 3-1: Vegetation Communities within the MRS amendment area



Figure 3-2: Vegetation condition within MRS amendment area

### 3.1.3 Floristic Community Type Analysis

An FCT analysis was undertaken by JBS&G ecologists in accordance with the EPA Technical Guidance – *Flora and Vegetation Surveys for Environmental Impact Assessment* (2020), utilising the Keighery et al. (2020) Swan Coastal Plain (SCP) dataset, compiled with the site survey datasets.

This analysis incorporated all of the quadrats from the broader AECOM (2020) study area that were placed within the vegetation communities observed within the MRS amendment area. Although some of the quadrats themselves were outside of the study area, using these quadrats enabled a better and more robust FCT analysis. All but one of these quadrats were surveyed by AECOM in 2019, with the other quadrat surveyed by JBS&G in 2021. The JBS&G quadrat was located in vegetation that has become degraded due to adjacent clearing; however, the information from this quadrat is still valuable as it represents a larger patch of vegetation nearby that could not be directly accessed for survey purposes. The locations of these quadrats are shown in Figure 1-2. The FCTs inferred from the analysis include:

- FCT/SCP 20a *B. attenuata* woodlands over species rich dense shrublands
- FCT/SCP 23a central *B. attenuata* -*B. menziesii* woodlands
- Potential for FCT/SCP 20b *Banksia attenuata* — *Eucalyptus marginata* woodlands of the eastern side of the Swan Coastal Plain

The FCT analysis results were used to inform the TEC and PEC assessment discussed in Section 3.1.4 (Appendix D). Details for each quadrat, with the highest percentage in similarity to the SCP quadrats, and the inferred FCT conclusions are presented in Table 3-4.

The MRS amendment area occurs at the confluence of three major landforms; the Foothills (Ridge Hill Shelf) (east), the Pinjarra Plain, and a combination of Bassendean Dunes and Pinjarra Plain. Because of this, one of the inferred FCTs remain slightly cryptic as it is unclear what landform they would represent at this scale. Furthermore, low similarity was observed across all quadrats analysed, suggesting poor comparability to the SCP data. A number of factors would influence this, such as position of survey area along the base of the Darling Scarp – species present may not be typical of that landform due to the proximity of the scarp, single quadrat sampling event, drying climate; and isolation of native vegetation patches and existing disturbances (AECOM 2020).

The areas of remnant native vegetation within the MRS amendment area are small and range in size from 0.05 to 2.07 ha. Given these small areas, it is believed that the sampling undertaken is representative of the vegetation communities present at each occurrence. Through single site insertion of the quadrat results from the vegetation surveys undertaken against the Keighery (2020) Swan Coastal Plain (SCP) dataset, it was found that definitive flora community types could be attributed to the native vegetation for the majority of the MRS amendment area, and therefore, it is considered that the small number of quadrats sampled provides sufficient information on the vegetation communities present within accessible properties present in the MRS amendment area.

**Table 3-4 Inferred FCTs for Remnant Native Vegetation within the MRS Amendment Area**

Vegetation unit	Total area within MRS amendment area (ha)	Quadrat (# of species)	Inside MRS area?	FCTs based on similarity	Dendro-gram FCTs	Inferred FCT
<b>BaEpPf</b> <b>Banksia Woodland</b> <i>Banksia attenuata</i> , <i>Banksia menziesii</i> and <i>Eucalyptus todtiana</i> low open woodland over <i>Eremaea pauciflora</i> var. <i>pauciflora</i> , <i>Hibbertia hypericoides</i> and <i>Allocasuarina humilis</i> low shrubland over <i>Phlebocarya filifolia</i> , <i>Mesomelaena pseudostygia</i> and <i>Lepidosperma leptostachyum</i> low sedgeland.	<b>4.233</b>	4 (62)	No	20b (Site: Rush02) 0.37% 20a (Site: hart01) 0.37% 20a (Site: activ01) 0.34% 20a (Site: APBF-2) 0.34% 20a (Site: m5303) 0.34%	20a, 20c, 20b.	TEC <i>Banksia attenuata</i> woodlands over species rich dense shrublands (FCT/SCP 20a).  However, there may be an ecotone and/or some overlap with 20b, 20c, 23a and/or 23b.
		6 (52)	Yes	20c (Site: talb8) 0.43% 23b (Site: ELE03) 0.43% 23a (Site: Perth06) 0.42% 23a (Site: Kens01) 0.42%	20a, 20c, 20b.	The soil and landform units correspond to those of 20a; all of these quadrats include <i>Isopogon autumnalis</i> , which is a taxa useful in distinguishing FCT/SCP 20a from all of the eastern southern Swan Coastal Plain FCT/SCPs (3a, 3b, 3c, 20b, 20c)
		13 (57)	Yes	S09 (Site: BNR18) 0.42% 23b (Site: ELE28) 0.42% 23a (Site: perth08) 0.4% 23a (Site: Tele01) 0.39% 20a (Site: activ01) 0.39%	20a, 20c, 20b.	The quadrats sampled contained 12 out of the 19 typical species identified by Gibson et al (1994), and 10 out of the 12 identified as 'common' for this FCT by DPAW (2016): <i>Banksia attenuata</i> , <i>Bossiaea eriocarpa</i> , <i>Hibbertia huegelii</i> , <i>Hibbertia hypericoides</i> , <i>Petrophile linearis</i> , <i>Scaevola repens</i> , <i>Stirlingia latifolia</i> , <i>Mesomelaena pseudostygia</i> , and <i>Alexgeorgea nitens</i> . Two of the quadrats also contain <i>Daviesia nudiflora</i> which can be useful in differentiating 20a from 20b and 20c.
		JBSG01 (50)	Yes	23a (Site: Tele01) 0.44% 20a (Site: activ03) 0.44% 21a (Site: card7) 0.43% 20a (Site: KOON-1) 0.43%	21a, 21b, 21c.	
<b>BmXpEc</b> <b>Banksia Woodland</b> <i>Banksia menziesii</i> , <i>Allocasuarina fraseriana</i> and <i>Eucalyptus todtiana</i> low open woodland over <i>Xanthorrhoea preissii</i> , <i>Eremaea pauciflora</i> var. <i>pauciflora</i> and <i>Stirlingia latifolia</i> low open shrubland over * <i>Ehrharta calycina</i> , <i>Dasyopogon bromeliifolius</i> and <i>Anigozanthos manglesii</i>	<b>0.424</b>	9 (38)	Yes	23a (Site: perth04) 0.45% 23a (Site: Kens01) 0.44% 23a (Site: Tele01) 0.43% 23a (Site: perth08) 0.42% 20a (Site: activ03) 0.41%	20b, 20a, 20c.	May be <i>Banksia attenuata</i> – <i>B. menziesii</i> woodlands (FCT/SCP 23a), however there is some similarity with other FCT/SCPs such as 20a and 20b, and there are some species present ( <i>Cyathochaeta avenacea</i> , <i>Dasyopogon bromeliifolius</i> , and <i>Morelotia octandra</i> (previously <i>Tetraria octandra</i> ), which imply lower-lying landforms and heavier soils than are typical for this FCT.
		18 (41)	No	28 (Site: wire01) 0.40% 23a (Site: perth08) 0.40% 20a (Site: activ03) 0.38% 23a (Site: Tele01) 0.38%	21a, 23a, 4, 21c	
		19 (45)	No	20a (Site: activ03) 0.41% 20b (Site: Rush02) 0.4% 23a (Site: Tele01) 0.38% 23a (Site: Kens01) 0.38%	20a, 20c, 20b.	

Vegetation unit	Total area within MRS amendment area (ha)	Quadrat (# of species)	Inside MRS area?	FCTs based on similarity	Dendrogram FCTs	Inferred FCT
subsp. <i>manglesii</i> mixed grass and forbland.						
<b>EmMpLp</b> <b>E. marginata Woodland</b> <i>Eucalyptus marginata</i> subsp. <i>marginata</i> and <i>Allocasuarina fraseriana</i> mid open forest over <i>Mesomelaena pseudostygia</i> and <i>Tetraria octandra</i> low sedgeland with <i>Lomandra preissii</i> , <i>Tricoryne elatior</i> and <i>Dampiera linearis</i> low open forbland.	0.13	20 (44)	No	23a (Site: perth04) 0.35 % 23a (Site: perth08) 0.34% 23a (Site: bibra01) 0.33% 20a (Site: activ03) 0.33% 20b (Site: card5) 0.33%	21a, 21c, 23a, 4	Inconclusive; may be TEC <i>Banksia attenuata</i> — <i>Eucalyptus marginata</i> woodlands of the eastern side of the Swan Coastal Plain (FCT/SCP 20b), as per AECOM (2020) conclusions. FCT/SCP 20b is known from pre-European vegetation complexes at the base of the Darling Scarp and largely on the Forrestfield unit (Ridge Hill Shelf), Guildford unit (Pinjarra Plain), and Southern River Unit, which aligns with the surveyed location, however it is primarily known to occur between Byford and Yarloop, both of which are considerably south of this location. According to DBCA (2023), this FCT differs from FCT/SCP 20a and 20c in the presence of understorey species that can include <i>Grevillea pilulifera</i> , <i>Babingtonia camphorosmae</i> , <i>Hibbertia vaginata</i> , <i>Caladenia flava</i> , <i>Hakea stenocarpa</i> and <i>Conostylis setosa</i> : None of the abovementioned species were recorded in this quadrat, however this does not definitively indicate that it is not FCT/SCP 20b. FCT/SCP 20b is also characterised by and the general absence of <i>Alexgeorgea nitens</i> - a common component of FCT/SCP 20a –not observed in this quadrat.

### 3.1.4 Threatened and Priority Ecological Communities

Native vegetation was mapped over 4.70 ha within the survey area. Conservation-significant ecological communities occur within four major vegetation patches (Figure 3.3) (Appendix E). Two of these include TECs, and another one may include very small and heavily degraded patches of another TEC (pending verification). The four patches are:

- Patch 1: Contained within Lot 254 is 1.8 ha of BaEpPf which is inferred as being FCT/SCP 20a (refer to Table 3-4), which is a State-listed TEC (Critically Endangered). Whilst FCT/SCP 20a is not a Commonwealth-listed TEC, 0.99 ha is in excellent condition (contains AECOM quadrats 6 and 4), and meets the condition threshold requirement for the Commonwealth-listed Banksia Woodlands of the Swan Coastal Plain TEC. Located adjacent on Lot 2 is 0.82 ha of BaEpPf which is mapped as completely degraded and is not included as part of the Commonwealth-listed Banksia Woodlands of the Swan Coastal Plain TEC. Also, a small (0.05 ha) area of the Eucalyptus woodland which may be FCT/SCP 20b TEC (contains AECOM quadrat 5), in very good condition. Patch 1 also supports occurrences of threatened flora species *Conospermum undulatum* (Vulnerable) and priority flora *Isopogon autumnalis* (Priority 3).
- Patch 2: Contained within Lot 84 is 0.35 ha of BaEpPf which is inferred as being FCT/SCP 20a (contains AECOM quadrat 13) and 0.14 ha of BmXpEc which is inferred as being FCT/SCP 23a; however there is some similarity with other FCT/SCPs such as 20a and 20b (refer to Table 3-4) (contains AECOM relève 12). FCT/SCP 20a is a State-listed TEC (Critically Endangered) and whilst this patch represents two discreet areas that are different vegetation communities and inferred FCTs they are broadly defined as Banksia Woodland. Furthermore, due to the connection of canopies of trees these two areas are considered representative of the same patch. Whilst the area falls outside the required 0.5 ha by a minute amount the precautionary principle has been applied and therefore, the patch meets the threshold requirements for the Commonwealth listed Banksia Woodlands of the Swan Coastal Plain TEC. Patch 2 also supports occurrences of threatened flora species *Conospermum undulatum* (Vulnerable) and priority flora *Isopogon autumnalis* (Priority 3).
- Patch 3: Contains approximately 0.3 ha of BmXpEc which is inferred as being FCT/SCP 23a (refer to Table 3-4) (contains AECOM quadrat 9 and relève 8), which is not a State-listed TEC and whilst it is broadly considered to be Banksia Woodlands, this patch is not considered to be representative of the Commonwealth-listed Banksia Woodlands of the Swan Coastal Plain TEC due to its degradation and patch size.
- Patch 4: a total of 2.07 ha of BaEpPf which is inferred as being FCT/SCP 20a (refer to Table 3-4) (contains JBS&G quadrat S01), which is a State-listed TEC, and given it is in excellent condition it meets the condition threshold requirement for the Commonwealth-listed Banksia Woodlands of the Swan Coastal Plain TEC. Patch 4 also supports occurrences of threatened flora species *Conospermum undulatum* (Vulnerable) and priority flora *Isopogon autumnalis* (Priority 3).



Figure 3-3: Conservation Significant Ecological Communities within the Amendment Area

### 3.1.5 Conservation Significant Flora

AECOM undertook an ecological spring survey, incorporating flora and vegetation in October 2019 (AECOM 2020). The survey recorded data from twelve quadrats and eight relevés, covering a broader area of the Wattle Grove locality. The result of this survey has been augmented by the further survey work by JBS&G. It is considered that the MRS amendment area has been adequately surveyed and values appropriately assessed.

AECOM (2020) recorded two conservation significant flora taxa, concentrated in two localised areas, within the MRS amendment area (Appendix B).

- *Conospermum undulatum* (T)
- *Isopogon autumnalis* (P3), previously named *Isopogon drummondii*.

The AECOM field survey was undertaken at an appropriate time to identify conservation significant orchid species if present. JBS&G conducted flora and vegetation surveys in October 2021 and August and October 2022, incorporating both previously surveyed and unsurveyed lots within the MRS amendment area.

In addition, flora surveys conducted by JBS&G in January 2022 recorded observations of conservation significant flora from the boundary of Lots 210 and 801. Observations of Lot 210 and Lot 801 noted the presence of *Conospermum undulatum* (T) and *Isopogon autumnalis* (P3).

***Conospermum undulatum*** (waxy-leaved smokebush) is an erect shrub which grows to 1.5 m height and is characterised by its fibrous, longitudinally fissured stems and wide leaves with wavy margins. It is listed as Vulnerable under the BC Act and EPBC Act and is ranked as Vulnerable (VU) under World Conservation Union (IUCN 1994) Red List criterion B1+2c, with its main threats being listed as further land clearing, poor habitat quality, road and firebreak maintenance, inappropriate fire regimes, weeds, recreational activities and rabbit grazing (DEC 2009). *Conospermum undulatum* is recorded from 25 historical populations, comprising 83 subpopulations. However, only 20 populations currently contain extant plants (DEC 2009). It occurs on sand and sandy clay soils, often over laterite, on flat or gently sloping sites between the Swan and Canning Rivers. A few records are from slightly swampy habitat. Habitat critical to the survival of *Conospermum undulatum* includes the area of occupancy of important populations and areas of similar habitat surrounding important populations (DEC 2009). Important populations of *Conospermum undulatum* are listed in the species' recovery plan.

***Isopogon autumnalis*** is an erect shrub growing to 1 m height with cream-yellow flowers and mostly terete leaves (Rye and MacFarlane 2019). It is listed as a Priority 3 taxon by DBCA. It is known from a large range extending from the southern Lesueur Sandplains through the Swan Coastal Plain and Dandaragan Plateau to the Northern Jarrah Forrest. It prefers white, grey or yellow sand, often over laterite. It was previously known as *Isopogon drummondii* but was renamed in 2019 due to lack of a type specimen and descriptions being based on cultivated specimens (Rye and MacFarlane 2019). Variants of the taxon with larger leaves were transferred to *Isopogon sphaerocephalus*.

Two additional conservation significant flora species, *Banksia mimica* and *Lasiopetalum glutinosum* subsp. *glutinosum*, were identified in the 2018 desktop assessment through DBCA records (360 Environmental 2018). *Banksia mimica* was previously recorded southeast of the Crystal Brook Road and Brentwood Road junction. All properties in this vicinity have since been cleared for residential development, and no native vegetation remains. *Banksia mimica* was not recorded during the field survey (AECOM 2020) or by JBS&G during subsequent site surveys.

Records of *Lasiopetalum glutinosum* within the site are associated with Paganoni Swamp, approximately 60 km southwest of the site (360 Environmental, 2018)). The occurrence of *Lasiopetalum glutinosum* within the site is therefore considered a result of mapping inaccuracies. AECOM determined that the species is unlikely to occur within the site, given it is associated with lateritic outcrops on the Darling Scarp. AECOM (2020) did not identify *Lasiopetalum glutinosum* during the survey or JBS&G during subsequent site surveys.

### Targeted flora survey – *Drakea elastica*

On 25 August 2021 an experienced JBS&G ecologist visited Lot 254 Victoria Road, Wattle Grove to undertake a targeted flora survey for conservation significant species. Vegetation at Lot 254 is an open to sparse *Banksia* woodland over closed, medium-low shrubland. As previously discussed, the vegetation (BaEpPf) within Lot 254 has been inferred as FCT/SCP 20a *Banksia attenuata* woodlands over species rich dense shrublands.

The survey primarily targeted the Threatened (T) orchid species *Drakea elastica*, a small, tuberous orchid, whose distinctive leaves appear at ground level in late winter. Remnant native vegetation within the lot was traversed at 10 m intervals and the ground was observed for *Drakea elastica* leaves. The survey tracks were recorded on a Garmin™ GPS (Figure 1.2).

No *Drakea elastica* were identified by this survey, though one other conservation significant taxa, *Conospermum undulatum* (T), previously identified from Lot 254, was observed in abundance. *Isopogon autumnalis* (P3), previously named *Isopogon drummondii*, was also seen in abundance. *Conospermum undulatum* (T) was also visible, flowering, in the adjacent Lot 2.

Vegetation within the remnant was in Very Good to Excellent condition, but with significant invasive weed species at the edges. Significant weed taxa observed during the *D. elastica* survey included \**Acacia iteaphylla* (Flinders Range wattle), \**Leptospermum laevigatum* (Victorian tea tree), \**Cytisus proliferus* (tree lucerne), \**Eragrostis curvula* (African love grass), \**Ehrharta longifolia* (annual veldt grass) and \**Asparagus asparagoides* (bridal creeper).

Understorey vegetation was dense and leaf litter at the site had built up to around 20 cm depth, mostly obscuring the ground, and resulting in high fuel loadings that may present a fire hazard. This also resulted in a low level of detectability for *Drakea elastica*, though in such circumstances, it was unlikely to be present as any individuals would not receive sufficient light.

## 3.2 Fauna

### 3.2.1 Terrestrial Fauna Habitat

A terrestrial fauna survey was undertaken by AECOM in October 2019 (Appendix B), which primarily focused on mapping fauna habitats and assessing their potential to be utilised by conservation significant fauna species within the wider Wattle Grove area. Fauna habitats were assessed for specific habitat components, including consideration of structural diversity and refuge opportunities for fauna. The survey covered a broader area than the site, and six broadly defined habitats were mapped in the survey area, with only three of these habitats mapped within the MRS amendment area. Further surveys undertaken by JBS&G have corroborated the findings of the AECOM surveys within the MRS amendment area.

Fauna habitats within the MRS amendment area has been severely compromised through historic and ongoing land uses, which have resulted in the clearing of the majority of native vegetation, and degradation of the little remnant native vegetation through ongoing rural land uses. The remnant vegetation provides the greatest significant of fauna habitat, comprising Banksia Woodland and Eucalyptus Woodland, which exist in four distinct patches (Figure 3.3). Eucalyptus Woodland was mapped as Completely Degraded and Very Good, where Banksia Woodland was mapped as completely Degraded to Excellent.

The habitat types of 'Planted and Maintained Gardens' and 'Scattered Trees' are both highly disturbed and highly degraded. These habitat types contain a mixture of native and non-native eucalypt trees, as well as other introduced species such as Cape Lilac and Jacaranda. The main distinction between the two habitat types is the understorey; understorey is not present in the Scattered Trees habitat and is variable in the Planted and Maintained Gardens habitat. These habitat types, whilst highly degraded, retain some value for species of conservation significance, namely black cockatoos. These habitat types may be utilised as breeding, roosting and/or foraging habitat by the Forest Red-tailed Black Cockatoo, Carnaby's Cockatoo and Baudin's Cockatoo.

The majority of the MRS amendment area lacks any natural attributes and is now only utilised by generally common and widespread fauna species with non-specific requirements which allow them to persist in disturbed to highly disturbed habitats. As a result, the fauna diversity is well below levels present prior to historical disturbances having occurred. Due to these factors, most of the MRS amendment area has very little conservation significance to fauna in general.

The terrestrial fauna habitat is described in Table 3-5 and Figure 3-4.

**Table 3-5: Fauna Habitats Recorded within the MRS amendment area**

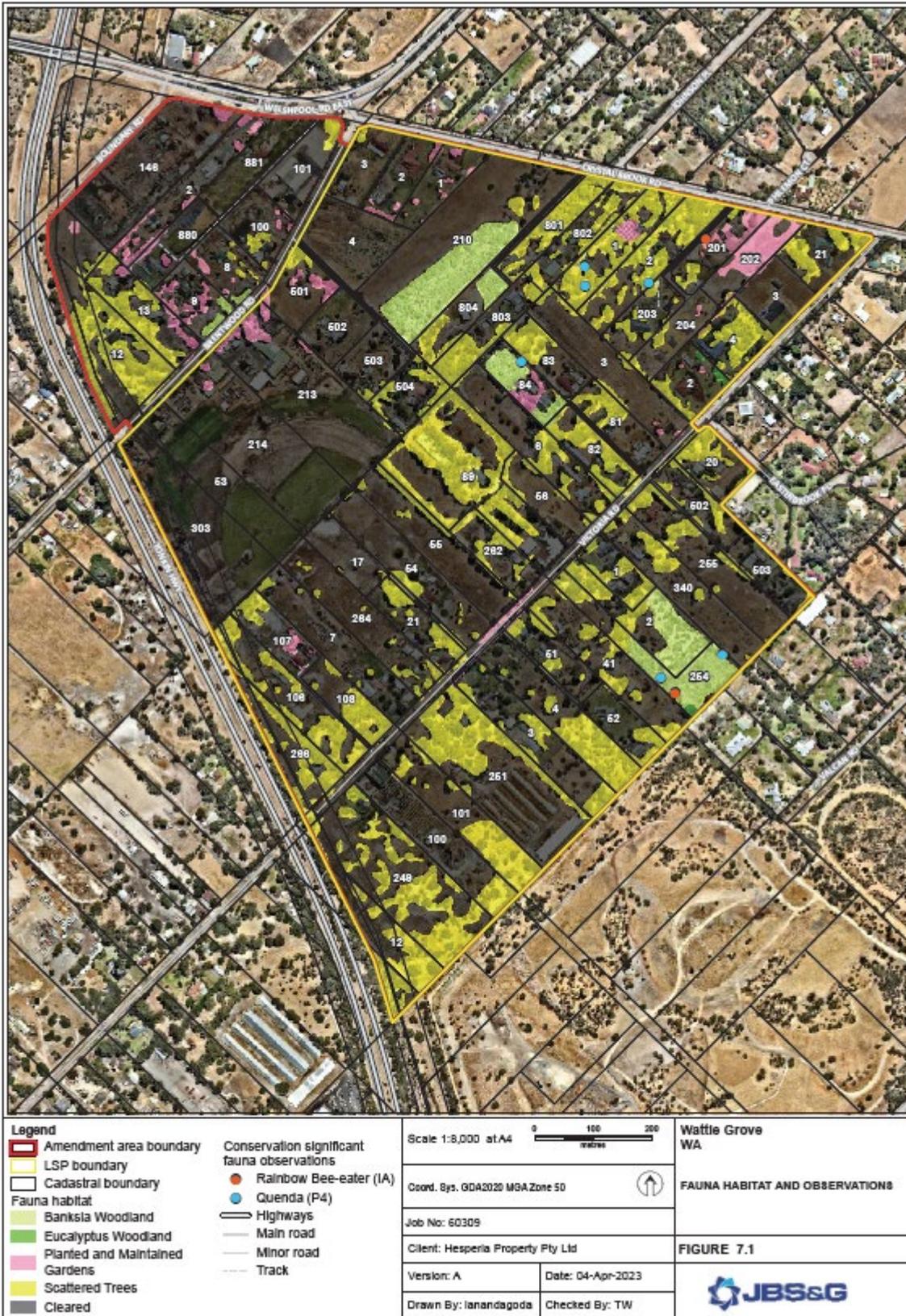
Fauna Habitat	Description	Conservation Significant Species with Potential to Utilise Habitat	Area within MRS amendment area	Representative Photo
Banksia Woodland	<p>This habitat generally comprised a low open woodland of Banksia and Eucalyptus over a low open shrubland on loamy, sandy brown soil (AECOM 2020).</p> <p>The habitat is generally considered high quality due to presence of Banksia, its complexity and limited disturbance levels. Habitat quality is reduced where areas are significantly degraded due to impacts from clearing and edge effects (AECOM 2020).</p> <p>Significant habitat characteristics include (AECOM 2020):</p> <ul style="list-style-type: none"> <li>• dense understorey common</li> <li>• logs of various sizes are common</li> <li>• fine and course leaf litter common to abundant</li> <li>• bare ground occasionally present</li> <li>• absence of stones and boulders</li> <li>• Large mature trees in rare to occasional abundance</li> <li>• Large hollows generally absent, small hollows common.</li> </ul>	<ul style="list-style-type: none"> <li>• Generally good quality foraging habitat for Carnaby’s Cockatoo and Baudin’s Cockatoo (AECOM 2020)</li> <li>• Low to moderate quality foraging habitat for the Forest Red-tailed Black Cockatoo (AECOM)</li> <li>• Contains occasional breeding tree for black cockatoos (AECOM 2020)</li> <li>• Habitat for Quenda (AECOM 2020).</li> </ul>	4.66 ha	 <p>Source: AECOM 2020</p>

Fauna Habitat	Description	Conservation Significant Species with Potential to Utilise Habitat	Area within MRS amendment area	Representative Photo
Eucalyptus Woodland	<p>This habitat is variable throughout the survey area though generally contains a Eucalyptus woodland / open forest over a low shrubland over sandy brown soils (AECOM 2020).</p> <p>This habitat is considered high to moderate (depending on degree of degradation) quality due to the structural complexity and disturbance levels (AECOM 2020).</p> <p>Significant habitat characteristics include (AECOM 2020):</p> <ul style="list-style-type: none"> <li>• presence of large mature eucalypts</li> <li>• dense understorey occasionally present</li> <li>• logs of various sizes in variable abundance</li> <li>• fine and coarse leaf litter common</li> <li>• bare ground occasionally present</li> <li>• absence of stones and boulders</li> <li>• large hollows occasionally present, small hollows common</li> <li>• soils of areas at base of Darling scarp contained pea-gravel</li> </ul>	<ul style="list-style-type: none"> <li>• Potential foraging, breeding and roosting habitat for (AECOM 2020):               <ul style="list-style-type: none"> <li>○ Forest Red-tailed Black Cockatoo</li> <li>○ Carnaby’s Cockatoo</li> <li>○ Baudin’s Cockatoo</li> </ul> </li> <li>• Habitat for Quenda (AECOM 2020)</li> </ul>	0.13 ha	 <p>Source: AECOM 2020</p>  <p>Source: AECOM 2020</p>

Fauna Habitat	Description	Conservation Significant Species with Potential to Utilise Habitat	Area within MRS amendment area	Representative Photo
Planted and Maintained Gardens	<p>Highly variable habitat including areas of planted and maintained native and introduced vegetation (AECOM 2020).</p> <p>The habitat is considered low to moderate quality due to disturbance levels and limited habitat complexity (AECOM 2020).</p> <p>Significant habitat characteristics include (AECOM 2020):</p> <ul style="list-style-type: none"> <li>• mature trees rare</li> <li>• variability of understorey, with areas of dense understorey generally absent</li> <li>• general lack of hollows</li> <li>• bare sandy ground abundant</li> <li>• absence of stones, boulders and rock crevices.</li> </ul>	<ul style="list-style-type: none"> <li>• Predominantly foraging habitat, but also occasionally potential breeding and roosting habitat for (AECOM 2020): <ul style="list-style-type: none"> <li>○ Forest Red-tailed Black Cockatoo</li> <li>○ Carnaby’s Cockatoo</li> <li>○ Baudin’s Cockatoo</li> </ul> </li> <li>• Habitat for Quenda (AECOM 2020).</li> </ul>	2.80 ha	 <p>Source: AECOM 2020</p>
Scattered Trees	<p>This habitat is varied and contains large mature native and non-native eucalypt trees, as well as other introduced species such as Cape Lilac and Jacaranda. Trees were generally recorded over cleared areas. (AECOM 2020)</p> <p>The significant fauna habitat characteristics include (AECOM 2020):</p> <ul style="list-style-type: none"> <li>• presence of large mature trees</li> <li>• absence of dense understorey</li> <li>• small hollows are common, large hollows are rare</li> <li>• logs of all sizes are rare to occasionally present</li> </ul>	<ul style="list-style-type: none"> <li>• Potential foraging, breeding and roosting habitat for (AECOM 2020): <ul style="list-style-type: none"> <li>○ Forest Red-tailed Black Cockatoo</li> <li>○ Carnaby’s Cockatoo</li> <li>○ Baudin’s Cockatoo</li> </ul> </li> <li>• Marginal habitat for Quenda (AECOM 2020).</li> </ul>	26.90	 <p>Source: AECOM 2020</p>

Fauna Habitat	Description	Conservation Significant Species with Potential to Utilise Habitat	Area within MRS amendment area	Representative Photo
	<ul style="list-style-type: none"> <li>• coarse and fine litter are present but generally only under trees.</li> <li>• bare sandy ground abundant</li> <li>• absence of stones, boulders and rock crevices.</li> </ul>			 <p>Source: AECOM 2020</p>  <p>Source: AECOM 2020</p>

Fauna Habitat	Description	Conservation Significant Species with Potential to Utilise Habitat	Area within MRS amendment area	Representative Photo
Cleared Ground	<p>Generally consists of areas which have been cleared (e.g. paddocks) and now comprise bare soil and / or weeds (may contain the occasional shrub/ tree), or hardstand areas (e.g. roads).</p> <p>Habitat is considered very low quality.</p>	This habitat may contain the occasional individual foraging tree/ shrub for black cockatoos.	91.10 ha	



File Name: I008PMPMR004V001.jpg used JBS Perth Project\1\Open\Hesperia\0000 Wattle Grove MRG and LPS Amendment\GIS\Map\RD6\_Rev\_A\0000\_07\_01\_Fauna\habitat.mxd  
 Image Reference: www.nearmap.com - Imagery Date: 20 February 2023.

Figure 3-4: Fauna habitat

### 3.2.2 Terrestrial Fauna Occurrence

Fifty-one vertebrate fauna species were recorded within the MRS amendment area and in adjacent areas during the AECOM and JBS&G field surveys. This comprised 36 bird, 11 mammal, one amphibian and three reptile species. The species observed during field surveys are presented in Table 3-6.

**Table 3-6: Fauna Species Observed During Field Surveys**

Species	Common Name	Status	Observations
<b>Birds</b>			
<i>Anas superciliosa</i>	Pacific Black Duck	Native	Observed in artificial ponds
<i>Anthochaera carunculata</i>	Red Wattlebird	Native	Commonly seen and heard throughout survey area
<i>Cacatua roseicapilla roseicapilla</i>	Galah	Native	Observed multiple times during survey
<i>Cacatua sanguinea</i>	Western Corella	Native	Small flock observed in trees
<i>Cacomantis flabelliformis</i>	Fan-tailed Cuckoo	Native	Heard in trees in paddock
<i>Calyptorhynchus banksii</i>	Forest Red-tailed Black Cockatoo	Native	Two birds observed foraging in Marri tree, multiple birds seen flying over area, multiple observations of foraging evidence
<i>Chenonetta jubata</i>	Australia Wood Duck	Native	Observed multiple times during survey
<i>Chrysococcyx basalis</i>	Horsfield's Bronze Cuckoo	Native	Heard multiple times
<i>Colluricincla harmonica</i>	Grey Shrike thrush	Native	Heard in Flooded Gums adjacent drainage line
<i>Corvus coronoides</i>	Australian Raven	Native	Commonly seen and heard throughout survey
<i>Cracticus tibicen</i>	Australian Magpie	Native	Commonly seen and heard throughout survey
<i>Cracticus torquatus</i>	Grey Butcherbird	Native	Observed flying through maintained gardens
<i>Dacelo novaeguineae</i>	Laughing Kookaburra	Naturalised exotic	Commonly seen and heard throughout survey area
<i>Dromaius novaehollandiae</i>	Emu	Native	Individual observed in an enclosure
<i>Petrochelidon nigricans</i>	Tree Martin	Native	Flock of 10 birds observed flying in survey area
<i>Gerygone fusca</i>	Western Gerygone	Native	Seen in survey area
<i>Grallina cyanoleuca</i>	Magpie Lark	Native	Commonly seen and heard throughout Survey
<i>Gavicalis virescens</i>	Singing Honeyeater	Native	Common throughout survey area
<i>Malurus splendens</i>	Splendid Fairywren	Native	Seen and heard twice in survey area
<i>Merops ornatus</i>	Rainbow Bee-Eater	Native	Multiple observations recorded throughout survey area
<i>Ocyphaps lophotes</i>	Crested Pigeon	Native	Observed several times
<i>Pardalotus striatus</i>	Striated Pardalote	Native	Commonly seen and heard throughout survey area
<i>Pavo cristatus</i>	Common Peafowl	Introduced	Heard several times
<i>Phaps chalcoptera</i>	Common Bronzewing	Native	Observed several times in survey area
<i>Phylidonyris niger</i>	White-cheeked Honeyeater	Native	Observed multiple times in survey area
<i>Phylidonyris novaehollandiae</i>	New Holland Honeyeater	Native	Commonly seen and heard throughout survey
<i>Platycercus spurius</i>	Red-capped Parrot	Native	Observed individuals and foraging evidence multiple times
<i>Platycercus zonarius</i>	Australian Ringneck	Native	Commonly seen and heard throughout survey area
<i>Rhipidura leucophrys</i>	Willie Wagtail	Native	Commonly seen and heard throughout survey area
<i>Spilopelia senegalensis senegalensis</i>	Laughing Turtle Dove	Introduced	Seen and heard multiple times in trees and flying over survey area
<i>Taeniopygia guttata</i>	Zebra Finch	Native	Two finches observed in Jarrah tree
<i>Threskiornis moluccus</i>	Australian White Ibis	Native	Observed multiple times during survey
<i>Todiramphus sanctus</i>	Sacred Kingfisher	Native	Individual in tree in maintained garden
<i>Zanda latirostris</i>	Carnaby's Cockatoo	Native	Foraging evidence observed
<i>Zosterops lateralis</i>	Silver-eye	Native	Observed twice in survey area, flying through trees and in banksia woodland
<b>Mammals</b>			

Species	Common Name	Status	Observations
<i>Canis familiaris</i>	Dog	Introduced	Common throughout survey area
<i>Capra hircus</i>	Goat	Introduced	Observed in paddock
<i>Equus asinus</i>	Donkey	Introduced	Observed in field
<i>Equus caballus</i>	Horse	Introduced	Horses observed in multiple paddocks in survey area
<i>Felis catus</i>	Cat	Introduced	Seen once during survey
<i>Isoodon fusciventer</i>	Quenda	Native	Observed directly and indirectly (conical digging and scat) several times in survey area
<i>Lama glama</i>	Llama	Introduced	Observed in field
<i>Macropus fuliginosus</i>	Western Grey Kangaroo	Native	Observed directly and indirectly several times in survey area
<i>Oryctolagus cuniculus</i>	Rabbit	Introduced	Observed directly and indirectly several times in survey area
<i>Ovis aries</i>	Sheep	Introduced	Observed in paddock
<i>Vulpes vulpes</i>	Red Fox	Introduced	Multiple scats recorded
<b>Amphibians</b>			
<i>Crinia glauerti</i>	Clicking Froglet	Native	Multiple
<b>Reptiles</b>			
<i>Cryptoblepharus buchananii</i>	Buchanan's Snake- Eyed Skink	Native	Seen multiple times on trees throughout survey area
<i>Pogona minor minor</i>	Western Bearded Dragon	Native	Observed in survey area
<i>Tiliqua rugosa rugosa</i>	Bobtail	Native	Observed twice during survey

### 3.2.3 Conservation Significant Terrestrial Fauna

Four of the 51 recorded vertebrate fauna species are identified as having some conservation significance, including three birds and one mammal, summarised as follows:

- Forest Red-Tailed Black Cockatoo *Calyptorhynchus banksii* (listed as Vulnerable under the EPBC Act and the BC Act).
- Carnaby's Cockatoo *Zanda latirostris* (listed as Endangered under the EPBC Act and the BC Act).
- Quenda *Isoodon fusciventer* (listed as Priority 4 by DBCA). Refer to Plate 3 for photographs of Quenda diggings and scat recorded within the survey area.
- Rainbow Bee-Eater *Merops ornatus* (listed as Marine under the EPBC Act). Species listed as Marine under the EPBC Act are only considered significant in Commonwealth land and as the MRS amendment area does not contain Commonwealth land, these species will not be further discussed within the report.

Based on the desktop assessment and the field survey, an additional conservation significant fauna species is also considered to have the potential to utilise the habitats within the survey area:

- Baudin's Cockatoo *Zanda baudinii* - listed as Vulnerable under the BC Act and the EPBC Act.

#### Black Cockatoo Survey

Targeted Black Cockatoo surveys were conducted to identify potential breeding, roosting and foraging habitat for the three threatened black cockatoo species that occur in WA, as all three species have the potential to utilise the habitats present in the MRS Amendment Area:

- Carnaby's Cockatoo *Zanda latirostris* (Endangered under both EPBC and BC Acts);
- Baudin's Cockatoo *Zanda baudinii* (Endangered under both EPBC and BC Acts); and
- Forest Red-tailed Black Cockatoo *Calyptorhynchus banksii naso* (Vulnerable under both EPBC and BC Acts).

The AECOM and JBS&G surveys were undertaken in accordance with the DSEWPaC (2012), the draft DotEE (2017) and the DAWE (2022) referral guidelines for all three black cockatoos, as were relevant at that time. These survey's will inform future habitat assessment and reporting.

### **Quenda**

The quenda (*Isoodon obesulus*) is a medium-sized ground dwelling marsupial of the bandicoot and bilby family (Marsupialia: Peramelemorphia) and is endemic to the south-west of Western Australia. This species is identified as a Priority 4 species at a state level under the BC Act, however it is not listed as threatened under either State or Commonwealth legislation. Like many small-to-medium sized Australian marsupials, quenda have suffered a drastic population decline post European settlement and it is estimated that their historical range distribution has contracted by approximately 40% (Abbott 2008). The Priority 4 listing means that this species is categorised as "Rare, Near Threatened and other species in need of monitoring".

The species is found in forest, woodland, heath and shrub communities, and preferred habitat usually consists of a combination of sandy soils and dense heathy vegetation. Quenda are known to inhabit urban backyards, urban parklands, bush fragments, and conservation reserves, even where no predator control programs occur (Bryant, Kobryn, Hardy, & Fleming, 2017; Howard *et al.*, 2014; Valentine *et al.*, 2013). However, they prefer dense, understory vegetation and are found in both open forest, and dense vegetation near swamps and watercourses (Valentine *et al.*, 2013). They are currently found in an arc along the Swan Coastal Plain with some sightings near Geraldton in the North extending past Cape Naturaliste and Cape Leeuwin to the south, through to Albany and Esperance in the southeast.

The habitat types of Cleared and Scattered trees do not provide favourable habitat for quenda, as they lack the dense understorey vegetation and cover that the species prefers. The preferred Quenda habitat, primarily the Banksia Woodland, will be retained in Conservation areas to ensure the species can continue to occupy the MRS amendment area. Quenda are not considered to be conservation significant in the context of the proposed MRS amendment area due to the Priority 4 listing and limited suitable habitat.

### **Rainbow Bee-eater**

Whilst the Rainbow Bee-eater has historically been listed as a migratory species of conservation significance, it, has since been removed from the EPBC migratory species list. Currently, the Rainbow Bee-eater is only listed under the EPBC Act as "Marine", and therefore are only considered conservation significant in Commonwealth marine environments. In addition, the Rainbow Bee-eater is currently considered to be a low priority for management, although population size and trends have not been quantified, the population size is assumed to be reasonably large and there is little documented evidence of population declines (DAWE, 2021). Subsequently, this species is not considered to be conservation significant in the context of the proposed MRS amendment area.

## 4. Adequacy of Flora and Vegetation Surveys

### 4.1 Key Flora and Vegetation Survey Guideline Requirements

The flora and vegetation surveys considered in this memo were conducted in accordance with the EPA's (2016a) Technical Guidance Flora and Vegetation Surveys for Environmental Impact Assessment as outlined in Table 4-1.

**Table 4-1 Flora and vegetation guidance requirements (EPA 2016a)**

Survey Aspect	Overview of guideline requirement
Survey Timing	The recommended survey timing for surveys on the swan coastal plain is spring (September, October, November)
Survey Effort	<p>A detailed survey should include assessment of quadrats, multiple sampling periods and targeted surveys where appropriate</p> <p>A minimum of three quadrats should be sampled in each vegetation unit, with additional quadrats proportional to the size of the vegetation. To clarify vegetation unit boundaries, additional quadrats can be deployed.</p>

### 4.2 Flora and Vegetation survey adequacy assessment

#### 4.2.1 Survey 1: Wattle Grove South Ecological Surveys AECOM (2020)

An assessment of the accuracy and validity of the AECOM (2020) ecological survey against the EPA's Technical Guidance: Flora and Vegetation Surveys for Environmental Impact Assessment (2016a) has been undertaken. This technical guidance provides a range of potential limitations and constraints that may affect the thoroughness of a field survey and the conclusions reached. Results of this assessment are provided below in Table 4-2. In summary, the survey was predominately constrained by access restrictions within the survey area, however it is considered to provide an adequate level of survey for lots accessed for the purposes of the MRS amendment.

**Table 4-2 AECOM (2020) potential limitations and constraints**

Potential limitation	Impact on assessment	Comment
Availability of contextual information at a regional and local scale	<b>Not a constraint</b>	The survey was undertaken on the Swan Coastal Plain which has been well studied and documented with ample literature available. Furthermore, two desktop assessments were undertaken of the site in question (360 Environmental 2018; AECOM 2020) which informed the field survey methodology.
Competency / experience of the team carrying out the survey, including experience in the bioregion surveyed	<b>Not a constraint</b>	Competency and experience of field personnel is presented within Section 4.2 of the report. The field survey was undertaken by Floora de Wit, an ecologist with 13 years of experience undertaking flora and vegetation assessments on the Swan Coastal Plain. Her qualifications include: <ul style="list-style-type: none"> <li>• Bachelor of Science (Environmental Biology); and</li> <li>• Postgraduate Diploma (Environmental Management and Impact Assessment).</li> </ul>
Completeness and further work which might be needed (i.e., was the relevant survey area fully surveyed).	<b>Potential constraint</b>	Floristic data was collected from 4 non-permanent quadrats and 3 relèvé's within the MRS amendment area. Data collected included the presence of plant species, their cover abundance, structural composition of vegetation, physical environment, and presence / absence of disturbance.
Was the appropriate area fully surveyed (effort and extent)	<b>Not a constraint.</b>	Floristic data was collected from 4 non-permanent quadrats and 3 relèvé's across the MRS amendment area. Quadrats were 10x10 m in size. Vegetation type and vegetation condition was mapped across the entirety of the survey area.
Access restrictions within the survey area	<b>Constraint</b>	Access to undertake the flora assessment was not provided for a number of private lots within the project area. Of the 77 private

Potential limitation	Impact on assessment	Comment
		properties within the MRS amendment area, 52 (67%) were available for surveying.
Survey timing, rainfall, season of survey	<b>Potential constraint</b>	<p>The survey was undertaken in October 2019 following a period of below average rainfall in the preceding months.</p> <p>A total of six flora species of conservation significance were determined likely to be present within the study area based on a desktop assessment. Of these species, the following three would not be flowering during the time in which the survey was undertaken:</p> <ul style="list-style-type: none"> <li>• <i>Banksia mimica</i> – December to February</li> <li>• <i>Haemodorum loratum</i> – November</li> <li>• <i>Isopogon drummondii</i> – February to June</li> </ul>
Disturbance that may have affected the results of the survey such as fire, flood or clearing	<b>Not a constraint.</b>	<p>Vegetation within the study area is highly fragmented as a result of clearing for rural and residential purposes. Additionally, degrading processes that are currently active within the site include:</p> <ul style="list-style-type: none"> <li>• edge effects;</li> <li>• weed incursion; and</li> <li>• a drying climate.</li> </ul>

#### 4.2.2 Survey 2: Targeted Flora, Habitat and Supplementary Flora & Vegetation surveys JBS&G 2021 and 2022

Five further flora and vegetation surveys have been completed of the MRS amendment area by JBS&G as follows:

- Tree survey (February 2021): Habitat tree survey of various lots and the Victoria Road reserve.
- Targeted flora survey (August 2021): 1,500 m meandering survey at 10 m intervals throughout approximately 1.65ha.
- Supplementary spring vegetation and flora assessment (October 2021): Various lots, including 1 quadrat, and numerous relève and observation points.
- Reconnaissance vegetation and flora assessment (January 2022) (Appendix F): Various lots, including relève and observation points.
- Further reconnaissance vegetation and flora assessment of targeted lots (October 2022): Various lots, including relève and observation points.

The supplementary surveys in 2021 included a targeted flora survey in late winter for *Drakea elastica* on Lot 254 Victoria Road and spring survey in October for Lots 12 and 13 Brentwood Road, Lots 81, 106 and 107 Victoria Road and Lots 210 and 804 Crystal Brook Road. One quadrat and one relève were surveyed in the areas of vegetation on each of these previously unsurveyed lots, with the exception of Lot 210, as access to this lot was still not granted at the time.

In lieu of this limited access, the surveying botanists made observations of Lot 210 from the fence line shared with the adjacent Lot 804. The observations were adequate to enable vegetation type and condition mapping to be extrapolated for Lot 210, using the Keighery scale (1994), which is consistent with the mapping completed for all other lots surveyed within the MRS amendment area.

In January 2022, JBS&G undertook a reconnaissance flora and vegetation assessment which included observations from the boundary of several other previously unsurveyed lots where access had still not been granted. This survey included Lots 21, 801, 802 and 803 Crystal Brook Road and Lot 4 (No.36) Victoria Road. Vegetation type and condition were assessed based on visual observations made from the fence line of adjacent lots.

In October 2022, JBS&G undertook a further reconnaissance flora and vegetation assessment, to provide further gap analysis. Data from multiple relèvements and observation points was collected across Lots 1, 54 and 83 Victoria Road, Lots 502, 503 and 504 Brentwood Road and Lot 3 Crystal Brook Road.

As such, the majority of the MRS amendment area (~92%) has been subject to an ecological assessment. Survey effort has focused on areas of remnant native vegetation, based on aerial imagery assessments undertaken as part of desktop surveys. All areas of intact remnant native vegetation identified in the desktop assessments has been subject to some form of field survey.

Table 4-3 displays the evaluation of the Targeted Flora survey, supplementary vegetation and flora assessment, and reconnaissance vegetation and flora assessment from lot boundaries undertaken by JBS&G in 2021 and 2022, against a range of potential limitations that may have had effect on that assessment. Based on this evaluation, the assessment has not been subject to constraints that would affect the thoroughness of the assessment and the conclusions reached. It is considered that these surveys provide an adequate level of survey to meet EPA guidance for the purposes of the MRS Amendment.

**Table 4-3: Targeted Flora and Supplementary Flora & Vegetation surveys JBS&G (2021 & 2022) – limitations and constraints.**

Potential limitation	Impact on assessment	Comment
Availability of contextual information at a regional and local scale	<b>Not a constraint</b>	The survey was undertaken on the Swan Coastal Plain which has been well studied and documented with ample literature available. Furthermore, desktop assessments were undertaken of the site in question which informed the field survey methodology
Competency / experience of the team carrying out the survey, including experience in the bioregion surveyed	<b>Not a constraint</b>	The field surveys were undertaken by: Rachael Pratt, senior ecologist with over 20 years of experience undertaking flora and vegetation assessments on the Swan Coastal Plain). Richard Lloyd, principal ecologist with over 20 years of experience.
Completeness and further work which might be needed (i.e., was the relevant survey area fully surveyed).	<b>Not a constraint.</b>	Floristic data was collected from 1 non-permanent quadrat, and numerous relèvements and observation points across the site. A targeted survey was undertaken in August 2021, comprising 1500 m of meandering survey at 10 m intervals throughout approximately 1.65 ha at Lot 254 Victoria Road. Data collected included the presence of plant species, their cover abundance, structural composition of vegetation, physical environment, and presence / absence of disturbance.
Was the appropriate area fully surveyed (effort and extent)	<b>Not a constraint.</b>	Floristic data was collected from 1 non-permanent quadrat, and various relèvements and observation points across the site. Quadrats were 10x10 m in size. Vegetation type and vegetation condition was mapped across the entirety of the survey area.
Access restrictions within the survey area	<b>Potential constraint.</b>	Access to undertake the targeted flora and supplementary flora and vegetation surveys was not provided for all of the previously surveyed and 8 previously non surveyed lots, and a further 13 lots were surveyed from the boundary of the property.
Survey timing, rainfall, season of survey	<b>Potential constraint</b>	Flora and vegetation surveys were undertaken on 25 August 2021, 7 October 2021, 24 January 2022, 22 August 2022 and 6 October 2022.  A total of six flora species of conservation significance were determined likely to be present within the study area based on a desktop assessment. Of these species, two would not be flowering during the time in which the survey was undertaken. These include: <ul style="list-style-type: none"> <li>• <i>Haemodorum loratum</i> – November</li> <li>• <i>Isopogon drummondii</i> – February to June</li> </ul>

Potential limitation	Impact on assessment	Comment
Disturbance that may have affected the results of the survey such as fire, flood or clearing	<b>Not a constraint.</b>	Vegetation within the study area is highly fragmented as a result of clearing for rural and residential purposes. Additionally, degrading processes that are currently active within the site include: <ul style="list-style-type: none"><li>• edge effects</li><li>• weed incursion</li><li>• a drying climate.</li></ul>

## 5. Adequacy of Fauna Surveys

### 5.1 Key Fauna survey guideline requirements

The fauna surveys considered in this memo were conducted in accordance with key survey requirements prescribed by EPA’s (2020) Technical Guidance: Terrestrial vertebrate fauna surveys for environmental impact assessment as outlined in Table 5-1.

**Table 5-1 Fauna guidance requirements (EPA 2020)**

Survey Aspect	Overview of guideline requirement
Survey Timing	The recommended survey timing for surveys on the swan coastal plain is generally September for December.
Survey Effort	Surveys for EIA should use primary techniques to develop species inventories. Supplementary techniques can then be used to build on and refine results as necessary. Primary techniques include but are not limited to Pit Traps, Funnel Traps, Aluminium box traps, cage traps, spotlighting and head torching, observation – bird surveys, opportunistic observations, searching for tracks and signs, acoustic surveys – audible calls and ultrasonic calls, and camera traps

### 5.2 Fauna survey adequacy assessment

**The majority of the site has been subject to an ecological or Black Cockatoo Habitat Assessment.**

AECOM (2020) conducted a Level 1 fauna survey in accordance with Technical Guidance – Terrestrial Fauna Surveys (EPA 2016b) and Technical Guidance – Sampling Methods for Terrestrial Vertebrate Fauna (EPA 2016c). The fauna survey was conducted by AECOM’s Ecologist in conjunction with the detailed flora and vegetation survey. Conducting the two surveys concurrently enabled consistent and clear mapping of the fauna habitats and vegetation communities. The Level 1 fauna survey primarily focused on mapping of fauna habitat and assessing this habitat for potential utilisation by conservation significant fauna species. Fauna habitats were assessed for specific habitat components, including consideration of structural diversity and refuge opportunities for fauna.

Records of all observed fauna and birds, species identified from distinctive calls and details of indirect evidence such as scats, tracks and diggings were documented. Particular attention was given to searching for conservation significant species identified in the desktop assessment as having potential to occur in the area. All observations were made between daylight hours of 0700 and 1700.

A targeted black cockatoo survey was conducted in conjunction with the Level 1 fauna survey and detailed flora and vegetation survey by AECOM Ecologists and Botanist. This survey was conducted over multiple mobilisations due to site accessibility, including 9 and 10 September 2019; 1 to 4, and the 8 October 2019; 18 and 21 November. JBS&G conducted a further tree survey over various lots within the MRS amendment area in February 2021 to supplement the habitat survey data.

## 6. Conclusions

The significant ecological findings from the assessment of the MRS amendment area are outlined below:

- Timings for the surveys undertaken for the Proposal were considered adequate based on EPA guidance, i.e. a primary survey and targeted survey undertaken during the spring season. The surveys were undertaken across multiple years with effort focused on areas of remnant native vegetation.
- The survey effort undertaken within the MRS amendment area is considered appropriate based on EPA's (2016a) guidance:
  - The area of greatest impact and habitat loss, areas of native vegetation and Banksia Woodlands, have been extensively surveyed over multiple years and seasons.
  - The MRS amendment areas has been surveyed with sufficient detail to characterise the receiving environment and to assess the vegetation condition, with targeted surveys undertaken to identify flora of conservation significance. In particular, the presence of TECs and a PEC within the MRS amendment area has been identified and FCT analysis undertaken.
  - An adequate number of quadrats have been undertaken within vegetation units (with the exception of vegetation unit EmMplp due to the small area of this unit located in Lot 254 Victoria Road) i.e. a minimum of three quadrats have been sampled in each vegetation unit. Information on flora and vegetation has been provided in a report that aligns with the requirements of the EPA (2016a). Desktop reviews and interrogation of recommended spatial data and existing ecological survey reports has been completed, with this information used to guide survey planning, with specific reference to determining the presence or absence of flora or ecological communities of conservation significance.
- Surveys over the Amendment Area meet the requirements for a detailed survey. Targeted searches for flora of conservation were completed. Information on survey effort and the location of quadrats is provided in all Appendix C as required by EPA (2016a) guidance.

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## 8. Limitations

### Scope of services

This report (“the report”) has been prepared by JBS&G in accordance with the scope of services set out in the contract, or as otherwise agreed, between the Client and JBS&G. In some circumstances, a range of factors such as time, budget, access and/or site disturbance constraints may have limited the scope of services. This report is strictly limited to the matters stated in it and is not to be read as extending, by implication, to any other matter in connection with the matters addressed in it.

### Reliance on data

In preparing the report, JBS&G has relied upon data and other information provided by the Client and other individuals and organisations, most of which are referred to in the report (“the data”). Except as otherwise expressly stated in the report, JBS&G has not verified the accuracy or completeness of the data. To the extent that the statements, opinions, facts, information, conclusions and/or recommendations in the report (“conclusions”) are based in whole or part on the data, those conclusions are contingent upon the accuracy and completeness of the data. JBS&G has also not attempted to determine whether any material matter has been omitted from the data. JBS&G will not be liable in relation to incorrect conclusions should any data, information or condition be incorrect or have been concealed, withheld, misrepresented or otherwise not fully disclosed to JBS&G. The making of any assumption does not imply that JBS&G has made any enquiry to verify the correctness of that assumption.

The report is based on conditions encountered and information received at the time of preparation of this report or the time that site investigations were carried out. JBS&G disclaims responsibility for any changes that may have occurred after this time. This report and any legal issues arising from it are governed by and construed in accordance with the law of Western Australia as at the date of this report.

### Environmental conclusions

Within the limitations imposed by the scope of services, the preparation of this report has been undertaken and performed in a professional manner, in accordance with generally accepted environmental consulting practices. No other warranty, whether express or implied, is made.

The advice herein relates only to this project and all results conclusions and recommendations made should be reviewed by a competent person with experience in environmental investigations, before being used for any other purpose.

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## **Appendix A 360 Environmental (2018) Environmental Assessment Report**



Various Lots, Wattle Grove

# Environmental Assessment Report

Prepared for:  
**Burgess Design Group**

April 2018

● people ● planet ● professional

Document Reference	Revision	Prepared by	Reviewed by	Admin Review	Submitted to Client:	
					Copies	Date
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2188AB	2 CLIENT DRAFT	CM	-	NL	1x electronic	13/03/18
2188AB	3 CLIENT FINAL	CM	KC	NL	1x electronic	24/04/18

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## 1 Introduction

### 1.1 Background

360 Environmental Pty Ltd was commissioned by Burgess Design Group Pty Ltd on behalf of the City of Kalamunda to prepare an environmental assessment report (EAR) for various lots bound by Tonkin Highway, Kelvin Road, Welshpool Road East, Fontano Road, Judith Road and Crystal Brook Road in Wattle Grove ('the site').

The purpose of this EAR is to inform a feasibility study on the future rezoning of the site from 'Rural' to 'Urban' under the Metropolitan Region Scheme (MRS).

The site is approximately 325 ha in size and is located approximately 14.75 km southeast of Perth's Central Business District (CBD). The site is situated within the City of Kalamunda local government area and is zoned 'Special Rural' and 'Rural Composite' under the City's Local Planning Scheme No. 3 (LPS 3).

### 1.2 Environmental Assessment Objectives

This Environmental Assessment Report (EAR) provides an overview of the general environmental features of the Site and includes an overview of the Site's remaining biological and social environment including wetlands, Aboriginal and non-Aboriginal Heritage sites, regional soil types, hydrology, geomorphology, flora, vegetation and fauna, planning context and social environment as determined through a review of existing information.

### 1.3 Scope of Works

The scope of works for this study is as follows:

- Literature review of relevant environmental and planning documents;
- Desktop review of geology, regional surface hydrology and groundwater information using databases and digital mapping information;
- Preliminary acid sulfate soils (ASS) assessment, including review of ASS risk mapping and local soil types;
- Desktop site assessment of contamination and review of historical and current land uses;
- Detailed desktop assessment of flora, vegetation, fauna from searches of the Department of Biodiversity, Conservation and Attractions' (DBCAs) Threatened and Priority searches, NatureMap and the Commonwealth's Protected Matters Search Tool;
- Review of mapped conservation areas;

- 
- Desktop heritage (Aboriginal and non-Aboriginal) assessment;
  - Identification of other environmental issues associated with proposed rezoning;  
and
  - Formulation of a report detailing the above.

## 2 Key Environmental Legislation and Policies

### 2.1 Commonwealth Legislation

#### 2.1.1 Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is the central piece of environmental legislation which protects Matters of National Environmental Significance (MNES) and broadly, to conserve Australia’s biodiversity. If a proposed action is likely to have a significant impact on any MNES, a referral to the Commonwealth Department of the Environment and Energy (DEE) is required.

### 2.2 State Legislation

#### 2.2.1 Environmental Protection Act 1986

The *Environmental Protection Act 1986* (EP Act) is the key legislative tool for environmental protection in Western Australia. It is administered by the Environmental Protection Authority (EPA) and the Minister for Environment. Under Part IV of the EP Act, the EPA undertakes environmental impact assessment of proposals and schemes to provide advice on environmental acceptability of developments. The environment impact assessment process provides an orderly and systematic evaluation of a proposal and its potential impact on the environment. A critical component of the assessment is the consideration of ways in which the implemented proposal could avoid or reduce any potential impact on the environment.

#### 2.2.2 Relevant Legislation and Regulations

All future rezoning and development will be required to comply with the requirements of other relevant state legislation and regulations. Table 1 provides a summary of the key state legislation and regulations relevant to the proposed residential development.

**Table 1. Key State Legislation**

KEY LEGISLATION	RESPONSIBLE GOVERNMENT AGENCY	ASPECT
<i>Aboriginal Heritage Act 1972</i>	Department of Planning, Lands and Heritage	Archaeological and ethnographic heritage
<i>Aboriginal Heritage Regulations 1974</i>	Department of Planning, Lands and Heritage	Archaeological and ethnographic heritage

KEY LEGISLATION	RESPONSIBLE GOVERNMENT AGENCY	ASPECT
<i>Agricultural and Related Resources Protection Act 1976</i>	Department of Primary Industries and Regional Development	Weeds and feral animals
<i>Biosecurity and Agriculture Management Act 2007</i>	Department of Primary Industries and Regional Development	Weeds / pests / diseases
<i>Bush Fires Act 1954</i>	Department of Fires and Emergency Services	Bush fire control
<i>Conservation and Land Management Act 1984</i>	Department of Biodiversity Conservation and Attractions Department of Agriculture	Flora and fauna / habitat / weeds / pests / diseases
<i>Conservation and Land Management Regulations 2002</i>	Department of Biodiversity Conservation and Attractions Department of Agriculture	Flora and fauna / habitat / weeds / pests / diseases
<i>Contaminated Sites Act 2003</i>	Department of Water and Environmental Regulation	Management of contaminated soils and water
<i>Environmental Protection Act 1986</i>	Environmental Protection Authority Department of Water and Environmental Regulation	Part IV – Environmental Impact Assessment Part V – Works Approvals and Licences
<i>Environmental Protection (Clearing of Native Vegetation) Regulations 2004</i>	Department of Water and Environmental Regulation	Clearing of native vegetation
<i>Planning and Development Act 2005</i>	Department of Planning, Lands and Heritage	Structure planning and subdivision approval
<i>Rights in Water and Irrigation Act 1914</i>	Department of Water and Environmental Regulation	Governs management of the use, service and health of water and watercourses (including beds and banks).  Water licensing is required in all proclaimed areas and for all artesian groundwater wells throughout the state.

KEY LEGISLATION	RESPONSIBLE GOVERNMENT AGENCY	ASPECT
<i>Wildlife Conservation Act 1950</i>	Department of Biodiversity Conservation and Attractions	Wildlife conservation and protection

**2.2.3 Relevant Standards, Guidelines and Policies**

Future development is subject to compliance with applicable standards, guidelines and policies developed by the State’s regulators to assist proponents in understanding the minimum requirements for environmental protection. The following table details the key standards, guidelines and State Planning Policies relevant to future residential development of the site (Table 2).

**Table 2. Relevant Standards, Guidelines and Policies**

DOCUMENT	DESCRIPTION
<b><i>EPA Policies and Guidance</i></b>	
Statement of Environmental Principles, Factors and Objectives (EPA 2016a)	This statement communicates the EPA considers the object and principles of the EP Act, uses environmental factors and objectives to organise and systemise environmental impact assessment, taking a holistic view of the environment and considering significance of a proposal.
Environmental Factor Guideline – Flora and Vegetation (EPA 2016b)	Provides guidance to protect flora and vegetation so that biological diversity and ecological integrity are maintained.
Environmental Factor Guideline – Terrestrial Environmental Quality (EPA 2016c)	Provides guidance with the objective to maintain the quality of land and soils so that environmental values are protected.
Environmental Factor Guideline – Terrestrial Fauna (EPA 2016d)	Provides guidance with the objective to protect terrestrial fauna so that biological diversity and ecological integrity at maintained.
Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment (EPA 2016e)	Provides technical guidance to ensure adequate flora and vegetation data of an appropriate standard are obtained and used in environmental impact assessment.
Technical Guidance – Terrestrial Fauna Surveys (EPA 2004)	Provides technical on the direction and information on general standards and protocols for terrestrial fauna surveys for environmental impact assessment.
Guidance Statement No. 3: <i>Separation Distances between Industrial and Sensitive Land Uses</i> (EPA 2005)	Provides guidance on the generic separation (buffer) distances between Industrial and Sensitive land uses to avoid conflicts between these land uses.
Guidance Statement No. 6: <i>Rehabilitation of Terrestrial Ecosystems</i> (EPA 2006)	Provides guidance to ensure the return of biodiversity in rehabilitated areas by increasing the quality, uniformity, and efficiency of standards and processes for rehabilitation of native vegetation in Western Australia and to allow more effective monitoring and auditing of outcomes.
Guidance Statement No. 33: <i>Environmental Guidance for Planning and Development</i> (EPA	Provides information and advice to assist land use planning and development processes to protect, conserve and enhance the environment.

DOCUMENT	DESCRIPTION
2008)	Describes the processes the EPA may apply under the EP Act to land use planning and development in Western Australia, and the environmental impact assessment process applied by the EPA to schemes.
Guidance Statement No. 41: <i>Aboriginal Heritage Assessment</i> (EPA 2004b)	Provides guidance on the EPA's position on the assessment of Aboriginal heritage and information that the EPA will consider when assessing proposals where Aboriginal heritage is a relevant environmental factor.
Guidance Statement No. 56: <i>Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia</i> (EPA 2004d)	Provides guidance and information on the EPA's expected standards and protocols for terrestrial flora and vegetation surveys to environmental consultants and proponents.
WA Environmental Offsets Policy (EPA 2011)	Seeks to protect and conserve environmental and biodiversity values for present and future generations. The policy ensures that economic and social development may occur while supporting long term environmental and conservation values.
<b>EPA Bulletins</b>	
Environmental Protection Bulletin No. 1: <i>Environmental Offsets</i> (EPA 2014b)	Clarifies how the EPA will consider offsets through the environmental impact assessment process.
<b>State Planning Policies</b>	
State Planning Policy 2.8: <i>Bushland Policy for the Perth Metropolitan Region</i> (WAPC 2010)	Provide policy and implementation framework that will ensure bushland protection and management issues in the Perth Metropolitan Region are appropriately addressed and integrated with broader land use planning and decision making. Ensure the long-term protection of biodiversity and associated environmental values.
State Planning Policy 2.9: <i>Water Resources</i> (WAPC 2006)	Provides clarification and additional guidance to planning decision-makers for consideration of water resources identified as having significant economic, social, cultural or environmental values.
State Planning Policy 3.7: <i>Planning in Bushfire Prone Areas</i> (WAPC 2015)	Provides guidance on the implementation of effective risk-based land use planning and development to preserve life and reduce the impact of bushfire on property and

DOCUMENT	DESCRIPTION
	infrastructure.
Road and Rail Transport Noise and Freight Considerations in Land Use Planning (WAPC 2009)	Provides guidance to promote a system in which sustainable land use and transport are mutually compatible.
<b>Department of Water and Environmental Regulation (DWER) Guidelines</b>	
Assessment and management of contaminated sites Guideline (DER 2014)	Provides guidance on the assessment and management of contaminated sites in Western Australian within legislative framework of the Contaminated Sites Act 2003 and the Contaminated Sites Regulations 2006.
Identification and investigation of acid sulfate soils and acidic landscapes (DER 2013)	Provides guidance to assist with the identification, assessment and management of acid sulfate soils in Western Australia.

## 3 Planning Context

### 3.1.1 Shire of Kalamunda Local Planning Scheme No. 3

Under the City of Kalamunda's LPS 3, the site is zoned 'Special Rural' or 'Rural Composite'.

### 3.1.2 Draft Perth and Peel @3.5 Million Sub-regional Planning Framework

The draft Perth and Peel @ 3.5 million suite of strategic land use planning documents aim to accommodate 3.5 million people by the year 2050. The WAPC identified part of the Site as 'Urban Expansion' in the draft Metropolitan Perth and Peel Sub-regional Planning Framework (WAPC 2015).

### 3.1.3 Draft Perth and Peel Green Growth Plan for 3.5 million

In response to the draft Perth and Peel Sub-Regional Frameworks, the draft Perth and Peel Green Growth Plan for 3.5 million (draft GGP) has been prepared. The draft Green Growth Plan proposes to secure upfront Commonwealth environmental approvals and streamline State environmental approvals for development required to support growth to 3.5 million people. The Plan also aims to provide protection of bushland, rivers, wildlife and wetlands through implementation of a strategic conservation plan (DCP 2016).

The site has been identified under the draft GGP as having areas identified within the:

- Urban class of action area; or
- Rural Residential class of action area; or
- Area not within the Urban, Industrial or Rural Residential classes of action (DCP 2016).

The site has also been identified as having areas mapped as Broad and Specific Commitments and Values under the draft GGP (DCP 2016).

The draft Broad Commitments and Values relate to seeking an overall conservation outcome where further work is needed to determine when intervention is required to reach an outcome. Draft Broad Commitments and Values include the following environmental aspects (DoP 2017):

- Threatened fauna habitat;
- Vegetation complexes of more than 10 % and less than 30 % remaining;
- Negotiated planning solution and rural complementary Bush Forever areas with three classes of action mapped;

- Resource Enhancement Wetlands with remnant vegetation and a 50 m buffer; and
- Conservation Category Wetlands 50 m buffer.

The draft Specific commitments relate to draft commitments for protecting a specific occurrence of an environmental value, including (DPC 2016):

- Threatened flora;
- Threatened Ecological Communities;
- Conservation Category Wetlands;
- Vegetation complexes with less than 10 % remaining;
- Bush Forever areas within three classes of action mapped (excluding those within the 'rural complementary' or 'negotiated planning solution' categories); and
- Short-tongued Bee (*Leioproctus douglasiellus*) distribution.

Some areas within the site have known existing approvals where the draft commitments do not apply (while such approvals remain valid). These approvals include Part IV or V Division 2 of the *Environmental Protection Act 1986* or under subdivision approval; or for matters of national environmental significance under Part 9 of the EPBC Act.

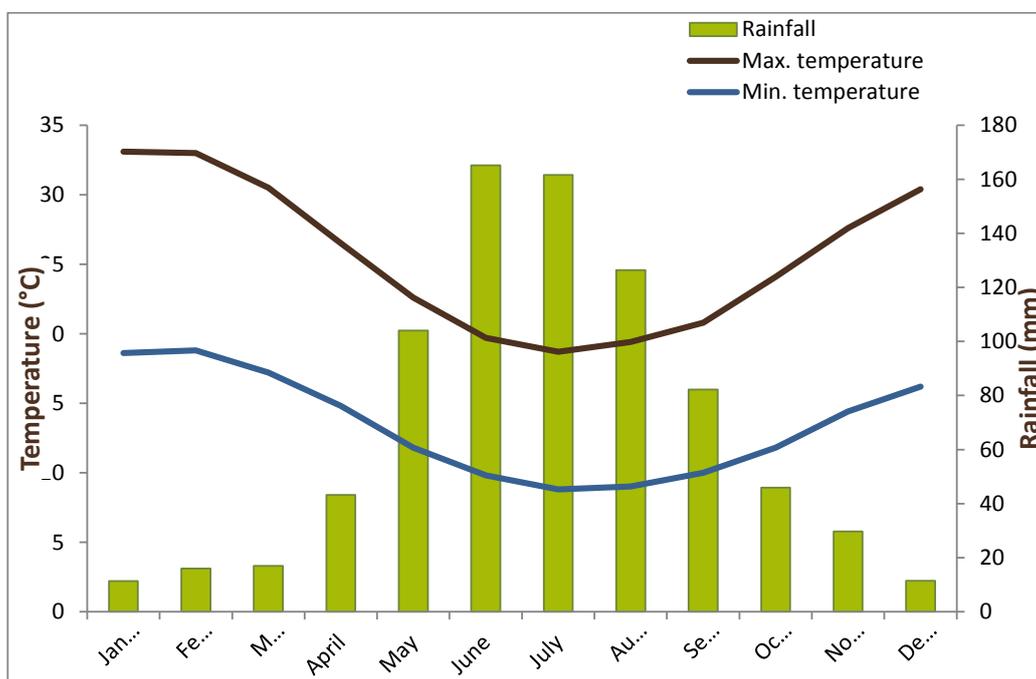
#### 3.1.4 City of Kalamunda Local Biodiversity Strategy

The City of Kalamunda's Local Biodiversity Strategy has been developed in anticipation of future urban development encroaching into natural assets. The Strategy aims to strategically plan natural area protection to ensure biodiversity conservation is incorporated into decision making processes. The Strategy focusses on protection of natural areas containing endemic species or ecological communities that are described as having high biodiversity values (Local Natural Areas (LNAs)). LNAs are natural areas outside of management by the DBCA and Bush Forever Sites, where Local Government Authorities can exercise the most control. The site does not contain any LNAs (Shire of Kalamunda 2008).

## 4 Site Environmental Features

### 4.1 Climate

The Site is within a warm Mediterranean climate with warm summers and cool winters. Weather data was collected between 1961 and 2017 from the Gosnells City Station (#009106) located approximately 5.7 km southeast from the Site. The annual mean maximum temperature is 25.5 °C and the annual mean minimum temperature is 13.4 °C. The annual mean rainfall was recorded at 820.3 mm (BoM 2017) (Graph 1).



Graph 1: Climate Statistics for 1961 and 2017 Gosnells City Station (BoM 2017)

### 4.2 Topography

The elevation across the site ranges from 21 m Australian Height Datum (AHD) to 79 m AHD, falling from the east to the west (Figure 2) (DoW 2010).

### 4.3 Regional Geology and Soils

Surface geology profile mapping at 1: 250 000 indicates the geology of the Site is typically basal conglomerate overlain by dune quartz with heavy mineral concentrations associated with the Kwinana Group and the Yoganup Formation, and alluvial sand and clay with shallow-marine and estuarine lenses and local basal conglomerate associated with the Guildford formation (GSWA 2008):

Soil Landscapes and Land Systems mapping has identified the Site is within the following land systems (DAFWA 2012):

- **Pinjarra System:** Poorly drained coastal plain with variable alluvial and Aeolian sands; and
- **Forrestfield System:** Duplex sandy gravels, pale deep sands and grey deep sandy duplexes.

The (then) Department of Agriculture and Food (DAFWA) Soil Subsystems mapping indicates the Site is within the following soil subsystems (DAFWA 2008):

- Pinjarra Gf3 Phase: Level to very gently sloping plain. Poorly drained mottled yellow earths with loamy topsoil;
- Pinjarra Gf6 Phase: Seasonally inundated swamps with very poorly drained uniform non-cracking clays;
- Pinjarra Gf7 Phase: Minor rises with deep rapidly drained brownish, siliceous or bleached sands underlain by mottled yellow clay;
- Forrestfield (D Range) F1 Phase: Foot and low slopes (<10%) with deep rapidly drained siliceous yellow brown sands, and pale or bleached sands with yellow-brown subsoil;
- Forrestfield (D Range) F2 Phase: Well drained foot and low slopes. Gravelly yellow or brown duplex soils with sandy topsoil;
- Forrestfield F4 Phase: Incised stream channels within gentle slopes with deep acidic yellow duplex soils and sandy alluvial gradational brown earths; and
- Forrestfield (D Range) F8 Phase: Slopes 3-15%. Moderately well drained gravelly duplex soils with sandy loam to loam topsoil.

## 4.4 Hydrogeology

### 4.4.1 Groundwater

Data from the Perth Groundwater Map indicates the groundwater table ranges between 12 m Australian Height Datum (AHD) and 17 m AHD. Groundwater flows from east to west (DWER 2017a).

The Site is not within a Public Drinking Water Source Area (DWER 2017a).

### 4.4.2 Surface Water

Yule Brook, a major tributary, exists 55 m to the north of the site, separated by Welshpool Road East (Figure 4) (DoW 2012a).

An un-named minor non-perennial watercourse traverses the northern portion of the site connecting to Yule Brook in the northeast. In addition, another minor perennial

watercourse traverses along the boundary in the south-western corner of the site (DoW 2012a)

The site also contains three constructed earth dams and two perennial lakes. A constructed minor drain extends south of Crystal Brook Road to a constructed dam (Figure 4) (DoW 2012a).

The site is not within a mapped 100 Year ARI Floodplain Area (DoW 2015).

#### 4.4.3 Wetlands

A wetland is defined in Schedule 5 of the *Environmental Protection Act 1986* as a 'an area of seasonally, intermittently or permanently waterlogged or inundated land, whether natural or otherwise, and includes a lake, swamp, marsh, spring, dampland, tidal flat or estuary' (Hill et al. 1996).

Desktop mapping has identified that small portions along the western boundary of the Site (along Tonkin Highway) are mapped as Conservation Category (CCW) and Resource Enhancement wetlands (Figure 4) (DPaW 2017).

Wetland categories and their management objectives are described within Table 3 below:

**Table 3. Wetland Categories and Management Objectives (WAPC 2005)**

CATEGORY	CATEGORY DESCRIPTION	MANAGEMENT OBJECTIVES
Conservation Category	High conservation and ecological value	To preserve the wetlands (natural) attributes and functions
Resource Enhancement	Moderate natural and human use attributes that can be restored or enhanced	To restore wetlands through maintenance and enhancement of wetland functions and attributes
Multiple Use	Little remaining important wetland attributes, functions and ecological value	To use, develop and manage wetlands in the context of water, town and environmental planning

## 4.5 Contamination

### 4.5.1 Acid Sulfate Soils

Desktop mapping has identified the entire Site as having 'Moderate to Low' risk of acid sulfate soils (ASS) risk within 3 m of natural soil surface and 'High to Moderate' risk beyond 3 m (DER 2014) (Figure 5).

#### 4.5.2 Contaminated Sites

Under the *Contaminated Sites Act 2003*, contaminated sites must be reported to the DWER, investigated and, if necessary, remediated.

Review of DWER’s Contaminated Sites Database has identified there are no registered contaminated sites within the Site, however, there are four contaminated sites within a 1 km radius (DWER 2017b) (Table 4) (Figure 5):

**Table 4. Contaminated Sites Within the Vicinity of the Site (DWER 2017b)**

LOT	NATURE AND EXTENT OF CONTAMINATION	STATUS	DISTANCE FROM SITE (KM)
Lot 804 on Plan 59983, Kenwick	Fragments of asbestos containing material (ACM) are present within the soils at the Site	Contaminated – Restricted Us	0.41
Lot 9005 on Plan 40777, Maddington	Landfill gases have been identified along the eastern boundary and the southwest corner of the Site. Hydrocarbon-impacted groundwater was identified across the majority of the Site.  Asbestos impacted fill was identified beneath the landfill capping layer across a majority of the Site.	Contaminated – Restricted Use	1.61
Lot 7, Former Caltex Service Station, Welshpool Rd, Wattle Grove.	Surface and subsurface soils are impacted with hydrocarbons. Groundwater beneath the Source and Affected Sites is impacted with hydrocarbons.	Contaminated – remediation required	0.90
Lot 566 Orchard Road, Maddington	Hydrocarbons (such as from petrol or diesel) are present in groundwater beneath the south-western portion of the Site.	Remediated for Restricted Use	1.40

#### 4.6 Reserves and Conservation Areas

Desktop mapping has identified that the Site is not within any conservation areas. However, there are a number of conservation areas abutting the site and within a 2 km radius (Figure 6). Five Bush Forever sites (ID: 50, 51, 53, 320 and 387) exist within 2 km of the site to the north, south and west (DoP 2014).

Several lots outside of the site boundary have been identified as DBCA Managed Lands that are managed and vested under the Conservation and Land Management Act 1984 (CALM Act) (DPaW 2016) (Figure 6).

#### 4.6.1 Environmentally Sensitive Areas

Environmentally Sensitive Areas (ESAs) are identified and protected under the *Environmental Protection (Environmentally Sensitive Areas) Notice 2005*. Under the Notice, it is an offence to kill or destroy vegetation within an ESA without a Native Vegetation Clearing Permit (NVCP).

A number of Environmentally Sensitive Areas (ESAs) impinge the site (Figure 6) (DER 2014b). DWER's online Clearing Permit System has identified that the ESAs across the Site refer to the presence of the following; Declared Rare Flora (DRF) or a Threatened Ecological Community (DWER 2017c).

Cross referencing data obtained from DBCA's Threatened and Priority Flora database and the TEC/PEC database search, these ESA's refer to the location of the following two DRF and the area of vegetation within 50 m of the DRF location:

- Wavy Smoke-bush (*Conospermum undulatum*); and
- Summer Honey-pot (*Banksia mimica*).

## 4.7 Flora and Vegetation

### 4.7.1 Bioregion

The Site is located within the Swan Coastal Plain and the Jarrah Forest bioregions of the Interim Biogeographic Regionalisation of Australia (IBRA).

The Swan Coastal Plain Perth subregion (SWA02) is a low lying coastal plain composed of colluvial and Aeolian sands, alluvial river flats and coastal limestone rising to duricrusted Mesozoic sediments in the east. Outwash plains are extensive only in the south, while a complex series of seasonal wetlands and swamps extends from north to south. Vegetation comprises heath and/or Tuart woodlands on limestone, Banksia and Jarrah- Banksia woodlands on Quaternary marine dunes of various ages, Marri on colluvial and alluvial soils, *Casuarina obesa* on out-wash plains, and paperbark (*Melaleuca spp.*) in wetland areas (Mitchell *et al.* 2002).

The Northern Jarrah Forest subregion (JF1) incorporates the area east of the Darling Scarp, overlying Archaean granite and metamorphic rocks of an average elevation of 300 m, capped by an extensive lateritic duricrust, dissected by later drainage and broken by occasional granite hills. In the east, the laterite becomes deeply dissected until it compresses isolated remnants. Rainfall is from 1300 mm on the scarp to approximately 700 mm in the east and north. Vegetation comprises Jarrah – Marri forest in the west with Bullich and Blackbutt in the valleys grading to Wandoo and Marri woodlands in the east with Powder bark on breakaways. There are extensive but localised sand sheets

with *Banksia* low woodlands. Heath is found on granite rocks and as a common understorey of forests and woodlands in the north and east. The majority of the diversity in the communities occurs on the lower slopes or near granite soils where there are rapid changes in site conditions (Williams *et al.* 2001).

#### 4.7.2 Broad Vegetation Types

Vegetation mapping of the Swan Coastal Plain subregion of WA was completed on a broad scale (1:250,000) by Beard (1980). These vegetation units were re-assessed by Shepherd *et al.* (2001) to account for clearing in the intensive land use zone, dividing some larger vegetation units into smaller units.

The Site is within three vegetation units described below (Shepherd *et al.* 2001) (Figure 7):

- **Pinjarra 3:** Medium forest; Jarrah – Marri;
- **West Darling 4:** Medium woodland; Marri and Wandoo; and
- **Pinjarra 968:** Medium woodland; Jarrah, Marri and Wandoo.

Remnant vegetation statistics of the IBRA region and the above vegetation association is detailed in Table 5.

**Table 5. Remnant Vegetation Statistics (Government of Western Australia 2016)**

	PRE-EUROPEAN (HA)	CURRENT EXTENT (HA)	% REMAINING	% REMAINING IN DBCA RESERVES
IBRA Region Swan Coastal Plain	1,501,221.93	578,432.17	38.53	37.85
IBRA Region Jarrah Forest	4,506,660.26	2,416,018.14	53.61	69.17
<b>State wide</b>				
Beard Veg Assoc No. 3	2,661,405.06	1,806,812.23	67.89	81.22
Beard Veg Assoc No. 4	1,054,279.89	293,367.54	27.83	22.78
Beard Veg Assoc No. 968	296,877.84	95,642.43	32.22	57.30
<b>In IBRA Sub-region SWA02</b>				
Beard Veg Assoc No. 3	16,754.96	2,798.11	16.70	12.66
Beard Veg Assoc No. 4	13,107.83	1,903.81	14.52	13.36

	PRE-EUROPEAN (HA)	CURRENT EXTENT (HA)	% REMAINING	% REMAINING IN DBCA RESERVES
Beard Veg Assoc No. 968	136,188.20	8,967.05	6.58	21.83
<b>In IBRA Sub-region JF01</b>				
Beard Veg Assoc No. 3	908,099.69	723,075.06	79.63	83.87
Beard Veg Assoc No. 4	614,200.81	198,940.05	32.39	30.36
Beard Veg Assoc No. 968	72,007.43	53,204.08	73.89	60.30
<b>Local Government Authority – City of Kalamunda</b>				
Beard Veg Assoc No. 3	26,414.55	21,061.60	79.73	89.46
Beard Veg Assoc No. 4	2,882.29	2,046.48	71.00	58.89
Beard Veg Assoc No. 968	663.60	95.65	14.41	1.25

The biodiversity conservation goals are based on the national targets for biodiversity conservation as set out in *The National Objectives and Targets for Biodiversity Conservation 2001 – 2005*, which aim to:

- Prevent clearing of ecological communities with **less than 30%** of the original extent remaining;
- Recover ecological communities with **less than 10%** of the original extent remaining; and
- Protect threatened species and ecological communities.

The State Government acknowledges that 30% representation of the original extent of each vegetation type is regarded as the threshold level below which species loss appears to accelerate exponentially at an ecosystem level, and 10% representation of the original extent of each vegetation type is regarded as the level representing ‘endangered’ (WAPC 2011). Based on the figures provided above for representation across the State, all vegetation types, except **West Darling 4** are above the 30% target. Within the City of Kalamunda, all vegetation types except **Pinjarra 968** are above the 30% target. However, it is important to note that in comparison, there is a small proportion of **Pinjarra 968** within the City of Kalamunda’s boundary.

Vegetation complexes of the Southwest botanical district have been mapped by Heddle *et al.* (1980). Four vegetation complexes exist across the site which relates to the underlying soil profile (Figure 7):

- **Guildford Complex:** Open forest to tall open forest and woodland;
- **Southern River Complex:** Open woodland;
- **Forrestfield Complex:** Open forest and fringing woodland; and
- **Darling Scarp Complex:** Low open woodland to lichens.

#### 4.7.3 Declared, Rare and Priority Flora

Database searches were undertaken to identify the conservation significant flora species occurring or potentially occurring within a 5 km radius of the site. The searches included the DEE’s Protected Matters Search Tool (PMST), DBCA’s NatureMap database and DBCA’s Threatened and Priority Flora database request (DEE 2017; DBCA 2017a; DBCA 2017b).

Review of the database searches identified 75 conservation significant flora species as potentially occurring within the site and a likelihood assessment of the species was undertaken (Table 6) (Figure 8).

**Table 6. Likelihood Assessment of Conservation Significant Fauna Species Occurring Within the Site (DEE 2017; DBCA 2017a; b)**

TAXON	CONSERVATION STATUS		LIKELIHOOD OF OCCURRENCE IN SITE
	EPBC	DBCA	
<i>Calectasia cyanea</i>	Critically Endangered	Threatened	Possible
<i>Grevillea thelemanniana subsp. thelemanniana</i>	Critically Endangered	Threatened	Possible
<i>Ptilotus pyramidatus</i>	Critically Endangered	Threatened	Unknown
<i>Synaphea sp. Fairbridge Farm (D. Papenfus 696)</i>	Critically Endangered	Threatened	Likely
<i>Andersonia gracilis</i>	Endangered	Threatened	Possible
<i>Austrostipa bronwenae</i>	Endangered	Threatened	Likely
<i>Banksia mimica</i>	Endangered	Threatened	Unknown
<i>Caladenia huegelii</i>	Endangered	Threatened	Unknown
<i>Calytrix breviseta subsp. breviseta</i>	Endangered	Threatened	Likely
<i>Chamelaucium sp. Gingin</i>	Endangered	Threatened	Possible
<i>Darwinia apiculata</i>	Endangered	Threatened	Possible
<i>Diuris drummondii</i>	Endangered	Threatened	Unknown
<i>Diuris purdiei</i>	Endangered	Threatened	Unknown
<i>Drakaea elastica</i>	Endangered	Threatened	Likely
<i>Eremophila glabra subsp. chlorella</i>	Endangered	Threatened	Likely
<i>Eucalyptus x balanites</i>	Endangered	Threatened	Likely
<i>Grevillea curviloba subsp. incurva</i>	Endangered	Threatened	Likely
<i>Lasiopetalum pterocarpum</i>	Endangered	Threatened	Possible

TAXON	CONSERVATION STATUS		LIKELIHOOD OF OCCURRENCE IN SITE
	EPBC	DBCA	
<i>Lepidosperma rostratum</i>	Endangered	Threatened	Likely
<i>Macarthuria keigheryi</i>	Endangered	Threatened	Possible
<i>Thelymitra stellata</i>	Endangered	Threatened	Likely
<i>Acacia anomala</i>	Vulnerable	Threatened	Possible
<i>Acacia aphylla</i>	Vulnerable	Threatened	Possible
<i>Conospermum undulatum</i>	Vulnerable	Threatened	Likely
<i>Diuris micrantha</i>	Vulnerable	Threatened	Possible
<i>Drakaea micrantha</i>	Vulnerable	Threatened	Unknown
<i>Eleocharis keigheryi</i>	Vulnerable	Threatened	Possible
<i>Amanita quenda</i>	-	Priority 1	Possible
<i>Calandrinia sp. Piawaning</i>	-	Priority 1	Likely
<i>Schoenus sp. Beaufort (G.J. Keighery 6291)</i>	-	Priority 1	Possible
<i>Thelymitra magnifica</i>	-	Priority 1	Likely
<i>Comesperma griffinii</i>	-	Priority 2	Likely
<i>Comesperma rhadinocarpum</i>	-	Priority 2	Unknown
<i>Isotropis cuneifolia subsp. glabra</i>	-	Priority 2	Possible
<i>Lepyrodia curvescens</i>	-	Priority 2	Possible
<i>Melaleuca viminalis</i>	-	Priority 2	Possible
<i>Schoenus loliaceus</i>	-	Priority 2	Possible
<i>Acacia horridula</i>	-	Priority 3	Likely
<i>Amanita wadjukiorum</i>	-	Priority 3	Likely
<i>Babingtonia urbana</i>	-	Priority 3	Unlikely
<i>Banksia pteridifolia subsp. vernalis</i>	-	Priority 3	Unlikely
<i>Byblis gigantea</i>	-	Priority 3	Unlikely
<i>Chamaescilla gibsonii</i>	-	Priority 3	Possible
<i>Eryngium pinnatifidum subsp. Palustre (G.J. Keighery 13459)</i>	-	Priority 3	Likely
<i>Eryngium sp. Subdecumbens (G.J. Keighery 5390)</i>	-	Priority 3	Likely
<i>Haemodorum loratum</i>	-	Priority 3	Likely
<i>Isopogon drummondii</i>	-	Priority 3	Possible
<i>Lasiopetalum glutinosum subsp. glutinosum</i>	-	Priority 3	Likely
<i>Meionectes tenuifolia</i>	-	Priority 3	Possible
<i>Myriophyllum echinatum</i>	-	Priority 3	Possible
<i>Pithocarpa corymbulosa</i>	-	Priority 3	Possible
<i>Platysace ramosissima</i>	-	Priority 3	Possible

TAXON	CONSERVATION STATUS		LIKELIHOOD OF OCCURRENCE IN SITE
	EPBC	DBCA	
<i>Schoenus benthamii</i>	-	Priority 3	Possible
<i>Schoenus capillifolius</i>	-	Priority 3	Possible
<i>Schoenus pennisetis</i>	-	Priority 3	Possible
<i>Stylidium aceratum</i>	-	Priority 3	Possible
<i>Stylidium periscelanthum</i>	-	Priority 3	Possible
<i>Styphelia filifolia</i>	-	Priority 3	Unknown
<i>Thysanotus anceps</i>	-	Priority 3	Possible
<i>Acacia oncinophylla</i> subsp. <i>patulifolia</i>	-	Priority 4	Likely
<i>Aponogeton hexatepalus</i>	-	Priority 4	Likely
<i>Boronia tenuis</i>	-	Priority 4	Unlikely
<i>Centrolepis caespitosa</i>	-	Priority 4	Unknown
<i>Cyanicula ixiooides</i> subsp. <i>ixioides</i>	-	Priority 4	Unknown
<i>Drosera occidentalis</i> subsp. <i>occidentalis</i>	-	Priority 4	Unknown
<i>Hibbertia montana</i>	-	Priority 4	Possible
<i>Hydrocotyle lemnooides</i>	-	Priority 4	Likely
<i>Lasiopetalum bracteatum</i>	-	Priority 4	Likely
<i>Ornduffia submersa</i>	-	Priority 4	Unknown
<i>Pimelea rara</i>	-	Priority 4	Possible
<i>Schoenus natans</i>	-	Priority 4	Possible
<i>Senecio leucoglossus</i>	-	Priority 4	Possible
<i>Stylidium longitubum</i>	-	Priority 4	Possible
<i>Stylidium striatum</i>	-	Priority 4	Possible
<i>Verticordia lindleyi</i> subsp. <i>lindleyi</i>	-	Priority 4	Likely

24 flora species were considered Likely to occur due to the presence of suitable habitat and close proximity to previous records. 35 species were considered Possible and four considered Unlikely to occur within the site. 12 species had an unknown likelihood of occurrence due to the lack of available data.

Several occurrences of the following five DRF species have been identified as occurring within or close to the boundary of the site based on the DBCA Threatened Priority Flora database search (DBCA 2017a) (Figure 8):

- *Conospermum undulatum*;
- *Isopogon drummondii*;
- *Banksia mimica*;
- *Lasiopetalum glutinosum* subsp. *glutinosum*; and

● *Thelymitra magnifica*.

Given the above, site specific flora and vegetation surveys will be required to confirm the presence of DRF within the site.

**4.7.4 Threatened and Priority Ecological Communities**

Desktop searches of the DBCA’s Threatened and Priority Ecological Communities dataset identified several TECs or TEC buffers occurring within and surrounding the site. The dataset provided by the DBCA has generic buffers of 200 m or 500 m surrounding the TECs or PECs (DBCA 2017c) (Figure 9):

- Banksia Dominated Woodlands of the Swan Coastal Plain;
- SCP20a - *Banksia attenuata* woodlands over species rich dense shrublands;
- SCP3a - *Eucalypt calophylla* – *Kingia australis* woodlands on heavy soils, Swan Coastal Plain;
- SCP3b - *Eucalyptus calophylla* – *eucalyptus marginata* woodlands on sandy clay soils of the southern Swan Coastal Plain;
- Shrublands and woodlands on Muchea Limestone;
- Herb rich shrublands in clay pans;
- SCP10a - Shrublands on dry clay flats; and
- Central Granite Shrublands Community.

Given the above, site specific flora and vegetation surveys will be required to identify the presence of TECs or PECs within the site.

**4.7.5 Weeds**

A desktop search of the EPBC PMST has identified a total of 19 introduced species that may occur within a 5 km radius of the Site (Table 7) (DEE 2017).

Of these 19 weed species, nine are Declared under the *Biosecurity and Agriculture Management Act 2007* (BAM Act) and 15 are listed as Weeds of National Significance (WONS).

**Table 7. Introduced Flora Recorded in the Survey Area.**

TAXON	(COMMON NAME)	DECLARED BAM ACT	WONS
* <i>Anredera cordifolia</i>	Madeira Vine	-	Yes
* <i>Asparagus asparagoides</i>	Bridal Creeper	s22(2) C3	Yes
* <i>Brachiaria mutica</i>	Para Grass	-	-
* <i>Cenchrus ciliaris</i>	Buffel-grass	-	-
* <i>Chrysanthemoides monilifera</i>	Bitou Bush	s12 C2	Yes

TAXON	(COMMON NAME)	DECLARED BAM ACT	WONS
* <i>Chrysanthemoides monilifera</i> <i>subsp. monilifera</i>	Boneseed	s12 C2	Yes
* <i>Eichhornia crassipes</i>	Water Hyacinth	s12 C2	Yes
* <i>Genista linifolia</i>	Flax-leaved Broom	-	Yes
* <i>Genista monspessulana</i>	Cape Broom	-	Yes
* <i>Genista sp. X Genista monspessulana</i>	Broom	-	Yes
* <i>Lantana camara</i>	White Sage	s22(2) C3	Yes
* <i>Lycium ferocissimum</i>	African Boxthorn	-	Yes
* <i>Olea europaea</i>	Olive	-	-
* <i>Pinus radiata</i>	Pine	-	-
* <i>Rubus fruticosus aggregate</i>	Blackberry	-	Yes
* <i>Sagittaria platyphylla</i>	Slender Arrowhead	s22(2) C3	Yes
* <i>Salix spp. except S. babylonica, S.x calodendron &amp; S. x reichardtii</i>	Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow	s12 C1	Yes
* <i>Salvinia molesta</i>	Giant Salvinia	s12 C1	Yes
* <i>Tamarix aphylla</i>	Athel Pine	s22(2) C3	Yes

\*The (then) Department of Agriculture and Food WA (DAFWA) maintains a list of Declared Plants for Western Australia under the Biosecurity and Agriculture Management Act 2007 (BAM Act). If a plant is declared for the whole of the State or for particular Local Government Areas, all landholders are obliged to comply with the relevant species-specific control measures.

\*The DAFWA maintains a list of Declared Plants for Western Australia under the BAM Act. If a plant is declared for the whole of the State or for particular Local Government Areas, all landholders are obliged to comply with the relevant species-specific control measures.

<sup>1</sup>Declared Pest - s22(2)

Declared pests 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.

Under the BAM Act, all declared pests are placed in one of three categories, namely C1 (exclusion), C2 (eradication) or C3 (management).

C1 category (Exclusion) - Pests will be assigned to this category if they are 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 category (Eradication) – Pests will be assigned to this category if they are present in Western Australia in low enough numbers or in sufficiently limited areas that their eradication is still a possibility.

C3 category (Management) – Pests will be assigned to this category if they are established in Western Australia but it is feasible, or desirable, to manage them in order to limit their damage. Control measures can prevent a C3 pest from increasing in population size or density or moving from an area in which it is established into an area which currently is free of that pest (DAFWA 2017).

## 4.8 Fauna

### 4.8.1 Threatened and Priority Fauna

Conservation significant fauna potentially occurring within a 5 km radius of the Site were determined through desktop searches using DEE’s PMST, DBCA’s NatureMap search tool and DBCA’s Threatened and Priority Fauna databases.

A number of species returned in the databases were historical records of locally extinct species (e.g. Malleefowl) and these have been omitted from further discussion.

A likelihood assessment was undertaken to determine the likelihood of these species occurring within the Site based on suitable habitat present and the species known distribution based on the following criteria:

The Likelihood of each species is based on the following criteria:

- Recorded: Recorded during the field survey or site reconnaissance;
- Likely: Suitable habitat is present in the Survey Area and the Survey Area is in the species’ known distribution;
- Possible: Limited or no suitable habitat is present in Survey Area, but is nearby. The species has good dispersal abilities and is known from the general area; and
- Unlikely: No suitable habitat is present in Survey Area but is nearby, the species has poor dispersal abilities, but is known from the general area; or suitable habitat is present, however, the Survey Area is outside of the species’ known distribution.

**Table 8. Likelihood Assessment of Conservation Significant Fauna Occurring Within the Site (DEE 2017) (DBCA 2017a;d)**

SPECIES	CONSERVATION STATUS		LIKELIHOOD OF OCCURRENCE
	DBCA	EPBC	
Australasian Bittern ( <i>Botaurus poiciloptilus</i> )	Threatened	Endangered	Unlikely
Brush-tailed Bettong ( <i>Bettongia penicillata ogilbyi</i> )	Threatened	Critically Endangered	Unlikely
Eastern Curlew ( <i>Numenius madagascariensis</i> )	Threatened	Critically Endangered	Unlikely
Curlew Sandpiper ( <i>Calidris ferruginea</i> )	Threatened	Critically Endangered	Unlikely
Australian Painted Snipe ( <i>Rostratula australis</i> )	Threatened	Endangered	Possible
Western Ringtail Possum ( <i>Pseudocheirus occidentalis</i> )	Threatened	Vulnerable	Unlikely
Quokka ( <i>Setonix brachyurus</i> )	Threatened	Vulnerable	Unlikely

SPECIES	CONSERVATION STATUS		LIKELIHOOD OF OCCURRENCE
	DBCA	EPBC	
Baudin's Cockatoo ( <i>Calyptorhynchus baudinii</i> )	Threatened	Vulnerable	Possible
Forest Red-tailed Black Cockatoo ( <i>Calyptorhynchus banksii naso</i> )	Threatened	Vulnerable	Likely
Carnaby's Cockatoo ( <i>Calyptorhynchus latirostris</i> )	Threatened	Endangered	Likely
Chuditch ( <i>Dasyurus geoffroii</i> )	Threatened	Vulnerable	Unlikely
Short-tongued Bee ( <i>Leioproctus douglasiellus</i> )	Threatened	Critically Endangered	Unlikely
Western Swamp Tortoise ( <i>Pseudemydura umbrina</i> )	Threatened	Critically Endangered	Unlikely
South Western Phascogale ( <i>Phascogale tapoatafa wambenger</i> )	Conservation Dependent Fauna	-	Unknown
Great Egret ( <i>Ardea modesta</i> )	International Agreement	Marine	Possible
Rainbow Bee-eater ( <i>Merops ornatus</i> )	International Agreement	Marine	Possible
Wood Sandpiper ( <i>Tringa glareola</i> )	International Agreement	Marine/Migratory	Possible
Common Sandpiper ( <i>Tringa hypoleucos</i> )	International Agreement	Marine/Migratory	Possible
Common Greenshank ( <i>Tringa nebularia</i> )	International Agreement	Marine/Migratory	Possible
Marsh Sandpiper ( <i>Tringa stagnatilis</i> )	International Agreement	Marine/Migratory	Possible
Peregrine Falcon ( <i>Falco peregrinus</i> )	Other Specially Protected Fauna	-	Unlikely
Western Swamp Tortoise ( <i>Pseudemydura umbrina</i> )	Threatened	-	Unlikely
Scorpionfly ( <i>Austromerope poultoni</i> )	Priority 2	-	Unknown
A short-tongued bee ( <i>Leioproctus bilobatus</i> )	Priority 2	-	Unknown
Southern Death Adder ( <i>Acanthophis antarcticus</i> )	Priority 3	-	Unlikely
Black Striped Snake ( <i>Neelaps colonotos</i> )	Priority 3	-	Possible
Water-rat ( <i>Hydromys chrysogaster</i> )	Priority 4	-	Possible
Southern Brown Bandicoot ( <i>Isodon obesulus fusciventer</i> )	Priority 4	-	Likely
Western Brush Wallaby ( <i>Macropus irma</i> )	Priority 4	-	Possible
Blue billed Duck	Priority 4	-	Unlikely

SPECIES	CONSERVATION STATUS		LIKELIHOOD OF OCCURRENCE
	DBCA	EPBC	
( <i>Oxyura australis</i> )			

Due to the site being mostly cleared of native vegetation and used for rural purposes, it is not likely that the site would offer large areas of valuable intact habitat. The surrounding environment is also representative of clearing and rural land uses containing limited vegetation to the north, west and south of the site. Large areas of intact vegetation area located to the east of the site and therefore, may provide better fauna habitat than the site itself.

Some fauna species may utilise the minor watercourse that traverses the site which appears to have intact vegetation along the foreshore area and within remaining patches. However, fauna are more likely to utilise surrounding larger areas of intact vegetation to the east.

## 4.9 Heritage

### 4.9.1 Aboriginal Heritage

In Western Australia, the *Aboriginal Heritage Act 1972* protects places and objects customarily used by or traditional to the original inhabitants of Australia or their descendants. A register of such places and objects are maintained under the Act, however, all sites are protected under the Act whether they are registered or not (DPLH 2017).

A desktop search has identified two Registered Aboriginal Heritage Sites and one Lodged Aboriginal Heritage Site intersecting the Site and three Registered sites located within 1 km of the site (Table 9; Figure 10) (DPLH 2017).

**Table 9. Aboriginal Heritage Sites Within or in the Vicinity of the Site (DPLH 2017)**

NUMBER	SITE NAME	TYPE	STATUS	DISTANCE FROM SITE (M)
4343	Brentwood Road Swamp	Artefacts / Scatter	Registered	0
4342	Brentwood Road Quarry	Artefacts / Scatter, Quarry	Registered	0
4341	Brentwood Road NW	Artefacts / Scatter	Lodged	0
3264	White Road, Orange Grove	Artefacts/Scatter, Skeletal Material/Burial	Registered	679

NUMBER	SITE NAME	TYPE	STATUS	DISTANCE FROM SITE (M)
3631	Yule Brook A & B	Artefacts/Scatter	Registered	420
3773	Welshpool Reserve	Camp	Registered	275

#### 4.9.2 European Heritage

A desktop search of the State Heritage Office has identified there are no State Heritage Sites within the Site or within a 2 km radius of the Site (SHO 2017). No World Heritage or National Heritage places are located within a 5 km radius of the Site (DEE 2017).

The Site does contain one Shire of Kalamunda Municipal Heritage place, Mrs Wright’s Home (former) located at 150 Crystal Brook Road, Wattle Grove. This site is not registered under State Legislation. However, it is graded as Category 4 which states ‘Photographically record prior to major development or demolition. Recognise and interpret the site if possible’ (SHO 2017) (Figure 10).

The Site contains one heritage site listed as ‘Other Heritage Sites’, White’s home & store located at 80 Crystal Brook Road, Wattle Grove. The site is currently a single storey residence and there are no other details regarding this Site with the State Heritage Office (SHO 2017) (Figure 10).

### 4.10 Site History

#### 4.10.1 Historical Aerial Imagery

Review of historical aerial imagery was undertaken to identify and assess land use and development changes within the area over time. The earliest available aerial of the site was taken in 1953 and more recent aerial images (from approximately 10 year intervals up to present) were viewed (Figures 11a-h).

The review of historical aerial imagery has identified substantial clearing of majority of vegetation within the site and surrounding areas occurred prior to 1953 and subdivided for rural land uses including market gardens, agricultural/animal grazing and pastures. Portions in the south-west of the site were identified as wet during this time. Some patches of remnant vegetation remained until prior to 1974. It appears potential sand extraction activities were undertaken in the northern and south-eastern portions of the site and adjacent areas which expanded between 1953 and 1974.

Further clearing of remnant native vegetation occurred by 1974 and some rural residential dwellings were constructed. It appears some vegetation regrowth or planting has occurred prior to 1974. Development and rural land uses replaced the sand extraction areas by 1985. During this time, further rural residential development occurred

within the site and surrounding areas. Majority of the clearing within the site occurred by 1995 and some regeneration and plantation occurred between 1995 and 2010.

Urban residential developments began between 2010 and 2017 to the north, north-west and north-east of the site boundary.

#### 4.10.2 WIN Groundwater Bore Database Search

A search of the (then) Department of Water (DoW)'s WIN Groundwater bore database has identified 51 bores within the site boundary (Figure 12) (DoW 2017). These operational statuses and current owners of these bores are unknown. Information on each WIN bore's ID, purpose, status, drill depth, drill date and owner are provided in Appendix C.

### 4.11 Surrounding Land Uses

The Lesmurdie Reserve exists to the east of the site. Pockets of residential developments exist to the north, west, south-west and east of the site beyond the rural areas. The Hartfield Country Club Golf Course is located 236 m to the north. An industrial and commercial precinct is located to the south-west of the site in Kenwick.

### 4.12 Industrial Separation Distances

Under the EPA's *Guidance Statement No. 3: Separation Distances between Industrial and Sensitive Land Uses*, all new industries, infrastructure and estates in the vicinity of proposed/existing sensitive land uses, and vice versa, require a suitable separation distance. Sensitive land uses are defined by the EPA as; residential developments, hospitals, hotels, motels, hostels, caravan parks, schools, nursing homes, child care facilities, institutions, shopping centres (EPA 2005). This Guidance Statement outlines the generic buffer distances between sensitive and industrial land uses in the absence of site-specific technical investigations (EPA 2005).

#### 4.12.1 Kennels

Three kennels exist to the west of the site (Figure 13). The EPA's Guidance Statement No. 3 provides a generic buffer distance of 500 m from sensitive land uses within rural zones and a 1000 m buffer in or nearby urban areas in the absence of site specific investigations (EPA 2005). Kennels have associated odour and noise impacts. It is to be noted that separation distances are not required to other industrial land uses under GS3.

Proposed zoning of the site to Urban will require a generic 1000 m buffer distance between the existing kennels and future residential and sensitive land use developments. A buffer of 1000 m from all three kennels will impinge the western portion of the site (Figure 13). Site specific noise and odour modelling would be required to determine a more appropriate buffer distance in negotiation with the City of Kalamunda.

Lots 24, 25, 26 and 36 Welshpool Road East, Wattle Grove have been identified as having an additional use under the LPS 3 for dog kennels. Despite provision within the Scheme, it does not appear the lots are currently used for dog kennels. Current uses of these lots include a garden centre and veterinary hospital.

#### 4.12.2 Poultry Farms

One poultry farm exists within the southern portion of the site (Poultry Farm 1) and two poultry farm exists to the south and west of the site (Poultry Farm 2 and 3 respectively) (Figure 13). Under GS3, the generic buffer distance for Poultry Farms ranges from 300 m – 1000 m (EPA 2005). Under the City of Kalamunda's LSP, a 300 m buffer is mapped from Poultry Farm 1 and 3. Under the City of Gosnell's Town Planning Scheme No. 6 (TSP 6) a buffer of 500 m has been applied to Poultry Farm 2 (Figure 13). Buffers of Poultry Farm 1 and 2 impact the developable potential of the site for sensitive land uses, however, industrial development are unaffected by poultry farm buffers.

#### 4.12.3 Turf Farms

One turf farm is located within the south-western portion of the site (Figure 13). Under GS3, a generic buffer distance of 500 m from turf farm is applicable from sensitive land uses or developments. This buffer distance only impinges the site south of Crystal Brook Road (Figure 13). Industrial development to the south of Crystal Brook Road is unlikely to be affected by the turf farm buffer.

## 5 Potential Site Environmental Constraints

The potential key environmental issues associated with the existing development include:

- Wetlands and wetland buffers;
- Watercourse and Foreshore Areas;
- Declared Rare Flora;
- Threatened Ecological Communities;
- Water Management; and
- Industrial separation buffers.

### 5.1 Wetlands and Wetland Buffers

Under the Western Australian Planning Commission's *Guideline for the Determination of Wetland Buffer Requirements* (2005), the consideration of wetlands is required during a change in land use or a proposed development in the immediate vicinity of a wetland where the future land use is likely to conflict with the established wetland management objectives. Under the guidelines, an appropriate buffer distance should be identified to achieve an acceptable planning outcome. Buffer distances determined based on the wetland's category and no development is permitted within buffers (WAPC 2005).

As the site contains and is within the vicinity of wetlands, there is the potential for their associated buffers to impinge on the south-western portion of the site and decrease the developable potential of the site. A minimum buffer distance of 50 m from a CCW and a 30 – 50 m buffer from REWs is generally applicable. Figure 14 identifies the worst case scenario of the area of land onsite that may be impinged by wetland buffers of 50 m. This would equate to approximately 8.44 ha of land within the site to be sterilised from future development.

However, the REW's located within the site appear to have been historically cleared of most vegetation. Reclassification of the REWs to MUWs may be possible and this would remove this wetland area as a constraint to future development (approximately 8.44 ha). Development within MUWs is generally permissible as they have little remaining ecological wetland attributes and function, provided adequate depth to groundwater is established as part of future development.

A CCW located south of the Tonkin Highway and Welshpool Road East intersection, at worst case, would have a minimum 50 m buffer applicable (see Figure 14). However, as the area within the site and within a potential 50 m buffer has already been cleared, developed and is separated by a road reserve, it is considered unlikely that a buffer would be required.

### 5.1.1 Further Investigations and Management Requirements

The vegetation of the mapped wetlands within the site and the applicable buffers is representative of previous land uses and historical clearing. It is likely that these areas would include patches of non-endemic species and plantings. Ground surveys would be required to assess the vegetation within the site to determine the impacts of mapped wetlands and associated buffers to future urban development.

A Wetland and Wetland Buffer Management Plan (WWBMP) will be required for the lots located within or adjacent to wetlands at the local structure planning or subdivision stage.

## 5.2 Watercourse and Foreshore Areas

The minor non-perennial stream watercourse that traverses the northern portion of the site is likely to require a defined foreshore area due to the vegetation along the watercourse in accordance with DoW's Operational Policy 4.3: *Identifying and establishing waterways foreshore areas* (2012). Development within the foreshore area of a watercourse is generally not permitted and therefore has the potential to reduce the developable potential of the site.

There are no standard foreshore widths and should be determined in discussion with DWER and other relevant agencies. Generally, the foreshore area can be defined as the furthest extent of riparian vegetation and other associated riverine landforms and functions. Figure 14 identifies a potential foreshore area; however, groundtruthing is required through survey work to identify watercourses, and determine foreshore areas and watercourse buffer zones. Watercourses, foreshore areas and watercourse buffer zones require protection through the creation of easements for drainage and water management purposes, specify approved and un-approved land uses and activities within the zones and providing Watercourse and Foreshore Management Plans detailing these.

### 5.2.1 Further Investigations and Management Requirements

As part of future structure planning, identification of watercourses and foreshore area, will be undertaken as part of a biophysical assessment. The biophysical assessment will be undertaken in accordance with the (then) Department of Water's (DoW's) *Operational Policy 4.3: Identifying and establishing waterways foreshore areas* (2012) and the (then) Water and Rivers Commission policy *Determining Foreshore Reserves* (2001).

To ensure these watercourses and their associated foreshore area and buffer zone is appropriately protected and managed, the following will be required as part of future development:

- The creation of easements for the purpose of drainage and water management;
- Specifying approved or unapproved activities within the buffer zone; and

- Preparation of a Watercourse and Foreshore Management Plan at the local structure planning or subdivision stage.

### 5.3 Declared Rare Flora

Several occurrences of the Wavy Smoke Bush (*Conospermum undulatum*) and the Summer Honeypot (*Banksia mimica*) have been identified as occurring within the site based on DBCA database searches. These species and the vegetation within 50 m of the DRF are protected under the EPBC Act.

The occurrences of both these DRFs throughout the site are considered a potential constraint to development as the DRF and vegetation within 50 m of the flora are protected under the EPBC Act (Figure 14).

#### 5.3.1 Further Investigations and Management Requirements

It is likely a Flora and Vegetation survey would be required to confirm the presence and locations of these DRF species to inform future rezoning and structure planning. In addition, an EPBC referral would likely be required at structure planning stage to address potential impacts associated with urban development near DRFs.

A Flora and Vegetation Management Plan may be required at the subdivision stage.

### 5.4 Threatened Ecological Communities

Portions within the site have been mapped by DBCA as the Banksia Woodlands of the Swan Coastal Plain TEC, *Eucalyptus calophylla-Kingia australis* woodlands and Shrublands and Woodlands on Muchea Limestone listed as Endangered under the EPBC Act (Figure 9). However, the DBCA's mapping is based on the Commonwealth's 'likely to occur' areas and represents broad scale vegetation units that are most likely to contain the ecological communities.

#### 5.4.1 Further Investigations and Management Requirements

Site specific flora and vegetation surveys will be required to identify the presence of TECs or PEC, which will inform the structure planning stage. Depending on the potential impacts, the presence of TECs within the site may require the project to be referred to the DEE under the EPBC Act for an assessment of potential impacts associated with urban development within or nearby TECs.

A Flora and Vegetation Management Plan may be required at the subdivision stage for the protection of identified TECs or PECs.

### 5.5 Water Management

The Site has a few tributaries which traverse the site and there are small portions of CCW and REW along the western boundary of the site. It should be noted that development proposals within 200 m of the boundary of a CCW or REW should be

referred to DBCA for advice where the quality or volume of water flowing into the wetland may be affected by a development.

#### 5.5.1 Further Investigations and Management Requirements

A District Water Management Strategy (DWMS) will be required to support any future MRS Amendment. The purpose this document will be to provide a coordinating framework that guides the key requirements for water sensitive urban design. It will also demonstrate that Site can support urban and/or industrial development and best practice urban water management.

A groundwater monitoring program will also be required prior to the development of a Local Water Management Strategy at the local structure planning stage.

### 5.6 Industrial Separation Buffers

The presence of prescribed premises, including poultry farms, kennels and a turf farm, within and adjacent to the site has the potential to impact on the type of future land uses within the site (should these premises remain in operation).

The three surrounding kennels, poultry farms and turf farm buffers impinge on the site. However, the buffers are only applicable for sensitive land uses. Majority of the land use buffers impinge across the southern half of the site (south of Crystal Brook Road) which would identify this portion to be potentially used for future industrial development (Figure 13).

#### 5.6.1 Further Investigations and Management Requirements

The portion of the site to the north of Crystal Brook Road is impinged by fewer buffers and may have a better potential for residential development (Figure 13). However, site specific odour and noise modelling would need to be undertaken to identify opportunities with reduced buffers from surrounding land uses. In addition, management and mitigation measures may be required to support urban residential development in this area.

## 6 Summary

### 6.1 Outcome and Key Findings of Assessment

The site is currently used for rural land uses and has been historically cleared of majority of native vegetation. A desktop review of the environmental aspects of the site has determined the following are relevant:

- **Wetlands and Wetland Buffers:** As the site is mapped as containing and within the vicinity of geomorphic wetlands, there is the potential for their associated buffers to impinge on the south-western portion of the site. A buffer distance of 30 – 50 m is generally imposed on REWs and a minimum 50 m buffer is generally imposed on CCWs. However, as the vegetation within the mapped wetlands and the corresponding buffers does not appear to be intact and has been subject to clearing, it is likely that smaller buffer distances from the wetlands could be negotiated. Alternatively, there is a potential opportunity to reclassify the wetlands within and surrounding the site to increase the developable potential of the site. Site specific surveys would be required to assess the vegetation remaining and the condition of the wetlands. A Wetland and Wetland Buffer Management Plan may be required at subdivision.
- **Watercourse and Foreshore Area:** The minor non-perennial watercourse that traverses through the northern portion of the site would likely require a biophysical assessment to identify the extent of the foreshore area. The extent of the foreshore area would impact on the developable potential of the surrounding area. A Watercourse and Foreshore Management Plan may be required at the structure planning or subdivision stage. Additionally, the creation of easements for the foreshore and buffer area for the purpose of drainage and water management, as well as specifying the approved and unapproved activities within the buffer zone will provide further protection and management.
- **Declared Rare Flora:** There are several historical occurrences of DRF within the site. The species and the vegetation within 50 m of the occurrence are protected under Federal legislation. Flora and vegetation surveys would be required to confirm the presence or absence of these DRF species which would provide a better indication of the land available for development. A Flora and Vegetation Management Plan may be required at the subdivision stage.
- **Threatened Ecological Communities:** The site is mapped as having several TECs and associated buffers across the site. These mapped TECs are based on the DEE's likelihood of TEC occurrences and are not based on actual recorded data. These TECs appear to correspond with patches of possible remnant vegetation which is likely to be associated with the Banksia Woodlands TEC, *Eucalyptus*

*calophylla-Kingia australis* woodlands and Shrublands TEC and Woodlands on Muchea Limestone TEC. Flora and vegetation surveys of these patches of vegetation would be required to determine the presence or absence of these TECs. Should these TECs be identified as occurring within the site, clearing or potential impacts to the TECs will require approval from the DEE and the DWER. A Flora and Vegetation Management Plan may be required at the subdivision stage.

- **Water Management:** There are several tributaries which traverse the site, as well as wetland located along the western boundary of the site. A DWMS will be required as part of any future rezoning under the MRS, as well as groundwater monitoring to inform the LWMS at the local structure planning stage.
- **Land Use Buffers:** The site is constrained by generic or imposed buffers on prescribed premises (Poultry farms, turf farm and kennels). The opportunities for land development within the site is recommended to be split into two land uses, the area to the south of Crystal Brook Road would be more suitable for continued rural uses or industrial development. While the area to the north of Crystal Brook Road has the potential to be developed to urban residential - should the generic buffers be reduced. Site specific studies and modelling would be required to determine appropriate buffers from the surrounding.

## 7 Limitations

This report is produced strictly in accordance with the scope of services set out in the contract or otherwise agreed in accordance with the contract. 360 Environmental makes no representations or warranties in relation to the nature and quality of soil and water other than the visual observation and analytical data in this report.

In the preparation of this report, 360 Environmental has relied upon documents, information, data and analyses ("client's information") provided by the client and other individuals and entities. In most cases where client's information has been relied upon, such reliance has been indicated in this report. Unless expressly set out in this report, 360 Environmental has not verified that the client's information is accurate, exhaustive or current and the validity and accuracy of any aspect of the report including, or based upon, any part of the client's information is contingent upon the accuracy, exhaustiveness and currency of the client's information. 360 Environmental shall not be liable to the client or any other person in connection with any invalid or inaccurate aspect of this report where that invalidity or inaccuracy arose because the client's information was not accurate, exhaustive and current or arose because of any information or condition that was concealed, withheld, misrepresented, or otherwise not fully disclosed or available to 360 Environmental.

Aspects of this report, including the opinions, conclusions and recommendations it contains, are based on the results of the investigation, sampling and testing set out in the contract and otherwise in accordance with normal practices and standards. The investigation, sampling and testing are designed to produce results that represent a reasonable interpretation of the general conditions of the site that is the subject of this report. However, due to the characteristics of the site, including natural variations in site conditions, the results of the investigation, sampling and testing may not accurately represent the actual state of the whole site at all points.

It is important to recognise that site conditions, including the extent and concentration of contaminants, can change with time. This is particularly relevant if this report, including the data, opinions, conclusions and recommendations it contains, are to be used a considerable time after it was prepared. In these circumstances, further investigation of the site may be necessary.

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# FIGURES



**Legend**  
 Site Location (325 ha)

NOTE THAT POSITION ERRORS CAN BE >9M IN SOME AREAS  
 - AERIAL PHOTOGRAPHY SOURCED LANDSAT 2017  
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**LOCALITY MAP**



PROJECT ID	2118	DATE	6/03/2018
HORIZONTAL DATUM AND PROJECTION	GDA 1994 MGA Zone 50		
CREATED	CHECKED	APPROVED	REVISION
SL	CM	KC	1
Burgess Design Group			
Various Lots, Wattle Grove			
Environmental Assessment Report			

**Figure 1**  
 Site Location 108



**Legend**

- Site Location
- Topographical Contours 1m

- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS  
 - ELEVATION SOURCED DOW 2012  
 - AERIAL PHOTOGRAPHY SOURCED LANDSAT 2017  
 - AERIAL PHOTOGRAPHY SOURCED LANDSAT 2017  
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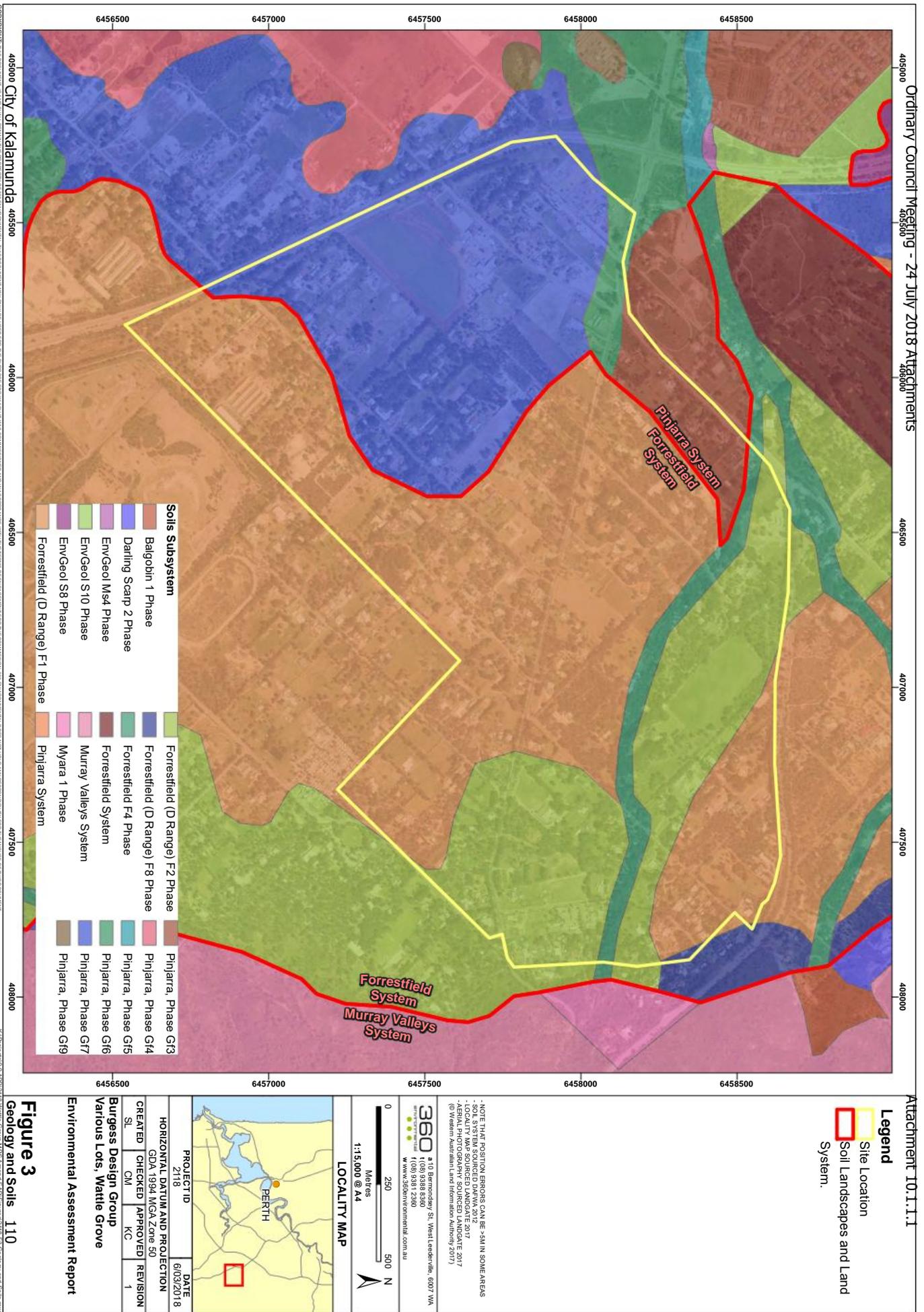
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**LOCALITY MAP**



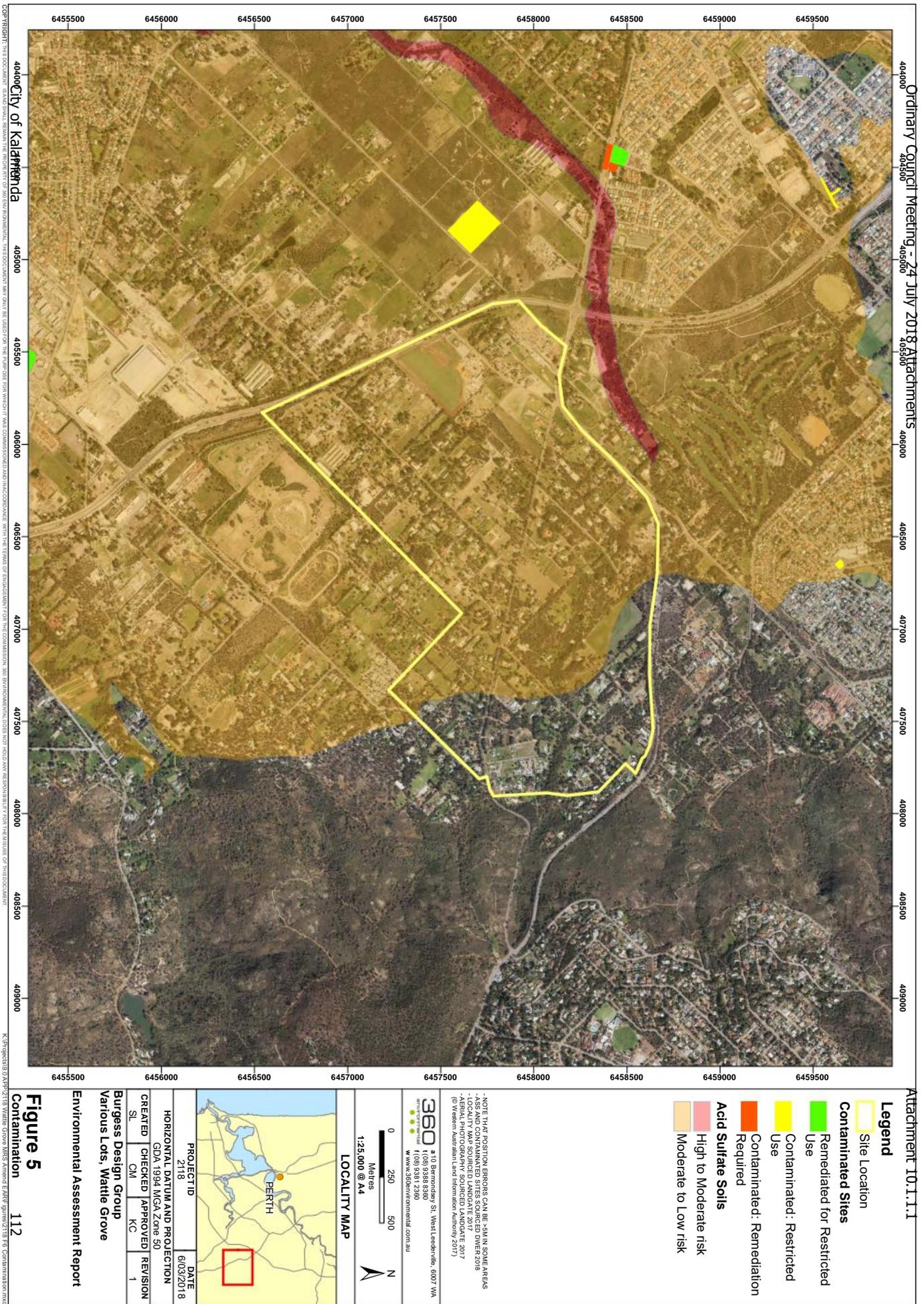
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HORIZONTAL DATUM AND PROJECTION			
GDA 1994 MGA Zone 50			
CREATED	CHECKED	APPROVED	REVISION
SL	CM	KC	1
Burgess Design Group			
Various Lots, Wattle Grove			
Environmental Assessment Report			

**Figure 2**  
 Topography 109

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 K:\Projects\04\Projects\Wattle Grove\MS\Aerial\Aerial\_Summary\_2118\_P2\_topography.dwg







- Legend**
- Site Location
  - Contaminated Sites**
    - Remediated for Restricted Use
    - Contaminated: Restricted Use
    - Contaminated: Remediation Required
  - Acid Sulfate Soils**
    - High to Moderate risk
    - Moderate to Low risk

\*NOTE THAT POSITION ERRORS CAN BE <math>\pm 9\text{m}</math> IN SOME AREAS

- Aerial and Contaminated Sites Sourced DWER 2018

- Aerial Photography Sourced LANDSAT 2017

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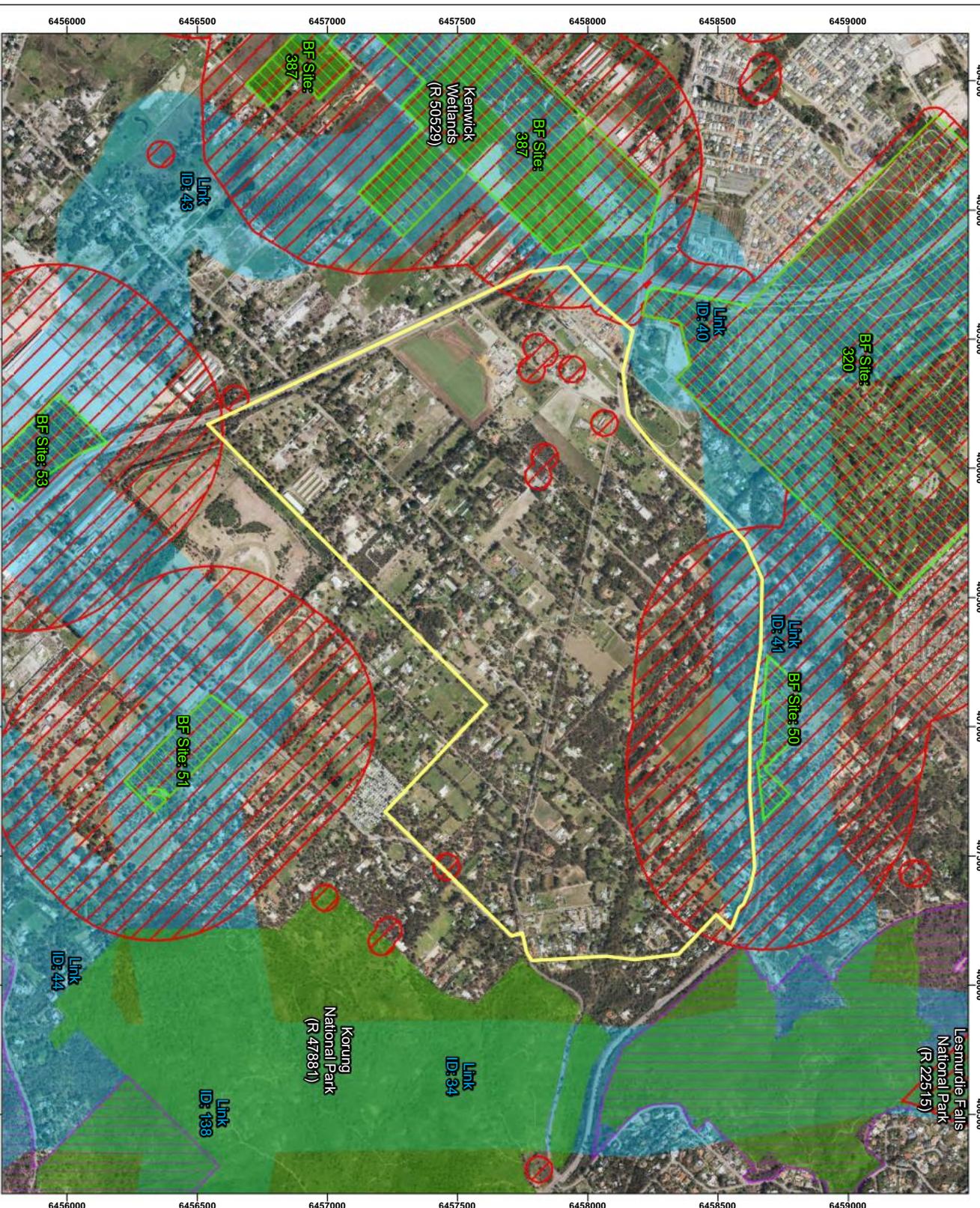
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 Metres  
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**LOCALITY MAP**

PROJECT ID	2118	DATE	6/03/2018
HORIZONTAL DATUM AND PROJECTION	GDA 1994 MGA Zone 50		
CREATED	CHEKED	APPROVED	REVISION
SL	CM	KC	1
Burgess Design Group Various Lots, Wattle Grove			
Environmental Assessment Report			

**Figure 5**  
 Contamination 112

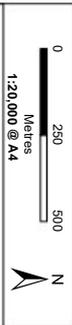
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- Legend**
- Site Location
  - Bush Forever Sites
  - Environmentally Sensitive Areas
  - DBCA Managed Lands
  - Regional Parks
  - Perth Regional Ecological Linkages

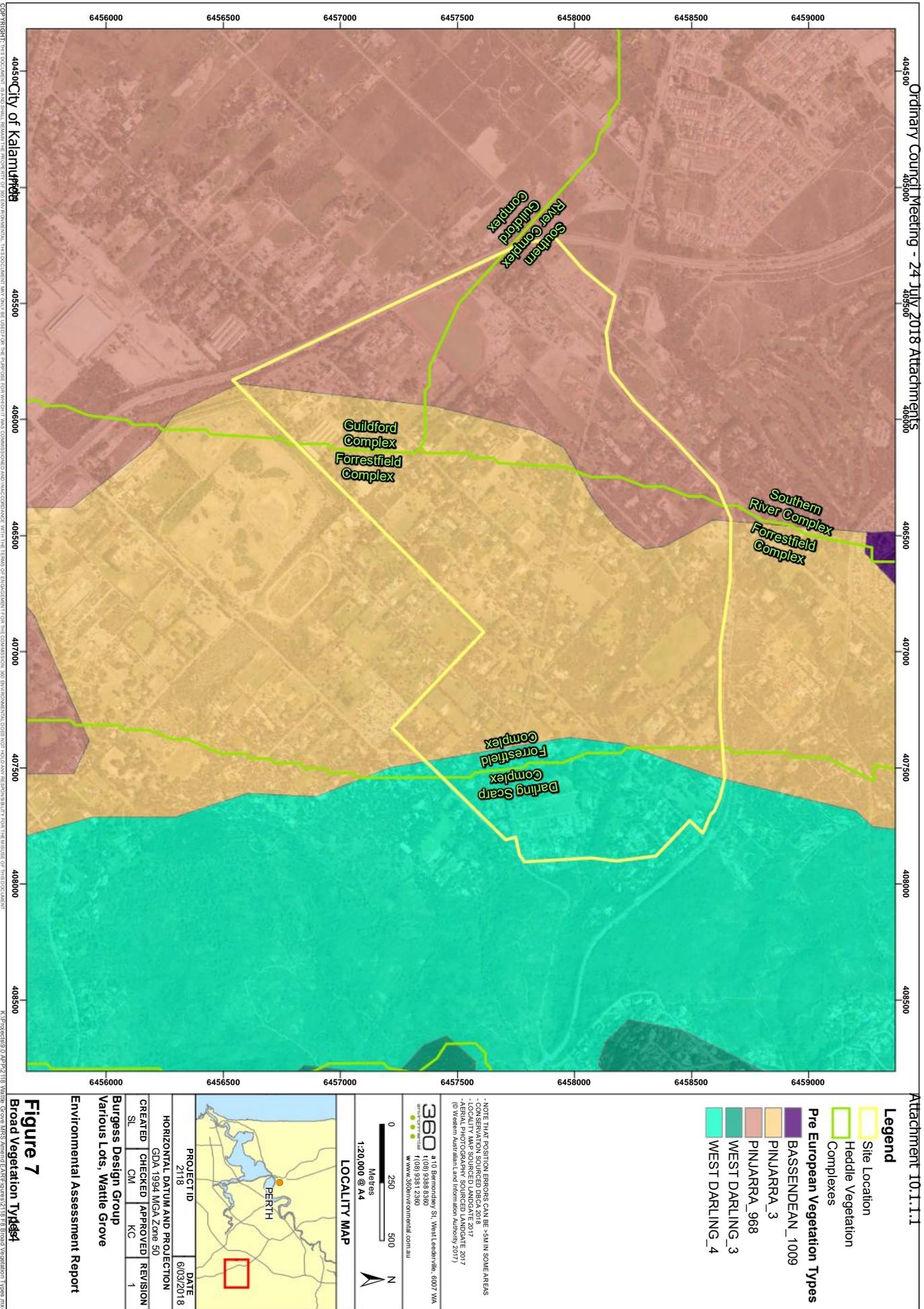
NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS  
 - CONSERVATION SOURCED DBCA 2018  
 - BUSH FOREVER SOURCED DBCA 2017  
 - AERIAL PHOTOGRAPHY SOURCED LANDSAT 2017  
 - @ Western Australian Land Information Authority 2017

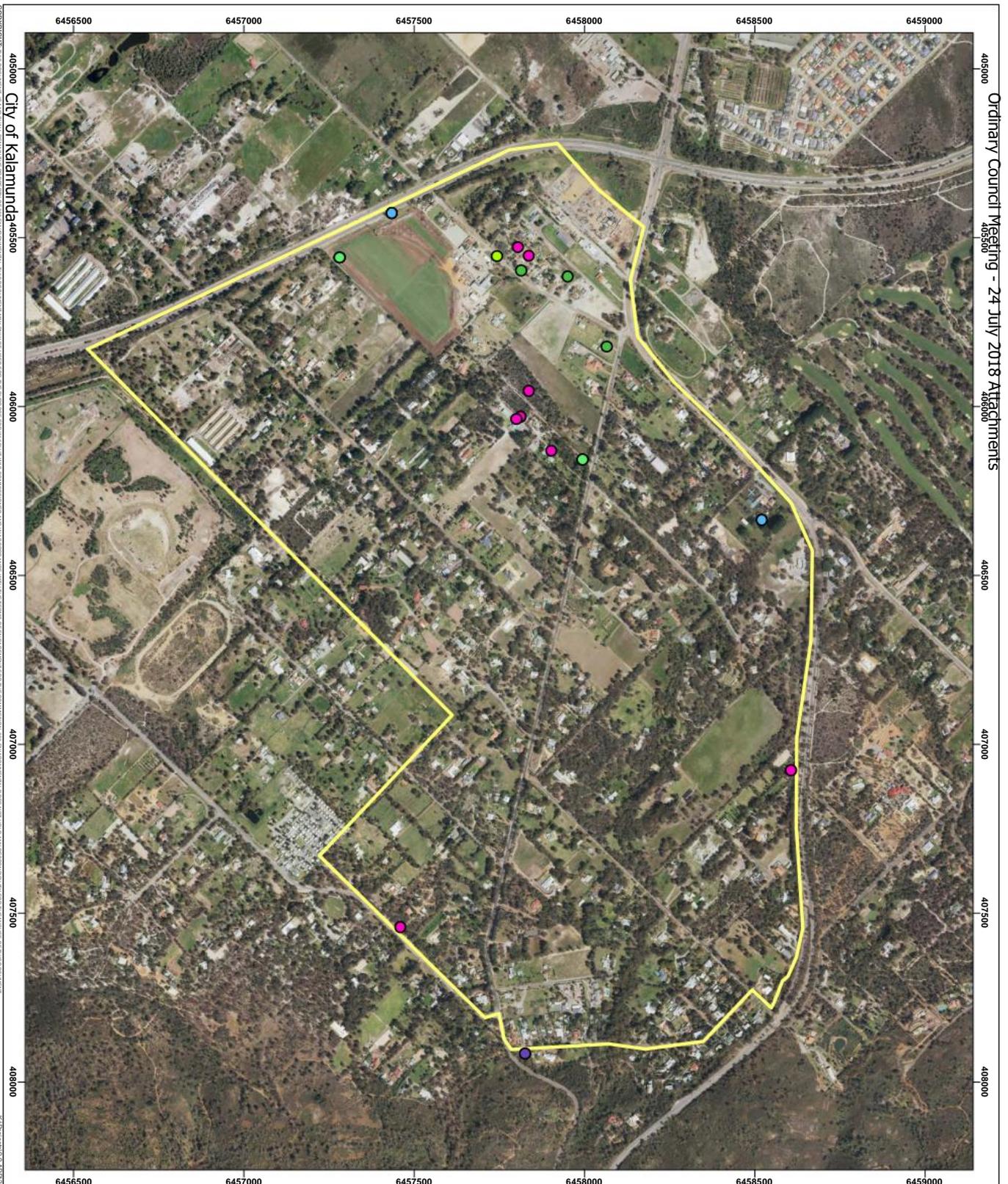
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PROJECT ID		DATE
2118		6/03/2018
HORIZONTAL DATUM AND PROJECTION		
GDA 1994 MGA Zone 50		
CREATED	CHECKED	APPROVED
SL	CM	KC
		1
Burgess Design Group		
Various Lots, Wattle Grove		
Environmental Assessment Report		

**Figure 6**  
 Conservation Areas 113

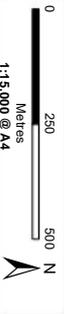




- Legend**
- *Banksia mimica*
  - *Conospermum undulatum*
  - *Isopogon drummondii*
  - *Lasioptelalum glutinosum* subsp. *glutinosum*
  - *Thelymitra magnifica*

- NOTE THAT POSITION ERRORS CAN BE >8M IN SOME AREAS  
 - FLORA SOURCED DEGA 2016 AUGUST 2017  
 - FLORA SOURCED DEGA 2016 AUGUST 2017  
 - AERIAL PHOTOGRAPHY SOURCED LANDSAT 2017  
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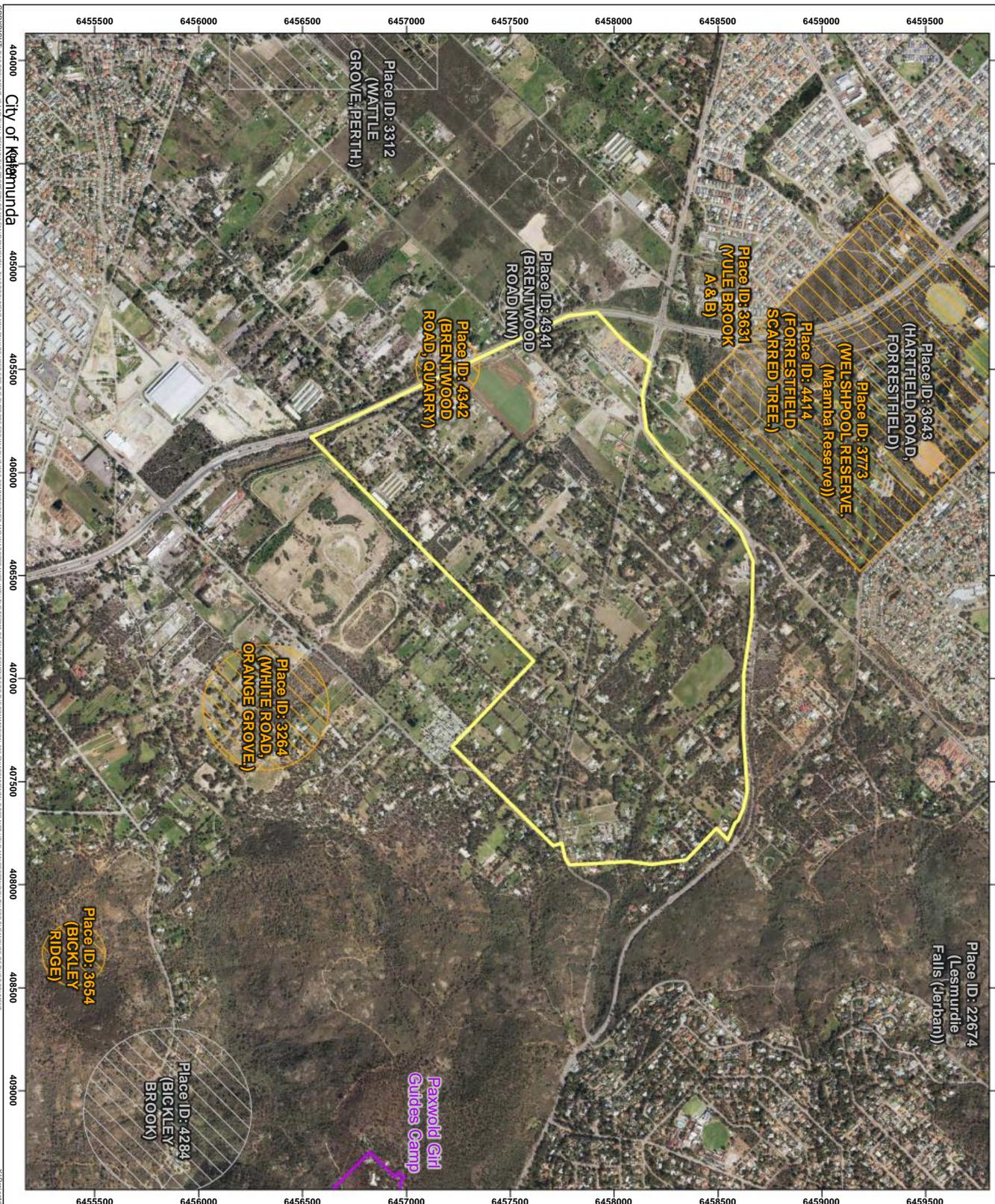
**LOCALITY MAP**



PROJECT ID	2118	DATE	6/03/2018
HORIZONTAL DATUM AND PROJECTION			
GDA 1994 MGA Zone 50			
CREATED	CHECKED	APPROVED	REVISION
SL	CM	KC	1
Burgess Design Group			
Various Lots, Wattle Grove			
Environmental Assessment Report			

**Figure 8**  
 Declared Rare Flora 115





**Legend**

- Site Location
- State Heritage Office Registered Sites
- Aboriginal Heritage Sites - Registered
- Aboriginal Heritage Sites - Lodged

\* NOTE THAT POSITION ERRORS CAN BE > 5M IN SOME AREAS

- HERITAGE SOURCED DDA AND SHO 2018
- AERIAL PHOTOGRAPHY SOURCED LANDSAT 2017
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**LOCALITY MAP**

PROJECT ID: 2118 DATE: 6/03/2018

HORIZONTAL DATUM AND PROJECTION: GDA 1994 MGA Zone 50

CREATED	CHECKED	APPROVED	REVISION
SL	CM	KC	1

Burgess Design Group  
Various Lots, Wattle Grove

Environmental Assessment Report

**Figure 10** 117  
Heritage

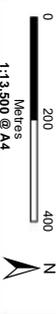
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**Legend**  
 Site Location

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**LOCALITY MAP**



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HORIZONTAL DATUM AND PROJECTION			
GDA 1994 MGA Zone 50			
CREATED	CHECKED	APPROVED	REVISION
SL	CM	KC	1
Burgess Design Group			
Various Lots, Wattle Grove			
Environmental Assessment Report			

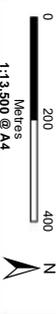
**Figure 11a**  
 Historical Aerial - 1958/18



**Legend**  
 Site Location

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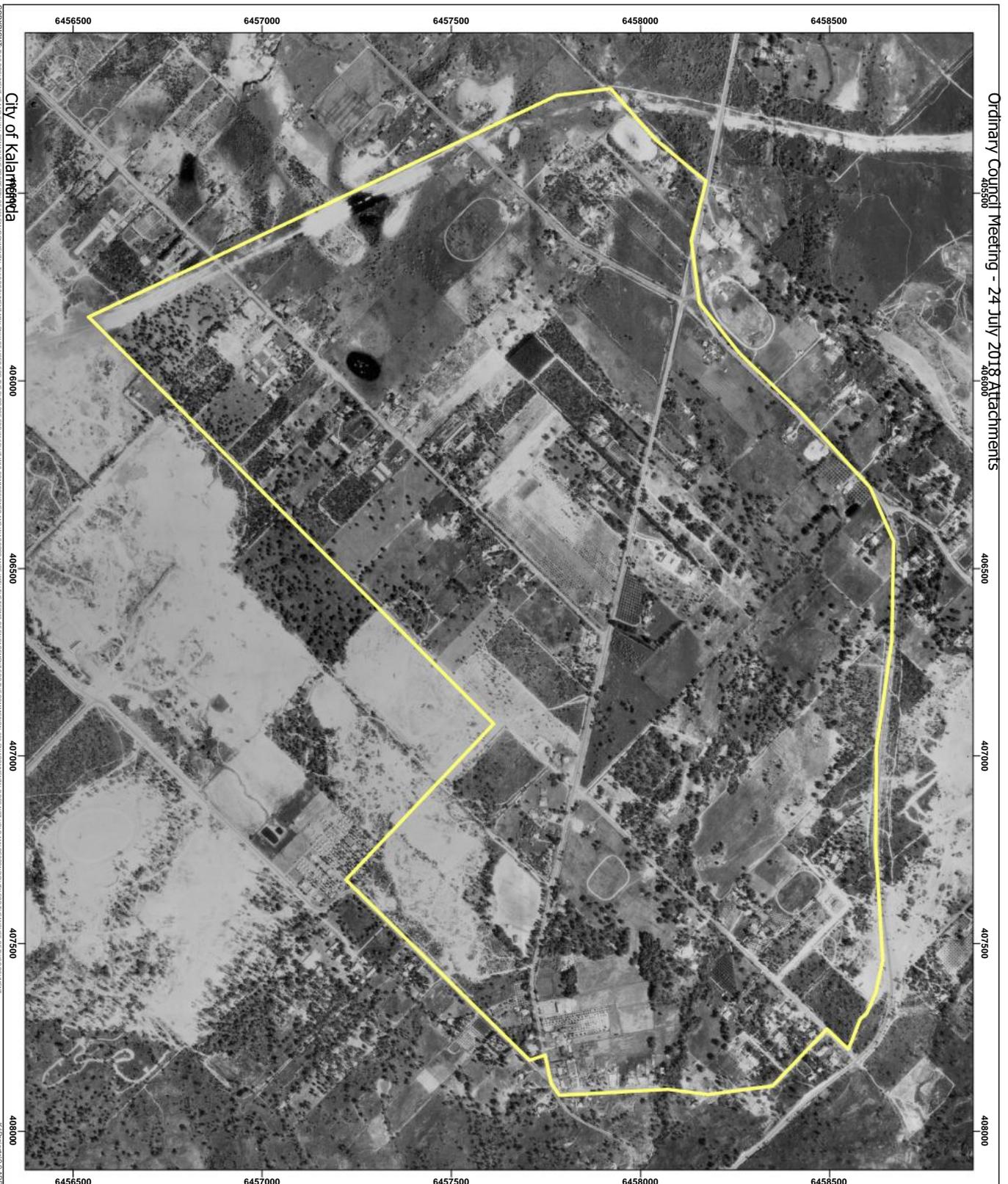


**LOCALITY MAP**



PROJECT ID	2118	DATE	6/03/2018
HORIZONTAL DATUM AND PROJECTION			
GDA 1994 MGA Zone 50			
CREATED	CHECKED	APPROVED	REVISION
SL	CM	KC	1
Burgess Design Group			
Various Lots, Wattle Grove			
Environmental Assessment Report			

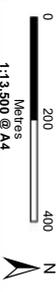
**Figure 11b**  
 Historical Aerial - 1965/19



**Legend**  
 Site Location

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HORIZONTAL DATUM AND PROJECTION			
GDA 1994 MGA Zone 50			
CREATED	CHECKED	APPROVED	REVISION
SL	CM	KC	1
Burgess Design Group			
Various Lots, Wattle Grove			
Environmental Assessment Report			

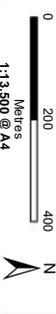
**Figure 11c**  
 Historical Aerial - 1974/20



**Legend**  
 Site Location

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HORIZONTAL DATUM AND PROJECTION	GDA 1994 MGA Zone 50		
CREATED	CHEKED	APPROVED	REVISION
SL	CM	KC	1
Burgess Design Group			
Various Lots, Wattle Grove			
Environmental Assessment Report			

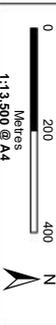
**Figure 11d**  
 Historical Aerial - 1984/21



**Legend**  
 Site Location

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**LOCALITY MAP**



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HORIZONTAL DATUM AND PROJECTION	GDA 1994 MGA Zone 50		
CREATED	CHEKED	APPROVED	REVISION
SL	CM	KC	1
Burgess Design Group			
Various Lots, Wattle Grove			
Environmental Assessment Report			

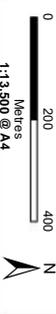
**Figure 11e**  
 Historical Aerial - 1992/2



**Legend**  
 Site Location

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**LOCALITY MAP**



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HORIZONTAL DATUM AND PROJECTION			
GDA 1994 MGA Zone 50			
CREATED	CHECKED	APPROVED	REVISION
SL	CM	KC	1
Burgess Design Group			
Various Lots, Wattle Grove			
Environmental Assessment Report			

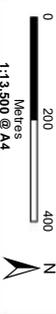
**Figure 11f**  
 Historical Aerial - 200023



**Legend**  
 Site Location

NOTE THAT POSITION ERRORS CAN BE >9M IN SOME AREAS  
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HORIZONTAL DATUM AND PROJECTION			
GDA 1994 MGA Zone 50			
CREATED	CHECKED	APPROVED	REVISION
SL	CM	KC	1
Burgess Design Group			
Various Lots, Wattle Grove			
Environmental Assessment Report			

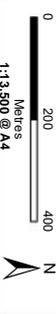
**Figure 19**  
 Historical Aerial - 201824



**Legend**  
 Site Location

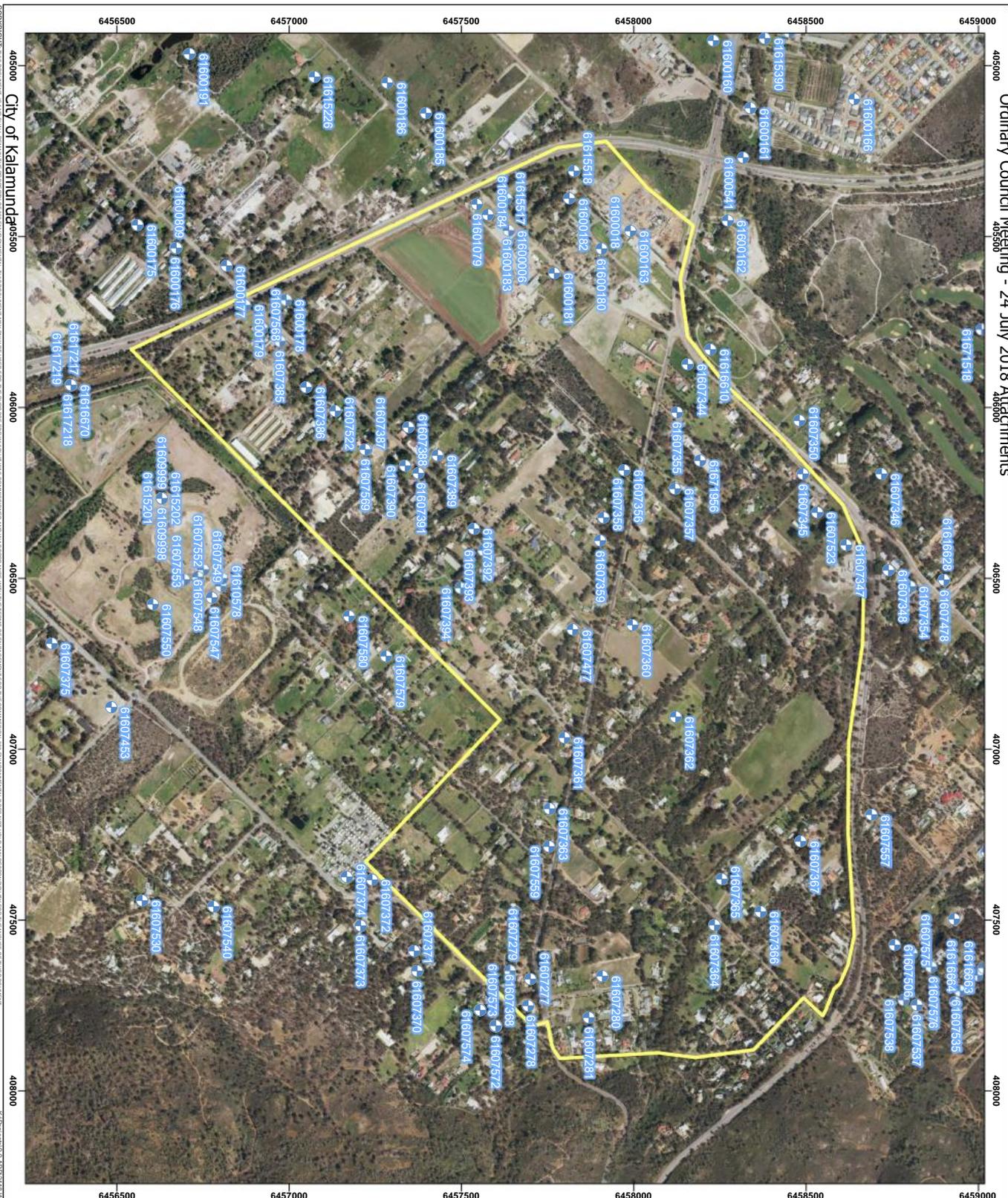
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HORIZONTAL DATUM AND PROJECTION	GDA 1994 MGA Zone 50		
CREATED	CHECKED	APPROVED	REVISION
SL	CM	KC	1
Burgess Design Group			
Various Lots, Wattle Grove			
Environmental Assessment Report			

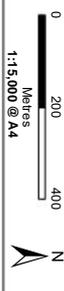
**Figure 11h**  
 Historical Aerials 2017/25



- Legend**
- Site Location
  - WIN Groundwater Bores

NOTE THAT POSITION ERRORS CAN BE >3M IN SOME AREAS  
 - WIN BORES SOURCED DOW 2018  
 - AERIAL PHOTOGRAPHY SOURCED LANDSAT 2017  
 - AERIAL PHOTOGRAPHY SOURCED LANDSAT 2017  
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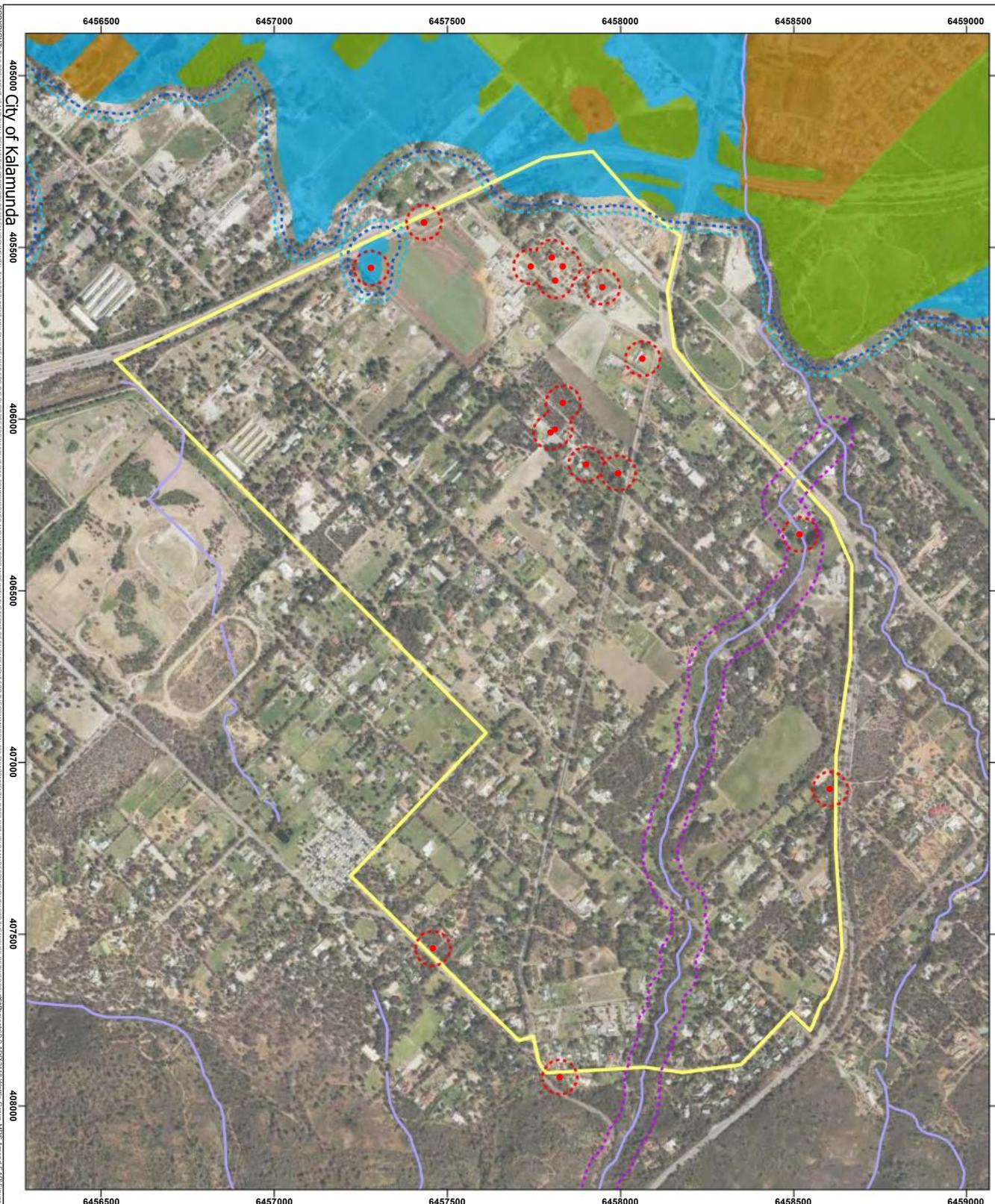


PROJECT ID	DATE		
2118	6/03/2018		
HORIZONTAL DATUM AND PROJECTION			
GDA 1994 MGA Zone 50			
CREATED	CHECKED	APPROVED	REVISION
SL	CNI	KC	1

**Burgess Design Group**  
 Various Lots, Wattle Grove  
 Environmental Assessment Report

**Figure 12**  
**WIN Groundwater Bore**





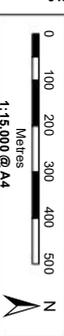
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**Legend**

- Site Boundary
- Declared Rare Flora
- Declared Rare Flora 50m Buffer
- Watercourse - minor, perennial
- Potential Foreshore Area
- Geomorphic Wetlands
- Conservation
- Resource Enhancement
- Multiple Use
- Not Assessed
- Wetland Buffers
- 30m Buffer
- 50m Buffer

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**LOCALITY MAP**



PROJECT ID	2118	DATE	23/04/2018
HORIZONTAL DATUM AND PROJECTION			
GDA 1994 MGA Zone 50			
CREATED	CH	CHECKED	APPROVED
SL	OH	KC	2
BURGESS DESIGN GROUP			
Various Lots, Wattle Grove			
ENVIRONMENTAL ASSESSMENT REPORT			

**Figure 14**  
 Environmental Opportunities  
 and Constraints 128

# APPENDIX A

## EPBC Protected Matters Report



## EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about [Environment Assessments](#) and the EPBC Act including significance guidelines, forms and application process details.

Report created: 25/10/17 19:14:08

### [Summary](#)

### [Details](#)

[Matters of NES](#)

[Other Matters Protected by the EPBC Act](#)

[Extra Information](#)

### [Caveat](#)

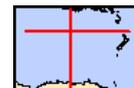
### [Acknowledgements](#)



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[Coordinates](#)

[Buffer: 5.0Km](#)



## Summary

### Matters of National Environmental Significance

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

<a href="#">World Heritage Properties:</a>	None
<a href="#">National Heritage Places:</a>	None
<a href="#">Wetlands of International Importance:</a>	None
<a href="#">Great Barrier Reef Marine Park:</a>	None
<a href="#">Commonwealth Marine Area:</a>	None
<a href="#">Listed Threatened Ecological Communities:</a>	3
<a href="#">Listed Threatened Species:</a>	38
<a href="#">Listed Migratory Species:</a>	9

### Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at <http://www.environment.gov.au/heritage>

A [permit](#) may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

<a href="#">Commonwealth Land:</a>	1
<a href="#">Commonwealth Heritage Places:</a>	None
<a href="#">Listed Marine Species:</a>	15
<a href="#">Whales and Other Cetaceans:</a>	None
<a href="#">Critical Habitats:</a>	None
<a href="#">Commonwealth Reserves Terrestrial:</a>	None
<a href="#">Commonwealth Reserves Marine:</a>	None

### Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

<a href="#">State and Territory Reserves:</a>	7
<a href="#">Regional Forest Agreements:</a>	1
<a href="#">Invasive Species:</a>	43
<a href="#">Nationally Important Wetlands:</a>	1
<a href="#">Key Ecological Features (Marine)</a>	None

## Details

### Matters of National Environmental Significance

#### Listed Threatened Ecological Communities [ Resource Information ]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
<a href="#">Banksia Woodlands of the Swan Coastal Plain ecological community</a>	Endangered	Community likely to occur within area
<a href="#">Clay Pans of the Swan Coastal Plain</a>	Critically Endangered	Community likely to occur within area
<a href="#">Corymbia calophylla - Kingia australis woodlands on heavy soils of the Swan Coastal Plain</a>	Endangered	Community known to occur within area

#### Listed Threatened Species [ Resource Information ]

Name	Status	Type of Presence
<b>Birds</b>		
<a href="#">Botaurus poiciloptilus</a> Australasian Bittern [1001]	Endangered	Species or species habitat known to occur within area
<a href="#">Calidris ferruginea</a> Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
<a href="#">Calyptorhynchus banksii naso</a> Forest Red-tailed Black-Cockatoo, Karrak [67034]	Vulnerable	Species or species habitat known to occur within area
<a href="#">Calyptorhynchus baudinii</a> Baudin's Cockatoo, Long-billed Black-Cockatoo [769]	Vulnerable	Roosting known to occur within area
<a href="#">Calyptorhynchus latirostris</a> Carnaby's Cockatoo, Short-billed Black-Cockatoo [59523]	Endangered	Species or species habitat known to occur within area
<a href="#">Leipoa ocellata</a> Malleefowl [934]	Vulnerable	Species or species habitat likely to occur within area
<a href="#">Numenius madagascariensis</a> Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
<a href="#">Rostratula australis</a> Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area
<b>Insects</b>		
<a href="#">Leioproctus douglasiellus</a> a short-tongued bee [66756]	Critically Endangered	Species or species habitat known to occur within area
<b>Mammals</b>		

Name	Status	Type of Presence
<a href="#">Bettongia penicillata</a> Brush-tailed Bettong, Woylie [213]	Endangered	Species or species habitat may occur within area
<a href="#">Dasyurus geoffroi</a> Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat known to occur within area
<a href="#">Pseudocheirus occidentalis</a> Western Ringtail Possum, Ngwayir, Womp, Woder, Ngoor, Ngoolangit [25911]	Vulnerable	Species or species habitat may occur within area
<a href="#">Setonix brachyurus</a> Quokka [229]	Vulnerable	Species or species habitat likely to occur within area
<b>Plants</b>		
<a href="#">Acacia anomala</a> Grass Wattle, Chittering Grass Wattle [8153]	Vulnerable	Species or species habitat known to occur within area
<a href="#">Andersonia gracilis</a> Slender Andersonia [14470]	Endangered	Species or species habitat known to occur within area
<a href="#">Anthocercis gracilis</a> Slender Tailflower [11103]	Vulnerable	Species or species habitat likely to occur within area
<a href="#">Banksia mimica</a> Summer Honeypot [82765]	Endangered	Species or species habitat likely to occur within area
<a href="#">Caladenia huegelii</a> King Spider-orchid, Grand Spider-orchid, Rusty Spider-orchid [7309]	Endangered	Species or species habitat likely to occur within area
<a href="#">Calytrix breviseta subsp. breviseta</a> Swamp Starflower [23879]	Endangered	Species or species habitat known to occur within area
<a href="#">Chamelaucium sp. Gingin (N.G.Marchant 6)</a> Gingin Wax [88881]	Endangered	Species or species habitat may occur within area
<a href="#">Conospermum undulatum</a> Wavy-leaved Smokebush [24435]	Vulnerable	Species or species habitat likely to occur within area
<a href="#">Darwinia apiculata</a> Scarp Darwinia [8763]	Endangered	Species or species habitat likely to occur within area
<a href="#">Diuris drummondii</a> Tall Donkey Orchid [4365]	Vulnerable	Species or species habitat likely to occur within area
<a href="#">Diuris micrantha</a> Dwarf Bee-orchid [55082]	Vulnerable	Species or species habitat likely to occur within area
<a href="#">Diuris purdiei</a> Purdie's Donkey-orchid [12950]	Endangered	Species or species habitat known to occur within area
<a href="#">Drakaea elastica</a> Glossy-leaved Hammer Orchid, Glossy-leaved Hammer Orchid, Warty Hammer Orchid [16753]	Endangered	Species or species habitat likely to occur within area
<a href="#">Drakaea micrantha</a> Dwarf Hammer-orchid [56755]	Vulnerable	Species or species habitat may occur within area

Name	Status	Type of Presence
<a href="#">Eleocharis keigheryi</a> Keighery's Eleocharis [64893]	Vulnerable	Species or species habitat known to occur within area
<a href="#">Eucalyptus x balanites</a> Cadda Road Mallee, Cadda Mallee [87816]	Endangered	Species or species habitat may occur within area
<a href="#">Grevillea curviloba subsp. incurva</a> Narrow curved-leaf Grevillea [64909]	Endangered	Species or species habitat likely to occur within area
<a href="#">Lasiopetalum pterocarpum</a> Wing-fruited Lasiopetalum [64922]	Endangered	Species or species habitat may occur within area
<a href="#">Lepidosperma rostratum</a> Beaked Lepidosperma [14152]	Endangered	Species or species habitat likely to occur within area
<a href="#">Macarthuria keigheryi</a> Keighery's Macarthuria [64930]	Endangered	Species or species habitat likely to occur within area
<a href="#">Ptilotus pyramidatus</a> Pyramid Mulla-mulla [18216]	Critically Endangered	Species or species habitat known to occur within area
<a href="#">Synaphea sp. Fairbridge Farm (D. Papenfus 696)</a> Selena's Synaphea [82881]	Critically Endangered	Species or species habitat known to occur within area
<a href="#">Synaphea stenoloba</a> Dwellingup Synaphea [66311]	Endangered	Species or species habitat may occur within area
<a href="#">Thelymitra dedmaniarum</a> Cinnamon Sun Orchid [65105]	Endangered	Species or species habitat likely to occur within area
<a href="#">Thelymitra stellata</a> Star Sun-orchid [7060]	Endangered	Species or species habitat known to occur within area

**Listed Migratory Species** [ Resource Information ]

\* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
<b>Migratory Marine Birds</b>		
<a href="#">Apus pacificus</a> Fork-tailed Swift [678]		Species or species habitat likely to occur within area
<b>Migratory Terrestrial Species</b>		
<a href="#">Motacilla cinerea</a> Grey Wagtail [642]		Species or species habitat may occur within area
<b>Migratory Wetlands Species</b>		
<a href="#">Actitis hypoleucos</a> Common Sandpiper [59309]		Species or species habitat may occur within area
<a href="#">Calidris acuminata</a> Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
<a href="#">Calidris ferruginea</a> Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area

Name	Threatened	Type of Presence
Ordinary Council Meeting - 24 July 2018 Attachments <a href="#">Calidris melanotos</a> Pectoral Sandpiper [858]		Species or species habitat may occur within area
<a href="#">Numenius madagascariensis</a> Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
<a href="#">Pandion haliaetus</a> Osprey [952]		Species or species habitat may occur within area
<a href="#">Tringa nebularia</a> Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

### Other Matters Protected by the EPBC Act

#### Commonwealth Land [ Resource Information ]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Name
Commonwealth Land -

#### Listed Marine Species [ Resource Information ]

\* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
<b>Birds</b>		
<a href="#">Actitis hypoleucos</a> Common Sandpiper [59309]		Species or species habitat may occur within area
<a href="#">Apus pacificus</a> Fork-tailed Swift [678]		Species or species habitat likely to occur within area
<a href="#">Ardea alba</a> Great Egret, White Egret [59541]		Species or species habitat known to occur within area
<a href="#">Ardea ibis</a> Cattle Egret [59542]		Species or species habitat may occur within area
<a href="#">Calidris acuminata</a> Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
<a href="#">Calidris ferruginea</a> Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
<a href="#">Calidris melanotos</a> Pectoral Sandpiper [858]		Species or species habitat may occur within area
<a href="#">Haliaeetus leucogaster</a> White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
<a href="#">Merops ornatus</a> Rainbow Bee-eater [670]		Species or species habitat may occur within

Name	Threatened	Type of Presence
Ordinary Council Meeting - 24 July 2018 Attachments <a href="#">Motacilla cinerea</a> Grey Wagtail [642]		Presence area Species or species habitat may occur within area
<a href="#">Numenius madagascariensis</a> Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
<a href="#">Pandion haliaetus</a> Osprey [952]		Species or species habitat may occur within area
<a href="#">Rostratula benghalensis (sensu lato)</a> Painted Snipe [889]	Endangered*	Species or species habitat may occur within area
<a href="#">Thinornis rubricollis</a> Hooded Plover [59510]		Species or species habitat may occur within area
<a href="#">Tringa nebularia</a> Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

## Extra Information

State and Territory Reserves	[ Resource Information ]
Name	State
Kenwick Wetlands	WA
Korung	WA
Lesmurdie Falls	WA
Unnamed WA23076	WA
Unnamed WA24657	WA
Unnamed WA29815	WA
Unnamed WA37997	WA

Regional Forest Agreements	[ Resource Information ]
Note that all areas with completed RFAs have been included.	
Name	State
<a href="#">South West WA RFA</a>	Western Australia

Invasive Species	[ Resource Information ]
Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resources Audit, 2001.	

Name	Status	Type of Presence
<b>Birds</b>		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur

Name	Status	Type of Presence
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		within area Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Passer montanus Eurasian Tree Sparrow [406]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Streptopelia senegalensis Laughing Turtle-dove, Laughing Dove [781]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Turdus merula Common Blackbird, Eurasian Blackbird [596]		Species or species habitat likely to occur within area
<b>Mammals</b>		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Capra hircus Goat [2]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Feral deer Feral deer species in Australia [85733]		Species or species habitat likely to occur within area
Funambulus pennantii Northern Palm Squirrel, Five-striped Palm Squirrel [129]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus norvegicus Brown Rat, Norway Rat [83]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur

Name	Status	Type of Presence
Vulpes vulpes Red Fox, Fox [18]		within area  Species or species habitat likely to occur within area
<b>Plants</b>		
Anredera cordifolia Madeira Vine, Jalap, Lamb's-tail, Mignonette Vine, Anredera, Gulf Madeiravine, Heartleaf Madeiravine, Potato Vine [2643] Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area  Species or species habitat likely to occur within area
Brachiaria mutica Para Grass [5879]		Species or species habitat may occur within area
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat may occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area
Chrysanthemoides monilifera subsp. monilifera Boneseed [16905]		Species or species habitat likely to occur within area
Eichhornia crassipes Water Hyacinth, Water Orchid, Nile Lily [13466]		Species or species habitat likely to occur within area
Genista linifolia Flax-leaved Broom, Mediterranean Broom, Flax Broom [2800]		Species or species habitat likely to occur within area
Genista monspessulana Montpellier Broom, Cape Broom, Canary Broom, Common Broom, French Broom, Soft Broom [20126]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892] Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area  Species or species habitat likely to occur within area
Olea europaea Olive, Common Olive [9160]		Species or species habitat may occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Sagittaria platyphylla Delta Arrowhead, Arrowhead, Slender Arrowhead [68483]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and		Species or species

Name	Status	Type of Presence
Sterile Pussy Willow [68497]		habitat likely to occur within area
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
Tamarix aphylla Athel Pine, Athel Tree, Tamarisk, Athel Tamarisk, Athel Tamarix, Desert Tamarisk, Flowering Cypress, Salt Cedar [16018]		Species or species habitat likely to occur within area
<b>Reptiles</b>		
Hemidactylus frenatus Asian House Gecko [1708]		Species or species habitat likely to occur within area
Ramphotyphlops braminus Flowerpot Blind Snake, Brahminy Blind Snake, Cacing Besi [1258]		Species or species habitat likely to occur within area
<b>Nationally Important Wetlands</b>		<b>[ Resource Information ]</b>
Name	State	
<a href="#">Brixton Street Swamps</a>	WA	

## Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

## Coordinates

-32.00957 116.00676

## Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

- [Office of Environment and Heritage, New South Wales](#)
- [Department of Environment and Primary Industries, Victoria](#)
- [Department of Primary Industries, Parks, Water and Environment, Tasmania](#)
- [Department of Environment, Water and Natural Resources, South Australia](#)
- [Department of Land and Resource Management, Northern Territory](#)
- [Department of Environmental and Heritage Protection, Queensland](#)
- [Department of Parks and Wildlife, Western Australia](#)
- [Environment and Planning Directorate, ACT](#)
- [Birdlife Australia](#)
- [Australian Bird and Bat Banding Scheme](#)
- [Australian National Wildlife Collection](#)
- [Natural history museums of Australia](#)
- [Museum Victoria](#)
- [Australian Museum](#)
- [South Australian Museum](#)
- [Queensland Museum](#)
- [Online Zoological Collections of Australian Museums](#)
- [Queensland Herbarium](#)
- [National Herbarium of NSW](#)
- [Royal Botanic Gardens and National Herbarium of Victoria](#)
- [Tasmanian Herbarium](#)
- [State Herbarium of South Australia](#)
- [Northern Territory Herbarium](#)
- [Western Australian Herbarium](#)
- [Australian National Herbarium, Canberra](#)
- [University of New England](#)
- [Ocean Biogeographic Information System](#)
- [Australian Government, Department of Defence Forestry Corporation, NSW](#)
- [Geoscience Australia](#)
- [CSIRO](#)
- [Australian Tropical Herbarium, Cairns](#)
- [eBird Australia](#)
- [Australian Government – Australian Antarctic Data Centre](#)
- [Museum and Art Gallery of the Northern Territory](#)
- [Australian Government National Environmental Science Program](#)
- [Australian Institute of Marine Science](#)
- [Reef Life Survey Australia](#)
- [American Museum of Natural History](#)
- [Queen Victoria Museum and Art Gallery, Inveresk, Tasmania](#)
- [Tasmanian Museum and Art Gallery, Hobart, Tasmania](#)
- Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the [Contact Us](#) page.

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# APPENDIX B

## DBCA Naturemap Report

# NatureMap Species Report

Created By Guest user on 26/10/2017

**Current Names Only** Yes  
**Core Datasets Only** Yes  
**Method** 'By Circle'  
**Centre** 116° 00' 26" E, 32° 00' 41" S  
**Buffer** 5km  
**Group By** Kingdom

Kingdom	Species	Records
Animalia	395	9190
Fungi	23	45
Plantae	1063	3808
Protozoa	4	5
<b>TOTAL</b>	<b>1485</b>	<b>13048</b>

Name ID	Species Name	Naturalised	Conservation Code	Endemic To Query Area
<b>Animalia</b>				
1.	24260 <i>Acanthiza apicalis</i> (Broad-tailed Thornbill, Inland Thornbill)			
2.	24261 <i>Acanthiza chrysorrhoa</i> (Yellow-rumped Thornbill)			
3.	24262 <i>Acanthiza inornata</i> (Western Thornbill)			
4.	24265 <i>Acanthiza uropygialis</i> (Chestnut-rumped Thornbill)			
5.	25242 <i>Acanthophis antarcticus</i> (Southern Death Adder)		P3	
6.	24560 <i>Acanthorhynchus superciliosus</i> (Western Spinebill)			
7.	25535 <i>Accipiter cirrocephalus</i> (Collared Sparrowhawk)			
8.	25536 <i>Accipiter fasciatus</i> (Brown Goshawk)			
9.	24282 <i>Accipiter fasciatus subsp. fasciatus</i> (Brown Goshawk)			
10.	42368 <i>Acritoscincus trilineatus</i> (Western Three-lined Skink)			
11.	25755 <i>Acrocephalus australis</i> (Australian Reed Warbler)			
12.	41323 <i>Actitis hypoleucos</i> (Common Sandpiper)		IA	
13.	<i>Agraptocorixa parvipunctata</i>			
14.	<i>Ainudrilus nhama</i>			
15.	<i>Alboa worooa</i>			
16.	<i>Allodessus bistrigatus</i>			
17.	<i>Alona affinis</i>			
18.	<i>Alona cf. guttata</i>			
19.	<i>Alona rigidicaudis</i>			
20.	<i>Alona setigera</i>			
21.	<i>Alonella clathratula</i>			
22.	<i>Aname mainae</i>			
23.	<i>Aname tepperi</i>			
24.	24312 <i>Anas gracilis</i> (Grey Teal)			
25.	24313 <i>Anas platyrhynchos</i> (Mallard)			
26.	24315 <i>Anas rhynchotis</i> (Australasian Shoveler)			
27.	24316 <i>Anas superciliosa</i> (Pacific Black Duck)			
28.	47414 <i>Anhinga novaehollandiae</i> (Australasian Darter)			
29.	<i>Anisops thienemanni</i>			
30.	<i>Anopheles annulipes s.l.</i>			
31.	<i>Anser anser</i>			
32.	25241 <i>Antaresia stimsoni subsp. stimsoni</i> (Stimson's Python)			
33.	24561 <i>Anthochaera canunculata</i> (Red Wattlebird)			
34.	24562 <i>Anthochaera lunulata</i> (Western Little Wattlebird)			
35.	24991 <i>Aprasia repens</i> (Sand-plain Worm-lizard)			
36.	<i>Apsectrotanypus nr maculosa</i>			
37.	24285 <i>Aquila audax</i> (Wedge-tailed Eagle)			
38.	<i>Arachnura higginsi</i>			
39.	<i>Araneus cyphoxis</i>			
40.	<i>Araneus eburnus</i>			
41.	41324 <i>Ardea modesta</i> (great egret, white egret)		IA	
42.	24340 <i>Ardea novaehollandiae</i> (White-faced Heron)			
43.	24341 <i>Ardea pacifica</i> (White-necked Heron)			

Name ID	Species Name	Naturalised	Conservation Code	<sup>1</sup> Endemic To Query Area
44.	<i>Arrenurus (Micruracarus) sp. 1 (SAP)</i>			
45.	25566 <i>Artamus cinereus (Black-faced Woodswallow)</i>			
46.	24353 <i>Artamus cyanopterus (Dusky Woodswallow)</i>			
47.	<i>Artoria linnaei</i>			
48.	<i>Artoriopsis joergi</i>			
49.	<i>Austracantha minax</i>			
50.	<i>Austrolestes analis</i>			
51.	<i>Austrolestes io</i>			
52.	24318 <i>Aythya australis (Hardhead)</i>			
53.	<i>Backobourkia heroine</i>			
54.	<i>Ballarra longipalpus</i>			
55.	<i>Barnardius zonarius</i>			
56.	<i>Bennelongia sp.</i>			
57.	<i>Berosus approximans</i>			
58.	<i>Berosus australiae</i>			
59.	24162 <i>Bettongia penicillata subsp. ogilbyi (Woylie, Brush-tailed Bettong)</i>		T	
60.	<i>Bezzia sp.</i>			
61.	<i>Bezzia sp. 2 (SAP)</i>			
62.	24319 <i>Biziura lobata (Musk Duck)</i>			
63.	<i>Boeckella bispinosa</i>			
64.	<i>Brachionus quadridentatus</i>			
65.	42381 <i>Brachyurophis semifasciatus (Southern Shovel-nosed Snake)</i>			
66.	25713 <i>Cacatua galerita (Sulphur-crested Cockatoo)</i>			
67.	25714 <i>Cacatua pastinator (Western Long-billed Corella)</i>			
68.	25715 <i>Cacatua roseicapilla (Galah)</i>			
69.	25716 <i>Cacatua sanguinea (Little Corella)</i>			
70.	24729 <i>Cacatua tenuirostris (Eastern Long-billed Corella)</i>	Y		
71.	25598 <i>Cacomantis flabelliformis (Fan-tailed Cuckoo)</i>			
72.	42307 <i>Cacomantis pallidus (Pallid Cuckoo)</i>			
73.	25717 <i>Calyptorhynchus banksii (Red-tailed Black-Cockatoo)</i>			
74.	24731 <i>Calyptorhynchus banksii subsp. naso (Forest Red-tailed Black-Cockatoo)</i>		T	
75.	24733 <i>Calyptorhynchus baudinii (Baudin's Cockatoo (long-billed black-cockatoo), Baudin's Cockatoo)</i>		T	
76.	24734 <i>Calyptorhynchus latirostris (Carnaby's Cockatoo (short-billed black-cockatoo), Carnaby's Cockatoo)</i>		T	
77.	48400 <i>Calyptorhynchus sp. (white-tailed black cockatoo)</i>		T	
78.	<i>Candonocypris novaehollandiae</i>			
79.	<i>Ceinidae sp.</i>			
80.	<i>Cephalodella gibba</i>			
81.	<i>Ceratopogonidae sp.</i>			
82.	<i>Cercophonius granulosus</i>			
83.	<i>Cercophonius sulcatus</i>			
84.	<i>Ceriodaphnia sp.</i>			
85.	24186 <i>Chalinolobus gouldii (Gould's Wattle Bat)</i>			
86.	<i>Chaoboridae sp.</i>			
87.	43380 <i>Chelodina colliei (South-western Snake-necked Turtle)</i>			
88.	24321 <i>Chenonetta jubata (Australian Wood Duck, Wood Duck)</i>			
89.	33939 <i>Cherax cainii (Marron)</i>			
90.	<i>Cherax destructor</i>			
91.	<i>Cherax quinquecarinatus</i>			
92.	<i>Chironominae sp.</i>			
93.	24980 <i>Christinus marmoratus (Marbled Gecko)</i>			
94.	<i>Chroicocephalus novaehollandiae</i>			
95.	<i>Chydorus sp.</i>			
96.	24288 <i>Circus approximans (Swamp Harrier)</i>			
97.	<i>Coenagrionidae sp.</i>			
98.	25675 <i>Colluricincla harmonica (Grey Shrike-thrush)</i>			
99.	24399 <i>Columba livia (Domestic Pigeon)</i>	Y		
100.	24361 <i>Coracina maxima (Ground Cuckoo-shrike)</i>			
101.	25568 <i>Coracina novaehollandiae (Black-faced Cuckoo-shrike)</i>			
102.	24363 <i>Coracina novaehollandiae subsp. subpallida (Black-faced Cuckoo-shrike)</i>			
103.	<i>Corixidae sp.</i>			
104.	<i>Cormocephalus aurantiipes</i>			
105.	<i>Cormocephalus rubriceps</i>			
106.	<i>Cormocephalus strigosus</i>			
107.	25592 <i>Corvus coronoides (Australian Raven)</i>			
108.	24417 <i>Corvus coronoides subsp. perplexus (Australian Raven)</i>			
109.	<i>Corynoneura sp. (V49) (SAP)</i>			
110.	24420 <i>Cracticus nigrogularis (Pied Butcherbird)</i>			
111.	25595 <i>Cracticus tibicen (Australian Magpie)</i>			

Name ID	Species Name	Naturalised	Conservation Code	<sup>1</sup> Endemic To Query Area
112.	24422 <i>Cracticus tibicen subsp. dorsalis</i> (White-backed Magpie)			
113.	25596 <i>Cracticus torquatus</i> (Grey Butcherbird)			
114.	<i>Cricotopus 'brevicornis'</i>			
115.	25398 <i>Crinia georgiana</i> (Quacking Frog)			
116.	25399 <i>Crinia glauerti</i> (Clicking Frog)			
117.	25400 <i>Crinia insignifera</i> (Squelching Froglet)			
118.	25401 <i>Crinia pseudinsignifera</i> (Bleating Froglet)			
119.	30893 <i>Cryptoblepharus buehananii</i>			
120.	<i>Cryptochironomus griseidorsum</i>			
121.	24883 <i>Ctenophorus ornatus</i> (Ornate Crevice-Dragon)			
122.	25027 <i>Ctenotus australis</i>			
123.	25039 <i>Ctenotus fallens</i>			
124.	<i>Culex (Culex) annulirostris</i>			
125.	<i>Culicoides sp.</i>			
126.	24322 <i>Cygnus atratus</i> (Black Swan)			
127.	<i>Cypretta sp.</i>			
128.	<i>Cyprinotus cingalensis</i>			
129.	30901 <i>Dacelo novaeguineae</i> (Laughing Kookaburra)	Y		
130.	25673 <i>Daphoenositta chrysoptera</i> (Varied Sittella)			
131.	24092 <i>Dasyurus geoffroii</i> (Chuditch, Western Quoll)		T	
132.	<i>Delena cancerides</i>			
133.	25766 <i>Delma fraseri</i> (Fraser's Legless Lizard)			
134.	24999 <i>Delma grayii</i>			
135.	25296 <i>Demansia psammophis subsp. reticulata</i> (Yellow-faced Whipsnake)			
136.	<i>Diaphanosoma sp.</i>			
137.	25607 <i>Dicaeum hirundinaceum</i> (Mistletoebird)			
138.	<i>Dingosa serrata</i>			
139.	<i>Dinocambala ingens</i>			
140.	24939 <i>Diplodactylus polyophthalmus</i>			
141.	<i>Diptera sp.</i>			
142.	<i>Dolichopodidae sp.</i>			
143.	<i>Dunhevedia crassa</i>			
144.	<i>Dytiscidae sp.</i>			
145.	25096 <i>Egernia kingii</i> (King's Skink)			
146.	<i>Egretta novaehollandiae</i>			
147.	<i>Elanus axillaris</i>			
148.	47937 <i>Euseyornis melanops</i> (Black-fronted Dotterel)			
149.	<i>Eolophus roseicapillus</i>			
150.	24652 <i>Eopsaltria georgiana</i> (White-breasted Robin)			
151.	<i>Ephydriidae sp.</i>			
152.	<i>Eriophora biapicata</i>			
153.	24379 <i>Erythronyctis cinctus</i> (Red-kneed Dotterel)			
154.	<i>Euchlanis sp.</i>			
155.	<i>Eupograptus kottae</i>			
156.	<i>Eylais sp.</i>			
157.	25621 <i>Falco berigora</i> (Brown Falcon)			
158.	25622 <i>Falco cenchroides</i> (Australian Kestrel, Nankeen Kestrel)			
159.	24472 <i>Falco cenchroides subsp. cenchroides</i> (Australian Kestrel, Nankeen Kestrel)			
160.	25623 <i>Falco longipennis</i> (Australian Hobby)			
161.	25624 <i>Falco peregrinus</i> (Peregrine Falcon)		S	
162.	24041 <i>Felis catus</i> (Cat)	Y		
163.	25727 <i>Fulica atra</i> (Eurasian Coot)			
164.	24761 <i>Fulica atra subsp. australis</i> (Eurasian Coot)			
165.	30916 <i>Funambulus pennanti</i> (Indian Palm Squirrel)	Y		
166.	34028 <i>Galaxias occidentalis</i> (Western Minnow)			
167.	25729 <i>Gallinula tenebrosa</i> (Dusky Moorhen)			
168.	24763 <i>Gallinula tenebrosa subsp. tenebrosa</i> (Dusky Moorhen)			
169.	25730 <i>Gallirallus philippensis</i> (Buff-banded Rail)			
170.	24765 <i>Gallirallus philippensis subsp. mellori</i> (Buff-banded Rail)			
171.	<i>Gallus gallus</i>			
172.	25530 <i>Gerygone fusca</i> (Western Gerygone)			
173.	24271 <i>Gerygone fusca subsp. fusca</i> (Western Gerygone)			
174.	<i>Glacidorbidae sp.</i>			Y
175.	47962 <i>Glyciphila melanops</i> (Tawny-crowned Honeyeater)			
176.	<i>Glyptophysa sp.</i>			
177.	24443 <i>Grallina cyanoleuca</i> (Magpie-lark)			
178.	<i>Gripopterygidae sp.</i>			
179.	24295 <i>Haliastur sphenurus</i> (Whistling Kite)			
180.	<i>Haliplus gibbus</i>			
181.	<i>Hebrididae sp.</i>			

Name ID	Species Name	Naturalised	Conservation Code	<sup>1</sup> Endemic To Query Area
182.	25409 <i>Heleioporus barycragus</i> (Hooting Frog)			
183.	25410 <i>Heleioporus eyrei</i> (Moaning Frog)			
184.	<i>Hemianax papuensis</i>			
185.	<i>Hemicordulia tau</i>			
186.	<i>Hemicorduliidae</i> sp.			
187.	25115 <i>Hemiergis initialis</i> subsp. <i>initialis</i>			
188.	25119 <i>Hemiergis quadrilineata</i>			
189.	24961 <i>Heteronotia binoei</i> (Bynoe's Gecko)			
190.	47965 <i>Hieraaetus morphnoides</i> (Little Eagle)			
191.	25734 <i>Himantopus himantopus</i> (Black-winged Stilt)			
192.	24491 <i>Hirundo neoxena</i> (Welcome Swallow)			
193.	<i>Holasteron perth</i>			
194.	24215 <i>Hydromys chrysogaster</i> (Water-rat, Rakali)		P4	
195.	<i>Hydrophilidae</i> sp.			
196.	<i>Idiommatia blackwalli</i>			
197.	<i>Ilyocyptus</i> sp.			
198.	<i>Ilyodromus</i> sp.			
199.	<i>Isidorella</i> sp.			
200.	25478 <i>Isoodon obesulus</i> (Southern Brown Bandicoot)		P4	
201.	24153 <i>Isoodon obesulus</i> subsp. <i>fusciventer</i> (Quenda, Southern Brown Bandicoot)		P4	
202.	<i>Isopeda leishmanni</i>			
203.	<i>Isopedella cana</i>			
204.	<i>Lacrimicypris "drummondii" n.sp.</i> (SAP)			
205.	<i>Latonopsis brehmi</i>			
206.	<i>Latrodectus hasseltii</i>			
207.	<i>Leberis aenigmatica</i>			
208.	33981 <i>Leioproctus bilobatus</i> (short-tongued bee)		P2	
209.	33983 <i>Leioproctus douglasiellus</i> (short-tongued bee)		T	
210.	<i>Leptoceridae</i> sp.			
211.	25131 <i>Lerista distinguenda</i>			
212.	25133 <i>Lerista elegans</i>			
213.	25005 <i>Lialis burtonis</i>			
214.	<i>Libellulidae</i> sp.			
215.	25661 <i>Lichmera indistincta</i> (Brown Honeyeater)			
216.	24582 <i>Lichmera indistincta</i> subsp. <i>indistincta</i> (Brown Honeyeater)			
217.	<i>Limbodessus shuckhardi</i>			
218.	<i>Limnadia</i> sp.			
219.	<i>Limnocharax australica</i>			
220.	<i>Limnophyes vestitus</i> (V41)			
221.	25378 <i>Litoria adelaidensis</i> (Slender Tree Frog)			
222.	25388 <i>Litoria moorei</i> (Motorbike Frog)			
223.	<i>Longepi woodman</i>			
224.	<i>Lophoictinia isura</i>			
225.	<i>Lycidas chlorophthalmus</i>			
226.	<i>Lycosa leuckartii</i>			
227.	<i>Lynceus</i> sp.			
228.	24132 <i>Macropus fuliginosus</i> (Western Grey Kangaroo)			
229.	24133 <i>Macropus irma</i> (Western Brush Wallaby)		P4	
230.	<i>Macrothrix</i> sp.			
231.	24326 <i>Malacorhynchus membranaceus</i> (Pink-eared Duck)			
232.	25650 <i>Malurus elegans</i> (Red-winged Fairy-wren)			
233.	24551 <i>Malurus pulcherrimus</i> (Blue-breasted Fairy-wren)			
234.	25654 <i>Malurus splendens</i> (Splendid Fairy-wren)			
235.	24552 <i>Malurus splendens</i> subsp. <i>splendens</i> (Splendid Fairy-wren)			
236.	24583 <i>Manorina flavigula</i> (Yellow-throated Miner)			
237.	<i>Maraura macracantha</i> (formerly <i>Alona macracantha</i> )			
238.	<i>Masasteron maini</i>			
239.	25758 <i>Megalurus gramineus</i> (Little Grassbird)			
240.	<i>Megaporus</i> sp.			
241.	25663 <i>Melithreptus brevirostris</i> (Brown-headed Honeyeater)			
242.	24587 <i>Melithreptus chloropsis</i> (Western White-naped Honeyeater)			
243.	25184 <i>Menetia greyii</i>			
244.	24598 <i>Merops ornatus</i> (Rainbow Bee-eater)		IA	
245.	<i>Mesocyclops brooksi</i>			
246.	<i>Microcarbo melanoleucos</i>			
247.	<i>Microcyclops varicans</i>			
248.	<i>Microvelia</i> sp.			
249.	<i>Missulena granulosa</i>			
250.	<i>Missulena occatoria</i>			
251.	<i>Mizoruga insularis</i>			

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252.	<i>Monohelea</i> sp. 1 (SAP)			
253.	<i>Monohelea</i> sp. 2 (SAP)			
254.	25240 <i>Morelia spilota</i> subsp. <i>imbricata</i> (Carpet Python)			
255.	24223 <i>Mus musculus</i> (House Mouse)	Y		
256.	<i>Myandra bicincta</i>			
257.	25420 <i>Myobatrachus gouldii</i> (Turtle Frog)			
258.	<i>Nannoperca vittata</i>			
259.	25248 <i>Neelaps bimaculatus</i> (Black-naped Snake)			
260.	25249 <i>Neelaps calonotos</i> (Black-striped Snake, black-striped burrowing snake)		P3	
261.	<i>Nematoda</i> sp.			
262.	25686 <i>Neochmia temporalis</i> (Red-browed Finch)	Y		
263.	24738 <i>Neophema elegans</i> (Elegant Parrot)			
264.	24739 <i>Neophema petrophila</i> (Rock Parrot)			
265.	<i>Nicodamus mainae</i>			
266.	25747 <i>Ninox connivens</i> (Barking Owl)			
267.	25252 <i>Notechis scutatus</i> (Tiger Snake)			
268.	<i>Notiasemus glauerti</i>			
269.	<i>Notonectidae</i> sp.			
270.	25564 <i>Nycticorax caledonicus</i> (Rufous Night Heron)			
271.	24194 <i>Nyctophilus geoffroyi</i> (Lesser Long-eared Bat)			
272.	<i>Occiperipatoides gilesii</i>			
273.	24407 <i>Ocyphaps lophotes</i> (Crested Pigeon)			
274.	<i>Oligochaeta</i> sp.			
275.	<i>Ommatoiulus moreletii</i>			
276.	<i>Onychohydus</i> sp.			
277.	<i>Oribatida</i> sp.			
278.	<i>Orthocladinae</i> sp.			
279.	<i>Orthocladinae</i> sp. C = V44 <i>Gymnometriocnemus</i> (SAP)			
280.	<i>Oxyopes gracilipes</i>			
281.	24328 <i>Oxyura australis</i> (Blue-billed Duck)		P4	
282.	25680 <i>Pachycephala rufiventris</i> (Rufous Whistler)			
283.	24624 <i>Pachycephala rufiventris</i> subsp. <i>rufiventris</i> (Rufous Whistler)			
284.	<i>Palaemonidae</i> sp.			
285.	<i>Paramerina levidensis</i>			
286.	<i>Paramphisopus palustris</i>			
287.	25253 <i>Parasuta gouldii</i>			
288.	25681 <i>Pardalotus punctatus</i> (Spotted Pardalote)			
289.	25682 <i>Pardalotus striatus</i> (Striated Pardalote)			
290.	24628 <i>Pardalotus striatus</i> subsp. <i>murchisoni</i> (Striated Pardalote)			
291.	24648 <i>Pelecanus conspicillatus</i> (Australian Pelican)			
292.	48060 <i>Petrochelidon ariel</i> (Fairy Martin)			
293.	48061 <i>Petrochelidon nigricans</i> (Tree Martin)			
294.	48066 <i>Petroica boodang</i> (Scarlet Robin)			
295.	24659 <i>Petroica goodenovii</i> (Red-capped Robin)			
296.	25697 <i>Phalacrocorax carbo</i> (Great Cormorant)			
297.	25698 <i>Phalacrocorax melanoleucus</i> (Little Pied Cormorant)			
298.	24667 <i>Phalacrocorax sulcirostris</i> (Little Black Cormorant)			
299.	25699 <i>Phalacrocorax varius</i> (Pied Cormorant)			
300.	24409 <i>Phaps chalcoptera</i> (Common Bronzewing)			
301.	48070 <i>Phascogale tapoatafa</i> subsp. <i>wambenger</i> (South-western Brush-tailed Phascogale, Wambenger)		T	
302.	<i>Phreatoicidae</i> sp.			
303.	<i>Phryganoporus gausapatus</i> subsp. <i>occidentalis</i>			Y
304.	48071 <i>Phylidonyris niger</i> (White-cheeked Honeyeater)			
305.	24596 <i>Phylidonyris novaehollandiae</i> (New Holland Honeyeater)			
306.	<i>Physidae</i> sp.			
307.	<i>Planicirculus alticarinatus</i>			
308.	<i>Planorbidae</i> sp.			
309.	24841 <i>Platalea flavipes</i> (Yellow-billed Spoonbill)			
310.	24842 <i>Platalea regia</i> (Royal Spoonbill)			
311.	25720 <i>Platyercus icterotis</i> (Western Rosella)			
312.	24745 <i>Platyercus icterotis</i> subsp. <i>icterotis</i> (Western Rosella)			
313.	25721 <i>Platyercus zonarius</i> (Australian Ringneck, Ring-necked Parrot)			
314.	24751 <i>Platyercus zonarius</i> subsp. <i>zonarius</i> (Port Lincoln Parrot)			
315.	25007 <i>Pletholax gracilis</i> subsp. <i>gracilis</i> (Keeled Legless Lizard)			
316.	25703 <i>Podargus strigoides</i> (Tawny Frogmouth)			
317.	24679 <i>Podargus strigoides</i> subsp. <i>brachypterus</i> (Tawny Frogmouth)			
318.	25510 <i>Pogona minor</i> (Dwarf Bearded Dragon)			
319.	24907 <i>Pogona minor</i> subsp. <i>minor</i> (Dwarf Bearded Dragon)			
320.	24681 <i>Poliiocephalus poliiocephalus</i> (Hoary-headed Grebe)			

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321.	<i>Poltys laciniosus</i>			
322.	<i>Polygonarea repanda</i>			Y
323.	25731 <i>Porphyrio porphyrio</i> (Purple Swamphen)			
324.	24767 <i>Porphyrio porphyrio subsp. bellus</i> (Purple Swamphen)			
325.	24771 <i>Porzana tabuensis</i> (Spotless Crane)			
326.	<i>Procladius paludicola</i>			
327.	<i>Procladius sp. (normal claws)</i>			
328.	25261 <i>Pseudechis australis</i> (Mulga Snake)			
329.	25345 <i>Pseudemydura umbrina</i> (Western Swamp Tortoise, Western Swamp Turtle)		T	
330.	25259 <i>Pseudonaja affinis subsp. affinis</i> (Dugite)			
331.	25433 <i>Pseudophryne guentheri</i> (Crawling Toadlet)			
332.	25710 <i>Pterodroma macroptera</i> (Great-winged Petrel)			
333.	24173 <i>Pteropus scapulatus</i> (Little Red Flying-fox)			
334.	<i>Purpureicephalus spurius</i>			
335.	24245 <i>Rattus rattus</i> (Black Rat)	Y		
336.	<i>Raveniella cirrata</i>			
337.	<i>Raveniella peckorum</i>			
338.	<i>Rhantus suturalis</i>			
339.	48096 <i>Rhipidura albiscapa</i> (Grey Fantail)			
340.	25614 <i>Rhipidura leucophrys</i> (Willie Wagtail)			
341.	24199 <i>Scotorepens balstoni</i> (Inland Broad-nosed Bat)			
342.	25534 <i>Sericornis frontalis</i> (White-browed Scrubwren)			
343.	<i>Simocephalus elizabethae</i>			
344.	<i>Simuliidae sp.</i>			
345.	30948 <i>Smicromis brevirostris</i> (Weebill)			
346.	<i>Spencerhydrus sp.</i>			Y
347.	24645 <i>Stagonopleura oculata</i> (Red-eared Firetail)			
348.	<i>Steatoda grossa</i>			
349.	<i>Sternopriscus sp.</i>			
350.	25655 <i>Stipiturus malachurus</i> (Southern Emu-wren)			
351.	<i>Storena formosa</i>			
352.	24426 <i>Strepera versicolor subsp. plumbea</i> (Grey Currawong)			
353.	25589 <i>Streptopelia chinensis</i> (Spotted Turtle-Dove)	Y		
354.	25590 <i>Streptopelia senegalensis</i> (Laughing Turtle-Dove)	Y		
355.	24943 <i>Strophurus spinigerus subsp. inornatus</i>			
356.	24942 <i>Strophurus spinigerus subsp. spinigerus</i>			
357.	<i>Supunna funerea</i>			
358.	<i>Tabanidae sp.</i>			
359.	25705 <i>Tachybaptus novaehollandiae</i> (Australasian Grebe, Black-throated Grebe)			
360.	24682 <i>Tachybaptus novaehollandiae subsp. novaehollandiae</i> (Australasian Grebe, Black-throated Grebe)			
361.	24331 <i>Tadorna tadornoides</i> (Australian Shelduck, Mountain Duck)			
362.	<i>Tanypodinae sp.</i>			
363.	<i>Tanytarsus fuscithorax</i>			
364.	24167 <i>Tarsipes rostratus</i> (Honey Possum, Noolbenger)			
365.	<i>Tasmanicosa leuckartii</i>			
366.	<i>Testudinella patina</i>			
367.	24845 <i>Threskiornis spinicollis</i> (Straw-necked Ibis)			
368.	25519 <i>Tiliqua rugosa</i>			
369.	25204 <i>Tiliqua rugosa subsp. aspera</i>			
370.	25207 <i>Tiliqua rugosa subsp. rugosa</i>			
371.	<i>Tipulidae sp.</i>			
372.	25549 <i>Todiramphus sanctus</i> (Sacred Kingfisher)			
373.	24309 <i>Todiramphus sanctus subsp. sanctus</i> (Sacred Kingfisher)			
374.	48141 <i>Tribonyx ventralis</i> (Black-tailed Native-hen)			
375.	<i>Trichocerca similis</i>			
376.	25723 <i>Trichoglossus haematodus</i> (Rainbow Lorikeet)			
377.	24755 <i>Trichoglossus haematodus subsp. moluccanus</i> (Rainbow Lorikeet)	Y		
378.	24806 <i>Tringa glareola</i> (Wood Sandpiper)		IA	
379.	24808 <i>Tringa nebularia</i> (Common Greenshank, greenshank)		IA	
380.	<i>Triplectides australis</i>			
381.	<i>Turbellaria sp.</i>			
382.	48147 <i>Turnix varius</i> (Painted Button-quail)			
383.	24852 <i>Tyto alba subsp. delicatula</i> (Barn Owl)			
384.	24983 <i>Underwoodisaurus milii</i> (Barking Gecko)			
385.	<i>Urodacus novaehollandiae</i>			
386.	<i>Urodacus planimanus</i>			
387.	25218 <i>Varanus gouldii</i> (Bungarra or Sand Monitor)			
388.	25225 <i>Varanus rosenbergi</i> (Heath Monitor)			
389.	25526 <i>Varanus tristis</i> (Racehorse Monitor)			

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390.	<i>Venator immansueta</i>			
391.	<i>Venatrix arenaris</i>			
392.	<i>Venatrix pullastra</i>			
393.	24206 <i>Vespadelus regulus</i> (Southern Forest Bat)			
394.	34113 <i>Westralunio carteri</i> (Carter's Freshwater Mussel)		T	
395.	25765 <i>Zosterops lateralis</i> (Grey-breasted White-eye, Silvereye)			
<b>Fungi</b>				
396.	45014 <i>Amanita quenda</i>		P1	
397.	43542 <i>Amanita wadjukiorum</i>		P3	
398.	38757 <i>Amanita xanthocephala</i>			
399.	<i>Boletus</i> sp.			
400.	38774 <i>Cortinarius archeri</i>			
401.	<i>Cortinarius sublargus</i>			Y
402.	<i>Dermocybe clelandii</i>			
403.	38784 <i>Descomyces albus</i>			
404.	27748 <i>Flavoparmelia rutidota</i>			
405.	<i>Fomitopsis lilacinogilva</i>			
406.	<i>Gymnopilus purpuratus</i>			
407.	<i>Hygrocybe astatogala</i>			Y
408.	38800 <i>Labyrinthomyces varius</i>			
409.	<i>Lactarius clarkeae</i>			
410.	38804 <i>Lactarius eucalypti</i>			
411.	<i>Phytophthora cinnamomi</i>			
412.	38825 <i>Pluteus pauperculus</i>			
413.	38836 <i>Russula erumpens</i>			
414.	<i>Scleroderma cepa</i>			
415.	<i>Tubaria rufofulva</i>			
416.	45896 <i>Ustilago bromivora</i>			
417.	45902 <i>Ustilago nuda</i>			
418.	45906 <i>Ustilago tepperi</i>			
<b>Plantae</b>				
419.	19708 <i>Abutilon grandifolium</i>	Y		
420.	15429 <i>Acacia alata</i> var. <i>alata</i>			
421.	3219 <i>Acacia anomala</i> (Grass Wattle)		T	
422.	3220 <i>Acacia aphylla</i> (Leafless Rock Wattle)		T	
423.	15466 <i>Acacia applanata</i>			
424.	3233 <i>Acacia barbinervis</i>			
425.	3294 <i>Acacia dentifera</i>			
426.	11926 <i>Acacia drewiana</i> subsp. <i>drewiana</i>			
427.	3373 <i>Acacia horridula</i>		P3	
428.	3374 <i>Acacia huegellii</i>			
429.	3382 <i>Acacia incrassata</i>			
430.	3409 <i>Acacia lasiocarpa</i> (Panjang)			
431.	11611 <i>Acacia lasiocarpa</i> var. <i>lasiocarpa</i>			
432.	3454 <i>Acacia nervosa</i> (Rib Wattle)			
433.	3464 <i>Acacia obovata</i>			
434.	14131 <i>Acacia oncinophylla</i> subsp. <i>patulifolia</i>		P4	
435.	17860 <i>Acacia podalyriifolia</i>	Y		
436.	3502 <i>Acacia pulchella</i> (Prickly Moses)			
437.	15481 <i>Acacia pulchella</i> var. <i>glaberrima</i>			
438.	15483 <i>Acacia pulchella</i> var. <i>pulchella</i>			
439.	30033 <i>Acacia saligna</i> subsp. <i>lindleyi</i>			
440.	3541 <i>Acacia sessilis</i>			
441.	3557 <i>Acacia stenoptera</i> (Narrow Winged Wattle)			
442.	3574 <i>Acacia teretifolia</i>			
443.	3602 <i>Acacia willdenowiana</i> (Grass Wattle)			
444.	1205 <i>Acanthocarpus canaliculatus</i>			
445.	7811 <i>Acanthospermum hispidum</i> (Starburr)	Y		
446.	6205 <i>Actinotus leucocephalus</i> (Flannel Flower)			
447.	14970 <i>Adenanthos barbiger</i>			
448.	1775 <i>Adenanthos cygnorum</i> (Common Woollybush)			
449.	11837 <i>Adenanthos cygnorum</i> subsp. <i>cygnorum</i> (Common Woollybush)			
450.	18396 <i>Aeonium haworthii</i>	Y		
451.	1505 <i>Agave americana</i> (Century Plant)	Y		
452.	5316 <i>Agonis flexuosa</i> (Peppermint, Wonil)			
453.	179 <i>Agrostis gigantea</i> (Redtop Bent)	Y		
454.	23474 <i>Agrostocrinum hirsutum</i>			
455.	1261 <i>Agrostocrinum scabrum</i> (Blue Grass Lily)			
456.	23501 <i>Agrostocrinum scabrum</i> subsp. <i>scabrum</i>			

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457.	184 <i>Aira caryophyllea</i> (Silvery Hairgrass)	Y		
458.	185 <i>Aira cupaniana</i> (Silvery Hairgrass)	Y		
459.	1056 <i>Alexgeorgea nitens</i>			
460.	1374 <i>Allium ampeloprasum</i>	Y		
461.	1728 <i>Allocauarina fraseriana</i> (Sheoak, Kondii)			
462.	1732 <i>Allocauarina humilis</i> (Dwarf Sheoak)			
463.	1734 <i>Allocauarina microstachya</i>			
464.	2648 <i>Alternanthera denticulata</i> (Lesser Joyweed)			
465.	7820 <i>Ambrosia artemisiifolia</i> (Annual Ragweed, Bitterweed, Hay-feverweed, Hog-weed)	Y		
466.	7821 <i>Ambrosia psilostachya</i> (Perennial Ragweed)	Y		
467.	13380 <i>Amphibromus nervosus</i>			
468.	197 <i>Amphipogon debilis</i>			
469.	199 <i>Amphipogon strictus</i> (Greybeard Grass)			
470.	200 <i>Amphipogon turbinatus</i>			
471.	1058 <i>Anarthria gracilis</i>			
472.	1059 <i>Anarthria humilis</i>			
473.	1060 <i>Anarthria laevis</i>			
474.	6300 <i>Andersonia aristata</i> (Rice Flower)			
475.	6309 <i>Andersonia gracilis</i>		T	
476.	6312 <i>Andersonia involucrata</i>			
477.	6314 <i>Andersonia lehmanniana</i>			
478.	11471 <i>Andersonia lehmanniana</i> subsp. <i>lehmanniana</i>			
479.	7833 <i>Angianthus preissianus</i>			
480.	1406 <i>Anigozanthos bicolor</i> (Little Kangaroo Paw)			
481.	11470 <i>Anigozanthos bicolor</i> subsp. <i>bicolor</i>			
482.	1409 <i>Anigozanthos humilis</i> (Catspaw)			
483.	11434 <i>Anigozanthos humilis</i> subsp. <i>humilis</i>			
484.	1411 <i>Anigozanthos manglesii</i> (Mangles Kangaroo Paw, Kurulbrang)			
485.	11261 <i>Anigozanthos manglesii</i> subsp. <i>manglesii</i>			
486.	1416 <i>Anigozanthos viridis</i> (Green Kangaroo Paw, Kurulbardang)			
487.	11566 <i>Anigozanthos viridis</i> subsp. <i>viridis</i>			
488.	6946 <i>Anthocercis gracilis</i> (Slender Tailflower)		T	
489.	12724 <i>Anthotium junციiforme</i>			
490.	202 <i>Anthoxanthum odoratum</i> (Sweet Vernal Grass)	Y		
491.	3686 <i>Aotus cordifolia</i>			
492.	1116 <i>Aphelia brizula</i>			
493.	1117 <i>Aphelia cyperoides</i>			
494.	1118 <i>Aphelia drummondii</i>			
495.	43548 <i>Aphelia</i> sp. <i>Albany</i> (B.G. Briggs 596)			
496.	141 <i>Aponogeton hexatepalus</i> (Stalked Water Ribbons)		P4	
497.	32314 <i>Archidium rehmannii</i>			
498.	7838 <i>Arctotheca calendula</i> (Cape Weed, African Marigold)	Y		
499.	1264 <i>Arnocrinum preissii</i>			
500.	28288 <i>Artemisia arborescens</i> (Silver Wormwood)	Y		
501.	1364 <i>Asphodelus fistulosus</i> (Onion Weed)	Y		
502.	20350 <i>Astartea affinis</i> (West-coast Astartea)			
503.	20283 <i>Astartea scoparia</i> (Common Astartea)			
504.	<i>Asterella drummondii</i>			
505.	6323 <i>Astroloma ciliatum</i> (Candle Cranberry)			
506.	6327 <i>Astroloma foliosum</i> (Candle Cranberry)			
507.	6334 <i>Astroloma pallidum</i> (Kick Bush)			
508.	6337 <i>Astroloma stomarrhena</i> (Red Swamp Cranberry)			
509.	38480 <i>Austrostipa bronwenae</i>		T	
510.	17233 <i>Austrostipa campylachne</i>			
511.	17234 <i>Austrostipa compressa</i>			
512.	17241 <i>Austrostipa hemipogon</i>			
513.	17245 <i>Austrostipa mollis</i>			
514.	17254 <i>Austrostipa tenuifolia</i>			
515.	17257 <i>Austrostipa variabilis</i>			
516.	231 <i>Avellinia michelii</i>	Y		
517.	233 <i>Avena barbata</i> (Bearded Oat)	Y		
518.	20013 <i>Axonopus fissifolius</i>	Y		
519.	18279 <i>Babiana angustifolia</i>	Y		
520.	36441 <i>Babingtonia camphorosmae</i> (Camphor Myrtle)			
521.	45403 <i>Babingtonia pelloeae</i> (Pelloe's Babingtonia)			
522.	45402 <i>Babingtonia urbana</i> (Coastal Plain Babingtonia)		P3	
523.	1382 <i>Baeometra uniflora</i>	Y		
524.	32682 <i>Banksia armata</i> var. <i>armata</i>			
525.	1800 <i>Banksia attenuata</i> (Slender Banksia, Piara)			
526.	32580 <i>Banksia dallanneyi</i> var. <i>dallanneyi</i>			

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527.	32577 <i>Banksia dallanneyi</i> var. <i>mellicula</i>			
528.	1819 <i>Banksia grandis</i> (Bull <i>Banksia</i> , <i>Pulgarla</i> )			
529.	1822 <i>Banksia ilicifolia</i> (Holly-leaved <i>Banksia</i> )			
530.	1823 <i>Banksia incana</i>			
531.	33399 <i>Banksia incana</i> var. <i>incana</i>			
532.	1834 <i>Banksia menziesii</i> (Firewood <i>Banksia</i> )			
533.	32211 <i>Banksia mimica</i> (Summer <i>Honeypot</i> )		T	
534.	32202 <i>Banksia nivea</i> ( <i>Honeypot Dryandra</i> , <i>Pudjam</i> )			
535.	32138 <i>Banksia pteridifolia</i> subsp. <i>vernalis</i>		P3	
536.	32080 <i>Banksia sessilis</i> var. <i>sessilis</i>			
537.	1852 <i>Banksia telmatiaea</i> (Swamp Fox <i>Banksia</i> )			
538.	32031 <i>Banksia vestita</i> (Summer <i>Dryandra</i> )			
539.	1855 <i>Banksia victoriae</i> (Woolly Orange <i>Banksia</i> )			
540.	32315 <i>Barbula calycina</i>			
541.	32321 <i>Bartramia breutelii</i>			
542.	32323 <i>Bartramia pseudostricta</i>			
543.	15037 <i>Bartsia trixago</i>	Y		
544.	740 <i>Baumea arthropphylla</i>			
545.	743 <i>Baumea juncea</i> (Bare <i>Twigrush</i> )			
546.	747 <i>Baumea rubiginosa</i>			
547.	5387 <i>Beaufortia macrostemon</i> (Darling Range <i>Beaufortia</i> )			
548.	5393 <i>Beaufortia squarrosa</i> (Sand <i>Beaufortia</i> , Sand <i>Bottlebrush</i> , <i>Puno</i> )			
549.	4413 <i>Boronia crenulata</i> (Aniseed <i>Boronia</i> )			
550.	16636 <i>Boronia crenulata</i> subsp. <i>viminea</i>			
551.	11503 <i>Boronia crenulata</i> var. <i>crenulata</i>			
552.	4414 <i>Boronia cymosa</i> (Granite <i>Boronia</i> )			
553.	4432 <i>Boronia ovata</i>			
554.	4438 <i>Boronia ramosa</i>			
555.	11381 <i>Boronia ramosa</i> subsp. <i>anethifolia</i>			
556.	11564 <i>Boronia ramosa</i> subsp. <i>ramosa</i>			
557.	4444 <i>Boronia tenuis</i> (Blue <i>Boronia</i> )		P4	
558.	1272 <i>Borya scirpoidea</i>			
559.	1273 <i>Borya sphaerocephala</i> ( <i>Pincushions</i> )			
560.	3710 <i>Bossiaea eriocarpa</i> (Common <i>Brown Pea</i> )			
561.	3714 <i>Bossiaea omata</i> (Broad Leaved <i>Brown Pea</i> )			
562.	7867 <i>Brachyscome bellidioides</i>			
563.	3000 <i>Brassica tournefortii</i> (Mediterranean <i>Turnip</i> )	Y		
564.	244 <i>Briza maxima</i> (Blowfly <i>Grass</i> )	Y		
565.	245 <i>Briza minor</i> (Shivery <i>Grass</i> )	Y		
566.	249 <i>Bromus diandrus</i> (Great <i>Brome</i> )	Y		
567.	250 <i>Bromus hordeaceus</i> (Soft <i>Brome</i> )	Y		
568.	1366 <i>Bulbine semibarbata</i> (Leek <i>Lily</i> )			
569.	1383 <i>Burchardia bairdiae</i>			
570.	12770 <i>Burchardia congesta</i>			
571.	1385 <i>Burchardia multiflora</i> (Dwarf <i>Burchardia</i> )			
572.	3178 <i>Byblis gigantea</i> (Rainbow <i>Plant</i> )		P3	
573.	1276 <i>Caesia micrantha</i> (Pale <i>Grass Lily</i> )			
574.	1277 <i>Caesia occidentalis</i>			
575.	15330 <i>Caladenia arenicola</i>			
576.	44900 <i>Caladenia denticulata</i> subsp. <i>rubella</i>			
577.	1590 <i>Caladenia ferruginea</i> (Rusty <i>Spider Orchid</i> )			
578.	1592 <i>Caladenia flava</i> (Cowslip <i>Orchid</i> )			
579.	15348 <i>Caladenia flava</i> subsp. <i>flava</i>			
580.	13859 <i>Caladenia longicauda</i> subsp. <i>clivicola</i>			
581.	15365 <i>Caladenia longicauda</i> subsp. <i>longicauda</i>			
582.	17760 <i>Caladenia nobilis</i>			
583.	15503 <i>Caladenia paludosa</i>			
584.	2854 <i>Calandrinia granulifera</i> (Pygmy <i>Purslane</i> )			
585.	2856 <i>Calandrinia liniflora</i> (Parakeelya)			
586.	20096 <i>Calandrinia</i> sp. <i>Piawaning</i> (A.C. <i>Beaughole 12257</i> )		P1	
587.	1213 <i>Calectasia cyanea</i> (Blue <i>Tinsel Lily</i> )		T	
588.	1214 <i>Calectasia grandiflora</i> (Blue <i>Tinsel Lily</i> )			
589.	19309 <i>Calectasia narragara</i>			
590.	4717 <i>Callitriche stagnalis</i> (Common <i>Starwort</i> )	Y		
591.	36520 <i>Callitris acuminata</i> (Dwarf <i>Cypress</i> )			
592.	36600 <i>Callitris pyramidalis</i> (Swamp <i>Cypress</i> )			
593.	5411 <i>Calothamnus hirsutus</i>			
594.	5426 <i>Calothamnus quadrifidus</i> (One-sided <i>Bottlebrush</i> , <i>Kwowdjard</i> )			
595.	35816 <i>Calothamnus quadrifidus</i> subsp. <i>quadrifidus</i>			
596.	5428 <i>Calothamnus rupestris</i> (Mouse <i>Ears</i> )			

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597.	5431 <i>Calothamnus torulosus</i>			
598.	5437 <i>Calytrix acutifolia</i>			
599.	5439 <i>Calytrix angulata</i> (Yellow Starflower)			
600.	5441 <i>Calytrix aurea</i>			
601.	13653 <i>Calytrix breviseta</i> subsp. <i>breviseta</i>		T	
602.	5458 <i>Calytrix flavescens</i> (Summer Starflower)			
603.	5460 <i>Calytrix fraseri</i> (Pink Summer Calytrix)			
604.	5461 <i>Calytrix glutinosa</i>			
605.	5485 <i>Calytrix variabilis</i>			
606.	19713 <i>Campsis radicans</i>	Y		
607.	32461 <i>Campylopus bicolor</i> var. <i>bicolor</i>			
608.	32338 <i>Campylopus introflexus</i>	Y		
609.	11351 <i>Cassytha aurea</i> var. <i>hirta</i>			
610.	2951 <i>Cassytha flava</i> (Dodder Laurel)			
611.	2952 <i>Cassytha glabella</i> (Tangled Dodder Laurel)			
612.	11501 <i>Cassytha glabella</i> forma <i>casuarinae</i>			
613.	2956 <i>Cassytha pomiformis</i> (Dodder Laurel)			
614.	2957 <i>Cassytha racemosa</i> (Dodder Laurel)			
615.	11242 <i>Cassytha racemosa</i> forma <i>pilosa</i>			
616.	11799 <i>Cassytha racemosa</i> forma <i>racemosa</i>			
617.	760 <i>Cautis dioica</i>			
618.	6539 <i>Centaurium erythraea</i> (Common Centaury)	Y		
619.	7918 <i>Centipeda cunninghamii</i> (Common Sneezewood, Gukwonderuk, Old Man Weed)			
620.	<i>Centratherum punctatum</i>			
621.	1121 <i>Centrolepis aristata</i> (Pointed Centrolepis)			
622.	1123 <i>Centrolepis caespitosa</i>		P4	
623.	1125 <i>Centrolepis drummondiana</i>			
624.	1129 <i>Centrolepis glabra</i> (Smooth Centrolepis)			
625.	1131 <i>Centrolepis inconspicua</i>			
626.	43642 <i>Centrolepis</i> sp. <i>Kalannie</i> (B.J. Lepschi et al. B.JL 3517)			
627.	17685 <i>Chaetanthus aristatus</i>			
628.	1280 <i>Chamaescilla corymbosa</i> (Blue Squill)			
629.	11299 <i>Chamaescilla corymbosa</i> var. <i>corymbosa</i>			
630.	19338 <i>Chamaescilla gibsonii</i>		P3	
631.	8788 <i>Chamaescilla versicolor</i>			
632.	1513 <i>Chasmanthe floribunda</i> (African Cornflag)	Y		
633.	31 <i>Cheilanthes austrotenuifolia</i>			
634.	3169 <i>Cheiranthra preissiana</i>			
635.	17706 <i>Chordiflex sinuosus</i>			
636.	763 <i>Chorizandra enodis</i> (Black Bristlerush)			
637.	764 <i>Chorizandra multiarticulata</i>			
638.	3753 <i>Chorizema dicksonii</i> (Yellow-eyed Flame Pea)			
639.	11900 <i>Chrysanthemoides monilifera</i> subsp. <i>monilifera</i>	Y		
640.	6543 <i>Cicendia filiformis</i> (Slender Cicendia)	Y		
641.	7370 <i>Citrullus lanatus</i> (Pie Melon)	Y		
642.	2929 <i>Clematis pubescens</i> (Common Clematis)			
643.	32999 <i>Colocasia esculenta</i> var. <i>esculenta</i>	Y		
644.	4550 <i>Comesperma calymega</i> (Blue-spike Milkwort)			
645.	4551 <i>Comesperma ciliatum</i>			
646.	14663 <i>Comesperma griffinii</i>		P2	
647.	4560 <i>Comesperma rhadinocarpum</i> (Slender-fruited Comesperma)		P2	
648.	4564 <i>Comesperma virgatum</i> (Milkwort)			
649.	40864 <i>Commersonia cygnorum</i>			
650.	15607 <i>Conospermum acerosum</i> subsp. <i>acerosum</i>			
651.	15041 <i>Conospermum canaliculatum</i>			
652.	16853 <i>Conospermum capitatum</i> subsp. <i>glabratum</i>			
653.	1875 <i>Conospermum huegelii</i> (Slender Smokebush)			
654.	1882 <i>Conospermum stoechadis</i> (Common Smokebush)			
655.	1885 <i>Conospermum triplinervium</i> (Tree Smokebush)			
656.	13999 <i>Conospermum undulatum</i>		T	
657.	6347 <i>Conostephium minus</i> (Pink-tipped Pearl flower)			
658.	6348 <i>Conostephium pendulum</i> (Pearl Flower)			
659.	6349 <i>Conostephium preissii</i>			
660.	11826 <i>Conostylis aculeata</i> subsp. <i>aculeata</i>			
661.	12109 <i>Conostylis aculeata</i> subsp. <i>preissii</i>			
662.	1420 <i>Conostylis androstemma</i> (Trumpets)			
663.	1423 <i>Conostylis aurea</i> (Golden Conostylis)			
664.	1429 <i>Conostylis caricina</i>			
665.	12035 <i>Conostylis caricina</i> subsp. <i>caricina</i>			
666.	1434 <i>Conostylis festucacea</i>			

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667.	11695 <i>Conostylis festuacea</i> subsp. <i>festuacea</i>			
668.	1436 <i>Conostylis juncea</i>			
669.	1437 <i>Conostylis latens</i>			
670.	11388 <i>Conostylis pauciflora</i> subsp. <i>euryrhipis</i>		P4	
671.	1454 <i>Conostylis setigera</i> (Bristly Cottonhead)			
672.	11597 <i>Conostylis setigera</i> subsp. <i>setigera</i>			
673.	1455 <i>Conostylis setosa</i> (White Cottonhead)			
674.	5502 <i>Conothamnus trinervis</i>			
675.	20074 <i>Conyza sumatrensis</i>	Y		
676.	48259 <i>Cortaderia seloana</i> subsp. <i>seloana</i>	Y		
677.	17104 <i>Corymbia calophylla</i> (Marri)			
678.	7945 <i>Cotula coronopifolia</i> (Waterbuttons)	Y		
679.	13354 <i>Crassedia variabilis</i>			
680.	17701 <i>Crassula closiana</i>			
681.	3137 <i>Crassula colorata</i> (Dense Stonecrop)			
682.	11563 <i>Crassula colorata</i> var. <i>colorata</i>			
683.	3138 <i>Crassula decumbens</i> (Rufous Stonecrop)			
684.	3142 <i>Crassula natans</i>	Y		
685.	18397 <i>Crassula tetragona</i> subsp. <i>robusta</i>	Y		
686.	29054 <i>Crepis foetida</i> subsp. <i>foetida</i> (Stinking Hawksbeard)	Y		
687.	35838 <i>Cristonia biloba</i> subsp. <i>biloba</i>			
688.	13470 <i>Cryptandra arbutiflora</i> var. <i>arbutiflora</i>			
689.	4809 <i>Cryptandra pungens</i>			
690.	11021 <i>Cuscuta planiflora</i>	Y		
691.	15114 <i>Cyanicula gemmata</i>			
692.	15404 <i>Cyanicula sericea</i>			
693.	51 <i>Cyathea cooperi</i>	Y		
694.	768 <i>Cyathochaeta avenacea</i>			
695.	769 <i>Cyathochaeta clandestina</i>			
696.	17618 <i>Cyathochaeta equitans</i>			
697.	40661 <i>Cynogeton lineare</i>			
698.	283 <i>Cynodon dactylon</i> (Couch)	Y		
699.	285 <i>Cynosurus echinatus</i> (Rough Dogstail)	Y		
700.	783 <i>Cyperus congestus</i> (Dense Flat-sedge)	Y		
701.	18198 <i>Cyperus papyrus</i>	Y		
702.	815 <i>Cyperus tenellus</i> (Tiny Flatsedge)	Y		
703.	816 <i>Cyperus tenuiflorus</i> (Scaly Sedge)	Y		
704.	17692 <i>Cytogonidium leptocarpoides</i>			
705.	7420 <i>Dampiera alata</i> (Winged-stem Dampiera)			
706.	7428 <i>Dampiera coronata</i> (Wedge-leaved Dampiera)			
707.	7454 <i>Dampiera linearis</i> (Common Dampiera)			
708.	7462 <i>Dampiera pedunculata</i>			
709.	5505 <i>Darwinia apiculata</i> (Scarp Darwinia)		T	
710.	5508 <i>Darwinia citriodora</i> (Lemon-scented Darwinia)			
711.	18193 <i>Darwinia thymoides</i> subsp. <i>thymoides</i>			
712.	1218 <i>Dasygogon bromeliifolius</i> (Pineapple Bush)			
713.	1220 <i>Dasygogon obliquifolius</i>			
714.	6218 <i>Daucus glochidiatus</i> (Australian Carrot)			
715.	3793 <i>Daviesia angulata</i>			
716.	3799 <i>Daviesia cordata</i> (Bookleaf)			
717.	3805 <i>Daviesia decurrens</i> (Prickly Bitter-pea)			
718.	19747 <i>Daviesia decurrens</i> subsp. <i>decurrens</i>			
719.	18560 <i>Daviesia divaricata</i> subsp. <i>divaricata</i>			
720.	3815 <i>Daviesia horrida</i> (Prickly Bitter-pea)			
721.	3824 <i>Daviesia nudiflora</i>			
722.	3832 <i>Daviesia physodes</i>			
723.	3834 <i>Daviesia polyphylla</i>			
724.	3839 <i>Daviesia rhombifolia</i>			
725.	3845 <i>Daviesia triflora</i>			
726.	17336 <i>Dennstaedtia davallioides</i>	Y		Y
727.	17663 <i>Desmocladius asper</i>			
728.	17691 <i>Desmocladius fasciculatus</i>			
729.	11636 <i>Dianella revoluta</i> var. <i>divaricata</i>			
730.	1287 <i>Dichopogon capillipes</i>			
731.	32345 <i>Didymodon australasiae</i>			
732.	17838 <i>Dielsia stenostachya</i>			
733.	311 <i>Digitaria ciliaris</i> (Summer Grass)	Y		
734.	316 <i>Digitaria longiflora</i>			
735.	320 <i>Digitaria sanguinalis</i> (Crab Grass)	Y		
736.	1509 <i>Dioscorea hastifolia</i> (Warrine, Warram)			

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737.	18589 <i>Diplopeltis huegelii</i> subsp. <i>lehmannii</i>			
738.	3867 <i>Dipogon lignosus</i> ( <i>Dolichos</i> Pea)	Y		
739.	19649 <i>Disa bracteata</i>	Y		
740.	32347 <i>Ditrichum difficile</i>			
741.	7961 <i>Ditrichia graveolens</i> ( <i>Stinkwort</i> )	Y		
742.	12943 <i>Diuris brumalis</i>			
743.	11049 <i>Diuris corymbosa</i>			
744.	1634 <i>Diuris laxiflora</i> ( <i>Bee Orchid</i> )			
745.	1637 <i>Diuris purdiei</i> ( <i>Purdie's Donkey Orchid</i> )		T	
746.	4757 <i>Dodonaea ceratocarpa</i>			
747.	15406 <i>Drakaea gracilis</i>			
748.	3095 <i>Drosera erythrorhiza</i> ( <i>Red Ink Sundew</i> )			
749.	13211 <i>Drosera erythrorhiza</i> subsp. <i>collina</i>			
750.	3097 <i>Drosera gigantea</i> ( <i>Giant Sundew</i> )			
751.	15453 <i>Drosera gigantea</i> subsp. <i>gigantea</i>			
752.	3098 <i>Drosera glanduligera</i> ( <i>Pimpernel Sundew</i> )			
753.	13195 <i>Drosera helodes</i>			
754.	3101 <i>Drosera heterophylla</i> ( <i>Swamp Rainbow</i> )			
755.	13197 <i>Drosera hyperostigma</i>			
756.	3106 <i>Drosera macrantha</i> ( <i>Bridal Rainbow</i> )			
757.	14298 <i>Drosera macrantha</i> subsp. <i>macrantha</i>			
758.	3109 <i>Drosera menziesii</i> ( <i>Pink Rainbow</i> )			
759.	11853 <i>Drosera menziesii</i> subsp. <i>menziesii</i>			
760.	13216 <i>Drosera menziesii</i> subsp. <i>penicillaris</i>			
761.	3110 <i>Drosera microphylla</i> ( <i>Golden Rainbow</i> )			
762.	3115 <i>Drosera occidentalis</i> ( <i>Western Sundew</i> )			
763.	13191 <i>Drosera occidentalis</i> subsp. <i>occidentalis</i>		P4	
764.	3118 <i>Drosera pallida</i> ( <i>Pale Rainbow</i> )			
765.	3123 <i>Drosera platystigma</i> ( <i>Black-eyed Sundew</i> )			
766.	3125 <i>Drosera pycnoblata</i> ( <i>Pearly Sundew</i> )			
767.	8911 <i>Drosera rosulata</i>			
768.	3131 <i>Drosera stolonifera</i> ( <i>Leafy Sundew</i> )			
769.	3135 <i>Drosera zonaria</i> ( <i>Painted Sundew</i> )			
770.	33500 <i>Dysphania ambrosioides</i> ( <i>Mexican Tea</i> )	Y		
771.	7374 <i>Ecballium elaterium</i> ( <i>Squirting Cucumber</i> )	Y		
772.	32351 <i>Ecchremidium pulchellum</i>			
773.	328 <i>Echinochloa colona</i> ( <i>Awnless Barnyard Grass</i> )	Y		
774.	11105 <i>Echinochloa crus-galli</i>	Y		
775.	329 <i>Echinochloa crus-pavonis</i> ( <i>South American Barnyard Grass</i> )	Y		
776.	16093 <i>Echinochloa esculenta</i>	Y		
777.	8450 <i>Eclipta prostrata</i>	Y		
778.	347 <i>Ehrharta calycina</i> ( <i>Perennial Veldt Grass</i> )	Y		
779.	349 <i>Ehrharta longiflora</i> ( <i>Annual Veldt Grass</i> )	Y		
780.	5187 <i>Elatine gratioloides</i> ( <i>Waterwort</i> )			
781.	822 <i>Eleocharis acuta</i> ( <i>Common Spikerush</i> )			
782.	17605 <i>Eleocharis keigheryi</i>		T	
783.	352 <i>Eleusine coracana</i> ( <i>Indian Millet</i> )	Y		
784.	353 <i>Eleusine indica</i> ( <i>Crowsfoot Grass</i> )	Y		
785.	1644 <i>Elythranthera emarginata</i> ( <i>Pink Enamel Orchid</i> )			
786.	32353 <i>Entosthodon apophysatus</i>			
787.	32354 <i>Entosthodon productus</i>			
788.	374 <i>Eragrostis cilianensis</i> ( <i>Stinkgrass</i> )	Y		
789.	376 <i>Eragrostis curvula</i> ( <i>African Lovegrass</i> )	Y		
790.	379 <i>Eragrostis elongata</i> ( <i>Clustered Lovegrass</i> )			
791.	<i>Eragrostis</i> sp.			
792.	5540 <i>Eremaea fimbriata</i>			
793.	5541 <i>Eremaea pauciflora</i>			
794.	14103 <i>Eremaea pauciflora</i> var. <i>calyptra</i>			
795.	14104 <i>Eremaea pauciflora</i> var. <i>pauciflora</i>			
796.	17150 <i>Eremophila glabra</i> subsp. <i>chlorella</i>		T	
797.	15414 <i>Eriochilus helonomos</i>			
798.	6219 <i>Eryngium pinnatifidum</i> ( <i>Blue Devils</i> )			
799.	41801 <i>Eryngium pinnatifidum</i> subsp. <i>Palustre</i> (G.J. Keighery 13459)		P3	
800.	15446 <i>Eryngium pinnatifidum</i> subsp. <i>pinnatifidum</i>			
801.	41810 <i>Eryngium</i> sp. <i>Subdecumbens</i> (G.J. Keighery 5390)		P3	
802.	18299 <i>Erythrina x sykesii</i>	Y		
803.	5580 <i>Eucalyptus camaldulensis</i> ( <i>River Gum, Yabalinyba</i> )			
804.	5708 <i>Eucalyptus marginata</i> ( <i>Jarraah, Djara</i> )			
805.	13547 <i>Eucalyptus marginata</i> subsp. <i>marginata</i> ( <i>Jarraah</i> )			
806.	13548 <i>Eucalyptus marginata</i> subsp. <i>thalassica</i> ( <i>Blue-leaved Jarraah</i> )			

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807.	5763 <i>Eucalyptus rudis</i> (Flooded Gum, Kulurda)			
808.	5797 <i>Eucalyptus wandoo</i> (Wandoo, Wondu)			
809.	12906 <i>Eucalyptus wandoo</i> subsp. <i>wandoo</i>			
810.	3872 <i>Euchilopsis linearis</i> (Swamp Pea)			
811.	3880 <i>Eutaxia virgata</i>			
812.	32367 <i>Fissidens megalotis</i>			
813.	32368 <i>Fissidens taylorii</i>			
814.	32469 <i>Fissidens taylorii</i> var. <i>taylorii</i>			
815.	<i>Fossombronia attilamellosa</i>			
816.	2969 <i>Fumaria capreolata</i> (Whiteflower Fumitory)	Y		
817.	31532 <i>Fumaria muralis</i> subsp. <i>muralis</i>	Y		
818.	<i>Fumaria</i> sp.			
819.	32370 <i>Funaria hygrometrica</i>			
820.	900 <i>Gahnia aristata</i>			
821.	907 <i>Gahnia trifida</i> (Coast Saw-sedge)			
822.	7321 <i>Galium divaricatum</i>	Y		
823.	3887 <i>Gastrolobium acutum</i>			
824.	20475 <i>Gastrolobium capitatum</i>			
825.	20483 <i>Gastrolobium linearifolium</i>			
826.	3912 <i>Gastrolobium oxylaboides</i> (Champion Bay Poison)			
827.	3923 <i>Gastrolobium spathulatum</i> (Poison Bush)			
828.	16311 <i>Gazania linearis</i>	Y		
829.	32374 <i>Gemmabryum cheelii</i>			
830.	32375 <i>Gemmabryum chrysoneuron</i>			
831.	32379 <i>Gemmabryum inaequale</i>			
832.	32380 <i>Gemmabryum pachythecum</i>			
833.	32381 <i>Gemmabryum preissianum</i>			
834.	32383 <i>Gemmabryum sullivani</i>			
835.	3936 <i>Genista linifolia</i> (Flaxleaf Broom)	Y		
836.	32384 <i>Gigaspermum repens</i>			
837.	18298 <i>Gladiolus carneus</i>	Y		
838.	1520 <i>Gladiolus caryophyllaceus</i> (Wild Gladiolus)	Y		
839.	6143 <i>Glischrocaryon aureum</i> (Common Popflower)			
840.	6587 <i>Gomphocarpus fruticosus</i> (Narrowleaf Cottonbush)	Y		
841.	11051 <i>Gomphocarpus physocarpus</i>	Y		
842.	10909 <i>Gompholobium confertum</i>			
843.	3950 <i>Gompholobium knightianum</i>			
844.	3951 <i>Gompholobium marginatum</i>			
845.	3954 <i>Gompholobium polymorphum</i>			
846.	3955 <i>Gompholobium preissii</i>			
847.	3956 <i>Gompholobium shuttleworthii</i>			
848.	3957 <i>Gompholobium tomentosum</i> (Hairy Yellow Pea)			
849.	6149 <i>Gonocarpus cordiger</i>			
850.	6159 <i>Gonocarpus nodulosus</i>			
851.	6160 <i>Gonocarpus paniculatus</i>			
852.	6161 <i>Gonocarpus pithyoides</i>			
853.	29362 <i>Goodenia coerulea</i>			
854.	12520 <i>Goodenia fasciculata</i>			
855.	7517 <i>Goodenia incana</i> (Hoary Goodenia)			
856.	12551 <i>Goodenia micrantha</i>			
857.	7538 <i>Goodenia pulchella</i>			
858.	19286 <i>Goodenia pulchella</i> subsp. <i>Coastal Plain A</i> (M. Hislop 634)			
859.	19284 <i>Goodenia pulchella</i> subsp. <i>Coastal Plain B</i> (L.W. Sage 2336)			
860.	14282 <i>Gratiola pubescens</i>			
861.	1964 <i>Grevillea bipinnatifida</i> (Fuchsia Grevillea)			
862.	19628 <i>Grevillea bipinnatifida</i> subsp. <i>bipinnatifida</i>			
863.	1997 <i>Grevillea endlicheriana</i> (Spindly Grevillea)			
864.	13450 <i>Grevillea manglesii</i> subsp. <i>manglesii</i>			
865.	2066 <i>Grevillea pilulifera</i> (Woolly-flowered Grevillea)			
866.	15839 <i>Grevillea preissii</i> subsp. <i>preissii</i>			
867.	2080 <i>Grevillea quercifolia</i> (Oak-leaf Grevillea)			
868.	2101 <i>Grevillea synapheae</i> (Catkin Grevillea)			
869.	2107 <i>Grevillea thelemanniana</i> (Spider Net Grevillea)			
870.	2122 <i>Grevillea wilsonii</i> (Native Fuchsia)			
871.	1465 <i>Haemodorum discolor</i>			
872.	1468 <i>Haemodorum laxum</i>			
873.	1469 <i>Haemodorum loratum</i>		P3	
874.	1472 <i>Haemodorum simplex</i>			
875.	1474 <i>Haemodorum sparsiflorum</i>			
876.	2128 <i>Hakea amplexicaulis</i> (Prickly Hakea)			

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877.	2136 <i>Hakea candolleana</i>			
878.	2137 <i>Hakea ceratophylla</i> (Horned Leaf Hakea)			
879.	2143 <i>Hakea conchifolia</i> (Shell-leaved Hakea)			
880.	2152 <i>Hakea cyclocarpa</i> (Ramshorn)			
881.	2158 <i>Hakea erinacea</i> (Hedge-hog Hakea)			
882.	2166 <i>Hakea incrassata</i> (Marble Hakea)			
883.	2175 <i>Hakea lissocarpha</i> (Honey Bush)			
884.	2185 <i>Hakea myrtoidea</i> (Myrtle Hakea)			
885.	2197 <i>Hakea prostrata</i> (Harsh Hakea)			
886.	2203 <i>Hakea ruscifolia</i> (Candle Hakea)			
887.	31793 <i>Hakea</i> sp. Eastern coastal plain (G.J. Keighery 8014)			
888.	2206 <i>Hakea stenocarpa</i> (Narrow-fruited Hakea)			
889.	2212 <i>Hakea sulcata</i> (Furrowed Hakea)			
890.	2214 <i>Hakea trifurcata</i> (Two-leaf Hakea)			
891.	2215 <i>Hakea undulata</i> (Wavy-leaved Hakea)			
892.	2216 <i>Hakea varia</i> (Variable-leaved Hakea)			
893.	3961 <i>Hardenbergia comptoniana</i> (Native Wisteria)			
894.	3016 <i>Heliophila pusilla</i>	Y		
895.	6838 <i>Hemiandra linearis</i> (Speckled Snakebush)			
896.	6839 <i>Hemiandra pungens</i> (Snakebush)			
897.	6856 <i>Hemigenia incana</i> (Silky Hemigenia)			
898.	41020 <i>Hemiphora bartlingii</i> (Woolly Dragon)			
899.	1526 <i>Hesperantha falcata</i>	Y		
900.	5108 <i>Hibbertia acerosa</i> (Needle Leaved Guinea Flower)			
901.	5112 <i>Hibbertia aurea</i>			
902.	5114 <i>Hibbertia commutata</i>			
903.	19778 <i>Hibbertia glomerata</i> subsp. <i>darlingensis</i>			
904.	5134 <i>Hibbertia huegellii</i>			
905.	5135 <i>Hibbertia hypericoides</i> (Yellow Buttercups)			
906.	45534 <i>Hibbertia hypericoides</i> subsp. <i>hypericoides</i>			
907.	5146 <i>Hibbertia montana</i>		P4	
908.	5148 <i>Hibbertia mylnei</i>			
909.	5152 <i>Hibbertia ovata</i>			
910.	5155 <i>Hibbertia pilosa</i> (Hairy Guinea Flower)			
911.	5162 <i>Hibbertia racemosa</i> (Stalked Guinea Flower)			
912.	5169 <i>Hibbertia serrata</i> (Serrate Leaved Guinea Flower)			
913.	<i>Hibbertia</i> sp.			
914.	5171 <i>Hibbertia spicata</i>			
915.	11481 <i>Hibbertia spicata</i> subsp. <i>spicata</i>			
916.	48381 <i>Hibbertia striata</i>			
917.	444 <i>Holcus lanatus</i> (Yorkshire Fog)	Y		
918.	6222 <i>Homalosciadium homalocarpum</i>			
919.	451 <i>Hordeum vulgare</i> (Barley)	Y		
920.	3964 <i>Hovea chorizemifolia</i> (Holly-leaved Hovea)			
921.	3966 <i>Hovea pungens</i> (Devil's Pins, Puyenak)			
922.	3968 <i>Hovea trisperma</i> (Common Hovea)			
923.	12859 <i>Hovea trisperma</i> var. <i>trisperma</i>			
924.	18296 <i>Humulus lupulus</i>	Y		
925.	12741 <i>Hyalosperma cotula</i>			
926.	5216 <i>Hybanthus calycinus</i> (Wild Violet)			
927.	6223 <i>Hydrocotyle alata</i>			
928.	6226 <i>Hydrocotyle callicarpa</i> (Small Pennywort)			
929.	6229 <i>Hydrocotyle diantha</i>			
930.	6233 <i>Hydrocotyle lemnoidea</i> (Aquatic Pennywort)		P4	
931.	452 <i>Hyparrhenia hirta</i> (Tambookie Grass)	Y		
932.	5817 <i>Hypocalymma angustifolium</i> (White Myrtle, Kudjid)			
933.	35070 <i>Hypocalymma angustifolium</i> subsp. <i>Swan Coastal Plain</i> (G.J. Keighery 16777)			
934.	5825 <i>Hypocalymma robustum</i> (Swan River Myrtle)			
935.	8086 <i>Hypochaeris glabra</i> (Smooth Catsear)	Y		
936.	1070 <i>Hypolaena exsulca</i>			
937.	17841 <i>Hypolaena pubescens</i>			
938.	910 <i>Isolepis cernua</i> (Nodding Club-rush)			
939.	20199 <i>Isolepis cernua</i> var. <i>cernua</i>			
940.	20200 <i>Isolepis cernua</i> var. <i>setiformis</i>			
941.	912 <i>Isolepis cyperoides</i>			
942.	14540 <i>Isolepis hystrix</i>	Y		
943.	917 <i>Isolepis marginata</i> (Coarse Club-rush)			
944.	919 <i>Isolepis oldfieldiana</i>			
945.	2221 <i>Isopogon asper</i>			
946.	29775 <i>Isopogon drummondii</i>		P3	

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947.	2229 <i>Isopogon dubius</i> (Pincushion Coneflower)			
948.	2237 <i>Isopogon sphaerocephalus</i> (Drumstick Isopogon)			
949.	7396 <i>Isotoma hypocrateriformis</i> (Woodbridge Poison)			
950.	7398 <i>Isotoma pusilla</i> (Small Isotome)			
951.	3992 <i>Isotropis cuneifolia</i> (Granny Bonnets)			
952.	16317 <i>Isotropis cuneifolia</i> subsp. <i>glabra</i>		P2	
953.	1533 <i>Ixia paniculata</i>	Y		
954.	1534 <i>Ixia polystachya</i> (Variable Ixia)	Y		
955.	3997 <i>Jacksonia alata</i>			
956.	3998 <i>Jacksonia angulata</i>			
957.	4010 <i>Jacksonia floribunda</i> (Holly Pea)			
958.	4012 <i>Jacksonia furcellata</i> (Grey Stinkwood)			
959.	4018 <i>Jacksonia lehmannii</i>			
960.	4025 <i>Jacksonia restioides</i>			
961.	4029 <i>Jacksonia sternbergiana</i> (Stinkwood, Kapur)			
962.	1298 <i>Johnsonia pubescens</i> (Pipe Lily)			
963.	19632 <i>Johnsonia pubescens</i> subsp. <i>pubescens</i>			
964.	1177 <i>Juncus articulatus</i> (Jointed Rush)	Y		
965.	1180 <i>Juncus capitatus</i> (Capitate Rush)	Y		
966.	1188 <i>Juncus pallidus</i> (Pale Rush)			
967.	4037 <i>Kennedia coccinea</i> (Coral Vine)			
968.	4044 <i>Kennedia prostrata</i> (Scarlet Runner)			
969.	4045 <i>Kennedia stirlingii</i> (Bushy Kennedia)			
970.	1221 <i>Kingia australis</i> (Kingia, Pulonok)			
971.	5832 <i>Kunzea ericifolia</i> (Spearwood, Pondil)			
972.	15498 <i>Kunzea glabrescens</i> (Spearwood)			
973.	5835 <i>Kunzea micrantha</i>			
974.	17461 <i>Kunzea micrantha</i> subsp. <i>micrantha</i>			
975.	3669 <i>Labichea punctata</i> (Lance-leaved Cassia)			
976.	20019 <i>Lachnagrostis filiformis</i>			
977.	19955 <i>Lachnagrostis plebeia</i>			
978.	29046 <i>Lactuca serriola</i> forma <i>serriola</i>	Y		
979.	2249 <i>Lambertia multiflora</i> (Many-flowered Honeysuckle)			
980.	14083 <i>Lambertia multiflora</i> var. <i>darlingensis</i>			
981.	28342 <i>Landoltia punctata</i> (Thin Duckweed)			
982.	5025 <i>Lasiopetalum bracteatum</i> (Helena Velvet Bush)		P4	
983.	45081 <i>Lasiopetalum glutinosum</i> subsp. <i>glutinosum</i>		P3	
984.	4047 <i>Lathyrus tingitanus</i> (Tangier Pea)	Y		
985.	4959 <i>Lawrenzia squamata</i>			
986.	1307 <i>Laxmannia ramosa</i> (Branching Lily)			
987.	11911 <i>Laxmannia ramosa</i> subsp. <i>ramosa</i>			
988.	11464 <i>Laxmannia sessiliflora</i> subsp. <i>australis</i>			
989.	1309 <i>Laxmannia squarrosa</i>			
990.	7568 <i>Lechenaultia biloba</i> (Blue Leschenaultia)			
991.	1051 <i>Lemna disperma</i> (Duckweed)			
992.	925 <i>Lepidosperma angustatum</i>			
993.	42741 <i>Lepidosperma apicola</i>			
994.	936 <i>Lepidosperma leptostachyum</i>			
995.	937 <i>Lepidosperma longitudinale</i> (Pithy Sword-sedge)			
996.	940 <i>Lepidosperma pubisquameum</i>			
997.	942 <i>Lepidosperma rostratum</i>		T	
998.	944 <i>Lepidosperma scabrum</i>			
999.	<i>Lepidosperma</i> sp.			
1000.	29150 <i>Lepidosperma</i> sp. Margaret River (B.J. Lepschi 1841)			
1001.	16284 <i>Lepidosperma</i> sp. P1 small head (M.D. Tindale 166A)			
1002.	949 <i>Lepidosperma tuberculatum</i>			
1003.	118 <i>Lepilaena australis</i> (Austral Water Mat)			
1004.	1653 <i>Leporella fimbriata</i> (Hare Orchid)			
1005.	1077 <i>Leptocarpus canus</i> (Hoary Twine-rush)			
1006.	1078 <i>Leptocarpus coangustatus</i>			
1007.	46375 <i>Leptocarpus decipiens</i>			
1008.	1080 <i>Leptocarpus scariosus</i>			
1009.	2342 <i>Leptomeria cunninghamii</i>			
1010.	5850 <i>Leptospermum laevigatum</i> (Coast Teatree)	Y		
1011.	19241 <i>Lepyrodia curvescens</i>		P2	
1012.	1085 <i>Lepyrodia glauca</i>			
1013.	1088 <i>Lepyrodia macra</i> (Large Scale Rush)			
1014.	1090 <i>Lepyrodia muirii</i>			
1015.	6367 <i>Leucopogon capitellatus</i>			
1016.	6374 <i>Leucopogon conostephioides</i>			

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1017.	6397 <i>Leucopogon glaucifolius</i>			
1018.	6427 <i>Leucopogon parviflorus</i> (Coast Beard-heath)			
1019.	6434 <i>Leucopogon polymorphus</i>			
1020.	6436 <i>Leucopogon propinquus</i>			
1021.	6439 <i>Leucopogon pulchellus</i> (Beard-heath)			
1022.	14637 <i>Leucopogon</i> sp. <i>Coujinup</i> (M.A. Burgman 1085)			
1023.	6444 <i>Leucopogon sprengeloides</i>			
1024.	6445 <i>Leucopogon squarrosus</i>			
1025.	40803 <i>Leucopogon squarrosus</i> subsp. <i>squarrosus</i>			
1026.	6447 <i>Leucopogon strictus</i>			
1027.	7676 <i>Levenhookia pusilla</i> (Midget Stylewort)			
1028.	7677 <i>Levenhookia stipitata</i> (Common Stylewort)			
1029.	4363 <i>Linum trigynum</i> (French Flax)	Y		
1030.	36160 <i>Liparophyllum capitatum</i>			
1031.	7406 <i>Lobelia rhombifolia</i> (Tufted Lobelia)			
1032.	7407 <i>Lobelia rhytidosperra</i> (Wrinkled-seeded Lobelia)			
1033.	475 <i>Lolium multiflorum</i> (Italian Ryegrass)	Y		
1034.	11073 <i>Lolium x hybridum</i>	Y		
1035.	1223 <i>Lomandra caespitosa</i> (Tufted Mat Rush)			
1036.	1228 <i>Lomandra hermaphrodita</i>			
1037.	1229 <i>Lomandra integra</i>			
1038.	1232 <i>Lomandra micrantha</i> (Small-flower Mat-rush)			
1039.	14542 <i>Lomandra micrantha</i> subsp. <i>micrantha</i>			
1040.	1234 <i>Lomandra nigricans</i>			
1041.	1236 <i>Lomandra odora</i> (Tiered Matrush)			
1042.	1239 <i>Lomandra preissii</i>			
1043.	1240 <i>Lomandra purpurea</i> (Purple Mat Rush)			
1044.	1243 <i>Lomandra sericea</i> (Silky Mat Rush)			
1045.	1245 <i>Lomandra spartea</i>			
1046.	1246 <i>Lomandra suaveolens</i>			
1047.	7365 <i>Lonicera japonica</i> (Japanese Honeysuckle)	Y		
1048.	8564 <i>Lotus subbiflorus</i>	Y		
1049.	4063 <i>Lotus uliginosus</i> (Greater Lotus)	Y		
1050.	4067 <i>Lupinus luteus</i> (Yellow Lupin)	Y		
1051.	1097 <i>Lyginia barbata</i>			
1052.	18049 <i>Lyginia imberbis</i>			
1053.	36375 <i>Lysimachia arvensis</i> (Pimpernel)	Y		
1054.	36373 <i>Lysimachia minima</i>	Y		
1055.	6456 <i>Lysinema ciliatum</i> (Curry Flower)			
1056.	34736 <i>Lysinema pentapetalum</i>			
1057.	5281 <i>Lythrum hyssopifolia</i> (Lesser Loosestrife)	Y		
1058.	2839 <i>Macarthuria australis</i>			
1059.	17106 <i>Macarthuria keigheryi</i>		T	
1060.	85 <i>Macrozamia riedlei</i> (Zamia, Djiridji)			
1061.	17636 <i>Marianthus coeruleopunctatus</i> (Blue-spotted Marianthus)			
1062.	4079 <i>Medicago polymorpha</i> (Burr Medic)	Y		
1063.	4080 <i>Medicago sativa</i> (Alfalfa)	Y		
1064.	33638 <i>Meionectes tenuifolia</i>		P3	
1065.	37580 <i>Melaleuca acutifolia</i>			
1066.	36296 <i>Melaleuca armillaris</i> subsp. <i>armillaris</i>	Y		
1067.	5881 <i>Melaleuca brevifolia</i>			
1068.	13273 <i>Melaleuca incana</i> subsp. <i>incana</i>			
1069.	5926 <i>Melaleuca lateritia</i> (Robin Redbreast Bush)			
1070.	5932 <i>Melaleuca leucadendra</i>			
1071.	20297 <i>Melaleuca osullivanii</i>			
1072.	18394 <i>Melaleuca parviceps</i>			
1073.	5958 <i>Melaleuca radula</i> (Graceful Honeymyrtle)			
1074.	5959 <i>Melaleuca rhapsiophylla</i> (Swamp Paperbark)			
1075.	5961 <i>Melaleuca scabra</i> (Rough Honeymyrtle, Wurru Bush)			
1076.	5983 <i>Melaleuca trichophylla</i>			
1077.	37683 <i>Melaleuca viminalis</i>		P2	
1078.	5987 <i>Melaleuca viminea</i> (Mohan)			
1079.	4516 <i>Melia azedarach</i> (White Cedar)			
1080.	14985 <i>Melinis repens</i>	Y		
1081.	953 <i>Mesomelaena graciliceps</i>			
1082.	955 <i>Mesomelaena pseudostygia</i>			
1083.	957 <i>Mesomelaena tetragona</i> (Semaphore Sedge)			
1084.	485 <i>Microlaena stipoides</i> (Weeping Grass)			
1085.	15419 <i>Microtis media</i> subsp. <i>media</i>			
1086.	8106 <i>Millotia tenuifolia</i> (Soft Millotia)			

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1087.	14344 <i>Millotia tenuifolia</i> var. <i>tenuifolia</i> (Soft Millotia)			
1088.	4097 <i>Mirbelia ramulosa</i>			
1089.	4100 <i>Mirbelia spinosa</i>			
1090.	7410 <i>Monopsis debilis</i>	Y		
1091.	37440 <i>Monopsis debilis</i> var. <i>depressa</i>	Y		
1092.	4662 <i>Monotaxis grandiflora</i> (Diamond of the Desert)			
1093.	19585 <i>Monotaxis grandiflora</i> var. <i>grandiflora</i>			
1094.	19179 <i>Moraea flaccida</i> (One-leaf Cape Tulip)	Y		
1095.	19178 <i>Moraea lewisiae</i>	Y		
1096.	19438 <i>Moraea ochroleuca</i>	Y		
1097.	14187 <i>Myriocephalus occidentalis</i>			
1098.	6189 <i>Myriophyllum crispatum</i>			
1099.	6193 <i>Myriophyllum echinatum</i>		P3	
1100.	44496 <i>Narcissus tazetta</i> subsp. <i>italicus</i>	Y		
1101.	492 <i>Neurachne alopecuroidea</i> (Foxtail Mulga Grass)			
1102.	1381 <i>Nothoscordum gracile</i>	Y		
1103.	2401 <i>Nuytsia floribunda</i> (Christmas Tree, Mudja)			
1104.	6138 <i>Oenothera drummondii</i> (Beach Evening Primrose)	Y		
1105.	20052 <i>Oenothera jamesii</i>	Y		
1106.	16347 <i>Oenothera laciniata</i>	Y		
1107.	6140 <i>Oenothera mollissima</i>	Y		
1108.	14292 <i>Oenothera stricta</i> subsp. <i>stricta</i>	Y		
1109.	2365 <i>Olax benthamiana</i>			
1110.	2367 <i>Olax scalariformis</i>			
1111.	8127 <i>Olearia axillaris</i> (Coastal Daisybush)			
1112.	8143 <i>Olearia paucidentata</i> (Autumn Scrub Daisy)			
1113.	18254 <i>Opercularia apiciflora</i>			
1114.	18255 <i>Opercularia vaginata</i> (Dog Weed)			
1115.	5227 <i>Opuntia stricta</i> (Common Prickly Pear)	Y		
1116.	46207 <i>Opuntia tomentosa</i>	Y		
1117.	36200 <i>Ornduffia submersa</i>		P4	
1118.	4113 <i>Ornithopus compressus</i> (Yellow Serradella)	Y		
1119.	7122 <i>Orobanche minor</i> (Lesser Broomrape)	Y		
1120.	11749 <i>Orthrosanthus laxus</i> var. <i>laxus</i> (Morning Iris)			
1121.	168 <i>Ottelia ovalifolia</i> (Swamp Lily)			
1122.	14531 <i>Ottelia ovalifolia</i> subsp. <i>ovalifolia</i>			
1123.	4348 <i>Oxalis caprina</i>	Y		
1124.	4349 <i>Oxalis corniculata</i> (Yellow Wood Sorrel)	Y		
1125.	4352 <i>Oxalis glabra</i>	Y		
1126.	4355 <i>Oxalis perennans</i>			
1127.	4356 <i>Oxalis pes-caprae</i> (Soursob)	Y		
1128.	4358 <i>Oxalis purpurea</i> (Largeflower Wood Sorrel)	Y		
1129.	20101 <i>Paragonis grandiflora</i>			
1130.	7089 <i>Parentucellia latifolia</i> (Common Bartsia)	Y		
1131.	7090 <i>Parentucellia viscosa</i> (Sticky Bartsia)	Y		
1132.	527 <i>Paspalum dilatatum</i>	Y		
1133.	528 <i>Paspalum distichum</i> (Water Couch)	Y		
1134.	5225 <i>Passiflora filamentosa</i>	Y		
1135.	1542 <i>Patersonia babianooides</i>			
1136.	1546 <i>Patersonia juncea</i> (Rush Leaved Patersonia)			
1137.	1550 <i>Patersonia occidentalis</i> (Purple Flag, Koma)			
1138.	1551 <i>Patersonia pygmaea</i> (Pygmy Patersonia)			
1139.	43765 <i>Pauridia glabella</i> var. <i>glabella</i>			
1140.	43761 <i>Pauridia occidentalis</i> var. <i>occidentalis</i>			
1141.	43762 <i>Pauridia occidentalis</i> var. <i>quadriloba</i>			
1142.	10828 <i>Pavonia hastata</i>	Y		
1143.	40424 <i>Pentameris airoides</i> subsp. <i>airoides</i>	Y		
1144.	40422 <i>Pentameris pallida</i>	Y		
1145.	6245 <i>Pentapeltis peltigera</i>			
1146.	16477 <i>Pericalymma ellipticum</i> var. <i>ellipticum</i>			
1147.	16478 <i>Pericalymma ellipticum</i> var. <i>floridum</i>			
1148.	13911 <i>Persicaria decipiens</i>			
1149.	2255 <i>Persoonia angustiflora</i>			
1150.	2262 <i>Persoonia elliptica</i> (Spreading Snottygobble)			
1151.	2273 <i>Persoonia saccata</i> (Snottygobble)			
1152.	2284 <i>Petrophile biloba</i> (Granite Petrophile)			
1153.	20391 <i>Petrophile juncifolia</i>			
1154.	2299 <i>Petrophile linearis</i> (Pixie Mops)			
1155.	2301 <i>Petrophile macrostachya</i>			
1156.	2308 <i>Petrophile seminuda</i>			

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1157.	2312 <i>Petrophile striata</i>			
1158.	19825 <i>Petrorhagia dubia</i>	Y		
1159.	547 <i>Phalaris angusta</i>	Y		
1160.	551 <i>Phalaris minor</i> (Lesser Canary Grass)	Y		
1161.	552 <i>Phalaris paradoxa</i> (Paradoxa Grass)	Y		
1162.	20460 <i>Pheladenia deformis</i>			
1163.	32409 <i>Philonotis australiensis</i>			
1164.	18529 <i>Philothea spicata</i> (Pepper and Salt)			
1165.	1172 <i>Philydrella drummondii</i>			
1166.	1173 <i>Philydrella pygmaea</i> (Butterfly Flowers)			
1167.	14306 <i>Philydrella pygmaea</i> subsp. <i>pygmaea</i>			
1168.	1478 <i>Phlebocarya ciliata</i>			
1169.	1479 <i>Phlebocarya filifolia</i>			
1170.	16825 <i>Phyllangium divergens</i>			
1171.	4675 <i>Phyllanthus calycinus</i> (False Boronia)			
1172.	17794 <i>Phyllanthus tenellus</i>	Y		
1173.	4 <i>Phylloglossum drummondii</i> (Pigmy Clubmoss)			
1174.	6983 <i>Physalis peruviana</i> (Cape Gooseberry)	Y		
1175.	2408 <i>Pilostyles hamiltonii</i>			
1176.	78 <i>Pilularia novae-hollandiae</i> (Austral Pillwort)			
1177.	5231 <i>Pimelea angustifolia</i> (Narrow-leaved Pimelea)			
1178.	5238 <i>Pimelea ciliata</i> (White Banjine)			
1179.	11928 <i>Pimelea ciliata</i> subsp. <i>ciliata</i>			
1180.	11404 <i>Pimelea imbricata</i> var. <i>major</i>			
1181.	11402 <i>Pimelea imbricata</i> var. <i>piliger</i>			
1182.	5260 <i>Pimelea rara</i> (Summer Pimelea)		P4	
1183.	12041 <i>Pimelea suaveolens</i> subsp. <i>suaveolens</i>			
1184.	5268 <i>Pimelea sulphurea</i> (Yellow Banjine)			
1185.	8163 <i>Pithocarpa corymbulosa</i> (Corymbose Pithocarpa)		P3	
1186.	8165 <i>Pithocarpa pulchella</i> (Beautiful Pithocarpa)			
1187.	18352 <i>Pithocarpa pulchella</i> var. <i>melanostigma</i>			
1188.	7303 <i>Plantago lanceolata</i> (Ribwort Plantain)	Y		
1189.	6253 <i>Platysace filiformis</i>			
1190.	6255 <i>Platysace juncea</i>			
1191.	11132 <i>Platysace ramosissima</i>		P3	
1192.	32478 <i>Pleurodium nervosum</i> var. <i>nervosum</i>			
1193.	571 <i>Poa annua</i> (Winter Grass)	Y		
1194.	573 <i>Poa drummondiana</i> (Knotted Poa)			
1195.	8175 <i>Podolepis gracilis</i> (Slender Podolepis)			
1196.	8177 <i>Podolepis lessonii</i>			
1197.	8182 <i>Podotheca angustifolia</i> (Sticky Longheads)			
1198.	8183 <i>Podotheca chrysantha</i> (Yellow Podotheca)			
1199.	8188 <i>Pogonolepis stricta</i>			
1200.	8395 <i>Polygala myrtifolia</i> (Myrtleleaf Milkwort)	Y		
1201.	4578 <i>Polygala virgata</i>	Y		
1202.	2416 <i>Polygonum arenastrum</i> (Sand Wireweed)	Y		
1203.	2419 <i>Polygonum aviculare</i> (Wireweed)	Y		
1204.	582 <i>Polypogon monspeliensis</i> (Annual Beardgrass)	Y		
1205.	583 <i>Polypogon tenellus</i>			
1206.	4691 <i>Poranthera microphylla</i> (Small Poranthera)			
1207.	2884 <i>Portulaca oleracea</i> (Purslane, Wakati)			
1208.	1670 <i>Prasophyllum drummondii</i> (Swamp Leek Orchid)			
1209.	1672 <i>Prasophyllum fimbria</i> (Fringed Leek Orchid)			
1210.	1674 <i>Prasophyllum giganteum</i> (Bronze Leek Orchid)			
1211.	16688 <i>Prasophyllum gracile</i>			
1212.	1680 <i>Prasophyllum parvifolium</i> (Autumn Leek Orchid)			
1213.	10853 <i>Prasophyllum plumiforme</i>			
1214.	17211 <i>Prunus cerasifera</i>	Y		
1215.	4155 <i>Psoralea pinnata</i> (African Scurfpea)	Y		
1216.	13255 <i>Pterochaeta paniculata</i>			
1217.	1686 <i>Pterostylis barbata</i> (Bird Orchid)			
1218.	12217 <i>Pterostylis sanguinea</i>			
1219.	1698 <i>Pterostylis vittata</i> (Banded Greenhood)			
1220.	2716 <i>Ptilotus declinatus</i> (Curved Mulla Mulla)			
1221.	2720 <i>Ptilotus esquamatus</i>			
1222.	2742 <i>Ptilotus manglesii</i> (Pom Poms, Mulamula)			
1223.	2753 <i>Ptilotus pyramidatus</i>		T	Y
1224.	4172 <i>Pultenaea ericifolia</i>			
1225.	16367 <i>Pyrorchis nigricans</i> (Red beaks, Elephants ears)			
1226.	8195 <i>Quinetia urvillei</i>			

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1227.	13312 <i>Rhodanthe pyrethrum</i>			
1228.	<i>Riccia multifida</i>			
1229.	6020 <i>Rinzia crassifolia</i> (Darling Range Rinzia)			
1230.	17020 <i>Robinia pseudoacacia</i>	Y		
1231.	14485 <i>Romulea flava</i> var. <i>minor</i>	Y		
1232.	1556 <i>Romulea rosea</i> (Guildford Grass)	Y		
1233.	11151 <i>Rostraria pumila</i>	Y		
1234.	44608 <i>Rosulabryum billardieri</i>			
1235.	20506 <i>Rubus anglocandicans</i>	Y		
1236.	2432 <i>Rumex conglomeratus</i> (Clustered Dock)	Y		
1237.	40431 <i>Rytidosperma acerosum</i>			
1238.	40425 <i>Rytidosperma caespitosum</i>			
1239.	79 <i>Salvinia molesta</i> (Salvinia)	Y		
1240.	6483 <i>Samolus junceus</i>			
1241.	2356 <i>Santalum acuminatum</i> (Quandong, Warnga)			
1242.	7368 <i>Scabiosa atropurpurea</i> (Purple Pincushion)	Y		
1243.	7602 <i>Scaevola calliptera</i>			
1244.	7613 <i>Scaevola glandulifera</i> (Viscid Hand-flower)			
1245.	7619 <i>Scaevola lanceolata</i> (Long-leaved Scaevola)			
1246.	7635 <i>Scaevola pilosa</i> (Hairy Fan-flower)			
1247.	7636 <i>Scaevola platyphylla</i> (Broad-leaved Fanflower)			
1248.	13182 <i>Scaevola repens</i> var. <i>repens</i>			
1249.	32432 <i>Schizymenium bryoides</i>			
1250.	6263 <i>Schoenolaena juncea</i>			
1251.	971 <i>Schoenus andrewsii</i>			
1252.	974 <i>Schoenus benthamii</i>		P3	
1253.	975 <i>Schoenus bifidus</i>			
1254.	978 <i>Schoenus brevisetis</i>			
1255.	979 <i>Schoenus caespitosus</i>			
1256.	980 <i>Schoenus capillifolius</i>		P3	
1257.	984 <i>Schoenus curvifolius</i>			
1258.	985 <i>Schoenus discifer</i>			
1259.	986 <i>Schoenus efoliatus</i>			
1260.	987 <i>Schoenus elegans</i>			
1261.	991 <i>Schoenus grammatophyllus</i>			
1262.	994 <i>Schoenus humilis</i>			
1263.	996 <i>Schoenus laevigatus</i>			
1264.	998 <i>Schoenus latitans</i>			
1265.	999 <i>Schoenus loliaceus</i>		P2	
1266.	1002 <i>Schoenus nanus</i> (Tiny Bog Rush)			
1267.	1003 <i>Schoenus natans</i> (Floating Bog-rush)		P4	
1268.	1006 <i>Schoenus odontocarpus</i>			
1269.	1007 <i>Schoenus pedicellatus</i>			
1270.	1008 <i>Schoenus pennisetis</i>		P3	
1271.	1009 <i>Schoenus pleiostemoneus</i>			
1272.	17614 <i>Schoenus plumosus</i>			
1273.	1011 <i>Schoenus rigens</i>			
1274.	1013 <i>Schoenus sculptus</i> (Gimlet Bog-rush)			
1275.	16280 <i>Schoenus</i> sp. <i>Beaufort</i> (G.J. Keighery 6291)		P1	
1276.	17731 <i>Schoenus</i> sp. <i>Waroona</i> (G.J. Keighery 12235)		P3	
1277.	1017 <i>Schoenus subbulbosus</i>			
1278.	1018 <i>Schoenus subfascicularis</i>			
1279.	1019 <i>Schoenus subflavus</i> (Yellow Bog-rush)			
1280.	1026 <i>Schoenus unispiculatus</i>			
1281.	17409 <i>Schoenus variicellae</i>			
1282.	6033 <i>Scholtzia involucrata</i> (Spiked Scholtzia)			
1283.	6 <i>Selaginella gracillima</i> (Tiny Clubmoss)			
1284.	32433 <i>Sematophyllum homomallum</i>			
1285.	8203 <i>Senecio diaschides</i>			
1286.	8212 <i>Senecio leucoglossus</i>		P4	
1287.	20663 <i>Senecio multicaulis</i> subsp. <i>multicaulis</i>			
1288.	609 <i>Setaria palmifolia</i> (Palm Grass)	Y		
1289.	19453 <i>Setaria parviflora</i>	Y		
1290.	2909 <i>Silene gallica</i> (French Catchfly)	Y		
1291.	8225 <i>Siloxerus humifusus</i> (Procumbent Siloxerus)			
1292.	14583 <i>Siloxerus multiflorus</i>			
1293.	8231 <i>Sonchus oleraceus</i> (Common Sowthistle)	Y		
1294.	617 <i>Sorghum halepense</i> (Johnson Grass)	Y		
1295.	1312 <i>Sowerbaea laxiflora</i> (Purple Tassels)			
1296.	1558 <i>Sparaxis bulbifera</i>	Y		

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1297.	4205 <i>Sphaerolobium linophyllum</i>			
1298.	4206 <i>Sphaerolobium macranthum</i>			
1299.	4207 <i>Sphaerolobium medium</i>			
1300.	635 <i>Sporobolus virginicus</i> (Marine Couch)			
1301.	4716 <i>Stachystemon vermicularis</i>			
1302.	4733 <i>Stackhousia monogyne</i>			
1303.	9070 <i>Stackhousia pubescens</i> (Downy Stackhousia)			
1304.	13475 <i>Stenanthemum humile</i>			
1305.	19403 <i>Stenopetalum gracile</i>			
1306.	2316 <i>Stirlingia latifolia</i> (Blueboy)			
1307.	2317 <i>Stirlingia simplex</i>			
1308.	18564 <i>Stylidium aceratum</i>		P3	
1309.	7681 <i>Stylidium affine</i> (Queen Triggerplant)			
1310.	7684 <i>Stylidium amoenum</i> (Lovely Triggerplant)			
1311.	30278 <i>Stylidium androsaceum</i>			
1312.	25831 <i>Stylidium araeophyllum</i> (Stilt Walker)			
1313.	7692 <i>Stylidium breviscapum</i> (Boomerang Triggerplant)			
1314.	7693 <i>Stylidium brunonianum</i> (Pink Fountain Triggerplant)			
1315.	7694 <i>Stylidium bulbiferum</i> (Circus Triggerplant)			
1316.	7696 <i>Stylidium calcaratum</i> (Book Triggerplant)			
1317.	7698 <i>Stylidium caricifolium</i> (Milkmaids)			
1318.	7702 <i>Stylidium ciliatum</i> (Golden Triggerplant)			
1319.	7712 <i>Stylidium despectum</i> (Dwarf Triggerplant)			
1320.	7713 <i>Stylidium dichotomum</i> (Pins-and-needles)			
1321.	7716 <i>Stylidium diuroides</i> (Donkey Triggerplant)			
1322.	7717 <i>Stylidium divaricatum</i> (Daddy-long-legs)			
1323.	7721 <i>Stylidium emarginatum</i> (Biddy-four-legs)			
1324.	19251 <i>Stylidium eriopodium</i>			
1325.	7734 <i>Stylidium guttatum</i> (Dotted Triggerplant)			
1326.	7736 <i>Stylidium hispidum</i> (White Butterfly Triggerplant)			
1327.	7742 <i>Stylidium inundatum</i> (Hundreds and Thousands)			
1328.	7745 <i>Stylidium junceum</i> (Reed Triggerplant)			
1329.	7756 <i>Stylidium longitubum</i> (Jumping Jacks)		P4	
1330.	7768 <i>Stylidium obtusatum</i> (Pinafore Triggerplant)			
1331.	7771 <i>Stylidium periscelanthum</i> (Pantaloon Triggerplant)		P3	
1332.	7772 <i>Stylidium perpusillum</i> (Tiny Triggerplant)			
1333.	7773 <i>Stylidium petiolare</i> (Horn Triggerplant)			
1334.	7774 <i>Stylidium piliferum</i> (Common Butterfly Triggerplant)			
1335.	7782 <i>Stylidium pulchellum</i> (Thumbelina Triggerplant)			
1336.	7783 <i>Stylidium pycnostachyum</i> (Downy Triggerplant)			
1337.	33106 <i>Stylidium recurvum</i>			
1338.	7785 <i>Stylidium repens</i> (Matted Triggerplant)			
1339.	7790 <i>Stylidium roseoalatum</i> (Pink-wing Triggerplant)			
1340.	25806 <i>Stylidium scarosum</i>			
1341.	7798 <i>Stylidium schoenoides</i> (Cow Kicks)			
1342.	7803 <i>Stylidium striatum</i> (Fan-leaved Triggerplant)		P4	
1343.	45594 <i>Stylidium tenue</i> subsp. <i>majusculum</i> (Showy Fountain Triggerplant)			
1344.	23511 <i>Stylidium thesioides</i> (Delicate Triggerplant)			
1345.	7806 <i>Stylidium utricularioides</i> (Pink Fan Triggerplant)			
1346.	40947 <i>Stylidium xanthellum</i>			
1347.	1260 <i>Stypandra glauca</i> (Blind Grass)			
1348.	48297 <i>Styphelia filifolia</i>		P3	
1349.	6476 <i>Styphelia tenuiflora</i> (Common Pinheath)			
1350.	2321 <i>Synaphea acutiloba</i> (Granite Synaphea)			
1351.	2323 <i>Synaphea gracillima</i>			
1352.	2324 <i>Synaphea petiolaris</i> (Synaphea)			
1353.	16864 <i>Synaphea petiolaris</i> subsp. <i>petiolaris</i>			
1354.	2325 <i>Synaphea pinnata</i> (Helena Synaphea)			
1355.	18590 <i>Synaphea</i> sp. <i>Fairbridge Farm</i> (D. Papenfus 696)		T	
1356.	2329 <i>Synaphea spinulosa</i>			
1357.	15532 <i>Synaphea spinulosa</i> subsp. <i>spinulosa</i>			
1358.	32438 <i>Syntrichia pagorum</i>			
1359.	20135 <i>Taxandria linearifolia</i>			
1360.	4251 <i>Templetonia drummondii</i>			
1361.	4256 <i>Templetonia retusa</i> (Cockies Tongues)			
1362.	32441 <i>Tetrapterum cylindricum</i>			
1363.	1034 <i>Tetralia capillaris</i> (Hair Sedge)			
1364.	1036 <i>Tetralia octandra</i>			
1365.	667 <i>Tettrarrhena laevis</i> (Forest Ricegrass)			
1366.	4535 <i>Tetradlea hirsuta</i> (Black Eyed Susan)			

Name ID	Species Name	Naturalised	Conservation Code	<sup>1</sup> Endemic To Query Area
1367.	48342 <i>Tetradlea hirsuta</i> subsp. <i>hirsuta</i>			
1368.	4537 <i>Tetradlea nuda</i>			
1369.	4544 <i>Tetradlea setigera</i>			
1370.	1701 <i>Thelymitra antennifera</i> (Vanilla Orchid)			
1371.	10856 <i>Thelymitra benthamiana</i> (Leopard Orchid)			
1372.	1705 <i>Thelymitra crinita</i> (Blue Lady Orchid)			
1373.	1707 <i>Thelymitra flexuosa</i> (Twisted Sun Orchid)			
1374.	11053 <i>Thelymitra macrophylla</i>			
1375.	20729 <i>Thelymitra magnifica</i> (Crystal Brook Star Orchid)		P1	
1376.	1715 <i>Thelymitra spiralis</i> (Curlylocks)			
1377.	10862 <i>Thelymitra stellata</i> (Star Orchid)		T	
1378.	1718 <i>Thelymitra villosa</i> (Custard Orchid)			
1379.	20731 <i>Thelymitra vulgaris</i>			
1380.	673 <i>Themeda triandra</i>			
1381.	5080 <i>Thomasia foliosa</i>			
1382.	5084 <i>Thomasia grandiflora</i> (Large Flowered Thomasia)			
1383.	5087 <i>Thomasia macrocarpa</i> (Large Fruited Thomasia)			
1384.	1317 <i>Thysanotus anceps</i>		P3	
1385.	1318 <i>Thysanotus arbuscula</i>			
1386.	1319 <i>Thysanotus arenarius</i>			
1387.	1328 <i>Thysanotus dichotomus</i> (Branching Fringe Lily)			
1388.	1338 <i>Thysanotus manglesianus</i> (Fringed Lily)			
1389.	1339 <i>Thysanotus multiflorus</i> (Many-flowered Fringe Lily)			
1390.	1343 <i>Thysanotus patersonii</i>			
1391.	46055 <i>Thysanotus</i> sp. Coastal plain (N.H. Brittan 66/63)			
1392.	1351 <i>Thysanotus sparteus</i>			
1393.	1354 <i>Thysanotus tenellus</i>			
1394.	1357 <i>Thysanotus thyrsoides</i>			
1395.	1358 <i>Thysanotus triandrus</i>			
1396.	8248 <i>Tolpis barbata</i> (Yellow Hawkweed)	Y		
1397.	<i>Tortula recurvata</i>			
1398.	6280 <i>Trachymene pilosa</i> (Native Parsnip)			
1399.	17684 <i>Tremulina tremula</i>			
1400.	11112 <i>Tribolium uniolae</i>	Y		
1401.	1481 <i>Tribonanthes australis</i>			
1402.	1482 <i>Tribonanthes brachypetala</i>			
1403.	1483 <i>Tribonanthes longipetala</i>			
1404.	1485 <i>Tribonanthes violacea</i>			
1405.	4383 <i>Tribulus terrestris</i> (Caltrop)	Y		
1406.	8251 <i>Trichocline spathulata</i> (Native Gerbera)			
1407.	1361 <i>Tricoryne elatior</i> (Yellow Autumn Lily)			
1408.	1362 <i>Tricoryne humilis</i>			
1409.	1363 <i>Tricoryne tenella</i>			
1410.	43207 <i>Tricostularia exsul</i>			
1411.	17145 <i>Trifolium angustifolium</i> var. <i>angustifolium</i>	Y		
1412.	4291 <i>Trifolium arvense</i> (Hare's Foot Clover)	Y		
1413.	17542 <i>Trifolium arvense</i> var. <i>arvense</i>	Y		
1414.	4292 <i>Trifolium campestre</i> (Hop Clover)	Y		
1415.	4295 <i>Trifolium dubium</i> (Suckling Clover)	Y		
1416.	4298 <i>Trifolium hirtum</i> (Rose Clover)	Y		
1417.	17788 <i>Trifolium pratense</i> var. <i>sativum</i>	Y		
1418.	15509 <i>Trifolium tomentosum</i> var. <i>tomentosum</i>	Y		
1419.	33676 <i>Triglochin calcitrapa</i>			
1420.	146 <i>Triglochin minutissima</i>			
1421.	147 <i>Triglochin mucronata</i>			
1422.	148 <i>Triglochin muelleri</i>			
1423.	18587 <i>Triglochin nana</i>			
1424.	150 <i>Triglochin stowardii</i>			
1425.	151 <i>Triglochin striata</i>			
1426.	4737 <i>Tripterococcus brunonis</i> (Winged Stackhousia)			
1427.	1139 <i>Trithuria bibracteata</i>			
1428.	1141 <i>Trithuria submersa</i>			
1429.	38401 <i>Tritonia gladiolaris</i> (Lined Tritonia)	Y		
1430.	13479 <i>Trymalium ledifolium</i> var. <i>rosmarinifolium</i>			
1431.	33418 <i>Trymalium odoratissimum</i> subsp. <i>odoratissimum</i>			
1432.	8255 <i>Ursinia anthemoides</i> ( <i>Ursinia</i> )	Y		
1433.	38388 <i>Ursinia anthemoides</i> subsp. <i>anthemoides</i>	Y		
1434.	7138 <i>Utricularia inaequalis</i>			
1435.	7148 <i>Utricularia multifida</i>			
1436.	7153 <i>Utricularia tenella</i>			

Name ID	Species Name	Naturalised	Conservation Code	<sup>1</sup> Endemic To Query Area
1437.	17868 <i>Vallisneria nana</i>			
1438.	7665 <i>Velleia trinervis</i>			
1439.	8257 <i>Vellereophyton dealbatum</i> (White Cudweed)	Y		
1440.	6070 <i>Verticordia acerosa</i>			
1441.	15431 <i>Verticordia acerosa</i> var. <i>acerosa</i>			
1442.	12388 <i>Verticordia acerosa</i> var. <i>preissii</i>			
1443.	6076 <i>Verticordia densiflora</i> (Compacted Featherflower)			
1444.	15432 <i>Verticordia densiflora</i> var. <i>densiflora</i>			
1445.	6088 <i>Verticordia huegelii</i> (Variegated Featherflower)			
1446.	15433 <i>Verticordia huegelii</i> var. <i>huegelii</i>			
1447.	15434 <i>Verticordia insignis</i> subsp. <i>insignis</i>			
1448.	14714 <i>Verticordia lindleyi</i> subsp. <i>lindleyi</i>		P4	
1449.	6107 <i>Verticordia pennigera</i>			
1450.	6110 <i>Verticordia plumosa</i> (Plumed Featherflower)			
1451.	12449 <i>Verticordia plumosa</i> var. <i>brachyphylla</i>			
1452.	15618 <i>Verticordia plumosa</i> var. <i>plumosa</i>			
1453.	4322 <i>Vicia sativa</i> (Common Vetch)	Y		
1454.	12070 <i>Vicia sativa</i> subsp. <i>sativa</i>	Y		
1455.	4325 <i>Viminaria juncea</i> (Swishbush, Koweda)			
1456.	6575 <i>Vinca major</i> (Blue Periwinkle)	Y		
1457.	17042 <i>Vitis vinifera</i>	Y		
1458.	722 <i>Vulpia bromoides</i> (Squirrel Tail Fescue)	Y		
1459.	11018 <i>Vulpia muralis</i>	Y		
1460.	724 <i>Vulpia myuros</i> (Rat's Tail Fescue)	Y		
1461.	7384 <i>Wahlenbergia capensis</i> (Cape Bluebell)	Y		
1462.	7389 <i>Wahlenbergia preissii</i>			
1463.	13103 <i>Watsonia borbonica</i>	Y		
1464.	1566 <i>Watsonia marginata</i>	Y		
1465.	18108 <i>Watsonia meriana</i> var. <i>bulbillifera</i>	Y		
1466.	18118 <i>Watsonia meriana</i> var. <i>meriana</i>	Y		
1467.	1569 <i>Watsonia versfeldii</i>	Y		
1468.	32456 <i>Weissia rutilans</i>			
1469.	12072 <i>Wurmbea dioica</i> subsp. <i>alba</i>			
1470.	1401 <i>Wurmbea pygmaea</i>			
1471.	1249 <i>Xanthorrhoea acanthostachya</i>			
1472.	1251 <i>Xanthorrhoea brunonis</i>			
1473.	14544 <i>Xanthorrhoea brunonis</i> subsp. <i>brunonis</i>			
1474.	1252 <i>Xanthorrhoea drummondii</i>			
1475.	1253 <i>Xanthorrhoea gracilis</i> (Graceful Grass Tree, Mimidi)			
1476.	1256 <i>Xanthorrhoea preissii</i> (Grass tree, Palga)			
1477.	6283 <i>Xanthosia atkinsoniana</i>			
1478.	6284 <i>Xanthosia candida</i>			
1479.	6289 <i>Xanthosia huegelii</i>			
1480.	44861 <i>Xerochrysum macranthum</i>			
1481.	2331 <i>Xylomelum occidentale</i> (Woody Pear, Djandin)			
<b>Protozoa</b>				
1482.	38969 <i>Arcyria minuta</i>			
1483.	38976 <i>Badhamia follicola</i>			
1484.	39030 <i>Enerthenema papillatum</i>			
1485.	39097 <i>Trichia decipiens</i>			

**Conservation Codes**  
T - Rare or likely to become extinct  
X - Presumed extinct  
IA - Protected under international agreement  
S - Other specially protected fauna  
1 - Priority 1  
2 - Priority 2  
3 - Priority 3  
4 - Priority 4  
5 - Priority 5

<sup>1</sup> For NatureMap's purposes, species flagged as endemic are those whose records are wholly contained within the search area. Note that only those records complying with the search criterion are included in the calculation. For example, if you limit records to those from a specific datasource, only records from that datasource are used to determine if a species is restricted to the query area.

# APPENDIX C

## WIN Groundwater Bores

WIN BORE ID	OWNER	CURRENT PURPOSE	STATUS	DRILL DATE	DRILL DEPTH (M BELOW GROUND LEVEL)
61600006	No Current Owner	-	Unknown	01-01-1900 - Unknown	9.14
61600018	No Current Owner	-	Unknown	01-01-1900 - Unknown	9.75
61600163	No Current Owner	-	Unknown	01-01-1900 - Unknown	3.35
61600178	No Current Owner	-	Unknown	01-01-1900 - Unknown	2.74
61600179	No Current Owner	Garden Irrigation	Unknown	01-01-1900 - Unknown	4.57
61600180	No Current Owner	-	Unknown	01-01-1900 - Unknown	5.18
61600181	No Current Owner	Garden Irrigation	Unknown	01-01-1900 - Unknown	4.88
61600182	No Current Owner	Livestock; Garden Irrigation	Unknown	30-06-1958 - Known year	8.23
61600183	No Current Owner	Garden Irrigation; Livestock	Unknown	01-01-1900 - Unknown	24.38
61600184	No Current Owner	-	Unknown	01-01-1900 - Unknown	2.74
61601079	No Current Owner	Irrigation	Unknown	19-06-1998 - Known day	63.00
61607277	No Current Owner	-	Unknown	01-01-1900 - Unknown	10.67
61607278	No Current Owner	-	Unknown	30-06-1950 - Known year	31.09
61607279	No Current Owner	Domestic/Household	Unknown	30-06-1955 - Known year	34.14
61607280	No Current Owner	-	Unknown	30-06-1962 - Known year	40.23
61607281	No Current Owner	-	Unknown	30-06-1962 - Known year	31.09
61607344	No Current Owner	Garden Irrigation	Unknown	01-01-1900 - Unknown	8.84
61607345	No Current Owner	-	Unknown	01-01-1900 - Unknown	11.58
61607347	No Current Owner	Garden Irrigation	Unknown	01-01-1900 - Unknown	8.53
61607355	No Current Owner	-	Unknown	01-01-1900 - Unknown	12.50
61607356	No Current Owner	Garden Irrigation	Unknown	01-01-1900 - Unknown	13.72
61607357	No Current Owner	-	Unknown	01-01-1900 - Unknown	6.10
61607358	No Current Owner	Garden Irrigation	Unknown	01-01-1900 - Unknown	11.58
61607359	No Current Owner	-	Unknown	30-06-1961 - Known year	27.13

WIN BORE ID	OWNER	CURRENT PURPOSE	STATUS	DRILL DATE	DRILL DEPTH (M BELOW GROUND LEVEL)
61607360	No Current Owner	-	Unknown	30-06-1961 - Known year	22.25
61607361	No Current Owner	Domestic/Household; Garden Irrigation	Unknown	01-01-1900 - Unknown	25.91
61607362	No Current Owner	Domestic/Household; Garden Irrigation	Unknown	01-01-1900 - Unknown	-
61607363	No Current Owner	Livestock; Garden Irrigation	Unknown	30-06-1962 - Known year	33.83
61607364	No Current Owner	Garden Irrigation	Unknown	01-01-1900 - Unknown	36.58
61607365	No Current Owner	Garden Irrigation	Unknown	30-06-1962 - Known year	34.75
61607366	No Current Owner	Orchard	Unknown	30-06-1958 - Known year	33.53
61607367	No Current Owner	Garden Irrigation	Unknown	01-01-1900 - Unknown	36.58
61607385	No Current Owner	-	Unknown	01-01-1900 - Unknown	3.05
61607386	No Current Owner	-	Unknown	30-06-1970 - Known year	30.48
61607387	No Current Owner	Garden Irrigation	Unknown	01-01-1900 - Unknown	7.92
61607388	No Current Owner	Garden Irrigation	Unknown	30-06-1962 - Known year	13.41
61607389	No Current Owner	Orchard	Unknown	30-06-1971 - Known year	22.86
61607390	No Current Owner	Garden Irrigation	Unknown	30-06-1950 - Known year	6.10
61607391	No Current Owner	Garden Irrigation; Livestock	Unknown	01-01-1900 - Unknown	-
61607392	No Current Owner	Garden Irrigation	Unknown	01-01-1900 - Unknown	-
61607393	No Current Owner	Garden Irrigation	Unknown	01-01-1900 - Unknown	15.24
61607394	No Current Owner	-	Unknown	30-06-1962 - Known year	28.04
61607477	No Current Owner	-	Unknown	15-12-1977 - Known day	30.48
61607522	No Current Owner	Irrigation	Unknown	15-02-1978 - Known day	21.03
61607523	No Current Owner	-	Unknown	30-01-1979 - Known day	25.00
61607559	No Current Owner	-	Unknown	04-05-1989 - Known day	26.00
61607568	No Current Owner	Garden Irrigation	Unknown	01-01-1900 - Unknown	6.00
61607569	No Current Owner	Garden Irrigation	Unknown	30-06-1990 - Known year	24.38

WIN BORE ID	OWNER	CURRENT PURPOSE	STATUS	DRILL DATE	DRILL DEPTH (M BELOW GROUND LEVEL)
61615517	No Current Owner	-	Unknown	08-11-1991 - Known day	-
61615518	No Current Owner	-	Unknown	08-11-1991 - Known day	-
61671956	No Current Owner	-	Unknown	Unknown	-

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● people ● planet ● professional

## **Appendix B AECOM (2020) Wattle Grove South Ecological Surveys Report.**

# Wattle Grove South Ecological Surveys



## Wattle Grove South Ecological Surveys

Client: City of Kalamunda

ABN: 60 741 095 678

Prepared by

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28-Feb-2020

Job No.: 60611889

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## Quality Information

Document Wattle Grove South Ecological Surveys

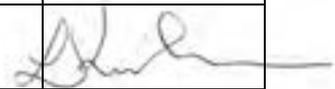
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Date 28-Feb-2020

Prepared by Floora de Wit & Jared Leigh

Reviewed by Linda Kirchner

### Revision History

Rev	Revision Date	Details	Authorised	
			Name/Position	Signature
A	24-Jan-2020	Draft for Internal Review	Linda Kirchner Associate Director - Environment	
B	24-Jan-2020	Draft for Client Review	Linda Kirchner Associate Director - Environment	
0	13-Feb-2020	Final Submission (Client Review)	Linda Kirchner Associate Director - Environment	
1	21-Feb-2020	Final Submission (additional Client comments)	Linda Kirchner Associate Director - Environment	
2	28-Feb-2020	Final Submission	Linda Kirchner Associate Director - Environment	

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## Executive Summary

AECOM Australia Pty Ltd (AECOM) was engaged by City of Kalamunda (the City) to conduct ecological assessments for the Wattle Grove South Project. The ecological assessments included a detailed flora and vegetation assessment, a level 1 fauna assessment and a Black Cockatoo assessment.

The desktop assessment was completed to identify the flora, fauna and communities of conservation significance that may occur in the Wattle Grove South area. The results identified 14 communities, 51 flora species and 26 fauna species of conservation significance that may occur in the survey area. The high number of communities and flora species reflects the unique landforms of the eastern Swan Coastal Plain including claypan wetlands, gravel substrates and influences from the Darling Scarp.

Field surveys commenced following stakeholder consultation (led by the City) to obtain permission to access private properties. Properties where access was granted were defined as the survey area within the Wattle Grove South area. The field surveys were conducted across six days and included all roadside/public access areas and 94 private properties. Most properties supported a mix of native and planted trees and landscaped gardens. These properties were represented by observation points and black cockatoo breeding and foraging assessments. Areas of native vegetation were traversed on foot and subject to detailed surveys including flora quadrats, targeted flora surveys, fauna habitat surveys and black cockatoo assessments.

Key outcomes of the ecological surveys are presented below:

- Banksia Woodlands of the Swan Coastal Plain (*Environment Protection and Biodiversity Conservation Act 1999* [EPBC Act] Endangered) was mapped in three patches extending across 2.41 ha within the survey area.
- Three WA Threatened Ecological Communities (TECs) and one WA Priority Ecological Community (PEC) were identified across 4.55 ha, including WA TEC *B. attenuata* over species rich dense shrublands (SCP20a); WA TEC *B. attenuata* and/or *E. marginata* woodlands of the Eastern SCP (SCP20b); WA TEC *Corymbia calophylla* – *Eucalyptus marginata* woodlands on sandy clay soils of the southern SCP (SCP3b); and WA PEC Banksia dominated woodlands of the SCP.
- *Conospermum undulatum* (EPBC Act Vulnerable, WA Vulnerable) was recorded on two properties comprising 95 individuals. *Isopogon drummondii* (WA P3) populations were recorded at the same two locations comprising 160 individuals.
- Three fauna species of conservation significance were recorded including the Forest Red-tailed Black Cockatoo *Calyptorhynchus banksii* (EPBC Act and BC Act Vulnerable), Carnaby's Cockatoo *Calyptorhynchus latirostris* (EPBC Act and BC Act Endangered) and the Quenda *Isodon fusciventer* (WA P4).
- A total of 730 breeding and potential breeding trees were recorded including 17 trees with one or more hollows considered suitable for breeding black cockatoos (27 hollows in total).
- Foraging habitat quality was mapped for Carnaby's Cockatoo, Baudin's Cockatoo *Calyptorhynchus baudinii* and the Forest Red-tailed Black Cockatoo. This included 41.14 ha of Very High and High Quality foraging habitat for Carnaby's Cockatoo and Baudin's Cockatoo, and 33.52 ha of Very High and High Quality foraging habitat for the Forest Red-tailed Black Cockatoo.

The ecological assessments were successfully completed for the Wattle Grove South Project. Obtaining access to all private properties was a significant limitation with 94 properties accessible from approximately 262 properties. It is likely that the other properties that were not surveyed have significant environmental value.

## 1.0 Introduction

### 1.1 Background

The Western Australian Planning Commission (WAPC) adopted the North-East Sub-Regional Planning Framework (the Framework) in March 2018. This plan identifies Wattle Grove South as Urban Expansion, with an eastern portion identified as Urban Investigation. The City of Kalamunda's (the City) 2010 Local Planning Strategy identified the whole area as an investigation area. The City is preparing Concept Plans for the area to investigate the most appropriate land use and development outcomes for the area. The Council may decide to proceed with further detailed planning in order to support the preferred development approach determined during concept planning.

In September 2017, the City appointed consultants to undertake the Wattle Grove South Feasibility Study. This study investigated the potential opportunities and constraints of Wattle Grove South, which outlined the key considerations for future planning and recommended appropriate future land uses. During this process the environmental desktop review identified a number of Threatened flora, fauna habitat and Environmentally Sensitive Areas (ESAs) within and/or adjacent to Wattle Grove South.

In order to finalise the concept plans and to support any future detailed planning, detailed information regarding the environmental values within the area is required. This will ensure that any conservation significant factors are accounted for and environmental assets are understood and managed appropriately. AECOM Australia Pty Ltd (AECOM) was engaged by the City to conduct ecological assessments for Wattle Grove South.

### 1.2 Location

Wattle Grove South is located within the south-eastern portion of the suburb Wattle Grove in Western Australia. It is bounded by Welshpool Road East (north), Tonkin Highway (west) and Kelvin Road, Judith Road, Fontano Road and the City's border with the City of Gosnells (east), shown in Figure 1. Wattle Grove South incorporates 340 ha of land comprising private and council land with 262 properties defined by cadastral boundaries.

### 1.3 Objectives

The objective of the ecological assessments was to define the environmental values within the survey area to inform Concept Plans and future detailed planning for Wattle Grove South. Specifically, the Project included:

- a desktop assessment to identify significant flora, vegetation and fauna that potentially occur in the area
- a detailed flora and vegetation assessment in accordance with relevant standards and technical guides, including targeted flora and vegetation community surveys
- a Level 1 fauna assessment in accordance with relevant standards and technical guides
- a targeted black cockatoo assessment.
- a Environmental Area Assessment

This technical report presents the methods, results and retention area assessment.



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 CREATED BY KW  
 APPROVED BY FDW  
 LAST MODIFIED 24 JAN 2020

**AECOM**  
 www.aecom.com

DATUM GDA 1994 MGA Zone 50  
 0 100 200 300 400  
 Metres

1:20,000  
 (when printed at A4)

Data sources:  
 Base Data: (c) Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2010) Geoscience Australia, Streetspro

**LEGEND**  
 Wattle Grove South Area  
 Suburb Boundary

<b>Wattle Grove South Area</b>	
CITY OF KALAMUNDA	
WATTLE GROVE SOUTH ECOLOGICAL SURVEYS	
Figure	1

## 2.0 Existing Environment

### 2.1 Climate

The climate of the Perth Metropolitan Region is described as Warm Mediterranean (Mitchell et al 2002). A Mediterranean climate is characterised by warm to hot dry summers and mild to cool wet winters. The Mediterranean climate in Australia is a result of the Indian Ocean High, a high pressure cell that shifts towards the poles in summer and the equator in winter, playing a major role in the formation of the deserts of Western Australia, and the Mediterranean climate of southwest and south-central Australia. Precipitation occurs during winter months, with the possibility of some summer storms.

The closest meteorological station to the survey area with comprehensive data is Perth Airport (Station 009021), which is located 6 km northwest of the survey area. Perth Airport meteorological station is maintained by the Bureau of Meteorology (BoM) and commenced recording in 1944.

Perth Airport has experienced an average annual rainfall of 762 mm, with the majority of rainfall occurring between May and September. In the twelve months preceding the survey rainfall was below average for most months, except for June which was slightly above average (Figure 2). The months with the greatest decline (<40mm) include May, July and September with an overall reduction in annual rainfall. No significant evidence of this was noted in the field, however some orchid species and other ephemeral species may have been missing due to lower rainfall. Furthermore, an earlier start to the Spring season in 2019 may have influenced the presence of ephemeral species.

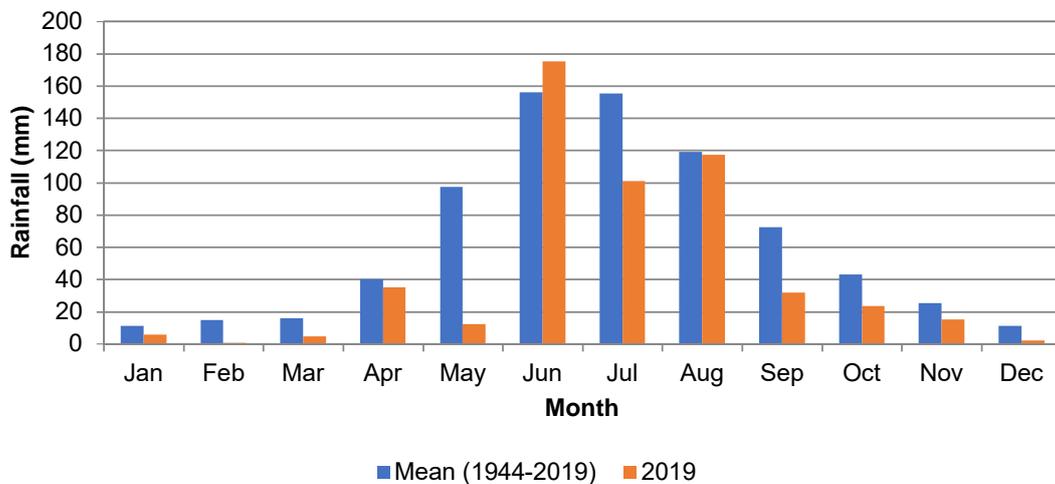


Figure 2 Rainfall Data From Perth Airport Weather Station (9021) (BOM, 2019)

### 2.1 IBRA Regions

The survey area is located on the Swan Coastal Plain bioregion described in CALM (2002), including Perth and the outer suburbs (excluding the Hills suburbs). The Swan Coastal Plain consists of the Dandaragan Plateau and the Perth Coastal Plain and is comprised of a narrow belt less than 30 km wide of Aeolian, alluvial and colluvial deposits of Holocene or Pleistocene age incorporating a complex series of seasonal fresh water wetlands, alluvial river flats, coastal limestone and several offshore islands. Younger sandy areas and limestone are dominated by heath and/or Tuart woodlands, while *Banksia* and *Jarrah-Banksia* woodlands are found on the older dune systems.

The Swan Coastal Plain subregion, described by Mitchell *et al.* (2002), is a low-lying coastal plain covered with woodlands dominated by *Banksia* or Tuart on sandy soils, *Casuarina obesa* on outwash plains, and paperbark in swampy areas. The area includes a complex series of seasonal wetlands and includes Rottnest, Carnac and Garden Islands. Land use is predominantly cultivation, conservation, urban and rural residential. The area contains a number of rare features including Holocene dunes and wetlands and a large number of threatened species and ecological communities.

## 2.2 Vegetation

There are three Beard (1981) vegetation associations mapped within the survey area comprising of Jarrah, Marri and/or Wandoo woodlands (Table 1). Of these Association 968 is below the applicable 10% threshold as set by EPA (2015).

**Table 1 Pre-European vegetation associations of the survey area (Beard, 1979) and percent remaining (Govt. of WA, 2018)**

Association	Description	Percent Remaining
3	Medium Jarrah and Marri forest	18.13
4	Medium woodland; Marri and Wandoo	18.89
968	Medium woodland; Jarrah, Marri and Wandoo	6.56

Heddle *et al.* (1980) completed vegetation complex mapping which used to assess the extent of pre-European vegetation. The survey area is situated on the border of three vegetation complexes, including the Forrestfield, Southern River, and Guildford complex. These complexes align with three major landforms, Foothills (Ridge Hill Shelf) in the east of the survey area, the Pinjarra Plain, and a combination of Bassendean Dunes and Pinjarra Plain. The Guildford Complex is currently below the 10% threshold. These three are described in Table 2.

**Table 2 Vegetation complexes of the survey area (Heddle *et al.* 1980) and percent remaining in the Perth-Peel region (EPA, 2015)**

Complex	Description	Percent Remaining
Forrestfield complex	Vegetation ranges from open forest of <i>Corymbia calophylla</i> – <i>Eucalyptus wandoo</i> – <i>E. marginata</i> to open forest of <i>E. marginata</i> – <i>C. calophylla</i> – <i>A. fraseriana</i> – <i>Banksia</i> spp. With fringing woodland of <i>E. rudis</i> in the gullies that dissect this landform	10.3
Southern River	Open woodland of Marri-Jarrah-banksia on the elevated areas and a fringing woodland of <i>Eucalyptus rudis</i> - <i>Melaleuca raphiophylla</i> along the streams.	16.8
Guildford complex	A mixture of open forest to tall open forest of <i>C. calophylla</i> – <i>E. wandoo</i> – <i>E. marginata</i> and woodland of <i>E. wandoo</i> (with rare occurrences of <i>E. lane-polei</i> ). Minor components include <i>E. rudis</i> – <i>M. raphiophylla</i> .	5.87

### 2.3 Environmentally Sensitive Areas and Conservation Estates

Environmentally Sensitive Areas (ESAs) are areas that have been identified for protection due to their environmental significance as outlined in the Western Australian Environmental Protection (Environmentally Sensitive Areas) Notice 2005, which was gazetted on 8 April 2005.

Exceptions offered for clearing under Regulation 5 of the Environmental Protection (Clearing of Native Vegetation) Regulations 2004 do not apply within ESAs. ESAs are gazetted due to supporting environmental values of State or Commonwealth importance and, in this situation, include:

- Declared World Heritage properties (EPBC Act)
- areas included on the Register of the National Estate
- defined wetlands and associated buffers
- vegetation within 50 m of rare flora
- TECs.

Several ESAs occur within Wattle Grove South. One of these represents a TEC listed under the EPBC Act which is also captured in Bush Forever site 51. This bush block is located outside the survey area. The others are likely to represent locations (current and old) of Threatened flora populations and TECs. There are no Bush Forever sites within Wattle Grove South and no conservation estates within or directly adjacent to the survey area.

### 2.4 Wetlands

The locations of wetlands have been determined using the Geomorphic Wetlands of the Swan Coastal Plain dataset adapted from *Hill et al* (1996). The dataset displays the location, boundary, geomorphic classification (wetland type) and management category of wetlands of the Swan Coastal Plain.

Two unnamed resource enhancement wetlands are located within the survey area including sumpland UFI 8037 and palusplain UFI 15257. Both wetlands have been almost entirely or entirely cleared.

## 3.0 Legislative Framework

### 3.1 Overview

Table 3 summarises the key legislation governing the protection and management of Western Australia's conservation significant species and communities, which are further discussed below.

**Table 3 Relevant legislation, regulations and guidance**

Legislation	Purpose
<b>Commonwealth of Australia</b>	
<i>Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)</i>	Provides for the protection of the environment and the conservation of biodiversity.
<i>EPBC Act Referral Guidelines for Three Threatened Black Cockatoo Species.</i>	To assist in determining whether an action needs to be referred to the Australian Government. Also provides guidance on black cockatoo survey methodology.
<i>EPBC Act Draft Referral Guidelines, 2017</i>	These draft guidelines are intended to assist proponents in determining whether an action needs to be referred to the Australian Government. Definitions of habitat are provided as are criteria used to judge significant impact for these black cockatoo species.
<b>Western Australia</b>	
<i>Biodiversity Conservation Act 2016 (BC Act)</i>	Provides for the conservation and protection of Western Australia's biodiversity and biodiversity components.
<i>Environmental Protection Act 1986 (EP Act)</i>	Preventing, controlling and abating environmental harm and conserving, preserving, protecting, enhancing and managing the environment.
<i>Biosecurity and Agriculture Management Act 2007 (BAM Act)</i>	Provides for the management, control and prevention of certain plants and animals, and for the protection of agriculture and related resources generally.
<i>EPA Technical Guidance – Terrestrial Fauna Surveys, 2016</i>	Provides guidance on the standard of survey required to assist in collecting the appropriate data for decision-making associated with the protection of Western Australia's terrestrial fauna.
<i>EPA Technical Guidance – flora and vegetation Surveys for Environmental Impact Assessment, 2016</i>	Provides guidance to ensure adequate flora and vegetation data of an appropriate standard are obtained and used in EIA.

## 3.2 **Environment Protection and Biodiversity Conservation Act 1999**

### 3.2.1 **Matters of National Environmental Significance**

Matters of national environmental significance include:

- listed threatened species and ecological communities
- migratory species protected under international agreements
- Ramsar wetlands of international importance
- the Commonwealth marine environment
- world Heritage properties
- national Heritage places
- Great Barrier Reef Marine Park
- a water resource, in relation to coal seam gas development and large coal mining development
- nuclear actions.

If an action is likely to have a significant impact on a MNES this action must be referred to the Minister for the Environment for a decision on whether assessment and approval is required under the EPBC Act.

### 3.2.2 **Flora and fauna**

The EPBC Act is the main piece of Federal legislation protecting biodiversity in Australia. Species at risk of extinction are recognised at a Commonwealth level and are categorised in one of six categories as outlined in Table 4, with an additional category for other specially protected fauna.

**Table 4 Categories of species listed under Schedule 179 of the EPBC Act**

Code	Conservation Category
Ex	Extinct Taxa
ExW	Extinct in the Wild
CE	Critically Endangered
E	Endangered
V	Vulnerable
CD	Conservation Dependent
OS	Other specially protected fauna

### 3.2.3 **Vegetation Communities**

Communities can be classified as Threatened Ecological Communities (TECs) under the EPBC Act. The EPBC Act protects Australia's ecological communities by providing for:

- identification and listing of ecological communities as threatened
- development of conservation advice and recovery plans for listed ecological communities
- recognition of key threatening processes
- reduction of the impact of these processes through threat abatement plans.

Categories of federally listed TECs are described in Table 5.

Table 5 Categories of TECs that are listed under the EPBC Act

Code	Conservation Category
CE	Critically Endangered If, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future.
E	Endangered If, at that time, it is not critically endangered and is facing a very high risk of extinction in the wild in the near future.
V	Vulnerable If, at that time, it is not critically endangered or endangered, and is facing a high risk of extinction in the wild in the medium-term future.

### 3.3 Western Australian Legislation

#### 3.3.1 Flora and Fauna

Threatened flora are plants which have been assessed as being at risk of extinction (DPaW, 2019). Under the BC Act, the Minister for the Environment may declare species of flora to be protected if they are considered to be in danger of extinction, rare or otherwise in need of special protection (WAH, 1998).

Plants and animals that are considered Threatened and need to be specially protected because they are under identifiable threat of extinction are listed under the BC Act. These categories are defined in Table 6.

Table 6 Conservation codes for flora and fauna listed under the *Biodiversity Conservation Act 2016* (Jan 2019)

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

Species that have not yet been adequately surveyed to warrant being listed under the BC Act, or are otherwise data deficient, are added to a Priority Lists under Priorities 1, 2 or 3 by the State Minister for Environment. Species that are adequately known, are rare but not threatened, or meet criteria for near threatened, or that have been recently removed from the threatened species or other specially protected fauna lists for other than taxonomic reasons, are placed in Priority 4. Categories and definitions of Priority Flora and Fauna species are provided in Table 7.

**Table 7 Conservation codes for WA flora and fauna listed by DBCA and endorsed by the Minister for Environment**

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

### 3.3.2 Vegetation Communities

Threatened Ecological Communities (TECs) are naturally occurring biological assemblages that occur in a particular type of habitat and that may be subject to processes that threaten to destroy or significantly modify the assemblage across its range. TECs are listed by both state and commonwealth legislation.

Vegetation communities in Western Australia are described as TECs if they have been endorsed by the Western Australian Minister for Environment following recommendations made by the Threatened Species Scientific Committee. Categories of TECs are defined in Table 8.

Department of Biodiversity, Conservation and Attractions (DBCA) maintains a database of state listed TECs which is available for online searches via their website. Possible TECs that do not meet survey criteria or are not adequately defined are listed as Priority Ecological Communities (PECs) under Priorities 1, 2 and 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. Conservation dependent communities are classified as Priority 5. PECs are endorsed by the Minister for Environment and are described in Table 9.

DBCA requires that all Priority and Threatened ecological communities are considered during environmental impact assessments and clearing permit applications.

There is currently no formal protection afforded to TECs or PECs listed at the state level.

**Table 8 Conservation codes for State listed ecological communities**

Conservation Code	Category
PD	Presumed Totally Destroyed
CR	Critically Endangered
EN	Endangered
VU	Vulnerable

**Table 9 Conservation categories for Priority Ecological Communities**

Code	Conservation Category
P1	Priority One: poorly-known ecological communities
P2	Priority Two: poorly-known ecological communities
P3	Priority Three: poorly known ecological communities
P4	Priority Four: ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list.
P5	Priority Five: conservation dependent ecological communities

### 3.3.3 Biosecurity and Agriculture Management Act 2007

Biosecurity is the management of the risk of animal and plant pests and diseases entering, emerging, establishing or spreading in WA to protect the economy, environment and community. Biosecurity is managed under the BAM Act which came into effect 1 May 2013. Exotic animals and plants can become an invasive species if they can establish in new areas where local conditions are favourable for their growth. Each organism listed under the BAM Act comes with certain legal / import requirements:

- Declared Pest, Prohibited - s12. Prohibited organisms are declared pests by virtue of section 22(1), and may only be imported and kept subject to permits.
- Permitted - s11. Permitted organisms may be subject to an import permit if they are potential carriers of high-risk organisms.
- Declared Pest - s22(2). Declared pests may be subject to an import permit if they are potential carriers of high-risk organisms, and may also be subject to control and keeping requirements once within Western Australia.
- Permitted, Requires Permit - r73. Regulation 73 permitted organisms may only be imported subject to an import permit.

Declared pests can be assigned to a C1, C2 or C3 control category under the Biosecurity and Agriculture Management Regulations 2013:

- C1 Exclusion - Organisms which should be excluded from part or all of Western Australia.
- C2 Eradication - Organisms which should be eradicated from part or all of Western Australia.
- C3 Management - Organisms that should have some form of management applied that will alleviate the harmful impact of the organism, reduce the numbers or distribution of the organism or prevent or contain the spread of the organism.
- Unassigned - Declared pests that are recognised as having a harmful impact under certain circumstances, where their subsequent control requirements are determined by a Plan or other legislative arrangements under the BAM Act.

#### **3.3.4 Environmental Protection Act 1986 (and Clearing Regulations)**

Section 38 (Part IV) of the EP Act provides that any person may refer a significant proposal (one that is likely to have a significant effect on the environment) to the EPA. The EP Act also states that where the environmental impact of a proposal can be adequately assessed and managed through other legislative mechanisms the proposal is unlikely to require formal environmental impact assessment.

If a proposal is not formally assessed by the EPA under Part IV of the EP Act, a Part V native Vegetation Clearing Permit may be required. Under Section 51C of the EP Act, clearing of native vegetation without a Native Vegetation Clearing Permit is an offence unless an exemption applies. Exemptions offered for clearing under Regulation 5 of the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* do not apply within Environmentally Sensitive Areas (ESA).

## 4.0 Methodology

### 4.1 Desktop Assessment

The desktop assessment involved gathering background information for the local area. Desktop database searches were requested from the following government databases (including a 10 km buffer from the survey area boundary):

- Department of Biodiversity Conservation and Attractions (DBCA) threatened and priority flora, fauna and communities database
- WA Herbarium (WAH) records
- Atlas of Living Australia (AoLA)
- NatureMap
- EPBC Act Protected Matters search.

All flora, fauna and communities of conservation significance identified in the desktop assessment were assessed for their likelihood of occurrence within the survey area (Table 10). Available literature was consulted to describe the existing environment and define broad vegetation types. References included Beard (1981) vegetation mapping, the Biodiversity Audit of Western Australia (CALM 2002), and Heddle *et al.* (1980) vegetation complex mapping.

**Table 10 Categories of likelihood of occurrence for species and communities**

Likelihood	Flora	Fauna	Communities
Likely to occur	Habitat is present in the Survey area and the species has been recorded in close proximity to the survey area.	Survey area is within the known distribution of the species, habitat is present in the survey area and the species has been recorded in close proximity to the survey area.	Known occurrences of the community in close proximity to the survey area. Vegetation looks the same within the known occurrence and Survey area based on aerial imagery. Geographic location is similar to the survey area.
May occur	Habitat may be present and/or the species has been recorded in close proximity to the survey area.	Survey area is within the known distribution of the species, marginal habitat may be present and/or the species has been recorded in close proximity to the survey area.	Known occurrence of the community in the local area, and/or vegetation looks the same within known occurrence and Survey area based on aerial imagery. Geographic location is similar to the survey area.
Unlikely to occur	No suitable habitat is present and the species has not been recorded in close proximity to the survey area.	Survey area is outside the known distribution for the species, or no suitable habitat is present and the species has not been recorded in close proximity to the survey area.	Known occurrence of the community in close proximity to the survey area however geographic location does not occur in survey area.

## 4.2 Flora and Vegetation Assessment

A detailed flora and vegetation survey was undertaken by Floora de Wit (collection permit FB62000137). Floora de Wit has 13 years' experience undertaking flora and vegetation assessments on the Swan Coastal Plain. Floora completed a Bachelor of Science in Environmental Biology (Environmental Restoration) and completed a Postgraduate Diploma in Environmental Management and Impact Assessment.

A field survey was undertaken on 1 to 4, 8, 18 and 21 October 2019 and included all properties where access was allowed (see Figure 3). Floristic data was collected from 12 non-permanent quadrats and 8 relevés. Quadrats were used in native vegetation in Good or better condition while degraded patches were recorded as relevés.

Quadrats were 10x10 metres (m) defined by a measuring tape. Data collected from quadrats included the presence of plant species, their cover abundance, structural composition of vegetation, physical environment, and presence/absence of disturbance. Each Site was given a unique site number, and the following parameters recorded:

- date
- location using hand-held GPS (accuracy of 5 m)
- sample site type (quadrat/relevé and size)
- photograph (northwest corner)
- soil details (type, colour, moisture)
- landform
- vegetation condition using the Keighery (1994) scale and description of disturbance
- fire history
- comprehensive species list
- estimated height
- estimated percentage cover (for trees both percentage within quadrat and within community was recorded to enable better description of vegetation community).

Any species unable to be identified in the field were collected for identification in AECOM's in-house herbarium and the specimens and taxonomic references and keys at the Western Australian Herbarium (WAH). Naming of species followed the convention of the WAH.

### 4.2.1 Vegetation mapping

Vegetation communities were described and mapped based on changes in dominant species composition and landform. Quadrat data was analysed using cluster analysis to determine their floristic similarity and support vegetation community delineation. Vegetation community descriptions were based on the National Vegetation Information System (NVIS) framework (Commonwealth of Australia, 2003).

Vegetation condition was determined using the Keighery (1994) condition scale (Table 11). The scale is based on disturbance (e.g. grazing, erosion), degree of alteration to community and habitat structure and site ecology.

Table 11 Bushland condition ratings (Keighery, 1994)

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

#### 4.2.2 Floristic Community Type Analysis

The Keighery (2012) SCP dataset was used for the FCT analysis. The survey data was reconciled with this dataset and all species coded using the three first letters of the genus and species, reducing infra-specific names. All nomenclature of species followed the WA Plant Census.

The program PC Ord was used to undertake the Bray Curtis distance measure. The Bray Curtis dissimilarity measure was used to quantify the compositional dissimilarity between the quadrats based on presence absence data. Subtracting the results from 1 gives the similarity index, also known as the Bray Curtis index. This method is easily interpretable and provides meaningful results. A sense check was completed incorporating appropriate geology, soils, landscape and the description provided in the Gibson *et al.* (1994) reference material and Bush Forever (Government of WA, 2000).

#### 4.2.3 Banksia Woodlands TEC Verification

All patches of native vegetation were assessed to determine the presence of the Banksia Woodlands TEC. Patches are defined as a discreet and mostly continuous area of the ecological community. All native vegetation in Good or better condition were considered for an assessment against the key diagnostic criteria for the TEC.

A preliminary review of Banksia species present was undertaken. Patches that were clearly not associated with Banksia Woodlands, e.g. had no Banksia overstorey species were excluded for further consideration. This is in line with the Approved Conservation Advice key diagnostic criteria which defines the requirement of at least one of the following Banksia species: *B. attenuata*, *B. menziesii*, *B. prionotes* or *B. ilicifolia*. Their omission was further supported by a review of vegetation condition and FCT analysis results.

The native vegetation has been separated into five patches:

- Patch 1 = quadrats 4 and 6
- Patch 2 = quadrats 12 and 13
- Patch 3 = quadrats 18 and 19
- Patch 4 = relevé 08 and quadrat 09
- Patch 5 = relevé 14.

For each patch the key diagnostic characteristics, condition, size and relevant contextual information was considered. The key diagnostic characteristics summarise the main features that characterise the Banksia Woodland. The condition categories are applied to identify the varying quality of patches, usually as a result of degradation, and ensure that patches of high quality are considered a Matter of National Significance (MNES). The condition of the patch was informed by species richness of quadrat data compared to available datasets, most notably the Keighery *et al.* (2012) SCP dataset and weed cover. The condition of the patch and size thresholds are then used to determine whether the quality of the patch is suitable to meet MNES standards.

### 4.3 Level 1 Fauna Survey

A Level 1 fauna survey was conducted in accordance with Technical Guidance – Terrestrial Fauna Surveys (EPA, 2016b) and Technical Guidance – Sampling Methods for Terrestrial Vertebrate Fauna (EPA, 2016c). The fauna survey was conducted by Ecologist Jared Leigh, in conjunction with the detailed flora and vegetation survey. Conducting the two surveys concurrently enabled consistent and clear mapping of the fauna habitats and vegetation communities.

The Level 1 fauna survey primarily focused on mapping of fauna habitat and assessing this habitat for potential utilisation by conservation significant fauna species. Fauna habitats were assessed for specific habitat components, including consideration of structural diversity and refuge opportunities for fauna. The fauna habitat assessments included:

- Location
- General habitat description
- Habitat condition and disturbance types
- Dominant / characteristic flora species and vegetation layers
- Presence and abundance of:
  - large mature trees
  - small and large hollows
  - varying sizes of fallen logs
  - coarse and fine litter
  - decorticated bark
  - bare ground
  - grass
  - varying sizes of stones and boulders
  - rock crevices
  - soil cracks
  - cryptogamic crust
  - vines
  - dense shrubs
  - water bodies etc.
- Presence of fauna and secondary signs (e.g. scats, digging, tracks, burrows, egg shell, bones, feathers etc.)
- Connectivity of habitat.

In addition to the habitat mapping, records of all observed fauna and birds identified from distinctive calls, details of indirect evidence such as scats, tracks and diggings were documented. Particular attention was given to searching for conservation significant species identified in the desktop assessment as having the potential to occur in the area. All observations were made between daylight hours of 0700 and 1700.

The taxonomy and nomenclature of all vertebrate species is consistent with the Western Australian Museum's (2019) Checklist of Vertebrates of Western Australia.

#### 4.4 Targeted Black Cockatoo Survey

A targeted black cockatoo survey was conducted in conjunction with the Level 1 fauna survey and detailed flora and vegetation survey by Ecologists Jared Leigh and Cassandra House, and Botanist Floora de Wit. This survey was conducted over multiple mobilisations due to site accessibility, including 9 and 10 September 2019; 1 to 4, 8 October 2019; 18 and 21 November.

The targeted black cockatoo survey was conducted to identify potential breeding, roosting and foraging habitat for the three threatened black cockatoo species that occur in WA, as all three species have the potential to utilise the habitats of the survey area. These are Carnaby's Cockatoo *Calyptorhynchus latirostris* (Endangered under the EPBC Act and under the BC Act), Baudin's Cockatoo *Calyptorhynchus baudinii* (Endangered under the EPBC Act and under the BC Act) and the Forest Red-tailed Black Cockatoo *Calyptorhynchus banksii naso* (Vulnerable under the EPBC Act and under the BC Act). Refer to Section 5.2.2 for further information on these species. The survey was undertaken in accordance with the DSEWPaC (2012), also utilising the draft DotEE (2017) Referral Guidelines.

##### 4.4.1.1 Breeding Habitat

The black cockatoo breeding habitat assessment focussed on quantifying breeding and potential breeding trees within the survey area. "Potential breeding trees" are generally considered to be hollow-forming eucalypt trees with a Diameter at Breast Height (DBH) >500 mm with "breeding trees" containing potentially suitable hollows. Details collected for each tree included:

- location
- tree species
- DBH
- number of potentially suitable hollows.
- hollow details – including dimensions, height from ground, direction, type of hollow, evidence of use etc.

##### 4.4.1.2 Roosting Habitat

Carnaby's and Baudin's Cockatoos roost in or near riparian environments or near other permanent water sources, generally within any tall trees, but particularly Flat-topped Yate, Salmon Gum, Wandoo, Marri, Karri, Blackbutt, Tuart, introduced eucalypts and introduced pines. The Forest Red-tailed Black Cockatoo prefers the edges of forests for roosting, within any tall trees, but particularly tall Jarrah, Marri, Blackbutt, Tuart and introduced eucalypt trees (DotEE, 2017). Potential roosting trees were searched for and assessed during the field survey.

##### 4.4.1.3 Foraging Habitat

The quality of foraging habitat not only reflects the availability of food sources, but also the proximity to reliable water sources, connectivity to other suitable habitat, presence of breeding habitats, and proximity to confirmed roost and breeding sites (amongst others). These parameters were utilised by the DotEE (2017) to produce a draft quality of foraging habitat scoring system (Table 13). This scoring system was amended slightly to incorporate additional habitats and utilised to assess potential foraging habitat throughout the survey area.

The scoring tool is used by initially defining the quality of the overall habitat present (i.e. Very High Quality, High Quality, Quality and Low Quality) and then adding or subtracting points from this depending on the ecological values of the habitat (i.e. proximity to water, proximity to a known roost site, evidence of foraging material etc.). This determines an overall quantitative rating. These scores were then used as representative scores for that unit.

Table 12 defines the levels of foraging habitat quality used during the assessment.

**Table 12 Black cockatoo foraging assessment scoring**

Score	Foraging Quality
1 – 3	Low Quality
4 – 6	Quality
7 – 8	High Quality
>8	Very High Quality

Table 13 Foraging habitat quality scoring tool for the three Western Australian black Cockatoo species

	<b>Carnaby's Cockatoo</b>	<b>Baudin's Cockatoo</b>	<b>Forest Red-tailed Black Cockatoo</b>
10	Foraging habitat that is being managed for black cockatoos, including successful rehabilitation and/or has some level of protection from clearing.	Foraging habitat that is being managed for black cockatoos, including successful rehabilitation and/or has some level of protection from clearing.	Foraging habitat that is being managed for black cockatoos, including successful rehabilitation and/or has some level of protection from clearing.
7	Native shrubland, kwongan heathland and woodland dominated by proteaceous plant species such as <i>Banksia</i> species (including <i>Dryandra</i> species) <i>Hakea</i> species and <i>Grevillea</i> species as well as eucalypt woodland and forest that contains foraging species. Does not include orchards, canola, or areas under RFA	Eucalyptus woodlands and forest of suitable foraging species and proteaceous woodland and heath, particularly Marri. Does not include orchards or areas under RFA	Jarrah and Marri woodlands and forest, and edges of Karri forests, including Wandoo and Blackbutt, within the range of the subspecies. Does not include areas under RFA.
5	Pine plantation, introduced eucalypts and areas of native vegetation that are not dominated by foraging species but contain more than the occasional plant	Pine plantation, introduced eucalypts and areas of native vegetation that are not dominated by foraging species but contain more than the occasional plant	Introduced eucalypts as well as the introduced Cape lilac ( <i>Melia acedtrach</i> ), an areas of native vegetation that are not dominated by foraging species but contain more than the occasional plant
1	Individual foraging plants or small stand of foraging plants (≤2 ha)	Individual foraging plants or small stand of foraging plants (≤2 ha)	Individual foraging plants or small stand of foraging plants (≤2 ha)
<b>Additions: Context adjustor – attributes improving habitat quality</b>			
+3	Is within the Swan Coastal Plain	Is within known foraging area	Jarrah and/or Marri shows good recruitment
+3	Contains trees with suitable nest hollows		
+2	Primarily comprises Marri	Primarily contains Marri	Primarily contains Marri and/or Jarrah
+2	Contains trees with potential to be used for breeding (DBH ≥500 mm or ≥300 mm for Salmon Gum and Wandoo)		
+1	Is used for roosting		

	Carraby's Cockatoo	Baudin's Cockatoo	Forest Red-tailed Black Cockatoo
<b>Subtractions: Context adjustor – attributes reducing habitat quality</b>			
-2	No clear evidence of foraging debris		
-2	No other foraging habitat within 6 km		
-1	Is >12 km from known breeding location		
-1	Is >12 km from known roosting location		
-1	Is >2 km from watering point		
-1	Disease present (e.g. <i>Phytophthora cinnamomi</i> or Marri canker)		

Notes: Scoring tool sourced from DoEE (2017) and amended slightly by AECOM

## 4.5 Environmental Values Assessment

The Environmental Values Assessment (EVA) included consideration of the Ecology survey outcomes and the inclusion of areas outside the ecology survey boundary for which a series of assumptions were made. The three categories used for the EVA are defined in Table 14.

**Table 14 Categories for the environmental values assessment**

Category	Values
High	<ul style="list-style-type: none"> <li>• Good connectivity and/or suitable size for maintaining ecological integrity</li> <li>• BC foraging and/or breeding trees</li> <li>• All populations of <i>C. undulatum</i> that were recorded during the survey</li> <li>• Incorporates all TECs with the exception of two patches that are &lt;0.2 ha which are captured as Medium</li> <li>• Includes 90% of areas mapped as “native vegetation” with exception of areas &lt;0.2 ha with poor connectivity.</li> </ul>
Medium	<ul style="list-style-type: none"> <li>• Connects high value areas to adjacent high value areas or as ‘stepping stone’</li> <li>• Includes BC foraging and/or breeding</li> <li>• May include native vegetation (understorey) species</li> </ul>
Low	<ul style="list-style-type: none"> <li>• Mostly cleared open areas or stands of trees over grassland</li> <li>• Includes planted gardens and hardscape</li> </ul>

A significant limitation of the assessment is the proportion of areas not able to be assessed during the field survey. Assumptions for these areas were made based on aerial imagery and some on-ground observations. It is possible that areas not surveyed include ‘high’ value areas that were not captured in the EVA.

#### 4.6 Survey Limitations

Limitations of the Flora and Vegetation, Level 1 fauna and targeted black cockatoo surveys are discussed in Table 15. Wattle Grove South includes 262 private properties. Of these, 94 landowners granted access permission to facilitate the field surveys. The ecological surveys are therefore restricted to public access areas and these 94 properties.

**Table 15** Limitations of the Ecological Surveys

Limitation	Flora and Vegetation Survey	Targeted Black Cockatoo Survey	Level 1 Fauna Survey
Availability of contextual information on the region	<b>Nil</b> Sufficient resources for the Swan Coastal Plain (SCP) were available to provide contextual information including Beard (1981), Heddle <i>et al.</i> (1980) vegetation mapping, Perth @ 3.5 million (Government of WA, 2015) and the Gibson <i>et al.</i> (1994) and Keighery <i>et al.</i> (2012) swan coastal plain datasets.	<b>Minor</b> Sufficient contextual information is generally available on the SCP and survey area. Some of the resources utilised to inform the black cockatoo survey include the DBCA database, DoTEE (2017), Birdlife (2018) and DSEWPac (2012), though not all layers within these resources are updated regularly.	<b>Nil</b> Sufficient contextual information is available on the SCP and survey area. Some of the resources utilised to inform the level 1 fauna survey include the DBCA database, Naturemap, EPBC Act PMST, AoLA, as well as several field guides and other publications.
Competency/experience of consultant conducting survey	<b>Nil</b> The flora and vegetation assessment was led by Floora de Wit who has more than 10 years' experience conducting surveys of similar scope.	<b>Nil</b> Floora has more than 10 years of experience with ecological surveys, and over six years' experience conducting targeted black cockatoo surveys. Jared is an ecologist with over 16 years' experience in the environmental industry and over three years' experience conducting targeted black cockatoo surveys.	<b>Nil</b> Jared is an ecologist with over 16 years' experience in the environmental industry who has conducted multiple Level 1 fauna surveys on the SCP.

Limitation	Flora and Vegetation Survey	Targeted Black Cockatoo Survey	Level 1 Fauna Survey
<p>Proportion of flora/fauna identified, recorded and/or collected (based on sampling, timing and intensity)</p>	<p><b>Moderate</b> The survey area comprised of mostly landscaped gardens, houses/development, and paddocks with remnant native trees (stand-alone and in patches). Native tree crowns were not readily identified using aerial imagery so vegetation mapping relied on field observations. Best effort was made to accurately identify and map all stands of native trees. The vegetation map was done to a scale where all crowns of native trees were captured.</p>	<p><b>Minor</b> The objective of the targeted black cockatoo survey is not necessarily to record black cockatoos within the survey area, but to map the habitat present. However, both Carnaby's Cockatoo and the Forest Red-tailed Black Cockatoo were recorded through either direct sightings or indirect (foraging) evidence. Foraging evidence can be searched for at any time of year, and can remain on the ground for up to two years (DoTEE, 2017).  Tree hollow presence and suitability for utilisation by black cockatoos cannot always be assessed adequately at ground level, and hence the Precautionary Principle is utilised where appropriate.</p>	<p><b>Minor</b> Information gained for a Level 1 fauna survey was sufficient for those areas surveyed. Fauna were observed (through direct or indirect evidence) during daylight hours (0700 and 1700hrs) and all habitats were assessed. Nocturnal species were only predominantly observed through indirect evidence.</p>
<p>Completion (is further work needed)</p>	<p><b>Moderate to High</b> Flora and vegetation values were adequately assessed on properties where access was granted. These properties are considered 'complete' for the survey. However, surveying the remainder of the survey area is required to gain a full understanding of the environmental values present.</p>	<p><b>Moderate to High</b> Potentially suitable hollows could be assessed further by utilising elevated work platforms (EWPs) or specialist tree climbers, however this is probably not required at this stage and the objectives of the targeted black cockatoo survey were met. Black cockatoo values were adequately assessed on properties where access was granted. These properties are considered 'complete' for the survey. However, surveying the remainder of the survey area is required to gain a full understanding of the environmental values present.</p>	<p><b>Moderate to High</b> The objectives of the level 1 fauna survey were met and no further work is required for those properties that are considered 'complete.' However, surveying the remainder of the survey area is required to gain a full understanding of the environmental values present.</p>

Limitation	Flora and Vegetation Survey	Targeted Black Cockatoo Survey	Level 1 Fauna Survey
Remoteness and/or access problems	<p><b>High</b></p> <p>Property access was denied for approximately 50% of the survey area (see Figure 3). This report presents the results of properties visited and no access limitations are associated with these properties.</p> <p>This data gap represents a significant limitation for informing the Retention Area Assessment as several properties were noted to support large areas of native vegetation.</p>	<p><b>High</b></p> <p>The owners of numerous properties have denied access for the survey and as such these properties have been removed from the assessment. The lack of data for these properties may however pose a limitation to the overall understanding of environmental values within the survey area outlined by the City.</p> <p>The objectives of the targeted black cockatoo survey were met for areas that were accessed.</p>	<p><b>High</b></p> <p>The owners of numerous properties have denied access for the survey and as such these properties have been removed from the assessment. The lack of data for these properties may however pose a limitation to the overall understanding of environmental values within the survey area outlined by the City.</p> <p>The objectives of the level 1 fauna assessment were met for areas that were accessed.</p>
Timing, weather, season, cycle	<p><b>Nil</b></p> <p>Rainfall was below average in the months preceding the survey.</p> <p>No significant limitations were identified relating to timing, weather, season or cycle.</p>	<p><b>Nil</b></p> <p>No limitations were identified relating to timing, weather, season or cycle. Foraging evidence can be searched for at any time of year and can remain on the ground for up to two years (DotEE, 2017).</p>	<p><b>Nil</b></p> <p>The survey was conducted during a period of reasonable weather in Spring. Although it was limited to one seasonal survey period during one year, and predominantly during daylight hours, this does not significantly impact a Level 1 fauna survey.</p>
Disturbances (e.g. fire flood, accidental human intervention) which affected results of the survey	<p><b>Nil</b></p> <p>The survey area represents a fragmented near-rural landscape that includes maintained gardens, grazed paddocks, hardscape, and native vegetation. Best effort was made to access all patches of native vegetation all of which were subject to degrading processes (edge effects, weeds, drying climate).</p>	<p><b>Nil</b></p> <p>The targeted black cockatoo survey was not disrupted or impacted.</p>	<p><b>Nil</b></p> <p>The Level 1 fauna survey was not disrupted or impacted.</p>



<p>PROJECT ID 60611889                  CREATED BY KW                  APPROVED BY FDW                  LAST MODIFIED 24 JAN 2020</p>	<p><b>AECOM</b>                  www.aecom.com</p> <p><b>LEGEND</b>   Wattle Grove South Area   Survey Area</p>	<p><b>Survey Area</b></p>	
<p>DATUM GDA 1994 MGA Zone 50</p> <p>1:15,000                  (when printed at A4)</p> <p>0 100 200 300 400                  Metres</p> <p><small>Data sources:                  Base Data: (c) Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2010) Geoscience Australia, Streets</small></p>	<p><b>CITY OF KALAMUNDA</b></p> <p><b>WATTLE GROVE SOUTH                  ECOLOGICAL SURVEYS</b></p>		<p><b>Figure</b>  <b>3</b></p>

## 5.0 Desktop Assessment Results

### 5.1 Threatened and Priority Ecological Communities

The database searches identified 14 conservation significant communities that may occur in the survey area. These results include six TECs that are listed under the EPBC Act. At the State-level TECs and PECs are determined by Floristic Community Type (FCTs) therefore some federally listed TECs represent one or more TEC/PEC at a State level.

The number of TECs and PECs identified reflect the unique landforms in a highly fragmented environment that occur at the base of the Darling Scarp. This area is influenced by the Scarp and the Swan Coastal Plain and supports a mix of Banksia and Eucalypt woodlands, Heath shrublands and wetlands.

The 14 significant communities are described in Table 16 including their State and Federal conservation status and the relationship of State listed communities to Federal listings. TECs and PECs are mapped in Figure 4.

Table 16 Threatened Ecological Communities identified in the desktop assessment

Community Name and Description	Cons. Status		Likelihood
	State	EPBC	
<p><b>Banksia Woodlands of the Swan Coastal Plain</b></p> <p>The Banksia Woodlands TEC (TSSC, 2017) incorporates woodland of <i>Banksia</i> species with scattered Eucalypts and other tree species over a species rich mix of sclerophyllous shrubs, graminoids, and forbs. The community shows high endemism and considerable local variation in species composition across its range. It is restricted to the southwest of WA on the Swan Coastal Plain. It occurs mainly on deep Bassendean and Spearwood sands or occasionally on Quindalup sands. The TEC is identified using the key diagnostic features, condition thresholds and consideration of other environmental factors as described in the approved conservation advice. The community is associated with several State-listed TECs and PECs. Those relevant for this project include:</p> <ul style="list-style-type: none"> <li>• <i>Banksia attenuata</i> woodlands over species rich dense shrublands (FCT20a)</li> <li>• <i>Banksia attenuata</i> and/or <i>Eucalypt marginata</i> woodlands of the eastern side of the Swan Coastal Plain (SCP20b)</li> <li>• Low lying <i>Banksia attenuata</i> woodlands or shrublands (SCP21c)</li> <li>• Banksia dominated woodlands of the Swan Coastal Plain</li> </ul> <p><b>SCP20c Shrublands and Woodlands of the Eastern Swan Coastal Plain (FCT20c)</b></p> <p>Described in the approved conservation advice (DoEE, 2017b), this TEC is restricted to the eastern side of the SCP in the foothills of the Darling Scarp. It reflects the transitional landform and soil zone between the Scarp and SCP. It is known from approximately 130 ha at T albot Road Bushland, Bushmead Rifle Range, Great Eastern Highway bypass/Roe Highway intersection, Farrall Road, and Clifford St/Tonkin Highway intersection. Critical habitat for this TEC includes:</p> <ul style="list-style-type: none"> <li>• Known occurrences</li> <li>• Areas within 200 m of known occurrences on sandy to gravelly soils on eastern SCP and foothills of Darling Scarp</li> <li>• Remnant vegetation that surrounds or links several occurrences.</li> </ul> <p>This TEC is identified through FCT analysis. It is recommended that outcomes would be verified by DBCA experts.</p>	Various	E	Known/buffer overlaps
	EN		Known/buffer overlaps
	EN		Likely
	P3		May
	P3		Likely
CR	E	Likely	

Community Name and Description	Cons. Status		Likelihood
	State	EPBC	
<p><b>Clay Pans of the Swan Coastal Plain</b></p> <p>This TEC occurs where clay soils form an impermeable layer close to the surface where wetlands form that rely solely on rainfall to fill in winter and dry in summer (DSEWPac, 2012b). The community is a shrubland (sometimes a low open woodland) over geophytes, herbs and sedges in the wetter parts of the site. The TEC is associated with several Ramsar sites including Brixton Street Wetlands, Ellen Brook Swamps System and Forrestdale Lake Nature Reserve. The identification of this TEC relies on FCT analysis and a consideration of characteristics unique to this TEC including hydrological functions.</p> <p>Associated State-listed TECs include:</p> <ul style="list-style-type: none"> <li>• Herb rich saline shrublands in clay pans (SCP07)</li> <li>• Herb rich shrublands in clay pans (SCP08)</li> <li>• Shrublands on dry clay flats. (SCP10a)</li> </ul>		CE	Known/buffer overlaps
	VU		Unlikely
	VU		Known/buffer overlaps
	EN		Unlikely
<p><b>SCP 3a <i>Corymbia calophylla</i> – <i>Kingia australis</i> Woodlands on Heavy Soils of the Swan Coastal Plain (FCT3a)</b></p> <p>Described in DotEE (2017a) approved conservation advice, this TEC is located on heavy soils of the eastern SCP between Ruabon and Guildford. The floristic composition varies with water regime which is typically within 3 m of the natural ground surface therefore communities are likely to be heavily reliant on groundwater. Critical habitat for this TEC includes heavy soils, fresh superficial groundwater, and/or surface water that helps sustain flora species in these wetland communities, and the catchment for this groundwater and surface water. All areas meeting the description of the ecological community are habitat areas critical to its survival (i.e. no condition thresholds apply).</p>	CR	E	Known/buffer overlaps
<p><b>SCP3b <i>Corymbia calophylla</i> – <i>Eucalyptus marginata</i> Woodlands on Sandy Clay Soils of the southern Swan Coastal Plain (FCT3b)</b></p> <p>Occurs on alluvial soils near the Peel-Harvey estuary and on better drained sites on the eastern side of the plain with vegetation dominated by both <i>C. calophylla</i> and <i>E. marginata</i> (Gibson <i>et al.</i>, 1994). Common understory species include <i>Bossiaea eriocarpa</i> and <i>Conostylis juncea</i>.</p>	VU		May

Community Name and Description	Cons. Status		Likelihood
	State	EPBC	
<p><b>SCP3c <i>Corymbia calophylla</i> – <i>Xanthorrhoea preissii</i> Woodlands and Shrublands, Swan Coastal Plain (FCT3c)</b></p> <p>Located on heavy soils of the eastern side of the Swan Coastal Plain between Bullsbrook and Capel. Dominant trees include <i>C. calophylla</i>, <i>E. wandoo</i> and shrubs <i>Xanthorrhoea preissii</i>, <i>Acacia pulchella</i>, <i>Banksia dallanneyi</i>, <i>Gompholobium marginatum</i> and <i>Hypocalymma angustifolium</i> and herbs <i>Burchardia congesta</i>, <i>Cyathochaeta avenacea</i> and <i>Neurachne alopecuroides</i>.</p>	CR	E	Likely
<p><b>Central Northern Darling Scarp Granite Shrubland Community</b></p> <p>This PEC is described as shrublands and heath on deeper loams and red earths on fragmented granite/quartzite. Heath species typically consist of the taller shrubs <i>Xanthorrhoea acanthostachya</i> and <i>Allocasuarina humilis</i> over smaller proteaceous and myrtaceous shrubs, namely <i>Melaleuca aff. scabra</i>, <i>Baeckea camphorosmae</i> and to a lesser extent, the proteaceous shrubs <i>Dryandra armata</i>, <i>Hakea incrassata</i> and <i>Hakea undulata</i>. Located in central region of the Northern Darling Scarp near Perth.</p>	P4		Unlikely
<p><b>SCP02 Southern Wet Shrublands, Swan Coastal Plain (FCT02)</b></p> <p>Shrublands or open low woodlands identified by Gibson in the Busselton area but is now also known to occur at Perth Airport. The community occurs on seasonally inundated sandy clay soils that support diverse shrubs including <i>Kingia australis</i>, <i>Eutaxia virgata</i> and <i>Calothamnus lateralis</i>.</p>	EN		Unlikely
<p><b>Muchea Limestone – Shrublands and Woodlands on Muchea Limestone of the Swan Coastal Plain</b></p> <p>Occurs on heavy soils on eastern side of the plain. Occurrences include wetland and well-drained habitats and a variety of landforms. Its presence is defined by limestone-influenced substrates. Soils and flora species are influenced by the type of limestone substrate.</p>	EN	E	Unlikely

## 5.2 Conservation Significant Flora

A total of 51 flora species of conservation significance were identified in the desktop study. This included 32 species listed as threatened under the EPBC Act and 19 species listed by DBCA as Priority species. It should be noted that 22 of the 32 threatened species were identified in the Protected Matters Search with no known records from the vicinity of the survey area. The majority of these were considered unlikely to occur.

Four flora species are known to occur within the survey area, including two threatened species *Banksia mimica* and *Conospermum undulatum* and two Priority species *Isopogon drummondii* (Priority 3) and *Lasiopetalum glutinosum* subsp. *glutinosum* (Priority 3).

Further investigation determined that *L. glutinosum* subsp. *glutinosum* is unlikely to occur in the survey area as it is associated with lateritic outcrops on the Darling Scarp.

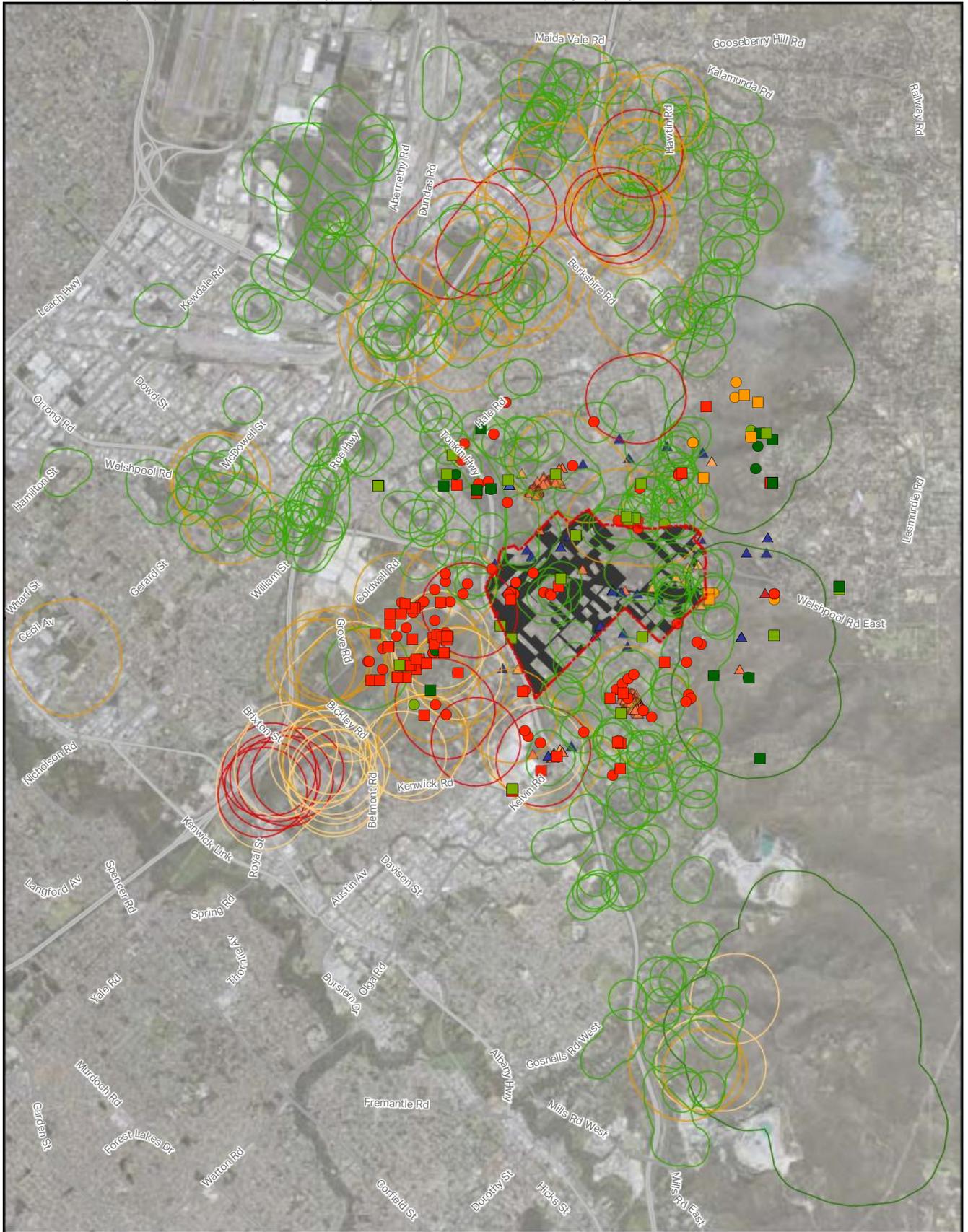
Two flora species are considered likely to occur including *Haemodorum loratum* (Priority 3) and *Verticordia lindleyi* subsp. *lindleyi* (Priority 4). An additional 12 species may occur based on habitat and proximity of known records. The fragmented and mostly cleared private residences within the survey area and lack of wetland habitat as led to the exclusion of many species as being likely to occur.

Table 17 Threatened and Priority Flora that are likely to, or known to occur within the survey area

Species	Cons. Code <sup>1</sup>		Habitat <sup>2</sup>	Count Date	Likelihood of Occurrence
	EPBC	WA			
<i>Banksia mirnica</i>	E	VU	Flat to gentle slopes on grey sand in open woodlands. DBCA population 3 occurs within the survey area where it occurs in mixed low heath with a <i>Banksia attenuata</i> /B. <i>menziesii</i> open-low woodland overstorey. It is associated with species such as <i>Adenanthos cygnorum</i> , <i>Eucalyptus todiana</i> , <i>Nuyisia floribunda</i> , <i>Jacksonia floribunda</i> , <i>Xanthorrhoea preissii</i> , <i>Banksia chamaephyton</i> , <i>Hakea conchifolia</i> and <i>Stirlingia latifolia</i>	2000	Known. DBCA population 3 recorded in 2000 on properties southeast of Crystal Brook Road and Brentwood Road.
<i>Conospermum undulatum</i>	V	VU	Grows on sand and sandy clay soils, often over laterite, on flat or gently sloping sites between the Swan and Canning Rivers. The species is known from <i>Banksia</i> and Jarrah/marri woodland, with a few records from slightly swampy habitat	2011	Known. Population no. 11 occurs within the survey area.
<i>Haemodorum loratum</i>		P3	Grey or yellow sand and gravel.	2004	Likely. Suitable habitat and record in close proximity to survey area.
<i>Isopogon drummondii</i>		P3	No information available on WAH (1998-). Database results describe flats on grey brown sand with or without gravel in <i>Banksia</i> woodlands.	2013	Known. Numerous records in vicinity of survey area.
<i>Lasiopetalum glutinosum</i> subsp. <i>glutinosum</i>		P3	No information available on WAH (1998-). One record nearby recorded on sandplain with Darling Scarp outwash in <i>Banksia</i> /Jarrah woodland.	2008	Known. No suitable habitat in survey area. Records on Darling Scarp.
<i>Verticordia lindleyi</i> subsp. <i>lindleyi</i>		P4	Grows in white to grey and yellow sand, often with or over clay and gravel, usually low-lying and winter-wet (George, 2002). Frequently in association with a few other <i>verticordias</i> in heath, shrubland and open woodland (George, 2002). Records from 1990 and 1994.		Likely. Suitable habitat present, several records in close proximity.

1. Conservation codes are outlined in Section 3.0

2. Sourced from Florabase (WAH, 1998-) and DoIEE (2019) unless otherwise referenced



<p>PROJECT ID 60611889                  CREATED BY KW                  APPROVED BY FDW                  LAST MODIFIED 24 JAN 2020</p> <p><b>AECOM</b>                  www.aecom.com</p> <p>DATUM GDA 1994 MGA Zone 50                  1:60,000                  (when printed at A4)</p> <p>Scale: 0 500 1,000 Metres</p> <p>Base Data: (c) Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2010) Geoscience Australia, Streetspro</p>	<p><b>LEGEND</b></p> <p>Wattle Grove South</p> <p>Project Area</p> <p>WAHerb</p> <ul style="list-style-type: none"> <li>Threatened</li> <li>Priority 1</li> <li>Priority 3</li> <li>Priority 4</li> </ul> <p>Threatened and Priority Flora Database</p> <ul style="list-style-type: none"> <li>Threatened</li> <li>Priority 1</li> <li>Priority 3</li> <li>Priority 4</li> </ul> <p>TEC / PEC</p> <ul style="list-style-type: none"> <li>Critically Endangered</li> <li>Endangered</li> <li>Vulnerable</li> <li>Priority 3</li> <li>Priority 4</li> </ul> <p>Desktop Threatened Fauna</p> <ul style="list-style-type: none"> <li>Critically Endangered</li> <li>Endangered</li> <li>Vulnerable</li> <li>Priority 3</li> <li>Priority 4</li> </ul>	<p><b>Desktop Flora and Fauna Results</b></p> <p><b>CITY OF KALAMUNDA</b></p> <p><b>WATTLE GROVE SOUTH ECOLOGICAL SURVEYS</b></p> <p>Figure 4</p>
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### 5.3 Conservation Significant Fauna

The NatureMap search identified a total of 192 vertebrate and invertebrate fauna species that have been recorded within the survey and surrounding area. This included seven amphibian, 108 bird, one fish, 31 invertebrate, 14 mammal and 31 reptile species. A review of species habitat was undertaken at which time 26 conservation significant fauna species may occur within the survey area. The likelihood assessment concluded that:

- three species are 'likely to occur'
- two species 'may occur'
- 21 species are 'unlikely to occur'.

The five species considered as 'likely to occur' and 'may occur' in the survey area include three bird, one invertebrate and one mammal species. Table 18 identifies these species and provides relevant ecological information. The conservation significant categories as defined by DBCA, the BC Act and the EPBC Act are defined in Section 3. The comprehensive desktop results are presented in Appendix A.

The EPBC Protected Matters Search identified five fauna species listed as Marine under the EPBC Act. These were omitted as they only pertain to Commonwealth Land.

Table 18 Conservation significant fauna species that are Likely to Occur or May Occur in the survey area

Scientific Name	Common Name	Conservation Status		Ecology
		WA	EPBC Act	
<i>Calyptrorhynchus banksii</i> naso	Forest Red-tailed Black Cockatoo	VU	V	Requires tree hollows to nest and breed, occurs in forests of Karri <i>Eucalyptus diversicolor</i> , Jarrah <i>E. marginata</i> and Marri <i>Corymbia calophylla</i> , with flocks moving out onto the Swan Coastal Plain in search of food from exotic trees such as White Cedar (Johnstone <i>et al.</i> , 2010). Foraging habitat for the species consists of Jarrah and Marri woodlands and forest throughout its range. Has become more common in the Metropolitan area in the past few years.
<i>Calyptrorhynchus baudinii</i>	Baudin's Cockatoo	EN	E	Habitat critical to the survival of this species includes forests of Karri, Jarrah and Marri, in areas of 600 mm average rainfall per year. Individuals typically move north through the Perth region from March to May and south through the Perth region from August to October. This species ranges north to Gidgegannup and Hoddy Well and west to the Eastern Strip of the Swan Coastal Plain including West Midland in the north, heading south through Armadale, Byford and south and towards the coast until Lake Clifton where it continues to hug the coastline to east of Albany (Johnstone <i>et al.</i> , 2010). Breeding has been recorded to the south-west of the area bounded by Leschenault, Collie and Albany (DSEWPaC, 2012), with the most northerly record at Lowden, near Donnybrook (Johnstone & Storr, 1998). Breeding has also been recorded at Serpentine (hills area), and east to Kojoonup and near Albany (Johnstone & Kirkby, 2008).
<i>Calyptrorhynchus latirostris</i>	Carnaby's Cockatoo	EN	E	The species nests in hollows in eucalypts, particularly Salmon Gum <i>Eucalyptus salmonophloia</i> and Wandoo <i>E. Wandoo</i> , but nests have been found in other eucalypts including York Gum <i>E. loxophleba</i> , Flooded Gum <i>E. rudis</i> , Tuart <i>E. gomphrocephala</i> and Marri <i>Corymbia calophylla</i> (Johnstone <i>et al.</i> , 2010). Breeding success is largely dependent on suitable feeding habitat adjacent to the nest site to provide the necessary food for the survival of the chick (Johnstone <i>et al.</i> , 2010). Diet consists of an array of Proteaceous and <i>Eucalyptus</i> species.
<i>Isoodon fusciventer</i>	Quenda	P4	-	The Quenda exists only in a fragmented distribution to its former range in southern south western and eastern Australia. It is found in forest, woodland, heath and shrub communities in these regions. Preferred habitat usually consists of a combination of sandy soils and dense healthy vegetation (Van Dyck & Strahan, 2008).
<i>Westralunio carteri</i>	Carter's Freshwater Mussel	VU	V	The only reasonably large bivalve in freshwaters of south-west Western Australia. Occurs in greatest abundance in slower flowing waters with stable sediments that are soft enough for burrowing. Salinity tolerance is quite low (>3 g /L is lethal) (TSSC, 2018).

## 6.0 Field Survey Results and Discussion

### 6.1 Vegetation

#### 6.1.1 Floristic Community Type Analysis

A total of 11 quadrats were subject to the statistical analysis to infer the FCT for these quadrats and associated vegetation patches. Five FCTs were inferred, including:

- FCT3b *C. calophylla-E. marginata* woodlands on sandy clay soils (WA TEC)
- FCT20a *B. attenuata* over species rich dense shrublands (EPBC TEC, WA TEC)
- FCT20b eastern *B. attenuata* and/or *E. marginata* woodlands (partial EPBC TEC, WA TEC)
- FCT21a central *B. attenuata-E. marginata* woodlands (partial EPBC TEC)
- FCT23a central *B. attenuata-B. menziesii* woodlands (partial EPBC TEC)

The FCT analysis results were used to inform the TEC and PEC assessment discussed in the following Section. Details for each quadrat, the top three to four similar SCP quadrats, and inferred FCT conclusions are presented in Table 19.

The survey area extends across three major landforms; the Foothills (Ridge Hill Shelf) (east), the Pinjarra Plain, and a combination of Bassendean Dunes and Pinjarra Plain. Because of this, some of the inferred FCTs remain slightly cryptic as it is unclear what landform they would represent at this scale. Furthermore, low similarity was observed across all quadrats analysed, suggesting poor comparability to the SCP data. A number of factors would influence this, such as:

- position of survey area along the base of the Darling Scarp. It crosses three major landforms and species present may not be typical of that landform due to the proximity of the scarp.
- single quadrat sampling event
- drying climate
- isolation native vegetation patches and existing disturbances.

Table 19 Inferred FCT for Wattle Grove quadrats

Quadrat	Quadrat, % similarity, FCT	Inferred FCT
01	ACTON-1, 31%, 1a Hart01, 31%, 20a Sams01 31%, 28	None of these FCTs align with quadrat data. FCT cannot be inferred.
04	Rush 02, 46%, 20b Hart01, 43%, 20a APBF-2, 40%, 20a	FCT20a <i>B. attenuata</i> over species rich dense shrublands is a good fit. High diversity with 61 species/quadrat.
06	Activ03, 47%, 20a Bushm01, 45%, 20a Hart01, 45%, 20a Tal8, 45%, 20a	FCT20a <i>B. attenuata</i> over species rich dense shrublands is a good fit. High diversity with 46 species/quadrat. Some edge effects have degraded condition.
07	BURNRD02, 26%, 3b 5C01, 23%, S18 Serp04, 23%, 3b Yarl03, 23%, 3b	FCT3b <i>C. calophylla-E. marginata</i> woodlands on sandy clay soils is a good fit. TEC description suggests 'southern SCP' only however Gibson <i>et al.</i> (1994) includes better drained sites on eastern side of plain.
09	Kens01, 44%, 23a Perth04, 43%, 23a Perth08, 43%, 23a Tele01, 43%, 23a	FCT23a central <i>B. attenuata-B. menziesii</i> woodlands is a good fit.

Quadrat	Quadrat, % similarity, FCT	Inferred FCT
10	Yarl03, 39%, 3b BURNRD02, 37%, 3b KOOLJ-5, 32%, 3b Sunday02, 32%, 21a	FCT3b <i>C. calophylla-E. marginata</i> woodlands on sandy clay soils is a good fit. TEC description suggests 'southern SCP' only however Gibson <i>et al.</i> (1994) includes better drained sites on eastern side of plain.
11	AMBRAL-1, 38%, 1b Yarl01, 37%, 3c BURNRD02, 35%, 3b R116703, 35%, 1b Waro 02, 35%, 3b	FCT3b <i>C. calophylla-E. marginata</i> woodlands on sandy clay soils is a good fit. FCT1b is restricted to southern SCP.
13	Activ03, 44%, 20a BNR18, 41%, S09 Card2, 41%, 20b ELE28, 41%, 23b KOON-1, 41%, 20a KOON-2, 41%, 20a	Does not meet description of FCT20a or 23b. Could be S09 <i>Banksia attenuata</i> woodlands over dense low shrubs however its geographical location aligns better with FCT20b eastern <i>B. attenuata</i> and/or <i>E. marginata</i> woodlands may also be accurate.
15	KING-2, 30%, 28 Cavs11, 30%, 21a Star01, 29%, 24 WOODV-2, 29%, 28	Poor alignment with FCT28 and 24 as they pertain to Spearwood dunes dominated by <i>Banksia</i> overstorey. Vegetation represented by Q15 is representative of <i>E. marginata</i> woodland therefore may be aligned with FCT21a central <i>B. attenuata-E. marginata</i> woodlands.
18	Perth08, 42%, 23a Wire01, 42%, 28 Activ03, 40%, 20a	Similar to Q19, likely to represent FCT20b as it aligns with geographical location, key species, and species richness.
19	Activ03, 42%, 20a Rush02, 42%, 20b KING-2, 38%, 28 Tele01, 38%, 23a	Could represent FCT20a or 20b with presence of key species and correct landform (Ridge Hill Shelf). The lower species richness indicates FCT20b eastern <i>B. attenuata</i> and/or <i>E. marginata</i> woodlands.
20	Activ03, 37%, 20a Perth04, 36%, 23a	Does not align with 20a or 23a. Is a better fit with FCT20b eastern <i>B. attenuata</i> and/or <i>E. marginata</i> woodlands. Confirmation from DBCA would be required however as a precaution we have determined this area to be the State listed TEC.

### 6.1.2 Threatened and Priority Ecological Communities

Native vegetation was mapped for 7.41 ha within the 168 ha survey area. Of this area, 4.55 ha is considered a TEC or PEC. This reflects the condition of vegetation and the size of the patch.

Four conservation significant communities were recorded and mapped, all of which are either wholly or partially under one federally listed TEC:

- EPBC TEC *Banksia* Woodlands of the SCP
- WA TEC FCT20a *B. attenuata* over species rich dense shrublands (SCP20a)
- WA TEC FCT20b *B. attenuata* and/or *E. marginata* woodlands of the Eastern SCP (SCP20b)
- WA TEC *Corymbia calophylla* – *Eucalyptus marginata* woodlands on sandy clay soils of the southern SCP (SCP3b)
- WA PEC *Banksia* dominated woodlands of the SCP.

These communities are described in detail below.

#### ***Banksia* Woodlands of the Swan Coastal Plain – EPBC Endangered**

The presence of the EPBC Act-listed *Banksia* Woodlands of the Swan Coastal Plain has been confirmed. Native vegetation within the survey area was grouped into patches as defined in the Approved Conservation Advice. Each patch was assessed separately.

Five patches were defined:

- Patch 1 = quadrats 4 and 6
- Patch 2 = quadrats 12 and 13
- Patch 3 = quadrats 18 and 19
- Patch 4 = relevé 08 and quadrat 09
- Patch 5 = relevé 14

Of these, patches 1, 2 and 3 met all criteria to be considered the EPBC TEC Banksia Woodlands of the SCP. The vegetation within these patches was often co-dominated by a mix of *Banksia attenuata*, *Banksia menziesii*, *Allocasuarina fraseriana* and *Eucalyptus marginata* subsp. *marginata*. The vegetation varied from 'Good' to 'Excellent' condition. Patch 1 and 2 also support EPBC threatened flora species *Conospermum undulatum*.

The three patches of Banksia Woodlands TEC represent three State listed communities, discussed separately. The total area of native vegetation representing this TEC is 2.41 ha. A detailed assessment of each of these patches is provided in Appendix B.

#### **FCT20a *B. attenuata* over species rich dense shrublands (SCP20a) – WA TEC Endangered**

The identification of this TEC was supported by FCT analysis of two quadrats (04 and 06). This area was notably species rich with an average of 53.5 species/quadrat. This TEC is isolated to one location, represented by vegetation community BaEpPf extending for 0.94 ha.

This TEC was identified in the desktop assessment as known to occur in Wattle Grove and coincides with Patch 1 of the Banksia Woodlands TEC.



Plate 1 Photograph representative of FCT20a

#### **FCT20b *B. attenuata* and/or *E. marginata* woodlands of the Eastern SCP (SCP20b) – WA TEC Endangered**

This TEC has been tentatively mapped at two locations that correspond with Patch 2 and 3 of the Banksia Woodlands TEC. The low confidence mapping is a result of poor clarity from the FCT analysis (low similarity). Verification from DBCA is advisable.

This TEC is represented by three vegetation communities in the survey area including EmMpLp, BaEpPf and BmXpEc and is mapped across 1.80 ha.

***Corymbia calophylla* – *Eucalyptus marginata* woodlands on sandy clay soils of the southern SCP (SCP3b) – WA TEC Vulnerable**

This TEC was identified following FCT analysis for three quadrats (07, 10 and 11). Further confirmation from DBCA would be required to verify the presence of this TEC. FCT3b is more commonly known from the Peel-Harvey estuary further south, but has been recorded on 'better drained sites on the eastern side of the plain' (Gibson *et al.*, 1994). This TEC is represented by vegetation communities EmPcAh and EmLpFa extending for 1.71 ha.

A precautionary approach has been adopted, where liaison with DBCA may help facilitate a better understanding of the TECs present as this TEC is generally associated with areas further south.

**Banksia dominated woodlands of the SCP – WA P3 PEC**

This PEC was recorded at one location which coincides with Patch 2 of the EPBC TEC Banksia Woodlands of the SCP. This TEC is not associated with a specific FCT therefore has been assumed to refer to all occurrences of the federal TEC listing. This PEC extends for 0.15 ha.

**Tuart Woodlands of the SCP – EPBC TEC, WA P3 PEC**

*E. gomphocephala* trees were observed in the survey area, however all trees were recorded in Completely Degraded areas devoid of native understorey species. For this reason, these patches were excluded for consideration as the EPBC TEC Tuart Woodlands of the SCP.



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### 6.1.3 Vegetation Communities

Six native vegetation communities were described and mapped. These communities fall into three broad categories including Banksia Woodlands, Eucalypt Woodlands and Riparian Vegetation.

Vegetation descriptions are presented in Table 20 and mapped in Figure 7.

The delineation of vegetation communities was supported by cluster analysis of floristic data. The cluster outcomes are presented below.

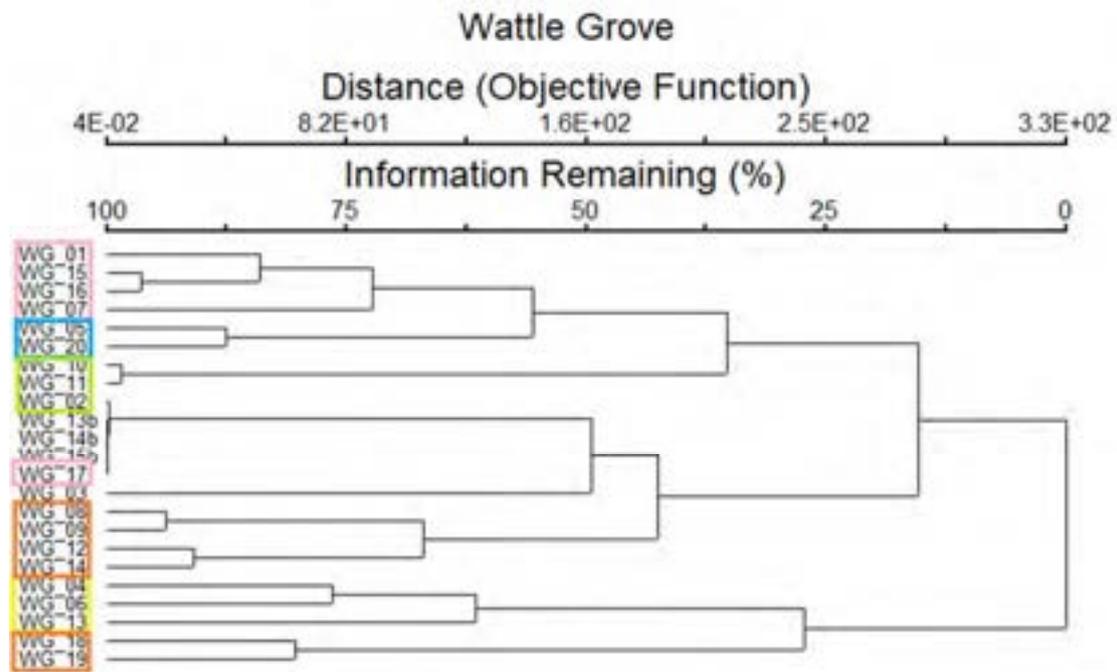


Figure 6 Dendrogram Showing Community Groups in Colours (pink = EmCaFa, blue = EmMpLp, green = EmPcAh, orange = BmXpEc, yellow = BaEpPf)

Table 20 Vegetation community descriptions including mapping code and photographs

Community Description	Additional Details	Photograph
<p><b>EmCaFa</b> <b><i>E. marginata</i> Woodland</b></p> <p><i>Eucalyptus marginata</i> subsp. <i>marginata</i> and <i>Allocasuarina fraseriana</i> low woodland over <i>Cyathochaeta avenacea</i>, <i>Mesomelaena tetragona</i> and <i>Daviesia decurrens</i> subsp. <i>decurrens</i> mixed sedge and shrubland over *<i>Freesia alba</i> x <i>leichtlinii</i>; <i>Lomandra preissii</i> and <i>Stylidium brunonianum</i> low forbland.</p> <p>Numerous strata present in understorey including forbs, sedges, rushes and shrubs. Other dominant species include <i>Tripterococcus brunonis</i>, <i>Neurachne alopecuroidea</i>, <i>Xanthorrhoea preissii</i>, <i>Labichea punctata</i> and <i>Hakea undulata</i>.</p> <p>Represents WA TEC C. <i>calophylla</i>-<i>E. marginata</i> woodlands on sandy clay soils.</p>	<p>Survey effort: Q01, Q07, Q15, R16</p> <p>Species richness: 76 native and 12 weed species</p> <p>Area: 0.78 ha</p>	
<p><b>EmMplp</b> <b><i>E. marginata</i> Woodland</b></p> <p><i>Eucalyptus marginata</i> subsp. <i>marginata</i> and <i>Allocasuarina fraseriana</i> mid open forest over <i>Mesomelaena pseudostygia</i> and <i>Tetraria octandra</i> low sedge/land with <i>Lomandra preissii</i>, <i>Tricoryne elatior</i> and <i>Dampiera linearis</i> low open forbland.</p> <p>Larger patch of this community represents WA TEC B. <i>attenuata</i> and/or <i>E. marginata</i> woodlands of the eastern SCP (SCP20b).</p>	<p>Survey effort: R05, Q20</p> <p>Species richness: 42 native and 9 weed species</p> <p>Area: 0.48 ha</p>	

Community Description	Additional Details	Photograph
<p><b>EmPcAh</b> <b>E. marginata Woodland</b></p> <p><i>Eucalyptus marginata</i> subsp. <i>marginata</i> and <i>Corymbia calophylla</i> mid open forest over <i>Phyllanthus calycinus</i>, <i>Xanthorrhoea preissii</i> and <i>Xanthorrhoea gracilis</i> low shrubland with <i>Agrostocrinum hirsutum</i>, <i>Lomandra sonderi</i> and <i>Thysanotus paterstonii</i> low open forbland.</p> <p>Represents WA TEC C. <i>calophylla</i>-<i>E. marginata</i> woodlands on sandy clay soils</p>	<p>Survey effort: R02, Q10, Q11</p> <p>Species richness: 47 native and 9 weed species</p> <p>Area: 1.61 ha</p>	
<p><b>CcHaEc</b> <b>Riparian Vegetation</b></p> <p><i>Corymbia calophylla</i> mid open woodland over <i>Spyridium globulosum</i>, <i>Hypocalymma angustifolium</i> and <i>Acacia pulchella</i> var. <i>pulchella</i> tall to low shrubland over *<i>Ehrharta calycina</i>, *<i>Avena barbata</i> and *<i>Biza minor</i> low grassland.</p> <p>Represents riparian vegetation associated with a minor water course.</p>	<p>Survey effort: 03</p> <p>Species richness: 12 native and 5 weed species</p> <p>Area: 0.23 ha</p>	

Community Description	Additional Details	Photograph
<p><b>BaEoPf</b> <b>Banksia Woodland</b></p> <p><i>Banksia attenuata</i>, <i>Banksia menziesii</i> and <i>Eucalyptus tottiana</i> low open woodland over <i>Eremaea pauciflora</i> var. <i>pauciflora</i>, <i>Hibbertia hypericoides</i> and <i>Allocasuarina humilis</i> low shrubland over <i>Phlebocarya filifolia</i>, <i>Mesomeaena pseudostygia</i> and <i>Lepidosperma leptostachyum</i> low sedgeland.</p> <p>Represents EPBC TEC Banksia Woodlands of the SCP. One patch also represents the WA TEC <i>Banksia attenuata</i> woodlands over species rich dense shrublands (SCP20a).</p> <p>Supports the Threatened <i>Conospermum undulatum</i> and Priority 3 <i>Isopogon drummondii</i>.</p>	<p>Survey effort: Q04, Q06, Q13</p> <p>Species richness: 88 native and 7 weed species</p> <p>Area: 1.55 ha</p>	
<p><b>BmXpEc</b> <b>Banksia Woodland</b></p> <p><i>Banksia menziesii</i>, <i>Allocasuarina fraseriana</i> and <i>Eucalyptus tottiana</i> low open woodland over <i>Xanthorrhoea preissii</i>, <i>Eremaea pauciflora</i> var. <i>pauciflora</i> and <i>Stirlingia latifolia</i> low open shrubland over *<i>Einharta calycina</i>, <i>Dasyogon bromeliifolius</i> and <i>Antigozanthos manglesii</i> subsp. <i>manglesii</i> mixed grass and forbland.</p> <p>Represents EPBC TEC Banksia Woodlands of the SCP and WA TEC eastern <i>B. attenuata</i> and/or <i>E. marginata</i> woodlands (SCP20b).</p>	<p>Survey effort: R08, Q09, R12, R14, Q18, Q19</p> <p>Species richness: 80 native and 12 weed species</p> <p>Area: 1.92 ha</p>	
<p><b>Significantly Altered</b></p> <p>Includes planted, gardens, scattered trees (both native and introduced). Condition considered Completely Degraded.</p>	<p>Area: 56.56 ha</p>	



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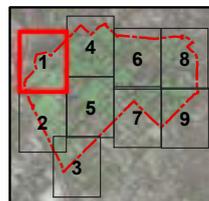
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 Metres

Data sources:  
 Base Data: (c) Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2010) Geoscience Australia, Streetspro

**LEGEND**

- Wattle Grove South Area
- Survey Area
- Quadrat
- Relevé
- BmXpEc
- Trees
- Planted
- Cleared
- Hardstand

Vegetation Communities



**Vegetation Communities**

CITY OF KALAMUNDA

WATTLE GROVE SOUTH  
 ECOLOGICAL SURVEYS

Figure  
 7.1



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DATUM GDA 1994 MGA Zone 50  
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**LEGEND**

- Wattle Grove South Area
- Survey Area
- Quadrat
- Relevé
- BmXpEc
- Trees
- Planted
- Cleared
- Hardstand

**Vegetation Communities**

**CITY OF KALAMUNDA**

**WATTLE GROVE SOUTH ECOLOGICAL SURVEYS**

Figure  
**7.2**



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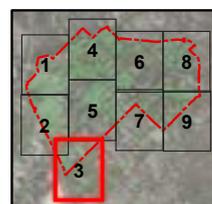
0 25 50 75 100  
 Metres

Data sources:  
 Base Data: (c) Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2018) Geoscience Australia, Streets

**LEGEND**

- Wattle Grove South Area
- Survey Area
- Quadrat
- Relevé
- BaEpPf
- EmMpLp
- Trees
- Planted
- Cleared
- Hardstand

Vegetation Communities



**Vegetation Communities**

CITY OF KALAMUNDA

WATTLE GROVE SOUTH  
 ECOLOGICAL SURVEYS

Figure  
 7.3

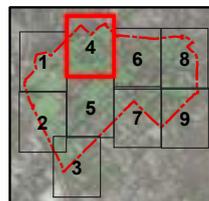


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 (when printed at A4)  
 Metres

Base Data: (c) Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2018) Geoscience Australia, Streetspro

- LEGEND**
- Wattle Grove South Area
  - Survey Area
  - Relevé
  - CcHaEc
  - Trees
  - Planted
  - Cleared
  - Hardstand



**Vegetation Communities**

CITY OF KALAMUNDA  
 WATTLE GROVE SOUTH  
 ECOLOGICAL SURVEYS

Figure  
 7.4



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**AECOM**  
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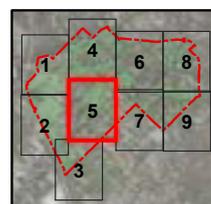
DATUM GDA 1994 MGA Zone 50  
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 (when printed at A4)

0 25 50 75 100  
 Metres

Base Data: (c) Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2010) Geoscience Australia, Streetspro

**LEGEND**

- Wattle Grove South Area
- Survey Area
- Quadrat
- Relevé
- Vegetation Communities
- BaEpPf
- BmXpEc
- EmLpFa
- EmMpLp
- Trees
- Planted
- Cleared
- Hardstand



**Vegetation Communities**

CITY OF KALAMUNDA

WATTLE GROVE SOUTH  
 ECOLOGICAL SURVEYS

Figure  
 7.5



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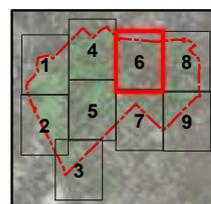
**AECOM**  
 www.aecom.com

DATUM GDA 1994 MGA Zone 50  
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 (when printed at A4)

Scale: 0 25 50 75 100 Metres

Data sources:  
 Base Data: (c) Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2018) Geoscience Australia, Streets

- LEGEND**
- Wattle Grove South Area
  - Survey Area
  - Relevé
  - EmPcAh
  - Trees
  - Planted
  - Cleared
  - Hardstand
  - BmXpEc



**Vegetation Communities**

CITY OF KALAMUNDA

WATTLE GROVE SOUTH  
 ECOLOGICAL SURVEYS

Figure  
 7.6



<p>PROJECT ID 60611889                  CREATED BY KW                  APPROVED BY FDW                  LAST MODIFIED 24 JAN 2020</p> <p><b>AECOM</b>                  www.aecom.com</p> <p>DATUM GDA 1994 MGA Zone 50                  1:4,125                  (when printed at A4)</p> <p>0 25 50 75 100                  Metres</p> <p>Base Data: (c) Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2018) Geoscience Australia, Streetpro</p>	<p><b>LEGEND</b></p> <ul style="list-style-type: none"> <li><span style="border: 1px dashed red; display: inline-block; width: 10px; height: 10px; margin-right: 5px;"></span> Wattle Grove South Area</li> <li><span style="border: 1px solid black; display: inline-block; width: 10px; height: 10px; margin-right: 5px;"></span> Survey Area</li> <li><span style="background-color: green; display: inline-block; width: 10px; height: 10px; margin-right: 5px;"></span> Quadrat</li> <li><span style="border: 1px solid black; border-radius: 50%; width: 10px; height: 10px; margin-right: 5px; display: inline-block;"></span> Relevé</li> <li><span style="background-color: blue; display: inline-block; width: 10px; height: 10px; margin-right: 5px;"></span> BaEpPf</li> <li><span style="background-color: lightgreen; display: inline-block; width: 10px; height: 10px; margin-right: 5px;"></span> EmCaFa</li> <li><span style="background-color: pink; display: inline-block; width: 10px; height: 10px; margin-right: 5px;"></span> EmLpFa</li> <li><span style="background-color: brown; display: inline-block; width: 10px; height: 10px; margin-right: 5px;"></span> EmPcAh</li> <li><span style="background-color: yellow; display: inline-block; width: 10px; height: 10px; margin-right: 5px;"></span> Trees</li> <li><span style="background-color: lightblue; display: inline-block; width: 10px; height: 10px; margin-right: 5px;"></span> Planted</li> <li><span style="background-color: grey; display: inline-block; width: 10px; height: 10px; margin-right: 5px;"></span> Cleared</li> <li><span style="background-color: black; display: inline-block; width: 10px; height: 10px; margin-right: 5px;"></span> Hardstand</li> </ul>		<p><b>Vegetation Communities</b></p> <p><b>CITY OF KALAMUNDA</b></p> <p><b>WATTLE GROVE SOUTH ECOLOGICAL SURVEYS</b></p> <p style="text-align: right;">Figure <b>7.7</b></p>
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**AECOM**  
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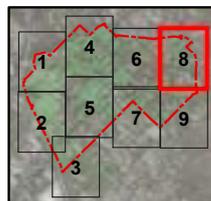
DATUM GDA 1994 MGA Zone 50  
 1:4,125  
 (when printed at A4)

Scale: 0 25 50 75 100 Metres

Data sources:  
 Base Data: (c) Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2010) Geoscience Australia, Streets

**LEGEND**

- Wattle Grove South Area
- Survey Area
- Quadrat
- Relevé
- Vegetation Communities
  - BmXpEc
  - EmCaFa
  - EmLpFa
  - EmMpLp
  - EmPcAh
  - Trees
  - Planted
  - Cleared
  - Hardstand

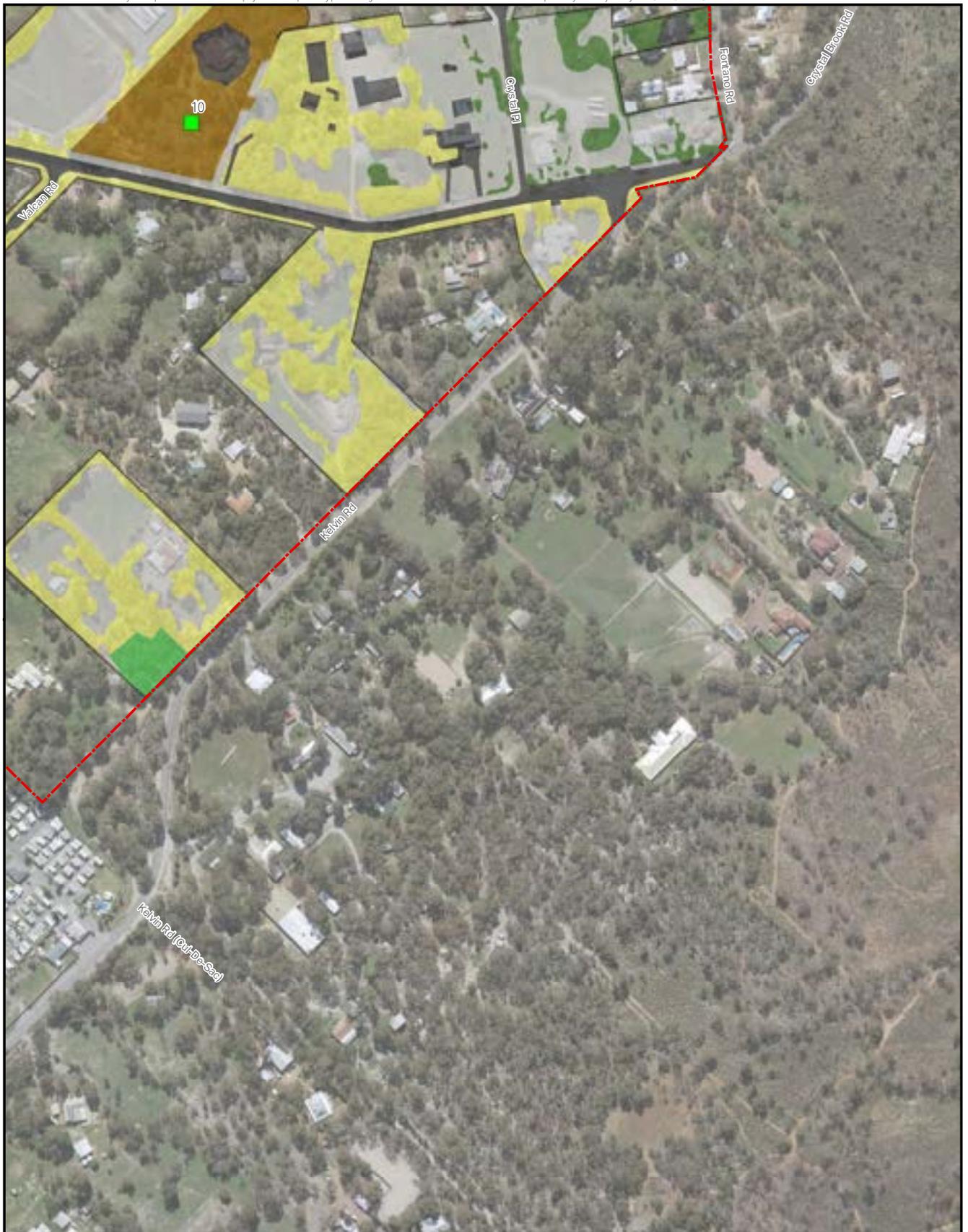


**Vegetation Communities**

CITY OF KALAMUNDA

WATTLE GROVE SOUTH  
 ECOLOGICAL SURVEYS

Figure  
**7.8**



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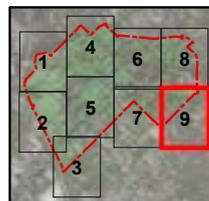
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 www.aecom.com

DATUM GDA 1994 MGA Zone 50  
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 (when printed at A4)

0 25 50 75 100  
 Metres

Data sources:  
 Base Data: (c) Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2018) Geoscience Australia, Streets

- LEGEND**
- Wattle Grove South Area
  - Survey Area
  - Quadrat
  - EmPcAh
  - Trees
  - Planted
  - Cleared
  - Hardstand
  - EmCaFa



**Vegetation Communities**

**CITY OF KALAMUNDA**

**WATTLE GROVE SOUTH  
 ECOLOGICAL SURVEYS**

Figure  
**7.9**

#### 6.1.4 Vegetation Condition

Vegetation condition within the Survey area varied from 'Excellent' to 'Completely Degraded', shown in Figure 8. The condition map reflects the current land use (private estate). Majority of residences comprise cleared grasslands (lawn) and maintained gardens. Condition extent is presented in Table 21.

**Table 21** Vegetation condition

Condition Rating	Area (ha)	Percentage of Survey area (%)
Excellent	2.24	20
Very Good	2.22	76
Good	1.45	1
Degraded	1.59	1
Completely Degraded	127.39	1
Cleared	33.07	1
Total	167.97	100



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DATUM GDA 1994 MGA Zone 50

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 (when printed at A4)

0 25 50 75 100  
 Metres

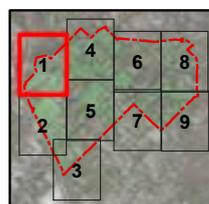
Base Data: (c) Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2010) Geoscience Australia, Streets

**LEGEND**

- Wattle Grove South Area
- Survey Area

**Vegetation Condition**

- Very Good
- Good
- Degraded
- Completely Degraded
- Cleared



**Vegetation Condition**

CITY OF KALAMUNDA

WATTLE GROVE SOUTH  
 ECOLOGICAL SURVEYS

Figure  
 8.1



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DATUM GDA 1994 MGA Zone 50  
 1:4,000  
 (when printed at A4)

0 25 50 75 100  
 Metres

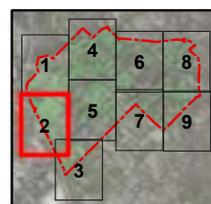
Data sources:  
 Base Data: (c) Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2018) Geoscience Australia, Streetpro

**LEGEND**

- Wattle Grove South Area
- Survey Area

**Vegetation Condition**

- Very Good
- Good
- Degraded
- Completely Degraded
- Cleared



**Vegetation Condition**

**CITY OF KALAMUNDA**

**WATTLE GROVE SOUTH  
 ECOLOGICAL SURVEYS**

**Figure  
 8.2**



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DATUM GDA 1994 MGA Zone 50  
 1:4,000  
 (when printed at A4)

0 25 50 75 100  
 Metres

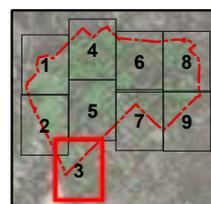
Data sources:  
 Base Data: (c) Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2010) Geoscience Australia, Streetpro

**LEGEND**

- Wattle Grove South Area
- Survey Area

**Vegetation Condition**

- Excellent
- Very Good
- Completely Degraded
- Cleared



**Vegetation Condition**

**CITY OF KALAMUNDA**

**WATTLE GROVE SOUTH  
 ECOLOGICAL SURVEYS**

**Figure  
 8.3**



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**AECOM**  
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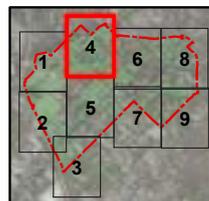
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1:4,000  
 (when printed at A4)

0 25 50 75 100  
 Metres

Data sources:  
 Base Data: (c) Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2018) Geoscience Australia, Streetpro

- LEGEND**
- Wattle Grove South Area
  - Survey Area
  - Vegetation Condition**
  - Degraded
  - Completely Degraded
  - Cleared



**Vegetation Condition**

**CITY OF KALAMUNDA**

**WATTLE GROVE SOUTH  
 ECOLOGICAL SURVEYS**

**Figure  
 8.4**



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**AECOM**  
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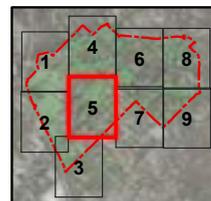
DATUM GDA 1994 MGA Zone 50  
 1:4,000  
 (when printed at A4)

0 25 50 75 100  
 Metres

Base Data: (c) Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2018) Geoscience Australia, Streetpro

**LEGEND**

- Wattle Grove South Area
- Survey Area
- Excellent
- Very Good
- Good
- Degraded
- Completely Degraded
- Cleared



**Vegetation Condition**

**CITY OF KALAMUNDA**

**WATTLE GROVE SOUTH  
 ECOLOGICAL SURVEYS**

Figure  
**8.5**



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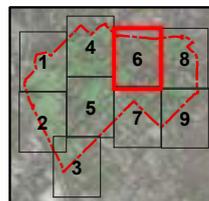
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 www.aecom.com

DATUM GDA 1994 MGA Zone 50  
 1:4,000  
 (when printed at A4)

Scale: 0 25 50 75 100 Metres

Data sources:  
 Base Data: (c) Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2018) Geoscience Australia, Streets

- LEGEND**
- Wattle Grove South Area
  - Survey Area
  - Vegetation Condition**
  - Good
  - Degraded
  - Completely Degraded
  - Cleared



**Vegetation Condition**

CITY OF KALAMUNDA

WATTLE GROVE SOUTH  
 ECOLOGICAL SURVEYS

Figure  
 8.6



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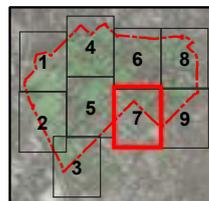
DATUM GDA 1994 MGA Zone 50  
 1:4,000  
 (when printed at A4)

Scale bar: 0, 25, 50, 75, 100 Metres

Data sources:  
 Base Data: (c) Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2010) Geoscience Australia, Streets

**LEGEND**

- Wattle Grove South Area
- Survey Area
- Excellent
- Very Good
- Degraded
- Completely Degraded
- Cleared



**Vegetation Condition**

**CITY OF KALAMUNDA**  
 WATTLE GROVE SOUTH  
 ECOLOGICAL SURVEYS

Figure  
**8.7**



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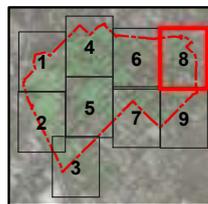
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 1:4,000  
 (when printed at A4)

Scale bar: 0, 25, 50, 75, 100 Metres

Data sources:  
 Base Data: (c) Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2018) Geoscience Australia, Streets

**LEGEND**

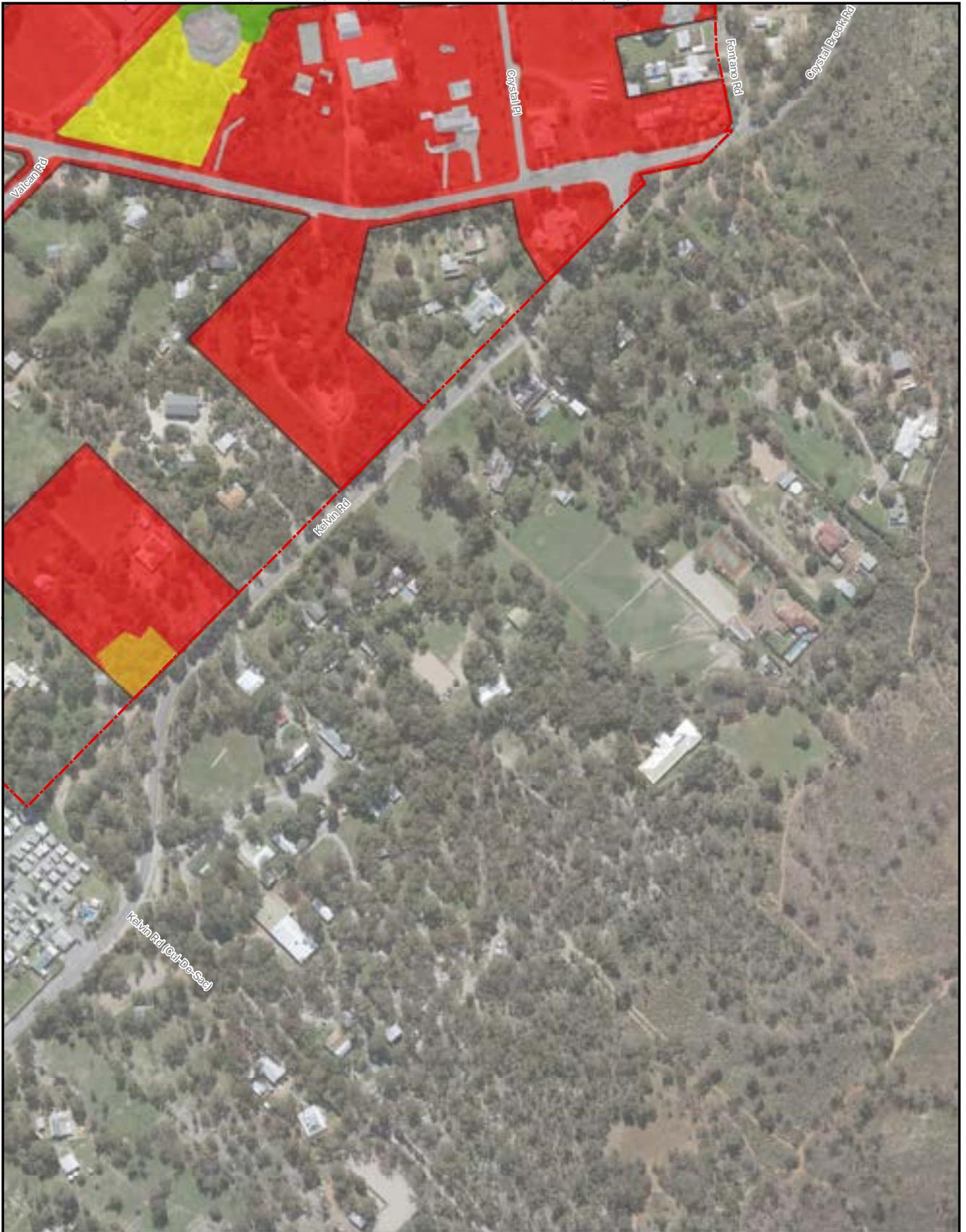
- Wattle Grove South Area
- Survey Area
- Excellent
- Very Good
- Good
- Degraded
- Completely Degraded
- Cleared



**Vegetation Condition**

**CITY OF KALAMUNDA**  
**WATTLE GROVE SOUTH**  
**ECOLOGICAL SURVEYS**

Figure  
**8.8**



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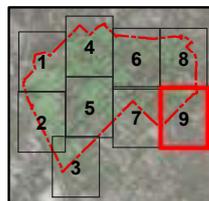
**AECOM**  
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DATUM GDA 1994 MGA Zone 50  
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Scale: 0 25 50 75 100 Metres

Data sources:  
 Base Data: (c) Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2010) Geoscience Australia, Streets

- LEGEND**
- Wattle Grove South Area
  - Survey Area
  - Vegetation Condition**
  - Very Good
  - Good
  - Degraded
  - Completely Degraded
  - Cleared



**Vegetation Condition**

**CITY OF KALAMUNDA**  
 WATTLE GROVE SOUTH  
 ECOLOGICAL SURVEYS

Figure  
**8.9**

## 6.2 Flora

### 6.2.1 Threatened and Priority Flora

#### *Conospermum undulatum* (T)

One Threatened species listed under the EPBC Act and BC Act was recorded within the survey area. *Conospermum undulatum* (EPBC Vulnerable, BC Vulnerable) has been previously recorded in the survey area. This was verified during the field survey where two populations were recorded comprising 95 individuals (see Table 22 and Figure 9). No photograph was taken of this species in the survey area.

DBCA population 11 is located within the survey area. This population is located on land where no access was granted for this field survey.

Populations of *C. undulatum* recorded during this survey are not represented in the DBCA dataset.

**Table 22** *C. undulatum* population information within and in vicinity of survey area

Parameter	AECOM <sup>1</sup>		DBCA <sup>2</sup>	
	Populations	Individuals	Populations	Individuals
Within survey area	2	95	3	528
In vicinity			10	3694

1. Restricted to properties for which access was granted

2. applicable to wider Wattle Grove survey area.

#### *Isopogon drummondii*

One Priority 3 species, *Isopogon drummondii*, was recorded in the survey area. These two populations correspond with the *C. undulatum* populations. There is one known record of this species in the survey area from 1990 (see Table 23 and Figure 9). This species is regionally restricted but locally common.

**Table 23** *I. drummondii* population information within and in vicinity of survey area

Parameter	AECOM <sup>1</sup>		DBCA <sup>2</sup>	
	Populations	Individuals	Populations	Individuals
Within survey area	2	160	1	Not available
In vicinity			9	Described as 'locally abundant'

1. Restricted to properties for which access was granted

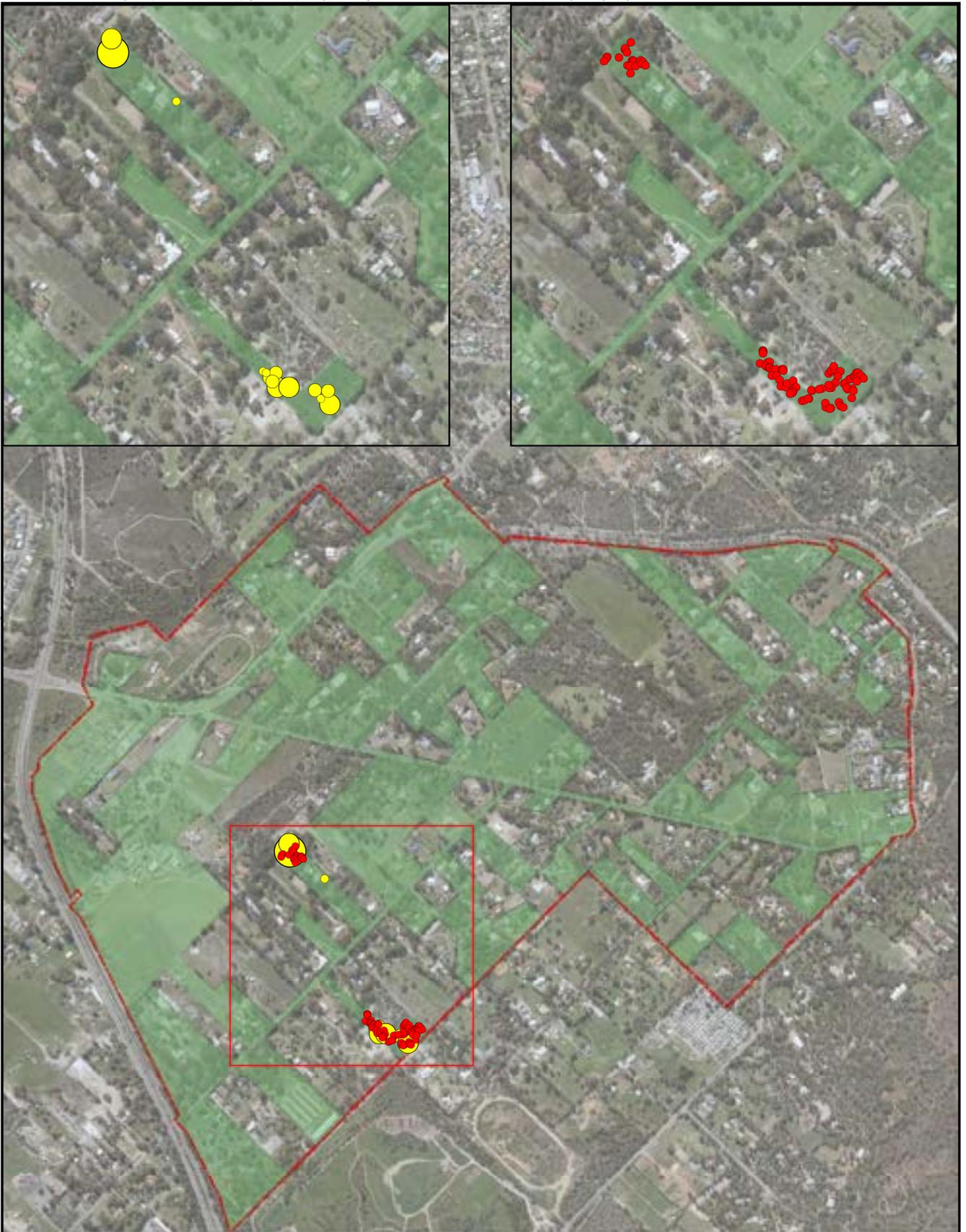
2. applicable to wider Wattle Grove survey area.



**Plate 2** *Isopogon drummondii* recorded in the survey area

### ***Banksia mimica***

The *B. mimica* population (DBCA population 3) was previously recorded south east of the Crystal Brook Road and Brentwood Road junction. All properties in this vicinity have been cleared for development and no native vegetation remains. *B. mimica* was not recorded during the field survey.



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Scale: 0 100 200 300 400 Metres

Data sources:  
 Base Data: (c) Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2018) Geoscience Australia, Streets

**LEGEND**

Survey Area

Wattle Grove South Area

*Conospermum undulatum* T

Abundance:

• 1

*Isopogon drummondii* P3

Abundance:

• 1

• 2-5

• 6-25

• 26-100

**Conservation Significant Vegetation**

CITY OF KALAMUNDA

WATTLE GROVE SOUTH  
 ECOLOGICAL SURVEYS

Figure  
 9

## 6.2.2 Inventory of Flora Species

A total of 165 native species from 95 genera and 38 families were recorded during the field survey. Families with the highest representation are Proteaceae (25 native taxa), Fabaceae (23 native taxa) and Myrtaceae (17 native taxa).

The full list of vascular flora species recorded and representative communities in which they occur in are presented in Appendix C. Qualitative data recorded from individual quadrats is presented in Appendix D.

In total, 21 introduced species were recorded. Of these, one is listed as a Declared Pest under the BAM Act. *Asparagus asparagoides*, Bridal Creeper (Declared Pest – S22(2)) is listed as Exempt therefore no permit or conditions are applicable.

*Rubus ulmifolius* (Declared Pest – s22(2)), also known as Blackberry, was observed along a drainage channel where access was restricted due to fencing (despite the area being zoned as Reserve). This species is listed as C3 – Management / Exempt where some form of management should be applied to alleviate the harmful impacts of this species.

## 6.3 Fauna

### 6.3.1 Level 1 Fauna Survey

#### 6.3.1.1 Fauna Inventory

Fifty-one vertebrate fauna species were recorded within the survey area during the field survey. This comprised three reptile, one amphibian, 11 mammal and 36 bird species. The observed species are presented in Table 24.

#### 6.3.1.2 Conservation Significant Fauna Species

Seven of the 51 recorded vertebrate fauna species were of conservation significance, including six birds and one mammal. These include:

- Forest Red-Tailed Black Cockatoo *Calyptorhynchus banksii* (listed as Vulnerable under the EPBC Act and the BC Act). Refer to 6.3.3 for further details.
- Carnaby's Cockatoo *Calyptorhynchus latirostris* (listed as Endangered under the EPBC Act and the BC Act). Refer to 6.3.3 for further details.
- Quenda *Isoodon fusciventer* (listed as Priority 4 by DBCA). Refer to Plate 3 for photographs of Quenda diggings and scat recorded within the survey area.
- Fan-Tailed Cuckoo *Cacomantis flabelliformis*, Horsfield's Bronze Cuckoo *Chrysococcyx basalus*, Magpie Lark *Grallina cyanoleuca* and Rainbow Bee-Eater *Merops ornatus* (listed as Marine under the EPBC Act). Species listed as Marine under the EPBC Act are only considered significant in Commonwealth land and as the survey area does not contain Commonwealth land these species will not be further discussed within the report.

Based on the desktop assessment and the field survey, the following additional conservation significant fauna species are considered to have the potential to utilise the habitats within the survey area:

- Baudin's Cockatoo *Calyptorhynchus baudinii* - listed as Vulnerable under the BC Act and the EPBC Act
- Carter's Freshwater Mussel *Westralunio carteri* - listed as Vulnerable under the BC Act and the EPBC Act.

Refer to Table 25 and Appendix A for further detail on these conservation significant species.



Plate 3 Quenda observations within the survey area

Table 24 Vertebrate fauna species recorded within the survey area

Species	Vernacular	Status	Observations
<b>Birds</b>			
<i>Anas superciliosa</i>	Pacific Black Duck	Native	Observed in artificial ponds
<i>Anthochaera carunculata</i>	Red Wattlebird	Native	Commonly seen and heard throughout survey area
<i>Cacatua roseicapilla roseicapilla</i>	Galah	Native	Observed multiple times during survey
<i>Cacatua sanguinea</i>	Western Corella	Native	Small flock observed in trees
<i>Cacomantis flabelliformis</i>	Fan-tailed Cuckoo	Native	Heard in trees in paddock
<i>Calyptorhynchus banksii</i>	Forest Red-tailed Black Cockatoo	Native	Two birds observed foraging in Marri tree, multiple birds seen flying over area, multiple observations of foraging evidence
<i>Calyptorhynchus latirostris</i>	Carnaby's Cockatoo	Native	Foraging evidence observed
<i>Chenonetta jubata</i>	Australia Wood Duck	Native	Observed multiple times during survey

Species	Vernacular	Status	Observations
<b>Birds</b>			
<i>Chrysococcyx basalix</i>	Horsfield's Bronze Cuckoo	Native	Heard multiple times
<i>Colluricincla harmonica</i>	Grey Shrikethrush	Native	Heard in Flooded Gums adjacent drainage line
<i>Corvus coronoides</i>	Australian Raven	Native	Commonly seen and heard throughout survey
<i>Cracticus tibicen</i>	Australian Magpie	Native	Commonly seen and heard throughout survey
<i>Cracticus torquatus</i>	Grey Butcherbird	Native	Observed flying through maintained gardens
<i>Dacelo novaeguineae</i>	Laughing Kookaburra	Naturalised exotic	Commonly seen and heard throughout survey area
<i>Dromaius novaehollandiae</i>	Emu	Native	Individual observed in an enclosure
<i>Petrochelidon nigricans</i>	Tree Martin	Native	Flock of approx. 10 birds observed flying in survey area
<i>Gerygone fusca</i>	Western Gerygone	Native	Seen in survey area
<i>Grallina cyanoleuca</i>	Magpie Lark	Native	Commonly seen and heard throughout Survey
<i>Gavicalis virescens</i>	Singing Honeyeater	Native	Common throughout survey area
<i>Malurus splendens</i>	Splendid Fairywren	Native	Seen and heard twice in survey area
<i>Merops ornatus</i>	Rainbow Bee-Eater	Native	Multiple observations recorded throughout survey area
<i>Ocyphaps Lophotes</i>	Crested Pigeon	Native	Observed several times
<i>Pardalotus striatus</i>	Striated Pardalote	Native	Commonly seen and heard throughout survey area
<i>Pavo cristatus</i>	Common Peafowl	Introduced	Heard several times
<i>Phaps chalcoptera</i>	Common Bronzewing	Native	Observed several times in survey area
<i>Phylidonyris niger</i>	White-cheeked Honeyeater	Native	Observed multiple times in survey area
<i>Phylidonyris novaehollandiae</i>	New Holland Honeyeater	Native	Commonly seen and heard throughout survey
<i>Platycercus spurius</i>	Red-capped Parrot	Native	Observed individuals and foraging evidence multiple times
<i>Platycercus zonarius</i>	Australian Ringneck	Native	Commonly seen and heard throughout survey area
<i>Rhipidura leucophrys</i>	Willie Wagtail	Native	Commonly seen and heard throughout survey area
<i>Spilopelia senegalensis senegalensis</i>	Laughing Turtle Dove	Introduced	Seen and heard multiple times in trees and flying over survey area
<i>Taeniopygia guttata</i>	Zebra Finch	Native	Two finches observed in Jarrah tree
<i>Threskiornis moluccus</i>	Australian White Ibis	Native	Observed multiple times during survey

Species	Vernacular	Status	Observations
<b>Birds</b>			
<i>Todiramphus sanctus</i>	Sacred Kingfisher	Native	Individual in tree in maintained garden
<i>Trichoglossus moluccanus</i>	Rainbow Lorikeet	Introduced	Seen and heard multiple times within survey area
<i>Zosterops lateralis</i>	Silver Eye	Native	Observed twice in survey area, flying through trees and in banksia woodland
<b>Mammals</b>			
<i>Canis familiaris</i>	Dog	Introduced	Common throughout survey area
<i>Capra hircus</i>	Goat	Introduced	Observed in paddock
<i>Equus asinus</i>	Donkey	Introduced	Observed in field
<i>Equus caballus</i>	Horse	Introduced	Horses observed in multiple paddocks in survey area
<i>Felis catus</i>	Cat	Introduced	Seen once during survey
<i>Isodon fusciventer</i>	Quenda	Native	Observed directly and indirectly (conical digging and scat) several times in survey area
<i>Lama glama</i>	Llama	Introduced	Observed in field
<i>Macropus fuliginosus</i>	Western Grey Kangaroo	Native	Observed directly and indirectly several times in survey area
<i>Oryctolagus cuniculus</i>	Rabbit	Introduced	Observed directly and indirectly several times in survey area
<i>Ovis aries</i>	Sheep	Introduced	Observed in paddock
<i>Vulpes vulpes</i>	Red Fox	Introduced	Multiple scats recorded
<b>Amphibians</b>			
<i>Crinia glauerti</i>	Clicking Froglet	Native	Heard calling multiple times in drainage lines
<b>Reptiles</b>			
<i>Cryptoblepharus buchananii</i>	Buchanan's Snake-Eyed Skink	Native	Seen multiple times on trees throughout survey area
<i>Pogona minor minor</i>	Western Bearded Dragon	Native	Observed in survey area
<i>Tiliqua rugosa rugosa</i>	Bobtail	Native	Observed twice during survey

### 6.3.1.3 Introduced Species

Thirteen introduced and naturalised exotic species were recorded during the field survey. The species and their legal status under the BAM Act are listed below:

- Cat *Felis catus* – Permitted – s11
- Common Peafowl *Pavo cristatus* – Permitted – s11 (Exempt)
- Domestic Dog *Canis familiaris* – Permitted – s11
- Donkey *Equus asinu* - Permitted - s11
- Horse *Equus caballus* - Permitted - s11
- European Wild Rabbit *Oryctolagus cuniculus* – Declared Pest – s22(2) (C3 Prohibited)
- Goat *Capra hircus* - Permitted - s11
- Laughing Kookaburra *Dacelo novaeguineae* – Permitted – s11
- Laughing Turtle-Dove *Streptopelia senegalensis* – Permitted – s11.
- Llama *Lama glama* - Permitted - s11
- Rainbow Lorikeet *Trichoglossus haematodus* - Declared Pest - s22(2) (C3 Exempt)
- Red Fox *Vulpes vulpes* - Declared Pest – s22(2) (C3 Prohibited)
- Sheep *Ovis aries* - Permitted - s11.

The European Wild Rabbit, Red Fox and Rainbow Lorikeet are listed as Declared Pests under the BAM Act. Generally, these species were recorded sporadically throughout the survey area and were observed directly, or identified by tracks, scats and burrows.

Refer to Section 3.0 for explanations of BAM Act categories.

### 6.3.2 Fauna Habitat

Six broadly defined fauna habitats have been mapped within the survey area (Table 25 and Figure 10). Other than cleared areas, the most common fauna habitat is Scattered Trees. This habitat is highly variable and highly modified, and includes a mix of native and non-native eucalypts and other tree species over predominantly cleared ground. This habitat occupies 48.78 ha (28.5%) of the survey area. This habitat may be utilised as breeding, roosting and foraging habitat by the Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*), Carnaby's Cockatoo (*Calyptorhynchus latirostris*) and Baudin's Cockatoo (*Calyptorhynchus baudinii*), depending on the tree species present. This habitat is also likely to be utilised by many of the common avian species in the area.

Table 25 describes these fauna habitats, includes the area and percentage these cover within the survey area, and the conservation significant fauna species likely to utilise these habitats.

### 6.3.3 Fauna Habitat Linkages

Habitat linkages are typically areas or corridors of vegetation that link (larger) areas of fauna habitat. Linkages are important as they enable fauna to move freely between remnant bushland patches, therefore increasing gene-flow between populations. A study conducted by Gilbert *et al.* (1998) found that corridors and/or linkages do maintain species richness in the fragmented landscapes.

The survey area is located on the edge of a metropolitan area with significant amounts of cleared and highly modified land. Although the survey area probably does not contain any significant habitat linkages, predominantly due to clearing, habitat fragmentation and arterial roads bisecting the area, it does contain degraded drainage lines that may enable some fauna taxa to move through the area. It also sits near the Kenwick Wetlands and habitat adjacent the Hartfield Golf Club, and the survey area may provide for movement of fauna into and out of these areas. In saying the above, avian fauna species are more likely to utilise the survey area as a stepping stone from the larger areas of fauna habitat on the darling scarp, to the fragmented habitats of the Swan Coastal Plain.

**Table 25 Fauna habitats recorded within the survey area**

Fauna Habitat	Description	Conservation Significant Species with Potential to Utilise Habitat	Area (ha)	% of Survey Area	Photo
Banksia Woodland	<p>This habitat generally comprised a low open woodland of Banksia and Eucalyptus over a low open shrubland on loamy, sandy brown soil.</p> <p>The habitat is generally considered high quality due to presence of Banksia, its complexity and limited disturbance levels. Habitat quality is be reduced where areas are significantly degraded due to impacts from clearing and edge effects.</p> <p>Significant habitat characteristics include:</p> <ul style="list-style-type: none"> <li>• dense understorey common</li> <li>• logs of various sizes are common</li> <li>• fine and course leaf litter common to abundant</li> <li>• bare ground occasionally present</li> <li>• absence of stones and boulders</li> <li>• Large mature trees in rare to occasional abundance</li> <li>• Large hollows generally absent, small hollows common.</li> </ul>	<ul style="list-style-type: none"> <li>• Generally good quality foraging habitat for Carnaby's Cockatoo and Baudin's Cockatoo</li> <li>• Moderate to low quality foraging habitat for the Forest Red-tailed Black Cockatoo</li> <li>• Contains occasional breeding tree for black cockatoos</li> <li>• Habitat for Quenda.</li> </ul>	3.52	2.06	

Fauna Habitat	Description	Conservation Significant Species with Potential to Utilise Habitat	Area (ha)	% of Survey Area	Photo
Drainage Line	<p>This riparian habitat is generally degraded and variable throughout the survey area, but often contains a drainage line with scattered Marri and Flooded Gum over shrubland and introduced weeds / reeds.</p> <p>The habitat is considered high to moderate quality due to its wetland and riparian nature, but often reduced in quality due to limited understorey, high weed cover and disturbance levels.</p>	<ul style="list-style-type: none"> <li>• May contain foraging, roosting and / or breeding habitat for all three black cockatoo species, where mature eucalypts are present</li> <li>• Habitat for Quenda</li> <li>• Potential marginal habitat for Carter's Freshwater Mussel.</li> </ul>	1.27	0.74	

Fauna Habitat	Description	Conservation Significant Species with Potential to Utilise Habitat	Area (ha)	% of Survey Area	Photo
Eucalyptus Woodland	<p>This habitat is variable throughout the survey area though generally contains a <i>Eucalyptus</i> woodland / open forest over a low shrubland over sandy brown soils.</p> <p>This habitat is considered high to moderate (depending on degree of degradation) quality due to the structural complexity and disturbance levels.</p> <p>Significant habitat characteristics include:</p> <ul style="list-style-type: none"> <li>• presence of large mature eucalypts</li> <li>• dense understorey</li> <li>• occasionally present logs of various sizes in variable abundance</li> <li>• fine and course leaf litter common</li> <li>• bare ground occasionally present</li> <li>• absence of stones and boulders</li> <li>• large hollows occasionally present, small hollows common</li> <li>• soils of areas at base of Darling scarp contained pea gravel.</li> </ul>	<ul style="list-style-type: none"> <li>• Foraging, breeding and roosting habitat for:               <ul style="list-style-type: none"> <li>- Forest Red-tailed Black Cockatoo</li> <li>- Carnaby's Cockatoo</li> <li>- Baudin's Cockatoo</li> </ul> </li> <li>• Habitat for Quenda</li> </ul>	3.94	2.31	

Fauna Habitat	Description	Conservation Significant Species with Potential to Utilise Habitat	Area (ha)	% of Survey Area	Photo
Shrubland	<p>This habitat generally comprised small areas of open, often degraded shrubland on sandy soils.</p> <p>This habitat was generally considered moderate to low quality fauna due to being highly modified and disturbed, with limited structural complexity.</p> <p>The significant fauna habitat characteristics include:</p> <ul style="list-style-type: none"> <li>• bare ground occasional to common abundance</li> <li>• dense understorey present in patches</li> <li>• minimal large trees</li> <li>• vegetation containing occasional small hollows, large hollows rare</li> <li>• decorticated bark and coarse leaf litter present in patches</li> <li>• stones and boulders generally absent</li> <li>• small and medium sized fallen branches occasional abundance.</li> </ul>	<ul style="list-style-type: none"> <li>• Potentially provides low quality foraging habitat for all three black cockatoo species depending on flora species present.</li> <li>• Habitat for Quenda.</li> </ul>	0.30	0.18	

Fauna Habitat	Description	Conservation Significant Species with Potential to Utilise Habitat	Area (ha)	% of Survey Area	Photo
Planted and Maintained Gardens	<p>Highly variable habitat including areas of planted and maintained native and introduced vegetation. The habitat is considered low to moderate quality due to disturbance levels and limited habitat complexity.</p> <p>Significant habitat characteristics include:</p> <ul style="list-style-type: none"> <li>• mature trees rare</li> <li>• variability of understorey, with areas of dense understorey generally absent</li> <li>• general lack of hollows</li> <li>• bare sandy ground abundant</li> <li>• absence of stones, boulders and rock crevices.</li> </ul>	<ul style="list-style-type: none"> <li>• Predominantly foraging habitat, but also occasionally breeding and roosting habitat for: <ul style="list-style-type: none"> <li>- Forest Red-tailed Black Cockatoo</li> <li>- Carnaby's Cockatoo</li> <li>- Baudin's Cockatoo</li> </ul> </li> <li>• Habitat for Quenda.</li> </ul>	7.25	4.24	
Scattered Trees	<p>This habitat is varied and contains large mature native and non-native eucalypt trees, as well as other introduced species such as Cape Lilac and Jacaranda. Trees were generally recorded over cleared areas.</p> <p>The significant fauna habitat characteristics include:</p> <ul style="list-style-type: none"> <li>• Presence of large mature trees</li> <li>• Absence of dense understorey</li> <li>• Small hollows are common,</li> </ul>	<ul style="list-style-type: none"> <li>• Foraging, breeding and roosting habitat for: <ul style="list-style-type: none"> <li>- Forest Red-tailed Black Cockatoo</li> <li>- Carnaby's Cockatoo</li> <li>- Baudin's Cockatoo</li> </ul> </li> <li>• Marginal habitat for Quenda.</li> </ul>	48.78	28.54	

Fauna Habitat	Description	Conservation Significant Species with Potential to Utilise Habitat	Area (ha)	% of Survey Area	Photo
	<ul style="list-style-type: none"> <li>• large hollows are rare</li> <li>• Logs of all sizes are rare to occasionally present</li> <li>• Course and fine litter are present but generally only under trees.</li> <li>• Bare sandy ground abundant</li> <li>• Absence of stones, boulders and rock crevices.</li> </ul>				

Fauna Habitat	Description	Conservation Significant Species with Potential to Utilise Habitat	Area (ha)	% of Survey Area	Photo
Cleared Ground	Generally areas which have been cleared (e.g. paddocks) and now comprise bare soil and / or weeds (may contain the occasional shrub / tree), or hardstand areas (e.g. roads). Habitat is considered very low quality	This habitat may contain the occasional individual foraging tree / shrub for black cockatoos.	71.82	42.02	

Note: Areas of hardstand (e.g. buildings, roads etc) were also mapped, however these provide little in the way of fauna habitat.



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			<p>Figure 10.1</p>



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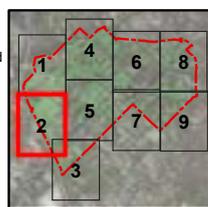
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**LEGEND**

- Wattle Grove South Area
- Survey Area
- Opportunistic Fauna Observations
- FaunaHabit**
- Banksia Woodland
- Drainage Line
- Eucalyptus Woodland
- Planted and Maintained Gardens
- Scattered Trees
- Shrubland
- Hardstand
- Cleared



**Fauna Habitats**

**CITY OF KALAMUNDA**

**WATTLE GROVE SOUTH ECOLOGICAL SURVEYS**

Figure  
**10.2**



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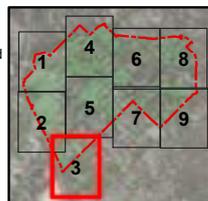
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 Base Data: (c) Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2010) Geoscience Australia, Streetpro

**LEGEND**

- Wattle Grove South Area
- Survey Area
- Opportunistic Fauna Observations

**FaunaHabit**

- Banksia Woodland
- Drainage Line
- Eucalyptus Woodland
- Planted and Maintained Gardens
- Scattered Trees
- Shrubland
- Hardstand
- Cleared

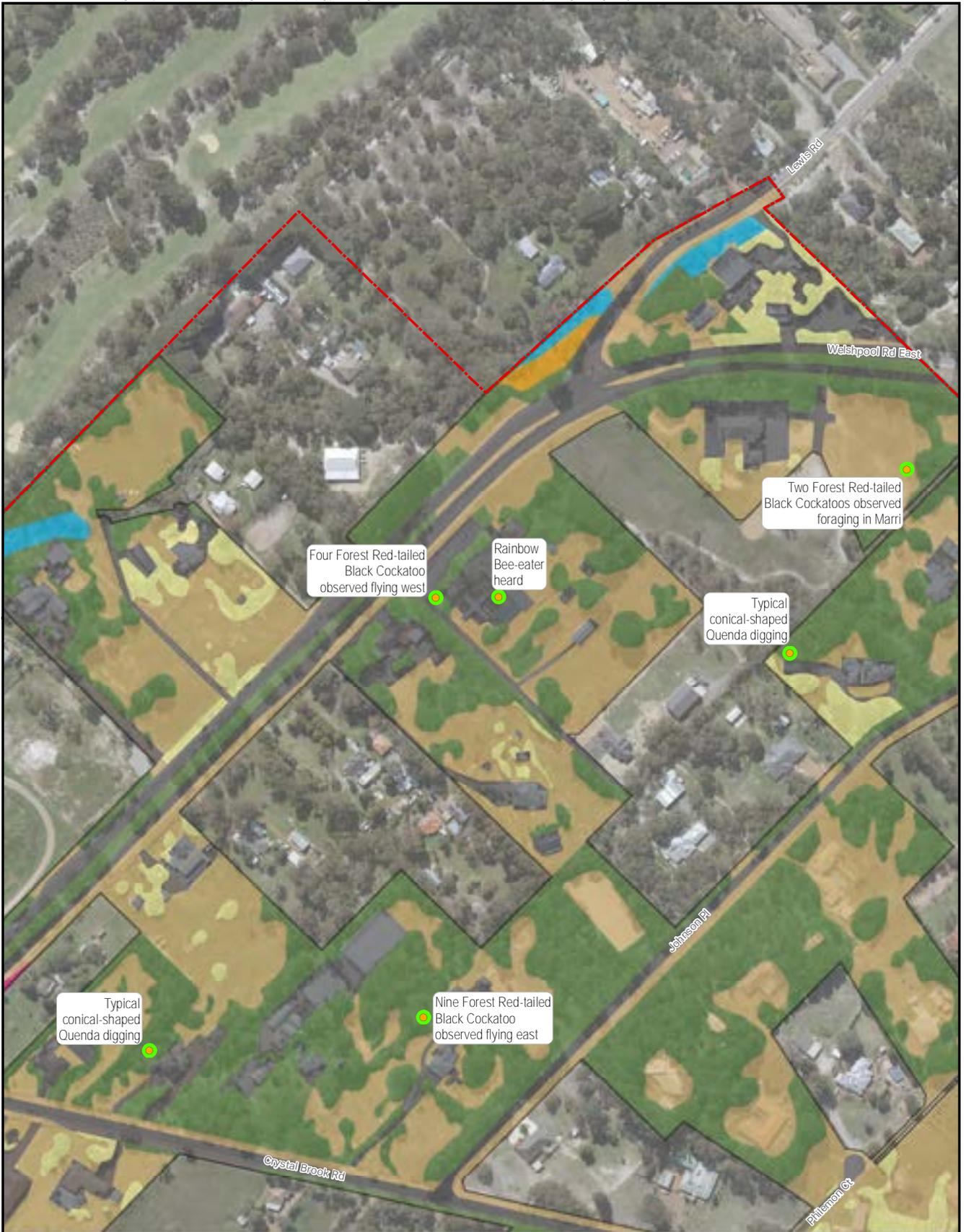


**Fauna Habitats**

**CITY OF KALAMUNDA**

**WATTLE GROVE SOUTH ECOLOGICAL SURVEYS**

**Figure 10.3**



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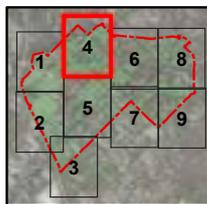
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Data sources:  
 Base Data: (c) Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2010) Geoscience Australia, Streets

- LEGEND**
- Wattle Grove South Area
  - Survey Area
  - Opportunistic Fauna Observations
  - FaunaHabit**
  - Banksia Woodland
  - Drainage Line

- Eucalyptus Woodland
- Planted and Maintained Gardens
- Scattered Trees
- Shrubland
- Hardstand
- Cleared

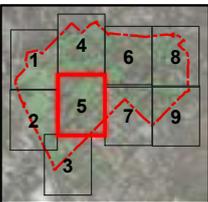


**Fauna Habitats**

**CITY OF KALAMUNDA**  
 WATTLE GROVE SOUTH  
 ECOLOGICAL SURVEYS

Figure  
 10.4



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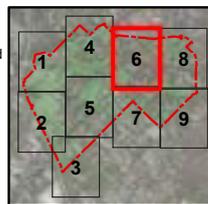
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**LEGEND**

- Wattle Grove South Area
- Survey Area
- Opportunistic Fauna Observations

**FaunaHabit**

- Banksia Woodland
- Drainage Line
- Eucalyptus Woodland
- Planted and Maintained Gardens
- Scattered Trees
- Shrubland
- Hardstand
- Cleared



**Fauna Habitats**

CITY OF KALAMUNDA

WATTLE GROVE SOUTH  
 ECOLOGICAL SURVEYS

Figure  
 10.6



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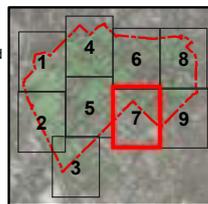
**LEGEND**

Wattle Grove South Area  
 Survey Area  
 Opportunistic Fauna Observations

**FaunaHabit**

Banksia Woodland  
 Drainage Line

Eucalyptus Woodland  
 Planted and Maintained Gardens  
 Scattered Trees  
 Shrubland  
 Hardstand  
 Cleared



**Fauna Habitats**

**CITY OF KALAMUNDA**

**WATTLE GROVE SOUTH  
 ECOLOGICAL SURVEYS**

Figure  
**10.7**



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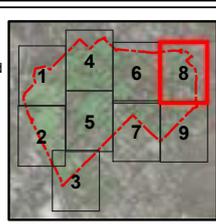
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Data sources:  
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**LEGEND**

- Wattle Grove South Area
- Survey Area
- Opportunistic Fauna Observations
- FaunaHabit**
- Eucalyptus Woodland
- Planted and Maintained Gardens
- Scattered Trees
- Shrubland
- Hardstand
- Cleared
- Banksia Woodland
- Drainage Line

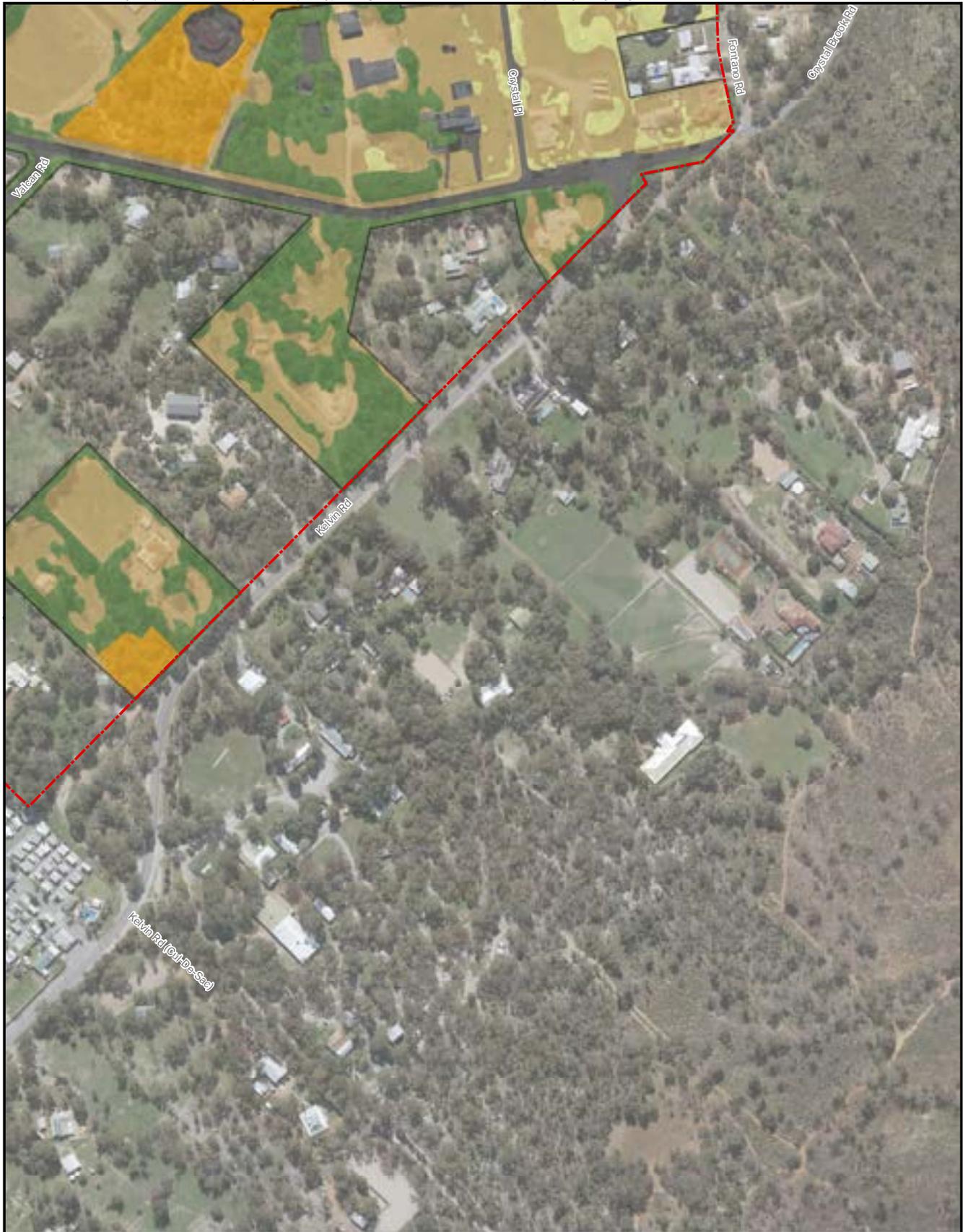


**Fauna Habitats**

**CITY OF KALAMUNDA**

**WATTLE GROVE SOUTH ECOLOGICAL SURVEYS**

Figure 10.8



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## 6.4 Black Cockatoos

### 6.4.1 Ecology

#### 6.4.1.1 Carnaby's Cockatoo

Carnaby's Cockatoo *Calyptorhynchus latirostris* is endemic to the southwest of Western Australia, extending from the Murchison River to Esperance, and inland to Coorow, Kellerberrin and Lake Cronin. This black cockatoo has a white patch on its cheek, white bands on its tail, and a strong curved bill. Carnaby's Cockatoo is a seasonal visitor to the Swan Coastal Plain, which provides important foraging and roosting habitat during the non-breeding season.

Carnaby's Cockatoo feeds on seeds, nuts and flowers of a variety of native and exotic plants. Feed plants include the various proteaceous species (e.g. *Banksia*, *Grevillea* and *Hakea*), Marri *Corymbia calophylla*, Jarrah *Eucalyptus marginata*, and seeds from the cones of Pine *Pinus* sp. trees. Cockatoo flocks follow vegetation corridors and actively avoid cleared and open areas when moving between roosting, water and food resources. Habitat fragmentation increases the distances cockatoos need to travel between resources. Proximity of foraging habitat and water has been demonstrated to be critical to support roosting and breeding sites (Le Roux, 2017).

Carnaby's Cockatoo displays strong pair bonds and nest in the hollows of live or dead mature eucalypts including Salmon Gum *Eucalyptus salmonophloia*, York Gum *E. loxophleba* subsp. *loxophleba*, Flooded Gum *E. rudis*, Karri *E. diversicolor*, Wandoo *E. wandoo* and Tuart *E. gomphocephala* and Marri *Corymbia calophylla*, (DSEWPac, 2012). Nest hollows generally range from 2.5-12 m above ground, size of entrance from 23-30 cm and depth of hollows from 1-2.5 m (Johnstone and Storr, 1998).

Carnaby's Cockatoo has undergone a dramatic decline of approximately 50 percent in the past 45 years, with the main contributing factors the clearing of core breeding habitat in the Wheatbelt, the deterioration of nesting hollows, and clearing of foraging habitat.

Breeding habitat for this species occurs in the Wheatbelt, Jarrah Forest and South Coast regions, and the species is expanding its current breeding range with small patches of breeding habitat now being utilised across the SCP. After breeding, Carnaby's Cockatoo disperse to the higher rainfall coastal areas of the south-west of Western Australia to feed in late December to July. Breeding has been recorded from early July to mid-December.

Carnaby's Cockatoos were not directly observed during the field survey, however probable foraging evidence was recorded on three occasions.

#### 6.4.1.2 Forest Red-tailed Black Cockatoo

The Forest Red-tailed Black Cockatoo *Calyptorhynchus banksii naso* is endemic to the south-west humid and semi-humid zones of Western Australia, where it inhabits dense Jarrah, Karri and Marri forests which receive more than 600 mm average annual rainfall (DSEWPac, 2012). It has a pair of black central tail feathers and a bright red, orange or yellow barring on the tail.

This species predominantly feeds in eucalypt forests, preferring Marri *Corymbia calophylla* and Jarrah *Eucalyptus marginata* seeds, but also feeding on Blackbutt *E. patens*, Albany Blackbutt *E. staeri*, Karri *E. diversicolor*, Sheoak *Allocasuarina* sp. and Snottygobble *Persoonia longifolia* (Johnstone, 2016 pers. comm.).

Forest Red-tailed Black Cockatoo are monogamous and pairs nest in tree hollows from 6.5 to 33 m above ground. Most nests are in very large and very old, mature Marri (Johnstone, Kirkby & Sarti, 2013), though they will nest in other eucalypts such as Tuart (Johnstone, 2016 pers. comm.). Breeding habitat for this species occurs in the eastern margins of the Jarrah forests of the Wheatbelt, and within the Jarrah Forest regions, and the Forest Red-tailed Black Cockatoo is expanding its current breeding range with small patches of breeding habitat now being utilised across the SCP.

Two individuals of the Forest Red-tailed Black Cockatoo were observed foraging in a Marri tree, multiple birds were seen and heard flying over the survey area, and multiple observations of old and recent foraging evidence (Table 24) was recorded during the field survey.

### 6.4.1.3 Baudin's Cockatoo

Baudin's Cockatoo *Calyptorhynchus baudinii* is distributed throughout the south-western humid and subhumid zones, from the northern Darling Range and adjacent far east of the SCP (south of the Swan River), south to Bunbury and across to Albany (Johnstone & Storr, 1998). It is a large black cockatoo with rectangular white patches in the tail. Males have a pink eye ring, the female a dark eye ring.

Baudin's Cockatoo forages primarily in eucalypt forest, where it feeds on seeds, flowers, nectar and buds from Marri *Corymbia calophylla*, and seeds of *Eucalyptus* and proteaceous species (e.g. *Banksia* and *Hakea*), as well as orchard fruits and Pines *Pinus* sp. It also takes insect larvae and insects (including beetle, wasp and moth larvae) from under bark and in wood of live and dead trees, from galls and from flower spikes of *Xanthorrhoea* and the pith of *Anigozanthos flavidus* (Johnstone & Kirkby, 2008).

This black cockatoo primarily nests in tree hollows in live or dead Karri *Eucalyptus diversicolor*, Marri *Corymbia calophylla*, Wandoo *Eucalyptus wandoo* and Tuart *Eucalyptus gomphocephala* (DSEWPaC, 2012b). Baudin's Cockatoo nests in spring in the deep southwest of Western Australia.

No Baudin's Cockatoos or foraging evidence were observed in or adjacent the survey area.

### 6.4.2 Breeding

Hollow formation in Eucalypt trees is a result of a number of processes including fungal attack, termites and fire, and the propensity for hollow formation varies between species (Whitford, 2002). In order to be suitable for black cockatoos, hollow entrances need to be at least 100 mm in diameter.

A total of 730 hollow-forming (generally native) breeding habitat trees were identified within the survey area. Just over 56% of these were Marri and 27% were Jarrah, with the remaining Tuart, stags, Flooded Gums, Wandoo and *Eucalyptus todtiana*. Hollows in Jarrah tend to be smaller than those found in Marri, consequently, black cockatoos, particularly Forest Red-tailed Black Cockatoos breed predominantly in Marri in the Jarrah-Marri forest of the south west (Whitford, 2002; Johnstone *et al.*, 2013). On the Swan Coastal Plain most black cockatoo breeding records, particularly for Carnaby's Cockatoo are in Tuart (Johnstone & Kirkby, 2011), which were just over 6% of the total number of breeding habitat trees within the survey area.

Seventeen of the 730 trees contain a total of 26 potentially suitable hollows for breeding black cockatoos. All were considered to be large enough at their entrances with potentially sufficient floor and chamber space (when observed from the ground). However, hollows could not generally be fully inspected from the ground to determine if the hollows were deep enough for nesting to occur.

Refer to Appendix E for the details of the 17 trees with potentially suitable hollows, Figure 11 for locations of these trees and Appendix F full details of all 730 breeding habitat trees.

### 6.4.3 Roosting

Carnaby's and Baudin's Cockatoos roost in or near riparian environments or near other permanent water sources, generally within any tall trees, but particularly Flat-topped Yate, Salmon Gum, Wandoo, Marri, Karri, Blackbutt, Tuart, introduced eucalypts and introduced pines. The Forest Red-tailed Black Cockatoo prefers the edges of forests for roosting, within any tall trees, but particularly tall Jarrah, Marri, Blackbutt, Tuart and introduced eucalypt trees (DotEE, 2017). The Birdlife (2018) black cockatoo roosting data contains a confirmed Forest Red-tailed Black Cockatoo roosting site in the survey area at 35 Gavour Road, with one unconfirmed roost site located at 121 Crystal Brooke Road.

No additional roosting sites were confirmed during the field survey.

#### 6.4.4 Foraging habitat

##### 6.4.4.1 Carnaby's Cockatoo

The survey area contains a total of 69.39 ha of foraging habitat for Carnaby's Cockatoo. This includes 41.14 ha of Very High and High Quality foraging habitat. This generally consisted of habitats containing scattered mature eucalypts (potential breeding trees). Foraging habitat is presented in Figure 12, and total areas for each foraging quality are presented in Table 26. The foraging quality assessments are presented in Appendix E.

Carnaby's Cockatoo foraging evidence was recorded at three locations within the survey area (refer to Table 27).

**Table 26 Carnaby's Cockatoo foraging habitat areas**

Foraging Quality	Area (ha)
Low Quality (1-3)	10.33
Quality (4-6)	17.91
High Quality (7-8)	4.52
Very High Quality (>8)	36.62
<b>TOTAL</b>	<b>69.39</b>

**Table 27 Potential Carnaby's Cockatoo foraging evidence**

ID	Coordinates	Plate
16	116.0177, -32.0122	
46	116.004, -32.0048	

ID	Coordinates	Plate
107	116.0022, -32.0219	

#### 6.4.4.2 Forest Red-tailed Black Cockatoo

The survey area contains a total of 59.53 ha of foraging habitat for the Forest Red-tailed Black Cockatoo. This includes 33.52 ha of Very High and High Quality foraging habitat, which generally consists of scattered mature Jarrah and Marri trees (potential breeding trees). Foraging habitat is presented spatially in Figure 13, and the total areas for each foraging quality are presented in Table 28. The foraging quality assessments are presented in Appendix E.

Potential foraging evidence from the Forest Red-tailed Black Cockatoo were recorded commonly throughout the survey area (Table 30).

**Table 28 Forest Red-tailed Black Cockatoo foraging habitat areas**

Foraging Quality	Area (ha)
Low Quality (1-3)	22.10
Quality (4-6)	3.92
High Quality (7-8)	0.00
Very High Quality (>8)	33.52
<b>TOTAL</b>	<b>59.53</b>

#### 6.4.4.3 Baudin's Cockatoo

The survey area contains a total of 69.39 ha of foraging habitat for the Baudin's Cockatoo. This includes 41.14 ha of High Quality and Very High Quality foraging habitat, which generally consists of scattered eucalypts (potential breeding trees). Foraging habitat is presented spatially in Figure 14, and the total areas for each foraging quality are presented in Table 29. The foraging quality assessments are presented in Appendix E.

No foraging evidence from the Baudin's Cockatoo was recorded within the survey area.

**Table 29 Baudin's Cockatoo foraging habitat areas**

Foraging Quality	Area (ha)
Low Quality (1-3)	13.73
Quality (4-6)	14.51
High Quality (7-8)	4.52
Very High Quality (>8)	36.62
<b>TOTAL</b>	<b>69.39</b>

**Table 30 Potential Forest Red-tailed Black Cockatoo foraging evidence**

ID	Coordinates	Plate	ID	Coordinates	Plate
5	116.0183, -32.0100		48	116.0067, -32.0058	
7	116.0177, -32.0105		59	116.0133, -32.0094	
10	116.0207, -32.0128		72	116.0207, -32.0106	
11	116.02, -32.01267		83	116.018, -32.0070	
12	116.0185, -32.01241		85	116.0208, -32.0056	
27	116.0084, -32.0040		87	116.0196, -32.0163	

ID	Coordinates	Plate	ID	Coordinates	Plate
30	116.0051, -32.00934		89	116.02, -32.0162	
31	116.0055, -32.0092		90	116.0233, -32.0129	
39	116.0166, -32.0135		94	116.0071, -32.0058	
42	116.0115, -32.0059		106	116.003, -32.0227	



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- LEGEND**
- Wattle Grove South Area
  - Survey Area
  - Black Cockatoo Breeding Trees
  - Black Cockatoo Breeding Trees
  - Potential Black Cockatoo Breeding Trees

<b>Black Cockatoo Breeding Trees</b>	
<b>CITY OF KALAMUNDA</b>	
<b>WATTLE GROVE SOUTH ECOLOGICAL SURVEYS</b>	
<b>Figure</b> <b>11</b>	



<p>PROJECT ID: 60611889                  CREATED BY: KW                  APPROVED BY: FDW                  LAST MODIFIED: 24 JAN 2020</p> <p><b>AECOM</b>                  www.aecom.com</p> <p>DATUM GDA 1994 MGA Zone 50</p> <p>1:15,000                  (when printed at A4)</p> <p>0 100 200 300 400                  Metres</p> <p>Base Data: (c) Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2010) Geoscience Australia, Streetspro</p>	<p><b>LEGEND</b></p> <ul style="list-style-type: none"> <li><span style="border: 1px dashed red; display: inline-block; width: 15px; height: 10px; margin-right: 5px;"></span> Wattle Grove South Area</li> <li><span style="border: 1px solid black; display: inline-block; width: 15px; height: 10px; margin-right: 5px;"></span> Survey Area</li> <li><span style="display: inline-block; width: 15px; height: 10px; background-color: red; margin-right: 5px;"></span> Low Quality</li> <li><span style="display: inline-block; width: 15px; height: 10px; background-color: orange; margin-right: 5px;"></span> Quality</li> <li><span style="display: inline-block; width: 15px; height: 10px; background-color: yellow; margin-right: 5px;"></span> High Quality</li> <li><span style="display: inline-block; width: 15px; height: 10px; background-color: green; margin-right: 5px;"></span> Very High Quality</li> <li><span style="display: inline-block; width: 0; height: 0; border-left: 5px solid transparent; border-right: 5px solid transparent; border-bottom: 10px solid black; margin-right: 5px;"></span> Opportunistic Fauna Observations</li> </ul>	<p><b>Carnaby's Cockatoo Foraging Habitat</b></p> <p>CITY OF KALAMUNDA</p> <p>WATTLE GROVE SOUTH                  ECOLOGICAL SURVEYS</p> <p>Figure                  12</p>
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<p>PROJECT ID 60611889                  CREATED BY KW                  APPROVED BY FDW                  LAST MODIFIED 24 JAN 2020</p> <p><b>AECOM</b>                  www.aecom.com</p> <p>DATUM GDA 1994 MGA Zone 50                  1:15,000                  (when printed at A4)</p> <p>Scale: 0 100 200 300 400 Metres</p> <p>Data sources:                  Base Data: (c) Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2010) Geoscience Australia, Streetspro</p>	<p><b>LEGEND</b></p> <ul style="list-style-type: none"> <li><span style="border: 1px dashed red; display: inline-block; width: 15px; height: 10px; margin-right: 5px;"></span> Wattle Grove South Area</li> <li><span style="border: 1px solid black; display: inline-block; width: 15px; height: 10px; margin-right: 5px;"></span> Survey Area</li> <li><span style="display: inline-block; width: 15px; height: 10px; background-color: red; margin-right: 5px;"></span> Low Quality</li> <li><span style="display: inline-block; width: 15px; height: 10px; background-color: yellow; margin-right: 5px;"></span> Quality</li> <li><span style="display: inline-block; width: 15px; height: 10px; background-color: green; margin-right: 5px;"></span> Very High Quality</li> <li><span style="color: yellow;">★</span> Possible foraging evidence</li> <li><span style="color: blue;">★</span> Possible old foraging evidence</li> <li><span style="color: black;">★</span> Possible recent foraging evidence</li> <li><span style="color: pink;">★</span> Recent and old possible foraging evidence</li> <li><span style="color: purple;">★</span> Two Forest Red-tailed Black Cockatoos observed foraging in Marri</li> </ul>	<p><b>Forest Red-tailed Black Cockatoo Foraging Habitat</b></p> <p><b>CITY OF KALAMUNDA</b></p> <p>WATTLE GROVE SOUTH ECOLOGICAL SURVEYS</p> <p style="text-align: right;">Figure <b>13</b></p>
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## 6.5 Environmental Values Assessment

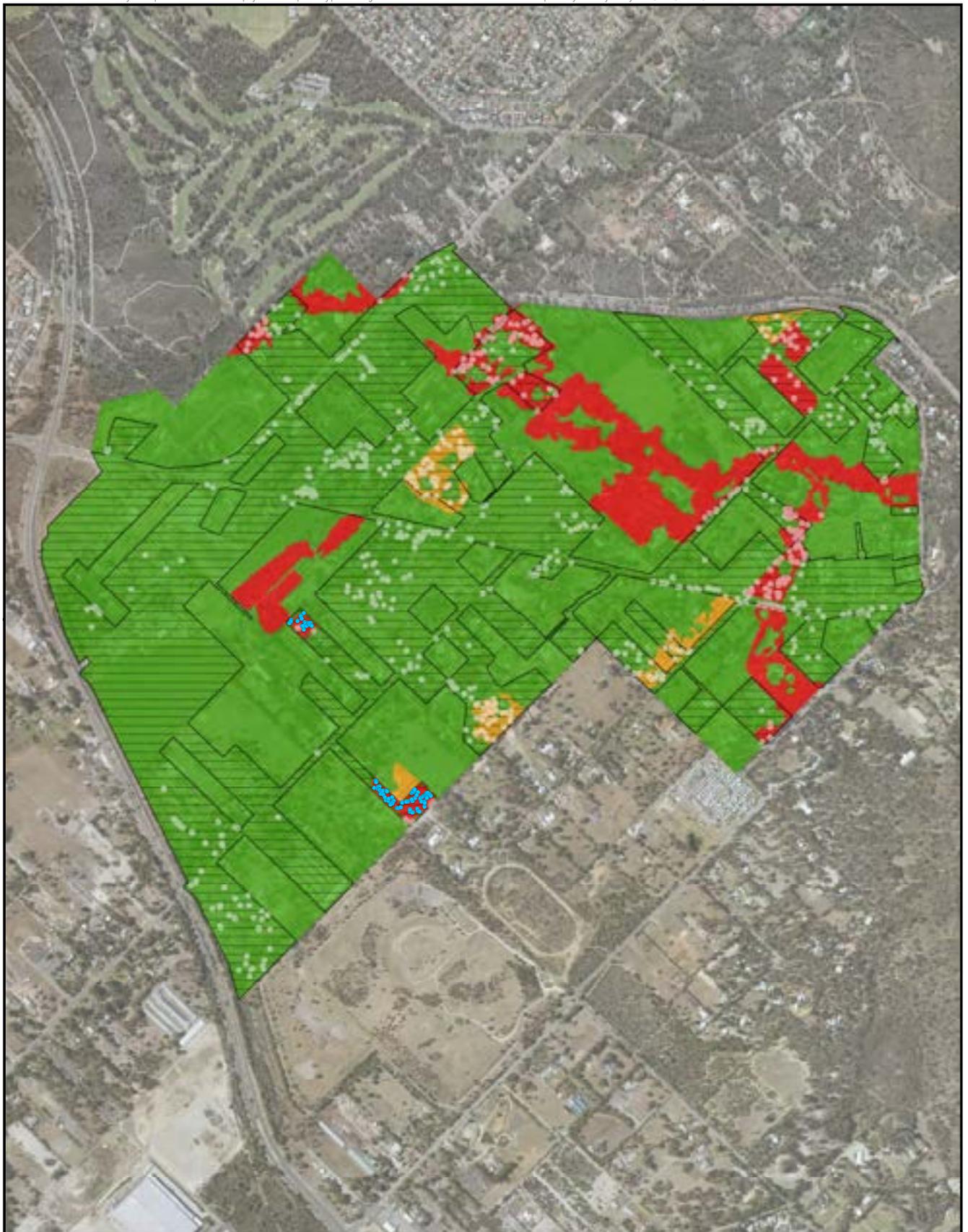
The EVA was undertaken for the entire Wattle Grove South survey area (Figure 15). This Figure shows the high, medium and low value areas. Evaluation for areas that were not surveyed was based on observations taken from outside the property and review of aerial photographs. The Environmental Values assessment for areas surveyed is presented in Figure 16.

The resultant values assessment map also depicts black cockatoo habitat trees (with a 10 m buffer) to ensure these valuable assets are captured. These buffer areas are not included as part of the EVA unless they form part of a dense collection or support remnant understorey as such because they reflect point data. It is recommended that all trees are retained wherever possible. Mature trees take decades to establish and as such should be considered high value throughout. It is likely that areas not surveyed would also support black cockatoo breeding habitat trees that are as yet undefined in the EVA.

The extent of areas captured in high, medium and low are presented in Table 31.

**Table 31 Categories for the environmental values assessment**

Category	Values	Area
High	<ul style="list-style-type: none"> <li>• Good connectivity and/or suitable size for maintaining ecological integrity</li> <li>• BC foraging and/or breeding trees</li> <li>• All populations of <i>C. undulatum</i> that were recorded during the survey</li> <li>• Incorporates all TECs with the exception of two patches that are &lt;0.2 ha which are captured as Medium</li> <li>• Includes 90% of areas mapped as “native vegetation” with exception of areas &lt;0.2 ha with poor connectivity.</li> </ul>	35.13 ha
Medium	<ul style="list-style-type: none"> <li>• Connects high value areas to adjacent high value areas or as ‘stepping stone’</li> <li>• Includes BC foraging and/or breeding</li> <li>• May include native vegetation (understorey) species</li> </ul>	6.88 ha
Low	<ul style="list-style-type: none"> <li>• Mostly cleared open areas or stands of trees over grassland</li> <li>• Includes planted gardens and hardscape</li> </ul>	301.36 ha



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0 100 200 300 400  
 Metres

Data sources:  
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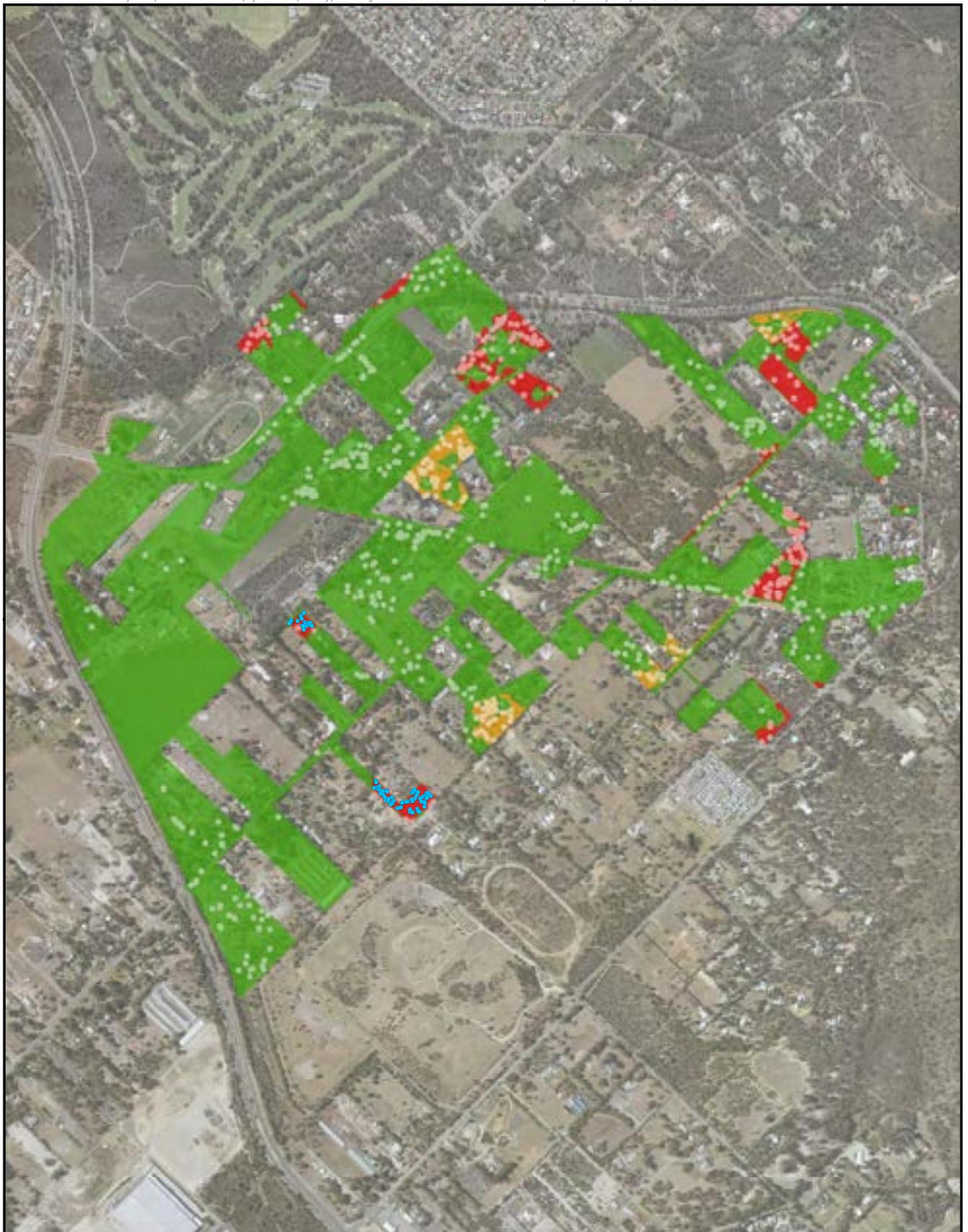
- LEGEND**
-  Survey Area
  -  High Value
  -  Medium Value
  -  Low Value
  -  Black Cockatoo Breeding Habitat
  -  *Conospermum undulatum* Locations

**Environmental Values –  
Extrapolated and Surveyed**

**CITY OF KALAMUNDA**

**WATTLE GROVE SOUTH  
ECOLOGICAL SURVEYS**

**Figure  
15**



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 Metres

Base Data: (c) Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2018) Geoscience Australia, Streetspro

- LEGEND**
- High Value
  - Medium Value
  - Low Value
  - Black Cockatoo Breeding Habitat
  - *Conospermum undulatum* Locations

**Environmental Values – Surveyed**

**CITY OF KALAMUNDA**  
 WATTLE GROVE SOUTH  
 ECOLOGICAL SURVEYS

Figure  
**16**

## 7.0 Conclusions

The significant ecological findings from the assessment of the survey area are outlined below:

- The EPBC TEC Banksia Woodlands of the SCP occurs in three patches, extending 2.41 ha.
- Three TECs and one PEC listed by DBCA were identified including;
  - WA TEC *C. calophylla-E. marginata* woodlands on sandy clay soils (SCP3b) – requires verification from DBCA, extending 1.71 ha across two patches
  - WA TEC *B. attenuata* and/or *E. marginata* woodlands of the eastern side of the SCP (SCP20b) – requires verification from DBCA extending 1.80 across three patches
  - WA TEC *Banksia attenuata* woodland over species rich dense shrublands (SCP20a) extending 0.94 ha at one location
  - WA PEC Banksia dominated woodlands of the SCP extending for 0.15 ha at one location.
- One Threatened flora species, *Conospermum undulatum* (Wavy-leaved Smokebush) was recorded on two properties comprising 95 individuals. These locations are not represented in the DBCA database records.
- Three conservation significant fauna species were recorded including the Forest Red-tailed Black Cockatoo *Calyptorhynchus banksii* (listed as Vulnerable under the EPBC Act and the BC Act), Carnaby's Cockatoo *Calyptorhynchus latirostris* (listed as Endangered under the EPBC Act and the BC Act) and the Quenda *Isoodon fusciventer* (listed as Priority 4 by DBCA).
- Six fauna habitats were mapped. The most common fauna habitat is the Scattered Trees habitat which may be utilised by conservation significant species including the Forest Red-tailed Black Cockatoo *Calyptorhynchus banksii* *naso*, Carnaby's Cockatoo *Calyptorhynchus latirostris* and Baudin's Cockatoo *Calyptorhynchus baudinii*, as well as by many of the common bird species in the area.
- The presence of 730 hollow-forming (generally native) breeding and potential breeding trees including 410 (56%) Marri *Corymbia calophylla*, 195 (27%) Jarrah *Eucalyptus marginata*, and 125 mixed Flooded Gum \**E. grandis*, Tuart *E. gomphocephala*, *E. todtiana*, *E. wandoo*, introduced species and stags (dead unidentifiable trees). Seventeen of the 730 trees contain a total of 26 potentially suitable hollows for breeding black cockatoos.
- A total of 69.39 ha of foraging habitat for Carnaby's Cockatoo. This includes 41.14 ha of Very High and High Quality foraging habitat which generally consisted of eucalypt and Banksia woodland and scattered mature eucalypts.
- A total of 59.53 ha of foraging habitat for the Forest Red-tailed Black Cockatoo. This includes 33.52 ha of Very High Quality foraging habitat which generally consists of eucalypt woodland containing breeding and potential breeding trees.
- A total of 69.39 ha of foraging habitat for Baudin's Cockatoo. This includes 41.14 ha of Very High and High Quality foraging habitat which generally consisted of eucalypt and Banksia woodland and scattered mature eucalypts.

The ecological assessments for the Wattle Grove project included significant access and completeness limitations. This report presents the results for a selection of private properties and public land where access was granted by private land owners. It is not a comprehensive assessment of ecological values of the Wattle Grove area with approximately 50% of landowners denying access.

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## Appendix C    Quadrat and relevé data sheets

## Quadrat and relevé data sheets

<b>Site: 6</b>	<b>Location: 116.00805 -32.01803</b>	<b>Date: 02-10-2019</b>
Type: Quadrat	Size: 10x10	Community: BaEpPf
Topography: flat	Soils: sand	Colour: Grey
Bare Ground: 20% litter	Fire: 10+	
Vegetation significance: EPBC TEC Banksia Woodlands of the SCP; WA TEC <i>B. attenuata</i> over species rich dense shrublands		
Condition: excellent weed encroachment		
Photo		



*	Taxon	Height cm	Foliage %
	<i>Burchardia congesta</i>	20	0.1
	<i>Conostylis setigera</i>	10	0.1
	<i>Dasypogon bromeliifolius</i>	10	0.1
	<i>Hemiphora bartlingii</i>	40	0.1
*	<i>Hypochaeris glabra</i>	1	0.1
	<i>Lomandra hermaphrodita</i>	20	0.1
	<i>Lomandra sonderi</i>	30	0.1
	<i>Melaleuca trichophylla</i>	30	0.1

*	Taxon	Height cm	Foliage %
	<i>Mesomelaena tetragona</i>	30	0.1
	<i>Persoonia angustiflora</i>	10	0.1
	<i>Stirlingia latifolia</i>	30	0.1
	<i>Stylidium amoenum</i>	3	0.1
	<i>Thysanotus patersonii</i>		0.1
	<i>Thysanotus thyrsoideus</i>	10	0.1
	<i>Trachymene pilosa</i>	5	0.1
	<i>Banksia dallanneyi</i>	10	0.2
	<i>Cassytha glabella</i>		0.2
	<i>Conospermum undulatum</i>	80	0.2
	<i>Hibbertia huegellii</i>	20	0.2
	<i>Philotheca spicata</i>	80	0.2

*	<i>Ursinia anthemoides</i>	10	0.2
*	<i>Gladiolus caryophyllaceus</i>	60	0.3
	<i>Isopogon autumnalis</i>	40	0.3
*	<i>Briza maxima</i>	30	0.5
	<i>Drosera porrecta</i>	10	0.5
*	<i>Ehrharta calycina</i>	80	0.5
	<i>Hovea trisperma</i>	30	0.5
	<i>Lomandra preissii</i>	40	0.5
	<i>Alexgeorgea nitens</i>	10	1
	<i>Hakea prostrata</i>	80	1
	<i>Scaevola repens</i> var. <i>repens</i>	5	1
	<i>Phlebocarya filifolia</i>	10	1
	<i>Schoenus pedicellatus</i>	40	1
	<i>Tetragia octandra</i>	20	1
	<i>Banksia armata</i> var. <i>armata</i>	70	2
	<i>Eremaea pauciflora</i> var. <i>pauciflora</i>	30	2
	<i>Hemiandra pungens</i>	10	2
	<i>Lambertia multiflora</i> var. <i>darlingensis</i>	100	2
	<i>Lyginia imberbis</i>	40	2
	<i>Xanthorrhoea preissii</i>	100	2
	<i>Patersonia occidentalis</i>	30	3
	<i>Tricoryne elatior</i>	20	4
	<i>Banksia attenuata</i>	600	5
	<i>Allocasuarina humilis</i>	150	8
	<i>Mesomelaena pseudostygia</i>	30	8

*	Taxon	Height cm	Foliage %
	<i>Hibbertia hypericoides</i>	50	10
	<i>Banksia menziesii</i>	600	
	<i>Gompholobium confertum</i>		
	<i>Lepidosperma leptostachyum</i>		
	<i>Nuytsia floribunda</i>		
	<i>Petrophile linearis</i>		
	<i>Stylidium schoenoides</i>		

Note: \* depicts an introduced (weed) species

<b>Site: 9</b>	<b>Location: 116.00003 -32.01200</b>	<b>Date: 03-10-2019</b>
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Type: Quadrat	Size: 10x10	Community: BmXpEc
Topography: flat	Soils: sand	Colour: Grey
Bare Ground: 20% litter	Fire: 10+	
Vegetation significance: None		
Condition: very good		



*	Taxon	Height cm	Foliage %
*	<i>Avena barbata</i>	30	0.1
	<i>Burchardia congesta</i>	20	0.1
	<i>Conostylis aculeata</i>	5	0.1
	<i>Dampiera alata</i>	10	0.1
	<i>Dampiera linearis</i>	20	0.1
*	<i>Gladiolus caryophyllaceus</i>	40	0.1
	<i>Hovea trisperma</i>	20	0.1
*	<i>Hypochaeris glabra</i>	1	0.1
	<i>Thysanotus patersonii</i>		0.1
	<i>Trachymene Pilosa</i>	5	0.1
	<i>Calectasia narragara</i>	20	0.2
	<i>Cyathochaeta avenacea</i>	40	0.2
	<i>Jacksonia floribunda</i>	20	0.2
	<i>Lyginia imberbis</i>	30	0.2
	<i>Dasypogon bromeliifolius</i>	10	0.5
	<i>Hemiandra pungens</i>	5	0.5
	<i>Mesomelaena tetragona</i>	30	0.5
	<i>Stirlingia latifolia</i>	40	0.5
	<i>Agonis flexuosa</i>	800	1
	<i>Allocasuarina fraseriana</i>	200	1
	<i>Allocasuarina humilis</i>	100	1
	<i>Austrostipa compressa</i>	40	1

*	<i>Briza maxima</i>	20	1
	<i>Hemiandra pungens</i>	10	1
	<i>Mesomelaena pseudostygia</i>	30	1
	<i>Patersonia occidentalis</i>	20	1
	<i>Scaevola repens</i> var. <i>repens</i>	5	1
	<i>Lambertia multiflora</i> var. <i>darlingensis</i>	100	1.5
	<i>Alexgeorgea nitens</i>	5	2
*	<i>Ursinia anthemoides</i>	10	2
	<i>Xanthorrhoea preissii</i>	80	2
	<i>Adenanthos cygnorum</i> subsp. <i>cygnorum</i>	300	3
	<i>Hibbertia hypericoides</i>	30	3
	<i>Banksia menziesii</i>	600	5
*	<i>Ehrharta calycina</i>	70	5
	<i>Eremaea pauciflora</i> var. <i>pauciflora</i>	30	10
	<i>Lomandra micrantha</i>		
	<i>Melaleuca systema</i>		

Note: \* depicts an introduced (weed) species

<b>Site: 13</b>	<b>Location: 116.00524 -32.01307</b>	<b>Date: 03-10-2019</b>
Type: Quadrat	Size: 10x10	Community: BaEpPf
Topography: Flat	Soils: Sand	Colour: Grey
Bare Ground: 20% litter	Fire: 10+	
Vegetation significance: EPBC TEC Banksia Woodlands of the SCP; WA TEC eastern <i>B. attenuata</i> and/or <i>E. marginata</i> woodlands		
Condition: excellent		



*	Taxon	Height cm	Foliage %
	<i>?Lobelia anceps</i>	20	0.1
	<i>Burchardia congesta</i>	40	0.1
	<i>Conostylis aurea</i>	10	0.1
	<i>Conostylis setigera</i>	15	0.1
	<i>Drosera porrecta</i>	15	0.1
*	<i>Gladiolus caryophyllaceus</i>	60	0.1
	<i>Gompholobium confertum</i>	20	0.1
	<i>Haemodorum laxum</i>	100	0.1

*	Taxon	Height cm	Foliage %
*	<i>Hypochaeris glabra</i>	1	0.1
	<i>Monotaxis grandiflora</i> var. <i>grandiflora</i>	20	0.1
	<i>Pericalymma ellipticum</i>	40	0.1
	<i>Petrophile linearis</i>	30	0.1
	<i>Tetragia octandra</i>	30	0.1
	<i>Trachymene pilosa</i>	2	0.1
	<i>Tricoryne elatior</i>	30	0.1
	<i>Agrostocrinum hirsutum</i>	50	0.2
	<i>Dampiera linearis</i>	20	0.2
	<i>Desmocladius fasciculatus</i>	10	0.2

	<i>Hovea trisperma</i>	20	0.2
	<i>Patersonia occidentalis</i>	30	0.2
	<i>Tetrarrhena laevis</i>	30	0.2
*	<i>Ursinia anthemoides</i>	10	0.2
	<i>Bossiaea eriocarpa</i>	30	0.5
*	<i>Briza maxima</i>	30	0.5
	<i>Conospermum undulatum</i>	130	0.5
	<i>Drosera erythrorhiza</i>	1	0.5
	<i>Lomandra sonderi</i>	30	0.5
	<i>Stirlingia latifolia</i>	40	0.5
	<i>Acanthocarpus preissii</i>	40	1
	<i>Lomandra drummondii</i>	30	1
	<i>Philotheca spicata</i>	60	1
	<i>Schoenus pedicellatus</i>	50	1
	<i>Banksia dallanneyi</i>	10	2
	<i>Melaleuca trichophylla</i>	50	2
	<i>Banksia attenuata</i>	300	3
	<i>Lepidosperma leptostachyum</i>	50	3
	<i>Lomandra micrantha</i>	20	3
	<i>Petrophile macrostachya</i>	80	3
	<i>Xanthorrhoea preissii</i>	100	3
	<i>Isopogon autumnalis</i>	60	6
	<i>Hibbertia hypericoides</i>	40	8
	<i>Eremaea pauciflora var. pauciflora</i>	50	12
	<i>Banksia menziesii</i>	600	15
	<i>Mesomelaena pseudostygia</i>	40	15
	<i>Eucalyptus todtiana</i>		

*	Taxon	Height cm	Foliage %
	<i>Adenanthos cygnorum subsp. cygnorum</i>		
	<i>Caladenia flava</i>		
	<i>Daviesia nudiflora subsp. nudiflora</i>		
*	<i>Eragrostis curvula</i>		
	<i>Hakea prostrata</i>		
	<i>Hemiphora bartlingii</i>		
	<i>Hybanthus calycinus</i>		
	<i>Jacksonia lehmannii</i>		
	<i>Lysinema pentapetalum</i>		
	<i>Petrophile seminuda</i>		
	<i>Scaevola repens var. repens</i>		
	<i>Thelymitra graminea</i>		

Note: \* depicts an introduced (weed) species

## JBS&G QUADRAT

<b>Site: Q01</b>	<b>Location: 116.003695, -32.012625</b>	<b>Date: 24-01-2022</b>
Type: Quadrat	Size: 10x10	Community: BaEpPf
Topography: flat	Soils: sand, sandy loam.	Soil Colour: Light brown gray
Bare Ground: 5% Litter 10%	Fire: 10+ years	
Vegetation significance: EPBC TEC Banksia Woodlands of the SCP; WA TEC eastern <i>B. attenuata</i> and/or <i>E. marginata</i> woodlands		
Condition: Excellent		



Scientific Name	Height	Cover
<i>Banksia menziesii</i>	500	15
<i>Banksia attenuata</i>	800	10
<i>Xanthorrhoea preissii</i>	120	3
<i>Xanthorrhoea gracilis</i>	110	3
<i>Stirlingia latifolia</i>	60	0.01
<i>Dasypogon bromeliifolius</i>	30	5
<i>Bossiaea eriocarpa</i>	50	0.001
<i>Melaleuca trichophylla</i>	55	0.01
<i>Mesomelaena pseudostygia</i>	50	2
<i>Petrophile macrostachya</i>	60	0.02
<i>Hibbertia hypericoides</i>	30	0.5
<i>Hemiophora bartlingii</i>	30	0.001
<i>Monotaxis grandiflora</i> subsp. <i>grandiflora</i>	25	0.001
<i>Lomandra sonderi</i>	30	0.001
<i>Isopogon autumnalis</i>	50	0.03
<i>Pimelia sulphurea</i>	45	0.005
<i>Patersonia occidentalis</i>	40	0.01
<i>Banksia dallanneyi</i> subsp. <i>dallanneyi</i> ?var. <i>mellicula</i>	25	0.025
<i>Lyginia imberbis</i>	60	0.001
<i>Trachymene pilosa</i>	10	0.001
<i>Hypochaeris glabra</i>	10	0.001

Scientific Name	Height	Cover
<i>Burchardia congesta</i>	65	0.005
<i>Hakea lissocarpha</i>	150	0.005
<i>Desmocladius fasciculatus</i>	15	0.1
<i>Conostylis setigera</i> subsp. <i>setigera</i>	20	0.001
<i>Gladiolus caryophyllaceus</i>	100	0.001
<i>Allocasuarina humilis</i>	60	0.25
<i>Lomandra nigricans</i>	45	0.001
<i>Petrophile rigida</i>	60	0.2
<i>Tetraria octandra</i>	80	5
<i>Hemiandra linearis</i>	30	1
<i>Philothea spicata</i>	60	0.01
<i>Conospermum undulatum</i>	120	0.5
<i>Eremaea pauciflora</i> var. <i>pauciflora</i>	35	2
<i>Haemodorum laxum</i>	35	0.001
<i>Xanthosia huegelii</i>	15	0.001
<i>Isopogon autumnalis</i>	50	1
<i>Drosera erythrorrhiza</i>	0	0.001
<i>Petrophile linearis</i>	60	0.01
<i>Scaevola repens</i> var. <i>repens</i>	20	0.2
<i>Gastrolobium linearifolium</i>	35	0.01
<i>Dampiera linearis</i>	25	0.001
<i>Desmocladius flexuosus</i>	20	0.001
<i>Lepidosperma leptostachyum</i>	45	0.001
<i>Conostylis setigera</i> subsp. <i>setigera</i>	20	0.001
<i>Stylidium carnosum</i>	5	0.001
<i>Chaetospora curvifolia</i>	20	0.001
<i>Stachystemon vermicularis</i>	80	0.001
<i>Melaleuca trichophylla</i>	30	0.01
<i>Hovea trisperma</i> var. <i>trisperma</i>	40	0.001
<i>Stylidium androsaceum</i>	10	0.001

Scientific Name	Height	Cover
<i>Drosera ?macrantha</i>	60	0.001
<i>Caladenia ?flava</i>	5	0.001
<i>Nuytsia floribunda</i>	1200	5
<i>Pinus pinaster</i>	1800	5
<i>Corymbia calophylla</i>	800	3
<i>Adenanthos cygnorum</i> subsp. <i>cygnorum</i>	300	5
<i>Xanthorrhoea preissii</i>	130	1.5
<i>Ehrharta calycina</i>	100	15
<i>Briza maxima</i> *	25	10
<i>Ursinia anthemoides</i>	20	0.5
<i>Hypochaeris glabra</i>	20	5
<i>Gladiolus caryophyllaceus</i> *	60	0.001
<i>Erodium botrys</i>	20	0.001
<i>Acacia saligna</i>	170	0.5
<i>Briza minor</i> *	20	0.001
<i>Eragrostis curvula</i> *	80	0.001

## JBS&G OBSERVATION POINT NOTES

<b>Relevé Number:</b> S1	<b>Project:</b> Wattle Grove
<b>Lot/Plan:</b> 804 / P059946	<b>Location:</b> 116.004815, -32.01172
Photo:	
	
<p>Site Description:            Area is cleared and contained *<i>Pinus pinaster</i>, <i>Corymbia calophylla</i> (marri) and <i>Nuytsia floribunda</i> (Western Australian Christmas tree) over <i>Adenanthos cygnorum</i>, <i>Xanthorrhoea preissii</i>, <i>Acacia saligna</i> and weeds.</p>	
Species noted	
Scientific Name	Common Name
* <i>Pinus pinaster</i>	Pine
<i>Corymbia calophylla</i>	Marri
<i>Adenanthos cygnorum</i>	Common Woolybush
<i>Xanthorrhoea preissii</i>	Grass Tree
<i>Acacia saligna</i>	Orange Wattle

<b>Relevé Number:</b> S2	<b>Project:</b> Wattle Grove
<b>Lot/Plan:</b> 804 / P059946	<b>Location:</b> 116.003652, -32.012589

Photo:



**Site Description:**

Predominantly cleared area., with scattered remnant tree and shrub species.

Species noted

Scientific Name

Common Name

*Allocasuarina sp.*

She-oak

*Corymbia calophylla*

Marri

*Adenanthos cygorum*

Common Woolybush

*Xanthorrhoea preissii*

Grass Tree

*Acacia saligna*

Orange Wattle

**Relevé Number:** S3

**Project:** Wattle Grove

**Lot/Plan:** 804 / P059946

**Location:** 116.004838, -32.011721

Photo:



**Site Description:**

Vegetation in Excellent condition consisting of Banksia woodland over a species rich native shrubland. The threatened plant *Conospermum undulatum* was observed in this community.

Species noted	
Scientific Name	Common Name
<i>Banksia menziesii</i>	Grass tree
<i>Xanthorrhoea preissii</i>	
<i>Conospermum undulatum</i>	

<b>Relevé Number:</b> S4	<b>Project:</b> Wattle Grove
<b>Lot/Plan:</b> 107 / D85261	<b>Location:</b> 116.000499, -32.016746
Photo:	



Site Description: Area completely degraded and has recently been partially cleared.	
Species noted	
Scientific Name	Common Name
<i>Eucalyptus marginata</i>	Jarrah
<i>Leptospermum laevigatum</i> *	Victorian tea tree

<b>Relevé Number:</b> S5	<b>Project:</b> Wattle Grove
<b>Lot/Plan:</b> 81 / D085279	<b>Location:</b> 116.006996, -32.013683
Photo:	



**Site Description:**

Site was cleared and grassed, with planted *Eucalyptus camaldulensis* (River red Gum) along the fence lines. The condition was Completely Degraded (Keighery, 1994).

Species noted	
Scientific Name	Common Name
<i>Eucalyptus camaldulensis</i>	River Red Gum

<b>Relevé Number: S6</b>	<b>Project: Wattle Grove</b>
<b>Lot/Plan: 12 / Do69292</b>	<b>Location: 115.998016, -32.012823</b>

Photo:



**Site Description:**

East of the easement is cleared with patches of *Melaleuca preissiana* (moonah) with an understory of *\*Zantedeschia aethiopica* (arum lily) and mixed grasses. The remainder of the lot is parkland cleared with occasional *Xanthorrhoea preissii* and planted Eucalypts, including the eastern states *\*E. robusta*. Condition is completely degraded.

Species noted	
Scientific Name	Common Name
<i>Melaleuca preissiana</i>	Moonah
<i>*Zantedeschia aethiopica</i>	Arum Lily
<i>Xanthorrhoea preissii</i>	Grass Tree
<i>*E. robusta</i>	Swmap Mahogany

<b>Relevé Number: S7</b>	<b>Project: Wattle Grove</b>
<b>Lot/Plan: 12/ D069292</b>	<b>Location: 115.99786, -32.013487</b>

Photo:



**Site Description:**

The western side of Lot 12 is an easement for a gas pipeline. Planted *Eucalyptus camaldulensis* line the lot boundary with a walkway beneath them. The remainder of the easement contains weeds and weedy grasses

Species noted	
Scientific Name	Common Name
<i>Eucalyptus camaldulensis</i>	River Red Gum

<b>Relevé Number:</b> S8	<b>Project:</b> Wattle Grove
<b>Lot/Plan:</b> 12 / D069292	<b>Location:</b> 1155.998315, -32.013406
Photo:	



**Site Description:**

East of the easement is cleared with patches of *Melaleuca preissiana* (moonah) with an understory of *\*Zantedeschia aethiopica* (arum lily) and mixed grasses. The remainder of the lot is parkland cleared with occasional *Xanthorrhoea preissii* and planted Eucalypts, including the eastern states *\*E. robusta*. Condition is completely degraded.

Species noted

Scientific Name

Common Name

*Melaleuca preissiana*

Moonah

*\*Zantedeschia aethiopica*

Arum Lily

*Xanthorrhoea preissii*

Grass Tree

*\*E. robusta*

Swmap Mahogany

<b>Relevé Number:</b> S9	<b>Project:</b> Wattle Grove
<b>Lot/Plan:</b> 13 / D069293	<b>Location:</b> 115.997889, -32.011637

Photo:



**Site Description:**

Lot 13 was parkland cleared and contained numerous introduced trees, including \**Melia azedarach* (Cape lilac), \**Erythrina xsykesii* (coral tree), \**Leptospermum laevigatum* (Victorian tea tree) and Eastern states ironbarks (\**Eucalyptus* sp.). One mature *Eucalyptus todtiana* was also present.

Species noted	Common Name
* <i>Melia azedarach</i>	Cape lilac
* <i>Erythrina xsykesii</i>	coral tree
* <i>Leptospermum laevigatum</i>	Victorian tea tree
* <i>Eucalyptus</i> sp.	Ironbark (Eastern States)
<i>Eucalyptus todtiana</i>	Pricklybark

<b>Relevé Number:</b> S10	<b>Project:</b> Wattle Grove
<b>Lot/Plan:</b> 12 / Do69292	<b>Location:</b> 115.998276, -32.013358
Photo: 	
<b>Site Description:</b> Area is completely degraded and has recently had trees removed.	
Species noted	
Scientific Name	Common Name

<b>Relevé Number:</b> S11	<b>Project:</b> Wattle Grove
<b>Lot/Plan:</b> 107 / D85261	<b>Location:</b> 116.000315, -32.01701

Photo:



**Site Description:**

Area completely degraded. Scattered native vegetation present. Recent clearing has taken place.

Species noted	
Scientific Name	Common Name
<i>Melaleuca preissiana</i>	Moonah
<i>Eucalyptus camaldulensis</i>	River Red Gum
<i>Corymbia calophylla</i>	Marri

<b>Relevé Number:</b> S12	<b>Project:</b> Wattle Grove
<b>Lot/Plan:</b> 13 / D069293	<b>Location:</b> 115.998806, -32.011927

Photo:



**Site Description:**

Area was parkland cleared and contained numerous introduced trees and one mature *Eucalyptus tottiana* was also present. Area completely degraded.

Species noted	
Scientific Name	Common Name
* <i>Melia azedarach</i>	Cape lilac
* <i>Erythrina xsykesii</i>	coral tree
* <i>Leptospermum laevigatum</i>	Victorian tea tree
* <i>Eucalyptus sp.</i>	Eastern states ironbarks
<i>Eucalyptus tottiana</i>	Pricklybark

<b>Relevé Number:</b> S13	<b>Project:</b> Wattle Grove
<b>Lot/Plan:</b> 12 / D069292	<b>Location:</b> 115.997607, -32.012858

Photo:



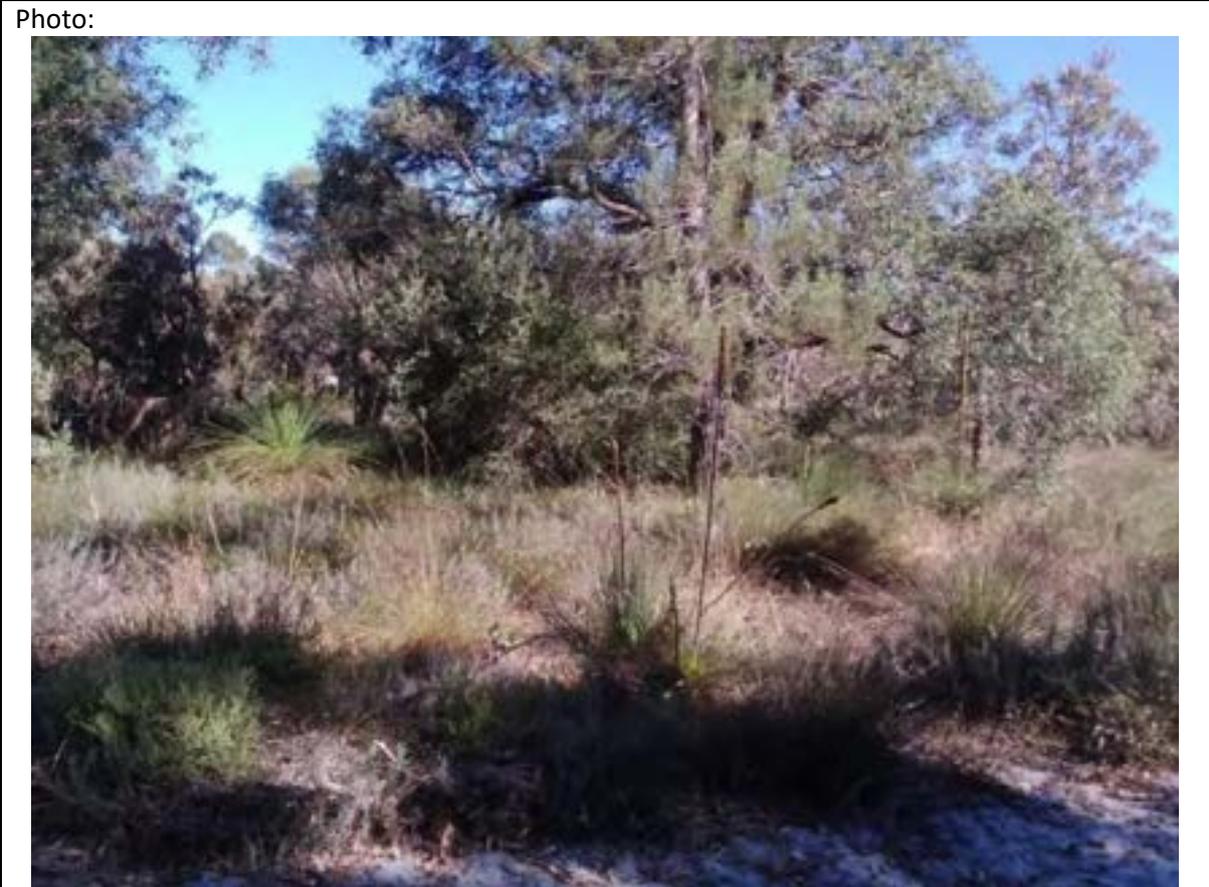
**Site Description:**

The western side of Lot 12 is an easement for a gas pipeline. Planted line of *Eucalyptus camaldulensis* occurs along the lot boundary with a walkway beneath them. The remainder of the easement contains weeds and weedy grasses. East of the easement is cleared with patches of *Melaleuca preissiana* with an understory of arum lily and grass. The remainder of the lot is parkland cleared with occasional *Xanthorrhoea preissii* and planted Eucalypt species, including the eastern states *\*E. robusta*.

Species noted	Common Name
<i>Eucalyptus camaldulensis</i>	River Red Gum
<i>Melaleuca preissiana</i>	Grass Tree
<i>Xanthorrhoea preissii</i>	Swamp Mahogany
<i>*E. robusta</i>	

<b>Relevé Number:</b> NO1	<b>Project:</b> Wattle Grove
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<b>Lot/Plan:</b> 210 / P003380	<b>Location:</b> 804 / P059946
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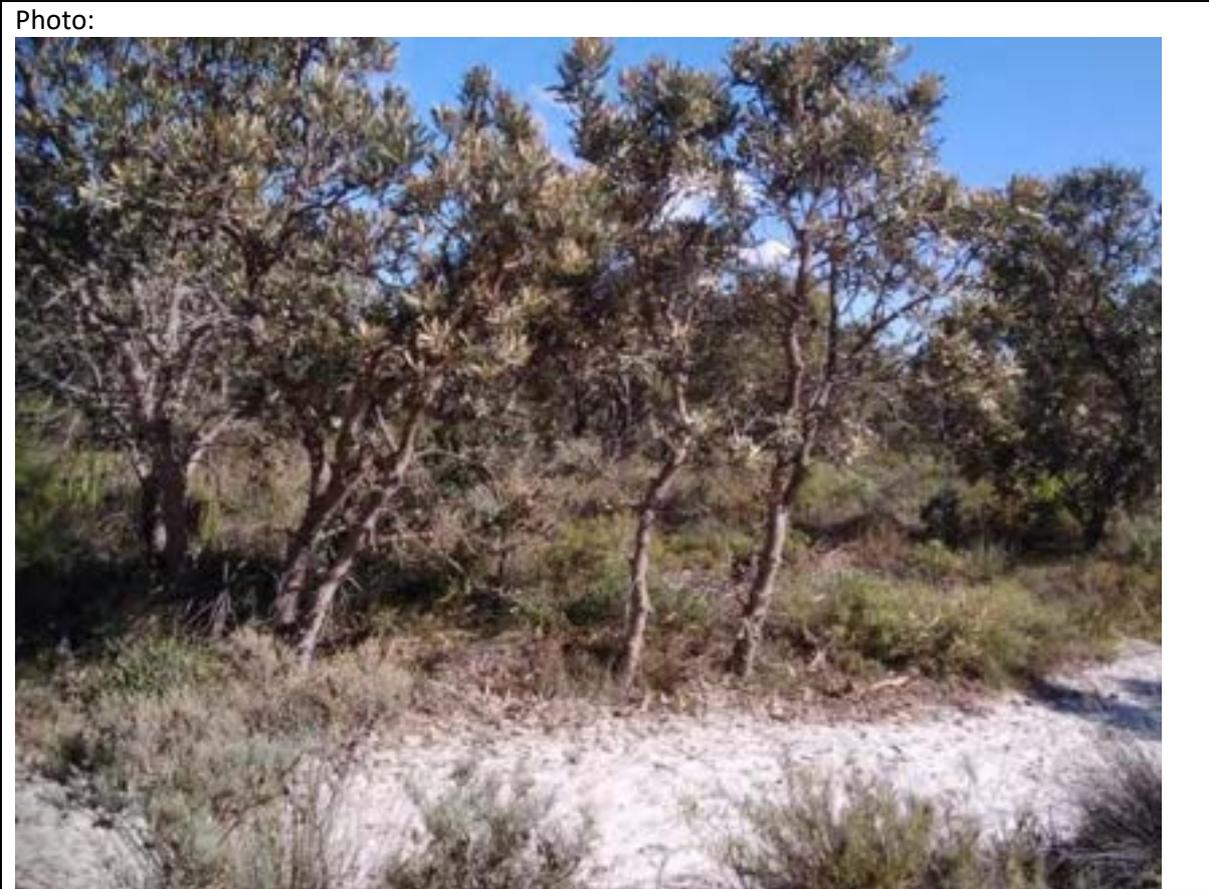
**Site Description:**  
 Lot 210 was observed through the fence from Lot 804. The vegetation was consistent with Lot 804's Banksia woodland, condition appeared Excellent and *Conospermum undulatum* (T) was visible through the fence.

Species noted	
Scientific Name	Common Name
<i>Conospermum undulatum</i>	
<i>Adenanthos cygnorum</i> subsp. <i>cygnorum</i>	
<i>Eremaea pauciflora</i> var. <i>pauciflora</i>	
<i>Anigozanthos manglesii</i> subsp. <i>manglesii</i>	
<i>Hibbertia hypericoides</i>	
<i>Isopogon autumnalis</i>	
<i>Eucalyptus marginata</i>	
<i>Banksia attenuata</i>	
<i>Allocasuarina fraseriana</i>	
<i>Gompholobium tomentosum</i>	
<i>Bossiaea eriocarpa</i>	
<i>Mesomelaena pseudostygia</i>	
<i>Ehrharta calycina</i>	
<i>Gastrolobium capitatum</i>	
<i>Scholtzia involucrate</i>	
<i>Ursinia anthemoides</i>	
<i>Wahlenbergia capensis</i>	

<i>Briza maxima</i> <i>Leptospermum laevigatum</i> <i>Acacia saligna</i> <i>Tetraria octandra</i> <i>Allocasuarina humilis</i> <i>Styphelia sp.</i> <i>Gladiolus caryophyllaceus</i> <i>Scaevola sp.</i> <i>Dasypogon bromeliifolius</i> <i>Petrophile seminuda</i> <i>Xanthorrhoea preissii</i> <i>Jacksonia floribunda</i>	
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<b>Relevé Number:</b> NO2	<b>Project:</b> Wattle Grove
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<b>Lot/Plan:</b> 804 / P059946	<b>Location:</b> 116.0043678, -32.0119128
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**Site Description:**  
 Open woodland of *Banksia menziesii*, *B attenuata*, *Euc todtiana* and *Allocasuarina fraseriana* over *Xanthorrhoea preissi*, *Allocasuarina humilis* and *Jacksonia* sp. Area is in excellent condition.

Species noted	
Scientific Name	Common Name
<i>Conospermum undulatum</i>	
<i>Adenanthos cygnorum</i> subsp. <i>cygnorum</i>	
<i>Eremaea pauciflora</i> var. <i>pauciflora</i>	
<i>Anigozanthos manglesii</i> subsp. <i>manglesii</i>	
<i>Hibbertia hypericoides</i>	
<i>Isopogon autumnalis</i>	
<i>Eucalyptus marginata</i>	
<i>Banksia attenuata</i>	
<i>Allocasuarina fraseriana</i>	
<i>Gompholobium tomentosum</i>	
<i>Bossiaea eriocarpa</i>	
<i>Mesomelaena pseudostygia</i>	
<i>Ehrharta calycina</i>	
<i>Gastrolobium capitatum</i>	
<i>Scholtzia involucrate</i>	
<i>Ursinia anthemoides</i>	
<i>Wahlenbergia capensis</i>	

<i>Briza maxima</i> <i>Leptospermum laevigatum</i> <i>Acacia saligna</i> <i>Tetraria octandra</i> <i>Allocasuarina humilis</i> <i>Styphelia sp.</i> <i>Gladiolus caryophyllaceus</i> <i>Scaevola sp.</i> <i>Dasypogon bromeliifolius</i> <i>Petrophile seminuda</i> <i>Xanthorrhoea preissii</i> <i>Jacksonia floribunda</i>	
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<b>Relevé Number:</b> NO3	<b>Project:</b> Wattle Grove
<b>Lot/Plan:</b> 804 / P059946	<b>Location:</b> 116.0051977, -32.0112041

Photo:



**Site Description:**

Open woodland of *Banksia menziesii*, *B attenuata*, *Euc todtiana* and *Allocasuarina fraseriana* over *Xanthorrhoea preissi*, *Allocasuarina humilis* and *Jacksonia sp.* Area is in excellent condition.

Species noted	
Scientific Name	Common Name
<i>Conospermum undulatum</i> <i>Adenanthos cygnorum subsp. cygnorum</i> <i>Eremaea pauciflora var. pauciflora</i> <i>Anigozanthos manglesii subsp. manglesii</i>	

*Hibbertia hypericoides*  
*Isopogon autumnalis*  
*Eucalyptus marginata*  
*Banksia attenuata*  
*Allocasuarina fraseriana*  
*Gompholobium tomentosum*  
*Bossiaea eriocarpa*  
*Mesomelaena pseudostygia*  
*Ehrharta calycina*  
*Gastrolobium capitatum*  
*Scholtzia involucrate*  
*Ursinia anthemoides*  
*Wahlenbergia capensis*  
*Briza maxima*  
*Leptospermum laevigatum*  
*Acacia saligna*  
*Tetraria octandra*  
*Allocasuarina humilis*  
*Styphelia sp.*  
*Gladiolus caryophyllaceus*  
*Scaevola sp.*  
*Dasypogon bromeliifolius*  
*Petrophile seminuda*  
*Xanthorrhoea preissii*  
*Jacksonia floribunda*

**Relevé Number:** NO4

**Project:** Wattle Grove

**Lot/Plan:** 804 / P059946

**Location:** 116.0051, -32.0115

Photo:



**Site Description:**

Degraded Banksia woodland with some foraging value. *Leptospermum laevigatum* (Victorian tea tree) common.

Species noted

Scientific Name

Common Name

*Conospermum undulatum*  
*Adenanthos cygnorum* subsp. *cygnorum*  
*Eremaea pauciflora* var. *pauciflora*  
*Anigozanthos manglesii* subsp. *manglesii*  
*Hibbertia hypericoides*  
*Isopogon autumnalis*  
*Eucalyptus marginata*  
*Banksia attenuata*  
*Allocasuarina fraseriana*  
*Gompholobium tomentosum*  
*Bossiaea eriocarpa*  
*Mesomelaena pseudostygia*  
*Ehrharta calycina*  
*Gastrolobium capitatum*  
*Scholtzia involucrate*  
*Ursinia anthemoides*  
*Wahlenbergia capensis*  
*Briza maxima*  
*Leptospermum laevigatum*  
*Acacia saligna*  
*Tetraria octandra*  
*Allocasuarina humilis*

*Styphelia* sp.  
*Gladiolus caryophyllaceus*  
*Scaevola* sp.  
*Dasypogon bromeliifolius*  
*Petrophile seminuda*  
*Xanthorrhoea preissii*  
*Jacksonia floribunda*

<b>Relevé Number:</b> NO5	<b>Project:</b> Wattle Grove
<b>Lot/Plan:</b> 801 / P059946	<b>Location:</b> 116.0053466, -32.0117235

Photo:



**Site Description:**

Degraded Banksia woodland with some foraging value. The introduced species *Leptospermum laevigatum* was found to be common in this area.

Species noted

Scientific Name

*Leptospermum laevigatum*  
*Banksia menziesii*  
*B attenuata*  
*Euc todtiana*

Common Name

<b>Relevé Number:</b> NO6	<b>Project:</b> Wattle Grove
<b>Lot/Plan:</b> 802 /P059946	<b>Location:</b> 116.0056487, -32.0117065

Photo:



<b>Site Description:</b>	
Area is completely degraded	
Species noted	
Scientific Name	Common Name
<i>Xanthorrhoea preissi</i>	Grass Tree
<i>Corymbia calophylla</i>	Marri

<b>Relevé Number:</b> NO7	<b>Project:</b> Wattle Grove
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<b>Lot/Plan:</b> 802 / P059946	<b>Location:</b> 116.0061534, -32.0114913
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Photo:



**Site Description:**  
Landscaping around a dwelling. Area is completely degraded.

Species noted	
Scientific Name	Common Name

<b>Relevé Number:</b> NO8	<b>Project:</b> Wattle Grove
<b>Lot/Plan:</b> 802 / P059946	<b>Location:</b> 116.0072796, -32.0105869

Photo:



**Site Description:**

This site has been extensively cleared of vegetation. Completely degraded but with scattered tree species.

Species noted	
Scientific Name	Common Name
<i>Xanthorrhoea preissi</i>	Grass Tree
<i>Corymbia calophylla</i>	Marri

<b>Relevé Number:</b> NO9	<b>Project:</b> Wattle Grove
<b>Lot/Plan:</b> 801 / P059946	<b>Location:</b> 116.0062489, -32.0107514

Photo:



**Site Description:**

Completely degraded. Area has been historically landscaped and mown. This property is a significant source of weeds invading remnant vegetation on adjacent Lot 210. Lot 801 contained bamboo, Victorian tea tree, common fig, eastern states bottle brush species, Brazilian pepper tree, Flinders Range wattle, Cootamundra wattle and pines. Two old growth Jarrah were present, with a DBH of approximately 1000 mm.

Species noted	
Scientific Name	Common Name
* <i>Poa sp.</i>	Bamboo
* <i>Leptospermum laevigatum</i>	Victorian Teatree
* <i>Acacia iteaphylla</i>	Flinders Ranges Wattle
* <i>Acacia baileyana</i>	Cootamundra Wattle
* <i>Pinus sp.</i>	Pine

<b>Relevé Number:</b> NO10	<b>Project:</b> Wattle Grove
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<b>Lot/Plan:</b> 801 / P059946	<b>Location:</b> 116.0062489, -32.0107514
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Photo:



**Site Description:**  
Completely degraded. Area has been historically landscaped and mown.

Species noted	
Scientific Name	Common Name
* <i>Poa sp.</i>	Bamboo
* <i>Leptospermum laevigatum</i>	Victorian Teatree
* <i>Acacia iteaphylla</i>	Flinders Ranges Wattle
* <i>Acacia baileyana</i>	Cootamundra Wattle
* <i>Pinus sp.</i>	Pine

<b>Relevé Number:</b> ATT01	<b>Project:</b> Wattle Grove
<b>Lot Plan:</b> 12 / D069292	<b>Location:</b> 115.998155, -32.013885

Photo:



**Site Description:**

This property has been substantially cleared and has been maintained for residential/garden purposes. Scattered trees are present.

Species noted	
Scientific Name	Common Name
<i>Eucalyptus marginata</i>	Jarrah

<b>Relevé Number:</b> ATT02	<b>Project:</b> Wattle Grove
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<b>Lot/Plan:</b> 12 / D069292	<b>Location:</b> 115.99767, -32.012668
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**Site Description:**

Species noted	
Scientific Name	Common Name
<i>Eucalyptus camaldulensis</i>	River Red Gum
<i>Eucalyptus marginata</i>	Jarrah

<b>Relevé Number:</b> ATT03	<b>Project:</b> Wattle Grove
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<b>Lot/Plan:</b> 101 / D072046	<b>Location:</b> 116.005135, -32.02092
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**Site Description:**  
Disturbed area with scattered Eucalypt trees remaining. Area appears to be sporadically maintained and affected by the dumping of rubbish.

Species noted	
Scientific Name	Common Name
<i>Eucalyptus marginata</i>	Jarrah

<b>Relevé Number:</b> ATT04	<b>Project:</b> Wattle Grove
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<b>Lot/Plan:</b> 100 / D072046	<b>Location:</b> 116.004757, -32.020907
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**Site Description:**  
Disturbed area with scattered Eucalypt trees. Area appears to be continuously maintained.

Species noted	
Scientific Name	Common Name

**Relevé Number:** ATT05 **Project:** Wattle Grove

**Lot/Plan:** 21 / D080126 **Location:** 116.11642, -32.011233



**Site Description:**  
This property has been extensively cleared. Scattered Eucalyptus trees are present. Access to this property could not be obtained. Lot 21 did not contain any native vegetation other than one large tuart (*Eucalyptus gomphocephala*). Several eastern states Eucalypts (*\*Eucalyptus grandis* and *\*E. botryoides*) on the property would have roosting or foraging value for black cockatoos and were of greater than 500 mm DBH.

Species	
Scientific Name	Common Name
<i>Eucalyptus gomphocephala</i>	Tuart
<i>*Eucalyptus grandis</i>	Flooded Gum (Eastern States Species)
<i>*E. botryoides</i>	Bangalay (Eastern States Species)

Relevé Number:6	Project: Wattle Grove
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Property Lot/Plan: 4 / P061512	Location: 116.009968, -32.012962
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Site Description:  
Lot 4 did not contain any native vegetation other than one large jarrah (*Eucalyptus marginata*) of approximately 400 mm DBH. One lemon scented gum (*\*Corymbia citriodora*) would have roosting or foraging value for black cockatoos and was of greater than 500 mm DBH.

Species noted	
Scientific Name	Common Name
<i>*Corymbia citriodora</i>	Lemon Scented Gum (Eastern States Species)
<i>Eucalyptus marginata</i>	Jarrah

<b>Relevé Number:</b> ATT07	<b>Project:</b> Wattle Grove
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<b>Lot/Plan:</b> 54 / D075466	<b>Location:</b> 116.00453, -32.017372
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**Site Description:**  
Completely degraded site, used for horse grazing. Scattered trees present.

Species noted	
Scientific Name	Common Name

<b>Relevé Number:</b> ATT08	<b>Project:</b> Wattle Grove
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<b>Lot/Plan:</b> 55 / D075466	<b>Location:</b> 116.002873, -32.015337
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**Site Description:**  
Area is completely degraded and has been used for the grazing of livestock.

Species noted	
Scientific Name	Common Name

**Relevé Number:** ATT9 **Project:** Wattle Grove

**Lot/Plan:** 3 / D089357

**Location:** 116.002167, -32.009819

Photo:



**Site Description:**

Area of Banksia woodland in excellent condition.

Species noted

Scientific Name

*Leptospermum laevigatum*

*Banksia menziesii*

*B. attenuata*

*Euc. totiana*

Common Name

Victorian tea tree

Firewood banksia

Candlestick banksia

Pricklybark

<b>Relevé Number:</b> ATT10	<b>Project:</b> Wattle Grove
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<b>Lot/Plan:</b> 2 / D020390	<b>Location:</b> 116.008209, -32.016949
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**Site Description:**  
Section of property has been disturbed with mowing activities. This has degraded the condition of this area of vegetation.

Species noted	
Scientific Name	Common Name
<i>Banksia menziesii</i>	Firewood banksia
<i>B attenuata</i>	Candlestick banksia
<i>Xanthorrea pressei</i>	Grass tree

<b>Relevé Number:</b> ATT11	<b>Project:</b> Wattle Grove
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<b>Lot/Plan:</b> 3 / D089357	<b>Location:</b> 116.002153, -32.009827
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Photo:



**Site Description:**

Property is completely degraded with disturbance associated with mowing activities.

Species noted	
Scientific Name	Common Name

<b>Relevé Number:</b> ATT12	<b>Project:</b> Wattle Grove
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<b>Lot/Plan:</b> 3 / D024545	<b>Location:</b> 116.006407, -32.012785
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**Site Description:**  
Area completely degraded. Area dominated by mown lawns and scattered landscaping trees.

Species noted	
Scientific Name	Common Name

<b>Relevé Number:</b> ATT13	<b>Project:</b> Wattle Grove
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<b>Lot/Plan:</b>	<b>Location:</b> 115.997068, -32.010630
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Photo:

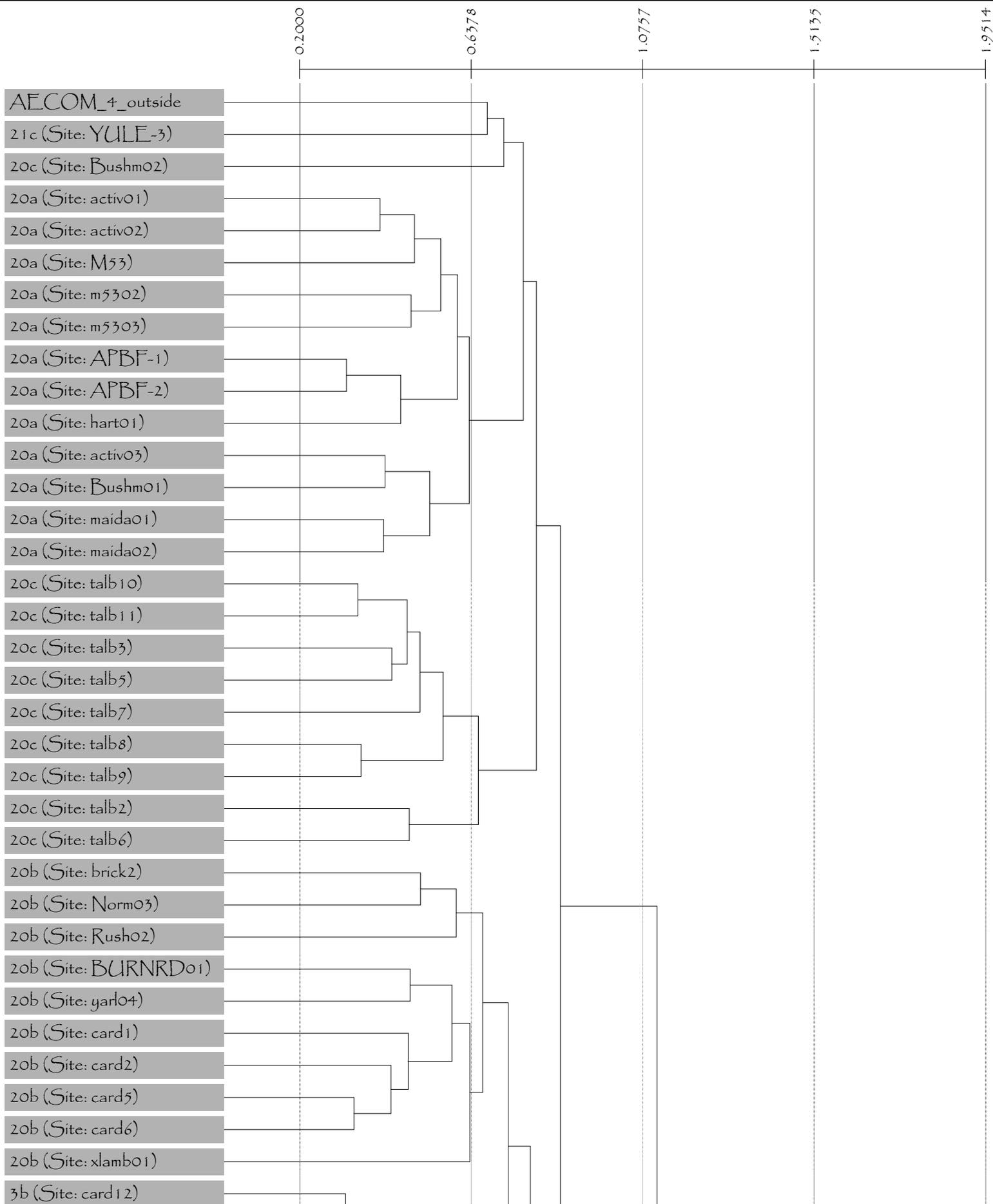


**Site Description:**  
Completely degraded area, mown and maintained as clear. Photo looking west toward wetland area.

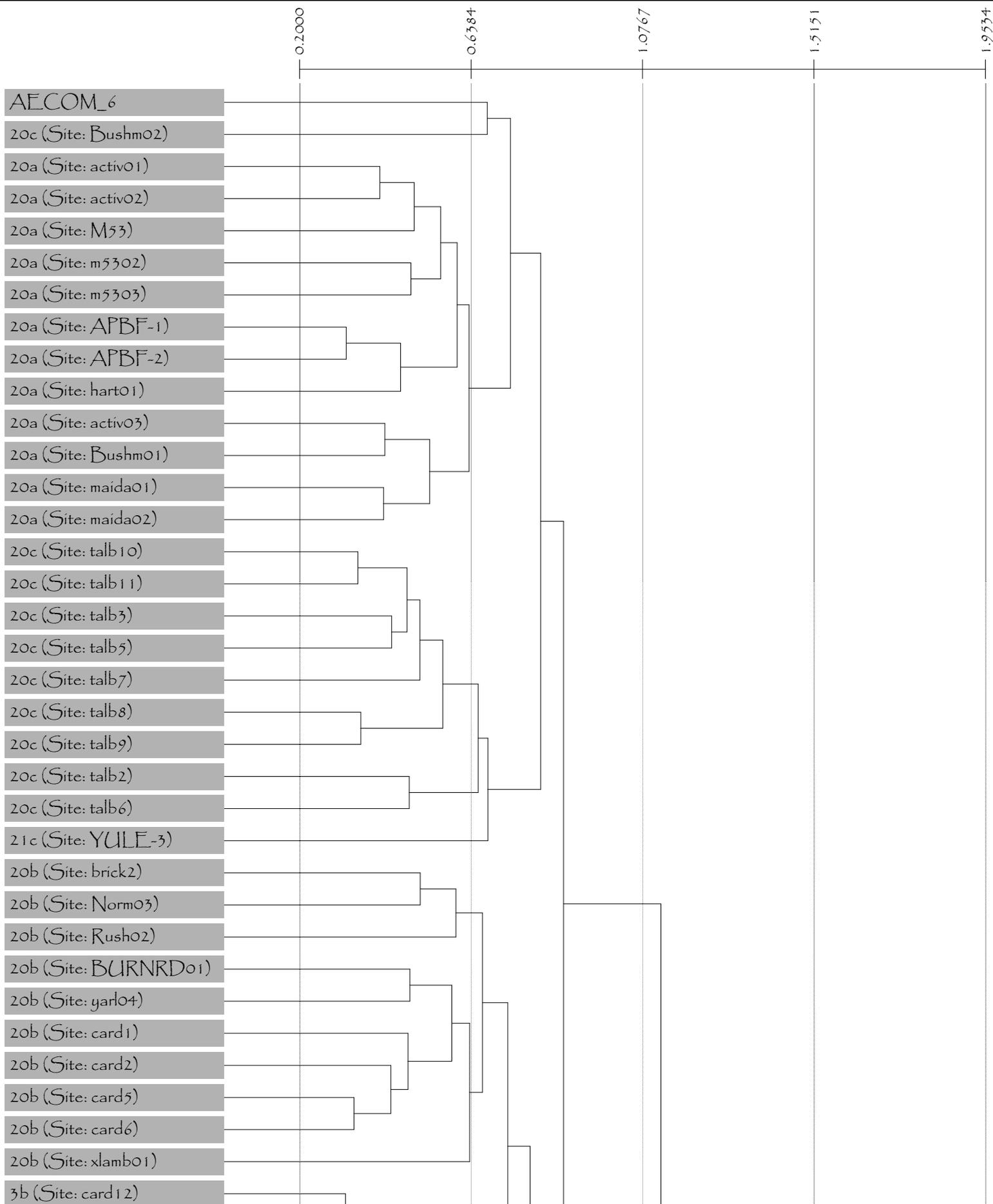
Species noted	
Scientific Name	Common Name
Poa sp.	Various Grasses

## **Appendix D Floristic Community Type Analysis 2023 (PATN results)**

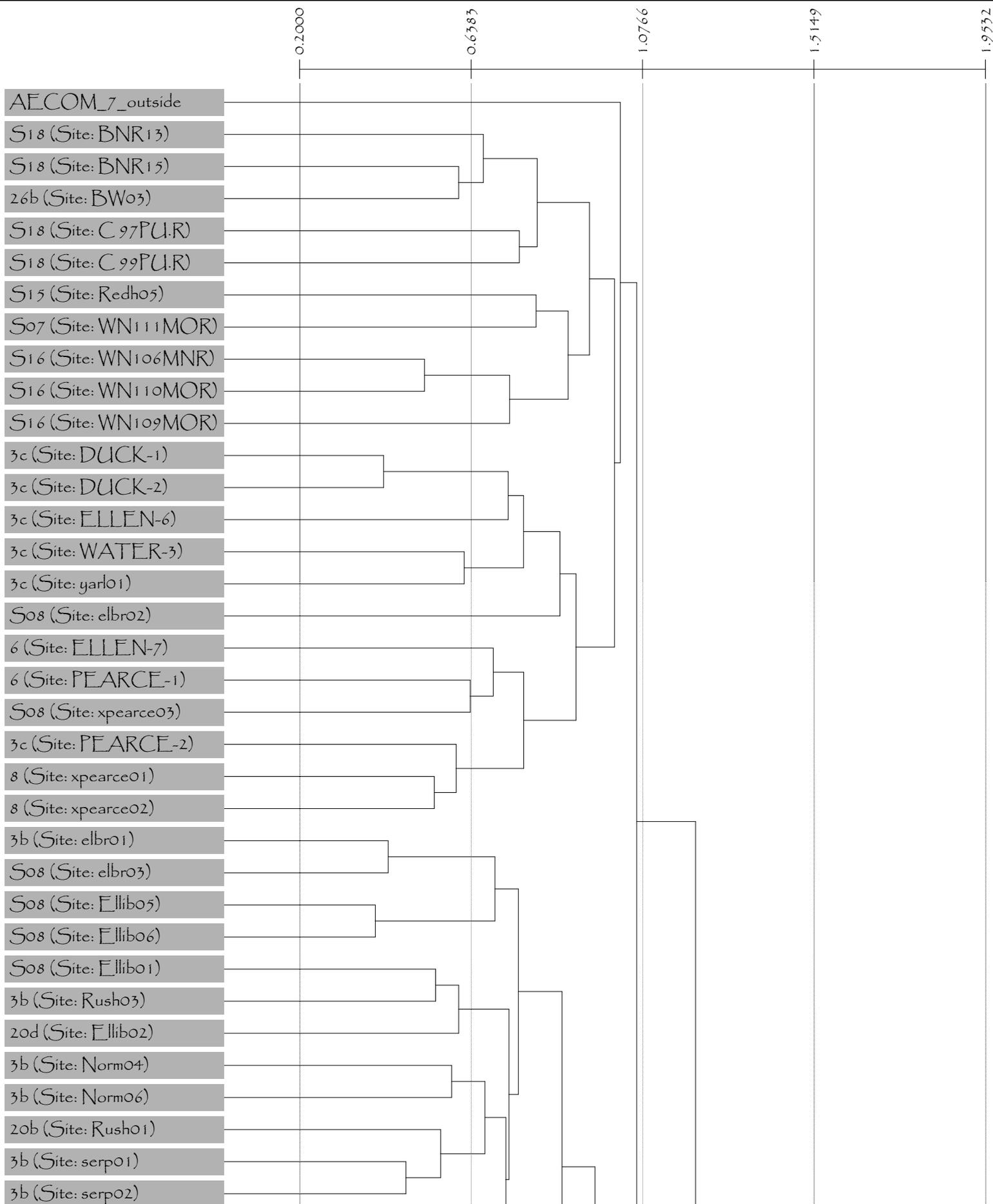
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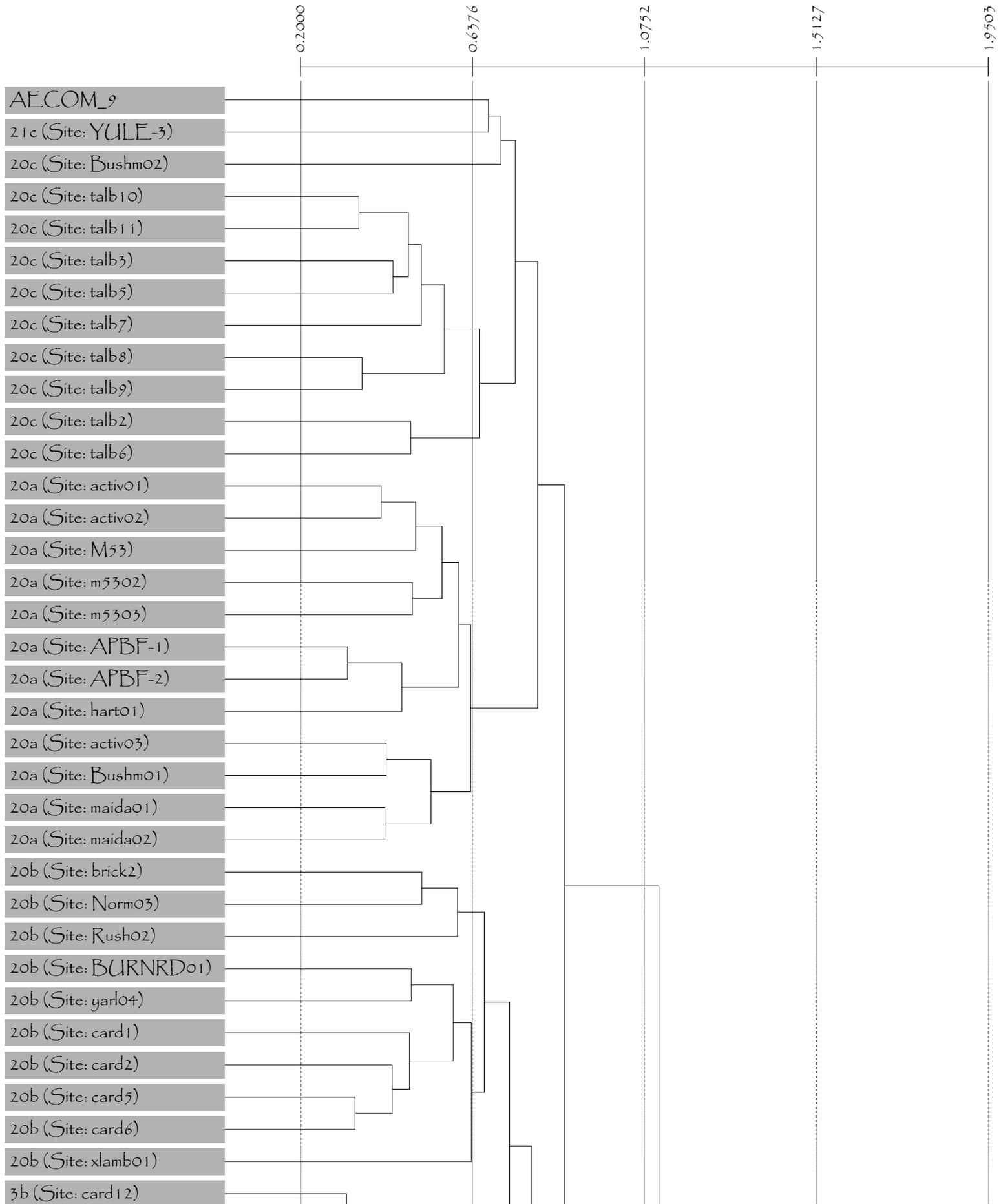
# Column Fusion Dendrogram



# Column Fusion Dendrogram



# Column Fusion Dendrogram



Source Table Name:

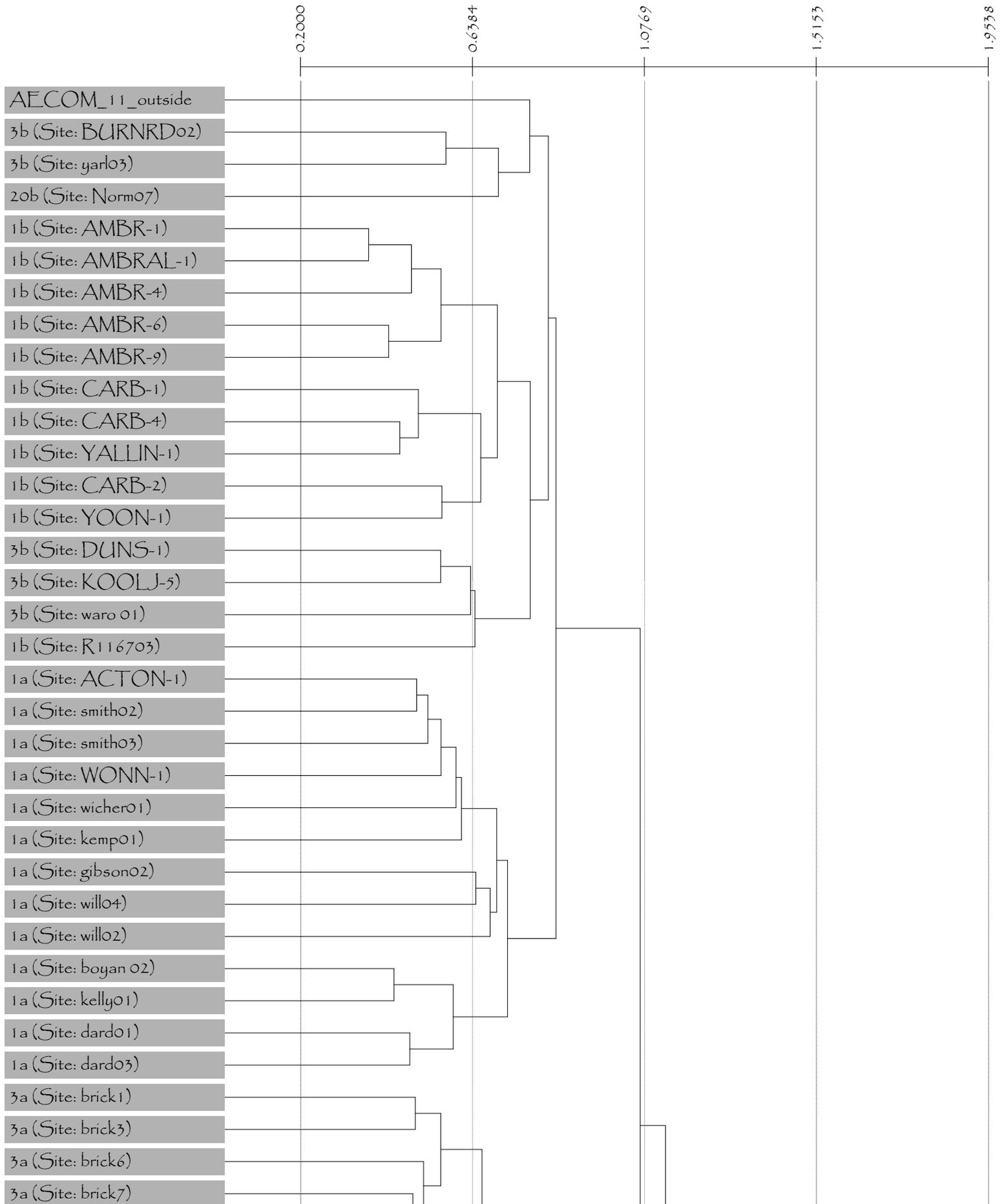
Derived From Association of type: Bray & Curtis (Columns)

Fusion Type: Flexible UPGMA Beta = -0.10

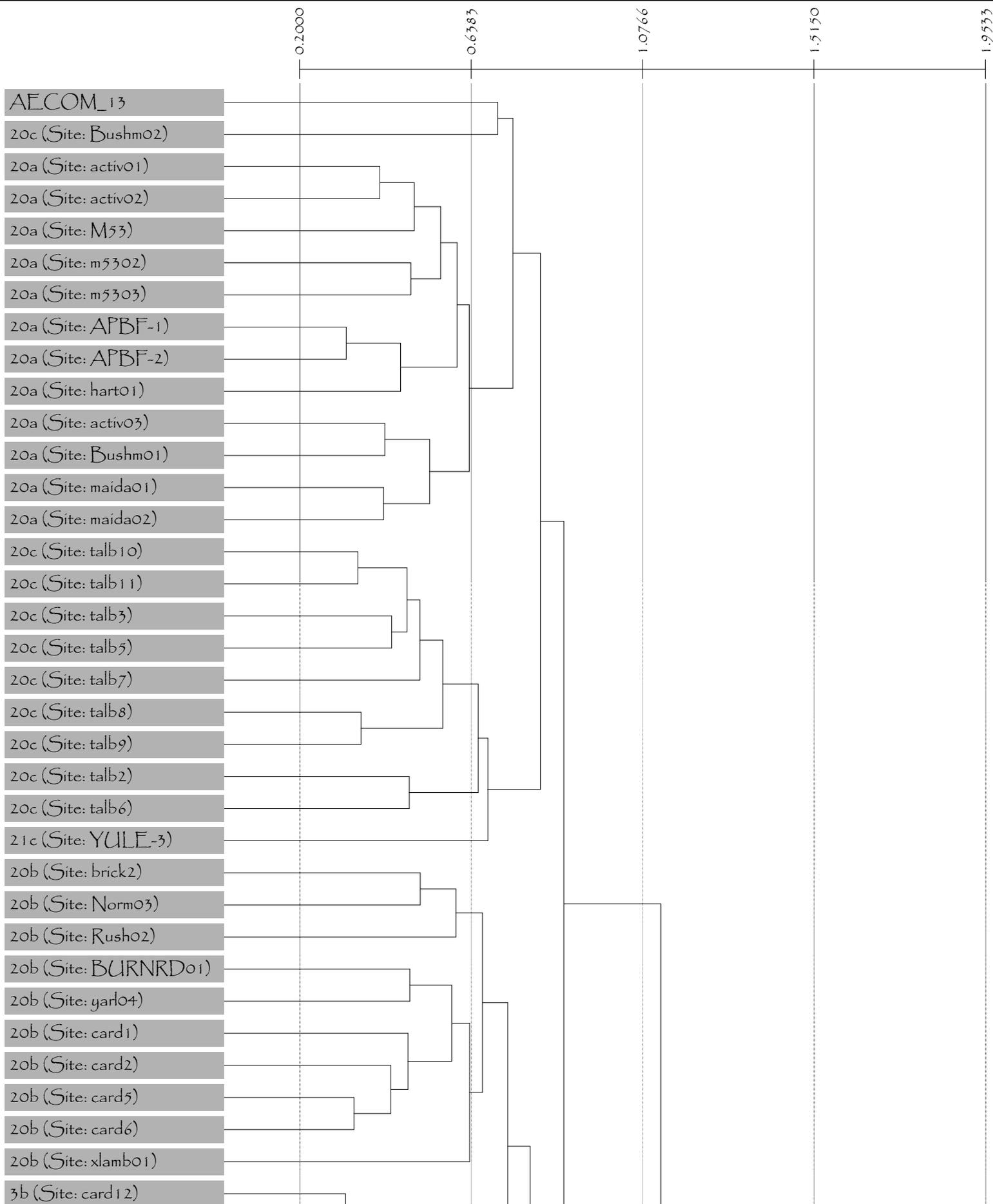
Created: 12:47:29, March 20, 2023

Groups	First Object	Second Object	New Object	Level	Stress	Diff
0	S13 (Site: SW02) (852)	+ S13 (Site: SW02) (852)	=GP(852)-	0.200	0.200	
1	29b (Site: NWIL-1) (682)	+ 29b (Site: NWIL-1) (682)	=GP(682)-	0.205	0.005	
2	23b (Site: MILT-7) (554)	+ 23b (Site: MILT-7) (554)	=GP(554)-	0.232	0.027	
3	S11 (Site: M104) (527)	+ S11 (Site: M104) (527)	=GP(527)-	0.234	0.002	
4	S14 (Site: M115) (538)	+ S14 (Site: M115) (538)	=GP(538)-	0.238	0.004	
5	23a (Site: YULE-1) (1079)	+ 23a (Site: YULE-1) (1079)	=GP(1079)-	0.246	0.008	
6	27 (Site: YALG-4) (1034)	+ 27 (Site: YALG-4) (1034)	=GP(1034)-	0.262	0.016	
7	23b (Site: MNP01) (560)	+ 23b (Site: MNP01) (560)	=GP(560)-	0.264	0.002	
8	S11 (Site: SW08) (858)	+ S11 (Site: SW08) (858)	=GP(858)-	0.269	0.005	
9	23b (Site: ELE08) (279)	+ 23b (Site: ELE08) (279)	=GP(279)-	0.277	0.008	
10	23b (Site: MP04) (584)	+ 23b (Site: MP04) (584)	=GP(584)-	0.277	0.000	
11	27 (Site: YALG-3) (1033)	+ 27 (Site: YALG-3) (1033)	=GP(1033)-	0.282	0.005	
12	4 (Site: MP03) (583)	+ 4 (Site: MP03) (583)	=GP(583)-	0.286	0.004	
13	20a (Site: KOON-1) (450)	+ 20a (Site: KOON-1) (450)	=GP(450)-	0.287	0.001	
14	S09 (Site: MOOR01) (569)	+ S09 (Site: MOOR01) (569)	=GP(569)-	0.289	0.005	
15	23a (Site: gosn02) (366)	+ 23a (Site: gosn02) (366)	=GP(366)-	0.295	0.006	
16	23a (Site: Light01) (465)	+ 23a (Site: Light01) (465)	=GP(465)-	0.296	0.001	
17	S13 (Site: M111) (534)	+ S13 (Site: M111) (534)	=GP(534)-	0.300	0.004	
18	23b (Site: ELDO-1) (271)	+ 23b (Site: ELDO-1) (271)	=GP(271)-	0.301	0.001	
19	23a (Site: WARB-1) (919)	+ 23a (Site: WARB-1) (919)	=GP(919)-	0.301	0.000	
20	5 (Site: low09a) (475)	+ 5 (Site: low09a) (475)	=GP(475)-	0.304	0.003	
21	23a (Site: kailis02) (430)	+ 23a (Site: kailis02) (430)	=GP(430)-	0.305	0.001	
22	23b (Site: ELE01) (272)	+ 23b (Site: ELE01) (272)	=GP(272)-	0.305	0.000	
23	23b (Site: ME1A-6) (509)	+ 23b (Site: ME1A-6) (509)	=GP(509)-	0.309	0.004	
24	21b (Site: MANEA-3) (498)	+ 21b (Site: MANEA-3) (498)	=GP(498)-	0.309	0.000	
25	S11 (Site: SW08) (858)	+ S11 (Site: SW08) (858)	=GP(858)-	0.315	0.006	
26	3b (Site: card12) (201)	+ 3b (Site: card12) (201)	=GP(201)-	0.317	0.002	

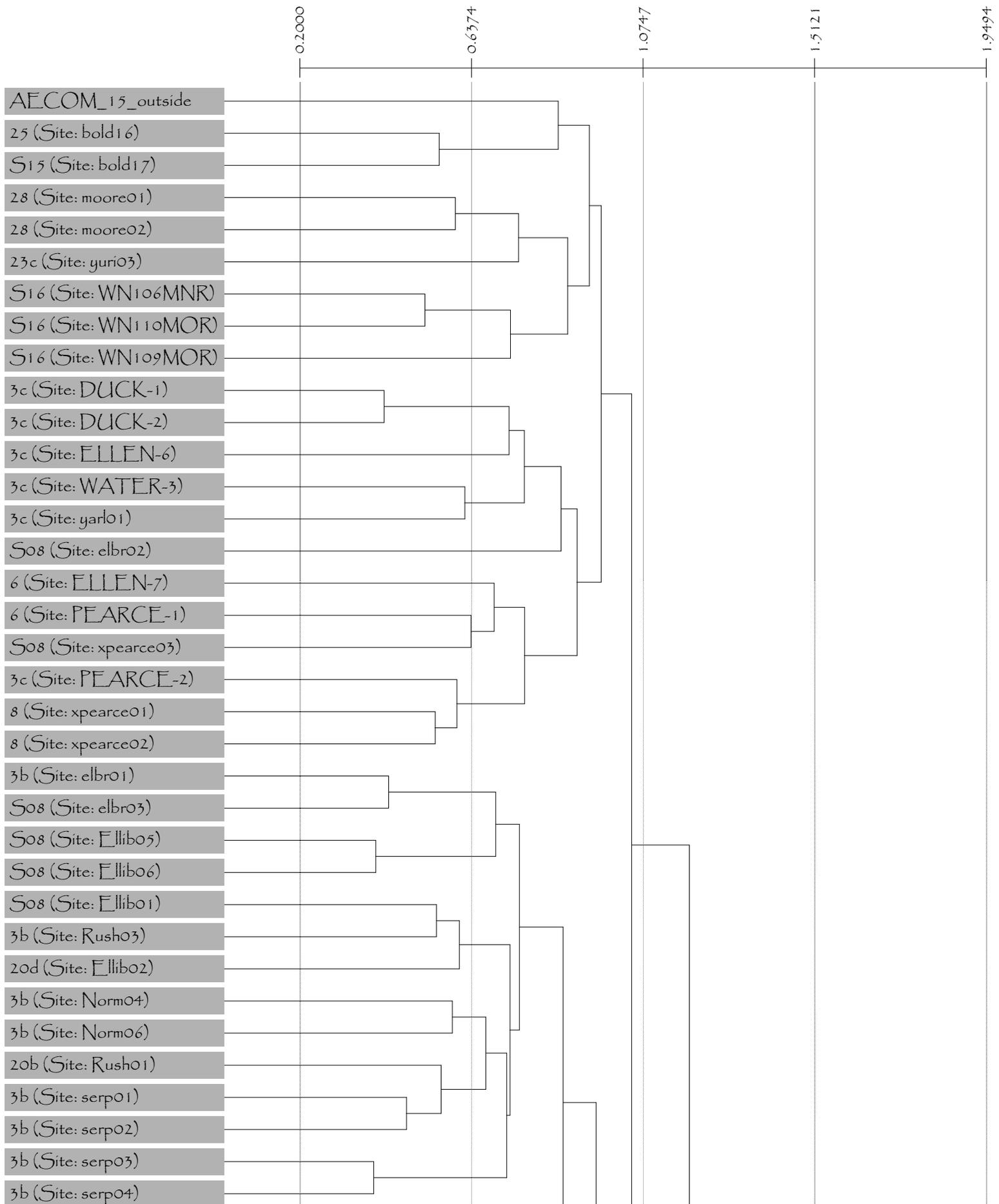
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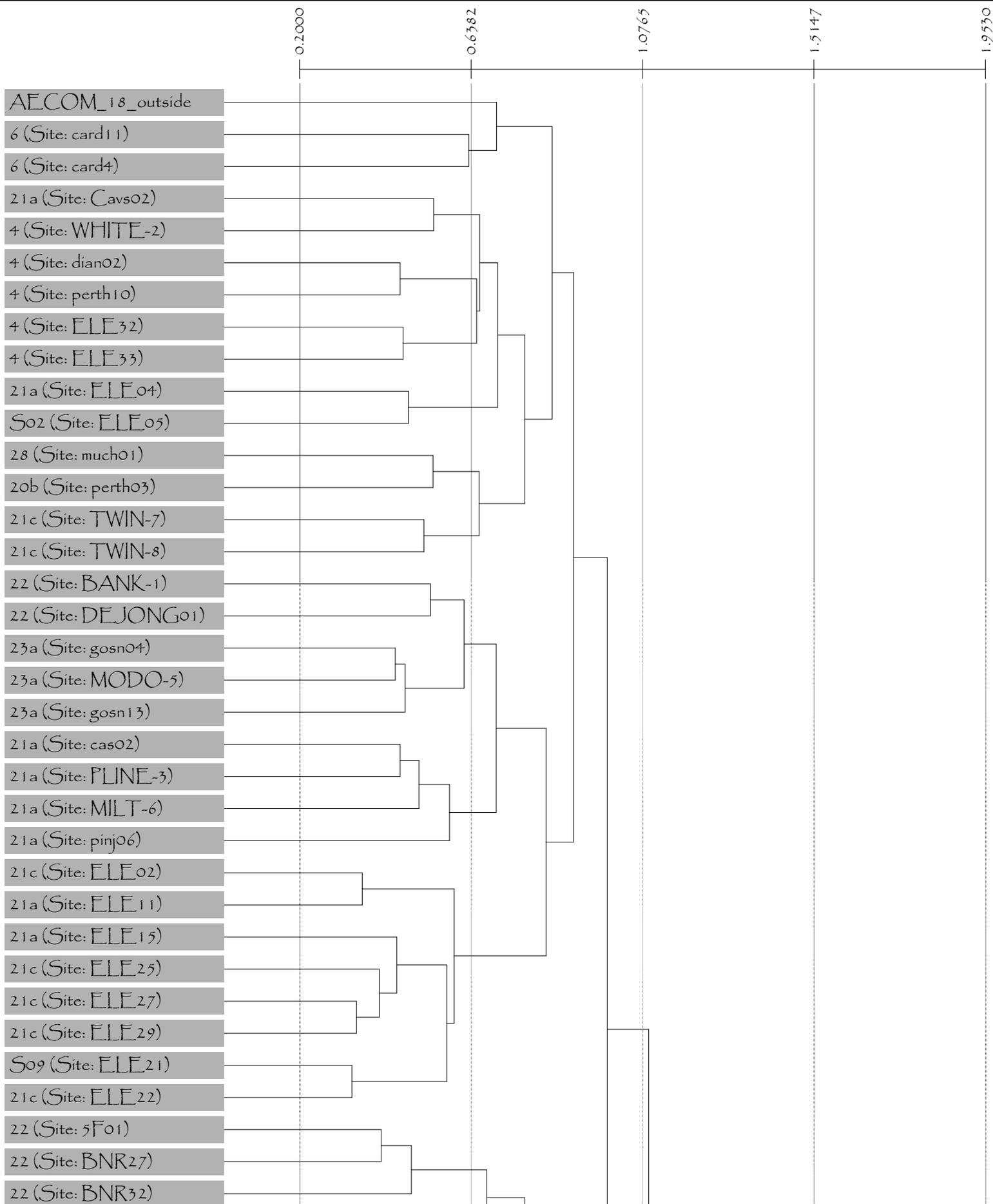
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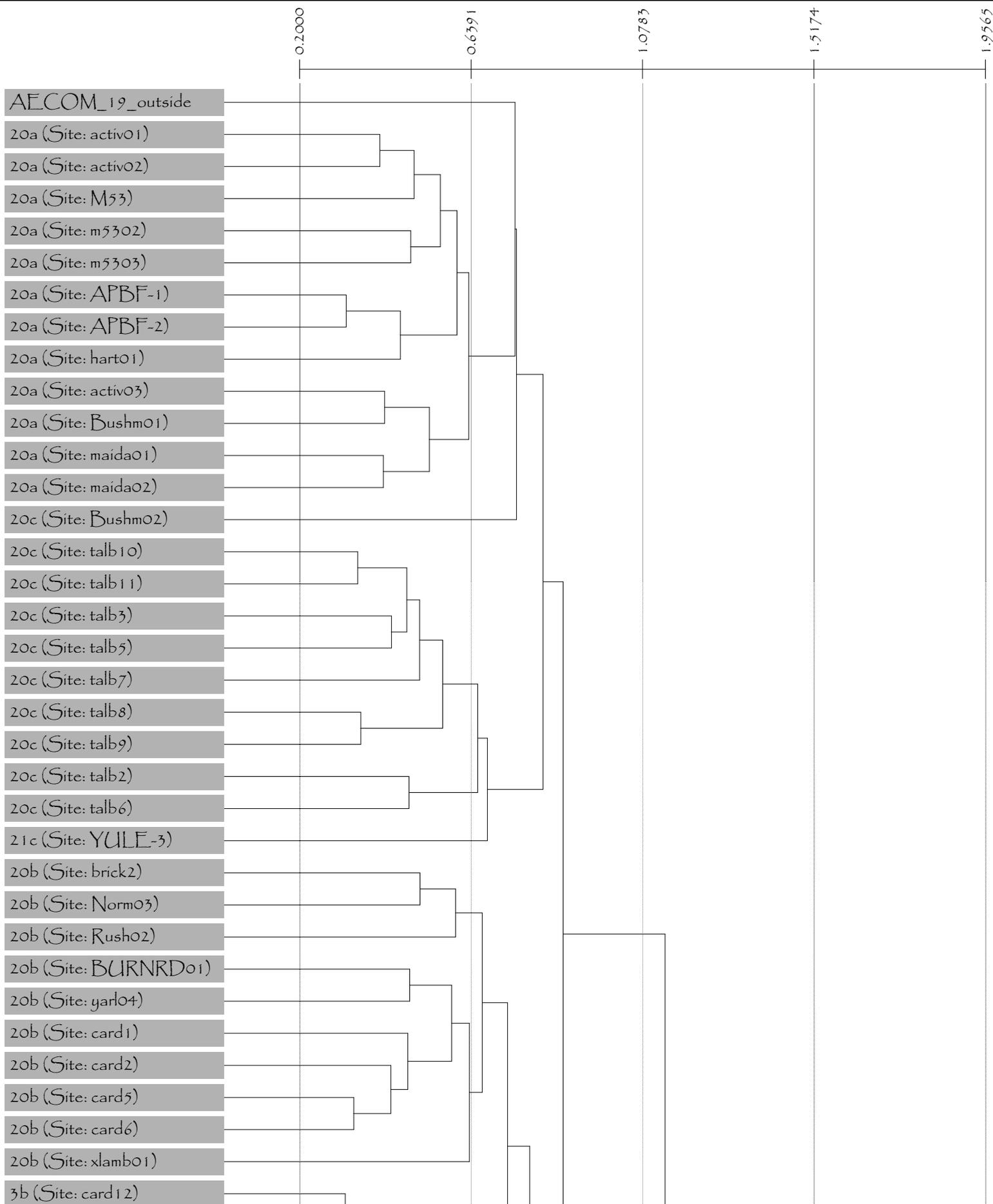
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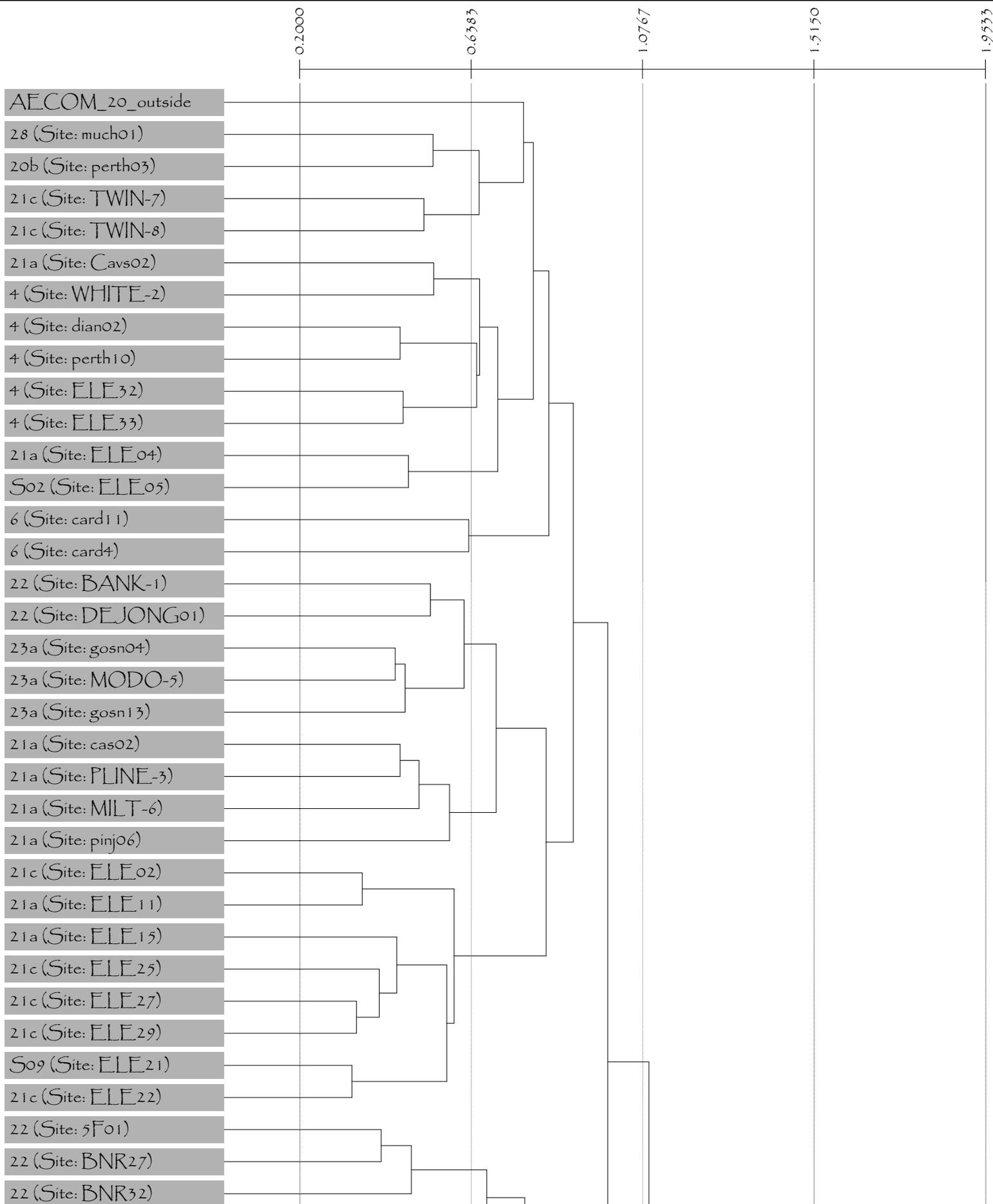
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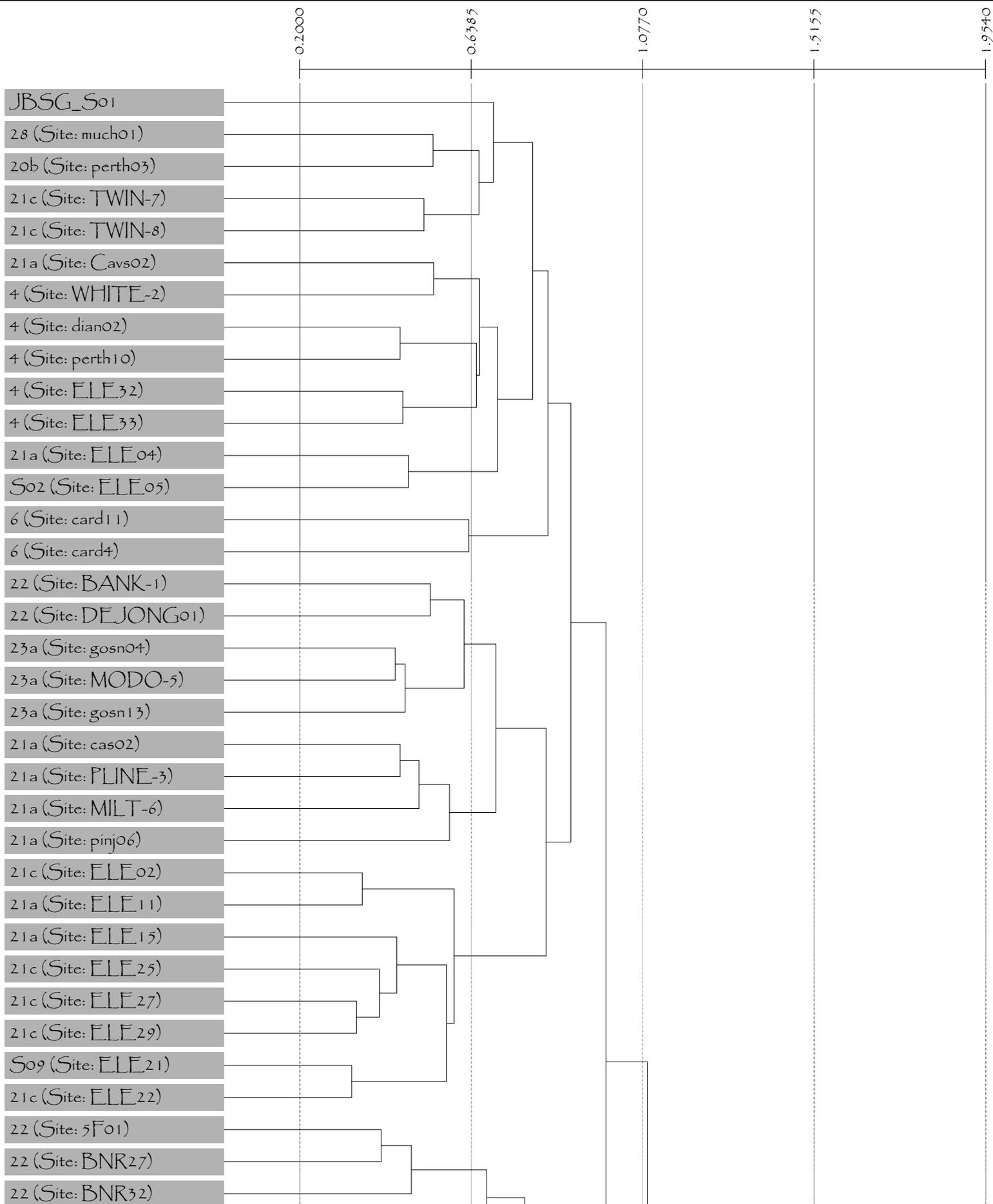
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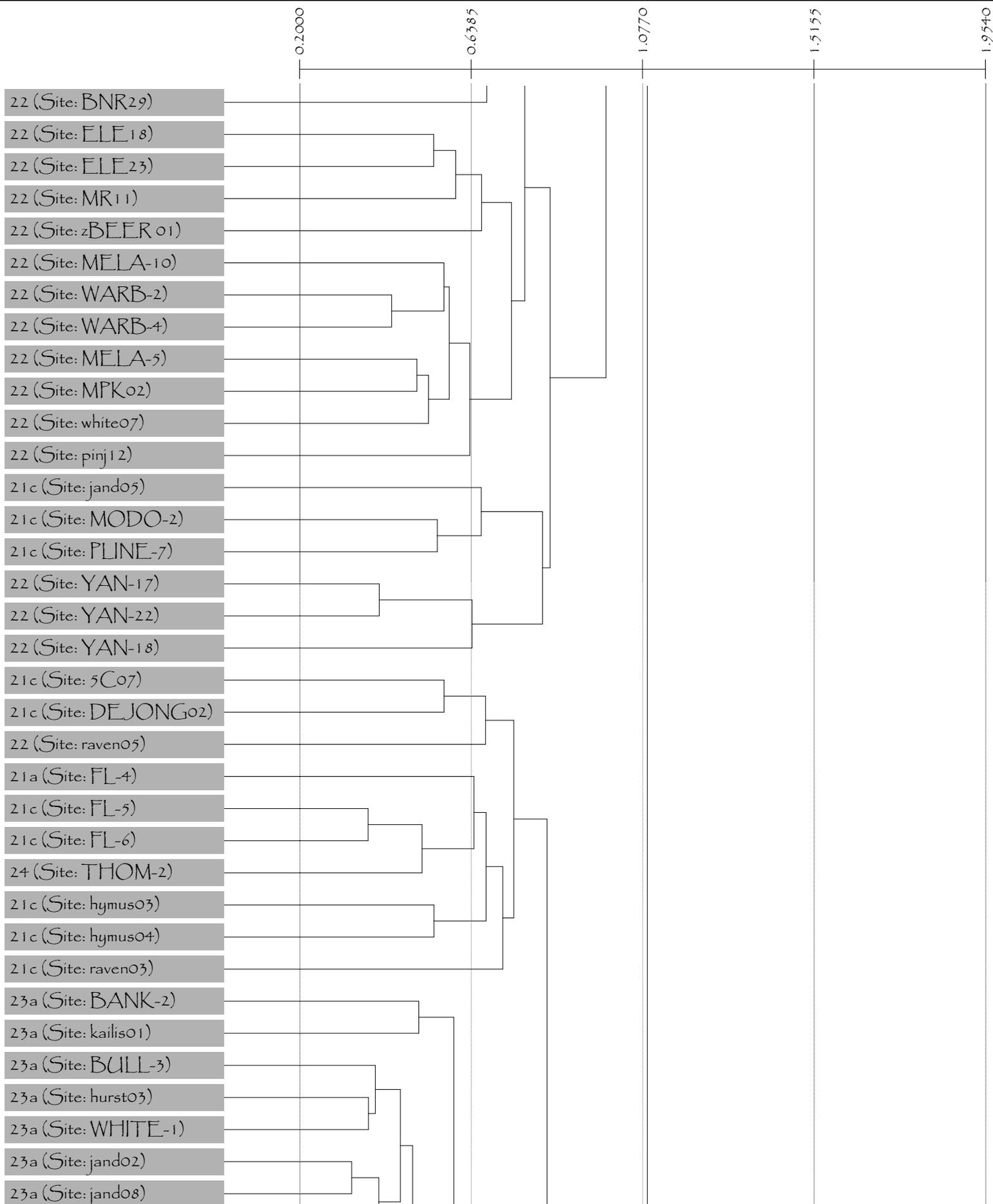
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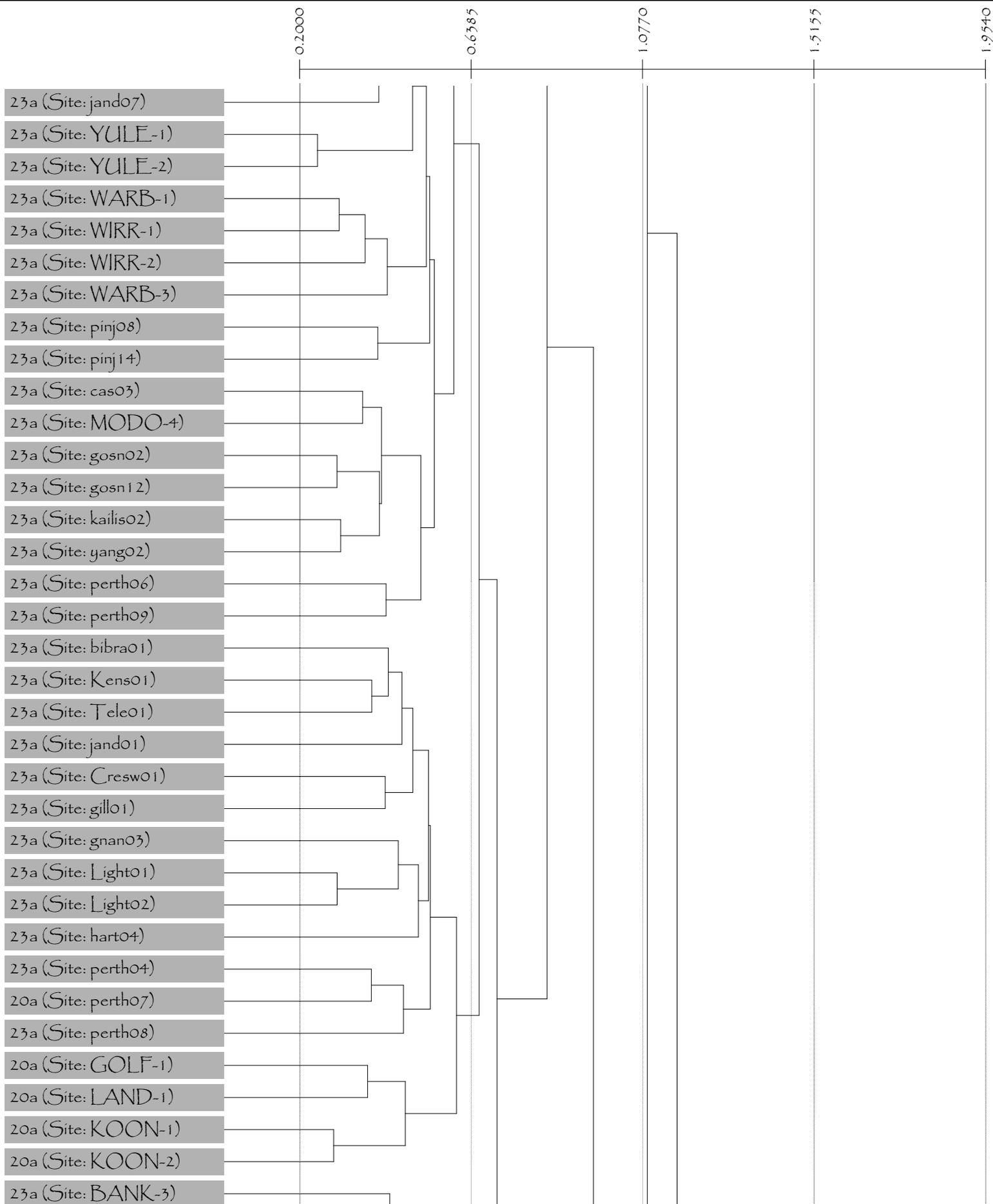
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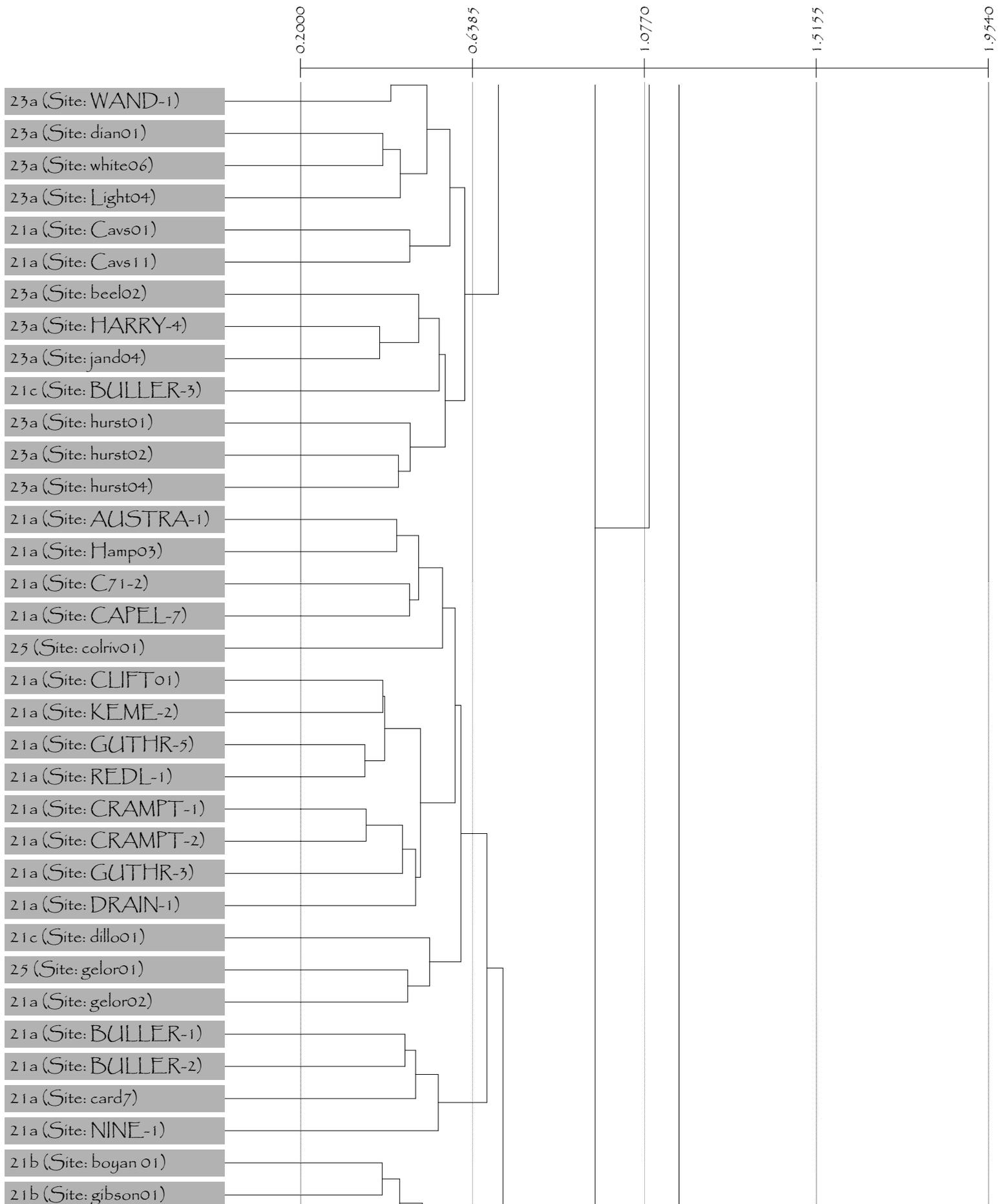
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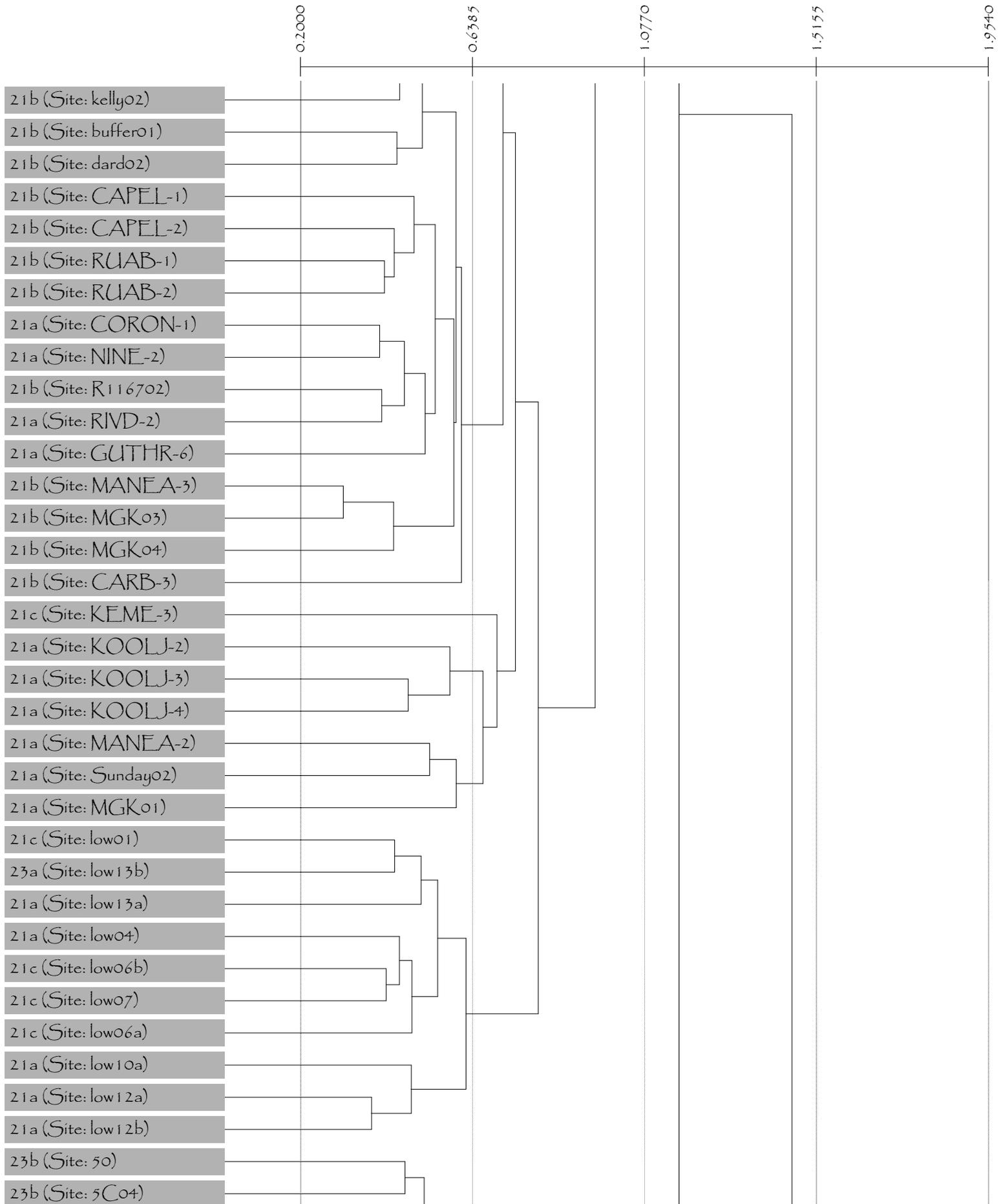
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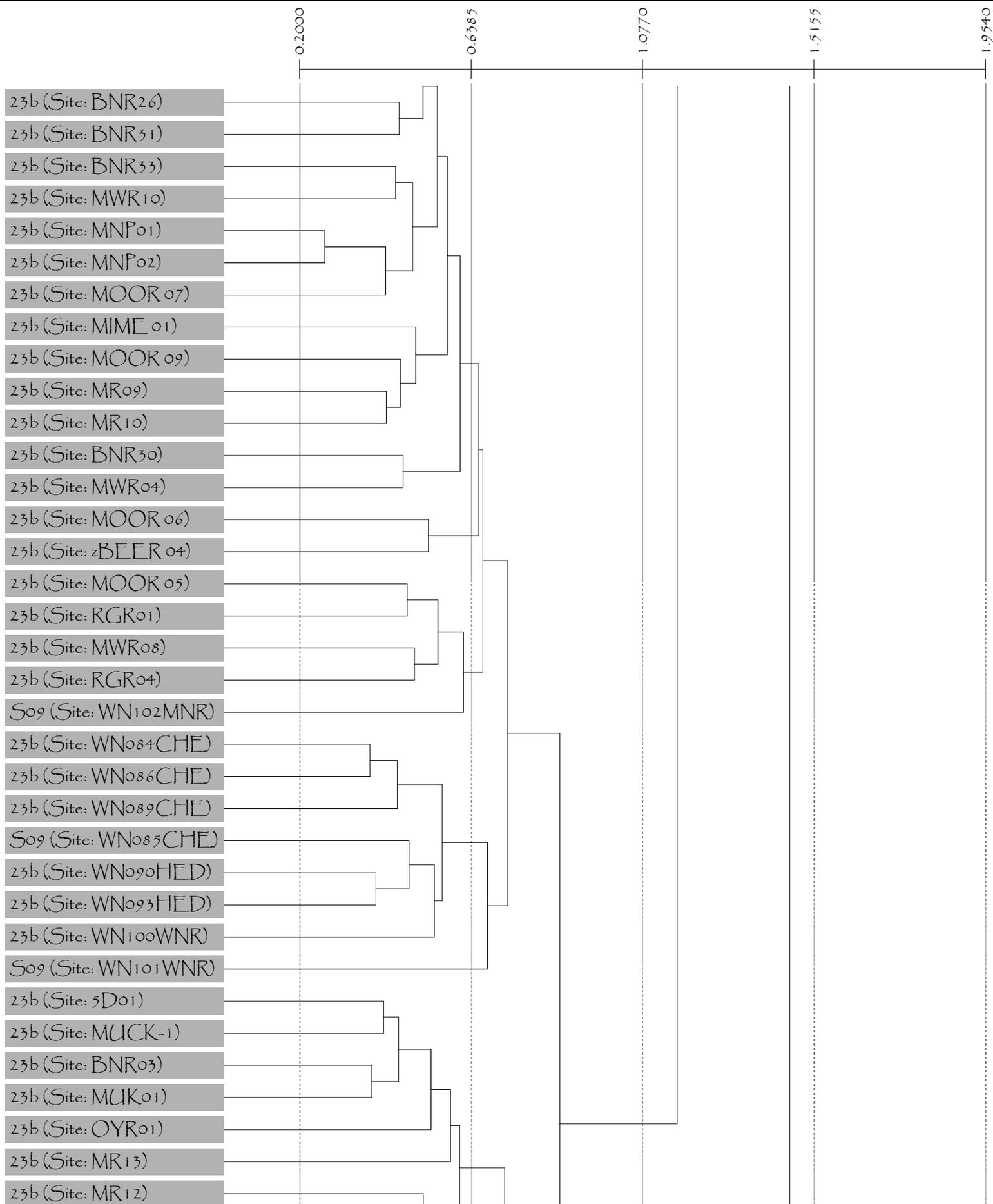
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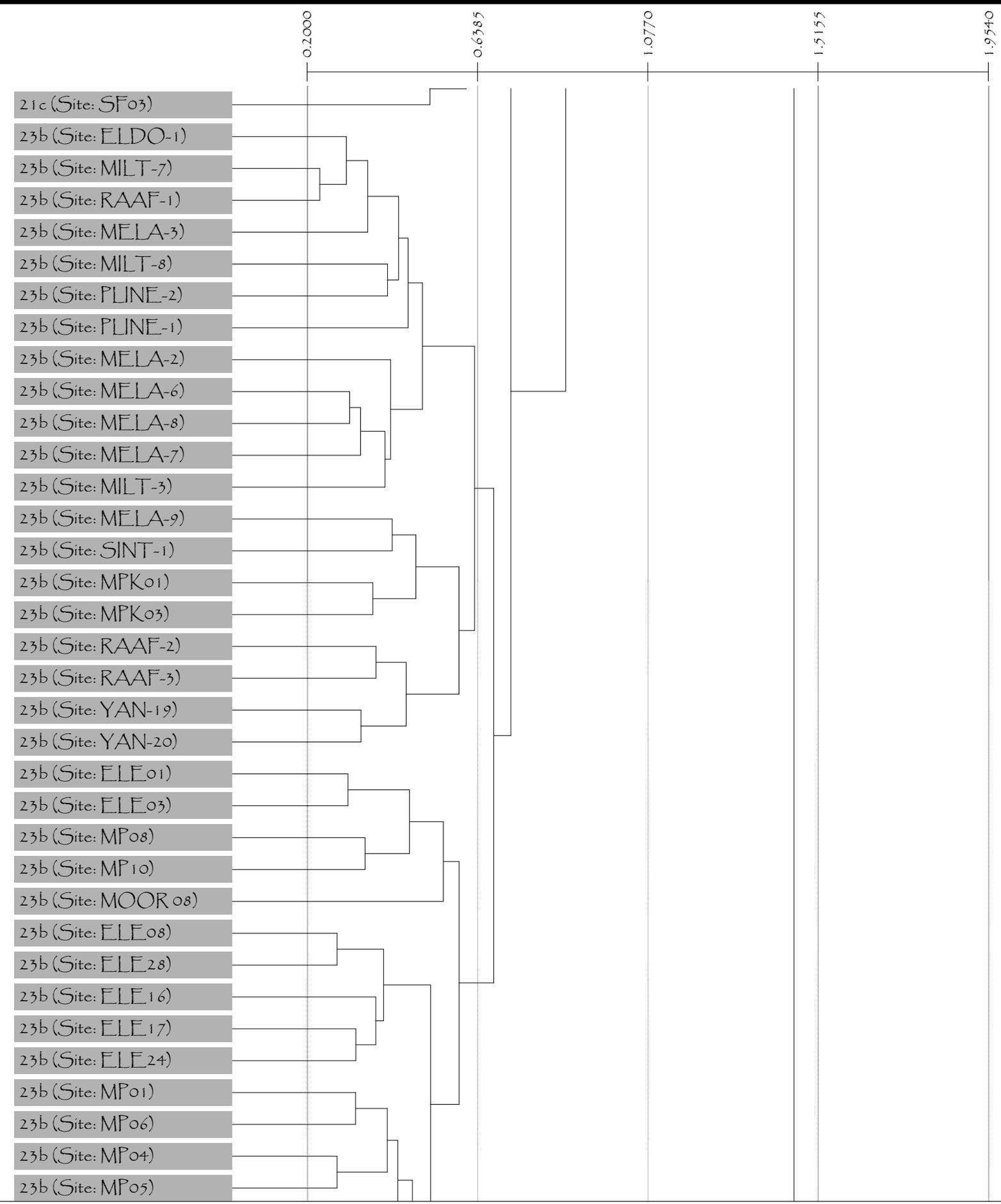
# Column Fusion Dendrogram



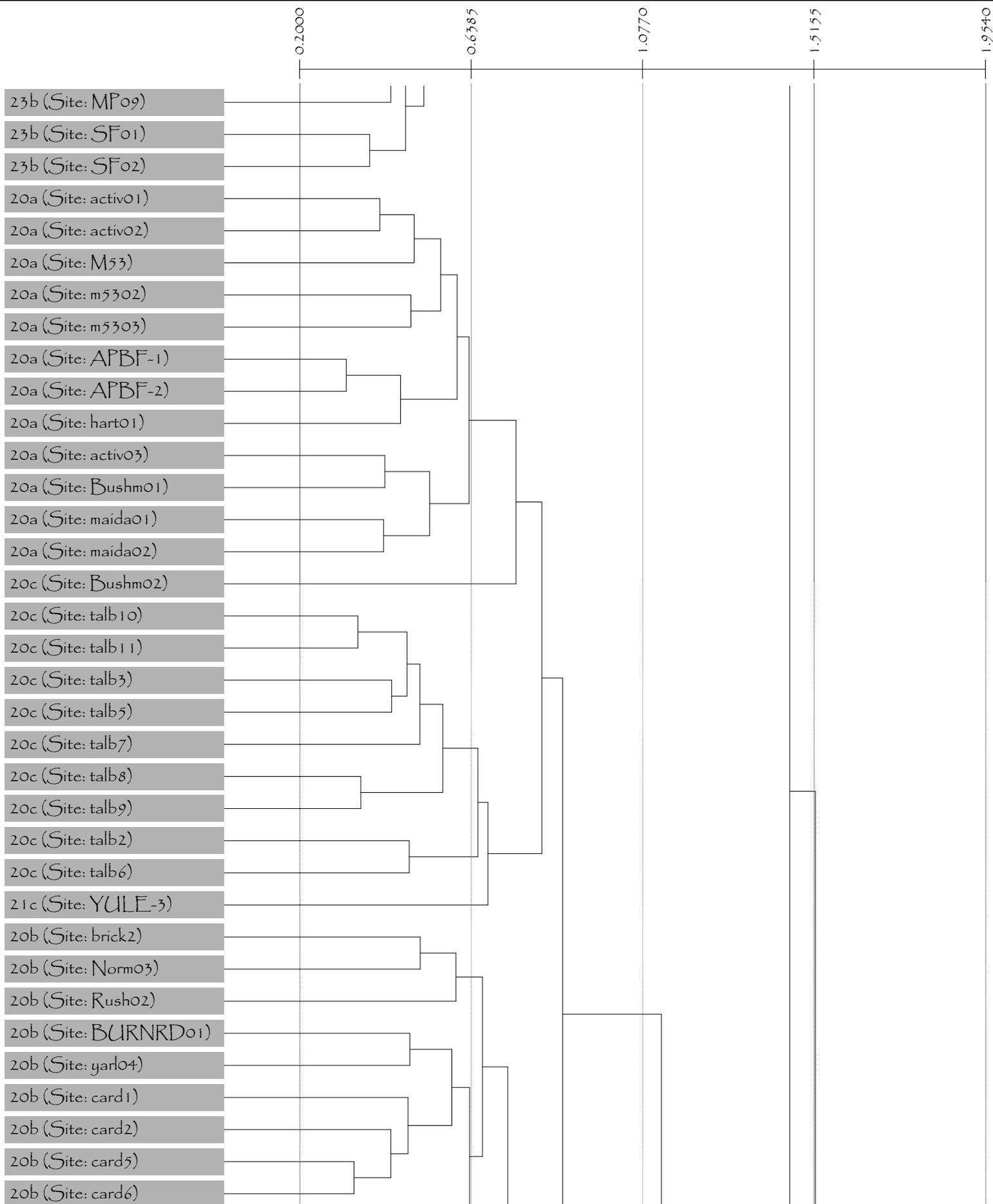
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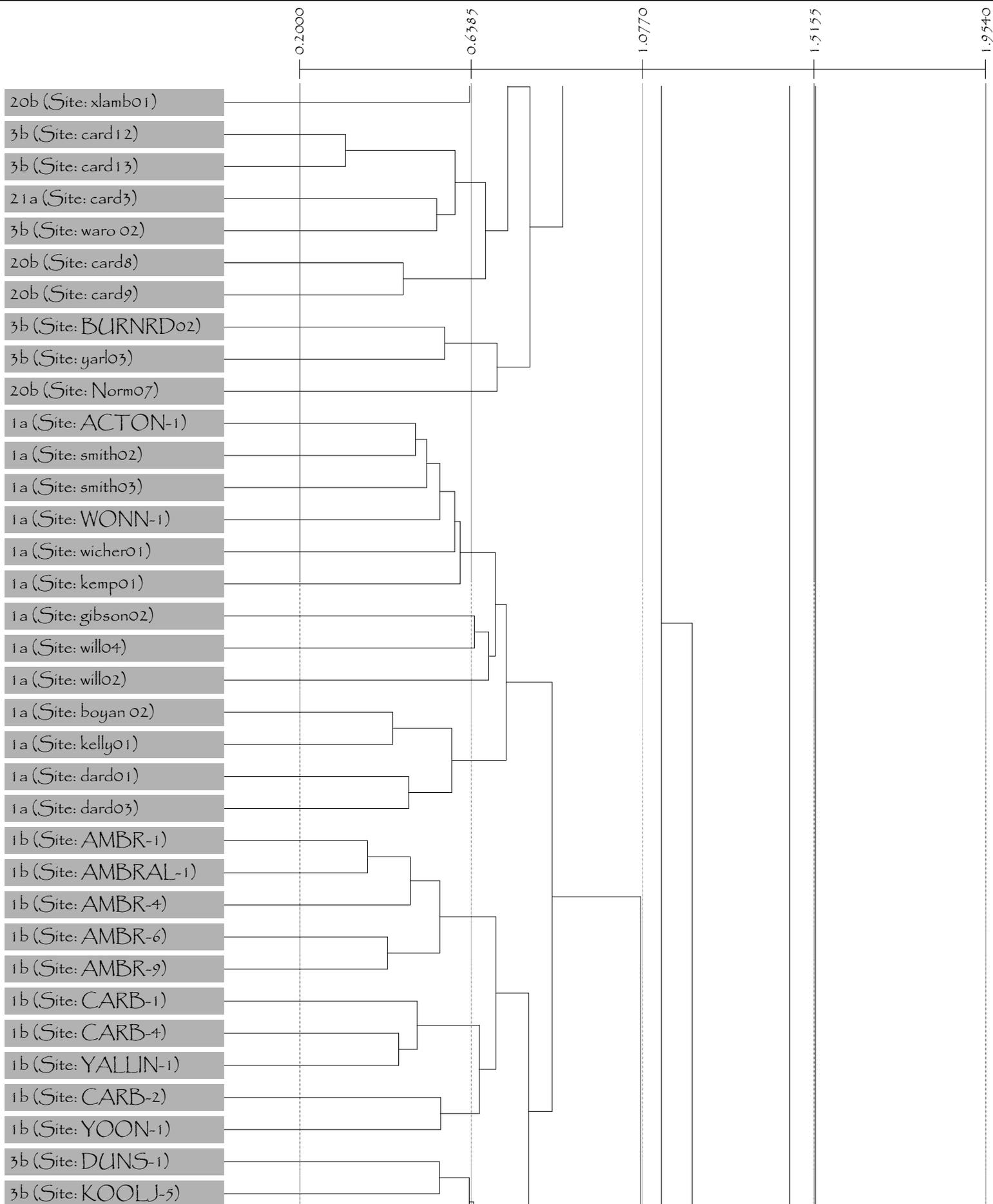
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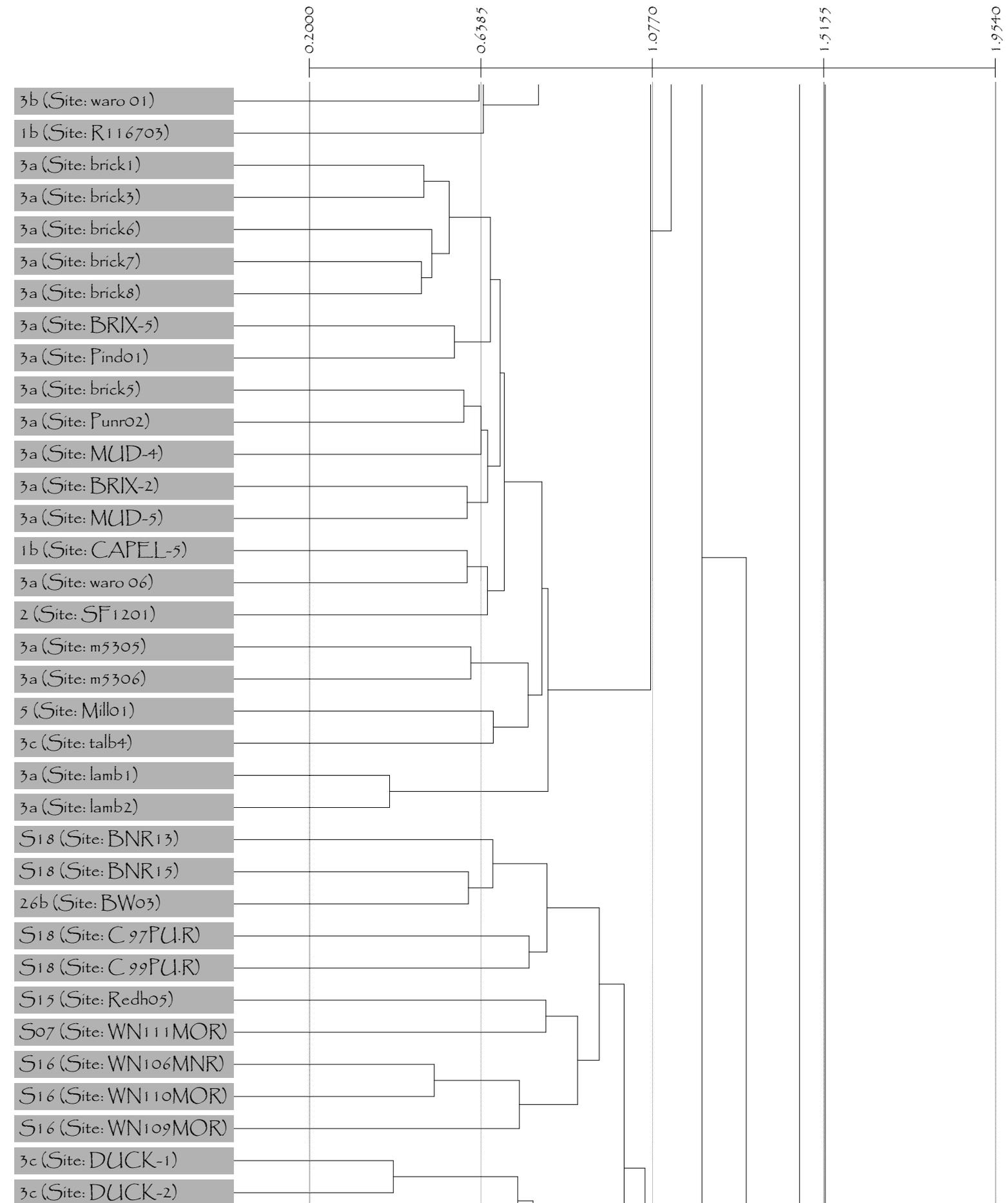
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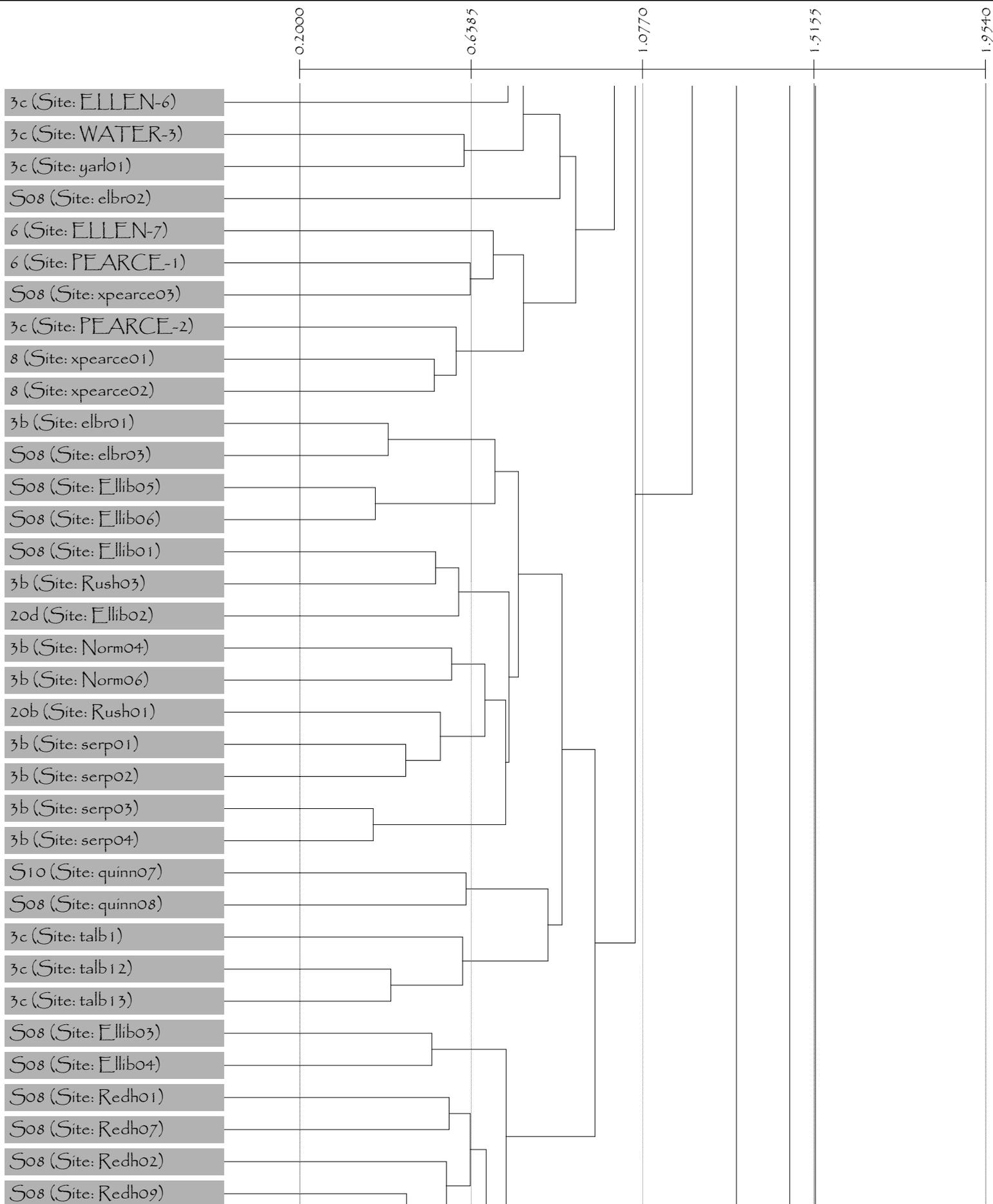
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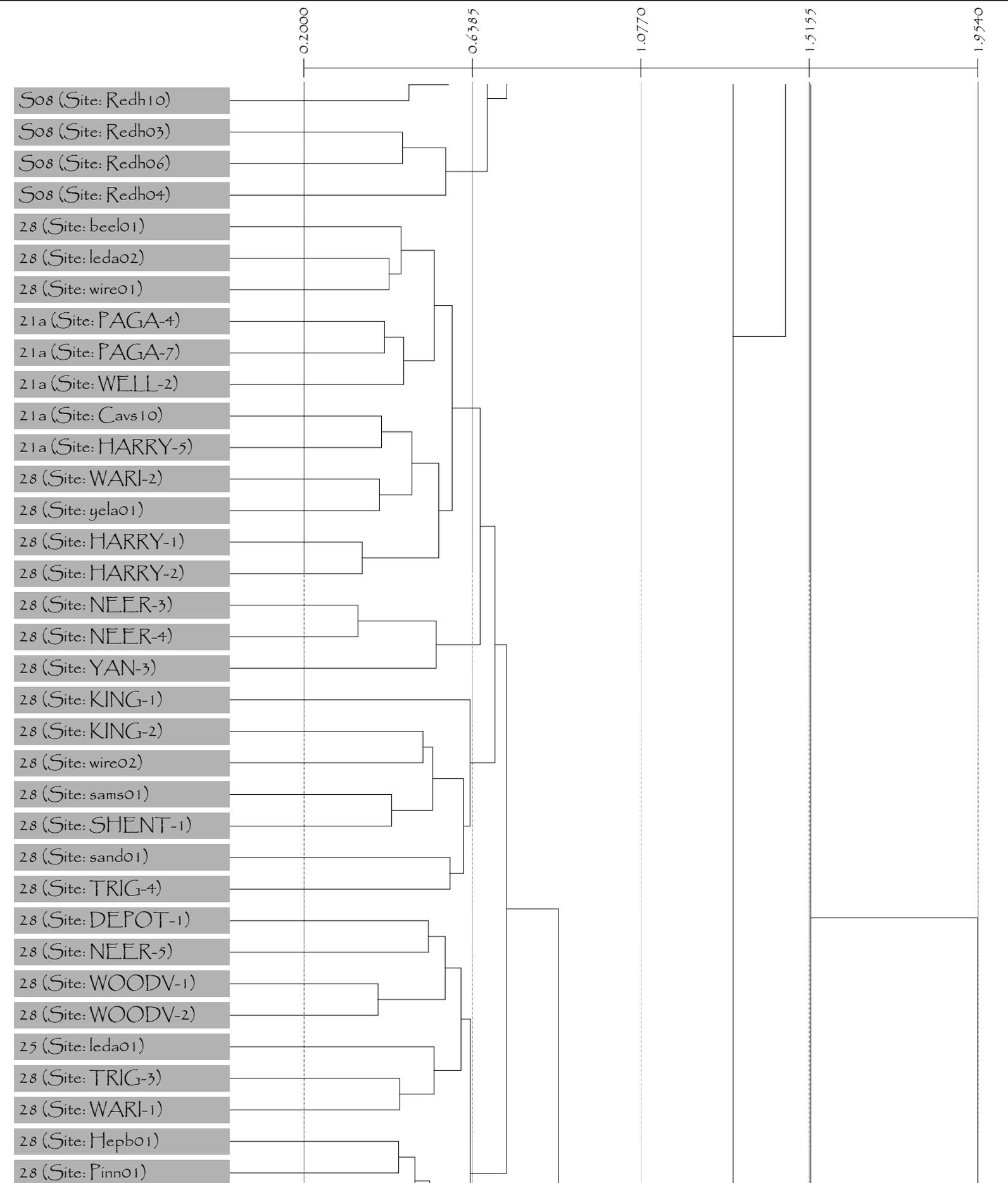
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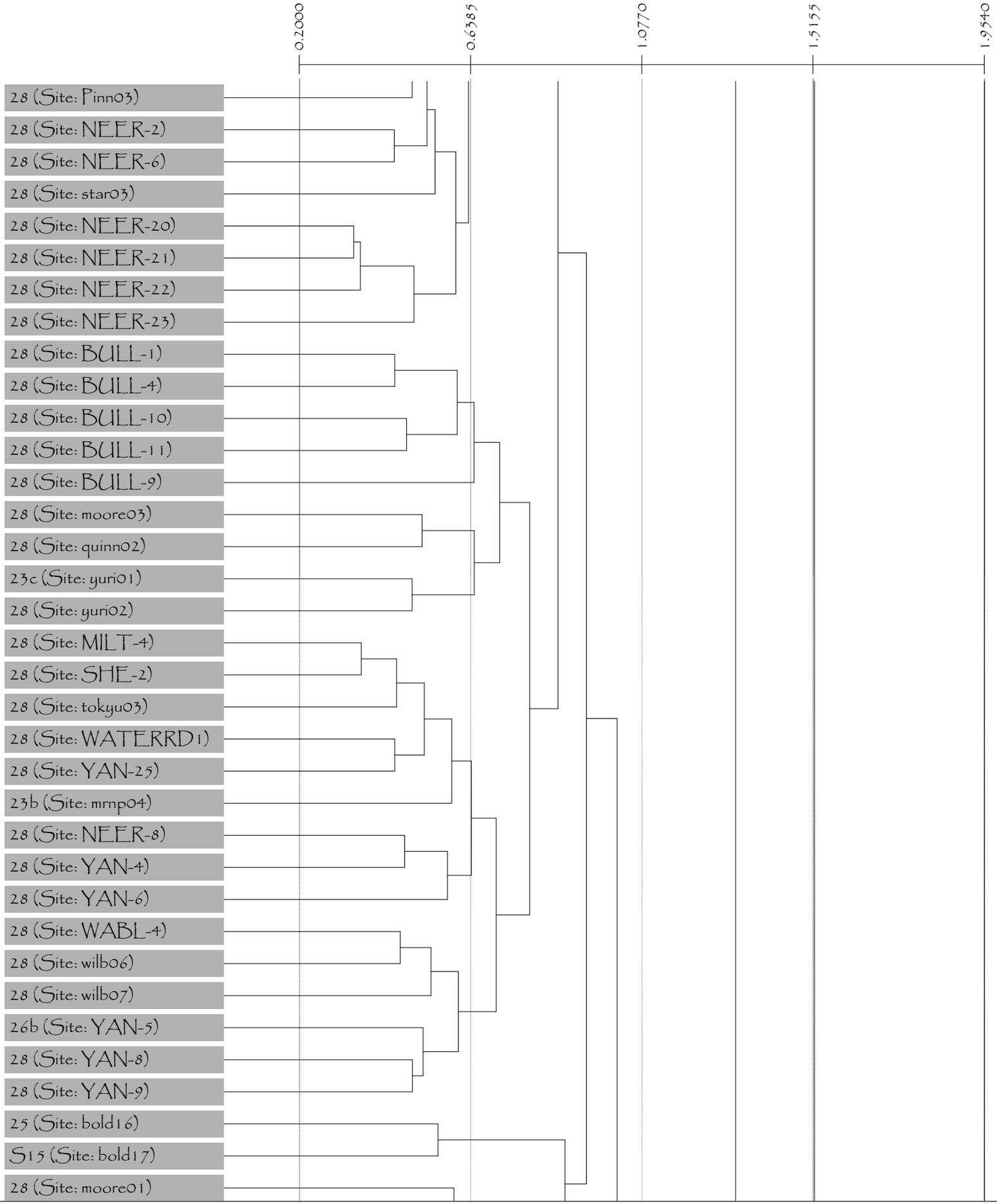
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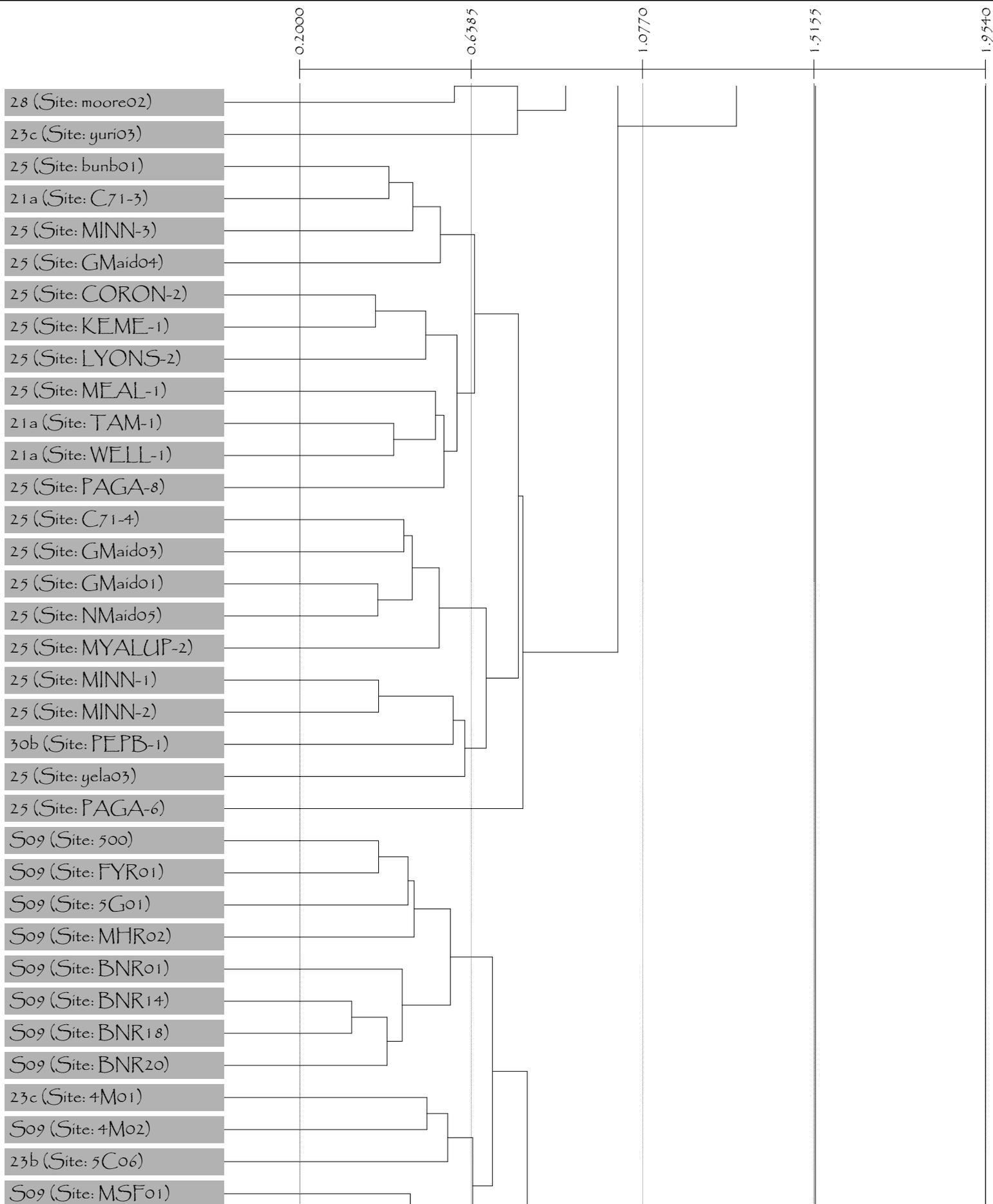
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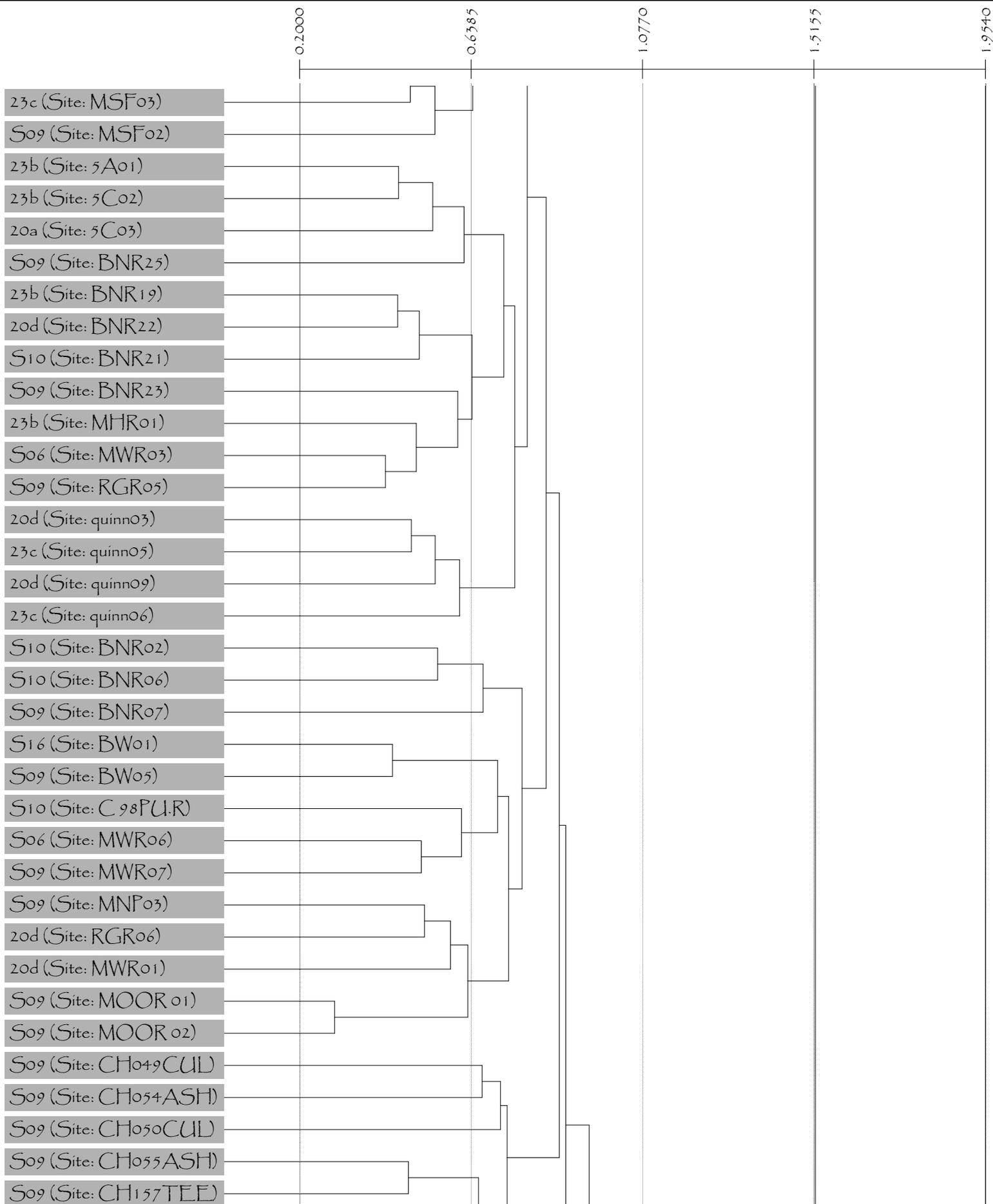
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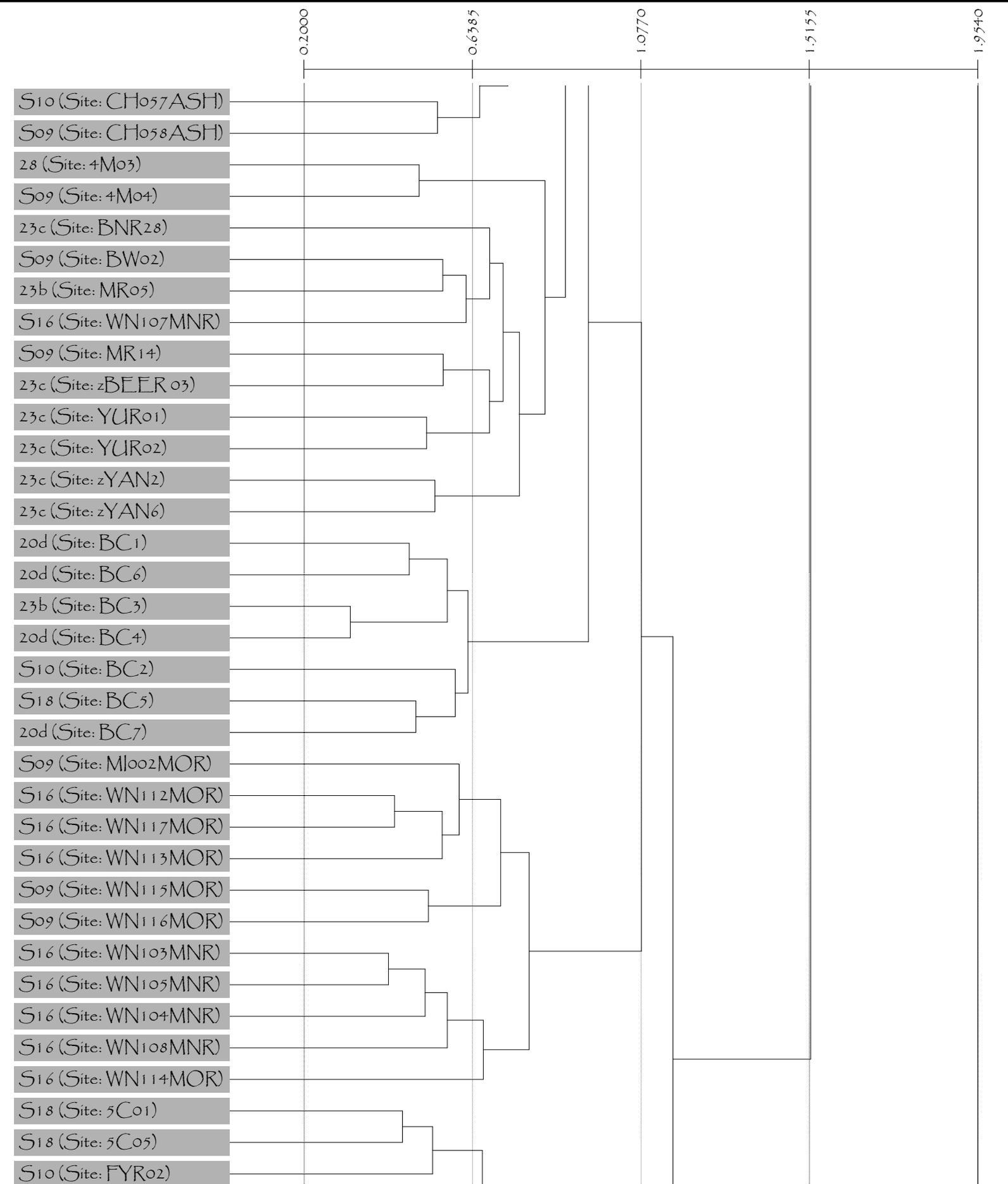
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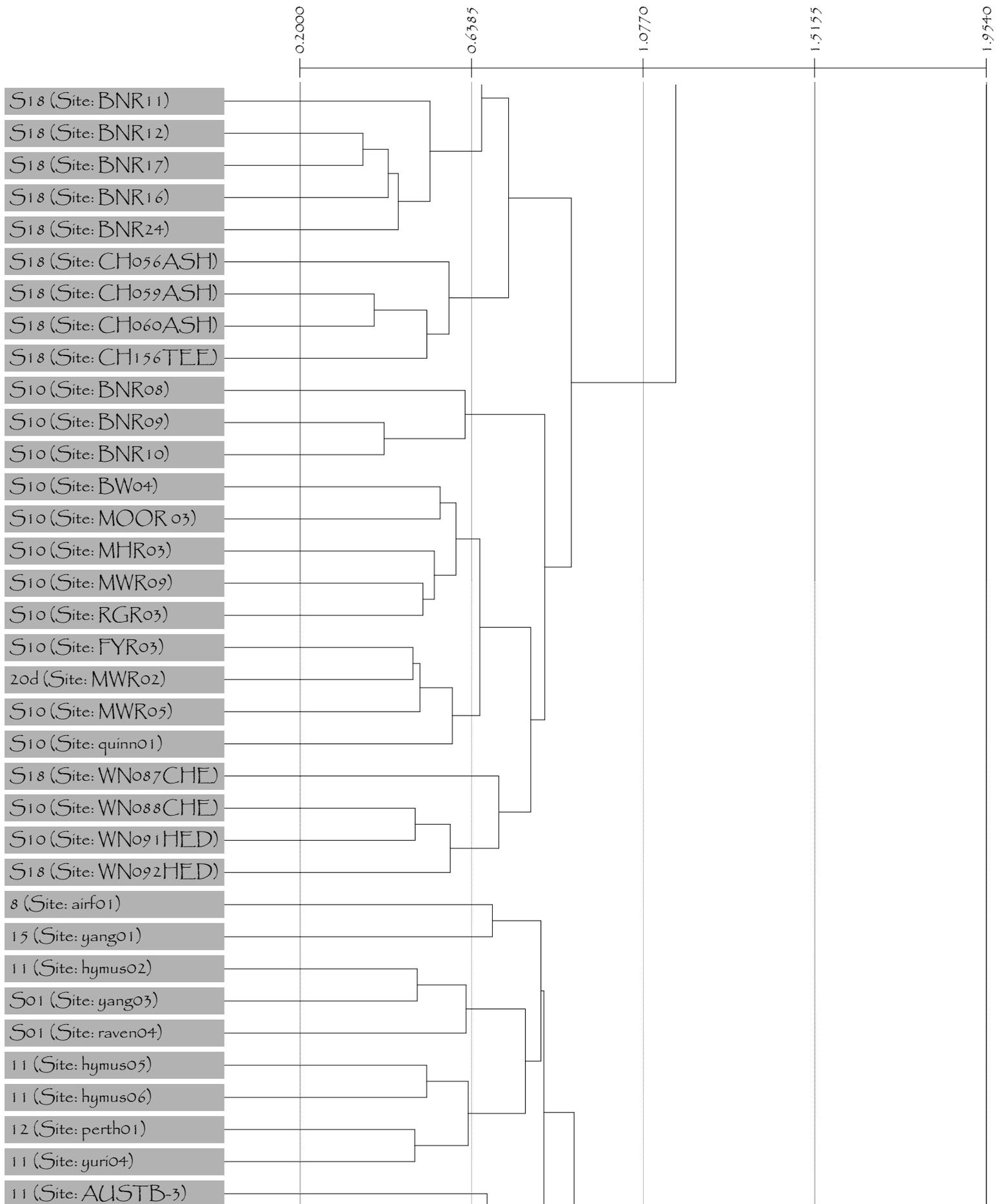
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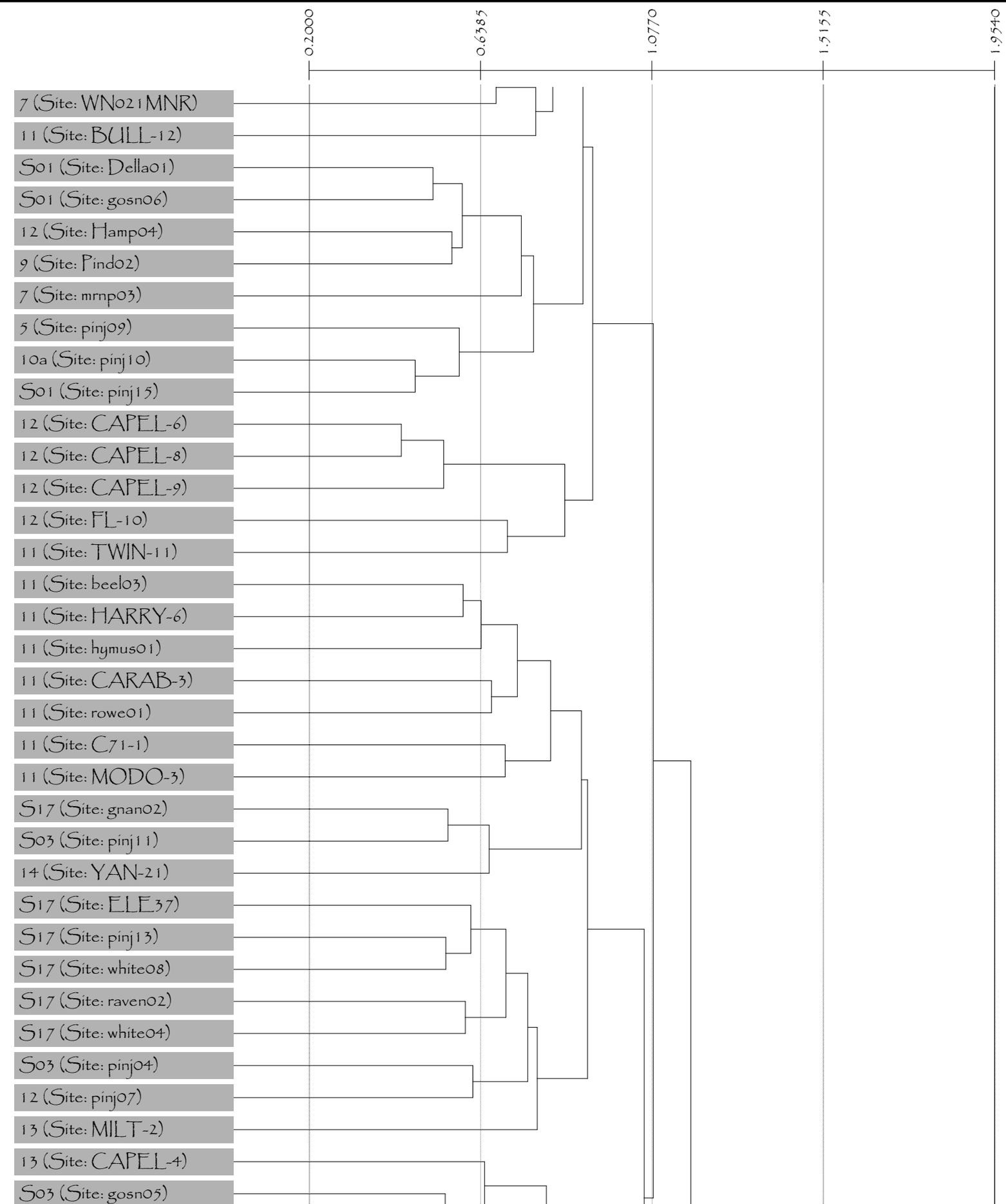
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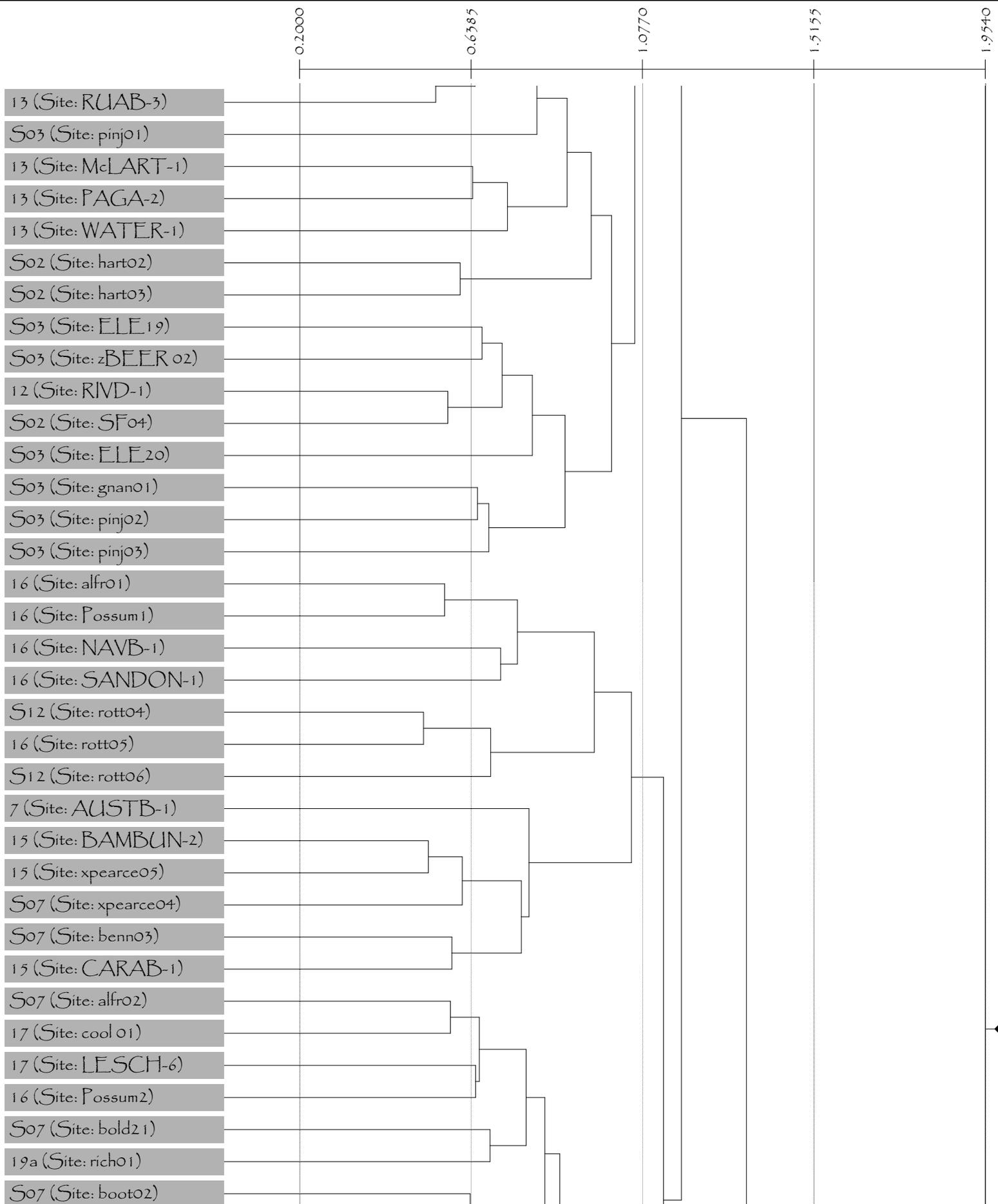
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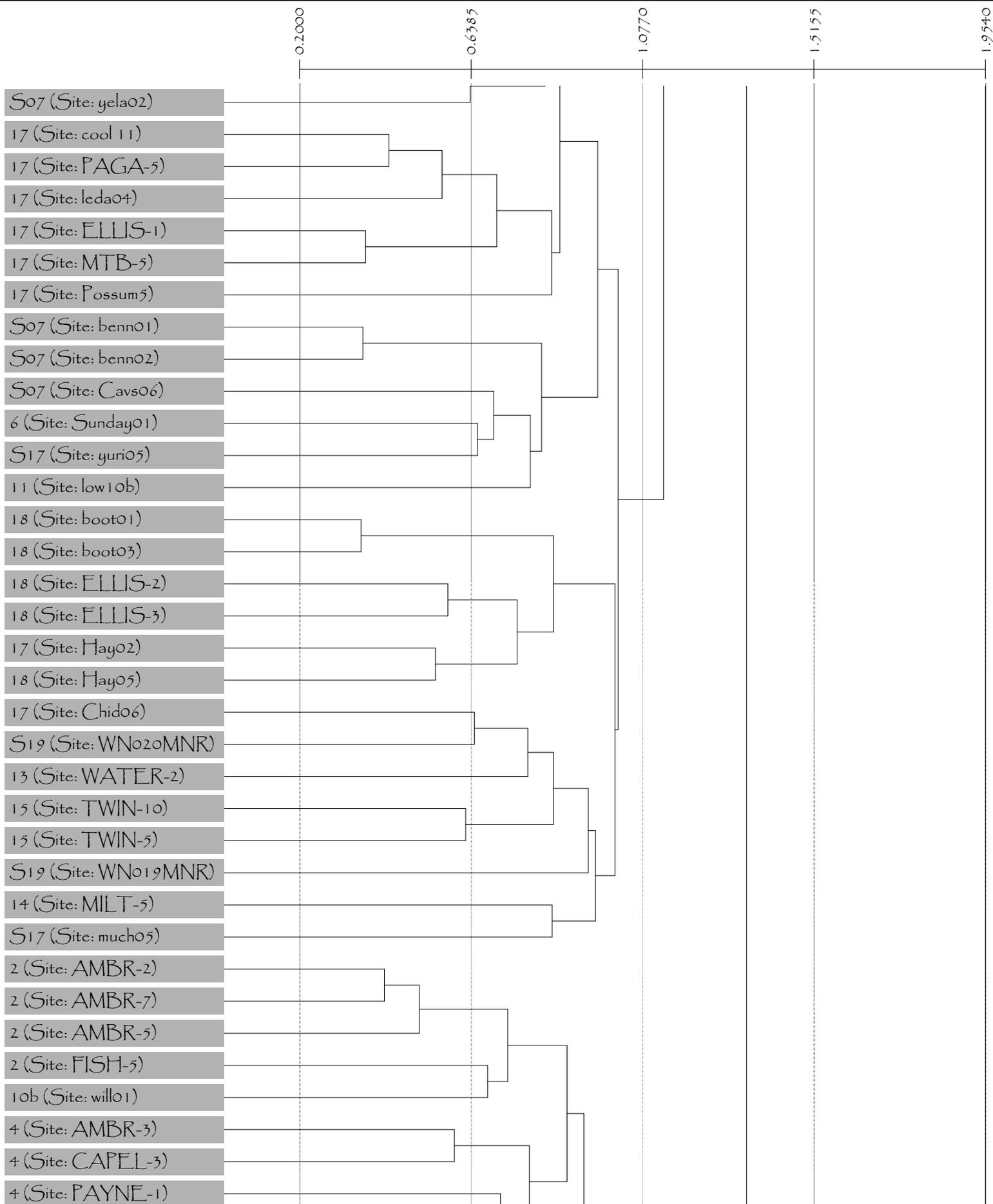
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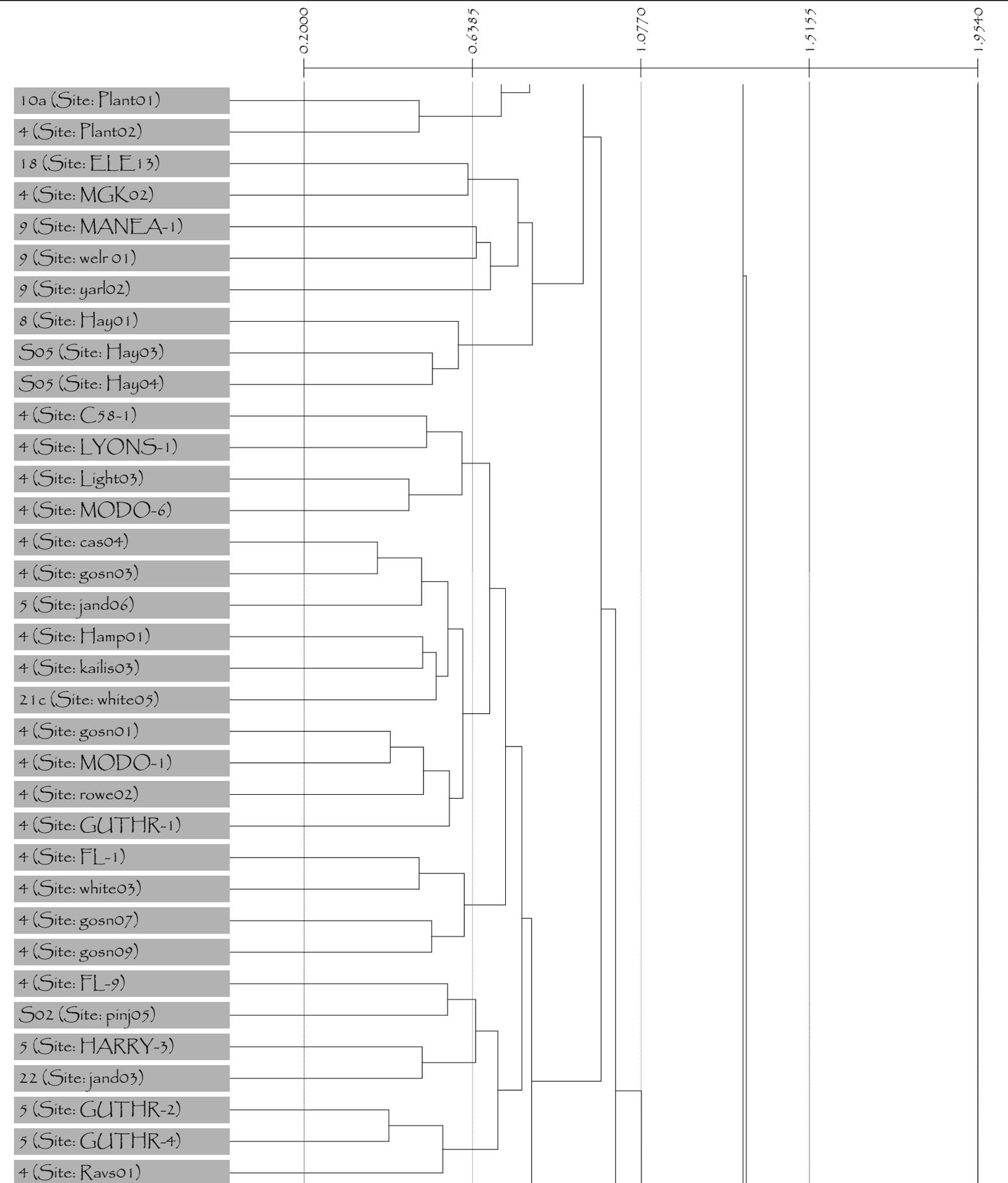
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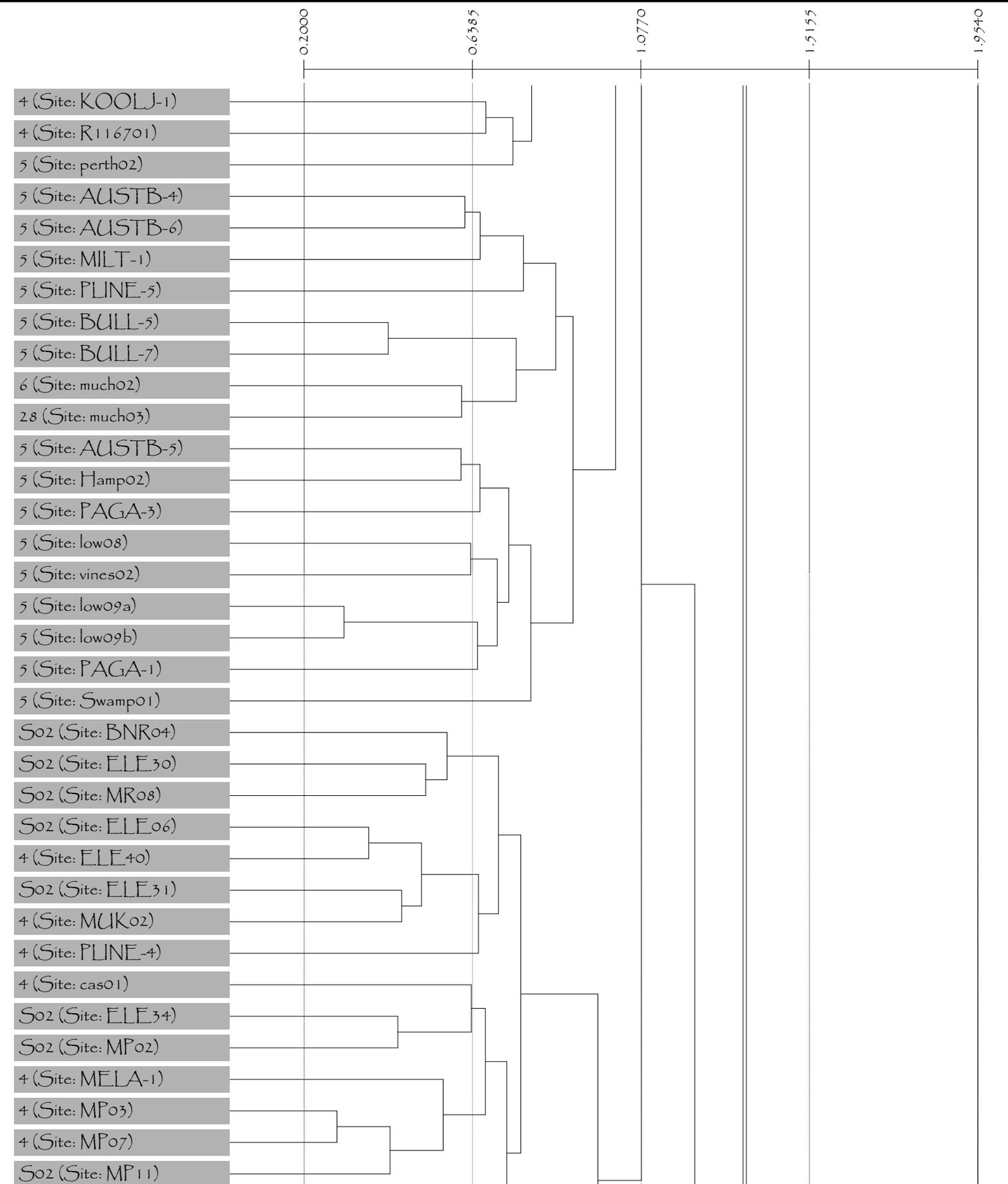
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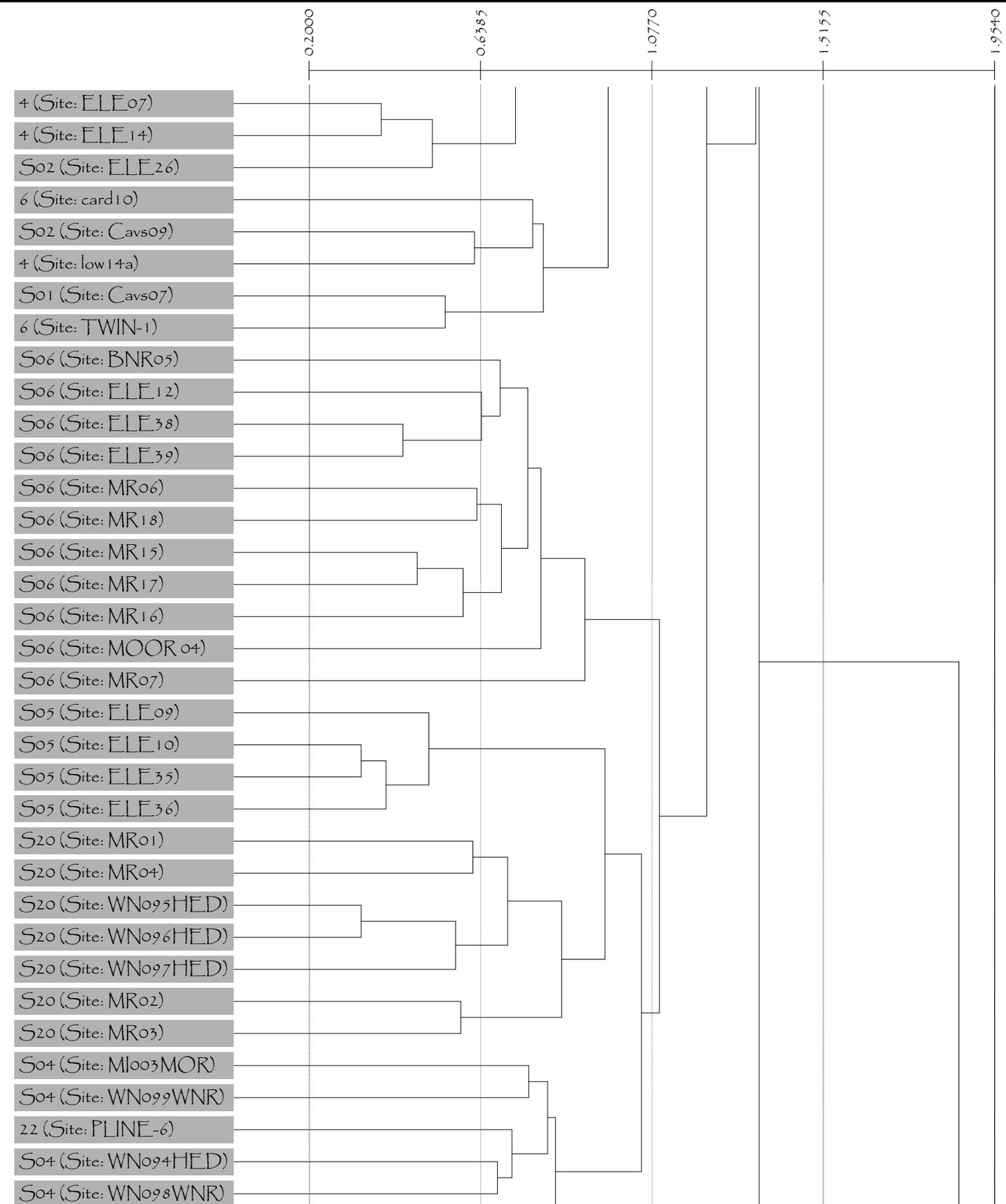
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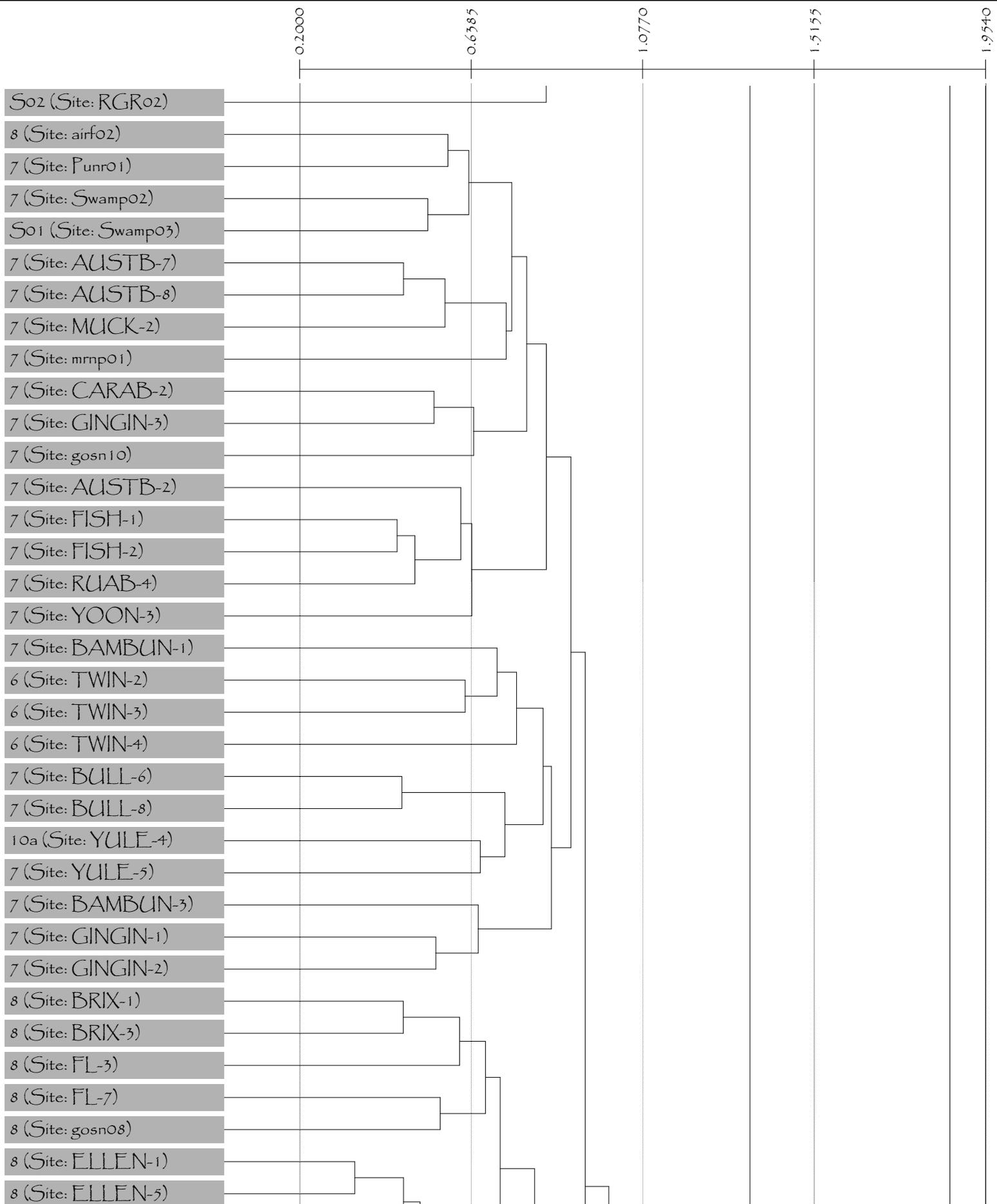
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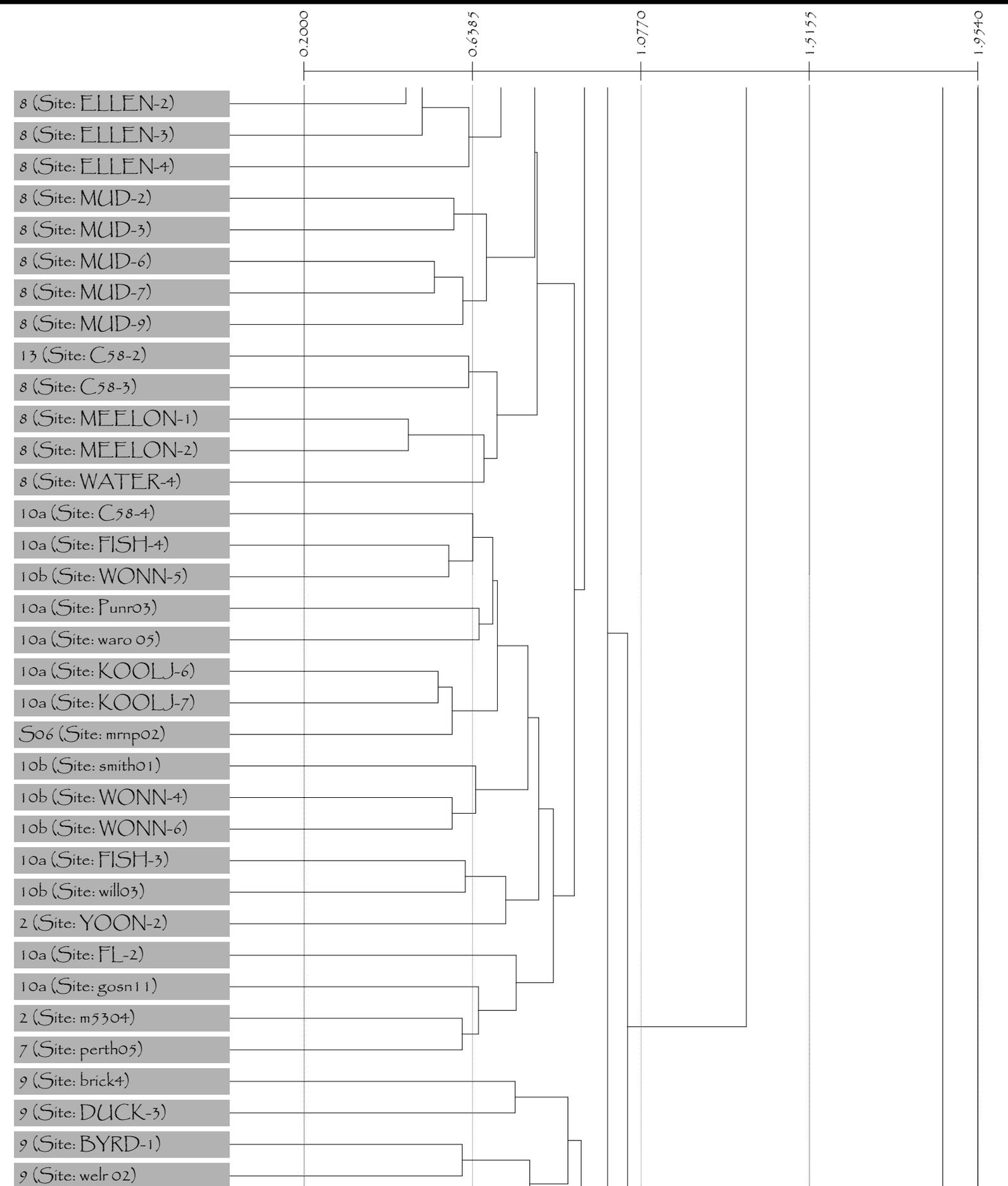
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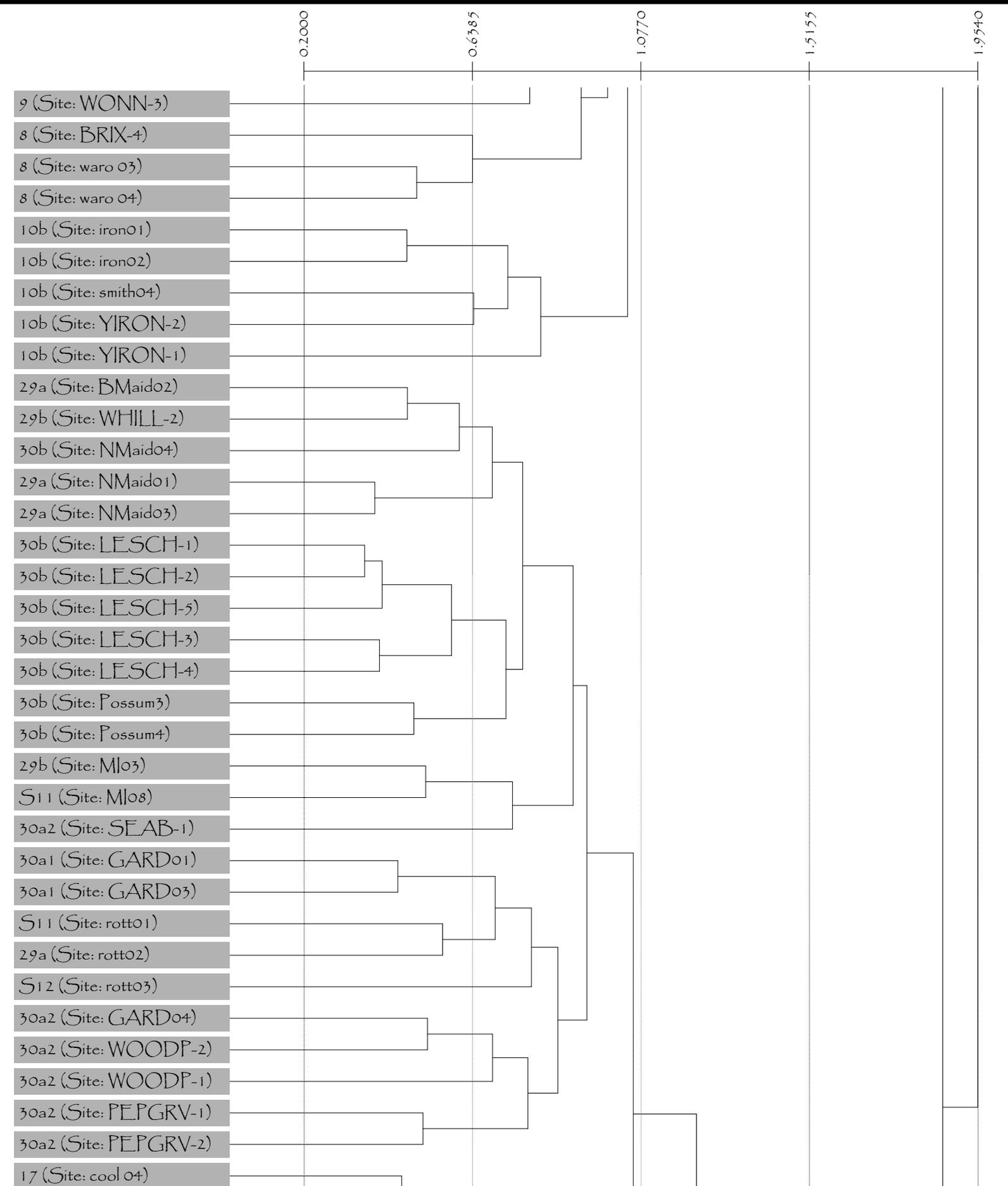
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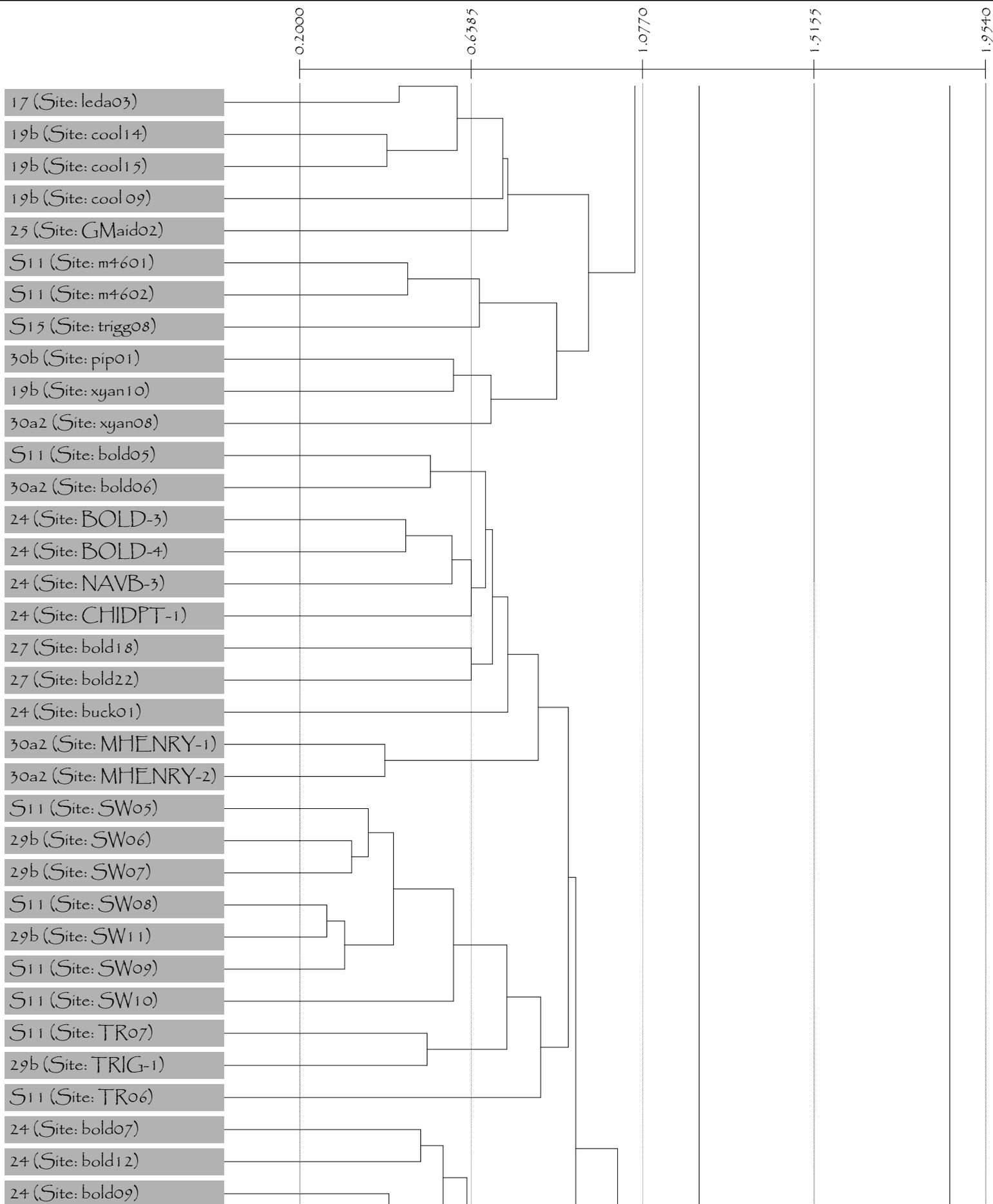
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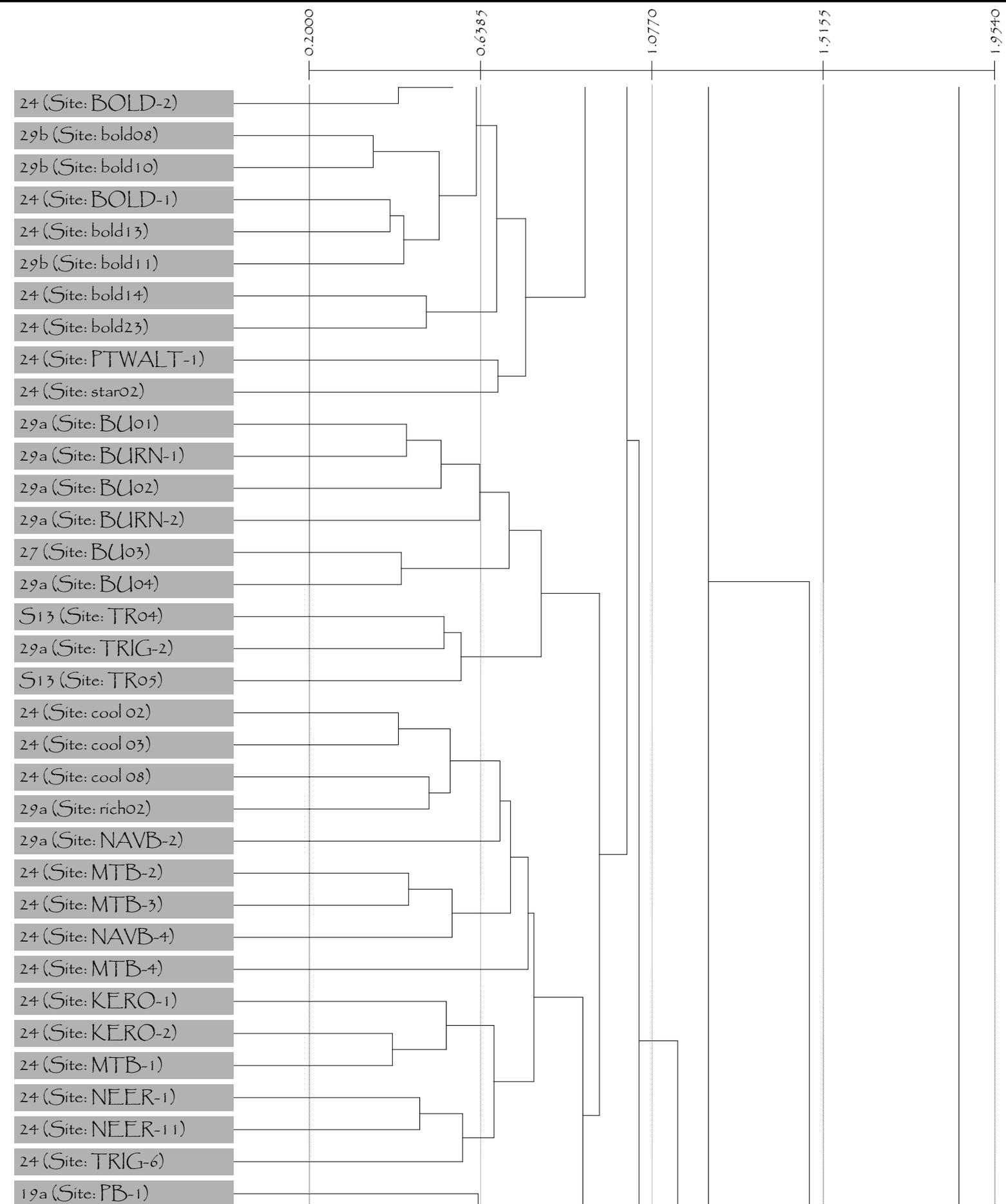
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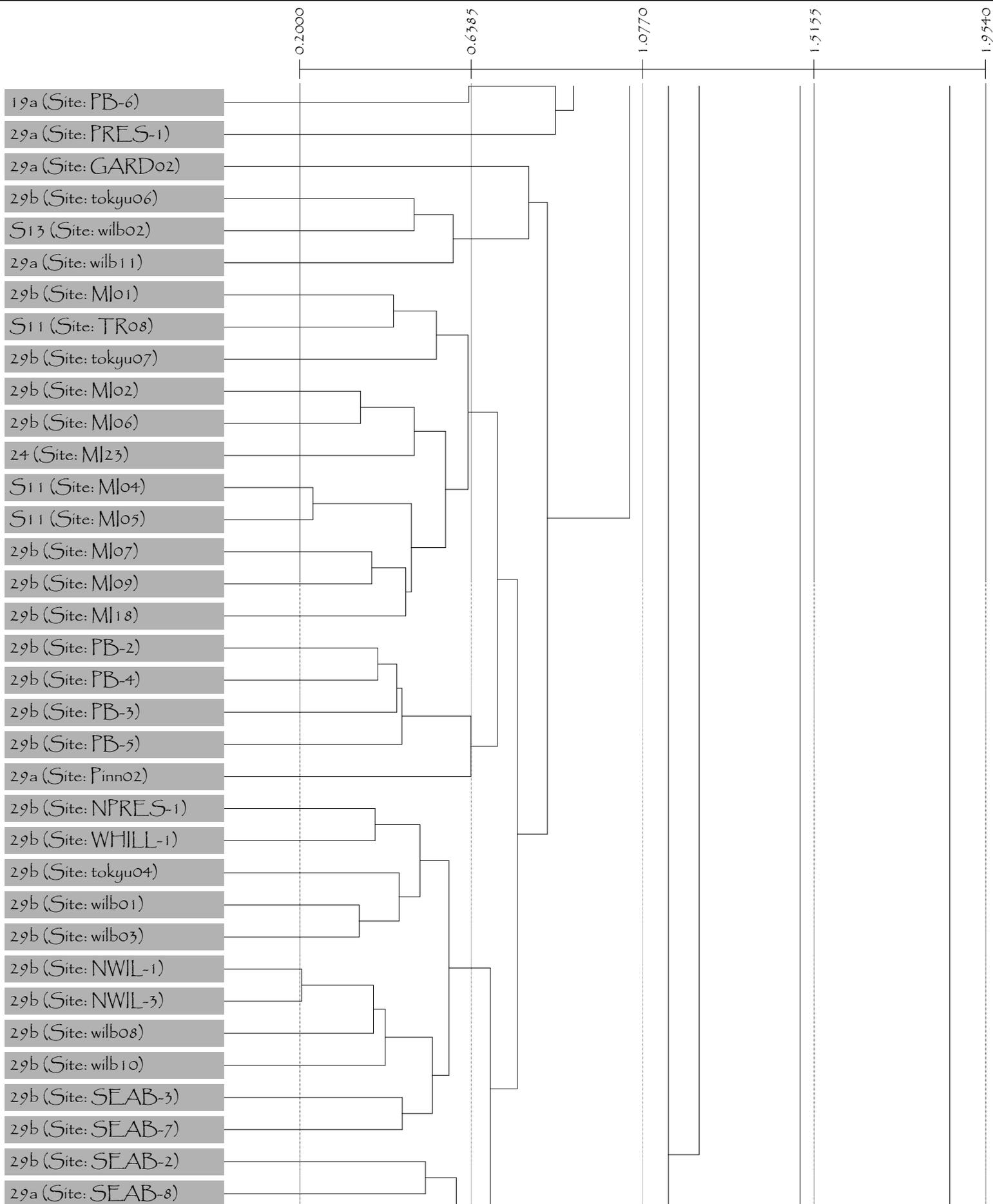
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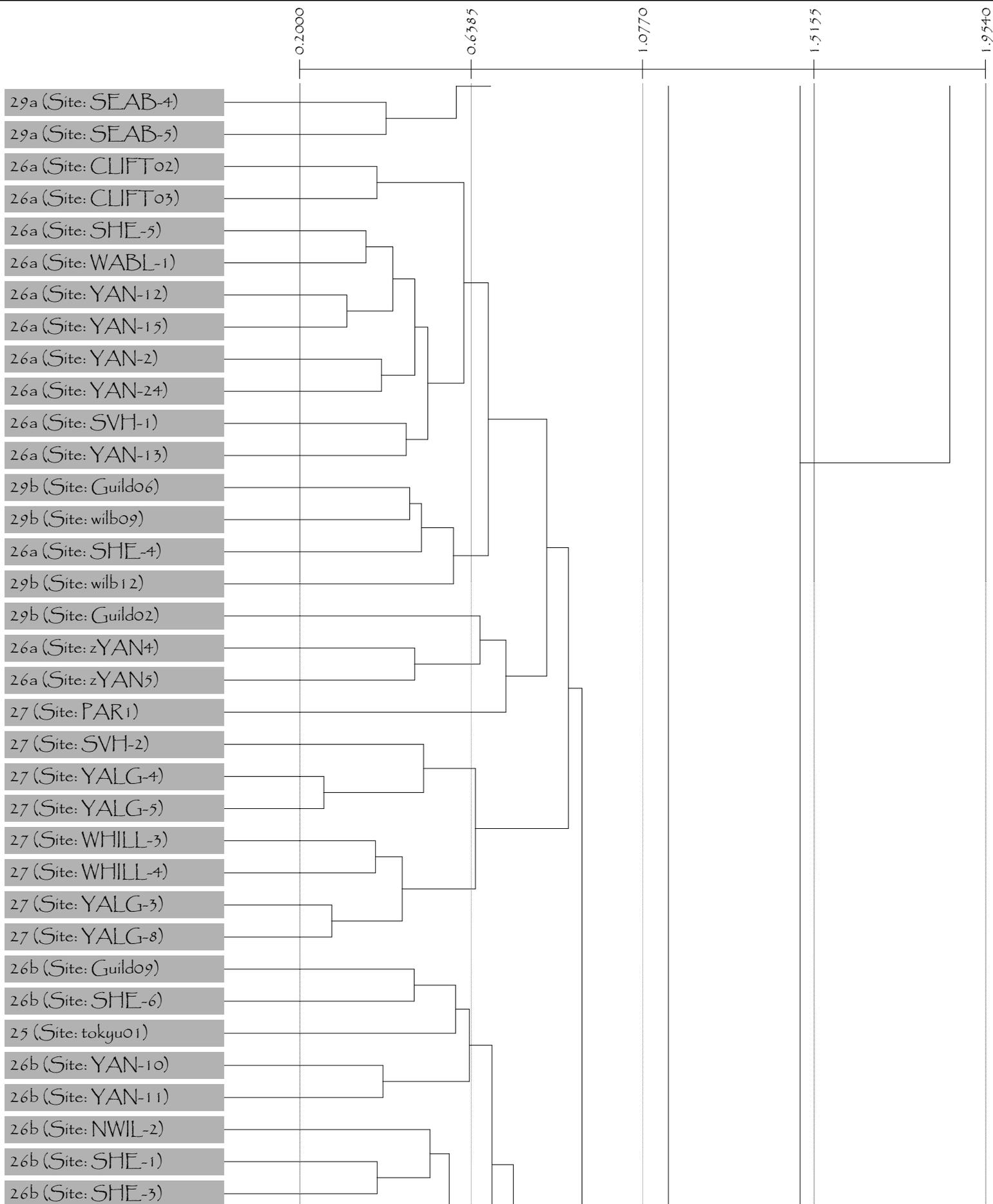
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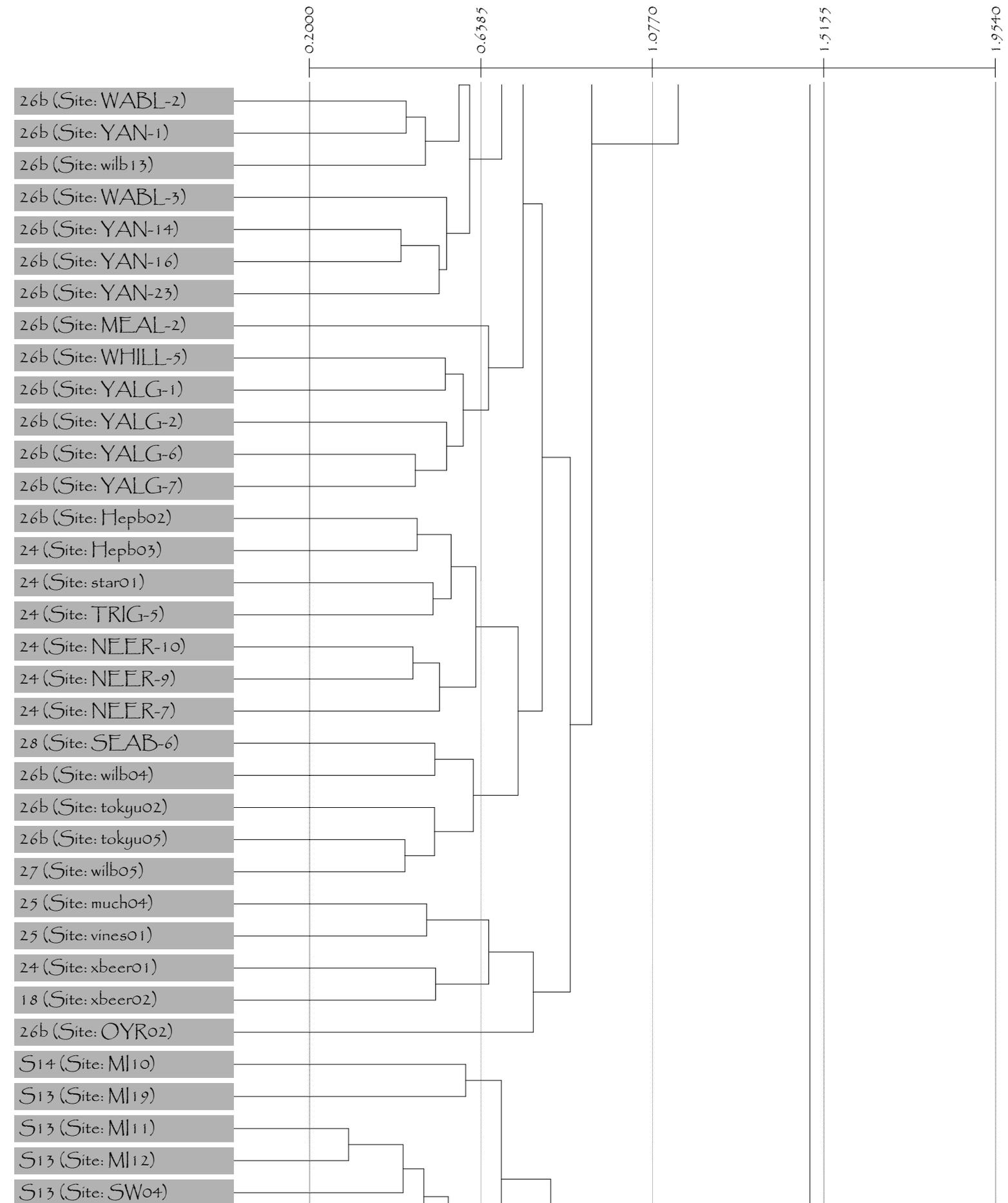
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## **Appendix E Banksia Woodlands of the Swan Coastal Plain Assessment**

# Banksia Woodland of the SCP Assessment

## 1.0 Methods

### 1.1 Introduction

The Banksia woodlands of the Swan Coastal Plain encompasses a large natural variation across its range. Furthermore it is subject to varying degrees of disturbance and degradation that have influenced the quality of patches.

The Threatened Species Scientific Committee (TSSC) published the approved Conservation Advice for this community in September 2016. This document details the key diagnostic features applicable for determining the presence of this TEC. Patches must meet the following key diagnostic characteristics, condition thresholds, and minimum patch sizes:

- Step 1: use key diagnostic characteristics to determine if TEC is present
- Step 2: determine condition of patch
- Step 3: consider if patch meets minimum size threshold
- Step 4: surrounding context of a patch must be taken into account when considering factors that add to the importance of a patch that meets the condition thresholds.

### 1.2 Condition

The condition of vegetation of each patch needs to be determined in accordance with the following:

- The condition assessment of a patch should be centred on the area of highest native floristic diversity and/or cover of the patch.
- Timing of surveys and recent disturbance should be taken into account
- Surrounding context of a patch should be considered
- Certain vegetation components of Banksia Woodlands community merit consideration as critical elements to protect. Three components are recognised as threatened in their own right i.e. Priority Ecological Communities
- A relevant expert may be useful to help identify the ecological community and its condition.
- Vegetation must be in 'Good' or better condition in accordance with **Table 1**.

**Table 1 Keighery (1994) Condition Scale For Vegetation**

KEIGHERY (1994) VEGETATION CONDITION SCALE	INDICATIVE CONDITION MEASURES/THRESHOLDS	
	TYPICAL NATIVE VEGETATION COMPOSITION	TYPICAL WEED COVER
<b>Pristine</b> No obvious signs of disturbance	Native plant species diversity fully retained or almost so <sup>1</sup> .	Zero or almost no weed cover/abundance
<b>Excellent</b> Vegetation structure intact, disturbance only affecting individual species, weeds are non-aggressive species.	High native plant species diversity <sup>1</sup>	Less than 10%
<b>Very Good</b> Vegetation structure altered, obvious signs of disturbance (e.g. repeated fires, dieback, logging, grazing). Aggressive weeds present.	Moderate native plant species diversity <sup>1</sup>	5-20%
<b>Good</b> Vegetation structure altered but retains basic vegetation structure or ability to regenerate it. Obvious signs of disturbance (from partial clearing, dieback, logging, grazing). Presence of very aggressive weeds.	Low native plant species diversity <sup>1</sup>	5-50%
<b>Degraded</b> Basic vegetation structure severely impacted by disturbance. Requires intensive management. Disturbance evident such as partial clearing, dieback, logging and grazing. Presence of very aggressive weeds at high density.	Very low native plant species diversity	20-70%

KEIGHERY (1994) VEGETATION CONDITION SCALE	INDICATIVE CONDITION MEASURES/THRESHOLDS	
Completely Degraded Vegetation structure is no longer intact and the area is completely or almost completely without native flora. Equivalent to 'Parkland Cleared'.	Very low to no native species diversity	Greater than 70%

1. relative to expected natural range of diversity for that vegetation unit e.g. Floristic Community Type where comparative data exists.

### 1.3 Minimum Patch Size

Different minimum patch sizes apply to different levels of condition, as outlined below:

- Pristine – no minimum patch size
- Excellent – 0.5 ha or 5,000 m<sup>2</sup> (50 x 100 m)
- Very Good – 1 ha or 10,000 m<sup>2</sup> (100 x 100 m)
- Good – 2 ha or 20,000 m<sup>2</sup> (200 x 100 m)

### 1.4 Further Information

The following information should be taken into consideration when applying the key diagnostic criteria and condition thresholds:

- Land use history and landscape position of patch including position relative to surrounding vegetation
- A patch is a discreet and mostly continuous area of the ecological community and may include small-scale variations (<30 m), gaps and disturbances such as tracks paths or breaks that do not significantly alter the overall functionality of the ecological community.
- Variation in canopy cover, quality or condition of vegetation across a patch should not be considered evidence of multiple patches
- A buffer zone is a contiguous area immediately adjacent to a patch of the ecological community. The recommended minimum buffer zone is 20-50 m. larger buffer zones should be considered for patches of particularly high conservation value, or if patches are down slope of drainage lines or a source of nutrient enrichment, or groundwater drawdown.
- Restored vegetation is not excluded provided it meets the key diagnostic criteria, condition threshold and patch size.
- Sampling protocols includes developing a quick map of the vegetation, landscape qualities and management history. Following this, a thorough sampling exercise must be undertaken to represent the range of variation. At least one hour per plot in early to mid-spring and a second survey in late spring may be required to detect the majority of species. plots to be at least 100 m<sup>2</sup> (10 x 10 m). Search effort (number of person hours per plot across entire patch) and surveyor's level of expertise can be useful for future reference.
- Timing of surveys should allow a reasonable interval after a disturbance. Surveys at least one year post fire may be required to assess a site against the key diagnostic characteristics and minimum condition thresholds.
- Surrounding environment, landscape context and other significance considerations:
  - patches that are more species rich and less disturbed are likely to provide greater biodiversity value.
  - Patches that provide corridors or linkages within a largely modified landscape are particularly important.

The Conservation Advice provides an additional ten indicators to be considered when assessing impacts of actions or proposed actions under the EPBC Act. These are not further listed here.

## 2.0 Assessment

Patches are defined as a discreet and mostly continuous area of the ecological community. All native vegetation in Good or better condition were considered for an assessment against the key diagnostic criteria for the TEC. A preliminary review of Banksia species present was undertaken. Patches that had no Banksia overstorey species were excluded from further consideration.

The native vegetation has been separated into four patches:

- Patch 1 = quadrat 6
- Patch 2 = quadrat 13
- Patch 3 = quadrat 9; and
- Patch 4 = quadrat S01.

The key diagnostic features have been assessed using quadrats from each patch .

Key diagnostic characteristics of Patch	1	2	3	
Location and physical environment				
The Banksia Woodlands ecological community primarily occurs on the Swan Coastal Plain IBRA bioregion. Pockets of the community also extent into the adjacent lower parts of the Darling and Whicher escarpments that lie within the Jarrah Forest IBRA bioregion to the immediate east and south of the Swan Coastal Plain.	Y	Y	Y	Y

Key diagnostic characteristics of Patch	1	2	3	
<b>Soils and landform</b>				
Typically occurs on well drained, low nutrient soils on sandplain landforms, particularly deep Bassendean and Spearwood sands and occasionally on Quindalup sands. Is also common on sandy colluvium and Aeolian sands of the Ridge Hill Shelf, Whicher Scarp and Dandaragan Plateau. In other less common scenarios (transitional substrates, sandflats)	Y	Interzone of Pinjarra Plain and Bassendean Sands.	Y	Y
<b>Structure</b>				
A distinctive upper sclerophyllous layer of low trees (occasionally large shrubs more than 2 m tall), typically dominated or co-dominated by one or more of the <i>Banksia</i> species identified below; AND	Y – sparse low woodland	Y – low open woodland	Y – low open woodland	Y – low open woodland
Emergent trees of medium or tall (<10 m) height <i>Eucalyptus</i> or <i>Allocasuarina</i> species may sometimes be present above the <i>Banksia</i> canopy; AND	Y – <i>A. fraseriana</i> , <i>Nuytsia floribunda</i>	Y – <i>A. fraseriana</i> , <i>Nuytsia floribunda</i>	Y – <i>E. todtiana</i> , <i>A. fraseriana</i>	Y – <i>A. fraseriana</i> , <i>Nuytsia floribunda</i>
An often highly species-rich understorey that consists of: <ul style="list-style-type: none"> <li>· A layer of sclerophyllous shrubs of various heights</li> <li>· A herbaceous ground layer of cord rushes, sedges and perennial and ephemeral forbs that sometimes includes grasses.</li> </ul> The development of a ground layer may vary depending on the density of the shrub layer and disturbance history.	Y – 31 sclerophyllous shrubs, 12 sedges and rushes, and 26 forbs	Average – 19 sclerophyllous shrubs, 5 rushes and sedges, and 21 forbs	Average (due to poor condition) – 14 sclerophyllous shrubs, 4 rushes and sedges, 15 forbs.	
<b>Composition</b>				
Canopy is most commonly dominated or co- dominated by <i>Banksia attenuata</i> and/or <i>Banksia menziesii</i> . Other <i>Banksia</i> species that dominate in some examples of the ecological community are <i>B. prionotes</i> or <i>B. ilicifolia</i> ; AND	Y – 5% <i>B. attenuata</i>	Y – 3-8% <i>B. attenuata</i> , 10-15% <i>B. menziesii</i>	Y – 5% <i>B. menziesii</i>	Y – 3-8% <i>B. attenuata</i> , 10-15% <i>B. menziesii</i>
Patch must include at least one of the following diagnostic species: <ul style="list-style-type: none"> <li>· <i>Banksia attenuata</i></li> <li>· <i>Banksia menziesii</i></li> <li>· <i>Banksia prionotes</i></li> <li>· <i>Banksia ilicifolia</i></li> </ul>	Y	Y	Y	Y
If present, the emergent tree layer often includes <i>Corymbia calophylla</i> , <i>E. marginata</i> , or less commonly <i>E. gomphocephala</i> ; AND	Not present	Not present	Not present	Not present
Other trees of a medium height may be present and may be co-dominant with the <i>Banksia</i> species across a patch, include <i>E. todtiana</i> , <i>Nuytsia floribunda</i> , <i>Allocasuarina fraseriana</i> , <i>Callitris arenaria</i> , <i>Callitris pyramidalis</i> and <i>Xylomelum occidentale</i> ; AND	Sparse <i>A. fraseriana</i>	Y – 0-15% <i>A. fraseriana</i> , isolated <i>E. todtiana</i>	Y – 5% <i>E. todtiana</i>	Y – 0-15% <i>A. fraseriana</i> , isolated <i>E. todtiana</i>
Understorey typically contains high to very high diversity of shrub and herb species that often vary from patch to patch.	Y – 76 total species richness (n=2)	Average – 53 total species richness (n=2)	Average – 42 total species richness (n=2)	Average -
<b>Contra-indicators</b>				

Key diagnostic characteristics of Patch	1	2	3	
Patches clearly dominated by <i>Banksia littoralis</i> are not part of the TEC	N	N	N	N
Patches clearly dominated by <i>Banksia burdettii</i> are not the TEC	N	N	N	N
FCT 20c – Eastern shrublands and woodlands, corresponds with a separate EPBC ecological community listing, Shrublands and Woodlands of the eastern Swan Coastal Plain. Occurrences of this FCT should be considered under that separate listing.	N	N	N	N

## 2.1 Patch 1 – 79 Victoria Road

Patch 1 incorporates native vegetation at 79 Victoria Road. This patch meets all the key diagnostic features, size and condition thresholds as published in the approved conservation advice (TSSC, 2016).

It is likely that the patch extends beyond this cadastral boundary however adjacent properties were excluded from the survey. The patch is mapped as Banksia woodland with an isolated pocket of Jarrah woodland on the southern tip. The patch also represents the WA TEC SCP20a *B. attenuata* over species rich dense shrublands. Vegetation condition is excellent.

Site Detail	Site Description
<b>Location</b>	79 Victoria Road, Wattle Grove
<b>Key Diagnostic characteristics</b>	Meets all key diagnostic characteristics. Very open overstorey of Banksia trees over species-rich dense shrublands.
<b>Condition</b>	Excellent
<b>Patch Size</b>	1.8 ha
<b>Additional features</b>	Represents FCT20a <i>B. attenuata</i> over species rich dense shrublands. Potential to re-establish connection with adjacent Banksia woodlands beyond survey area. Supports populations of threatened <i>Conospermum undulatum</i> and Priority 3 <i>Isopogon autumnalis</i> .
<b>Land use history</b>	Rural to urban development
<b>Any variations in patch</b>	Patch has been resilient to significant weed invasion (<1m from edge excluded).
<b>Buffer zone present</b>	Limited buffer present for approximately 25% of patch.
<b>Sampling protocol</b>	Single scoring event of one non-permanent quadrat 10X10m delineated by measuring tape.
<b>Disturbance History</b>	Represents remnant native vegetation
<b>Surrounding environment</b>	Predominantly cleared for lawn, houses and various private estate use.



Plate 1 Patch 1 photograph

2.2 Patch 2 – 58 Victoria Road

Patch 2 is isolated to remnant native vegetation on 58 Victoria Road. This patch meets all key diagnostic criteria, condition and size thresholds.

The patch is likely to extend beyond this cadastral boundary, particularly northwest. The patch includes two discreet areas separated by planted and native trees and a house. Due to the connection of canopies of trees along both sides of the house these two areas are considered representative of the same patch.

The patch represents two vegetation communities, both broadly described as Banksia woodlands. Vegetation condition varied between Degraded to Excellent which reflects historical clearing. In particular, the patch at the front of the house has been subject to partial clearing of the understorey. It falls outside the required 0.5 ha by such a minute amount which relies on precise mapping. The precautionary principle has been applied.

Site Detail	Site Description
Location	58 Victoria Road, Wattle Grove
Key Diagnostic characteristics	Meets all key diagnostic characteristics. Very open overstorey of Banksia trees over species-rich dense shrublands.
Condition	Excellent
Patch Size	0.49
Additional features	Patch represents two occurrences on 58 Victoria Road separated by planted trees and a house. Has the potential to be linked to larger remnant native vegetation on adjacent property. Continues to support high species richness and be resilient to weed invasion. Supports small population of threatened <i>Conospermum undulatum</i> flora.
Land use history	Rural to urban development
Any variations in patch	The northwest section of the patch has been resilient to significant weed invasion (<1 m from edge excluded). The area in front of the house has been partially cleared (understorey only) and weeds have displaced some native vegetation.
Buffer zone present	Buffer of native and introduced trees (no hardstand) present around entire patch.
Sampling protocol	Single scoring event of one non-permanent quadrat 10x10 m delineated by measuring tape and one relevé.
Disturbance History	Represents remnant native vegetation
Surrounding environment	Predominantly cleared for lawn, houses and various private estate use.



Plate 2 Patch 2 vegetation

2.4 Patch 3 – 30 and 38 Brentwood Road

Patch 3 is restricted to the southeast corner of 30 and 38 Brentwood Road, separated by a cleared track approximately 15 m wide. The northern area of this patch (represented by relevé 08) is significantly disturbed with understorey species displaced by weeds and suffering from considerable edge effects. The southern area represented by quadrat 09 was in better condition.

This patch is not representative of the EPBC TEC Banksia Woodlands of the SCP due to degradation and size of the patch.

Site Detail	Site Description
<b>Location</b>	30 and 38 Brentwood Road, Wattle Grove
<b>Key Diagnostic characteristics</b>	Arguably could meet the key diagnostic characteristics despite low diversity due to degraded condition.
<b>Condition</b>	Good to Very Good
<b>Patch Size</b>	0.42
<b>Additional features</b>	Isolated from other patches of native vegetation with the exception of native and introduced trees. The quadrat infers FCT23a central <i>B. attenuata</i> - <i>B. menziesii</i> woodlands.
<b>Land use history</b>	Rural to urban development
<b>Any variations in patch</b>	Weeds affect 50% of the patch. Edge effects are significant.
<b>Buffer zone present</b>	Surrounded by gardens, road and cleared areas.
<b>Sampling protocol</b>	Single scoring event of one non-permanent 10x10 m quadrat delineated by measuring tape and one relevé.
<b>Disturbance History</b>	Unknown. The area in better condition is likely to represent remnant native vegetation. The other area may represent regrowth or has been significantly cleared.
<b>Surrounding environment</b>	Cleared for lawn, houses and various private estate use.



Plate 4 – Patch 3 vegetation

## 2.5 Patch 4 – 30 and 38 Crystal Brook Road, Wattle Grove

Patch 4 is restricted to the eastern half of 30 Crystal Brook Road, with some sections of more disturbed vegetation on 38 Crystal Brook Road, separated by a property access road approximately 8 m wide. The western area of this patch (which could not be accessed) appeared to be in excellent condition compared to the more disturbed understorey species displaced by weeds and suffering from considerable edge effects in the eastern section. The eastern area is represented by quadrat N04, with 5 relevés helping to delineate this community.

This patch is representative of the EPBC TEC Banksia Woodlands of the SCP due to its generally excellent condition and the size of the patch.

Site Detail	Site Description
<b>Location</b>	30 and 38 Crystal Brook Road, Wattle Grove
<b>Key Diagnostic characteristics</b>	Meets all key diagnostic characteristics. Very open overstorey of Banksia trees over species-rich dense shrublands.
<b>Condition</b>	Good to Excellent
<b>Patch Size</b>	2.07 ha

Site Detail	Site Description
<b>Additional features</b>	Isolated from other patches of native vegetation with the exception of native and introduced trees. The quadrat infers FCT23a central <i>B. attenuata</i> - <i>B. menziesii</i> woodlands.
<b>Land use history</b>	Rural to urban development
<b>Any variations in patch</b>	Western area of vegetation is in excellent condition, but the area on 38 Crystal Brook Road is affected by weeds 50% of the patch and also significant edge effects.
<b>Buffer zone present</b>	Surrounded by gardens, road and cleared areas.
<b>Sampling protocol</b>	Single scoring event of one non-permanent quadrat 10x10 m delineated by measuring tape and five relevés.
<b>Disturbance History</b>	Represents remnant native vegetation
<b>Surrounding environment</b>	Predominantly cleared for lawn, houses and various private estate use.



Plate 5 – Patch 4 vegetation

## Flora Species by Family & Community Matrix

Family	Taxon	Community					
		BaEpPf	BmXpEc	CcHaEc	EmCaFa	EmMpLp	EmPcAh
Anarthriaceae	<i>Lyginia imberbis</i>	x	x				
Apiaceae	<i>Platysace tenuissima</i>				x		
	<i>Xanthosia atkinsoniana</i>				x		
	<i>Xanthosia candida</i>				x		x
	<i>Xanthosia huegelii</i>						x
Araliaceae	<i>Trachymene pilosa</i>	x	x			x	
Asparagaceae	<i>Acanthocarpus preissii</i>	x					
	<i>Asparagus asparagoides</i>			x			
	<i>Lomandra caespitosa</i>		x				x
	<i>Lomandra drummondii</i>	x					
	<i>Lomandra hermaphrodita</i>	x	x				x
	<i>Lomandra micrantha</i>	x	x				x
	<i>Lomandra preissii</i>	x	x		x	x	x
	<i>Lomandra sonderi</i>	x	x		x	x	x
	<i>Lomandra sp.</i>	x					
	<i>Thysanotus multiflorus</i>					x	
	<i>Thysanotus patersonii</i>	x	x	x		x	x
	<i>Thysanotus thyrsoideus</i>	x					
	<i>Thysanotus triandrus</i>				x		
Asteraceae	* <i>Arctotheca calendula</i>	x	x				
	* <i>Hypochoeris glabra</i>	x	x		x	x	x
	<i>Podolepis gracilis</i>		x				
	* <i>Sonchus oleraceus</i>						x
	* <i>Ursinia anthemoides</i>	x	x		x		x
Campanulaceae	? <i>Lobelia anceps</i>	x		x	x		x
Casuarinaceae	<i>Allocasuarina fraseriana</i>	x	x		x	x	
	<i>Allocasuarina humilis</i>	x	x			x	
Celastraceae	<i>Tripterococcus brunonis</i>				x		
Colchicaceae	<i>Burchardia congesta</i>	x	x		x	x	x
Cyperaceae	<i>Cyathochaeta avenacea</i>		x	x	x		
	<i>Lepidosperma leptostachyum</i>	x				x	x
	<i>Lepidosperma pubisquameum</i>				x		
	<i>Lepidosperma sp.</i>				x		
	<i>Lepidosperma tenue</i>		x		x	x	
	<i>Mesomelaena pseudostygia</i>	x	x		x	x	
	<i>Mesomelaena tetragona</i>	x	x		x		
	<i>Phlebocarya filifolia</i>	x	x				
	<i>Schoenus clandestinus</i>	x					
	<i>Schoenus pedicellatus</i>	x	x				
	<i>Tetraria capillaris</i>						x
	<i>Tetraria octandra</i>	x	x	x	x	x	x
Dasypogonaceae	<i>Calectasia narragara</i>		x				
	<i>Dasypogon bromeliifolius</i>	x	x			x	
Dilleniaceae	<i>Hibbertia aurea</i>	x					
	<i>Hibbertia huegelii</i>	x					

## Appendix C Flora Species by Family by Community Matrix

Family	Taxon	Community					
		BaEpPf	BmXpEc	CcHaEc	EmCaFa	EmMpLp	EmPcAh
Dilleniaceae	<i>Hibbertia hypericoides</i>	x	x		x	x	x
	<i>Hibbertia subvaginata</i>			x			
Droseraceae	<i>Drosera erythrorhiza</i>	x			x		x
	<i>Drosera gigantea</i>				x		
	<i>Drosera porrecta</i>	x	x			x	x
Ericaceae	<i>Conostephium preissii</i>		x			x	
	<i>Leucopogon capitellatus</i>						x
	<i>Lysinema pentapetalum</i>	x					
Euphorbiaceae	<i>Monotaxis grandiflora</i> var. <i>grandiflora</i>	x					
Fabaceae	<i>Acacia alata</i> var. <i>alata</i>		x				
	<i>Acacia lasiocarpa</i> var. <i>lasiocarpa</i>		x		x	x	x
	* <i>Acacia longifolia</i>					x	
	<i>Acacia nervosa</i>				x		
	<i>Acacia pulchella</i> var. <i>pulchella</i>			x	x	x	x
	<i>Acacia</i> sp.		x			x	x
	<i>Bossiaea aquifolium</i>				x		
	<i>Bossiaea eriocarpa</i>	x	x		x	x	
	<i>Bossiaea ornata</i>				x		
	* <i>Chamaecytisus palmensis</i>					x	x
	<i>Daviesia decurrens</i> subsp. <i>decurrens</i>	x			x		
	<i>Daviesia divaricata</i> subsp. <i>divaricata</i>		x		x		
	<i>Daviesia nudiflora</i> subsp. <i>nudiflora</i>	x	x				
	<i>Gompholobium confertum</i>	x					
	<i>Gompholobium knightianum</i>		x		x		x
	<i>Gompholobium tomentosum</i>				x		x
	<i>Hovea chorizemifolia</i>			x			
	<i>Hovea pungens</i>	x	x				
	<i>Hovea trisperma</i>	x	x		x		x
	<i>Isotropis cuneifolia</i> subsp. <i>cuneifolia</i>				x		x
	<i>Jacksonia floribunda</i>		x		x		
	<i>Jacksonia furcellata</i>				x	x	
	<i>Jacksonia lehmannii</i>	x					
	<i>Kennedia coccinea</i>				x		x
	<i>Labichea punctata</i>	x	x		x	x	x
	* <i>Lotus angustissimus</i>		x		x	x	
	* <i>Lupinus angustifolius</i>						x
<i>Sphaerolobium medium</i>	x						
Goodeniaceae	<i>Dampiera alata</i>		x				
	<i>Dampiera linearis</i>	x	x			x	x
	<i>Lechenaultia biloba</i>				x	x	x
	<i>Scaevola canescens</i>						x
	<i>Scaevola repens</i> var. <i>repens</i>	x	x				
Haemodoraceae	<i>Anigozanthos manglesii</i> subsp. <i>manglesii</i>		x		x		
	<i>Conostylis aculeata</i>		x				
	<i>Conostylis aurea</i>	x					

## Appendix C Flora Species by Family by Community Matrix

Family	Taxon	Community					
		BaEpPf	BmXpEc	CcHaEc	EmCaFa	EmMpLp	EmPcAh
Haemodorum	<i>Conostylis setigera</i>	x			x		
	<i>Conostylis setigera</i> subsp. <i>setigera</i>		x				
	<i>Haemodorum laxum</i>	x	x		x	x	x
	<i>Haemodorum</i> sp.		x		x	x	
	<i>Haemodorum spicatum</i>	x			x		
Haloragaceae	<i>Gonocarpus pithyoides</i>				x	x	
Hemerocallidaceae	<i>Agrostocrinum hirsutum</i>	x			x		x
	<i>Caesia micrantha</i>		x		x	x	
	<i>Tricoryne elatior</i>	x	x		x	x	
Iridaceae	* <i>Freesia alba</i> x <i>leichtlinii</i>		x		x	x	x
	* <i>Gladiolus caryophyllaceus</i>	x	x		x	x	
	<i>Patersonia juncea</i>				x		
	<i>Patersonia occidentalis</i>	x	x				
	<i>Patersonia pygmaea</i>	x					
	* <i>Romulea rosea</i>				x		
	* <i>Watsonia meriana</i>			x			
Lamiaceae	<i>Hemiandra pungens</i>	x	x				
	<i>Hemiphora bartlingii</i>	x					
Lauraceae	<i>Cassytha glabella</i>	x			x		
Loranthaceae	<i>Nuytsia floribunda</i>	x					
Myrtaceae	<i>Agonis flexuosa</i>		x				
	<i>Babingtonia camphorosmae</i>		x				x
	<i>Calytrix glutinosa</i>				x		
	<i>Chamelaucium uncinatum</i>		x				
	<i>Conothamnus trinervis</i>	x					
	<i>Corymbia calophylla</i>			x	x		x
	<i>Darwinia citriodora</i>			x			
	<i>Eremaea pauciflora</i> var. <i>pauciflora</i>	x	x		x	x	
	<i>Eucalyptus gomphocephala</i>		x				
	<i>Eucalyptus marginata</i> subsp. <i>marginata</i>		x		x	x	x
	<i>Eucalyptus</i> sp.		x		x		
	<i>Eucalyptus todtiana</i>	x	x				
	<i>Hovea chorizemifolia</i>				x		
	<i>Hypocalymma angustifolium</i>			x			
	<i>Hypocalymma robustum</i>		x		x	x	
	<i>Melaleuca systema</i>		x			x	
	<i>Melaleuca trichophylla</i>	x					
<i>Pericalymma ellipticum</i>	x						
Orchidaceae	<i>Caladenia flava</i>	x					
	<i>Prasophyllum</i> sp.				x		
	<i>Pterostylis sanguinea</i>				x		
	<i>Thelymitra graminea</i>	x			x		x
Oxalidaceae	* <i>Oxalis pes-caprae</i>		x				

Family	Taxon	Community					
		BaEpPf	BmXpEc	CcHaEc	EmCaFa	EmMpLp	EmPcAh
Phyllanthaceae	<i>Phyllanthus calycinus</i>				X		X
	Pittosporaceae				X		
	<i>Billardiera fraseri</i>				X		
Poaceae	<i>Austrostipa compressa</i>		X				X
	* <i>Avena barbata</i>		X	X			
	* <i>Briza maxima</i>	X	X		X	X	X
	* <i>Briza minor</i>			X	X		
	* <i>Ehrharta calycina</i>	X	X	X	X	X	X
	* <i>Eragrostis curvula</i>	X			X		
	<i>Neurachne alopecuroidea</i>	X			X		
	<i>Tetrarrhena laevis</i>	X					X
Primulaceae	* <i>Lysimachia arvensis</i>				X		X
Proteaceae	<i>Adenanthos cygnorum</i> subsp. <i>cygnorum</i>	X	X				
	<i>Banksia armata</i> var. <i>armata</i>	X			X		
	<i>Banksia attenuata</i>	X	X				
	<i>Banksia dallanneyi</i>	X			X	X	
	<i>Banksia menziesii</i>	X	X				
	<i>Banksia sessilis</i> var. <i>sessilis</i>		X				X
	<i>Conospermum undulatum</i>	X					
	<i>Grevillea bipinnatifida</i> subsp. <i>bipinnatifida</i>		X		X	X	
	<i>Hakea amplexicaulis</i>		X				
	<i>Hakea conchifolia</i>	X					
	<i>Hakea lissocarpha</i>						X
	<i>Hakea prostrata</i>	X					
	<i>Hakea ruscifolia</i>		X				
	<i>Hakea stenophylla</i>				X		
	<i>Hakea trifurcata</i>		X	X	X	X	
	<i>Hakea undulata</i>		X		X		
	<i>Isopogon autumnalis</i>	X	X				
	<i>Isopogon dubius</i>	X			X	X	
	<i>Lambertia multiflora</i> var. <i>darlingensis</i>	X	X		X	X	
	<i>Persoonia angustiflora</i>	X					
	<i>Petrophile linearis</i>	X					
	<i>Petrophile macrostachya</i>	X			X		
	<i>Petrophile seminuda</i>	X					
	<i>Stirlingia latifolia</i>	X	X			X	
	<i>Synaphea spinulosa</i> subsp. <i>spinulosa</i>		X			X	
Restionaceae	<i>Alexgeorgea nitens</i>	X	X				
	<i>Desmocladius fasciculatus</i>	X	X		X	X	X
	<i>Hypolaena exsulca</i>	X					
	<i>Loxocarya cinerea</i>	X			X		
Rhamnaceae	<i>Spyridium globulosum</i>			X			
Rubiaceae	<i>Opercularia vaginata</i>		X				
Rutaceae	<i>Philotheca spicata</i>	X	X		X	X	

Family	Taxon	Community					
		BaEpPf	BmXpEc	CcHaEc	EmCaFa	EmMpLp	EmPcAh
Solanaceae	* <i>Solanum nigrum</i>						x
Stylidiaceae	<i>Stylidium amoenum</i>	x					
	<i>Stylidium brunonianum</i>		x		x		
	<i>Stylidium hispidum</i>				x		
	<i>Stylidium piliferum</i>				x		x
	<i>Stylidium schoenoides</i>	x	x				x
Violaceae	<i>Hybanthus calycinus</i>	x	x				
Xanthorrhoeaceae	<i>Chamaescilla corymbosa</i> var. <i>corymbosa</i>		x				x
	<i>Xanthorrhoea acanthostachya</i>	x	x				
	<i>Xanthorrhoea gracilis</i>		x				x
	<i>Xanthorrhoea preissii</i>	x	x		x	x	x

## Appendix F Reconnaissance Flora and Vegetation Assessment

A reconnaissance flora and vegetation assessment was undertaken by Rachel Pratt, an ecologist with over 20 years' experience undertaking flora and vegetation assessments on the swan coast plan. Surveys were undertaken on 24 January 2022 date on Lot 210, 21, 4, 803, 802 and 801.

Lot 210 (Plate 1; Plate 2) contained an intact Banksia woodland with a high diversity of shrubs and groundcover. Structurally the vegetation was consistent with the *Banksia Woodlands of the Swan Coastal Plain* Threatened Ecological Community (TEC) listed under the EPBC Act. The site showed floristic similarities to the Western Australian listed TEC *Banksia attenuata woodlands over species rich dense shrublands* (SCP20A).

Due to the time of year (summer) and lack of access to the lot, it was not possible to record the quadrat data which would be required for a Floristic Community Analysis using statistical software, however the site appeared floristically similar to vegetation in Lot 804 in which data was collected from a spring quadrat that could be used to infer the Floristic Community Type of Lot 210.



Plate 1: Lot 210



**Plate 2: Lot 210**

The following taxa were identifiable from the south-eastern boundary of lot 210:

- *\*Briza maxima*
- *\*Ehrharta calycina*
- *\*Gladiolus caryophyllaceus*
- *\*Leptospermum laevigatum*
- *\*Pinus pinaster*
- *\*Ursinia anthemoides*
- *Adenanthos cygnorum* subsp. *cygnorum*
- *Allocasuarina fraseriana*
- *Allocasuarina humilis*
- *Banksia ?dallanneyi*
- *Banksia attenuata*
- *Banksia dallanneyi*
- *Banksia menziesii*
- *Bossiaea eriocarpa*
- *Burchardia congesta*
- *Calothamnus* sp.
- *Conospermum undulatum* (T)
- *Dampiera linearis*
- *Dasyogon bromeliifolius*
- *Daviesia decurrens* subsp. *decurrens*
- *Daviesia nudiflora*
- *Desmocladius fasciculatus*
- *Desmocladius flexuosus*
- *Eremaea pauciflora* var. *pauciflora*
- *Eucalyptus marginata*
- *Eucalyptus todtiana*
- *Gastrolobium capitatum*
- *Gompholobium tomentosum*
- *Haemodorum* sp.
- *Isopogon autumnalis* (P3)
- *Jacksonia floribunda*
- *Johnsonia pubescens*
- *Lambertia multiflora*
- *Lomandra sonderi*
- *Lyginia* sp.
- *Mesomelaena pseudostygia*
- *Patersonia* sp.
- *Petrophile ?rigida*
- *Petrophile macrostachya*
- *Pterostylis* sp.

- *Scaevola repens*
- *Scholtzia involucrata*
- *Stirlingia latifolia*
- *Thysanotus* sp.
- *Xanthorrhoea brunonis*
- *Xanthorrhoea preissii*
- *Xylomelum occidentale*

The majority of remnant vegetation on Lot 210 was in Excellent condition, with the north-eastern vegetation being more degraded due to an infestation of Victorian tea tree (*\*Leptospermum laevigatum*), as shown in Plate 3.



**Plate 3: Victorian tea-tree infestation**

Two conservation significant flora taxa were identified from Lot 210, *Conospermum undulatum* (T) and *Isopogon autumnalis* (P3). Both taxa have been identified on neighboring lots previously (Plate 4)



**Plate 4 *Conospermum undulatum* on Lot 210**

Lot 201 contained suitable foraging habitat for Western Australia's three Threatened black cockatoo species. Based on visual estimates from the site boundary, The lot most likely contained foraging species at sufficient cover to qualify as Moderate (3-4) foraging value (Bamford, 2018). The site context score is low (0) as the local area (within 15 km) contains approximately 32,000 ha of remnant native vegetation. It was not possible to assess the Species Density (stocking rate).

An ecological linkage is present between vegetation in Lot 210 and vegetation in neighbouring lots.

#### **Lot 21**

Lot 21 did not contain any native vegetation other than one large tuart (*Eucalyptus gomphocephala*). Several eastern states Eucalypts (*\*Eucalyptus grandis* and *\*E. botryoides*) on the property would have roosting or foraging value for black cockatoos and were of greater than 500 mm DBH (Plates 5 and 6)



Plate 5: Lot 21



**Plate 6: Lot 21**

**Lot 4**

Lot 4 did not contain any native vegetation other than one large jarrah (*Eucalyptus marginata*) of approximately 400 mm DBH. One lemon scented gum (*\*Corymbia citriodora*) would have roosting or foraging value for black cockatoos and was of greater than 500 mm DBH.



**Plate 7: Lot 4**



**Plate 8: Lot 4**

**Lot 803**

Lot 803 appears predominately cleared, with the rear of the block appearing to contain pines with no understorey (Plate 9).



**Plate 9: Lot 803**

**Lot 802**

Lot 802 was predominantly cleared (Completely Degraded) with a small pocket of native vegetation (Condition: Good) (0.05 ha) at the rear of the block (see photos below of the pocket of veg) as shown in Plate 10, 11, 12 and 13.



**Plate 10: Lot 802**



**Plate 11 Lot 802**



**Plate 12 Lot 802**



**Plate 13 Lot 802**

Remnant vegetation on Lot 802 contained the following taxa:

- *\*Briza maxima*
- *\*Ehrharta calycina*
- *\*Gladiolus caryophyllaceus*
- *\*Leptospermum laevigatum*
- *\*Ursinia anthemoides*
- *\*Wahlenbergia capensis*
- *?Styphelia sp.*
- *Acacia saligna*
- *Adenanthos cygnorum* subsp.  
*cygnorum*
- *Allocasuarina fraseriana*
- *Allocasuarina humilis*
- *Anigozanthos manglesii* subsp.  
*manglesii*
- *Banksia attenuata*
- *Banksia menziesii*
- *Bossiaea eriocarpa*
- *Conospermum undulatum* (T)
- *Dasypogon bromeliifolius*
- *Eremaea pauciflora* var. *pauciflora*
- *Eucalyptus marginata*
- *Gastrolobium capitatum*
- *Gompholobium tomentosum*
- *Hibbertia hypericoides*
- *Isopogon autumnalis* (P3)
- *Jacksonia floribunda*
- *Mesomelaena pseudostygia*
- *Petrophile seminuda*
- *Scaevola repens*
- *Scholtzia involucrata*
- *Tetraria octandra*
- *Xanthorrhoea? preissii* (a seedling)



**Plate 14 *Conospermum undulatum* on Lot 802.**

**Lot 801**

Lot 801 was cleared (Completely Degraded) and is a significant source of weeds invading remnant vegetation on Lot 210. Lot 801 contained bamboo, Victorian tea tree, common fig, eastern states bottle brush species, Brazilian pepper tree, Flinders Range wattle, Cootamundra wattle and pines. Two old growth Jarrah were present, with a DBH of approximately 1000 mm (Plate 15-17).



Plate 15 Lot 801



Plate 16 Lot 801



**Plate 17 Lot 801**

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## **Appendix 4      FCT analysis (Plantecology 2024)**

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15 July 2024

Kathy Choo  
Director  
CoTerra Environment  
Level 1, 98 Colin St  
West Perth, WA 6005

Dear Kathy,

Plantecology Consulting was commissioned to undertake the numerical analysis and assignment of plot data to existing Floristic Community Types of the Swan Coastal Plain for a site in Wattle Grove. The methods and results outlined below are based on the data as supplied on the 17<sup>th</sup> June 2024.

## 1 Introduction

The remnant vegetation of the southern Swan Coastal Plain (SCP) was surveyed by Gibson et al. (1994) to provide an understanding of the major floristic gradients across the region. The major plant communities (or FCTs) were defined by classifying the data according to the similarities in species composition between plots. When determining the FCT of a new record, a floristic analysis of species composition provides the most robust method that is consistent with the original classification. Presently, a single consistent method for the determination of FCTs for vegetation data in the Swan Coastal Plain is not available. Therefore, it is preferable to use multiple methods and compare the output for the most likely result. The methods used are those outlined in *Methods for Survey and Identification of Western Australian Threatened Ecological Communities* (DBCA 2024) being FCT assignment using the Gibson et al. (1994) and Keighery et al. (2012) datasets, and assignment by the minimum dissimilarity between the Wattle Grove plots and plots from the two regional datasets (nearest neighbour). All analyses described below were undertaken using R packages Cluster (Maechler et al 2019), Vegclust (De Cáceres et al. 2010), optpart (Roberts 2020) and Vegan (Oksanen et al. 2020).

## 2 Methods

### 2.1. Hierarchical Clustering Assignments

Hierarchical agglomerative clustering is the usual first stage in classifying vegetation data into community types. This involves calculating the similarity (or more often, the dissimilarity) between plots within the dataset and then sequentially fusing the plots into groups according to their similarity. This type of method was used in the analysis of the original Swan Coastal Plain dataset (Gibson et al. 1994) and to determine the conservation status of additional plots, data is often added to the original dataset and the analysis re-run (Environmental Protection Authority 2016). The direct use of the original dataset as the basis for assigning new plot data to the regional classification has some drawbacks, however. First, a hierarchical clustering only applies to the relationships between plots, and the relative distances between them, within that particular dataset. The addition of new data often alters the relative cophenetic distances and disrupts the clustering output. Second, as an unsupervised method, hierarchical clustering does not define rules for the membership of the defined groups, and so the addition of new plots requires the rebuilding of the entire hierarchy (De Cáceres and Wiser 2012).

The data for the Swan Coastal Plain regional survey (Gibson et al. 1994) and that of Keighery et al. (2012) was downloaded from the NatureMap website. The current Gibson et al. (1994) dataset has been modified from that of the original survey with the removal of one site (OATES-1), resulting in a dataset of 508 plots. The Keighery et al. (2012) dataset is a compilation of data from a number of floristic studies and extended the Gibson et al. (1994) dataset. The composite dataset used in this analysis was that curated on the NatureMap website as of 2015. Notwithstanding the proviso in Keighery et al. (2012) that the composite dataset should not be used for FCT analyses, it can be useful when assigning new plot data that are potentially from FCT that were under-sampled in the Gibson et al. (1994) survey e.g. FCT 14 and FCT 18.

The species nomenclature of the datasets was updated to be consistent with current usage. Where original names could not be matched clearly to the updated usage, those taxa were removed from the analysis. Intraspecies ranks were raised to species level when no matching rank had been used in the original datasets. Taxa that could not be identified to species level in the Wattle Grove dataset were removed.

The new data from the Wattle Grove survey was added to both Swan Coastal Plain datasets and the new dataset was then analysed using the Bray-Curtis distance coefficient (or resemblance measure) and the flexible beta linkage method (beta = -0.1). Assignment of the Wattle Grove plots was to the nearest distinct group by inspection of the resulting dendrogram. To examine any effect of spatial correlation between the new plots, data was also added to the matrix one plot at a time and the analyses re-run.

In practice, there is often less similarity between a new plot and the plots of the FCT to which it is assigned than between the original plots themselves. That is, new plots are usually most similar to fringing members of the original group.

## 2.2. Nearest Neighbour

The nearest neighbour assignment method uses the minimum Bray-Curtis distance between a new plot and a plot from the original dataset. The comparison of individual samples is seldom useful as new plots are rarely similar to diagnostic plots from the original FCT classification. More often, the nearest neighbour is a fringe member of a FCT and may not be a 'near' neighbour, which regularly leads to misclassifications. Assignments to the nearest group (as in the clustering methods described above) are more robust.

## 3 Results

The cluster analysis of the Wattle Grove plots indicates that there are at least three vegetation units present at the Wattle Grove sites (Figure 1). Cluster 1 comprises Aecom plots 1, 7, 10 and 11, Cluster 2 comprises Aecom plots 4, 6, 9 and 13 as well as JBSG 01, and Cluster 3 comprises Aecom plots 15, 18, 19 and 20.

When assigning all plots at once to the Gibson et al. (1994) and Keighery et al. (2012) datasets, a strong spatial correlation can be seen (Figures 2 and 3) as all Wattle Grove plots fused together as a group and without altering the structure seen in Figure 1.

Assignment to FCTs was more definitive for the single-plot analysis, with some variation in results between datasets (Figures 4-29). Plots from Cluster 1 are most likely members of FCT 3b '*Corymbia calophylla* – *Eucalyptus marginata* woodlands on sandy clay soils'. The assignments to both Swan Coastal Plain datasets were the same although that of Aecom 7 to the Keighery et al. (2012) dataset was more equivocal (Figure 20).

Plots from Cluster 2 were assigned to FCT 20c 'Eastern shrublands and woodlands', except for Aecom 15, which was assigned to FCT 3b by the Gibson et al. (1994) dataset, and S09 ('*Banksia attenuata*

woodlands over dense low shrublands’) or S16 (‘Highly saline seasonal wetlands’) when using the Keighery et al. (2012) dataset. The latter assignment appears unlikely.

Apart from Aecom 9, Cluster 3 plots were assigned to FCT 20a ‘*Banksia attenuata* woodlands over species rich dense shrublands’. Aecom 9 was clearly assigned to FCT 20c using the Gibson et al. (1994) dataset but were equivocal when assigning to the Keighery et al. (2012) dataset.

The presence of typical species for FCTs on the eastern side of the Swan Coastal Plain (DBCA 2024) supports the results of the cluster analysis. Typical species for FCT 3b such as *Gompholobium knightianum*, *Hakea stenocarpa*, *Hakea undulata* and *Xanthosia candida* were recorded for the Cluster 1 plots. Within the Cluster 2 plots, *Grevillea bipinnatifida* and *Podolepis gracilis* were both recorded and are typical for FCT 20c, and taxa typical for FCT 20a such as *Conospermum undulatum*, *Conothamnus trinervis*, *Isopogon autumnalis*, *Hemiphora bartlingii* and *Xanthorrhoea acanthostachya* were all present within Cluster 3 plots.

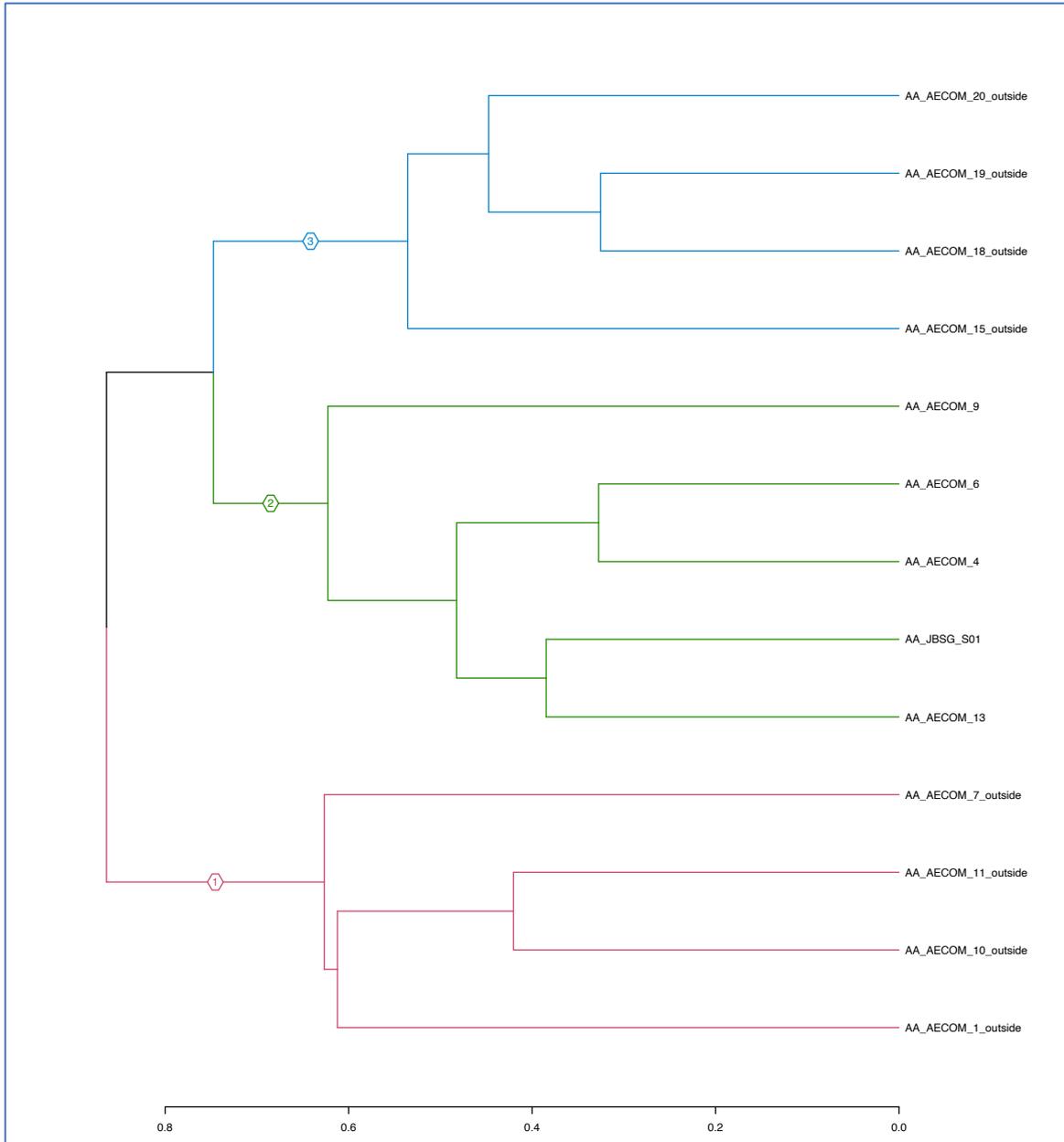
In determining probable FCTs for the Wattle Grove dataset, most weight was given to assignment to the Gibson et al. (1994) dataset, as this produced clearer and more consistent results (Table 1). While assignment to the Keighery et al. (2012) dataset was mostly similar, more disruption to the original classification was observed, with a consequent reduction in confidence of the results. Least weight was given to the nearest neighbour assignments as these were less consistent with the results of the clustering analyses, and none were less 0.5. The cross tabulation of the Bray Curtis dissimilarities between the Swan Coastal Plain and the Wattle Grove plots is shown on Table 2.

**Table 1: Floristic Community Type assignment summary.**

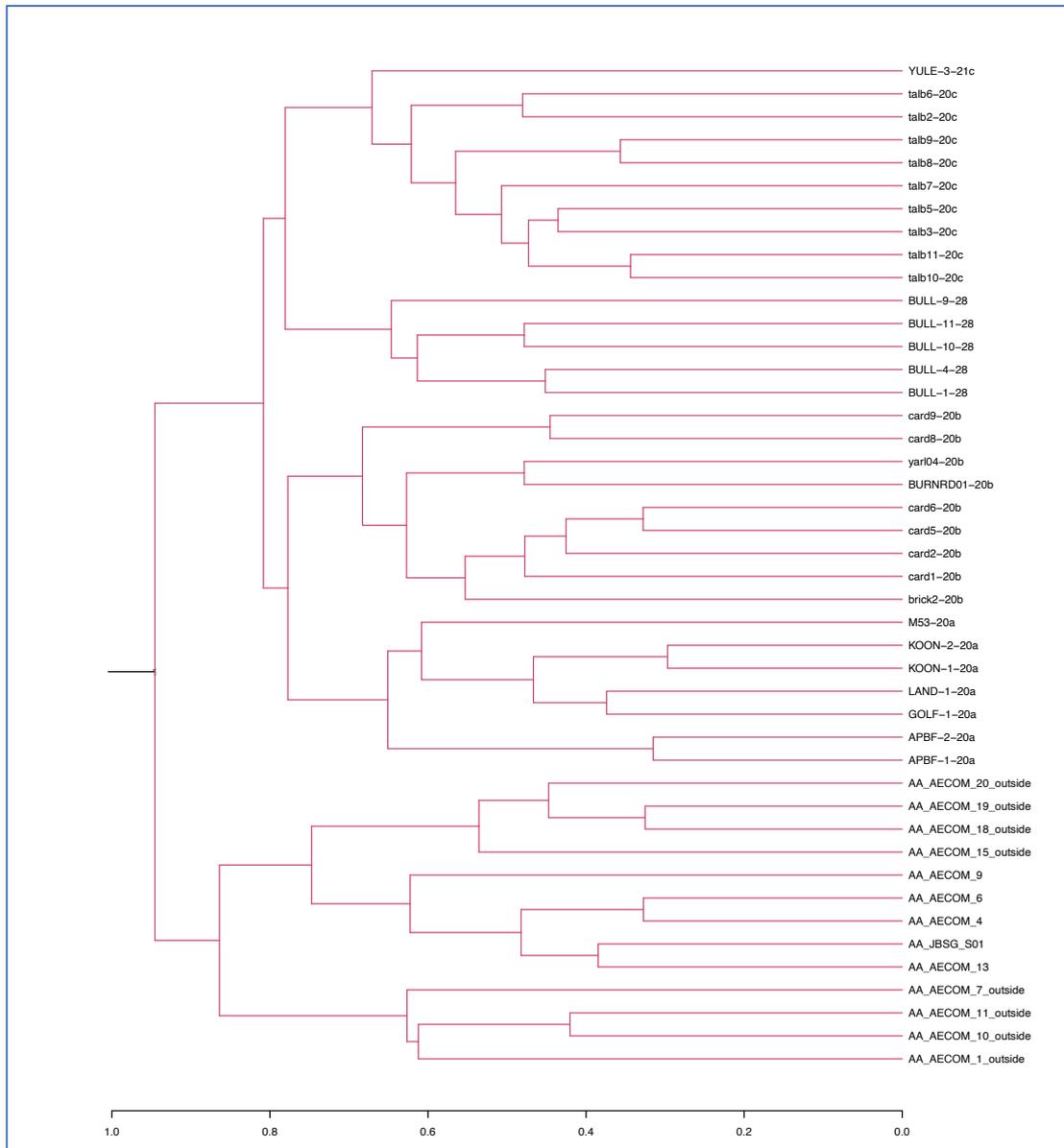
Plot	Assignment to Gibson et al. (1994)	Assignment to Keighery et al. (2012)	Nearest Neighbour	Probable FCT
AECOM_1_outside	3b	3b	20b	3b
AECOM_4	20a	20a	20a	20a
AECOM_6	20a	20a	20c	20a
AECOM_7_outside	3b	3/20	3b	3b
AECOM_9	20c	Undetermined	20c	20c
AECOM_10_outside	3b	3b	3b	3b
AECOM_11_outside	3b	3b	3b	3b
AECOM_13	20a	20a	20a	20a
AECOM_15_outside	3b	S09/S16	20c	3b
AECOM_18_outside	20c	20b	20b	20c
AECOM_19_outside	20c	20c	20b	20c
AECOM_20_outside	20c	Undetermined	20b	20c
JBSG_S01	20a	20a	20a	20a

## 4 Discussion

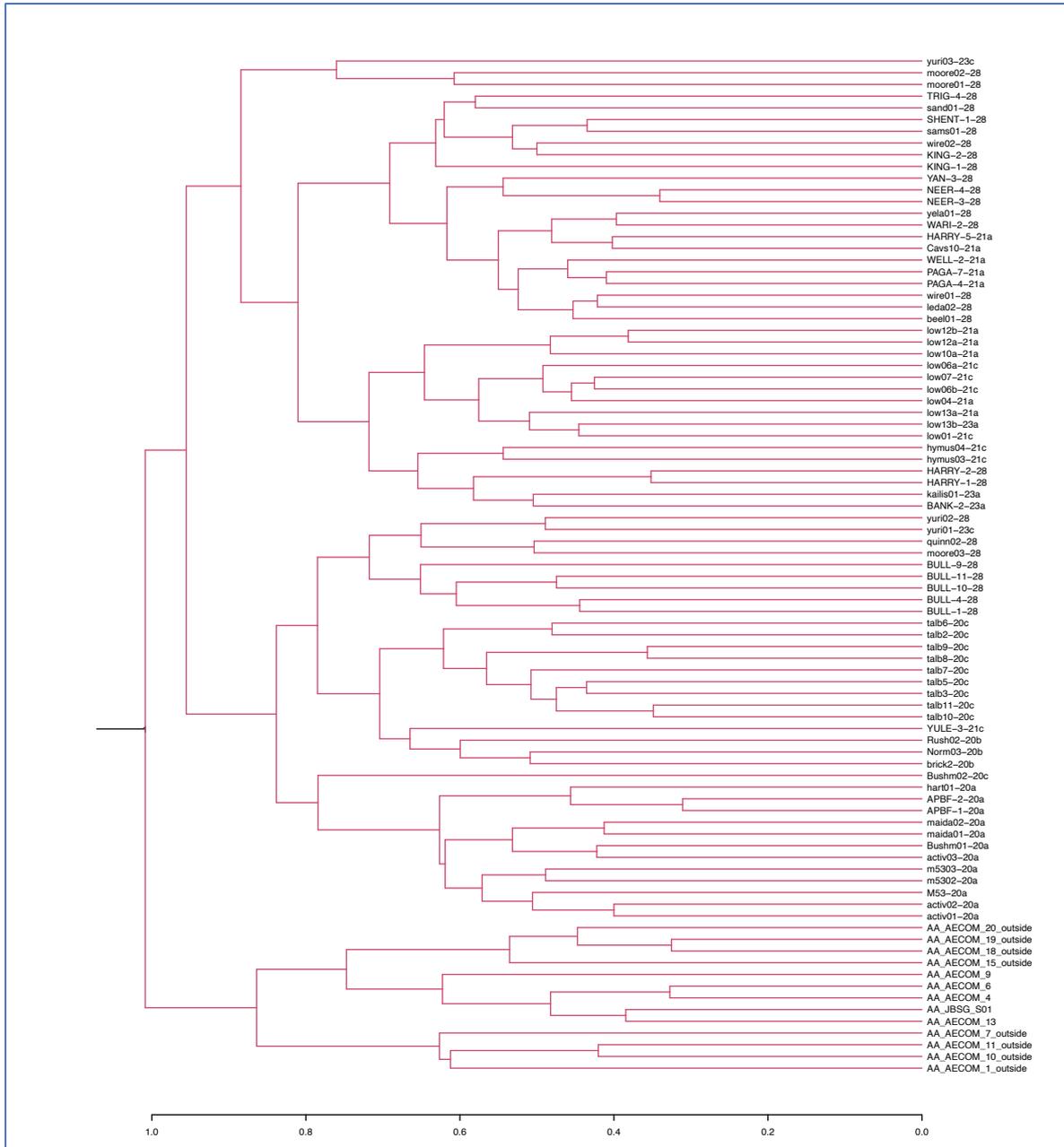
The results of the cluster assignments show that three FCTs are present within the Wattle Grove dataset - FCTs 3b, 20a and 20c. All are listed as Threatened Ecological Communities pursuant to the *Biodiversity Conservation Act 2016*. FCT 20c is also listed as an Endangered TEC pursuant to the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), with FCT 20a forming part of the Endangered ‘*Banksia* woodlands of the Swan Coastal Plain ecological community’ TEC. FCT 3b is not listed under the EPBC Act.



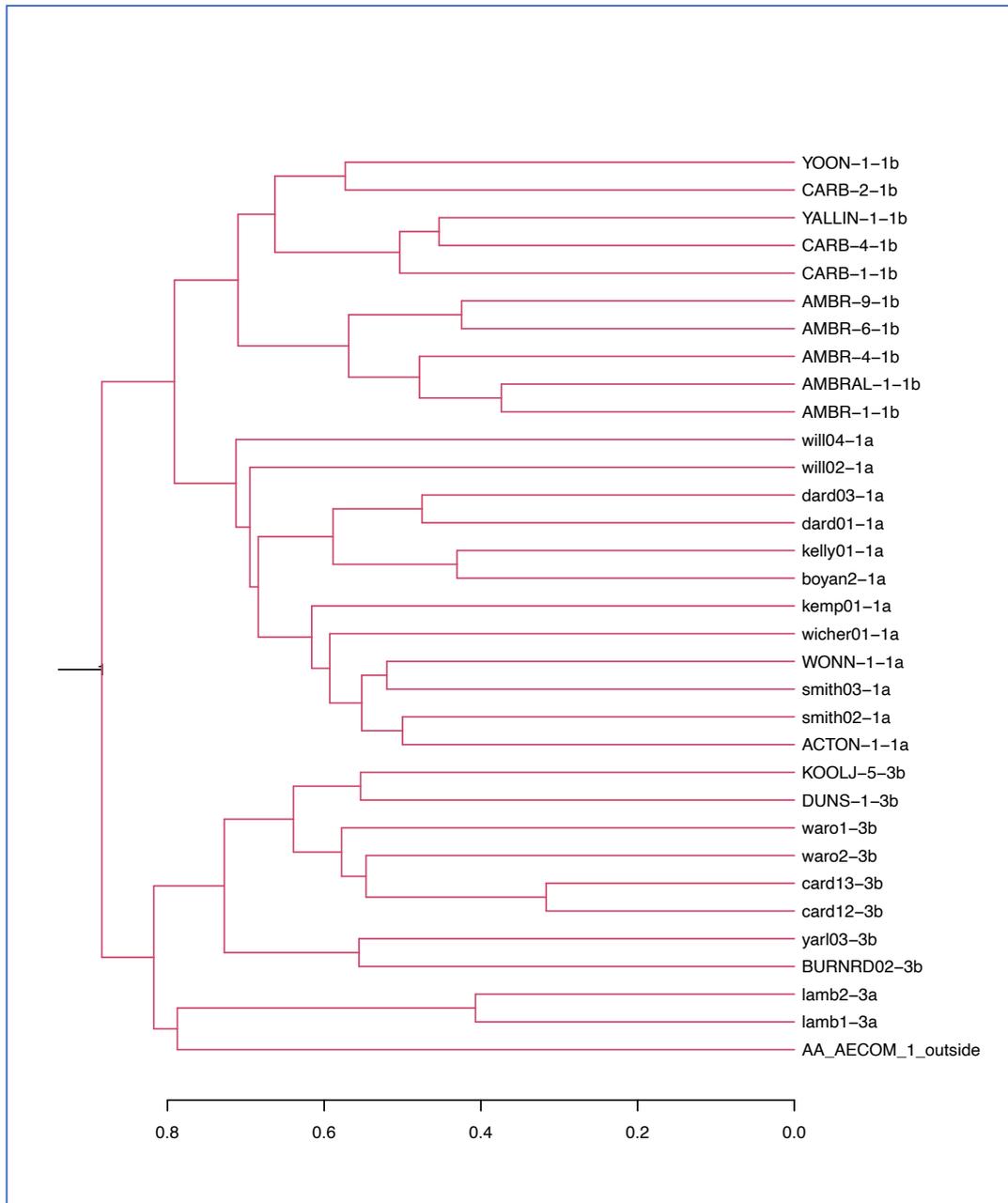
**Figure 1: Dendrogram of Wattle Grove plots.**



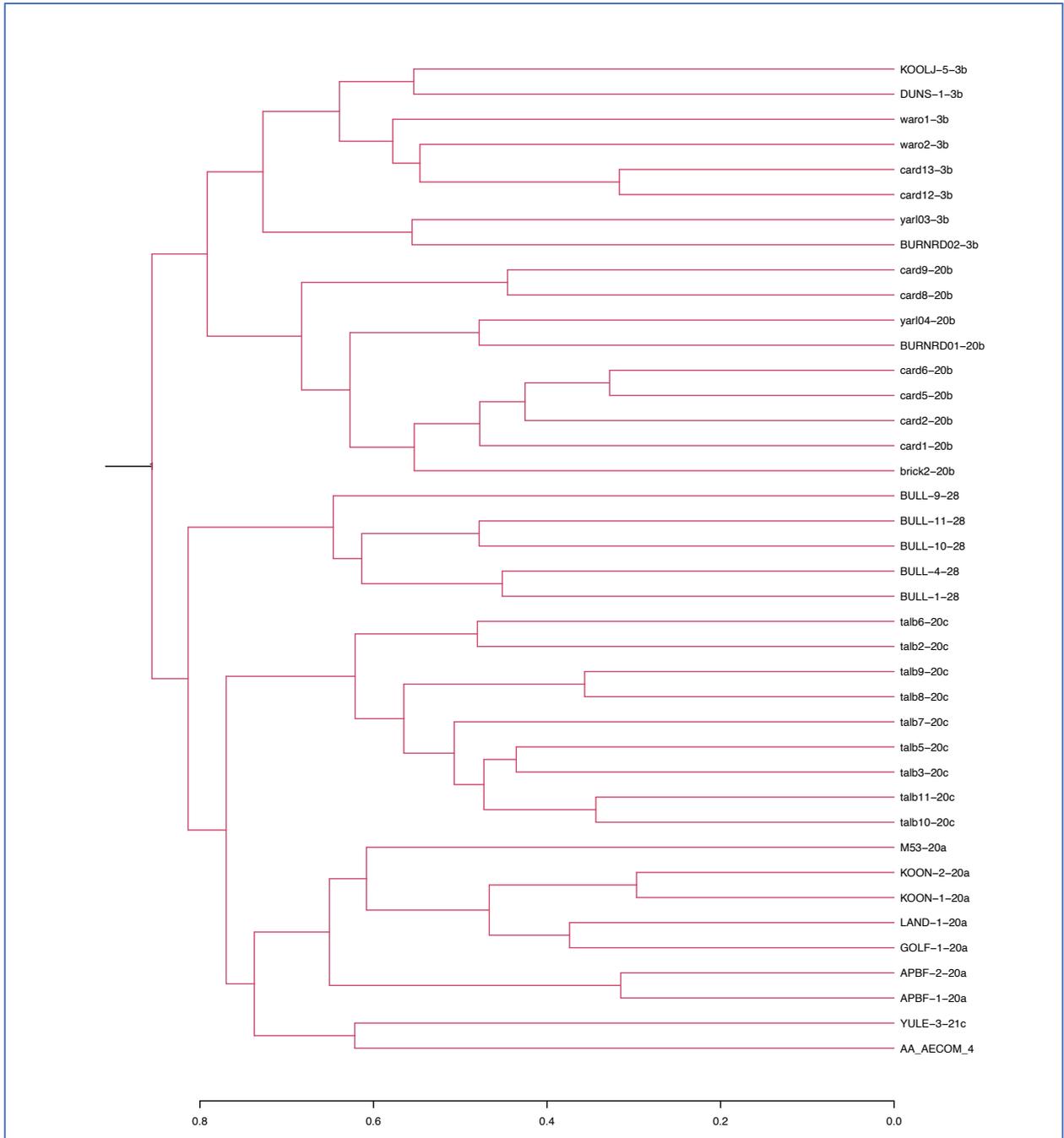
**Figure 2: Partial dendrogram for the assignment of the Wattle Grove plots to the Swan Coastal Plain floristic community types.**



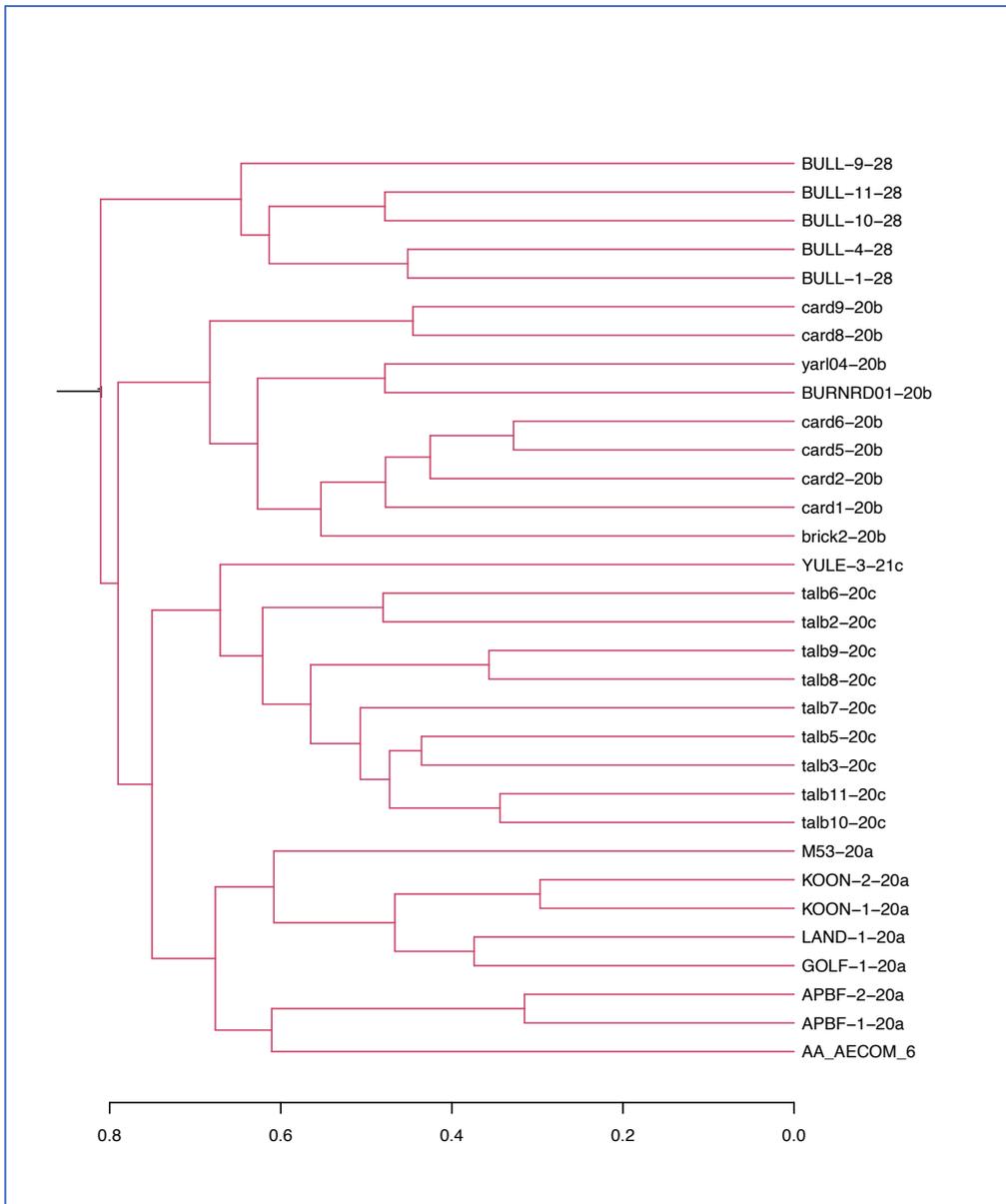
**Figure 3: Partial dendrogram for the assignment of the Wattle Grove plots to the Keighery et al. (2012) floristic community types.**



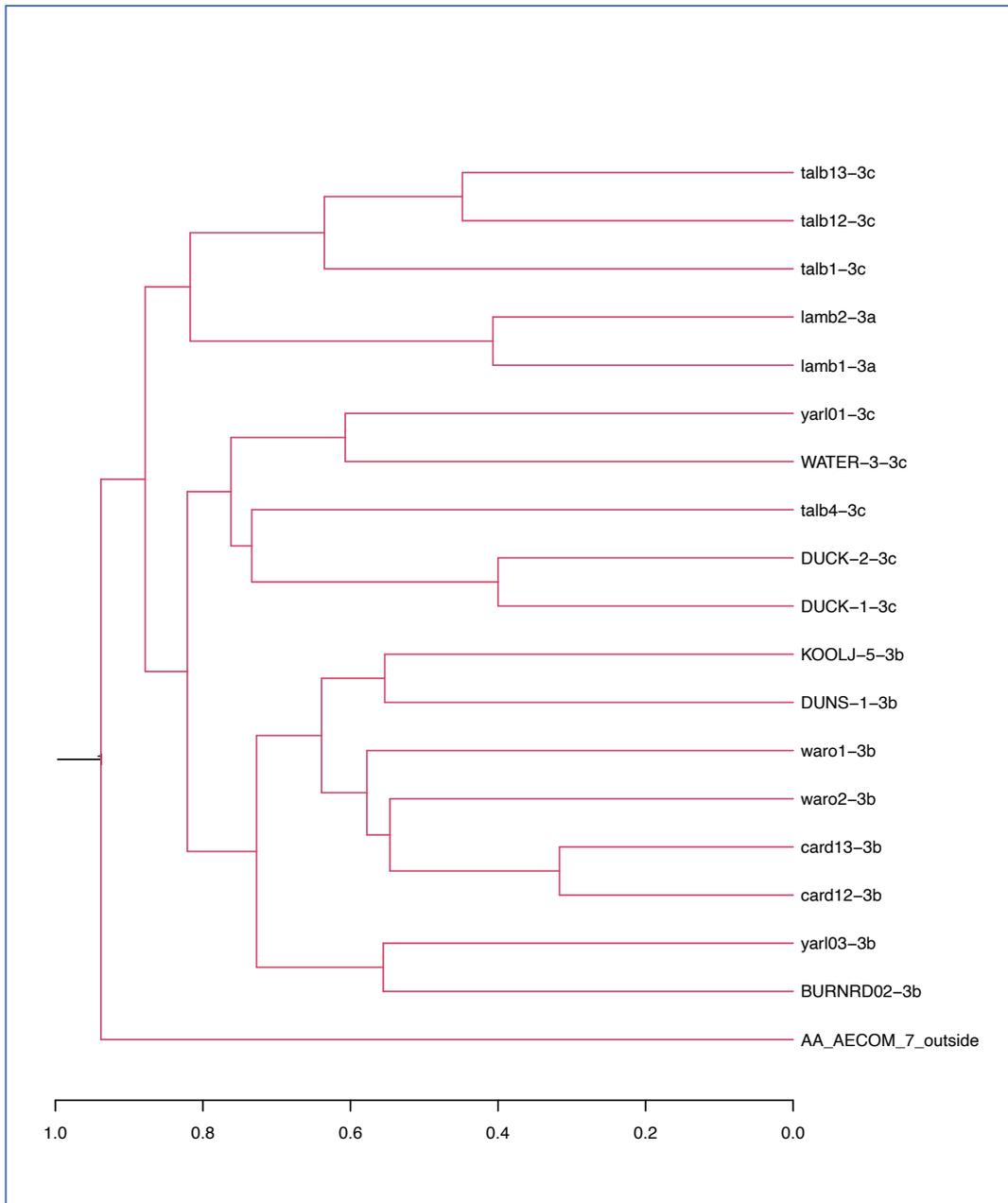
**Figure 4: Partial dendrogram for the assignment of plot AECOM\_1 to the Swan Coastal Plain floristic community types.**



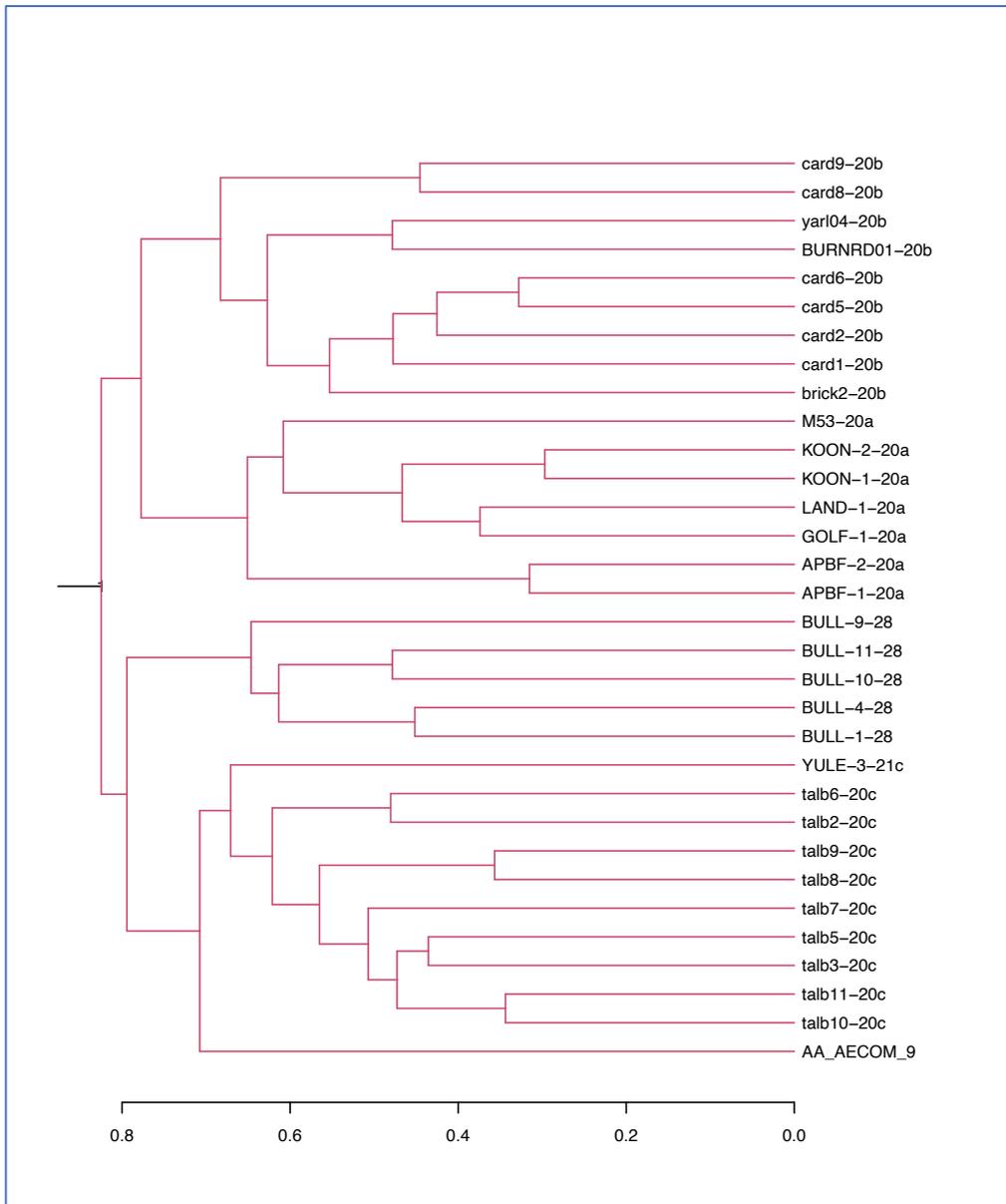
**Figure 5: Partial dendrogram for the assignment of Plot AECOM\_4 to the Swan Coastal Plain floristic community types.**



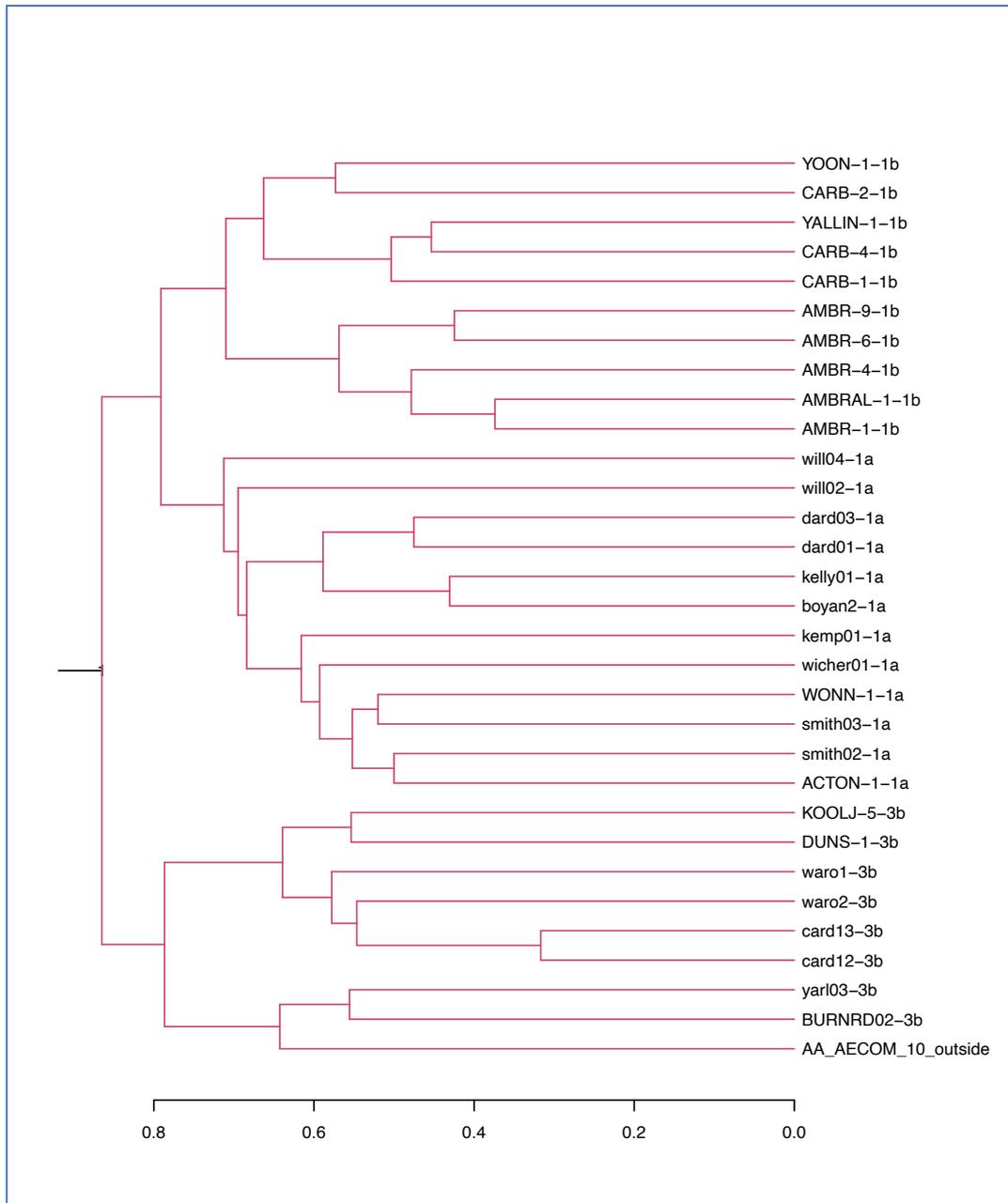
**Figure 6: Partial dendrogram for the assignment of Plot AECOM\_6 to the Swan Coastal Plain floristic community types.**



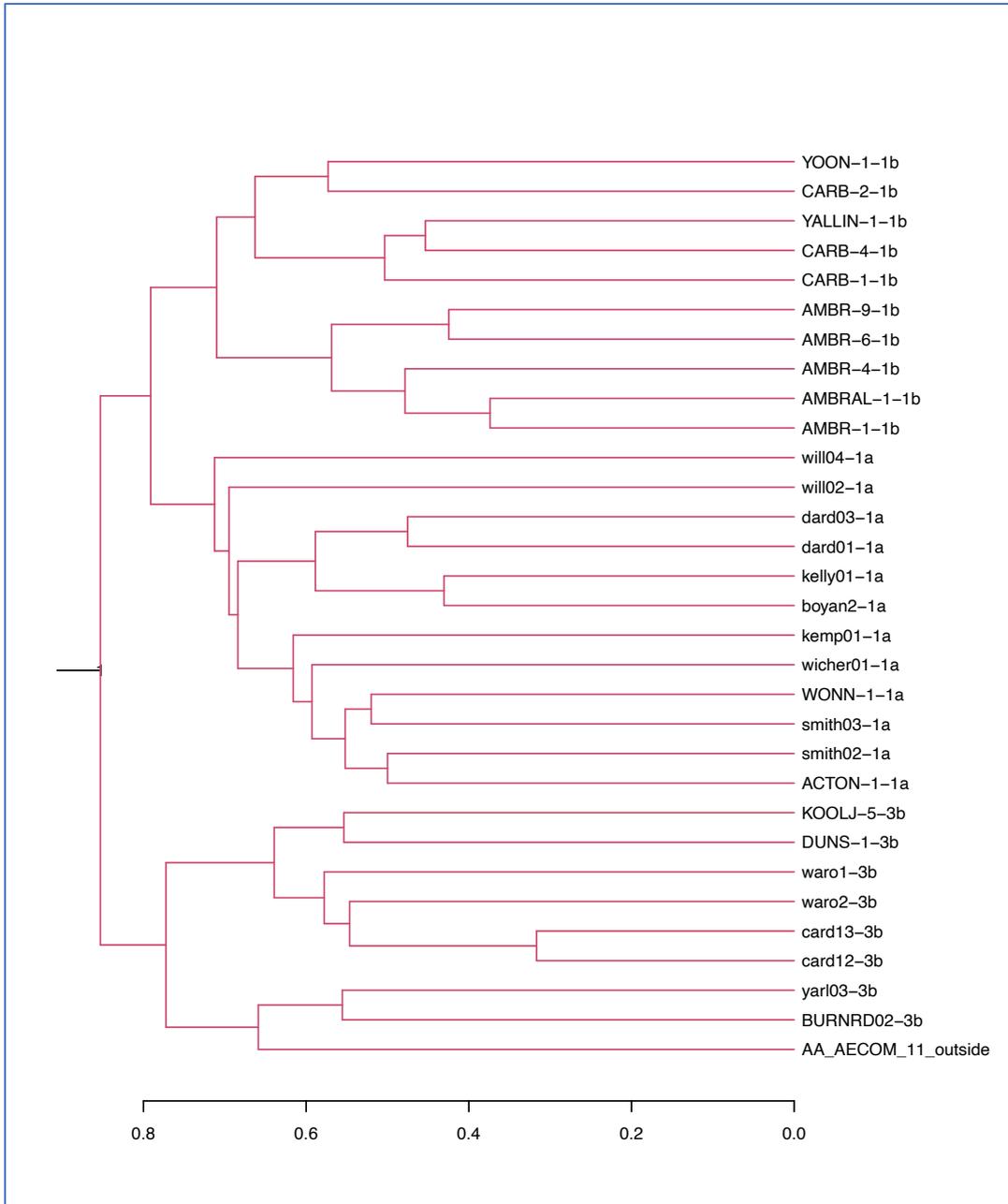
**Figure 7: Partial dendrogram for the assignment of Plot AECOM\_7 to the Swan Coastal Plain floristic community types.**



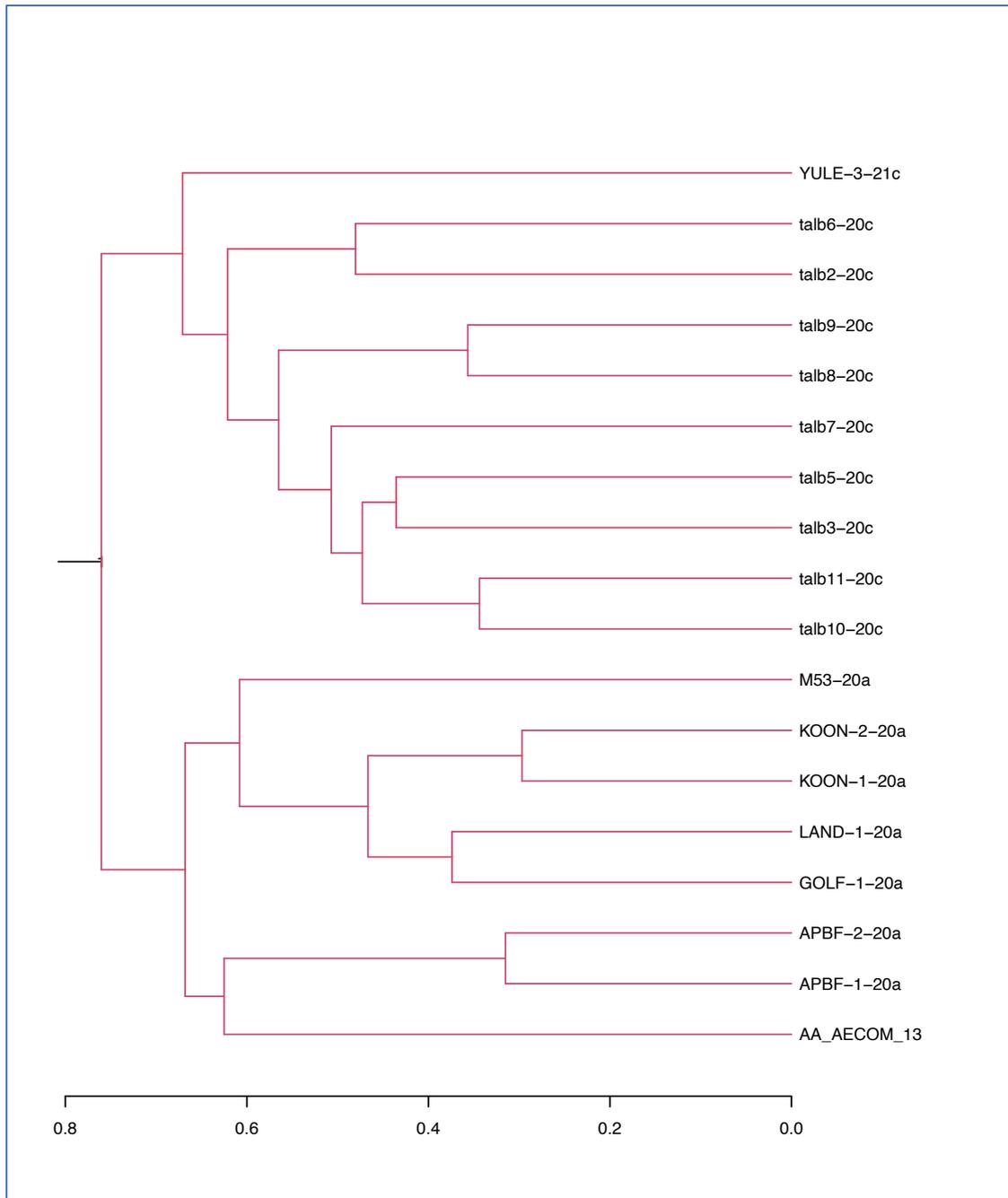
**Figure 8: Partial dendrogram for the assignment of Plot AECOM\_9 to the Swan Coastal Plain floristic community types.**



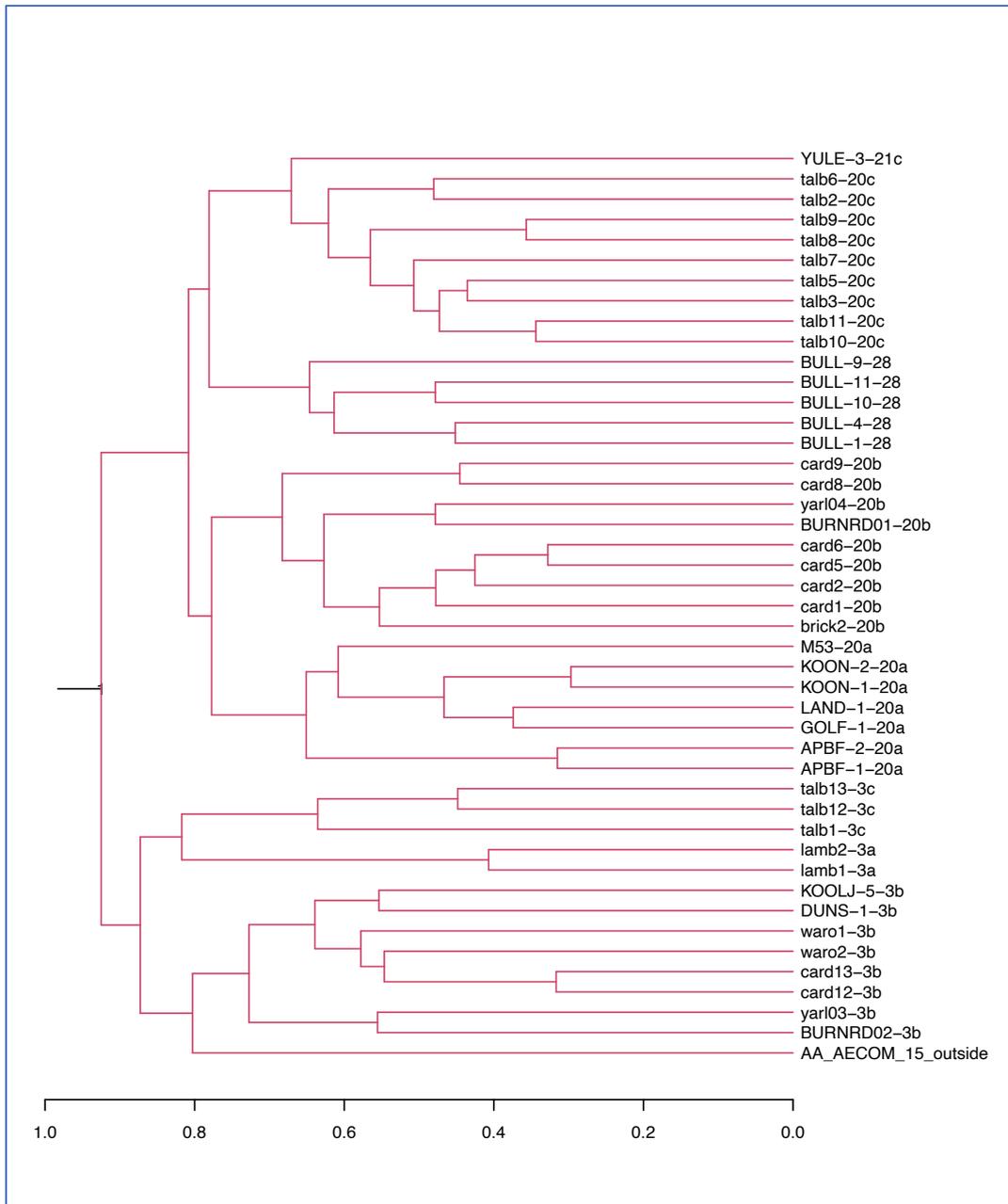
**Figure 9: Partial dendrogram for the assignment of Plot AECOM\_10 to the Swan Coastal Plain floristic community types.**



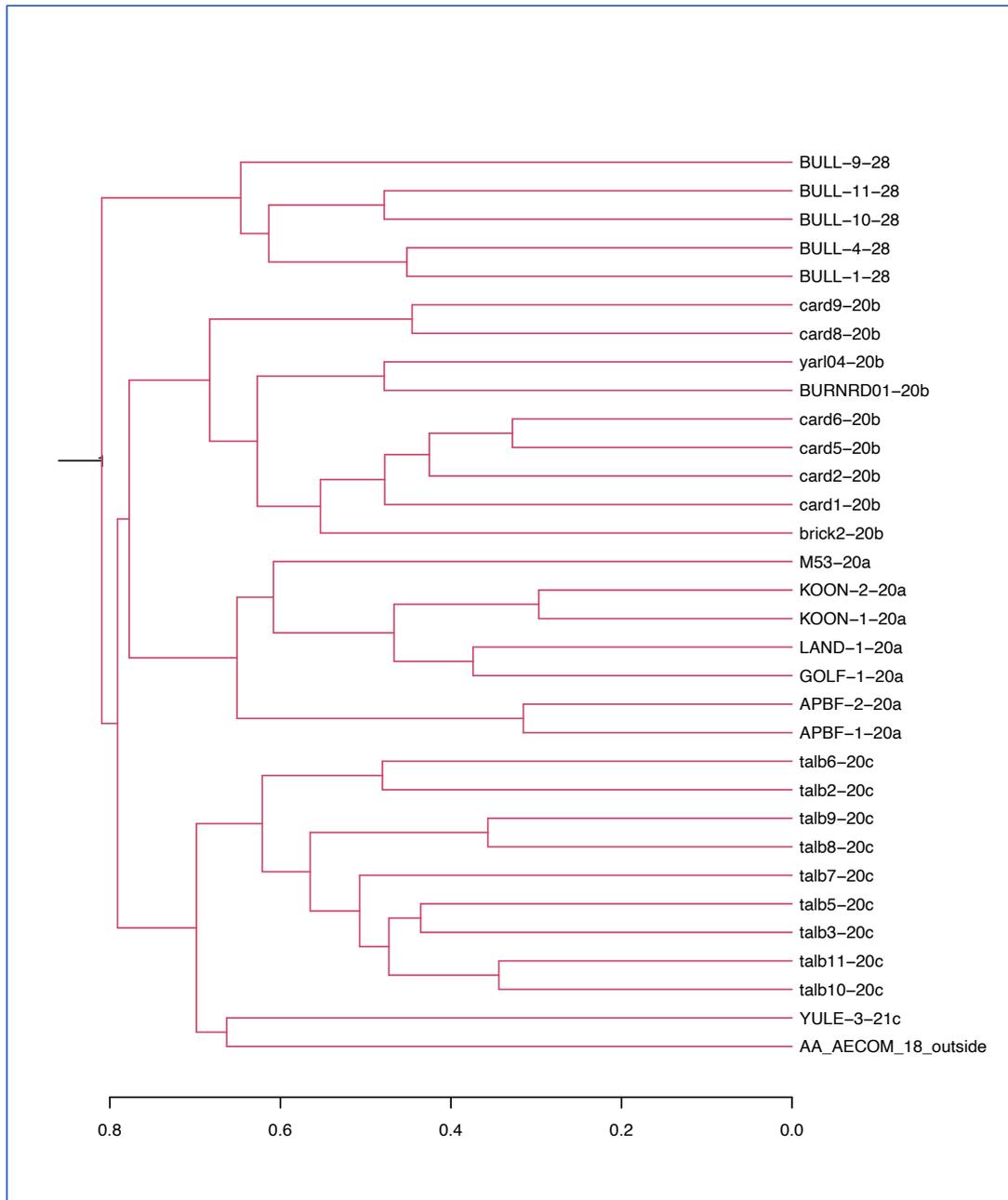
**Figure 10: Partial dendrogram for the assignment of Plot AECOM\_11 to the Swan Coastal Plain floristic community types.**



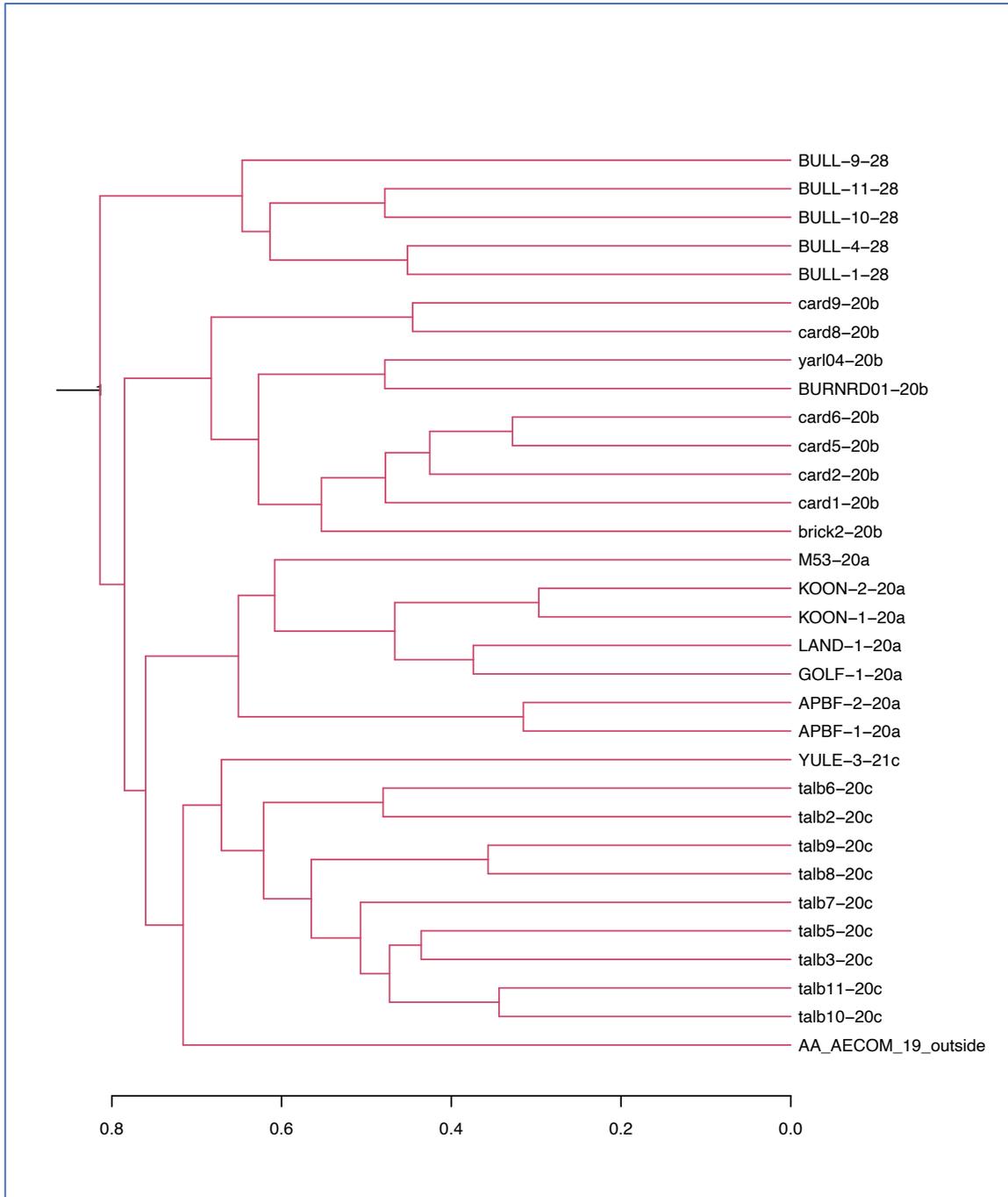
**Figure 11: Partial dendrogram for the assignment of Plot AECOM\_4 to the Swan Coastal Plain floristic community types.**



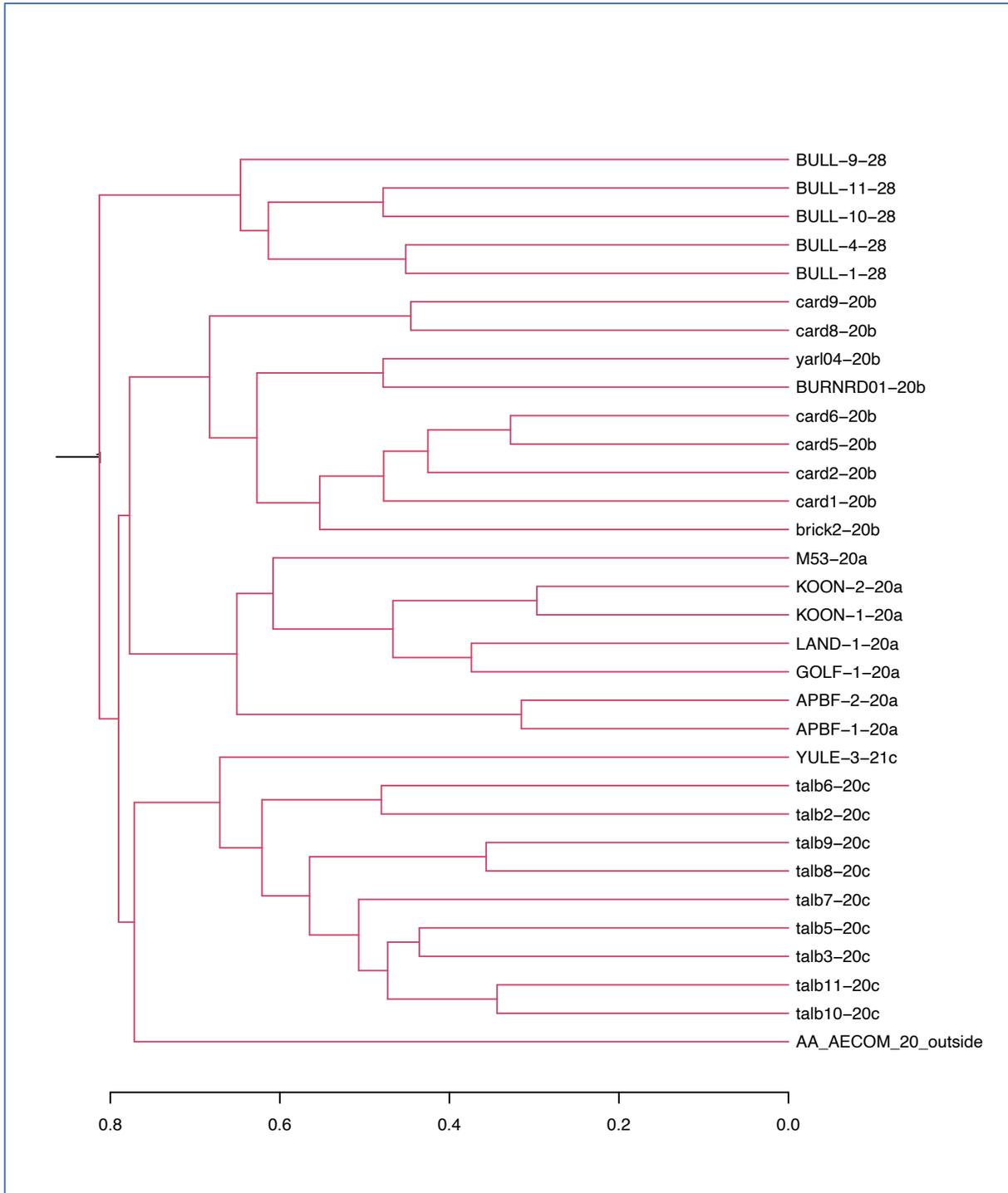
**Figure 12: Partial dendrogram for the assignment of Plot AECOM\_15 to the Swan Coastal Plain floristic community types.**



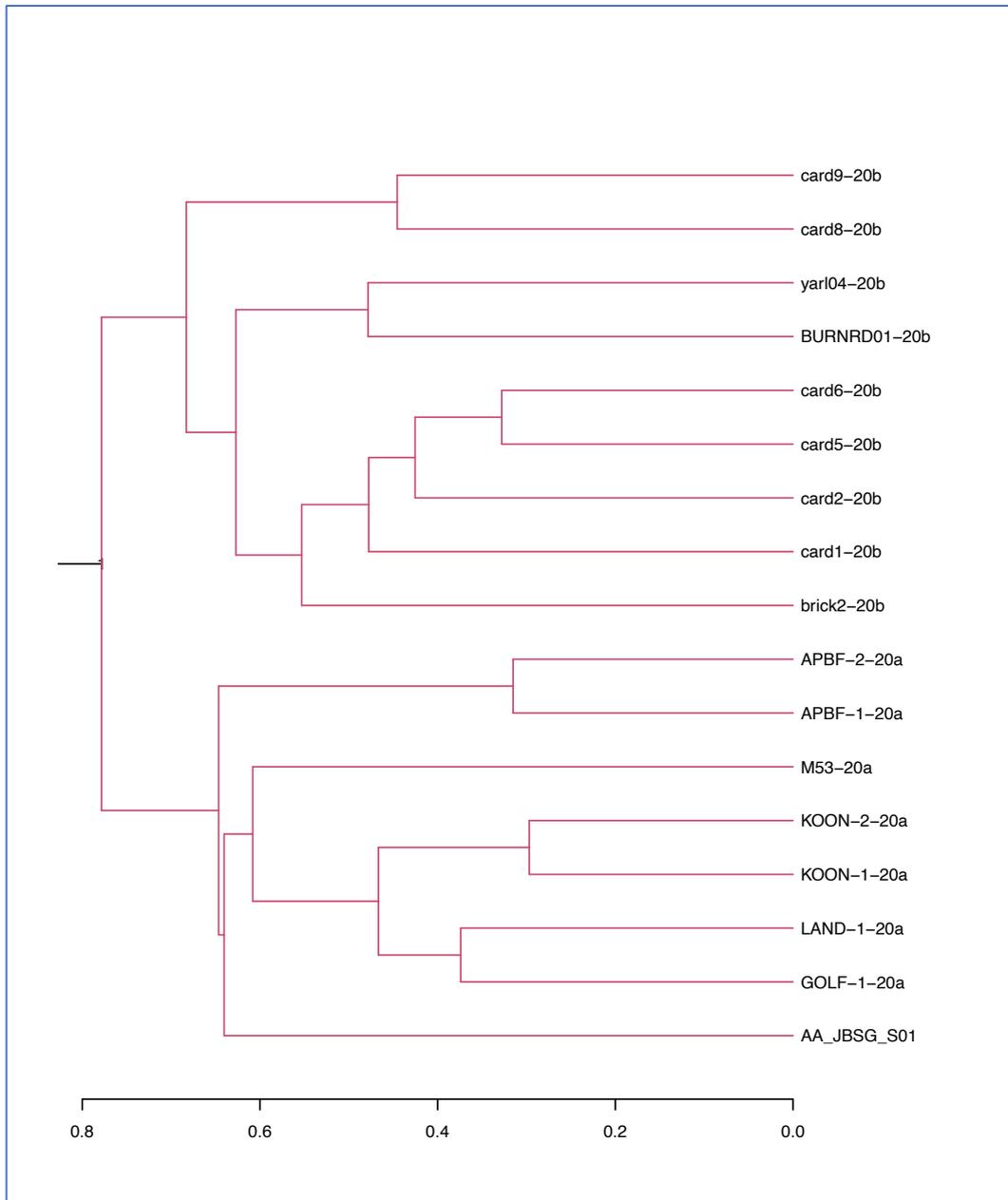
**Figure 13: Partial dendrogram for the assignment of Plot AECOM\_18 to the Swan Coastal Plain floristic community types.**



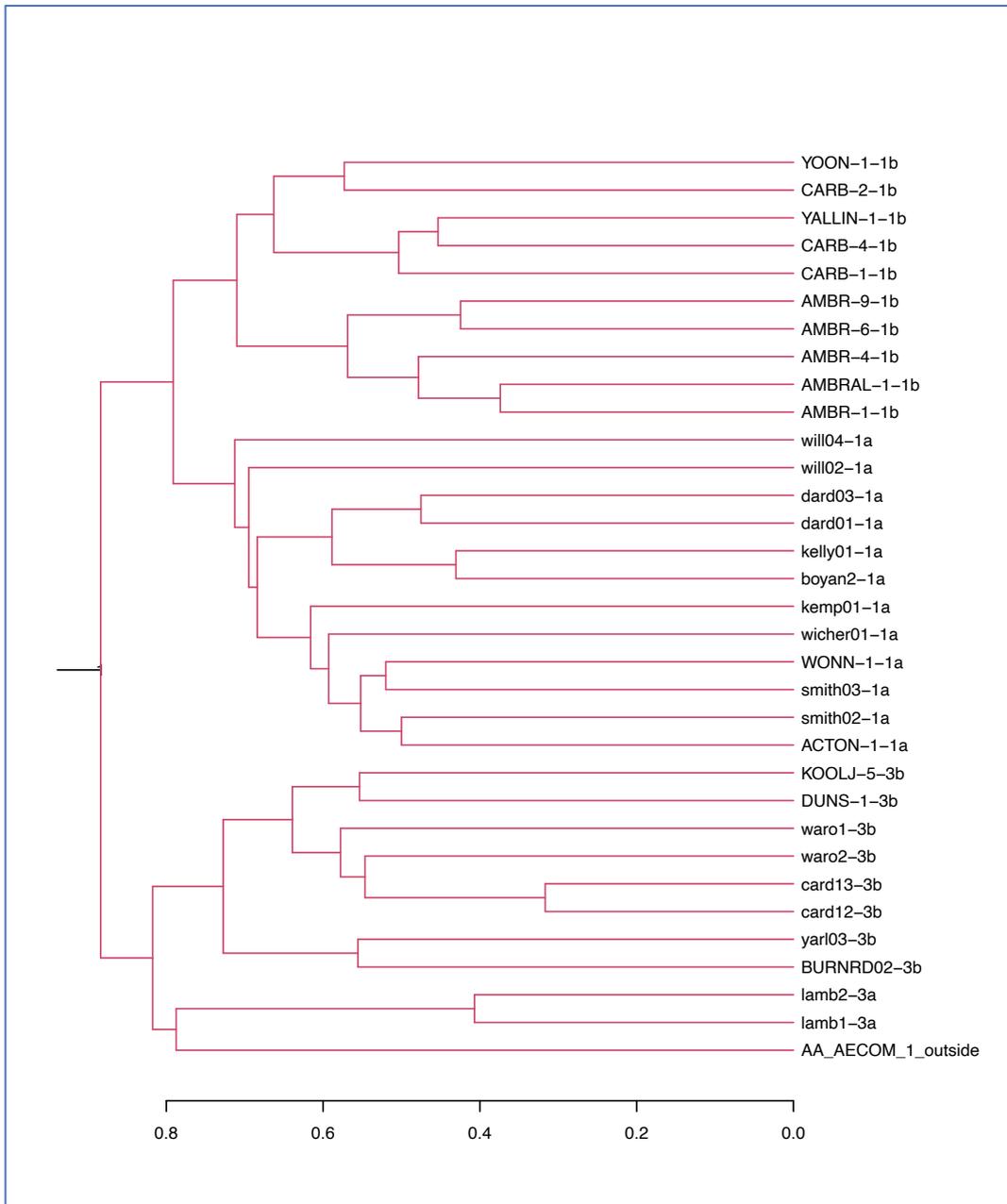
**Figure 14: Partial dendrogram for the assignment of Plot AECOM\_19 to the Swan Coastal Plain floristic community types.**



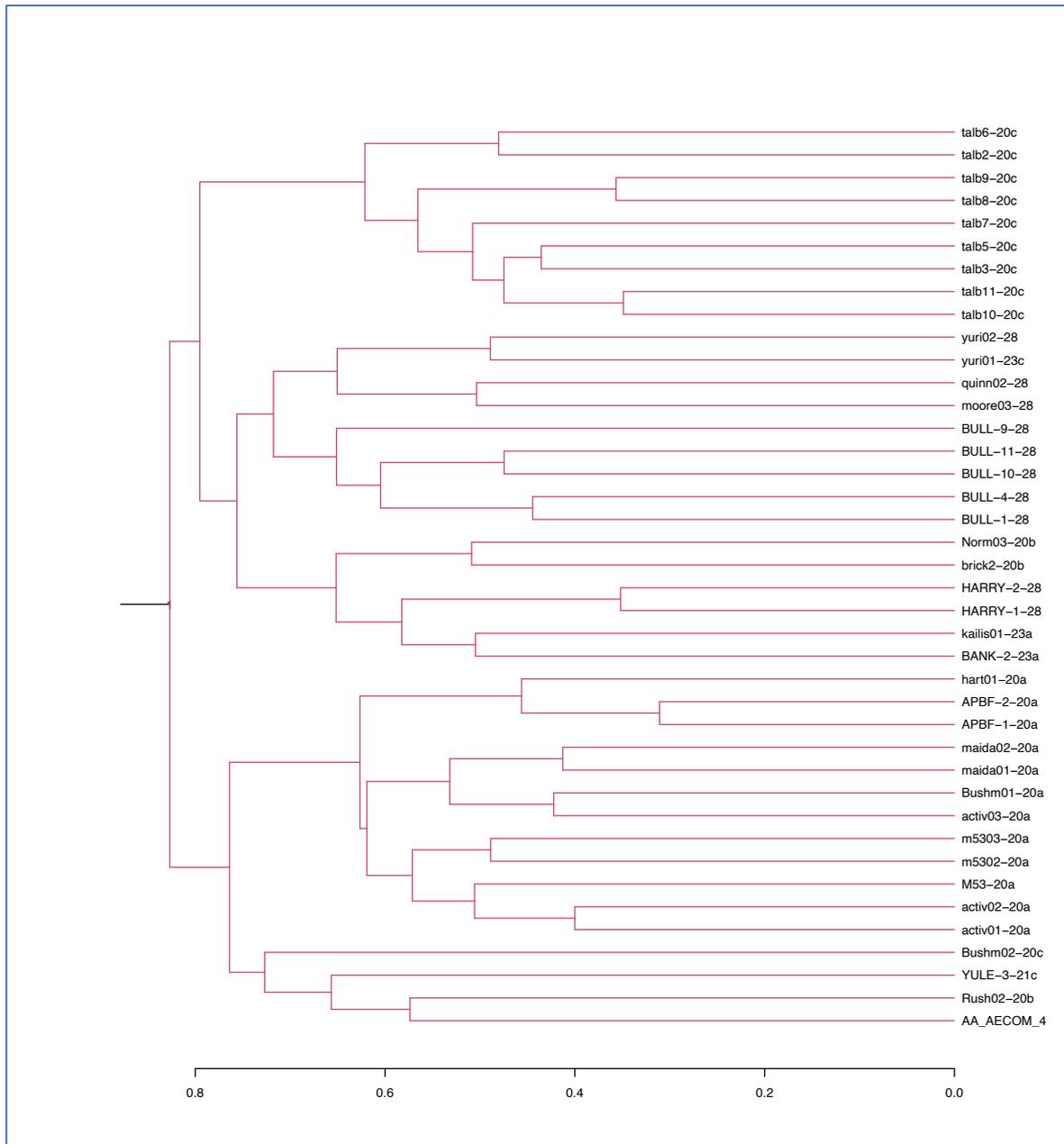
**Figure 15: Partial dendrogram for the assignment of Plot AECOM\_20 to the Swan Coastal Plain floristic community types.**



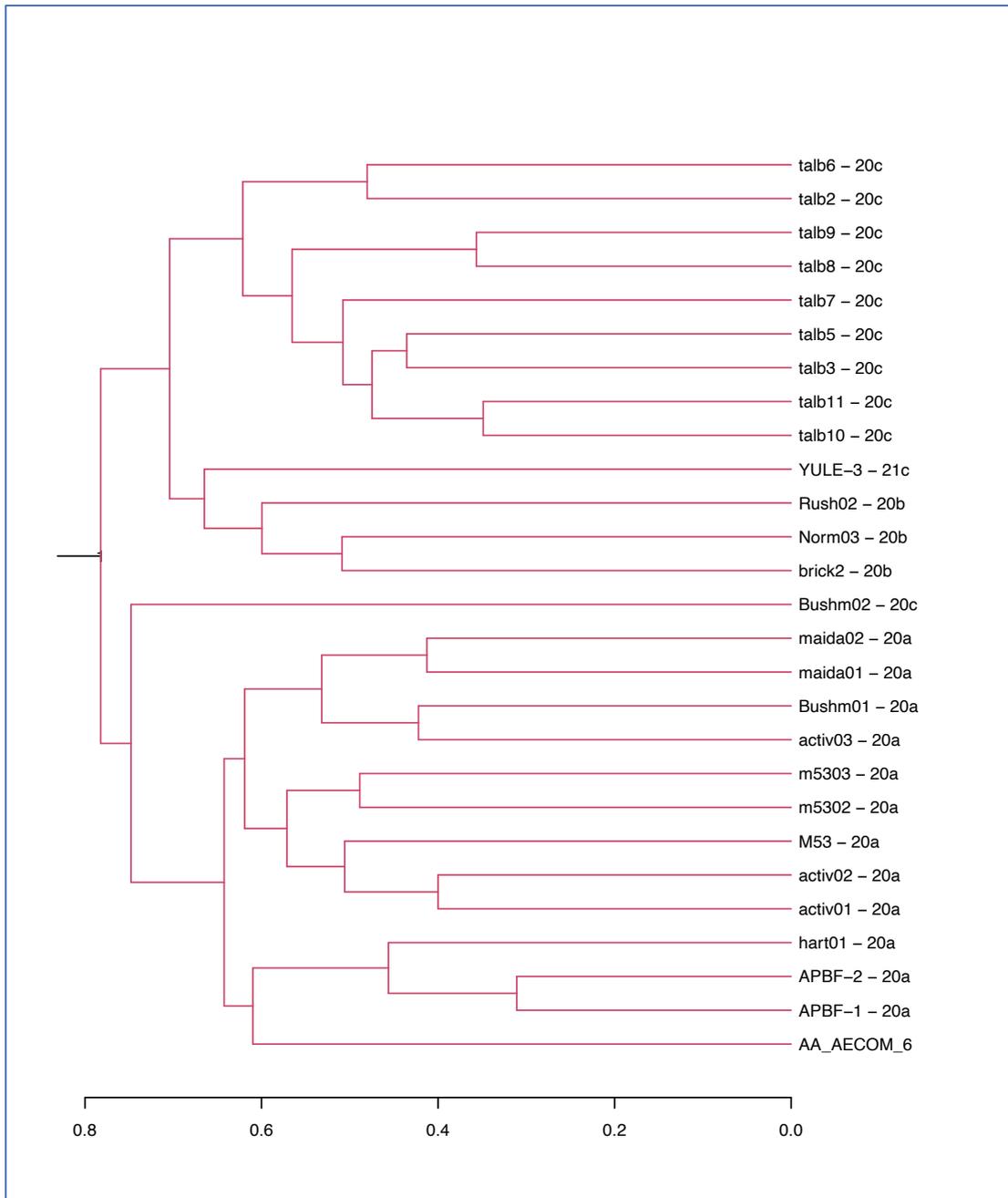
**Figure 16: Partial dendrogram for the assignment of Plot JBSG\_01 to the Swan Coastal Plain floristic community types.**



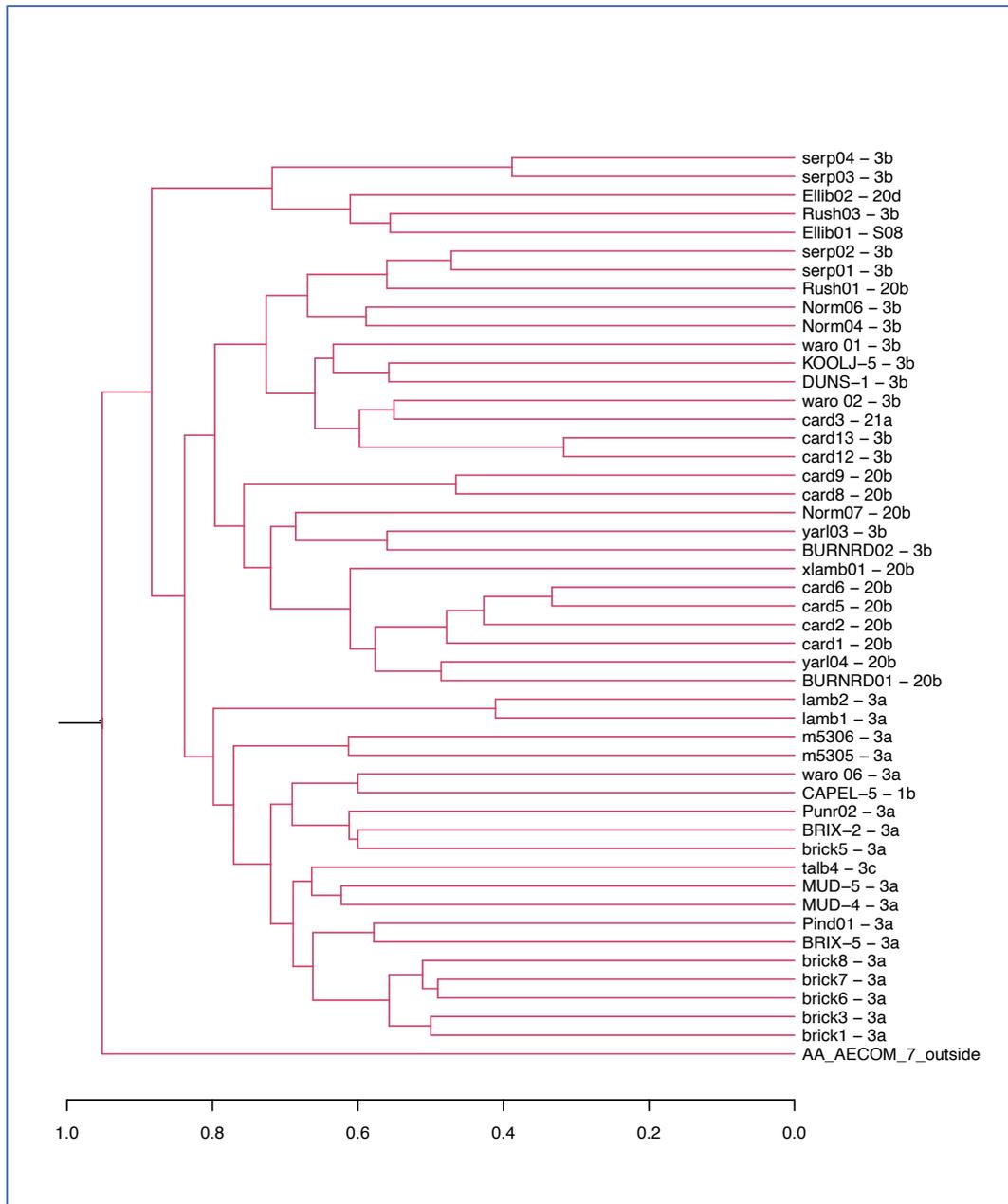
**Figure 17: Partial dendrogram for the assignment of Plot AECOM\_1 to the Keighery et al. (2012) floristic community types.**



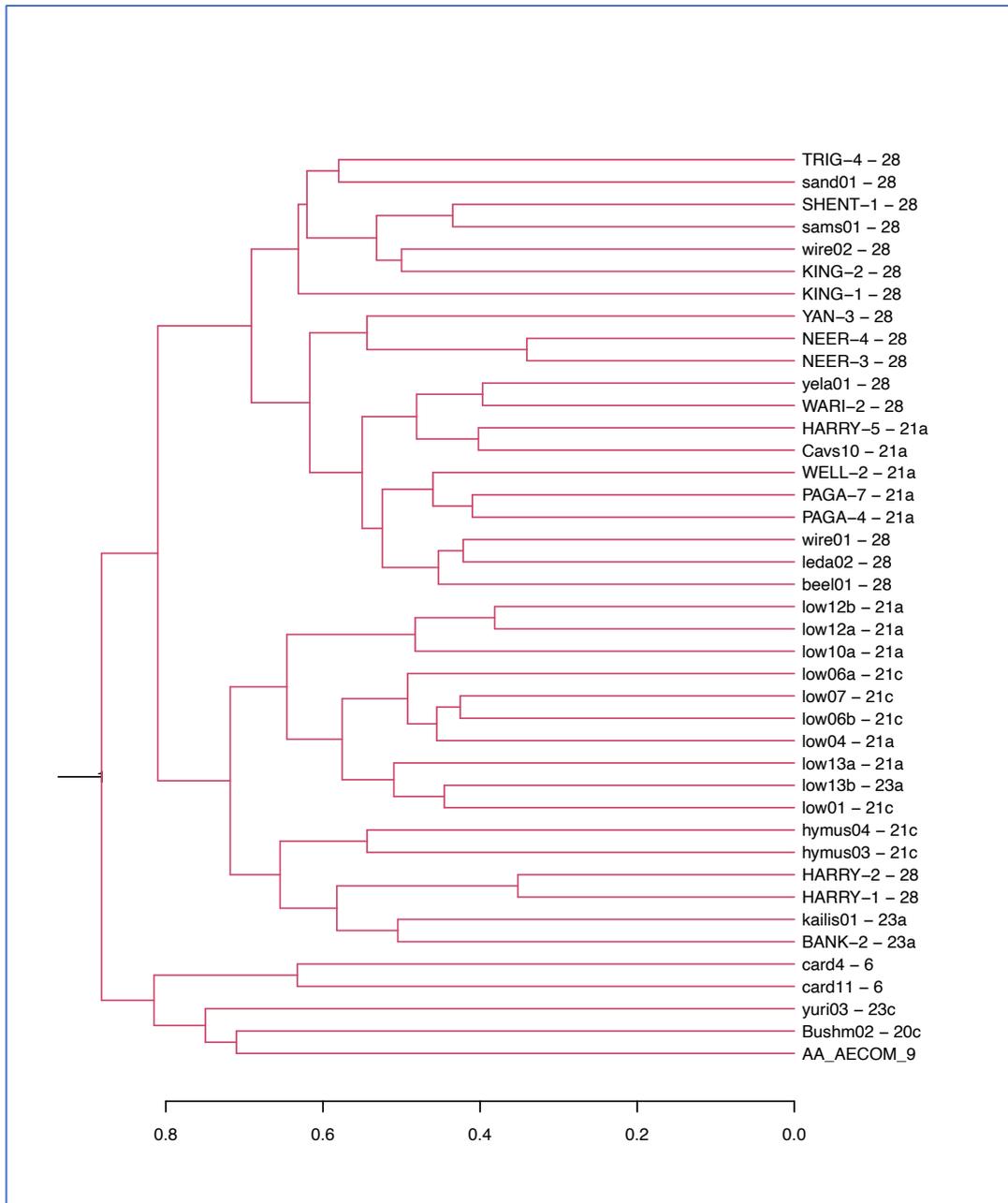
**Figure 18: Partial dendrogram for the assignment of Plot AECOM\_4 to the Keighery et al. (2012) floristic community types.**



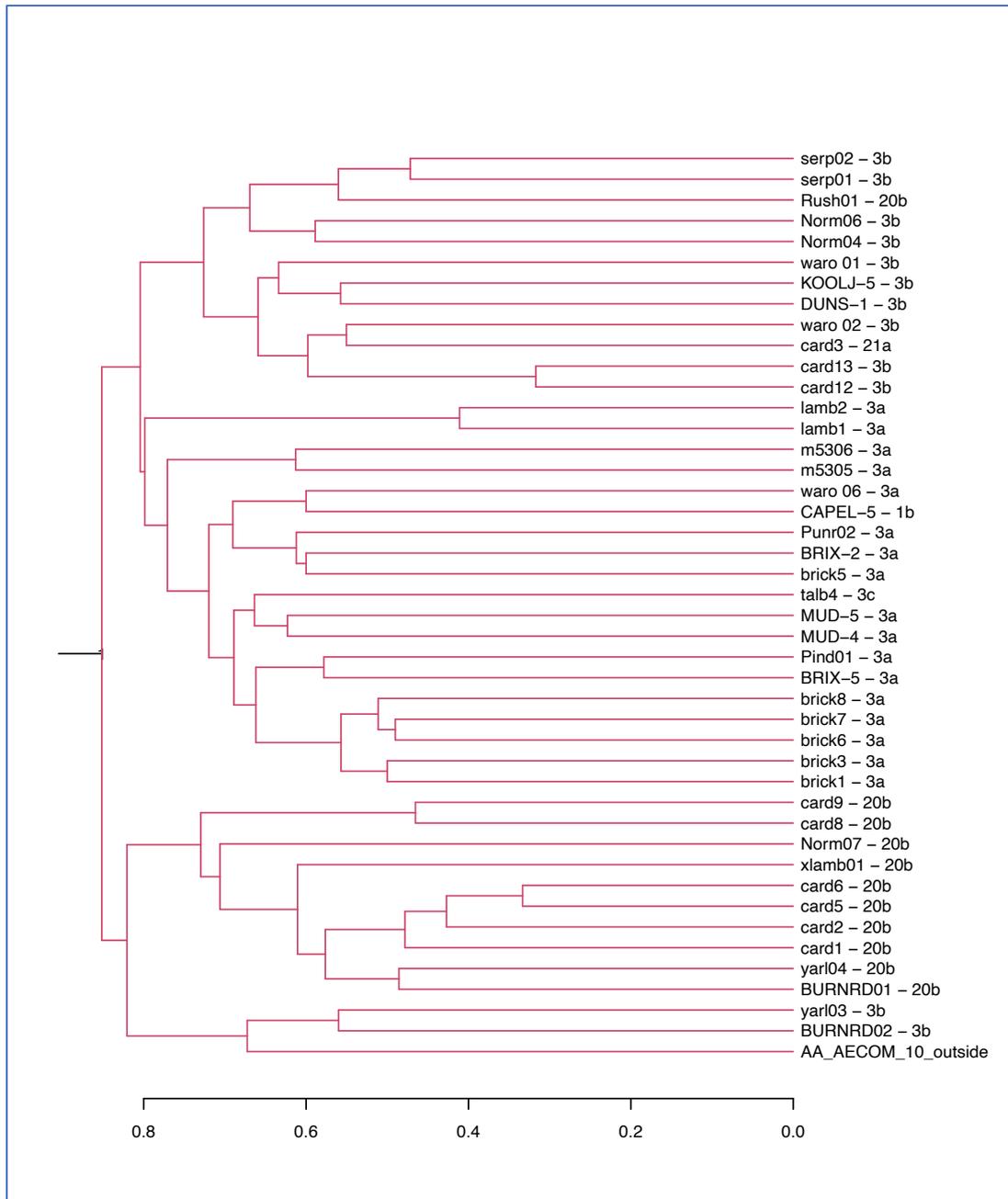
**Figure 19: Partial dendrogram for the assignment of Plot AECOM\_6 to the Keighery et al. (2012) floristic community types.**



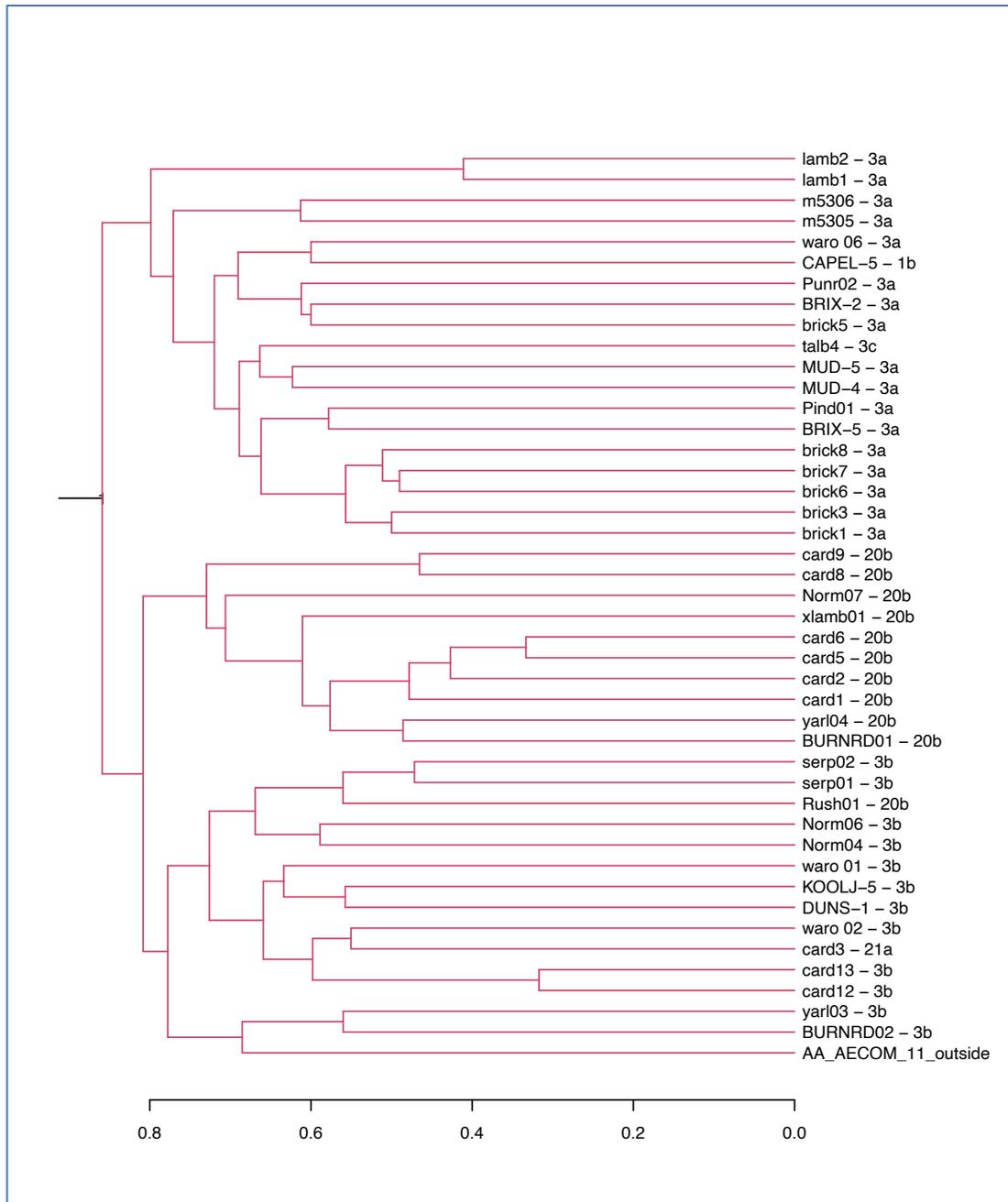
**Figure 20: Partial dendrogram for the assignment of Plot AECOM\_7 to the Keighery et al. (2012) floristic community types.**



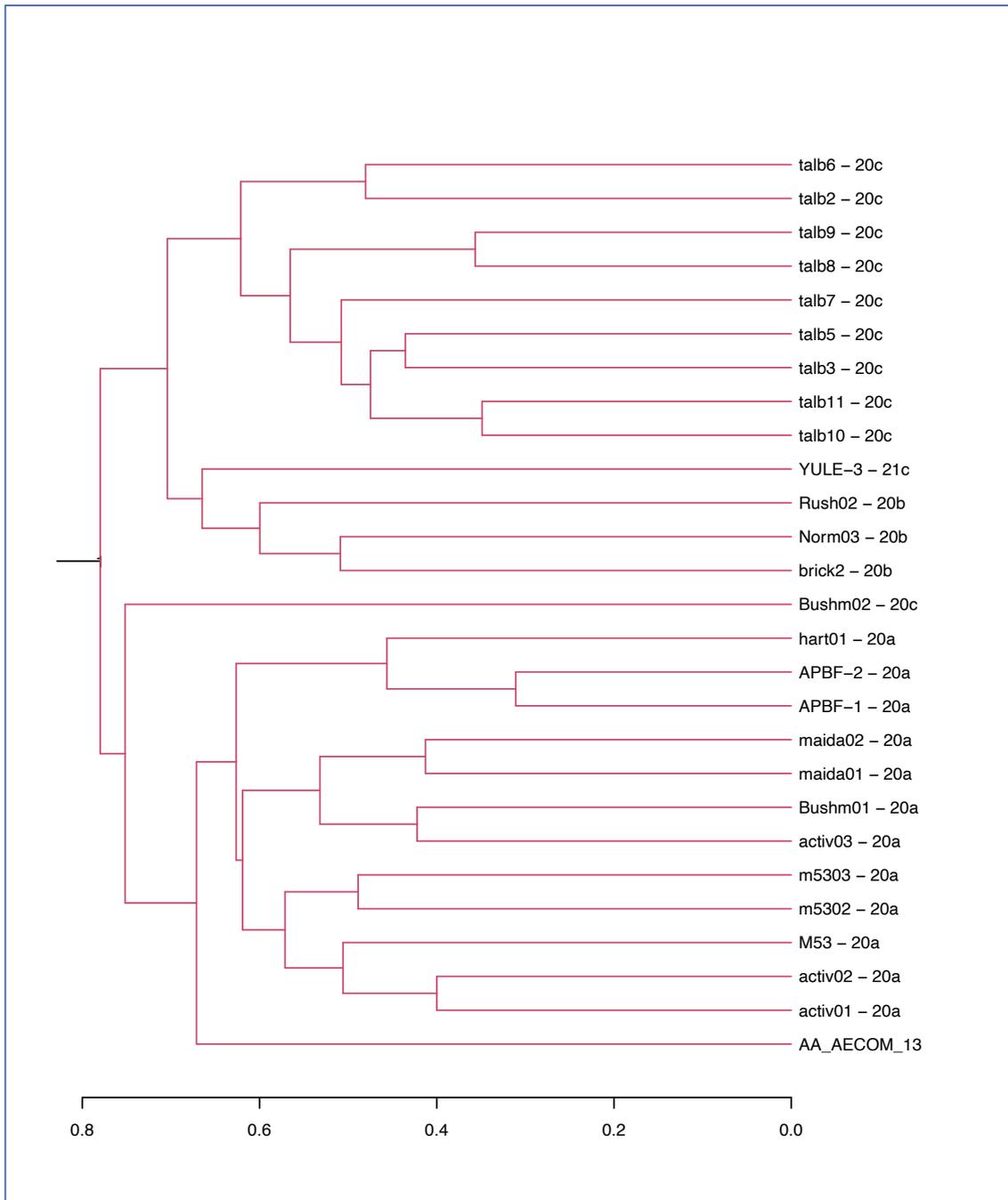
**Figure 21: Partial dendrogram for the assignment of Plot AECOM\_9 to the Keighery et al. (2012) floristic community types.**



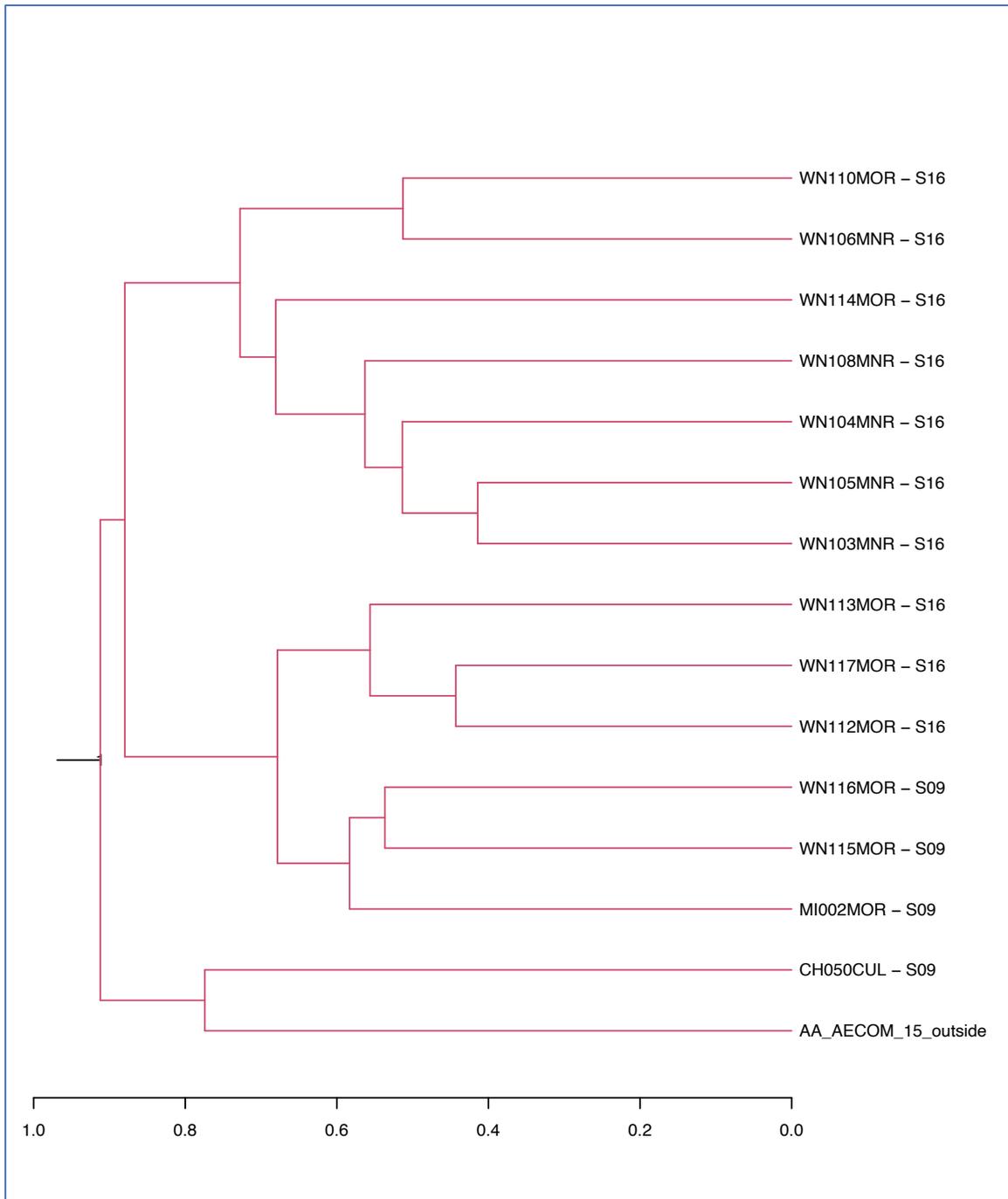
**Figure 22: Partial dendrogram for the assignment of Plot AECOM\_10 to the Keighery et al. (2012) floristic community types.**



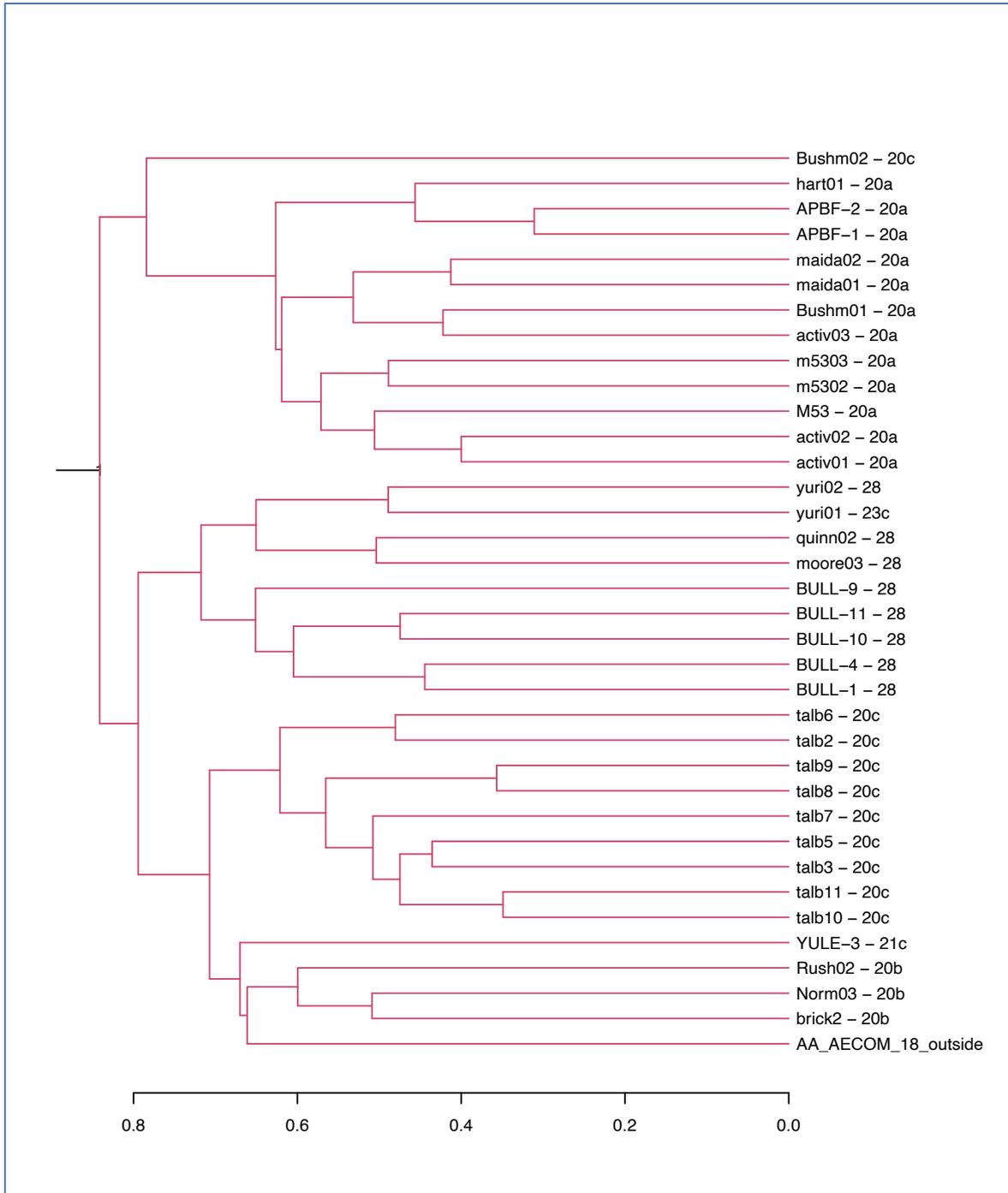
**Figure 23: Partial dendrogram for the assignment of Plot AECOM\_11 to the Keighery et al. (2012) floristic community types.**



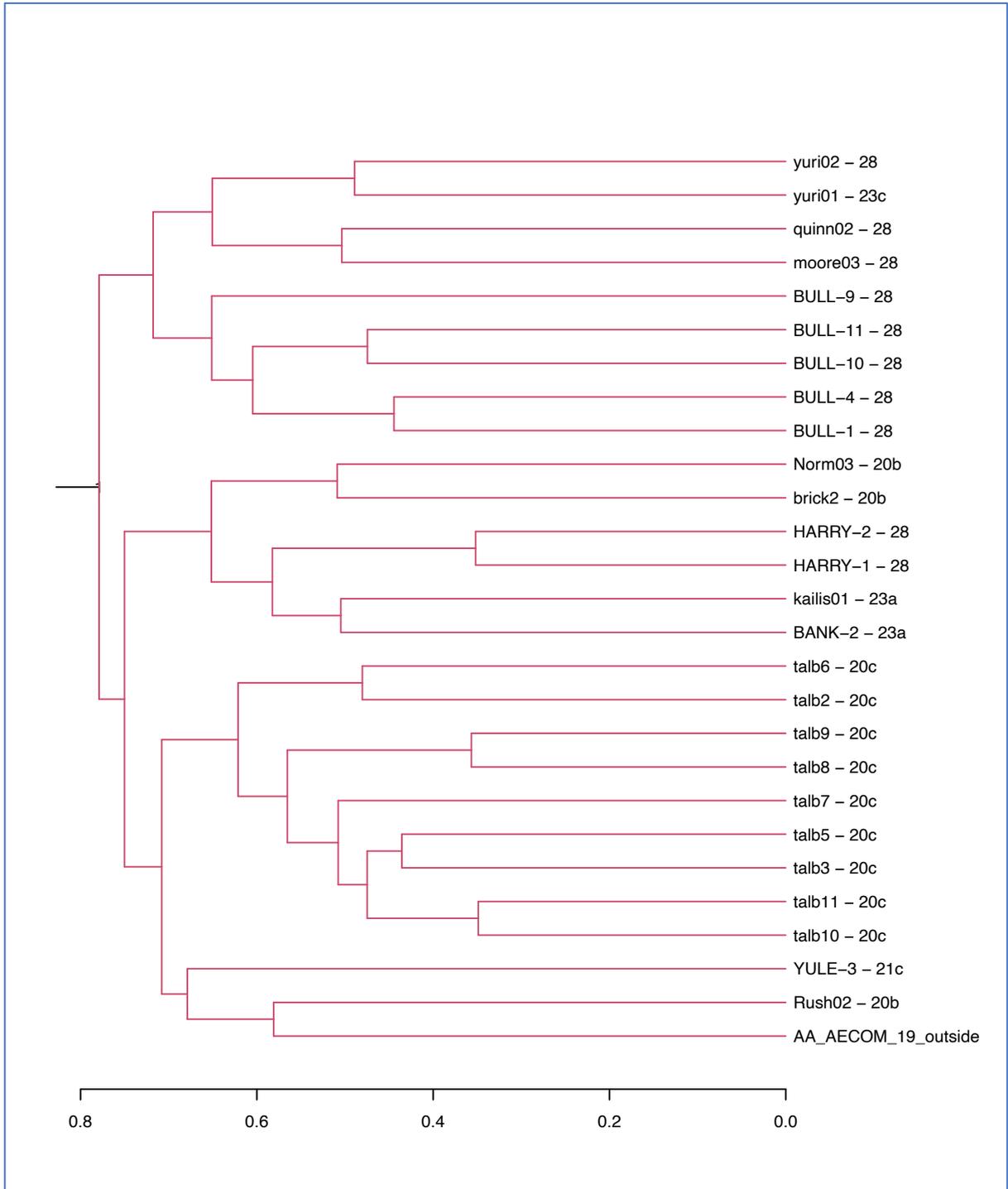
**Figure 24: Partial dendrogram for the assignment of Plot AECOM\_13 to the Keighery et al. (2012) floristic community types.**



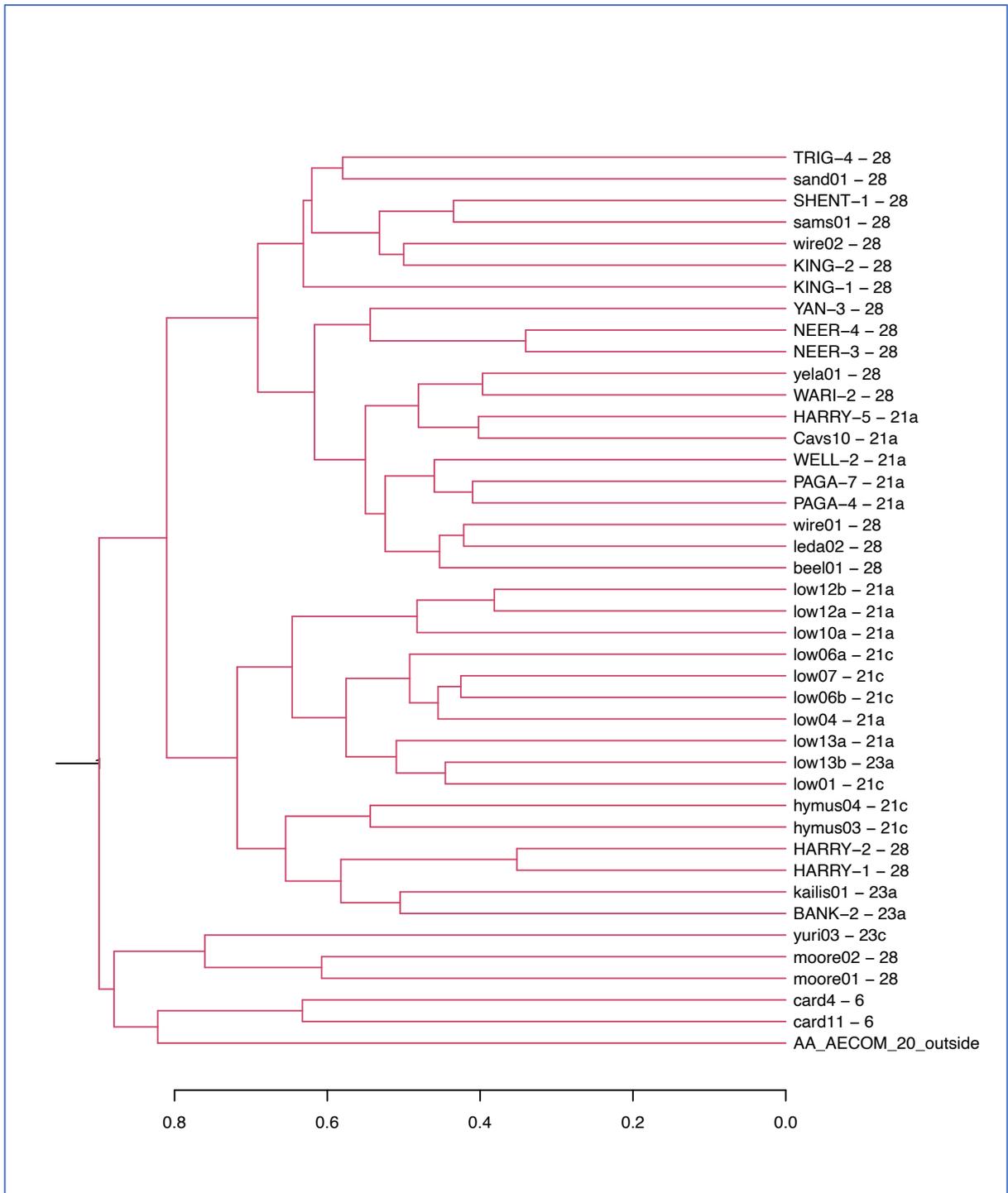
**Figure 25: Partial dendrogram for the assignment of Plot AECOM\_15 to the Keighery et al. (2012) floristic community types.**



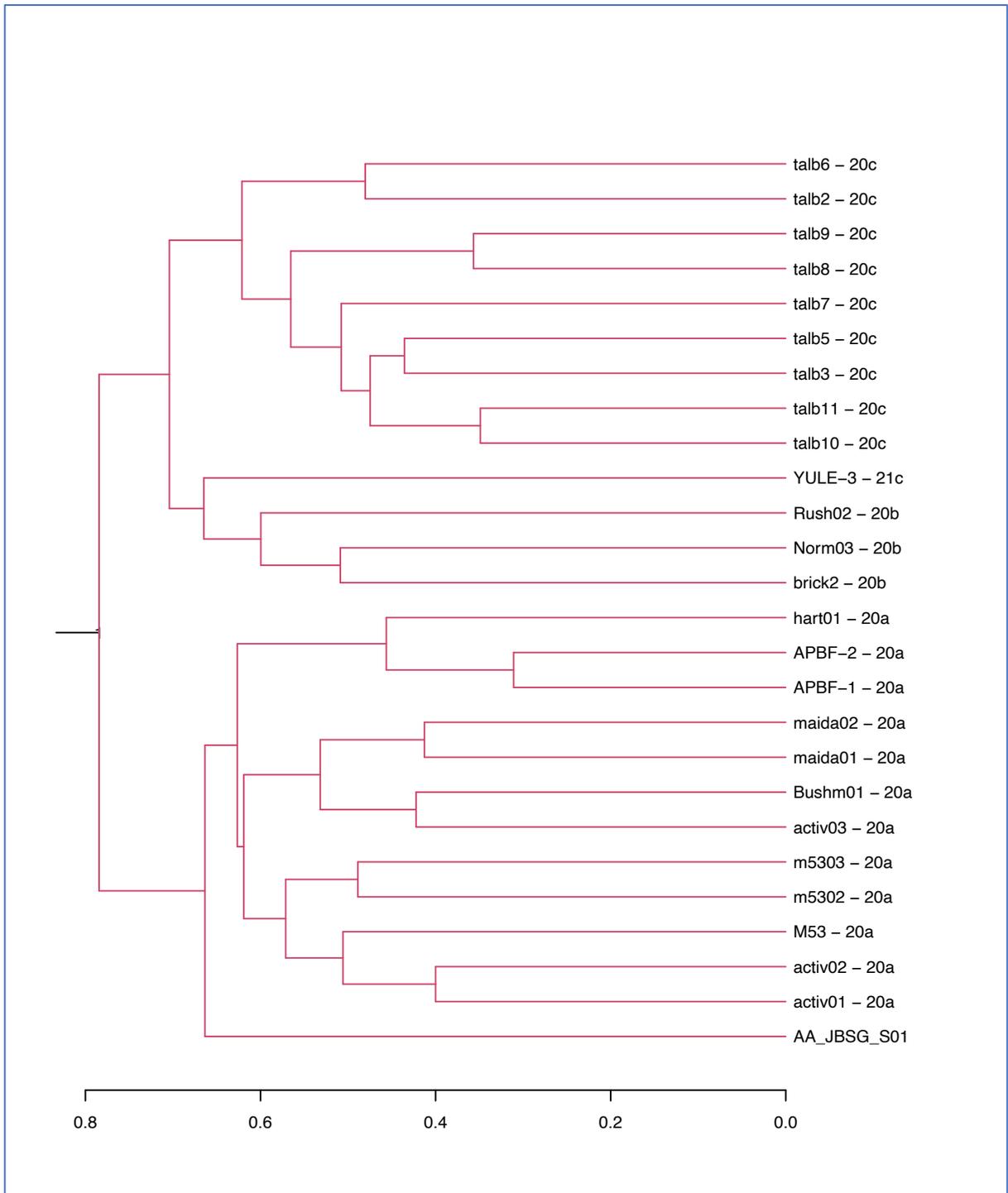
**Figure 26: Partial dendrogram for the assignment of Plot AECOM\_18 to the Keighery et al. (2012) floristic community types.**



**Figure 27: Partial dendrogram for the assignment of Plot AECOM\_19 to the Keighery et al. (2012) floristic community types.**



**Figure 28: Partial dendrogram for the assignment of Plot AECOM\_20 to the Keighery et al. (2012) floristic community types.**



**Figure 29: Partial dendrogram for the assignment of Plot AECOM\_30 to the Keighery et al. (2012) floristic community types.**



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**Table 2: Bray Curtis dissimilarity values for Wattle Grove and the closest Swan Coastal Plain plots**

Swan Coastal Plain Plot (FCT)	AECOM_11_outside	AECOM_15_outside	AECOM_20_outside	AECOM_7_outside	AECOM_1_outside	AECOM_13	AECOM_9	AECOM_10_outside	AECOM_6	AECOM_19_outside	AECOM_4	JBSG_S01	AECOM_18_outside
activ01-20a	0.855	0.813	0.770	0.940	0.845	0.575	0.704	0.901	0.593	0.670	0.621	0.563	0.745
activ02-20a	0.864	0.791	0.752	0.926	0.871	0.630	0.672	0.890	0.649	0.659	0.657	0.606	0.678
APBF-1-20a	0.772	0.856	0.778	0.885	0.783	0.618	0.768	0.848	0.638	0.714	0.676	0.642	0.772
APBF-2-20a	0.821	0.835	0.774	0.922	0.814	0.612	0.745	0.883	0.568	0.692	0.597	0.620	0.732
brick1-3a	0.808	0.861	0.832	0.894	0.800	0.818	0.824	0.853	0.812	0.835	0.810	0.841	0.846
brick2-20b	0.731	0.802	0.720	0.894	0.836	0.736	0.784	0.789	0.744	0.706	0.746	0.681	0.654
brick3-3a	0.849	0.825	0.817	0.917	0.875	0.805	0.808	0.897	0.782	0.784	0.813	0.791	0.811
brick6-3a	0.795	0.812	0.736	0.897	0.830	0.733	0.791	0.823	0.802	0.763	0.782	0.773	0.795
brick7-3a	0.783	0.775	0.789	0.854	0.816	0.853	0.822	0.880	0.771	0.794	0.807	0.822	0.848
brick8-3a	0.780	0.814	0.806	0.911	0.811	0.778	0.796	0.824	0.699	0.714	0.754	0.798	0.740
BURNRD01-20b	0.727	0.813	0.752	0.840	0.810	0.717	0.815	0.782	0.691	0.722	0.712	0.647	0.745
BURNRD02-3b	0.671	0.780	0.818	0.787	0.802	0.784	0.831	0.658	0.776	0.778	0.776	0.787	0.765
Bushm02-20c	0.915	0.882	0.838	0.934	0.922	0.705	0.710	0.903	0.667	0.763	0.720	0.800	0.746
card1-20b	0.706	0.778	0.771	0.826	0.722	0.714	0.800	0.785	0.687	0.701	0.710	0.694	0.667
card11-6	0.806	0.898	0.815	0.846	0.853	0.823	0.733	0.811	0.760	0.761	0.810	0.803	0.710
card12-3b	0.729	0.763	0.717	0.860	0.765	0.752	0.787	0.793	0.780	0.723	0.729	0.790	0.688
card13-3b	0.714	0.745	0.722	0.832	0.730	0.770	0.806	0.771	0.763	0.691	0.732	0.772	0.695
card2-20b	0.735	0.782	0.707	0.806	0.782	0.646	0.730	0.788	0.651	0.644	0.748	0.639	0.664
card4-6	0.877	0.806	0.794	0.964	0.859	0.854	0.714	0.821	0.769	0.771	0.839	0.865	0.692
card5-20b	0.733	0.824	0.685	0.895	0.748	0.689	0.748	0.792	0.661	0.655	0.701	0.649	0.657
card6-20b	0.750	0.849	0.778	0.860	0.804	0.752	0.787	0.839	0.725	0.762	0.763	0.676	0.729
CH050CUL-S09	0.969	0.774	0.853	0.891	0.944	0.878	0.810	0.929	0.821	0.800	0.885	0.865	0.785
DUNS-1-3b	0.792	0.786	0.798	0.896	0.821	0.805	0.846	0.794	0.815	0.766	0.828	0.791	0.755



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Swan Coastal Plain Plot (FCT)	AECOM_11_outside	AECOM_15_outside	AECOM_20_outside	AECOM_7_outside	AECOM_1_outside	AECOM_13	AECOM_9	AECOM_10_outside	AECOM_6	AECOM_19_outside	AECOM_4	JBSG_S01	AECOM_18_outside
Ellib01-S08	0.828	0.867	0.833	0.880	0.838	0.855	0.868	0.857	0.849	0.796	0.774	0.863	0.806
Ellib02-20d	0.848	0.789	0.805	0.884	0.859	0.833	0.844	0.857	0.804	0.738	0.723	0.795	0.772
GOLF-1-20a	0.859	0.833	0.706	0.933	0.810	0.690	0.670	0.867	0.643	0.712	0.702	0.648	0.737
hart01-20a	0.792	0.806	0.717	0.814	0.745	0.628	0.723	0.839	0.560	0.683	0.559	0.600	0.771
KOOLJ-5-3b	0.788	0.780	0.795	0.920	0.824	0.745	0.759	0.737	0.776	0.756	0.794	0.809	0.741
KOON-1-20a	0.810	0.765	0.722	0.853	0.802	0.574	0.670	0.854	0.678	0.636	0.717	0.544	0.657
KOON-2-20a	0.728	0.860	0.736	0.892	0.853	0.583	0.703	0.851	0.655	0.704	0.712	0.571	0.728
lamb1-3a	0.842	0.838	0.829	0.885	0.817	0.878	0.911	0.905	0.827	0.798	0.809	0.854	0.842
lamb2-3a	0.800	0.813	0.823	0.840	0.741	0.827	0.833	0.802	0.740	0.774	0.773	0.832	0.764
LAND-1-20a	0.818	0.776	0.735	0.880	0.810	0.606	0.722	0.822	0.642	0.635	0.667	0.597	0.655
M53-20a	0.794	0.808	0.745	0.897	0.876	0.694	0.733	0.878	0.667	0.679	0.736	0.655	0.701
m5302-20a	0.820	0.835	0.709	0.911	0.830	0.675	0.633	0.846	0.646	0.695	0.705	0.688	0.700
m5303-20a	0.820	0.833	0.772	0.921	0.846	0.625	0.706	0.863	0.581	0.707	0.624	0.633	0.730
maida01-20a	0.820	0.796	0.737	0.901	0.778	0.734	0.743	0.804	0.677	0.690	0.714	0.717	0.694
maida02-20a	0.806	0.800	0.792	0.904	0.838	0.691	0.802	0.810	0.679	0.673	0.704	0.725	0.656
MI002MOR-S09	0.942	0.909	0.889	1.000	0.893	0.860	0.821	0.967	0.854	0.865	0.846	0.872	0.855
moore01-28	0.860	0.835	0.864	0.956	0.887	0.897	0.816	0.824	0.858	0.886	0.852	0.908	0.840
moore02-28	0.859	0.854	0.818	0.893	0.890	0.863	0.759	0.868	0.796	0.844	0.776	0.894	0.835
Norm03-20b	0.750	0.812	0.736	0.846	0.809	0.695	0.744	0.797	0.703	0.656	0.673	0.629	0.659
Rush02-20b	0.800	0.814	0.709	0.889	0.811	0.641	0.735	0.868	0.628	0.581	0.574	0.651	0.640
Rush03-3b	0.686	0.838	0.771	0.848	0.796	0.832	0.800	0.828	0.809	0.794	0.758	0.838	0.804
serp03-3b	0.718	0.867	0.852	0.824	0.810	0.874	0.895	0.826	0.868	0.807	0.800	0.816	0.744
serp04-3b	0.718	0.878	0.864	0.787	0.780	0.863	0.855	0.816	0.837	0.756	0.813	0.830	0.765
talb10-20c	0.864	0.826	0.802	0.926	0.871	0.630	0.724	0.890	0.634	0.675	0.700	0.638	0.678



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Swan Coastal Plain Plot (FCT)	AECOM_11_outside	AECOM_15_outside	AECOM_20_outside	AECOM_7_outside	AECOM_1_outside	AECOM_13	AECOM_9	AECOM_10_outside	AECOM_6	AECOM_19_outside	AECOM_4	JBSG_S01	AECOM_18_outside
talb11-20c	0.798	0.907	0.783	0.924	0.832	0.642	0.724	0.875	0.627	0.660	0.712	0.633	0.685
talb2-20c	0.778	0.719	0.717	0.888	0.821	0.716	0.739	0.796	0.692	0.672	0.741	0.746	0.658
talb3-20c	0.863	0.859	0.810	0.870	0.889	0.697	0.700	0.871	0.757	0.738	0.790	0.730	0.745
talb5-20c	0.880	0.814	0.786	0.933	0.868	0.744	0.673	0.868	0.735	0.733	0.721	0.743	0.720
talb6-20c	0.886	0.765	0.714	0.923	0.851	0.733	0.674	0.823	0.743	0.763	0.782	0.794	0.682
talb7-20c	0.859	0.805	0.727	0.893	0.868	0.706	0.614	0.895	0.714	0.667	0.738	0.702	0.671
talb8-20c	0.804	0.780	0.791	0.882	0.814	0.659	0.655	0.825	0.552	0.675	0.687	0.653	0.679
talb9-20c	0.798	0.774	0.696	0.899	0.826	0.619	0.664	0.800	0.574	0.632	0.695	0.661	0.651
waro01-3b	0.804	0.817	0.826	0.941	0.814	0.829	0.836	0.864	0.840	0.795	0.821	0.818	0.804
waro02-3b	0.678	0.791	0.752	0.833	0.823	0.733	0.793	0.761	0.756	0.724	0.786	0.748	0.695
WN112MOR-S16	0.950	0.896	0.880	0.943	0.884	0.835	0.846	0.944	0.806	0.835	0.765	0.865	0.850
WN113MOR-S16	0.943	0.910	0.863	0.967	0.947	0.885	0.912	0.967	0.904	0.840	0.848	0.848	0.886
WN115MOR-S09	0.973	0.886	0.921	0.873	0.899	0.800	0.803	0.969	0.860	0.872	0.811	0.878	0.863
WN116MOR-S09	0.977	0.905	0.889	0.948	0.914	0.808	0.859	1.000	0.840	0.826	0.817	0.854	0.862
WN117MOR-S16	0.948	0.919	0.900	0.881	0.928	0.936	0.920	1.000	0.911	0.878	0.818	0.930	0.896
yarl03-3b	0.677	0.778	0.771	0.831	0.758	0.764	0.846	0.667	0.792	0.755	0.774	0.804	0.742
yarl04-20b	0.759	0.810	0.802	0.837	0.789	0.760	0.830	0.798	0.736	0.735	0.769	0.761	0.759
YULE-3-21c	0.783	0.775	0.768	0.902	0.898	0.688	0.689	0.855	0.657	0.691	0.649	0.743	0.674
yuri03-23c	0.873	0.921	0.878	0.942	0.906	0.833	0.714	0.857	0.739	0.833	0.782	0.841	0.797
<b>Minimum dissimilarity</b>	<b>0.671</b>	<b>0.719</b>	<b>0.685</b>	<b>0.787</b>	<b>0.722</b>	<b>0.574</b>	<b>0.614</b>	<b>0.658</b>	<b>0.552</b>	<b>0.581</b>	<b>0.559</b>	<b>0.544</b>	<b>0.640</b>

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## **Appendix 5      Black Cockatoo Habitat Assessment (Phoenix Environmental 2024)**

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# PHOENIX

ENVIRONMENTAL SCIENCES

## Black cockatoo habitat assessment for the Wattle Grove (South) MRS Rezoning Project

Hesperia on behalf of the Western Australian Planning Commission

July 2024

Final



**Black cockatoo habitat assessment for the Wattle Grove (South) MRS Rezoning Project  
Prepared for Hesperia on behalf of the Western Australian Planning Commission**

Black cockatoo habitat assessment for the Wattle Grove (South) MRS Rezoning Project  
Prepared for Hesperia on behalf of the Western Australian Planning Commission

**Version history**

<b>Author/s</b>	<b>Reviewer/s</b>	<b>Version</b>	<b>Version number</b>	<b>Date submitted</b>	<b>Submitted to</b>
Deon Loo and Anna Jacks	J. Clark	Draft for client comments	0.1	14-Mar-24	K. Choo (Coterra Environment)
J. Clark		Final, client comments addressed	1.0	18-Mar-24	K. Choo (Coterra Environment)
A. Jacks		Final, client comments addressed	2.0	11-July-24	K. Choo (Coterra Environment)

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## **ACRONYMS AND ABBREVIATIONS**

<b>Abbreviations</b>	<b>Definition</b>
BC Act	Biodiversity Conservation Act (WA)
CD	Species considered 'Conservation Dependent' and protected under the BC Act (WA)
CR	Species considered 'Critically Endangered' and protected under the EPBC or BC Acts
DBCA	Department of Biodiversity, Conservation and Attractions
DBH	Diameter at breast height
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DWER	Department of Water and Environmental Regulation
EN	Species considered 'Endangered' and protected under the EPBC or BC Acts
EPA	Environmental Protection Authority
EPBC Act	Environmental Protection and Biodiversity Conservation Act
FRTBC	Forest Red-tailed Black Cockatoo
Mig.	A migratory species protected under the EPBC or BC Acts
MRS	Metropolitan Region Scheme
NES	National Environmental Significance
OS	Species otherwise in need of special protection under the BC Act
PHT	Potential habitat tree
SP	Specially protected species under the BC Act
SQL	Structured Query Language
TEC	Threatened Ecological Community, protected under the EPBC and BC Acts
VU	Species considered 'Vulnerable' and protected under the EPBC or BC Acts
WA	Western Australia
WAPC	Western Australia Planning Commission

# 1 INTRODUCTION

The Wattle Grove (South) Metropolitan Regional Scheme (MRS) Amendment Project (the 'Project') involves the Western Australia Planning Commission (WAPC) plans to re-zone 126 ha of 'Rural' zoned land (77 lots) for residential purposes within Wattle Grove, under MRS Amendment 1388/57.

The Project has been investigated since at least 2019, with numerous consultants having undertaken biological surveys in that time. Phoenix was approached to review biological work done to date with respect to current Environmental Protection Authority (EPA) and Department of Climate Change, Energy, the Environment and Water (DCCEEW) guidelines. This report specifically provides technical assessment and advice in respect to the black cockatoo habitat assessment for the Project area, including the compliance and adequacy of historic biological surveys and any additional work required. In order to obtain necessary approvals environmental impact assessment documentation is being prepared for the Project on behalf of the WAPC.

The Project lies within the Perth subregion of the Swan Coastal Plain bioregion.

## 1.1 BACKGROUND

Since 2019, multiple black cockatoo surveys have been completed for the (larger) Project:

- In spring of 2019 AECOM (2020) undertook biological surveys, including a Level 1 (equivalent to a Basic) fauna survey and a Targeted black cockatoo survey of a larger 340 ha area, which included the current Project area. The survey involved mapping fauna habitat, fauna observations, and recording of potential habitat trees (PHTs). The surveys of the larger area (noting that not all of these findings relate specifically to the Project area) recorded:
  - direct sightings foraging in the study area and multiple foraging evidence of Forest Red-Tailed Black Cockatoo (FRTBC) (*Calyptorhynchus banksii naso*; VU)
  - foraging evidence of Carnaby's Cockatoo (*Zanda latirostris*; EN)
  - 730 PHTs, including 17 trees with one or more hollows considered potentially suitable for breeding black cockatoos (27 hollows in total).
  - a total of 41.14 ha of very high and high-quality foraging habitat for Carnaby's Cockatoo and Baudin's Cockatoo, and 33.52 ha of very high and high-quality foraging habitat for the FRTBC.
- In February and August 2021, and May 2022, JBS&G (2023) conducted a black cockatoo habitat assessment within the current Wattle Grove (South) MRS Amendment (Project) Area. The results from this survey took into consideration AECOM (2020) survey data in addition to new survey data:
  - a total of 153 PHTs were recorded of which 3 had potentially suitable hollows
  - a total of 32.44 ha of vegetation both native and introduced, of varying quality suitable for foraging for all 3 black-cockatoo species.
- In January 2024, Phoenix undertook a review of the previous biological surveys to ensure they adhered to current State and Federal government guidelines for the species (Bamford 2020; DAWE 2022a, b; EPA 2019). In regards to black cockatoos both the AECOM (2020) and JBS&G (2023) surveys were found to be compliant with current guidelines for those species, however several items required re-analysis:
  - foraging habitat required re-scoring due to 2 components of the analysis being incorrectly interpreted (Site context and Species stocking rate)
  - inconsistencies between the reported number of PHTs reported (AECOM 2020; JBS&G 2023) and in the supplied spatial data, which resulted in uncertainty around the

correct number of PHTs and PHTs with possibly suitable hollows within the Wattle Grove (South) MRS Amendment Area.

The Department of Biodiversity, Conservation and Attractions (DBCA) Threatened fauna dataset (DBCA 2023) includes 32 monitored black cockatoo sites within 10 km of the study area. The maximum number of white-tailed black cockatoos (Carnaby's and Baudin's Cockatoo) sighted was 215 individuals located 7 km NE of the study area in 2017. The maximum number of FRTBC sighted in 2018 was 334 individuals at a site located 2.5 km west of the study area.

Black cockatoos utilise the Swan Coastal Plain mainly for foraging resources and breeding habitat in small patches of suitable habitat. Carnaby's Cockatoo primarily use vegetation dominated by *Banksia* spp. and Tuart (*Eucalyptus gomphocephala*) woodlands, as well as Marri (*Corymbia calophylla*), with Jarrah (*E. marginata*) in the east. An important focus for this region is the ongoing viability of foraging resources for black cockatoos, particularly Carnaby's Cockatoo (*Zanda latirostris*).

The Jarrah Forest, just east of the study area provides breeding habitat for all 3 black cockatoo species as well as providing key foraging and wintering areas for Baudin's Cockatoo (*Zanda baudinii*) and the FRTBC. Marri is a primary food resource for Baudin's Cockatoo and the FRTBC. Foraging areas associated with breeding are critical for all species (DAWE 2022b).

The results of Phoenix' re-assessment of foraging habitat value per the Bamford (2021) method is presented below in section 0.

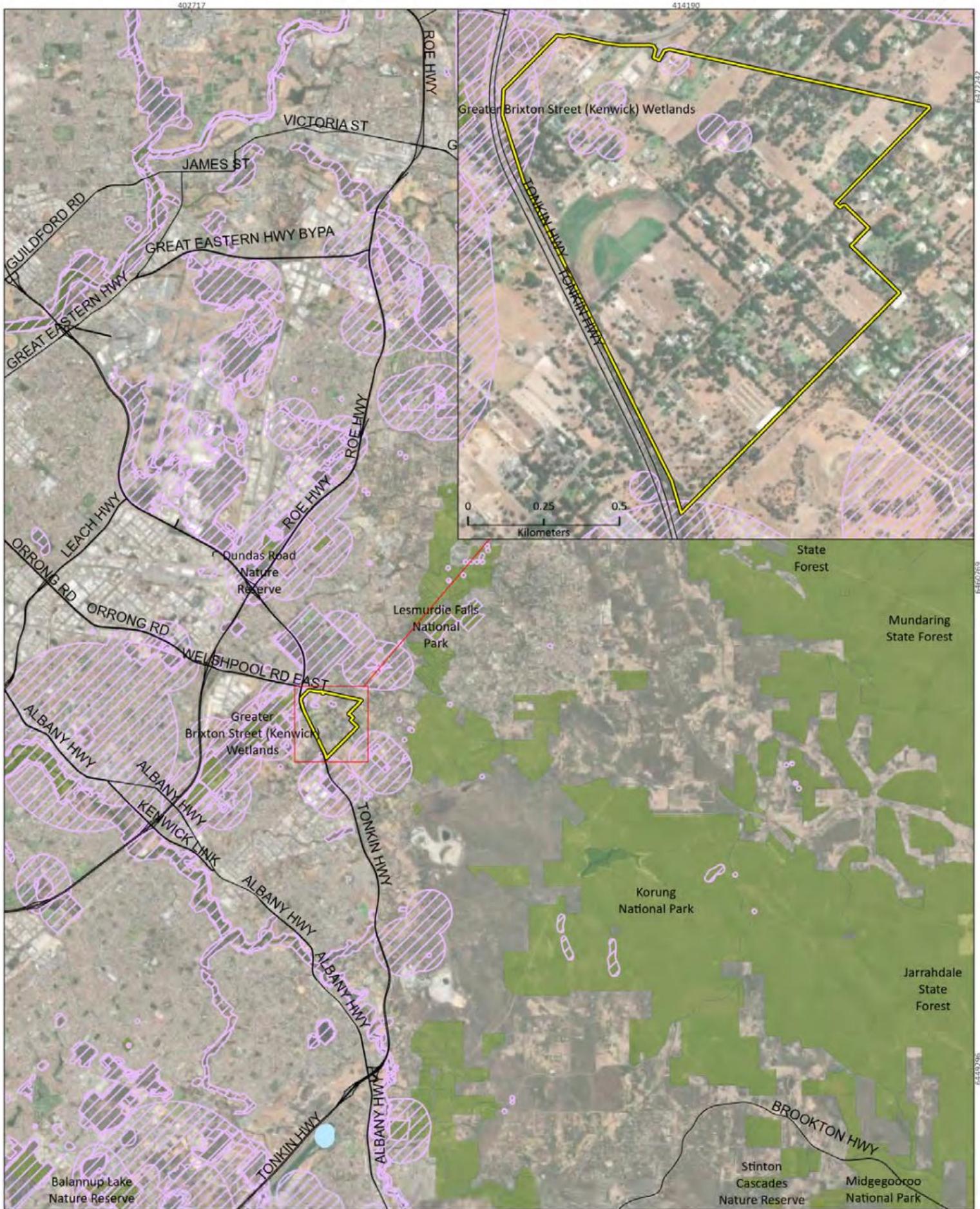
## **1.2 SCOPE OF WORK**

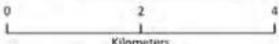
The scope of work for the black cockatoo habitat assessment of the Project area was as follows:

- review habitat mapping with respect to consistency with the vegetation type and condition mapping and black cockatoo species foraging habitat
- review the potential habitat tree dataset
- undertake a hollow inspection, if required
- undertake black cockatoo species foraging habitat quality scoring per the "Bamford Method" (Bamford 2021).

## **1.3 PROJECT AREA**

The Wattle Grove (South) MRS Amendment Area (the 'Project area') is located within Wattle Grove, approximately 15 km ESE from Perth, Western Australia (WA; Figure 1-1). The Project area is bound by Welshpool Road East and Crystal Brook Road to the north, and Tonkin Highway to the west.



Coterra Environment Wattle grove MRS Rezoning	
Project No 1633	
Date 28/02/2024	
Drawn by JL	
Map author BK	
	
1:113,600(at A4) GDA 1994 MGA Zone 50	

-  Study area
-  Lakes
-  DBCA managed land
-  Environmentally Sensitive Areas

**Figure 1-1**  
Project location and study area



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All information within the map is current as of 28/02/2024. This product is subject to COPYRIGHT and is property of Phoenix Environmental Sciences (Phoenix). While Phoenix has taken care to ensure the accuracy of this product, Phoenix make no representations or warranties about its accuracy, completeness or suitability for any particular purpose.

## 2 LEGISLATIVE CONTEXT

The protection of fauna in WA is principally governed by 3 acts:

- Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)
- State *Biodiversity Conservation Act 2016* (BC Act)
- State *Environmental Protection Act 1986* (EP Act).

### 2.1 COMMONWEALTH

The EPBC Act is administered by the Federal DCCEE. The EPBC Act provides for the listing of Threatened fauna as matters of National Environmental Significance (NES). Under the EPBC Act, actions that have, or are likely to have, a significant impact on a matter of NES, require approval from the Australian Government Minister for the Environment through a formal referral process. Key threats and habitat critical to the survival of EPBC Act Threatened species are usually defined in the conservation advice and/or recovery plan for the species.

Conservation categories applicable to Threatened fauna species under the EPBC Act are as follows:

- Extinct (EX)<sup>1</sup> – there is no reasonable doubt that the last individual has died
- Extinct in the Wild (EW) – taxa known to survive only in captivity
- Critically Endangered (CR) – taxa facing an extremely high risk of extinction in the wild in the immediate future
- Endangered (EN) – taxa facing a very high risk of extinction in the wild in the near future
- Vulnerable (VU) – taxa facing a high risk of extinction in the wild in the medium-term
- Conservation Dependent (CD)<sup>1</sup> – taxa whose survival depends upon ongoing conservation measures; without these measures, a conservation dependent taxon would be classified as Vulnerable, Endangered or Critically Endangered.

### 2.2 STATE

#### 2.2.1 Threatened and Priority species

In WA, the BC Act provides for the listing of Threatened fauna species (Government of Western Australia 2018a, b) in the following categories:

- Critically Endangered (CR) – species facing an extremely high risk of extinction in the wild in the immediate future<sup>2</sup>
- Endangered (EN) – species facing a very high risk of extinction in the wild in the near future<sup>2</sup>
- Vulnerable (VU) – species facing a high risk of extinction in the wild in the medium-term future<sup>2</sup>.

Species may also be listed as specially protected (SP) under the BC Act in one or more of the following categories:

- species of special conservation interest (conservation dependent fauna, CD) – species with a naturally low population, restricted natural range, of special interest to science, or subject to or recovering from a significant population decline or reduction in natural range

---

<sup>1</sup> Species listed as Extinct and Conservation Dependent are not matters of NES and therefore do not trigger the EPBC Act.

<sup>2</sup> As determined in accordance with criteria set out in the ministerial guidelines.

- migratory species (Mig.), including birds subject to international agreement
- species otherwise in need of special protection (OS).

DBCA administers the BC Act and also maintains a non-statutory list of Priority fauna. Priority species are still considered to be of conservation significance – that is they may be Threatened – but cannot be considered for listing under the BC Act until there is adequate understanding of threat levels imposed on them. Species on the Priority fauna list are assigned to one of 4 Priority (P) categories, P1 (highest) – P4 (lowest), based on level of knowledge/concern.

### **2.2.2 Critical habitat**

Under the BC Act, habitat is eligible for listing as critical habitat if it is critical to the survival of a Threatened species or a Threatened Ecological Community (TEC) and its listing is otherwise in accordance with the ministerial guidelines.

### 3 METHODS

This memo has been written with consideration of the following guidelines and guidance:

- Referral guideline for 3 WA threatened black cockatoo species Carnaby's Cockatoo (*Zanda latirostris*), Baudin's Cockatoo (*Zanda baudinii*) and the FRTBC (*Calyptorhynchus banksii naso*) (DAWE 2022b).
- Black cockatoos and development in South-West Western Australia (DAWE 2022a).
- Scoring System for the Assessment of Foraging Value of Vegetation for Black-Cockatoos (Bamford 2021).

#### 3.1 BREEDING HABITAT ANALYSIS

Breeding habitat for black cockatoos consists of woodland or forest; however, they will also breed in areas of former woodland or forest habitats which consist of now fragmented patches of habitat and/or isolated trees. Breeding habitat is defined in DAWE (2022b) as "habitat that contains known, suitable or potential nesting trees."

A breeding tree is considered by DAWE (2022b) as any tree species where "suitable nest hollows" are present. Suitable nest hollows are only found in live trees with a diameter at breast height (DBH) of at least 500 mm. Trees suitable to develop a nest hollow in the future are 300-500 mm DBH. Note that many species of eucalypt may develop suitable hollows for breeding DAWE (2022b), however, All *E. tottiana* and introduced eucalypts were removed from the dataset on the basis the form, habit, and/or hollow forming properties of these species is generally unsuitable for black cockatoo nesting.

AECOM (2020) and JBS&G (2023) recorded trees with a DBH equal to or greater than 500 mm, including any hollow-bearing trees. The following information was recorded for each tree:

- tree species
- DBH (mm)
- number of hollows present
- hollow height (m) and orientation
- hollow suitability (e.g. size of entrance, condition of outside of the hollow)
- evidence of use.

After reviewing the previous reports (AECOM 2020; JBS&G 2023) and associated data provided it was determined that 7 PHT within the study area required re-inspection to confirm the precise location (as there were discrepancies with locations in the different datasets) and suitability of those hollows as nests for black cockatoos. In particular, 3 of these trees had been previously identified as having 'possibly suitable' hollows, however, no further investigation of these tree hollows was undertaken during or immediately after the previous biological surveys.

Subsequently, on 19 January 2024 Anna Jacks (Phoenix) and Steve Robertson (Activate Projects) inspected those 7 trees. After each tree was located, their position was again recorded using a GPS and the same data as recorded previous was re-collected. Binoculars were used to assess each hollow from ground-level and then inspected with a GoPro camera mounted on a pole to verify suitability, if necessary. The information collected during the survey was compared to the original descriptions to determine accuracy of initial recordings and any changes to tree and hollow condition since the original survey was noted.

## 3.2 ROOSTING HABITAT ANALYSIS

Roosting habitat within the Wattle Grove (South) MRS Amendment Area was determined using trees known as roosting for any of the black cockatoo species and the habitat types containing these trees:

- Carnaby's Roosting habitat is found in any tall trees near or in riparian environments or permanent water sources. These trees include Flat-topped Yate, Salmon Gum, Wandoo, Marri, Karri, Blackbutt, Tuart, introduced eucalypts and introduced pines.
- RFTBC favour tall trees such as Jarrah, Marri, Blackbutt, Tuart and introduced eucalypt trees or large trees on the edge of forests. The pine plantations between Mandurah, Bunbury and north of the Perth metropolitan area can provide foraging and night roosting habitat in the Swan Coastal Plain.
- Baudin's Cockatoo also prefer to be near riparian environments or other permanent water sources. Any tall trees may provide roosting habitat for Baudin's Cockatoo, but particularly Jarrah, Flooded Gum, Blackbutt, Tuart and introduced eucalypts such as Blue Gum (*E. globulus*) and Lemon Scented Gum (*Corymbia citriodora*) (DAWE 2022b). Suitable roosting habitat has to also be within 20 km of foraging habitat (DAWE 2022a).

## 3.3 FORAGING HABITAT ANALYSIS

The foraging value of each habitat type within the Wattle Grove (South) MRS Amendment Area was assessed for each black cockatoo species using the HQS methodology developed by Bamford Consulting Ecologists (Appendix 1). The scoring system provides a numerical value that reflects the significance of vegetation as foraging habitat for black cockatoos and this numerical value is designed to provide the information needed by DCCEEW, Department of Water and Environmental Regulation (DWER) and the EPA to assess impact significance and offset requirements.

The foraging value of the vegetation is dependent on the type, density and condition of vegetation in an area and is determined by factors such as foraging habitats near it.

Calculating the total score (out of 10) requires these following steps:

- A. Site condition. Finding out a score out of 6 for the vegetation composition, condition, and structure; plus
- B. Site context. Find out a score out of 3 for the context of the site; plus
- C. Species stocking rate. Determining a score out of one for species density.
- D. Determining the total score out of 10, which may require moderation for context and species density with respect to the site condition (vegetation) score. Moderation also includes consideration of pine plantations as a special case for foraging value.

Site condition was determined using existing vegetation mapping and compiling all the relevé and quadrat species-level spatial data and imported it into Phoenix' biological database, along with the supplied vegetation type spatial dataset. Using spatial Structured Query Language (SQL) we then used a series of stored routines to:

- gather the array of foraging species present within each sample plot for each cockatoo species, their respective cover (%) and height (cm) values, and the total number foraging species.
- intersect species records with vegetation type and vegetation condition.
- output a polygon dataset containing the above information.

## 4 RESULTS

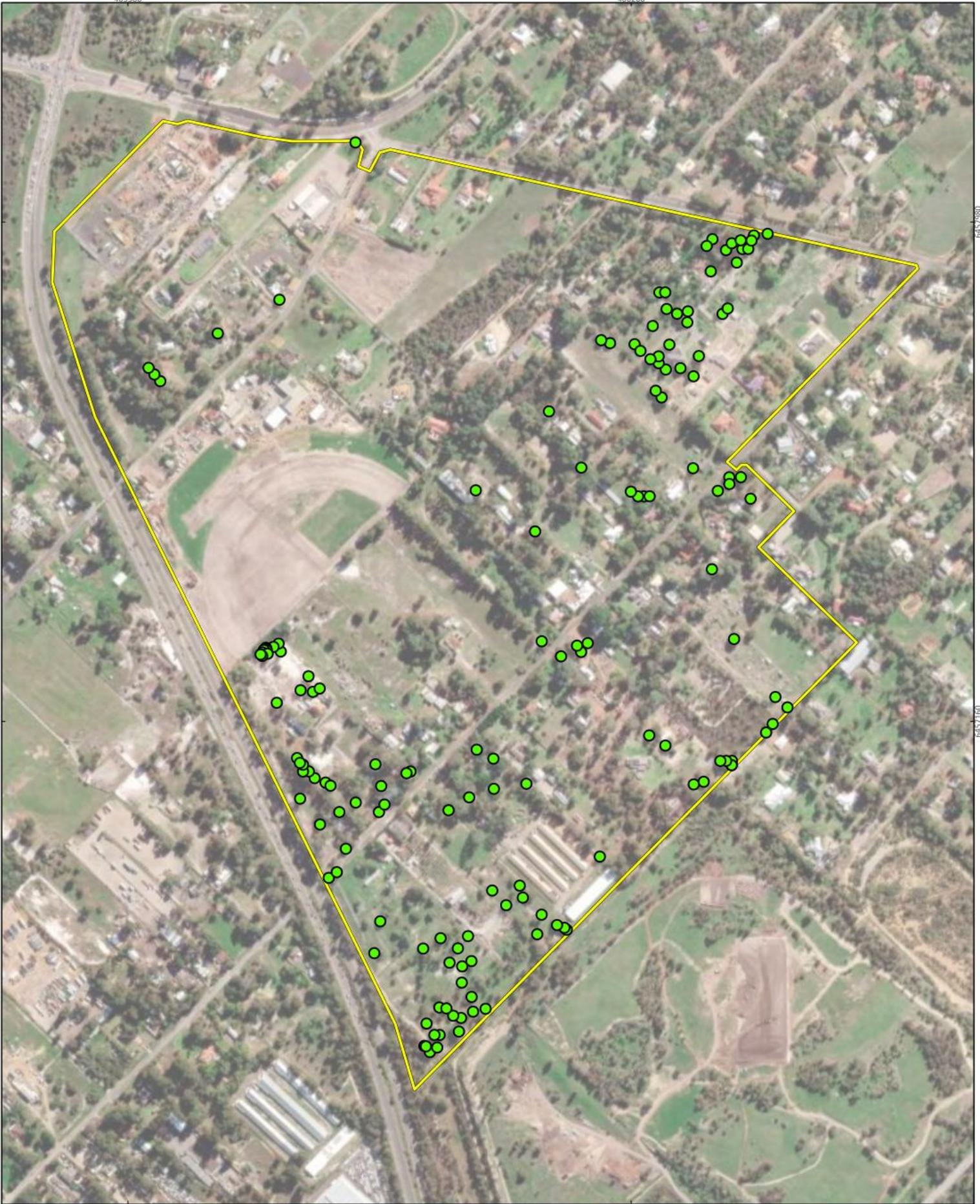
### 4.1 BREEDING HABITAT ANALYSIS

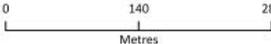
A total of 153 PHTs occur within the Wattle Grove (South) MRS Amendment Area Figure 4-1; Appendix 2). These consist of native WA trees known to support breeding, that is, Jarrah, Marri, Tuart, Flooded Gums and stag trees. The majority of trees are scattered in areas of degraded habitat or cleared land/paddocks.

As above, a total of 7 trees identified previously (DAWE 2022b; JBS&G 2023) as having possibly suitable breeding hollows were inspected again on 19 January 2024 by Phoenix (Figure 4-2), and the following was observed (Table 4-1):

- Two records are considered to be erroneous and were removed from the dataset (NewID = 0).
- Habitat tree 417 is no longer present; given its age and comments at the time of the original inspection, it is assumed that this tree had further deteriorated and been removed.
- Habitat tree 482 was in poor condition and no longer contained suitable hollows.
- The remaining 3 trees (438, 491, 561) contained unsuitable hollows (too small and/or inhabited by bees).
- Tree 491 appears to be regularly visited with both preening and old and new foraging evidence present; but it is not a breeding tree.

As a result, Phoenix has confirmed that no breeding trees occur within the Wattle Grove (South) MRS Amendment Area.



Coterra Environment Wat le Grove MRS Re-zoning		
Project No	1633	
Date	14/03/2024	
Map author	AJ	
		
1:8,000 (at A4)		GCS WGS 1984

-  Wat le Grove (South) MRS Amendment Area
-  Potential habitat trees

**Figure 4-1**  
**Potential habitat trees in the Wat le Grove (South) MRS Amendment Area**



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Table 4-1 Potential habitat trees with hollows within the Wattle Grove (South) MRS Amendment Area re-assessed in January 2024

NewID / Tree ID	Latitude	Longitude	Species	DBH (mm)	AECOM (2019) hollow comments and determination		Phoenix (2024) hollow comments and determination	
417	116.0034	-32.0213	Jarrah	1,100	very stressed, dead old	Possibly suitable	A stand of 3 young Jarrah present at this location. None contain hollows. No very old Jarrah were near this location, assumed no longer present (Figure 4-3).	Not no longer present
438	116.0037	-32.0211	Jarrah	1,300	healthy	Possibly suitable	Hollow in fork of tree at about 5 m (Figure 4-4). Opening and inside is too narrow (Figure 4-5).	Not suitable
482	116.0024	-32.0212	Stag	600	Hollow 1: 15x20 cm, west facing, vertical on trunk, 6 m above ground, no evidence of use. Hollow 2: 30x30 cm entrance, facing upward/vertical on spout, 7 m above ground	Possibly suitable	Tree now very degraded and does not contain any suitable hollows (Figure 4-6). Two adjacent alive trees did not contain any hollows.	Not suitable
491	116.0036	-32.0213	Jarrah	1,200	Tree split into 2. Hollow 1: East facing branch, 8 m above ground, 10x40 cm, tree utilised by Lorikeets. Hollow 2: West facing branch, 6 m above ground, 15x50 cm, at 45 degrees. Hollow 3: South facing branch, 7 m above ground, 15x20 cm, at 45 degrees.	Possibly suitable	Tree split in 2 with 4 potential hollows (Figure 4-7): <ul style="list-style-type: none"> <li>• Hollow 1 western branch is not hollow inside (Figure 4-8)</li> <li>• Hollow 2 in northwestern branch is too small inside (Figure 4-9). Evidence of nesting from other species such as galahs (scarring below hollow)</li> <li>• Hollow 3 in northwestern branch is occupied by bees</li> <li>• Hollow 4 is too narrow inside.</li> </ul> Abundant new to old foraging on Jarrah nuts and at least 4 preened black cockatoo feathers under tree (Figure 4-10).	Not suitable

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NewID / Tree ID	Latitude	Longitude	Species	DBH (mm)	AECOM (2019) hollow comments and determination		Phoenix (2024) hollow comments and determination	
561	116.0088	-32.0108	Jarraah	900	Hollow 1: West facing branch, 11 m above ground, 50x10 cm, 45 degrees, unable to assess chamber size, hollow occupied by Galahs Hollow 2: North-west facing branch, 10 m above ground, 10x100 cm, 45 degrees, old evidence of use, occupied by bees.	Possibly suitable	Tree viewed from road as no access to property. Several hollows were noticed, however one had bees and the others were too small, but had evidence of scarring indicating possible use by other species, e.g. the Australian Ringneck present in tree at the time of survey. Female Carnaby's Cockatoo perched in adjacent planted eucalypt.	Not suitable
0 (north)	116.0088	-32.0108	Jarraah	0	Hollow 1: West facing branch hollow, 11 m above ground, 50x10 cm entrance at 45 degrees, unable to assess chamber size, hollow occupied by pink and grey galahs Hollow 2: North-west facing branch hollow 10 m above ground, 10x100 cm entrance at 45 degrees.	Possibly suitable	Given there is no tree ID, the description is very similar to habitat tree 561 (a Marri tree with no suitable hollows) and the point is 2 m away, it is assumed this is a duplicate.	Not suitable
0 (south)	116.0023	-32.0212	Stag	0	Hollow 1: 15x20 cm entrance, west facing hollow, vertical on trunk, 6 m above ground, unable to assess depth, no evidence of use Hollow 2: 30x30 cm entrance, facing upward/vertical on spout, 7 m above ground.	Possibly suitable	The tree at this point location was an <i>Allocasuarina</i> . No other trees nearby. Given there is no "NewID" for this record, this is likely to represent a data error. No habitat tree present.	Not suitable



Coterra		
Wattle Grove MRS Amendment		
Project No	1633	
Date	19 Jan 2024	
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Map author	AJ	
1:5,380 (at A3)		GDA 1994 MGA Zone 50

Potential habitat trees  
 Wattle Grove MRS Amendment Area

**Figure 4-2**  
**Potential habitat trees re-assessed by Phoenix in 2024**

**PHOENIX**  
 ENVIRONMENTAL SCIENCES

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Figure 4-3 Trees at location of habitat tree 417



Figure 4-4 Habitat tree 438



Figure 4-5      Hollow of habitat tree 438



Habitat tree 482

Figure 4-6 Habitat tree 482



Figure 4-7      Habitat tree 491



Figure 4-8 Hollow 1 in habitat tree 491



Figure 4-9 Hollow 2 in habitat tree 491



Figure 4-10 Foraging evidence and black cockatoo feathers underneath habitat tree 491

## 4.2 ROOSTING HABITAT ANALYSIS

There are 50 confirmed roosting sites (23 FRT roosting sites, 7 White-tailed sp. roosting sites, 20 White-tailed and FRT roosting sites) and 10 unconfirmed roosting sites within 12 km of the study area (Figure 4-11) (Birdlife 2024).

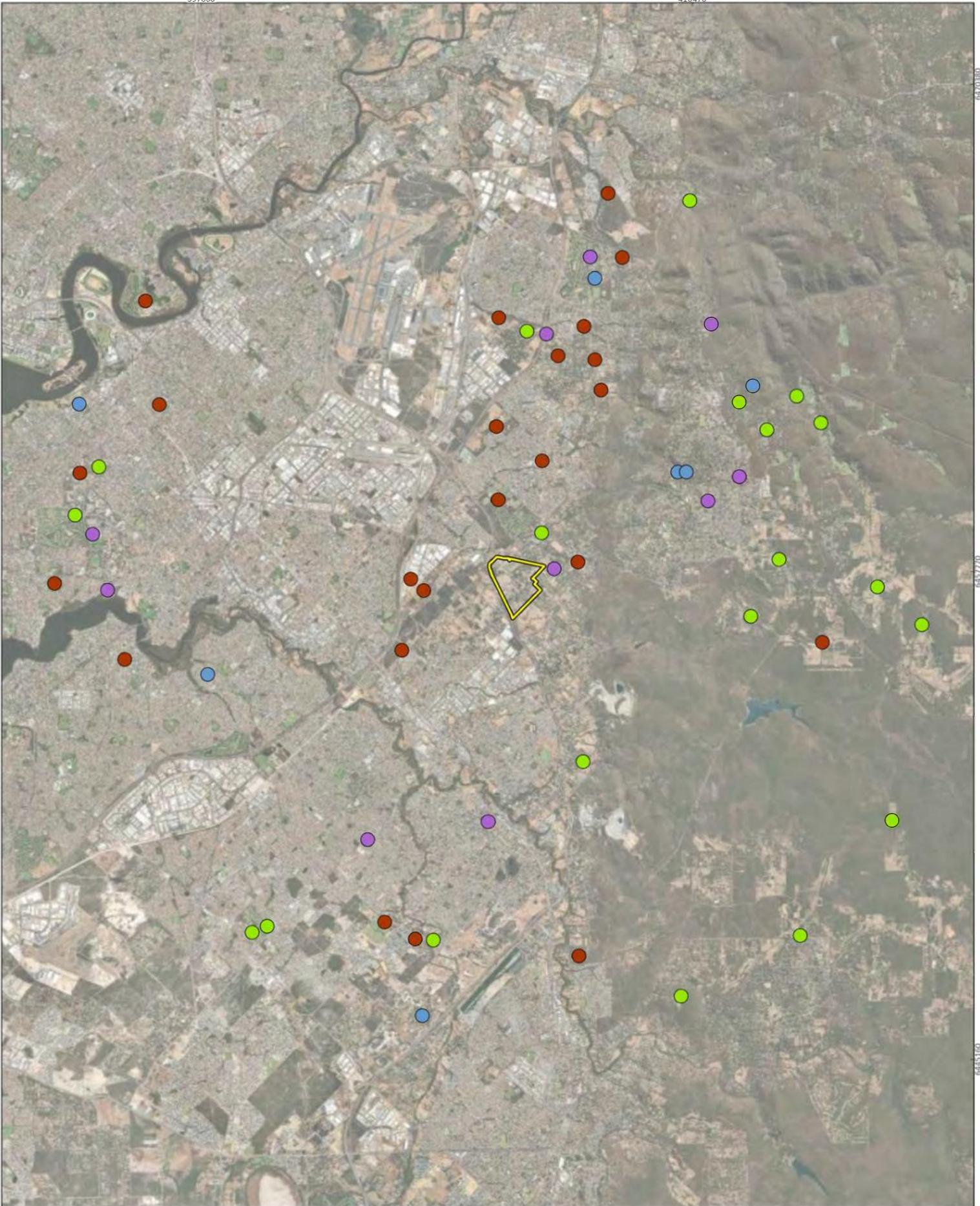
The nearest roosting site to the study area is an unconfirmed roosting site located 250 m east of the study area (KALWATR001). An unconfirmed roosting site is where roosting black-cockatoos have been reported but have not had a positive count recorded ( $\geq 1$  bird) during any GCC; these sites may be used at other times of year or may have only recently been added to the GCC database (Birdlife 2024).

The nearest FRT and white-tailed sp. roosting site is 825 m north of the study area (KALWATR003) recorded 21 and 28 individuals in 2021 and 2023 respectively during the Great cocky Count census.

The confirmed site (KALWATR002), recorded 850 m east of the study area supports FRTBC roosting of up to 150 individuals (Great Cocky Count Census 2016, 2018), with lower numbers recorded in subsequent years (23, 87, 0, and 37)

The unconfirmed roosting site (KALWATR001) is just 350 m east of the study area (DBCA 2023).

The habitat assessment undertaken by (AECOM 2020) determined that 29.8 ha of suitable roosting habitat was present, consisting of remnant native vegetation, planted gardens and scattered trees (Figure 4-1). Numerous surveys have been undertaken for this Project since 2019, and numerous sites in close proximity are part of annual black cockatoo monitoring, and to date no roosting sites for black cockatoo species have been identified within the study area. So while there may be habitat considered suitable for roosting, it does not appear to have been used as such for almost the last decade.



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 Wattle Grove Metropolitan Region Scheme

Project No	1647
Date	11/07/2024
Drawn by	JL
Map author	AJ

0 1.5 3  
 Kilometers

1:125 100 (at A4) GDA 1994 MGA Zone 50

Study area

**Site category**

- FRT - roost site
- WT - roost site
- WT and FRT roost site
- unconfirmed roost site

**Figure 4-11**  
 Roosting locations within 12 km of the study area (Birdlife 2024)

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## 4.3 FORAGING HABITAT ANALYSIS

Foraging habitat scores have been calculated per the methods presented in Bamford (2021) (Table 4-2, Table 4-3, Table 4-4).

### 4.3.1 Site context

Site context was allocated a '3' to all species in being that:

- Carnaby's cockatoo: local breeding is also known and 32.9% of native vegetation remains within 15km of the Amendment Area
- Baudin's cockatoo: no local breeding is known or likely, but 32.9% of native vegetation remains within 15km of the Amendment Area
- FRTBC: no local breeding is known or likely, but 32.9% of native vegetation remains within 15km of the Amendment Area.

### 4.3.2 Species stocking rate

Species stocking rate was given '1' for Carnaby's Cockatoo and FRTBC and '0' for Baudin's Cockatoo:

- Carnaby's Cockatoo: stocking rate = 1, observed feeding and multiple recent and historic evidence of feeding activity were recorded (i.e. AECOM 2020; DBCA 2023; JBS&G 2023 and here).
- Baudin's Cockatoo: stocking rate = 0, as no feeding was directly observed, nor was recent or historical evidence found and desktop records are also absent within 15km of the Amendment Area .
- FRTBC: stocking rate = 1 as observed feeding and multiple recent and historic evidence of feeding activity have been recorded (i.e. AECOM 2020; DBCA 2023; JBS&G 2023 and here).

### 4.3.3 Site condition

Per Bamford (2021) "site condition" is scored out of 6 and is the biggest factor in the overall score. Site condition varied between vegetation types and between species of black cockatoo, with higher scores being attributed to those vegetation units/habitats with a higher density of foraging species.

### 4.3.4 Moderation

Moderation has been applied to parts of the habitat polygons that did not record a known forage species (native or introduced).

### 4.3.5 Site score

The results for the black cockatoo foraging habitat analysis are summarised below, per vegetation type (Table 4-2; Table 4-3; Table 4-4), per relative score (Table 4-5; Table 4-6) and shown visually in Figure 4-12 (Carnaby's Cockatoo), Figure 4-13 (Baudin's Cockatoo) and Figure 4-14 (FRTBC).

**Table 4-2 Site score for Carnaby's Cockatoo**

<b>Veg. type/ Site score with justification</b>	<b>2</b>	<b>3</b>	<b>5</b>	<b>6</b>	<b>8</b>	<b>Total</b>
<b>BaEpPf</b>				<b>0.82</b>	<b>3.41</b>	<b>4.23</b>
32.9% native veg. remaining (within 15km). Local breeding confirmed (within 12km).					3.41	3.41
32.9% native veg. remaining (within 15km). Some foraging species present, but moderated down due to degraded condition.				0.82		0.82
<b>BmXpEc</b>					<b>0.29</b>	<b>0.29</b>
32.9% native veg. remaining (within 15km). Local breeding confirmed (within 12km).					0.29	0.29
32.9% native veg. remaining (within 15km). Some foraging species present, but moderated down due to degraded condition.				0.13		0.13
<b>Cleared</b>	<b>91.23</b>					<b>91.23</b>
32.9% native veg. remaining (within 15km). But no foraging species present; 32.9% native veg. remaining (within 15km). Local breeding confirmed (within 12km).	91.23					91.23
<b>EmMplp</b>	<b>0.08</b>				<b>0.05</b>	<b>0.13</b>
32.9% native veg. remaining (within 15km). But no foraging species present.	0.08					0.08
32.9% native veg. remaining (within 15km). Local breeding confirmed (within 12km).					0.05	0.05
<b>Planted</b>	<b>2.80</b>					<b>2.80</b>
32.9% native veg. remaining (within 15km). But no foraging species present.	2.80					2.80
<b>Trees</b>	<b>20.43</b>	<b>5.84</b>	<b>0.59</b>	<b>0.05</b>		<b>26.91</b>
32.9% native veg. remaining (within 15km). But no foraging species present; moderated down due to degraded condition.	20.43					20.43
32.9% native veg. remaining (within 15km). Local breeding confirmed (within 12km).			0.59			0.59
32.9% native veg. remaining (within 15km). Some foraging species present, but moderated down due to degraded condition.		5.84		0.05		5.89
<b>Total</b>	<b>114.54</b>	<b>5.84</b>	<b>0.59</b>	<b>0.87</b>	<b>3.75</b>	<b>125.59</b>

**Table 4-3 Site score for Baudin’s Cockatoo**

Veg. type/ site score with justification	2	3	5	7	Total
<b>BaEpPf</b>	<b>0.82</b>		<b>1.34</b>	<b>2.08</b>	<b>4.24</b>
32.9% native veg. remaining (within 15km). Foraging species present.			1.34		1.34
32.9% native veg. remaining (within 15km). Foraging species present. Moderated down due to degraded condition.	0.82				0.82
32.9% native veg. remaining (within 15km). Multiple foraging species present, veg in good or better condition.				2.08	2.08
<b>BmXpEc</b>				<b>0.29</b>	<b>0.29</b>
32.9% native veg. remaining (within 15km). Multiple foraging species present, veg in good or better condition.				0.29	0.29
<b>Cleared</b>	<b>91.23</b>				<b>91.23</b>
32.9% native veg. remaining (within 15km). Foraging species present. Moderated down due to degraded condition.	91.23				91.23
<b>EmMpLp</b>	<b>0.08</b>			<b>0.05</b>	<b>0.13</b>
32.9% native veg. remaining (within 15km). Foraging species present. Moderated down due to degraded condition.	0.08				0.08
32.9% native veg. remaining (within 15km). Multiple foraging species present, veg in good or better condition.				0.05	0.05
<b>Planted</b>	<b>2.80</b>				<b>2.80</b>
32.9% native veg. remaining (within 15km).	2.80				2.80
<b>Trees</b>	<b>21.63</b>	<b>4.48</b>	<b>0.81</b>		<b>26.92</b>
32.9% native veg. remaining (within 15km). Moderated down due to degraded condition.	21.06				20.66
32.9% native veg. remaining (within 15km). Foraging species present. Moderated down due to degraded condition.	0.57	4.48	0.81		6.25
<b>Total</b>	<b>116.55</b>	<b>4.48</b>	<b>2.14</b>	<b>2.41</b>	<b>125.59</b>

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Prepared for Hesperia on behalf of the Western Australian Planning Commission**

**Table 4-4 Site score for FRTBC**

<b>Veg. type/ site score with justification</b>	<b>2</b>	<b>3</b>	<b>7</b>	<b>8</b>	<b>Total</b>
<b>BaEpPf</b>		<b>0.82</b>		<b>3.41</b>	<b>4.23</b>
32.9% native veg. remaining				2.42	2.42
32.9% native veg. remaining (within 15km). But Moderated down due to clearing, despite foraging species present.		0.82			0.82
32.9% native veg. remaining (within 15km). No foraging species present.				0.99	0.99
<b>BmXpEc</b>			<b>0.05</b>	<b>0.24</b>	<b>0.29</b>
32.9% native veg. remaining (within 15km)			0.05	0.24	0.29
<b>Cleared</b>	<b>91.23</b>				<b>91.23</b>
32.9% native veg. remaining (within 15km). But Moderated down due to clearing, despite foraging species present.	84.45				84.45
32.9% native veg. remaining (within 15km). But Moderated down due to clearing.	0.13				0.13
32.9% native veg. remaining (within 15km). No foraging species present. Moderated down due to condition.	6.64				6.64
<b>EmMpLp</b>		<b>0.08</b>		<b>0.05</b>	<b>0.13</b>
32.9% native veg. remaining (within 15km)				0.05	0.05
32.9% native veg. remaining (within 15km). But Moderated down due to clearing, despite foraging species present.		0.08			0.08
<b>Planted</b>	<b>2.80</b>				<b>2.80</b>
32.9% native veg. remaining (within 15km). No foraging species present. Moderated down due to condition.	2.80				2.80
<b>Trees</b>	<b>20.61</b>	<b>6.30</b>			<b>26.91</b>
32.9% native veg. remaining (within 15km). But Moderated down due to clearing, despite foraging species present.		6.30			6.30
32.9% native veg. remaining (within 15km). No foraging species present. Moderated down due to condition.	20.61				20.61
<b>Total</b>	<b>114.63</b>	<b>7.20</b>	<b>0.05</b>	<b>3.70</b>	<b>125.59</b>

**Black cockatoo habitat assessment for the Wattle Grove (South) MRS Rezoning Project  
Prepared for Hesperia on behalf of the Western Australian Planning Commission**

Overall, the majority of the Project Area has low value foraging habitat for Carnaby's Cockatoo (120.38 ha; 95.86%), Baudin's Cockatoo (121.03 ha; 96.37%) and FRTBC (121.84 ha; 97.02%) as the area is comprised largely of cleared areas and degraded remnant vegetation (Table 4-6). A small proportion of the study area consists of high value foraging habitat for Carnaby's Cockatoo (3.75 ha; 2.99%), Baudin's Cockatoo (2.413 ha; 1.92%) and FRTBC (3.75 ha; 2.99%).

**Table 4-5 Black cockatoo foraging habitat value per Bamford 2021 scoring method. Low value habitat (1-3) is in green, Moderate value habitat (4-6) is in yellow, High value habitat (7-10) is in Red.**

Veg. type	Relative rating	Carnaby's Cockatoo		Baudin's Cockatoo		FRTBC	
		Score	Sum area (ha)	Score	Sum area (ha)	Score	Sum area (ha)
BaEpPf	Low			2	0.822	3	0.822
	Med.	6	0.82	5	1.337		
	High	8	3.41	7	2.075	8	3.412
BmXpEc	High			7	0.29	7	0.051
		8	0.29	-	-	8	0.239
Cleared	Low	2	91.229	2	91.229	2	91.229
EmMpLp	Low	2	0.079	3	0.079	3	0.079
	High	8	0.048	7	0.048	8	0.048
Planted	Low	2	2.80	3	2.796	2	2.796
Trees	Low	2	20.43	2	21.627	2	20.609
		3	5.84	3	4.476	3	6.3
	Med.	5	0.59	5	0.806	-	-
		6	0.05	-	-	-	-
<b>Total area (ha)</b>			<b>125.59</b>		<b>125.59</b>		<b>125.59</b>

**Table 4-6 Summary of foraging habitat scores and species**

Habitat value/Score	Carnaby's Cockatoo	Baudin's Cockatoo	FRTBC
Low	2	114.5	113.68
	3	5.8	7.35
<b>Subtotal</b>	<b>120.38</b>	<b>121.03</b>	<b>121.84</b>
Med.	5	0.59	2.14
	6	0.87	0
<b>Subtotal</b>	<b>1.46</b>	<b>2.14</b>	<b>0.00</b>
High	7	0	2.41
	8	3.75	0
<b>Subtotal</b>	<b>3.75</b>	<b>2.413</b>	<b>3.75</b>
<b>Total</b>	<b>125.585</b>	<b>125.585</b>	<b>125.585</b>

It is also worth noting that 'local' native remnant vegetation (within 15km of the Amendment Area) is comprised of thousands of small, fragmented remnants (to the north, south and west), and a handful of very large, connected remnants to the east (comprising National Park, Nature Reserve, Conservation Park and Conservation Covenanted land) that dramatically impact the summary statistics (Table 4-7), e.g. the mean size of remnants is 10.1 ha, but the median size is just 0.8 ha.

**Table 4-7** Summary statistics for remnant vegetation within 15 km of the study area

Statistic	Result
Count	2,543.0
Min.	0.0
Max.	4,689.5
Range	4,689.5
Sum	25,632.5
Mean	10.1
Median	0.8
Std.dev.	116.8
q1	0.3
q3	2.3



Hesperia Projects Pty Ltd  
 Wattle Grove Metropolitan Region Scheme

Project No 1633  
 Date 15/03/2024  
 Drawn by JL  
 Map author JC

0 250 500  
 Meters

1:12,200(at A4) GDA 1994 MGA Zone 50

- Study area
- 15 km buffer
- Remaining native vegetation

- Foraging habitat score**
- 2
  - 3
  - 5
  - 6
  - 8

**Figure 4-12**  
 Carnaby's Cockatoo foraging  
 habitat value per Bamford  
 (2021) scoring method



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Project No 1633  
 Date 15/03/2024  
 Drawn by JL  
 Map author JC

0 250 500  
 Meters

1:12,200(at A4) GDA 1994 MGA Zone 50

- Study area
  - 15 km buffer
  - Remaining native vegetation
- Foraging habitat score**
- 2
  - 3
  - 4
  - 5
  - 7

**Figure 4-13**  
 Baudin's Cockatoo foraging habitat value per Bamford (2021) scoring method



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 Map author JC

0 250 500  
 Meters

1:12,200 (at A4) GDA 1994 MGA Zone 50

- Study area
- 15 km buffer
- Remaining native vegetation

- Foraging habitat score**
- 2
  - 3
  - 7
  - 8

**Figure 4-14**  
 FRTBC foraging habitat value per Bamford (2021) scoring method



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## 5 DISCUSSION AND CONCLUSION

DAWE's (2022b) objective for black cockatoos is to promote avoidance and mitigation of impacts. Black cockatoos have been and may continue to be impacted through various mechanisms, of which are essentially related to the loss or degradation of breeding habitat (in the form of hollow-bearing trees), roosting habitat (suitable trees in proximity to water, breeding trees and foraging habitat) and foraging habitat (food resources).

In terms of breeding habitat, none of the PHTs in the study area are suitable for black cockatoo nesting. All hollows are either too degraded, too small or too young to contain suitable hollows at present, as per the inspection undertaken for this report which further ground-truthed using a pole camera, 7 hollow-containing trees identified previously (AECOM 2020; JBS&G 2023). Hollows can take hundreds of years to develop, therefore, a lack of suitable hollows today does not necessarily downgrade the value of breeding habitat. Trees with hollows today are the "foundation of life for future generations of black cockatoos" (DAWE 2022a). In this case the study area contains a small area of high-quality foraging habitat and extensive areas of high-quality foraging habitat is found nearby to the east, there are water sources and roosting sites in close proximity. Thus, the study area could be considered high-quality 'future breeding habitat'. However, the study area comprises semi-rural residential land that is heavily developed, and in only the last 3 years numerous PHTs have been lost due to age and condition. In the context of the current land use, it is considered highly unlikely that the current crop of trees will still be standing in 50-100 years, when they may begin to offer the larger hollows needed for breeding, regardless of the current proposed scheme amendment change.

Similarly for roosting habitat, the currently standing trees do present potential habitat in the form of planted trees, scattered native trees and remnant eucalypt woodland, but has been found to be of largely of low value. In the absence of the proposed scheme amendment roosting cannot be ruled out as there is one confirmed and one unconfirmed roosting location within 1km of the Project area, and foraging evidence over a number of years tells us that Carnaby's Cockatoo and FRTBC are using this area regularly. However, over the last decade local black cockatoo monitoring and the surveys completed for this Project (AECOM 2020; JBS&G 2023) have failed to identify any evidence of roosting in this Project area, and, the nearby roosting sites are in riparian vegetation which does not occur in the Project area.

The value of the Project area to black cockatoos is therefore primarily as foraging habitat. Evidence of Carnaby's Cockatoo and FRTBC foraging has been recorded on all 3 surveys (AECOM 2020; JBS&G 2023 and in this survey) in the form of clipped branches and chewed nuts, as well as by direct sighting. Baudin's Cockatoo however is considered far less likely to occur. It may occur on occasion as vagrants from the Perth foothills, and records further west onto the Swan Coastal Plain are known (Bamford 2019), however no sightings or evidence have been recorded during the surveys completed to date (AECOM 2020; JBS&G 2023) or by inspection of the most relevant databases (DBCA 2023).

According to the calculations per the Bamford (2021) methods 4% of the study area is considered medium-high quality foraging habitat, and 96% is low value habitat. Given all of the above, it is entirely appropriate that the approximately 3.75 ha (3%) of high-quality TEC remnant vegetation present be retained to support local breeding, roosting and foraging for Carnaby's Cockatoo and FRTBC. With the remainder offering little value to those species.

The foraging habitat scores obtained using BCE's black cockatoo foraging habitat scoring method were lower than those used by AECOM in 2020. The reasons for this pertain to a more accurate depiction of foraging value used in the current scoring system. The factors used in the DCCEEW scoring tool include foraging potential, connectivity, proximity to breeding, proximity to roosting and plant disease, and since all of these factors favour the site, a larger area was considered Very high and High value for all 3 species of black cockatoo, when in reality, the abundance of forage species is minimal for both high quality forage species such as Marri, *Banksia* and Pine (predominantly < 10 % foliage cover), and also for lower quality forage species such as small fruited eucalypts and introduced fruit

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trees. BCEs method also takes into account actual foraging observations, as well as predicted distribution.

There are no recent records of fire at the time of the vegetation survey so this is not likely to have impacted forage species coverage scores. The presence of weeds and introduced forage species does indicate low value forage habitat due to their sparse coverage and/or poor quality food source and poor accessibility, compared to native forage species which are generally higher quality and in higher abundance when in native remnant patches.

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**Appendix 1 Scoring system for the assessment of foraging value of vegetation for black cockatoos (Bamford 2021)**

Total score (out of 10) comprises:

- A score out of 6 for the vegetation composition, condition and structure, plus
- A score out of 3 for the context of the site, plus
- A score out of one for species density.

These are described in detail below.

A. Vegetation composition, condition and structure scoring

Site score	Description of vegetation values		
	Carnaby's Black-Cockatoo	Baudin's Black-Cockatoo	FRTBC
0	<p>No foraging value. No Proteaceae, eucalypts or other potential sources of food. Examples:</p> <ul style="list-style-type: none"> <li>• Water bodies (e.g. salt lakes, dams, rivers)</li> <li>• Bare ground</li> <li>• Developed sites devoid of vegetation (e.g. infrastructure, roads, gravel pits).</li> </ul>	<p>No foraging value. No eucalypts or other potential sources of food. Examples:</p> <ul style="list-style-type: none"> <li>• Water bodies (e.g. dams, rivers)</li> <li>• Bare ground</li> <li>• Developed sites devoid of vegetation (e.g. infrastructure, roads, gravel pits).</li> </ul>	<p>No foraging value. No eucalypts or other potential sources of food. Examples:</p> <ul style="list-style-type: none"> <li>• Water bodies (e.g. dams, rivers)</li> <li>• Bare ground</li> <li>• Developed sites devoid of vegetation (e.g. infrastructure, roads, gravel pits).</li> </ul>
1	<p>Negligible to low foraging value. Examples:</p> <ul style="list-style-type: none"> <li>• Scattered specimens of known food plants but projected foliage cover of these is &lt; 2%. This could include urban areas with scattered foraging trees</li> <li>• Paddocks that are partly vegetated with melons or other known food-source weeds (e.g. <i>Erodium</i> spp.) that represent a short-term and/or seasonal food-source</li> <li>• Blue Gum plantations (foraging by Carnaby's Cockatoos has been reported but appears to be unusual).</li> </ul>	<p>Negligible to low foraging value. Scattered specimens of known food plants but projected foliage cover of these &lt; 1%. This could include urban areas with scattered foraging trees.</p>	<p>Negligible to low foraging value. Scattered specimens of known food plants but projected foliage cover of these &lt; 1%. Could include urban areas with scattered foraging trees.</p>

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Site score	Description of vegetation values		
	Carnaby's Black-Cockatoo	Baudin's Black-Cockatoo	FRTBC
2	<p>Low foraging value. Examples:</p> <ul style="list-style-type: none"> <li>• Shrubland in which species of foraging value, such as shrubby banksias, have &lt; 10% projected foliage cover</li> <li>• Woodland with tree banksias 2-5% projected foliage cover</li> <li>• Woodland with tree banksias (of key species <i>B.attenuata</i> and <i>B. menziesii</i>) with &lt;10%projected foliage cover but vegetation condition reduced due to weed invasion and/or some tree deaths</li> <li>• Open eucalypt woodland/mallee of small-fruited species</li> <li>• Paddocks that are densely vegetated with melons or other known food-source weeds (e.g. <i>Erodium</i> spp.) that represent a short-term and/or seasonal food-source.</li> </ul>	<p>Low foraging value. Examples:</p> <ul style="list-style-type: none"> <li>• Woodland with scattered specimens of known food plants (e.g. Marri and Jarrah) 1-5% projected foliage cover</li> <li>• Marri-Jarrah Woodland with &lt;10% projected foliage cover but vegetation condition reduced due to weed invasion and/or some tree deaths</li> <li>• Parkland-cleared Eucalypt Woodland/Forest with known food plants &lt;10% projected foliage cover (poor long-term viability without management)</li> <li>• Younger areas of (managed) revegetation with known food plants &lt;10% projected foliage cover (establishing food sources with good long-term viability)</li> <li>• Urban areas with scattered foraging trees.</li> </ul>	<p>Low foraging value. Examples:</p> <ul style="list-style-type: none"> <li>• Woodland with scattered specimens of known food plants (e.g. Marri, Jarrah) 1-5%projected foliage cover</li> <li>• Marri-Jarrah Woodland with &lt;10% projected foliage cover but vegetation condition reduced due to weed invasion and/or some tree deaths</li> <li>• Sheoak Woodland with &lt;10% projected foliage cover</li> <li>• Parkland-cleared Eucalypt Woodland/Forest with known food plants &lt;10% projected foliage cover (poor long-term viability without management)</li> <li>• Younger areas of (managed) revegetation with known food plants &lt;10% projected foliage cover (establishing food sources with good long-term viability)</li> <li>• Urban areas with scattered food plants such as Cape Lilac, <i>Eucalyptus caesia</i> and <i>E. erythrocorys</i>.</li> </ul>

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Site score	Description of vegetation values		
	Carnaby's Black-Cockatoo	Baudin's Black-Cockatoo	FRTBC
3	<p>Low to Moderate foraging value. Examples:</p> <ul style="list-style-type: none"> <li>• Shrubland in which species of foraging value, such as shrubby banksias, have 10-20% projected foliage cover</li> <li>• Woodland with tree banksias 5-20% projected foliage cover</li> <li>• Woodland with tree Banksia (of key species <i>B. attenuata</i> and <i>B. menziesii</i>) with 10-40% projected foliage cover but vegetation condition reduced due to weed invasion and/or some tree deaths</li> <li>• Eucalypt Woodland/Mallee of small-fruited species</li> <li>• Eucalypt Woodland with Marri &lt; 10% projected foliage cover.</li> </ul>	<p>Low to Moderate foraging value. Examples:</p> <ul style="list-style-type: none"> <li>• Eucalypt Woodland with known food plants (especially Marri) 5-20% projected foliage cover</li> <li>• Marri-Jarrah Woodland with 10-40% projected foliage cover but vegetation condition reduced due to weed invasion and/or some tree deaths</li> <li>• Parkland-cleared Eucalypt Woodland/Forest with known food plants 10-40% projected foliage cover (poor long-term viability without management)</li> <li>• Younger areas of (managed) revegetation with known food plants 10-40% projected foliage cover (establishing food sources with good long-term viability).</li> </ul>	<p>Low to Moderate foraging value. Examples:</p> <ul style="list-style-type: none"> <li>• Eucalypt Woodland with known food plants (especially Marri and Jarrah) 5-20% projected foliage cover</li> <li>• Marri-Jarrah Woodland with 10-40% projected foliage cover but vegetation condition reduced due to weed invasion and/or some tree d</li> <li>• Sheoak Forest with 10-40% projected foliage cover</li> <li>• Parkland-cleared Eucalypt Woodland/Forest with known food plants 10-40% projected foliage cover (poor long-term viability without management)</li> <li>• Younger areas of (managed) revegetation with known food plants 10-40% projected foliage cover (establishing food sources with good long-term viability).</li> </ul>
4	<p>Moderate foraging value. Examples:</p> <ul style="list-style-type: none"> <li>• Woodland/low forest with tree banksias (of key species <i>B. attenuata</i> and <i>B. menziesii</i>) 20-40% projected foliage cover</li> <li>• Woodland/low forest with tree banksias (of key species <i>B. attenuata</i> and <i>B. menziesii</i>) with 40-60% projected foliage cover but vegetation condition reduced due to weed invasion and/or some tree deaths</li> <li>• Kwongan/ Shrubland in which species of foraging value, such as shrubby banksias, have 20-40% projected foliage cover</li> <li>• Eucalypt Woodland/Forest with Marri 20-40% projected foliage cover.</li> </ul>	<p>Moderate foraging value. Examples:</p> <ul style="list-style-type: none"> <li>• Marri-Jarrah Woodland/Forest with 20-40% projected foliage cover</li> <li>• Marri-Jarrah Forest with 40-60% projected foliage cover but vegetation condition reduced due to weed invasion and/or some tree deaths</li> <li>• Parkland-cleared Eucalypt Woodland/Forest with known food plants 40-60% projected foliage cover (poor long-term viability without management)</li> <li>• Younger areas of (managed) revegetation with known food plants 40-60% projected foliage cover (establishing food sources with good long-term viability)</li> <li>• Orchards with highly desirable food sources (e.g. apples, pears, some stone fruits).</li> </ul>	<p>Moderate foraging value. Examples:</p> <ul style="list-style-type: none"> <li>• Marri-Jarrah Woodland/Forest with 20-40% projected foliage cover</li> <li>• Marri-Jarrah Forest with 40-60% projected foliage cover but vegetation condition reduced due to weed invasion and/or some tree deaths</li> <li>• Sheoak Forest with 40-60% projected foliage cover</li> <li>• Parkland-cleared Eucalypt Woodland/Forest with known food plants 40-60% projected foliage cover (poor long-term viability without management)</li> <li>• Younger areas of (managed) revegetation with known food plants 40-60% projected foliage cover (establishing food sources with good long-term viability).</li> </ul>

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Site score	Description of vegetation values		
	Carnaby's Black-Cockatoo	Baudin's Black-Cockatoo	FRTBC
5	<p>Moderate to High foraging value. Examples:</p> <ul style="list-style-type: none"> <li>• Banksia Forest with 40-60% projected foliage cover</li> <li>• Banksia Forest with &gt; 60% projected foliage cover but vegetation condition reduced due to weed invasion and/or some tree deaths</li> <li>• Kwongan/ Shrubland in which species of foraging value, such as shrubby banksias, have 40-60% projected foliage cover</li> <li>• Marri-Jarrah Forest with 40-60% projected foliage cover and vegetation condition good with low weed invasion and/or low tree deaths (indicating it is robust and unlikely to decline in the medium-term)</li> <li>• Pine plantations with trees more than 10 years old.</li> </ul>	<p>Moderate to High foraging value. Examples:</p> <ul style="list-style-type: none"> <li>• Marri-Jarrah Forest with 40-60% projected foliage cover</li> <li>• Marri-Jarrah Forest with &gt; 60% projected foliage cover but vegetation condition reduced due to weed invasion and/or some tree deaths</li> <li>• Parkland-cleared Eucalypt Woodland/Forest with known food plants &gt;60% projected foliage cover (poor long-term viability without management)</li> <li>• Younger areas of (managed) revegetation with known food plants &gt;60% projected foliage cover (establishing food sources with good long-term viability).</li> </ul>	<p>Moderate to High foraging value. Examples:</p> <ul style="list-style-type: none"> <li>• Marri-Jarrah Forest with 40-60% projected foliage cover</li> <li>• Marri-Jarrah Forest with &gt; 60% projected foliage cover but vegetation condition reduced due to weed invasion and/or some tree deaths</li> <li>• Sheoak Forest with &gt; 60% projected foliage cover</li> <li>• Parkland-cleared Eucalypt Woodland/Forest with known food plants &gt;60% projected foliage cover (poor long-term viability without management)</li> <li>• Younger areas of (managed) revegetation with known food plants &gt;60% projected foliage cover (establishing food sources with good long-term viability).</li> </ul>
6	<p>High foraging value. Example:</p> <ul style="list-style-type: none"> <li>• Banksia Forest with &gt; 60% projected foliage cover and vegetation condition good with low weed invasion and/or low tree deaths (indicating it is robust and unlikely to decline in the medium-term)</li> <li>• Kwongan/ Shrubland in which species of foraging value, such as shrubby banksias, have &gt;60% projected foliage cover</li> <li>• Marri-Jarrah Forest with &gt; 60% projected foliage cover and vegetation condition good with low weed invasion and/or low tree deaths (indicating it is robust and unlikely to decline in the medium-term).</li> </ul>	<p>High foraging value. Example:</p> <ul style="list-style-type: none"> <li>• Marri-Jarrah Forest with &gt; 60% projected foliage cover and vegetation condition good with low weed invasion and/or low tree deaths (indicating it is robust and unlikely to decline in the medium-term).</li> </ul>	<p>High foraging value. Example:</p> <ul style="list-style-type: none"> <li>• Marri-Jarrah Forest with &gt; 60% projected foliage cover and vegetation condition good with low weed invasion and/or low tree deaths (indicating it is robust and unlikely to decline in the medium-term).</li> </ul>

Vegetation structural class terminology follows Keighery (1994).

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**B. Site context.**

The maximum score is given in situations where foraging habitat is supporting breeding birds. It can also be given in fragmented landscapes where there is little foraging habitat remaining and thus what is left has a high contextual value. The site context score is species specific as it depends upon factors such as the vegetation type and extent, and the presence of breeding birds, and the following table, developed by Bamford consulting in conjunction with DCCEEW, provides a *guide* to the assignment of site context scores (note that 'local area' is defined as within a 15 km radius of the centre point of the study site):

Site context score	Percentage of the existing native vegetation within the 'local' area that the study site represents	
	'Local' breeding known/likely	'Local' breeding unlikely
3	> 5%	> 10%
2	1– 5%	5–10%
1	0.1–1%	0.1–5%
0	< 0.1%	< 0.1%

**C. Species density.**

Assignment of the species density score (0 or 1) is based upon the black-cockatoo species being either abundant or not abundant, and is species specific. A score of 1 is used where the species is seen or reported regularly and/or there is abundant foraging evidence. Regularly is when the species is seen at intervals of every few days or weeks for at least several months of the year. A score of 0 is used when the species is recorded or reported very infrequently and there is little or no foraging evidence.

**D. Moderation of scores.**

The context and species density scores need to be moderated based on the vegetation condition score to prevent vegetation of little or no foraging value receiving an excessive score out of 10. For example, a habitat with no black cockatoo foraging value (such as a wetland) may receive a foraging score as high as 4 out of 10 if it occurs in an area where the species breed (context score of 3) and are abundant (context score of 1). Black cockatoos would only be present in habitat with foraging value, so applying the context and species scores to vegetation that received a low condition score would not give an accurate reflection of their foraging value.

The moderation approach is outlined below, where context and species density scores of zero are given to sites with a condition score of 3 or less.

Vegetation composition, condition and structure score	Context score	Species density score
3-6 (low/moderate to high value)	Assessed as per B above	Assessed as per C above
0-2 (no to low value)	0	0

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**Appendix 2 Potential habitat trees within the study area**

Tree code	Species	Tree height	DBH (cm)	# of possible hollows	suitable hollows	condition	Author	Latitude	Longitude	Comment
	<i>C. calophylla</i>	17	52	0	No		AECOM, 2020	-32.0106	116.0092	
	<i>C. calophylla</i>	25	53	0	No		AECOM, 2020	-32.00919	116.0021	
	<i>C. calophylla</i>	18	70	0	No		AECOM, 2020	-32.02267	116.0032	
	<i>C. calophylla</i>	17	70	0	No		AECOM, 2020	-32.012	115.9997	
358	<i>C. calophylla</i>	0	60	0	No	healthy	JBS&G, 2021	-32.02258	116.0031	
215	<i>C. calophylla</i>	0	55	0	No	stressed	JBS&G, 2021	-32.01929	116.0014	
359	<i>C. calophylla</i>	0	55	0	No	healthy	JBS&G, 2021	-32.02261	116.0034	
360	<i>C. calophylla</i>	0	65	0	No	healthy	JBS&G, 2021	-32.02259	116.0032	
372	<i>C. calophylla</i>	0	70	0	No	healthy	JBS&G, 2021	-32.02242	116.0034	
374	<i>C. calophylla</i>	0	60	0	No	healthy	JBS&G, 2021	-32.02237	116.0037	
1221	<i>C. calophylla</i>	0	0	0	No	slightly stressed	JBS&G, 2022	-32.0173	116.0011	
1222	<i>C. calophylla</i>	0	0	0	No	slightly stressed	JBS&G, 2022	-32.01732	116.0013	
1223	<i>C. calophylla</i>	0	0	0	No	healthy	JBS&G, 2022	-32.01727	116.0014	
1226	<i>C. calophylla</i>	0	0	0	No	stressed	JBS&G, 2022	-32.01672	116.0007	
1227	<i>C. calophylla</i>	0	0	0	No	healthy	JBS&G, 2022	-32.0166	116.0007	
1228	<i>C. calophylla</i>	0	0	0	No	healthy	JBS&G, 2022	-32.01665	116.0006	
1229	<i>C. calophylla</i>	0	0	0	No	slightly stressed	JBS&G, 2022	-32.01666	116.0005	
1230	<i>C. calophylla</i>	0	0	0	No	slightly stressed	JBS&G, 2022	-32.01668	116.0005	
1231	<i>C. calophylla</i>	0	0	0	No	healthy, slightly stressed	JBS&G, 2022	-32.0167	116.0005	
1232	<i>C. calophylla</i>	0	0	0	No	healthy	JBS&G, 2022	-32.0167	116.0004	
1233	<i>C. calophylla</i>	0	0	0	No	slightly stressed, healthy	JBS&G, 2022	-32.01673	116.0004	
1234	<i>C. calophylla</i>	0	0	0	No	stressed	JBS&G, 2022	-32.01675	116.0005	
1235	<i>C. calophylla</i>	0	0	0	No	stressed	JBS&G, 2022	-32.01678	116.0004	
1236	<i>C. calophylla</i>	0	0	0	No	slightly stressed	JBS&G, 2022	-32.01676	116.0004	
	<i>E. gomphocephala</i>	25	70	0	No		AECOM, 2020	-32.01911	116.0024	
	<i>E. gomphocephala</i>	25	100	0	No		AECOM, 2020	-32.0182	116.0041	
	<i>E. gomphocephala</i>	22	60	0	No		AECOM, 2020	-32.019	116.0025	
	<i>E. gomphocephala</i>	18	60	0	No		AECOM, 2020	-32.0186	116.0013	
	<i>E. gomphocephala</i>	20	65	0	No		AECOM, 2020	-32.0185	116.0012	DBH measured above fork
	<i>E. gomphocephala</i>	20	100	0	No		AECOM, 2020	-32.0185	116.0011	
	<i>E. gomphocephala</i>	22	130	0	No		AECOM, 2020	-32.0184	116.0011	
	<i>E. gomphocephala</i>	22	65	0	No		AECOM, 2020	-32.0183	116.001	
	<i>E. gomphocephala</i>	25	120	0	No		AECOM, 2020	-32.0127	115.9987	
	<i>E. gomphocephala</i>	20	100	0	No		AECOM, 2020	-32.0126	115.9986	
	<i>E. gomphocephala</i>	25	75	0	No		AECOM, 2020	-32.0125	115.9985	
151	<i>E. gomphocephala</i>	0	60	0	No	healthy	JBS&G, 2021	-32.01867	116.0015	
153	<i>E. gomphocephala</i>	0	60	0	No	healthy	JBS&G, 2021	-32.01871	116.0016	

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Tree code	Species	Tree height	DBH (cm)	# of possible hollows	suitable hollows	condition	Author	Latitude	Longitude	Comment
179	<i>E. gomphocephala</i>	0	50	0	No	slightly stressed	JBS&G, 2021	-32.01897	116.002	
1	<i>E. gomphocephala</i>	0	50	0	No	healthy	JBS&G, 2021	-32.01851	116.003	
2	<i>E. gomphocephala</i>	0	100	0	No	healthy	JBS&G, 2021	-32.01854	116.0029	
21	<i>E. gomphocephala</i>	0	60	0	No	healthy	JBS&G, 2021	-32.0184	116.0024	
25	<i>E. gomphocephala</i>	0	65	0	No	slightly stressed	JBS&G, 2021	-32.01873	116.0024	
1143	<i>E. gomphocephala</i>	0	70	0	No		JBS&G, 2021	-32.01871	116.005	
1158	<i>E. gomphocephala</i>	0	100	0	No		JBS&G, 2021	-32.01834	116.0044	
230	<i>E. gomphocephala</i>	0	50	0	No	slightly stressed	JBS&G, 2021	-32.0189	116.001	
404	<i>E. gomphocephala</i>	0	55	0	No	very stressed	JBS&G, 2021	-32.02096	116.0039	
1060	<i>E. gomphocephala</i>	0	100	0	No		JBS&G, 2021	-32.01878	116.0044	
Road Reserve	<i>E. gomphocephala</i>	0	70	0	No		JBS&G, 2021	-32.02	116.0017	
	<i>E. marginata</i>	15	100	0	No		AECOM, 2020	-32.0142	116.0085	
	<i>E. marginata</i>	17	60	0	No		AECOM, 2020	-32.0144	116.0083	
	<i>E. marginata</i>	12	51	0	No		AECOM, 2020	-32.01447	116.007	
	<i>E. marginata</i>	16	52	0	No		AECOM, 2020	-32.01447	116.0069	
	<i>E. marginata</i>	15	55	0	No		AECOM, 2020	-32.01404	116.0059	
	<i>E. marginata</i>	15	55	0	No		AECOM, 2020	-32.02073	116.0024	
	<i>E. marginata</i>	18	80	0	No		AECOM, 2020	-32.02217	116.0038	
	<i>E. marginata</i>	18	60	0	No		AECOM, 2020	-32.02201	116.0034	
	<i>E. marginata</i>	14	90	0	No		AECOM, 2020	-32.02186	116.004	
	<i>E. marginata</i>	14	55	0	No		AECOM, 2020	-32.02135	116.0036	Hollow checked by Phoenix Jan 2024, not suitable
	<i>E. marginata</i>	16	65	0	No		AECOM, 2020	-32.02099	116.0034	
	<i>E. marginata</i>	15	60	0	No		AECOM, 2020	-32.0144	116.0068	
	<i>E. marginata</i>	18	110	0	No		AECOM, 2020	-32.01447	116.0071	
	<i>E. marginata</i>	10	70	0	No		AECOM, 2020	-32.01799	116.0091	
	<i>E. marginata</i>	10	80	0	No		AECOM, 2020	-32.01786	116.0092	
	<i>E. marginata</i>	13	60	0	No		AECOM, 2020	-32.01846	116.0085	
	<i>E. marginata</i>	13	60	0	No		AECOM, 2020	-32.0184	116.0085	
	<i>E. marginata</i>	12	55	0	No		AECOM, 2020	-32.01846	116.0085	
	<i>E. marginata</i>	14	65	0	No		AECOM, 2020	-32.0184	116.0084	
	<i>E. marginata</i>	12	55	0	No		AECOM, 2020	-32.0184	116.0083	Two trunks on tree
	<i>E. marginata</i>	17	80	0	No		AECOM, 2020	-32.0124	116.008	
	<i>E. marginata</i>	15	65	0	No		AECOM, 2020	-32.01258	116.0077	Tree has multiple large trunks
	<i>E. marginata</i>	18	80	0	No		AECOM, 2020	-32.01301	116.0073	
	<i>E. marginata</i>	15	75	0	No		AECOM, 2020	-32.01291	116.0072	
	<i>E. marginata</i>	17	62	0	No		AECOM, 2020	-32.0126	116.0074	
	<i>E. marginata</i>	10	52	0	No		AECOM, 2020	-32.01115	116.0082	
	<i>E. marginata</i>	15	75	0	No		AECOM, 2020	-32.0117	116.0074	
	<i>E. marginata</i>	18	85	0	No		AECOM, 2020	-32.01177	116.0076	
	<i>E. marginata</i>	15	60	0	No		AECOM, 2020	-32.01195	116.0072	Multiple trunks on tree

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Tree code	Species	Tree height	DBH (cm)	# of possible hollows	suitable hollows	condition	Author	Latitude	Longitude	Comment
	<i>E. marginata</i>	16	75	0	No		AECOM, 2020	-32.01222	116.0069	
	<i>E. marginata</i>	12	51	0	No		AECOM, 2020	-32.01232	116.007	
	<i>E. marginata</i>	18	70	0	No		AECOM, 2020	-32.0122	116.0065	
	<i>E. marginata</i>	16	60	0	No		AECOM, 2020	-32.01215	116.0063	
	<i>E. marginata</i>	16	90	0	No		AECOM, 2020	-32.01145	116.0073	
	<i>E. marginata</i>	16	65	0	No		AECOM, 2020	-32.01145	116.0074	
	<i>E. marginata</i>	18	70	0	No		AECOM, 2020	-32.01084	116.0085	
	<i>E. marginata</i>	10	56	0	No		AECOM, 2020	-32.01102	116.0087	
	<i>E. marginata</i>	14	53	0	No		AECOM, 2020	-32.01178	116.0084	
	<i>E. marginata</i>	15	60	0	No		AECOM, 2020	-32.0127	116.0079	
	<i>E. marginata</i>	18	70	0	No		AECOM, 2020	-32.01151	116.0008	
	<i>E. marginata</i>	14	52	0	No		AECOM, 2020	-32.0143	116.0085	
	<i>E. marginata</i>	10	55	0	No		AECOM, 2020	-32.0142	116.0087	
	<i>E. marginata</i>	20	70	0	No		AECOM, 2020	-32.01452	116.0089	Two trunks
	<i>E. marginata</i>	16	60	0	No		AECOM, 2020	-32.01406	116.0079	
	<i>E. marginata</i>	8	55	0	No		AECOM, 2020	-32.0132	116.0054	
	<i>E. marginata</i>	12	55	0	No		AECOM, 2020	-32.0117	116.0085	Multiple trunks
	<i>E. marginata</i>	22	110	0	No		AECOM, 2020	-32.01074	116.0086	
	<i>E. marginata</i>	20	90	2	No		AECOM, 2020	-32.01082	116.0088	Hollow 1: West facing branch hollow, 11 m above ground, 50x10 cm entrance at 45 degrees, unable to assess chamber size, hollow occupied by pink and grey galahs Hollow 2: North-west facing branch hollow 10 m above ground, 10x100 cm entrance at 45 degrees, Hollow checked by Phoenix Jan 2024, not suitable
	<i>E. marginata</i>	14	60	0	No		AECOM, 2020	-32.01082	116.0089	
	<i>E. marginata</i>	15	55	0	No		AECOM, 2020	-32.01062	116.009	
	<i>E. marginata</i>	14	90	0	No		AECOM, 2020	-32.0107	116.0089	
	<i>E. marginata</i>	16	110	0	No		AECOM, 2020	-32.01069	116.0087	
	<i>E. marginata</i>	14	65	0	No		AECOM, 2020	-32.01067	116.0082	
	<i>E. marginata</i>	18	110	0	No		AECOM, 2020	-32.01077	116.0081	
	<i>E. marginata</i>	14	50	0	No		AECOM, 2020	-32.0125	116.0073	
	<i>E. marginata</i>	18	50	0	No		AECOM, 2020	-32.0124	116.0073	
	<i>E. marginata</i>	14	80	0	No		AECOM, 2020	-32.01174	116.0078	
	<i>E. marginata</i>	17	52	0	No		AECOM, 2020	-32.0119	116.0078	
	<i>E. marginata</i>	16	52	0	No		AECOM, 2020	-32.01223	116.0075	
	<i>E. marginata</i>	18	60	0	No		AECOM, 2020	-32.01244	116.0072	
1113	<i>E. marginata</i>	0	60	0	No		JBS&G, 2021	-32.0198	116.0062	
1033	<i>E. marginata</i>	0	60	0	No		JBS&G, 2021	-32.01871	116.008	

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Tree code	Species	Tree height	DBH (cm)	# of possible hollows	suitable hollows	condition	Author	Latitude	Longitude	Comment
1038	<i>E. marginata</i>	0	60	0	No		JBS&G, 2021	-32.01664	116.006	
1039	<i>E. marginata</i>	0	70	0	No		JBS&G, 2021	-32.01677	116.0059	
1187	<i>E. marginata</i>	0	90	0	No	very stressed	JBS&G, 2021	-32.02094	116.0051	
1180	<i>E. marginata</i>	0	50	0	No		JBS&G, 2021	-32.02029	116.0043	
1181	<i>E. marginata</i>	0	50	0	No		JBS&G, 2021	-32.02051	116.0046	
1197	<i>E. marginata</i>	0	60	0	No		JBS&G, 2021	-32.02088	116.0056	
1198	<i>E. marginata</i>	0	70	0	No		JBS&G, 2021	-32.02085	116.0056	
1199	<i>E. marginata</i>	0	50	0	No		JBS&G, 2021	-32.02081	116.0055	
1202	<i>E. marginata</i>	0	60	0	No		JBS&G, 2021	-32.02065	116.0052	
1210	<i>E. marginata</i>	0	50	0	No		JBS&G, 2021	-32.0204	116.0049	
1211	<i>E. marginata</i>	0	50	0	No		JBS&G, 2021	-32.02022	116.0048	
378	<i>E. marginata</i>	0	50	0	No	healthy	JBS&G, 2021	-32.02208	116.004	
385	<i>E. marginata</i>	0	80	0	No	healthy	JBS&G, 2021	-32.02214	116.0037	
393	<i>E. marginata</i>	0	60	0	No	very stressed	JBS&G, 2021	-32.02203	116.0035	
361	<i>E. marginata</i>	0	60	0	No	healthy	JBS&G, 2021	-32.02242	116.0033	
414	<i>E. marginata</i>	0	50	0	No	healthy	JBS&G, 2021	-32.02114	116.0031	
418	<i>E. marginata</i>	0	60	0	No	slightly stressed	JBS&G, 2021	-32.02141	116.0038	
399	<i>E. marginata</i>	0	50	0	No	healthy	JBS&G, 2021	-32.02225	116.0032	
403	<i>E. marginata</i>	0	50	0	No	slightly stressed	JBS&G, 2021	-32.02204	116.0042	
435	<i>E. marginata</i>	0	50	0	No	healthy	JBS&G, 2021	-32.02133	116.004	
525	<i>E. marginata</i>	0	80	0	No		JBS&G, 2021	-32.01436	116.0041	
421	<i>E. marginata</i>	0	55	0	No	slightly stressed	JBS&G, 2021	-32.02165	116.0038	
438	<i>E. marginata</i>	0	130	0	No	healthy	JBS&G, 2021	-32.02114	116.0037	checked by Phoenix 2024, not suitable
829	<i>E. marginata</i>	0	60	0	No	healthy	JBS&G, 2021	-32.01556	116.0082	
988	<i>E. marginata</i>	0	60	0	No		JBS&G, 2021	-32.01667	116.0058	
797	<i>E. marginata</i>	0	90	0	No	healthy	JBS&G, 2021	-32.01746	116.0093	
798	<i>E. marginata</i>	0	55	0	No	healthy	JBS&G, 2021	-32.01762	116.0095	
799	<i>E. marginata</i>	0	60	0	No	healthy	JBS&G, 2021	-32.0166	116.0086	
1013	<i>E. marginata</i>	0	50	0	No		JBS&G, 2021	-32.01801	116.0071	
1028	<i>E. marginata</i>	0	70	0	No		JBS&G, 2021	-32.01874	116.0078	
1021	<i>E. marginata</i>	0	60	0	No		JBS&G, 2021	-32.01817	116.0074	
989	<i>E. patens</i>	0	60	0	No		JBS&G, 2021	-32.01683	116.0056	
1057	<i>E. patens</i>	0	60	0	No		JBS&G, 2021	-32.01891	116.004	
1171	<i>E. patens</i>	0	50	0	No		JBS&G, 2021	-32.01909	116.0036	
	<i>E. rudis</i>	8	0	0	No		AECOM, 2020	-32.01965	116.0018	Hollow 2: 30x30 cm entrance, facing upward/vertical on spout, 7 m above ground
846	<i>E. rudis</i>	0	50	0	No		JBS&G, 2021	-32.01498	116.0051	
46	<i>E. rudis</i>	0	60	0	No	healthy, slightly stressed	JBS&G, 2021	-32.01748	116.0007	
110	<i>E. rudis</i>	0	50	0	No	slightly stressed	JBS&G, 2021	-32.01837	116.001	
306	<i>E. rudis</i>	0	50	0	No	stressed	JBS&G, 2021	-32.0166	116.0052	

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	<i>E. rudis</i>	0	60	0	No	healthy	JBS&G, 2021	-32.01911	116.0017	
	Introduced sp.	12	52	0	No		AECOM, 2020	-32.02008	116.0015	
1225	Introduced sp.	0	0	0	No		JBS&G, 2022	-32.01709	116.0012	
	Stag	12	60	2	No		JBS&G, 2022	-32.0212	116.0023	Hollow 1: 15x20 cm entrance, west facing hollow, vertical on trunk, 6 m above ground, unable to assess depth, no evidence of use Hollow checked by Phoenix Jan 2024, not suitable

