Biodiversity and Conservation Science

Methods for survey and identification of Western Australian threatened ecological communities

Species and Communities Program

12 July 2023

GOVERNMENT OF WESTERN AUSTRALIA

Department of **Biodiversity, Conservation and Attractions**

Methods for Survey and Identification of Western Australian Threatened Ecological Communities

Draft version 4.2: 12 July 2023

Contents

Introduction

The document was compiled in preparation for the consultation for the first TEC listing under the *Biodiversity Conservation Act 2016*. A draft was available on the DBCA website and public comment was sought from December 2021 to 31 March 2022.

Table 1 and the appendices outline the survey and identification requirements for Western Australian threatened ecological communities (TECs). The document draws broadly on EPA guidance notes, and standard DBCA practice developed over many years.

References listed in Table 1 and the appendices are largely available through library.dbca.wa.gov.au. Some DBCA internal reports will need to be requested through the DBCA library (library@dbca.wa.gov.au).

There is potential for TECs to be identified outside of their known mapped range. Where appropriate habitat exists outside of the current range, the potential for range extensions should be considered during surveys.

Restored (for example: regenerated, revegetated, or replanted) sites are considered to be the listed ecological community if: the occurrence meets the description of the TEC as per Table 1 below; is in appropriate condition (for vegetation-based TECs, this is generally Good or better condition as per Table 2 in Environmental Protection Authority 2016a); occurs in appropriate habitat; and there is evidence of post-regeneration recruitment that could contribute to longer-term persistence of the occurrence. For TECs that are floristic community types on the Swan Coastal Plain, occurrences will also need to meet the requisites as outlined in Appendix 1.

This document incorporates and addresses public comments received during the public comment period. It is intended to support a consistent, repeatable, rigorous approach to assessing and assigning community types, with a particular focus on floristic community types (FCTs) on the Swan Coastal Plain (SCP).

Table 1: Descriptions, key references, characteristics, and survey methods for Western Australian TECs

	Name of community	Summary Description	Key references	Key characteristics	Survey methods
Aquatic and subterranean					
1	Aquatic Root Mat Community Number 1 of Caves of the Leeuwin-Naturaliste Ridge (Easter and Jewel Caves)	The community occurs in the cave system of the Leeuwin-Naturaliste Ridge incorporating Easter and Jewel Caves. It comprises a complete food web. Rootlets and their associated microflora provide the primary food source, and root mat grazers, predators, parasites, detritivores and scavengers complete the interactions. The root mats are produced by *Eucalyptus diversicolor* (karri). Aquatic cavernicoles (cave animals) in the community include crustaceans (Amphipoda, Copepoda, Ostracoda) and worms (Oligochaeta). The ostracod *Acandona admiratio* Karanovic 2003 is specific to Jewel and Easter Caves. The community was originally described in Jasinska E.J. (1997) *Faunae of aquatic root mats in caves of southwestern Australia: origins and ecology* (unpublished doctoral thesis, The University of Western Australia).	Department of Environment and Conservation (2008). Interim Recovery Plan 2008-2013 for the 'Aquatic root mat communities numbers 1 to 4 of caves of the Leeuwin-Naturaliste Ridge'. Interim Recovery Plan No. 281 Department of Environment and Conservation, Perth. Eberhard, S. (2004). Ecology and hydrology of a threatened groundwater-dependant ecosystem: The Jewel Cave Karst System in Western Australia. Unpublished PhD Thesis, Murdoch University, Western Australia. Jasinska E. J. J. (1997). Faunae of aquatic root mats in caves of southwestern Australia: origins and ecology. Unpublished PhD Thesis submitted to the Zoology Department, University of Western Australia.	A key characteristic is habitat of pools or permanently damp areas in cave habitats on Leeuwin-Naturaliste Ridge (Easter and Jewel Caves). Comprises a distinctive suite of aquatic fauna, some of which are restricted to particular caves.	Sample and report on cave fauna using methods described in EPA (2021) and key references. Describe habitat including hydrological status. Compare habitat and cave fauna to summary description and descriptions in key references.
2	Aquatic Root Mat Community Number 1 of Caves of the Swan Coastal Plain	The community occurs in caves at sites that include Yanchep National Park and surrounds. It comprises root mats of *Eucalyptus gomphocephala* (tuart) supported by groundwater fed streams and pools that occur in the caves. The root mats support a highly diverse and distinctive assemblage of cave fauna including the critically endangered cave shrimp *Hurleya* sp. (WAM C23193; Crystal Cave Crangonyctoid).	Department of Conservation and Land Management (2003). Aquatic Root Mat Community of Caves of the Swan Coastal Plain, and the Crystal Cave Crangonyctoid Interim Recovery Plan 2003-2008. No. 117. Department of Conservation and Land Management, Perth. Knott, B., Storey, A.W. & Tang, D. (2008). Yanchep Cave streams and East Gnangara (Lexia) – Egerton Spring & Edgecombe Spring: Invertebrate Monitoring. Unpublished report prepared for the Department of Water by School of Animal Biology, the University of Western Australia. April 2008.	A key characteristic is a habitat of pools or permanently damp areas in cave habitats in the Yanchep area. Comprises a distinctive suite of cave fauna.	Sample and report on cave fauna using methods described in EPA (2021) and key references. Describe habitat including hydrological status. Compare habitat and cave fauna to summary description and description in key references

			Knott, B., Storey, A.W. & Tang, D. (2008). Yanchep Cave streams and East Gnangara (Lexia) – Egerton Spring & Edgecombe Spring: Invertebrate Mo5nitoring. Unpublished report prep6ared for the Department of Water by School of Animal Biology, the University of Western Australia. April 2009		
3	Aquatic Root Mat Community Number 2 of Caves of the Leeuwin-Naturaliste Ridge (Strongs Cave)	The community occurs in the cave system of the Leeuwin-Naturaliste Ridge incorporating Strongs Cave. It comprises a complete food web. Rootlets and their associated microflora provide the primary food source, and root mat grazers, predators, parasites, detritivores and scavengers complete the interactions. The root mats are produced by *Eucalyptus diversicolor* (karri). Aquatic cavernicoles (cave animals) in the community include crustaceans (Amphipoda, Copepoda, Syncarida) and worms (Oligochaeta, Turbellaria, Nematoda). The copepod Harpacticoida Family indet. and turbellarian *Macrostomum* sp. 4 (Jasinska 1997) are specific to Strongs Cave. The community was originally described in Jasinska E.J. (1997) *Faunae of aquatic root mats in caves of southwestern Australia: origins and ecology* (unpublished doctoral thesis, The University of Western Australia).	Department of Environment and Conservation (2008). Interim Recovery Plan 2008-2013 for the 'Aquatic root mat communities numbers 1 to 4 of caves of the Leeuwin-Naturaliste Ridge'. Interim Recovery Plan No. 281 Department of Environment and Conservation, Perth. Eberhard, S. (2004). Ecology and hydrology of a threatened groundwater-dependant ecosystem: The Jewel Cave Karst System in Western Australia. Unpublished PhD Thesis, Murdoch University, Western Australia. Jasinska E. J. J. (1997). Faunae of aquatic root mats in caves of southwestern Australia: origins and ecology. Unpublished PhD Thesis submitted to the Zoology Department, University of Western Australia.	A key characteristic is a habitat of pools or permanently damp areas in cave habitats on Leeuwin-Naturaliste Ridge (Strongs Cave). Comprises a suite of aquatic fauna, some of which are restricted to particular caves.	Sample and report on cave fauna using methods described in EPA (2021) and key references. Describe habitat including hydrological status. Compare habitat and cave fauna to summary description, and description in key references
4	Aquatic Root Mat Community Number 3 of Caves of the Leeuwin-Naturaliste Ridge (Kudjal Yolgah and Budjur Mar Caves)	The community occurs in the cave system of the Leeuwin-Naturaliste Ridge, incorporating Kudjal Yolgah and Budjur Mar Caves. It comprises a complete food web. Rootlets and their associated microflora provide the primary food source, and root mat grazers, predators, parasites, detritivores and scavengers complete the interactions. The root mats are produced by *Eucalyptus diversicolor* (karri) and *Agonis flexuosa* (peppermint). Aquatic cavernicoles (cave animals) in the community include crustaceans (Copepoda, Syncarida), a mite (Oribatida), worms (Oligochaeta), a tardigrade (Eutardigrada) and insects (Coleoptera,	Department of Environment and Conservation (2008). Interim Recovery Plan 2008-2013 for the 'Aquatic root mat communities numbers 1 to 4 of caves of the Leeuwin-Naturaliste Ridge'. Interim Recovery Plan No. 281 Department of Environment and Conservation, Perth. Eberhard, S. (2004). Ecology and hydrology of a threatened groundwater-dependant ecosystem: The Jewel Cave Karst System in Western Australia.	A key characteristic is a habitat of pools or permanently damp areas in cave habitats on Leeuwin-Naturaliste Ridge (Kudjal Yolgah and Budjur Mar Caves). Comprises a suite of aquatic fauna, some of which are restricted to particular caves.	Sample and report on cave fauna using methods described in EPA (2021) and key references. Describe habitat including hydrological status. Compare habitat and cave fauna to summary description, and description in key references

		Diptera). The Acarina, Oribatida sp. 6 (Jasinska 1997), the oligochaetes *Aeolosoma* sp., Enchytraeidae sp. 5, Enchytraeidae sp. 6, Phreodrilidae WA25 sp. n., the copepod '*Kudjalmoraria nana*' n.g., n.sp. Karanovic in prep., the coleopteran Helodidae sp. indet., the turbellarians *Alloeocoela* sp. 1 (Jasinska 1997) and *Stenostomum* sp. 3 (Jasinska 1997) are specific to the community. The community was originally described in Jasinska E.J. (1997) *Faunae of aquatic root mats in caves of southwestern Australia: origins and ecology* (unpublished doctoral thesis, The University of Western Australia).	Unpublished PhD Thesis, Murdoch University, Western Australia. Jasinska E. J. J. (1997). Faunae of aquatic root mats in caves of southwestern Australia: origins and ecology. Unpublished PhD Thesis submitted to the Zoology Department, University of Western Australia.		
5	Aquatic Root Mat Community Number 4 of Caves of the Leeuwin-Naturaliste Ridge (Calgardup Cave)	The community occurs in the cave system of the Leeuwin-Naturaliste Ridge incorporating Calgardup Cave. It comprises a complete food web. Rootlets and their associated microflora provide the primary food source, and root mat grazers, predators, parasites, detritivores and scavengers complete the interactions. The root mats are produced by *Corymbia calophylla* (marri). Aquatic cavernicoles (cave animals) in the community include *Cherax preissii* (koonac), other crustaceans (*Perthia acutitelson, Paracyclops, Harpacticoida*), meiobenthic mites (*Soldanellonyx monardi* and *Oribatida*), non-biting midges (*Chironomus* aff. *alternans* Walker, *Polypedilum* sp.), rotifers (*Rotifera*) and microscopic worms (*Stenostomum* sp.). The community was originally described in Jasinska E.J. (1997) *Faunae of aquatic root mats in caves of southwestern Australia: origins and ecology* (unpublished doctoral thesis, The University of Western Australia).	Department of Environment and Conservation (2008). Interim Recovery Plan 2008-2013 for the 'Aquatic root mat communities numbers 1 to 4 of caves of the Leeuwin-Naturaliste Ridge'. Interim Recovery Plan No. 281 Department of Environment and Conservation, Perth. Eberhard, S. (2004). Ecology and hydrology of a threatened groundwater-dependant ecosystem: The Jewel Cave Karst System in Western Australia. Unpublished PhD Thesis, Murdoch University, Western Australia. Jasinska E. J. J. (1997). Faunae of aquatic root mats in caves of southwestern Australia: origins and ecology. Unpublished PhD Thesis submitted to the Zoology Department, University of Western Australia. Storey, A. and Knott. B (2002) Leeuwin/Naturaliste Caves: Stream Invertebrate Monitoring: Report to Threatened Species and Communities Unit, Department of Conservation and Land Management. University of Western Australia.	A key characteristic is a habitat of pools or permanently damp areas in cave habitats on Leeuwin-Naturaliste Ridge (Calgardup Cave). Comprises a suite of aquatic fauna, some of which are restricted to particular caves.	Sample and report on cave fauna using methods described in EPA (2021) and key references. Describe habitat including hydrological status. Compare habitat and cave fauna to summary description, and description in key references
6	Camerons Cave	The community is known from Camerons Cave on the Cape Range peninsula. It comprises a unique assemblage of species,	Department of Environment and Conservation (2012). Camerons Cave Troglobitic Community,	Cave habitat on Cape Range. Comprises a distinctive suite of cave fauna.	Sample and report on cave fauna using methods described in

	Troglobitic Community	at least eight of which are known only from this location. The threatened species *Stygiochiropus peculiaris* (Camerons Cave millipede; critically endangered) and *Indohya damocles* (Camerons Cave pseudoscorpion; critically endangered) (previously *Hyella* sp. BES 1154.2525, 1546, 2554) are endemic to Camerons Cave. *Milyeringa veritas* (blind gudgeon; vulnerable) and *Draculoides bramstokeri* (Barrow Island draculoides; vulnerable) also occur in the cave.	Camerons Cave Millipede and Camerons Cave Pseudoscorpion Interim Recovery Plan 2012-2017. Interim Recovery Plan No. 324. Department of Environment and Conservation, Western Australia Humphreys, W.F. and Brooks, D. (2015) Camerons Cave fauna and water quality, Exmouth. Final report to the Rangelands NRM, Western Australia.		EPA (2016b, 2021) and key references. Describe habitat including hydrological status. Compare habitat and cave fauna to summary description, and description in key references
7	Cape Range Remipede Community (Bundera Sinkhole)	The community is known from the Bundera Sinkhole, which is a landlocked body of water with a subterranean connection to the ocean (an anchialine cave). Anchialine ecosystems are inland underground mixohaline waters (seawater dilutes of variable salinity) affected by marine tides, usually with little if any surface exposure. The community comprises a rich stygobitic faunal assemblage composed primarily of crustaceans but also includes a blind fish, *Milyeringa veritas* (blind gudgeon). The crustaceans include atyid shrimp, ostracods, gammarid amphipods, diverse copepods, and the remipede *Kumonga exleyi* of the crustacean class Remipedia (a class of blind crustaceans).	Department of Conservation and Land Management (2001). Cape Range Remipede Community (Bundera Sinkhole) and Cape Range Remipede Interim Recovery Plan 2000-2003. Interim Recovery Plan No. 75. Department of Conservation and Land Management, Western Australia. Humphreys, W.H. (2020). Bundera Sinkhole. Presentation to Royal Society of Western Australia, Singleton, Western Australia 18 December 2020.	Anchialine cave habitat on Cape Range. Comprises a distinctive suite of cave fauna. At least 16 stygobiont species as follows, are recorded from Bundera Sinkhole by Humphreys, W.H. (2020) in "Bundera Sinkhole. Presentation to Royal Society of Western Australia, Singleton, Western Australia 18 December 2020". These include: *Bunderia misophaga* epacteriscid calanoid, *Speleophria bunderae* speleophriid misophrioid, *Stygocyclopia australis* pseudocyclopiid calanoid copepod, *Stygoridgewayia trispinosa* (Copepoda: Calanoida Ridgewayiidae), *Kumonga exleyi* Remipedia, *Welesina kornickeri* Thaumatocypridide, *Halosbaena tulki* Thermosbaenacea, *Speleophria bunderae* speleophriid misophrioid*, Ophisternon candidum Pisces, Milyeringa veritas Pisces, Stygiocaris sp. nov.* (Page *et al*. 2008), *Haptolana sp., Hadzia (Liagoceradocus) branchialis, Phlyctenophora mesembria Candonidae: Paracypridinae, Nitokra fragilis Harpacticoida Ameiridae, Hydractinia betkensis? Anthoathecata Hydractiniidae, Iravadia sp. Neotaenioglossa Iravadiidae, Halicyclops longifurcatus Cyclopoidea Cyclopidae, Kiefferulus intertinctus Chironomidae, Limnoonus sp. Hemiptera: Gerridae g, 'Prionospio' sp. [under revision by Alejandro Martinez), Bunderanthura bundera, Leptanthuridae (Isopoda)*.	Sample and report on cave fauna using methods described in EPA (2021) and key references. Describe habitat including hydrological status. Compare habitat and cave fauna to summary description, and description in key references
8	Depot Springs stygofauna community	The community is known from the Depot Springs groundwater calcrete in Sandstone. It comprises an assemblage of stygofaunal (groundwater) species not known from anywhere else. The calcretes that support the community include those around Friday Well and Puncture Well (southern) and in the area of the shearing shed on Depot Springs Station (northern). Species restricted to this community include Dytiscidae (water beetles), *Limbodessus fridaywellensis* and *Paroster*	Humphries, W.F. (2001) Groundwater calcrete aquifers in the Australian arid zone: the context to an unfolding plethora of stygal biodiversity. *Records of the Western Australian Museum* Supplement No. 64: 63–83. Johnson, S.L., Commander, D.P. and O'Boy, C.A. (1999) Groundwater Resources of the Northern Goldfields, Western	The Depot Springs groundwater calcrete is known from a single occurrence between Sandstone and Leinster and contains a distinctive assemblage of stygofauna. Community is hosted in palaeochannel aquifers that are coupled with the superficial (shallow) calcrete aquifers. These are less than 5m below ground and commonly brackish to saline (between 2,000 and 6,000 mg/L Total Dissolved Solids). The community's habitat is maintained by saturation of these aquifers (Johnson *et al*. 1999).	Sample and report on stygofauna assemblages using methods described in EPA (2021) and key references. Describe habitat. Compare habitat, and stygofauna assemblages to summary description

		hinzeae. The dytiscid (water beetle) species are known only from the Depot Springs calcrete, and the latter species only from Friday Well and belong to a different tribe of invertebrates (Hydroporini). Other fauna from Friday Well itself include Ostracoda (aquatic crustaceans: *Ryocypris* n. sp., *Plesiocypridopsis* n. sp., *Candonopsis* n. sp. 1), Cyclopoida (small custaceans: *Halicyclops* n. sp. 2, *Apocyclops* n. sp. 1, *Metacyclops* n. sp. 1) and Harpacticoida (New genus sp. 1 (Canthocamptidae)).	Australia: Water and Rivers Commission, Hydrogeological Record Series, Report HG 2, 57p. Watts, C.H.S. and Humphreys, W.F. (1999) Three new genera and five new species of Dytiscidae (Coleoptera) from underground waters in South Australia. *Records of the South Australian Museum* 32(2): 121–142.		and descriptions in key references.
9	Ethel Gorge aquifer stygobiont community	The community is known from the Ethel Gorge (Ophthalmia Basin) alluvium calcrete aquifer on the Fortescue River in the vicinity of the town of Newman. It comprises a diverse assemblage of stygofaunal species. It includes Oligochaeta and the crustaceans Bathynellacea (Syncarida), cyclopoid and harpacticoid copepods, Candonidae: Candoninae C (Ostracoda: Podocopida), Candonidae: Candoninae D (Ostracoda: Podocopida), Limnocytheridae (Ostracoda: Podocopida), flabelliferan Isopod (Tainisopidae) and one new genus of Crangonyctoid amphipoda (*Chydaekata*, family Paramelitidae), in which 14 species (13 in this aquifer) have been described on morphological characters. At least one species of *Chydaekata* is known only from this community.	Bennelongia Environmental Consultants (2015). Strategic Environmental Assessment: Description of Regional Subterranean Fauna. Final Report prepared for BHP Billiton Iron Ore. BHP Billiton Iron Ore (2019). Ophthalmia Borefield *in* Triennial Aquifer Review (TAR). BHP Billiton Perth. Humphreys, W.F. (2001) Groundwater calcrete aquifers in the Australian arid zone: the context to an unfolding plethora of stygal biodiversity. *Records of the Western Australian Museum* Supplement No. 64: 63–83.	Known from a single location in the southeast Pilbara, The Ethel Gorge/Ophthalmia Basin alluvium calcrete aquifer, on the Fortescue River. Invertebrate assemblage that inhabits groundwater aquifer habitat in the southeast Pilbara.	Sample and report on subterranean fauna and habitat, using methods described in EPA (2021), and key references. Compare aquifer habitat, and its' associated assemblages, to summary description, and descriptions in key references.
10	Species-rich faunal community of the intertidal mudflats of Roebuck Bay	The community occurs on the intertidal mudflats of Roebuck Bay. Roebuck Bay is a sheltered marine embayment on the macrotidal Kimberley coast containing large intertidal flats composed predominantly of carbonate sediments, which receives freshwater inputs mainly during the wet season. The community comprises a diverse and abundant marine fauna, with an estimated 300 to 500 species of macrobenthic fauna as well as a high diversity and abundance of migratory shorebirds. The threatened species *Caretta caretta* (loggerhead turtle), *Chelonia mydas* (green turtle), *Natator depressus* (flatback turtle) and the dwarf sawfish (*Pristis clavata*) (priority 1), as well as large proportions of the Australian	Bennelongia (2009) Ecological Character Description for Roebuck Bay. Report to the Department of Environment and Conservation. Bennelongia Pty Ltd, Jolimont. Pepping M., Piersma T., Pearson G. and Lavaleye M. (eds) (1999). Intertidal sediments and benthic animals of Roebuck Bay Western Australia: Report of the Roebuck Bay Intertidal benthic mapping programme, June 1997 (ROEBIM-97). Netherlands Institute for sea research, TEXEL, CALM, and Curtin University of Technology. Piersma T. and Watkins D. (1997). The Roebuck Bay Intertidal	Roebuck Bay is a sheltered marine embayment with large flats composed of sediments of carbonate origin exposed at low tide. It has relatively little fresh water input and slow tidal flows, and supports a diverse and abundant marine fauna (particularly benthic invertebrates) as well as a high diversity and abundance of transequatorial migratory shorebirds. The species-rich faunal community of the intertidal mudflats of Roebuck Bay community occurs as one large occurrence alongside the Broome townsite. The benthic faunal assemblage of the Roebuck Bay intertidal mudflats differs from assemblages in other well-surveyed northern Australian intertidal habitats. Many of the benthic invertebrate fauna known from Roebuck Bay are short-range endemics. Examples include *Anomalocardia squamosa, Sunetta contempa* and *Sunetta perexcavata* are restricted to north	Sample and report on fauna of intertidal mudflat fauna using methods described in EPA (2020) and key references. Describe and compare habitat and biota to summary description, and description in key references.

		populations of the birds *Limosa lapponica* (bar-tailed godwit; migratory species) and the threatened *Calidris (Calidris) tenuirostris* (great knot), utilise the habitat and comprise part of the assemblage.	Benthic Mapping Program - Preliminary Report. Roebuck Bay and Eighty Mile Beach in "Wetlands nominated by the Government of Western Australia, Australia for inclusion on the List of Wetlands of International Importance". Department of Conservation and Land Management, Perth WA, 1990. Wetland Research and Management (2019) Development of a Monitoring Program for Benthic Infauna at Roebuck Bay and Eighty-Mile Beach. Prepared for the Department of Biodiversity, Conservation and Attractions, Parks and Wildlife Service, Broome, Western Australia, by Wetland Research & Management. Draft Report v1, 24 January 2019	Western Australia; *Littoraria sulculosa* is only known from Exmouth Gulf to Vansittart Bay; *Littoraria cingulata cingulata* is only known from Exmouth Gulf to Buccaneer Archipelago.	
Aquatic - microbialites					
11	Rimstone pools and cave structures formed by microbial activity on marine shorelines (Augusta microbialites)	The community occurs along the south-west coast near Augusta and comprises microbialites (tufa), which are structures produced through the growth and metabolic activity of benthic microbial communities. The tufa that comprise the community are microbialite structures that have a less defined internal framework that are precipitated from freshwater springs and seeps, formed through the growth and metabolic activity of a diverse variety of microbial organisms, including cyanobacteria, diatoms and other algal components. They form chemical sedimentary rock composed of calcium carbonate. These tufa have many forms including drapes, curtains, small cylindrical stalactites and larger campanulate (bell-shaped) masses on the sea cliffs, as well as fans or terraces consisting of a series of rimstone pools and nodular masses in small brackish pools.	Forbes, M., Vogwill, R., and Onton, K. (2010). A characterisation of the coastal tufa deposits of south–west Western Australia. *Sedimentary Geology*, 232(1-2), 52–65. Government of Western Australia (2000). Bush Forever. Western Australian Planning Commission, Perth. Gradziński, M. (2010). Factors controlling growth of modern tufa: results of a field experiment. Geological Society, London, Special Publications, 336, 143-191. Grey, K. and Awramik, S.M. (2020). Handbook for the study and description of microbialites. Geological Survey of Western Australia, Bulletin 147 278p. Moore, L. (1993) The Modern Thrombolites of Lake Clifton South Western Australia. Unpublished PhD Thesis. University of Western Australia. Onton, K., Clarke, V., and Harding, C. (2009). Monitoring Protocol:	Community occurs in fresh to brackish waters with low nutrient status. Changes to physical parameters eg altered nutrient status could likely cause a shift in dominant microbes. Community identified by L. Moore, and further described in Forbes *et al*. (2010).	Sample microbial mats and microbialites as per Grey and Awramik (2020).

			Augusta Microbial Threatened Ecological Community. Version 1.0 (August 2009). Prepared for Significant Native Species and Ecological Communities – Resource Condition Monitoring Project, Department of Environment and Conservation, Western Australia. Regan, J. (2009) Effect of climate change and eutrophication on the thrombolites and microbial mats within Lake Clifton. Honours dissertation. University of Western Australia.		
12	Stromatolite like freshwater microbialite community of coastal brackish lakes (Lake Clifton)	The community occurs on a relict foredune plain on Holocene sands at Lake Clifton. It is a thrombolitic community comprising a distinctive complex assemblage of photosynthetic cyanobacteria and purple sulphur bacteria, eukaryotic microalgae and "true bacteria". The thrombolitic structures generally have an internal clotted structure, as opposed to those that have a laminated organisation, that are stromatolitic. The structures are formed through precipitation of calcium carbonate within the microenvironment of microbes as a result of photosynthetic and metabolic activity. The most abundant cyanobacterium in the early 1990s was Scytonema, as well as others including Oscillatoria, Dichothrix, Chroococcus, Gloeocapsa, Johannesbaptistia, Gomphosphaeria and Spirulina (Moore L.S. 1993, *The modern thrombolites of Lake Clifton, south-western Australia,* unpublished doctoral thesis, The University of Western Australia). More recent work suggests there has been a dramatic shift in the cyanobacterial population.	Grey, K. and Awramik, S.M. (2020). Handbook for the study and description of microbialites. Geological Survey of Western Australia, Bulletin 147 278p. Luu, R., Mitchell, D. and Blyth, J. (2004) Thrombolite (Stromatolite-like Microbialite) community of a coastal brackish lake (Lake Clifton). Interim Recovery Plan 2004-2009. Department of Conservation and Land Management, Western Australia. Moore, L. (1993) The Modern Thrombolites of Lake Clifton South Western Australia. Unpublished PhD Thesis. University of Western Australia. Moore, L.S. and Burne, R.V. (1994) The modern thrombolites of Lake Clifton, Western Australia. In Bertrand, J. and Monty, C. (eds), Phanerozoic Stromatolites II, Kluwer Academic Publishers, Netherlands. Moore, L., Knott, B., and Stanley, N. (1984) The Stromatolites of Lake Clifton, Western Australia. Living structures representing the origins of life. *Search* 14 (11-12): 309-313.	Community originally described by Moore (1993). Occurs at a single location in Lake Clifton, Yalgorup National Park. Thrombolite reef is in a zone ~15m wide on the eastern side of the lake and occupies a total area of ~5km2. Isolated thrombolites also reported by Moore (1993) on north-western shoreline of the lake. The most abundant cyanobacterium in the early 1990s was *Scytonema*, as well as others including *Oscillatoria*, *Dichothrix*, *Chroococcus*, *Gloeocapsa*, *Johannesbaptistia*, *Gomphosphaeria* and *Spirulina* (Moore 1993). More recent work by Warden *et al*. (2016) suggest there has been a dramatic shift in the cyanobacterial population toward coccoid, non-heterocystous forming taxa primarily from the order Chroococcales. Dominance of coccoid cyanobacteria occurs in microbialites of other hypersaline environments.	Sample microbial mats and microbialites as per Grey and Awramik (2020). Compare habitat, and composition to summary description, and descriptions in Moore (1993) and more recent characterisations by Warden *et al*. (2016).

			Smith, M.D., Goater, S.E., Reichwaldt, E.S., Knott, B. and Ghadouani, A. (2010) Effects of recent increases in salinity and nutrient concentrations on the microbialite community of Lake Clifton (Western Australia): are the thrombolites at risk? *Hydrobiologia* 649: 207. Warden, J. G., Casaburi, G., Omelon, C. R., Bennett, P. C., Breecker, D. O., and Foster, J. S. (2016) Characterization of microbial mat microbiomes in the modern thrombolite ecosystem of Lake Clifton, Western Australia using shotgun metagenomics. *Frontiers in Microbiology* 7: 1064. Warden, J.G.,Coshell, L., Rosen, M.R., Breecker, D.O., Rutrof, K.X. and Omelon, C.R. (2019). The importance of groundwater flow to the formation of modern thrombolitic microbialites. Geobiology 17 (5): 536-550.		
13	Stromatolite like microbialite community of coastal freshwater lakes (Lake Richmond)	The community occurs on a relict foredune plain on Holocene sands at Lake Richmond, Rockingham. It is a thrombolitic community comprising a distinctive complex assemblage of photosynthetic cyanobacteria and purple sulphur bacteria, eukaryotic microalgae and true bacteria. The thrombolitic structures generally have an internal clotted structure, and are formed through precipitation of calcium carbonate within the microenvironment of microbes as a result of photosynthetic and metabolic activity.	English, V., Blyth, J., Goodale, A., Goodale, B., Moore, L., Mitchell, D., Loughton, B., Tucker, J., Halse, S. and King, S. (2003) Thrombolite community of coastal freshwater lakes (Lake Richmond). Interim Recovery Plan 2003-2008. Department of Conservation and Land Management, Western Australia. Grey, K. and Awramik, S.M. (2020). Handbook for the study and description of microbialites. Geological Survey of Western Australia, Bulletin 147 278p. Guerreiro, J.P., Vogwill, R. and Collins, L.B. (2017) Lake Richmond Microbialites. Summary Report to the Department of Biodiversity, Conservation and Attractions (DBCA). Curtin University of Technology	Community originally identified by Moore (1993). In the early 1990s Dichothrix sp., a cyanobacterium was the dominant microbe in microbialites in Lake Richmond. It grows in fresh to brackish waters with low nutrient status. Changes to physical parameters eg altered salinity and nutrient levels have likely caused a shift in dominant microbes. Microbial mats are persisting but composition is moving away from sulphur oxidation/reduction towards photosynthesis.	Sample microbial mats and microbialites as per Grey and Awramik (2020). Compare habitat, and composition to descriptions in Moore (1993) and more recent characterisations (eg Vogwill and Whitehead 2018).

			Moore, L. (1993) The Modern Thrombolites of Lake Clifton South Western Australia. Unpublished PhD Thesis. University of Western Australia. Regan, J. (2009) Effect of climate change and eutrophication on the thrombolites and microbial mats within Lake Clifton. Honours dissertation. University of Western Australia. Vogwill, R. and Whitehead, M. (2018) Lake Richmond – Microbialites, Microbial Mat Mapping and Hydrology Report. Report prepared for the City of Rockingham.		
14	Stromatolite community of stratified hypersaline coastal lakes (Lake Thetis)	The community occurs in Lake Thetis, in Cervantes. It comprises a distinctive and diverse group of benthic microbial assemblages, each producing a mat that is associated with one specific zone within the lake. Crenulate cyanobacterial mats occur in the low-lying areas adjacent to the lake. Lithified stromatolites, resembling those at Shark Bay, with patches of living cyanobacterial mats and nodular mats characterise the littoral areas. Filamentous mats reside in cavities and coat the surface of the flocculant mat in the basin, a mobile diatomaceous mat occurs in the shallows, and thick flocculant mats of phototrophic prokaryotes, other microbes or diatoms (or microbes and diatoms) occur in the central basin. Lake Thetis has benthic microbial mats adjacent to the lithified stromatolites and well-developed flocculant mats in the basin. Under current conditions microbial reef-forming communities and flocculant mat communities are both scarce. Some stromatolites have branching columns.	Department of Environment and Conservation (2012) Stromatolite community of stratified hypersaline coastal lake – Lake Thetis. Interim Recovery Plan No. 325, 2012-2017. Department of Environment and Conservation, Western Australia. Grey, K. and Awramik, S.M. (2020). Handbook for the study and description of microbialites. Geological Survey of Western Australia, Bulletin 147 278p. Grey, K, Moore, LS, Burne, RV, Pierson, BK and Bauld, J. (1990) Lake Thetis, western australia: an example of saline lake sedimentation dominated by benthic microbial processes. *Australian Journal of Freshwater Resources*, vol. 41, pp. 275-300. Grey, K. and Plavansky, N.J. (2009) Microbialites of Lake Thetis Cervantes, Western Australia – a field guide. Geological Survey of Western Australia Record 2009/11. .	Lake Thetis is a small, permanent, hyper-saline lake located on the coastal plain east of Cervantes. It occupies a deflation basin with limestone pavement situated between Holocene parabolic and nested parabolic dunes, and is separated from the ocean by a relict fore-dune plain. Lake is underlaid by the Superficial Aquifer, an unconfined aquifer system constituted with sediments from sand and limestone (Tamala limestone) (Rutherford *et al*. 2005). The lake waters are typically alkaline and nutrient-poor, so ideal for the growth of benthic microbial communities (Grey *et al*. 1990). Lake Thetis is fed by direct rainfall, surface water, and possibly by groundwater bearing calcium and carbonates. It loses water by evaporation and no rivers or creeks discharge into it. There is no evidence for active subterranean water exchange with the sea (Por 1985). Water level fluctuates seasonally with rainfall, rather than with the tides, around mean sea level due to the proximity of the lake to sea level (Grey *et al*. 1990). Salinity varies from 39 to 59 gL^{-1} (>35gL^{-1} is classified as brine), and the ionic proportions of the lake water reflect seawater origins (Arp *et al*. 2001; DEC records 2009, 2010; Grey *et al*. 1990). Lake Thetis is characterised by a diverse assemblage of benthic microbial communities, each producing a distinctive mat type including: crenulate, nodular, filamentous, diatomaceous and flocculent mats. The mats are confined to specific zones that are determined	Sample microbial mats and microbialites as per Grey and Awramik (2020). Compare habitat, and composition to descriptions in Grey et al (1990, 2009).

				by environmental controls (Grey *et al*. 1990; Grey and Plavansky 2009). The stromatolites are just one expression of the diverse microbial assemblage that occurs in the lake (DEC 2012). Crenulate mats grow in seasonally flooded high foreshore areas around Lake Thetis. They consist of a few millimetres of organic-rich sediment intercalated with lake sediments comprising mainly calcareous mud, underlain by coarse calcareous sand. The mat contains the filamentous cyanobacteria identified as Calothrix and Scytonema as well as small colonies of the coccoid cyanobacterium, Gloeocapsa (DEC 2012). Nodular mats are generally restricted to splash zones around the sides of stromatolite domes along the south-western shoreline of Lake Thetis. The nodular mat consists of coccoid cyanobacteria, principally Gloeocapsa, with variable quantities of diatoms depending on seasonal lake level. These organisms secrete mucilage which, along with the layer of living mat, forms a thin coating on the lithified nodules. Copious mucilage production provides a matrix for sediment accumulation and carbonate precipitation. Domes are one form of microbial mat in the lake and are marked by a thin outer rind that is dominated by coccoid cyanobacteria (Gloeocapsa and also Entophysalis (Arp *et al*. 2001)) and deeper layers that are dominated by filamentous cyanobacteria (Scytonema) and by branching and tufts (DEC 2012). Filamentous mats occur in areas of reduced light penetration where they mainly consist of oscillatorian cyanobacteria including chasmoliths. In the deeper part of the lake, and within cracks of lithified plates and angular fragments on the lower marginal shelf, it forms a thin, fragile, often incomplete film comprising the uppermost layer of flocculent mat (DEC 2012). Diatomaceous mats form an orange-brown gelatinous band in the shallow parts of Lake Thetis, usually just below or sometimes coating the nodular mat. Diatom frustules are a significant component of the lithified surface of many of the Lake Thetis stromatolites. Diatoms as well as cyanobacteria are consistently associated with carbonate particles and may have a role in trapping or precipitating carbonate sediments (DEC 2012; Grey *et al*. 1990). Floating flocculant mats comprise a relatively thin (1-2mm) surface mosaic of brown-to-blue-green patches over a massive pinkish-red accumulation of biogenic	

				sediment and colonise the bottom of the central, submerged basin, of Lake Thetis. The upper film is made up of several species of oscillatoriacean cyanobacteria and other non-phototrophic filamentous bacteria such as Beggiatoa sp., a boundary species that tolerates oxygen and oxidises hydrogen sulphide (H_2S). Other major contributors to biomass in this community include several pennate (long tapering) and naviculoid (boat shaped) diatom species and a small unicellular, coccoid cyanobacterium (Synechocystis). The underlying bulk of the mat lacks oxygen and has red–purple organic material mainly comprising purple sulfur bacteria (anoxygenic, H_2S utilizing photosynthetic bacteria, Thiocystis/Thiocapsa group) (Grey *et al*. 1990). The massive sediment in the lake basin is also likely home to sulphur reducing bacteria and other chemautotophs (DEC 2012).	
Soaks, swamps and mound springs					
15	Assemblages of Big Springs organic mound springs	The known occurrence of the community comprises a complex system of freshwater seepages and peaty springs with internal moats with broad tidal flats on the seaward margin and cracking clay flats on the landward margin. It occurs in the West Kimberley. A further feature is the scattered clusters of small outlying, densely vegetated mound springs. The main seepage area supports well developed rainforest vegetation dominated by forests of *Terminalia microcarpa* (damson plum). Several mistletoe species (Loranthaceae) have been recorded in the *Terminalia* canopy, which reaches 20 m in places. Other trees present include *Ficus racemosa* (stem-fruit fig), *Ficus virens* (Albayi), *Melaleuca leucadendra* (weeping paperbark), *Pandanus* sp. (screwpines), *Sesbania formosa* (white dragon tree) and *Timonius timon*. Much less common species noted were *Antidesma ghaesembilla* (Yangu), *Diospyros maritima* and *Nauclea orientalis* (Leichardt tree). The understorey varies from central open glades with turf of Cyperaceae to pure leaf litter under the *Terminalia* canopies. Internal moats support *Acrostichum speciosum* (mangrove fern). The outer perimeter of the large seepage feature is relatively dry in most places with this ring	Department of Biodiversity, Conservation and Attractions (2020) Biodiversity Survey, Mapping, Delineation and Assessment of Selected Organic Mound Springs of the Kimberley Region. Department of Biodiversity, Conservation and Attractions, Kensington. Keneally, K.F., Keighery, G.J. and Hyland, B.P.M. (1991) Floristics and phytogeography of Kimberley rainforests, Western Australia. In: Kimberley Rainforests of Australia. McKenzie N.L., Johnston, R.B. and Kendrick, P.G. (eds) Surrey Beatty and Sons, Norton, NSW. Pryde J (2017) Survey of assemblages of Bunda Bunda, and Big Springs organic mound springs of the west Kimberley threatened ecological communities: a report to the Kimberley Region - August 2017 survey of Bunda Bunda and Big Springs organic mound springs TECs. Department of Biodiversity, Conservation and Attractions, Kensington, WA. 26 p.	The permanent groundwater discharge from the springs provides aquatic habitats (pools and seepages, plus the saturated peat itself) that support distinct assemblages of aquatic invertebrates, often with stygal and restricted elements. Big Springs organic mound springs contain a complex system of freshwater seepages, peaty springs and pools with internal moats. Internal moats surround peaty mounds supporting large mature trees. The largest mound (BIGS01) is a heavily vegetated mound to an elevation of approximately 8m. The main seepage area has an extensive outflow swamp on its north west side. The mound springs occur along the coast where groundwater discharges under pressure from depth through the overlying alluvium to the surface. The springs contain underlying hydrogeology, mineral composition and biogeochemical processes that are likely to be complex and variable. Community occurs on eastern shore of King Sound, with broad saline coastal tidal flats on the seaward margin at the mouth of the Meda River, and cracking clay flats on the landward margin. Surface geology is supratidal mudflat deposits with a mixture of clay, silt, sand and minor salt, and the substrate varies from peat through to peaty grey clay to grey clay, mostly damp with light to very heavy leaf litter and decaying vegetation (DBCA 2019). The invertebrates and flora in the community are a major part of characterising and differentiating the	Sample and report on habitat, flora and aquatic fauna using methods described in EPA (2016a, b), and key references. Determine if habitat meets description of permanently moist peat mounds. Clarify if wetland hydrology is supported by groundwater. Compare key peat substrate, and its' associated assemblages, to summary description, and descriptions in key references.

		generally dominated by dense thickets of *Melaleuca alsophila* or *Acacia ampliceps* (or both) with scattered *Lysiphyllum cunninghamii, Dichrostachys spicata* (Pied Piper bush) and occasional *Adansonia gregorii* (boab) of small stature. Outlying mound spring islands on tidal flats vary markedly in size and in the diversity of vegetation. Some of the smallest islands consist solely of *Typha domingensis* (bulrush). Larger examples often feature *Pandanus spiralis*, *Sesbania formosa*, *Acacia neurocarpa* and occasionally *Terminalia microcarpa* and *Ficus* sp. (fig), with a range of Cyperaceae. Several islands were noted with unusual associations such as *Typha* sp. growing with the mangrove *Lumnitzera* sp. The permanent groundwater discharge from the springs provides aquatic habitats (pools and seepages, plus the saturated peat itself) that support distinct assemblages of aquatic invertebrates, often with stygal and restricted elements. The mesic environment in these springs probably also support distinct terrestrial invertebrate fauna assemblages.	Stoneham, T.C., McArthur, W.M. and Walsh, F.J. (1991) Soils and landforms of Kimberley rainforests, Wester Australia. In: Kimberley Rainforests of Australia. McKenzie N.L., Johnston, R.B. and Kendrick, P.G. (eds) Surrey Beatty and Sons, Norton, NSW.	community The Big Springs community contains six species of invertebrates that have rarely or never been collected in WA, including a water mite, *Arrenurus* sp. WA29, the ostracod *Strandesia* sp. 653 which was recorded from Big Spring in 1999 and 2017 (also occurring in King Gordon Spring), but is not known from elsewhere; *Mesocyclops woutersi* which has rarely been collected in Australia, but is widely distributed in south-east and east Asia; a harpacticoid copepod *Canthacamptus grandidieri* which has rarely been collected in Australia; *Picropleuroxus quasidenticulatus* which is a new record for WA; and *Phyllognathopus volcanicus* which is the first collection record for Australia but the species is also known from New Zealand (DBCA 2019). Community is comparable to the Bunda Bunda organic mound springs community in its near tidal setting however, it has an entirely different physiography and flora. The vegetation found in the Bunda Bunda community also appear to be different from that of wetland rainforest patches described in the Kimberley Rainforest Survey (Keneally *et al*. 1991). Some of the same dominant species also occur at Walcott Inlet, 90km north east of Big Springs; *Ficus* spp., *Nauclea orientalis* and *Celtis philippinensis* (Stoneman *et al*. 1991).	
16	Black Spring organic mound spring community	The community occurs in the East Kimberley and the known occurrence consists of a raised central mound supporting a forest of *Melaleuca viridiflora* (broadleaf paperbark), *Ficus* spp., *Timonius timon* and *Pandanus spiralis* (screwpine) over *Colocasia esculenta* (taro) and ferns, including *Cyclosorus interruptus* (swamp shield-fern). The tall *Phragmites karka* (tropical reed) dominates the outer edge of the mound and the entire mound is ringed by a moat of water supporting sedges and grasses. The springs contain a rich assemblage of aquatic invertebrate fauna. The community consists of raised peaty soaks or wetlands that occur on saturated peaty black clay soil with high organic content.	Bennelongia Environmental Consultants (2017) Ecological Character of Kimberley Mound Springs. Bennelongia Environmental Consultants. Department of Biodiversity, Conservation and Attractions (draft 2019) Biodiversity Survey, Mapping, Delineation and Assessment of Selected Organic Mound Springs of the Kimberley Region. Department of Biodiversity, Conservation and Attractions, Perth. Halse, S. (2001) Comments on Kimberley Mound Springs sampled by Sally Black. Unpublished Report to Department of Conservation and Land Management.	Known from a single occurrence. Consists of raised peaty soaks or wetlands that occur on saturated peaty black, clay soil with high organic content. Situated in either low tributaries or associated with floodplains adjacent to rivers and streams (Bennelongia 2017). Contains a raised, peaty mound surrounded by a moat or bog, and is fed by permanent freshwater seepage (Bennelongia 2017). Occurs where groundwater discharges under pressure from depth through the overlying alluvium to the surface. Invertebrate and flora assemblages that inhabit habitats comprising permanently moist or inundated mounds of peat in this East Kimberley. Distinguished from other mound springs in the Kimberley region by the invertebrate biota that inhabits it, and also the vegetation that typifies the core seepage zones of the spring. Other mound springs may be vegetated by sedges over herbs and grasses; this spring can be described as a forest on the mound with the outer edge dominated by tall grass, and sedgelands on the moat.	Sample and report on flora and vegetation and habitat, using methods described in EPA (2016a, b); and key references. Bennelongia (2017) established permanent flora quadrats to record flora, inventory of aquatic invertebrates and water chemistry and soils. Compare key peat substrate, and associated assemblages, to summary description and description in key references.

				Several rarely collected aquatic invertebrate species also occur within the mound spring community. Bennelongia (2017) recorded a unique and undescribed water mite (referred to as *Arrenurus* sp. WA27 in DBCA 2019); the darwinulid ostracod *Alicenula serricaudata*, a largely groundwater associated species with a Gondwanan distribution was the first record for Australia; the harpacticoid copepod *Canthacamptus grandidieri* which is a pan-tropical species, but has rarely been collected in Australia; and an ostracod from the genus *Chrissia*, that has not previously been recorded in Australia (Bennelongia 2017; DBCA 2019).	
17	Assemblages of Bunda Bunda organic mound springs	The community comprises a complex system of organic mound springs on tidal mudflats in Carnot Bay on the Dampier Peninsula north of Broome. Peaty mounds rise 2 to 3 m above the surrounding tidal flats and are composed of accumulated leaf litter and living vegetation, supporting a dense closed rainforest and tall shrubland, with mangroves forming a concentriform on the surrounding mudflats. The smaller mound is dry in the centre but encircled by a moat, fed by permanent freshwater seepage. The larger mound is wet and incompletely enclosed by a very fine scale channel or moat of variable depth, which broadens to a microscale saline lake on the north side. The moats and pools are saline and occasionally inundated during large tides. The western end of the large mound is covered by a very dense closed forest dominated by evergreen *Carallia brachiata* trees and a bracken-like layer of the fern *Cyclosorus interruptus* (swamp shield-fern). *Timonius timon* and *Sesbania formosa* (white dragon tree) also occur. The eastern portion of the mound is covered by tall closed forest of *Melaleuca cajuputi*, *Timonius timon*, *Sesbania formosa* with fewer *Carallia brachiata* with an understorey of *Cyclosorus interruptus*. Climbers including *Cassytha filiformis* (love vine) and *Secamone elliptica*, drape from trees with ferns *Lygodium microphyllum* (climbing maidenhair) forming a curtain filtering the light. A moat-like channel surrounding the large mound contains mangroves, predominantly *Rhizophora*	Department of Biodiversity, Conservation and Attractions (2020). Biodiversity Survey, Mapping, Delineation and Assessment of Selected Organic Mound Springs of the Kimberley Region. Department of Biodiversity, Conservation and Attractions, Kensington Keneally, K.F., Keighery, G.J. and Hyland, B.P.M. (1991) Floristics and phytogeography of Kimberley rainforests, Western Australia. In: Kimberley Rainforests of Australia. McKenzie N.L., Johnston, R.B. and Kendrick, P.G. (eds) Surrey Beatty and Sons, Norton, NSW. Pryde (2017). Kimberley threatened ecological communities: a report to the Kimberley Region - August 2017 survey of Bunda Bunda and Big Springs organic mound springs TECs. Department of Biodiversity, Conservation and Attractions, Kensington, WA. 26 p. DBCA, Kensington. Stoneham, T.C., McArthur, W.M. and Walsh, F.J. (1991) Soils and landforms of Kimberley rainforests, Wester Australia. In: Kimberley Rainforests of Australia. McKenzie N.L., Johnston, R.B. and Kendrick, P.G. (eds). (1991) Kimberley Rainforests of Australia. Surrey Beatty and Sons in	Known from two occurrences over a 1.2km range in the West Kimberley. The flora and invertebrates are a major part of characterising and differentiating the community. Comprises peaty mounds surrounded by a moat, stream channels and standing pools of water of variable depth. Saturated peaty black soils and thick leaf litter combine to form a quaking substrate. The permanent groundwater discharge from the springs provides aquatic habitats (pools and seepages, plus the saturated peat itself) that support distinct assemblages of aquatic invertebrates, often with stygal and restricted elements. Community also supports three species of invertebrates rarely or never collected in Western Australia, including; a potentially new species of water mites *Axonopsella*; the darwinulid ostracod *Alicenula serricaudata*, also located in other Kimberley springs, is the first record for Australia; and a harpacticoid copepod *Nitokra* '*lacustris*' B07 also likely to be undescribed and not previously collected (DBCA 2020).	Sample and report on habitat, flora and aquatic fauna using methods described in EPA (2016a, b, 2021), and key references (DBCA 2019; vegetation, physico-chemical, and invertebrate sampling). Clarify if wetland hydrology is supported by groundwater. Compare key peat substrate, and its' associated assemblage, to summary description, and descriptions in key references.

		stylosa (spotted-leaved red mangrove) and *Avicennia marina* (white mangrove) with *Acrostichum speciosum* (mangrove fern).	association with the Department of Conservation and Land Management and Department of Arts, Heritage and Environment. Chipping Norton, NSW		
18	Assemblages of Dragon Tree Soak organic mound spring	The community occurs in the Great Sandy Desert bioregion and is a wetland landform supporting plants and animals that are absent or scarce elsewhere in the bioregion. At its centre, the community comprises a closed sedgeland of jointed twig-rush *Machaerna articulata* (jointed twig-rush) to 2.5 m high and 95% canopy cover. *Sesbania formosa* (white dragon tree) occurs as a sparse emergent and some clumps of *Typha domingensis* (bullrush) are also present in the centre of the soak. At the southern and northern ends of the wetland is a low-closed forest or scrub of *Sesbania formosa*, averaging 10 m in height, with some *Typha domingensis* understorey. In wet areas on the periphery of the wetland, a grassland of *Paspalum vaginatum* (saltwater couch) occurs, with sparse emergent *Fimbristylis ferruginea.* The slightly higher and drier surrounding flats support *Sporobolus virginicus* (marine couch), *Acacia ampliceps* and *Melaleuca glomerata*. The priority 3 sedge species *Fimbristylis sieberiana* also occurs.	Australian Nature Conservation Agency (1996) A Directory of Important Wetlands in Australia. Second Edition. Australian Nature Conservation Agency, Canberra. Pinder A, Lewis L, Shiel, R. 2020. Aquatic invertebrates of three wetlands in the Great Sandy Desert sampled in September 2018, Department of Biodiversity, Conservation and Attractions, Perth.	Invertebrate and flora assemblages that inhabit habitats comprising permanently moist or inundated mounds of peat on the in the Great Sandy Desert bioregion. Peat habitat is supported by groundwater seepage.	Sample and report on flora and vegetation and habitat, using methods described in EPA (2016a); and key references. Compare key peat substrate, and associated flora assemblage, to summary description.
19	Assemblages of the organic springs and mound springs of the Mandora Marsh area	The community occurs in the Mandora Marsh (Walyarta) area, which is located 140 km south-west of Broome, and approximately 40 to 100 km inland from Eighty-Mile Beach. Plant assemblages associated with the springs include paperbark *Melaleuca leucadendra* forest with or without an understorey of *Acrostichum speciosum* (mangrove fern), and *Sesbania formosa* (white dragon tree) woodland with or without an understorey of mangrove ferns. Stands of the bullrush *Typha domingensis* and sedgelands dominated by *Schoenoplectus* spp. with *Fimbristylis* spp., along with patches of the grass *Sporobolus virginicus* also occur. In addition, a few *Avicennia marina* (white mangrove) occur on the more brackish springs. *Acacia ampliceps* is often present in the mid-storey but is not abundant. *Typha*	Department of Biodiversity, Conservation and Attractions (2019). Draft Interim Recovery Plan 2019-2024 for Assemblages of the organic springs and mound springs of Mandora Marsh area and inland mangroves community of Salt Creek. Department of Biodiversity, Conservation and Attractions, Western Australia. Quinlan K., Pinder A.M. and Lewis L. (2016) *Aquatic Fauna Survey at Mandora Marsh (Walyarta) in September 2015*. Department of Parks and Wildlife, Perth. Rutherford, J.L., Cendón, D.I., Soerensen, C., Batty, S., Huntley, B., Bourke, L., Quinlan, K., Englsih, V. and Coote, M. (2018)	Invertebrate and flora assemblages that inhabit habitats comprising permanently moist or inundated mounds of peat in the Walyarta area. Peat habitat is supported by groundwater seepage.	Sample and report on habitat, flora and aquatic fauna using methods described in EPA (2016a, b), and key references. Determine if habitat meets description of permanently moist peat mounds. Clarify if wetland hydrology is supported by groundwater. Compare key habitat of peat substrate, and its' associated assemblages, to summary description,

		domingensis (bulrush) and sedges with a few emergent trees or mangroves dominate the vegetation on some of the small mound springs. The dominant vegetation of the springs varies between occurrences and over time due to damage by cyclonic winds. Invertebrate fauna from mound springs of the Mandora Marsh area are much richer than in springs further north in the Kimberley, and very few species are common to both areas. The permanent water and dense vegetation of the springs provide a refuge for these invertebrate fauna within an otherwise arid desert landscape.	*Hydrological conceptualisation of the Walyarta Mound springs*. Department of Biodiversity, Conservation and Attractions, Wetlands Conservation Program, Perth Western Australia.		and descriptions in key references.
20	Organic mound spring sedgeland community of the North Kimberley bioregion	Occurrences of the community are centred on mound spring habitat in the North Kimberley bioregion. The community is comprised of sedgelands and grasslands that are almost completely devoid of trees and shrubs due to a waterlogged seepage zone, and can also include boggy fernlands. Associated woodlands occur at the margins. The community encompasses the associated woodlands that are also affected by the hydrology of each mound spring. The community is distinguished in particular by the invertebrate biota that inhabit them, and also the sedgelands or grasslands that typify the core seepage zones of the springs. Most of the sedges present on these mound springs are restricted to the periphery of wetlands and creeks, or broad drainage depressions on sandier soils where grasses are dominant. Eight plant species found in the mound spring community have priority conservation status in Western Australia: *Cyperus unioloides* (uniola flatsedge; priority 1), *Eleocharis ochrostachys* (spike rush; priority 3), *Eriocaulon inapertum* (pipewort; priority 1), *Lobelia leucotos* (blue lobelia; priority 1), *Rhynchospora gracillima* (thin beaksedge; priority 1), *Rhynchospora rubra* (priority 3), *Spiranthes sinensis* (austral ladies tresses; priority 1) and *Utricularia circumvoluta* (bladderwort; priority 1). Seven of these species (all except *Rhynchospora rubra*) are considered useful indicators of mound springs in this location, since their occurrence is	Barrett, M. and English, V. (2017) A flora and vegetation survey of North Kimberley mound springs, Mt Elizabeth Station. Department of Parks and Wildlife, WA. Bennelongia Environmental Consultants (2017) *Ecological Character of Kimberley Mound Springs*. Bennelongia Environmental Consultants. Department of Biodiversity, Conservation and Attractions (draft 2019) Biodiversity Survey, Mapping, Delineation and Assessment of Selected Organic Mound Springs of the Kimberley Region. Department of Biodiversity, Conservation and Attractions, Perth	Community consists of raised peaty soaks or wetlands that occur on saturated peaty black, grey/black clayey soils with some sandstone. Generally occurs as freshwater seepages and vegetated mound springs with internal moats. Community occurs where groundwater discharges under pressure from depth through the overlying alluvium to the surface. Sampled springs were fresh and highly acidic, *in situ*, which is natural in peat bogs due to the release of organic acids from decomposition of plant matter. Rarely collected aquatic invertebrate species were recorded in the community; a unique and undescribed *Arrenurus*; the darwinulid ostracod *Alicenula serricaudata*, the atyid shrimp *Caridina spelunca*, which is restricted to groundwater associated habitats in the central Kimberley.	Sample and report on habitat, flora and aquatic fauna using methods described in EPA (2016a, 2021), and key references. Determine if habitat meets description of permanently moist peat mounds. Clarify if wetland hydrology is supported by groundwater. Compare key peat substrate, and its' associated assemblage, to descriptions in summary description, and descriptions in key references. Detailed methods: Vegetation surveys (from Barrett and English 2017) Surveys best undertaken in June. Flora specimens should be collected from the central core mound spring seepage areas, and damplands

		almost entirely restricted to mound springs in Western Australia, or their margins.			that surround the springs. Physico-chemical sampling (from Bennelongia 2017) Includes electrical conductivity (EC), pH and temperature, water samples, and analytes (TDS, pH, EC, major ions, ammonia, nitrate, nitrite, soluble reactive phosphorous (P_SR), total N and total P). Invertebrate sampling (from Bennelongia 2017): Collect aquatic invertebrates with bilge pump. A 1m length core of consolidated peat is extracted and the hole allowed to fill with porewater. Water is then pumped through a 53µm net using the bilge pump and retained material preserved in 100% ethanol. Dig a small well (i.e. 30cm x 30cm) around the base of the pump to allow water to infiltrate the pumping zone. Sort in laboratory under dissecting microscopes and all aquatic invertebrates identified to species level where possible. Animals dissected and examined under the compound microscopes as

					necessary. Species are identified using relevant keys, where available; otherwise, appropriate anatomical features from keys are used to characterise undescribed species, to which voucher codes are assigned. Some samples can be collected by sweep-netting through a range of surface water habitats
21	Assemblages of Roe River rainforest swamp	The known occurrence of the community is located within the Roe River area of the Prince Regent National Park in the northern Kimberley. The rainforest canopy is 16 m high. Tree species include *Aglaia elaeagnoidea* (priyangu), *Alphitonia excelsa* (red ash; priority 2), *Alstonia actinophylla* (white cheesewood), *Antidesma ghaesembilla* (yangu), *Bombax ceiba* (kapok tree), *Carallia brachiata*, *Cryptocarya cunninghamii, Ficus hispida*, *Lophostemon grandiflorus*, *Melaleuca viridiflora* (broadleaf paperbark), *Melastoma affine*, *Memecylon pauciflorum*, *Nauclea orientalis* (Leichardt pine), *Monoon australe*, *Sersalisia sericea* (nangi), *Syzygium angophoroides*, *Syzygium forte* subsp. *potamophilum*, *Timonius timon*, *Trema tomentosa* and *Vitex acuminata*. The camaenid land snail assemblages in rainforest communities of the Kimberley Region can be used to distinguish patches from similar rainforest communities elsewhere in northern Australia. The community was originally described in McKenzie N.L., Johnston R.B. and Kendrick P.G. (eds) (1991) "Kimberley rainforests of Australia" (Surrey Beatty & Sons, Chipping Norton, NSW, in association with the Department of Conservation and Land Management and Department of Arts, Heritage and Environment, Canberra).	Kenneally K. F., Keighery G. J, and Hyland B. P. M. (1991). Floristics and phytogeography of Kimberley rainforests, Western Australia. In: Kimberley Rainforests of Australia. McKenzie N. L., Johnston R. B. and Kendrick P. G. (eds). Surrey Beatty and Sons, Norton, NSW. McKenzie, N.L., Belbin, L., Keighery, G.J. and Kenneally, K.F. (1991) Kimberley rainforest communities: Patterns of species composition and Holocene biogeography. In: Kimberley Rainforests of Australia. McKenzie, N.L., Johnston, R.B. and Kendrick, P.G. (eds). Surrey Beatty and Sons, Norton, NSW. Solem, A. (1991). Land snails of Kimberley rainforest patches and biogeography of all Kimberley land snails. In: Kimberley Rainforests of Australia. McKenzie N. L., Johnston R. B. and Kendrick P. G. (eds). Surrey Beatty and Sons, Norton, NSW. Stoneman, T. C., McArthur, W.M. and Walsh F.J. (1991). Soils and landforms of Kimberley rainforests, Western Australia. In: Kimberley Rainforests of Australia. McKenzie N. L., Johnston R. B. and Kendrick P. G. (eds). Surrey Beatty and Sons, Norton, NSW	The only known occurrence of this community is 2.0 ha in size, and is located within the Prince Regent Nature Reserve. Most of the camaenid land snails recorded in the McKenzie *et al*. (1991) are restricted endemics in the Kimberley. McKenzie et al. (1991) sampled 1 occurrence of this community, Patch 16/2. This patch classified by itself in the analysis of the species assemblages of 95 sites surveyed for McKenzie *et al*. (1991). It occurs in the wettest part of their study area (1200 mm rainfall). The lithology of the site is Quaternary alluvium and King Leopold Sandstone/Hart dolerite. Soil drainage is excessive or free, and soil inundation is seasonal.	Sample and report on habitat, flora and land snail fauna using methods described in EPA (2016a, b), and key references (McKenzie *et al.* 1991). Compare habitat, and its' associated assemblages, to summary description, and descriptions in key references.

22	Assemblages of Theda Soak rainforest swamp	The known occurrence of the community comprises a patch of rainforest around a spring-fed soak (Theda Soak) on a floodplain in the east Kimberley. Trees grow to 20 m high and include *Albizia lebbeck* (lebbek tree), *Antidesma ghaesembilla* (Yangu), *Bombax ceiba* (kapok-tree), *Garuga floribunda*, *Glochidion disparipes* (cheese tree), *Ficus aculeata* (sandpaper fig), *Ficus racemosa* var. *racemosa* (cluster fig tree), *Litsea glutinosa*, *Melaleuca leucadendra* (weeping paperbark), *Sesbania formosa* (white dragon tree), *Sterculia quadrifida* (redfruit kurrajong), *Syzygium nervosum* (Daly River satinash) and *Terminalia microcarpa* (damson plum). The camaenid land snail assemblage distinguishes this community. The community was originally described in McKenzie N.L., Johnston R.B. and Kendrick P.G. (eds) (1991) "Kimberley rainforests of Australia" (Surrey Beatty & Sons, Chipping Norton, NSW, in association with the Department of Conservation and Land Management and Department of Arts, Heritage and Environment, Canberra).	Johnstone, R.E. and Burbidge, A.H. (1991) The Avifauna of Kimberley rainforests. In: Kimberley Rainforests of Australia. McKenzie, N.L., Johnston, R.B. and Kendrick, P.G. (eds). Surrey Beatty and Sons, Norton, NSW. McKenzie, N.L. (1991) An ecological survey of tropical rainforests in Western Australia: background and methods. In: Kimberley Rainforests of Australia. McKenzie, N.L., Johnston, R.B. and Kendrick, P.G. (eds). Surrey Beatty and Sons, Norton, NSW. McKenzie, N.L., Belbin, L., Keighery, G.J. and Kenneally, K.F. (1991) Kimberley rainforest communities: Patterns of species composition and Holocene biogeography. In: Kimberley Rainforests of Australia. McKenzie, N.L., Johnston, R.B. and Kendrick, P.G. (eds). Surrey Beatty and Sons, Norton, NSW. Solem, A. (1991) Land snails of Kimberley rainforest patches and biogeography of all Kimberley land snails. In: Kimberley Rainforests of Australia. McKenzie, N.L., Johnston, R.B. and Kendrick, P.G. (eds). Surrey Beatty and Sons, Norton, NSW.	The community originally described in McKenzie *et al*. (1991) in the Kimberley Rainforest Survey. The Theda Soak rainforest swamp community contains a discrete patch of rainforest occurring around a spring-fed soak, on a floodplain. The community is likely to be supported by sustained upwelling of groundwater. Community can be distinguished from other rainforest assemblages through its species composition including perennial plants, birds and land snails; and physical attributes such as climate, lithology, geomorphic setting, soil and geographic location. The assemblage grouping is described by McKenzie *et al*. (1991) as a small patch of rainforest around a spring-fed soak on a floodplain, 0.5km from a tributary of the Morgan River. The camaenid land snail assemblages in rainforest communities of the Kimberley Region can be used to distinguish this patch from similar rainforest communities elsewhere in northern Australia (Solem 1991)	Sample and report on habitat, flora and aquatic fauna using methods described in EPA (2016a, b), and key references (McKenzie 1991). Determine if habitat meets description of permanently moist peat mounds. Clarify if wetland hydrology is supported by groundwater. Compare key peat substrate, and its' associated assemblages, to summary description, and descriptions in key references. McKenzie (1991) vegetation and molluscs survey methods: Surveys were undertaken in June and late January/early March for a wet season comparison. Included detailed geomorphic appraisal, soil profile description made along topographically representative transects and the soil profiles for laboratory analysis; flora (establishment of long-term monitoring quadrats along a transect) and fauna.
23	Assemblages of the organic mound	The community occurs in the Three Springs area. The mound spring habitat is characterised by continuous discharge of	Pinder, A., Clarke, V. and Harding, C. (2009). Monitoring of the Invertebrate Assemblages of	Invertebrate and flora assemblages that inhabit habitats comprising permanently moist or inundated mounds of	Sample and report on habitat, flora and aquatic fauna using

	springs of the Three Springs area	groundwater in raised areas of peat. The peat and surrounds provide a stable, permanently moist series of micro-habitats. There is a high level of heterogeneity of invertebrate fauna assemblages between occurrences, and all are associated with a rich and healthy fauna. The distinctive assemblages are composed of invertebrate groups that commonly include beetles, oligochaetes, non-biting midges and bugs. The vegetation component of the community contains many moisture loving species including an overstorey of *Melaleuca preissiana* (moonah) trees. *Eucalyptus camaldulensis* (river gum) and *Eucalyptus rudis* (flooded gum) are also found in a number of the mound springs. The shrub layer often includes *Hypocalymma* angustifolium (white myrtle) and *Acacia saligna* (orange wattle) over *Machaerina vaginalis* (sheath twigrush) and other sedges. The herbaceous *Patersonia occidentalis* (swamp variant) has been recorded at several occurrences.	Mound Springs of the Three Springs Area Threatened Ecological Community. Version 1.0 (August 2009). Prepared for Significant Native Species and Ecological Communities – Resource Condition Monitoring Project. Rees, R. and Broun, G. (2005) Assemblages of Organic Mound Springs of the Three Springs area Interim Recovery Plan #196, 2005-2010. Department of Conservation and Land Management, Western Australia.	peat in the Three Springs area. Peat habitat is supported by groundwater seepage.	methods described in EPA (2016a, b), and key references. Determine if habitat meets description of permanently moist peat mounds. Clarify if wetland hydrology is supported by groundwater. Compare key peat substrate, and its' associated assemblages, to summary description, and descriptions in key references.
24	Communities of Tumulus Springs (Organic Mound Springs, Swan Coastal Plain)	The community occurs in tumulus springs (organic mound springs) on the Swan Coastal Plain. The habitat of the mound springs is characterised by continuous discharge of groundwater in raised areas of peat. The peat and surrounds provide a stable, permanently moist series of microhabitats, with a high level of heterogeneity of invertebrate fauna assemblages between sites. Groups commonly represented include Ostracoda, Nematoda, Cladocera, Copepoda, Oligochaeta, Tardigrada, Turbellaria and Insecta. Typical and common native vascular plant species associated with the tumulus springs are the trees *Banksia littoralis* (swamp banksia), *Melaleuca preissiana* (moonah) and *Eucalyptus rudis* (flooded gum), and the shrubs *Taxandria linearifolia* (swamp peppermint), *Pteridium esculentum* (bracken), *Astartea scoparia* (common astartea) and *Cyclosorus interruptus* (swamp shield-fern)..	Department of Conservation and Land Management (2006) Community of Tumulus (organic mound) springs of the Swan Coastal Plain Interim Recovery Plan 2005-2010. Interim Recovery Plan No. 198. Perth, Western Australia. Jasinska, E.J., and Knott, B., (1994) Aquatic fauna in Gnangara Mound discharge areas of the Ellen Brook catchment, Western Australia. A report submitted to the Water Authority of Western Australia. Tang, D., Storey, A.W. & B. Knott, (2008) *Mound (Tumulus) Springs of the Bullsbrook Region, Western Australia: Limnology and Invertebrates.* Report prepared for Department of Environment and Conservation by the School of Animal Biology, UWA. Groundwater Consulting Services Pty Ltd. (2006) *Shallow Groundwater Investigation and*	Invertebrate and flora assemblages that inhabit habitats comprising permanently moist or inundated mounds of peat on the southern Swan Coastal Plain. Peat habitat is supported by groundwater seepage.	Sample and report on habitat, flora and aquatic fauna using methods described in EPA (2016a), and key references. Determine if habitat meets description of permanently moist peat mounds. Clarify if wetland hydrology is supported by groundwater. Compare key peat substrate, and its' associated assemblage, to summary description, and descriptions in key references.

			Monitoring. Northern Perth Springs, Neaves Nature Reserve, Western Australia. Report prepared for Department of Conservation and Land Management.		
25	Assemblages of Walcott Inlet rainforest swamps	The known occurrences of this community occur on the extensive floodplain that fringes a tidal mudflat in the Walcott Inlet in the north-west Kimberley. The community is focused on swampy rainforests, but associated swamp and woodland communities are included in the boundaries where they are closely linked with the rainforest. The vegetation structure varies with hydrology and includes dense rainforest to dense woodland, open savanna woodland, *Melaleuca* or grassy swamps and occasional open water. The rainforest vegetation comprises closed-canopy rainforest to 30 m in height, and is dominated by *Ficus* spp., *Nauclea orientalis* (Leichhardt pine), *Celtis strychnoides* (hackberry), and *Acrostichum speciosum* (mangrove fern). Eight priority flora occur in the community, including two not found anywhere else in Western Australia. Five threatened or endemic fauna including the endangered northern quoll (*Dasyurus hallucatus*) also occur. The tree *Cordia subcordata* and the snail *Torresitrachia* sp. were recorded at one patch of the community. The camaenid land snail assemblage distinguishes this community. The community was originally described in McKenzie N.L., Johnston R.B. and Kendrick P.G. (eds) (1991) "Kimberley rainforests of Australia" (Surrey Beatty & Sons, Chipping Norton, NSW, in association with the Department of Conservation and Land Management and Department of Arts, Heritage and Environment, Canberra).	Barrett, M. and Corey, B. (2016) Flora and fauna surveys of the Walcott River Threatened Ecological Community Rainforest Swamp. WA Department of Parks and Wildlife, Kununurra. Kenneally K. F., Keighery G. J, and Hyland B. P. M. (1991). Floristics and phytogeography of Kimberley rainforests, Western Australia. In: Kimberley Rainforests of Australia. McKenzie N. L., Johnston R. B. and Kendrick P. G. (eds). Surrey Beatty and Sons, Norton, NSW McKenzie N. L., Belbin, L., Keighery G. J., and Kenneally K. F. (1991). Kimberley rainforest communities: Patterns of species composition and Holocene biogeography. In: Kimberley Rainforests of Australia. McKenzie N. L., Johnston R. B. and Kendrick P. G. (eds). Surrey Beatty and Sons, Norton, NSW McKenzie N.L., Johnston R.B. and Kendrick P.G. (eds) (1991) Kimberley rainforests of Australia. Surrey Beatty & Sons, Chipping Norton, NSW, in association with the Department of Conservation and Land Management and Department of Arts, Heritage and Environment, Canberra. Solem, A. (1991). Land snails of Kimberley rainforest patches and biogeography of all Kimberley land snails. In: Kimberley Rainforests of Australia. McKenzie N. L., Johnston R. B. and Kendrick P. G. (eds). Surrey Beatty and Sons, Norton, NSW.	Three occurrences are known of this tall closed-canopied swamp rainforest on the extensive floodplain that fringes a tidal mudflat in the Walcott Inlet. The centre of the swamp supports Melaleuca forest on higher ground. The soils are generally highly organic and Quaternary alluvium. Most of the camaenid land snails recorded in the Kimberley Rainforest Survey are restricted endemics in the Kimberley. The median range for a wet area Kimberley camaenid is 20km, and 82 of the 93 camaenids were only collected in 1 to 5 patches (Solem 1991).	Sample and report on habitat, flora and invertebrate using methods described in EPA (2016a, b), and key references (McKenzie 1991). Determine if habitat meets description. Compare substrate, and its' associated assemblages, to summary description, and descriptions in McKenzie *et al*. (1991), who sampled 95 patches of tropical rainforest through inventory of perennial plants, birds and land snails.

			Stoneman, T. C., McArthur, W.M. and Walsh F.J. (1991). Soils and landforms of Kimberley rainforests, Western Australia. In: Kimberley Rainforests of Australia. McKenzie N. L., Johnston R. B. and Kendrick P. G. (eds). Surrey Beatty and Sons, Norton, NSW		
Grasslands, wetlands, herbfields					
26	Herblands and bunch grasslands on gypsum lunette dunes alongside saline playa lakes	The community has been recorded from the Lake Magenta area, on grey sandy clay on the top of a lake edge dune on gypsum lunette dunes alongside saline playa lakes. Floristic composition includes the taxa *Rytidosperma caespitosum*, *Lawrencia squamata, Maireana marginata, Podolepis rugata* (pleated podolepis), *Senecio pinnatifolius* var. *maritimus* (coastal groundsel)*, Asteridea chaetopoda*, *Atriplex paludosa* (marsh saltbush), *Tecticornia syncarpa, Scaevola spinescens* (currant bush) and *Austrostipa juncifolia*.	Jones, D.C. (1993) Gypsum deposits of Western Australia. Geological Survey of Western Australia. Record 1993/5. Lyons, M.N., Gibson, N., Keighery, G.J. Lyons, S.D. (2004). Wetland flora and vegetation of the WA Wheatbelt. Records of the Western Australian Museum Supplement No. 67. 39-89. Mattiske Consulting Pty Ltd. (1995). A review of botanical values on a range of gypsum dunes in the Wheatbelt of Western Australia. Report to the Department of Conservation and Land Management, Perth. O'Keefe, M. (2003) Room for Discovery: do we know enough about Australia's gypsophiles? Australasian Plant Conservation 12: 6-7. Rick, A. (2011) Survey and analysis of plant communities growing on gypsum in the Western Australian Wheatbelt. A report for the wheatbelt NRM Region and the Department of Environment and Conservation WA.	Gypsum substrate forms from sediments sourced from shores during wet phases and exposed lake floors during dry, arid phases. Gypsum occurs in salt lakes or playas, coastal basins and sequences in ancient sedimentary rock. This community consists of a grey sandy clay substrate on the top of a playa lake, gypsum lunette dune. This distinctive floral assemblage is associated with gypsum substrate in the Lake Magenta area. Community occurs on transverse lunette dune on downwind margin of a playa lake.	Sample, analyse data and report on flora and vegetation using methods described in EPA (2016a), and key references including Rick (2011). Determine if gypsum substrate that is key to identification of the community, occurs. Verify if substrate and flora assemblage meet summary description.
27	Herbaceous plant assemblages on Bentonite Lakes as originally described by Griffin and	The community occurs on the lake margins of bentonite lakes in the Watheroo-Marchagee region, as originally described by Griffin, E.A. and Associates (1991). Flora and Vegetation of Watheroo Bentonitic Lakes. Unpublished report prepared for Bentonite Australia Pty Ltd. The community comprises herbaceous plant assemblages dominated by a combination of *Triglochin mucronata,*	Department of Conservation and Land Management (2002). Interim Recovery Plan 2002-2007 for Herbaceous plant assemblages on bentonite lake beds (Vegetation Types 1,2,3&7) and margins (Vegetation Types 4,5&6) of the Watheroo-Marchagee region.	Habitat is perched ephemeral freshwater playa lakes and claypans, and bentonite substratum. Known from between Watheroo and Marchagee /Enagu, immediately south and east of Lake Pinjarrega. Bentonite substate of lakes supports distinctive assemblages of herbaceous flora, and occasionally a tree or shrub layer. Floral assemblage differs from other lakes in the region, likely due to the bentonite substrate. Herb-dominated community depends on intermittent	Sample and report on flora and vegetation and habitat, using methods described in EPA (2016a); and key references. Compare lake substrate and habitat and associated

	Associates (1991)	*Trichanthodium exilis*, *Asteridea athrixioides* and *Puccinellia stricta* (marsh grass) on the lake beds, and a combination of *Siemssenia capillaris* (wiry podolepis), *Angianthus tomentosus* (camel-grass) and *Pogonolepis stricta* (stiff angianthus). These herbaceous plant assemblages are characterised by a dependence on a bentonite (saponite) substrate — naturally restricted to the lake beds and margins of perched, ephemeral freshwater playa lakes and claypans of the Watheroo-Marchagee region. While most lakes comprise only herbaceous species, there are a number with varying densities of *Casuarina obesa* (swamp sheoak) trees, and shrubs of *Melaleuca lateriflora* (gorada) and *Acacia ligustrina*.	Interim Recovery Plan No. 108. CALM, Perth. Griffin, E. A. and Associates (1991). *Flora and Vegetation of Watheroo Bentonitic Lakes*. Unpublished report prepared for Bentonite Australia Pty Ltd.	freshwater inundation and drying out within a few weeks of filling.	distinctive assemblages, to summary description, and descriptions in key references.
28	Perched wetlands of the Wheatbelt region with extensive stands of living *Casuarina obesa* (swamp sheoak) and *Melaleuca strobophylla* (paperbark) across the lake floor	The community occurs in large ephemeral wetlands in the inland Wheatbelt of south-west Western Australia. It comprises intact *Casuarina obesa* (swamp sheoak) and *Melaleuca strobophylla* (paperbark) dominated stands of vegetation over the lake floor.	Department of Biodiversity, Conservation and Attractions (2017). Toolibin Lake Catchment Recovery Plan (2015) 2015–35. Halse S.A., Pearson G.P., McRae J.M. & Shiel R.J. (2000). Monitoring aquatic invertebrates and waterbirds at Toolibin and Walbyring Lakes in the Western Australian Wheatbelt. *Journal of the Royal Society of Western Australia* **83**, 17–28 Toolibin Lake Recovery Plan (1994). Prepared by the Toolibin Lake Recovery Team and Toolibin Lake Technical Advisory Group, September 1994. Perched wetlands of the Wheatbelt region with extensive stands of living sheoak and paperbark across the lake floor (Toolibin Lake) Recovery Plan (1994).	Seasonal w*etlands that* receive water from rainfall and overland flow. The wetlands are dominated by *Casuarina obesa* and *Melaleuca strobophylla* and occur in the inland agricultural area of south-west Western Australia.	Sample, analyse data and report on flora and vegetation and habitat, using methods described in EPA (2016a); and key references. Compare habitat and composition to summary description, and descriptions in DBCA (2017) and Toolibin Lake Recovery Team and Toolibin Lake Technical Advisory Group (1994)

29	Sedgelands in Holocene dune swales of the southern Swan Coastal Plain (floristic community type 19 as originally described in in Gibson *et al*. (1994))	The community is within wetland depressions (swales) occurring between parallel Holocene dunes, mostly located on the Rockingham-Becher Plain but also extending further north to Lancelin and south to Dalyellup. Typical and common native species in the community are the shrubs *Acacia rostellifera* (summer-scented wattle), *Acacia saligna* (orange wattle) and *Xanthorrhoea preissii* (balga), the sedges *Machaerina juncea* (bare twigrush), *Ficinia nodosa* (knotted club rush) and *Lepidosperma gladiatum* (coast sword-sedge), and the grass *Poa porphyroclados.* The community is also known as 'floristic community type 19' as originally described in Gibson N., Keighery B.J., Keighery G.J., Burbidge A.H. and Lyons M.N. (1994) A floristic survey of the southern Swan Coastal Plain (unpublished report for the Australian Heritage Commission prepared by the Department of Conservation and Land Management and the Conservation Council of Western Australia (Inc.)).	Department of Environment and Conservation (2011) Interim Recovery Plan 2011-2016 for Sedgelands in Holocene dune swales. Interim Recovery Plan No. 314. Department of Environment and Conservation, Perth. Gibson, N., Keighery, B., Keighery, G., Burbidge, A and Lyons, M. (1994*). A floristic survey of the Southern Swan Coastal Plain*. Unpublished report for the Australian Heritage Commission prepared by the Department of Conservation and Land Management and the Conservation Council of Western Australia (Inc.). Keighery B.J., Keighery G.J., Longman V.M. and Clarke K.A. (2012) Native and Weed Flora of the Southern Swan Coastal Plain: 2005 Dataset. Department of Environment and Conservation, Kensington, Western Australia.	The community typically occurs in dampland and sumpland habitats that occur largely on Quindalup dunes in Holocene beach ridge dune swales. Typically a dense, species-poor sedgeland dominated by bare twigrush (*Baumea juncea*) and knotted club rush (*Ficinia nodosa*) in younger near-coastal dunes. In some of the older swales an open tree cover has developed over the sedgeland. Combinations of plant species provide supporting evidence for particular floristic community types (FCTs). Lists of taxa that are 'typical' or 'common' to particular FCTs are listed in Gibson *et al*. (1994). Taxa listed as 'common' would be expected to be present in at least 75%, and those listed as 'common' expected in at least 50% of FCT 19 sites. The absence of one or a number of the 'typical' or 'common' taxa does not definitively indicate that FCT 19 does not occur. There were few quadrats established in this community for Gibson *et al*. (1994), and the interim recovery plan; Department of Environment and Conservation (2011) provides a more extensive list of flora for the type.	Sample, analyse data and report on flora and vegetation using methods described in EPA (2016a); and further detail in DBCA (2021 -see Appendix 1 below), and key references.
30	Themeda grasslands on cracking clays (Hamersley Station, Pilbara)	The community is known from Hamersley Station in the Pilbara. It comprises an open to closed tussock grassland on cracking clays and is dominated by the perennial *Themeda* sp. Hamersley Station (M.E. Trudgen 11431) (priority 3) that grows to approximately 1.8 m high. A suite of other grasses and herbs also occur. In some areas there is scattered open overstorey of low trees present including *Hakea lorea* subsp. *lorea* (witinti) and *Eucalyptus victrix* (smooth-barked coolibah).	Biota Environmental Sciences (2012) *Themeda Grasslands Threatened Ecological Community – Seasonal Botanical Survey*. Report prepared for Rio Tinto Iron Ore Pty Ltd. CSIRO (2016) The Australian Soil Classification. Second Edition. CSIRO Publishing, Australia. Ecoscape (2011) 'Themeda Grasslands on Cracking Clay' TEC Assessment. Report prepared for Fortescue Metals Group Limited. Grant, C.D. and Blackmore, A.V. (1991) Self-mulching behaviour in clay soils: Its definition and measurement. *Australian Journal of Soil Research* 29: 155−173. Van Vreeswyk, A.M.E., Payne, A.L., Leighton, K.A. and Hennig, P. (2004) An inventory and condition survey of the Pilbara region, Western Australia. Department of Agriculture and Food, Western	Originally mapping of the community was based on land system mapping by the Department of Agriculture and Food (van Vreeswyk *et al*. 2004). Coincided with the Brockman land system in Hamersley subregion. Land system described by van Vreeswyk *et al*. (2004) as 'level alluvial plains with cracking clay soils and gilgai microrelief, supporting tussock grasslands (land type 14)' and comprised six land units. Of these land units, the gilgai plains were associated with the tussock grassland vegetation types. The soils are described by van Vreeswyk *et al*. (2004) as 'self-mulching cracking clays (soil group 602)' and 'red/brown non-cracking clays (soil group 622)'. The term 'self-mulching' describes the way heavy clay soils (35%+ clay) form a loose granular mulch of fine aggregates at the soil surface, after wetting and drying, which falls to the bottom of the profile and increases its volume (Grant and Blackmore 1991). These soils have shrink-swell properties that exhibit strong cracking at depth when dry hence, 'cracking' soils (CSIRO 2016). The uppermost soil layer exhibits large surface cracks or has crumbly (self-mulching) surfaces when dry, and when wet heave, often showing rough mounded (gilgai)	Sample, analyse data and report on flora and vegetation using methods described in EPA (2016a), and key references. Determine if habitat (Pilbara cracking clay flats) and associated floral assemblages occur, and meet summary description, and are consistent with descriptions in key references.

			Australia, Perth. *Technical Bulletin 92*.	surfaces forming a network of gilgai plains. The soil surface is generally non-saline, to partially saline in deep sub soils. Community is dependent on inundation with fresh water from sporadic rainfall events and run-on rainfall from surface flows. The floristic units described by Biota (2012) are all dominated by *Themeda* sp. Hamersley Station (M.E. Trudgen 11431) but vary in composition with the addition of scattered tall shrubs, woodlands and shrublands. The composition varies between sites depending on soil depth and probably chemistry, local hydrology, fire history, and possibly other factors such as land use. The following priority flora also occur in the community: *Euphorbia inappendiculata* var. *queenslandica (P1); Euphorbia australis* var. *glabra (P2); Glycine falcata (P3); Iotasperma sessilifolium (P3); Oldenlandia* sp. Hamersley Station (A.A. Mitchell PRP 1479) (P3); *Rostellularia adscendens* var. *latifolia (P3): Stackhousia clementii (P3); Swainsona thompsoniana (P3); Themeda* sp. Hamersley Station (M.E. Trudgen 11431) (P3). Three vegetation units are considered a subtype of the TEC with *Hakea lorea* subsp. *lorea* scattered tall shrubs to low open woodland over Themeda sp. Hamersley Station (M.E. Trudgen 11431) tussock grassland to be included in the TEC. HLTHs typically occurs on boundaries of the TEC providing a buffer to the community.	
31	Unwooded freshwater wetlands of the southern Wheatbelt of Western Australia, dominated by *Duma horrida* subsp. *adbita* and *Tecticornia verrucosa* across the lake floor (Lake Bryde)	The community occurs in freshwater wetlands (Lake Bryde wetland system) of the southern Wheatbelt of Western Australia. The habitat of this community is characterised by intermittent inundation, and it sometimes holds little water for several consecutive years. The major components of the community and other biota depend on relatively fresh water and regular drying out of the clay and silt wetland bed for survival. In addition to *Duma horrida* subsp. *abdita* (threatened) and *Tecticornia verrucosa* across the lake floor, the wetlands support fringing open woodlands of *Eucalyptus occidentalis* (flat-topped yate) over *Melaleuca strobophylla* dominated scrub.	Department of Biodiversity, Conservation and Attractions (2020). Lake Bryde Landscape Recovery Program 2020-2040. DBCA, Perth. Hamilton-Brown, S., and J. Blyth. 2001. Unwooded Fresh Water Lakes of the Southern Wheatbelt of Western Australia, dominated by *Muehlenbeckia horrida* subsp. *abdita* and *Tecticornia verrucosa* across the lake floor and, *Muehlenbeckia horrida* supsp. *abdita* Interim Recovery Plan 2001- 2006., Department of Conservation and Land Management, Wanneroo, Western Australia.	Lakes that are seasonally inundated with fresh water, with key flora *Duma horrida* subsp. *abdita* and and *Tecticornia verrucosa*. Only known from Lake Bryde, East Lake Bryde and Lakeland Nature Reserve. Major flora and other biota depend on relatively fresh water and regular drying out of the clay and silt wetland bed for survival.	Sample and report on flora and vegetation and habitat, using methods described in EPA (2016a); and key references. Compare seasonal freshwater lake habitat, and composition of dominant flora to summary description, and description in key references

Shrublands					
32	*Calothamnus graniticus* subsp. *graniticus* heaths on south-west coastal granites	The community is known from a narrow band parallel to the western shores of Geographe Bay near Meelup. It occurs in areas of exposed granite outcrops and isolated pockets of shallow gravelly-loam soils predominantly found lower in the landscape, but also in isolated pockets upslope where granite boulders dominate. The distinctive *Calothamnus graniticus* subsp. *graniticus* (one-sided bottle brush; priority 4) forms a dense shrub layer often with *Dodonaea ceratocarpa* and occasionally *Gastrolobium spinosum* (prickly poison) and *Allocasuarina humilis* (dwarf sheoak). Downslope, smaller shrubs can include *Boronia tenuis* (blue boronia) (priority 4), *Chorizema aciculare* (needle-leaved chorizema), *Hibbertia hypericoides* (yellow buttercups), *Hibbertia prolata*, *Lysiandra calycina* (false boronia), *Thryptomene saxicola* (rock thryptomene) and *Xanthorrhoea preissii* (balga). *Burchardia congesta*, *Caladenia caesarea* subsp. *maritima* (cape mustard orchid; critically endangered), a fern *Cheilanthes austrotenuifolia*, *Conostylis setigera* (bristly cottonhead), *Laxmannia sessiliflora* (nodding lily), *Lomandra micrantha* (small-flower mat-rush), trigger plants including *Stylidium affine* (queen trigger plant), *Stylidium megacarpum*, *Sylidium repens* (matted trigger plant) and sedges and grasses, *Lepidosperma squamatum*, *Morelotia octandra* and *Neurachne alopecuroidea* (foxtail mulga grass) can also be found in the understorey.	Keating, C. and Trudgen, M. (1986) A Flora and Vegetation Survey of the Coastal Strip from Forrest Beach – Cape Naturaliste – Woodlands. Report prepared for the Department of Conservation and Environment, WA. Shire of Busselton (2007). Fire Management Plan Meelup Regional Park. Written by Meelup Regional Parks Management Committee Reviewed August 2007. Webb, A. (2013). The Flora and Vegetation of the Meelup reserve system. An unpublished report for the Meelup Park Management Committee. Bunbury, Western Australia.	The presence of *Calothamnus graniticus* subsp. *graniticus* is key to identification of the community. Keating and Trudgen (1986) mapped the following units as including the species: • AgCg – *Agonis flexuosa*, *Calothamnus graniticus* subsp. *graniticus* closed scrub. • GH1 – *Calothamnus graniticus* subsp. *graniticus* Open to Closed Heath. • AgM – *Agonis flexuosa*, *Corymbia calophylla* Low Woodland. • Ah – *Allocasuarina humilis*, *Thryptomene saxicola*, *Dodonaea ceratocarpa*, *Calothamnus graniticus* subsp. *graniticus* low shrubland. • MGr – *Corymbia calophylla* Woodland. These are amalgamated into '*Calothamnus graniticus* Closed Heath' that represents the community.	Sample, analyse data and report on flora and vegetation using methods described in EPA (2016a), and key references. Determine if *Calothamnus graniticus* subsp. *graniticus* occurs, (key to identification of the community). Verify if substrate and vegetation units meet summary description and descriptions in key references.
33	Herb rich saline shrublands in clay pans (floristic community type 7 as originally described in Gibson *et al.* (1994))	The community is generally dominated by *Melaleuca viminea* (mohan), *Melaleuca osullivanii*, *Melaleuca cuticularis* (saltwater paperbark) or *Casuarina obesa* (swamp sheoak) or a mixture of these species. It has been recorded between Nambung and Ambergate on heavy clay soils that are generally inundated from winter into mid-summer. The species *Melaleuca cuticularis* and *Casuarina obesa* may indicate some saline influence for at least part of the year.	Department of Parks and Wildlife (2015). Interim Recovery Plan 2015-2020 for Clay pans of the Swan Coastal Plain (Swan Coastal Plain community types 7, 8, 9 and 10a) and Clay pans with mid dense shrublands of *Melaleuca lateritia* over herbs. Interim Recovery Plan No. 354. Perth. Gibson, N., Keighery, B., Keighery, G., Burbidge, A and Lyons, M.	Community occurs on heavy clay soils that are generally wet, and may have surface water present, from winter to mid-summer. Many locations hold water up to 30cm deep in early spring, and early flowering aquatic species are common. A succession of species including *Centrolepis* spp. and *Stylidium* spp. flower as the clay pans dry over a period of up to three months. The community can occur under a shrub layer comprising *Melaleuca viminea, M. osullivanii, M. cuticularis* or *Casuarina obesa* or other shrubs but can	Sample, analyse data and report on flora, vegetation and habitat using methods described in EPA (2016a); and further detail in DBCA (2021 - see Appendix 1 below), and key references.

		Herbs such as *Brachyscome bellidioides*, *Centrolepis polygyna* (wiry centrolepis), *Pogonolepis stricta* (stiff angianthus) and *Cotula coronopifolia* (waterbuttons) are typical of this community. In addition, species such as *Angianthus drummondii* (priority 3), *Eryngium pinnatifidum* subsp. Palustre (priority 3), and *Blennospora drummondii* occur in the community at low frequency. A suite of annual flora is seen in the community as the season progresses. In early spring many of the occurrences of the community are covered by free water up to 30 cm deep. *Cotula coronopifolia* sometimes forms yellow floating mats in some pools while others may be dominated by *Ornduffia submersa* (priority 4). Aquatic species are common in the community early in the growing season. As the wetland dries a succession of species such as *Centrolepis* spp. and annual *Stylidium* spp. successively germinate, grow and flower, resulting in an extended flowering period of over three months. The community is also known as 'floristic community type 7' as originally described in Gibson N., Keighery B.J., Keighery G.J., Burbidge A.H. and Lyons M.N. (1994) 'A floristic survey of the southern Swan Coastal Plain' (unpublished report for the Australian Heritage Commission prepared by the Department of Conservation and Land Management and the Conservation Council of Western Australia (Inc.)).	(1994*). A floristic survey of the Southern Swan Coastal Plain*. Unpublished report for the Australian Heritage Commission prepared by the Department of Conservation and Land Management and the Conservation Council of Western Australia (Inc.). Keighery B.J., Keighery G.J., Longman V.M. and Clarke K.A. (2012) Native and Weed Flora of the Southern Swan Coastal Plain: 2005 Dataset. Department of Environment and Conservation, Kensington, Western Australia.	also occur as woodlands or herblands. Some areas such as where *Melaleuca cuticularis* or *Casuarina obesa* occur as an overstorey may be saline for part of the year due to evaporation resulting in increased salinity. Herbs such as *Philydrella pygmaea*, *Brachyscome bellidioides*, *Centrolepis aristata, Centrolepis polygyna*, *Pogonolepis stricta* and *Cotula coronopifolia* (alien species in Florabase); frequently occur in the community. Species such as *Angianthus drummondii*, *Eryngium pinnatifidum* subsp. palustre (G.J. Keighery 13459) and *Blennospora drummondii* occur in low frequency and were not recorded in community types 8 to 10 (Gibson *et al*. 1994). Combinations of plant taxa provide supporting evidence for particular floristic community types (FCTs). Lists of taxa that are 'typical' or 'common' to particular FCTs are listed in Gibson *et al*. (1994). Taxa listed as 'common' taxa would be expected to be present in at least 75%, and those listed as 'common' expected in at least 50% of FCT 7 sites. The absence of a number of 'typical' or 'common' taxa does not definitively indicate that FCT 7 does not occur.	
34	Herb rich shrublands in clay pans (floristic community type 8 as originally described in Gibson *et al*. (1994))	The community has been recorded between Bullsbrook and Ludlow, and occurs in low lying flats with a clay impeding layer that facilitates seasonal inundation. The vegetation can be dominated by *Viminaria juncea* (swishbush), *Melaleuca viminea* (mohan), *Melaleuca lateritia* (robin redbreast bush) or *Melaleuca osullivanii* but also occasionally by *Eucalyptus wandoo* (wandoo). Commonly occurring species include *Hypocalymma angustifolium* (white myrtle), *Acacia lasiocarpa* var. *bracteolata* (long peduncle form) and *Verticordia huegelii* (variegated featherflower), and aquatic annuals. The community is also known as 'floristic community type 8' as originally	Department of Parks and Wildlife (2015). Interim Recovery Plan 2015-2020 for Clay pans of the Swan Coastal Plain (Swan Coastal Plain community types 7, 8, 9 and 10a) and Clay pans with mid dense shrublands of *Melaleuca lateritia* over herbs. Interim Recovery Plan No. 354. Perth. Gibson, N., Keighery, B., Keighery, G., Burbidge, A and Lyons, M. (1994*). A floristic survey of the Southern Swan Coastal Plain*. Unpublished report for the Australian Heritage Commission prepared by the Department of	The surface pools in this community do not generally contain water to the same depth or for as long as in floristic community type 7, but aquatic annuals are still common. In the most recent analysis of a more comprehensive dataset of clay pan data by Gibson *et al*. (2005) that included areas outside of the Swan Coastal Plain, however, sites in these deeper basin clay pans grouped separately into the community 'Clay pans with shrubs over herbs', described below. This includes clay pans in the Brixton St wetlands (occurrences 35, 53), Bandicoot Brook (occurrence 37), Pursers (occurrences 102, 103, 106, 107), Julimar (occurrence 101), and Drummond (occurrences 99, 100).	Sample, analyse data and report on flora, vegetation and habitat using methods described in EPA (2016a); and further detail in DBCA (2021 - see Appendix 1 below), and key references.

		described in Gibson N., Keighery B.J., Keighery G.J., Burbidge A.H. and Lyons M.N. (1994) 'A floristic survey of the southern Swan Coastal Plain' (unpublished report for the Australian Heritage Commission prepared by the Department of Conservation and Land Management and the Conservation Council of Western Australia (Inc.)).	Conservation and Land Management and the Conservation Council of Western Australia (Inc.). Keighery B.J., Keighery G.J., Longman V.M. and Clarke K.A. (2012) Native and Weed Flora of the Southern Swan Coastal Plain: 2005 Dataset. Department of Environment and Conservation, Kensington, Western Australia.	*Viminaria juncea*, *Melaleuca viminea*, *M. lateritia* or *M. osullivanii* and occasionally *Eucalyptus wandoo* generally dominate this community. *Hypocalymma angustifolium*, *Acacia lasiocarpa* var. *bracteolata* (long peduncle form P1) and *Verticordia huegelii* can also occur. Typical herbs include *Centrolepis aristata*, *Chorizandra enodis, Drosera menziesii* subsp. *menziesii, Drosera rosulata* and *Hyalosperma cotula*. This community included a relatively high proportion of weeds due to historical disturbance (Gibson *et al.* 1994). Combinations of plant species provide supporting evidence for particular floristic community types (FCTs). Lists of taxa that are 'typical' or 'common' to particular FCTs are listed in Gibson *et al*. (1994). Taxa listed as 'common' taxa would be expected to be present in at least 75%, and those listed as 'common' expected in at least 50% of FCT 8 sites. The absence of a number of 'typical' or 'common' taxa does not definitively indicate that FCT 8 does not occur.	
35	Dense shrublands on clay flats (floristic community type 9 as originally described in Gibson *et al*. (1994))	The community occurs as shrublands or open woodlands on clay flats that are inundated for long periods. It has been recorded between Moore River National Park and Dunsborough. Sedges are more apparent in the community than in other claypans, generally with moderate frequencies of *Chorizandra enodis* (black bristlerush), *Cyathochaeta avenacea*, *Lepidosperma longitudinale* (pithy sword-sedge) and *Leptocarpus coangustatus*. The community has a lower species richness and weed frequency than other claypan threatened ecological communities. The community is also known as 'floristic community type 9' as originally described in Gibson N., Keighery B.J., Keighery G.J., Burbidge A.H. and Lyons M.N. (1994) "A floristic survey of the southern Swan Coastal Plain" (unpublished report for the Australian Heritage Commission prepared by the Department of Conservation and Land Management and the Conservation Council of Western Australia (Inc.)).	Department of Parks and Wildlife (2015). Interim Recovery Plan 2015-2020 for Clay pans of the Swan Coastal Plain (Swan Coastal Plain community types 7, 8, 9 and 10a) and Clay pans with mid dense shrublands of *Melaleuca lateritia* over herbs. Interim Recovery Plan No. 354. Perth. Gibson, N., Keighery, B., Keighery, G., Burbidge, A and Lyons, M. (1994*). A floristic survey of the Southern Swan Coastal Plain*. Unpublished report for the Australian Heritage Commission prepared by the Department of Conservation and Land Management and the Conservation Council of Western Australia (Inc.). Keighery B.J., Keighery G.J., Longman V.M. and Clarke K.A. (2012) Native and Weed Flora of the Southern Swan Coastal Plain: 2005 Dataset. Department of Environment and Conservation, Kensington, Western Australia.	Community recorded from shrublands or open woodlands that are inundated for longer periods and have lower species richness and numbers of weeds than the other clay pan types on the Swan Coastal Plain (FCT07, 08, 10a). Sedges including *Chorizandra enodis*, *Cyathochaeta avenacea*, *Lepidosperma longitudinale* and *Leptocarpus coangustatus (*formerly *Meeboldina coangustata)* are more common in this community. Shrubs including *Hakea varia, Melaleuca viminea* and *Eutaxia virgata* are common. Community is known from the following vegetation complexes, that equate to soil and landform units: Bassendean Complex North, Guildford, Serpentine River, Bassendean Complex Central and South, Karrakatta complex Central and South, and Southern River Complex. Combinations of plant species provide supporting evidence for particular floristic community types (FCTs). Lists of taxa that are 'typical' or 'common' to particular FCTs are listed in Gibson *et al*. (1994). Taxa listed as 'common' taxa would be expected to be present in at least 75%, and those listed as 'common' expected in at least 50% of FCT 9 sites. The absence of a number of the 'typical' or 'common' taxa does not definitively indicate that FCT 9 does not occur.	Sample, analyse data and report on flora, vegetation and habitat using methods described in EPA (2016a); and further detail in DBCA (2021 - see Appendix 1 below), and key references.

36	Ferricrete floristic community (Rocky Springs type)	The community generally comprises tall shrubland and has been recorded between Arrino and Eneabba, on irregularly inundated red brown sandy loams over ferricrete. It is generally dominated by *Acacia blakelyi*, *Allocasuarina campestris* and *Labichea lanceolata* subsp. *lanceolata*. Associated species include *Alyogyne hakeifolia*, *Borya sphaerocephala* (pincushions), *Isotoma hypocrateriformis* (Woodbridge poison), *Petrophile seminuda*, *Stylidium dichotomum* (pins-and-needles), *Thysanotus patersonii* and *Pterochaeta paniculata* (woolly waitzia).	Department of Parks and Wildlife (2004). Interim Recovery Plan 2004-2009 for 'Ferricrete floristic community (Rocky Springs type)' (update). Interim Recovery Plan No. 154. Department of Parks and Wildlife, Perth. Griffin, E. A., Hopkins, A. J. M and Hnatiuk, R. J. (1983) Regional variation in Mediterranean-type shrublands near Eneabba, south-western Australia. *Vegetatio* 52, 103-127. Hnatiuk, R. J. and Hopkins, A. J. M (1981) An ecological analysis of kwongan south of Eneabba, Western Australia. *Australian Journal of Ecology* 6, 423-438. Lowry, D.C. (1974) Dongara-Hill River, Western Australia 1:250,000 Geological Series – explanatory notes. Geological survey of Western Australia. Mory, A. J. (1994) Geology of the Arrowsmith-Beagle Islands 1: 100,000. Geological Survey of Western Australia.	Community is defined by the presence of ferricrete and derived substrates that underlie the distinctive vegetation. Ferricrete is formed in the soil profile at the water-table when iron-oxides accumulate and cement together to form a gravely or nodule-rich band. This community occurs on infrequently inundated red and brown sandy loams over ferricrete. Ferricrete substrate is extremely restricted in distribution in the Eneabba region. The floral composition of the Ferricrete community varies with substrate types and depths. The Rocky Springs sites lie within the 'Rocky Springs complex' - a combination of exposures of a ferrugineous layer and Mesozoic sediments with varying amounts of shallow sand and gravel mantle. Community occurs over range of 45km between Arrino and Eneabba in the Northern Perth Basin.	Sample, analyse data and report on flora and vegetation using methods described in EPA (2016a), and key references. Compare key substrate characteristics, and its' associated assemblages, to descriptions in key references. The range of flora and vegetation that occurs on Ferricrete substrate in the Eneabba area and the habitats of this TEC may not have been fully documented.
37	Lesueur-Coomallo floristic community A1.2 as originally described by Griffin and Hopkins (1990)	The community is known from Warradarge. It comprises a species-rich heath with emergent *Hakea obliqua* (needles and corks) on sand with faithful species of *Hakea obliqua* and *Beaufortia elegans* (elegant beaufortia) and constant species of *Dasypogon bromeliifolius* (pineapple bush) and *Stirlingia latifolia* (blueboy) over well-drained grey sand over pale yellow sand on lateritic uplands. Associated species include *Allocasuarina humilis* (dwarf sheoak), *Calothamnus sanguineus* (silky-leaved blood flower), *Hibbertia hypericoides* (yellow buttercups), *Hypocalymma xanthopetalum* and *Schoenus subflavus* (yellow bog-rush). The community was originally described by Griffin E.A. and Hopkins A.J.M. in the vegetation chapter (pp. 25-38) in Burbidge A.A., Hopper S.D. and van Leeuwen S. (eds.) (1990) "Nature conservation, landscape and recreation	Griffin, E. A. and Hopkins, A. J. M. (1990). Vegetation. In: Burbidge, A. A., Hopper, S. D. and van Leeuwen, S. (eds.) *Nature Conservation, Landscape and Recreation values of the Lesueur Area, pp. 25-38.* A report to the Environmental Protection Authority from the Department of Conservation and Land Management. Bulletin 424, Environmental Protection Authority, Perth. Griffin, E. A., Hopkins, A. J. M and Hnatiuk, R. J. (1983). Regional variation. Hamilton-Brown, S. (2002). Lesueur-Coomallo Floristic Community A1.2 Interim Recovery Plan No. 106. Department of Conservation and	A distinctive sand heath known from a single location in the Lesueur area. Community is strongly associated with landform and soil distribution and only occurs in the south-eastern part of the Banovich Upland landform, characterised by old undulating lateritic slopes. Martinick and Associates (1989) observed that sandplain heath with emergent *Hakea obliqua* (Floristic Community A1.2) only occurred in one site.	Sample and report on flora and vegetation and habitat, using methods described in EPA (2016a); and key references. Compare substrate and habitat, and associated distinctive assemblage, with summary description and description in key references.

		values of the Lesueur area" (A report to the Environmental Protection Authority from the Department of Conservation and Land Management. Bulletin 424, Environmental Protection Authority, Perth).	Land Management, Western Australia. Martinick, W. G. and Associates Pty Ltd. (1989). Hill River Project Biological Studies: Vegetation of the Project Area in a Regional Context. Unpublished Report.		
38	Lesueur-Coomallo Floristic Community D1 as originally described by Griffin and Hopkins (1990)	The community occurs in Hill River. It comprises a species-rich low heath on moderately to well-drained lateritic gravels on lower slopes and low rises, generally dominated by *Allocasuarina microstachya* with *Allocasuarina ramosissima* (priority 3), *Allocasuarina humilis* (dwarf sheoak), *Babingtonia grandiflora* (large-flowered babingtonia), *Borya nitida* (pincushions), *Calytrix flavescens* (summer starflower), *Calothamnus sanguineus* (silky-leaved blood flower), *Conostylis androstemma* (trumpets), *Cryptandra pungens*, *Banksia armata* (prickly dryandra), *Gastrolobium polystachyum* (horned poison), *Hakea auriculata*, *Hakea incrassata* (marble hakea), *Hakea erinacea*, *Hibbertia hypericoides* (yellow buttercups), *Hypocalymma xanthopetalum*, *Melaleuca trichophylla*, *Petrophile chrysantha*, *Schoenus subflavus* (yellow bog-rush) and *Xanthorrhoea drummondii*. The community was originally described by Griffin E.A. and Hopkins A.J.M. in the vegetation chapter (pp. 25-38) of Burbidge A.A., Hopper S.D. and van Leeuwen S. (eds.) (1990) 'Nature conservation, landscape and recreation values of the Lesueur area' (A report to the Environmental Protection Authority from the Department of Conservation and Land Management. Bulletin 424, Environmental Protection Authority, Perth).	Department of Conservation and Land Management (2002). Lesueur-Coomallo Floristic Community D1 Interim Recovery Plan 109. Sheila-Hamilton Brown, Western Australian Threatened Species and Communities Unit. Griffin, E. A. and Hopkins, A. J. M. (1990). Vegetation. In: Burbidge, A. A., Hopper, S. D. and van Leeuwen, S. (eds.). Nature Conservation, Landscape and Recreation values of the Lesueur Area, pp. 25-38. A report to the Environmental Protection Authority from the Department of Conservation and Land Management. Bulletin 424, Environmental Protection Authority, Perth.	Heath of floristic composition as described in Griffin and Hopkins (1990), on habitat of lateritic gravels on lower slopes and low rises (Lesueur area).	Sample, analyse data and report on vegetation using methods described in EPA (2016a); and key references. Compare habitat and composition to summary description, and description in key references.
39	*Melaleuca huegelii — Melaleuca systena* shrublands on limestone ridges (floristic community type 26a as	The community is found on skeletal soils on limestone ridge slopes and ridge tops between Yanchep north of Perth, and south of Perth near Lake Clifton. The community commonly comprises species-rich thickets, heaths and scrubs dominated by *Melaleuca huegelii* (chenille honeymyrtle), *Melaleuca systena* (coastal honeymyrtle) and *Banksia sessilis* (parrot bush), commonly over *Grevillea preissii* (spider net grevillea),	Department of Environment and Conservation (2005). Interim Recovery Plan 2004-2009 for *Melaleuca huegelii – Melaleuca systena* shrublands of limestone ridges (Swan Coastal Plain Community type 26a - Gibson *et al.* 1994) Interim Recovery Plan No. 193. DEC, Perth.	The Tamala limestone ridges that support the community occur intermittently as late Pleistocene ridges (1-2 million years old) that are roughly parallel to the coast on the Swan Coastal Plain. FCT26a has been located on the Cottesloe and Karrakatta soil units mainly within the Spearwood system. The Cottesloe soil unit consists of low hilly landscape with shallow brown sands over limestone, and Karrakatta is yellow sands with a limestone layer, and grey surface colouring due to organic matter.	Sample, analyse data and report on flora and vegetation using methods described in EPA (2016a); and further detail in DBCA (2021 -see Appendix 1 below), and key references. Determine if substrate and

	originally described in Gibson *et al*. (1994))	*Spyridium globulosum* (basket bush), and *Acacia lasiocarpa* (pajang). A suite of herbs commonly occur under the shrub layer. The community is also known as "floristic community type 26a" as originally described in Gibson N., Keighery B.J., Keighery G.J., Burbidge A.H. and Lyons M.N. (1994) "A floristic survey of the southern Swan Coastal Plain" (unpublished report for the Australian Heritage Commission prepared by the Department of Conservation and Land Management and the Conservation Council of Western Australia (Inc.)).	Gibson, N., Keighery, B., Keighery, G., Burbidge, A and Lyons, M. (1994*). A floristic survey of the Southern Swan Coastal Plain*. Unpublished report for the Australian Heritage Commission prepared by the Department of Conservation and Land Management and the Conservation Council of Western Australia (Inc.). Keighery B.J., Keighery G.J., Longman V.M. and Clarke K.A. (2012) Native and Weed Flora of the Southern Swan Coastal Plain: 2005 Dataset. Department of Environment and Conservation, Kensington, Western Australia.	There are two distinct subgroups within the FCT26 type, related to the degree of soil development. Subgroup FCT26b is on the lower slopes or in pockets with deeper soil and is dominated by low shrubs such as *Acacia lasiocarpa*, *Trymalium ledifolium*, *Melaleuca systena*, *Hibbertia hypericoides*, and *Grevillea preissii* with overstorey of *Eucalyptus gomphocephala*, *E. foecunda* and *E. petrensis* on deeper soils. Subgroup FCT26a occurs on skeletal soil on ridge slopes and tops of ridges, and is dominated by *M. huegelii*, *M. systena* and *M.* aff. *systena* often over scattered limestone heath species such as *Dryandra sessilis* and *G. preissii* (Keighery *et al*. 2003). Combinations of plant species provide supporting evidence for particular floristic community types (FCTs). Lists of taxa that are 'typical' or 'common' to particular FCTs are listed in Gibson *et al*. (1994). Taxa listed as 'common' taxa would be expected to be present in at least 75%, and those listed as 'common' expected in at least 50% of FCT 26a sites. The name assigned to the floristic community type in Gibson *et al* (1994) does not indicate that an area must contain, or must have previously contained, *Melaeuca huegelii or Melaleuca systena* before it can be categorised as FCT 26a. *Melaeuca huegelii or Melaleuca systena* would however be expected to be present in at least 75% of FCT 26a sites. Similarly, the absence of a number of other 'typical' or 'common' taxa does not definitively indicate that FCT26a does not occur. Other communities identified on limestone by Gibson *et al*. (1994) are 'species poor mallees and shrublands on limestone (floristic community type 27), FCT24 northern Spearwood shrublands and woodlands, and Southern *Eucalyptus gomphocephala – Agonis flexuosa* woodlands (floristic community type 25). Each of these is indicated as floristically distinct through statistical analyses.	associated assemblages are as described in summary description, and description in key references.
40	Montane Heath and Thicket of the South West Botanical Province, above approximately 900 m above sea level	The community occurs in the high peaks of the eastern Stirling Range mountains. It is commonly found at altitudes of approximately 900 to 1 090 m above sea level, but extends to lower altitudes in two occurrences. It comprises a heathland and dense shrub thicket with a number of endemic species. Several endemic and characteristic species within the community and the near absence of *Eucalyptus* species differentiate it from other	Barrett S. (1996). Biological Survey of Mountains of southern Western Australia. Department of Conservation and Land Management, Albany. Department of Parks and Wildlife (2016). Montane Heath and Thicket of the South West Botanical Province, above approximately 900 m above sea	Heath and thicket composition including a suite of endemic flora and fauna as described in Barrett (1996), and DPaW (2016) on montane habitat in the eastern Stirling range	Sample, analyse data and report on flora and vegetation using methods described in EPA (2016a, and key references). Compare habitat and composition to summary description and descriptions in

	(Eastern Stirling Range Montane Heath and Thicket Community)	plant communities in the range. Thirteen species of threatened flora are known in the community: *Andersonia axilliflora* (giant andersonia; critically endangered), *Banksia brownii* (feather-leaved banksia; critically endangered), *Banksia montana* (critically endangered), *Darwinia collina* (yellow mountain bell; critically endangered), *Darwinia nubigena* (endangered), *Darwinia squarrosa* (pink mountain bell; vulnerable), *Daviesia obovata* (endangered), *Deyeuxia drummondii* (Drummond grass; vulnerable), *Lambertia fairallii* (Fairall's honeysuckle; critically endangered), *Latrobea colophona* (critically endangered), *Leucopogon gnaphalioides* (critically endangered), *Persoonia micranthera* (critically endangered) *and Sphenotoma drummondii* (mountain paper-heath; endangered).. Twenty three priority flora taxa also occur in the community. *Andersonia axilliflora* is a characteristic endemic species of the community. Five threatened and one priority fauna species occur within the community: *Setonix brachyurus* (quokka; vulnerable), *Pseudococcus markharveyi* (*Banksia montana* mealybug; critically endangered), *Trioza barrettae* (*Banksia brownii* plant-louse; endangered), *Zephyrarchaea robinsi* (eastern massif assassin spider; vulnerable), *Atelomastix tumula* (Bluff Knoll atelomastix millipede; vulnerable), *Bothriembryon glauerti* (a bothriembryontid land snail; priority 2)..	level (Eastern Stirling Range Montane Heath and Thicket Community). Interim Recovery Plan 2016-2021 for Interim Recovery Plan No. 370. Perth. Pignatti E., Pignatti S., Lucchese F. (1993). Plant Communities of the Stirling Range, Western Australia. J. Veg. Sci. 4: 477-488.		Barrett (1996), and DPaW (2016).
41	Perth to Gingin Ironstone Association	The community occurs on ironstone soils in the Perth area and is characterised by massed everlastings. Many of the plant species present are specifically adapted to shallow seasonal inundation, specifically the rich herb layer present in late winter and early spring which is a major distinguishing characteristic of the community. The daisies *Rhodanthe manglesii*, *Rhodanthe spicata* and *Myriocephalus helichrysoides* dominate. Other common herbs include *Tribonanthes variabilis*, *Stylidium longitubum* (jumping jacks) (priority 4) and *Isotropis cuneifolia* subsp. *glabra* (priority 3). A very open shrub layer is typical with common shrubs	Department of Conservation and Land Management (2005). Interim Recovery Plan 2005-2010 for Shrublands and Woodlands on Perth to Gingin Ironstone. Interim Recovery Plan No. 197. Department of Conservation and Land Management, Perth.	Seasonal wetlands on ironstone and shallow ironstone-derived substrate on the eastern side of the Swan Coastal Plain, and characterised by massed everlastings and an open shrub layer.	Sample and report on flora and vegetation and habitat, using methods described in EPA (2016a), and key references. Compare habitat and composition to summary description, and descriptions in CALM (2005).

		Melaleuca viminea (mohan), *Banksia sessilis* (parrot bush), *Acacia saligna* (orange wattle), *Jacksonia furcellata* (grey stinkwood), *Grevillea curviloba* (endangered) and *Kunzea recurva*.			
42	Scott River ironstone association	The community occurs in a winter-wet habitat on red clay to clay loam often over massive ironstone on the Scott Coastal Plain. It mainly comprises heaths, shrublands and thickets and is variously dominated by *Melaleuca preissiana* (moonah), *Hakea tuberculata*, *Kunzea micrantha* or *Melaleuca incana* subsp. Gingilup, depending on the degree of waterlogging. The understorey is generally dominated by *Loxocarya magna* (priority 3). Most occurrences have very diverse annual flora of *Stylidium* spp. (triggerplants), *Centrolepis* spp., *Schoenus* spp., *Aphelia* spp. and other herbs. The community also contains a number of endemic and restricted taxa such as *Darwinia ferricola* (threatened), *Grevillea manglesioides* subsp. *ferricola* (priority 3), *Lambertia orbifolia* subsp. Scott River Plains (threatened) and *Melaleuca incana* subsp. Gingilup (priority 2).	Burton, S. of Groundwater Consulting Services (2007) The Hydrogeology of the Southern and Scott River Ironstone Communities South West Western Australia. Unpublished report for the Department of Environment and Conservation. Department of Parks and Wildlife (2015) Scott River Ironstone Association (update) Interim Recovery Plan 2015-2020. Interim Recovery Plan No 339. Parks and Wildlife, Western Australia. Gibson, N., Keighery, G. and Keighery, B. (2000) Threatened plant communities of Western Australia. 1. The ironstone communities of the Swan and Scott Coastal Plains. *Journal of the Royal Society of Western Australia* 83, 1-11. Gibson, N., Keighery, G.J. and Lyons, M.N. (2001) Vascular flora of Scott National Park, Camping Reserve 12951 and Gingilup Swamps Nature Reserve, Western Australia. *DECScience* 3(4), 411-432. Groundwater Consulting Services Pty Ltd (2007) The Hydrogeology of the Southern and Scott River Ironstone Communities, South West Western Australia. Unpublished report for the Department of Conservation and Land Management. Robinson, C. and Keighery, G. (1997) Vegetation and flora of Scott National Park and adjacent recreation reserves. *The Western Australian Naturalist* 21(4), 213-233.	Flora assemblages described by Gibson *et al.* (2000) in habitats comprising highly restricted ironstone and ironstone-derived substrates (sandy ironstone soils or grey sands over ironstone, in winter wet areas) on the Scott Coastal Plain. Occurrences are highly variable in floristic composition. Level of variation appears to be quite closely linked to soil depth and type. Vegetation in other areas does not correlate with the floristics and habitat in the Scott Ironstone community. Community supports a suite of threatened or priority flora and many are restricted to sites that experience seasonal inundation. Ironstone substrates also occur on the Swan Coastal Plain near Busselton, but very few flora that are confined to ironstone soils occur in both these areas. The assemblages are quite distinct. Tille and Lantzke (1990a, b) mapped ironstone substrate in the Scott River area. Ferruginisation of the Guildford Formation and the physical properties of the underlying geology are both considered important in local moisture retention that sustains the community.	Sample, analyse data and report on flora and vegetation using methods described in EPA (2016a), and key references. Compare key substrate characteristics, and their associated assemblages, to summary description, and descriptions in key references. The range of flora and vegetation that occurs in Scott River ironstone and the habitats of this TEC may not be fully documented.

			Tille, P.J. and Lantzke, N.C. (1990a) Busselton-Margaret River-Augusta land capability study. Land Resources Series No 5. Department of Agriculture, Perth. Tille, P.J. and Lantzke, N.C. (1990b) Busselton – Margaret River – Augusta land capability study; methodology and results Volume 1. Technical Report 109. Division of Resource Management. Western Australian Department of Agriculture, Perth.		
43	Shrublands on dry clay flats (floristic community type 10a as originally described in Gibson *et al*. (1994))	The community occurs on clay flats with thin skeletal soils and has been recorded largely between Wattle Grove and Sabina River. It comprises rapidly drying clay flats. Typical and common shrubs include *Hakea sulcata* (furrowed hakea), *Verticordia densiflora* (compacted featherflower), *Hakea varia* (variable-leaved hakea), *Pericalymma ellipticum* (swamp teatree) and *Viminaria juncea* (swishbush). *Aphelia cyperoides* (hairy aphelia), *Centrolepis aristata* (pointed centrolepis), *Drosera gigantea* (giant sundew) and *Drosera menziesii* (pink rainbow) also commonly occur. The community is also known as "floristic community type 10a" as originally described in Gibson N., Keighery B.J., Keighery G.J., Burbidge A.H. and Lyons M.N. (1994) "A floristic survey of the southern Swan Coastal Plain" (unpublished report for the Australian Heritage Commission prepared by the Department of Conservation and Land Management and the Conservation Council of Western Australia (Inc.)).	Department of Biodiversity, Conservation and Attractions (2018). National Recovery Plan for the Clay pans of the Swan Coastal Plain ecological community. Department of Biodiversity, Conservation and Attractions, Perth, Western Australia. Department of Parks and Wildlife (2015). Interim Recovery Plan 2015-2020 for Clay pans of the Swan Coastal Plain (Swan Coastal Plain community types 7, 8, 9 and 10a) and Clay pans with mid dense shrublands of *Melaleuca lateritia* over herbs. Interim Recovery Plan No. 354. DPaW Perth. Gibson, N., Keighery, G.J., Lyons, M.N., Keighery, B.J. (2005) Threatened plant communities of Western Australia. 2 The seasonal clay-based wetland communities of the South West. *Pacific Conservation Biology* 11:287-301. Gibson, N., Keighery, B., Keighery, G., Burbidge, A and Lyons, M. (1994*). A floristic survey of the Southern Swan Coastal Plain*. Unpublished report for the Australian Heritage Commission prepared by the Department of Conservation and Land Management and the Conservation Council of Western Australia (Inc.).	Community occurs on skeletal soils that have shallow microtopography and the habitat is the most rapidly drying of the four clay pans identified in Gibson *et al*. (1994; FCTs 7, 8, 9, and 10a). All of the clay pan types, except community type 10a that is generally a shrubland, are dominated by annual flora. Combinations of plant species provide supporting evidence for particular floristic community types (FCTs). Lists of taxa that are 'typical' or 'common' to particular FCTs are listed in Gibson *et al*. (1994). Taxa listed as 'common' would be expected to be present in at least 75%, and those listed as 'common' expected in at least 50% of FCT 10a sites. The absence of one or a number of the 'typical' or 'common' taxa does not definitively indicate that FCT 10a does not occur.	Sample, analyse data and report on flora and vegetation using methods described in EPA (2016a); and further detail in DBCA (2021 -see Appendix 1 below); and key references.

			Keighery B.J., Keighery G.J., Longman V.M. and Clarke K.A. (2012) Native and Weed Flora of the Southern Swan Coastal Plain: 2005 Dataset. Department of Environment and Conservation, Kensington, Western Australia. Keighery, B. and Trudgen, M. (1992). *Remnant vegetation on the alluvial soils of the eastern side of the Swan Coastal Plain.* Report prepared for the Department of Conservation and Land Management. Perth, Western Australia. Webb (2019) A preliminary assessment of vegetation change after 25 years within ephemeral claypans (FCT07 & 08). Report in draft for Department of Biodiversity and Conservation, South West Region.		
44	Shrublands and woodlands on Muchea Limestone of the Swan Coastal Plain	The community occurs on the heavy soils of the eastern side of the Swan Coastal Plain and has been recorded between Beermullah and Wokalup. Known patches include wetland and well-drained habitats, in a variety of landforms. It is defined on the basis of substrates with a limestone influence. Many of the species are commonly associated with the limestone soils that occur on the coast, and do not generally occur further inland. Typical and common native species in areas of best developed limestone are: the tree *Casuarina obesa* (swamp sheoak); the mallees *Eucalyptus decipiens* (redheart) and *Eucalyptus foecunda* (narrow-leaved red mallee); the shrubs *Melaleuca huegelii* (chenille honey-myrtle), *Alyogyne huegelii* (lilac hibiscus), *Grevillea curviloba* (threatened), and *Grevillea evanescens* (priority 1), *Melaleuca systena* (narrow-leaved paperbark); and the herb *Thysanotus arenarius* (fringed lily). Where the limestone substrate is less well developed and limestone may occur as nodules or chunks, the flora assemblages can be influenced by other characteristics of the substrate, such as	English, V and Blyth, J. (2000). Shrubland and woodlands on Muchea Limestone interim recovery plan No. 57 (2000-2003). Department of Conservation and Land Management. Perth. Gibson, N., Keighery, B., Keighery, G., Burbidge, A & Lyons, M. (1994). A floristic survey of the Southern Swan Coastal Plain. Unpublished report for the Australian Heritage Commission prepared by the Department of Conservation and Land Management and the Conservation Council of Western Australia (Inc.). Perth, Western Australia. Keighery, G. and Keighery, B. (1995). Muchea Limestones - Floristics Report for ANCA National Reserves Network. Unpublished report to Australian Nature Conservation Agency. Department of Conservation and Land Management and Department of	Community is defined on the basis of substrates with a limestone influence on the eastern side of the Swan Coastal Plain. Occurrences are highly variable in floristic composition. The level of variation appears to be quite closely linked to substrate and hydrology. The range of flora and vegetation that occurs in Muchea Limestone and the habitats of this TEC are not well documented. Flora assemblages were originally described by Keighery and Keighery (1995) and further described in other key references. Muchea Limestone was originally described from a geological unit also known as Plain Limestone (Gozzard, 1982). It occurs on the eastern side of the Swan Coastal Plain in a discontinuous distribution from Muchea to Benger.	Sample, analyse data and report on habitat, flora and vegetation using methods described in EPA (2016a), and key references. Compare key substrate characteristics, and their associated assemblages, to summary description, and descriptions in key references.

		clay content, with the presence of calcicoles such as *Thysanotus arenarius, Gahnia trifida* (coast saw-sedge), *Eremophila glabra* (tar bush) and *Melaleuca brevifolia* (mallee honey-myrtle), providing evidence of the limestone influence. *Melaleuca huegelii* shrublands, *Eucalyptus decipiens* mallee, *Casuarina obesa* woodlands and *Melaleuca brevifolia*, *Melaleuca systena* or *Melaleuca viminea* shrublands have been recorded on Muchea Limestone.	Environmental Protection. Perth, Western Australia. Tauss, C. and Weston, A.S. (2010). The flora, vegetation and wetlands of the Maddington-Kenwick Strategic Employment Area. A survey of the rural lands in the vicinity of the Greater Brixton Street Wetlands. Report to the City of Gosnells, W.A		
45	Shrublands on calcareous silts of the Swan Coastal Plain (floristic community type 18 as originally described in in Gibson *et al*. (1994))	The community is recorded from between Yalgorup National Park and Bunbury. It is species-rich, consists of open low shrubs with a rich annual flora and is known from calcareous silt flats. A suckering form of *Acacia saligna* (orange wattle), *Melaleuca viminea* (mohan), *Melaleuca teretifolia* (banbar), *Hakea varia* (variable-leaved hakea), *Xanthorrhoea preissii* (balga) and *Leptomeria ellytes* are common in the shrub layer, with sedges including *Lepidosperma longitudinale* (pithy sword-sedge) and *Gahnia trifida* (coast saw-sedge), and a suite of herbs including *Meionectes tenuifolia* (priority 3) are also common. The community is also known as 'floristic community type 18' as originally described in Gibson N., Keighery B.J., Keighery G.J., Burbidge A.H. and Lyons M.N. (1994) A floristic survey of the southern Swan Coastal Plain (unpublished report for the Australian Heritage Commission prepared by the Department of Conservation and Land Management and the Conservation Council of Western Australia (Inc.)).	Churchward, H.M. and McArthur, W.M. (1978). Darling System, Landforms and Soils. Department of Conservation and Environment. Division of Natural Resources Management, C.S.I.R.O. In: Atlas of Natural Resources Darling System, Western Australia. Perth. Gibson, N., Keighery, B., Keighery, G., Burbidge, A and Lyons, M. (1994*). A floristic survey of the Southern Swan Coastal Plain*. Unpublished report for the Australian Heritage Commission prepared by the Department of Conservation and Land Management and the Conservation Council of Western Australia (Inc.). Keighery B.J., Keighery G.J., Longman V.M. and Clarke K.A. (2012) Native and Weed Flora of the Southern Swan Coastal Plain: 2005 Dataset. Department of Environment and Conservation, Kensington, Western Australia. Wilson, J. et al 2008 Vegetation monitoring – Swan Coastal Plain (Bunbury, Busselton-Capel Groundwater Areas). A report to Water Smart Australia and the Department of Water. Centre of Ecosystem Management, Edith Cowan University.	The community is typically very species rich and found on calcareous silt flats. It has been recorded as open low scrubs with rich annual flora. It occurs in calcareous silts in wetlands classified as damplands. The community is known from the Yoongarillup soil and landform unit. This unit is described as plains with low ridges and swales, comprising shallow yellow and brown sands on fossiliferous limestone of marine or estuarine deposits. The community also occurs on the Vasse unit that comprises poorly drained plains with variable mixed layers of recent estuarine and marine deposits. Combinations of plant species provide supporting evidence for particular floristic community types (FCTs). Lists of taxa that are 'typical' or 'common' to particular FCTs are listed in Gibson *et al*. (1994). Taxa listed as 'common' taxa would be expected to be present in at least 75%, and those listed as 'common' expected in at least 50% of FCT 18 sites. The absence of a number of 'typical' or 'common' taxa does not definitively indicate that FCT 18 does not occur.	Sample, analyse data and report on flora and vegetation using methods described in EPA (2016a); and further detail in DBCA (2021 -see Appendix 1 below), and key references. Determine if substrate is as described in key references.
46	Southern wet shrublands, Swan Coastal Plain (floristic	The community typically comprises shrublands or open woodlands. It occurs on seasonally inundated sandy clay soils that are restricted to small remnants on the eastern	Gibson, N., Keighery, G.J., Lyons, M.N., Keighery, B.J. (2005) Threatened plant communities of Western Australia. 2 The seasonal	Combinations of flora provide supporting evidence for particular floristic community types (FCTs). Lists of taxa that are 'typical' or 'common' to particular FCTs are listed in Gibson *et al*. (1994). Taxa listed as 'common'	Sample, analyse data and report on flora and vegetation using methods described in

	community type 2 as originally described in Gibson *et al*. (1994))	side of the Swan Coastal Plain. It has been recorded from Forrestfield to Chapman Hill. The community has moderate species richness with the occurrence of species reflecting the wetter nature of the sites. Typical and common native taxa in the community are the shrubs *Kingia australis* (kingia), *Pericalymma ellipticum* (swamp teatree), *Hakea ceratophylla* (horned leaf hakea), *Calothamnus lateralis, Hypocalymma angustifolium* (white myrtle), *Eutaxia virgata, Stirlingia latifolia* (blueboy), *Banksia dallanneyi* (couch honeypot) and herbs, rushes and sedges including *Dampiera linearis* (common dampiera), *Comesperma virgatum* (milkwort), *Stylidium brunonianum* (pink fountain triggerplant), *Thysanotus multiflorus* (many-flowered fringe lily) and *Mesomelaena tetragona* (semaphore sedge). The community also contains priority flora including *Isopogon formosus* subsp. *dasylepis* (priority 3) and *Grevillea brachystylis* subsp. *brachystylis* (priority 3). This community is also known as "floristic community type 2" as originally described in Gibson N., Keighery B.J., Keighery G.J., Burbidge A.H. and Lyons M.N. (1994) "A floristic survey of the southern Swan Coastal Plain" (unpublished report for the Australian Heritage Commission prepared by the Department of Conservation and Land Management and the Conservation Council of Western Australia (Inc.)).	clay-based wetland communities of the South West. *Pacific Conservation Biology* 11:287-301. Gibson, N., Keighery, B., Keighery, G., Burbidge, A and Lyons, M. (1994*). A floristic survey of the Southern Swan Coastal Plain*. Unpublished report for the Australian Heritage Commission prepared by the Department of Conservation and Land Management and the Conservation Council of Western Australia (Inc.). Keighery B.J., Keighery G.J., Longman V.M. and Clarke K.A. (2012) Native and Weed Flora of the Southern Swan Coastal Plain: 2005 Dataset. Department of Environment and Conservation, Kensington, Western Australia. Keighery, B. and Trudgen, M. (1992). *Remnant vegetation on the alluvial soils of the eastern side of the Swan Coastal Plain.* Report prepared for the Department of Conservation and Land Management. Perth, Western Australia. Webb, A. (2019). A preliminary assessment of vegetation change after 25 years within the Parks & Wildlife South West Region. DBCA South West Region. (Unpublished report).	taxa would be expected to be present in at least 75%, and those listed as 'common' expected in at least 50% of FCT 2 sites. The absence of a number of the 'typical' or 'common' taxa does not definitively indicate that FCT 2 does not occur. Flora indicative of FCTs on the eastern side of the Swan Coastal Plain; that includes FCT 2 may be particularly helpful in determining the FCTs present (Keighery and Trudgen 1992, Table 4).	EPA (2016a); and further detail in DBCA (2021 -see Appendix 1 below), and key references.
47	Shrublands and woodlands of the eastern side of the Swan Coastal Plain (floristic community type 20c as originally described in in Gibson *et al*. (1994))	The community occurs mainly on the transitional soils of the Ridge Hill Shelf, on the Swan Coastal Plain adjacent to the Darling Scarp, but also extends marginally onto the alluvial clays deposited on the eastern fringe of the Swan Coastal Plain. It has been recorded between Stratton and Maddington. It generally comprises a shrubland or woodland of *Banksia attenuata* (slender banksia) and *Banksia menziesii* (firewood banksia), sometimes with *Allocasuarina fraseriana* (sheoak), over a shrub layer that can include the species *Adenanthos cygnorum* (common woollybush), *Hibbertia huegelii*, *Scaevola*	Department of Environment and Conservation (2006) Interim Recovery Plan 2006-2011 for the shrublands and woodlands of the eastern side of the Swan Coastal Plain (community type 20c). Interim Recovery Plan No. 230. Gibson, N., Keighery, B., Keighery, G., Burbidge, A and Lyons, M. (1994) A floristic survey of the Southern Swan Coastal Plain. Unpublished report for the Australian Heritage Commission prepared by the Department of	The community reflects the transitional landform and soil zone between the Scarp and the Swan Coastal Plain (see also Appendix 2 Table 1), with many species such as *Cristonia biloba*, present in the community being more common on the Scarp. The assemblage also regularly contains species such as *Neurachne alopecuroidea* more commonly associated with marri - wandoo woodlands on heavy soils. Combinations of flora provide supporting evidence for particular floristic community types (FCTs). Lists of taxa that are 'typical' or 'common' to particular FCTs are listed in Gibson *et al*. (1994). Taxa listed as 'common' taxa would be expected to be present in at least 75%, and those listed as 'common' expected in at least 50%	Sample, analyse data and report on flora and vegetation using methods described in EPA (2016a); also further detail in Appendices 1 and 2 below, and key references.

		repens var. *repens* (fan flower), *Allocasuarina humilis* (dwarf sheoak), *Bossiaea eriocarpa* (common brown pea), *Hibbertia hypericoides* (yellow buttercups) and *Stirlingia latifolia* (blueboy). A suite of herbs including *Conostylis aurea* (golden conostylis), *Trachymene pilosa* (native parsnip), *Lomandra hermaphrodita, Burchardia congesta* (milkmaids) and *Patersonia occidentalis* (purple flag), and the sedges *Mesomelaena pseudostygia* (semaphore sedge) and *Lyginia barbata* usually occur in the community. The community is also known as 'floristic community type 20c' as originally described in Gibson N., Keighery B.J., Keighery G.J., Burbidge A.H. and Lyons M.N. (1994) A floristic survey of the southern Swan Coastal Plain (unpublished report for the Australian Heritage Commission prepared by the Department of Conservation and Land Management and the Conservation Council of Western Australia (Inc.)).	Conservation and Land Management and the Conservation Council of Western Australia (Inc.). Perth, Western Australia Keighery B.J., Keighery G.J., Longman V.M. and Clarke K.A. (2012) Native and Weed Flora of the Southern Swan Coastal Plain: 2005 Dataset. Department of Environment and Conservation, Kensington, Western Australia. Keighery, B. and Trudgen, M. (1992). *Remnant vegetation on the alluvial soils of the eastern side of the Swan Coastal Plain.* Report prepared for the Department of Conservation and Land Management. Perth, Western Australia	of FCT 20c sites. The absence of a number of the 'typical' or 'common' taxa does not definitively indicate that FCT 20c does not occur. Taxa indicative of the eastern side of the Swan Coastal Plain; that includes FCT20c can be very helpful in determining the FCTs present (see Appendix 2 below; also Keighery and Trudgen 1992) The community has been recorded from heavy soils in the Perth SWA02 subregion of the Swan Coastal Plain IBRA region to date. There is potential for further survey to reveal northern expressions of FCT20c in the southern Dandaragan Plateau SWA01 subregion of the Swan Coastal Plain IBRA Region.	
48	Shrublands on southern Swan Coastal Plain Ironstones (Busselton area) (floristic community type 10b as originally described in Gibson *et al*. (1994))	This species-rich plant community is a seasonal wetland on ironstone sheet rock overlain by shallow loam soils on the Swan Coastal Plain and Whicher Scarp near Busselton. Much of the species diversity comes from annuals and geophytes (plants with an underground storage organ). Typical and common shrubs include *Kunzea micrantha*, *Pericalymma ellipticum* (swamp teatree), *Hakea oldfieldii* (priority 3), *Hemiandra pungens* (snakebush) and *Viminaria juncea* (swishbush). *Aphelia cyperoides* (hairy aphelia) and *Centrolepis aristata* (pointed centrolepis) also commonly occur. Many taxa in the community are endemic to this unusual geology including a suite of threatened flora. The community is also known as 'floristic community type 10b' as originally described in Gibson N., Keighery B.J., Keighery G.J., Burbidge A.H. and Lyons M.N. (1994) A floristic survey of the southern Swan Coastal Plain (unpublished report for the Australian Heritage Commission prepared by the Department of Conservation and Land Management and the Conservation Council of Western Australia (Inc.)).	Department of Conservation and Land Management (2005). Southern Swan Coastal Plain Ironstone (Busselton Area) (Busselton or Southern Ironstone Association). Interim recovery plan no 215: 2005- 2010. CALM, Perth, Western Australia Gibson, N., Keighery, B., Keighery, G., Burbidge, A & Lyons, M. (1994) *A floristic survey of the Southern Swan Coastal Plain.* Unpublished report for the Australian Heritage Commission prepared by the Department of Conservation and Land Management and the Conservation Council of Western Australia (Inc.). Perth, Western Australia Keighery B.J., Keighery G.J., Longman V.M. and Clarke K.A. (2012) Native and Weed Flora of the Southern Swan Coastal Plain: 2005 Dataset. Department of Environment and Conservation, Kensington, Western Australia.	Community occurs in habitat of ironstone and derived substrates that are restricted to the eastern side of the Swan Coastal Plain along the base of the Whicher Scarp near Busselton. Occurs on poorly drained flats that are waterlogged in winter. Community commonly occurs as shrublands of floristic composition as described in Gibson *et al*. (1994). Eleven threatened and six priority flora are associated with the community and many are totally or largely confined to ironstone soils in Busselton or to another community on ironstone substrates on the Scott Coastal Plain. Combinations of flora provide supporting evidence for particular floristic community types (FCTs). Lists of taxa that are 'typical' or 'common' to particular FCTs are listed in Gibson *et al*. (1994). Taxa listed as 'common' taxa would be expected to be present in at least 75%, and those listed as 'common' expected in at least 50% of FCT 10b sites. The absence of a number of the 'typical' or 'common' taxa does not definitively indicate that FCT 10b does not occur.	Sample, analyse data and report on flora and vegetation using methods described in EPA (2016a); and further detail in DBCA (2021 -see Appendix 1 below), and key references. Compare key substrate characteristics, and its' associated assemblages, to descriptions in key references.

			Webb A, Keighery B, Keighery G, Longman V, Black A, O'Connor A (2009). *The flora and vegetation of the Busselton Plain (Swan Coastal Plain).* Department of Environment and Conservation, Perth. 326 p.		
49	Russell Range mixed thicket complexes	The community occurs within the Russell Range system and was originally described in Beard J.S. (1973) *The vegetation of the Esperance and Malcolm areas, Western Australia*: *Map and explanatory memoir* (1:250,000 series, Vegmap Publications, Perth, Western Australia). It consists of an open mallee or shrub mallee-heath on the mid to upper slopes. Typical species are *Eucalyptus doratoxylon* (spearwood mallee), *Adenanthos oreophilus*, *Dampiera parvifolia* (many-bracted dampiera), *Dielsiodoxa oligarrhenoides*, *Chorizema nervosum*, *Acacia triptycha*, *Hakea pandanicarpa*, *Daviesia grossa*, and the endemic priority taxa *Banksia prolata* subsp. *archeos* (priority 2), *Beaufortia raggedensis* (Mt Ragged beaufortia; priority 2), *Rhadinothamnus rudis* subsp. *linearis* (priority 4), *Darwinia* sp. Mt Ragged (S. Barrett 663) (priority 2) and *Gastrolobium tergiversum* (priority 2). Other priority flora include *Beyeria simplex* (priority 2), *Dielsiodoxa propullulans* (priority 2), *Leucopogon apiculatus* (priority 3), *Styphelia rotundifolia* (priority 3), *Opercularia hirsuta* (silky-haired stinkweed) (priority 2), *Scaevola brookeana* (priority 2), *Gastrolobium pycnostachyum* (Mt Ragged poison) (Mt Ragged poison; priority 2) and *Kennedia beckxiana* (Cape Arid kennedia; priority 4) which occur mainly on the mid-lower slopes. *Anthocercis viscosa* (sticky tailflower) is common on granite on the south coast from Walpole to Cape Arid and occurs at its inland or eastern limit on Mt Ragged.	Barrett, S. (1996) Biological survey of mountains of southern Western Australia. Unpublished report by the Department of Conservation and Land Management for the Australian Nature Conservation Agency. Beard, J.S. (1973) The vegetation of the Esperance and Malcolm areas, Western Australia: map and explanatory memoir, 1:250,000 series. Vegetation Survey of Western Australia Lowry, D.C. and Doepel, J.J.G. (1974) Malcolm-Cape Arid. Geological Survey of Western Australia: 1:250,000 Geological Series Explanatory Notes. Geological Survey of Western Australia	Community was originally identified by Beard (1973) and then further defined by Barrett (1996) in a biological survey of mountains of southern Western Australia. It occurs on the highest peaks of the Russell Range, with characteristic open- mallee/shrub mallee-heath, with many endemic species. It comprises of five occurrences within chains running NNE to SSW, including the slopes of Mount Dean, Brooks Peak, Mount Ragged, Mount Esmond and Woolgrah Hill. The community is commonly found at altitudes of approximately 585 m above sea level but extends to lower altitudes. Several endemic and characteristic species within the community. Four priority flora taxa are endemic to the community including *Banksia prolata* subsp. *archeos*, *Beaufortia raggedensis*, *Rhadinothamnus rudis* subsp. *linearis*, *Darwinia* sp. Mt Ragged (S. Barrett 663) and *Gastrolobium tergiversum*. *Anthocercis viscosa*, although common on granite from Walpole to Cape Arid, is found at the inland or eastern limit of its range on the wave-cut bench on Mt Ragged. Community occurs within the Proterozoic Mt Ragged beds which over-lie Middle-Proterozoic granites, gneisses and migmatites of the Albany-Fraser Province (Lowry and Doepel 1974). The beds are composed of a sequence of quartzites, micaceous schists, quartz-pebble conglomerates and acid volcanic rocks exposed as a series of north-easterly trending belts. Mt Ragged is formed of vertically stratified gneiss with a central band of massive quartzite resistant to erosion. Soils are mostly acidic, have a low nutrient status and have been weathered from granitoid or quartzite bedrock. Soil depth is generally shallow with skeletal soils less than 25cm thick common on the upper slopes and peaks, and deeper in areas of more gentle topography (Barrett 1996).	Sample, analyse data and report on flora and vegetation using methods described in EPA (2016a), and key references. Determine if habitat (Russell Range and footslopes) and associated floral assemblages occur, and meet summary description, and description in key references. Details of survey method: survey should be conducted in the spring to determine the full suite of native species present. The following should be recorded to identify the community: Landform, rock type, soil type and colour, drainage Vegetation classification, flora species (as compared to Barrett 1996) Condition including vegetation structure. Condition classes will also need to incorporate the fire history, dieback disease presence and the abundance of major weed species.

					A flora species list should be compared against that provided in The Mountain Top survey (Barrett 1996).
50	Thumb Peak, Mid Mount Barren, Woolburnup Hill (Central Barren Ranges) *Eucalyptus acies* mallee heath	The community is restricted to three quartzite mountains within the Fitzgerald River National Park. It is characterised by a high diversity of proteaceous shrubs accompanied by several taxa endemic to or prevalent in high altitudinal areas of the Barren and Stirling Ranges. Three endangered flora species (*Daviesia obovate*, *Coopernookia georgei* (mauve coopernookia) and *Grevillea infundibularis* (fan-leaf grevillea) and a suite of priority flora occur within the community, some restricted only to mountain peaks. Common taxa include *Eucalyptus acies* (Woolburnup mallee), *Gastrolobium crenulatum* (priority 2), *Daviesia obovata*, *Andersonia echinocephala* (priority 4), *Petrophile divaricata, Grevillea coccinea* subsp. *lanata* (priority 3) and *Xanthosia candida*. Other taxa include *Eucalyptus preissiana* subsp. *preissiana* (bell-fruited mallee), *Banksia heliantha* (oak-leaved dryandra), *Banksia falcata* (prickly dryandra), *Banksia plumosa* subsp. *plumosa*, *Banksia baueri* (woolly banksia), *Banksia nutans* var. *nutans* (nodding banksia), *Banksia lemanniana* (Lemann's banksia), *Banksia oreophila* (mountain banksia), *Hakea cucullata* (hood-leaved hakea), *Hakea hookeriana, Grevillea fistulosa*, *Adenanthos labillardierei*, *Beaufortia anisandra* (dark beaufortia), *Melaleuca striata*, *Sphaerolobium racemulosum*, *Daviesia striata*, *Taxandria spathulata, Acacia cedroides, Rinzia oxycoccoides* (large-flowered rinzia), *Dampiera loranthifolia*, *Stachystemon mucronatus* and *Mesomelaena stygia* subsp. *stygia*.	Barrett, S. (1996). Biological Survey of Mountains of Southern Western Australia. Report for the National Reserves System Cooperative Program (Project Number AW03).	The central Barren Ranges (Thumb Peak- Mid-Mt Barren - Woolbernup Hill) form a distinct endemic community. Community is found only on these mountains with *Eucalyptus acies* dominant and includes four endemics as well as many species endemic to the Barren Ranges/quartzite ranges of Fitzgerald River National Park. Three threatened flora occur and a suite of priority taxa occur in the community.	Sample, analyse data and report on flora and vegetation using methods described in EPA (2016a), and key references. Determine if habitat Barren Ranges and footslopes) and associated floral assemblages occur, and meet summary description, and description in key references.
51	Vegetation alliances on ridges and slopes of the chert hills of the	The community occurs on ridges and slopes of the chert hills of the Coomberdale floristic region. It was originally described in Griffin E.A. (1992) "Floristic survey of remnant vegetation in the Bindoon to Moora area, Western Australia" (Agriculture Western	Department of Parks and Wildlife (2013). Interim Recovery Plan 2013-2018 for Heath dominated by one or more of *Regelia megacephala, Kunzea praestans* and *Allocasuarina campestris* on	The substrate on which the community is located is highly restricted and confined to the Noondine chert hills that extend discontinuously from Jingemia south to Moora and make up the Coomberdale Floristic Region. Based on the vegetation described in Trudgen *et al.* (2006), the community consists of the vegetation	Sample, analyse data and report on flora and vegetation using methods described in EPA (2016a); Compare substrate,

	Coomberdale floristic region	Australia Resource Management Technical Report 142, Perth). It encompasses seven vegetation alliances including the core units and three vegetation alliances of the buffer units of the Coomberdale Chert community. Core vegetation alliances include *Allocasuarina campestris* (sheoak) shrubland, *Allocasuarina microstachya* scrub, *Regelia megacephala* (priority 4) shrubland, *Kunzea praestans* shrubland and scrub, *Melaleuca calyptroides* heath, *Hibbertia subvaginata* shrubland and *Xanthorrhoea drummondii* shrubland.	ridges and slopes of the chert hills of the Coomberdale Floristic Region (update). Interim Recovery Plan No. 338. Department of Parks and Wildlife, Perth. Griffin, E. A. (1992). Floristic survey of remnant vegetation in the Bindoon to Moora area, Western Australia. Agriculture Western Australia Resource Management Technical Report 142. Perth. Griffin, E. A. (1994). Floristic Survey of Northern Sandplains between Perth and Geraldton, Western Australia. Agriculture Western Australia Resource Management Technical Report 144. Perth. Trudgen, M.E., Morgan, B., and Griffin, E.A. (2006). *A flora survey, floristic analysis and vegetation survey of the Coomberdale Chert TEC.* Prepared for Simcoa Operations Pty Ltd. Perth	alliances 13, 14, 15, 16, 17, 18 and 19 are considered the 'core' parts of the with units 4, 9 and 11 being more peripheral parts of the community but still associated with it. Included units are described as: *Allocasuarina campestris* high shrublands to open and closed scrub; *Allocasuarina microstachya* open scrub; *Regelia megacephala* high shrubland to open and closed scrub; *Kunzea praestans* high shrubland to open and closed scrub; *Melaleuca calyptroides* open to closed heath; *Hibbertia subvaginata* low shrublands to low open heath; *Xanthorrhoea drummondii* shrubland; *Eucalyptus eudesmoides* mallee; *Allocasuarina huegeliana* woodlands; *Acacia acuminata* low woodlands	and the associated assemblages, to summary description, and descriptions in key references.
Woodlands and forests					
52	*Banksia attenuata* woodlands over species rich dense shrublands (floristic community type 20a as originally described in Gibson *et al*. (1994))	The community has been recorded from sands near Koondoola and Banksia Grove, and at the base of the Darling Scarp largely between Wannamal and Maddington. This community is generally very species rich. It is usually dominated by *Banksia attenuata* (slender banksia), occasionally with *Eucalyptus marginata* (jarrah), with *Bossiaea eriocarpa* (common brown pea), *Conostephium pendulum* (pearl flower), *Hibbertia huegelii*, *Hibbertia hypericoides* (yellow buttercups), *Petrophile linearis* (pixie mops), *Scaevola repens*, *Stirlingia latifolia* (blueboy), *Mesomelaena pseudostygi*a and *Alexgeorgea nitens* being common in the understorey. The community is also known as "floristic community type 20a" as originally described in Gibson N., Keighery B.J., Keighery G.J., Burbidge A.H. and Lyons M.N. (1994) "A floristic survey of the southern Swan Coastal Plain" (unpublished report for the Australian Heritage Commission prepared by the Department of Conservation and Land	Department of Parks and Wildlife (2016). *Banksia attenuata* woodlands over species rich dense shrublands (Swan Coastal Plain community type 20a – Gibson *et al.* 1994). Interim Recovery Plan No. 359. Parks and Wildlife, Kensington, Western Australia. Gibson, N., Keighery, B., Keighery, G., Burbidge, A and Lyons, M. (1994*). A floristic survey of the Southern Swan Coastal Plain*. Unpublished report for the Australian Heritage Commission prepared by the Department of Conservation and Land Management and the Conservation Council of Western Australia (Inc.). Keighery B.J., Keighery G.J., Longman V.M. and Clarke K.A. (2012) Native and Weed Flora of the Southern Swan Coastal Plain: 2005 Dataset. Department of	Community occurs on sands at the base of the Darling Scarp between Chittering and Orange Grove and has been located on the Bassendean, Forrestfield, Southern River and Karrakatta soil and landform units, and on the southern Dandaragan Plateau subregion of the Swan Coastal Plain IBRA Region.Flora indicative of floristic community types (FCTs) on the eastern side of the Swan Coastal Plain; that includes FCT20a can be particularly helpful in determining the FCTs present (see Appendix 2; also Keighery and Trudgen 1992). Combinations of plant taxa provide supporting evidence for particular floristic community types (FCTs). Lists of taxa that are 'typical' or 'common' to particular FCTs are listed in Gibson *et al*. (1994). Taxa listed as 'typical' would be expected to be present in at least 75%, and those listed as 'common' expected in at least 50% of FCT 20a sites. *Banksia attenuata* would be expected to be present in at least 75% of FCT 20a sites and the name assigned to the floristic community type in Gibson *et al*. (1994) does not indicate that an area must contain, or must have previously contained, *Banksia attenuata* before it can be categorised as FCT 20a. Similarly, the absence	Sample, analyse data and report on flora and vegetation using methods described in EPA (2016a); and further detail in Appendices 1 and 2 below, and key references.

		Management and the Conservation Council of Western Australia (Inc.)).	Environment and Conservation, Kensington, Western Australia. Keighery, G. and Keighery, B. (2016). How many banksia woodlands? Floristics of Banksia Woodlands of the Swan Coastal Plain. In Stevens J.C., Rokich D.P., Newton V.G., Barrett R.L. and Dixon K.W. (Eds) (2016, in press). Restoring Perth's Banksia woodlands. UWA Publishing. Crawley, Western Australia. Keighery, B. and Trudgen, M. (1992). *Remnant vegetation on the alluvial soils of the eastern side of the Swan Coastal Plain.* Report prepared for the Department of Conservation and Land Management. Perth, Western Australia.	of a number of other 'typical' or 'common' taxa does not definitively indicate that FCT20a does not occur. This is one of three subtypes of floristic community type 20 as identified in Gibson *et al*. (1994), that differ in floristic composition. These are FCT20a, FCT20b and FCT20c. Gibson *et al.* (1994) states that FCT20a was distinctive in its' diverse shrub layer and *Mesomeleana pseudostygia* in all plots. FCT20a sites were differentiated from the other two subtypes by occurrence of species such as *Alexgeorgia nitens, Daviesia nudiflora, Synaphea spinulosa, Hibbertia racemosa* and *Stylidium calcaratum.* The richest of any Banksia community located on the coastal plain by Gibson *et al*. (1994).	
53	*Banksia attenuata — Eucalyptus marginata* woodlands of the eastern side of the Swan Coastal Plain (floristic community type 20b as originally described in Gibson *et al*. (1994))	The community is found on a range of soil and landform units at the base of the Darling Scarp that are described in Churchward and McArthur (1978) *The landforms and soils of the Darling System* (Division of Land Resources Management, CSIRO, Perth, Western Australia). The community occurs largely on the Forrestfield unit (Ridge Hill Shelf), Guildford unit or at the confluence of Guildford with Forrestfield, and also occurs on the Southern River unit. The community is generally very species rich. Most occurrences of this community type are *Banksia attenuata - Eucalyptus marginata* woodlands but Banksia woodlands and heaths are also found, with *Mesomelaena pseudostygia*, *Morelotia octandra*, *Banksia dallanneyi* (couch honeypot), *Desmocladus fasciculatus*, and *Chamaescilla corymbosa* (blue squill) being common in the understorey. The community is also known as "floristic community type 20b" as originally described in Gibson N., Keighery B.J., Keighery G.J., Burbidge A.H. and Lyons M.N. (1994) "A floristic survey of the southern Swan Coastal Plain" (unpublished report for the Australian Heritage Commission prepared by the Department of Conservation and Land	Department of Environment and Conservation (2012). Interim Recovery Plan 2012-2017 for *Banksia attenuata* and/or *Eucalyptus marginata* woodlands of the eastern side of the Swan Coastal Plain (Swan Coastal Plain community type 20b – Gibson *et al*. 1994). Interim Recovery Plan No. 328. Department of Environment and Conservation, Perth. Gibson, N., Keighery, B., Keighery, G., Burbidge, A and Lyons, M. (1994*). A floristic survey of the Southern Swan Coastal Plain*. Unpublished report for the Australian Heritage Commission prepared by the Department of Conservation and Land Management and the Conservation Council of Western Australia (Inc.). Keighery B.J., Keighery G.J., Longman V.M. and Clarke K.A. (2012) Native and Weed Flora of the Southern Swan Coastal Plain: 2005 Dataset. Department of	FCT20b commonly differs from the *Banksia attenuata* woodlands over species rich dense shrublands (FCT20a) and the eastern shrublands and woodlands (FCT20c) in the presence of understorey species that can include *Grevillea pilulifera, Babingtonia camphorosmae, Hibbertia vaginata, Caladenia flava, Hakea stenocarpa and Conostylis setosa,* and the general absence of *Alexgeorgea nitens* - a common component of FCT20a. Known from soil and landform units at the base of the Darling Scarp and largely on the Forrestfield unit (Ridge Hill Shelf), Guildford unit (Pinjarra Plain). Also located on Southern River unit, and mapped on Darling Scarp Unit, (in this instance, the latter location is more correctly mapped as Forrestfield unit). Taxa indicative of FCTs on the eastern side of the Swan Coastal Plain; that includes FCT20b can be particularly helpful in determining the FCTs present (see Appendix 2; also Keighery and Trudgen 1992). Combinations of plant species provide supporting evidence for particular floristic community types (FCTs). Lists of taxa that are 'typical' or 'common' to particular FCTs are listed in Gibson *et al*. (1994). The name assigned to the floristic community type in Gibson *et al* (1994) does not indicate that an area must contain, or must have previously contained, *Banksia attenuata, or Eucalyptus marginata* before it can be categorised as FCT 20b. *Banksia attenuata* would be expected to be	Sample, analyse data and report on flora and vegetation using methods described in EPA (2016a); and further detail in Appendices 1 and 2 below, and key references.

		Management and the Conservation Council of Western Australia (Inc.)).	Environment and Conservation, Kensington, Western Australia. Keighery, B. and Trudgen, M. (1992). *Remnant vegetation on the alluvial soils of the eastern side of the Swan Coastal Plain.* Report prepared for the Department of Conservation and Land Management. Perth, Western Australia.	present in at least 75% of FCT 20b sites and *Eucalyptus marginata* would be expected to be present in at least 50% of FCT 20b sites. Similarly, the absence of a number of other 'typical' or 'common' taxa does not definitively indicate that FCT20b does not occur. The community has been recorded from heavy soils in the SWA02 Perth subregion of the southern Swan Coastal Plain IBRA region to date. There is potential for further survey to reveal northern expressions of FCT20b in the southern SWA01 Dandaragan Plateau subregion of the Swan Coastal Plain IBRA Region.	
54	*Callitris preissii* (or *Melaleuca lanceolata*) forests and woodlands, Swan Coastal Plain (floristic community type 30a as originally described in Gibson *et al*. (1994))	The community is located on calcareous sandy soils of the Quindalup Dunes generally occurring between Craigie and Point Peron, and on the Swan River in Peppermint Grove. The community also occurs on Garden Island and Rottnest Island. Typical and common native taxa in the community are: *Callitris preissii* (Rottnest Island pine), *Melaleuca lanceolata* (Rottnest teatree), *Spyridium globulosum* (basket bush), *Acanthocarpus preissii*, *Rhagodia baccata* (berry saltbush), *Austrostipa flavescens* and *Trachymene pilosa* (native parsnip). The community is also known as 'floristic community type 30a' as originally described in Gibson N., Keighery B.J., Keighery G.J., Burbidge A.H. and Lyons M.N. (1994) 'A floristic survey of the southern Swan Coastal Plain' (unpublished report for the Australian Heritage Commission prepared by the Department of Conservation and Land Management and the Conservation Council of Western Australia (Inc.)).	Department of Parks and Wildlife (2014). *Callitris preissii* (or *Melaleuca lanceolata)* forests and woodlands. (Swan Coastal Plain community type 30a – Gibson *et al*. 1994). Interim Recovery Plan No. 340. Department of Parks and Wildlife, Perth Gibson, N., Keighery, B., Keighery, G., Burbidge, A and Lyons, M. (1994*). A floristic survey of the Southern Swan Coastal Plain*. Unpublished report for the Australian Heritage Commission prepared by the Department of Conservation and Land Management and the Conservation Council of Western Australia (Inc.). Keighery B.J., Keighery G.J., Longman V.M. and Clarke K.A. (2012) Native and Weed Flora of the Southern Swan Coastal Plain: 2005 Dataset. Department of Environment and Conservation, Kensington, Western Australia.	The coastal occurrences occur on calcareous sandy soils associated with the Quindalup dunes and the Swan River occurrence is on the aeolian deposits of the Cottesloe complex - central and south. Species richness is naturally quite low in the community. Community contains significant populations of the dominant tree species, *Callitris preissii* and *Melaleuca lanceolata* that are uncommon on the Swan Coastal Plain. Where this type is in poor condition it is generally not feasible to use quadrat data and statistical techniques to clarify the floristic community type present as degraded examples often link to other types. *Callitris preissii* is however, considered to be a definitive indicator of the *Callitris preissii* (or *Melaleuca lanceolata*) forests and woodlands when it is present in appropriate vegetation and coastal habitat on the southern Swan Coastal Plain. On Rottnest Island, and other areas of native vegetation that naturally contain *Callitris preissii* in appropriate habitat near Perth are considered to represent types and sub-types of this community. A similar assemblage on Bald Island is considered floristically distinct from this community.	Sample, analyse data and report on flora and vegetation using methods described in EPA (2016a); and further detail in DBCA (2021 -see Appendix 1 below), and key references. Determine if *Callitris preissii* is naturally occurring and in vegetation and coastal habitat on the southern Swan Coastal Plain that are appropriate for the community.
55	*Corymbia calophylla — Eucalyptus marginata* woodlands on sandy clay soils of the southern Swan Coastal Plain (floristic community	The community is known from the eastern side of the Swan Coastal Plain largely between Wannamal and Dunsborough. Most occurrences of the community type are dominated by both *Corymbia calophylla* (marri) and *Eucalyptus marginata* (jarrah) with additional common taxa comprising low shrubs, sedges, grasses and herbs. These include *Bossiaea eriocarpa* (common brown pea), *Conostylis juncea*, *Hibbertia hypericoides* (yellow buttercups), *Morelotia*	Gibson, N., Keighery, B., Keighery, G., Burbidge, A and Lyons, M. (1994*). A floristic survey of the Southern Swan Coastal Plain*. Unpublished report for the Australian Heritage Commission prepared by the Department of Conservation and Land Management and the Conservation Council of Western Australia (Inc.).	The community is one of three subtypes of floristic community type 3 as identified in Gibson *et al*. (1994), that differ in floristic composition. These are FCT3a, FCT3b and FCT3c. FCT 3b are usually dominated by both *E. calophylla and E. marginata*. Species including *Bossiaea eriocarpa* and *Conostylis juncea* are useful in differentiating this subgroup. The community has been recorded from alluvial soils near the Peel - Harvey estuary and better drained sites on the eastern side of the Swan Coastal Plain. It occurs predominantly on the	Sample, analyse data and report on flora and vegetation using methods described in EPA (2016a); and further detail in Appendices 1 and 2 below, and key references.

	type 3b as originally described in Gibson *et al*. (1994))	*octandra*, *Chamaescilla corymbosa* (blue squill), *Desmocladus fasciculatus*, *Banksia dallanneyi* (couch honeypot), *Mesomelaena tetragona* (semaphore sedge), *Babingtonia camphorosmae* (camphor myrtle), *Lepidosperma squamatum*, *Neurachne alopecuroidea* (foxtail mulga grass), *Philotheca spicata* (pepper and salt), *Burchardia congesta*, *Caesia micrantha* (pale grass-lily), *Kingia australis* (kingia), *Drosera erythrorhiza* (red ink sundew), *Lomandra hermaphrodita* and *Caladenia flava* (cowslip orchid). The community is also known as 'floristic community type 3b' as originally described in Gibson N., Keighery B.J., Keighery G.J., Burbidge A.H. and Lyons M.N. (1994) 'A floristic survey of the southern Swan Coastal Plain' (unpublished report for the Australian Heritage Commission prepared by the Department of Conservation and Land Management and the Conservation Council of Western Australia (Inc.)).	Keighery B.J., Keighery G.J., Longman V.M. and Clarke K.A. (2012) Native and Weed Flora of the Southern Swan Coastal Plain: 2005 Dataset. Department of Environment and Conservation, Kensington, Western Australia. Keighery, B. and Trudgen, M. (1992). *Remnant vegetation on the alluvial soils of the eastern side of the Swan Coastal Plain.* Report prepared for the Department of	Guilford and Forrestfield soil and landform units, and has northern expressions in the southern Dandaragan Plateau subregion of the Swan Coastal Plain IBRA region (see also Appendix 2 Table 1). Flora indicative of FCTs on the eastern side of the Swan Coastal Plain; that includes FCT3b can be particularly helpful in determining the FCTs present (see Appendix 2; also Keighery and Trudgen 1992). Combinations of plant species are useful in providing supporting evidence for particular floristic community types (FCTs). Lists of taxa that are 'typical' or 'common' to particular FCTs are listed in Gibson *et al*. (1994). The name assigned to the floristic community type in Gibson *et al* (1994) does not indicate that an area must contain, or must have previously contained, *Corymbia calophylla,* or *Eucalyptus marginata* before it can be categorised as FCT 3b. *Corymbia calophylla* or *Eucalyptus marginata* would be expected to be present in at least 75% of FCT 3b sites. Similarly, the absence of a number of other 'typical' or 'common' taxa does not definitively indicate that FCT3b does not occur.	
56	*Corymbia calophylla* — *Kingia australis* woodlands on heavy soils, Swan Coastal Plain (floristic community type 3a as originally described in Gibson *et al*. (1994))	The community has been recorded from heavy soils of the eastern side of the southern Swan Coastal Plain largely between Capel and Chittering. Typical native taxa in the community are: the tree *Corymbia calophylla* (marri); the shrubs *Banksia dallanneyi* (couch honeypot), *Philotheca spicata* (pepper and salt), *Kingia australis* (kingia) and *Xanthorrhoea preissii* (balga); and the herbs, rushes and sedges *Cyathochaeta avenacea, Dampiera linearis* (common dampiera), *Haemodorum laxum, Desmocladus fasciculatus, Mesomelaena tetragona* (semaphore sedge) and *Morelotia octandra*. The community is also known as "floristic community type 3a" as originally described in Gibson N., Keighery B.J., Keighery G.J., Burbidge A.H. and Lyons M.N. (1994) "A floristic survey of the southern Swan Coastal Plain" (unpublished report for the Australian Heritage Commission prepared by the Department of Conservation and Land Management and the Conservation Council of Western Australia (Inc.)).	Department of Environment and Conservation (2011). Interim Recovery Plan 2011-2016 for *Corymbia calophylla - Kingia australis* woodlands on heavy soil, Swan Coastal Plain. Interim Recovery Plan No. 315. DEC, Perth Gibson, N., Keighery, B., Keighery, G., Burbidge, A and Lyons, M. (1994*). A floristic survey of the Southern Swan Coastal Plain*. Unpublished report for the Australian Heritage Commission prepared by the Department of Conservation and Land Management and the Conservation Council of Western Australia (Inc.). Keighery B.J., Keighery G.J., Longman V.M. and Clarke K.A. (2012) Native and Weed Flora of the Southern Swan Coastal Plain: 2005 Dataset. Department of Environment and Conservation, Kensington, Western Australia.	Taxa indicative of the eastern side of the Swan Coastal Plain; that includes FCT3a can be particularly helpful in determining the FCTs present (See Appendix 2; also Keighery and Trudgen 1992). Combinations of plant species provide supporting evidence for particular floristic community types (FCTs). Lists of taxa that are 'typical' or 'common' to particular FCTs are listed in Gibson *et al*. (1994). The name assigned to the floristic community type in Gibson *et al* (1994) does not indicate that an area must contain, or must have previously contained, *Corymbia calophylla, or Kingia australis* before it can be categorised as FCT 3a. *Corymbia calophylla, or Kingia australis* would be expected to be present in at least 75% of FCT 3a sites. Similarly, the absence of a number of other 'typical' or 'common' taxa that may occur in the community does not definitively indicate that FCT3a does not occur. The community has been recorded from heavy soils in the SWA02 Perth subregion of the Swan Coastal Plain IBRA region. There is potential for further survey to reveal other northern expressions of FCT3a in the southern SWA01 Dandaragan Plateau subregion of the Swan Coastal Plain IBRA Region.	Sample, analyse data and report on flora and vegetation using methods described in EPA (2016a); and further detail in Appendix 1 and 2 below, and key references.

			Keighery, B. and Trudgen, M. (1992). *Remnant vegetation on the alluvial soils of the eastern side of the Swan Coastal Plain.* Report prepared for the Department of Conservation and Land Management. Perth, Western Australia.		
57	*Corymbia calophylla* — *Xanthorrhoea preissii* woodlands and shrublands, Swan Coastal Plain (floristic community type 3c as originally described in in Gibson *et al*. (1994))	The community occurs on heavy soils of the eastern side of the southern Swan Coastal Plain, generally between Bullsbrook and Stratham. The community is usually dominated by *Corymbia calophylla* (marri) and *Xanthorrhoea preissii* (balga). It also occasionally includes *Eucalyptus wandoo* (wandoo). The more common shrubs include *Gompholobium marginatum*, *Hypocalymma angustifolium* (white myrtle) and *Banksia dallanney*i (couch honeypot), with herbs, grasses and sedges including *Burchardia congesta*, *Cyathochaeta avenacea*, *Neurachne alopecuroidea* (foxtail mulga grass), *Caesia micrantha* (pale grass-lily), *Mesomelaena tetragona* (semaphore sedge), *Morelotia octandra*, *Desmocladus flexuosus, Opercularia vaginata* (dog weed), *Sowerbaea laxiflora* (purple tassels), *Lepidosperma* spp. and *Drosera menziesii* (pink rainbow) also common. The community is also known as "floristic community type 3c" as originally described in Gibson N., Keighery B.J., Keighery G.J., Burbidge A.H. and Lyons M.N. (1994) "A floristic survey of the southern Swan Coastal Plain" (unpublished report for the Australian Heritage Commission prepared by the Department of Conservation and Land Management and the Conservation Council of Western Australia (Inc.)).	English, V.J. and Blyth, J. (2000). Interim recovery plan for *Corymbia calophylla – Xanthorrhoea preissii* woodlands and shrublands 2000-2003. IRP No 60. Department of Conservation and Land Management, Wanneroo. Gibson, N., Keighery, B., Keighery, G., Burbidge, A and Lyons, M. (1994*). A floristic survey of the Southern Swan Coastal Plain*. Unpublished report for the Australian Heritage Commission prepared by the Department of Conservation and Land Management and the Conservation Council of Western Australia (Inc.). Keighery B.J., Keighery G.J., Longman V.M. and Clarke K.A. (2012). Native and Weed Flora of the Southern Swan Coastal Plain: 2005 Dataset. Department of Environment and Conservation, Kensington, Western Australia. Keighery, B. and Trudgen, M. (1992). *Remnant vegetation on the alluvial soils of the eastern side of the Swan Coastal Plain.* Report prepared for the Department of Conservation and Land Management. Perth, Western Australia.	Taxa indicative of the eastern side of the Swan Coastal Plain; that includes FCT3c can be particularly helpful in determining the FCTs present (See Appendix 2 below; also Keighery and Trudgen 1992). Combinations of plant taxa provide supporting evidence for particular floristic community types (FCTs). Lists of taxa that are 'typical' or 'common' to particular FCTs are listed in Gibson *et al*. (1994). The name assigned to the floristic community type in Gibson *et al* (1994) does not indicate that an area must contain, or must have previously contained, *Corymbia calophylla, or Xanthorrhoea preissii* before it can be categorised as FCT 3c. *Corymbia calophylla, or Xanthorrhoea preissii* would be expected to be present in at least 75% of FCT 3c sites. Similarly, the absence of a number of other 'typical' or 'common' taxa does not definitively indicate that FCT3c does not occur. The community has largely been recorded from heavy soils in the Perth SWA02 subregion of the Swan Coastal Plain IBRA region. There is potential for further survey to reveal northern expressions of FCT3c in the southern Dandaragan Plateau SWA01 subregion of the Swan Coastal Plain IBRA Region.	Sample, analyse data and report on flora and vegetation using methods described in EPA (2016a); and further detail in Appendices 1 and 2 below, and key references.
58	*Corymbia calophylla* woodlands on heavy soils of the southern Swan Coastal Plain (floristic community	The community is known from heavy fertile soils of the southern Swan Coastal Plain south of Dardanup. It consists largely of *Corymbia calophylla* (marri) forests and woodlands. *Eucalyptus marginata* (jarrah) is also common in the tree layer. Common understorey species include *Acacia extensa* (wiry wattle), *Gompholobium polymorphum,*	Gibson, N., Keighery, B., Keighery, G., Burbidge, A and Lyons, M. (1994*). A floristic survey of the Southern Swan Coastal Plain*. Unpublished report for the Australian Heritage Commission prepared by the Department of Conservation and Land	Community is known from the Busselton area, over a range of about 50km. It occurs predominantly on the Swan Southern River and Abba vegetation complexes (these equate to soil and landform units). FCT1b is one of the types that are found on the heavy soils of the eastern coastal plain identified in Gibson *et al.* (1994). Community type 1 is restricted to the eastern side of the Swan Coastal Plain, south of Bunbury and	Sample, analyse data and report on flora, vegetation and habitat using methods described in EPA (2016a); and further detail in DBCA (2021 - see Appendix 1

	type 1b as originally described in Gibson *et al*. (1994))	*Billardiera variifolia*, *Hibbertia hypericoides* (yellow buttercups), *Hypocalymma angustifolium* (white myrtle) and *Xanthorrhoea preissii* (balga) over a rich herb layer including *Scaevola calliptera*, *Agrostocrinum scabrum* (blue grass lily), *Austrostipa semibarbata*, *Dampiera linearis* (common dampiera), *Mesomelaena tetragona* (semaphore sedge), *Morelotia octandra* and *Lomandra purpurea* (purple mat rush). The community is also known as "floristic community type 1b" as originally described in Gibson N., Keighery B.J., Keighery G.J., Burbidge A.H. and Lyons M.N. (1994) "A floristic survey of the southern Swan Coastal Plain" (unpublished report for the Australian Heritage Commission prepared by the Department of Conservation and Land Management and the Conservation Council of Western Australia (Inc.)).	Management and the Conservation Council of Western Australia (Inc.). Keighery B.J., Keighery G.J., Longman V.M. and Clarke K.A. (2012) Native and Weed Flora of the Southern Swan Coastal Plain: 2005 Dataset. Department of Environment and Conservation, Kensington, Western Australia. Keighery, B. and Trudgen, M. (1992). *Remnant vegetation on the alluvial soils of the eastern side of the Swan Coastal Plain.* Report prepared for the Department of Department of Conservation and Land Management. Perth, Western Australia. Webb A, Keighery B, Keighery G, Longman V, Black A, O'Connor A (2009). *The flora and vegetation of the Busselton Plain (Swan Coastal Plain).* Department of Environment and Conservation, Perth. 326 p	has two distinct subgroups (FCT1a and FCT1b). These FCTs had the highest mean species richness recorded in Gibson *et al.* (1994). Community consists largely of *Corymbia calophlla* forests and woodlands on the eastern side of the Swan Coastal Plain south of Bunbury. The community is often waterlogged and supports wetland flora including *Hakea ceratocarpa, Pericalymma ellipticum, Hypocalymma angustifolia* and *Adenanthos obovatus*. Flora indicative of FCTs on the eastern side of the Swan Coastal Plain; that includes FCT1b may be particularly helpful in determining the FCTs present (Keighery and Trudgen 1992, Table 4). Combinations of plant species provide supporting evidence for particular floristic community types (FCTs). Lists of taxa that are 'typical' or 'common' to particular FCTs are listed in Gibson *et al*. (1994). The name assigned to the floristic community type in Gibson *et al* (1994) does not indicate that an area must contain, or must have previously contained, *Corymbia calophylla,* before it can be categorised as FCT 1b. *Corymbia calophylla* would be expected to be present in at least 75% of FCT 1b sites. Similarly, the absence of a number of other 'typical' or 'common' taxa does not definitively indicate that FCT 1b does not occur.	below), and key references.
59	Forests and woodlands of deep seasonal wetlands of the Swan Coastal Plain (floristic community type 15 as originally described in Gibson *et al*. (1994))	The community has been recorded from Bambun to Nirimba, on alluvial sediments on sites that are inundated for long periods resulting in more typical aquatic and flora of deeper wetlands. The community is generally dominated by *Melaleuca rhaphiophylla* (swamp paperbark) or *Casuarina obesa* (swamp sheoak). Other species that can occur include *Melaleuca teretifolia* (banbar), *Atriplex cinerea* (grey saltbush)*, Samolus repens* (creeping brookweed)*, Salicornia quinqueflora* (beaded samphire) and *Sporobolus virginicus (*marine couch). The community is also known as 'floristic community type 15' as originally described in Gibson N., Keighery B.J., Keighery G.J., Burbidge A.H. and Lyons M.N. (1994) 'A floristic survey of the southern Swan Coastal Plain' (unpublished report for the Australian Heritage Commission prepared by the Department of Conservation and Land Management and the Conservation Council of Western Australia (Inc.)).	Gibson, N., Keighery, B., Keighery, G., Burbidge, A and Lyons, M. (1994*). A floristic survey of the Southern Swan Coastal Plain*. Unpublished report for the Australian Heritage Commission prepared by the Department of Conservation and Land Management and the Conservation Council of Western Australia (Inc.). Keighery B.J., Keighery G.J., Longman V.M. and Clarke K.A. (2012) Native and Weed Flora of the Southern Swan Coastal Plain: 2005 Dataset. Department of Environment and Conservation, Kensington, Western Australia.	Gibson *et al.* (1994) lists the following native species as typical for this community: *Melaleuca rhaphiophylla*, *Isolepis producta*, *Lemna disperma*,*Triglochin procerum*, and *Melaleuca teretifolia* as a common species. Recorded as low forest A, low forest B, low woodland B and dense thicket in quadrats established for Gibson *et al*. (1994). Composition varies in particular in response to variations in salinity, and depth and timing of seasonal inundation. Community differs from other wetland floristic community types on the Swan Coastal Plain as it comprises the deep seasonal wetlands, as opposed to the shallower, generally more ephemeral wetlands of FCT07 and FCT08, which often occur in close proximity to FCT15 wetlands. Community recorded from Beermullah and Yanga fluviatile deposits, Southern River, Bassendean sands, Pinjarra Plain (Guildford unit) and Vasse estuarine deposits. Most occurrences occur in more saline waters than other related floristic communities. Community has an impeding clay layer and poor drainage that supports retention of surface water that supports germination and growth of the component wetland flora.	Sample, analyse data and report on flora and vegetation using methods described in EPA (2016a); and further detail in DBCA (2021 -see Appendix 1 below), and key references. Verify if habitat and substrate are as described in key references.

				Combinations of plant taxa provide supporting evidence for particular floristic community types (FCTs). Lists of taxa that are 'typical' or 'common' to particular FCTs are listed in Gibson *et al*. (1994). Taxa listed as 'common' taxa would be expected to be present in at least 75%, and those listed as 'common' expected in at least 50% of FCT 15 sites. The absence of a number of other 'typical' or 'common' taxa does not definitively indicate that FCT 15 does not occur.	
60	Koolanooka System as originally described in Beard (1976)	This community is known from the Koolanooka Hills, its footslopes and the Perenjori Hills. It comprises *Eucalyptus ebbanoensis* subsp. *ebbanoensis* mallee and *Acacia* sp. scrub with scattered *Allocasuarina huegeliana* over red loam and ironstone on the upper slopes and summits; *Allocasuarina campestris* scrub over red loam on hill slopes, shrubs and emergent mallees on shallow red loam over massive ironstone on steep rocky slopes; *Eucalyptus loxophleba* woodland over scrub on the footslopes; and mixed *Acacia* sp. scrub on granite. The community was originally described in Beard J.S. (1976) "The vegetation of the Perenjori area, Western Australia: Map and explanatory memoir" (1:250,000 series, Vegmap Publications, Perth, Western Australia).	Beard J.S. (1976) The vegetation of the Perenjori area, Western Australia: Map and explanatory memoir (1:250,000 series, Vegmap Publications, Perth, Western Australia). Borger, J. (2018) Vegetation and flora survey of proposed drill sites and access tracks in Koolanooka Hills in mining tenement M70/1164. For Westralia Iron Pty Ltd. Jenny Borger Botanical Consulting, Kalamunda. Hamilton-Brown, S. (2000) Plant assemblages of the Koolanooka System Interim Recovery Plan #73, 2000-2003. Department of Conservation and Land Management, Western Australia. Van Dongen, R (2019) Vegetation cover assessment for "Koolanooka Hills System' using satellite imagery, Unpublished internal report for the Department of Biodiversity Conservation and Attractions.	Community described based on Beards' Koolanooka System. Known from Koolanooka Hills, and Perenjori Hills, a range to the south east. Community occurs on the Archaean metamorphic rocks of the Koolanooka Hills, the surrounding footslopes, and the fork-shaped range to the south-east, referred to in this document as the Perenjori Hills. The hills have a particular series of plant communities recurring in a catenary sequence or mosaic pattern linked to topographic, pedological and/or geological features. This catenary sequence or 'System' has a distinctive geology, topography and vegetation, different from that of any other comparable system. The plant community on the Koolanooka and Perenjori hills comprises *Eucalyptus ebbanoensis* subsp. *ebbanoensis* mallee and *Acacia* sp. scrub with scattered *Allocasuarina huegeliana* over red loam and ironstone on the upper slopes and summits, *Allocasuarina campestris* scrub over red loam on hill slopes; mixed shrubs and emergent mallees on shallow red loam over massive ironstone on steep rocky slopes. A mixed *Acacia ramulosa, A. quadrimarginea*, *A. tetragonophylla* and *Hakea preissii* scrub on a granitic outcrop occurs on the north-east flank of the Koolanooka Hills; and a *Eucalyptus loxophleba* woodland over scrub on its footslopes (Beard 1976).	Sample, analyse data and report on flora and vegetation using methods described in EPA (2016a), and key references. Determine if habitat (Koolanooka or Perenjori Hills and footslopes) and associated floral assemblages occur, and meet summary description, and descriptions in key references.
61	Mt Lindesay — Little Lindesay vegetation complex	The community is known from Mount Lindesay and Little Lindesay. It comprises a unique combination of restricted flora including granite specialists. The granite complex also contains threatened flora and priority flora taxa. *Eucalyptus marginata* (jarrah), shrub-mallee and heath predominates the upper slopes and summit area with *Eucalyptus marginata*, *Corymbia calophylla* (marri) and *Eucalyptus megacarpa* (bullich) low woodland in gullies. Soils are shallow or skeletal. In these areas typical shrubs include *Banksia grandis* (bull banksia),	Barrett, S. (1996). Biological survey of mountains of southern Western Australia. Unpublished report by the Department of Conservation and Land Management for the Australian Nature Conservation Agency. Clarke, V. (2009). Monitoring the impacts of fire and Phytophthora within the shallow soil plant communities of the Mt Lindesay Threatened Ecological Community, Denmark WA. Version 1.0. (June	Restricted to porphyritic (crystalline) granite batholiths (large volcanic-derived rock formations) with shallow low-nutrient acidic soils derived from the granitoid (granite-like) bedrock and granite outcrops that are skeletal in areas. Known from two occurrences on granite massifs and associated shallow soils on Mount Lindesay and Little Lindesay approximately 15 km northwest of Denmark within Mount Lindsay National Park and adjoining reserves and private land. Community was identified through Barrett (1996).	Sample, analyse data and report on flora and vegetation using methods described in EPA (2016a). Compare substrate and habitat, and associated distinctive assemblages, with summary description, and description in and key references.

		Hakea varia (variable-leaved hakea) and *Beaufortia decussata* (gravel bottlebrush) with sedge *Mesomelaena graciliceps*. Other shrubs include *Sphenotoma parviflora*, *Gastrolobium brownii* and *Billardiera drummondii*. Three priority taxa of *Andersonia — Andersonia hammersleyana* (priority 2), *Andersonia* sp. Mitchell River (B.G. Hammersley 925) (priority 3) and *Andersonia* sp. Virolens (G.J. Keighery 12000) (priority 3) are found in the community. Relatively bare granite rock slabs dominate the middle slopes and support a unique community of scrub and open herbs including two species listed as vulnerable (*Grevillea fuscolutea* and *Laxmannia grandiflora* subsp. *brendae*) and four priority flora (*Borya longiscapa* (priority 3), *Cryptandra congesta* (priority 4), *Lasiopetalum* sp. Denmark (B.G. Hammersley 2012) (priority 3), and *Sphenotoma* sp. Stirling Range (P.G. Wilson 4235) (priority 4)). Additional non-endemic flora include *Drakaea micrantha* (threatened) and *Eucalyptus virginea* (Mount Lindesay white gum) (priority 4) with granite associates *Calothamnus scabridus* (priority 2) and *Verticordia endlicheriana* var. *angustifolia* (priority 3).	2009). Prepared for Significant Native Species and Ecological Communities – Resource Condition Monitoring Project – Department of Environment and Conservation, Western Australia https://www.dpaw.wa.gov.au/images/documents/plants-animals/monitoring/20090818_mt_lindesay_system_protocol_v1.0.pdf		
62	Monsoon (vine) thickets on coastal sand dunes of Dampier Peninsula	This community is a type of rainforest ecosystem that occurs in discrete patches along the Dampier Peninsula, from Broome to Derby in the south-western portion of the Kimberley region. Vine thickets occur as discrete areas of dense vegetation and can occur as a stand of a few trees or as larger patches. Common tree and tall shrub species include *Terminalia petiolaris* (masroorl or blackberry tree), *Grewia breviflora* (currant or coffee fruit), *Celtis strychnoides* (Goonj), *Diospyros humilis* (ebony wood), *Sersalisia sericea* (nangi), *Exocarpos latifolius* (broad-leaved cherry), *Mimusops elengi* (walara), *Lysiphyllum cunninghamii* (bauhinia or jigal tree) and *Gyrocarpus americanus* subsp. *pachyphyllus* (helicopter tree, *Flueggea virosa* subsp. *melanthesoides* (dogwood), *Croton habrophyllus* and *Dodonaea platyptera* (broad-winged hop bush). The most common climbers include *Abrus precatorius* (crabs	Biota Environmental Services (2009a). A Vegetation and Flora Survey of James Price Point: West Season 2009. Biota Environmental Sciences. Report prepared for Department of State Development. Black, S.J., Willing, T. and Dureau, D.M. (2010). A comprehensive survey of the flora, extent and condition of vine thickets on coastal sand dunes of Dampier Peninsula, West Kimberley 2000-2002. Final report September 2010. Broome Botanical Society (Inc.). Broome, Western Australia. Department of Biodiversity, Conservation and Attractions (2018). Interim Recovery Plan 2018-2023 for the Monsoon vine thickets on the coastal sand dunes of Dampier Peninsula. Interim	McKenzie *et al*. (1991) determined assemblages in the region through statistical analysis of composition. The study included data from four rainforest sites on the Dampier Peninsula. These four sites were distinguished as a separate floristic group in the 18 Group level analysis of perennial plant species data. The vine thickets were termed 'Patch Group 6' and classified together on the basis of similarities of the perennial plant species. Black *et al.* (2010) note that about 25% of the plant species they recorded in the vine thickets were mostly or completely confined to the community. While most patches were dominated by a mix of several different tree species that varied in height, a few patches were dominated by a single tree species at a uniform height, and had little to no understorey of shrubs. The main tree species include (from Black 2005; Environs Kimberley 2010): *Celtis philippinensis, Diospyros ferrea* var. *humilis, Ficus virens, Melaleuca cajuputi, Melaleuca dealbata, Melaleuca viridiflora,*	Sample, analyse data and report on flora and vegetation using methods described in EPA (2016a), and key references. Wet season surveys are required to detect seasonal flora. Determine if habitat as described in key references, and associated assemblages occur, and meet summary description, and description in key references. The full extent of variation of habitats and assemblages may

		eyes), *Capparis lasiantha* (bush caper), *Tinospora smilacina* (snakevine), *Jasminum didymum*, *Caesalpinia major* and *Vincetoxicum cinerascens* (oyster-catcher bill).	Recovery Plan No. 383. DBCA, Perth Environs Kimberley (2010) Threatened Ecological Community Nomination Form - for listing or changing the status of an ecological community under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Harding, C. (2009). Monitoring of the extent of Dampier Peninsula Vine Thickets Threatened Ecological Community. Version 1.0 (June 2009). Prepared for Significant Native Species and Ecological Communities – Resource Condition Monitoring Project. Kenneally, K. F., Choules Edinger, D., Willing, T. (1996). *Broome and Beyond. Plants and People of the Dampier Peninsula, Kimberley, Western Australia.* Department of Conservation and Land Management. McKenzie, N.L., Johnston, R.B., and Kendrick, P.G (eds) (1991). *Kimberley Rainforests Australia*. Surrey Beatty & Sons in Association with the Department of Conservation and Land Management and Department of Arts, Heritage and Environment. Chipping Norton, NSW	*Mimusops elengi, Sersalicia sericea* and *Terminalia petiolaris.* Shrub species in the understorey include: *Croton tomentellus, Dodonaea platyptera, Exocarpos latifolius, Pandanus spiralis, Plumbago zeylanica* and *Santalum lanceolatum.* Vine species include *Abrus precatorius, Adenia heterophylla, Caesalpinia major*, *Gymnanthera nitida, Jacquemontia paniculata, Tylophora cinerascens* and *Tinospora smilacina*. *Lophostemon grandiflora* often occurs in the wettest areas behind sand dunes as part of the vine thicket stand and occurs as a forest similar to the occurrence of *Melaleuca* sp. within vine thickets. *Capparis lasiantha* is a common sprawling vine found within most vine thicket occurrences, while *Capparis sepiaria* is a regular feature in most northern vine thicket patches. The vine thickets mainly occur on leeward slopes and swales and occasionally exposed dune crests. Many occurrences extend into the red pindan soils on the inland portions of the dunes. Landforms occupied by the vine thickets include beach fronts, sand-spit headlands, low cliffs above mangrove lined creeks, storm ridges within intertidal flats, and red soil gullies inland of coastal cliffs (Black *et al*. 2010). The soils in the Holocene dunes where the community occurs are deep coastal dunes, generally white but can be pink, with a thin humus layer.	not have been fully documented for this community.
63	Plant assemblages of the Inering System as originally described in Beard (1976)	The community occurs in the Inering Hills in the northern Wheatbelt of Western Australia. It generally comprises: *Allocasuarina campestris* scrub over chert and granite hills; *Allocasuarina campestris* thicket with scattered *Acacia acuminata* (jam) and *Allocasuarina huegeliana* (rock sheoak) over brown sandy loam over stony and lateritic summits and slopes; *Acacia* sp. mixed low woodland on red brown sandy loam over granite on summits and slopes; *Melaleuca cardiophylla* (tangling melaleuca) thicket with scattered *Eucalyptus loxophleba* (York gum) and *Eucalyptus salmonophloia* (salmon gum)	Beard, J. S. (1976). Vegetation Survey of Western Australia. The Vegetation of the Perenjori Area, Western Australia. 1:250,000 series. Vegmap Publications, Perth. Department of Conservation and Land Management (2002) Interim Recovery Plan No. 107, Plant assemblages of the Inering System. CALM, Perth. Orsini, J. P. and Lewis, S. (1992). Conservation of Remnant Vegetation in the Inering Creek Catchment. In: V. Read (ed),	The Inering System as described by (Beard 1976). has a distinctive geology, topography and vegetation, different from that of any other comparable system described by J. Beard. Beard (1976) notes that like the Billeranga system, the Inering System "covers some small and localised outcrops of resistant rocks. Inering hills is 12 km north of Carnamah and mapped as Archaean-granite complex. The system also includes Woodadying Hill west of Carnamah which is also granitic and some nearby hills to the northwest which are of the Proterozoic Coomberdale Chert. Community comprises a group of hills – stretching from Carnamah to Three Springs - with a particular series of plant assemblages recurring in a catenary sequence	Sample, analyse data and report on flora and vegetation using methods described in EPA (2016a), and key references. Determine if habitat (Inering Hills and footslopes) and associated floral assemblages occur, and meet summary description, and

		over granite on the lower slopes and foothills; and *Eucalyptus loxophleba* woodland over clay loam on the foothills. The community was originally described in Beard J.S. (1976) "The vegetation of the Perenjori area, Western Australia: Map and explanatory memoir" (1:250,000 series, Vegmap Publications, Perth, Western Australia).	*Inering Save the Bush Project, Bush Management Strategy*	linked to topographic, pedological and/or geological features. Community on Inering Hills is different from others on other Systems (eg. Billeranga and Koolanooka Systems). Most available survey information is from Woondadying Hill – the southern-most occurrence. Orsini and Lewis (1992) recorded the vegetation of many hills of the Inering hill range that are now highly fragmented, and mapped most of the locations as *Allocasuarina campestris*, *Hakea recurva*, *Grevillea paniculata*, *Acacia acuminata* and *Acacia tetragonophylla* low woodland/scrub. These species are the least palatable to sheep. They did not locate the *Melaleuca filifolia – Allocasuarina campestris* assemblage on Proterozoic Noondine chert as reported by Beard (1976). Community supports Priority flora including: *Scholtzia brevistylis* subsp. *prowaka* (P2), *Epitriche demissus* (P2) and *Acacia nodiflora* (P3).	description in key references.
64	Plant assemblages of the Moonagin System as originally described in Beard (1976)	The community occurs on the fine-grained Archaean rocks of the Moonagin and Milhun Ranges. It generally comprises *Acacia* spp. scrub on red soil on the summits and slopes of the hills; *Acacia* spp. scrub with scattered *Eucalyptus loxophleba* (York gum) and *Eucalyptus oleosa* (giant mallee) on red loam flats on the foothills; and *Eucalyptus loxophleba* (York gum) woodland on red loam flats of the pediments. The community was originally described in Beard J.S. (1976) "The vegetation of the Perenjori area, Western Australia: Map and explanatory memoir" (1:250,000 series, Vegmap Publications, Perth, Western Australia).	Beard, J. S. (1976). *Vegetation Survey of Western Australia. The Vegetation of the Perenjori Area, Western Australia.* 1:250,000 series. Vegmap Publications, Perth. Department of Conservation and Land Management (2002). Interim Recovery Plan 2002-2007 for Plant assemblages of the Moonagin System. Interim Recovery Plan No. 105. Department of Conservation and Land Management, Perth	The Moonagin and Milhun Ranges, north-east of Morawa, comprise a group of low rounded granite hills formed from Archaean metamorphic rock (Baxter and Lipple 1985). They have a particular series of plant communities recurring in a catenary sequence or mosaic pattern linked to topographic, pedological and/or geological features. This catenary sequence or 'system' has a distinctive geology, topography and vegetation assemblages that differ from surrounding areas and from that of any other comparable system (eg. Koolanooka and Billeranga Systems; Beard 1976).	Sample, analyse data and report on flora and vegetation using methods described in EPA (2016a), and key references. Determine if habitat (Moonagin Hills and footslopes) and associated floral assemblages occur, and meet summary description, and description in key references.
65	Plant assemblages of the Billeranga System as originally described in Beard (1976)	The community occurs in the Billeranga Hills in the north-eastern Wheatbelt of Western Australia. It generally comprises: *Melaleuca filifolia* (wiry honeymyrtle) — *Allocasuarina campestris* thicket on clay sands over laterite on slopes and ridges; open mallee over mixed scrub on yellow sand over gravel on western slopes; *Eucalyptus loxophleba* (York gum) woodland over sandy clay loam or rocky clay on lower slopes and creeklines; and mixed scrub or scrub dominated by *Dodonaea inaequifolia* over red brown loamy soils on the slopes and ridges. The community was originally described in Beard J.S. (1976) "The vegetation of the Perenjori area, Western	Baxter, J. L. and Lipple, S. L. (1985). *Perenjori, Western Australia.* 1:250,000 Geological Series – Explanatory Notes. Geological Survey of Western Australia, Perth Beard, J. S. (1976). Vegetation Survey of Western Australia. The Vegetation of the Perenjori Area, Western Australia. 1:250,000 series. Vegmap Publications, Perth. Hamilton-Brown (2000). Plant assemblages of the Billeranga System. Interim Recovery Plan 2000-2003. IRP number 71.	The Billeranga System as described by (Beard 1976). has a distinctive geology, topography and vegetation, different from that of any other comparable system described by J. Beard. It covers the outcrop of the Billeranga group of Proterozoic rocks as expressed in the Billeranga Hills comprising sandstone, acid lavas, chert, siltstone and shale. It comprises a number of assemblages. The variation in the floristic composition of the community on the Billeranga System is assumed to correspond to different aspects/exposures, soil/substrate types and depths, and moisture regimes A number of priority flora are either totally confined to the community or are very restricted in their distribution	Sample, analyse data and report on flora and vegetation using methods described in EPA (2016a), and key references. Determine if habitat (Billeranga Hills and footslopes) and associated floral assemblages occur, and meet summary description, and description in key references.

		Australia: Map and explanatory memoir" (1:250,000 series, Vegmap Publications, Perth, Western Australia).	Department of Conservation and Land Management, Wanneroo. Robertson, P. L. (2019). Vegetation cover assessment for "Plant assemblages of the Billeranga System as described by Beard (1976)" using satellite imagery. Unpublished internal report for the Department of Biodiversity, Conservation and Attractions, Kensington. True, D and O'Callaghan, A. (1998). *Community Bushland Surveys*. A joint project of Australian Trust for Conservation Volunteers, World Wide Fund for Nature Australia and Department of Conservation and Land Management.	in Western Australia. These include: *Acacia pterocaulon* (P1), *Baeckea* sp. Billeranga Hills (P1), *Calytrix chrysantha* (P4), *Lepidobolus densus* (P4), *Scholtzia subsessilis* (P1).	

References

Environmental Protection Authority (2016a). Technical Guidance. Flora and Vegetation Surveys for Environmental Impact Assessment. EPA, Western Australia

Environmental Protection Authority (2016b). Technical Guidance. Sampling of short-range endemic invertebrate fauna. EPA, Western Australia.

Environmental Protection Authority (2020). Technical Guidance – Terrestrial vertebrate fauna surveys for environmental impact assessment, EPA, Western Australia

Environmental Protection Authority (2021). Technical Guidance. Subterranean fauna surveys for environmental impact assessment. EPA, Western Australia.

Appendices

Appendix 1: Vegetation survey methods and analysis to determine floristic community types on the southern Swan Coastal Plain

Background

Gibson *et al.* (1994) outlines a study of the plant communities of the remnant vegetation of the southern Swan Coastal Plain between Seabird and the foothills of the Whicher Range. Five hundred and nine 10x10m quadrats were established to sample examples of vegetation in best available condition, with >95% of plots visited at least twice to ensure comprehensive species lists. All vascular plants and information on various physical parameters, vegetation structure and vegetation condition were recorded for each quadrat, but estimates of cover values for each taxon were not collected. Statistical techniques were applied to define the regional vegetation types. Thirty broad vegetation units were defined and the major environmental correlates being variations in seasonal moisture regime and geomorphology. Some of the units were further subdivided and 43 types and subtypes were then recognised. These vegetation units are now termed floristic community types (FCTs). Of the 43 FCTs, 18 have been classified as threatened ecological communities. The names applied to the FCTs in Gibson *et al.* (1994) are intended to be descriptive, not diagnostic. For example, areas of '*Banksia attenuata* woodlands over species rich dense shrublands' (FCT 20a) have been identified that do not contain *Banksia attenuata* but occur in appropriate habitat, and statistical analyses of quadrat data indicate align with this ecological community.

The Gibson *et al*. (1994) study did not sample all geographical or geomorphological variation of the southern Swan Coastal Plain, with Foothills, Pinjarra Plain and Quindalup dunes being under-sampled. The Dandaragan Plateau SWA01 subregion, which along with the Perth SWA02 subregion comprises the Swan Coastal Plain IBRA region, was not sampled at all. An additional 613 (10x10m) quadrats were then established for the System 6 and Part System 1 Update Program (Department of Environmental Protection (DEP) 1996) and were classified against the Gibson *et al*. (1994) data. The data were utilised in the Bush Forever report and included the identification of an additional 23 types (Government of Western Australia 2000; Bush Forever). The floristic dataset for Bush Forever was updated to 2012 taxonomy and essentially equates to Keighery *et al*. (2012). The methods applied to allocating quadrats to FCTs in Keighery *et al*. (2012) are not defined in the Bush Forever document. The Keighery *et al.* (2012) dataset provides context for many locations, vegetation units, and soil and landform units that are under-sampled in Gibson *et al.* (1994).

The Technical Guidance for Flora and Vegetation surveys for Environmental Impact Assessment (EPA 2016) states '*The datasets from Gibson et al. (1994) and Bush Forever (2000) are available for download from NatureMap and notes on survey and analysis methods to determine floristic community types on the southern Swan Coastal Plain are also available from Parks and Wildlife*'. The datasets are currently available through flora.data@dbca.wa.gov.au. Previous versions of recommended methods to determine FCTs on the southern Swan Coastal Plain have been available through DBCA's Species and Communities Program or its' predecessor since 2010.

Quadrat analysis

The recommended procedure for determining the floristic community types (FCTs) present at a new survey site on the southern Swan Coastal Plain is to repeat methods as described in Gibson *et al*. (1994). This includes establishing 10 by 10m quadrats in vegetation in best condition and avoiding ecotones,

and scoring them at least twice (ie recording all the flora species present) at appropriate times. As estimates of cover values were not collected for the Gibson *et al.* (1994) dataset this information is not available for comparisons.

A form that provides standard format for recording quadrat-based data occurs in Keighery (1994). Permanent markers such as fence droppers or plastic survey markers should be used to mark corners, and corner locations recorded with a GPS with an accuracy of +/- 0.5 m. A photo of the quadrat should be taken from a specified location; typically the north west corner, using a standard lens.

The scoring of quadrats should be planned around the flowering times of the majority of the species present. This will vary depending on whether the site is a wetland, and will also depend on the latitude, and specific characteristics of the season (late or early rains etc). Spring and late spring are usually optimal seasons for surveys (September, and late October /early November). A third or even fourth scoring was sometimes undertaken for quadrats established for Gibson *et al*. (1994), especially in wetlands. In addition, some quadrats were scored over a series of years for Gibson *et al.* (1994), due to poor seasonal rains. It is therefore possible that climate will influence results for quadrats established and scoring across a series of additional seasons or even years may be indicated.

A good quality flowering specimen of each taxon encountered should be collected and confirmed with the WA herbarium. Specimens of plants that are new or poorly known to the location or have special conservation status should be vouchered.

Taxonomy should be reconciled between datasets to current or historic species names. The species data from quadrats established should then be compared and analysed against quadrat data held in Gibson *et al*. (1994) and Keighery *et al*. (2012) applying statistical techniques and parameters as described in Gibson *et al.* (1994). Packages including PATN, Primer, and R have been successfully applied for determining FCTs of new quadrats to date.

New data need to be of similar quality to the reference datasets, or the results could be unreliable and potentially misleading. A measure of quality can be obtained through comparing the taxa number in a new site to the average species richness of quadrats established by Gibson *et.al* (1994) and Keighery *et.al* (2012). Determining appropriate locations for quadrats may be critical in regard to comparability, in that they should be placed in areas of best condition and not in ecotones.

The importance of the application of this quadrat-based method is highlighted where few taxa are recorded. Relevé data are generally not comparable with the quadrats for Gibson *et al.* (1994) and Keighery *et.al* (2012). In addition, it is generally not possible to exactly relocate relevés so they can't easily be rescored, and this will limit the opportunity for comprehensive observations of flora at a site over time.

Analyses should be carried out against the quadrat data from Gibson *et al.* (1994) and Keighery *et al*. (2012). That is, the full species lists for all quadrats in these datasets should be utilised for these comparisons, and not partial species lists held in the tables in the Gibson *et. al* (1994) report (eg Table 12). Similarly, all quadrats should be used in an analysis and not a specific selection of nearby, or another, selection of quadrats. The original datasets are available free of charge on request from flora.data@dbca.wa.gov.au ('Swan Coastal Plain Survey' by Gibson *et al.* 1994; and 'Weed and native flora data for the Swan Coastal Plain' by Keighery *et al*. 2012). Gibson *et al*. (1994) utilised the quadrat-based data collected during that survey and PATN was used to sort the quadrat data into a series of FCTs using specified parameters. To compare new data collected for new sites on the southern Swan Coastal Plain, these methods should be repeated. Gibson *et al.* (1994: page 6) states "Sites were classified according to similarities in species composition using the Czekanowski

coefficient *(Brae-Curtis used in PATN)* and “unweighted pair-group mean average” fusion method (UPGMA, Sneath and Sokal 1973).” Species were classified into groups according to their occurrence to the same sites by using the TWOSTEP similarity algorithm (Austin an Beblin 1982) followed by UPGMA fusion.”

The most reliable outcomes for FCT assignments will be from comparison of adequately sampled quadrat data. The new quadrat data should be inserted, the classification rerun and examined with cluster or ordination techniques. Running the original Gibson *et al.* (1994) data with application of the same statistical techniques and parameters should not yield major anomalies from the original results. Major deviations from original results indicate the package is not suitable for assigning new quadrat data to the original FCTs, and should not be used for this purpose.

Single site insertions of new quadrat data into the existing datasets are recommended as they will minimise disruption of the original datasets. Nearest neighbour distances of the new quadrats to the Gibson *et al*. (1994) and Keighery *et al*. (2012) data should be examined if supported by the statistical package. Tables of similarity indices for the FCTs that have closest affinity to the new quadrats assist in determining the most logical FCT assignments. Threshold similarity values are not specified, as similarity indices are influenced by a series of factors including proximity to suitable comparable quadrats, data quality, vegetation condition, and comprehensiveness of species lists.

It is common for new quadrat data to group with cohorts within a localised survey area. That is, floristic data for quadrats that are established in a localised area tend to group together when analysed against a regional dataset such as Gibson *et al*. (1994). Consideration of the grouping of the new quadrats with quadrats in pre-determined FCTs in dendrograms, and through examination of similarity indices of the new site when compared to the quadrats in the regional datasets will assist in elucidating an appropriate assignment of the new quadrat to an existing FCT. Single site insertions of the new quadrat data can also assist in addressing this issue.

Critical analysis of the logic of the outcomes of analysis is required. For example, the typical habitat features such as soil and landform, and hydrological status of quadrats established for Gibson *et al*. (1994) should be explicitly discussed and compared in reporting. Reference to the ‘typical’ floristics and structure of the FCTs as defined by Gibson *et al*. (1994) can be utilised to provide supporting evidence for assignment of FCTs. Results of analyses, key habitat characteristics, key flora combinations, hydrological status, and other relevant issues should be tabulated for each quadrat. The evidence and reasoning used to determine the FCT/s present should be stated. If results of statistical analysis do not indicate a ‘logical’ outcome in this regard then the reasons for this should be discussed. This may include factors such as vegetation condition, timing of survey, potential presence of previously unsampled FCTs or transitional zones, and issues associated with data quality. The most logical conclusion regarding FCTs present in the new quadrats should be stated and the evidence for concluding that a specified FCT occurs should be explicit.

Use of other methods

High numbers of weeds in data from new sites can skew FCT assignments towards alignment with quadrats with greater weed numbers. Exclusion of weeds from species lists for reference datasets and data for new sites used in statistical analyses has been shown to be useful in improving confidence in elucidation and assignment of the FCTs present where high proportions of weed taxa would otherwise override information about the underlying FCTs. For example, FCT type 6 is a weed dominated grouping in Gibson *et al.* (1994), and exclusion of weeds from reference and new datasets can reveal affinities for an underlying FCT (noting that any deletions and exclusions will affect the original analysis). Where numbers of weeds are low at the new sites, exclusion of weed species is likely to have minimal effect on assignments of FCTs.

Species lists for vegetation units can be collected and analysed using other methods where native species richness is inadequate to provide good quality data for statistical analysis; for example, where vegetation is not in suitable condition (degraded or poorer condition on Bush Forever vegetation condition scales: Government of Western Australia 2000). The flora and vegetation can be surveyed along a series of transects or relevés across the site, with species recorded for different vegetation units being compiled in separate lists. Detailed notes should be recorded about the species present, vegetation condition on Bush Forever scales, and soils and landform. Plant species that may be particularly significant in differentiating the floristic community types should also be noted. The species lists for each identified vegetation unit should be compared to full species lists compiled from all quadrats established for the Gibson *et al.* (1994) report and Keighery *et al*. (2012), for floristic community types considered most likely to occur at the site on the basis of soil and landform characteristics and general species composition. Results should be provided in the form of raw data (species lists) and tables that indicate the alignment (proportional overlap) of species present in each different vegetation unit, with species lists compiled for all quadrats in likely FCTs from Gibson *et al.* (1994) and Keighery *et al*. (2012). Combinations of plant species that are most frequently associated with a specified FCT should be evaluated from species present in each identified vegetation unit. Lists of taxa that are 'typical' (occur in >75% of quadrats) or 'common' (occur in 50-75% in quadrats) in particular FCTs are listed in Appendix 1 of Gibson *et al*. (1994).

In addition, further descriptive information and lists of taxa that are indicative of the communities of the eastern side of the Swan Coastal Plain are provided in Appendix 2.

Information about Reference Sites that provide good examples of specific FCTs in Bush Forever sites is on the Western Australian Local Government Association Data WA web site at:
https://catalogue.data.wa.gov.au/dataset/perth-plant-communities-reference-sites
The location in question should be compared to these Reference Sites in terms of composition and structure of the vegetation, habitat, and soil and landform.

The logic used to determine the likely FCTs present at the new site should be evident in reporting, (eg soil and landform, geology, patterns of species composition). Table 14 in the Gibson *et al*. (1994) report provides a list of the most frequent landforms on which the FCTs occur, but this is not a definitive list of landforms on which the FCTs were found. Table 2 in Appendix 2 below also lists the landforms on which some FCTs of the eastern side of the Plain have been recorded to date. Conclusions that certain Priority or threatened ecological communities could not occur because the soil and landform units from which they have been recorded do not occur at the survey site are not conclusive and additional evidence would need to be presented.

If taxa indicate that vegetation is generally transitional between specific FCTs, then this should be noted and the FCTs to which the vegetation aligns most closely should be identified. The status of each possible FCT should be noted (eg Priority or threatened ecological community, and rank).

Mapping

The assignment of floristic community types for each quadrat needs to occur prior to mapping boundaries of FCTs or alignment with other pre-determined vegetation units. A pre-determined vegetation unit may contain one or a suite of FCTs. The assignment of FCTs to pre-determined and mapped vegetation units is likely to result in flawed interpretation of FCTs present and their boundaries. Therefore when applying existing floristic community type classifications from Gibson *et al.* (1994) for the southern Swan Coastal Plain, individual quadrats at the new site first need to be analysed to determine the FCT present at the quadrat location. It may be necessary to clarify boundaries of FCTs through field verification after completion of analysis and assignment of quadrats to specified FCTs.

For the purposes of environmental impact assessment, it may not be necessary to map the boundaries of FCTs that do not have special conservation significance (ie FCTs that aren't threatened or priority ecological communities).

The boundaries between vegetation condition classes using Bush Forever vegetation condition scales should be mapped and digitised.

Example reports

Morgan, B. (2015). Survey of Floristic Community Types East of Dundas Road, High Wycombe for the Forrestfield-Airport Link Project. Prepared for Public Transport Authority. January 2015. Sourced from URL 11 January 2023: https://www.epa.wa.gov.au/sites/default/files/API_documents/Appendix%203a%20FLA%20API%20Morgan%202015a%20East%20of%20Dundas%20Road.pdf

Public Transport Authority (2015). Forrestfield Airport Link Project Targeted Survey of Vegetation Floristic Community Types in High Wycombe – Addendum Report Prepared by RPS. Sourced from URL 11 January 2023: https://www.epa.wa.gov.au/sites/default/files/API_documents/Appendix%203c%20FLA%20API%20Morgan%202015c%20High%20Wycombe%20addendum.pdf

References

Churchward, H.M. and McArthur, W.M.(1980). Landforms and soils of the Darling System, Western Australia. Division of Land Resources Management, CSIRO, Perth

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

DEP (1996). System 6 and Part System 1 Update Programme. Unpublished bushland plot and area records and analysis. Department of Environmental Protection, Perth, Western Australia.

EPA (2016). Technical Guidance for Flora and Vegetation surveys for Environmental Impact Assessment. EPA, Perth. Sourced from URL 25 January 2023: EPA Technical Guidance - Flora and Vegetation survey_Dec13.pdf.

Gibson, N., Keighery, B., Keighery, G., Burbidge, A. and Lyons, M. (1994). *A floristic survey of the Southern Swan Coastal Plain*. Unpublished report for the Australian Heritage Commission prepared by the Department of Conservation and Land Management and the Conservation Council of Western Australia (Inc.).

Government of Western Australia (2000). *Bush Forever*. Western Australian Planning Commission, Perth.

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

Keighery, B., Keighery, G., Longman, V.M., and Clarke, K.A. (2012). Weed and native flora quadrat data compiled between 1990 – 1996 for the Southern Swan Coastal Plain. Data compiled for the Departments of Environmental Protection and Conservation and Land Management. Perth.

Keighery, B. and Trudgen, M. (1992). *Remnant vegetation on the alluvial soils of the eastern side of the Swan Coastal Plain.* Report prepared for the Department of Conservation and Land Management. Perth, Western Australia.

Morgan, B. (2015). Survey of Floristic Community Types East of Dundas Road, High Wycombe for the Forrestfield-Airport Link Project. Prepared for Public Transport Authority. January 2015. Sourced from URL 11 January 2023:

https://www.epa.wa.gov.au/sites/default/files/API_documents/Appendix%203a%20FLA%20API%20Morgan%202015a%20East%20of%20Dundas%20Road.pdf
Public Transport Authority (2015). Forrestfield Airport Link Project Targeted Survey of Vegetation Floristic Community Types in High Wycombe – Addendum Report Prepared by RPS. Sourced from URL 11 January 2023: https://www.epa.wa.gov.au/sites/default/files/API_documents/Appendix%203c%20FLA%20API%20Morgan%202015c%20High%20Wycombe%20addendum.pdf

Appendix 2: Floristic community types on the eastern side of the southern Swan Coastal Plain

The eastern side of the Swan Coastal Plain is characterized by the presence of a suite of threatened ecological communities including three marri communities on heavy soils (floristic community type (FCT) 3a, 3b and 3c), and three closely allied woodlands and shrublands (FCT 20a, 20b and 20c). There is a suite of taxa associated with the highly cleared heavier soils. A number of these taxa are associated with these TECs, and provide supporting evidence for their presence. The list of taxa that are indicative of the eastern side of the Plain in Table 2 is adapted from Trudgen and Keighery (1992), supplemented with additions from particular experts. Flora listed for specified FCTs are derived from Keighery *et al*. (2012), and also has additions from particular experts.

Table 2: Taxa that assist in distinguishing FCTs of the eastern side of the Plain

Family	*Taxon*	Taxonomy	3a	3b^	3c	20a	20b	20c	Comments #
Fabaceae	*Acacia barbinervis*	current		1			1		
Fabaceae	*Acacia drewiana*	current	1	1					
Fabaceae	*Acacia latericola*	current		1			1		
Fabaceae	*Acacia teretifolia*	current		1					
Dasypogonaceae	*Acanthocarpus canaliculatus*	current							
Hemerocallidaceae	*Agrostocrinum scabrum*	current	1	1	1		1		
Casuarinaceae	*Allocasuarina microstachya*	current	1						
Casuarinaceae	*Allocasuarina thuyoides*	current				1	1		
Ericaceae	*Andersonia aristata*	current							
Ericaceae	*Andersonia gracilis*	current							T
Haemoraceae	*Anigozanthos bicolor*	current							
Goodeniaceae	*Anthotium junciforme*	current							Wetlands
Fabaceae	*Aotus cordifolia*	current							Wetlands
Aponogetonaceae	*Aponogeton hexatepalus*	current							P4
Poaceae	*Aristida contorta*	current							
Myrtaceae	*Babingtonia camphorosmae*	Was *Baeckea camphorosmae*	1	1	1	1	1		
Proteaceae	*Banksia armata*	Was *Dryandra armata*		1	1				
Proteaceae	*Banksia bipinnatifida*	current							
Proteaceae	*Banksia incana*	current				1			
Proteaceae	*Banksia mimica*	current							T
Proteaceae	*Banksia telmatiaea*	current							Wetlands
Myrtaceae	*Beaufortia macrostemon*	current	1	1			1		
Myrtaceae	*Beaufortia purpurea*				1				P3
Myrtaceae	*Beaufortia squarrosa*	current							
Haemodoraceae	*Blancoa canescens*	current				1			
Rutaceae	*Boronia ovata*	current							
Boryaceae	*Borya sphaerocephala*	current	1	1	1				
Fabaceae	*Bossiaea angustifolia*	current		1		1	1	1	
Fabaceae	*Bossiaea ornata*	current					1		
Colchicaceae	*Burchardia bairdiae*	current							Wetlands
Colchicaceae	*Burchardia multiflora*	current	1		1			1	Wetlands

Byblidaceae	*Byblis gigantea*	current							Wetlands
Montiaceae	*Calandrinia composita*	current							No data in Florabase
Dasypogonaceae	*Calectasia grandiflora* (P2)	current							Wetlands
Cupressaceae	*Callitris acuminata*	Was *Actinostrobus acuminatus*				1	1		
Myrtaceae	*Calothamnus hirsutus*	current	1						
Myrtaceae	*Calothamnus quadrifidus*	current		1					
Myrtaceae	*Calothamnus sanguineus*	current			1	1			
Myrtaceae	*Calytrix aurea*	current	1			1	1		
Myrtaceae	*Calytrix breviseta subsp breviseta*	current							T
Myrtaceae	*Calytrix simplex*	current							
Myrtaceae	*Calytrix variablis*	current							
Centrolepidaceae	*Centrolepis caespitosa*	current							
Restionaceae	*Chaetanthus tenellus*	Was *Leptocarpus*							Busselton area on SCP
Anthericaceae	*Chamaescilla versicolor*	current	1					1	
Myrtaceae	*Chamelaucium lullfitzii* N.G. Marchant	current							T
Haemodoraceae	*Conostylis caricina*	current	1		1	1		1	
Haemodoraceae	*Conostylis festucacea*	current							
Haemodoraceae	*Conostylis setosa*	current		1			1	1	
Proteaceae	*Conospermum huegelii*	Current							
Proteaceae	*Conospermum undulatum*	Current				1	1		T
Myrtaceae	*Conothamnus trinervis*	Current				1			
Fabaceae	*Cristonia biloba*	Was *Templetonia biloba*	1	1	1	1	1	1	
Cyperaceae	*Cyathochaeta equitans*	current				1	1	1	
Goodeniaceae	*Dampiera coronata*	current							
Myrtaceae	*Darwinia foetida* Keighery	current							Damplands
Myrtaceae	*Darwinia citriodora*	current					1		
Myrtaceae	*Darwinia thymoides* subsp. *thymoides*	current	1						
Dasypogonaceae	*Dasypogon obliquifolius*	current					1	1	
Fabaceae	*Daviesia cordata*	current							
Restionaceae	*Desmocladus lateriflorus*	Was *Harperia laterflora* (also *Leptocarpus?)*			1				
Asparagaceae	*Dichopogon preissii*	current							
Restionaceae	*Dielsia stenostachya*	Was *Restio stenostachyus*							Wetlands
Droseraceae	*Drosera bulbigena*	current	1						
Droseraceae	*Drosera bulbosa*	current	1	1	1				
Droseraceae	*Drosera erythrorhiza*	current	1	1	1	1	1		Wetter sites and heavier soils.

Droseraceae	*Drosera heterophylla*	current	1		1				Wetter sites and heavier soils.
Droseraceae	*Drosera occidentalis*	current							P4
Myrtaceae	*Eremaea fimbriata*	current				1			
Apiaceae	*Eryngium pinnatifidum* subsp. *palustre (*GJ Keighery 13459)	current	1	1					P3
Apiaceae	*Eryngium* sp. *subdecumbens* (GJ Keighery 5390)	current							
Myrtaceae	*Eucalyptus lane-poolei*	current	1	1					
Myrtaceae	*Eucalyptus wandoo*	current			1				
Fabaceae	*Gastrolobium spinosum*	current							
Fabaceae	*Gompholobium aristatum*	current	1	1				1	
Fabaceae	*Gompholobium knightianum*	current	1	1	1	1	1		
Fabaceae	*Gompholobium marginatum*	current	1	1	1				
Fabaceae	*Gompholobium polymorphum*	current	1	1	1		1		
Fabaceae	*Goodenia coerulea*	current							
Proteaceae	*Grevillea bipinnatifida*	current	1	1	1		1	1	Separate subspecies on the Plain (subsp. *pagna* – P1)
Proteaceae	*Grevillea diversifolia*	current							
Proteaceae	*Grevillea manglesii*	current							
Proteaceae	*Grevillea obtusifolia*	current	1						
Proteaceae	*Grevillea pilulifera*	current			1		1		
Proteaceae	*Grevillea synapheae*	current							
Proteaceae	*Grevillea thelemanniana*	current							
Proteaceae	*Grevillea wilsonii*	current	1	1			1		
Malvaceae	*Guichenotia sarotes*	current							
Haemodoraceae	*Haemodorum loratum*	current							
Haemodoraceae	*Haemodorum simplex*	current	1		1				
Proteaceae	*Hakea auriculata*	current	1	1					
Proteaceae	*Hakea ceratophylla*	current	1	1					
Proteaceae	*Hakea conchifolia*	current		1		1			
Proteaceae	*Hakea cyclocarpa*	current		1					
Proteaceae	*Hakea erinacea*	current			1				
Proteaceae	*Hakea lasianthoides*	current							
Proteaceae	*Hakea marginata*	current	1						
Proteaceae	*Hakea myrtoides*	current			1				
Proteaceae	*Hakea stenocarpa*	current		1			1		
Proteaceae	*Hakea undulata*	current		1	1		1		
Lamiaceae	*Hemiphora bartlingii*	Was *Pitryrodia bartlingii*				1	1		
Dillenaceae	*Hibbertia commutata*	current		1	1		1		

Dillenaceae	*Hibbertia nymphaea*	current							
Araliaceae	*Hydrocotyle lemnoides*	current							P4
Proteaceae	*Isopogon asper*	current	1	1					
Proteaceae	*Isopogon drummondii*	current				1			
Proteaceae	*Isopogon dubius*	current		1			1		
Campanulaceae	*Isotoma pusilla*	current							
Campanulaceae	*Isotoma scapigera*	current							
Campanulaceae	*Isotropis cuneifolia* subsp *glabra*	current	1			1	1	1	P3
Fabaceae	*Jacksonia alata*	current			1				
Fabaceae	*Jacksonia lehmannii*	current				1	1		
Fabaceae	*Jacksonia restioides*	current	1			1	1	1	
Fabaceae	*Kennedia stirlingii*	current			1				
Dasypogonaceae	*Kingia australis*	current	1	1	1	1		1	
Myrtaceae	*Kunzea micrantha*	current	1						
Myrtaceae	*Kunzea recurva*	current	1		1 (aff)				
Fabaceae	*Labichea lanceolata*	current							
Proteaceae	*Lambertia multiflora* var. *darlingensis*	current	1	1		1	1	1	
Malvaceae	*Lasiopetalum bracteatum*	current							P4
	Lasiopetalum floribundum	current							
Malvaceae	*Lasiopetalum glutinosa*	Current, was Thomasia	1						
Fabaceae	*Latrobea tenella*	current							Wetlands
Malvaceae	*Lawrencia squamata*	current							Wetlands
Anthericaceae	*Laxmannia grandiflora*	current			1				
Myrtaceae	*Leptospermum erubescens*	current					1		
Dasypogonaceae	*Lomandra brittanii*	current	1	1					
Dasypogonaceae	*Lomandra odora*	current	1	1				1	
Haloragaceae	*Meionectes tenuifolia*	Was *Haloragis tenuifolia*							P3
Myrtaceae	*Melaleuca incana* subsp. *incana*	Was *Melaleuca polygaloides*							Wetlands
Myrtaceae	*Melaleuca lateritia*	current							
Myrtaceae	*Melaleuca osullivanii*	Was *Melaleuca uncinata*	1						
Myrtaceae	*Melaleuca radula*	current		1					
Cyperaceae	*Mesomelaena graciliceps*	current		1		1	1		
Cyperaceae	*Mesomelaena tetragona*	current	1	1	1	1	1	1	
Orchidaceae	*Microtis alba*	current							Wetlands
Asteraceae	*Millotia tenuifolia*	current	1	1		1	1		
Cyperaceae	*Morelotia australiensis*	Was *Tetraria australiense*							T
Asteraceae	*Myriocephalus helichrysoides*	current							Wetlands
Haloragaceae	*Myriophyllum echinatum*	current							Wetlands. P3

Poaceae	*Neurachne allopecuroidea*	current	1	1	1	1	1	1	
Rubiaceae	*Opercularia apiciflora*	current		1	1				
Menyanthaceae	*Ornduffia submersa*	Was *Villarsia submersa*							Wetlands. P4
Iridaceae	*Patersonia juncea*	current	1	1	1	1	1		
Apiaceae	*Pentapeltis peltigera*	current		1			1		
Proteaceae	*Persoonia elliptica*	current				1	1		
Proteaceae	*Petrophile biloba*	current		1					
Proteaceae	*Petrophile seminuda*	current	1	1					
Proteaceae	*Petrophile squamata*	current	1						
Phylidraceae	*Philydrella drummondii*	current	1						
Phylidraceae	*Philydrella pygmaea*	current	1	1	1				
Loganiaceae	*Phyllangium palustre*	Was *Mitrasacme palustris*							Wetlands. P2
Thymelaeaceae	*Pimelea imbricata* var. *major*	current	1	1	1				
Asteraceae	*Podolepis gracilis*	current	1	?			1	1	
Orchidaceae	*Prasophyllum drummondii*	current	1	1					
Amaranthacea	*Ptilotus declinatus*	current			1				
Amaranthacea	*Ptilotus manglesii*	current				1		1	
Amaranthacea	*Ptilotus pyramidatus*	current							Wetlands. T
Asteraceae	*Rhodanthe manglesii*	Current. Was *Helichrysum manglesii*							
Asteraceae	*Rhodanthe pyrethrum*	Was *Hyalospermum pyrethrum*							Wetlands
Goodeniaceae	*Scaevola lanceolata*	current	1						
Goodeniaceae	*Scaevola calliptera*	current		1			1		
Apiaceae	*Schoenolaena juncea*	current	1						
Cyperaceae	*Schoenus andrewsii*	current							
Cyperaceae	*Schoenus capillifolius*	current							Claypans. P3
Cyperaceae	*Schoenus natans*	current							P4
Cyperaceae	*Schoenus pennisetus*	current							P3. Wetlands
Euphorbiaceae	*Stachystemon vermicularis*	current					1		
Proteaceae	*Stirlingia simplex*	current							
Stylidiaceae	*Stylidium affine*	current	1		1				
Stylidiaceae	*Stylidium breviscapum*	current		1	1				
Stylidiaceae	*Stylidium dichotomum*	current	1	1	1				
Stylidiaceae	*Stylidium divaricatum*	current							
Stylidiaceae	*Stylidium ecorne*	Current	1						
Stylidiaceae	*Stylidium guttatum*	Current							
Stylidiaceae	*Stylidium longitubum*	current							P4
Stylidiaceae	*Stylidium thesioides*	current							
Stylidiaceae	*Stylidium utricularioides*	current							
Surianaceae	*Stylobasium australe*	current							Wetlands
Hemerocallidaceae	*Stypandra glauca*	current			1		1		

Epacridaceae	*Styphelia tenuiflora*	current				1	1		
Proteaceae	*Synaphea acutiloba*	current	1	1	1				
Proteaceae	*Synaphea pinnata*	current							
Restionaceae	*Tremulina tremula*	Was *Restio tremulus*							
Malvaceae	*Thomasia foliosa*	current		1					
Malvaceae	*Thomasia macrocarpa*	current	1						
Anthericaceae	*Thysanotus dichotomus*	current			1				
Anthericaceae	*Thysanotus glaucus*	current							P4
Haemodoraceae	*Tribonanthes australis*	current	1						Wetlands
Haemodoraceae	*Tribonanthes brachypetala*	current			1				
Haemodoraceae	*Tribonanthes longipetala*	current	1		1				
Asteraceae	*Trichocline spathulata*	current							
Celastraceae	*Tripterococcus* sp. Brachylobus	Was *Tripterococcus* sp. Cannington							P4
Hydatellaceae	*Trithuria occidentalis*	Was *Hydatella dioica*							T
Rhamnaceae	*Trymalium ledifolium*	current	1						
Rhamnaceae	*Trymalium odoratissimum* Lindl. subsp. *odoratissimum*	Was *Trymalium floribundum*		1					
Myrtaceae	*Verticordia acerosa*	current							
Myrtaceae	*Verticordia huegelii*	current	1						
Myrtaceae	*Verticordia lindleyi* subsp. *lindleyi*	current							P4
Myrtaceae	*Verticordia pennigera*	current	1						
Myrtaceae	*Verticordia plumosa* var. *brachyphylla*	Was *Verticordia plumosa* subsp. *pleiobotrya*	1						
Myrtaceae	*Verticordia serrata* var. *linearis*	current							P3
Xanthorrhoeaceae	*Xanthorrhoea acanthostachya*	current		1		1	1		
Xanthorrhoeaceae	*Xanthorrhoea gracilis*			1			1		
Xanthorrhoeaceae	*Xanthorrhoea* sp. Lesueur (G.J. Keighery 16404)	current				1			
Apiaceae	*Xanthosia candida*	current	1	1	1				
Apiaceae	*Xanthosia ciliata*	current							

'Wetlands' includes all forms including damplands, winter-wet sites, swamps, and drainage lines.
T: Threatened flora

Table 3: Landforms on which the '3 group and 20 group' of FCTs have been recorded (derived from TEC database)

Soil#	Landform#	System#	FCT 3a	FCT 3b^	FCT 3c	FCT 20a	FCT 20b	FCT 20c
Abba Complex	Fluviatile Deposits	Swan Coastal Plain	1					
Bassendean complex - central and south	Aeolian Deposits	Swan Coastal Plain	1	1		1		
Beermullah complex	Fluviatile Deposits	Swan Coastal Plain	1		1			
Cannington complex	Fluviatile Deposits	Swan Coastal Plain		1				
Cullula complex	Lateritic Uplands	Dandaragan Plateau		1		1		
Darling Scarp complex*	Major Valley Floors and Scarps	Darling Plateau	*1	*1	*1		*1	
Forrestfield complex	Ridge Hill Shelf	Swan Coastal Plain	1	1	1	1	1	1
Guildford complex	Fluviatile Deposits	Swan Coastal Plain	1	1	1	1	1	1
Karrakatta complex - central and south	Aeolian Deposits	Swan Coastal Plain				1		
Mogumber complex - south	Lateritic Uplands	Dandaragan Plateau	1			1		
Reagan complex	Scarps	Dandaragan Plateau				1		
Southern River complex	Aeolian Deposits	Swan Coastal Plain	1	1	1	1	1	1
Swan complex	Fluviatile Deposits	Swan Coastal Plain			1			

Churchward, H.M. and McArthur, W.M.(1980). Landforms and soils of the Darling System, Western Australia. Division of Land Resources Management, CSIRO, Perth
*Western extremities of unit, on transitional zone.
^ One occurrence outside of extent of mapping by Churchward and McArthur 1980 (Dunsborough)