Detailed Flora and Vegetation Assessment

28 Placid Waters Parade Coodanup

Project No: EP23-081(02)

Prepared for Peel Rise Pty Ltd
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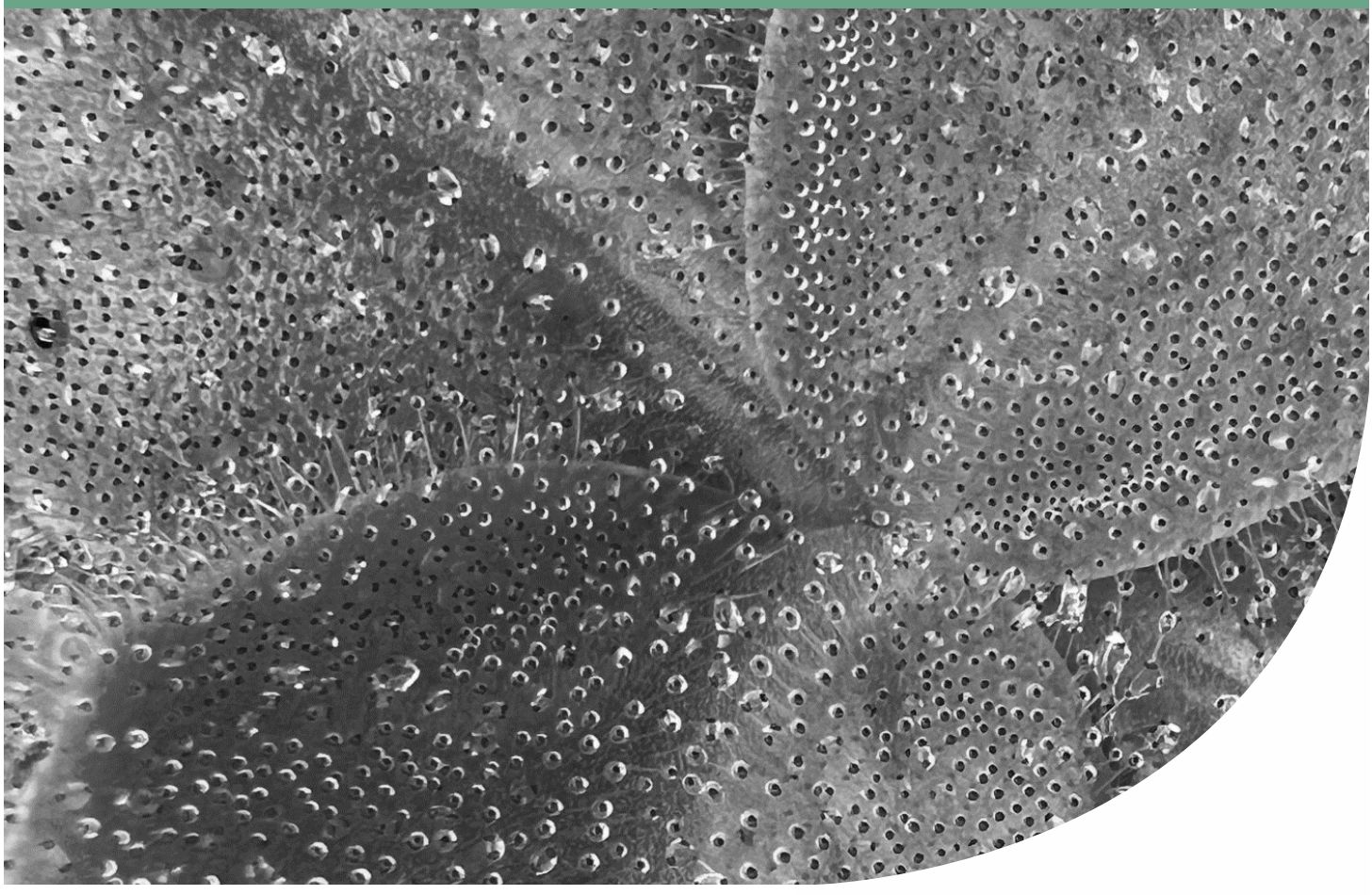

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Executive Summary

Peel Rise Pty Ltd engaged Emerge Associates to conduct a detailed flora and vegetation assessment within 28 Placid Waters Parade in Coodanup (the 'site').

The assessment included a desktop study of the environmental context of the site and the likelihood of occurrence of threatened and priority flora and ecological communities. Field surveys were conducted on 12th October and 16th November 2023, during which the composition and condition of vegetation was recorded. Flora and vegetation values were characterised to the standard required of a detailed survey with reference to EPA (2016b).

Outcomes of the assessment include the following:

- A total of 59 native and 48 non-native (weed) species were recorded within the site.
- No threatened or priority flora species were recorded or are considered likely to occur within the site.
- The vegetation within the site was classified into eight vegetation units: **CoErM**, **E**, **Er**, **ErCoTS**, **ErMr**, **Kg**, **TS** and **cleared**.
- The vegetation in the site is present in 'very good' to 'completely degraded' condition. The majority of the vegetation is in 'degraded' and 'completely degraded' condition (75.5% of the site).
- The site contains a 1.87 ha patch of the 'threatened ecological community' (TEC)/'priority ecological condition' (PEC) 'subtropical and temperate saltmarsh'. This community is listed as a 'vulnerable' TEC under the *Environmental Protection and Biodiversity Conservation Act 1999* and a 'priority 3' PEC in Western Australia. All occurrences of vegetation unit **TS** represent this TEC as well as a small portion of the **ErCoTS** vegetation unit.

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Abbreviation Tables

Table A1: Abbreviations – Organisations

Organisations	
EPA	Environmental Protection Authority
DBCA	Department of Biodiversity, Conservation and Attractions
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DoW	Department of Water (now DWER)
DWER	Department of Water and Environmental Regulation
DPaW	Department of Parks and Wildlife (now DBCA)
DSEWPaC	Department of Sustainability, the Environment, Water, Population and Communities (Now DCCEEW)
WALGA	Western Australia Local Government Association

Table A2: Abbreviations – General terms

General terms	
A	Annual
CCW	Conservation category wetland
CR	Critically endangered
EN	Endangered
ESA	Environmentally sensitive area
FCT	Floristic community type
IBRA	Interim Biogeographic Regionalisation for Australia
MNES	Matters of Ecological Significance
MUW	Multiple use wetland
NVIS	National Vegetation Information System (ESCAVI 2003)
P1	Priority 1
P2	Priority 2
P3	Priority 3
P4	Priority 4
P5	Priority 5
PEC	Priority ecological community
P	Perennial
PG	Perennial geophyte

General terms	
REW	Resource enhancement wetland
T	Threatened
TEC	Threatened ecological communities
UFI	Unique feature identifier
VU	Vulnerable

Table A3: Abbreviations – Legislation

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

Table A4: Abbreviations – Units of measurement

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

1 Introduction

1.1 Purpose

Emerge Associates (Emerge) were engaged by Peel Rise Pty Ltd to conduct a flora and vegetation assessment within 28 Placid Waters Parade in Coodanup, as shown in **Figure 1** (referred to herein as the 'site').

Flora and vegetation assessments are required to characterise vegetation values and, in particular, confirm the presence or absence of values relevant to environmental approvals process, such as, 'native vegetation', 'threatened' flora, 'priority' flora, 'threatened ecological communities' (TECs), 'priority ecological communities' (PECs) and weeds.

1.2 Legislation and policy

'Native vegetation' is defined by the *Environmental Protection Act 1986* (EP Act) as indigenous aquatic or terrestrial flora. In the *Environmental Factor Guideline – Flora and Vegetation* the EPA further defines it as native vascular flora and defines vegetation as groupings of flora (EPA 2016a). Native vegetation is protected in Western Australia and can't be cleared without a permit or valid exemption. Biological diversity, habitat function, scarcity, association with wetlands and other ecosystem services influence the value placed on native vegetation (DWER 2018a). Planted flora and vegetation are generally not regarded as native vegetation unless required to be established under the EP Act or other written law or regulation.

Flora and ecological communities may be listed as threatened under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) (DCCEEW 2021) and the State *Biodiversity Conservation Act 2016* (BC Act) (DBCA 2022b, 2023e). Threatened flora and TECs are classified as either 'critically endangered'(CR), 'endangered' (EN) and 'vulnerable' (VU) (DCCEEW 2021). Commonwealth and/or State ministerial approval is required to impact threatened flora or TECs.

Native flora and ecological communities that are not listed as threatened, but are otherwise considered rare or under threat, may be added to a Department of Biodiversity, Conservation and Attractions (DBCA) priority list (DBCA 2022a, b). 'Priority flora' and PECs are classified as either 'priority 1' (P1), 'priority 2' (P2), 'priority 3' (P3) or 'priority 4' (P4). They do not have direct statutory protection. However, their priority classification is taken into account during State and Local government approval processes.

Flora that are regarded as having negative environmental or economic impacts are often referred to as weeds (DBCA 2023g). Particularly detrimental weed species may be listed as a 'declared pest' pursuant to the State *Biosecurity and Agriculture Management Act 2007* (BAM Act) or as a 'weed of national significance' (WoNS) (DAWE 2021). Management of weeds, declared pests and WoNS may be required during government approval processes.

Further information on legislation and policy relevant to flora and vegetation assessments is provided in **Appendix A**.

1.3 Scope of work

The Environmental Protection Authority (EPA) *Technical Guidance - Flora and Vegetation Surveys for Environmental Impact Assessment* establishes standards for the assessment of flora and vegetation in Western Australia (EPA 2016b).

The scope of work was to undertake a detailed survey with reference to EPA (2016b). As part of this scope of work, the following tasks were undertaken:

- Desktop study to provide contextual information and determine the likelihood of occurrence of threatened and priority flora or ecological communities.
- Field surveys to record flora, vegetation units and vegetation condition.
- Analysis and mapping of contextual information, vegetation units, vegetation condition and threatened and priority flora or ecological communities (if present).
- Documentation of the desktop study, methods, results, discussion and conclusions.

2 Desktop Study

2.1 Site context

2.1.1 Location and extent

The site is located in the City of Mandurah in the Peel Region of Western Australia and extends over 21.2 hectares (ha) as shown in **Figure 1**. The site is bounded by William Rd to the east, Serpentine River to the north, residential development and a wetland to the west and Peel Parade along the Peel Inlet to the south.

2.1.2 Climate

The Peel region of Western Australia experiences a Mediterranean climate of hot dry summers and cool wet winters (BoM 2024). Recent rainfall at the closest weather station to the site has been generally consistent with long term averages, as shown in **Plate 1** (BoM 2024). Flora and vegetation surveys should be undertaken during the season that is most suitable for detection and identification of the range of flora likely to occur in the area (EPA 2016b). For the south-west botanical province in which the site lies, the primary survey time is spring (September to November) (EPA 2016b).

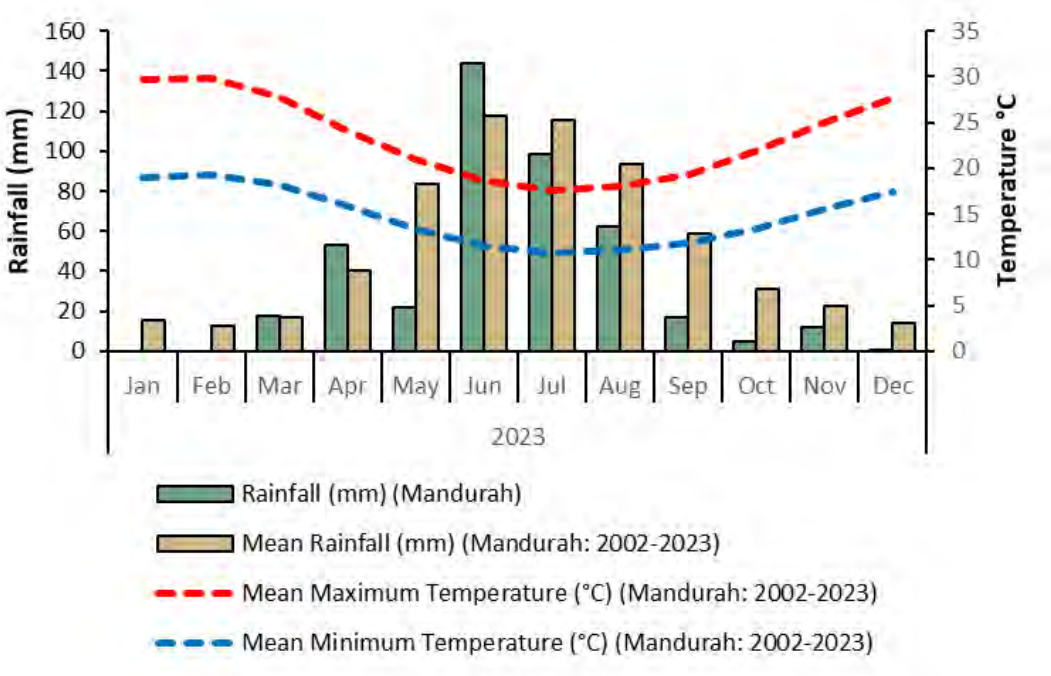

Plate 1: Recent rainfall and long-term mean temperature and rainfall

2.1.3 Geomorphology and soils

The site occurs on the Swan Coastal Plain, which is the geomorphic unit that characterises much of the Perth and Peel metropolitan area. The Swan Coastal Plain is approximately 500 km long and 20 to 30 km wide and is roughly bounded by the Indian Ocean to the west and the Darling Scarp to the east. Broadly, the Swan Coastal Plain consists of two sedimentary belts of different origin: its eastern side comprises the Pinjarra Plain which formed from the deposition of alluvial material washed down from the Darling Scarp and its western side comprises three dune systems that run roughly parallel to the Indian Ocean coastline. These dune systems, referred to as Quindalup, Spearwood and Bassendean associations, represent a succession of coastal deposition and, as a result, they contain soils at different stages of leaching and formation (Kendrick *et al.* 1991). The site is located between the Quindalup and Spearwood dune systems.

Examination of broad scale soil mapping places the site on the interface of the Vasse and Yoongarillup associations (Churchward and McArthur 1980). The Vasse association comprises poorly drained plains with variable undifferentiated estuarine and marine deposits, while the Yoongarillup association comprises plains with low ridges and swales, as well as shallow and brown sands over marine limestone. The soil types mapped within the site are shown in **Figure 2**.

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

2.1.4 Topography

The elevation of the site ranges from approximately 0 metres in relation to the Australian height datum (mAHD) on the northern and southern sides to 3 mAHD throughout the centre of the site. The rest of the site is between 1 and 2 mAHD (DoW 2008) (**Figure 2**).

2.1.5 Hydrology and wetlands

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

Wetlands of national or international significance may be afforded special protection under Commonwealth or international agreements. Review of the *Ramsar List of Wetlands of International Importance* (DBCA 2017) and *A Directory of Important Wetlands in Australia – Western Australia* (DBCA 2018) indicates that the site borders a Ramsar listed wetland, the Peel-Yalgorup System, located just south of the site.

The Department of Water and Environmental Regulation (DWER) hydrography linear dataset (DWER 2018b) records no wetland or water related features within the site. However, bordering the site's north and south are the following features:

- ID 404532 – Watercourse - major, perennial (north)
- ID 404362 – Lake, perennial (south)
- ID 404363 – Lake, perennial (south)

The *Geomorphic Wetlands of the Swan Coastal Plain* dataset maps geomorphic wetland features and classifies them based on their landform shape and water permanence (DBCA 2023a). Each wetland feature is assigned to one of three management categories: 'conservation', 'resource enhancement' and 'multiple use'.

The *Geomorphic Wetlands, Swan Coastal Plain* dataset records three 'multiple use' category wetland features (UFIs 3257, 14572 and 14576) within the site (DBCA 2023a). They are classified as flat and basin type wetlands. Five 'conservation' category wetland features (UFs 3255, 3408, 14573, 15229 and 15232) occur the north and south of the site, comprising the Serpentine River and the Peel Inlet respectively. The location of the geomorphic wetlands in the site is shown in **Figure 2**.

2.1.6 Regional vegetation

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

The site is contained within the Swan Coastal Plain IBRA region and within the 'SWA02' or Perth subregion. The Perth subregion is characterised by mainly banksia low woodland on leached sands with melaleuca swamps where ill-drained; and woodland of *Eucalyptus gomphocephala* (tuart), *E. marginata* (jarrah) and *Corymbia calophylla* (marri) on less leached soils (Beard 1990). This subregion is recognised as a biodiversity hotspot and contains a wide variety of endemic flora and vegetation types.

Variations in native vegetation can be further classified based on regional vegetation mapping. Heddle *et al.* (1980) mapping shows the site as comprising the Vasse and Yoongarillup complexes. The Vasse complex is described as a mixture of closed *Melaleuca* scrub fringing *Eucalyptus rudis* – *Melaleuca* woodland and open forest of *E. gomphocephala* – *E. marginata*. The Yoongarillup complex is described as open forest of *E. gomphocephala* – *E. marginata* – *Corymbia calophylla*.

The Vasse complex was determined to have 31.4% of its pre-European extent remaining on the Swan Coastal Plain in 2018, with 13.45% protected for conservation purposes[1].The Yoongarillup complex had 35.81% of its pre-European extent remaining on the Swan Coastal Plain in 2018, with 14.14% protected for conservation purposes (Government of Western Australia 2019).

2.1.7 Threatened and priority flora

The Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW) has compiled various datasets relating to 'matters of national environmental significance' (MNES) (DCCEEW 2023). The *Protected Matters Search Tool* provides general guidance on threatened flora listed under the EPBC Act that may occur within a location based on validated records and less reliable unvalidated habitat distribution modelling (DCCEEW 2023).

DBCA's *Threatened and Priority Flora Database* and *WA Herbarium Database* contain records of threatened and priority flora in Western Australia (DBCA 2023f). Searches of these databases provide

[1]Defined as being listed in the DBCA-legislated lands and waters dataset as either Crown reserves or lands managed under Section 8A of the CALM Act that have an IUCN category of I – IV (Government of Western Australia 2019).

point data for threatened and priority flora within a location, comprising validated and historical unvalidated records.

The *Protected Matters Search Tool* (DCCEEW 2023) and DBCA's threatened and priority flora databases (reference no. 49-0923FL) identified 12 threatened and 27 priority flora occurring or potentially occurring within a 10 km radius of the site (refer **Appendix B**).

2.1.8 TECs and PECs

The *Protected Matters Search Tool* provides general guidance on TECs listed as CR and EN under the EPBC Act that may occur within a location based on reliable records and less reliable habitat distribution modelling (DCCEEW 2023).

DBCA's *Threatened and Priority Ecological Community buffers and boundaries in WA* dataset contains validated records of TECs and PECs. Searches of this dataset provides buffered polygons of TEC and PEC records.

The *Protected Matters Search Tool* and DBCA's TEC and PEC database (reference no. 36-0923EC) identified 7 TECs, 5 of which are also PECs, occurring or potentially occurring within a 10 km radius of the site (refer **Appendix C**).

2.1.9 Historical land use

Review of historical images available from 1960 onwards shows that approximately half of the site was cleared of native vegetation prior to the beginning of the aerial imagery, with the second half being cleared prior to 1974, likely for grazing (WALIA 2023).

The vegetation has been largely left to regenerate after 1974. Roads bordered the site before 1960, with development bordering the east of site starting prior to 1979. Development encroached the western site boundary in the early 2000's.

2.1.10 Bush Forever

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

No *Bush Forever* sites occur within or near the site.

2.1.11 Regional natural areas

Environmental Protection Bulletin no. 12 Swan *Bioplan – Peel Regionally Significant Natural Areas* (EPB 12) (EPA 2013) is used to inform strategic land use planning in the Peel Region by identifying 'Peel regionally significant natural areas' (Peel RSNAs). Peel RSNAs are natural areas which have significant flora, vegetation and landform values that represent the original landscape of the Peel Region. Development proposals which may potentially impact upon a Peel RSNA require detailed

flora, vegetation and fauna investigations to be undertaken. Based on the outcomes of these investigations, development proposals should firstly aim to avoid, and then minimise, potential impacts on identified natural areas.

The 'Serpentine River Bushland' Peel RSNA intersects the northern portion of the site. This Peel RSNA extends over a large area, the majority of which occurs outside of the site but two small patches extend into the north-western and north-eastern portions of the site. The site is also intercepted by the 'Coodanup Foreshore Bushland' Peel RSNA, which extends as a strip along the length of the southern portion of the site. The Peel RSNAs mapped within the site are shown on **Figure 2**.

2.1.12 Ecological linkages

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

The South West Biodiversity Project identified and mapped ecological linkages within the South West region of Western Australia (Molloy *et al.* 2009). Two ecological linkages pass through or in close proximity to the site. These linkages represent the Serpentine River (linkage no. 13) and associated vegetation passing parallel to the north of the site, and the fringing vegetation of the Peel Inlet passing through the southern portion of the site (no. 12).

Review of aerial imagery indicates that the vegetation on the north and south edges of the site is connected to and forms part of extensive areas of native fringing and wetland vegetation within the local area, including that of the Peel-Yalgorup System Ramsar Wetland.

2.1.13 Previous surveys

No previous surveys are known to have been undertaken within this site.

2.2 Likelihood of occurrence

The distribution and habitat preferences of the threatened and priority flora species and ecological communities listed in **Appendix B** and **Appendix C** was reviewed against site context information described in **Section 2.1**. Likelihood of occurrence of threatened and priority flora species and ecological communities within the site was classified as 'high', 'moderate', 'low' or 'negligible' as outlined in **Table 1**.

Table 1: Decision matrix for likelihood of occurrence of threatened and priority flora and ecological communities

		Distribution[1]	
		Reliable record within search area	No reliable record within search area
Habitat	Suitable	High	Negligible
	Potentially suitable	Moderate	
	Unsuitable	Low	

[1] Reliable record defined as validated, recent (within the last ~40 years) and spatially accurate (refer DBCA search meta data) in order to exclude unverified range or habitat projections.

2.2.1 Threatened and priority flora

3 threatened and 20 priority flora were classified as having a 'high' or 'moderate' likelihood of occurrence within the site, as outlined in **Table 2**. The complete likelihood of occurrence assessment is provided as **Appendix B**.

Table 2: Threatened or priority flora species with a high or moderate likelihood occurrence in the site

Species	Status		Life strategy	Flowering period	Likelihood of occurrence
	WA	EPBC Act			
Drakaea elastica	CR	EN	PG	late Sep-Oct/Nov, survey Jul-Aug	Moderate
Synaphea stenoloba	CR	EN	P	Aug-Oct	High
Diuris micrantha	VU	VU	PG	Aug/Sep- early Oct	Moderate
Acacia benthamii	P2	-	P	Aug-Sept	Moderate
Grevillea ornithopoda	P2	-	P	Sep-Nov	High
Phyllangium palustre	P2	-	A	Oct-Nov	High
Pterostylis frenchii	P2	-	PG	Nov	Moderate
Chamaescilla gibsonii	P3	-	PG	Sep	Moderate
Cyathochaeta teretifolia	P3	-	P	Oct-Jan	Moderate
Dillwynia dillwynioides	P3	-	P	Aug - Dec	High
Eryngium sp. Ferox (G.J. Keighery 16034)	P3	-	P	Oct-Mar	High
Hemigenia microphylla	P3	-	P	Sep-Dec	Moderate
Myriophyllum echinatum	P3	-	A	Nov	High
Schoenus sp. Waroona (G.J. Keighery 12235)	P3	-	A	Oct-Nov	High
Drosera occidentalis	P4	-	P	Oct-Dec/Jan	Moderate
Jacksonia sericea	P4	-	P	Dec-Feb	Moderate

Table 2: Threatened or priority flora species with a high or moderate likelihood occurrence in the site (continued)

Species	Status		Life strategy	Flowering period	Likelihood of occurrence
	WA	EPBC Act			
Ornduffia submersa	P4	-	A	Aug-Nov	Moderate
Parsonsia diaphanophleba	P4	-	P	Jan-Feb or Apr-Sep	High
Rumex drummondii	P4	-	P	Aug-Nov	Moderate
Schoenus natans	P4	-	A	Oct	High
Stylidium longitubum	P4	-	A	Oct-Dec	Moderate
Tripterococcus sp. Brachylobus (A.S. George 14234)	P4	-	P	Oct-Feb	Moderate
Trithuria australis	P4	-	A	Oct-Nov	Moderate

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

2.2.2 TECs and PECs

Six TECs, three of which are also PECs, were classified as having a 'high' or 'moderate' likelihood of occurrence within the site, as detailed in **Table 3**. The complete likelihood of occurrence assessment is provided as **Appendix C**.

Table 3: Threatened or priority ecological communities with a high or moderate likelihood of occurrence in the site

Community	Status		Likelihood of occurrence
	WA	EPBC Act	
Herb rich saline shrublands in clay pans	EN	CR	Moderate
Tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain	P3	CR	High
Banksia ilicifolia woodlands	P3	EN	Moderate
Banksia woodlands of the Swan Coastal Plain	P3	EN	High
Low lying *Banksia attenuata* woodlands or shrublands	P3	EN	Moderate
Subtropical and temperate coastal saltmarsh	P3	VU	High
Forests and woodlands of deep seasonal wetlands of the Swan Coastal Plain	CR	-	Moderate

3 Methods

3.1 Field survey

Two experienced botanists visited the site on 12 October and 16 November 2023 to conduct the field survey. The site was traversed on foot and the composition and condition of vegetation was recorded. Plant specimens were collected where the identity of flora required further confirmation. Photographic images and notes were recorded as required.

3.1.1 Targeted searches

Targeted searches were conducted for threatened and priority flora and ecological communities, with a particular focus on those with a high or moderate likelihood of occurrence (refer **Section 2.2**). All patches of vegetation were traversed to determine presence of targeted species. Tracks and records were marked using a hand-held GPS receiver (±5 m accuracy).

3.1.2 Sampling

Detailed sampling of the vegetation was undertaken using a combination of non-permanent 10 x 10 m quadrats and relevés. The quadrats were established using fence droppers bounded by measuring tape. The relevés were completed over an equivalent 10 x 10 m area without the use of physical markers and were included to provide a more rapid sample of patches of vegetation in poorer condition and/or of smaller size. The position[2] of each sample was recorded with a hand-held GPS receiver (±5 m accuracy).

The data recorded within each sample included:

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

Ten locations were sampled, comprised of four quadrats and six relevés, as shown in **Figure 3**.

[2] For quadrats the north-west corner was recorded.

3.1.3 Vegetation condition

The condition of the vegetation was assessed using the Keighery (1994) scale (**Table 4**).

Table 4: Vegetation condition scale applied during the field survey

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

^relative to the expected natural diversity for that vegetation.

3.2 Analysis and data preparation

3.2.1 Flora identification

Flora were identified through comparison with named material and through the use of taxonomic keys. Plant specimens collected during the field survey were dried, pressed and named in accordance with requirements of the (Western Australian Herbarium 2024).

Flora was classified as native if indigenous to the IBRA region in which the site occurs. Non-native flora is denoted by '*' in text and raw data. The legal or policy status of flora was denoted using codes outlined in **Appendix A**.

3.2.2 Sampling adequacy

A species accumulation curve was plotted from sample data by generating a trendline (log) in Microsoft Excel. The trendline was forecast to locate the asymptote of the curve (the point at which the curve flattens), which provides an indication of amount of sampling that would be required before it can be assumed few species remain undetected.

Species richness was estimated in PRIMER v6 (Clarke and Gorley 2006). Jacknife1 and Chao2 non-parametric estimators are reported as these are known to perform well in comparison to simulated and real data sets and are also recommended for small sample sizes (Gotelli and Colwell 2011).

Differences between recorded and estimated species richness was used to evaluate the adequacy of sampling effort.

3.2.3 Threatened and priority flora confirmation

Threatened and priority flora were confirmed as absent from the site where no significant limitation was identified that could have affected their detection (refer **Section 3.3**).

3.2.4 Vegetation unit identification and description

The vegetation units within the site were identified from the sample data collected during the field survey. The vegetation was described according to the dominant species present using the structural formation descriptions of the *National Vegetation Inventory System* (NVIS) (NVIS Technical Working Group 2017).

3.2.5 Floristic community type assignment

The identified vegetation units were compared to the regional 'floristic community type' (FCT) dataset *A floristic survey of the southern Swan Coastal Plain* (Gibson *et al.* 1994). Each sample was compared to Gibson *et al.* (1994) separately to limit the influence of spatial correlation when assigning an FCT. FCT analysis was not undertaken for samples located within disturbed vegetation with low native species diversity as the vegetation was considered unlikely to currently represent an FCT.

Sample data (presence/absence) was first reconciled with Gibson *et al.* (1994) by standardising the names of taxa with those used in the earlier study. This was necessary due to changes in nomenclature in the intervening period. Taxa that were only identified to genus level were excluded, while some infra-species that have been identified since 1994 were reduced to species level. The combined dataset was then imported into the statistical analysis package PRIMER v6 (Clarke and Gorley 2006).

A resemblance matrix was generated using the Bray-Curtis distance measure which provided the percentage similarity between all pairs of samples. A cluster analysis was then performed using the resemblance matrix and hierarchical agglomerative clustering, to produce a dendrogram.

Where a sample tended to cluster with a grouping of different FCTs, the resemblance matrix was examined. Ultimately a combination of cluster analysis, resemblance matrix and contextual information relating to the soils, landforms and known FCTs within the region was considered in the final determination of an FCT for vegetation within the site.

3.2.6 TEC and PEC confirmation

Vegetation units were assessed against TEC and PEC diagnostic characteristics and, if available, size and/or vegetation condition thresholds (DBCA 2023b). TECs and PECs were confirmed as absent from the site where no significant limitation was identified that could have affected their detection (refer **Section 3.3**).

3.2.7 Mapping

Environmental features, vegetation units, vegetation condition, threatened or priority flora or ecological communities were mapped on aerial photography using notes and data collected in the field.

3.3 Limitations

It is important to note constraints imposed on assessments and the degree to which these may have limited outcomes. An evaluation of the desktop study and methods applied in the current assessment against standard constraints outlined in the EPA document *Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA 2016b) is provided in **Table 5**.

Table 5: Evaluation of assessment against standard constraints outlined in (EPA 2016b)

Constraint	Degree of limitation	Details
Availability of contextual information	No limitation	The broad scale contextual information described in **Section 2.1** is adequate to place the site and vegetation in context.
	No limitation	Regarding assignment of FCTs, the authoritative Gibson *et al.* (1994) dataset was derived from a necessarily limited sample of vegetation from largely publicly owned land which is now 30 years out of date. Consequently, it is unknown to what degree official FCTs are an appropriate reference for the biodiverse vegetation across the Swan Coastal Plain. Furthermore, Gibson *et al.* (1994) collected data in the main flowering period (spring) and in many cases sampled plots multiple times to provide a complete species list. This survey sampled the site twice in the main flowering period, providing a reasonable basis for the comparison of FCTs despite the limitations of Gibson *et al.* (1994).
Experience level of personnel	No limitation	This flora and vegetation assessment was undertaken by a qualified botanist with 13 years of botanical experience in Western Australia. Technical review was undertaken by a senior environmental consultant with 13 years' experience in environmental science in Western Australia.
Suitability of timing	No limitation	In Mediterranean climates some flora spend part of their lifecycle as underground storage organs or seed to avoid excessive heat and drought over the summer period. These species, known as 'geophytes' or 'annuals', tend to re-emerge during winter and are often most visible during spring, which is the flowering period for the majority of plant species. Therefore, spring is the optimal time to complete flora and vegetation surveys in the south-west of WA. The survey was conducted in November and thus within the main flowering season. High rainfall was recorded from May to October 2016 in the months preceding the site visit. Therefore, it is likely that many plant species would have been in flower and/or visible at the time of survey. The degraded nature of most of the site limits the potential habitat for native geophytic plants such as orchids and the majority of threatened and priority flora species with potential to occur are perennial species. The survey timing was considered adequate to allow the detection of species for which seasonal timing is critical.

Table 5: Evaluation of assessment against standard constraints outlined in (EPA 2016b) (continued)

Constraint	Degree of limitation	Details
Temporal coverage	No limitation	Detailed flora and vegetation assessments can require multiple visits, at different times of year, and over a period of a number of years, to enable observation of all species present. The site was visited twice over October and November 2023. The November site visit provided an insight into the vegetation condition and composition at the end of the main flowering period. Therefore, according to the EPA guidelines this survey is considered to meet the requirements of a 'detailed' survey.
Spatial coverage and access	No limitation / Limitation	Site coverage was comprehensive (track logged).
	No limitation / Limitation	All parts of the site could be accessed as required.
Sampling intensity	No limitation	A total of 107 species were recorded, of which 60 were recorded from ten sample locations and 47 were recorded opportunistically. Minimum species richness within site is estimated at between 92 (Jacknife1) and 101 (Chao2) species (refer species accumulation curve and estimates shown in **Plate 2**). The number of species recorded in the site is more than the Chao2 estimate and, combined with the degraded nature of the majority of the site, demonstrates that survey effort was adequate to prepare a comprehensive species inventory for the site.
Influence of disturbance	Limitation	Aerial imagery shows no evidence of recent fire and therefore short-lived species more common after fire may not have been visible.
	No limitation	Historical ground disturbance was evident in parts of the site and some native vegetation in the site is regrowth with less non-native species present. The disturbance history of the site was considered when undertaking field sampling.
Adequacy of resources	No limitation	All resources required to perform the survey were available.

4 Results

4.1 Flora

4.1.1 Species inventory

A total of 107 species were recorded during the field survey. A summary of legal and policy status of flora records is provided in **Table 6**. A complete species list is provided in **Appendix D**.

Table 6: Summary of legal and policy status of taxa recorded in the site

Status	Unlisted	Threatened	Priority	Declared Pest	Planted	Total
Native	59	0	0	-	0	**59**
Non-native	46	-	-	2	0	**48**
Total	105	0	0	2	0	**107**

Sampling recorded 60 species from 10 samples. A further 47 species were recorded opportunistically across the site. A species accumulation curve derived from sample data is presented in **Plate 2**. Species richness was estimated to be between 92 (Jacknife1) and 101 (Chao2).

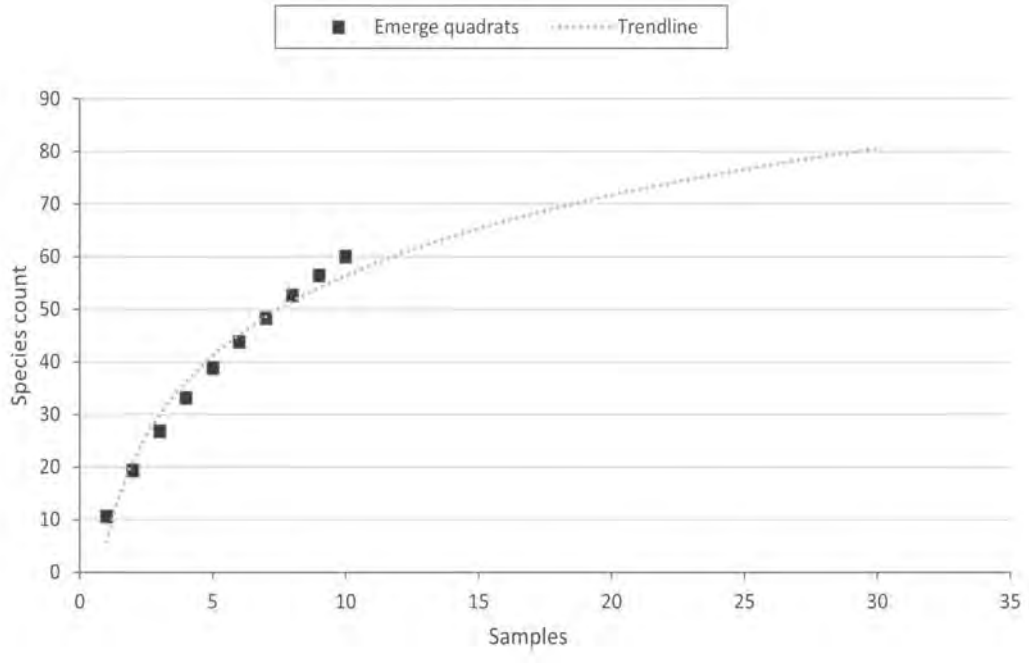

Plate 2: Species accumulation curve derived from sample data (y = 22.021ln(x) + 5.7202, R^2 = 0.97)

4.1.2 Threatened and priority flora

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

The threatened and priority flora species identified in **Section 2.2** are not considered to occur in the site as no significant limitation affecting their detection was identified (refer **Section 3.3**).

4.1.3 Declared pests

Two species listed as a declared pest (C3) pursuant to the BAM Act were recorded within the site: **Asparagus asparagoides* (bridal creeper) and **Moraea flaccida* (one-leaf Cape tulip). Bridal creeper was recorded in the southern portion of the site with low cover. One-leaf Cape tulip was recorded in the southern and central portions of the site, as scattered plants. Bridal creeper is also listed as a weed of national significance (WoNS).

4.2 Vegetation

4.2.1 Vegetation units

Eight vegetation units were identified within the site. A description and the area of each vegetation unit is provided in **Table 7**. The location of each vegetation unit is shown in **Figure 3**. A matrix of species recorded within each vegetation unit is provided in **Appendix E** and raw sample data in **Appendix F**.

Table 7: Description and extent of vegetation units identified within the site

Code	Description	Sample/s	Total area (ha)	Proportion of site (%)	Representative photograph
CoErM	Closed low woodland of *Casuarina obesa, Eucalyptus rudis* and *Melaleuca* spp. over open shrubland to shrubland of *Rhagodia baccata* subsp. *baccata*, *Salicornia quinqueflora* and *Suaeda australis* over open to closed sedgeland of *Machaerina juncea*, *Juncus* spp. and *Gahnia trifida* in creeklines	R2, Q5, R10	2.52	11.88	
E	Open woodland of *Eucalyptus marginata* or *Eucalyptus gomphocephala* over closed grassland of weeds on sandy soils	N/A	0.12	0.59	

Table 7: Description and extent of vegetation units identified within the site (continued)

Code	Description	Sample/s	Total area (ha)	Proportion of site (%)	Representative photograph
Er	Woodland of *Eucalyptus rudis* over sparse sedgeland of *Juncus* spp. and *Lepidosperma longitudinale* over grassland of weeds on sandy soils	N/A	1.31	6.17	
ErCoTS	Low woodland to open woodland of *Eucalyptus rudis* and *Casuarina obesa* over sparse shrubland to shrubland of *Salicornia quinqueflora*, *Tecticornia* spp. and *Suaeda australis* and sedgeland of *Lepidosperma longitudinale* and *Juncus* spp. over grassland of weeds on sandy soils	N/A	1.61	7.59	

Table 7: Description and extent of vegetation units identified within the site (continued)

Code	Description	Sample/s	Total area (ha)	Proportion of site (%)	Representative photograph
ErMr	Woodland of *Eucalyptus rudis* and *Melaleuca rhaphiophylla* over sparse shrubland and open to closed sedgeland of *Machaerina juncea*, *Lepidosperma longitudinale* and *Juncus* spp. over open forbland of *Cycnogeton lineare* and open to closed grassland of weeds in drainage lines and depressions	R7, R8, Q9	3.75	17.65	
Kg	Shrubland of *Kunzea glabrescens* over grassland of weeds on sandy soils	N/A	0.21	0.99	

Table 7: Description and extent of vegetation units identified within the site (continued)

Code	Description	Sample/s	Total area (ha)	Proportion of site (%)	Representative photograph
TS	Low open to closed shrubland of *Salicornia quinqueflora*, *Tecticornia* spp., *Suaeda australis* and *Frankenia pauciflora* over open forbland to forbland of *Triglochin mucronata*, **Cotula turbinata* and grassland of weeds (or layer absent) on low lying clay adjacent to the river	Q1, Q3, R4	1.61	7.61	
Cleared	Disturbed, cleared land dominated by non-native species and bare ground	N/A	10.09	47.54	

4.2.2 Vegetation condition

The extent of vegetation by condition category is detailed in **Table 8** and shown in **Figure 4**.

Table 8: Extent of vegetation condition categories within the site

Condition category (Keighery 1994)	Total area (ha)	Proportion of site (%)
Pristine	0	0
Excellent	0	0
Very good	1.45	6.85
Good	4.38	20.65
Degraded	5.30	24.96
Completely degraded	10.09	47.54

4.2.3 Floristic community types

Vegetation units **CoErM** and **ErMr** were determined to represent FCT 17 '*Melaleuca rhaphiophylla* – *Gahnia trifida* seasonal wetlands', as shown in **Table 9**. Vegetation unit **TS** was determined to represent FCT 16 'highly saline seasonal wetlands'. The relevant portions of the cluster dendrograms are provided in **Appendix G**.

Vegetation units **E**, **Er**, **ErCoTS** and **Kg** were considered to be too disturbed to assign an FCT.

Table 9: Vegetation unit FCT classification by sample

Vegetation unit	Sample unit	Most similar Gibson *et al.* (1994) sites	Similarity (%)	Floristic community type (FCT)
TS	**Q1**	SANDON-1 (FCT 16)	37	FCT 16: Highly saline seasonal wetlands
	Q3	POSSUM1 (FCT 16)	40	
	R4	POSSUM1 (FCT 16)	28	

Table 9: Vegetation unit FCT classification by sample (continued)

Vegetation unit	Sample unit	Most similar Gibson *et al.* (1994) sites	Similarity (%)	Floristic community type (FCT)
CoErM	**R2**	POSSUM5 (FCT 17)	20	FCT 17: *Melaleuca rhaphiophylla – Gahnia trifida* seasonal wetlands
	R2^	SANDON-1 (FCT 16)	26	
		ELLIS-2 (FCT 17)	25	
	Q5	POSSUM5 (FCT 17)	23	
	R10	SANDON-1 (FCT 16)	47	
ErMr	**R6^**	YAN-21 (FCT 14)	29	
		cool 09 (FCT 19)	26	
		PAGA-5 (FCT 17)	24	
	R7	POSSUM5 (FCT 17)	13	
	R7^	LESCH-6 (FCT 17)	25	
		Cool 01 (FCT 17)	21	
	R8^	POSSUM2 (FCT 16)	27	
		CARAB-1 (FCT 15)	22	
		SANDON-1 (FCT 16)	20	
		Cool 01 (FCT 17)	19	
	Q9	MTB-5 (FCT 17)	30	
		Cool 01 (FCT 17)	27	

Note: ^ shows highest percent similarity to individual Gibson et al. (1994) samples rather than similarity to a cluster of samples.

4.2.4 Threatened and priority ecological communities

The following TECs and PECs were identified within the site:

- Subtropical and temperate coastal saltmarsh TEC ('vulnerable')
- Subtropical and temperate coastal saltmarsh PEC (P3).

The locations of the TEC and PEC within the site are shown in **Figure 5**.

Vegetation unit **TS** and a small portion of vegetation unit **ErCoTS** met the criteria to represent the Commonwealth listed 'subtropical and temperate coastal saltmarsh' TEC, as detailed in **Table 10**.

Table 10: Assessment of site conditions against the subtropical and temperate coastal saltmarsh TEC criteria (adapted from (DSEWPaC 2013))

Criteria	Site implications		
	Vegetation Unit TS	**Vegetation Unit CoErM**	**Vegetation unit ErCoTS**
Occurs south of 23° 37’	The site occurs south of 23° 37’	The site occurs south of 23° 37’	The site occurs south of 23° 37’
Occurs on the coastal margin, along estuaries and on low energy coasts	The site occurs along an estuary	The site occurs along an estuary	The site occurs along an estuary
Occurs on sandy or muddy substrates and may include coastal clay pans (and the like)	The **TS** vegetation occurs on muddy substrates	The **CoErM** vegetation occurs on sandy or muddy substrates	The **ErCoTS** vegetation occurs on sandy or muddy substrates
Occurs on places with at least some tidal connection, including rarely inundated supratidal areas, intermittently opened or closed lagoons, and groundwater tidal influences, but not areas only receiving aerosol spray	The **TS** vegetation occurs directly adjacent to the Serpentine River and is subject to tidal connection	The **CoErM** vegetation occurs close to the Serpentine River and is subject to tidal connection	The **ErCoTS** vegetation occurs adjacent to the Serpentine River and is subject to tidal connection
Consists of dense to patchy areas of characteristic coastal saltmarsh plant species (i.e. salt tolerant herbs, succulent shrubs or grasses, that may also include bare sediment as part of the mosaic)	The **TS** vegetation consists of dense cover of *Salicornia quinqueflora*, *Tecticornia* spp., *Samolus* spp. and *Suaeda australis* which meets this criterion	The **CoErM** vegetation consists of patchy occurrences of salt tolerant shrubs including *Salicornia quinqueflora*, *Tecticornia* spp. and *Suaeda australis* which meets this criterion	The **ErCoTS** vegetation consists of patchy occurrences of salt tolerant shrubs including *Salicornia quinqueflora*, *Tecticornia* spp. and *Suaeda australis* which meets this criterion
Proportional cover by tree canopy such as mangroves, Melaleucas or Casuarinas is not greater than 50%, nor is proportional ground cover by seagrass greater than 50%	The **TS** vegetation (comprising 1.61 ha) is generally lacking an overstorey but some areas include low, scattered cover of *Casuarina obesa* and *Eucalyptus rudis*. As tree canopy cover does not exceed 50%, the **TS** vegetation does meet this criterion	The **CoErM** vegetation includes moderate to dense cover of *Casuarina obesa, Eucalyptus rudis* and *Melaleuca* spp. As tree canopy cover exceeds 50%, the **CoErM** vegetation does not meet this criterion	The **ErCoTS** vegetation includes a tree canopy of *Eucalyptus rudis* and *Casuarina obesa* which for the most part exceeds 50% cover. Thus most of the **ErCoTS** vegetation does not meet this criterion. However, two areas (comprising 0.26 ha) have lower canopy cover and do meet this criterion
Result	The site supports 1.87 ha of the subtropical and temperate coastal saltmarsh TEC		

DBCA’s *Priority Ecological Community* list indicates that the description, area and condition thresholds that apply to the Commonwealth-listed TEC of the same name also apply to the ‘subtropical and temperate coastal saltmarsh’ PEC (DBCA 2023d). Therefore, a total of 1.87 ha of this PEC occurs within the site as shown in **Figure 5**.

Three *Eucalyptus gomphocephala* (tuart) trees are present within vegetation units **ErCoTS**, **E** and **Er**. These trees are all separated by more than 60 m and thus do not meet the criteria to represent the Commonwealth listed ‘tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain’ TEC.

No other TECs or PECs occur within the site.

5 Discussion

5.1 Flora

5.1.1 Threatened and priority flora

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

As the timing of the surveys coincided with the main flowering period of the annual or geophytic species with potential to occur in the site, they should have been visible if present. Areas of suitable habitat for these species was searched on two occasions during the flowering period (October and November) but none of the species was recorded. Therefore, it is considered unlikely that they occur in the site.

One *Caladenia* sp. individual was recorded within the **ErMr** vegetation during the November survey. This specimen was dead with old fruit and thus could not be identified to species level. One threatened *Caladenia* species (*Caladenia huegelii*) occurs within 10 km of the site but inhabits well drained, deep sandy soils. The site, and particularly the **ErMr** vegetation, does not represent suitable habitat for *C. huegelii* and was classed as 'low' likelihood of occurrence (**Appendix B**). In addition, the specimen was approximately 75 cm in height where *Caladenia huegelii* reaches a maximum height of 60 cm (Brown *et al.* 2008; DEC 2009; Western Australian Herbarium 2024) and so was not considered likely to represent *C. huegelii.*

The survey was undertaken outside of the main flowering period of *Acacia benthamii, Jacksonia sericea* and *Parsonsia diaphanophleba* but these species are perennial and would be visible at any time of year, even if not flowering. Given that no sterile specimen potentially representing these species were collected, the survey is considered conclusive in determining that none of the species occur in the site.

5.1.2 Declared pests

Two species listed as declared pests pursuant to the BAM Act were recorded within the site (bridal creeper and one-leaf Cape tulip). No control category was assigned for these species and their keeping category is listed as 'exempt' under the Act, so no management is required.

5.2 Vegetation

5.2.1 Floristic community assignment

The FCT analysis for the **TS** vegetation was clear, with samples Q1, Q3 and R4 all clustering with Gibson *et al.* (1994) samples comprising FCT 16 with 28-40% similarity. With respect to the **ErMr** and **CoErM** vegetation the samples tended to show similarity to several FCTs, including FCTs 14, 15, 16 and 17. The similarity to FCT 16 was likely due to the proximity to the **TS** vegetation and presence of saline soils. FCTs 14 and 15 are not known to occur within the wider local area but represent deeper wetlands types typically found further east on the Bassendean dunes and Pinjarra Plain (Gibson *et al.* 1994). FCT 17 comprises wetlands on the Quindalup and Spearwood dune systems and tends to include wetland species including *Melaleuca rhaphiophylla*, *Eucalyptus rudis*, *Gahnia trifida*,

Lepidosperma longitudinale and *Machaerina juncea*. These species are common within the **ErMr** and **CoErM** vegetation within the site, and so FCT 17 is considered the most appropriate FCT for these vegetation units.

5.2.2 Threatened and priority ecological communities

All of the **TS** vegetation and a portion of the **ErCoTS** vegetation was determined to represent the 'subtropical and temperate coastal saltmarsh' TEC/PEC. These vegetation units comprise moderate to high cover of salt tolerant flora species including *Tecticornia*, *Salicornia* spp. and *Suaeda australis* and occur on muddy soils adjacent to the Serpentine River. The additional areas of **ErCoTS** and all of the **CoErM** vegetation was characterised by over 50% canopy cover by *Eucalyptus rudis* and *Casuarina obesa* so did not meet the criteria to represent the TEC/PEC. Confirmed occurrences of the 'subtropical and temperate coastal saltmarsh' TEC/PEC are present further north along the Serpentine River and to the south along the periphery of the Peel Inset to the south.

5.2.3 Local and regional significance

Vegetation in the north-eastern and southern portions of the site are mapped as part of two Peel RSNAs. As detailed in **Section 2.1.11**, Peel RSNAs are designated as such as they have significant flora, vegetation and landform values. The north-eastern Peel RSNA ('Serpentine River Bushland') covers some of the **TS** vegetation which comprises the 'subtropical and temperate coastal saltmarsh' TEC/PEC as well as some **CoErM** vegetation. This vegetation is in 'degraded' to 'very good' condition. The southern Peel RSNA ('Coodanup Foreshore Bushland') encompasses most of the **ErMr** vegetation, which does not represent any TECs or PECs but includes relatively intact wetland vegetation in 'degraded' to 'very good' condition.

6 Conclusions

Outcomes of the assessment include the following:

- A total of 59 native and 48 non-native (weed) species were recorded within the site.
- No threatened or priority flora species were recorded or are considered likely to occur within the site.
- The vegetation within the site was classified into eight vegetation units: **CoErM**, **E**, **Er**, **ErCoTS**, **ErMr**, **Kg**, **TS** and **cleared**.
- The vegetation within the site is present in 'very good' to 'completely degraded' condition. The majority of the vegetation is in 'degraded' and 'completely degraded' condition (75.5% of the site).
- The site contains a 1.87 ha patch of the 'subtropical and temperate saltmarsh' TEC/PEC. This community is listed as a 'vulnerable' TEC under the *Environmental Protection and Biodiversity Conservation Act 1999* and a 'priority 3' PEC in Western Australia. All occurrences of vegetation unit **TS** represent this TEC as well as a small portion of the **ErCoTS** vegetation unit.

7 References

7.1 General references

Alan Tingay and Associates 1998, *A Strategic Plan for Perth's Greenways - Final Report*. December 1998.

Buereau of Meterology (BoM) 2024, *Climate Data Online*, <http://www.bom.gov.au/climate/data/>.

Brown, A., Dundas, P., Dixon, K. and Hopper, S. 2008, *Orchids of Western Australia*, University of Western Australia Press, Crawley.

Churchward, H. M. and McArthur, W. M. 1980, *'Landforms and Soils of the Darling System, Western Australia'*, in Department of Conservation and Environment (ed.), *Atlas of Natural Resources Darling System Western Australia*, Department of Conservation and Environment.

Clarke, K. R. and Gorley, R. N. 2006, *PRIMER v6: User Manual/Tutorial*, PRIMER-E, Plymouth.

Department of Agriculture, Water and the Environment (DAWE) 2021, *Weeds of National Significance (WoNS)*, Centre for Invasive Species Solutions (CISS), <https://weeds.org.au/weeds-profiles/>.

Department of Biodiversity, Conservation and Attractions (DBCA) 2017, *Ramsar Sites (DBCA-010)*.

Department of Biodiversity, Conservation and Attractions (DBCA) 2018, *Directory of Important Wetlands in Australia - Western Australia (DBCA-045)*.

Department of Biodiversity, Conservation and Attractions (DBCA) 2022a, *Priority Ecological Communities for Western Australian Version 34*.

Department of Biodiversity, Conservation and Attractions (DBCA) 2022b, *Threatened and Priority Flora List 6 October 2022*, Perth.

Department of Biodiversity, Conservation and Attractions (DBCA) 2023a, *Geomorphic Wetlands, Swan Coastal Plain (DBCA-019)*, Perth, WA.

Department of Biodiversity, Conservation and Attractions (DBCA) 2023b, *Methods for survey and identification of Western Australian threatened ecological communities (draft)*, Perth, Western Australia.

Department of Biodiversity, Conservation and Attractions (DBCA) 2023c, *NatureMap*, <https://static.dbca.wa.gov.au/pages/naturemap.html>.

Department of Biodiversity, Conservation and Attractions (DBCA) 2023d, *Priority Ecological Communities for Western Australian Version 35*.

Department of Biodiversity, Conservation and Attractions (DBCA) 2023e, *Threatened Ecological Community List 26 May 2023*, Perth, WA, <https://www.dpaw.wa.gov.au/plants-and-animals/threatened-species-and-communities/wa-s-threatened-ecological-communities>.

Department of Biodiversity, Conservation and Attractions (DBCA) 2023f, *Threatened Species and Communities - Data Searches*, Perth, WA, <https://www.dpaw.wa.gov.au/plants-and-animals/threatened-species-and-communities>.

Department of Biodiversity, Conservation and Attractions (DBCA) 2023g, *Weeds*, Perth, WA, <https://www.dbca.wa.gov.au/parks-and-wildlife-service/threat-management/plant-diseases/weeds#:~:text=Weeds%20are%20plants%20(not%20necessarily,detectable%20environmental%20or%20economic%20impacts>.

Department of Climate Change, Energy, the Environment and Water (DCCEEW) 2021, *Threatened Ecological Communities*, <https://www.dcceew.gov.au/environment/biodiversity/threatened/communities>.

Department of Climate Change, Energy, the Environment and Water (DCCEEW) 2023, *Protected Matters Search Tool*, <https://pmst.awe.gov.au/#/map>.

Department of Environment and Conservation (DEC) 2009, *Grand Spider Orchid (Caladenia huegelii) Recovery Plan*, Department of the Environment, Water, Heritage and the Arts, Canberra.

Department of Water (DoW) 2008, *LiDAR Elevation Dataset, Swan Coastal Plain*, Perth.

Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) 2013, *Conservation advice for subtropical and temperate coastal saltmarsh*, Canberra.

Department of Water and Environmental Regulation (DWER) 2018a, *A Guide to Preparing Revegetation Plans for Clearing Permits*

Department of Water and Environmental Regulation (DWER) 2018b, *Hydrography Linear (Heirarchy) (DWER-031)*, Perth.

Environment Australia 2000, *Revision of the Interim Biogeographic Regionalisation for Australia (IBRA) and Development of Version 5.1 - Summary Report*, Department of Environment and Heritage.

Environmental Protection Authority (EPA) 2013, *Environmental Protection Bulletin No. 12 Swan Bioplan - Peel Regionally Significant Natural Areas*, Perth.

Environmental Protection Authority (EPA) 2016a, *Environmental Factor Guideline: Flora and Vegetation*, Perth.

Environmental Protection Authority (EPA) 2016b, *Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment*, Perth.

Gibson, N., Keighery, B., Keighery, G., Burbidge, A. and Lyons, M. 1994, *A Floristic survey of the southern Swan Coastal Plain*, Department of Conservation and Land Management and the Conservation Council of Western Australia, Perth.

Gotelli, N. J. and Colwell, R. K. 2011, *Estimating species richness*, Oxford University Press, Oxford.

Government of WA 2000, *Bush Forever - Volume 1: Policies, principles and processes*, Perth.

Government of Western Australia 2019, *2018 South West Vegetation Complex Statistics. Current as of March 2019*, WA Department of Biodiversity, Conservation and Attractions, Perth.

Heddle, E. M., Loneragan, O. W. and Havel, J. J. 1980, *'Vegetation Complexes of the Darling System Western Australia'*, in Department of Conservation and Environment (ed.), *Atlas of Natural Resources Darling System Western Australia*, Perth.

Hill, A. L., Semeniuk, C. A., Semeniuk, V. and Del Marco, A. 1996, *Wetlands of the Swan Coastal Plain: Volume 2A - Wetland Mapping, Classification and Evaluation*, Water and Rivers Commission and the Department of Environmental Protection, Perth.

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

Kendrick, G. W., Wyrwoll, K. H. and Szabo, B. J. 1991, *Pliocene-Pleistocene coastal events and history along the western margin of Australia*, Quaternary Science Reviews, 10: 419-439.

Molloy, S., Wood, J., Hall, S., Wallrodt, S. and Whisson, G. 2009, *South West Regional Ecological Linkages Technical Report*, Western Australian Local Government Association and Department of Environment and Conservation, Perth.

NVIS Technical Working Group 2017, *Australian Vegetation Attribute Manual: National Vegetation Information System*, Department of the Environment and Energy, Canberra.

Western Australian Land Information Authority (WALIA) 2023, *Landgate Map Viewer Plus*.

Western Australian Herbarium 2023, *Florabase*, Department of Biodiversity, Conservation and Attractions (DBCA), <https://florabase.dpaw.wa.gov.au/>.

Western Australian Herbarium 2024, *Florabase*, Department of Biodiveristy, Conservation and Attractions (DBCA), <https://florabase.dbca.wa.gov.au/>.

Wetlands Advisory Committee 1977, *The status of reserves in System Six*, Environmental Protection Authority, Perth.

7.2 Online references

The online resources that have been utilised in the preparation of this report are referenced in **Section 7.1**, with access date information provided in **Table R 1**.

Table R 1 Access dates for online references

Reference	Date accessed	Website or dataset name
(BoM 2024)	17 January 2024	Climate Data Online
(DBCA 2023e)	24 November 2023	Threatened Ecological Communities
(DAWE 2021)	6 November 2023	Weeds of National Significance (WoNS)

DCCEEW (2023)	6 November 2023	Protected Matters Search Tool
DBCA (2023c)	24 November 2023	NatureMap
WALIA (2023)	6 November 2023	Landgate Map Viewer
Western Australian Herbarium (2023)	29 February 2024	Florabase

Figures

Figure 1: Site Location

Project:	Detailed Flora and Vegetation Assessment 28 Placid Waters Parade, Coodanup
Client:	Peel Rise Pty Ltd

Plan Number:
EP23-081(02)--F21

Drawn:	GAR
Date:	26/02/2024
Checked:	SKP
Approved:	RAW
Date:	08/05/2024

N

0 100 200
Metres

Scale: 1:6,000@A4

GDA2020 MGA Zone 50

emerge ASSOCIATES

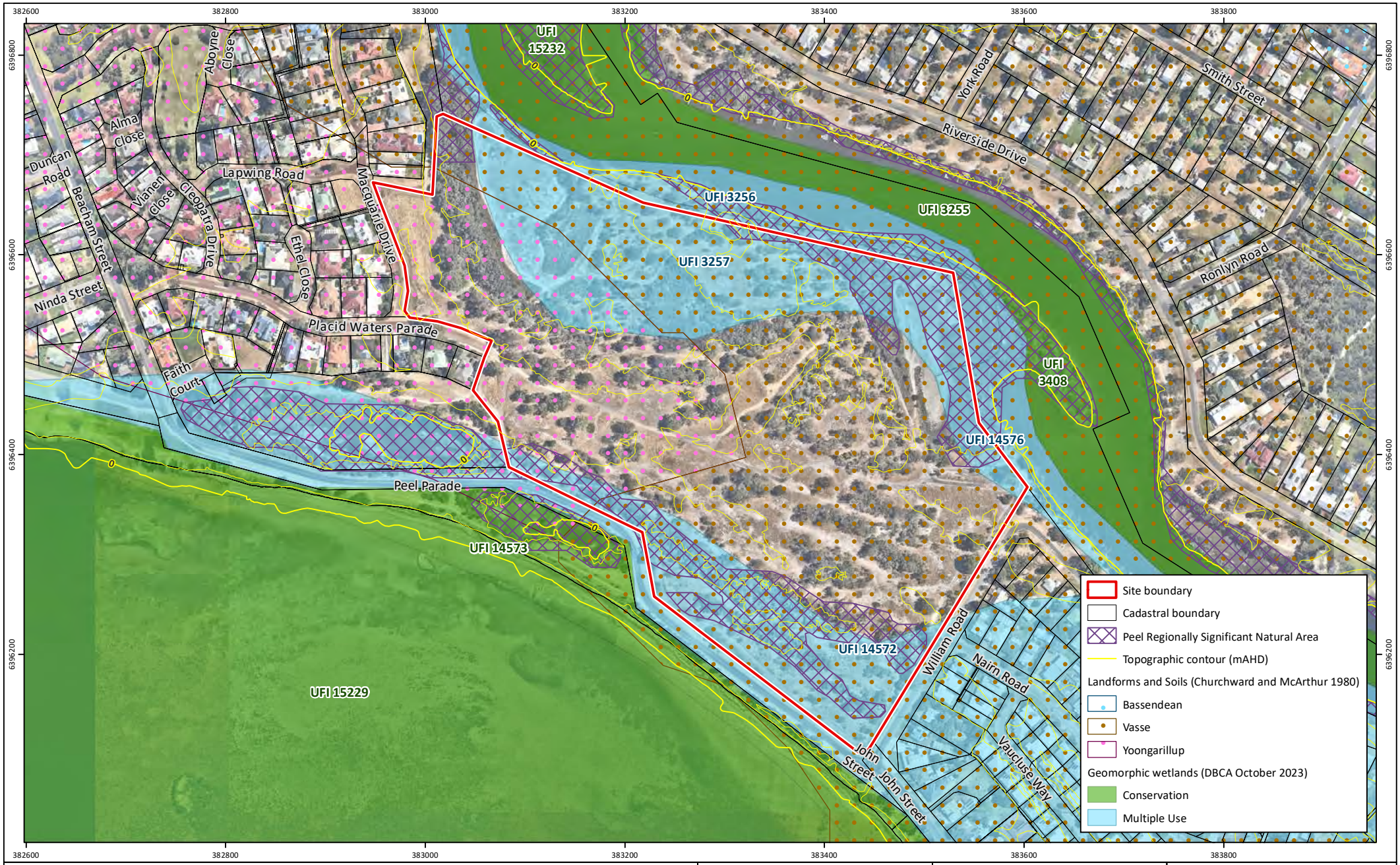

Figure 2: Environmental Features

Project:	Detailed Flora and Vegetation Assessment 28 Placid Waters Parade, Coodanup
Client:	Peel Rise Pty Ltd

Plan Number:
EP23-081(02)--F22

Drawn:	GAR
Date:	26/02/2024
Checked:	SKP
Approved:	RAW
Date:	08/05/2024

N

0 50 100 150
Metres

Scale: 1:5,000@A4

GDA2020 MGA Zone 50

emerge ASSOCIATES

Figure 3: Vegetation Units

Project: Detailed Flora and Vegetation Assessment
28 Placid Waters Parade, Coodanup
Client: Peel Rise Pty Ltd

Plan Number:
EP23-081(02)--F23
Drawn: GAR
Date: 26/02/2024
Checked: SKP
Approved: RAW
Date: 08/05/2024

N

0 50 100 150
Metres
Scale: 1:4,000@A4
GDA2020 MGA Zone 50

emerge ASSOCIATES

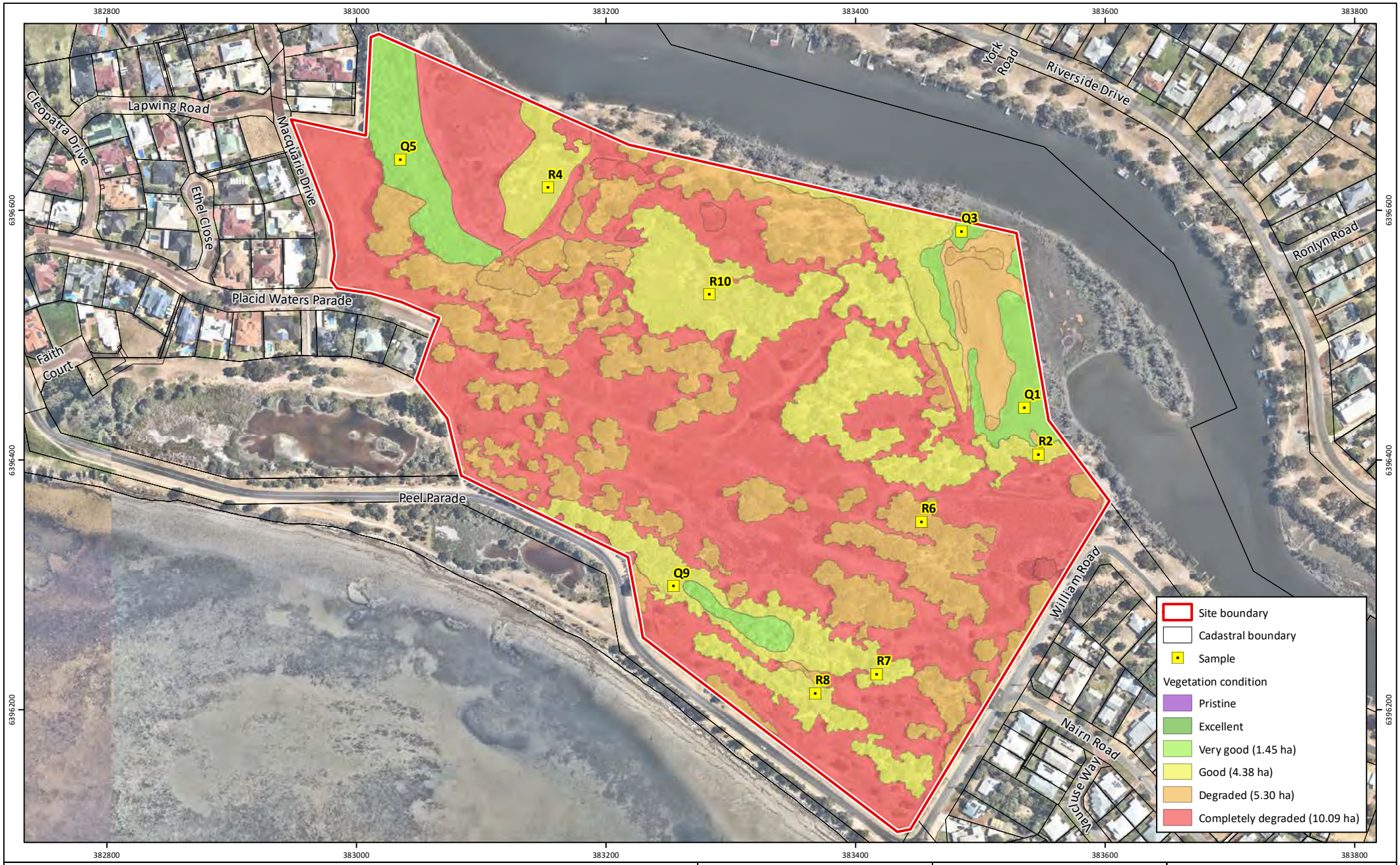

Figure 4: Vegetation Condition

Project: Detailed Flora and Vegetation Assessment
28 Placid Waters Parade, Coodanup

Client: Peel Rise Pty Ltd

Plan Number:
EP23-081(02)--F24

Drawn:	GAR
Date:	26/02/2024
Checked:	SKP
Approved:	RAW
Date:	08/05/2024

N

0 50 100 150
Metres

Scale: 1:4,000@A4

GDA2020 MGA Zone 50

emerge ASSOCIATES

Figure 5: Threatened Ecological Communities

Project:	Detailed Flora and Vegetation Assessment 28 Placid Waters Parade, Coodanup
Client:	Peel Rise Pty Ltd

Plan Number:
EP23-081(02)--F25

Drawn:	GAR
Date:	26/02/2024
Checked:	SKP
Approved:	RAW
Date:	08/05/2024

N

0 50 100 150
Metres

Scale: 1:4,000@A4

GDA2020 MGA Zone 50

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Appendix A

Additional Information

Conservation Significant Flora and Vegetation

Threatened and priority flora

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

In Western Australia, plant taxa may be classed as 'threatened' under the *Biodiversity Conservation Act 2016* (BC Act) which is enforced by Department of Biodiversity Conservation and Attractions (DBCA). Threatened flora species are listed under sections 19(1) and 26(2) of the BC Act and published in the Biodiversity Conservation (Species) Order 2022. It is an offence to 'take' or disturb threatened flora without Ministerial approval. Section 5(1)1 of the Act defines to take as including "… to gather, pluck, cut, pull up, destroy, dig up, remove, harvest or damage flora by any means" or to cause or permit the same to be done.

Threatened flora are assigned categories under the EPBC Act and BC Act according to their conservation status, as outlined in **Table 1**.

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

Table 1: Definitions of threatened and priority flora species pursuant to the EPBC Act and BC Act and on DBCA's Priority Flora List (DBCA 2023b)

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

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

Threatened and priority ecological communities

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

In Western Australia TECs are listed under sections 27(1), 31 and 33 of the BC Act. TECs are determined by the Western Australian Threatened Ecological Communities Scientific Advisory Committee (WATECSAC) and endorsed by the State Minister for the Environment. The WATECSAC is an independent group comprised of representatives from organisations including tertiary institutions, the Western Australian Museum and DBCA. The TECs listed under the BC Act are defined in Schedule 1 of the Biodiversity Conservation (Threatened Ecological Communities) Order 2023. State TECs are also acknowledged through other environmental approval processes such as 'environmental impact assessment' pursuant to Part IV of the *Environmental Protection Act 1986* (EP Act) and the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*.

TECs are assigned to one of the categories outlined in **Table 2** according to their level of threat.

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

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

An ecological community with insufficient information available to be considered a TEC or which are rare but not currently threatened may be listed as a 'priority ecological community' (PEC). PECs are categorised based on a variety of criteria, as described in **Table 3**. Listed PECs are published by DBCA (DBCA 2023a).

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

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

Reporting

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

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

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

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

Weeds

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

Declared Pests

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

Under the BAM Act, all declared pests are assigned a legal status, as described in **Table 7**. Species assigned to the 'declared pest, prohibited - s12' category are placed in one of three control categories, as described in **Table 8**.

The *Biosecurity and Agriculture Management Regulations 2013* specify keeping categories for species assigned to the 'declared pest - s22(2)' category, which relate to the purposes of which species can be kept, as well as the entities that can keep them. The categories are described in **Table 9**.

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

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

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

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

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

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

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

Wetland Habitat

Geomorphic wetland types

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

Table 7: Geomorphic Wetlands of the Swan Coastal Plain classification categories (DBCA 2017)

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

Wetland management categories

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

Table 8: Geomorphic Wetlands of the Swan Coastal Plain classification categories (DBCA 2017)

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

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

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

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

Wetland reclassification

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

References

General references

Department of Biodiversity, Conservation and Attractions (DBCA) 2017, *A methodology for the evaluation of wetlands on the Swan Coastal Plain*, draft prepared by the Wetlands Section of the Department of Biodiversity, Conservation and Attractions and the Urban Water Branch of the Department of Water and Environmental Regulation, Perth.

Department of Biodiversity, Conservation and Attractions (DBCA) 2018a, *Geomorphic Wetlands, Swan Coastal Plain (DBCA-019)*.

Department of Biodiversity, Conservation and Attractions (DBCA) 2018b, *Threatened and Priority Flora List 16 January 2018*, Perth.

Department of Biodiversity, Conservation and Attractions (DBCA) 2023a, *Priority Ecological Communities for Western Australia Version 35*, Perth.

Department of Biodiversity, Conservation and Attractions (DBCA) 2023b, *Threatened and Priority Flora List July 2023* Perth.

Department of Environment and Conservation (DEC) 2007, *Protocol for proposing modifications to the Geomorphic Wetlands Swan Coastal Plain dataset*, Perth.

Department of Environment and Conservation (DEC) 2009, *Definitions, Categories and Criteria for Threatened and Priority Ecological Communities*, Perth.

Department of Conservation (DEC) 2013, *Definitions, Categories and Criteria for Threatened and Priority Ecological Communities*, Perth.

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

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

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

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

Online references

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

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

Appendix B

Conservation Significant Flora Species and likelihood of Occurrence Assessment

Species name	Level of significance		Life strategy	Habitat	Flowering period	Likelihood of occurrence
	WA	EPBC Act				
Synaphea sp. Fairbridge Farm (D. Papenfus 696)	CR	CR	P	Low woodland on grey, clayey sand with lateritic pebbles (Pinjarra Plain) near winter wet flats.	Sep-Nov	Negligible
Synaphea sp. Serpentine (G.R. Brand 103)	CR	CR	P	Seasonally damp areas, loam - sand.	Sep-Oct	Negligible
Synaphea sp. Pinjarra Plain (A.S. George 17182)	EN	CR	P	White grey clayey sand on edges of seasonally inundated low lying areas.	Sep-Oct	Negligible
Caladenia huegelii	CR	EN	PG	Well-drained, deep sandy soils in lush undergrowth in a variety of moisture levels.	Sep-early Nov	Negligible
Drakaea elastica	CR	EN	PG	Bare patches of sand within otherwise dense vegetation in low-lying areas alongside winter-wet swamps. Typically in banksia woodland or thickets of Kunzea glabrescens.	late Sep-Oct/	Moderate
Synaphea stenoloba	CR	EN	P	Sandy or sandy clay soils. Winter-wet flats, granite.	Aug-Oct	High
Diuris purdiei	EN	EN	PG	Sand to sandy clay soils in areas subject to winter inundation.	late Septemb	Negligible
Andersonia gracilis	VU	EN	P	Seasonally damp, black sandy clay flats near or on the margins of swamps.	Sep-Nov	Negligible
Banksia mimica	VU	EN	P	Flat to gentle slopes in grey and white sand in open woodlands.	Dec-Jan	Negligible
Drakaea micrantha	EN	VU	PG	Open sandy patches often adjacent to winter-wet swamps.	Sept- early Oc	Negligible
Diuris drummondii	VU	VU	PG	In low-lying depressions in peaty and sandy clay swamps.	Nov-Jan	Negligible
Diuris micrantha	VU	VU	PG	Dark grey-black sandy clay-loam in winter wet depressions or swamps. Often in shallow standing water.	Aug/Sep- earl	Medium
Acacia benthamii	P2	-	P	Sand, typically on limestone breakaways	Aug-Sept	Medium
Grevillea ornithopoda	P2	-	P	River bank, creek. Clay, loam and sand.	Sep-Nov	High

Species name	Level of significance		Life strategy	Habitat	Flowering period	Likelihood of occurrence
	WA	EPBC Act				
Johnsonia pubescens subsp. cygnorum	P2	-	P	Grey white yellow sands on flats and seasonally wet areas.	Sep	Negligible
Phyllangium palustre	P2	-	A	Winter-wet claypans, low-lying seasonal wetlands on clay.	Oct-Nov	High
Pterostylis frenchii	P2	-	PG	Calcareous sand with limestone, laterite on flatlands and gentle slopes.	Nov	Medium
Beyeria cinerea subsp. cinerea	P3	-	P	Sand, limestone.	May-Oct	Negligible
Blennospora doliiformis	P3	-	A	Grey or red clay soils over ironstone. Seasonally-wet flats.	Oct-Nov	Low
Chamaescilla gibsonii	P3	-	PG	Clay to sandy clay in winter-wet flats, shallow water-filled claypans.	Sep	High
Cyathochaeta teretifolia	P3	-	P	Grey sand, sandy clay in swamps and creek edges.	Oct-Jan	Medium
Dillwynia dillwynioides	P3	-	P	Winter wet depressions on sandy soils	Aug - Dec	High
Eryngium sp. Ferox (G.J. Keighery 16034)	P3	-	P	Winter wet flats on clay	Oct-Mar	High
Hemigenia microphylla	P3	-	P	Sandy clay, peaty clay, granite. Winter-wet depressions.	Sep-Dec	Medium
Jacksonia gracillima	P3	-	P	Sand, often adjacent to winter wet areas	Sep-Dec	Negligible
Lasiopetalum membranaceum	P3	-	P	Sand over limestone	Sep-Dec	Negligible
Myriophyllum echinatum	P3	-	A	Clay in winter-wet flats.	Nov	High
Pimelea calcicola	P3	-	P	Sand, limestone on coastal ridges.	Sep-Nov	Negligible
Schoenus sp. Waroona (G.J. Keighery 12235)	P3	-	A	Clay or sandy clay. Winter-wet flats.	Oct-Nov	High
Drosera occidentalis	P4	-	P	Flat, brown/white/yellow moist sand/clay/peat, often near swamps.	Oct-Dec/Jan	Medium
Eucalyptus rudis subsp. cratyantha	P4	-	P	Loam on flats and hillsides.	Jul-Sep	Low
Jacksonia sericea	P4	-	P	Calcareous and sandy soils on Swan Coastal Plain	Dec-Feb	Medium
Ornduffia submersa	P4	-	A	Sandy clay in inundated wetland/creek.	Aug-Nov	Medium
Parsonsia diaphanophleba	P4	-	P	Alluvial soils along rivers.	Jan-Feb or Ap	High
Rumex drummondii	P4	-	P	Winter-wet disturbed areas.	Aug-Nov	Medium

Species name	Level of significance		Life strategy	Habitat	Flowering period	Likelihood of occurrence
	WA	EPBC Act				
Schoenus natans	P4	-	A	Aquatic, in winter-wet depressions.	Oct	High
Stylidium longitubum	P4	-	A	Sandy clay, clay. Seasonal wetlands.	Oct-Dec	Medium
Tripterococcus sp. Brachylobus (A.S. George 14234)	P4	-	P	Winter-wet areas on grey sand.	Oct-Feb	Medium
Trithuria australis	P4	-	A	Seasonally wet areas. Edge of wetlands. Grey clay, clay over sand. Sand over laterite.	Oct-Nov	Medium

Note: CR=critically endangered, EN=endangered, VU=vulnerable, P1=Priority 1, P2=Priority 2, P3=Priority 3, P4=Priority 4, P=perennial, PG=perennial geophyte, A=annual.

Appendix C

Conservation Significant Communities and Likelihood of Occurrence Assessment

Code	Community name	TEC/ PEC	Level of significance		Likelihood of occurrence
			State	EPBC Act	
SCP07	Herb rich saline shrublands in clay pans	TEC	EN	CR	Moderate
Tuart woodlands	Tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain	TEC/ PEC	P3	CR	High
SCP22	*Banksia ilicifolia* woodlands	TEC/ PEC	P3	EN	Moderate
Banksia WL SCP	Banksia Woodlands of the Swan Coastal Plain ecological community	TEC/ PEC	P3	EN	High
SCP21c	Low lying *Banksia attenuata* woodlands or shrublands	TEC/ PEC	P3	EN	Moderate
Coastal Saltmarsh	Subtropical and Temperate Coastal Saltmarsh	TEC/ PEC	P3	VU	Present
SCP15	Forests and woodlands of deep seasonal wetlands of the Swan Coastal Plain	TEC	CR	-	Moderate

Note: TEC=threatened ecological community, PEC=priority ecological community, CR=critically endangered, EN=endangered, VU=vulnerable, P3=priority 3

Appendix D

Species List

Family	Status	Species
Aizoaceae		
	*	*Carpobrotus edulis*
Anacardiaceae		
	*	*Schinus terebinthifolius*
Apiaceae		
		Apium prostratum subsp. *prostratum* var. *prostratum*
		Centella asiatica
		Daucus glochidiatus
Arecaceae		
	*	*Washingtonia* sp.
Asparagaceae		
	*, DP, WoNS	*Asparagus asparagoides*
		Sowerbaea laxiflora
Asphodelaceae		
	*	*Trachyandra divaricata*
Asteraceae		
	*	*Arctotheca calendula*
	*	*Cotula turbinata*
	*	*Hypochaeris glabra*
	*	*Sonchus oleraceus*
	*	*Ursinia anthemoides*
Campanulaceae		
		Lobelia anceps
	*	*Monopsis debilis*
Caryophyllaceae		
	*	*Petrorhagia dubia*
	*	*Sagina apetala*
Casuarinaceae		
		Casuarina obesa
Chenopodiaceae		
		Atriplex prostrata
		Rhagodia baccata subsp. *baccata*
		Salicornia quinqueflora
		Suaeda australis
		Tecticornia halocnemoides
		Tecticornia indica subsp. *bidens*
		Tecticornia pergranulata subsp. *pergranulata*
		Tecticornia syncarpa
Cyperaceae		
		Ficinia nodosa
		Gahnia trifida
		Isolepis cernua var. *cernua*
		Lepidosperma longitudinale
		Machaerina juncea
Euphorbiaceae		
	*	*Euphorbia terracina*
Fabaceae		
		Acacia cyclops

	*	*Acacia longifolia*
		Acacia rostellifera
		Acacia saligna
		Hardenbergia comptoniana
		Jacksonia furcellata
		Jacksonia sternbergiana
	*	*Lathyrus latifolius*
	*	*Lotus angustissimus*
	*	*Lupinus angustifolius*
	*	*Lupinus cosentinii*
	*	*Retama raetam*
	*	*Trifolium campestre*
	*	*Vicia sativa*
		Viminaria juncea
Frankeniaceae		
		Frankenia pauciflora
Haemodoraceae		
		Haemodorum spicatum
Hemerocallidaceae		
		Caesia micrantha
		Corynotheca micrantha
		Dianella revoluta
Iridaceae		
	*, DP	*Moraea flaccida*
		Patersonia occidentalis
	*	*Watsonia meriana* var. *bulbillifera*
Juncaceae		
	*	*Juncus bufonius*
		Juncus kraussii subsp. *australiensis*
		Juncus pallidus
		Juncus sp.
Juncaginaceae		
		Cycnogeton lineare
		Triglochin mucronata
		Triglochin striata
Lauraceae		
		Cassytha racemosa
Loranthaceae		
		Nuytsia floribunda
Malvaceae		
	*	*Lagunaria patersonia*
Meliaceae		
	*	*Melia azedarach*
Myrtaceae		
		Eucalyptus gomphocephala
		Eucalyptus marginata
		Eucalyptus rudis
		Kunzea glabrescens
		Melaleuca cuticularis

		Melaleuca lanceolata
		Melaleuca rhaphiophylla
Oleaceae		
	*	*Olea europaea*
Orchidaceae		
		Caladenia sp.
	*	*Disa bracteata*
		Microtis media
Oxalidaceae		
	*	*Oxalis pes-caprae*
Papaveraceae		
	*	*Fumaria capreolata*
Poaceae		
	*	*Avena barbata*
	*	*Briza maxima*
	*	*Briza minor*
	*	*Bromus* sp.
	*	*Cortaderia selloana*
	*	*Cynodon dactylon*
	*	*Cynosurus echinatus*
	*	*Ehrharta calycina*
	*	*Ehrharta longiflora*
	*	*Eragrostis curvula*
	*	*Hordeum marinum*
	*	*Lagurus ovatus*
	*	*Lolium perenne*
	*	*Polypogon maritimus*
		Sporobolus virginicus
Polygonaceae		
	*	*Rumex crispus*
Primulaceae		
	*	*Lysimachia arvensis*
		Samolus junceus
		Samolus repens var. *paucifolius*
Proteaceae		
		Banksia attenuata
Restionaceae		
		Hypolaena exsulca
		Leptocarpus canus
Santalaceae		
		Exocarpos sparteus
Scrophulariaceae		
		Myoporum caprarioides
Solanaceae		
		Anthocercis ilicifolia subsp. *ilicifolia*
Tropaeolaceae		
	*	*Tropaeolum majus*
Typhaceae		
		Typha orientalis

Zamiaceae	
	Macrozamia riedlei

*=non-native, DP=declared pest, WoNS=Weed of National Significance

Appendix E

Species x Vegetation Unit Matrix

Species	Vegetation Unit							
	CoErM	E	Er	ErMr	Kg	TS	ErCoTS	Cleared
Acacia cyclops								X
Acacia longifolia				X				X
Acacia rostellifera								X
Acacia saligna				X				X
Anthocercis ilicifolia subsp. ilicifolia								X
Arctotheca calendula								X
Asparagus asparagioides				X				
Atriplex prostrata	X							X
Avena barbata				X				
Banksia attenuata								X
Briza maxima		X						X
Briza minor				X				
Bromus sp.				X				X
Caesia micrantha				X				
Carpobrotus edulis			X		X			X
Cassytha racemosa				X				
Casuarina obesa	X						X	
Centella asiatica				X				
Cortaderia selloana	X							
Corynotheca micrantha				X				
Cotula turbinata	X					X	X	
Cycnogeton lineare				X				
Cynodon dactylon				X				X
Cynosurus echinatus				X				X
Daucus glochidiatus				X				
Dianella revoluta				X				
Disa bracteata				X				
Ehrharta calycina	X	X		X	X		X	X
Ehrharta longiflora		X	X					X
Eragrostis curvula		X	X		X			X
Eucalyptus gomphocephala		X						X
Eucalyptus marginata		X						
Eucalyptus rudis	X			X			X	
Euphorbia terracina		X		X				X
Exocarpos sparteus				X				X
Ficinia nodosa				X				
Frankenia pauciflora						X		
Fumaria capreolata				X				
Gahnia trifida	X							
Haemodorum spicatum				X				
Hardenbergia comptoniana				X				X
Hordeum marinum	X					X	X	
Hypochaeris glabra								X
Hypolaena exsulca				X				
Isolepis cernua var. *cernua*				X				
Jacksonia furcellata					X			X
Jacksonia sternbergiana								X

Species	Vegetation Unit							
	CoErM	E	Er	ErMr	Kg	TS	ErCoTS	Cleared
Juncus bufonius			X					X
Juncus kraussii subsp. *australiensis*	X		X	X				
Juncus pallidus				X				
Juncus sp.	X			X				
Kunzea glabrescens	X			X	X			
Lagunaria patersonia								X
Lagurus ovatus				X				
Lathyrus latifolius				X				
Lepidosperma longitudinale			X	X				
Leptocarpus canus				X				
Lobelia anceps				X				
Lolium perenne			X	X		X		
Lotus angustissimus			X	X				
Lupinus angustifolius			X					
Lupinus cosentinii								X
Lysimachia arvensis				X				
Machaerina juncea	X			X				
Macrozamia riedlei				X				
Melaleuca cuticularis	X							
Melaleuca lanceolata				X				
Melaleuca rhaphiophylla	X		X	X				
Melia azedarach								X
Microtis media	X			X				
Monopsis debilis			X					
Moraea flaccida			X	X				
Myoporum caprarioides	X							
Nuytsia floribunda								X
Olea europaea								X
Oxalis pes-capre	X			X				
Patersonia occidentalis				X				
Petrorhagia dubia				X				
Polypogon maritimus			X			X	X	
Retama raetam								X
Rhagodia baccata subsp. baccata	X			X				
Rumex crispus	X							
Sagina apetala						X	X	
Salicornia quinqueflora	X			X		X		
Samolus junceus	X							
Samolus repens var. paucifolius						X		
Schinus terebinthifolius	X			X				
Sonchus oleraceus								X
Sowerbaea laxiflora	X							
Sporobolus virginicus	X							
Suaeda australis	X			X		X	X	
Tecticornia indica subsp. bidens	X			X				
Tecticornia pergranulata subsp. pergranulata						X		

Species	Vegetation Unit							
	CoErM	**E**	**Er**	**ErMr**	**Kg**	**TS**	**ErCoTS**	**Cleared**
Tecticornia syncarpa						X		
Tecticornia halocnemoides						X	X	
Trachyandra divaricata				X				
Trifolium campestre				X				
Triglochin mucronata						X	X	
Triglochin striata				X				
Tropaeolum majus				X				
Typha orientalis				X				
Ursinia anthemoides				X				X
Vicia sativa	X							
Viminaria juncea				X				
Washingtonia sp.	X							
Watsonia meriana var. bulbillifera				X				

Appendix F

Sample Data

Vegetation Sample Data

28 Placid Waters Parade Coodanup

Sample Name: Q1

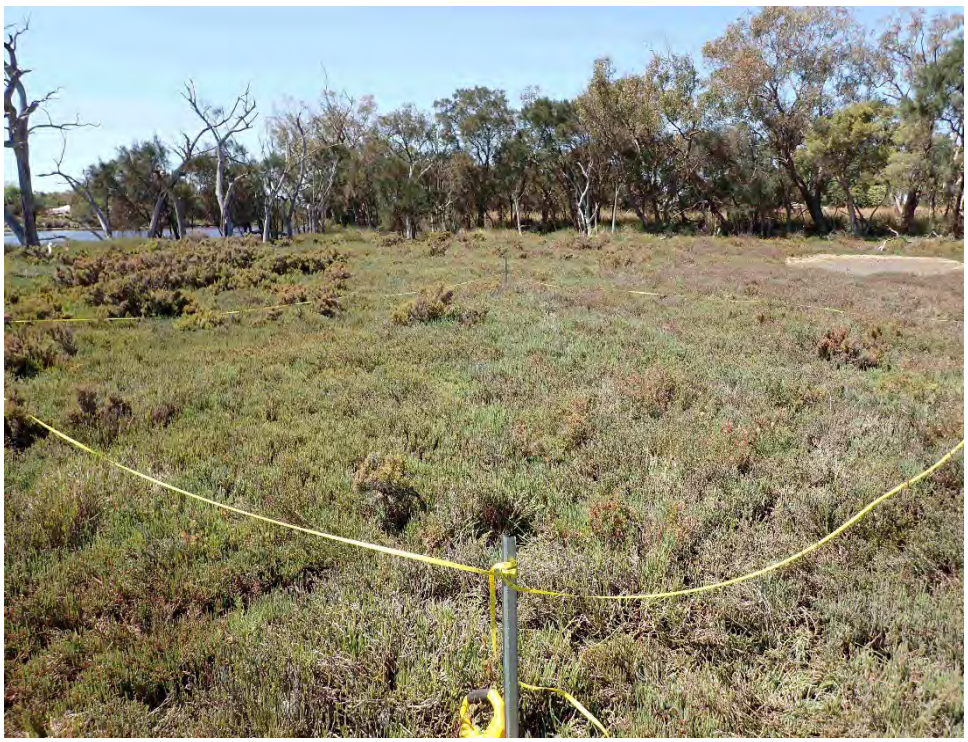
Project no.: EP23-081

Date: 12/10/2023, 16/11/2023 **Status** Permanent

Author: SKP,TDP Q1: Page 1 of 2

Quadrat and landform details

Sample type:	quadrat	Size:	10 m x 10 m
NW corner easting:	383535.357	NW corner northing:	6396441.813
Altitude (m):	-8	Geographic datum/zone:	GDA94/Zone 50
Soil water content:	damp	Landform:	flat
Time since fire:	no evidence	Disturbance:	low - 4wd tracks nearby
Soil type/texture	clay/ with organic layer	Bare ground (%):	1
Rocks (%) and type:	No rocks	Soil colour:	brown/black
Litter:	1% (leaves,twigs,)	Vegetation condition:	very good



Vegetation Sample Data

28 Placid Waters Parade Coodanup

Sample Name: Q1

Project no.: EP23-081

Date: 12/10/2023, 16/11/2023 **Status** Permanent

Author: SKP,TDP Q1: Page 2 of 2

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
	Salicornia quinqueflora	80
	Samolus repens var. paucifolius	2
	Suaeda australis	5
	Tecticornia halocnemoides	7

Vegetation Sample Data

28 Placid Waters Parade Coodanup

Sample Name: R2

Project no.: EP23-081

Date: 12/10/2023, 16/11/2023 **Status** Non-permanent

Author: SKP,TDP R2: Page 1 of 2

Quadrat and landform details

Sample type:	releve	Size:	other
NW corner easting:	383546.6854	NW corner northing:	6396404.357
Altitude (m):	-9	Geographic datum/zone:	GDA94/Zone 50
Soil water content:	damp	Landform:	flat
Time since fire:	0	Disturbance:	moderate - clearing to south
Soil type/texture	sand/	Bare ground (%):	2
Rocks (%) and type:	No rocks	Soil colour:	brown/
Litter:	5% (leaves,twigs,bark)	Vegetation condition:	good

Vegetation Sample Data
28 Placid Waters Parade Coodanup

Sample Name: R2

Project no.: EP23-081
Date: 12/10/2023, 16/11/2023 **Status** Permanent
Author: SKP,TDP R2: Page 2 of 2

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
	Casuarina obesa	
*	*Cortaderia selloana*	
*	*Ehrharta calycina*	opp
	Eucalyptus rudis	opp
	Gahnia trifida	
	Jacksonia furcellata	
	Juncus kraussii subsp. *australiensis*	opp
	Kunzea glabrescens	opp
	Melaleuca rhaphiophylla	opp
	Myoporum caprarioides	
	Rhagodia baccata subsp. *baccata*	opp
	Suaeda australis	

Vegetation Sample Data

28 Placid Waters Parade Coodanup

Sample Name: Q3

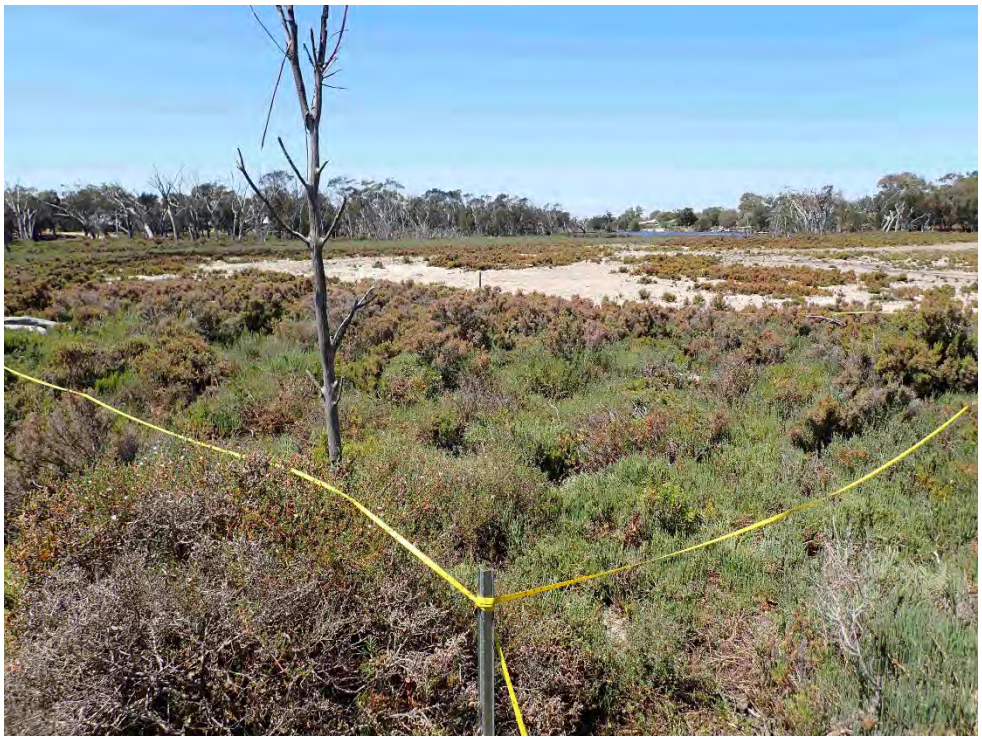
Project no.: EP23-081

Date: 12/10/2023, 16/11/2023 **Status** Permanent

Author: SKP,TDP Q3: Page 1 of 2

Quadrat and landform details

Sample type:	quadrat	Size:	10 m x 10 m
NW corner easting:	383484.882	NW corner northing:	6396583.26
Altitude (m):	-3	Geographic datum/zone:	GDA94/Zone 50
Soil water content:	damp	Landform:	flat
Time since fire:	no evidence	Disturbance:	low-moderate - 4wd tracks nearby, tracks
Soil type/texture	clay/ with organic layer	Bare ground (%):	2
Rocks (%) and type:	No rocks	Soil colour:	brown/grey
Litter:	5% (branches,twigs,leaves)	Vegetation condition:	very good



Vegetation Sample Data

28 Placid Waters Parade Coodanup

Sample Name: Q3

Project no.: EP23-081

Date: 12/10/2023, 16/11/2023 **Status** Permanent

Author: SKP,TDP Q3: Page 2 of 2

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
	Frankenia pauciflora	15
	Salicornia quinqueflora	40
	Samolus repens var. paucifolius	1
	Suaeda australis	5
	Tecticornia syncarpa	5
	Tecticornia halocnemoides	50
	Tecticornia halocnemoides	3
	Triglochin mucronata	0.5

Vegetation Sample Data

28 Placid Waters Parade Coodanup

Sample Name: R4

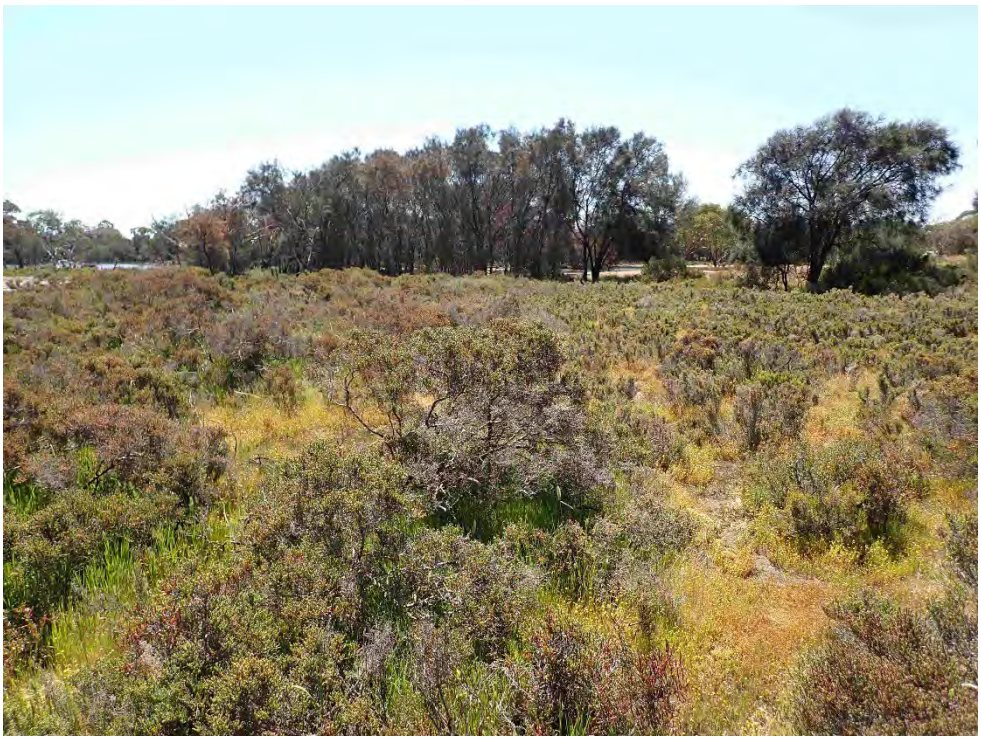
Project no.: EP23-081

Date: 12/10/2023, 16/11/2023 **Status** Non-permanent

Author: SKP,TDP R4: Page 1 of 2

Quadrat and landform details

Sample type:	releve	Size:	other
NW corner easting:	383153.5798	NW corner northing:	6396618.309
Altitude (m):	0	Geographic datum/zone:	GDA94/Zone 50
Soil water content:	damp	Landform:	flat
Time since fire:	0	Disturbance:	low - weeds
Soil type/texture	clay/	Bare ground (%):	2
Rocks (%) and type:	No rocks	Soil colour:	brown/grey
Litter:	1% (branches,twigs,leaves)	Vegetation condition:	degraded-good



Vegetation Sample Data
28 Placid Waters Parade Coodanup

Sample Name: R4

Project no.: EP23-081
Date: 12/10/2023, 16/11/2023 **Status** Permanent
Author: SKP,TDP R4: Page 2 of 2

Species Data

* denotes non-native species

Status	Confirmed name
*	*Cotula turbinata*
*	*Hordeum marinum*
*	*Lolium perenne*
*	*Polypogon maritimus*
*	*Sagina apetala*
	Tecticornia syncarpa
	Tecticornia halocnemoides
	Triglochin mucronata

Vegetation Sample Data

28 Placid Waters Parade Coodanup

Sample Name: Q5

Project no.: EP23-081

Date: 12/10/2023, 16/11/2023 **Status** Non-permanent

Author: SKP,TDP Q5: Page 1 of 2

Quadrat and landform details

Sample type:	quadrat	Size:	other
NW corner easting:	383034.9139	NW corner northing:	6396640.649
Altitude (m):	1	Geographic datum/zone:	GDA94/Zone 50
Soil water content:	damp	Landform:	flat
Time since fire:	0	Disturbance:	low - weeds
Soil type/texture	sand/	Bare ground (%):	1
Rocks (%) and type:	No rocks	Soil colour:	brown/grey
Litter:	15% (branches,twigs,leaves)	Vegetation condition:	very good

Vegetation Sample Data

28 Placid Waters Parade Coodanup

Sample Name: Q5

Project no.: EP23-081

Date: 12/10/2023, 16/11/2023 **Status** Permanent

Author: SKP,TDP Q5: Page 2 of 2

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
	Casuarina obesa	30
	Eucalyptus rudis	20
	Gahnia trifida	3
	Juncus sp.	3
	Machaerina juncea	50
	Melaleuca cuticularis	5
*	*Oxalis pes-capre*	1
*	*Schinus terebinthifolius*	2
	Tecticornia indica subsp. bidens	1

Vegetation Sample Data

28 Placid Waters Parade Coodanup

Sample Name: R6

Project no.: EP23-081

Date: 12/10/2023, 16/11/2023 **Status** Non-permanent

Author: SKP,TDP R6: Page 1 of 2

Quadrat and landform details

Sample type:	releve	Size:	other
NW corner easting:	383452.665	NW corner northing:	6396350.704
Altitude (m):	3	Geographic datum/zone:	GDA94/Zone 50
Soil water content:	dry	Landform:	depression
Time since fire:	0	Disturbance:	moderate - weeds
Soil type/texture	sand/ with organic layer	Bare ground (%):	5
Rocks (%) and type:	No rocks	Soil colour:	brown/grey
Litter:	10% (branches,twigs,leaves)	Vegetation condition:	degraded-good

Vegetation Sample Data
28 Placid Waters Parade Coodanup

Sample Name: R6

Project no.: EP23-081
Date: 12/10/2023, 16/11/2023 **Status** Permanent
Author: SKP,TDP R6: Page 2 of 2

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
*	*Acacia longifolia*	
	Acacia saligna	
*	*Briza minor*	
	Dianella revoluta	
*	*Ehrharta calycina*	
	Eucalyptus rudis	
	Ficinia nodosa	
	Hardenbergia comptoniana	
	Kunzea glabrescens	
	Lepidosperma longitudinale	
*	*Lotus angustissimus*	
	Melaleuca rhaphiophylla	
*	*Watsonia meriana var. bulbillifera*	

Vegetation Sample Data
28 Placid Waters Parade Coodanup

Sample Name: R7

Project no.: EP23-081
Date: 12/10/2023, 16/11/2023
Status Non-permanent
Author: SKP,TDP
R7: Page 1 of 2

Quadrat and landform details

Sample type:	releve	Size:	other
NW corner easting:	383416.9134	NW corner northing:	6396228.099
Altitude (m):	3	Geographic datum/zone:	GDA94/Zone 50
Soil water content:	damp	Landform:	waterway
Time since fire:	0	Disturbance:	moderate - weeds
Soil type/texture	sand/ with organic layer	Bare ground (%):	2
Rocks (%) and type:	No rocks	Soil colour:	brown/grey
Litter:	10% (branches,twigs,leaves)	Vegetation condition:	good

Vegetation Sample Data
28 Placid Waters Parade Coodanup

Sample Name: R7

Project no.: EP23-081
Date: 12/10/2023, 16/11/2023 **Status** Permanent
Author: SKP,TDP R7: Page 2 of 2

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
*	*Briza minor*	
*	*Ehrharta calycina*	
	Eucalyptus rudis	
	Ficinia nodosa	
	Hypolaena exsulca	
	Juncus kraussii subsp. australiensis	
*	*Lathyrus latifolius*	
	Lepidosperma longitudinale	
	Leptocarpus canus	
*	*Lolium perenne*	
*	*Lotus angustissimus*	
	Melaleuca rhaphiophylla	
	Suaeda australis	
	Tecticornia indica subsp. bidens	
*	*Ursinia anthemoides*	

Vegetation Sample Data
28 Placid Waters Parade Coodanup

Sample Name: R8

Project no.: EP23-081
Date: 12/10/2023, 16/11/2023 **Status** Non-permanent
Author: SKP,TDP R8: Page 1 of 2

Quadrat and landform details

Sample type:	releve	Size:	other
NW corner easting:	383367.7982	NW corner northing:	6396212.779
Altitude (m):	3	Geographic datum/zone:	GDA94/Zone 50
Soil water content:	damp	Landform:	waterway
Time since fire:	0	Disturbance:	moderate - weeds
Soil type/texture	sand/ with organic layer	Bare ground (%):	2
Rocks (%) and type:	No rocks	Soil colour:	brown/grey
Litter:	10% (branches,twigs,leaves)	Vegetation condition:	good-very good

Vegetation Sample Data
28 Placid Waters Parade Coodanup

Sample Name: R8

Project no.: EP23-081
Date: 12/10/2023, 16/11/2023 **Status** Permanent
Author: SKP,TDP R8: Page 2 of 2

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
	Anthocercis ilicifolia subsp. ilicifolia	opp
	Cassytha racemosa	
	Corynotheca micrantha	opp
	Cycnogeton lineare	
*	*Cynodon dactylon*	
	Eucalyptus rudis	
*	*Euphorbia terracina*	
	Juncus kraussii subsp. australiensis	
	Juncus sp.	
*	*Lagurus ovatus*	
*	*Lysimachia arvensis*	
	Macrozamia riedlei	opp
	Melaleuca lanceolata	
	Melaleuca rhaphiophylla	
*	*Petrorhagia dubia*	
	Salicornia quinqueflora	
*	*Schinus terebinthifolius*	opp
	Suaeda australis	
*	*Trachyandra divaricata*	opp
*	*Trifolium campestre*	
	Triglochin striata	

Vegetation Sample Data
28 Placid Waters Parade Coodanup

Sample Name: Q9

Project no.: EP23-081
Date: 12/10/2023, 16/11/2023 **Status** Non-permanent
Author: SKP,TDP Q9: Page 1 of 2

Quadrat and landform details

Sample type:	quadrat	Size:	other
NW corner easting:	383254.1195	NW corner northing:	6396298.935
Altitude (m):	3	Geographic datum/zone:	GDA94/Zone 50
Soil water content:	damp	Landform:	waterway
Time since fire:	0	Disturbance:	moderate - weeds
Soil type/texture	sand/ with organic layer	Bare ground (%):	1
Rocks (%) and type:	No rocks	Soil colour:	brown/grey
Litter:	10% (branches,twigs,leaves)	Vegetation condition:	very good

Vegetation Sample Data
28 Placid Waters Parade Coodanup

Sample Name: Q9

Project no.: EP23-081
Date: 12/10/2023, 16/11/2023 **Status** Permanent
Author: SKP,TDP Q9: Page 2 of 2

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
	Acacia rostellifera	opp
*	*Avena barbata*	2
	Banksia attenuata	opp
*	*Briza minor*	0.5
*	*Bromus sp.*	1
*	*Cynodon dactylon*	5
	Eucalyptus rudis	15
	Exocarpos sparteus	opp
*	*Fumaria capreolata*	2
	Haemodorum spicatum	opp
	Hardenbergia comptoniana	opp
	Isolepis cernua var. cernua	2
	Juncus kraussii subsp. australiensis	10
	Juncus pallidus	5
	Lepidosperma longitudinale	20
	Machaerina juncea	15
	Melaleuca rhaphiophylla	20
*	*Oxalis pes-capre*	2
	Rhagodia baccata subsp. baccata	opp
*	*Tropaeolum majus*	opp

Vegetation Sample Data
28 Placid Waters Parade Coodanup

Sample Name: R10

Project no.: EP23-081
Date: 12/10/2023, 16/11/2023 **Status** Non-permanent
Author: SKP,TDP R10: Page 1 of 2

Quadrat and landform details

Sample type:	releve	Size:	other
NW corner easting:	383282.845	NW corner northing:	6396532.559
Altitude (m):	0	Geographic datum/zone:	GDA94/Zone 50
Soil water content:	damp	Landform:	flat
Time since fire:	no evidence	Disturbance:	moderate - weeds
Soil type/texture	clay/silt with organic layer	Bare ground (%):	30
Rocks (%) and type:	No rocks	Soil colour:	black/
Litter:	20% (bark,branches,)	Vegetation condition:	good

Vegetation Sample Data

28 Placid Waters Parade Coodanup

Sample Name: R10

Project no.: EP23-081

Date: 12/10/2023, 16/11/2023 **Status** Permanent

Author: SKP,TDP R10: Page 2 of 2

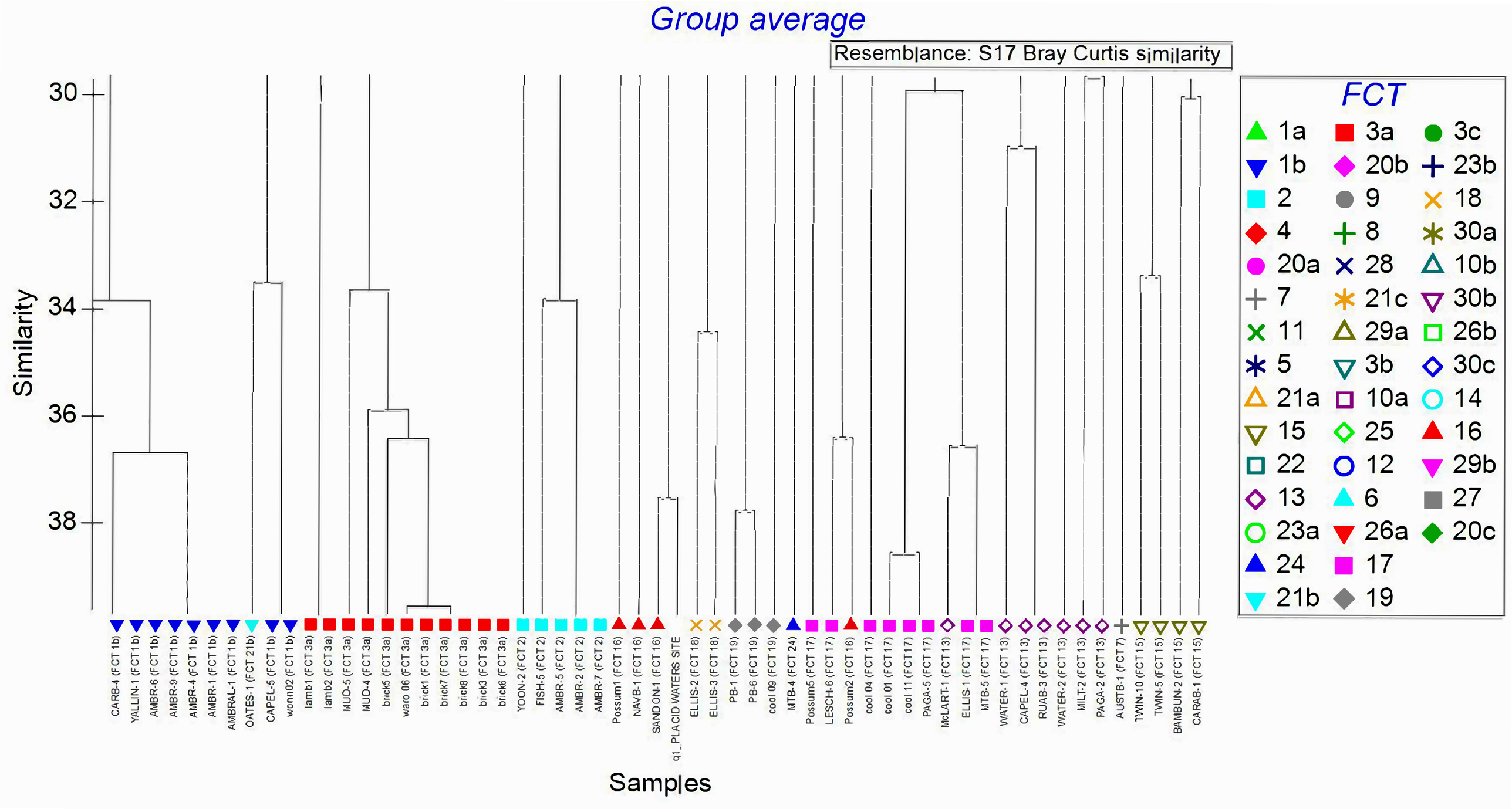
Species Data

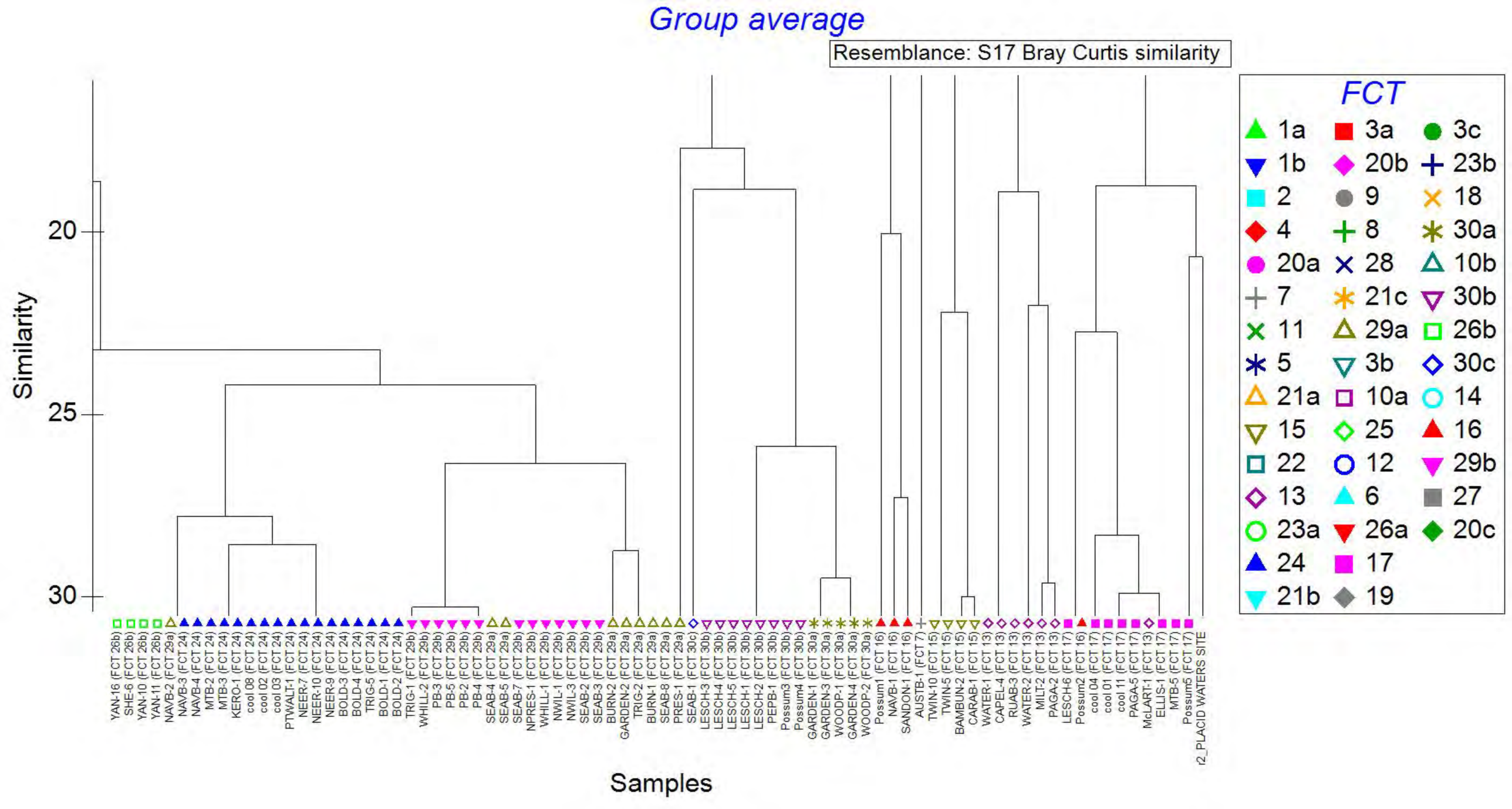
* denotes non-native species

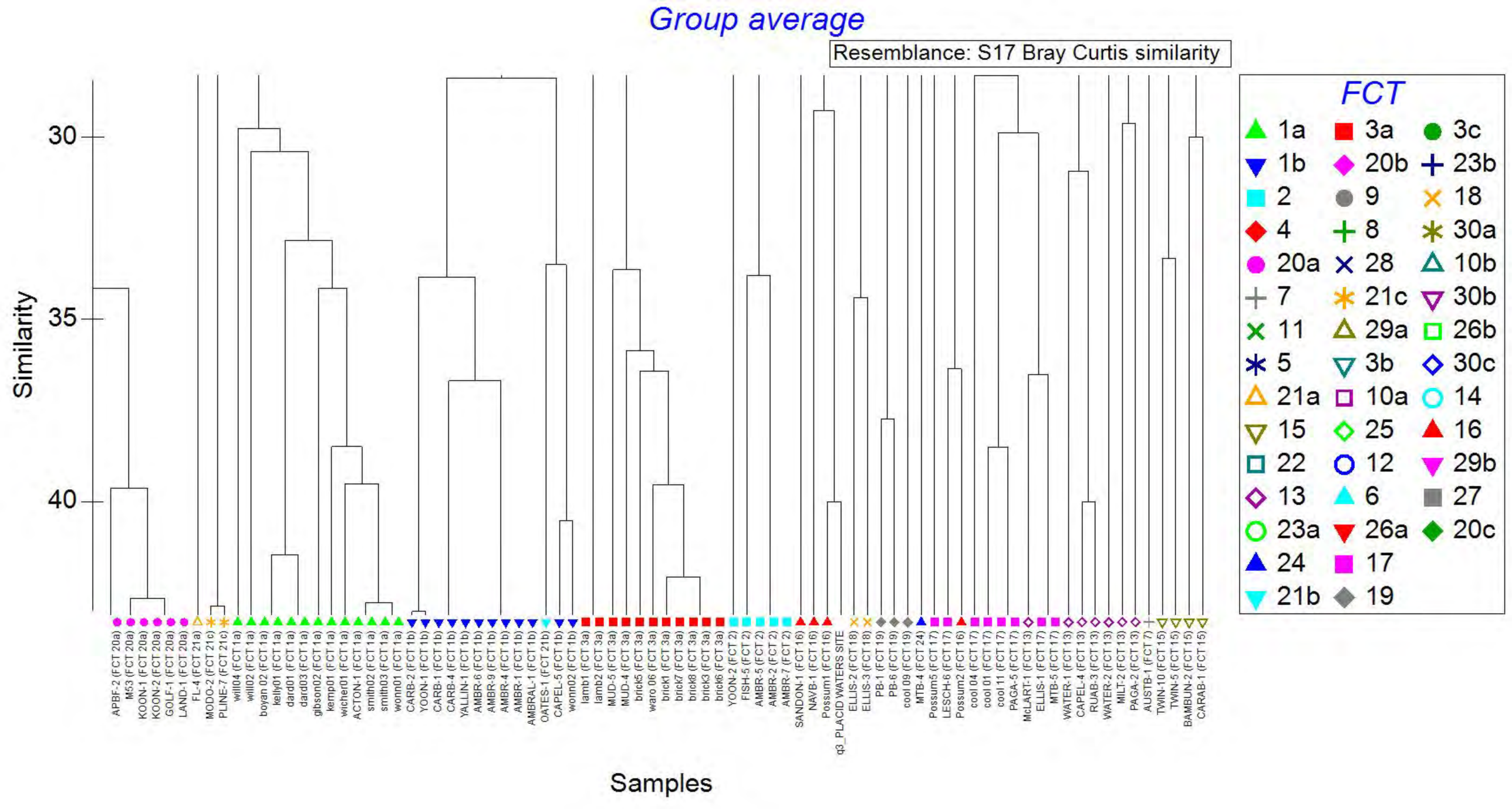
Status	Confirmed name	Cover (%)
	Casuarina obesa	
	Juncus kraussii subsp. australiensis	
	Melaleuca cuticularis	
	Melaleuca rhaphiophylla	opp
	Salicornia quinqueflora	
	Suaeda australis	

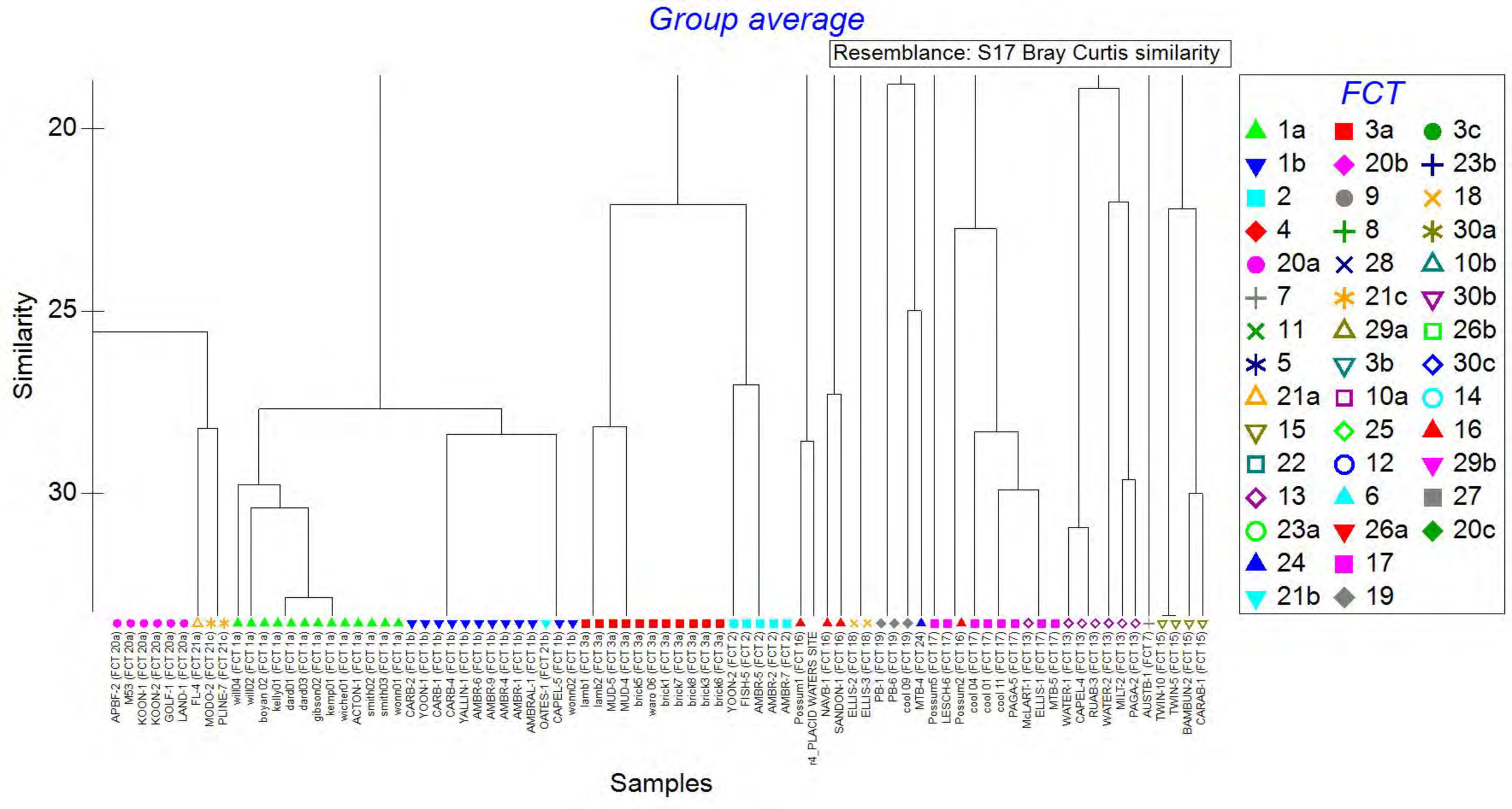
Appendix G

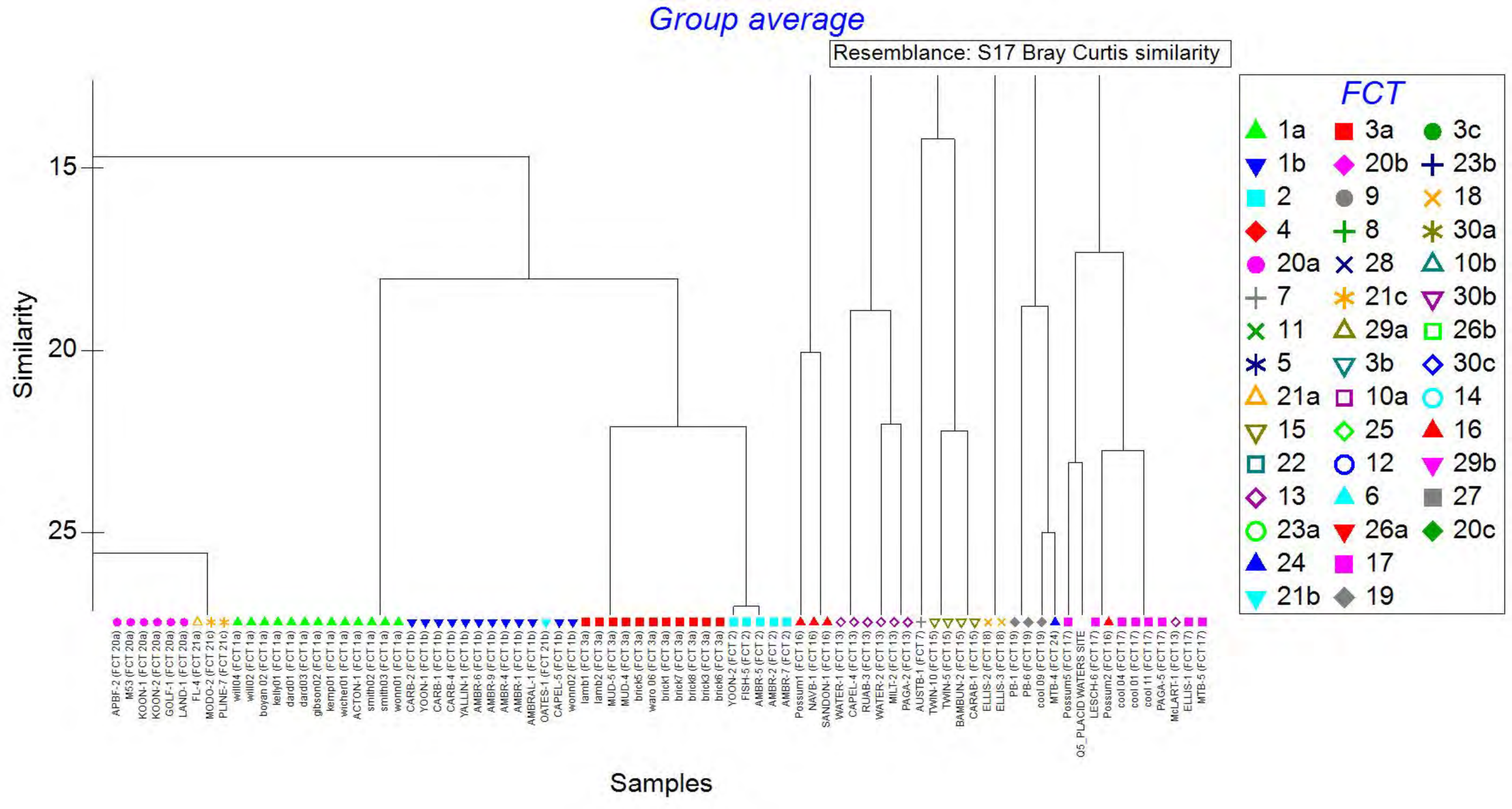
Cluster Dendrograms

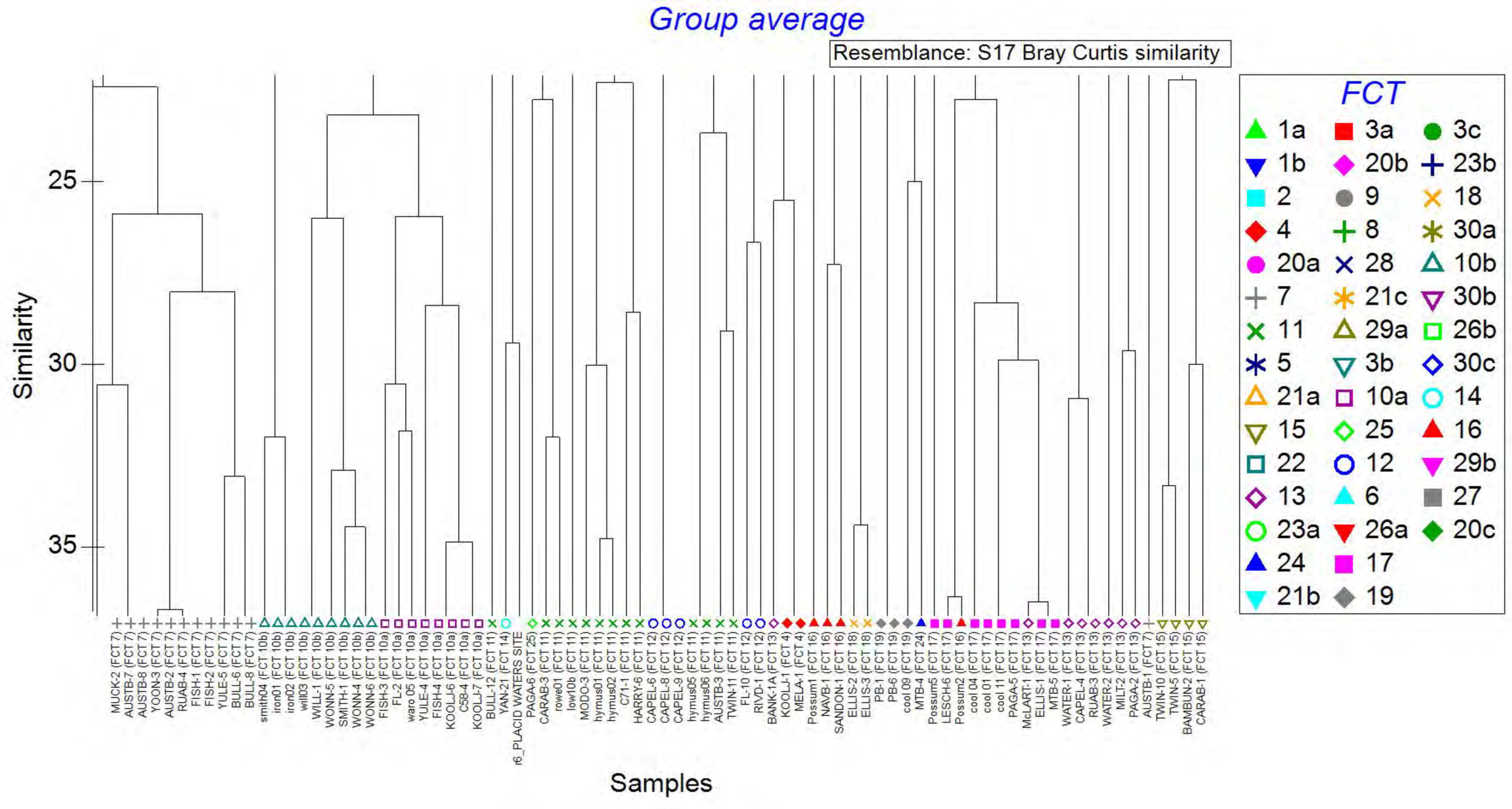

Group average
Resemblance: S17 Bray Curtis similarity
Similarity
30
32
34
36
38
Samples
CARB-4 (FCT 1b)
YALLIN-1 (FCT 1b)
AMBR-6 (FCT 1b)
AMBR-9 (FCT 1b)
AMBR-4 (FCT 1b)
AMBR-1 (FCT 1b)
AMBRAL-1 (FCT 1b)
OATES-1 (FCT 21b)
CAPEL-5 (FCT 1b)
wonn02 (FCT 1b)
lamb1 (FCT 3a)
lamb2 (FCT 3a)
MUD-5 (FCT 3a)
MUD-4 (FCT 3a)
brick5 (FCT 3a)
waro 06 (FCT 3a)
brick1 (FCT 3a)
brick7 (FCT 3a)
brick8 (FCT 3a)
brick3 (FCT 3a)
brick6 (FCT 3a)
YOON-2 (FCT 2)
FISH-5 (FCT 2)
AMBR-5 (FCT 2)
AMBR-2 (FCT 2)
AMBR-7 (FCT 2)
Possum1 (FCT 16)
NAVB-1 (FCT 16)
SANDON-1 (FCT 16)
q1_PLACID WATERS SITE
ELLIS-2 (FCT 18)
ELLIS-3 (FCT 18)
PB-1 (FCT 19)
PB-6 (FCT 19)
cool 09 (FCT 19)
MTB-4 (FCT 24)
Possum5 (FCT 17)
LESCH-6 (FCT 17)
Possum2 (FCT 16)
cool 04 (FCT 17)
cool 01 (FCT 17)
cool 11 (FCT17)
PAGA-5 (FCT 17)
McLART-1 (FCT 13)
ELLIS-1 (FCT 17)
MTB-5 (FCT 17)
WATER-1 (FCT 13)
CAPEL-4 (FCT 13)
RUAB-3 (FCT 13)
WATER-2 (FCT 13)
MILT-2 (FCT 13)
PAGA-2 (FCT 13)
AUSTB-1 (FCT 7)
TWIN-10 (FCT 15)
TWIN-5 (FCT 15)
BAMBUN-2 (FCT 15)
CARAB-1 (FCT 15)
FCT
1a
3a
3c
1b
20b
23b
2
9
18
4
8
30a
20a
28
10b
7
21c
30b
11
29a
26b
5
3b
30c
21a
10a
14
15
25
16
22
12
29b
13
6
27
23a
26a
20c
24
17
21b
19

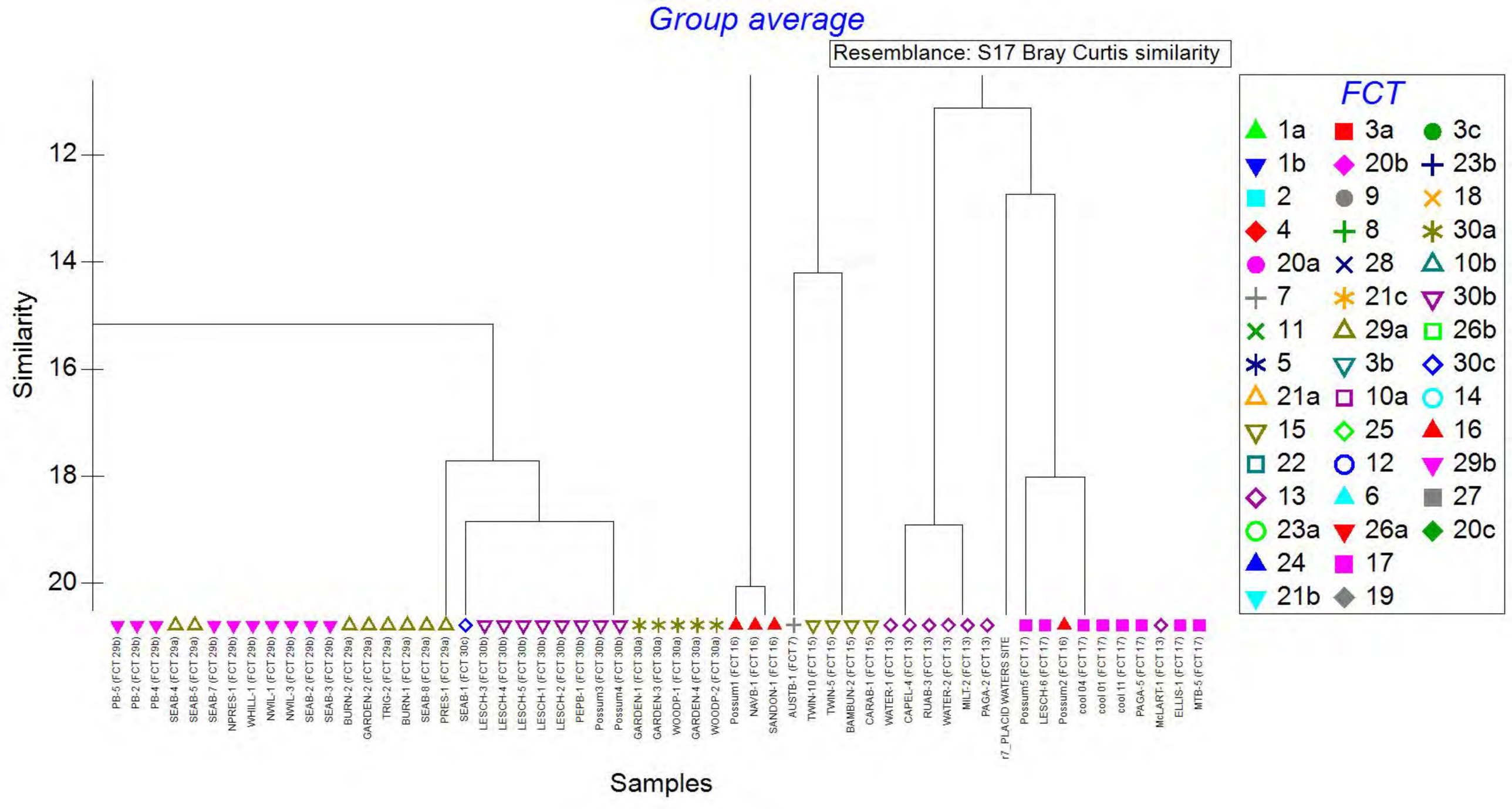

Group average
Resemblance: S17 Bray Curtis similarity
Similarity
20
25
30
Samples
FCT
1a
3a
3c
1b
20b
23b
2
9
18
4
8
30a
20a
28
10b
7
21c
30b
11
29a
26b
5
3b
30c
21a
10a
14
15
25
16
22
12
29b
13
6
27
23a
26a
20c
24
17
21b
19
YAN-16 (FCT 26b)
SHE-6 (FCT 26b)
YAN-10 (FCT 26b)
YAN-11 (FCT 26b)
NAVB-2 (FCT 29a)
NAVB-3 (FCT 24)
NAVB-4 (FCT 24)
MTB-2 (FCT 24)
MTB-3 (FCT 24)
KERO-1 (FCT 24)
cool 08 (FCT 24)
cool 02 (FCT 24)
cool 03 (FCT 24)
PTWALT-1 (FCT 24)
NEER-7 (FCT 24)
NEER-10 (FCT 24)
NEER-9 (FCT 24)
BOLD-3 (FCT 24)
BOLD-4 (FCT 24)
TRIG-5 (FCT 24)
BOLD-1 (FCT 24)
BOLD-2 (FCT 24)
TRIG-1 (FCT 29b)
WHILL-2 (FCT 29b)
PB-3 (FCT 29b)
PB-5 (FCT 29b)
PB-2 (FCT 29b)
PB-4 (FCT 29b)
SEAB-4 (FCT 29a)
SEAB-5 (FCT 29a)
SEAB-7 (FCT 29b)
NPRES-1 (FCT 29b)
WHILL-1 (FCT 29b)
NWIL-1 (FCT 29b)
NWIL-3 (FCT 29b)
SEAB-2 (FCT 29b)
SEAB-3 (FCT 29b)
BURN-2 (FCT 29a)
GARDEN-2 (FCT 29a)
TRIG-2 (FCT 29a)
BURN-1 (FCT 29a)
SEAB-8 (FCT 29a)
PRES-1 (FCT 29a)
SEAB-1 (FCT 30c)
LESCH-3 (FCT 30b)
LESCH-4 (FCT 30b)
LESCH-5 (FCT 30b)
LESCH-1 (FCT 30b)
LESCH-2 (FCT 30b)
PEPB-1 (FCT 30b)
Possum3 (FCT 30b)
Possum4 (FCT 30b)
GARDEN-1 (FCT 30a)
GARDEN-3 (FCT 30a)
WOODP-1 (FCT 30a)
GARDEN-4 (FCT 30a)
WOODP-2 (FCT 30a)
Possum1 (FCT 16)
NAVB-1 (FCT 16)
SANDON-1 (FCT 16)
AUSTB-1 (FCT 7)
TWIN-10 (FCT 15)
TWIN-5 (FCT 15)
BAMBUN-2 (FCT 15)
CARAB-1 (FCT 15)
WATER-1 (FCT 13)
CAPEL-4 (FCT 13)
RUAB-3 (FCT 13)
WATER-2 (FCT 13)
MILT-2 (FCT 13)
PAGA-2 (FCT 13)
LESCH-6 (FCT 17)
Possum2 (FCT 16)
cool 04 (FCT 17)
cool 01 (FCT 17)
cool 11 (FCT 17)
PAGA-5 (FCT 17)
McLART-1 (FCT 13)
ELLIS-1 (FCT 17)
MTB-5 (FCT 17)
Possum5 (FCT 17)
r2_PLACID WATERS SITE

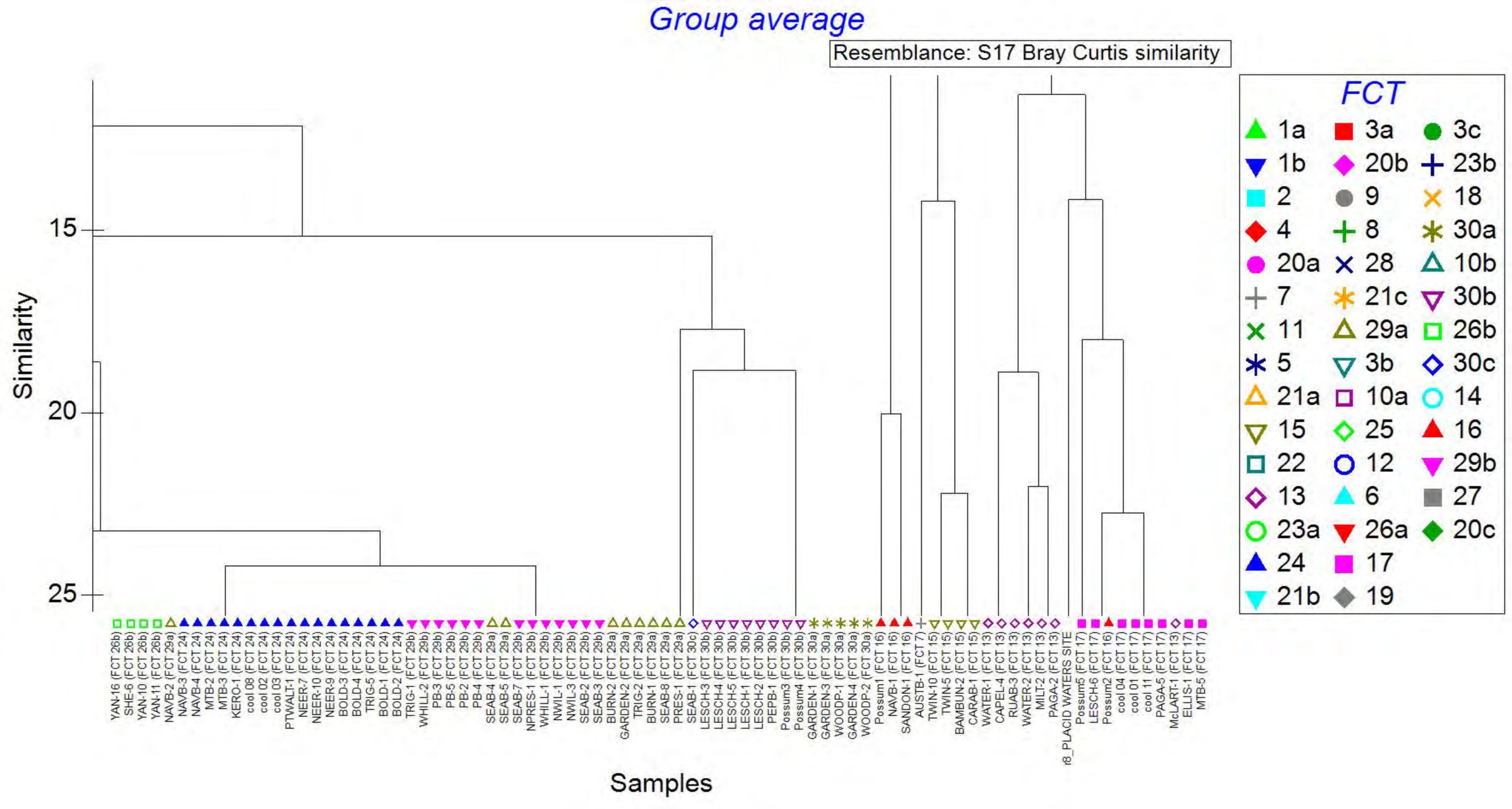

Group average
Resemblance: S17 Bray Curtis similarity
Similarity
30
35
40
Samples
FCT
1a
1b
2
4
20a
7
11
5
21a
15
22
13
23a
24
21b
3a
20b
9
8
28
21c
29a
3b
10a
25
12
6
26a
17
19
3c
23b
18
30a
10b
30b
26b
30c
14
16
29b
27
20c
APBF-2 (FCT 20a)
M53 (FCT 20a)
KOON-1 (FCT 20a)
KOON-2 (FCT 20a)
GOLF-1 (FCT 20a)
LAND-1 (FCT 20a)
FL-4 (FCT 21a)
MODO-2 (FCT 21c)
PLINE-7 (FCT 21c)
will04 (FCT 1a)
will02 (FCT 1a)
boyan 02 (FCT 1a)
kelly01 (FCT 1a)
dard01 (FCT 1a)
dard03 (FCT 1a)
gibson02 (FCT 1a)
kemp01 (FCT 1a)
wicher01 (FCT 1a)
ACTON-1 (FCT 1a)
smith02 (FCT 1a)
smith03 (FCT 1a)
wonn01 (FCT 1a)
CARB-2 (FCT 1b)
YOON-1 (FCT 1b)
CARB-1 (FCT 1b)
CARB-4 (FCT 1b)
YALLIN-1 (FCT 1b)
AMBR-6 (FCT 1b)
AMBR-9 (FCT 1b)
AMBR-4 (FCT 1b)
AMBR-1 (FCT 1b)
AMBRAL-1 (FCT 1b)
OATES-1 (FCT 21b)
CAPEL-5 (FCT 1b)
wonn02 (FCT 1b)
lamb1 (FCT 3a)
lamb2 (FCT 3a)
MUD-5 (FCT 3a)
MUD-4 (FCT 3a)
brick5 (FCT 3a)
waro 06 (FCT 3a)
brick1 (FCT 3a)
brick7 (FCT 3a)
brick8 (FCT 3a)
brick3 (FCT 3a)
brick6 (FCT 3a)
YOON-2 (FCT 2)
FISH-5 (FCT 2)
AMBR-5 (FCT 2)
AMBR-2 (FCT 2)
AMBR-7 (FCT 2)
SANDON-1 (FCT 16)
NAVB-1 (FCT 16)
Possum1 (FCT 16)
q3_PLACID WATERS SITE
ELLIS-2 (FCT 18)
ELLIS-3 (FCT 18)
PB-1 (FCT 19)
PB-6 (FCT 19)
cool 09 (FCT 19)
MTB-4 (FCT 24)
Possum5 (FCT 17)
LESCH-6 (FCT 17)
Possum2 (FCT 16)
cool 04 (FCT 17)
cool 01 (FCT 17)
cool 11 (FCT 17)
PAGA-5 (FCT 17)
McLART-1 (FCT 13)
ELLIS-1 (FCT 17)
MTB-5 (FCT 17)
WATER-1 (FCT 13)
CAPEL-4 (FCT 13)
RUAB-3 (FCT 13)
WATER-2 (FCT 13)
MILT-2 (FCT 13)
PAGA-2 (FCT 13)
AUSTB-1 (FCT 7)
TWIN-10 (FCT 15)
TWIN-5 (FCT 15)
BAMBUN-2 (FCT 15)
CARAB-1 (FCT 15)


Group average
Resemblance: S17 Bray Curtis similarity
Similarity
20
25
30
Samples
FCT
1a
3a
3c
1b
20b
23b
2
9
18
4
8
30a
20a
28
10b
7
21c
30b
11
29a
26b
5
3b
30c
21a
10a
14
15
25
16
22
12
29b
13
6
27
23a
26a
20c
24
17
21b
19
APBF-2 (FCT 20a)
M53 (FCT 20a)
KOON-1 (FCT 20a)
KOON-2 (FCT 20a)
GOLF-1 (FCT 20a)
LAND-1 (FCT 20a)
FL-4 (FCT 21a)
MODO-2 (FCT 21c)
PLINE-7 (FCT 21c)
will04 (FCT 1a)
will02 (FCT 1a)
boyan 02 (FCT 1a)
kelly01 (FCT 1a)
dard01 (FCT 1a)
dard03 (FCT 1a)
gibson02 (FCT 1a)
kemp01 (FCT 1a)
wicher01 (FCT 1a)
ACTON-1 (FCT 1a)
smith02 (FCT 1a)
smith03 (FCT 1a)
wonn01 (FCT 1a)
CARB-2 (FCT 1b)
YOON-1 (FCT 1b)
CARB-1 (FCT 1b)
CARB-4 (FCT 1b)
YALLIN-1 (FCT 1b)
AMBR-6 (FCT 1b)
AMBR-9 (FCT 1b)
AMBR-4 (FCT 1b)
AMBR-1 (FCT 1b)
AMBRAL-1 (FCT 1b)
OATES-1 (FCT 21b)
CAPEL-5 (FCT 1b)
wonn02 (FCT 1b)
lamb1 (FCT 3a)
lamb2 (FCT 3a)
MUD-5 (FCT 3a)
MUD-4 (FCT 3a)
brick5 (FCT 3a)
waro 06 (FCT 3a)
brick1 (FCT 3a)
brick7 (FCT 3a)
brick8 (FCT 3a)
brick3 (FCT 3a)
brick6 (FCT 3a)
YOON-2 (FCT 2)
FISH-5 (FCT 2)
AMBR-5 (FCT 2)
AMBR-2 (FCT 2)
AMBR-7 (FCT 2)
Possum1 (FCT 16)
r4_PLACID WATERS SITE
NAVB-1 (FCT 16)
SANDON-1 (FCT 16)
ELLIS-2 (FCT 18)
ELLIS-3 (FCT 18)
PB-1 (FCT 19)
PB-6 (FCT 19)
cool 09 (FCT 19)
MTB-4 (FCT 24)
Possum5 (FCT 17)
LESCH-6 (FCT 17)
Possum2 (FCT 16)
cool 04 (FCT 17)
cool 01 (FCT 17)
cool 11 (FCT 17)
PAGA-5 (FCT 17)
McLART-1 (FCT 13)
ELLIS-1 (FCT 17)
MTB-5 (FCT 17)
WATER-1 (FCT 13)
CAPEL-4 (FCT 13)
RUAB-3 (FCT 13)
WATER-2 (FCT 13)
MILT-2 (FCT 13)
PAGA-2 (FCT 13)
AUSTB-1 (FCT 7)
TWIN-10 (FCT 15)
TWIN-5 (FCT 15)
BAMBUN-2 (FCT 15)
CARAB-1 (FCT 15)


Group average
Resemblance: S17 Bray Curtis similarity
Similarity
15
20
25
Samples
FCT
1a
3a
3c
1b
20b
23b
2
9
18
4
8
30a
20a
28
10b
7
21c
30b
11
29a
26b
5
3b
30c
21a
10a
14
15
25
16
22
12
29b
13
6
27
23a
26a
20c
24
17
21b
19
APBF-2 (FCT 20a)
M53 (FCT 20a)
KOON-1 (FCT 20a)
KOON-2 (FCT 20a)
GOLF-1 (FCT 20a)
LAND-1 (FCT 20a)
FL-4 (FCT 21a)
MODO-2 (FCT 21c)
PLINE-7 (FCT 21c)
will04 (FCT 1a)
will02 (FCT 1a)
boyan 02 (FCT 1a)
kelly01 (FCT 1a)
dard01 (FCT 1a)
dard03 (FCT 1a)
gibson02 (FCT 1a)
kemp01 (FCT 1a)
wicher01 (FCT 1a)
ACTON-1 (FCT 1a)
smith02 (FCT 1a)
smith03 (FCT 1a)
wonn01 (FCT 1a)
CARB-2 (FCT 1b)
YOON-1 (FCT 1b)
CARB-1 (FCT 1b)
CARB-4 (FCT 1b)
YALLIN-1 (FCT 1b)
AMBR-6 (FCT 1b)
AMBR-9 (FCT 1b)
AMBR-4 (FCT 1b)
AMBR-1 (FCT 1b)
AMBRAL-1 (FCT 21b)
OATES-1 (FCT 21b)
CAPEL-5 (FCT 1b)
wonn02 (FCT 1b)
lamb1 (FCT 3a)
lamb2 (FCT 3a)
MUD-5 (FCT 3a)
MUD-4 (FCT 3a)
brick5 (FCT 3a)
waro 06 (FCT 3a)
brick1 (FCT 3a)
brick7 (FCT 3a)
brick8 (FCT 3a)
brick3 (FCT 3a)
brick6 (FCT 3a)
YOON-2 (FCT 2)
FISH-5 (FCT 2)
AMBR-5 (FCT 2)
AMBR-2 (FCT 2)
AMBR-7 (FCT 2)
Possum1 (FCT 16)
NAVB-1 (FCT 16)
SANDON-1 (FCT 16)
WATER-1 (FCT 13)
CAPEL-4 (FCT 13)
RUAB-3 (FCT 13)
WATER-2 (FCT 13)
MILT-2 (FCT 13)
PAGA-2 (FCT 13)
AUSTB-1 (FCT 7)
TWIN-10 (FCT 15)
TWIN-5 (FCT 15)
BAMBUN-2 (FCT 15)
CARAB-1 (FCT 15)
ELLIS-2 (FCT 18)
ELLIS-3 (FCT 18)
PB-1 (FCT 19)
PB-6 (FCT 19)
cool 09 (FCT 19)
MTB-4 (FCT 24)
Possum5 (FCT 17)
Q5_PLACID WATERS SITE
LESCH-6 (FCT 17)
Possum2 (FCT 16)
cool 04 (FCT 17)
cool 01 (FCT 17)
cool 11 (FCT 17)
PAGA-5 (FCT 17)
McLART-1 (FCT 13)
ELLIS-1 (FCT 17)
MTB-5 (FCT 17)


Group average
Resemblance: S17 Bray Curtis similarity
Similarity
25
30
35
Samples
FCT
1a
3a
3c
1b
20b
23b
2
9
18
4
8
30a
20a
28
10b
7
21c
30b
11
29a
26b
5
3b
30c
21a
10a
14
15
25
16
22
12
29b
13
6
27
23a
26a
20c
24
17
21b
19
MUCK-2 (FCT 7)
AUSTB-7 (FCT 7)
AUSTB-8 (FCT 7)
YOON-3 (FCT 7)
AUSTB-2 (FCT 7)
RUAB-4 (FCT 7)
FISH-1 (FCT 7)
FISH-2 (FCT 7)
YULE-5 (FCT 7)
BULL-6 (FCT 7)
BULL-8 (FCT 7)
smith04 (FCT 10b)
iron01 (FCT 10b)
iron02 (FCT 10b)
will03 (FCT 10b)
WILL-1 (FCT 10b)
WONN-5 (FCT 10b)
SMITH-1 (FCT 10b)
WONN-4 (FCT 10b)
WONN-6 (FCT 10b)
FISH-3 (FCT 10a)
FL-2 (FCT 10a)
waro 05 (FCT 10a)
YULE-4 (FCT 10a)
FISH-4 (FCT 10a)
KOOLJ-6 (FCT 10a)
C58-4 (FCT 10a)
KOOLJ-7 (FCT 10a)
BULL-12 (FCT 11)
YAN-21 (FCT 14)
r6_PLACID WATERS SITE
PAGA-6 (FCT 25)
CARAB-3 (FCT 11)
rowe01 (FCT 11)
low10b (FCT 11)
MODO-3 (FCT 11)
hymus01 (FCT 11)
hymus02 (FCT 11)
C71-1 (FCT 11)
HARRY-6 (FCT 11)
CAPEL-6 (FCT 12)
CAPEL-8 (FCT 12)
CAPEL-9 (FCT 12)
hymus05 (FCT 11)
hymus06 (FCT 11)
AUSTB-3 (FCT 11)
TWIN-11 (FCT 11)
FL-10 (FCT 12)
RIVD-1 (FCT 12)
BANK-1A (FCT 13)
KOOLJ-1 (FCT 4)
MELA-1 (FCT 4)
Possum1 (FCT 16)
NAVB-1 (FCT 16)
SANDON-1 (FCT 16)
ELLIS-2 (FCT 18)
ELLIS-3 (FCT 18)
PB-1 (FCT 19)
PB-6 (FCT 19)
cool09 (FCT 19)
MTB-4 (FCT 24)
Possum5 (FCT 17)
LESCH-6 (FCT 17)
Possum2 (FCT 16)
cool04 (FCT 17)
cool01 (FCT 17)
cool11 (FCT 17)
PAGA-5 (FCT 17)
McLART-1 (FCT 13)
ELLIS-1 (FCT 17)
MTB-5 (FCT 17)
WATER-1 (FCT 13)
CAPEL-4 (FCT 13)
RUAB-3 (FCT 13)
WATER-2 (FCT 13)
MILT-2 (FCT 13)
PAGA-2 (FCT 13)
AUSTB-1 (FCT 7)
TWIN-10 (FCT 15)
TWIN-5 (FCT 15)
BAMBUN-2 (FCT 15)
CARAB-1 (FCT 15)


Group average
Resemblance: S17 Bray Curtis similarity
Similarity
12
14
16
18
20
Samples
FCT
1a
3a
3c
1b
20b
23b
2
9
18
4
8
30a
20a
28
10b
7
21c
30b
11
29a
26b
5
3b
30c
21a
10a
14
15
25
16
22
12
29b
13
6
27
23a
26a
20c
24
17
21b
19
PB-5 (FCT 29b)
PB-2 (FCT 29b)
PB-4 (FCT 29b)
SEAB-4 (FCT 29a)
SEAB-5 (FCT 29a)
SEAB-7 (FCT 29b)
NPRES-1 (FCT 29b)
WHILL-1 (FCT 29b)
NWIL-1 (FCT 29b)
NWIL-3 (FCT 29b)
SEAB-2 (FCT 29b)
SEAB-3 (FCT 29b)
BURN-2 (FCT 29a)
GARDEN-2 (FCT 29a)
TRIG-2 (FCT 29a)
BURN-1 (FCT 29a)
SEAB-8 (FCT 29a)
PRES-1 (FCT 29a)
SEAB-1 (FCT 30c)
LESCH-3 (FCT 30b)
LESCH-4 (FCT 30b)
LESCH-5 (FCT 30b)
LESCH-1 (FCT 30b)
LESCH-2 (FCT 30b)
PEPB-1 (FCT 30b)
Possum3 (FCT 30b)
Possum4 (FCT 30b)
GARDEN-1 (FCT 30a)
GARDEN-3 (FCT 30a)
WOODP-1 (FCT 30a)
GARDEN-4 (FCT 30a)
WOODP-2 (FCT 30a)
Possum1 (FCT 16)
NAVB-1 (FCT 16)
SANDON-1 (FCT 16)
AUSTB-1 (FCT 7)
TWIN-10 (FCT 15)
TWIN-5 (FCT 15)
BAMBUN-2 (FCT 15)
CARAB-1 (FCT 15)
WATER-1 (FCT 13)
CAPEL-4 (FCT 13)
RUAB-3 (FCT 13)
WATER-2 (FCT 13)
MILT-2 (FCT 13)
PAGA-2 (FCT 13)
r7_PLACID WATERS SITE
Possum5 (FCT 17)
LESCH-6 (FCT 17)
Possum2 (FCT 16)
cool 04 (FCT 17)
cool 01 (FCT 17)
cool 11 (FCT 17)
PAGA-5 (FCT 17)
McLART-1 (FCT 13)
ELLIS-1 (FCT 17)
MTB-5 (FCT 17)


Group average
Resemblance: S17 Bray Curtis similarity
Similarity
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20
25
Samples
FCT
1a
3a
3c
1b
20b
23b
2
9
18
4
8
30a
20a
28
10b
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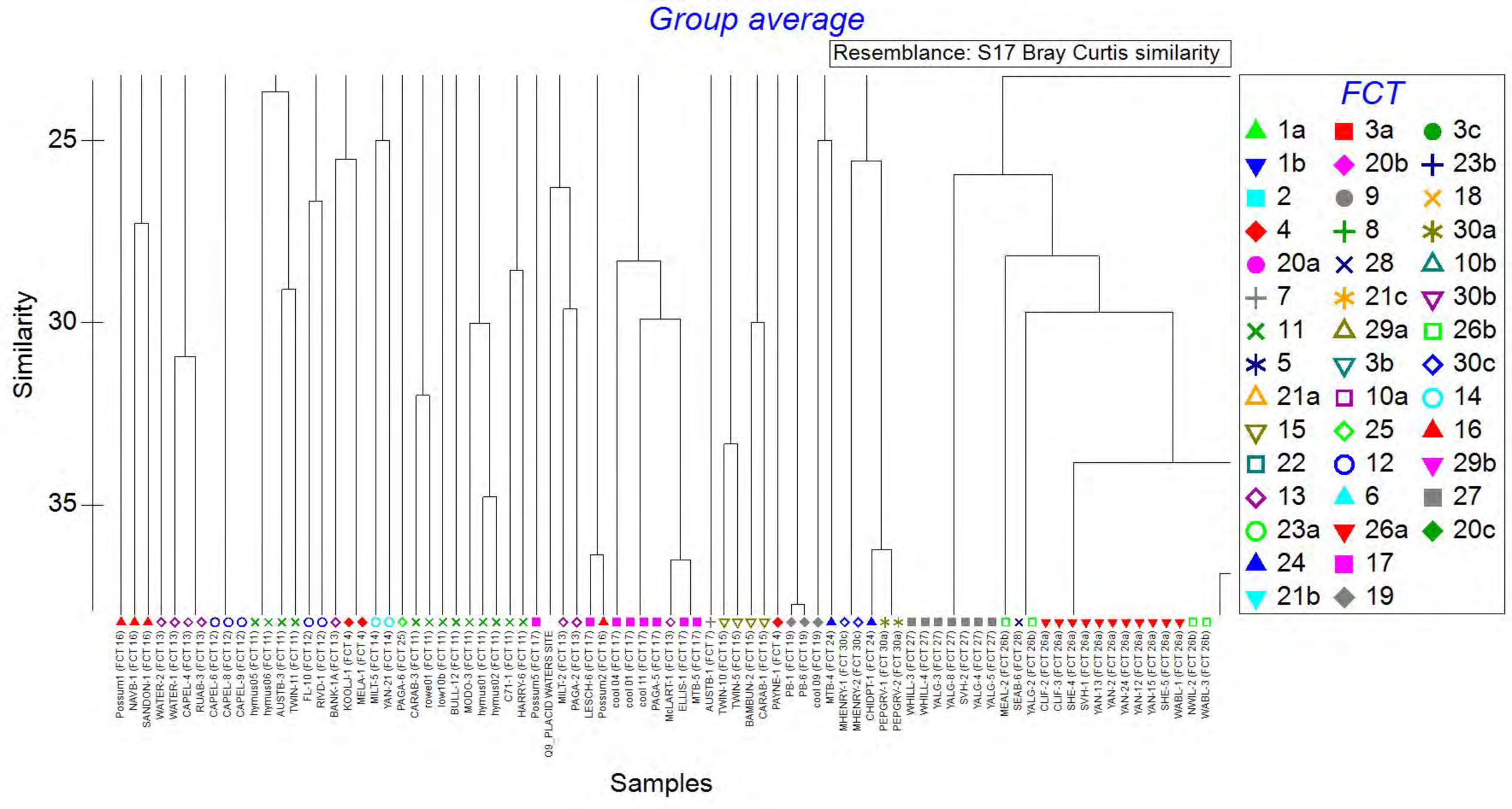
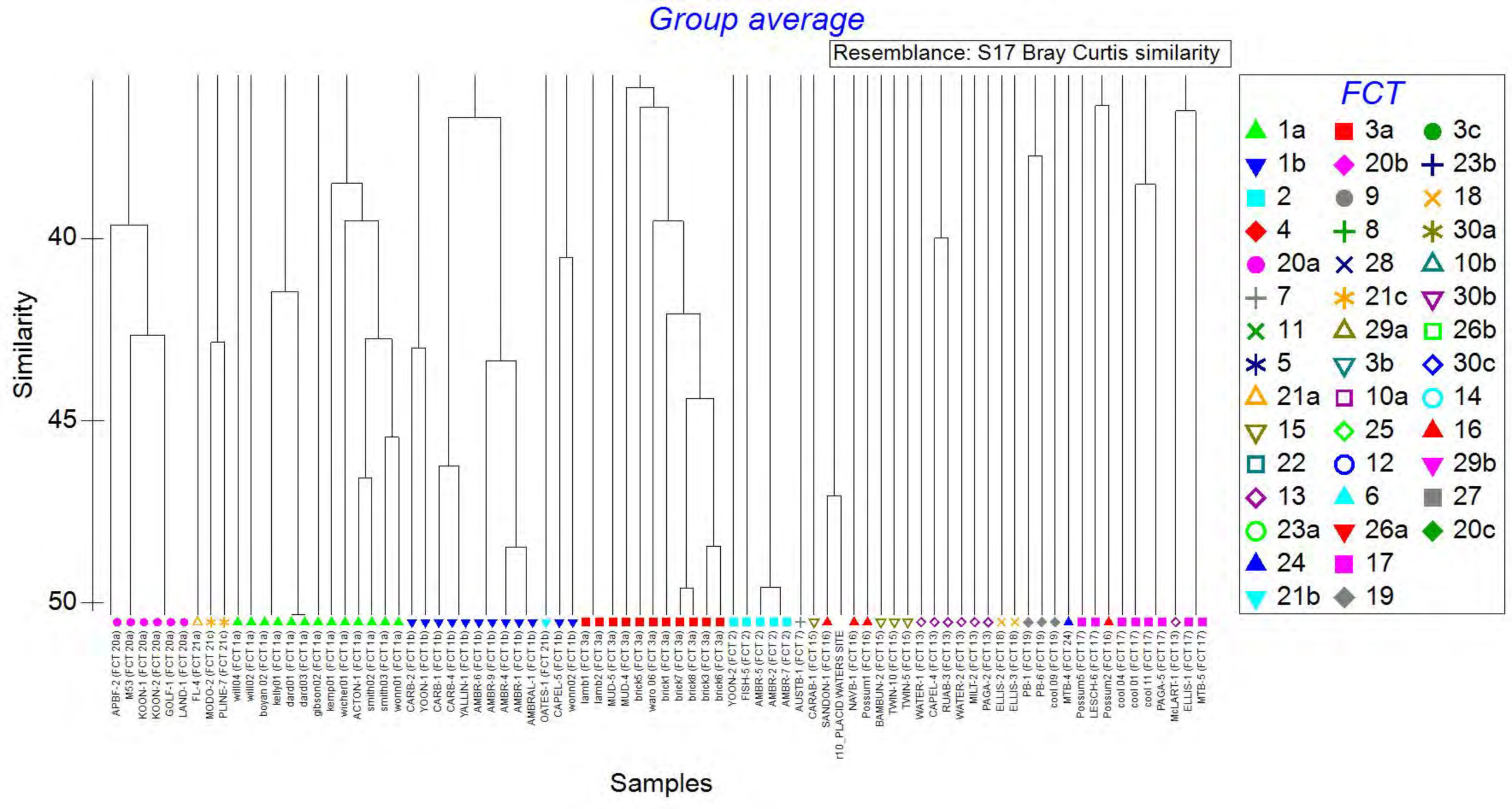
21c
30b
11
29a
26b
5
3b
30c
21a
10a
14
15
25
16
22
12
29b
13
6
27
23a
26a
20c
24
17
21b
19
YAN-16 (FCT 26b)
SHE-6 (FCT 26b)
YAN-10 (FCT 26b)
YAN-11 (FCT 26b)
NAVB-2 (FCT 29a)
NAVB-3 (FCT 24)
NAVB-4 (FCT 24)
MTB-2 (FCT 24)
MTB-3 (FCT 24)
KERO-1 (FCT 24)
cool 08 (FCT 24)
cool 02 (FCT 24)
cool 03 (FCT 24)
PTWALT-1 (FCT 24)
NEER-7 (FCT 24)
NEER-10 (FCT 24)
NEER-9 (FCT 24)
BOLD-3 (FCT 24)
BOLD-4 (FCT 24)
TRIG-5 (FCT 24)
BOLD-1 (FCT 24)
BOLD-2 (FCT 24)
TRIG-1 (FCT 29b)
WHILL-2 (FCT 29b)
PB-3 (FCT 29b)
PB-5 (FCT 29b)
PB-2 (FCT 29b)
PB-4 (FCT 29b)
SEAB-4 (FCT 29a)
SEAB-5 (FCT 29a)
SEAB-7 (FCT 29b)
NPRES-1 (FCT 29b)
WHILL-1 (FCT 29b)
NWIL-1 (FCT 29b)
NWIL-3 (FCT 29b)
SEAB-2 (FCT 29b)
SEAB-3 (FCT 29b)
BURN-2 (FCT 29a)
GARDEN-2 (FCT 29a)
TRIG-2 (FCT 29a)
BURN-1 (FCT 29a)
SEAB-8 (FCT 29a)
PRES-1 (FCT 29a)
SEAB-1 (FCT 30c)
LESCH-3 (FCT 30b)
LESCH-4 (FCT 30b)
LESCH-5 (FCT 30b)
LESCH-1 (FCT 30b)
LESCH-2 (FCT 30b)
PEPB-1 (FCT 30b)
Possum3 (FCT 30b)
Possum4 (FCT 30b)
GARDEN-1 (FCT 30a)
GARDEN-3 (FCT 30a)
WOODP-1 (FCT 30a)
GARDEN-4 (FCT 30a)
WOODP-2 (FCT 30a)
Possum1 (FCT 16)
NAVB-1 (FCT 16)
SANDON-1 (FCT 16)
AUSTB-1 (FCT 7)
TWIN-10 (FCT 15)
TWIN-5 (FCT 15)
BAMBUN-2 (FCT 15)
CARAB-1 (FCT 15)
WATER-1 (FCT 13)
CAPEL-4 (FCT 13)
RUAB-3 (FCT 13)
WATER-2 (FCT 13)
MILT-2 (FCT 13)
PAGA-2 (FCT 13)
r8_PLACID WATERS SITE
Possum5 (FCT 17)
LESCH-6 (FCT 17)
Possum2 (FCT 16)
cool 04 (FCT 17)
cool 01 (FCT 17)
cool 11 (FCT 17)
PAGA-5 (FCT 17)
McLART-1 (FCT 13)
ELLIS-1 (FCT 17)
MTB-5 (FCT 17)


Group average
Resemblance: S17 Bray Curtis similarity
Similarity
25
30
35
Samples
FCT
1a
1b
2
4
20a
7
11
5
21a
15
22
13
23a
24
21b
3a
20b
9
8
28
21c
29a
3b
10a
25
12
6
26a
17
19
3c
23b
18
30a
10b
30b
26b
30c
14
16
29b
27
20c
Possum1 (FCT 16)
NAVB-1 (FCT 16)
SANDON-1 (FCT 16)
WATER-2 (FCT 13)
WATER-1 (FCT 13)
CAPEL-4 (FCT 13)
RUAB-3 (FCT 13)
CAPEL-6 (FCT 12)
CAPEL-8 (FCT 12)
CAPEL-9 (FCT 12)
hymus05 (FCT 11)
hymus06 (FCT 11)
AUSTB-3 (FCT 11)
TWIN-11 (FCT 11)
FL-10 (FCT 12)
RIVD-1 (FCT 12)
BANK-1A (FCT 13)
KOOLJ-1 (FCT 4)
MELA-1 (FCT 4)
MILT-5 (FCT 14)
YAN-21 (FCT 14)
PAGA-6 (FCT 25)
CARAB-3 (FCT 11)
rowe01 (FCT 11)
low10b (FCT 11)
BULL-12 (FCT 11)
MODO-3 (FCT 11)
hymus01 (FCT 11)
hymus02 (FCT 11)
C71-1 (FCT 11)
HARRY-6 (FCT 11)
Possum5 (FCT 17)
Q9_PLACID WATERS SITE
MILT-2 (FCT 13)
PAGA-2 (FCT 13)
LESCH-6 (FCT 17)
Possum2 (FCT 16)
cool 04 (FCT 17)
cool 01 (FCT 17)
cool 11 (FCT 17)
PAGA-5 (FCT 17)
McLART-1 (FCT 13)
ELLIS-1 (FCT 17)
MTB-5 (FCT 17)
AUSTB-1 (FCT 7)
TWIN-10 (FCT 15)
TWIN-5 (FCT 15)
BAMBUN-2 (FCT 15)
CARAB-1 (FCT 15)
PAYNE-1 (FCT 4)
PB-1 (FCT 19)
PB-6 (FCT 19)
cool 09 (FCT 19)
MTB-4 (FCT 24)
MHENRY-1 (FCT 30c)
MHENRY-2 (FCT 30c)
CHIDPT-1 (FCT 24)
PEPGRV-1 (FCT 30a)
PEPGRV-2 (FCT 30a)
WHILL-3 (FCT 27)
WHILL-4 (FCT 27)
YALG-3 (FCT 27)
YALG-8 (FCT 27)
SVH-2 (FCT 27)
YALG-4 (FCT 27)
YALG-5 (FCT 27)
MEAL-2 (FCT 26b)
SEAB-6 (FCT 28)
YALG-2 (FCT 26b)
CLIF-2 (FCT 26a)
CLIF-3 (FCT 26a)
SHE-4 (FCT 26a)
SVH-1 (FCT 26a)
YAN-13 (FCT 26a)
YAN-2 (FCT 26a)
YAN-24 (FCT 26a)
YAN-12 (FCT 26a)
YAN-15 (FCT 26a)
SHE-5 (FCT 26a)
WABL-1 (FCT 26a)
NWIL-2 (FCT 26b)
WABL-3 (FCT 26b)


Group average
Resemblance: S17 Bray Curtis similarity
Similarity
40
45
50
Samples
FCT
1a
1b
2
4
20a
7
11
5
21a
15
22
13
23a
24
21b
3a
20b
9
8
28
21c
29a
3b
10a
25
12
6
26a
17
19
3c
23b
18
30a
10b
30b
26b
30c
14
16
29b
27
20c
APBF-2 (FCT 20a)
M53 (FCT 20a)
KOON-1 (FCT 20a)
KOON-2 (FCT 20a)
GOLF-1 (FCT 20a)
LAND-1 (FCT 20a)
FL-4 (FCT 21a)
MODO-2 (FCT 21c)
PLINE-7 (FCT 21c)
will04 (FCT 1a)
will02 (FCT 1a)
boyan 02 (FCT 1a)
kelly01 (FCT 1a)
dard01 (FCT 1a)
dard03 (FCT 1a)
gibson02 (FCT 1a)
kemp01 (FCT 1a)
wicher01 (FCT 1a)
ACTON-1 (FCT 1a)
smith02 (FCT 1a)
smith03 (FCT 1a)
wonn01 (FCT 1a)
CARB-2 (FCT 1b)
YOON-1 (FCT 1b)
CARB-1 (FCT 1b)
CARB-4 (FCT 1b)
YALLIN-1 (FCT 1b)
AMBR-6 (FCT 1b)
AMBR-9 (FCT 1b)
AMBR-4 (FCT 1b)
AMBR-1 (FCT 1b)
AMBRAL-1 (FCT 21b)
OATES-1 (FCT 21b)
CAPEL-5 (FCT 1b)
wonn02 (FCT 1b)
lamb1 (FCT 3a)
lamb2 (FCT 3a)
MUD-5 (FCT 3a)
MUD-4 (FCT 3a)
brick5 (FCT 3a)
waro 06 (FCT 3a)
brick1 (FCT 3a)
brick7 (FCT 3a)
brick8 (FCT 3a)
brick3 (FCT 3a)
brick6 (FCT 3a)
YOON-2 (FCT 2)
FISH-5 (FCT 2)
AMBR-5 (FCT 2)
AMBR-2 (FCT 2)
AMBR-7 (FCT 2)
AUSTB-1 (FCT 7)
CARAB-1 (FCT 15)
SANDON-1 (FCT 16)
r10_PLACID WATERS SITE
NAVB-1 (FCT 16)
Possum1 (FCT 16)
BAMBUN-2 (FCT 15)
TWIN-10 (FCT 15)
TWIN-5 (FCT 15)
WATER-1 (FCT 13)
CAPEL-4 (FCT 13)
RUAB-3 (FCT 13)
WATER-2 (FCT 13)
MILT-2 (FCT 13)
PAGA-2 (FCT 13)
ELLIS-2 (FCT 18)
ELLIS-3 (FCT 18)
PB-1 (FCT 19)
PB-6 (FCT 19)
cool 09 (FCT 19)
MTB-4 (FCT 24)
Possum5 (FCT 17)
LESCH-6 (FCT 17)
Possum2 (FCT 16)
cool 04 (FCT 17)
cool 01 (FCT 17)
cool 11 (FCT 17)
PAGA-5 (FCT 17)
McLART-1 (FCT 13)
ELLIS-1 (FCT 17)
MTB-5 (FCT 17)