Lakeland Nature Reserve 29023
Vegetation and Flora Survey

BOTANICAL CONSULTANTS
REPORT
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Disclaimer and Limitations

The scope of the survey may have been limited by time, budget, season, access and or other constraints. In the undertaking of this work the author has made every effort to ensure accuracy of the information provided. Data presented, maps, opinions and conclusions made in the report are done in good faith and the author is not responsible for the interpretation of this information subsequently by others.

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- Brett Beecham (Department of Biodiversity, Conservation and Attractions) for comments on the report.

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1.0 INTRODUCTION

1.1 Survey Objectives

The vegetation and flora survey of Lakeland Nature Reserve 29023 was commissioned by the Parks and Wildlife Service of the Department of Biodiversity, Conservation and Attractions to assist with the management of Nature Reserves in the Lake Bryde Recovery Catchment. Other Nature Reserves previously surveyed as part of this process include East Lake Bryde Nature Reserve, Lake Bryde Conservation Park and Lakeland Nature Reserves 29024 and 29025. The objectives of these surveys include:

- the description and mapping of vegetation types
- the assessment of the condition of the vegetation
- a list of plant species recorded during the survey.
- a report on Threatened, Priority and other significant flora.
- a report on Threatened Ecological Communities in the area

1.2 Background Information from previous reports

The Interim Biogeographical Regionalisation of Australia Version 7 (2012) divides Western Australia into 23 IBRA Bioregions which are subdivided into 53 IBRA sub regions. IBRA regions are large geographically distinct areas of similar climate, geology, landform, vegetation, and fauna communities. The boundaries of the IBRA regions are broadly comparable with the earlier Beard's phytogeographic regions made up of Botanical districts and sub districts. Lakeland Nature Reserves 29023, 29024 and 29025 are situated in the Western Mallee IBRA sub region.

The Western Mallee is a sparsely populated sub region with an area of about 47,000 square kilometres. The sub region is largely cleared for agriculture with about 31% of the sub region's native vegetation remaining. These areas are under environmental stress from threats such as rising salinity (especially valley floor woodlands), vegetation fragmentation, weeds, fire and feral animals. Areas low on the landscape e.g. salt lakes are also at risk from excess nutrient run off. Around 10% of the sub region is held within nature reserves for conservation purposes covering about 25% of the remaining native vegetation (Shepherd et al 2002). The trends are for decline or rapid decline in vegetation associations and many ecosystems are unknown.

The Lake Bryde Recovery catchment was established in 1999 as one of the Natural Biodiversity Recovery Catchments managed by the Department of Biodiversity, Conservation and Attractions. Sixteen crown reserves are situated within the Recovery Catchment, twelve of these are nature reserves including part of Lake Magenta Nature Reserve 25113 (see Figure 1).

The catchment, is about 400 kilometres south-east of Perth, covers 140,000 hectares, and includes the Lakeland Nature Reserves, Lake Bryde Conservation Park and East Lake Bryde Nature Reserve. Approximately 66% of the Lake Bryde catchment is cleared (Hamilton-Brown and Blyth 2001). Increased runoff from upper slope areas, secondary salinisation and increase waterlogging adversely impact on the biodiversity values provided by the catchment. The goal for the catchment is to slow the rate of decline of biodiversity across valley floor assemblages and to conserve specific high value biodiversity assets (DBCA 2018).

Figure 1: Reserves in the Lake Bryde Recovery Catchment

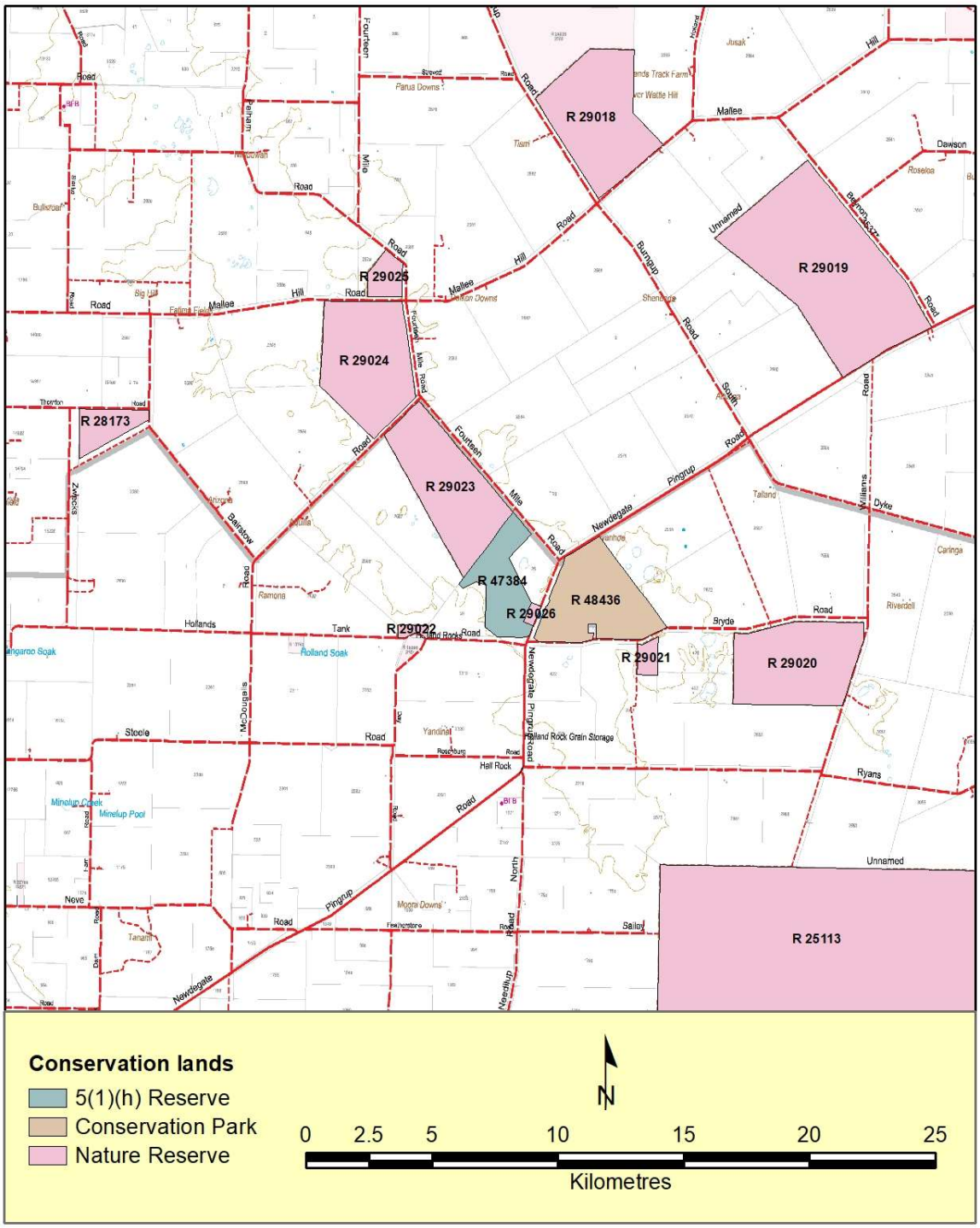
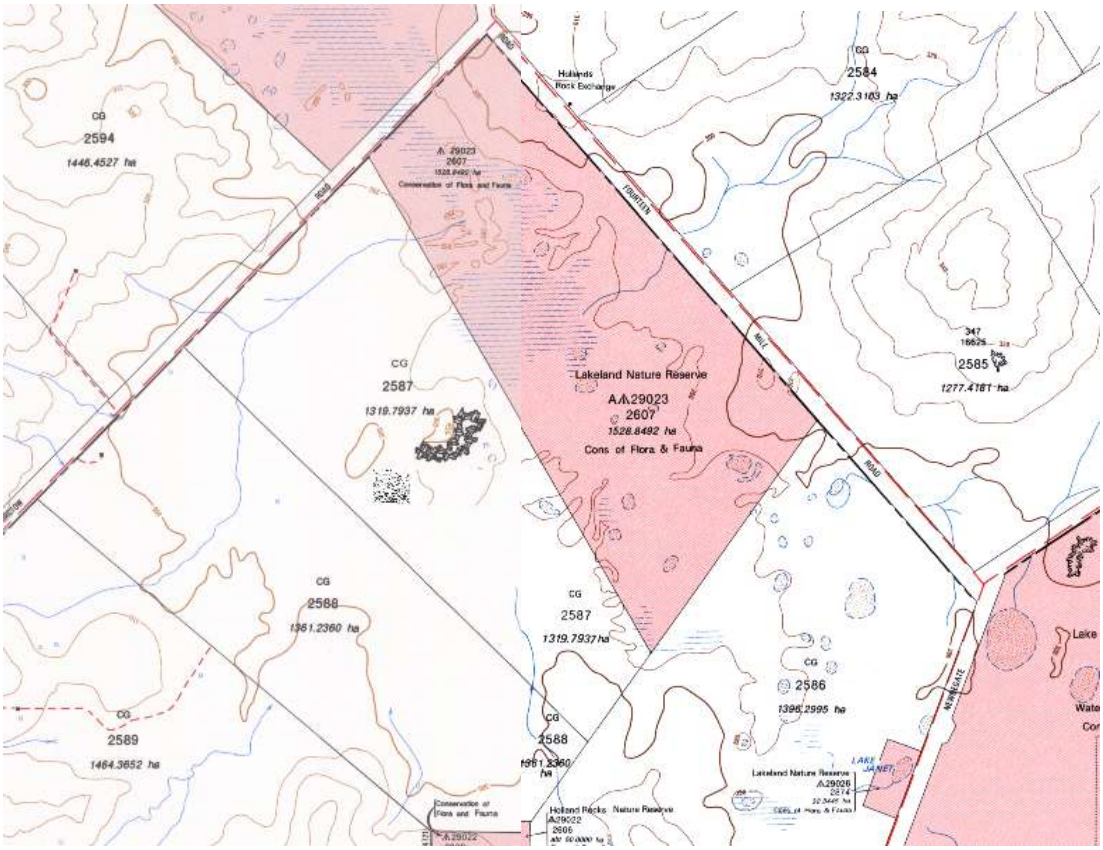


Figure 2: From South West WA 1:50,000 scale topographical maps (Landgate 2013)



1.3 Physical Features of Lakeland Nature Reserves 29023

Lakeland Nature Reserve 29023 is situated approximately 31kms SW of the Newdegate town site in the Shire of Kent and is 1528.8 ha in size. The Nature Reserve is bounded by Fourteen Mile Road to the East, Bairstow Road to the North and cleared farmland adjacent to the western boundary. Revegetation has taken place on areas of DBCA land adjacent to the south eastern boundary. The Nature Reserve is relatively flat with the highest points on the north eastern and south eastern part of the reserve with a drainage line in between. The terrain slopes gently to the western areas. The reserve includes small salt lakes and closed depressions. Extensive low-lying areas on the western side have clay soils and are poorly drained. A shallow waterway has been constructed to protect these areas from waterlogging by moving water through the valley floor system into a series of termination lakes.

1.4 Geology, landform and soils

The Lake Bryde Recovery Catchment lies on the Yilgarn Craton, an ancient and relatively stable area of granites and gneiss**.** Although mainly igneous rocks underlie the district, major valleys have been in filled by sediments that form the extensive Salt Lake system. These extensive Salt Lake chains grade north-west to join the Avon Catchment and eventually the Swan River. They have very low gradient and the whole system only flows after exceptionally high rainfall such as the flooding in 2006. Weathering of rock types, faulting and geological uplift have influenced the topography and soil types of the region (Sawkins 2011). Vegetation and associated soils form complex mosaics in the landscape and in most areas the soils vary over short distances and intergrade soils such as sand over gravel over clay are common, as are duplex sandy gravel soils. The landscape is subdued and comprised of gently undulating terrain with long, gentle slopes.
Map units covering Lakeland Nature Reserves 29023 from the 1:250 000 Geological series – Newdegate sheet (Thom el al 1984) include:

Agg	adamellite and granodiorite – granoblastic texture, strongly foliated; foliation defined by entrainment and alignment of biotite (rarely hornblende)
Qd	Aeolian and alluvial deposits of silt and sand in sheets and dunes, gypsiferous near playa lakes; Ancient drainage flats; commonly contain calcrete nodules.
Qc	Colluvium and minor alluvial – derived mainly from Czs (sandplain) and Czg (reworked sandplain and undulating surface – containing sand, clay, gravel and minor laterite outcrop)
Czl	Laterite – limonite nodules in cemented matrix

In the salt lake country soil particles are sorted and transported by alluvial processes (movement by water) and aeolian processes (movement by wind). Stabilized dunes of quartz sand (Qd) occur on the eastern and south eastern sides of playa lakes. The dunes are considered to have formed during a more arid period, 15000 to 20000 years ago under the influence of prevailing west-north westerly to north westerly winds. Areas of aeolian silt and sand, with numerous small claypans and irregular meandering channels, are often included in this unit.

Laterite occurs on upper slopes. Reworking and local removal of parts of the Tertiary soil profile have commonly exposed underlying gravels and form unit Czg. Deeper erosion has exposed laterite (Czl) and ultimately bedrock (Thom el al 1984). Duplex soils supporting eucalypts tend to dominate in areas less favourable to laterite development. These include fertile soils, alkaline soils and situations with restricted water movement through the soil, such as winter waterlogging, heavy textured and poorly structured soils (Sawkins 2011).

Soil-landscape mapping units developed by the Department of Agriculture and Food and outlined in Ecoscape (2001) are presented in Appendix 3.

2.0 METHOD

2.1 Field Survey

The ground survey of the vegetation and flora of the study area was carried out over the equivalent of 7 days during October and November 2019. The work included data collection through targeted and opportunistic searches. Traverses were made through the survey area to collect data to map vegetation boundaries, describe vegetation types and examine habitat where rare flora and endangered ecological communities were likely to occur.

General vegetation divisions were noted using aerial photography. Areas of interest thus delineated were examined in the field and the vegetation at selected sites (releves or unmarked areas of definite size) described. The releves were approximately 30m in diameter except where vegetation typical of the vegetation type being described covered smaller areas e.g. narrow ridge. This releve size was thought to be optimum for including all taller shrubs, mallee and trees that were considered to be characteristic of the vegetation types encountered. Releves were chosen rather than quadrats for sampling because of the large number of site descriptions required to capture the complexity of the vegetation patterns. Due to time limitations and constraints collecting data from many marked quadrats was not feasible.

Because of time limitations some areas were not covered in detail in the ground survey and mapping was carried out by extrapolation of known vegetation types using the aerial photographs. A GPS was used in the field to mark the approximate centre of releves, vegetation boundaries, location of rare flora and other sites of interest e.g. photo points.

Vegetation type descriptions were based on the National Vegetation Information System (NVIS) (ESCAVI 2003) Table 2. Descriptions are to Level 6 (Sub-Association). Descriptions using the classification system devised by Muir (1977, Table 1) which was specifically designed for describing Wheatbelt vegetation are also included so that comparisons can be made with surveys that have previously used the Muir classification system. The condition of the vegetation described follows the Vegetation Condition Scale modified from Trudgen 1991 by B.J. Keighery for the Swan Coastal Plain Survey 1994 (Table 3).

Information recorded at each releve included:

- GPS location at the centre of the releve
- Vegetation classification - Muir description (1977) and NVIS (2003)
- Vegetation condition
- Inventory of plant species
- Any Threatened, Priority species or other species of interest
- Physical description including soils, topography and landform.
- A high-resolution digital photograph

An example of the record sheet used in the field is presented in Appendix 1. The plant inventory in releves was comprehensive but small plants or those that would have been inconspicuous at the time of survey would not have been included. This contrasts with quadrat work where every species in the quadrat is included. The emphasis was on frequently occurring and characteristic species. As the same person carried out all field work it is expected that the method of data collection was consistent.

Specimens of plant species encountered were collected and identified using keys and by comparison with specimens at the Western Australian Herbarium. Plant specimens of interest will be lodged in the WA Herbarium. Experts involved in revising particular genera were consulted wherever possible to ensure accuracy with plant identifications. Searches for Threatened, Priority and other significant flora were made during the traverses walked through the survey area.

Table 1: Muir System of Vegetation Classification

LIFE FORM/ HEIGHT CLASS	**CANOPY COVER**			
	DENSE 70-100% d	**MID-DENSE 30-70% c**	**SPARSE 10-30% i**	**VERY SPARSE 2-10% r**
T Trees > 30m	Dense Tall Forest	Tall Forest	Tall Woodland	Open Tall Woodland
M Trees 15-30m	Dense Forest	Forest	Woodland	Open Woodland
LA Trees 5-15m	Dense Low Forest A	Low Forest A	Low Woodland A	Open Low Woodland A
LB Trees < 5m	Dense Low Forest B	Low Forest B	Low Woodland B	Open Low Woodland B
KT Mallee tree form	Dense Tree Mallee	Tree Mallee	Open Tree Mallee	Very Open Tree Mallee
KS Mallee shrub form	Dense Shrub Mallee	Shrub Mallee	Open Shrub Mallee	Very Open Shrub Mallee
S Shrubs > 2m	Dense Thicket	Thicket	Scrub	Open Scrub
SA Shrubs 1.5-2.0m	Dense Heath A	Heath A	Low Scrub A	Open Low Scrub A
SB Shrubs 1.0-1.5m	Dense Heath B	Heath B	Low Scrub B	Open Low Scrub B
SC Shrubs 0.5-1.0m	Dense Low Heath C	Low Heath C	Dwarf Scrub C	Open Dwarf Scrub C
SD Shrubs 0.0-0.5m	Dense Low Heath D	Low Heath D	Dwarf Scrub D	Open Dwarf Scrub D
P Mat plants	Dense Mat plants	Mat plants	Open Mat plants	Very Open Mat plants
H Hummock Grass	Dense Hum. Grass	Mid-Dense Hum.	Hummock Grass	Open Hummock Grass
GT Bunch grass > 0.5m	Dense Tall Grass	Grass	Open Tall Grass	Very Open Tall Grass
GL Bunch grass < 0.5m	Dense Low Grass	Tall Grass	Open Low Grass	Very Open Low Grass
J Herbaceous spp.	Dense Herbs	Low Grass Herbs	Open Herbs	Very Open Herbs
VT Sedges > 0.5m	Dense Tall Sedges	Tall Sedges	Open Tall Sedges	Very Open Tall Sedges
VL Sedges < 0.5m	Dense Low Sedges	Low Sedges	Open Low Sedges	Very Open Low Sedges
X Ferns	Dense Ferns	Ferns	Open Ferns	Very Open Ferns
Mosses, liverwort	Dense Mosses	Mosses	Open Mosses	Very Open Mosses

Table 2: NVIS structural Formation Terminology (ESCAVI 2003)

	Cover Characteristics							
	Foliage cover *	70-100	30-70	10-30	<10	≈0	0-5	unknown
	Crown cover **	>80	50-80	20-50	0.25-20	<0.25	0-5	unknown
	% Cover ***	>80	50-80	20-50	0.25-20	<0.25	0-5	unknown
	Cover code	d	c	i	r	bi	bc	unknown
Growth Form	**Height Ranges (m)**	**Structural Formation Classes**						
tree, palm	<10,10-30, >30	closed forest	open forest	woodland	open woodland	isolated trees	isolated clumps of trees	trees
tree mallee	<3, <10, 10-30	closed mallee forest	open mallee forest	mallee woodland	open mallee woodland	isolated mallee trees	isolated clumps of mallee trees	mallee trees
shrub, cycad, grass-tree, tree-fern	<1,1-2,>2	closed shrubland	shrubland	open shrubland	sparse shrubland	isolated shrubs	isolated clumps of shrubs	shrubs
mallee shrub	<3, <10, 10-30	closed mallee shrubland	mallee shrubland	open mallee shrubland	sparse mallee shrubland	isolated mallee shrubs	isolated clumps of mallee shrubs	mallee shrubs
heath shrub	<1,1-2,>2	closed heathland	heathland	open heathland	sparse heathland	isolated heath shrubs	isolated clumps of heath shrubs	heath shrubs
chenopod shrub	<1,1-2,>2	closed chenopod shrubland	chenopod shrubland	open chenopod shrubland	sparse chenopod shrubland	isolated chenopod shrubs	isolated clumps of chenopod shrubs	chenopod shrubs
samphire shrub	<0.5,>0.5	closed samphire shrubland	samphire shrubland	open samphire shrubland	sparse samphire shrubland	isolated samphire shrubs	isolated clumps of samphire shrubs	samphire shrubs
hummock grass	<2,>2	closed hummock grassland	hummock grassland	open hummock grassland	sparse hummock grassland	isolated hummock grasses	isolated clumps of hummock grasses	hummock grasses
tussock grass	<0.5,>0.5	closed tussock grassland	tussock grassland	open tussock grassland	sparse tussock grassland	isolated tussock grasses	isolated clumps of tussock grasses	tussock grasses
other grass	<0.5,>0.5	closed grassland	grassland	open grassland	sparse grassland	isolated grasses	isolated clumps of grasses	other grasses
sedge	<0.5,>0.5	closed sedgeland	sedgeland	open sedgeland	sparse sedgeland	isolated sedges	isolated clumps of sedges	sedges
rush	<0.5,>0.5	closed rushland	rushland	open rushland	sparse rushland	isolated rushes	isolated clumps of rushes	rushes
forb	<0.5,>0.5	closed forbland	forbland	open forbland	sparse forbland	isolated forbs	isolated clumps of forbs	forbs
fern	<1,1-2,>2	closed fernland	fernland	open fernland	sparse fernland	isolated ferns	isolated clumps of ferns	ferns
bryophyte	<0.5	closed bryophyteland	bryophyteland	open bryophyteland	sparse bryophyteland	isolated bryophytes	isolated clumps of bryophytes	bryophytes
lichen	<0.5	closed lichenland	lichenland	open lichenland	sparse lichenland	isolated lichens	isolated clumps of lichens	lichens
vine	<10,10-30, >30	closed vineland	vineland	open vineland	sparse vineland	isolated vines	isolated clumps of vines	vines
aquatic	0-0.5,<1	closed aquatic bed	aquatic bed	open aquatic bed	sparse aquatics	isolated aquatics	isolated clumps of aquatics	aquatics
seagrass	0-0.5,<1	closed seagrass bed	seagrassbed	open seagrassbed	sparse seagrassbed	isolated seagrasses	isolated clumps of seagrasses	seagrasses

Table 3: Vegetation Condition Scale

Vegetation Condition Scale Modified from Trudgen 1991 by B.J. Keighery for the Swan Coastal Plain Survey 1993
1 = Pristine Pristine or nearly so, no obvious signs of disturbance
2 = Excellent Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species. For example damage to trees caused by fire, the presence of non - aggressive weeds and occasional vehicle tracks.
3 = Very Good Vegetation structure altered, obvious signs of disturbance. For example disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.
4 = Good Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate to it. For example disturbance to vegetation structure caused by very frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback and grazing.
5 = Degraded Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example disturbance to vegetation structure caused by very frequent fires, the presence of some very aggressive weeds, partial clearing, dieback and grazing.
6 = Completely degraded The structure of the vegetation is no longer intact, and the area is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora composing weed or crop species with isolated native trees or shrubs.

2.3 PRIMER Analysis

The multivariate statistics package used to analyse the species information for each releve was PRIMER v6 (Clarke & Gorley, 2006). Releves were classified according to similarities in species composition (presence/absence data) using the Bray-Curtis Similarity Coefficient. The results of the Cluster classification are illustrated in a dendrogram. A SIMPROF test (similarity profile) was used in conjunction with cluster to test the significance of divisions displayed in the dendrogram. A SIMPROF test was carried out at each node of the dendrogram. The data set without the annuals, geophytes and introduced weeds was used in the analysis.

Data quality

Some taxonomic issues arose after the completion of plant identification work that was carried out at the WA Herbarium. 2019 was the second unusually dry season and lack of good quality flowering and/or fruiting material increased the difficulty of plant identification work.

Melaleuca "uncinata" group - *Melaleuca hamata/Melaleuca scalena.* Differentiating between *Melaleuca hamata* and *Melaleuca scalena* was difficult when flowering material was not available and therefore all specimens were assigned to *Melaleuca scalena*.

The identification of some of the *Hibbertia* species where flowering material was not available was also difficult and the specimens collected have been assigned to *Hibbertia gracilipes* complex.

Because of the difficulty of identifying some of the *Lepidosperma* collections a range of specimens were assigned to *Lepidosperma* sp. and will need to be re assessed at a future date.

Tecticornia species were often difficult to identify especially sterile material and expert assistance is required to check some of the identifications. Identification work was however consistent and final identifications should not affect the PRIMER analysis.

Good quality material for the Identification of *Eucalyptus* species was often lacking.

Databases

The following data sets were accumulated in EXCEL spread sheets.

- All species recorded at releves including weeds, annuals and geophytes.
- Plant species at releves no annuals, geophytes, weeds – used in Primer analysis.
- Releve descriptions including GPS location, soils, topography, landform and drainage.

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3.0 VEGETATION SURVEY

3.1 Previous surveys in the Lake Bryde Recovery Catchment

The survey area is situated in the Western Mallee Interim Biogeographical Regionalisation of Australia (IBRA) sub region and Beard's Hyden Vegetation System which is a subdivision of the Roe Botanical District.

Beard (1976) describes the vegetation of the Hyden vegetation system with its gently undulating landscape as follows. On upper slopes are remnants of ancient laterites giving rise to soils of deep yellow sand or sand over gravel on which the typical formation is scrub heath with *Eucalyptus tetragona* (now *Eucalyptus pleurocarpa*) occasional and Proteaceae dominant.

In mid slope and occupying the largest proportion of the area are yellow earths developed on granite and carrying mallee. Beard describes *Eucalyptus eremophila* and *E oleosa* as generally dominant with areas of *E. redunca* and *E. uncinata* occurring frequently with them. Taxonomic changes in the genus Eucalyptus have been considerable since Beard's descriptions. The mallee most similar to *Eucalyptus eremophila* that occurs on laterite in the Lake Bryde area is *Eucalyptus sporadica*. The *Eucalyptus oleosa* group has been split into many species. The Eucalyptus species from the "*Eucalyptus eremophila*" group occurring in the Lake Bryde catchment is *Eucalyptus tenera* and it typically occurs in Mallee over *Melaleuca* on duplex soils of sand over clay.

Beard describes the valleys as having red loams on which patches of eucalypt woodland appear and on the lowest ground there are salt flats and playa lakes. Bare granite outcrops appear in any section of the landscape. Around the salt lakes is an irregular stand of boree (*Melaleuca* species) including *Melaleuca thyoides, M. lateriflora* and *M. hamulosa*. Further out the boree is joined by trees of *Eucalyptus* k*ondininensis* and next *Melaleuca pauperiflora*, *Eucalyptus salmonophloia* and *Eucalyptus longicornis* come in.

Beard (1976) has mapped Lakeland Nature Reserve 29023 at a scale of 1:250 000. The map units covering the Reserve include:

eMi mixed woodland in lakes country *E salmonophloia, E longicornis, E salubris, E kondininensis*

eSi Mallee on lateritic soil Eucalyptus eremophila – E oleosa association

Mattiske (1999) mapped the vegetation of low-lying areas (below 300ms) of the Lakeland Nature Reserves. 4 sites were situated in Lakeland Nature Reserve 29023 including Peg 2 - plant community 2.6, LG1- plant community 2.1, LG2 – plant community 2.3 and LG3 – plant community 2.2.

The vegetation map covering Lakeland Nature Reserve 29023 and photographs of these sites is presented in Appendix 2. Those formations relevant to the Lakeland Nature Reserves are listed below.

Woodland Formations

1.1 Open Woodland of *Eucalyptus kondininensis* over Scrub over Open Dwarf Scrub C in loamy sand on the rises above salt lakes

1.2 Low Forest A of *Eucalyptus vegrandis* (now *Eucalyptus alipes*)*, Callitris roei* over Very Open Herbs in sand

1.3 Low Woodland of *Eucalyptus occidentalis*, *Eucalyptus kondininensis* over Scrub over Very Open Low Sedges in sand

1.4 Very Open Woodland of *Eucalyptus flocktoniae* (now *Eucalyptus urna*), *Eucalyptus phenax* over Dense Thicket in loamy sand

1.5 Tall Woodland of *Eucalyptus flocktoniae* (now *Eucalyptus urna*), *Eucalyptus phenax* over Open Scrub over Open Dwarf Scrub D

1.6 Open Woodland of Eucalyptus salmonophloia over Low Heath C over Open Herbs in loamy clay

Mallee Formation

2.1 Open Tree Mallee of *Eucalyptus vegrandis* (now identified *as Eucalyptus suggrandis*)*, Eucalyptus calycogona* var. *calycogona* and *Eucalyptus occidentalis* to Very Open Tree Mallee over Open Scrub over Dwarf Scrub C on sand

2.2 Open Tree Mallee of *Eucalyptus vegrandis* (now identified as *Eucalyptus suggrandis*), *Eucalyptus hypoclamydea* subsp. *ecdysiastes* (now *Eucalyptus horistes* and other)*, Eucalyptus transcontinentalis* (now *Eucalyptus neutra*) over Mid Dense Heath A over Open Low Sedges on sandy loam

2.3 Very Open Tree Mallee of *Eucalyptus sporadica, Eucalyptus incrassata*, *Eucalyptus phenax* over Open Low Scrub A over Mid-dense Low Scrub C

2.5 Dense Shrub Mallee of *Eucalyptus capillosa* subsp. *polyclada* (unlikely to occur in the area possibly *Eucalyptus phaenophylla*) over Open Dwarf Scrub D over Open Herbs

2.6 Shrub mallee of Eucalyptus vegrandis (now identified *as Eucalyptus suggrandis*), *Eucalyptus calycogona* var. *calycogona, Eucalyptus hypoclamydea* subsp. *ecdysiastes* (now *Eucalyptus horistes* and other)*, Eucalyptus sporadica* over Low Scrub A over Very Open Low Sedges in loamy soil.

Shrubland Formations

3.1 Thicket of *Melaleuca adnata, Melaleuca halmaturorum, Melaleuca lateriflora, Melaleuca uncinata (*now *Melaleuca hamata, Melaleuca scalena* or *Melaleuca atroviridis*) over Open Dwarf Scrub D in sandy soils

3.3 Open Scrub of *Acacia chamaeleon, Acacia saligna, Leptospermum erubescens* over Low Scrub B over Low Sedges in sand

3.4 Dwarf Scrub D or Open Dwarf Scrub D of *Halosarcia pergranulata* (now *Tecticornia pergranulata*)*, Halosarcia syncarpa* (now *Tecticornia syncarpa*), *Tecticornia verrucosa* over Very Open Herbs in clay soils

3.5 Open Dwarf Scrub D of *Halosarcia pergranulata (Tecticornia perangusta), Halosarcia syncarpa (Tecticornia syncarpa), Halosarcia indica* subsp. *bidens* (now Tecticornia *indica* subsp. *bidens*) over Dense Herbs in clay

In 2000 Ecoscape conducted a vegetation survey of reserves in the Lake Bryde Recovery Catchment. This survey included 6 quadrats situated in Lakeland Nature Reserve 29023 including Quadrat LB30, LB31, LG01, LG02, LG03, and Peg2. Details from the report can be found in Appendix 3.

One SAP site (salinity action plan sites) was situated in Lakeland Nature Reserve 29023, PI 19 (Gibson et al 2004). A description of this site is detailed below.

Quadrat number	**Vegetation Description (Muir 1977)**	**Vegetation Type present survey**
PI19 Reserve 29023	*Eucalyptus gratiae, Eucalyptus phaenophylla, Eucalyptus dissimulata* open shrub mallee, over *Hakea francisiana, Melaleuca uncinata* open scrub, over *Acacia leptospermoides, Beyeria leschenaultii* low heath D, over *Lepidosperma drummondii* open low sedges	Ems/L

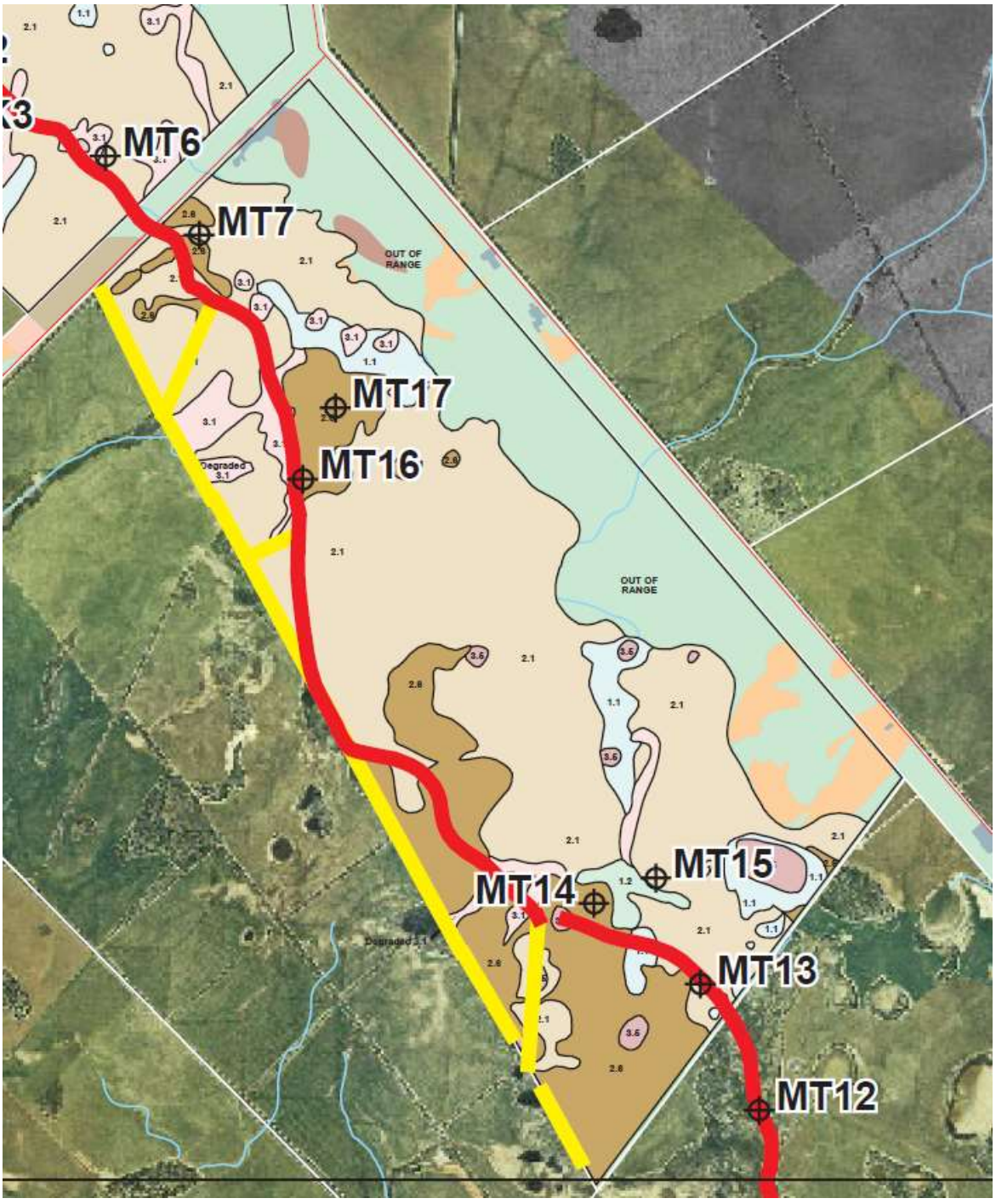
In 2005 17 permanent vegetation monitoring transects were established by Mattiske Consulting Pty Ltd in the Lake Bryde and Lakeland area to monitor the environmental impacts of the surface water management engineering project. Data on vegetation status and condition was collected in 2005 and 2009 (Mattiske 2010). Six of these transects were established in Lakeland Nature Reserve 29023 (MT7, MT13, MT14, MT15, MT16 and MT17). DBCA staff continued to monitor these transects in 2011 and 2013.
MT7 - Control
MT13 – Valley floor with drainage line
MT14 – Valley floor with drainage line
MT15- Valley floor, no drainage line (control)
MT16 – Valley floor with drainage line
MT17- Valley floor, no drainage line (control)

Mean Health change – living trees.
MT7 - Significant decline
MT13 – Significant decline
MT14 – significant decline
MT15- significant decline
MT16 – significant improvement
MT17- no significant difference

Mean Health change – living shrubs.
MT7 - no significant difference
MT13 – Significant improvement
MT14 – significant improvement

MT15- significant improvement
MT16 – significant improvement
MT17- significant improvement

Figure 3: The location of monitoring transects (Mattiske 2010) in Lakeland Nature Reserve 29023



3.2 Present Survey - Vegetation of Lakeland Nature Reserve 29023

The vegetation types mapped and described in the present study are outlined in Table 4. Descriptions of the vegetation structure (with photographs) recorded at releves can be found in Appendix 4. Muir (1977) and NVIS (to level 6 Sub-Association) vegetation descriptions are included. Detailed vegetation descriptions can be found in Appendix 5. The species are listed in order of prominence and the first 5 species in each layer/sub-stratum can be used for NVIS descriptions to level 6. Data sets (EXCEL spread sheets) with species recorded at each releve and habitat descriptions are also available.

Vegetation and associated soils form complex mosaics in the landscape. The vegetation can vary over short distances and vegetation types often merge into each other, intergrades or transition areas are common especially between mallee associations. In this situation species typical of adjacent vegetation types occur jointly. Variation in vegetation can also be related to changes in topography and geology e.g. presence of granite rock and hydrology (drainage). In the study area there is a trend towards heath/shrublands, and other vegetation associated with lateritic soils to occur on higher slopes and those associated with duplex soils (sandy soils over clay) and heavier soils to occur on mid slopes and in valleys. What defines a new vegetation type and what is viewed as a transition area is subjective and to a large degree will depend on the scale of mapping undertaken. There is a good relationship between species (e.g. Proteaceae on laterite), size and diversity of understory plants and soil properties. The understory becomes more diverse as depth to clay increases and soils are better drained (Sawkins 2011).

In Lakeland Nature Reserve 29023 only small areas of granite are present often adjacent to areas of lateritic soils which are widespread. Vegetation types associated with granite are isolated *Eucalyptus loxophleba* subsp. *gratiae* over shrubland (Elox) and herblands (Gh). Species rich heathland (H) and *Allocasuarina* shrubland (As) occur on lateritic soils higher in the landscape. Mallee over *Melaleuca scalena* /laterite (Ems/L) occurs on lateritic soils and intergrade soils of laterite and clay.

On the gentle mid slopes to the lower slopes/valley floor mallee associations are extensive including Mallee over *Melaleuca scalena* (EMs) merging into smaller areas of Mixed Mallee with a sparse understory (E).

In the Lake Bryde Conservation Park variation within the Mixed Mallee vegetation type was recorded as

- Mixed Mallee over Melaleuca depauperate (EMd) and
- Mixed Mallee over sparse understory (E).

In Lakeland NR 29024 only Mixed Mallee over Melaleuca depauperata (EMd) was mapped and in Lakeland NR 29023 during the present survey only Mixed Mallee over sparse understory (E) was recorded during field work.

Two small areas of *Eucalyptus salmonophloia* woodland (Es) occur on loam/clay on the mid slopes and on duplex soils of sand over clay, Mallee over *Melaleuca adnata* (EMa) covers areas on heavier duplex soils. Intergrades between EMs and EMa are mapped as Mallee over mixed Melaleuca species (EM). Mallee over *Melaleuca carrii* (EMc) occurs on deeper sandy duplex soils probably with laterite at depth and here intergrades into *Eucalyptus perangusta* over shrubland (Ep) which is typical of the deeper sandy soils associated with the salt lakes. *Eremaea* heathland (Er) was also found on deeper sandy soils.

On lower slopes/valley floor *Eucalyptus kondininensis* woodland (Ek) grows on elevated areas adjacent to salt lakes and one small area of *Eucalyptus salubris* (Esu) woodland was recorded on clay. *Melaleuca* shrublands (M) are found on poorly drained areas on clay soils and in depressions. Small salt lakes or playa lakes have areas of samphire (*Tecticornia)* shrublands (Te) and small closed depressions with clay soils are characterized by isolated shrubs of *Wilsonia humilis* and *Wilsonia rotundifolia* (W). Areas of Te also occur on low-lying areas on clay soils affected by waterlogging where Melaleuca shrubs have died.

The following definitions are used in the detailed vegetation descriptions (Appendix 5). Very sparse (2-10% canopy cover), sparse (10-30% canopy cover), mid dense (30-70% canopy cover) and dense (70-100% canopy cover) to describe cover. Growth forms are from NVIS (ESCAVI 2003) including Rush which is defined as including the monocotyledon families Juncaceae, Typhaceae, Liliaceae, Iridaceae, Xyridaceae and the genus *Lomandra* i.e. “graminoid” or grass-like genera.

3.3 Vegetation Map

The mallee vegetation types can vary over short distances and often merge into each other with intergrades or transition areas common. Vegetation boundaries were often difficult to distinguish on the aerial photography and therefore boundaries are only approximations. Mallee areas on sandy ridges in low lying areas were mapped as *Eucalyptus perangusta* over shrubland (Ep). Not all these areas were visited during fieldwork.

Melaleuca shrubland in low-lying areas sometimes included dead trees or mallee. These areas were probably healthy woodland/mallee areas in the past. Areas were mapped as samphire shrubland (Te) where Melaleuca shrubs had been dead for some time and *Tecticornia* species were prominent. *Melaleuca* shrubland as mapped will include degraded areas (Md). These areas were difficult to delineate on the available aerial photography (2008, 2014). Dead Melaleuca shrubs with an understory of *Tecticornia* shrubs were often recorded on the edge of small salt lakes or claypans and mapped as Md. Usually some live *Melaleuca* shrubs were present in these areas or the death of the shrubs was considered recent.

3.4 PRIMER analysis

The data set used for the analysis excluded annuals, geophytes and weeds. The SIMPROF test indicates those divisions which are statistically significant (black lines). The results are displayed by the dendrogram in Figure 4. Eighty-two releves were selected for the vegetation analysis. Some releves recorded during the survey were not included as they were thought to represent transition zones not typical of the vegetation types or influenced by edge affect (a number of species present considered to be characteristic of adjacent areas/vegetation types). Differences between the Vegetation classification based on characteristic species and vegetation structure and the classification based on the analysis of floristic composition data i.e. presence/absence of species at each releve are discussed below.

1. *Eucalyptus perangusta* over shrubland (Ep) releves clustered in 5 different groups bases on the presence/absence of species. Areas of Ep are sometimes small and confined to sandy ridges in the lower part of the land scape and are variable.
2. Two *Eucalyptus perangusta* over shrubland (Ep) releves clustered with Mallee over *Melaleuca carrii* (EMc) and one with *Eremaea pauciflora* heathland (Er). These vegetation types were mapped separately wherever possible however they tend to transition into each other, and boundaries are sometimes difficult to detect on the aerial photography.
3. The Mixed Mallee with sparse understory (E) and Mallee over *Melaleuca scalena* (EMs) releves were grouped together in the analysis with no significant difference shown in species composition. These vegetation types differ in the understory strata.
4. *Eucalyptus alipes* releves clustered in 2 distinct groups in the analysis. These were *Eucalyptus alipes* woodland on sandy ridges and *Eucalyptus alipes* open forest (only 1 releve). These areas are all mapped as Ea. Vegetation at one of the *Eucalyptus alipes* releves was degraded and this releve clustered with the *Melaleuca* shrublands in the analysis.
5. Mixed lateritic heathland and *Allocasuarina* shrubland (As) releves cluster together reflecting the similarity in species composition with the presence in both vegetation types of plants that prefer lateritic soils.
6. Mallee over mixed Melaleuca species (EM) releves cluster with Mallee over *Melaleuca scalena* (Ems) or Mallee over *Melaleuca adnata* (EMa) releves. This vegetation type represents vegetation that is an intergrade/transition between the two. EM covered only small areas elsewhere in the recovery catchment but is more extensive in Lakeland NR 29023 where it is therefore mapped as a separate vegetation type.

3.5 Vegetation Condition

The vegetation of Lakeland Nature Reserve 29023 which occurs higher in the landscape is in excellent condition with little disturbance and only the occasional nonaggressive weed species present. Weeds were more common in vegetation near the boundaries especially

adjacent to farmland and in degraded low-lying areas. Seven introduced or weed species were recorded during the present survey and a further 5 were recorded in previous surveys. The majority of these weeds were annuals from the families Poaceae and Asteraceae, and the remaining species were herbaceous. *Mesembryanthemum nodiflorum* was common in degraded low-lying areas.

Some of the low-lying areas in Lakelands Nature Reserve 29023 near the surface water drain show heath decline primarily associated with an increased period of waterlogging and subsequent recharge of groundwater resulting in rising groundwater levels. This has been described by Mattiske (2010). Degraded (Keighery 1994) areas where dead *Melaleuca* shrubs are prominent, and *Tecticornia* species present are mapped as Te. The Condition of other wetland areas is presented in Table 9 and Appendix 9 and the condition of the vegetation at releves is presented in the excel spreadsheet documenting releve physical characteristics.

Releve 32 mapped as Te with dead *Melaleuca* shrubs prominent

Table 4 - Vegetation Types in Lakeland Nature Reserve 29023

Vegetation Type	Map Unit	Soils/topography	Landform	releves	Comments/ Rare Flora
Woodland Formations					
Eucalyptus salmonophloia (salmon gum) woodland	Es	Loamy soils over clay. Gentle slope to flat terrain	Usually valley floor adjacent to lakes and in drainage lines	37, 40	2 small areas mid slopes
Eucalyptus salubris (gimlet)	Esu	Clay soils. Flat to gentle slope	Lower slopes, valley floor	81	One small area
Eucalyptus kondininensis (Kondinin blackbutt) woodland	Ek	Sandy loams. Flat to gentle slope	Valley floor, higher ground adjacent to lakes	14, 16, 21, 29, 72, 79	Frankenia drummondii P3
Eucalyptus alipes	Ea Open forest	Sandy loam over clay to clay soils. Flat to gentle slope	Valley floor	67 59 - degraded	
	Ea woodland	Sandy loam ridges over clay. Flat to gentle slope	Valley floor	58, 60, 62	
Mallee Formations					
Mallee over *Melaleuca scalena* - laterite	EMs/L	Sandy loam with laterite over clay	Upper to mid slope	34, 36, 54	Banksia xylothemelia P3 *Grevillea newbeyi* P3 *Persoonia brevirhachis* P3 Styphelia chlorantha P2
Mallee over *Melaleuca scalena*	EMs	Sandy loam over clay - duplex soils ~30cm to clay	Mid to lower slopes	6, 73	*Spyridium mucronatum* subsp. *recurvum* P3
Mixed Mallee – sparse understory	E	Sandy loam over clay - duplex soils	Mid to lower slopes	26, 28	Styphelia chlorantha P2
Mallee over *Melaleuca carrii*	EMc	Deeper sandy soils over clay laterite	Mid to lower slopes well drained	4, 42, 43, 55, 74,	Grevillea newbeyi P3 Melaleuca sculponeata P3 Spyridium mucronatum subsp. recurvum P3 Styphelia chlorantha P2
Eucalyptus perangusta over shrubland	Ep	Deeper sandy soils. Gentle slopes and flat terrain, sandy ridges	Lower slopes, usually adjacent to lakes	17, 56, 57, 65, 66, 75, 82	*Spyridium mucronatum* subsp. *recurvum* P3

Mallee over mixed Melaleuca species	EM	Heavier soils of loam over clay. Flat to gentle slope	Mid to lower slopes	8, 19, 44, 48, 50, 53, 80	*Melaleuca sculponeata* P3 Styphelia chlorantha P2
Mallee over *Melaleuca adnata*	EMa	Heavier soils of loam over clay. Flat to gentle slope	Upper to lower slopes	38, 49	
Shrubland Formations - Kwongan /Heath					
Mixed lateritic heathland	H	Sandy gravels. Gentle slopes to flat terrain	Upper slopes	2, 3, 9, 41, 46	Banksia xylothemelia P3 *Persoonia brevirhachis* P3 Rinzia affinis P4
Allocasuarina shrubland	As	Sandy gravel	Upper to mid slopes	1, 33, 47	Banksia xylothemelia P3 *Persoonia brevirhachis* P3 *Gastrolobium cruciatum* P3
Eremaea pauciflora heathland	Er	Deep sandy soils pale then yellow over laterite, flat to gently sloping terrain	Mid to lower slopes well drained	64, 70	
Shrubland Formations					
Isolated *Eucalyptus loxophleba* subsp. *gratiae* over shrubland	Elox	Gravelly sands and loams adjacent to granite. Flat to gentle slope	Mid to upper slopes associated with granite	39	Small area. Granite to surface amongst gravel
Melaleuca shrubland	M	Clay, poorly drained	Lower slopes, valley floor	7, 13, 22, 25, 31, 45, 51, 63, 69, 71, 78	Frankenia drummondii P3
	Md degraded	Clay, poorly drained, prone to waterlogging	Lower slopes, valley floor	18, 27, 61	
Wilsonia isolated shrubs	W	Silt and clay, poorly drained	Closed depressions, valley floor	5, 24, 76	
Samphire (*Tecticornia*) shrubland	Te	Clay soils, possibly with gypsum, poorly drained	Salt Lake, lakebed	12, 15, 20, 23, 30, 32, 35, 52, 68, 77	
Granite Complex					
Herbland	Gh	Shallow sandy loam over granite	Granite outcrop	10, 11	

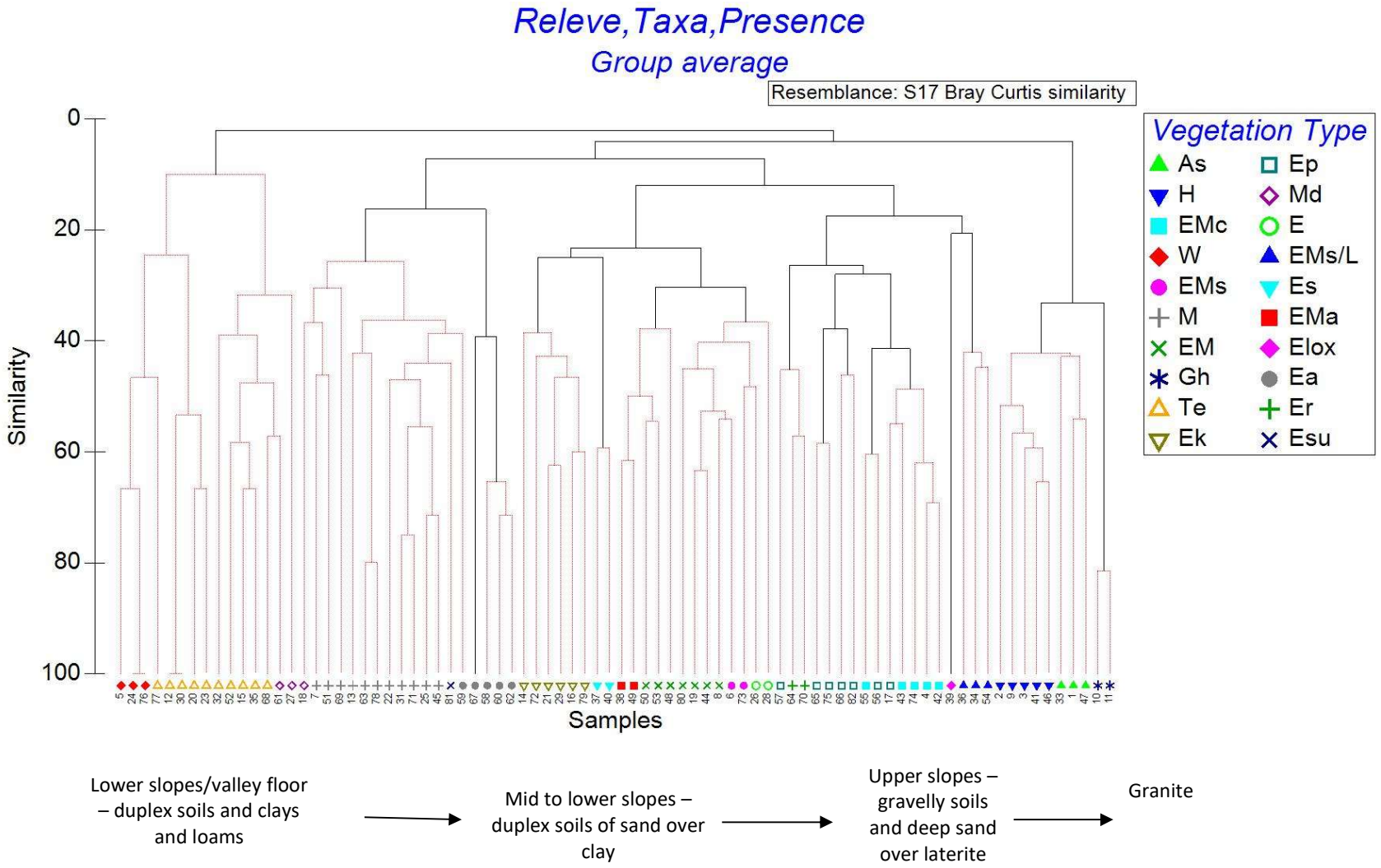


Figure 4: Dendrogram of the releve group classification

3.6 Threatened Ecological Communities

In Western Australia, the Minister for Environment may list an ecological community as being threatened if the community is presumed to be totally destroyed or at risk of becoming totally destroyed. As of May 2014, 376 ecological communities in WA have been entered into the threatened ecological community database. The WA Minister for Environment has endorsed 69 of these and the remaining 307 are allocated to one of five priority categories. Ecological communities with insufficient information available to be considered a threatened ecological community, or which are rare but not currently threatened, are placed on the Priority list and referred to as Priority Ecological Communities**.** 25 of these threatened ecological communities are also listed under the Commonwealth's Environment Protection and Biodiversity Conservation Act 1999.

State Listed Threatened Ecological Communities

The following Threatened Ecological community occurs in the Lake Bryde Recovery Catchment.

Unwooded freshwater wetlands of the southern wheatbelt of WA, dominated by Duma horrida subsp. abdita and Tecticornia verrucosa across the lake floor.

The following ecological community is recorded ~ 50.1 km South East of Lakeland Nature Reserve 29023. The level of gypsum at this site was 5% at 0 and 50cms.

> *The 'Vulnerable' threatened ecological community – 'Herblands and Bunch grasslands on gypsum lunette dunes alongside saline playa lakes.*

State Listed Priority Ecological Communities

The priority ecological community below is situated in the Lake Grace Salt Lake chain ~ 39 km SW of Lakeland Nature Reserve 29023.

> *Priority 2: Ecological Community - Gypsum Dunes (Lake Chinocup) Eucalyptus aff. incrassata mallee over low scrub on gypsum dunes.*

Commonwealth Listed Threatened Ecological Communities

> *Critically Endangered - Eucalypt Woodlands of the WA Wheatbelt*

The Threatened Ecological Community "Eucalypt Woodlands of the Western Australian Wheatbelt" has been listed under the Commonwealth's Environment Protection and Biodiversity Conservation Act 1999 as Critically Endangered. Western Australia has listed this threatened community as a Priority 3 (iii) Ecological Community. Red Morrel Woodland of the Wheatbelt (a component of the Eucalypt Woodlands of the WA Wheatbelt EPBC listed TEC) has been listed as Priority 1.

Woodlands of *Eucalyptus salmonophloia, Eucalyptus kondininensis* and *Eucalyptus alipes* mapped during the survey meet key diagnostic characteristics for the Critically Endangered - Eucalypt Woodlands of the WA Wheatbelt. The area of *Eucalyptus salubris* woodland (~0.25ha) is too small to meet the size criteria for this endangered community.

The key diagnostic characteristics for the Critically Endangered - Eucalypt Woodlands of the WA Wheatbelt are outlined below.

- They occur in the Western Mallee IBRA sub region.
- The structure of these woodlands is over 10% canopy cover with usually a maximum of 40%. The canopy cover can be higher in certain circumstances e.g. mallet form can be more densely spaced.
- Key species of the tree canopy are characteristic species of Eucalypt woodlands of the Wheatbelt.
- Native understory is present but is of variable composition.

Table 5 is taken from the Approved Conservation Advice for Eucalypt Woodlands of the Western Australian Wheatbelt (Nov 2015).

Table 5: Minimum condition for patches of the WA Wheatbelt Woodlands ecological community. For each category, both the weed cover and mature tree presence criteria must apply plus one of either patch size or patch width, depending on whether the patch is a roadside remnant or not.

Cover of exotic plants (weeds) AND	Mature trees [1] AND	Minimum patch size (non-roadside patches)[2] OR	Minimum patch width (roadsides only)[3]
Category A: *Patches likely to correspond to a condition of Pristine / Excellent / Very good (Keighery, 1994) or a High RCV (RCC, 2014).*			
Exotic plant species account for 0 to 30% of total vegetation cover in the understorey layers (i.e. below the tree canopy).	Mature trees may be present or absent.	2 hectares or more	5 metres or more
Category B: *Patches likely to correspond to a condition of Good (Keighery, 1994) or a Medium-High RCV (RCC, 2014), AND retains important habitat features.*			
Exotic plant species account for more than 30, to 50% of total vegetation cover in the understorey layers (i.e. below the tree canopy)	Mature trees are present with at least 5 trees per 0.5 ha.	2 hectares or more	5 metres or more
Category C: *Patches likely to correspond to a condition of Good (Keighery, 1994) or a Medium-High RCV (RCC, 2014).*			
Exotic plant species account for more than 30, to 50% of total vegetation cover in the understorey layers (i.e. below the tree canopy).	Mature trees either absent or less than 5 trees per 0.5 ha are present.	5 hectares or more	5 metres or more
Category D: *Patches likely to correspond to a condition of Degraded to Good (Keighery, 1994) or a Medium-Low to Medium-High RCV (RCC, 2014) BUT retains important habitat features.*			
Exotic plant species account for more than 50 to 70% of total vegetation cover in the understorey layers (i.e. below the tree canopy).	Mature trees are present with at least 5 trees per 0.5 ha.	5 hectares or more	5 metres or more

4.0 FLORA SURVEY

4.1 Taxonomy

Identifications with the name followed by "?" are uncertain due to a lack of flowering or fruiting material or to confusion in the current taxonomy of the group concerned. The nomenclature follows that of the Census of Western Australian Plants and Animals (The WA Herbarium data base). MAX V3 was used for the plant species list and plant labels for the WA Herbarium.

4.2 Flora of the Study Area.

A total of 342 plant species are recorded in Appendix 8 as occurring in the study area, 12 are introduced or weed species. 298 species were recorded during the present survey. A further 44 species are included from the Mattiske transect survey (2010), DBCA personnel and SAP site (Gibson et al 2004).

Due to time and seasonal constraints, Appendix 8 only represents part of the flora of the area. The spring is the best time of year for a flora survey and will provide the most comprehensive species list however further survey work at different times of the year will increase our knowledge of the flora of the area. 2019 was the second particularly dry year in a row and the flora survey was limited because of a lack of flowering and fruiting material and the absence of some annuals and geophytes.

The families with the largest representatives of genera and species during the present survey are listed in Table 6. The families Myrtaceae, Proteaceae, Asteraceae, Fabaceae, Chenopodiaceae, Ericaceae and Poaceae were the most strongly represented in the flora of the study area. The high number of Myrtaceae is expected given the extensive mallee, woodlands and *Melaleuca* shrublands present in the Nature Reserve and species rich heath areas on laterite include high numbers of Proteaceae.

Table 6: The number of species and genera represented within the major families in the study area.

Family	No. species	No. Genera	Weeds
Myrtaceae (*Melaleuca, Eucalyptus*)	77	17	0
Proteaceae (*Banksias Grevilleas* etc.)	35	7	0
Asteraceae (daisies)	25	21	3
Fabaceae (Acacia, peas)	35	12	0
Chenopodiaceae	18	9	0
Poaceae	14	8	6
Ericaceae	13	6	0

4.3 Threatened and Priority Flora

Department of Biodiversity, Conservation and Attractions Conservation Codes

The Department of Biodiversity, Conservation and Attractions classifies Threatened and Priority Flora into categories which reflect their conservation status. These categories are listed below:

T Threatened Species

Published as Specially Protected under the *Wildlife Conservation Act 1950 and* listed under Schedules 1 to 4 of the Wildlife Conservation (Rare Flora) Notice for Threatened Flora (which may also be referred to as Declared Rare Flora).

Threatened flora is flora that has been declared to be 'likely to become extinct or is rare, or otherwise in need of special protection', pursuant to section 23F(2) of the Wildlife Conservation Act. The assessment of the conservation status of these species is based on their national extent and ranked according to their level of threat using IUCN Red List categories and criteria. These categories include Critically Endangered, Endangered, Vulnerable and Presumed extinct species.

P Priority Species

Possibly threatened species that do not meet survey criteria, or are otherwise data deficient, are added to the Priority Flora lists under Priority 1, 2 or 3. These three categories are ranked in order of priority for survey and evaluation of conservation status so that consideration can be given to their declaration as threatened flora. Species that are adequately known, are rare but not threatened, or meet criteria for near threatened, or that have been recently removed from the threatened list for other than taxonomic reasons, are placed in Priority 4. These species require further monitoring.

Details of Priority conservation codes can be found in Appendix 8.

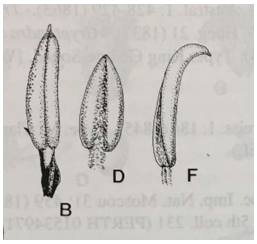
The Department of Biodiversity, Conservation and Attractions supplied information on Threatened and Priority flora known to occur in the Lake Bryde Recovery Catchment. Information was included from the Threatened (Declared Rare) Flora database (DEFL), the WA Herbarium Specimen database (waherb) and the Declared Rare and Priority Flora List (this list is searched using place names). This information has been updated using NatureMap (https://naturemap.dpaw.wa.gov.au/) and FloraBase (http://florabase.dpaw.wa.gov.au/)

Priority Flora Recorded in Lakeland Nature Reserve 29023

Nine priority species were recorded during the present survey. Information on the localities at which these species were recorded, growth form and habitat information is presented in Table 7. The coordinates of the priority flora populations are available in Appendix 8. A further 3 priority plants have been recorded from Lakeland NR 29023 but were not recorded in the 2019 survey. These species were recorded by Mattiske (2010) and by DBCA personnel and are detailed in Table 8.

More than one population of *Dampiera orchardii* is probably present in the reserve. This species is inconspicuous when not in flower and due to the dry season and lack of flowering material no new plants were found during the present survey.

The taxonomic difference between subspecies of *Spyridium mucronatum* is not always clear and the poor quality of plant material collected made identification difficult. Voucher specimens need to be checked by taxonomists at the WA Herbarium to confirm the identifications as subspecies recurvum P3. Subspecies *recurvum* is distinguished from *Spyridium mucronatum* subsp. *mucronatum* by its narrower leaves with a distinctly recurved apex and shorter hairs on the sepals and ovary summit (Rye 1995). Both subspecies are recorded as occurring in the Lakeland Nature Reserves.



From Rye (1995)
B - *Spyridium mucronatum* subsp. *mucronatum*
D - *Spyridium mucronatum* subsp. *multiflorum* P2
F - *Spyridium mucronatum* subsp. *recurvum* P3

***Spyridium mucronatum* subsp. *recurvum* P3 photographed in Lakelands NR 29023**

Table 7: Priority flora recorded in Lakeland Nature Reserves 29023

Taxa	Cons code	Location	Habitat	Growth form	Photograph
Banksia xylothemelia	P3	Releve 2 Releve 3 Releve 33 WP 231 Releve 46 WP 467 Releve 54	Mixed Heathland (laterite) *Allocasuarina* shrubland (As) Mallee over *Melaleuca scalena* – laterite (Ems/L) common on lateritic soils	Sprawling, lignotuberous shrub to 1m, flowers yellow in September to October	
Frankenia drummondii	P3	WP 191 WP 538	*Eucalyptus kondininensis* Woodland (Ek) Melaleuca shrubland (M) Sandy soils at the edge of salt lakes and has been recorded growing in gypsiferous soils	Prostrate shrub. Flowers are usually white, occasionally pink.	

Gastrolobium cruciatum	P3	Releve 33	*Allocasuarina* shrubland (As) Sand and clayey sand with gravel, rocky loams, laterite. Flats, gently undulating areas.	Spreading shrub to 0.5 m Flowers yellow and red in September, October	
Grevillea newbeyi	P3	WP 15 Releve 43 adjacent	Mallee over *Melaleuca scalena* – laterite (Ems/L) Mallee over *Melaleuca carrii* (EMc) Sandy gravelly soils	Bushy, intricately branched, spreading shrub to 1.5m, flowers pink, red, cream in January, June, September to November	

Melaleuca sculponeata	P3	Releve 43 Releve 44 Releve 54	Mallee over *Melaleuca carrii* (EMc) Mallee over mixed Melaleuca species (EM) Duplex soils sands over clay	Rounded shrub, flowers white in October	
Persoonia brevirhachis	P3	Releve 33 Releve 36 WP 467 Releve 54	Mixed heathland (laterite) H *Allocasuarina* shrubland (As) Mallee over *Melaleuca scalena* – laterite (Ems/L) common on lateritic soils	Erect, often spreading shrub, 0.3-2 m high. Flowers yellow, Aug to Oct.	

Rinzia affinis	P4	Releve 2	Mixed heathland (laterite) H Yellow sand, loam or sand with lateritic pebbles	Rounded or erect shrub, 0.2-0.7 m high. Flowers white/pink, July to November	
Spyridium mucronatum* subsp. *recurvum	P3	Releve 6 Releve 8 Releve 19 Releve 74 WP 338 WP 472	*Eucalyptus perangusta* over shrubland (Ep) Mallee over *Melaleuca scalena* (Ems) Mallee over *Melaleuca carrii* (EMc)	Erect or spreading shrub, 0.15-0.6 m high. Flowers white-cream-yellow, October to November	

***Styphelia chlorantha (previously Astroloma chloranthum*)**	P2	Releve 4 Releve 8 Releve 26 WP 671	Mixed Mallee – sparse understory (E) Mallee over Melaleuca scalena – laterite (Ems/L) Mallee over mixed *Melaleuca* (EM) Mallee over *Melaleuca carrii* (EMc)	Low spreading, dome shaped shrub to 15cm, flowers green in May to July	

Table 8: Priority Flora recorded during previous surveys in Lakeland Nature Reserve 29023

Taxa	Cons code	Location	Habitat and Growth Form	Photograph
Dampiera orchardii	P2	Transect MT15	Erect perennial herb, 0.2-0.4 m high. Flowers mauve	

Acacia mutabilis subsp. stipulifera	P3	Transect MT14. Loam or clay, usually slightly saline soils.	Spreading shrub, 0.3-1 m high. Flowers yellow.	
Eutaxia nanophylla	P3	Transect MT17	shrub, to 0.35 m high. Flowers yellow & orange & red, October to November	

5.0 WETLANDS

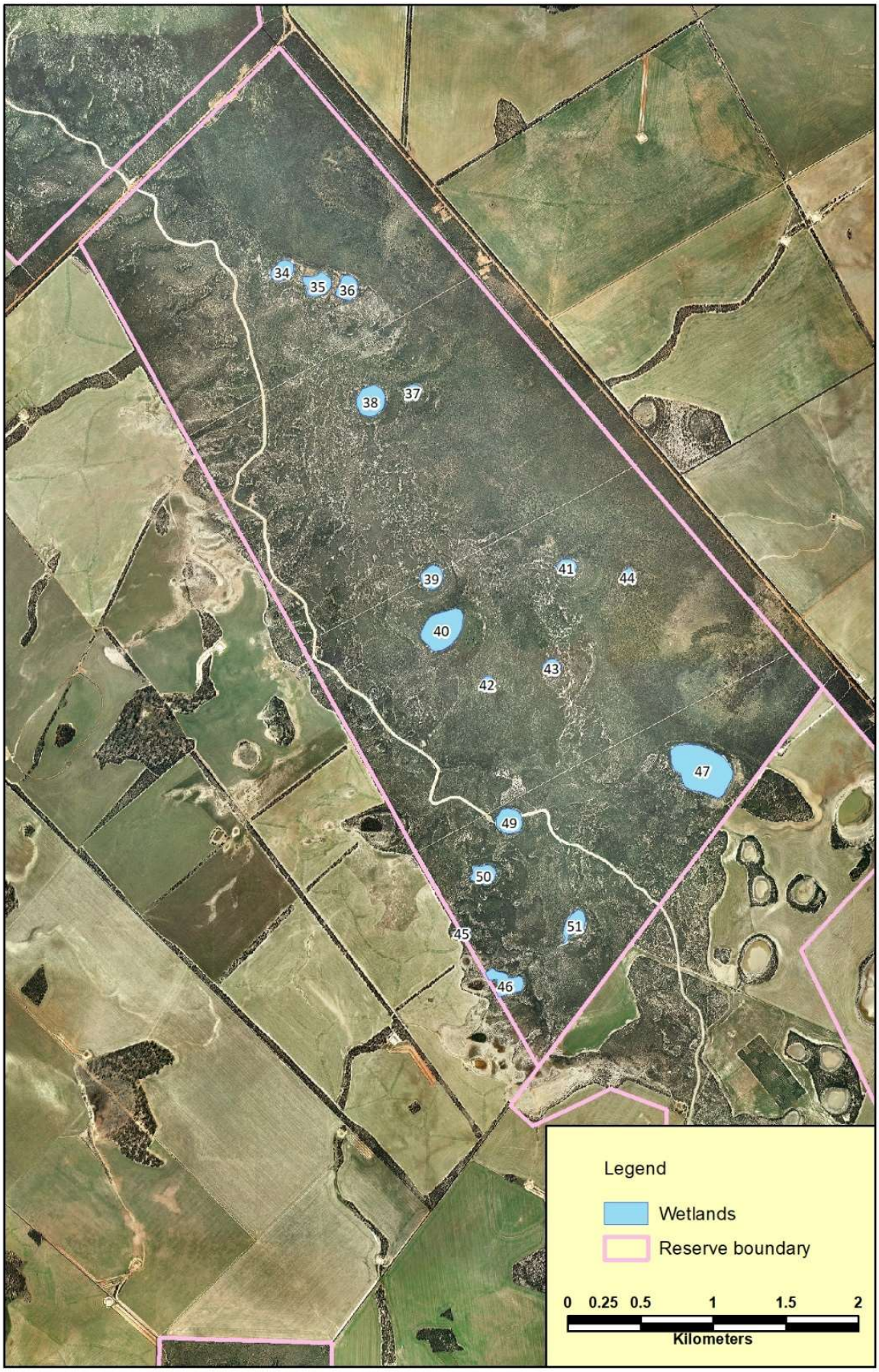
The Department of Biodiversity, Conservation and Attractions has identified 17 wetlands in Lakeland Nature Reserve 29023. Photographs and field notes recorded for these wetlands are presented in Appendix 9. Figure 5 shows the location of these wetlands in the reserve. A brief assessment of the wetlands is summarized in Table 9. Soil testing was not carried out as part of the present survey and therefore the presence of gypsum has not been assessed.

Table 9: Wetlands in Lakeland Nature Reserve 29024

No.	Description	Vegetation	Condition Scale (Keighery 1994)	WP/Releve/ vegetation map unit
34	Low lying area with clay soils – not visited in field. Poorly drained	*Tecticornia* shrubland – dead Melaleuca shrubs Te	Degraded, past waterlogging	Te No data collected. Visual survey only for mapping
35	Saline playa lake clay, silt poorly drained	Mostly bare of vegetation Te edge with dead Melaleuca shrubs *Melaleuca* shrubland M north	Degraded Past waterlogging	WP 192 Te isolated edge 30-70% under dead *Melaleuca* shrubs WP 193 bare lakebed
36	Saline playa lake clay and silt poorly drained	Mostly bare of vegetation Te with dead *Melaleuca* shrubs edges. *Melaleuca* shrubland on slightly higher ground	Degraded Past waterlogging	Releve 35 Te edge with dead *Melaleuca* shrubs WP 227 central point bare lakebed WP 225 M northern edge
37	Small, closed depression – salt clay and silt, poorly drained	Te Surrounded by *Melaleuca* shrubland	Very Good Past waterlogging Weeds Mesembryanthemum nodiflorum	Releve 30 Te WP 173 M northern edge
38	Closed depression. Shallow sandy soils over clay, poorly drained	Degraded *Melaleuca* shrubland Md *Melaleuca* shrubland M edge on higher ground	Good Past waterlogging Weeds Mesembryanthemum nodiflorum	Releve 27 Md WP 155 M north WP 159 M south east
39	Saline playa lake silt and gypsum? over clay Poorly drained	Te 10-30% Degraded Melaleuca shrubland Md edges - mostly dead Melaleuca shrubs	Degraded Track through middle. Past waterlogging Weeds Mesembryanthemum nodiflorum	WP 90 Te 10-30% WP 91 Md
40	Saline playa lake silt, sandy loam, ?gypsum over clay Poorly drained	Bare central area Te edge *Melaleuca* shrubland M surrounding on higher ground	Degraded Past waterlogging Te edge Good condition Some dead shrubs Weeds Kangaroo grazing	Releve 15 Te edge WP 97 M north WP 98 edge lake Te WP 99 bare lakebed WP 101 M South East
41	Small, closed depression sandy loam over clay, poorly drained	Western half - Wilsonia isolated shrubs W Eastern half - Te Surrounded by *Melaleuca* shrubland on higher ground. *Mesembryanthemum nodiflorum	Western half – condition Very Good Eastern half – condition Good Past waterlogging Kangaroo grazing Weeds	Releve 24 W Releve 23 Te

42	Small, closed depression shallow sandy loam over clay, poorly drained	Melaleuca shrubland – degraded Md sparse in middle 10-30% with *Acacia redolens* Melaleuca shrubland surrounding on higher ground	Condition - Very Good Seedlings Weed Mesembryanthemum nodiflorum	WP 109 M north west WP 111 M north west Releve 18 Md
43	Saline playa lake clay, sandy loam, ?gypsum at edge Poorly drained	Bare in middle, scattered samphire. Te 10-30% edge, some dead shrubs edge *Melaleuca* shrubland surrounding on higher ground	Condition - Degraded Scattered samphire and dead *Wilsonia* Condition - Good at edge Some dead shrubs, Weed Mesembryanthemum nodiflorum	Releve 20 Te edge WP 116 M west
44	Small, closed depression clay and silt Poorly drained	Wilsonia isolated shrubs W Surrounded by Melaleuca shrubland M on higher ground.	Condition - Excellent Dry season, kangaroo grazing Weeds - grasses Mesembryanthemum nodiflorum	WP 32 M south WP 34 M north west Releve 5 W
45	Closed depression – clay soils. Poor drainage	Bare – no vegetation Mallee on sandy ridge on eastern side	Degraded waterlogging	No data collected. Visual survey only for mapping
46	Low lying area clay soils, poor drainage	Te dead *Melaleuca* shrubs Mallee sandy ridge adjacent western boundary	Degraded waterlogging	No data collected. Visual survey only for mapping
47	Saline playa lake silt and clay, poorly drained	Bare area Te edges and eastern section *Melaleuca* shrubland degraded - low lying areas and *Melaleuca* shrubland M on higher ground	Degraded	Releve 51 M adjacent area Releve 52 Te north western edge
49	Closed depression. poorly drained, clay	West –Wilsonia isolated shrubs W Eastern edge - Te Degraded *Melaleuca* shrubland Md south and east Melaleuca shrubland on higher ground	Condition -Very Good Channel flow through Disturbance from construction Weeds - grasses *Spergularia Mesembryanthemum nodiflorum	Releve 76 W Releve 77 Te
50	Saline playa lake sand and silt, clay, ?gypsum Poorly drained	Bare of vegetation. Degraded Melaleuca shrubs Md eastern section Melaleuca shrubs M on higher ground Te with dead shrubs SW	Degraded Old dead shrubs Dead shrubs edges	WP 833 Md north WP 836 Md east WP 835 bear lakebed
51	Saline playa lake sandy silt, ?gypsum clay soils poorly drained	Bare of vegetation. Degraded *Melaleuca* shrubs Md adjacent *Melaleuca* shrubs M on higher ground	Degraded Dead shrubs edges	WP 871 M WP 872 dead *Melaleuca* shrubs south eastern edge WP 874 lakebed bare WP 875 edge north dead *Melaleuca* shrubs

Figure 5: Wetlands in Lakeland Nature Reserve 29023



6.0 CONSERVATION SIGNIFICANCE

Lakeland Nature Reserve 29023 has high conservation values. Some of these values are summarized below.

- The Reserve includes a range of vegetation types from the heath communities on lateritic soils on the upper slopes, small areas of granite rock flora, extensive mallee communities, woodlands and shrublands on the lower slopes and valley floor.

- A relatively high diversity of vascular plant species occurs in the area with 342 plant species recorded in Appendix 6.

- Twelve priority species have been recorded for Nature Reserve 29023 during the present and previous surveys.

- Lakeland Nature Reserve 29023 includes woodlands of Eucalyptus *salmonophloia, Eucalyptus kondininensis* and *Eucalyptus alipes* which meet key diagnostic characteristics for the Critically Endangered - Eucalypt Woodlands of the WA Wheatbelt.

- The reserve is an important part of the wildlife corridor connecting reserves and other remnant vegetation in the catchment. The salmon gums (nesting sites) and heath areas (feeding grounds) provide ideal habitat for the Carnaby's cockatoos. A Mallee fowl nest was observed during the survey.

7.0 SURVEY LIMITATIONS

Due to the time and seasonal constraints the present species list only represents part of the flora of the area. The spring was the best time of year for the survey however further field work at different times of the year will increase our knowledge of the flora of the Lakeland Nature Reserves. Some species do not flower every year and some species are not identifiable or even visible except for short periods of time. Fieldwork which covers only 7 days of the year cannot be expected to exclude the possibility that some species of rare flora have yet to be located. Further quadrat work is needed to confirm the releve groups identified in the PRIMER analysis and to increase the species list for the reserve especially those inconspicuous, small species, annuals and geophytes that may have been missed during the present survey.

Figures from the nearest Bureau of Meteorology Station (Newdegate Research Station) indicate that 2018 was a dry year in the Recovery Catchment with an annual rainfall of 230.2mm followed by another exceptionally dry year in 2019 with an annual rainfall of 209.4mm. The average annual rainfall for the station is 367.5mm. The flora survey was therefore limited because of a lack of flowering and fruiting material and the absence of some annuals and geophytes due to the dry seasons.

Because of time limitations some areas were not covered in detail in the ground survey and mapping was carried out by extrapolation of known vegetation types using the aerial photographs.

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Appendix 1

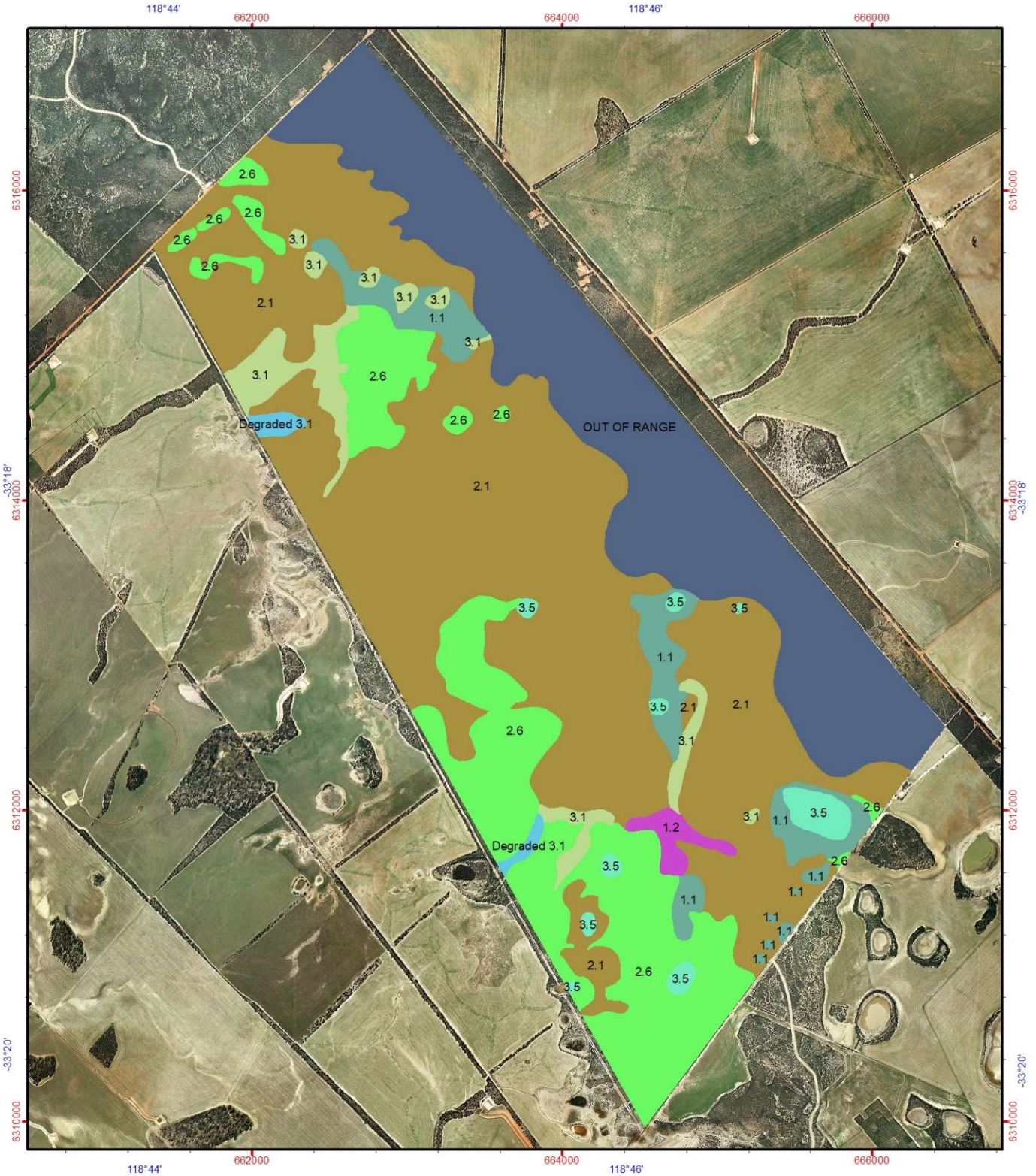
Field Releve Sheet

Location/releve:	
Date:	**Wp:**
Vegetation Type	
Photo No's	
Condition: Pristine Excellent Very Good Good Degraded **Notes:**	
Aspect: N NE E SE S SW W NW	**Slope:** Flat Gentle Moderate Steep
Geology: Granite Dolerite Laterite Ironstone Quartz	**% Loose Rock:** 0-10% 10-30% 30-50% 50-100%
Soil Type and colour:	
Hydrology: Good Drain Poor drain Perm wet Seasonally wet	
Landform: Crest Hill Ridge Outcrop Breakaway Slope: Lower Middle Upper Valley Flat Open Depression Drainage line Closed Depression Wetland: Salt lake Fresh water lake	
Vegetation Description	
Muir	
NVIS	

Appendix 2

Mattiske (1999) Vegetation Map of Lakeland Nature Reserve 29023

Mattiske (1999) vegetation map of Lakeland Nature Reserve 29023



Legend

- 1.1 - Open Woodland of Eucalyptus kondininansis
- 1.2 - Low Forest A of Eucalyptus vegrendis and Callitris roei
- 2.1 - Open Tree Mallee of Eucalyptus vegrendis, E. calycogona var. calycogona and E. occidentalis
- 2.6 - Shrub Mallee of Eucalyptus vegrendis, E. calycogana, E. hypoclamydea andE. sporadica
- 3.1 - Thicket of Melaleuca adnais, M. helmatorum, M. lateriflora and M. uncinata
- 3.5 - Open Dwarf Scrub D of Halosarcia pergranulata, H. syncarpa and H. indica
- Degraded 3.1 - Thicket of Melaleuca adnais, M. helmatorum, M. lateriflora and M. uncinata
- OUT OF RANGE

N

0 195 390 780 1,170 1,560
Metres

Appendix 3

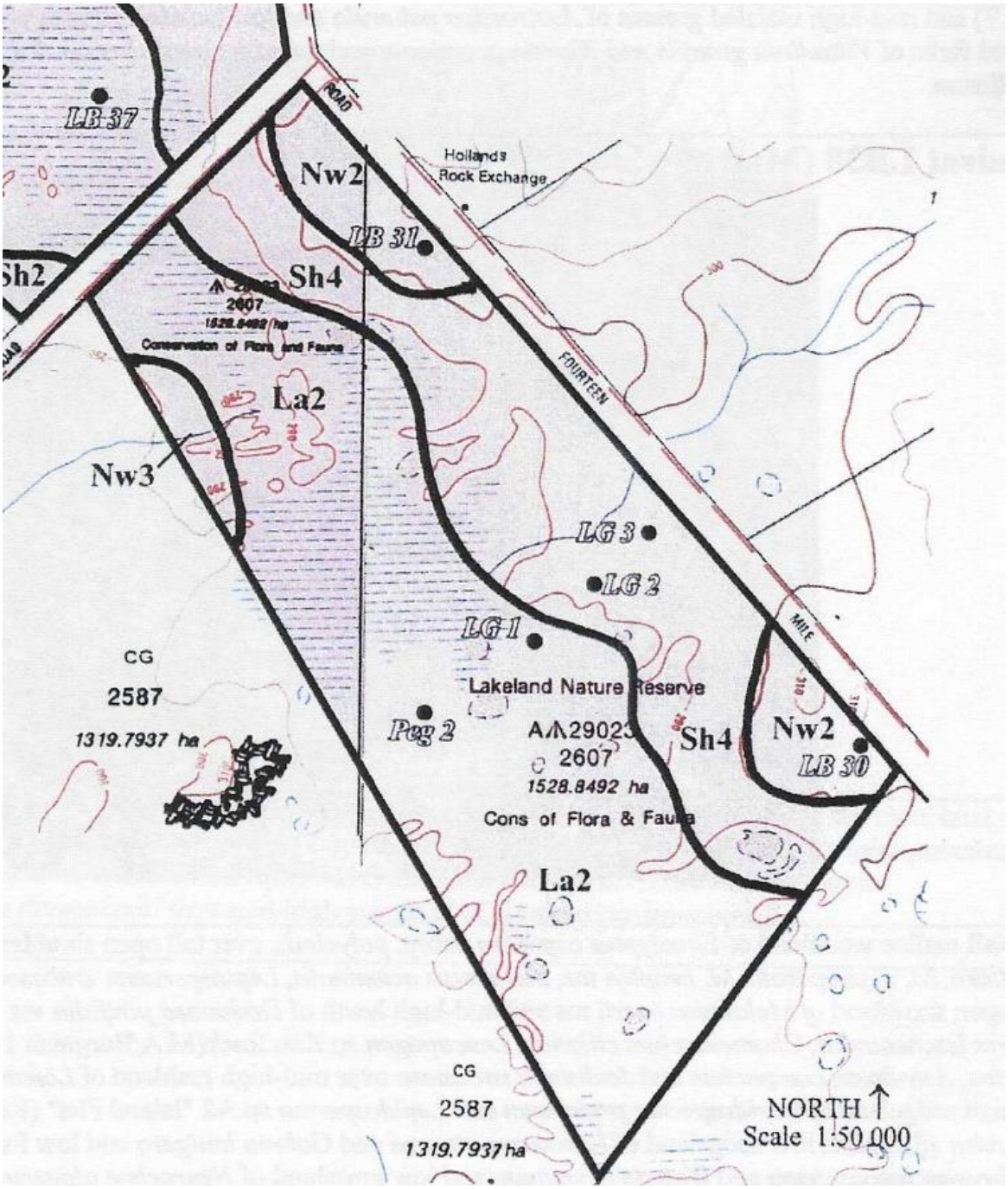
Ecoscape (2001)

Quadrat Descriptions NR 29023

and Soil-Landscape mapping units

Soil Landscape Descriptions (Ecoscape 2001)

Map Unit	Description
Newdegate. Undulating rises, in the south-eastern Zone of Ancient Drainage, with grey sandy duplex soils (shallow and deep), alkaline grey shallow duplex (sandy and loamy soils), pale deep sands and shallow gravels. Mallee-heath.	
Nw1	Level to very gently inclined, slightly incised (with coordinated drainage).
Nw2	Gently undulating to very gently inclined gravel plain. Hard setting soils such as 'moort type' soils are frequent.
Nw3	Similar landscape to Nw2 dominantly sandy soils.
Nw4	Gently undulating to undulating dissected plain to gently undulating rises, and distinct lateritic breakaway areas.
Nw5	As in landscape Nw4. Long slopes and no lateritic breakaways.
Nw6	Areas of significant rock outcrop including monadnocks, and sheet rock benches.
Sharpe. Valley floor of salt lakes and surrounding plains. Alkaline grey shallow loamy duplexes, alkaline grey shallow sandy duplexes, calcareous loamy earths, saline wet soils and salt lake soils. Mallee scrub and salmon gum-York gum woodland.	
Sh2	Level to very gently inclined plains. Dominant soils are alkaline grey shallow sandy and loamy duplex soils, grey deep sandy duplex soils, some calcareous loamy earths and saline wet soils.
Sh3	Gently undulating soil landscapes with dominantly deep sand sheets, lunettes or linear dunes occurring across the area.
Sh4	Undulating mid to upper valley slopes. Long slopes low relief gravels on upland, heavier soils on slopes and valleys.
Lagan. Salt lake chains, in the southern Zone of Ancient Drainage, with salt lake soil and calcareous loamy earths. Mallee, morrell woodland and saltbush-bluebush-samphire flats.	
La2	No specific description

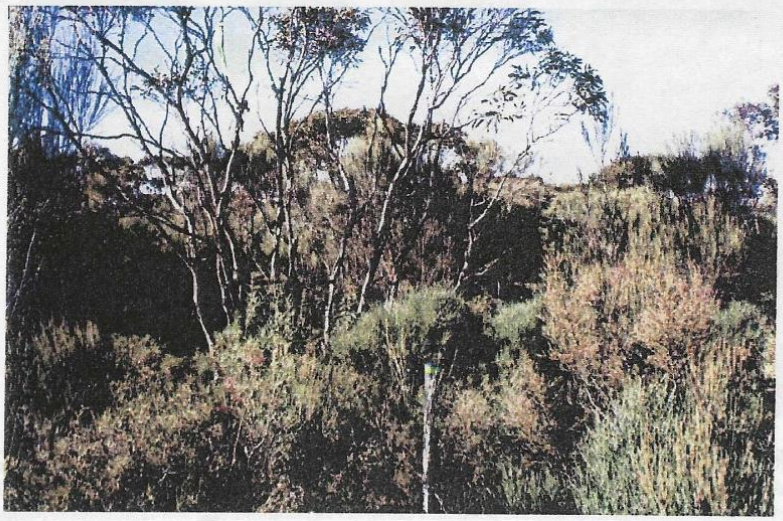

LB 37
ROAD
Holland's
Rock Exchange
Nw2
LB 31
Sh2
Sh4
2607
Conservation of Flora and Fauna
La2
Nw3
FOURTEEN
MILE
LG 3
LG 2
LG 1
CG
2587
1319.7937 ha
Lakeland Nature Reserve
Peg 2
2607
1528.8492 ha
Cons of Flora & Fauna
Sh4
Nw2
LB 30
La2
CG
2587
1319.7937 ha
NORTH
Scale 1:50 000

Reserve 29023 – Lakeland Nature Reserve

Quadrat LB30

Tall sparse emergent shrubs of *Hakea pandanicarpa* subsp. *crassifolia* and *Grevillea cagiana* over mid-high heathland of *Melaleuca tuberculata* var *macrophylla*, *Hakea cygna* subsp. *cygna*, *Allocasuarina microstachya*, *Dryandra erythrocephala* var *erythrocephala*, *Isopogon teretifolius*, *Leucopogon tamminensis* var *australis*, *Persoonia quinquenervis*, *Synaphea* cf *tripartita* and *Verticordia roei* subsp. *roei* and low heathland of *Adenanthos flavidiflorus*, *Andersonia* aff *sprengelioides*, *Baeckea preissiana*, *Banksia violacea*, *Beaufortia micrantha*, *Cryptandra nutans*, *Daviesia uncinata*, *Dryandra cirsioides*, *Eremaea pauciflora*, *Hakea incrassata*, *Hibbertia gracilipes*, *Jacksonia racemosa*, *Leucopogon* sp. Wheatbelt (S. Murray 257), *Persoonia striata*, *Petrophile glauca*, *Petrophile seminuda* and *Verticordia tumida* subsp. *therogona* and dwarf heathland of *Calectasia grandiflora* sp. wheatbelt (A Coates 4315) and *Nemcia punctata* over mid-high open sedgeland of *Mesomelaena pseudostygia* and low open sedgeland *of Schoenus pleiostemoneus* and *Gahnia lanigera* and dwarf open sedgeland of *Lepidobolus chaetocephalus* and low open forbland of *Chamaexeros serra*, *Conostylis argentea* and *Drosera* sp.3.

Quadrat LB31



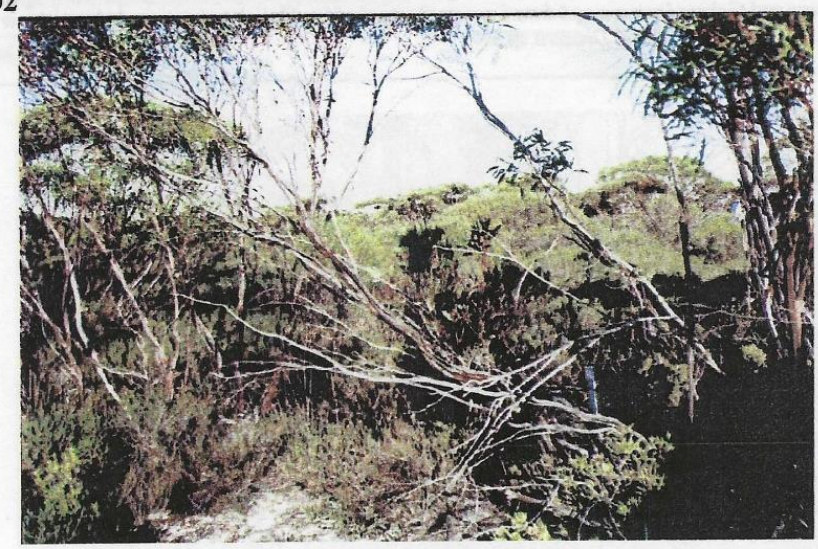
Very tall mallee woodland of *Eucalyptus uncinata* and *E. phaenophylla* subsp. *phaenophylla* over tall shrubland of *Allocasuarina acutivalvis*, *Callitris roei*, *Dryandra cuneata*, *Hakea pandanicarpa* subsp. *crassifolia*, *H. subsulcata*, *Isopogon buxifolius*, *Leptospermum spinescens*, *Melaleuca pungens* var 2 and *Santalum acuminatum* and mid-high shrubland of *Melaleuca tuberculata* var *macrophylla* over mid-high shrubland of *Beaufortia schaueri* and mid-high heathland of *Allocasuarina spinosissima*, *Astroloma serratifolium*, *Daviesia uniflora*, *Dryandra erythrocephala* var *erythrocephala*, *Hakea lissocarpha*, *Isopogon teretifolius*, *Leucopogon constephioides* var 1, *Lysinema ciliatum*, *Petrophile merrallii* and *Phebalium tuberculosum* and low heathland of *Banksia violacea*, *Beaufortia micrantha* var *puberula*, *Dryandra cirsioides*, *Dryandra ferruginea* subsp. *ferruginea*, *Nemcia cruciata* ms, *Petrophile glauca* and *Verticordia chrysantha* and dwarf heathland of *Acacia chrysocephala* over sparse sedgeland of *Gahnia lanigera and Lepidosperma brunonianum* and vines of *Cassytha melantha*.

Reserve 29023 – Lakeland Nature Reserve

Quadrat LG01

Very tall open mallee forest of *Eucalyptus suggrandis* subsp. *alipes* and *Eucalyptus calycogona* var *calycogona* over tall shrubland of *Melaleuca brophyi* ms, *M. pauperiflora*, *M. laxiflora*, *M. lateriflora* subsp. *lateriflora* and *M. uncinata* and mid-high *Grevillea oligantha* over sparse heathland of low *Exocarpus aphyllus* and tall *Melaleuca* sp.3 over tall sparse sedgeland of *Gahnia* sp. L (K.R. Newbey 7888) and mid-high grassland of *Austrodanthonia acerosa* and *Austrostipa drummondii* with vines of *Cassytha melantha*.

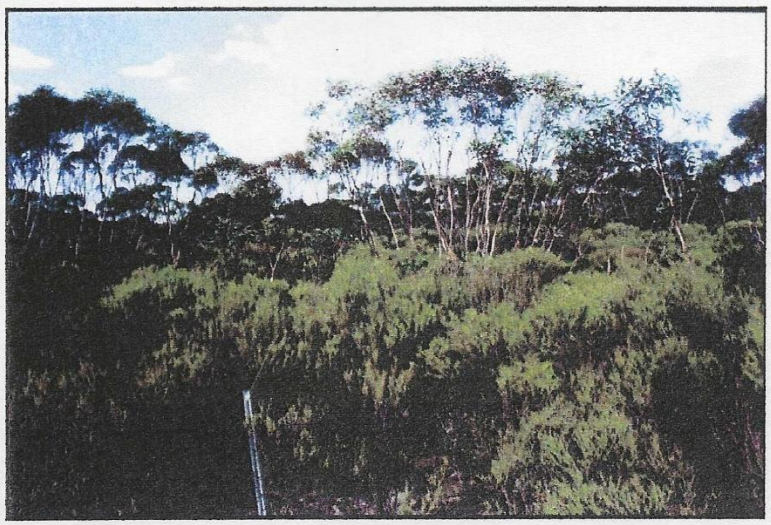
Quadrat LG02



Very tall mallee woodland of *Eucalyptus phaenophylla* subsp. *phaenophylla* over tall open shrubland of *Melaleuca uncinata* and *Hakea erecta* over mid-high heathland of *Melaleuca carrii* ms, *M. tuberculata* var *macrophylla*, Myrtaceae sp.1, *Isopogon buxifolius*, *Leucopogon minutifolius*, *Cryptandra minutifolia* and *Calytrix leschenaultii* and low heathland of *Melaleuca haplantha*, *Daviesia lancifolia*, *D. decurrens*, *Andersonia* aff *sprengelioides*, *Grevillea disjuncta*, *Nemcia punctata*, *Hibbertia gracilipes*, *Jacksonia racemosa*, *Lasiopetalum rosmarinifolium*, *Leucopogon constephioides* var 2 and *Westringia rigida* and mid-high forbland of *Platysace trachymenioides* over mid-high sparse sedgeland of *Gahnia* sp.L (K.R. Newbey 7888) and *Lepidosperma brunonianum* and low sparse sedgeland of *Loxocarya cinerea and Lepidobolus chaetocephalus* and low sparse forbland of *Stylidium repens* and *Conostylis petrophiloides*.

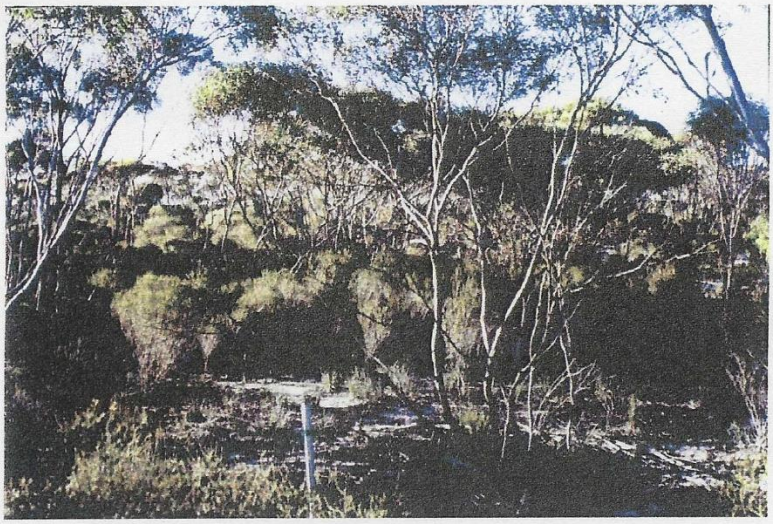
Reserve 29023 – Lakeland Nature Reserve

Quadrat LG03



Very tall open mallee forest of *Eucalyptus phenax* and *Eucalyptus suggrandis* subsp. *alipes* and tall open mallee forest of *Eucalyptus perangusta* over tall shrubland of *Melaleuca uncinata and M. depauperata* and mid-high shrubland of *Grevillea oligantha*, *Melaleuca lateriflora* subsp. *lateriflora* and *M. subtrigona* and mid-high heathland of *Templetonia sulcata* and *Westringia rigida* over mid-high shrubland of *Dodonaea bursariifolia* and *Melaleuca laxiflora* and mid-high heathland of *Daviesia gracilis* and low heathland of *Acacia viscifolia*, *Baeckea crispiflora*, *Cryptandra nutans*, *Grevillea disjuncta*, *Hibbertia gracilipes*, *Olearia ramosissima* and *Phebalium tuberculosum* and dwarf heathland of *Astroloma compactum* over mid-high sparse sedgeland of *Gahnia lanigera* and *Lepidosperma brunonianum*.

Quadrat Peg 2



Very tall open mallee forest of *Eucalyptus suggrandis* subsp. *alipes*, *E. calycogona*, *E. phenax* and *E. perangusta* over tall shrubland of *Melaleuca lateriflora* subsp. *lateriflora*, *Melaleuca pauperiflora* and *Hakea newbeyana* and mid-high shrubland of *Melaleuca depauperata* over mid-high heathland of *Chamelaucium ciliatum*, *Dodonaea pinifolia* var 1, *Hibbertia gracilipes* and *Templetonia sulcata* and low heathland of *Acacia viscifolia*, *Astroloma epacridis* var, *Calytrix leschenaultii*, *Cryptandra minutifolia*, *Leucopogon minutifolius* and *Olearia muelleri* and dwarf heathland of *Acacia erinacea* over mid-high open sedgeland of *Gahnia la*nigera and *Lepidosperma brunonianum* and low open sedgeland of *Desmocladus asper* and low open grassland of *Neurachne alopecuroidea*.

Appendix 4
Vegetation structure at releves and photographs

Releve 37 *Eucalyptus salmonophloia* (salmon gum) woodland Es

Muir Low Woodland A over Open Shrub Mallee over Scrub over Open Dwarf Scrub D (isolated low grasses and shrubs to 1.0m)

NVIS U1+\^tree\7\i; M1\^shrub mallee\6\i; M2\^shrub\4\i; G1\^shrub\2\bi; G2\^shrub, grass\r

Releve 40 *Eucalyptus salmonophloia* (salmon gum) woodland Es

Muir Low Woodland A over Very Open Shrub Mallee (isolated grasses and shrubs)

NVIS U1+\^tree\7\i; M1\^mallee shrub\6\r; M2\^shrub\4\bi; G1\^shrub\2\bi; G2\^shrub,tussock grass\1\bi

Releve 81 ***Eucalyptus salubris*** **(gimlet) Open Forest** **Esu**

Muir Low Forest A over Heath A (isolated grasses and shrubs to 0.5m)

NVIS U1+\^tree\6\c; M1\^shrub\3\c; G1\^shrub, tussock grass\1\bi

Releve 14 ***Eucalyptus kondininensis*** **(Kondinin blackbutt) woodland** **Ek**

Muir Low Woodland A over Open Scrub (isolated sedges, grasses, herbs and shrubs to 0.5m)

NVIS U1+\^tree\6\i; M1\^shrub\4\r; G1\^shrub,sedge,rush,tussock grass\1\bi

Releve 16 ***Eucalyptus kondininensis*** **(Kondinin blackbutt) woodland** **Ek**

Muir Low Woodland A over Thicket (isolated shrubs to 0.5m, sedges)

NVIS U1+\^tree\6\i; M1\^shrub\4\c; G1\^shrub,sedge\1\bi

Releve 21 ***Eucalyptus kondininensis*** **(Kondinin blackbutt) woodland** **Ek**

Muir Low Woodland A over Scrub over Low Scrub A (isolated shrubs to 0.5m)

NVIS U1+\^tree\6\i; M1\^shrub\4\i; M2\^shrub\3\i; G1\^shrub\1\bi

Releve 29 ***Eucalyptus kondininensis*** **(Kondinin blackbutt) woodland** **Ek**

Muir Low Woodland A over Scrub over Open Dwarf Scrub D (isolated shrubs to 1.5m)

NVIS U1+\^tree\7\i; M1\^shrub\4\i; M2\^shrub\3\bi; G1\^shrub\1\r

Releve 72 ***Eucalyptus kondininensis*** **(Kondinin blackbutt) woodland** **Ek**

Muir Low Woodland A over Thicket (isolated herb, grass and shrubs to 0.5m)

NVIS U1+\^tree\6\i; M1\^shrub\4\c; G1\^shrub,rush,tussock grass\1\bi

Releve 79 ***Eucalyptus kondininensis*** **(Kondinin blackbutt) woodland** **Ek**

Muir Low Forest A over Heath A (isolated shrubs to 0.5m, herbs and sedges)

NVIS U1+\^tree\6\c; M1\^shrub\3\c; G1\^ shrub,sedge,rush\1\bi

Releve 58 ***Eucalyptus alipes*** **(Hyden mallet) woodland** **Ea**

Muir Low Woodland A over Scrub over Dwarf Scrub D (isolated grass, herbs, sedges, shrub 1.0m)

NVIS U1+\^tree\6\i; M1\^shrub\4\i; G1\^shrub\2\bi; G1\^shrub,forb,sedge,tussock grass\1\i

Releve 60 ***Eucalyptus alipes*** **(Hyden mallet) woodland** **Ea**

Muir Low Woodland A over Dwarf Scrub C over Herbs (isolated grass and shrubs 2+m, 0.5m)

NVIS U1+\^tree\6\i; M1\^shrub\4\bi; G1\^shrub\2\i; G2\^forb,shrub,rush,tussock grass\1\c

Releve 62 ***Eucalyptus alipes*** **(Hyden mallet) woodland** **Ea**

Muir Low Forest A over Dwarf Scrub C over Open Dwarf Scrub D over Open Herbs (isolated grass and shrubs 2+m)

NVIS U1+\^tree\6\c; M1\^shrub\4\bi; G1\^shrub\2\i; G2\^forb,shrub,rush,tussock grass\1\i

Releve 59 *Eucalyptus alipes* (Hyden mallet) - degraded Ea

Muir Low Forest A over Open Dwarf Scrub D (isolated shrubs to 4m, herbs)

NVIS U1+\^tree\7\c; M1\^shrub\4\bi; G1\^shrub,forb\1\r

Releve 67 *Eucalyptus alipes* (Hyden mallet) open forest Ea

Muir Low Forest A over Heath A over Very Open Low Sedges (isolated grass, herbs, shrubs 0.5m)

NVIS U1+\^tree\6\c; M1\^shrub\3\c; G1\^sedge,shrub,forb,tussock grass\1\r

Releve 34 Mallee over *Melaleuca scalena* (laterite) EMs/L

Muir Open Shrub Mallee over Thicket over Open Dwarf Scrub C over Very Open Low Sedges (isolated grasses, herbs and shrubs to 0.5m)

NVIS M1+\^mallee shrub\6\i; M2\^shrub\4\c; G1\^shrub\2\r; G2\^sedge,shrub,grass,rush\1\r

Releve 36 Mallee over *Melaleuca scalena* (laterite) EMs/L

Muir Shrub Mallee over Open Scrub over Low Heath C over Dwarf Scrub D/Very Open Low sedges

NVIS M1+\^mallee shrub\6\c; M2\^shrub\4\r; G1+\^shrub\2\c; G2\^shrub,sedge\1\i

Releve 54 Mallee over *Melaleuca scalena* (laterite) EMs/L

Muir **Open** Shrub Mallee over Open Low Scrub A over Dwarf Scrub C over Dwarf Scrub D (isolated sedges)

NVIS M1+\^mallee shrub\6\i; M2\^shrub\3\r; G1\^shrub\2\i; G2\^shrub,sedge\1\i

Releve 6 Mallee over *Melaleuca scalena* EMs

Muir Open Shrub Mallee over Thicket over Low Scrub B over Open Dwarf Scrub D (isolated sedges, grass)

NVIS M1+\^shrub mallee\6\i; M2\^shrub\4\c; M2\^shrub\3\i; G1\^shrub,sedge,grass\1\r

Releve 73 Mallee over *Melaleuca scalena* EMs

Muir Shrub Mallee over Thicket over Low Scrub C (isolated sedges, shrub 0.5m)

NVIS M1+\shrub mallee\6\c; M2\^shrub\4\c; M3\^shrub\3\i; G1\^shrub,sedge\1\bi

Releve 26 Mixed Mallee over sparse understorey E

Muir Open Shrub Mallee over Scrub over Open Dwarf Scrub D/Open Low Sedge (isolated grasses)

NVIS M1+\^mallee shrub\6\i; M2\^shrub\4\i; G1\^shrub,sedge,grass\1\i

Releve 28 Mixed Mallee over sparse understorey E

Muir Open Shrub Mallee over Open Scrub over Open Dwarf Scrub D/Open Low Sedges (isolated herbs)

NVIS M1+\^mallee shrub\6\i; M2\^shrub\4\r; G1\^ sedge,shrub,forb\1\i

Releve 4 Mallee over *Melaleuca* low shrubland (*Melaleuca carrii*) EMc

Muir Open Shrub Mallee over Open Low Scrub A over Low Heath C over Open Dwarf Scrub D (isolated sedges, grasses)

NVIS M1+\^mallee shrub\6\i; M2\^shrub\3\r; G1\^shrub\2\c; G2\^shrub,sedge,grass\1\r

Releve 42 **Mallee over *Melaleuca* low shrubland (*Melaleuca carrii*)** **EMc**

Muir Open Shrub Mallee over Open Scrub over Low Heath C over Open Dwarf Scrub D (isolated sedges, herbs)

NVIS M1+\^mallee shrub\6\i; M2\^shrub\4\r; G1\^shrub\2\c; G2\^shrub,sedge,rush\1\r

Releve 43 **Mallee over *Melaleuca* low shrubland (*Melaleuca carrii*)** **EMc**

Muir Open Shrub Mallee over Open Low Scrub A over Low Heath C over Open Dwarf Scrub D (isolated sedges, herbs, grasses)

NVIS M1+\^mallee shrub\6\i; M2\^shrub\3\r; G1\^shrub\2\c; G2\^shrub,sedge,rush,grass\1\r

Releve 55 **Mallee over *Melaleuca* low shrubland (*Melaleuca carrii*)** **EMc**

Muir Open Shrub Mallee over Open Low Scrub A over Low Heath C over Dwarf Scrub D (isolated sedges)

NVIS M1+\^mallee shrub\6\i; M2\^shrub\3\r; G1\^shrub\2\c; G2\^shrub,sedge\1\i

Releve 74 **Mallee over *Melaleuca* low shrubland (*Melaleuca carrii*)** **EMc**

Muir Open Shrub Mallee over Open Low Scrub B over Low Heath C over Open Dwarf Scrub D (isolated sedges, herbs, grasses)

NVIS M1+\^mallee shrub\6\i; M2\^shrub\3\r; G1\^shrub\2\c; G2\^shrub,sedge,rush,grass\1\r

Releve 17 ***Eucalyptus perangusta*** **over mixed shrubland** **Ep**

Muir Open Shrub Mallee over Heath B over Open Low Sedges/Open Dwarf Scrub D (isolated herbs, grass, shrubs 3m)

NVIS M1+\^mallee shrub\6\i; M2\^shrub\4\bi; M3\^shrub\3\c; G1\^sedge,shrub,rush,grass\1\r

Releve 56 ***Eucalyptus perangusta*** **over mixed shrubland** **Ep**

Muir Open Shrub Mallee over Low Scrub A over Low Heath C over Open Dwarf Scrub D (isolated sedge, herb)

NVIS M1+\^mallee shrub\6\i; M2\^shrub\3\i; G1\^shrub\2\c; G2\^shrub, sedge,rush\1\r

Releve 57 ***Eucalyptus perangusta*** **over mixed shrubland** **Ep**

Muir Open Shrub Mallee over Open Low Scrub A over Low Heath C (isolated sedges, shrubs 0.5m)

NVIS M1+\^mallee shrub\6\i; M2\^shrub\3\r; G1\^shrub\2\c; G2\^sedge,shrub\1\bi

Releve 65 ***Eucalyptus perangusta*** **over mixed shrubland** **Ep**

Muir Open Shrub Mallee over Scrub over Low Heath C (isolated shrubs 0.5m, sedges, herbs, grass)

NVIS M1+\^mallee shrub\6\i; M2\^shrub\4\i; G1\^shrub\2\c; G2\^shrub,sedge,rush,grass\1\bi

Releve 66 ***Eucalyptus perangusta*** **over mixed shrubland** **Ep**

Muir Open Shrub Mallee over Heath B over Open Low Sedges (isolated herbs, grass, shrubs 2m, shrubs 0.5m)

NVIS M1+\^mallee shrub\6\i; M2\^shrub\3\c; G1\^sedge,shrub,forb,grass\1\i

Releve 75 ***Eucalyptus perangusta*** **over mixed shrubland** **Ep**

Muir Open Shrub Mallee over Low Scrub B over Dwarf Scrub D/Open Low Sedges (isolated grass, herbs)

NVIS M1+\^mallee shrub\6\i; M2\^shrub\3\i; G1\^shrub,sedge,rush,grass\1\i

Releve 82 ***Eucalyptus perangusta*** **over mixed shrubland** **Ep**

Muir Very Open Shrub Mallee over Heath A over Very Open Low Sedges (isolated shrubs 1.0m, herbs, grass)

NVIS M1\^mallee shrub\6\r; M2+\^shrub\3\c; G1\^shrub\2\bi; G2\^sedge,forb,grass\1\r

Releve 8 **Mallee over mixed** ***Melaleuca*** **species** **EM**

Muir Shrub Mallee over Low Heath C (Isolated shrubs 2m, 0.5m, sedges)

NVIS M1+\^mallee shrub\6\c; M2\^shrub\3\bi;G1\^shrub\2\c; G2\^shrub,sedge\1\bi

Releve 19 **Mallee over mixed *Melaleuca* species** **EM**

Muir Open Shrub Mallee over Scrub over Heath A over Open Dwarf Scrub D (isolated sedges, herbs)

NVIS M1+\^mallee shrub\6\i; M2\^shrub\4\i; M3\^shrub\3\c; G1\^shrub,sedge,rush\1\r

Releve 44 **Mallee over mixed *Melaleuca* species** **EM**

Muir Open Shrub Mallee over Thicket over Open Low Scrub C over Open Low Scrub D (Isolated sedges)

NVIS M1+\^mallee shrub\6\i; M2\^shrub\4\c; G1\^shrub\2\r; G2\^shrub,sedge\1\r

Releve 48 **Mallee over mixed *Melaleuca* species** **EM**

Muir Open Shrub Mallee over Heath A over Open Dwarf Scrub D (isolated shrubs 1.5m

NVIS M1+\^mallee shrub\6\i; M2\^shrub\3\c; G1\^shrub\2\r

Releve 50 **Mallee over mixed *Melaleuca* species** **EM**

Muir Open Shrub Mallee over Heath B (isolated shrubs 2.5m, 0.5m)

NVIS M1+\^mallee shrub\6\i; M2\^shrub\4\bi; M3\^shrub\3\c; G1\^shrub\1\bi

Releve 53 **Mallee over mixed *Melaleuca* species** **EM**

Muir Open Shrub Mallee over Heath B (isolated shrub 0.5m, sedge)

NVIS M1+\^mallee shrub\6\i; M2\^shrub\3\c; G1\^shrub,sedge\1\bi

Releve 80 **Mallee over mixed *Melaleuca* species** **EM**

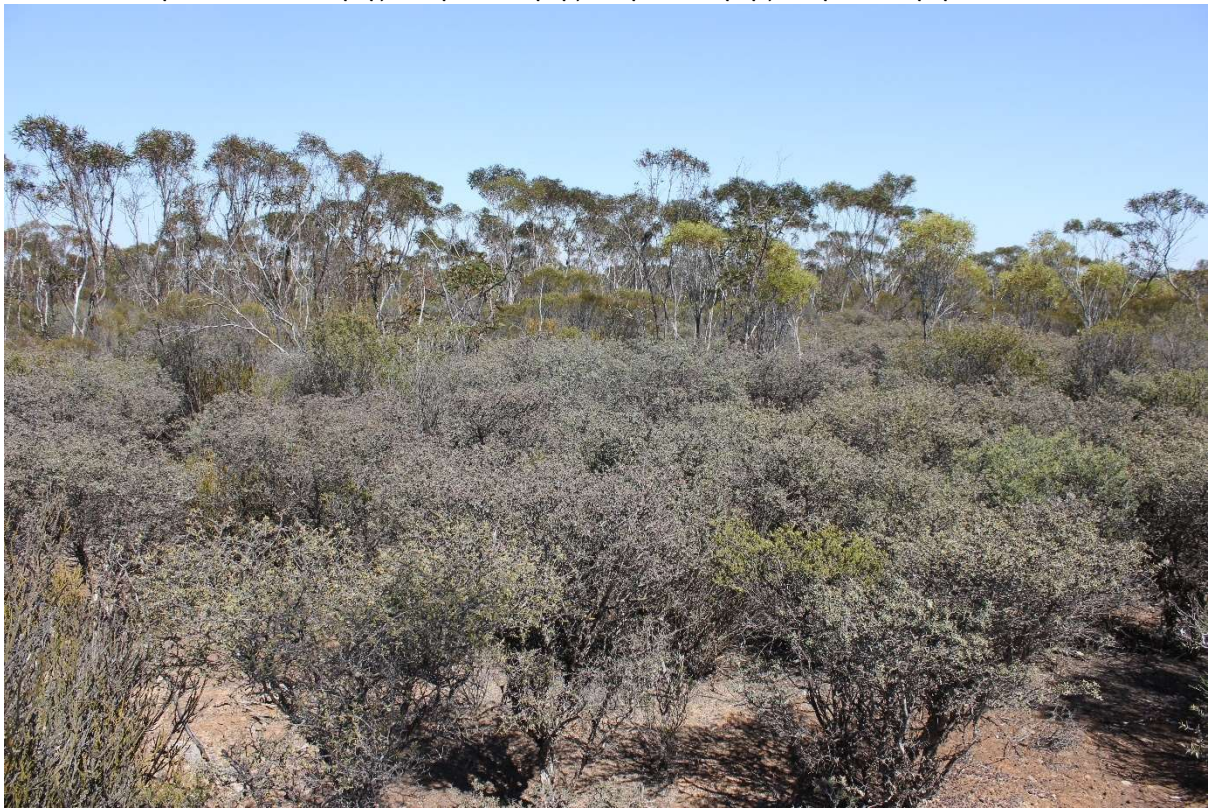
Muir Open Shrub Mallee over Heath B over Open Dwarf Scrub D (isolated sedges, shrubs 2m)

NVIS M1+\^mallee shrub\6\i; M2\^shrub\3\c; G1\^shrub,sedge\1\r

Releve 38 **Mallee over *Melaleuca adnata*** **EMa**

Muir Open Shrub Mallee over Open Low Scrub A over Heath C (Isolated shrubs 0.5m)

NVIS M1+\^mallee shrub\6\i; M2\^shrub\3\r; G1\^shrub\2\c; G2\^shrub\1\bi



Releve 49 **Mallee over *Melaleuca adnata*** **EMa**

Muir Open Shrub Mallee over Open Scrub over Low Heath C (isolated shrubs to 0.5m)

NVIS M1+\^mallee shrub\6\i; M2\^shrub\4\r; G1\^shrub\2\c; G2\^shrub\1\bi

Releve 2 **Mixed heathland (laterite)** **H**

Muir Low Heath C over Dwarf Scrub D (isolated shrubs 2+m, herbs, grasses)

NVIS M1\^shrub\4\bi; G1+\^shrub\2\c; G2\^shrub,sedge,forb,grass\i

Releve 3 **Mixed heathland (laterite)** **H**

Muir Dwarf Scrub C over Low Heath D (isolated shrubs to 2+m, grass, sedges, herbs)

NVIS M1\^shrub\4\bi; G1\^shrub\2\i; G2+\^shrub,sedge,forb,grass\c

Releve 9 **Mixed heathland (laterite)** **H**

Muir Open Dwarf Scrub C over C over Dwarf Scrub D/Open Low Sedges (isolated shrubs 2m, herbs, grass)

NVIS M1\^shrub\3\bi; G1\^shrub\2\r; G2+\^shrub,sedge,forb,rush,grass\c

Releve 41 **Mixed heathland (laterite)** **H**

Muir Low Scrub B over Low Heath D (isolated sedges, herbs, grasses)

NVIS M1+\^shrub\3\i; G1\^shrub,sedge,forb,grass\1\c

Releve 46 Mixed heathland (laterite) H

Muir Low Scrub B over Low Heath D (isolated sedges, herbs, shrubs to 3m)

NVIS M1\^shrub\4\bi; M2+\^shrub\3\i; G1\^shrub,sedge,forb,grass\1\c

Releve 1 *Allocasuarina* shrubland As

Muir Thicket over Open Dwarf Scrub C over Open Low Sedges (isolated herbs, grass)

NVIS M1+\^shrub\4\c; G1\^shrub\2\r; G2\^sedge,forb,grass,rush\1\i

Releve 33 ***Allocasuarina*** **shrubland** **As**

Muir Scrub over Low Scrub B over Dwarf Scrub D/Very Open Low Sedges (isolated herbs, grasses)

NVIS M1+\^shrub\4\i; M2\^shrub\3\i; G1\^shrub,sedge,forb,grass\1\i

Releve 47 ***Allocasuarina*** **shrubland** **As**

Muir Thicket (isolated shrubs 0.5m, sedges, grasses, herbs)

NVIS M1+\^shrub\4\c; G1\^shrub,sedge,grass,forb\1\bi

Releve 64 ***Eremaea pauciflora* heathland** **Er**

Muir Open Mallee over Open Low Scrub B over Heath C over Open Low Sedges (isolated shrub 0.5m, herbs)

NVIS M1\^mallee shrub\6\i; M2\^shrub\3\r; G1+\^shrub\2\c; G2\^sedge,shrub,rush\1\i

Releve 70 ***Eremaea pauciflora* heathland** **Er**

Muir Very Open Shrub Mallee over Heath B over Open Low Sedges (isolated herbs, grass, shrubs 0.5m, shrubs to 3m)

NVIS M1\^mallee shrub\6\r;M2\^shrub\4\bi;M3+\^shrub\3\c;G1\^sedge,shrub,forb,rush,grass\1\i

Releve 39 **Isolated *Eucalyptus loxophleba* subsp. *gratiae* over shrubland Elox**

Muir Very Open Shrub Mallee over Thicket over Open Dwarf Scrub C (isolated grasses, sedges)

NVIS M1\^mallee shrub\6\r; M2+\^shrub\4\c; G1\^shrub\2\r; G2\^sedge,grass\1\bi

Releve 7 ***Melaleuca* shrubland** **M**

Muir Thicket over Dwarf Scrub C (isolated sedges)

NVIS M1+\^shrub\4\c; G1\^shrub\2\i; G2\^sedge\1\bi

Releve 13 ***Melaleuca* shrubland** **M**

Muir Thicket (isolated herbs, grass, shrubs to 0.5m)

NVIS M1+\^shrub\4\c; G1\^shrub,forb,grass\bi

Releve 22 ***Melaleuca* shrubland** **M**

Muir Thicket (isolated herbs, grasses)

NVIS M1+\^shrub\4\c; G1\^forb,grass\bi

Releve 25 ***Melaleuca*** **shrubland** **M**

Muir Thicket over Open Dwarf Scrub D (isolated herbs and grasses)

NVIS M1+\^shrub\4\c; G1\^shrub,forbs,grass\1\r

Releve 31 ***Melaleuca*** **shrubland** **M**

Muir Thicket (isolated herbs, shrubs to 0.5m)

NVIS M1+\^shrub\4\c; G1\^shrub,forb\1\bi

Releve 45 ***Melaleuca* shrubland** **M**

Muir Thicket (isolated herbs, grass, shrubs to 0.5m)

NVIS M1+\^shrub\4\c; G1\^shrub,forb,grass\bi

Releve 51 ***Melaleuca* shrubland** **M**

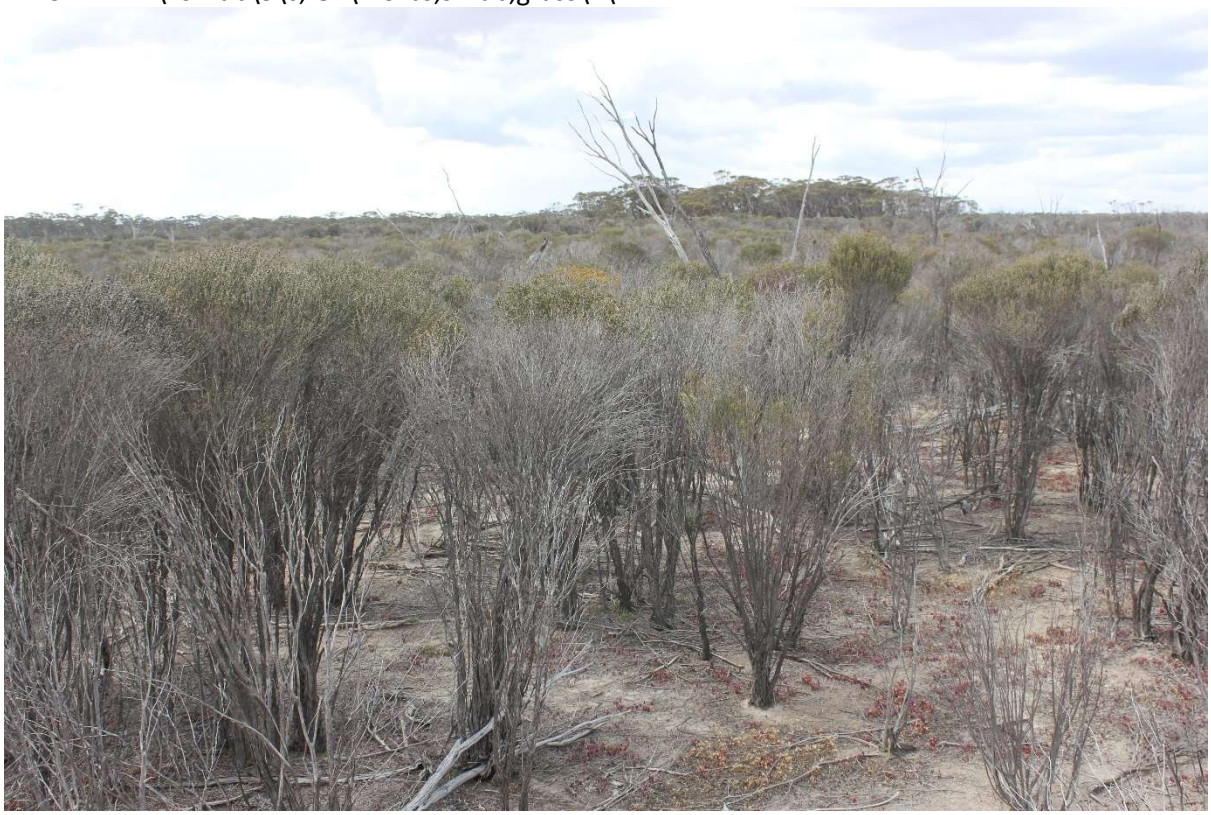
Muir Thicket (isolated herbs and shrubs to 0.5m)

NVIS M1+\^shrub\4\c; G1\^shrub,forbs\1\bi

Releve 63 ***Melaleuca* shrubland** **M**

Muir Heath B over Open Herbs/Open Dwarf Scrub D (isolated grasses)

NVIS M1+\^shrub\3\c; G1\^forbs,shrub,grass\1\i



Releve 69 ***Melaleuca* shrubland** **M**

Muir Thicket over Dwarf Scrub D (isolated grasses, herbs)

NVIS M1+\^shrub\4\c; G1\^shrub,forbs,grass\1\i

Releve 71 ***Melaleuca* shrubland** **M**

Muir Scrub over Heath B

NVIS M1\^shrub\4\i; M2+\^shrub\3\c

Releve 78 ***Melaleuca* shrubland** **M**

Muir Heath B (isolated herbs, sedge and shrubs to 0.5m)

NVIS M1+\^shrub\3\c; G1\^shrub,forbs,sedge\1\bi

Releve 18 ***Melaleuca*** **shrubland** **degraded** **Md**

Muir Open Scrub over Low Scrub A over Open Herbs (isolated sedges and shrubs to 0.5m)

NVIS M1\^shrub\4\r; M2+\^shrub\3\i; G1\^forb, shrub,sedge\1\i

Releve 27 ***Melaleuca*** **shrubland** **degraded** **Md**

Muir Dwarf Scrub C (patch) over Dwarf Scrub D over Herbs

NVIS G1+\^shrub\2\i; G1\^forbs\1\c

Releve 61 ***Melaleuca*** **shrubland degraded Md**

Muir Thicket over Dwarf Scrub C over Dwarf Scrub D/Open Herbs

NVIS M1+\^shrub\4\c; G1\^shrubs\2\i; G2\^shrub,forbs\1\i

Releve 5 ***Wilsonia*** **isolated shrubs W**

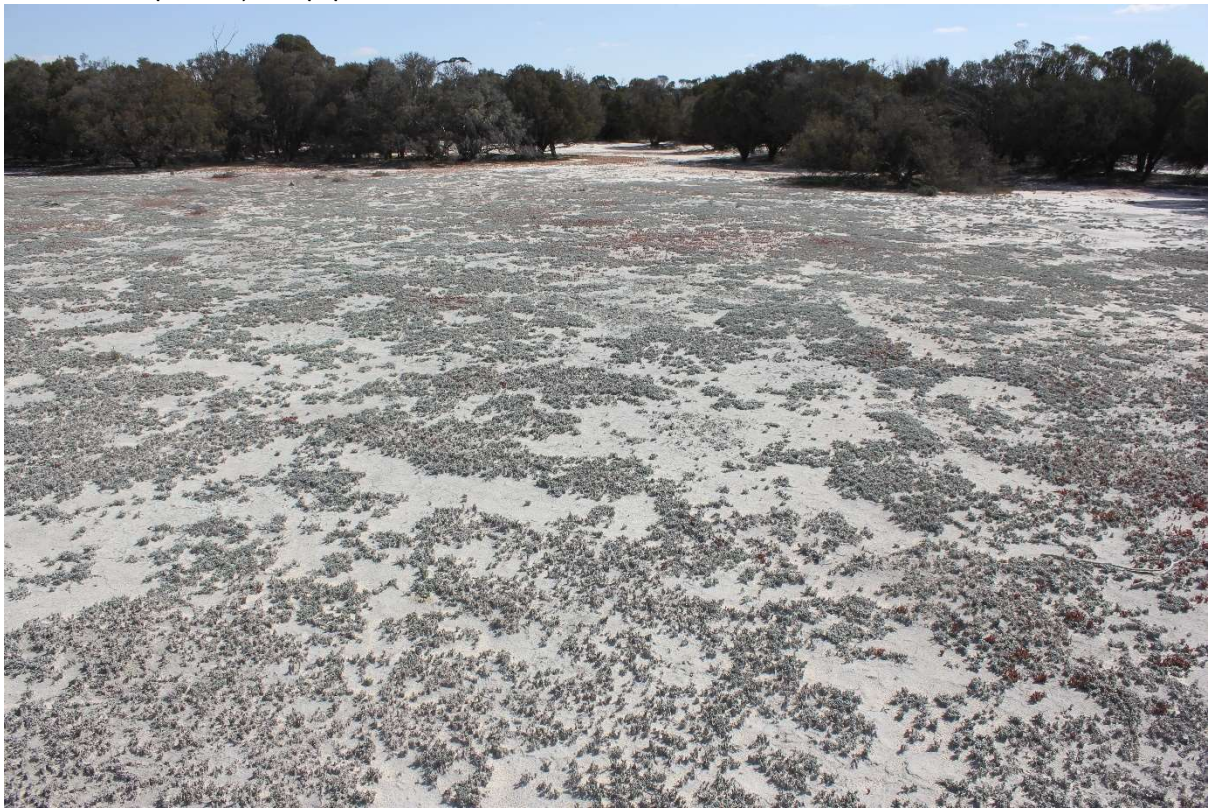
Muir Low Heath D (scattered herbs, grass)

NVIS G1+\^shrub,forb,grass\1\c

Releve 24 ***Wilsonia*** **isolated shrubs** **W**

Muir Low Heath D (scattered herbs)

NVIS G1+\^shrub,forb\1\c



Releve 76 ***Wilsonia*** **isolated shrubs** **W**

Muir Low Heath D (scattered herbs)

NVIS G1+\^shrub,forb\1\c

Releve 12 **Samphire (*Tecticornia*) shrubland** **Te**

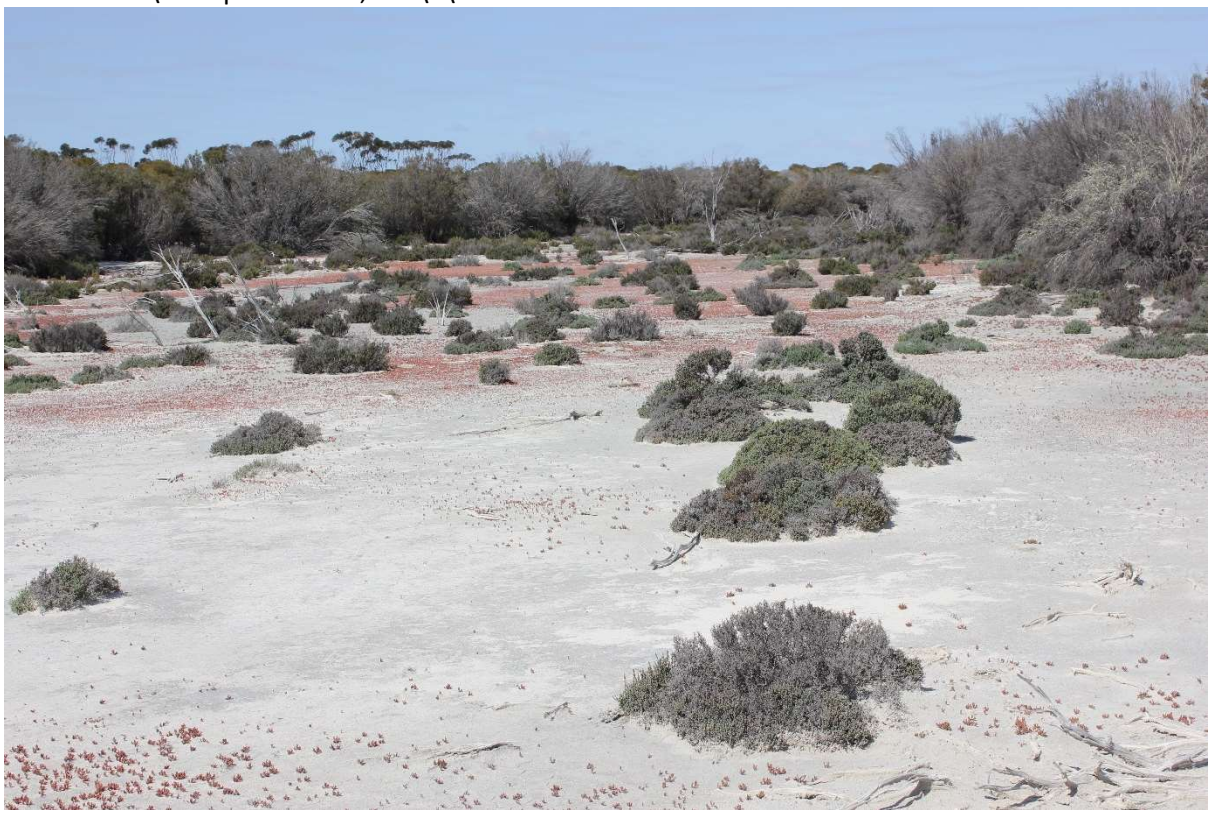
Muir Dwarf Scrub D

NVIS G1+\^samphire shrub\1\i

Releve 15 **Samphire (*Tecticornia*) shrubland** **Te**

Muir Dwarf Scrub D/Open Herbs

NVIS G1+\^samphire shrub,forb\1\i



Releve 20 **Samphire (*Tecticornia*) shrubland** **Te**

Muir Dwarf Scrub D (isolated herbs)

NVIS G1+\^samphire shrub,forb\1\i

Releve 23 **Samphire (*Tecticornia*) shrubland** **Te**

Muir Low Heath D (isolated herbs)

NVIS G1+\^samphire shrub,forb\1\c

Releve 30 **Samphire (*Tecticornia*) shrubland** **Te**

Muir Low Heath D

NVIS G1+\^samphire shrub\1\c

Releve 32 **Samphire (*Tecticornia*) shrubland** **Te** **(Degraded M)**

Muir Dwarf Scrub D (dead shrubs) (isolated forbs, grass)

NVIS G1+\samphire shrub,forb,grass\1\i

Releve 35 **Samphire (*Tecticornia*) shrubland** **Te** **(Degraded M)**

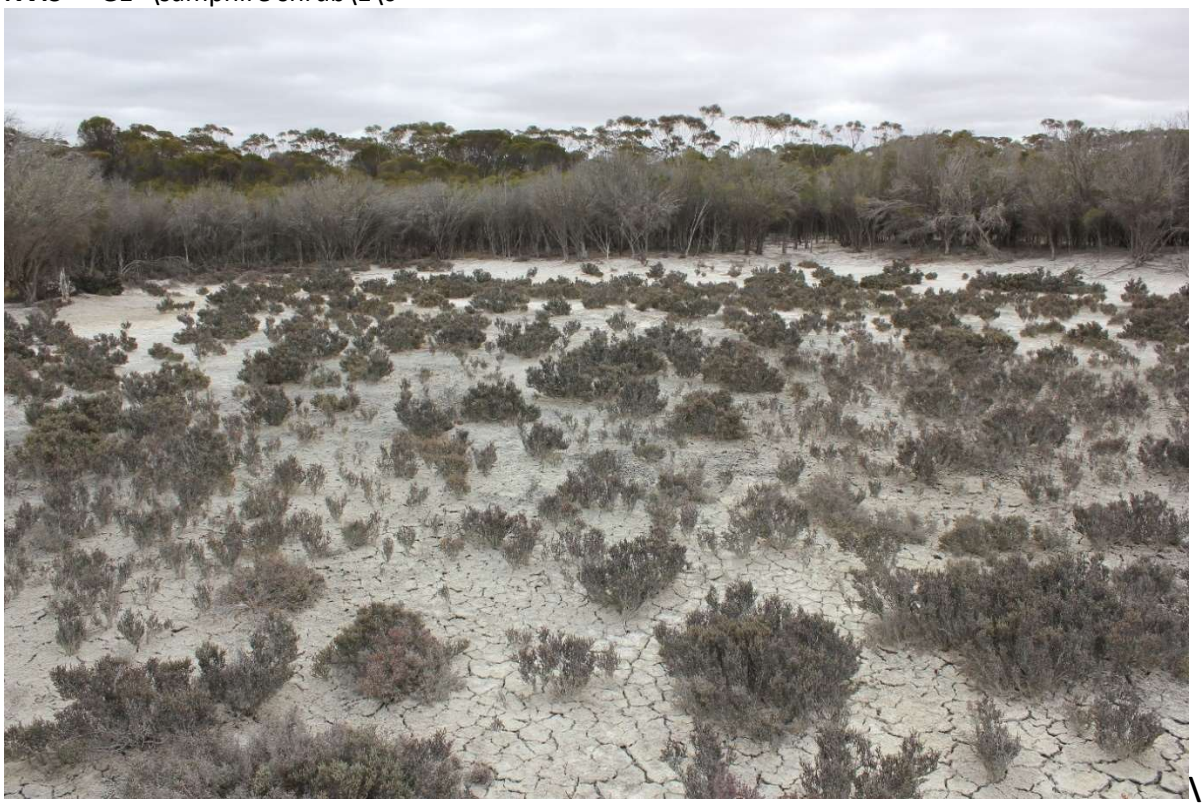
Muir Dwarf Scrub D (dead shrubs)

NVIS G1+\samphire shrub\1\i

Releve 52 **Samphire (*Tecticornia*) shrubland** **Te**

Muir Low Heath D

NVIS G1+\samphire shrub\1\c



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Releve 68 **Samphire (*Tecticornia*) shrubland** **Te** **(Degraded M)**

Muir Low Heath D (dead shrubs) (isolated herbs)

NVIS G1+\samphire shrub,forb\1\c

Releve 77 **Samphire (*Tecticornia*) shrubland** **Te**

Muir Dwarf Scrub D (isolated herbs)

NVIS G1+\samphire shrub,forb\1\i

Releve 10 **Granite Complex - Herbalnd** **Gh**

Muir Herbs/Open Dwarf Scrub D/Open Low Sedges (isolated grass)

NVIS G1+\^forb,shrub,sedge,grass\1\c

Releve 11 **Granite Complex - Herbalnd** **Gh**

Muir Open Dwarf Scrub D/Open Low Sedges/Herbs (isolated grasses)

NVIS G1+\^ forb,sedge,shrub,grass\1\c

Appendix 5
Vegetation Descriptions

Eucalyptus salmonophloia (salmon gum) woodland Es

Releves	**37, 40**
Landform	Usually valley floor, sometimes mid slopes on heavier soils
Soils, topography	Gentle slope to flat terrain, loamy soils over clay
Condition	Excellent
Vegetation Description	
Upper stratum (U1+)	Sparse *Eucalyptus salmonophloia* trees dominant.
Mid stratum 1 (M1)	Sparse to very sparse shrub mallee including *Eucalyptus pileata, Eucalyptus calycogona and Eucalyptus tenera.*
Mid stratum 2 (M2)	Sparse to isolated shrubs over 2m in height including *Melaleuca acuminata, Melaleuca lateriflora, Alyxia buxifolia, Santalum acuminatum, Melaleuca adnata* and *Melaleuca pauperiflora.*
Ground stratum (G1)	Isolated shrubs to 1.0m including *Melaleuca marginata*, *Acacia hemiteles, Eremophila decipiens* and *Hakea commutata*.
Ground stratum (G2)	Very sparse to isolated shrubs to 0.5m including *Olearia muelleri, Acacia erinacea, Templetonia rossii, Rhagodia preissii* and *Senna artemisioides* subsp. x *artemisioides.* Grass - *Austrostipa elegantissima.*
Comments	In Lakeland NR 29023 two areas of salmon gum woodland occur on mid slopes growing on heavier soils.

Eucalyptus salmonophloia **woodland at Releve 37**

Eucalyptus salmonophloia **woodland at Releve 40**

Eucalyptus salubris open forest (gimlet) Esu

Releve	**81**
Landform	Lower slopes
Soils, topography	Clay soils, gentle slope
Condition	Excellent
Vegetation Description	
Upper stratum (U1+)	Mid dense *Eucalyptus salubris* trees to 8m in height dominant
Mid stratum 1 (M1)	Mid dense shrubs to 2m including *Melaleuca acuminata, Melaleuca pauperiflora, Melaleuca lateriflora* and *Melaleuca thyoides.*
Ground stratum (G1)	Isolated shrubs to 0.5m including *Acacia erinacea, Microcybe multiflora* and *Rhagodia preissii.*
	Grass – *Austrostipa elegantissima.*
	Forb/perennial herb – *Carpobrotus modestus.*

***Eucalyptus salubris* open forest at releve 81**

Eucalyptus kondininensis (Kondinin blackbutt) woodland Ek

Releves	**14, 16, 21, 29, 72, 79**
Landform	Valley floor
Soils, topography	sandy loam over clay, slightly elevated well drained areas.
Condition	Excellent

Vegetation Description (mature)

Upper stratum (U1+)	Mid dense to sparse *Eucalyptus kondininensis* trees to 12m dominant.
Mid stratum 1 (M1)	Mid dense, occasionally sparse to very sparse, shrubs over 2m including *Melaleuca acuminata, Melaleuca lateriflora, Melaleuca thyoides, Melaleuca adnata, Melaleuca pauperiflora, Melaleuca atroviridis* and *Santalum acuminatum.*
Mid stratum 2 (M2)	Occasionally isolated to very sparse shrubs to 2m are present including *Exocarpos aphyllus, Melaleuca adnata, Melaleuca lateriflora* and *Melaleuca thyoides.*
Ground stratum (G1)	Very sparse to isolated shrubs to 0.5m including *Acacia erinacea, Olearia muelleri, Templetonia rossii*, Olearia sp. Eremicola, Grevillea huegelii, Phebalium filifolium, Hibbertia ?gracilipes, *Acacia verriculum, Microcybe multiflora, Dodonaea bursariifolia* and *Westringia rigida.* Perennial herb/rush - *Lomandra effusa.* Sedges - *Gahnia ancistrophylla.* Grasses – *Austrostipa trichophylla*, *Austrostipa elegantissima.* Rush/perennial herb – Dianella revoluta.

***Eucalyptus kondininensis* (Kondinin blackbutt) woodland at Releve 72**

***Eucalyptus kondininensis* (Kondinin blackbutt) woodland at Releve 14**

Eucalyptus alipes (Hyden mallet) woodland Ea

Releves	**58, 60, 62**
Landform	Valley floor.
Soils, topography	Well drained**,** sandy loam soils, sandy ridges.
Condition	Excellent.

Vegetation Description

Upper stratum (U1+)	Sparse to mid dense *Eucalyptus alipes* trees to 10m in height dominant.
Mid stratum (M1)	Isolated to sparse shrubs over 2m of *Melaleuca acuminata, Melaleuca lateriflora* and *Leptospermum erubescens.*
Ground stratum (G1)	Isolated to sparse shrubs to 1.0m including *Conostephium roei, Bossiaea halophila, Darwinia* sp. Karonie, *Cyathostemon tenuifolia, Chamelaucium ciliatum* and *Eremophila decipiens.*
Ground stratum (G2)	Isolated to sparse shrubs to 0.5m including *Calytrix leschenaultii, Darwinia* sp. Karonie*, Cyathostemon tenuifolia, Chamelaucium ciliatum, Disphyma crassifolia, Acacia viscifolia, Enchylaena ?lanata* and *Threlkeldia diffusa.* Sedges - *Lepidosperma* species. Forbs/herbs - *Calandrinia eremaea, Stenopetalum sphaerocarpa, Waitzia acuminata* and **Ursinia anthemoides.* Perennial herb/rush - *Lomandra effusa* and *Dianella revoluta.* Tussock grass - **Pentachistis airoides, Neurachne alopecuroidea.*

***Eucalyptus alipes* woodland at releve 58**

***Eucalyptus alipes* woodland at releve 60**

Eucalyptus alipes (Hyden mallet) open forest Ea

Releves	**67, 59 (degraded)**
Landform	Valley floor.
Soils, topography	Sandy loam over clay, flat to gently sloping terrain.
Condition	Excellent releve 67, Very Good releve 59.
Vegetation Description	
Upper stratum (U1+)	Mid dense *Eucalyptus alipes* trees to 12m in height dominant.
Mid stratum (M1)	Mid dense shrubs 2m and over with *Melaleuca acuminata* prominent and *Melaleuca lateriflora, Melaleuca adnata*, *and Melaleuca thyoides* also recorded (shrubs isolated in degraded areas).
Ground stratum (G1)	Isolated to very sparse shrubs to 0.5m including *Calytrix leschenaultii*, *Bossiaea halophila, Chamelaucium ciliatum, Darwinia* sp. Karonie and *Rinzia communis.* Shrub species recorded in degraded areas (releve 59) include *Disphyma crassifolia, Carpobrotus modestus, Enchylaena* species*, Threlkeldia diffusa, Rhagodia drummondii* and *Tecticornia* species. Very sparse sedges (releve 67) including *Gahnia ancistrophylla, Gahnia trifida, Lepidosperma* species and *Desmocladus* species. Tussock grass - *Austrostipa elegantissima* . Forbs/herbs – *Waitzia acuminata, Helichrysum leucopsideum.* Rush/perennial herb – Lomandra effusa.
Comment	*Eucalyptus alipes* releves clustered in 2 distinct groups in the PRIMER analysis. These were *Eucalyptus alipes* woodland on sandy ridges and *Eucalyptus alipes* open forest (releve 67). These areas are all mapped as Ea. Vegetation at releve 59 was degraded and this releve clustered with the *Melaleuca* shrublands.

Eucalyptus alipes **open forest at releve 67**

Eucalyptus alipes **open forest at releve 59 (degraded)**

Mallee over *Melaleuca scalena* – laterite EMs/L

Releves **34, 36, 54**

Landform Upper to mid slopes**.**

Soils, topography Sandy gravels over clay, flat to gentle slope.

Condition Excellent

Vegetation Description

Mid stratum (M1+) Mid dense to sparse shrub mallee to 6m including *Eucalyptus phaenophylla Eucalyptus uncinata* and *Eucalyptus perangusta.*

Mid stratum (M2) Very sparse to mid dense shrubs over 2m (occasionally 1.5 to 2m) including *Melaleuca scalena*, *Beyeria sulcata, Callitris preissii, Leptospermum erubescens,* Hakea erecta, *Allocasuarina acutivalvis, Hakea subsulcata, Hakea multilineata, Petrophile squamata, Hakea horrida, Grevillea cagiana.*

Ground stratum (G1) Mid dense to very sparse shrubs to 1.0m including *Phebalium tuberculosum*, *Beyeria sulcata, Hakea lissocarpha, Hakea scoparia,* Leptomeria preissiana, *Melaleuca rigidifolia, Isopogon* sp. Fitzgerald River*, Isopogon scabriusculus, Melaleuca laxiflora, Melaleuca depauperata, Beaufortia puberula, Melaleuca carrii, Melaleuca tuberculata, Verticordia roei,* ***Persoonia brevirhachis*** **P3.**

Ground stratum (G2) Sparse to isolated shrubs to 0.5m including *Grevillea acuaria, Verticordia chrysantha*, *Verticordia acerosa* subsp. *preissii*, *Westringia cephalantha,* Leucopogon dielsianus, *Gastrolobium punctatum, Calytrix leschenaultii, Hibbertia gracilipes, Hibbertia pungens, Leucopogon* sp. Newdegate, *Leucopogon* sp. Wheatbelt, *Rinzia communis, Ericomyrtus serpyllifolia*, *Micromyrtus triptycha*, *Persoonia coriacea, Gastrolobium musaceum, Verticordia picta,* ***Banksia xylothemelia P3, Styphelia chlorantha*** **P2**

Very sparse to isolated sedges including *Lepidosperma* species, *Gahnia ancistrophylla*, *Lepidobolus* ?*preissianus.*

Grass - *Neurachne alopecuroides.*

Perennial herb/rush - *Dianella revoluta.*

Comments In the Lakeland Nature Reserves the EMs/L vegetation type includes not only areas where *Melaleuca scalena* is prominent in the understory but also areas of transition between the shrublands on laterite and the Mallee on duplex soils of sand over clay where more species typical of lateritic soils are prominent.

Mallee over *Melaleuca scalena* – laterite at Releve 34

Mallee over *Melaleuca scalena* – laterite at Releve 36

Mallee over *Melaleuca scalena* EMs

Releves	**6, 73**
Landform	Mid to lower slopes.
Soils, topography	Duplex sandy soils over clay, flat to gentle slope.
Condition	Excellent.
Vegetation Description	
Mid stratum (M1+)	Mid dense to sparse shrub mallee, occasionally tree mallee to 8m including *Eucalyptus phenax, Eucalyptus perangusta, Eucalyptus suggrandis* subsp. *promiscua, Eucalyptus pileata.*
Mid stratum (M2)	Mid dense shrubs, to 2.5m with *Melaleuca scalena* prominent, other species recorded include *Melaleuca depauperata* and *Santalum acuminatum.*
Mid stratum (M3)	Sparse to isolated shrubs to 1.5m including *Melaleuca depauperata, Melaleuca laxiflora, Hakea newbeyana, Exocarpos aphyllus, Phebalium tuberculosum, Phebalium lepidotum, Daviesia scoparia, Melaleuca adnata.*
Ground stratum (G1)	Isolated to very sparse shrubs to 0.5m including *Dodonaea bursariifolia, Trymalium elachophyllum, Westringia rigida, Grevillea oligantha, Rinzia communis, Platysace trachymenioides, Hibbertia gracilipes, Templetonia rossii, Hibbertia pungens, Acacia viscifolia, Acacia bidentata,* ***Spyridium mucronatum*** **subsp.** ***recurvum P3.*** Sedges - *Gahnia ancistrophylla* and *Lepidosperma* species. Tussock grass - *Neurachne alopecuroidea.*
Comment	This vegetation type merges with Mallee over mixed *Melaleuca* species (EM) which grades into Mallee over *Melaleuca adnata* (EMa). Areas of EM cluster with EMs and EMa in the PRIMER analysis and would have been included as part of the EMs complex in Lakeland NRs 29024 and 29025. EM only covered small areas in these reserves. Vegetation boundaries are sometimes difficult to map.

Mallee over *Melaleuca scalena* at Releve 6

Mallee over *Melaleuca scalena* at Releve 73

Mixed Mallee - sparse understory E

Releves	**26, 28**
Landform	Mid to lower slopes.
Soils, topography	Duplex sandy soils over clay, flat to gentle slope.
Condition	Excellent.
Vegetation Description	
Mid stratum (M1+)	Sparse shrub mallee including *Eucalyptus phenax*, *Eucalyptus suggrandis* subsp. *promiscua, Eucalyptus perangusta.*
Mid Stratum (M2)	Very sparse to sparse shrubs over 2m including *Melaleuca depauperata, Melaleuca scalena, Santalum acuminatum, Melaleuca acuminata, Melaleuca thyoides, Melaleuca brophyi.*
Ground stratum (G1)	Sparse sedges including *Gahnia ancistrophylla, Lepidosperma* species, Desmocladus quiricanus. Very sparse shrubs to 0.5m including *Trymalium elachophyllum, Phebalium filifolium, Rinzia communis, Leucopogon obtusatus, Hibbertia gracilipes, Acacia viscifolia , Acacia erinacea, Olearia muelleri, Olearia* sp. Eremicola*, Darwinia sp. Lake Cobham, Bossiaea halophila, Westringia rigida, Verticordia plumosa, Hakea commutata, Chamelaucium ciliatum*, ***Styphelia chlorantha*** **P2.** Rush/perennial herb - *Lomandra effusa, Dianella revoluta.* Tussock grass - *Neurachne alopecuroidea.* Forb/annual herb - *Helichrysum leucopsideum.*
Comments	Mixed Mallee – sparse understory (E) and Mallee over *Melaleuca scalena* (EMs) releves were grouped together in the PRIMER analysis with no significant difference shown in species composition. Mixed Mallee over *Melaleuca depauperata* (EMd) mapped in Lakeland NR 29024 is part of the Mixed Mallee complex. E and EMd are both mapped in the Lake Bryde Conservation Park.

Mixed mallee – open understory at releve 26

Mixed mallee - open understory at releve 28

Mallee over *Melaleuca* low shrubland - *Melaleuca carrii* EMc

Releves	**4, 42, 43, 55, 74**
Landform	Mid to lower slopes.
Soils, topography	Duplex sandy soils over clay (scattered proteaceae indicate some laterite).
Condition	Excellent.

Vegetation Description

Mid stratum (M1+)	Sparse shrub mallee including *Eucalyptus dissimulata, Eucalyptus perangusta, Eucalyptus phaenophylla, Eucalyptus phenax, Eucalyptus suggrandis* subsp. *promiscua, Eucalyptus pileata.*
Mid Stratum (M2)	Very sparse shrubs to 2m including *Leptospermum erubescens, Hakea corymbosa, Melaleuca scalena, Melaleuca brophyi*, *Santalum acuminatum, Melaleuca lateriflora.*
Ground stratum (G1)	Mid dense shrubs usually to 1.0m including *Melaleuca carrii* (prominent), *Melaleuca subtrigona*, *Melaleuca laxiflora, Isopogon* sp. Fitzgerald River, *Leptomeria preissiana*, *Melaleuca depauperata*, *Melaleuca scalena, Melaleuca brophyi, **Melaleuca sculponeata*** **P3, Grevillea newbeyana P3.**
Ground stratum (G2)	Very sparse to sparse shrubs to 0.5m including *Rinzia communis, Darwinia* sp. Lake Cobham*, Hibbertia gracilipes, Leucopogon obtusatus, Calytrix leschenaultii, Verticordia plumosa, Templetonia rossii*, *Daviesia incrassata, Daviesia lancifolia*, *Melaleuca apodocephala*, *Gastrolobium punctatum, Melaleuca lateralis, Hibbertia pungens, Bertya dimerostigma, Westringia rigida, Verticordia acerosa* subsp. *preissii, Cryptandra minutiflora, Grevillea oligantha*, ***Styphelia chlorantha*** **P2, *Spyridium mucronatum*** **subsp. *recurvum P3.***
	Sedges - *Gahnia ancistrophylla, Gahnia trifida, Lepidosperma* species*, Desmocladus myriocladus, Desmocladus quiricanus, Desmocladus asper.*
	Rushes/perennial herbs - *Lomandra mucronata .*
	Grass – *Neurachne alopecuroides.*
Comments	Some of the Mallee over *Melaleuca carrii* (EMc) and *Eucalyptus perangusta* over shrubland (Ep) releves were grouped together in the PRIMER analysis with no significant difference shown in species composition. These vegetation types were mapped separately wherever possible however they tend to merge, and vegetation boundaries are sometimes difficult to detect on the aerial photography.

Mallee over *Melaleuca* low shrubland with *Melaleuca carrii* prominent at Releve 4

Mallee over *Melaleuca* low shrubland with *Melaleuca carrii* prominent at Releve 42

Eucalyptus perangusta over shrubland Ep

Releves	**17, 56, 57, 65, 66, 75, 82**
Landform	Lower slopes/valley floor including ridges or dunes adjacent to lakes.
Soils, topography	Deeper sandy soils over clay, sandy areas and ridges.
Condition	Excellent.

Vegetation Description

Mid stratum (M1+)	Sparse (occasionally very sparse) shrub mallee including *Eucalyptus perangusta*, *Eucalyptus sporadica, Eucalyptus suggrandis* subsp. *promiscua, Eucalyptus phenax.*
Mid stratum (M2)	Isolated to sparse shrubs usually to 2m and over including *Melaleuca brophyi, Leptospermum erubescens*, *Santalum acuminatum, Hakea corymbosa, Melaleuca scalena*, *Callitris preissii*, *Melaleuca lateriflora, Melaleuca acuminata.*
Ground stratum (G1)	Mid dense shrubs to 1.5m or 1.0m including *Melaleuca depauperata, Chamelaucium ciliatum, Melaleuca subtrigona, Isopogon* sp. Fitzgerald River, *Bossiaea halophila, Melaleuca brophyi, Leptospermum erubescens, Darwinia* sp. Karonie, *Grevillea huegelii, Melaleuca carrii, Phebalium filifolium.*
Ground stratum (G2)	Isolated to sparse shrubs to 0.5m including *Calytrix leschenaultii, Verticordia plumosa, Phebalium filifolium, Phebalium tuberculosum, Hibbertia gracilipes, Darwinia* sp. Lake Cobham*, Gastrolobium punctatum, Trymalium elachophyllum*, *Grevillea oligantha*, *Templetonia rossii, Westringia rigida***,** Rinzia communis**,** *Leucopogon obtusatus, Grevillea acuaria*, *Bertya dimerostigma****, Spyridium mucronatum*** **subsp.** ***recurvum P3.*** Sparse to isolated sedges including *Gahnia ancistrophylla, Gahnia trifida, Desmocladus myriocladus, Desmocladus quiricanus, Desmocladus parthenicus, Lepidosperma* species. Rushes/perennial herbs - *Lomandra micrantha* subsp. *teretifolia, Lomandra mucronata, Lomandra effusa, Dianella revoluta.* Forbs/herbs including *Helichrysum leucopsideum, Waitzia acuminata, Podolepis capillaris.* Tussock grass - *Neurachne alopecuroidea, Austrostipa elegantissima.*

Eucalyptus perangusta **over shrubland at Releve 17**

Eucalyptus perangusta **over shrubland at Releve 65**

Mallee over mixed *Melaleuca* species EM

Releves **8, 19, 44, 48, 50, 53, 80**

Landform Upper to lower slopes.

Soils, topography Heavier shallow duplex soils of sandy loam over clay, flat to gentle slope.

Condition Excellent.

Vegetation Description

Mid stratum (M1+) Mid dense to sparse shrub mallee to 6m (occasionally tree mallee to 8m) including *Eucalyptus phenax, Eucalyptus flocktoniae, Eucalyptus suggrandis* subsp. *promiscua, Eucalyptus tenera, Eucalyptus calycogona, Eucalyptus perangusta, Eucalyptus dissimulata* and *Eucalyptus neutra.*

Mid stratum (M2) Isolated to sparse shrubs (occasionally mid dense) to 2m or over including *Melaleuca lateriflora, Melaleuca scalena,* Melaleuca acuminata, *Melaleuca adnata, Melaleuca sapientes, Melaleuca depauperata, Exocarpos aphyllus, Hakea newbeyana.*

Mid stratum (M3) In some areas where M2 shrubs are isolated to very sparse, shrubs to 1.5m (occasionally to 1.0m) form a mid-dense stratum. Melaleuca species recorded include *Melaleuca scalena, Melaleuca lateriflora, Melaleuca depauperata, Melaleuca adnata, Melaleuca sapienties, Melaleuca acuminata, Melaleuca marginata, Melaleuca rigidifolia, Melaleuca laxiflora,* ***Melaleuca sculponeata*** **P3.** *Other species recorded include Exocarpos aphyllus, Daviesia aphylla, Santalum acuminatum, Dodonaea stenozyga.*

Ground stratum (G1) Isolated to very sparse shrubs to 0.5m including *Microcybe multiflora, Dodonaea bursariifolia, Acacia viscifolia, Olearia muelleri, Hibbertia gracilipes, Grevillea huegelii, Acacia erinacea, Grevillea oligantha, Hibbertia pungens, Trymalium elachophyllum, Gastrolobium reticulatum, Rinzia communis, Phebalium filifolium,* Leucopogon obtusatus, *Hakea commutata, Coopernookia strophiolata, Cryptandra minutifolia, Westringia rigida, Templetonia rossii, Olearia ramosissima,* ***Styphelia chlorantha P2, Spyridium mucronatum*** **subsp.** ***recurvum P3***

Rush/perennial herb - *Lomandra effusa.*

Sedges - *Gahnia ancistrophylla, Lepidosperma* species.

Comments This vegetation type merges with Mallee over *Melaleuca* scalena (EMs) and Mallee over *Melaleuca adnata* (EMa). Areas of EM cluster with EMs and EMa in the PRIMER analysis.

Mallee over mixed *Melaleuca* species at Releve 19

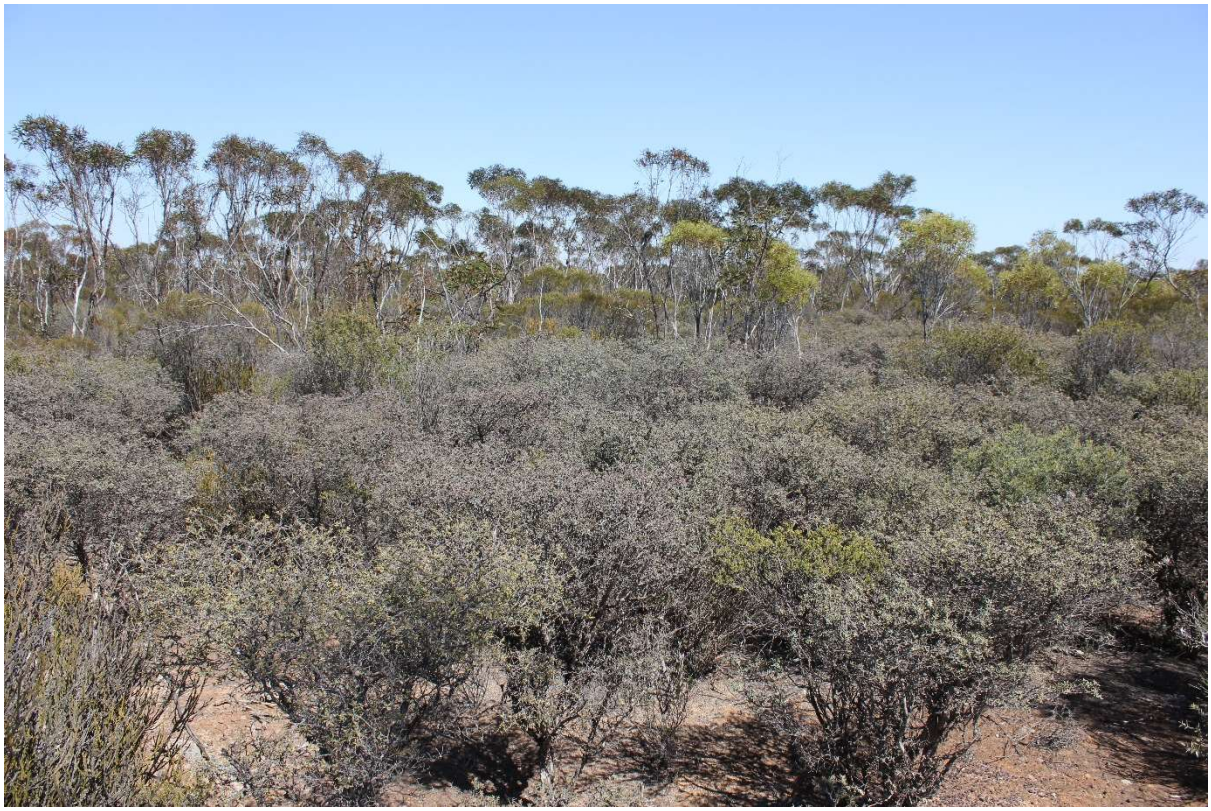
Mallee over mixed *Melaleuca* species at Releve 48

Mallee over *Melaleuca adnata* EMa

Releves	**38, 49**
Landform	Upper to lower slopes.
Soils, topography	Heavier shallow duplex soils of sandy loam over clay, flat to gentle slope.
Condition	Excellent.

Vegetation Description

Mid stratum (M1+)	Sparse shrub mallee to 6m including *Eucalyptus flocktoniae, Eucalyptus phenax and Eucalyptus suggrandis* subsp. *promiscua.*
Mid stratum (M2)	Very sparse shrubs to 2m or over including Melaleuca acuminata, *Melaleuca scalena, Santalum acuminatum.*
Ground stratum (G1)	Mid dense shrubs to 1.0m with *Melaleuca adnata* and *Melaleuca marginata* prominent. Other species recorded include *Melaleuca lateriflora, Melaleuca acuminata, Melaleuca scalena, Daviesia aphylla, Exocarpos aphyllus, Hakea commutata,* Melaleuca *sapientes.*
Ground stratum (G2)	Isolated shrubs to 0.5m including *Acacia viscifolia, Microcybe multiflora, Acacia erinacea, Olearia muelleri, Hakea commutata, Grevillea huegelii, Leucopogon obtusatus.*



Mallee over *Melaleuca adnata* at releve 38

Mallee over *Melaleuca adnata* at releve 49

Mixed lateritic heathland H

Releves **2, 3, 9, 41, 46**

Landform Upper slopes.

Soils, topography Sandy soils with gravel over laterite (ironstone in places), flat to gentle slope.

Condition Excellent.

Vegetation Description

Mid stratum (M1) Isolated over 2m including *Callitris preissii, Allocasuarina acutivalvis, Allocasuarina spinosissima, Hakea horrida.*

Mid stratum (M2) In some areas, sparse shrubs to 1.5m are present including *Hakea cygna, Banksia erythrocephala, Petrophile seminuda, Verticordia roei, Allocasuarina campestris, Leptospermum species.*

Ground stratum (G1+) Very sparse to mid dense shrubs to 1.0m including *Melaleuca tuberculata, Beaufortia puberula, Petrophile seminuda, Verticordia roei, Petrophile squamata, Grevillea teretifolia, Melaleuca carrii, Isopogon teretifolius, Lysinema pentapetalum, Hakea strumosa, Verticordia chrysantha, Petrophile ericifolia, Ericomyrtus serpyllifolia, Acacia multispicata, Grevillea hookeriana.*

Ground stratum (G2+) Sparse to mid dense shrubs to 0.5m including *Allocasuarina microstachya, Beaufortia micrantha, Hakea incrassata, Acacia patagiata, Verticordia chrysantha, Baeckea latens, Calytrix leschenaultii, Jacksonia racemosa, Verticordia eriocephala, Verticordia roei, Verticordia picta, Persoonia coriacea, Verticordia acerosa, Petrophile glauca, Cryptandra leucopogon, Daviesia lancifolia, Leucopogon sp. Wheatbelt, Leucopogon obtusatus, Andersonia lehmanniana, Hibbertia gracilipes, Leucopogon dielsianus, Pimelea imbricata, Melaleuca lecanantha, Synaphea species, Acacia sulcata, Microcorys sp. stellate, Halgania anagalloides, Dampiera lavandulacea, Mirbelia multicaulis, Chorizema aciculare, Acacia bidentata, Comesperma scoparia,* ***Banksia xylothemelia*** **P3,** ***Rinzia affinis*** **P4**
Rush/herb - Chamaexeros serra
Sedges - *Mesomelaena preissii, Gahnia ancistrophylla, Lepidobolus preissianus, Lepidosperma* species
Forbs/herbs - *Chamaescilla ?spiralis*, *Stylidium dichotomum, Stylidium zeicolor, Tricoryne tenella, Calectasia valida*
Tussock grass - *Neurachne alopecuroidea*

Comments Mixed lateritic heathland (H) releves cluster with *Allocasuarina* shrubland (As) releves in the PRIMER analysis with species characteristic of lateritic soils common to both. G1 or G2 can be the dominant stratum at different releves.

Mixed lateritic heathland at Releve 2

Mixed lateritic heathland at Releve 41

Allocasuarina shrubland **As**

Releves **1, 33, 47**

Landform Mid to upper slopes.

Soils, topography Sandy soils with gravel over laterite, flat to gentle slope.

Condition Excellent.

Vegetation Description

Mid stratum (M1+) Mid dense to sparse shrubs over 2m including *Allocasuarina acutivalvis*, *Allocasuarina corniculata, Allocasuarina spinosissima, Allocasuarina campestris, Callitris preissii, Hakea erecta*, *Leptospermum* species.

Mid stratum (M2) Sparse shrubs to 1.0m or 1.5m usually present including *Hakea scoparia*, Isopogon scabriusculus*, Verticordia roei, Beaufortia puberula, Verticordia chrysantha, Ericomyrtus serpyllifolia,* ***Persoonia brevirhachis*** **P3.**

Ground stratum (G1) Very sparse to sparse shrubs to 0.5m including *Acacia patagiata, Verticordia picta, Verticordia roei, Verticordia chrysantha, Hakea incrassata, Micromyrtus triptycha, Allocasuarina microstachya, Ericomyrtus serpyllifolia, Psammomoya choretroides, Jacksonia racemosa, Baeckea latens, Dampiera sacculata, Melaleuca platycalyx, Comesperma scoparium, Platysace trachymenioides, Hibbertia exasperata, Astroloma serratifolium,* ***Banksia xylothemelia*** **P3,** ***Gastrolobium cruciatum*** **P3.**

Sedges - *Gahnia ancistrophylla, Mesomelaena preissii, Lepidosperma* species, *Lepidobolus ?preissianus*.

Rush/perennial herbs - *Chamaexeros fimbriata*, *Lomandra mucronata.*

Forbs/herbs - *Stylidium zeicolor, Stylidium dichotomum, Pterochaeta paniculata, Chamaescilla* species, *Trachymene cyanopetala.*

Tussock grass - *Neurachne alopecuroidea.*

Comments *Allocasuarina spinosissima* identified in Lake Bryde CP is closely related to *Allocasuarina corniculata* with the differences between these species mainly related to the size of the fruit. The **As** vegetation type is characterised by the presence of *Allocasuarina* shrubs including *Allocasuarina acutivalvis, Allocasuarina campestris, Allocasuarina corniculata* and *Allocasuarina spinosissima.*

***Allocasuarina* shrubland at Releve 1**

***Allocasuarina* shrubland at Releve 33**

Eremaea pauciflora heathland Er

Releves	**64, 70**
Landform	Lower slopes, deep sandy soils.
Soils, topography	Deep sand, flat to gentle slope.
Condition	Excellent.
Vegetation Description	
Mid stratum (M1)	Sparse to very sparse shrub mallee including *Eucalyptus perangusta, Eucalyptus sporadica, Eucalyptus phaenophylla.*
Mid stratum (M2)	Sparse to very sparse shrubs over 1.5m including *Leptospermum erubescens, Callitris preissii, Isopogon* sp. Fitzgerald River*, Santalum acuminatum, Eremaea pauciflora.*
+Mid/Ground stratum	Mid dense shrubs to 1.0m (Releve 64) and to 1.5m (Releve 70) with *Eremaea pauciflora* prominent. Other species recorded include *Melaleuca subtrigona, Bossiaea halophila, Grevillea hookeriana, Leptospermum erubescens.*
Ground stratum	Sparse sedges including *Desmocladus myriocladus, Desmocladus quiricanus, Lepidosperma* species*, Desmocladus fasciculatus, Chordifex sphacelatus.* Isolated shrubs to 0.5m including *Calytrix leschenaultii, Verticordia plumosa, Leucopogon* sp. Conjinup*, Jacksonia racemosa, Beaufortia micrantha*, *Leucopogon obtusatus, Grevillea acuaria.* Rushes/perennial herbs - *Lomandra mucronata.* Herbs/forbs - *Stylidium repens, Conostylis petrophiloides.* Tussock grass - *Neurachne alopecuroidea.*
Comments	Areas of *Eremaea pauciflora* heathland (Er) in Lakeland NR 29023 grade into areas of *Eucalyptus perangusta* over shrubland (Ep) and are not typical of this vegetation type. These releves cluster with Ep releves in the PRIMER analysis. Typical Eremaea heathland (Er) is mapped in East Lake Bryde NR.

Eremaea pauciflora **heathland at Releve 64**

Eremaea pauciflora **heathland at Releve 70**

Isolated *Eucalyptus loxophleba* subsp. *gratiae* over shrubland Elox

Releves	**39**
Landform	Mid to upper slopes associated with granite.
Soils, topography	Gravelly sands and loams adjacent to granite, flat to gentle slope.
Condition	Excellent.

Vegetation Description

Mid stratum (M1)	Very sparse shrub mallee to 6m of *Eucalyptus loxophleba* subsp. *gratiae*
Mid stratum (M2+)	Mid dense shrubs to 3m with Melaleuca scalena prominent. Other species recorded include *Callitris preissii, Melaleuca laxiflora.*
Ground stratum (G1)	Very sparse shrubs to 1.0m including Melaleuca depauperata, *Phebalium tuberculosum, Westringia rigida, Hakea scoparia, Dodonaea bursariifolia, Leucopogon obtusatus, Olearia muelleri, Acacia acanthoclada.* Sedges - *Lepidosperma* species. Tussock grass - *Neurachne alopecuroidea.*

Isolated *Eucalyptus loxophleba* subsp. *gratiae* over shrubland at releve 39

Melaleuca shrubland M

Releves **7, 13, 22, 25, 31, 45, 51, 63, 69, 71, 78**

Landform Low lying areas, closed depressions, drainage lines, edge of salt lakes.

Soils, topography Silt and sandy soils over clay, clay soils, poorly drained.

Condition Excellent, some minor weeds and isolated *Tecticornia* species
Very Good in some areas.

Vegetation Description

Mid stratum (M1+) Mid dense shrubs usually over 2m (to 4m) occasionally to 1.5m including *Melaleuca lateriflora, Melaleuca halmaturorum, Melaleuca adenostyla, Melaleuca thyoides, Melaleuca 32acuminata, Melaleuca pauperiflora, Melaleuca hamulosa, Melaleuca atroviridis, Melaleuca brophyi* and *Melaleuca scalena.*

Ground stratum (G1) Isolated to sparse shrubs to 0.5m (occasionally 1.0m) including *Disphyma crassifolia, Threlkeldia diffusa, Enchylaena ?tomentosa, Sclerolaena diacantha, Rhagodia preissii, Darwinia* sp. Karonie*, Wilsonia humilis* and *Tecticornia* species.

Tussock grasses - *Austrostipa elegantissima,*Parapholis incurva* and **Avellinia michelii.*

Sedges - *Gahnia trifida.*

Forbs/herbs - *Calandrinia eremaea, Calandrinia granulifera, Angianthus pygmaeus, Carpobrotus modestus, Crassula colorata, Crassula exserta, Actinobole uliginosum, Podolepis capillaris, Pogonolepis muelleriana, Brachyscome pusilla, Siloxerus pygmaeus, Hydrocotyle callicarpa, *Mesembryanthemum nodiflorum* and **Ursinia anthemoides.*

Comments The presence of dead trees or mallee indicate areas that were woodland or mallee areas in the past.

***Melaleuca* shrubland at Releve 22**

***Melaleuca* shrubland at Releve 51**

Melaleuca shrubland - degraded Md

Releves	**18, 27, 61**
Landform	Low lying areas, valley floor.
Soils, topography	Silt and sandy soils over clay, clay soils, poorly drained.
Condition	Good to Very Good - weed invasion in some areas and some degradation due to water logging/salinity, dead shrubs.

Vegetation Description

Mid stratum (M1+)	Isolated to mid dense shrubs over 2m (to 4m) including *Melaleuca halmaturorum, Melaleuca lateriflora, Melaleuca adenostyla.*
Ground stratum (G1)	Isolated to sparse shrubs to 0.5m including *Disphyma crassifolia, Tecticornia pergranulata, Tecticornia species, Wilsonia rotundifolia* and *Wilsonia humilis.* Forbs/herbs including *Angianthus pygmaeus, Carpobrotus modestus, Pogonolepis muelleriana, Erymophyllum tenellum.* Areas of **Mesembryanthemum nodiflorum.*
Comments	Releve 18 is unusual with the presence of a sparse stratum of *Acacia redolens* shrubs to 2m. Areas where all *Melaleuca* shrubs have been dead for some time and samphire species are prominent are mapped as Te.

Degraded *Melaleuca* shrubland at Releve 18 with Acacia redolens shrubs

Degraded *Melaleuca* shrubland at Releve 27 with *Melaleuca halmaturorum* seedlings present.

Degraded *Melaleuca* shrubland at Releve 61

Wilsonia isolated shrubs W

Releve **5, 24, 76**

Landform Small closed depressions, valley floor.

Soils, topography Clay, silt - poorly drained.

Condition Excellent to Very Good, vegetation affected by dry season, kangaroo grazing and weeds especially **Mesembryanthemum nodiflorum.*

Vegetation Description

Ground stratum (G1+) Areas of mid dense shrubs to 10cms including *Wilsonia rotundifolia, Wilsonia humilis*, *Disphyma crassifolia.*

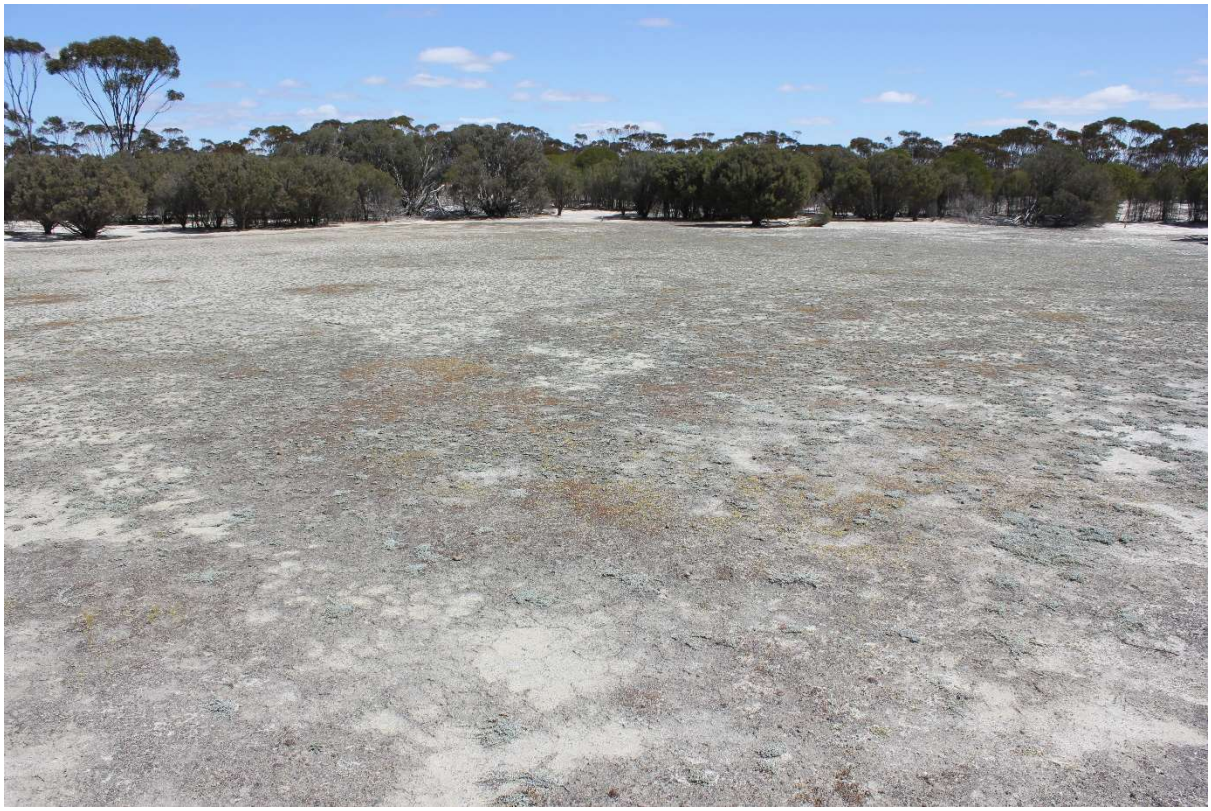
Forbs/herbs - *Angianthus pygmaeus, Senecio glossanthus, Calandrinia granulifera, Calandrinia eremaea, Crassula colorata* var. *acuminata*

Weed species - **Spergularia rubra, *Mesembryanthemum nodiflorum* prominent in some areas.

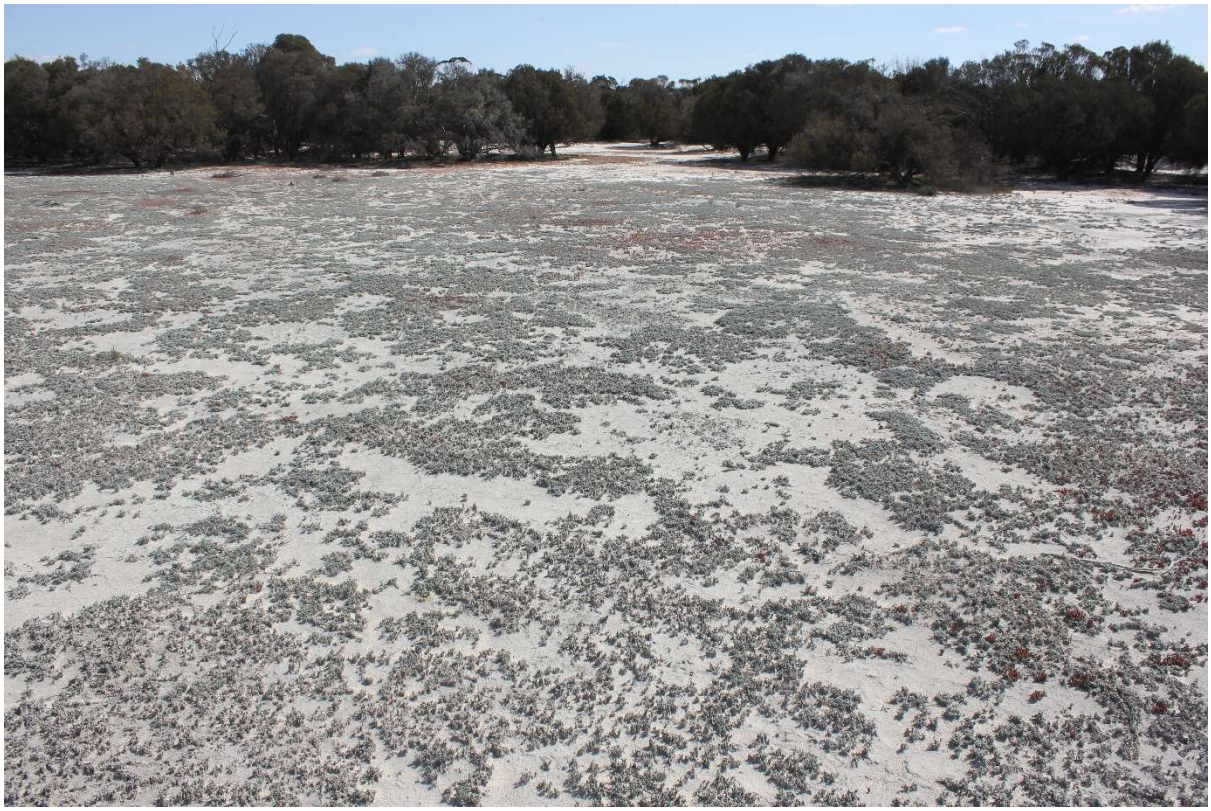
Sterile grasses.

Comments Patchy vegetation possibly more uniform in wetter season, *Melaleuca* shrubland adjacent.

***Wilsonia rotundifolia* and *Angianthus pygmaea* at** Releve 5



***Wilsonia* isolated shrubs at Releve 5**



***Wilsonia* isolated shrubs at Releve 24**

Samphire (*Tecticornia*) shrubland Te

Releve **12, 15, 20, 23, 30, 32, 35, 52, 68, 77**

Landform saline playa lake – lakebed.

Soils, topography Clay, silt - poorly drained salt lakes (?gypsum).

Condition Excellent to degraded, dead *Melaleuca* shrubs are present in some areas.

Vegetation Description

Ground Stratum (G1+) Very sparse to mid dense shrubs to 0.5m including *Tecticornia pergranulata, Tecticornia syncarpa, Tecticornia doliiformis, Tecticornia halocnemoides, Tecticornia indica subsp. bidens, Tecticornia lepidosperma, Disphyma crassifolia* and *Wilsonia humilis.*

Forbs/herbs - *Angianthus pygmaeus*, *Pogonolepis muelleriana*, *Isotoma scapigera, Senecio glossanthus, * Hypochaeris glabra, *Spergularia marina. *Mesembryanthemum nodiflorum- prominent in some areas*

Grass – **Parapholis incurva.*

Comments More information about specific wetlands is available in Table 9 and Appendix 9. Areas where *Melaleuca* shrubs have been dead for some time are mapped as Te (see Releve 68). These areas are classified as Degraded i.e. there is still some scope for regeneration but not to a state approaching good condition without intensive management.

Samphire (*Tecticornia*) shrubland at Releve 68 with dead *Melaleuca* shrubs

Samphire (*Tecticornia*) shrubland at Releve 23

Samphire (*Tecticornia*) shrubland at Releve 30

Granite complex

Herbland Gh

Releve	**10, 11**
Landform	granite outcrop and surrounds
Soils, topography	Shallow sandy soils over granite, soil pockets.
Condition	Excellent, some weed invasion.
Vegetation Description	
Ground stratum (G1+)	Mid dense herbs/forbs with *Borya constricta* prominent. Other species recorded include *Stylidium neglectum, Chamaescilla* species, *Stypandra glauca, Stylidium zeicolor, Pterochaeta paniculata.* Sparse sedges to 0.5m including *Lepidosperma* species*, Lepidobolus ?preissianus.* Very sparse to sparse shrubs to 0.5m including *Acacia patagiata, Baeckea latens, Verticordia picta, Platysace trachymenioides, Ericomyrtus serpyllifolia, Calytrix leschenaultii, Pimelea imbricata.* Grass - *Neurachne alopecuroidea, *Pentameris airoides.* Taller shrubs in adjacent areas include *Allocasuarina campestris*, *Calothamnus quadrifidus, Leptospermum* species.
Comments	The dry season has resulted in a lower number of annual herbs/forbs and geophytes than expected.

Granite complex – herbland at Releve 10

Granite complex – herbland at Releve 11

Appendix 6

Plant Species List

Plant Species List Lakeland Nature Reserve

Family Name	Weed	Taxa	Additions	Con Code
Aizoaceae		Carpobrotus modestus		
Aizoaceae		Disphyma crassifolium		
Aizoaceae	*	Mesembryanthemum nodiflorum		
Amaranthaceae		Ptilotus humilis	MT7 2011	
Apiaceae		Apium annuum		
Apiaceae		Platysace trachymenioides		
Apocynaceae		Alyxia buxifolia		
Araliaceae		Hydrocotyle callicarpa		
Araliaceae		Hydrocotyle diantha	MT17	
Araliaceae		Hydrocotyle rugulosa	MT15, 16, 17	
Araliaceae		Trachymene cyanopetala		
Asparagaceae		Chamaexeros fimbriata		
Asparagaceae		Chamaexeros serra		
Asparagaceae		Lomandra effusa		
Asparagaceae		Lomandra micrantha subsp. teretifolia		
Asparagaceae		Lomandra mucronata		
Asparagaceae		Lomandra rupestris	MT16, 17	
Asparagaceae		Thysanotus patersonii		
Asteraceae		Actinobole uliginosum		
Asteraceae		Angianthus pygmaeus		
Asteraceae		Blennospora drummondii	MT16	
Asteraceae		Brachyscome ciliaris		
Asteraceae		Brachyscome pusilla		
Asteraceae		Ceratogyne obionoides	MT7 2011	
Asteraceae	*	Cotula bipinnata	MT14, 15	
Asteraceae		Cotula cotuloides	MT14, 17	
Asteraceae		Erymophyllum tenellum		
Asteraceae		Gnephosis drummondii	MT14, 15	
Asteraceae		Helichrysum leucopsideum		
Asteraceae	*	Hypochaeris glabra		
Asteraceae		Olearia muelleri		
Asteraceae		Olearia ramosissima		
Asteraceae		Olearia sp. Eremicola (Diels & Pritzel s.n. PERTH 00449628)		
Asteraceae		Ozothamnus lepidophyllus		
Asteraceae		Podolepis capillaris		
Asteraceae		Podotheca angustifolia	MT16, MT16 2013	
Asteraceae		Pogonolepis muelleriana		

Asteraceae		Pterochaeta paniculata		
Asteraceae		Rhodanthe laevis	PI19	
Asteraceae		Senecio glossanthus		
Asteraceae		Siloxerus pygmaeus		
Asteraceae	*	Ursinia anthemoides		
Asteraceae		Waitzia acuminata		
Boraginaceae		Halgania anagalloides		
Boryaceae		Borya constricta		
Brassicaceae		Lepidium rotundum	MT17 2013	
Brassicaceae		Stenopetalum sphaerocarpum		
Campanulaceae		Isotoma scapigera		
Campanulaceae		Lobelia ?cleistogamoides	MT15 2013	
Campanulaceae		Lobelia ?heterophylla	MT14	
Campanulaceae		Wahlenbergia preissii	MT7	
Caryophyllaceae		Spergularia marina		
Caryophyllaceae	*	Spergularia rubra		
Casuarinaceae		Allocasuarina acutivalvis		
Casuarinaceae		Allocasuarina campestris		
Casuarinaceae		Allocasuarina corniculata		
Casuarinaceae		Allocasuarina microstachya		
Casuarinaceae		Allocasuarina spinosissima		
Celastraceae		Psammomoya choretroides		
Centrolepidaceae		Centrolepis humillima		
Chenopodiaceae		Atriplex ?vesicaria		
Chenopodiaceae		Atriplex semibaccata	MT7, 14	
Chenopodiaceae		Didymanthus roei		
Chenopodiaceae		Enchylaena lanata		
Chenopodiaceae		Maireana brevifolia		
Chenopodiaceae		Rhagodia crassifolia	MT16, 17	
Chenopodiaceae		Rhagodia drummondii		
Chenopodiaceae		Rhagodia preissii		
Chenopodiaceae		Salicornia blackiana	MT14, 15	
Chenopodiaceae		Salicornia quinqueflora	MT15, 17	
Chenopodiaceae		Sclerolaena diacantha		
Chenopodiaceae		Tecticornia doliiformis		
Chenopodiaceae		Tecticornia halocnemoides		
Chenopodiaceae		Tecticornia indica subsp. bidens		
Chenopodiaceae		Tecticornia lepidosperma		
Chenopodiaceae		Tecticornia pergranulata		
Chenopodiaceae		Tecticornia syncarpa		
Chenopodiaceae		Threlkeldia diffusa		
Convolvulaceae		Wilsonia humilis		

Convolvulaceae		Wilsonia rotundifolia		
Crassulaceae		Crassula colorata var. acuminata		
Crassulaceae		Crassula exserta		
Cupressaceae		Callitris preissii		
Cupressaceae		Callitris roei		
Cyperaceae		Gahnia ancistrophylla		
Cyperaceae		Gahnia sp. South West (K.L. Wilson & K. Frank KLW 9266)	MT14,15	
Cyperaceae		Gahnia trifida		
Cyperaceae		Isolepis marginata	MT14 2011	
Cyperaceae		Lepidosperma pruinosum		
Cyperaceae		Lepidosperma sanguinolentum		
Cyperaceae		Lepidosperma sp. Bandalup Scabrid (N. Evelegh 10798)		
Cyperaceae		Lepidosperma sp. Ravensthorpe (G.F. Craig 5188)		
Cyperaceae		Mesomelaena preissii		
Cyperaceae		Schoenus calcatus	MT15 2011	
Cyperaceae		Schoenus nanus	PI19	
Dasypogonaceae		Calectasia valida		
Dilleniaceae		Hibbertia gracilipes		
Dilleniaceae		Hibbertia psilocarpa	MT13	
Dilleniaceae		Hibbertia pungens		
Ericaceae		Andersonia lehmanniana		
Ericaceae		Astroloma serratifolium		
Ericaceae		Coleanthera myrtoides		
Ericaceae		Conostephium preissii		
Ericaceae		Conostephium roei		
Ericaceae		Leucopogon ?fimbriatus	MT16, 17	
Ericaceae		Leucopogon dielsianus		
Ericaceae		Leucopogon obtusatus		
Ericaceae		Leucopogon sp. Coujinup (M.A. Burgman 1085)		
Ericaceae		Leucopogon sp. Kau Rock (M.A. Burgman 1126)		
Ericaceae		Leucopogon sp. Newdegate (M. Hislop 3585)		
Ericaceae		Leucopogon sp. Wheatbelt (S. Murray 257)		
Ericaceae		Styphelia chlorantha		2
Euphorbiaceae		Bertya dimerostigma		
Euphorbiaceae		Beyeria sulcata		
Fabaceae		Acacia acanthoclada		

Fabaceae		Acacia acutata		
Fabaceae		Acacia bidentata		
Fabaceae		Acacia erinacea		
Fabaceae		Acacia evenulosa		
Fabaceae		Acacia hemiteles		
Fabaceae		Acacia lasiocarpa		
Fabaceae		Acacia leptopetala		
Fabaceae		Acacia leptospermoides	PI19	
Fabaceae		Acacia multispicata		
Fabaceae		Acacia mutabilis subsp. stipulifera	MT14 MT14 2011	3
Fabaceae		Acacia patagiata		
Fabaceae		Acacia pulchella var. glaberrima		
Fabaceae		Acacia redolens		
Fabaceae		Acacia sulcata		
Fabaceae		Acacia uncinella		
Fabaceae		Acacia verriculum		
Fabaceae		Acacia viscifolia		
Fabaceae		Bossiaea halophila		
Fabaceae		Chorizema aciculare		
Fabaceae		Daviesia aphylla		
Fabaceae		Daviesia incrassata		
Fabaceae		Daviesia lancifolia		
Fabaceae		Daviesia scoparia		
Fabaceae		Dillwynia sp. Mallee (W.R. Archer 1709959)		
Fabaceae		Eutaxia nanophylla	MT17 2013	3
Fabaceae		Gastrolobium cruciatum		3
Fabaceae		Gastrolobium musaceum		
Fabaceae		Gastrolobium punctatum		
Fabaceae		Jacksonia racemosa		
Fabaceae		Mirbelia multicaulis		
Fabaceae		Mirbelia trichocalyx		
Fabaceae		Pultenaea empetrifolia		
Fabaceae		Senna artemisioides subsp. x artemisioides		
Fabaceae		Templetonia rossii		
Frankeniaceae		Frankenia drummondii		3
Goodeniaceae		Coopernookia strophiolata		
Goodeniaceae		Dampiera lavandulacea		
Goodeniaceae		Dampiera orchardii	MT15	2
Goodeniaceae		Dampiera sacculata		
Haemodoraceae		Conostylis argentea		

Haemodoraceae		Conostylis petrophiloides		
Haloragaceae		Glischrocaryon roei		
Hemerocallidaceae		Dianella revoluta		
Hemerocallidaceae		Stypandra glauca		
Hemerocallidaceae		Tricoryne tenella		
Juncaginaceae		Triglochin minutissima	MT17	
Lamiaceae		Dicrastylis corymbosa		
Lamiaceae		Hemiphora lanata		
Lamiaceae		Microcorys ?subcanescens		
Lamiaceae		Microcorys exserta		
Lamiaceae		Microcorys sp. stellate (A. Strid 21885)		
Lamiaceae		Prostanthera serpyllifolia subsp. microphylla		
Lamiaceae		Westringia cephalantha		
Lamiaceae		Westringia rigida		
Lauraceae		Cassytha glabella		
Lauraceae		Cassytha melantha		
Malvaceae		Lasiopetalum rosmarinifolium		
Malvaceae		Lawrencia diffusa		
Montiaceae		Calandrinia calyptrata	MT16, 17	
Montiaceae		Calandrinia eremaea		
Montiaceae		Calandrinia granulifera		
Myrtaceae		Astus subroseus	MT14	
Myrtaceae		Baeckea latens		
Myrtaceae		Beaufortia micrantha		
Myrtaceae		Beaufortia puberula		
Myrtaceae		Calothamnus quadrifidus		
Myrtaceae		Calytrix leschenaultii		
Myrtaceae		Calytrix simplex subsp. suboppositifolia		
Myrtaceae		Chamelaucium ciliatum		
Myrtaceae		Cyathostemon tenuifolius		
Myrtaceae		Darwinia sp. Karonie (K. Newbey 8503)		
Myrtaceae		Darwinia sp. Lake Cobham (K. Newbey 3262)		
Myrtaceae		Eremaea pauciflora		
Myrtaceae		Ericomyrtus serpyllifolia		
Myrtaceae		Eucalyptus ?olivina		
Myrtaceae		Eucalyptus ?rigidula		
Myrtaceae		Eucalyptus albida		
Myrtaceae		Eucalyptus alipes		
Myrtaceae		Eucalyptus calycogona		
Myrtaceae		Eucalyptus captiosa		

Myrtaceae		Eucalyptus celastroides		
Myrtaceae		Eucalyptus dissimulata		
Myrtaceae		Eucalyptus flocktoniae		
Myrtaceae		Eucalyptus kondininensis		
Myrtaceae		Eucalyptus loxophleba subsp. gratiae		
Myrtaceae		Eucalyptus neutra		
Myrtaceae		Eucalyptus perangusta		
Myrtaceae		Eucalyptus phaenophylla		
Myrtaceae		Eucalyptus phenax		
Myrtaceae		Eucalyptus pileata		
Myrtaceae		Eucalyptus salicola		
Myrtaceae		Eucalyptus salmonophloia		
Myrtaceae		Eucalyptus salubris		
Myrtaceae		Eucalyptus sp. Southern Wheatbelt (D. Nicolle & M. French DN 5507)		
Myrtaceae		Eucalyptus sporadica		
Myrtaceae		Eucalyptus suggrandis subsp. promiscua		
Myrtaceae		Eucalyptus tenera		
Myrtaceae		Eucalyptus uncinata		
Myrtaceae		Kunzea jucunda		
Myrtaceae		Leptospermum erubescens		
Myrtaceae		Leptospermum incanum		
Myrtaceae		Melaleuca acuminata		
Myrtaceae		Melaleuca adenostyla		
Myrtaceae		Melaleuca adnata		
Myrtaceae		Melaleuca apodocephala		
Myrtaceae		Melaleuca atroviridis		
Myrtaceae		Melaleuca brophyi		
Myrtaceae		Melaleuca carrii		
Myrtaceae		Melaleuca depauperata		
Myrtaceae		Melaleuca halmaturorum		
Myrtaceae		Melaleuca hamulosa		
Myrtaceae		Melaleuca lateralis		
Myrtaceae		Melaleuca lateriflora		
Myrtaceae		Melaleuca laxiflora		
Myrtaceae		Melaleuca lecanantha		
Myrtaceae		Melaleuca marginata		
Myrtaceae		Melaleuca pauperiflora		
Myrtaceae		Melaleuca platycalyx		
Myrtaceae		Melaleuca rigidifolia		
Myrtaceae		Melaleuca sapientes		
Myrtaceae		Melaleuca scalena		

Myrtaceae		Melaleuca sculponeata		3
Myrtaceae		Melaleuca spicigera		
Myrtaceae		Melaleuca subtrigona		
Myrtaceae		Melaleuca thyoides		
Myrtaceae		Melaleuca tuberculata		
Myrtaceae		Melaleuca villosisepala		
Myrtaceae		Micromyrtus triptycha		
Myrtaceae		Rinzia affinis		4
Myrtaceae		Rinzia communis		
Myrtaceae		Verticordia acerosa var. preissii		
Myrtaceae		Verticordia chrysantha		
Myrtaceae		Verticordia eriocephala		
Myrtaceae		Verticordia grandiflora		
Myrtaceae		Verticordia picta		
Myrtaceae		Verticordia plumosa		
Myrtaceae		Verticordia roei		
Myrtaceae		Verticordia tumida subsp. therogana		
Phyllanthaceae		Poranthera microphylla	MT14 2011	
Pittosporaceae		Billardiera lehmanniana	MT16	
Pittosporaceae		Billardiera venusta		
Pittosporaceae		Cheiranthera filifolia		
Plantaginaceae	*	Plantago coronopus subsp. commutata	MT13,	
Poaceae		Austrostipa elegantissima		
Poaceae		Austrostipa exilis	MT7, 13, 14, 15, 17	
Poaceae		Austrostipa hemipogon	MT13, 16, 17	
Poaceae		Austrostipa pycnostachya	MT14	
Poaceae		Austrostipa trichophylla		
Poaceae	*	Avellinia michelii		
Poaceae	*	Hordeum glaucum	MT7 2011	
Poaceae		Neurachne alopecuroidea		
Poaceae	*	Parapholis incurva		
Poaceae	*	Pentameris airoides		
Poaceae		Rytidosperma acerosum	MT14	
Poaceae		Rytidosperma caespitosum	MT16, 17	
Poaceae	*	Vulpia bromoides	MT	
Poaceae	*	Vulpia myuros forma myuros	MT17	
Polygalaceae		Comesperma integerrimum		
Polygalaceae		Comesperma scoparium		
Polygalaceae		Comesperma spinosum		
Proteaceae		Banksia erythrocephala		
Proteaceae		Banksia xylothemelia		3

Proteaceae		Grevillea acuaria		
Proteaceae		Grevillea cagiana		
Proteaceae		Grevillea hookeriana		
Proteaceae		Grevillea huegelii		
Proteaceae		Grevillea newbeyi		3
Proteaceae		Grevillea oligantha		
Proteaceae		Grevillea teretifolia		
Proteaceae		Hakea commutata		
Proteaceae		Hakea corymbosa		
Proteaceae		Hakea cygna		
Proteaceae		Hakea erecta		
Proteaceae		Hakea horrida		
Proteaceae		Hakea incrassata		
Proteaceae		Hakea lissocarpha		
Proteaceae		Hakea meisneriana	PI19	
Proteaceae		Hakea multilineata		
Proteaceae		Hakea newbeyana		
Proteaceae		Hakea scoparia		
Proteaceae		Hakea strumosa		
Proteaceae		Hakea subsulcata		
Proteaceae		Isopogon scabriusculus		
Proteaceae		Isopogon sp. Fitzgerald River (D.B. Foreman 813)		
Proteaceae		Isopogon teretifolius		
Proteaceae		Persoonia brevirhachis		3
Proteaceae		Persoonia coriacea		
Proteaceae		Persoonia teretifolia		
Proteaceae		Petrophile circinata		
Proteaceae		Petrophile ericifolia		
Proteaceae		Petrophile glauca		
Proteaceae		Petrophile media		
Proteaceae		Petrophile seminuda		
Proteaceae		Petrophile squamata subsp. northern (J. Monks 40)		
Proteaceae		Synaphea ?spinulosa		
Restionaceae		Chordifex sphacelatus		
Restionaceae		Desmocladus asper		
Restionaceae		Desmocladus myriocladus		
Restionaceae		Desmocladus parthenicus		
Restionaceae		Desmocladus quiricanus		
Restionaceae		Lepidobolus preissianus		
Rhamnaceae		Cryptandra leucopogon		

Rhamnaceae		Cryptandra minutifolia		
Rhamnaceae		Spyridium mucronatum		
Rhamnaceae		Trymalium elachophyllum		
Rutaceae		Boronia coerulescens subsp. spinescens		
Rutaceae		Boronia crassifolia		
Rutaceae		Microcybe multiflora		
Rutaceae		Phebalium ?megaphyllum		
Rutaceae		Phebalium filifolium		
Rutaceae		Phebalium lepidotum		
Rutaceae		Phebalium obovatum		
Rutaceae		Phebalium tuberculosum		
Santalaceae		Exocarpos aphyllus		
Santalaceae		Leptomeria preissiana		
Santalaceae		Santalum acuminatum		
Sapindaceae		Dodonaea bursariifolia		
Sapindaceae		Dodonaea stenozyga		
Sapindaceae		Dodonaea viscosa subsp. spatulata		
Scrophulariaceae		Eremophila decipiens		
Stylidiaceae		Stylidium dichotomum		
Stylidiaceae		Stylidium neglectum		
Stylidiaceae		Stylidium repens		
Stylidiaceae		Stylidium zeicolor		
Thymelaeaceae		Pimelea ?aeruginosa		
Thymelaeaceae		Pimelea imbricata var. piligera		
Xanthorrhoeaceae		Chamaescilla corymbosa		
Xanthorrhoeaceae		Chamaescilla ?spiralis		

Appendix 7

Department of Biodiversity Conservation and Attractions
Parks and Wildlife Service

CONSERVATION CODES
For the Western Australian Flora and Fauna

Department of
Parks and Wildlife

CONSERVATION CODES

For Western Australian Flora and Fauna

Specially protected fauna or flora are species* which have been adequately searched for and are deemed to be, in the wild, either rare, at risk of extinction, or otherwise in need of special protection, and have been gazetted as such.

Categories of specially protected fauna and flora are:

T **Threatened species**

Published as Specially Protected under the *Wildlife Conservation Act 1950,* and listed under Schedules 1 to 4 of the Wildlife Conservation (Specially Protected Fauna) Notice for Threatened Fauna and Wildlife Conservation (Rare Flora) Notice for Threatened Flora (which may also be referred to as Declared Rare Flora).

Threatened fauna is that subset of 'Specially Protected Fauna' declared to be 'likely to become extinct' pursuant to section 14(4) of the Wildlife Conservation Act.

Threatened flora is flora that has been declared to be 'likely to become extinct or is rare, or otherwise in need of special protection', pursuant to section 23F(2) of the Wildlife Conservation Act.

The assessment of the conservation status of these species is based on their national extent and ranked according to their level of threat using IUCN Red List categories and criteria as detailed below.

CR **Critically endangered species**

Threatened species considered to be facing an extremely high risk of extinction in the wild. Published as Specially Protected under the *Wildlife Conservation Act 1950,* in Schedule 1 of the Wildlife Conservation (Specially Protected Fauna) Notice for Threatened Fauna and Wildlife Conservation (Rare Flora) Notice for Threatened Flora.

EN **Endangered species**

Threatened species considered to be facing a very high risk of extinction in the wild. Published as Specially Protected under the *Wildlife Conservation Act 1950,* in Schedule 2 of the Wildlife Conservation (Specially Protected Fauna) Notice for Threatened Fauna and Wildlife Conservation (Rare Flora) Notice for Threatened Flora.

VU **Vulnerable species**

Threatened species considered to be facing a high risk of extinction in the wild. Published as Specially Protected under the *Wildlife Conservation Act 1950,* in Schedule 3 of the Wildlife Conservation (Specially Protected Fauna) Notice for Threatened Fauna and Wildlife Conservation (Rare Flora) Notice for Threatened Flora.

EX **Presumed extinct species**

Species which have been adequately searched for and there is no reasonable doubt that the last individual has died. Published as Specially Protected under the *Wildlife Conservation Act 1950,* in Schedule 4 of the Wildlife Conservation (Specially Protected Fauna) Notice for Presumed Extinct Fauna and Wildlife Conservation (Rare Flora) Notice for Presumed Extinct Flora.

IA **Migratory birds protected under an international agreement**

Birds that are subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and The Republic of Korea (ROKAMBA), and the Bonn Convention, relating to the protection of migratory birds. Published as Specially Protected under the *Wildlife Conservation Act 1950,* in Schedule 5 of the Wildlife Conservation (Specially Protected Fauna) Notice.

CD **Conservation dependent fauna**

Fauna of special conservation need being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened. Published as Specially Protected under the *Wildlife Conservation Act 1950,* in Schedule 6 of the Wildlife Conservation (Specially Protected Fauna) Notice.

OS **Other specially protected fauna**

Fauna otherwise in need of special protection to ensure their conservation. Published as Specially Protected under the *Wildlife Conservation Act 1950,* in Schedule 7 of the Wildlife Conservation (Specially Protected Fauna) Notice.

P **Priority species**

Possibly threatened species that do not meet survey criteria, or are otherwise data deficient, are added to the Priority Fauna or Priority Flora Lists under Priorities 1, 2 or 3. These three categories are ranked in order of priority for survey and evaluation of conservation status so that consideration can be given to their declaration as threatened flora or fauna.

Species that are adequately known, are rare but not threatened, or meet criteria for near threatened, or that have been recently removed from the threatened species or other specially protected fauna lists for other than taxonomic reasons, are placed in Priority 4. These species require regular monitoring.

Assessment of Priority codes is based on the Western Australian distribution of the species, unless the distribution in WA is part of a contiguous population extending into adjacent States, as defined by the known spread of locations.

1 **Priority 1: Poorly-known species**

Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.

2 **Priority 2: Poorly-known species**

Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.

3 **Priority 3: Poorly-known species**

Species that are known from several locations, and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.

4 **Priority 4: Rare, Near Threatened and other species in need of monitoring**

(a) Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These species are usually represented on conservation lands.
(b) Near Threatened. Species that are considered to have been adequately surveyed and that are close to qualifying for Vulnerable, but are not listed as Conservation Dependent.
(c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.

*Species includes all taxa (plural of taxon - a classificatory group of any taxonomic rank, e.g. a family, genus, species or any infraspecific category i.e. subspecies or variety, or a distinct population).

Appendix 8

Priority Flora Coordinates

Taxa		Releve/WP	Latitude	Longitude
Styphelia chlorantha	P2	Releve 4	-33.308215	118.776545
Styphelia chlorantha	P2	Releve 8	-33.314442	118.772934
Styphelia chlorantha	P2	Releve 26	-33.294473	118.753657
Styphelia chlorantha	P2	WP 671	-33.288619	118.762199
Banksia xylothemelia	P3	Releve 2	-33.310366	118.779965
Banksia xylothemelia	P3	Releve 3	-33.309941	118.778115
Banksia xylothemelia	P3	Releve 33	-33.287414	118.758424
Banksia xylothemelia	P3	WP 231	-33.287121	118.752476
Banksia xylothemelia	P3	Releve 46	-33.314104	118.785129
Banksia xylothemelia	P3	WP 467	-33.278325	118.743516
Banksia xylothemelia	P3	Releve 54	-33.281185	118.744448
Frankenia drummondii	P3	WP 191	-33.289177	118.75142
Frankenia drummondii	P3	WP 538	-33.290391	118.745981
Gastrolobium cruciatum	P3	Releve 33	-33.287414	118.758424
Grevillea newbeyi	P3	WP 15	-33.309883	118.782351
Grevillea newbeyi	P3	Releve 43	-33.301216	118.763214
Melaleuca sculponeata	P3	Releve 43	-33.301216	118.763214
Melaleuca sculponeata	P3	Releve 44	-33.298515	118.761142
Melaleuca sculponeata	P3	Releve 45	-33.298988	118.757282
Persoonia brevirhachis	P3	Releve 33	-33.287414	118.758424
Persoonia brevirhachis	P3	Releve 36	-33.286812	118.750121
Persoonia brevirhachis	P3	WP 467	-33.278325	118.743516
Persoonia brevirhachis	P3	Releve 54	-33.281185	118.744448
Spyridium mucronatum subsp. recurvum	P3	Releve 6	-33.309622	118.773949
Spyridium mucronatum subsp. recurvum	P3	Releve 8	-33.314442	118.772934
Spyridium mucronatum subsp. recurvum	P3	Releve 19	-33.313426	118.765859
Spyridium mucronatum subsp. recurvum	P3	Releve 74	-33.298189	118.765615
Spyridium mucronatum subsp. recurvum	P3	WP 338	-33.30228	118.776095
Spyridium mucronatum subsp. recurvum	P3	WP 472	-33.280003	118.743976
Rinzia affinis	P4	Releve 2	-33.310366	118.779965

Appendix 9

Wetlands

Lakeland Nature Reserve 29023

Wetland 34 Low lying area

WP/Releve	Vegetation Description	Characteristic Species	Soils, topography	Condition
Not visited in field	***Tecticornia* shrubland Te** Dead *Melaleuca* shrubs	*Tecticornia* species	Flat terrain clay, poorly drained	Degraded past water logging

Wetland 35 Saline Playa Lake

WP/Releve	Vegetation Description	Characteristic Species	Soils, topography	Condition
192 Eastern edge	***Tecticornia* shrubland Te** Shrubs to 30cms, Scattered, 30-70% canopy cover under dead *Melaleuca* shrubs	*Tecticornia pergranulata*	Edge of lake - flat terrain Clay, silt, poorly drained	Degraded past waterlogging
193 Central point	**Bare lake bed**		lake bed clay, silt poorly drained	Degraded past waterlogging

Wetland 35 – eastern edge of lake

Wetland 35 with *Melaleuca* shrubland north and Mallee in background

Wetland 35 – bare lake with *Eucalyptus kondininensis* woodland east

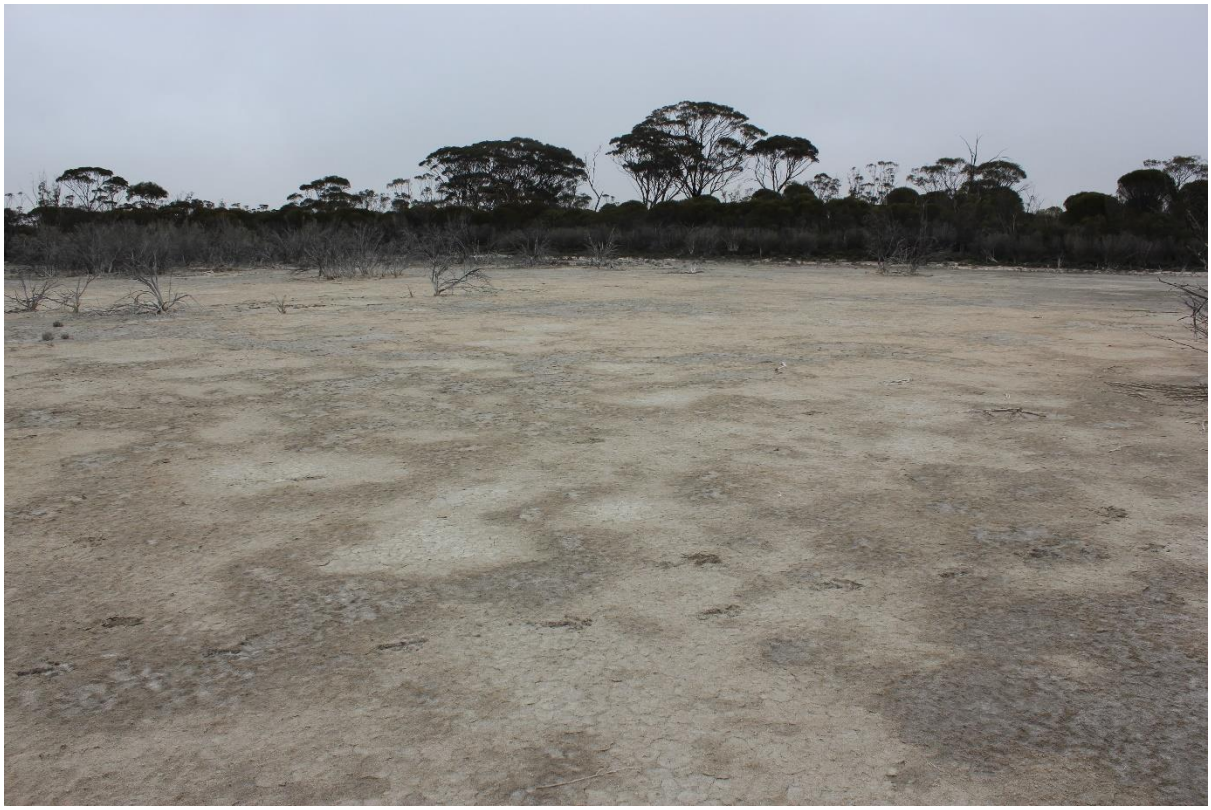
Wetland 35 – bare lakebed ?gypsum, clay and silt WP 193

Wetland 36 Saline Playa Lake

WP/Releve	Vegetation Description	Characteristic Species	Soils, topography	Condition
Releve 35 Northern edge	***Tecticornia* shrubland Te** 10-30% canopy cover dead *Melaleuca* shrubs	*Tecticornia pergranulata*	Edge of lake - flat terrain Clay, silt, poorly drained	Degraded past waterlogging
225 Northern side	***Melaleuca* shrubland M**	*Melaleuca lateriflora* and *Melaleuca adenostyla*	Clay soils, poorly drained	Excellent condition
227 central point	Bare lake bed		Clay soils, silt, poorly drained	Degraded past waterlogging

Wetland 36 - northern side with *Melaleuca* shrubland in foreground looking SW

Wetland 36 - Releve 35 – Te with dead *Melaleuca* shrubs



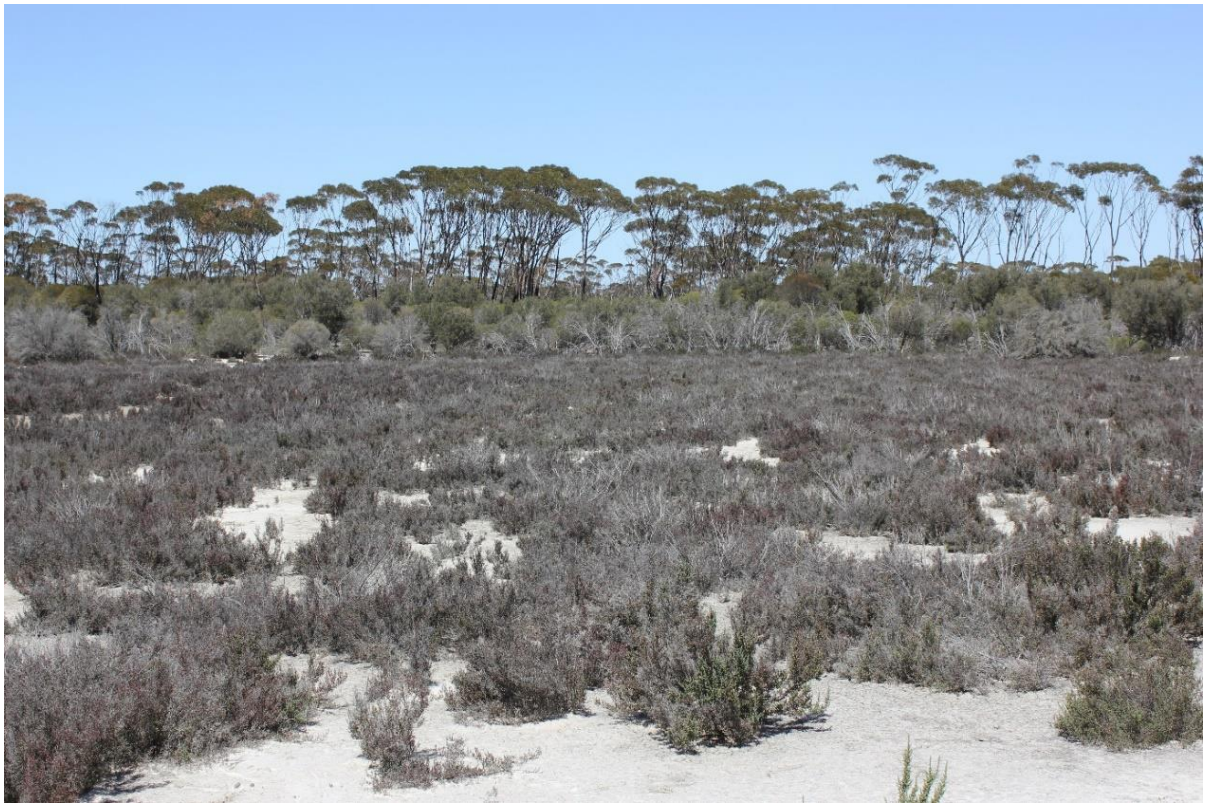
Wetland 36 - WP 227 bare lake bed. Area of *Eucalyptus kondininensis* woodland west side

Wetland 36 – bare lake bed with dead *Melaleuca* shrubs

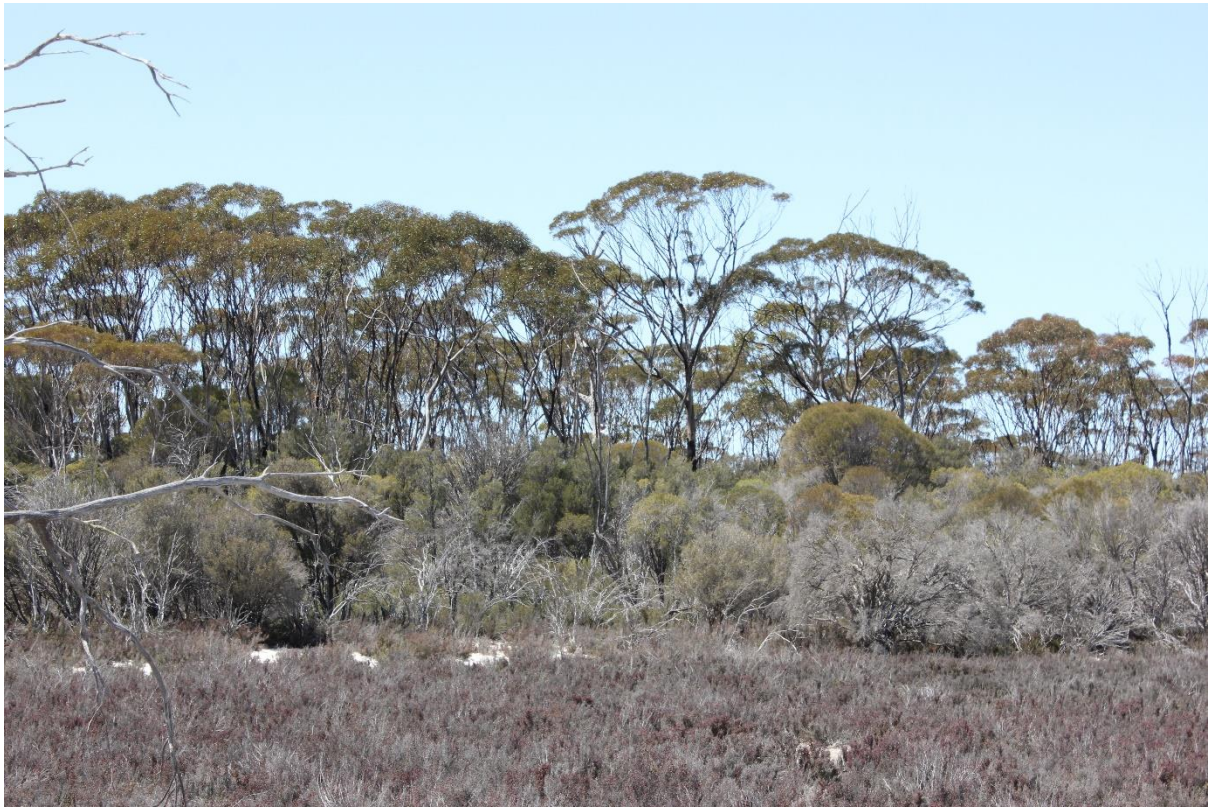
Wetland 37 Small Closed Depression

WP/Releve	Vegetation Description	Characteristic Species	Soils, topography	Condition
Releve 30 Eastern edge	***Tecticornia* shrubland Te** 30-70 % canopy cover	*Tecticornia syncarpa*	Salt, clay, silt, ?gypsum, poorly drained	Very Good
173 Northern side	***Melaleuca* shrubland M** 2-3m, 30-70% canopy cover dead *Melaleuca* shrubs edge only	*Melaleuca halmaturorum, Melaleuca atroviridis, Melaleuca acuminata, *Mesembryanthemum nodiflorum*	Clay soils, poorly drained	Excellent condition

Wetland 37 with *Eucalyptus kondininensis* woodland to the south east



Wetland 37 with *Eucalyptus kondininensis* woodland to the south east



Wetland 37 with *Eucalyptus kondininensis* woodland south and east and *Melaleuca* shrubland surrounding the wetland

Wetland 38 Closed Depression

WP/Releve	Vegetation Description	Characteristic Species	Soils, topography	Condition
Releve 27 Central point	***Melaleuca* shrubland - degraded Md** *Melaleuca* shrubs to 1m regeneration Dead shrubs to 4m	*Tecticornia pergranulata, Wilsonia rotundifolia, *Mesembryanthemum nodiflorum, Angianthus pygmaeus, Melaleuca halmaturorum*	Shallow sandy soils over clay, poorly drained	Good Past waterlogging weeds
155 North **159 south east**	***Melaleuca* shrubland M** 30-70% canopy cover dead *Melaleuca* shrubs edge	*155 - Melaleuca lateriflora, Melaleuca halmaturorum, Melaleuca thyoides* 159 - *Melaleuca adenostyla, Melaleuca thyoides, Eremophila decipiens*	Clay soils, poorly drained	Excellent condition

Wetland 38 - *Melaleuca halmaturorum* seedlings to 1m, **Mesembryanthemum nodiflorum, Angianthus pygmaeus and Wilsonia rotundifolia*

Wetland 38 - **Mesembryanthemum nodiflorum, Tecticornia perangusta,* dead shrubs

Wetland 38 - *Wilsonia rotundifolia, *Mesembryanthemum nodiflorum*

Wetland 39 Saline playa lake

WP/Releve	Vegetation Description	Characteristic Species	Soils, topography	Condition
90 central point	***Tecticornia* shrubland Te** 10-30% canopy cover	*Tecticornia syncarpa*	Sandy loam, silt and ?gypsum over clay, poorly drained	Degraded Track through middle Past waterlogging weeds
91 south western edge	***Melaleuca* shrubland - degraded Md** dead *Melaleuca* shrubs to 3m edge	*Melaleuca* species mostly dead *Tecticornia* species **Mesembryanthemum nodiflorum, Angianthus pygmaeus,* Pogonolepis muelleriana	Clay soils, poorly drained	Degraded Past waterlogging

Wetland 39 – sparse *Tecticornia* shrubs

Wetland 39 – sparse *Tecticornia* shrubs

Wetland 39 – Degraded *Melaleuca* shrubland with dead *Melaleuca* shrubs on the edges of the wetland

Wetland 40 Saline playa lake

WP/Releve	Vegetation Description	Characteristic Species	Soils, topography	Condition
Releve 15 eastern edge	***Tecticornia* shrubland Te** 10-30% canopy cover **Herbs/forbs** 30-70% canopy cover	*Tecticornia pergranulata, Tecticornia halocnemoides*, **Mesembryanthemum nodiflorum, Angianthus pygmaeus*	Sandy loam, silt and ?gypsum over clay, poorly drained	Good Some dead shrubs weeds
97 north **101 south east**	***Melaleuca* shrubland M** Surrounding to 3m Dead shrubs edge	97 – *Melaleuca atroviridis, Melaleuca lateriflora, Melaleuca halmaturorum*, **Mesembryanthemum nodiflorum, Angianthus pygmaeus, Wilsonia humilis* 101 - *Melaleuca halmaturorum, Melaleuca lateriflora*	Clay soils, poorly drained	Excellent dead shrubs edge weed
99 north eastern area	Lakebed Bare of vegetation		Sandy loam, silt and ?gypsum over clay, poorly drained	Degraded Past waterlogging

Wetland 40 - WP 99 bare lakebed. *Melaleuca* shrubland at the edge of the wetland and *Eucalyptus kondininensis* to the north

Wetland 40 - Edge lake with dead *Melaleuca* shrubs (north eastern section)

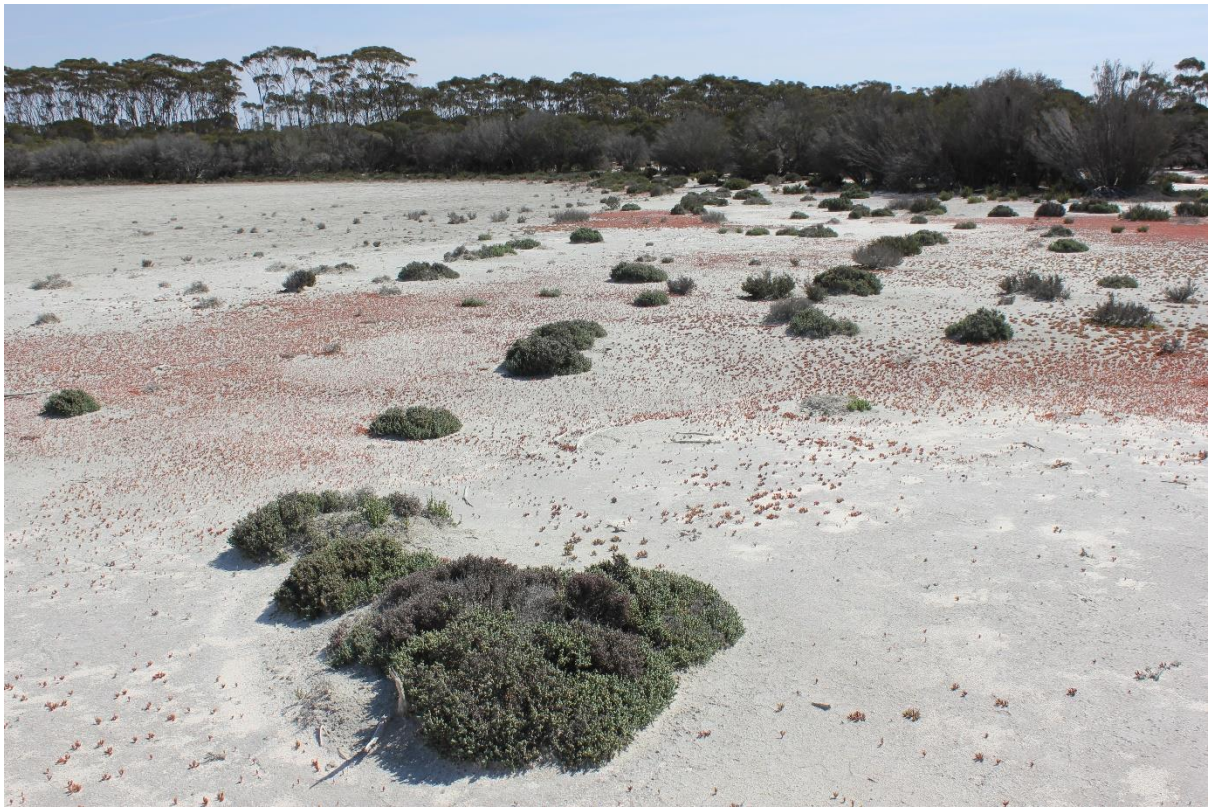
Wetland 40 - Edge lake dead *Melaleuca* shrubs north eastern section

Wetland 40 - Edge lake *Melaleuca* shrubs, north eastern section

Wetland 40 - *Melaleuca* shrubland WP97 north of wetland

Wetland 40 - *Melaleuca* shrubland WP101 south eastern edge of wetland

Wetland 40 - **Mesembryanthemum nodiflorum* and *Angianthus pygmaeus,*



Wetland 40 – Releve 15 eastern edge

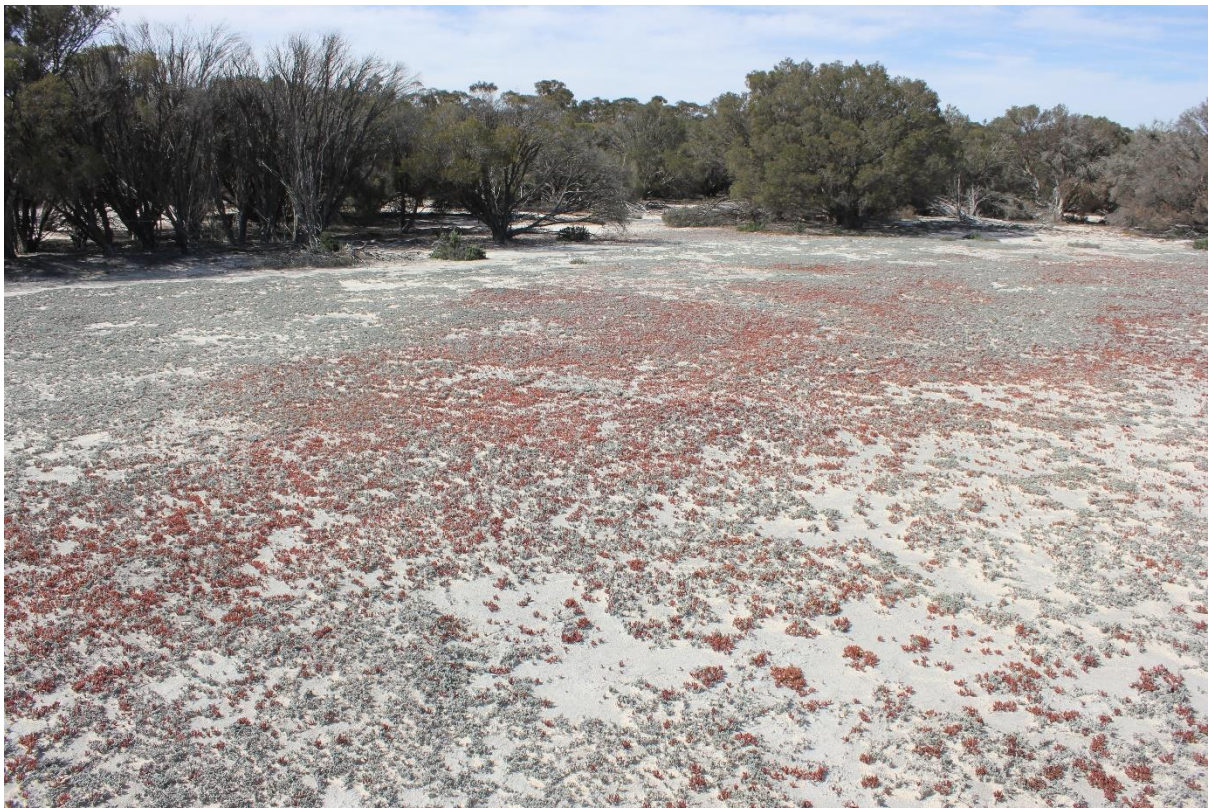
Wetland 40 – Releve 15 eastern edge

Wetland 41 Small Closed Depression

WP/Releve	Vegetation Description	Characteristic Species	Soils, topography	Condition
Releve 24 Western half	***Wilsonia* isolated shrubs W**	Wilsonia hunilis, **Mesembryanthemum nodiflorum, Angianthus pygmaeus*, Senecio glossanthus	Sandy loam, silt over clay, poorly drained	Very Good
Releve 23 Eastern half	***Tecticornia* shrubland Te** 30-70% canopy cover	*Tecticornia syncarpa, Wilsonia humilis, Isotoma scapigera, Angianthus pygmaeus, Senecio ?glossanthus,*	Saline, sandy loam, silt over clay, poorly drained	Good Past waterlogging Kangaroo grazing weeds
Edge south west	***Melaleuca* shrubland M** Surrounding on higher ground Shrubs to 2.5m Dead shrubs edge	*Melaleuca halmaturorum Disphyma crassifolia, Isotoma scapigera, Calandrinia granulifera, Senecia glossanthus, Pogonolepis muelleriana, Tecticornia syncarpa*	Clay soils, poorly drained	Excellent dead shrubs edge weed

Wetland 41 - Eastern half looking west– Releve 23 Te

Wetland 41 - Eastern half – Releve 23 Te

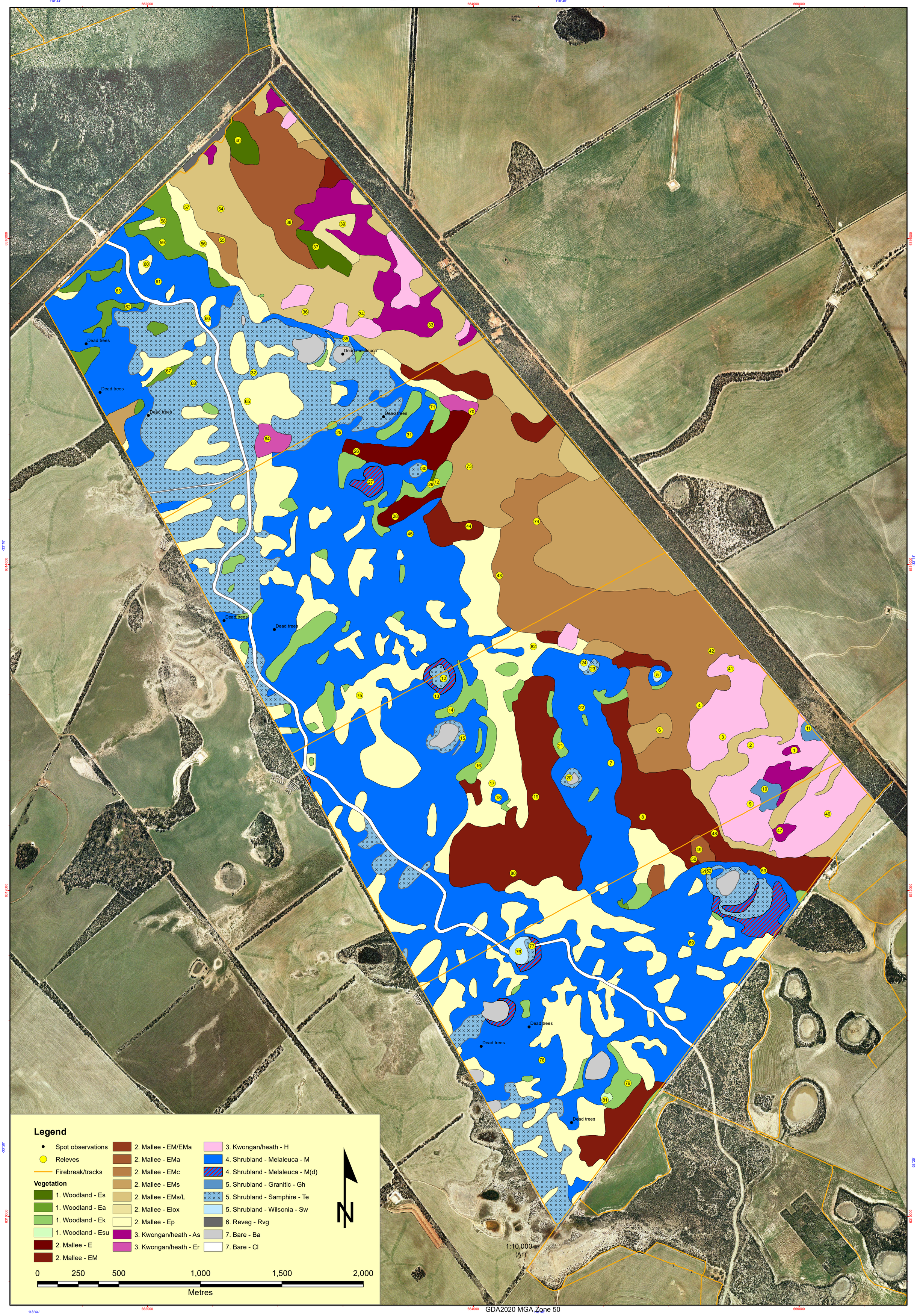


Wetland 41 - Western half - Releve 24 with *Wilsonia hunilis* and **Mesembryanthemum nodiflorum*

Wetland 41 - -Western half - Releve 24 with *Wilsonia hunilis*, **Mesembryanthemum nodiflorum* and *Angianthus pygmaeus*

Wetland 41 – some dead *Melaleuca* shrubs edge

Vegetation R 29023



Vegetation R 29023

118°44'
662000
664000
118°46'
666000
6315000
-33°18'
6314000
6312000
-33°20'
6310000
Dead trees
Dead melaleuca
1:10,000
(A1)
GDA2020 MGA Zone 50

Legend

- Spot observations
- Releves
- Firebreak/tracks

Vegetation

- 1. Woodland - Es
- 1. Woodland - Ea
- 1. Woodland - Ek
- 1. Woodland - Esu
- 2. Mallee - E
- 2. Mallee - EM
- 2. Mallee - EM/EMa
- 2. Mallee - EMa
- 2. Mallee - EMc
- 2. Mallee - EMs
- 2. Mallee - EMs/L
- 2. Mallee - Elox
- 2. Mallee - Ep
- 3. Kwongan/heath - As
- 3. Kwongan/heath - Er
- 3. Kwongan/heath - H
- 4. Shrubland - Melaleuca - M
- 4. Shrubland - Melaleuca - M(d)
- 5. Shrubland - Granitic - Gh
- 5. Shrubland - Samphire - Te
- 5. Shrubland - Wilsonia - Sw
- 6. Reveg - Rvg
- 7. Bare - Ba
- 7. Bare - Cl

0 250 500 1,000 1,500 2,000

Metres