LAKE COOLOONGUP, LAKE WALYUNGUP AND ADJACENT BUSHLAND, HILLMAN TO PORT KENNEDY

Boundary Definition: protected area/bushland (part taken to cadastre) boundary (Areas of bushland within the boundaries of the Site are not accurately mapped.)

SECTION 1: LOCATION INFORMATION

Bush Forever Site no. 356 **Area (ha):** bushland 1617.5 (Site also includes open water.)
Map no. 69, 70, 74, 75 **Map sheet series ref. no.** 2033–II NW, 2033–II SW
Other Names: White Lake, Salt Lake, Lark Hill, Tamworth Hill, part of Rockingham Lakes Regional Park
Local Authorities (Suburb): Shire of Rockingham (Hillman, Cooloongup, Waikiki, Warnbro, Port Kennedy, Baldivis)
System 6 (1983): M103 area of bushland goes beyond System area boundaries, all bushland described

SECTION 2: REGIONAL INFORMATION

LANDFORMS AND SOILS
Bassendean Dunes
Bassendean Sands (Qpb: S8)
Spearwood Dunes
Sands derived from Tamala Limestone (Qts: S7)
Tamala Limestone (Qtl: LS1)
Quindalup Dunes (Holocene dunes)
Safety Bay Sands (Qhs: S13, LS4)
Wetlands (within the Quindalup/Spearwood Dunes)
Holocene Swamp Deposits (Qhw: Cps, Cs1)
Lagoonal and Estuarine Deposits (at or near interface of Quindalup/Spearwood Dunes)
Lagoonal and Estuarine Deposits (Vasse) (Qhg: M5)

VEGETATION AND FLORA
Vegetation Complexes
Spearwood Dunes
Karrakatta Complex — Central and South
Cottesloe Complex — Central and South
Quindalup Dunes
Quindalup Complex
Floristic Community Types: *not sampled, types inferred
Supergroup 2: Seasonal Wetlands
17 *Melaleuca rhaphiophylla — Gahnia trifida* seasonal wetlands
*19a Sedgelands in Holocene dune swales (DEP 1996, equivalent to 19 in Gibson *et al.* 1994, English and Blyth 1997)
19b Woodlands over sedgelands in Holocene dune swales (DEP 1996, equivalent to 19 in Gibson *et al.* 1994, English and Blyth 1997)
Supergroup 3: Uplands centred on Bassendean Dunes and Dandaragan Plateau
21a Central *Banksia attenuata — Eucalyptus marginata* woodlands
Supergroup 4: Uplands centred on Spearwood and Quindalup Dunes
24 Northern Spearwood shrublands and woodlands (most southern occurrence)
*29b *Acacia* shrublands on taller dunes

WETLANDS
Wetland Types: lake, sumpland, dampland, artificial lake
Natural Wetland Groups
Spearwood Dunes
Stakehill (S.4)
Quindalup
Cooloongup (Qu.1)
Becher (Qu.2)
Wetland Management Objectives: Conservation (1462.3ha)
Swan Coastal Plain Lakes EPP: 312.8ha + 24.2ha + 438.6ha + 48.8ha = 824.4ha (total)

THREATENED ECOLOGICAL COMMUNITIES
Not assessed, Critically Endangered (floristic community type 19 as defined by Gibson *et al.* 1994)

SECTION 3: SPECIFIC SITE DETAIL

Landscape Features: open water, vegetated wetlands, vegetated uplands

Vegetation and Flora: detailed survey (part Site — Keighery, BJ, *et al.* 1997c, Tingay and Tingay 1977); limited survey (DEP 1999, EPA and WAWA 1990, Gibson *et al.* 1994 (Tam 01, Cool 01–04, 08–09, 11, Kero 01–02), Keighery, GJ, 1996 D (Cool 14–15))

Structural Units: mapping (part Site — EPA and WAWA 1990, Keighery, BJ, *et al.* 1997c, Tingay and Tingay 1977)

Spearwood Dunes

Uplands — Sands derived from Tamala Limestone: *Banksia attenuata* and *B. menziesii* Low Woodland; *Eucalyptus gomphocephala*, *E. marginata* and *Banksia attenuata* Open Forest; *Grevillea vestita* Closed Heath; *Hibbertia hypericoides* Open Low Heath

Quindalup Dunes

Uplands — Beach ridge plain: *Eucalyptus gomphocephala* Woodland to Forest; *Acacia rostellifera* Tall Open Scrub; *Jacksonia furcellata* and *Acacia rostellifera* Shrubland; *Acacia saligna* Low Open Woodland to Low Woodland; *Xanthorrhoea preissii* Open Heath

Wetlands (at or near the interface of the Quindalup and Spearwood Dunes): Open to Closed Sedgelands dominated by *Baumea juncea*, *Gahnia trifida*, *Lepidosperma longitudinale*, *Juncus kraussii* or *Baumea vaginalis* or combinations of these; *Banksia littoralis* Low Woodland; *Melaleuca rhaphiophylla* Low Woodland to Forest; *Eucalyptus gomphocephala* Woodland to Forest

Wetlands — Beach ridge plain: *Isolepis nodosa* and *Baumea juncea* Closed to Open Sedgeland, generally with an overstorey of *Xanthorrhoea preissii*

Scattered Native Plants: *Eucalyptus gomphocephala* Woodland; *Acacia saligna* Low Woodland; *Xanthorrhoea preissii* Open Heath

Vegetation Condition: >60% Very Good to Pristine, <40% Good to Degraded, with areas of severe localised disturbance

Total Flora: 174 native taxa, 82 weed taxa (part Site — Keighery, BJ, *et al.* 1997c) (>85% of expected flora)

Significant Flora: Keighery, BJ, *et al.* 1997c — *Trachymene coerulea*, *T. pilosa* (distinct form found also at Rottnest Island), *Sonchus hydrophilus* (at risk), *Atriplex suberecta* (not previously recorded on the Swan Coastal Plain), *Linum marginale* (rarely recorded on Quindalup dunes), *Acacia pulchella* var. *goadbyi* (only known occurrence on the Swan Coastal Plain), *Eremophila glabra* subsp. *albicans*, *Jacksonia furcellata* (floriferous shrub form), *Kennedia coccinea* (becoming increasingly uncommon on the western margins of the Plain)

Fauna: multiple surveys for birds (73 species) (Tingay and Tingay 1977; RAOU 1996 D, 3 visits), limited survey for native mammals (2 species), reptiles (1 species), amphibians (3 species) and fish (1 species) (Tingay and Tingay 1977). Significant bird species: category 2 (6), category 3 (10), category 4 (5). Significant population of Black Swan. Significant mammal species: Western Brush Wallaby and Quenda (Friend 1996 D)

Linkage: adjacent bushland to the north (Site 349, across road), south, east and west (Site 377, across road); part of Greenways 83, 85, 86, 89, 122 (Tingay, Alan & Associates 1998a); part of a regionally significant contiguous bushland/wetland linkage (Part A, Map 7)

Other Special Attributes

Meets five of the six specific criteria for coastal reserves—

(i) Quindalup Dune types: beach ridge plain and older dunes
(ii) Continuing natural processes: 1079.4ha (837.4 bushland) of Quindalup Dunes extending to 8.8km inland (through Site 377 to coast)
(iv) Linkage: Quindalup/Spearwood Dunes (Tamala Limestone) interface
(v) Vegetation: five regional floristic groups, one of which is a threatened community
(vi) Habitats: see Fauna section above;

Part Site (Lake Cooloongup and Lake Walyungup) — wetland of 'national significance'; part Site (Tamworth Lakes) — wetland of 'regional significance' (Semeniuk, V&C Research Group 1991b); contains examples of microbialites, organo-sedimentary structures formed by microorganisms, the oldest life-form on earth (Tingay, Alan & Associates 1997); majority of Site included in Port Kennedy and Rockingham Parks proposal (Tingay, Alan & Associates 1997)

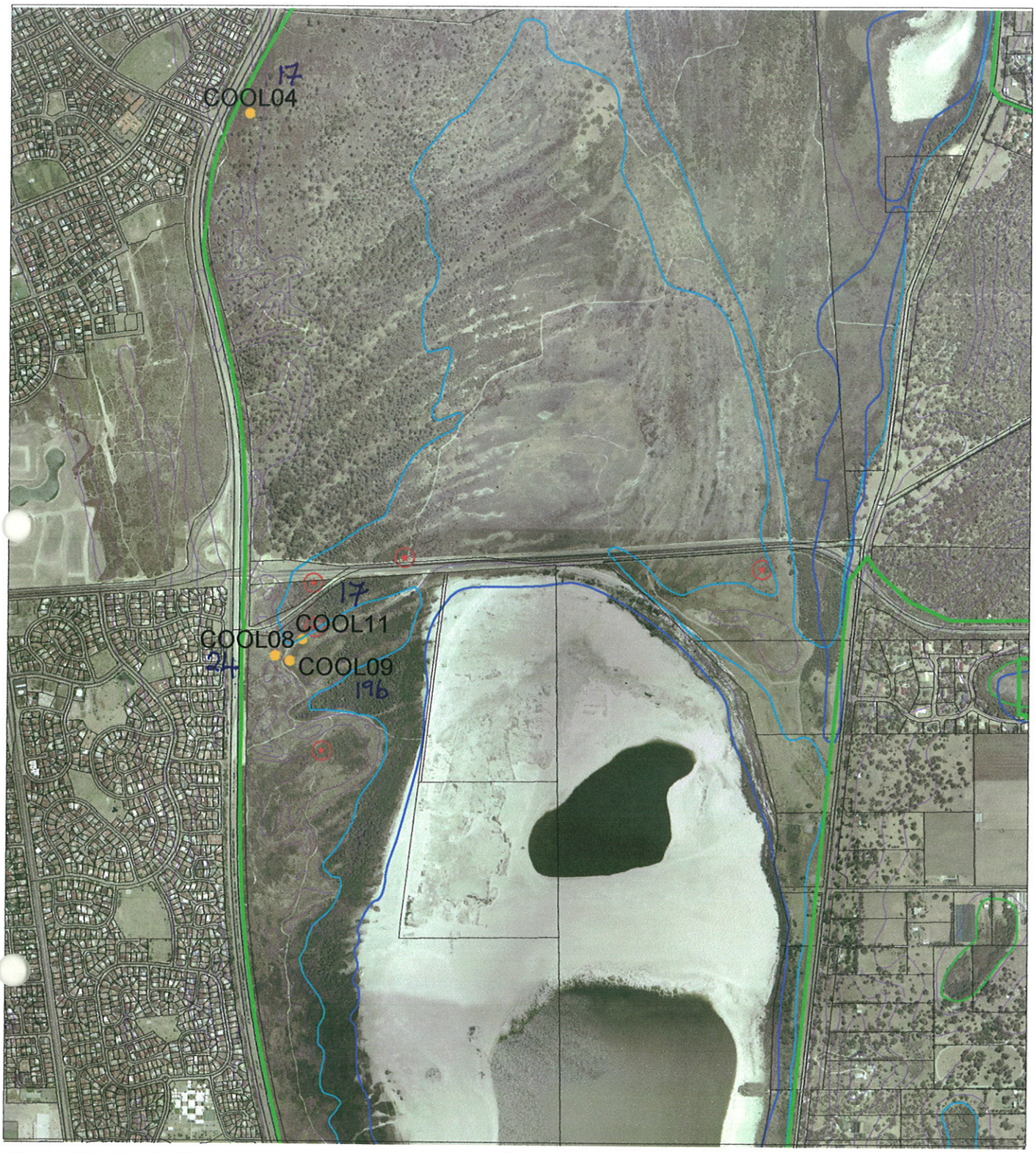
SECTION 4: INTERNATIONAL AND NATIONAL SIGNIFICANCE

Entered in the Register of the National Estate; location for JAMBA/CAMBA species; subject to protection under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*

SECTION 5: SELECTION CRITERIA AND RECOMMENDATIONS

Criteria: Representation of ecological communities, Diversity, Rarity, Maintaining ecological processes or natural systems, Scientific or evolutionary importance, General criteria for the protection of wetland, streamline and estuarine fringing vegetation and coastal vegetation

Recommendation: Part A: Site with Some Existing Protection; the care, control and management of this Site for conservation purposes within Rockingham Lakes Regional Park is endorsed. Part B: Other Government Land Mechanism. Part C: Proposed Parks and Recreation Reservation (see Table 3, Volume 1).



Bush Forever Sites
Local Government Authority Boundaries
Lakes EPP
Geomorphic Wetlands Feb04 by Evaluation
Conservation
Resource Enhancement
Multiple Use
Floristic Survey Sites of the Southern Swan Coastal Plain
GJKENV (Keighery 1996)
GRIFFIN (Griffen 1994)
SCP (Gibson et al 1994)
SYS6ENV (DEP 1996 and Trudgen & Keighery 1995)
SYS6ENV2 (DEP 1996 and Trudgen & Keighery 1995)
CALM Threatened Ecological Communities 2002
Roads - Perth Metropolitan

Bush Forever Site 356: Lake Cooloongup, Lake Walyungup and Adjacent Bushland, Hillman to Port Kennedy

0 500 1000 1500 Meters

N

1:20000

Datum: GDA - Projection: MGA Zone 50

Department of Environment

Data Sources:
Cadastre DLI
Aerial Phototography : Skyview DLI

Rockingham Lakes Regional Park

Bush Forever Sites
Local Government Authority Boundaries
Lakes EPP
Geomorphic Wetlands Feb04 by Evaluation
Conservation
Resource Enhancement
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0 500 1000 1500 Meters

N

1:20000

Datum: GDA - Projection: MGA Zone 50

Department of Environment

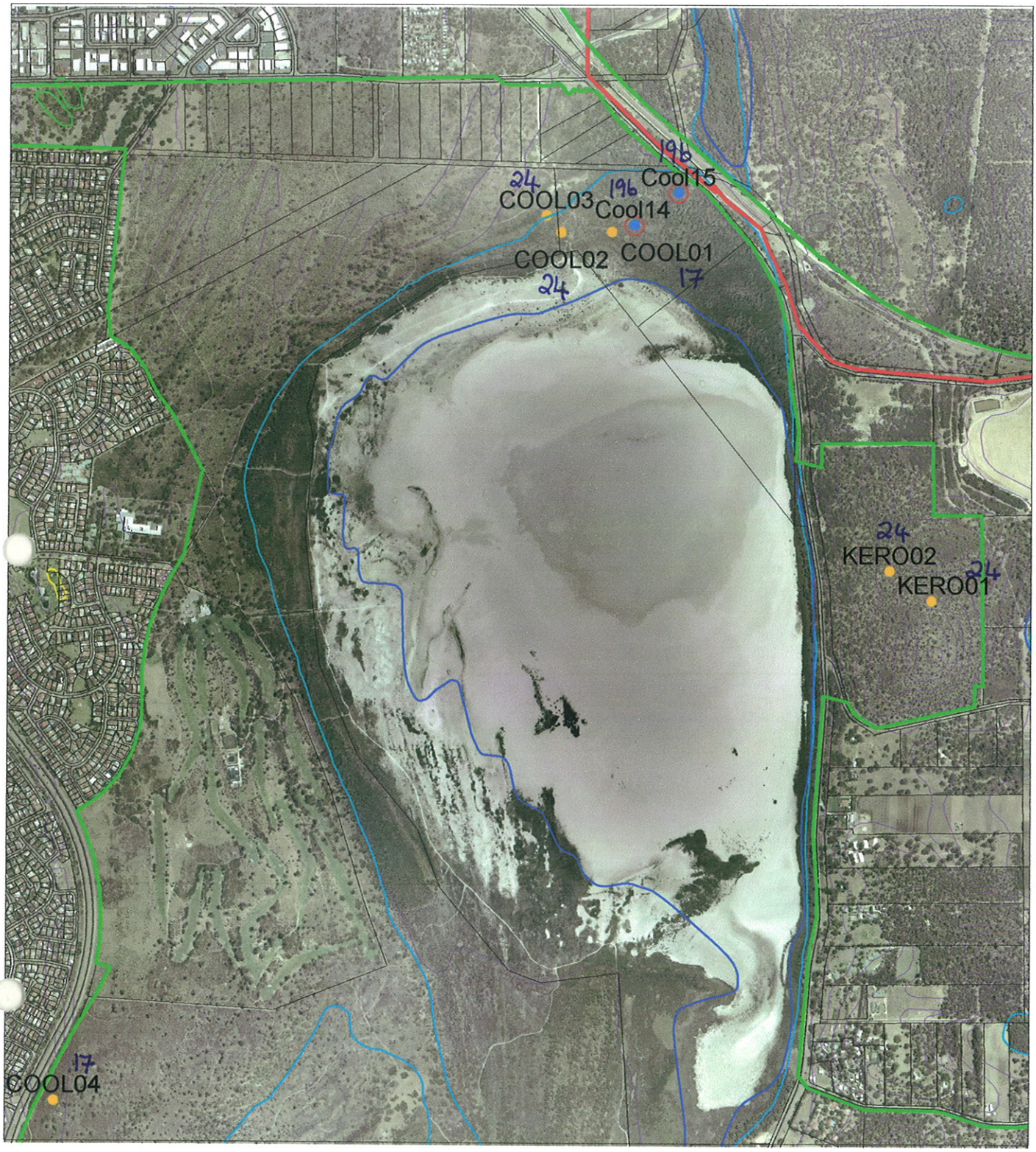
Data Sources:
Cadastre DLI
Aerial Phototography : Skyview DLI

Figure 2

Aerial Photograph of the Subject Site and Lake Richmond

Scale 1:1500

Source: Department of Land and Administration



Bush Forever Sites
Local Government Authority Boundaries
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SCP (Gibson et al 1994)
SYS6ENV (DEP 1996 and Trudgen & Keighery 1995)
SYS6ENV2 (DEP 1996 and Trudgen & Keighery 1995)
CALM Threatened Ecological Communities 2002
Roads - Perth Metropolitan

Bush Forever Site 356: Lake Cooloongup, Lake Walyungup and Adjacent Bushland, Hillman to Port Kennedy

0 400 800 1200 1600 Meters

N

1:20000

Datum: GDA - Projection: MGA Zone 50

Department of Environment

Data Sources:
Cadastre DLI
Aerial Phototography : Skyview DLI

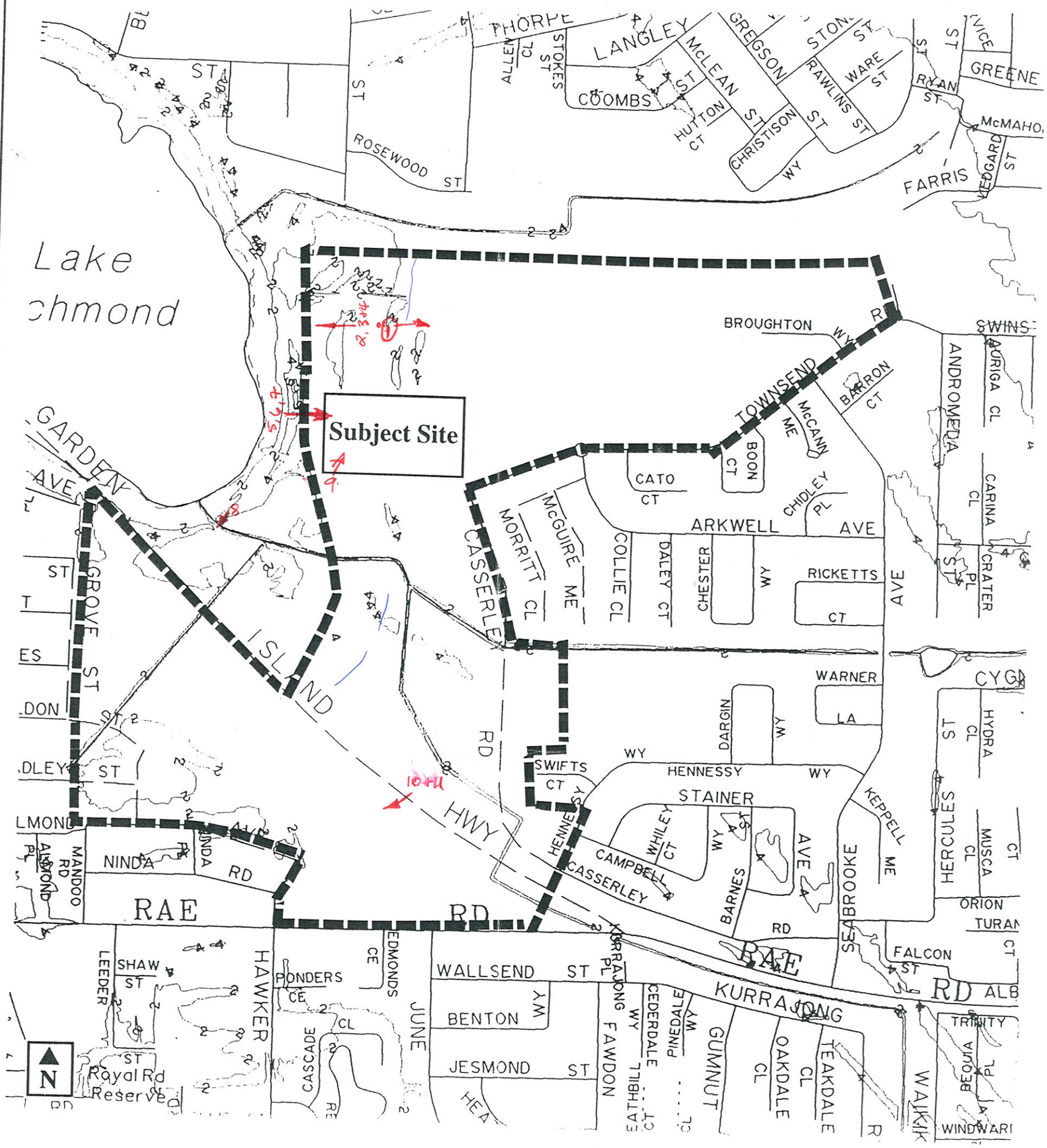


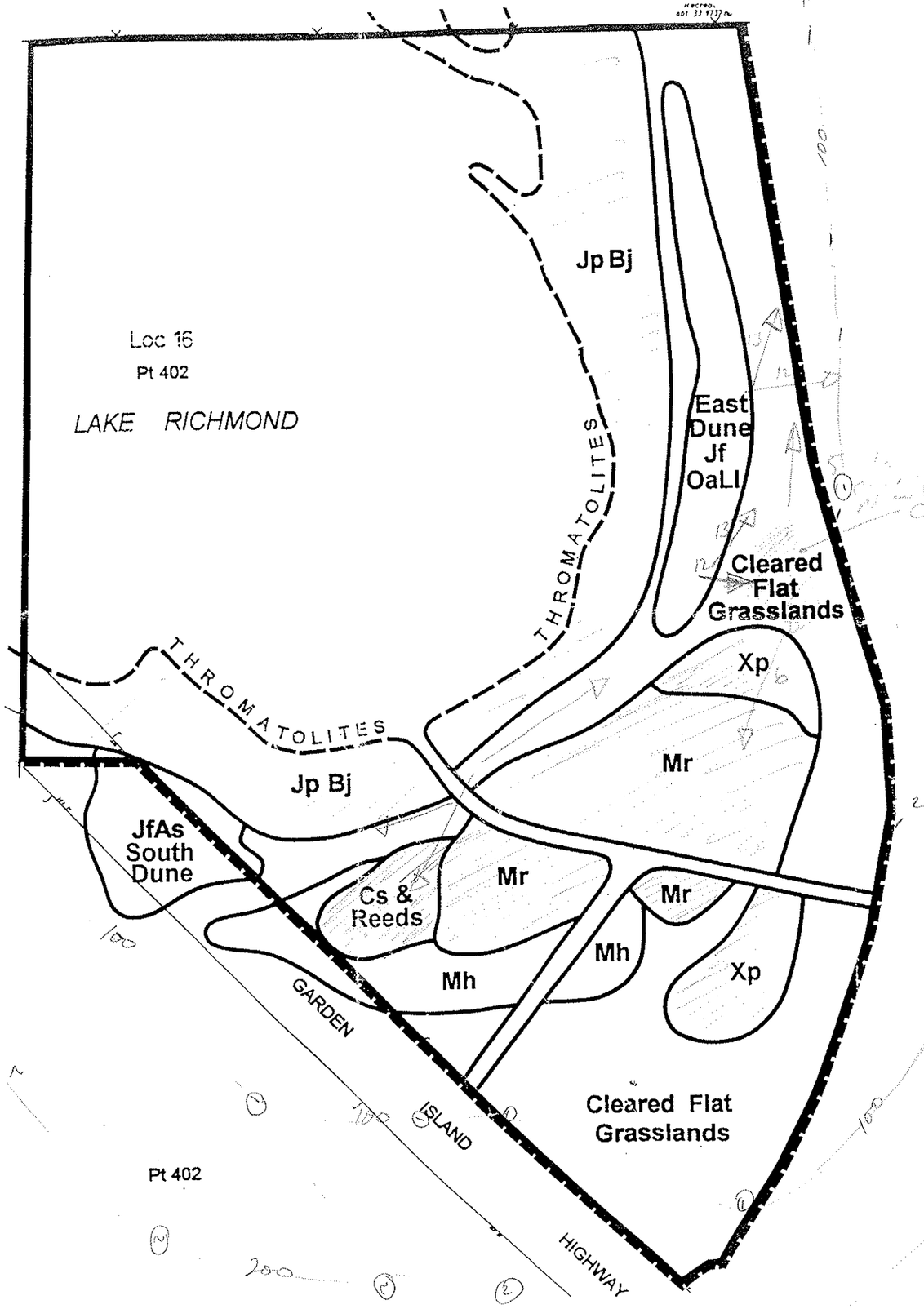
Figure 5

Topography (AHD) of the Site and Surrounding Areas

Scale 1:11 000

BOWMAN BISHAW GORHAM

ENVIRONMENTAL MANAGEMENT CONSULTANTS



LEGEND

	Subject Land
	Foreshore Reserve Boundary
Mr	*Melaleuca rhaphiophylla*
Mh	*Melaleuca huegelii*
Jp Bj	*Juncus pallidus* and *Baumea juncea* Rush/Sedgeland Sedge Land
Jf As	*Jacksonia furcellata* and *Acacia saligna* Southern Dune
Cs	Pampas Grass *Cortaderia selloana* Damp Low Lying Area
Xp	*Xanthorrhoea preissii* Open Area
JFOaLl	*Jacksonia furcellata, Olearia axillaris* and *Leptospermum laevigatum* Eastern Dune

metres

0 100

SCALE 1:3,000

Figure 15

Vegetation Surrounding Lake Richmond

Scale 1:3000

BOWMAN BISHAW GORHAM

ENVIRONMENTAL MANAGEMENT CONSULTANTS

25/10/92
Approx locations
Sites

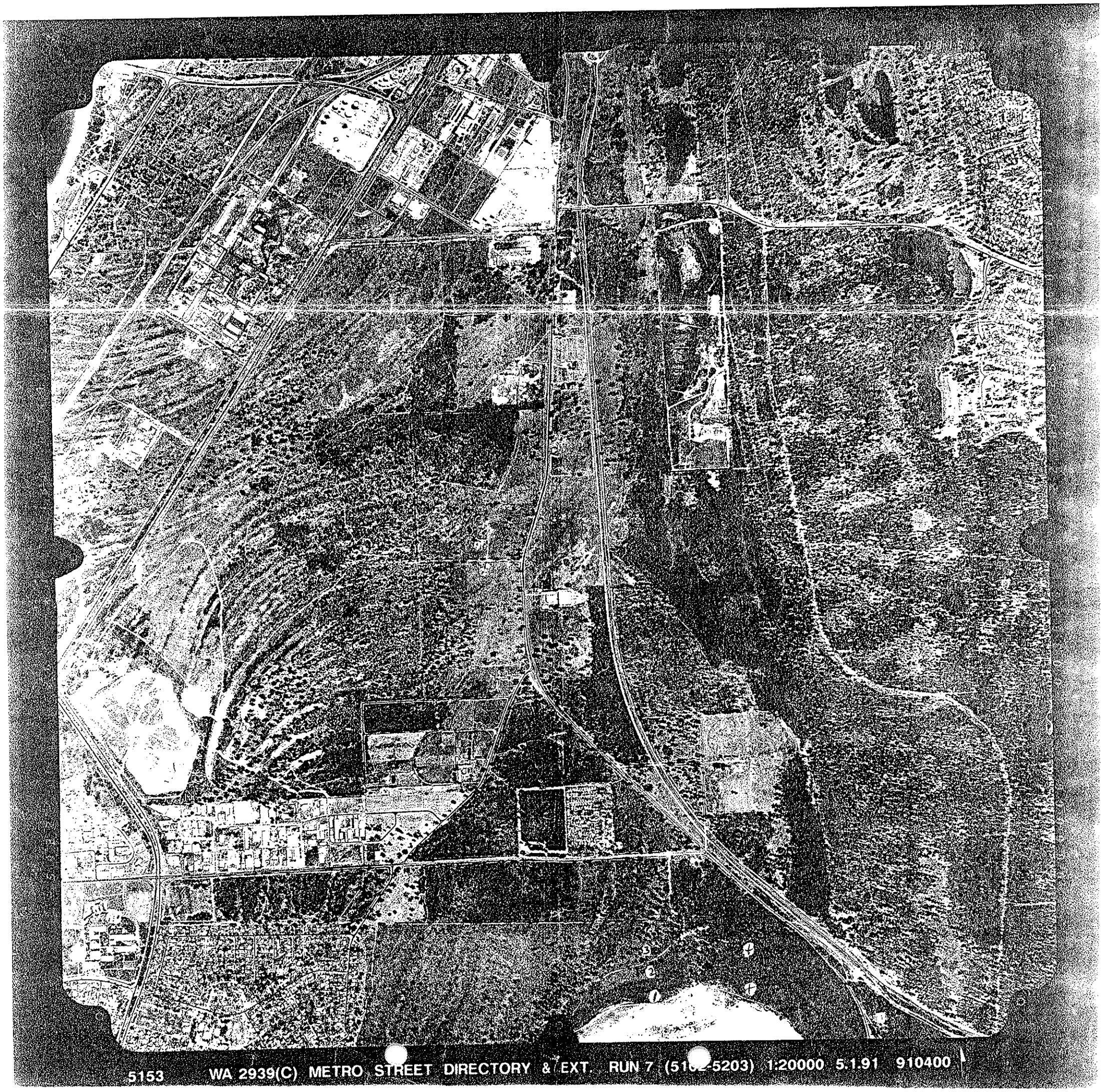
Lake Goloongup

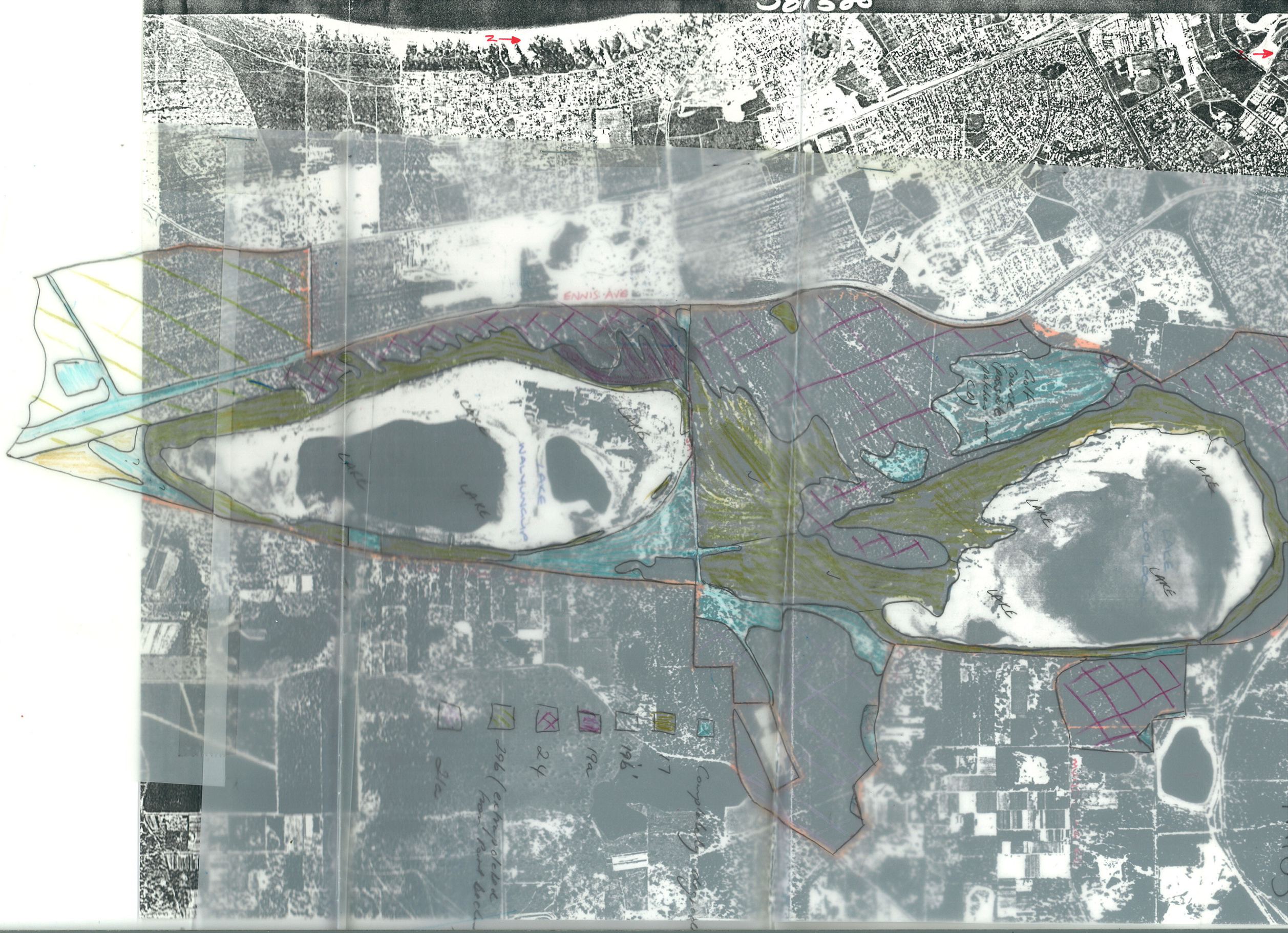
Sites

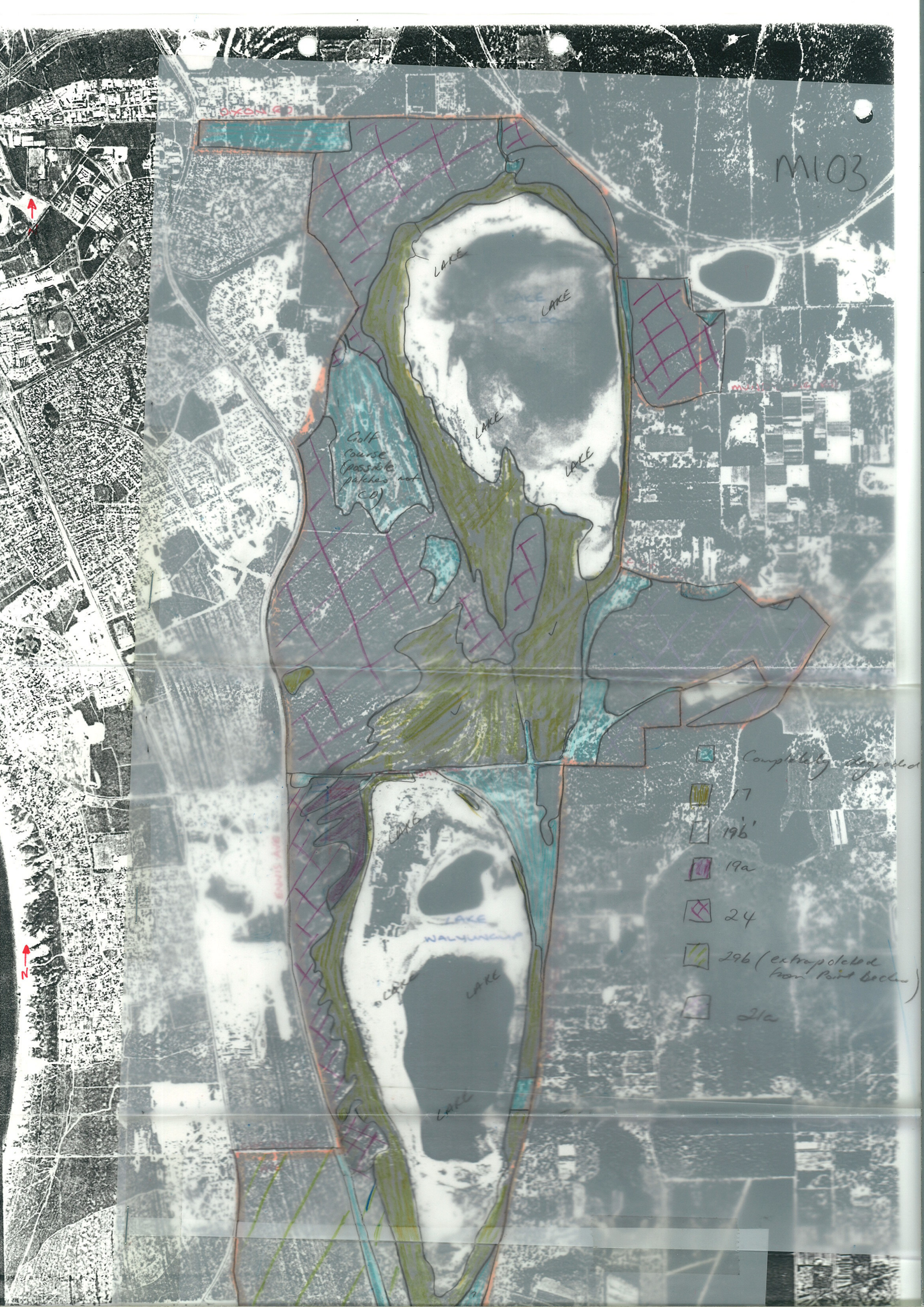
Planned

1. Lake edge
2. Tuart – V. open woodland
3. Tuart open woodland
4. Sand ridge
5. Steep Valley – Tuart Forest
6. Banksia Littoralis Woodland
7. Mel. raphiophylla Woodland
8. Sand heath
9. ? Shrubland/Grassland
10. ? Mel raphio Woodland

(+) ? Gregs sites
(+)




Completely degra
17
19b'
19a
24
29b (extrapolated
from Pans Rock
2a
LAKE
COOLOO
LAKE
LAKE
LAKE
LAKE
Golf course (possible not patches (D))
LAKE
WALYUNGUP
LAKE
LAKE
LAKE
ENNIS AVE
N


M103
DIXON RD
ENNIS AVE
LAKE
LAKE COOLOONGUP
LAKE WALYUNGUP
Golf course (possible patches not CD)
N
Completely degraded
17
19b'
19a
24
29b (extrapolated from Point Becher)
21a

SURVEY RECORDING SHEET — Please use pencil

QUADRAT No. 1006 8 VEGETATION TYPE Mal and shrubland

DATE FIRST TRIP 1/10/92 VOLUNTEERS Karen Jennifer Lorraine

DATE SECOND TRIP _____ VOLUNTEERS _____

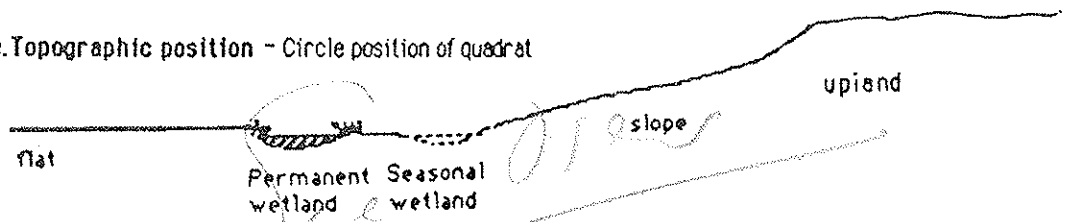
BOTANIST BJK

1. LOCATION of the QUADRAT

a. **Mud Map** Draw a sketch of the location of the quadrat the back of this sheet →

b. **Photograph** Photographer's name _____

c. **Topographic position** – Circle position of quadrat



Keighery and Keighery, 1990
Adapted from Griffin and Keighery, 1989
MOORE RIVER to JURIEN SANDPLAIN SURVEY. WILDFLOWER SOCIETY of WA

2. SITE DATA – Circle the correct response

Slope flat gentle steep **Aspect** N NE E SE S SW W NW

% Bare ground____ **Drainage** well mod poor **Wet** All year winter/spring

Litter (% cover)____ **Surface soil**_____ **Sub-surface soil** _____

3. VEGETATION STRUCTURE AND COVER. Record appropriate cover class

Cover Class – percentage classes: 0% | under 2% | 2–10% | 10–20% | 20–30% | 30–50% | 50–70% | over 70%

	TREES Not recorded		MALLEES		15m
LIFE FORM	>15m or 5-15m	under 5m	MALLEE SHRUB less than 8m	MALLEE TREE 8m or more	10m 5m
COVER CLASS (%)	>15m 5-15m 30, 50%				

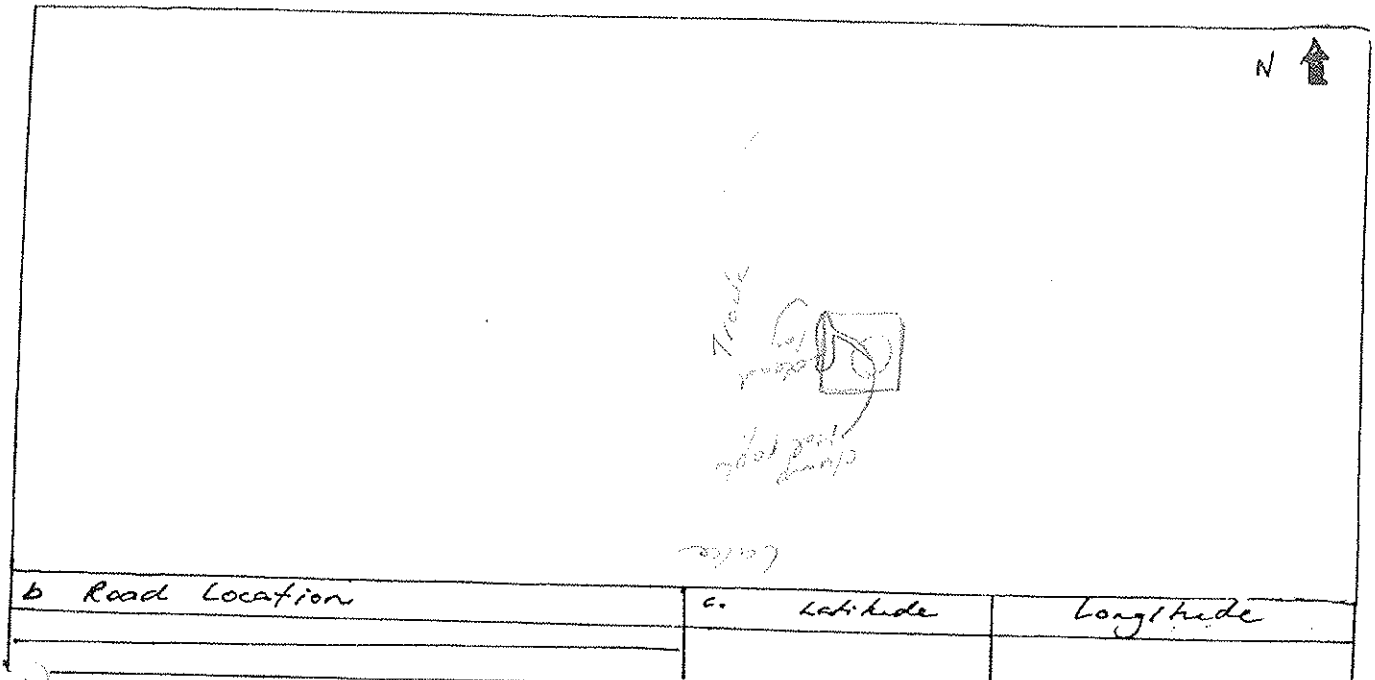
	SHRUBS					
LIFE FORM	over 2m	2·0-1·5m	1·5-1·0m	1·0m - ·5m	under 5m	3m 2m 1m
COVER CLASS (%)						

Height (metres)

	BUNCH GRASSES	HERBS	SEDGES	
LIFE FORM	under ·5m	under ·5m (except creepers)	over ·5m	under 5m	2·0m 1·5m 1·0m ·5m
COVER				

20 30% 70%

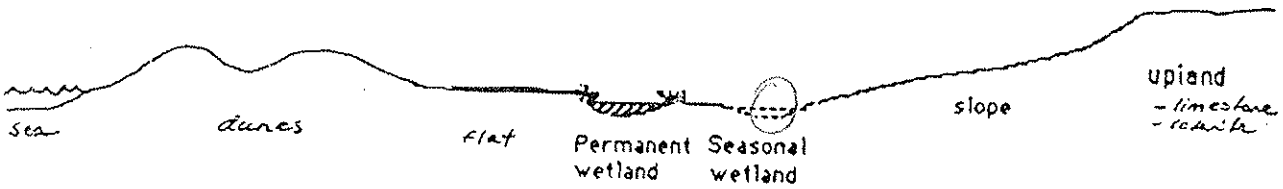
a. Mud Map Draw a sketch of the location of the quadrat COOL01



b Road Location	c. Latitude	Longitude

d. Photograph Photographer's name _____ Photograph No _____ Altitude

e. Topographic position - Circle position of quadrat



2. SITE DATA - Circle the correct response

Slope (flat) gentle steep

Aspect (N) NE E SE S SW W NW

Surface soil peaty black organic

Sub-surface soil grey clay

Drainage well mod (poor)

Wet All year (winter/spring)

Litter (% cover) 80%

% Bare ground 0%

4. VEGETATION CONDITION

		Comments
EXCELLANT	)	
VERY GOOD		
GOOD		
POOR		
VERY POOR		

1. SPECIES PRESENCE 27/10/92

QUADRAT No. ROC 01

- **work systematically through the vegetation**, start with the tallest stratum, i.e. trees
- within each stratum try to record the **most common species first** and the most uncommon last.
- as each species is collected **label** it with a numbered tag and use this number on your recording sheet
- indicate if the species is in **flower**

Keighery and Keighery, 1990
Adapted from Griffin and Keighery, 1989
MOORE RIVER to JURIEN SANDPLAIN SURVEY. WILDFLOWER SOCIETY of WA

Trees	No	ID
Mel cor	1	
Mallees		
SHRUBS		
Casuarina fraseriana	18	

SHRUBS	No	ID
Bunch Grasses		
Herbs		
Lin mar	5	✓
Eri	6	✓
Ger	7	✓
Hib	8	✓
Hib	9	✓
Sam	12	✓
Dia	13	✓
	14	
	15	

Herbs	No	ID
10/12/93 Not found		
Sedges		
Cyp	3	✓
Lom	4	✓
Tri	10	✓
Iso	11	✓
ADD		
Baumea juncea		

SURVEY RECORDING SHEET Please use pencil

QUADRAT No. Quad 5 VEGETATION TYPE _____

DATE FIRST TRIP 23 Oct 1992 VOLUNTEERS _____

DATE SECOND TRIP _____ VOLUNTEERS _____

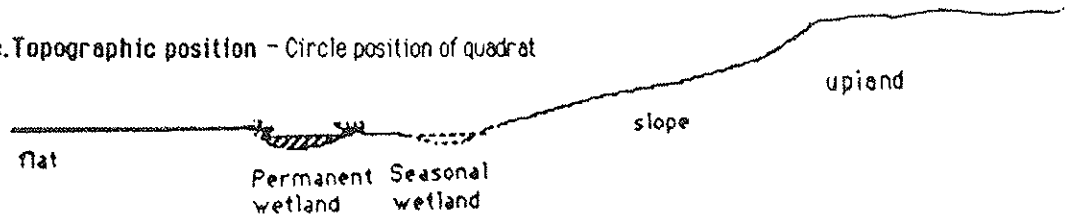
BOTANIST _____

1. LOCATION of the QUADRAT

a. **Mud Map** Draw a sketch of the location of the quadrat the back of this sheet →

b. **Photograph** Photographer's name _____

c. **Topographic position** – Circle position of quadrat



Keighery and Keighery, 1990
Adapted from Griffin and Keighery, 1989
MOORE RIVER to JURIEN SANDPLAIN
SURVEY. WILDFLOWER SOCIETY of WA

2. SITE DATA – Circle the correct response

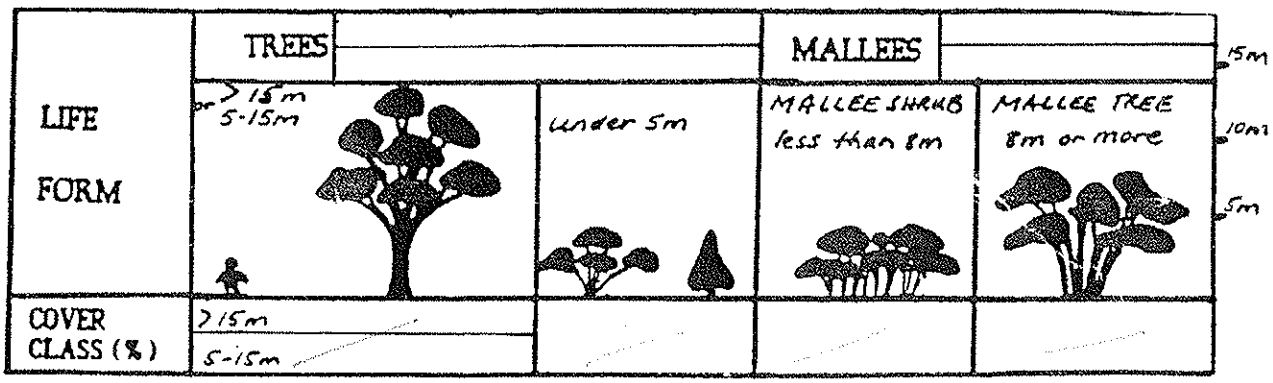
Slope flat gentle steep **Aspect** N NE E SE S SW W NW

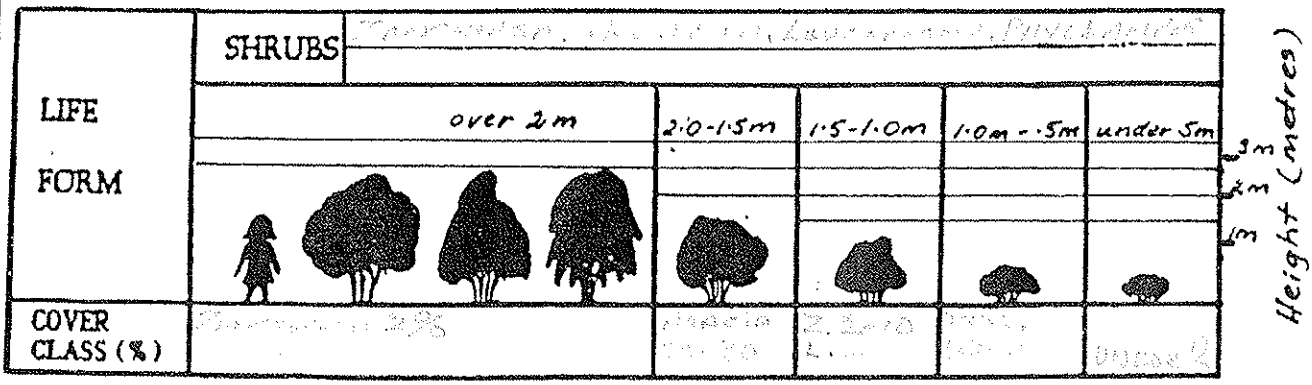
% Bare ground____ **Drainage** well mod poor **Wet** All year winter/spring

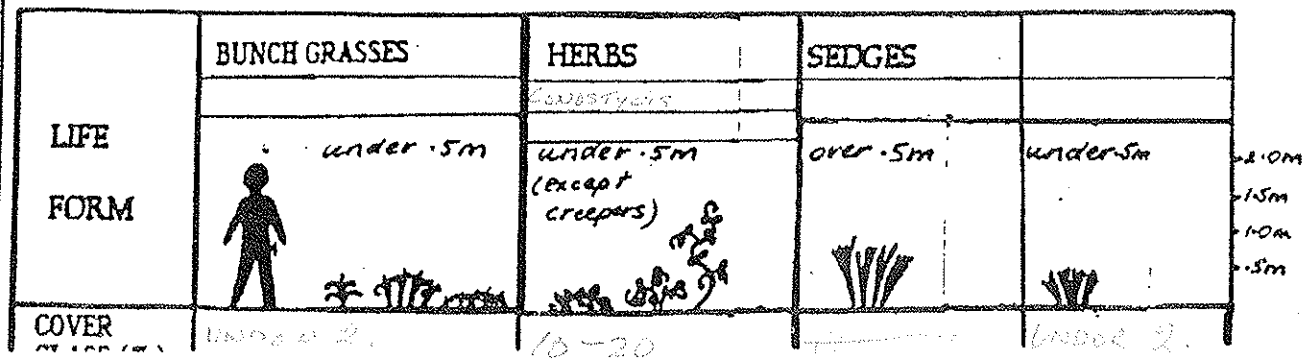
Litter (% cover)_____ Surface soil_____ Sub-surface soil _____

3. VEGETATION STRUCTURE AND COVER Record appropriate cover class

Cover Class – percentage classes: 0% | under 2% | 2–10% | 10–20% | 20–30% | 30–50% | 50–70% | over 70%







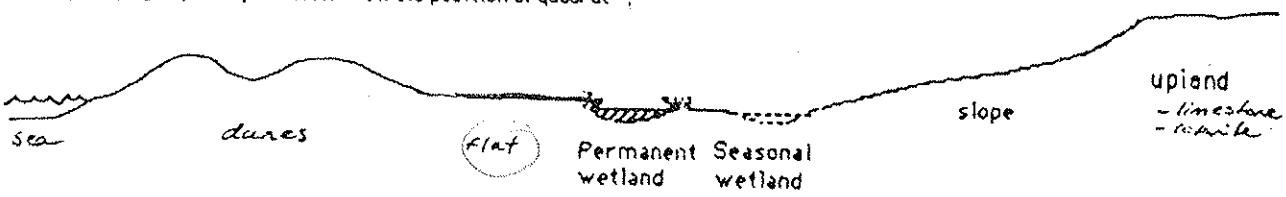
a. Mud Map Draw a sketch of the location of the quadrat

cool 02

N

b Road Location	c. Latitude	Longitude
d. Photograph Photographer's name	Photo # No	Altitude

e. Topographic position – Circle position of quadrat



2. SITE DATA – Circle the correct response

Slope (flat) gentle steep

Aspect N NE E SE S SW W NW

Surface soil Sandy Sand

Sub-surface soil Sandy

Drainage (well) mod poor

Wet All year winter/spring

Litter (% cover) Some

% Bare ground 10%

4. VEGETATION CONDITION

		Comments
EXCELLANT		
VERY GOOD		
GOOD		
POOR		
VERY POOR		

1. SPECIES PRESENCE

- work systematically through the vegetation, start with the tallest stratum, i.e. trees
- within each stratum try to record the **most common species first** and the most uncommon last.
- as each species is collected **label** it with a numbered tag and use this number on your recording sheet
- indicate if the species is in **flower**

Keighery and Keighery, 1990
Adapted from Griffin and Keighery, 1989
MOORE RIVER to JURIEN SANDPLAIN SURVEY. WILDFLOWER SOCIETY of WA

QUADRAT No. Cook 2 15/6/92

Trees	No	ID
Mallees		

SHRUBS	No	ID
✓ KAUTTERDORA PERISII. ✓	1.	✓
✓ ACACIA RUSTICELLIFORA ✓	2.	✓
✓ " SALICINA ✓	3.	✓
✓ LEUCOPOGON PARVIFLORUS ✓	4.	✓
✓ HORDEUM GEN. CONTORTUM ✓	5.	✓
✓ PHYLLANTHUS CALYCINUS ✓	6.	✓
✓ HYPOCALYMMA ? ✓	7.	✓
✓ ACACIA ? ✓	8.	✓
✓ JACKSONIA TERNATEA ✓	24	✓

SHRUBS	No	ID

Bunch Grasses	No	ID
✓ Eragrostis ? ✓	15.	
✓ BRIZA MINOR ✓	15.	✓
✓ POA ? ✓	17.	
✓ LOLIUM ? ✓	18.	✓
✓ BROMUS ? ✓	20.	

Herbs	No	ID
✓ CONOSTYLIS ? ✓	9.	✓
✓ LOMANDRA ? ✓	10.	✓
✓ ANAGALLIS ? ✓	11.	✓
✓ CRASSULA ? ✓	12.	
✓ STYLIDIUM ? ✓	14.	✓
✓ HYPOCALYMMA ? ✓	16.	✓
✓ CENTAURIUM ? ✓	19.	
✓ DIANELLA ? ✓	21.	
✓ STACKHOUSIA ? ✓	23.	
✓ STYLIDIUM ? ✓	24.	
✓ SILENE ? ✓	26.	
LOMANDRA SP. = Lepid. ?	27.	
✓ HIBB. Petrophila ? ✓	28.	
✓ CERASTIUM ? ✓	29.	
✓ CALANDRINIA SP. ✓	30.	
✓ STACKH. SP. MIN. ✓	31.	
✓ APHANES ? — Velleyella ? ✓	32.	
✓ PETROPH. sp. nov. ? ✓	33.	

Herbs	No	ID
12/10/93 also found.		
✓ Hirlaea ? ✓		
✓ Vulpia myuros ✓		

Sedges	No	ID
✓ Loxocarya ? ✓	23	
✓ Lepidosperma ? ✓	25	✓
✓ 16/10/93		
ADD Cyrosurus echinatus		

SURVEY RECORDING SHEET Please use pencil

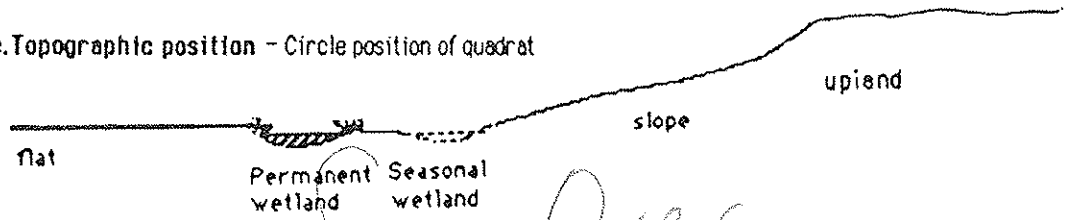
QUADRAT No. Cook #2 VEGETATION TYPE Tuart Open Woodland
DATE FIRST TRIP 23/10/92 VOLUNTEERS Karen Jennifer
DATE SECOND TRIP 20/11/93 VOLUNTEERS Meg
BOTANIST EJK

1. LOCATION of the QUADRAT

a. **Mud Map** Draw a sketch of the location of the quadrat the back of this sheet →

b. **Photograph** Photographer's name _____

c. **Topographic position** – Circle position of quadrat



Over.

Keighery and Keighery, 1990
Adapted from Griffin and Keighery, 1989
MOORE RIVER to JURIEN SANDPLAIN
SURVEY. WILDFLOWER SOCIETY of WA

2. SITE DATA – Circle the correct response

Slope flat gentle steep Aspect N NE E SE S SW W NW

% Bare ground____ Drainage well mod poor Wet All year winter/spring

Litter (% cover)____ Surface soil_____ Sub-surface soil _____

3. VEGETATION STRUCTURE AND COVER Record appropriate cover class

Cover Class – percentage classes: 0% | under 2% | 2–10% | 10–20% | 20–30% | 30–50% | 50–70% | over 70%

LIFE FORM	TREES	MALLEES		
	Tuart Ac. saligna			15m
	>15m or 5–15m	under 5m (goes up to Jarrah >70%)	MALLEE SHRUB less than 8m	MALLEE TREE 8m or more 10m 5m
COVER CLASS (%)	>15m 5–15m 20–30%	2–10%		

Jarrah canopy 10–20%

LIFE FORM	SHRUBS				
	Xanth. pressi over 2m	2.0–1.5m	1.5–1.0m	1.0m – .5m Phyl. calc. Ac. spp.	under 5m 3m 2m 1m
COVER CLASS (%)	10–20% (not at 6m)			50–70%	

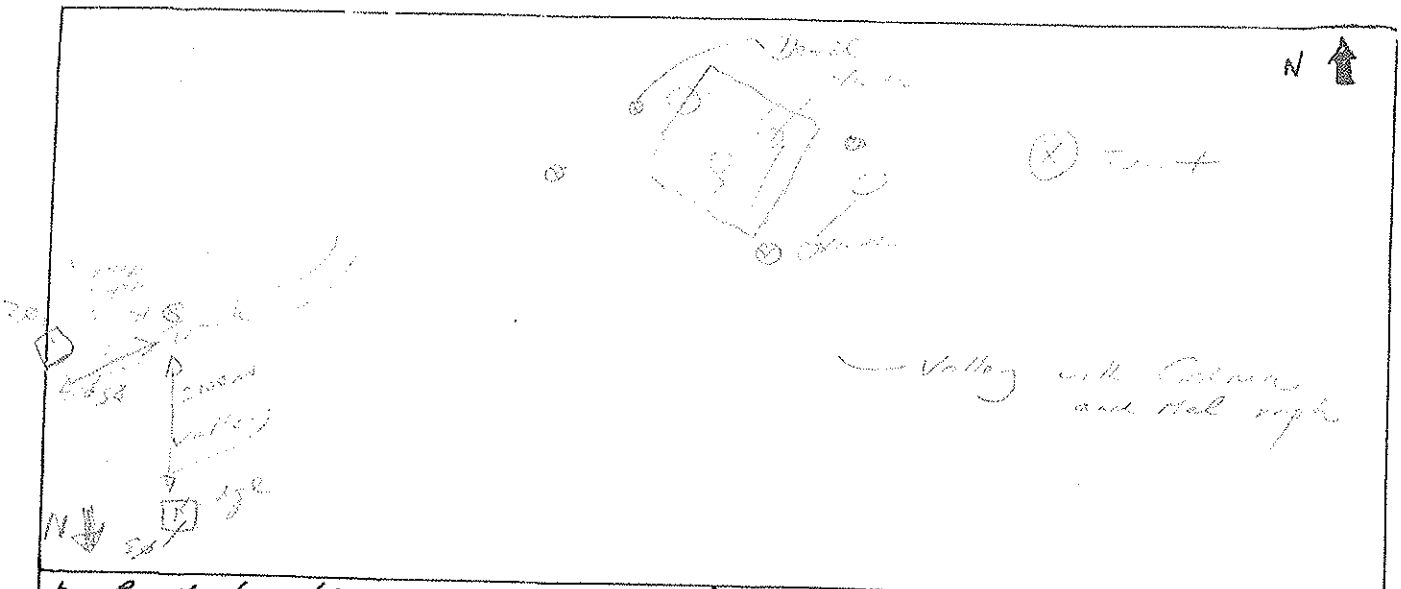
Height (metres)

LIFE FORM	BUNCH GRASSES	HERBS	SEDGES		
		Annuals			2.0m
	under .5m	under .5m (except creepers)	over .5m	under 5m	1.5m 1.0m .5m
COVER					

30–50%

a. **Mud Map** Draw a sketch of the location of the quadrat

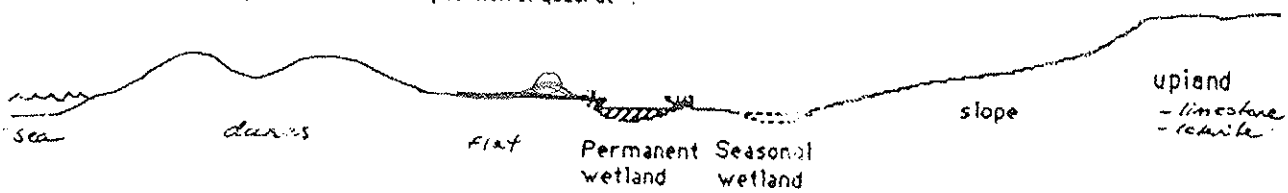
cool 03



b Road Location	c. Latitude	Longitude
West Bryon St Heron Bay		
		Altitude

d. **Photograph** Photographer's name Photo # No

e. **Topographic position** – Circle position of quadrat



2. SITE DATA – Circle the correct response

Slope (flat) gentle steep

Aspect N NE E SE S SW W NW

Surface soil black sand

Sub-surface soil grey-black sand

Drainage (well) mod poor

Wet All year winter/spring

Litter (% cover) 50%

% Bare ground 30%

4. VEGETATION CONDITION

EXCELLENT	
VERY GOOD	
GOOD	
POOR	
VERY POOR	

Comments

Fire 3yrs (young regrowth)
Thick layer weeds 50% Annuals
Grazed thick - Heavily Grazed

1. SPECIES PRESENCE 27/10/92

- **work systematically through the vegetation**, start with the tallest stratum, i.e. trees
- within each stratum try to record the **most common species first** and the most uncommon last.
- as each species is collected **label** it with a numbered tag and use this number on your recording sheet
- indicate if the species is in **flower**

QUADRAT No. Cook 03

Keighery and Keighery, 1990
Adapted from Griffin and Keighery, 1989
MOORE RIVER to JURIEN SANDPLAIN SURVEY. WILDFLOWER SOCIETY of WA

Trees

	No	ID
Tuart	1	
Acacia saligna	2	

Mallees

SHRUBS

	No	ID
Xanthorrhoea preissii	3	
Hakea lissocarpha	4	
Acanthocarpus preissii	5	
Banksia attenuata	6	
19 Sonchus hydrophilus		

SHRUBS

	No	ID

Bunch Grasses

	No	ID
Poa poiformis	10	
Stipa elegantissima	11	
Lomandra sonderi	24	

Herbs

	No	ID
Conostylis aculeata	7	
Hibbertia commutata	8	
Borya sphaerocephala	9	
Conostylis stylidioides	12	
Burchardia congesta (albino)	13	
Lomandra hastilis	16	
Anigozanthos flavidus	17	
Stylidium piliferum	18	
Trachymene pilosa	19	
Hypocalymma angustifolium	21	
Isotropis cuneifolia	22	
Conostylis aculeata	23	
Eucalyptus calophylla	25	
Drosera erythrorhiza	26	

Herbs

	No	ID
10/11/92 Poa effusa gone - not replaced		
ADJ Tuart swamp		

Sedges

	No	ID
Cyperus gymnocaulos	14	
Schoenus pedicellatus	15	
Isolepis fluitans	20	

27 Caps of annual Mallee under

Centaurium erythraea
25

- SURVEY RECORDING SHEET **Please use pencil**

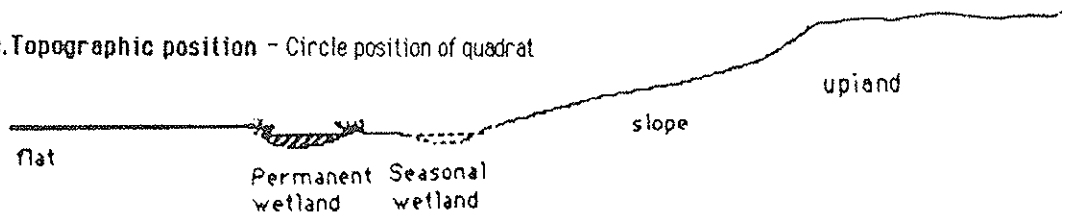
QUADRAT No. row 6 4 VEGETATION TYPE Dune forest
DATE FIRST TRIP 28/5/92 VOLUNTEERS Kerstin Trample Sth Bank
DATE SECOND TRIP 10/12/93 VOLUNTEERS NG
BOTANIST KK, AJK

1. LOCATION of the QUADRAT

a. Mud Map Draw a sketch of the location of the quadrat the back of this sheet →

b. Photograph Photographer's name _____

c. Topographic position – Circle position of quadrat



Keighery and Keighery, 1990
Adapted from Griffin and Keighery, 1989
MOORE RIVER to JURIEN SANDPLAIN SURVEY. WILDFLOWER SOCIETY of WA

2. SITE DATA – Circle the correct response

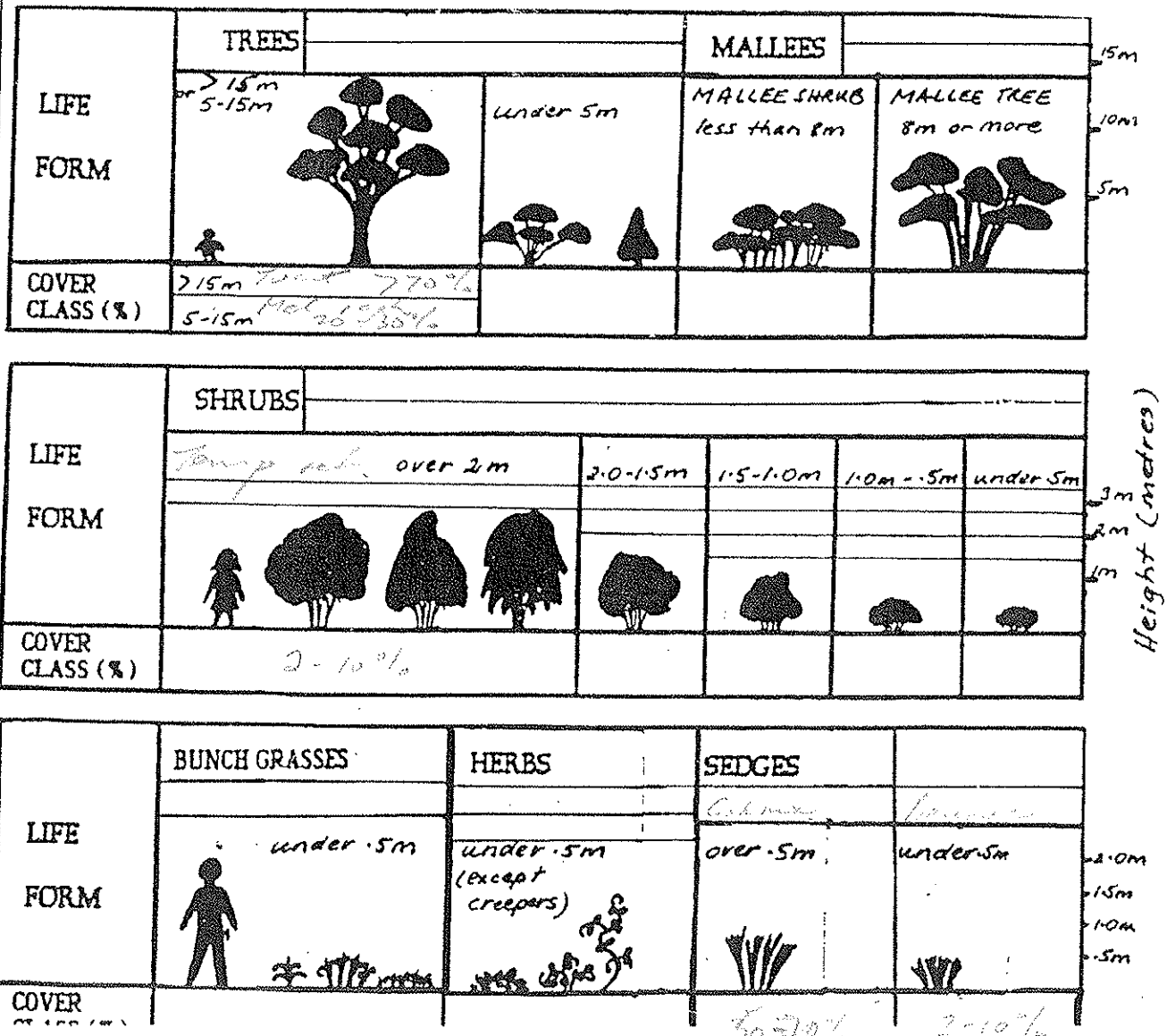
Slope flat gentle steep **Aspect** N NE E SE S SW W NW

% Bare ground____ Drainage well mod poor **Wet** All year winter/spring

Litter (% cover)____ Surface soil_____ Sub-surface soil _____

3. VEGETATION STRUCTURE AND COVER Record appropriate cover class

Cover Class – percentage classes: 0% | under 2% | 2-10% | 10-20% | 20-30% | 30-50% | 50-70% | over 70%



1. LOCATION OF THE QUADRAT

cool 04

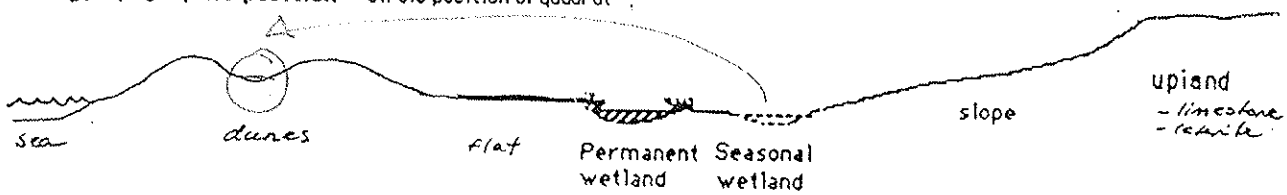
a. Mud Map Draw a sketch of the location of the quadrat

N

b Road Location	c. Latitude	Longitude

d. Photograph Photographer's name _____ Photo # No | Altitude

e. Topographic position – Circle position of quadrat



2. SITE DATA – Circle the correct response

Slope (flat) gentle steep

Aspect N NE E SE S SW W NW

Surface soil _____

Sub-surface soil _____

Drainage well (mod) poor

Wet All year winter/spring

Litter (% cover) _____

% Bare ground 10%

4. VEGETATION CONDITION

		Comments
EXCELLANT		
VERY GOOD	✓	
GOOD		
POOR		
VERY POOR		

1. SPECIES PRESENCE

- work systematically through the vegetation, start with the tallest stratum, i.e. trees
- within each stratum try to record the **most common species first** and the most uncommon last.
- as each species is collected **label** it with a numbered tag and use this number on your recording sheet
- indicate if the species is in **flower**

QUADRAT No. 25/10/92 Cook 4

Keighery and Keighery, 1990
Adapted from Griffin and Keighery, 1989
MOORE RIVER to JURIEN SANDPLAIN SURVEY. WILDFLOWER SOCIETY of WA

Trees	No	ID
[illegible]	✓ 1	
[illegible]	✓ 2	

Mallees	No	ID

SHRUBS	No	ID
[illegible]	✓ 3	✓
[illegible]	✓ 4	✓

SHRUBS	No	ID
[illegible]		
only 1 per [illegible]		
AND [illegible]	✓	
[illegible]	✓	
[illegible]	✓	

Bunch Grasses	No	ID
[illegible]	✓ 15	✓

Herbs	No	ID
[illegible]	✓ 6	
[illegible]	✓ 7	✓
[illegible]	✓ 9	✓
[illegible]	✓ 10	
[illegible]	✓	
[illegible]	✓ 12	
[illegible]	✓ 13	

Herbs	No	ID

Sedges	No	ID
[illegible]	✓	
[illegible]	✓ 8	
= vegetative		
[illegible]	✓	✓
[illegible]		

SURVEY RECORDING SHEET — Please use pencil

QUADRAT No. COOL 8 VEGETATION TYPE Heath

DATE FIRST TRIP 25/10/92 VOLUNTEERS Kate, Sue, Ron, Mary, Jan

DATE SECOND TRIP 1/11/92 VOLUNTEERS [illegible]

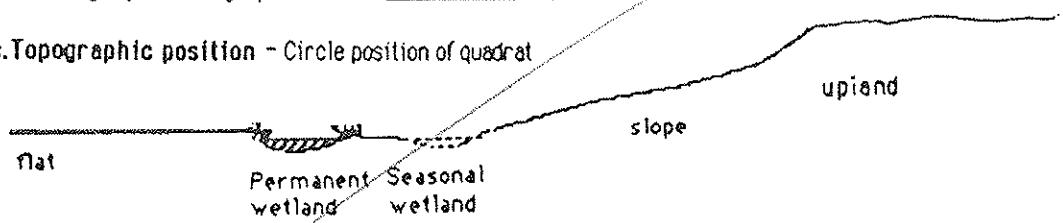
BOTANIST

1. LOCATION of the QUADRAT

a. **Mud Map** Draw a sketch of the location of the quadrat the back of this sheet

b. **Photograph** Photographer's name

c. **Topographic position** - Circle position of quadrat



Keighery and Keighery, 1990
Adapted from Griffin and Keighery, 1989
MOORE RIVER to JURIEN SANDPLAIN SURVEY. WILDFLOWER SOCIETY of WA

2. SITE DATA - Circle the correct response

Slope flat gentle steep **Aspect** N NE E SE S SW W NW

% Bare ground____ **Drainage** well mod poor **Wet** All year winter/spring

Litter (% cover)____ **Surface soil**____ **Sub-surface soil**____

3. VEGETATION STRUCTURE AND COVER. Record appropriate cover class

Cover Class - percentage cla...: 0% | under 2% | 2-10% | 10-20% | 20-30% | 30-50% | 50-70% | over 70%

LIFE FORM	TREES		MALLEES	
	>15m or 5-15m	under 5m	MALLEE SHRUB less than 8m	MALLEE TREE 8m or more
COVER CLASS (%)	>15m 5-15m			

15m
10m
5m

LIFE FORM	SHRUBS				
	over 2m	2.0-1.5m	1.5-1.0m	1.0m - .5m	under .5m
COVER CLASS (%)			20-30		

3m
2m
1m

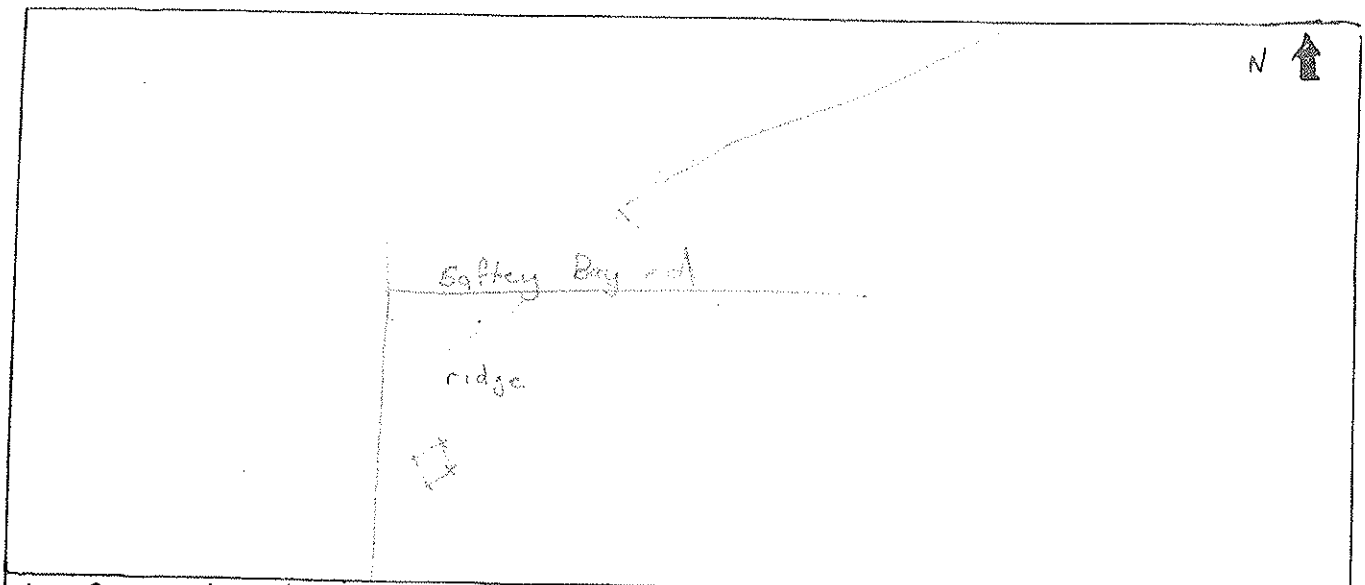
Height (metres)

LIFE FORM	BUNCH GRASSES	HERBS	SEDGES	
	under .5m	under .5m (except creepers)	over .5m	under .5m
COVER	30-50	20-30		

2.0m
1.5m
1.0m
.5m

cool 08

a. Mud Map Draw a sketch of the location of the quadrat

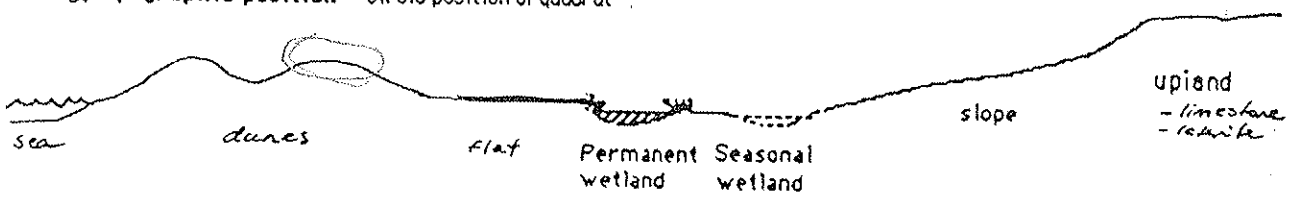


b Road Location	c. Latitude	Longitude
	32° 19' 45.1	115 46' 01.6

d. Photograph Photographer's name N.G 28 Photo No

Altitude 10 m E ± 10

e. Topographic position – Circle position of quadrat



2. SITE DATA – Circle the correct response

Slope flat (gentle) steep

Aspect [N] [NE] [E] [SE] [S] [SW] [W] [NW]

Surface soil white sand

Sub-surface soil " "

Drainage (well) mod poor

Wet All year winter/spring

Litter (% cover) [illegible]

% Bare ground 20 %

4. VEGETATION CONDITION

		Comments
EXCELLANT		
VERY GOOD	✓	
GOOD	✓	
POOR		
VERY POOR		

1. SPECIES PRESENCE

- **work systematically through the vegetation**, start with the tallest stratum, i.e. trees
- within each stratum try to record the **most common species first** and the most uncommon last.
- as each species is collected **label** it with a numbered tag and use this number on your recording sheet
- indicate if the species is in **flower**

QUADRAT No.

Keighery and Keighery, 1990
Adapted from Griffin and Keighery, 1989
MOORE RIVER to JURIEN SANDPLAIN
SURVEY. WILDFLOWER SOCIETY of WA

Trees	No	ID

Mallees	No	ID

SHRUBS	No	ID

SHRUBS	No	ID

Bunch Grasses	No	ID

Herbs	No	ID

Herbs	No	ID

Sedges	No	ID

SURVEY RECORDING SHEET — Please use pencil

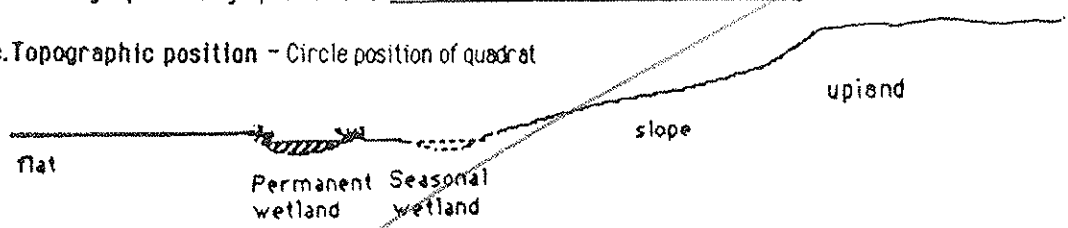
QUADRAT No. CDDS 9 VEGETATION TYPE [illegible]
DATE FIRST TRIP 25/10/92 VOLUNTEERS [illegible]
DATE SECOND TRIP [illegible] VOLUNTEERS [illegible]
BOTANIST [illegible]

1. LOCATION of the QUADRAT

a. Mud Map Draw a sketch of the location of the quadrat the back of this sheet →

b. Photograph Photographer's name _____

c. Topographic position – Circle position of quadrat



Keighery and Keighery, 1990
Adapted from Griffin and Keighery, 1989
MOORE RIVER to JURIEN SANDPLAIN
SURVEY. WILDFLOWER SOCIETY of WA

2. SITE DATA – Circle the correct response

Slope flat gentle steep Aspect N NE E SE S SW W NW

% Bare ground____ Drainage well mod poor Wet All year winter/spring

Litter (% cover)____ Surface soil_____ Sub-surface soil _____

3. VEGETATION STRUCTURE AND COVER Record appropriate cover class

Cover Class – percentage class: 0% | under 2% | 2–10% | 10–20% | 20–30% | 30–50% | 50–70% | over 70%

TREES			**MALLEES**		15m
LIFE FORM	>15m 5–15m	under 5m	MALLEE SHRUB less than 8m	MALLEE TREE 8m or more	10m 5m
COVER CLASS (%)	>15m 5–15m 10–20	10–30			

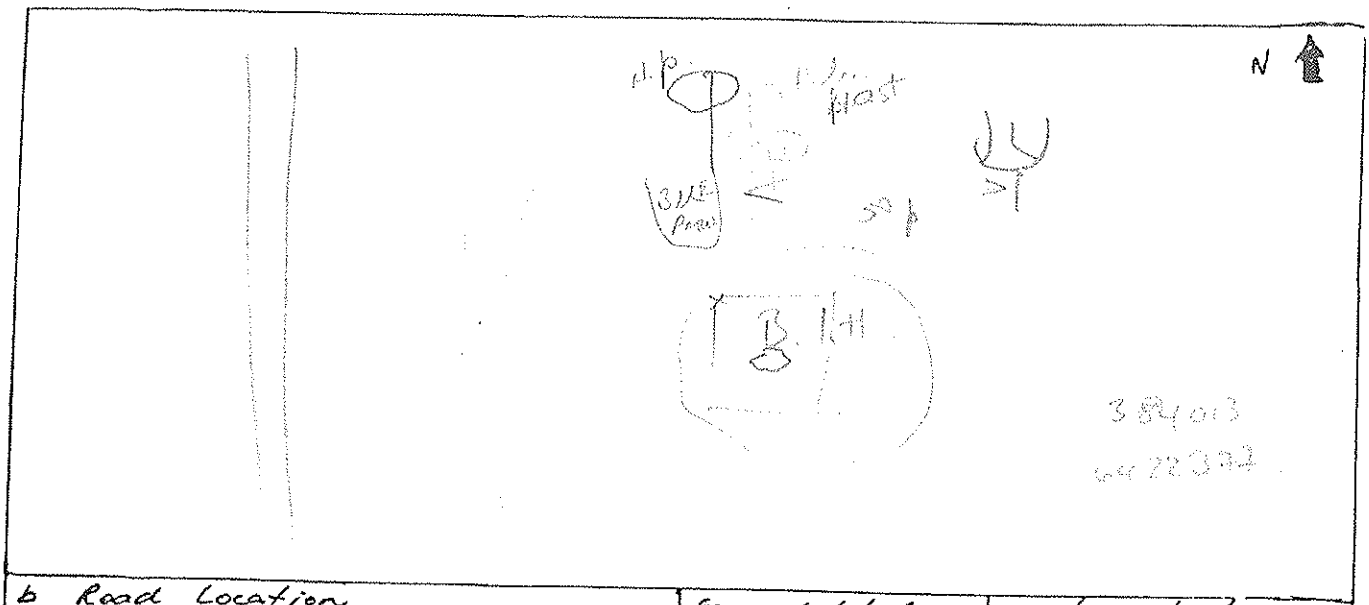
SHRUBS						
LIFE FORM	over 2m	2.0–1.5m	1.5–1.0m	1.0m – .5m	under 5m	3m 2m 1m
COVER CLASS (%)		30–50				

Height (metres)

BUNCH GRASSES	**HERBS**	**SEDGES**		
LIFE FORM	under .5m	under .5m (except creepers)	over .5m	under 5m	2.0m 1.5m 1.0m .5m
COVER					

cool ø9

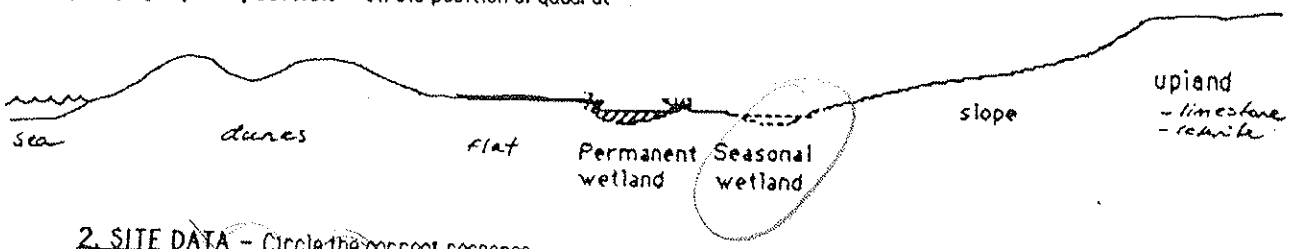
a. Mud Map Draw a sketch of the location of the quadrat



b Road Location	c. Latitude	Longitude
	32 19 45.7	115 46 03.6

d. Photograph Photographer's name _____ Photo No _____ Altitude 10 ± 100

e. Topographic position – Circle position of quadrat



2. SITE DATA – Circle the correct response

Slope flat gentle steep

Aspect N NE E SE S SW W NW

Surface soil br SAND

Sub-surface soil dk SAND

Drainage well mod poor

Wet All year winter/spring

Litter (% cover) 20

% Bare ground 10

4. VEGETATION CONDITION

EXCELLANT	
VERY GOOD	✓
GOOD	
POOR	
VERY POOR	

Comments

forb weed Mesembs
SOB 10/4/13

1. SPECIES PRESENCE

- work systematically through the vegetation, start with the tallest stratum, i.e. trees
- within each stratum tree record the **most common species first** and the most uncommon last.
- as each species is collected **label** it with a numbered tag and use this number on your recording sheet
- indicate if the species is in **flower**

QUADRAT No. 23/10/92

Keighery and Keighery, 1990
Adapted from Griffin and Keighery, 1989
MOORE RIVER to JURIEN SANDPLAIN
SURVEY. WILDFLOWER SOCIETY of WA

Trees	No	ID
Banksia attenuata	1	✓

Mallees	No	ID

SHRUBS	No	ID
Trymalium odoratissimum	2	✓
Hakea corymbosa	3	✓
Hakea conchifolia	4	✓
Melaleuca quadrifaria	5	✓
Verticordia grandiflora	7	✓
Melaleuca thymoides	9	✓
Xylomelum occidentale	10	✓

SHRUBS	No	ID

Bunch Grasses	No	ID

Herbs	No	ID
Podolepis gracilis	6	✓
Hypocalymma angustifolium	8	✓
Xanthosia candida	11	✓
Lechenaultia floribunda	12	✓
= alaternoides		

Herbs	No	IC
10/12/92		
Isotropis cuneifolia	✓	
Lyginia barbata	✓	

Sedges	No	IC
Conostylis candicans	✓	
Conostylis setigera	✓	
Desmocladus flexuosus	✓	
Tetraria octandra	✓	
Young Lepidosperma sp.	✓	

SURVEY RECORDING SHEET Please use pencil

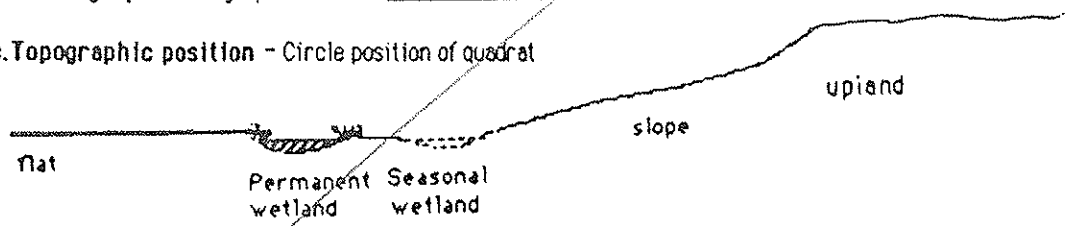
QUADRAT No. COOL 11 VEGETATION TYPE
DATE FIRST TRIP 25/10/92 VOLUNTEERS
DATE SECOND TRIP VOLUNTEERS NIL
BOTANIST

1. LOCATION of the QUADRAT

a. Mud Map Draw a sketch of the location of the quadrat the back of this sheet →

b. Photograph Photographer's name

c. Topographic position – Circle position of quadrat



Keighery and Keighery, 1990
Adapted from Griffin and Keighery, 1989
MOORE RIVER to JURIEN SANDPLAIN
SURVEY. WILDFLOWER SOCIETY of WA

2. SITE DATA – Circle the correct response

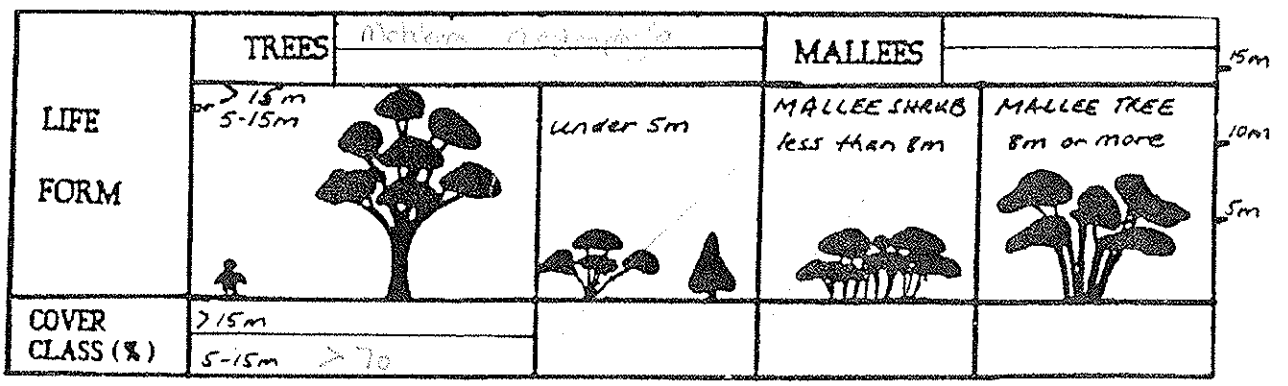
Slope flat gentle steep **Aspect** N NE E SE S SW W NW

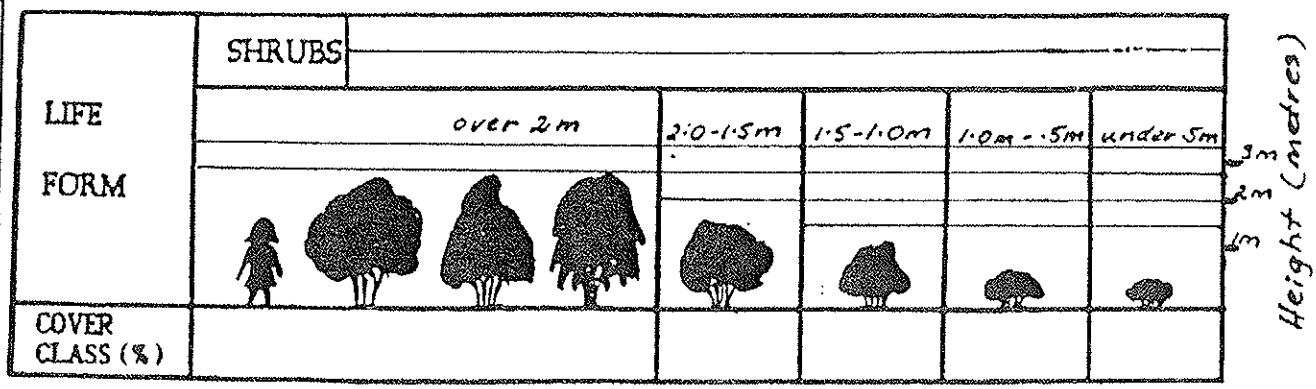
% Bare ground Drainage well mod poor **Wet** All year winter/spring

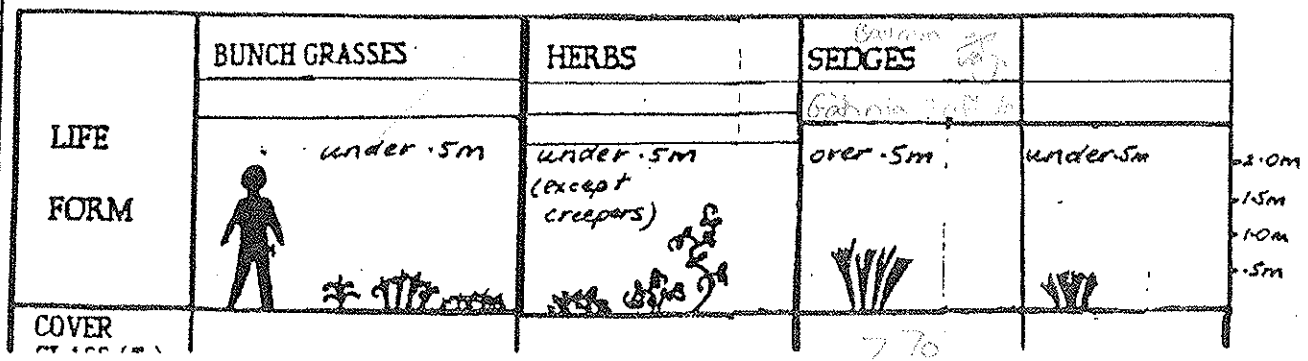
Litter (% cover) Surface soil Sub-surface soil

3. VEGETATION STRUCTURE AND COVER Record appropriate cover class

Cover Class = percentage class: over 70% | 50-70% | 30-50% | 20-30% | 10-20% | 2-10% | under 2% | 0%

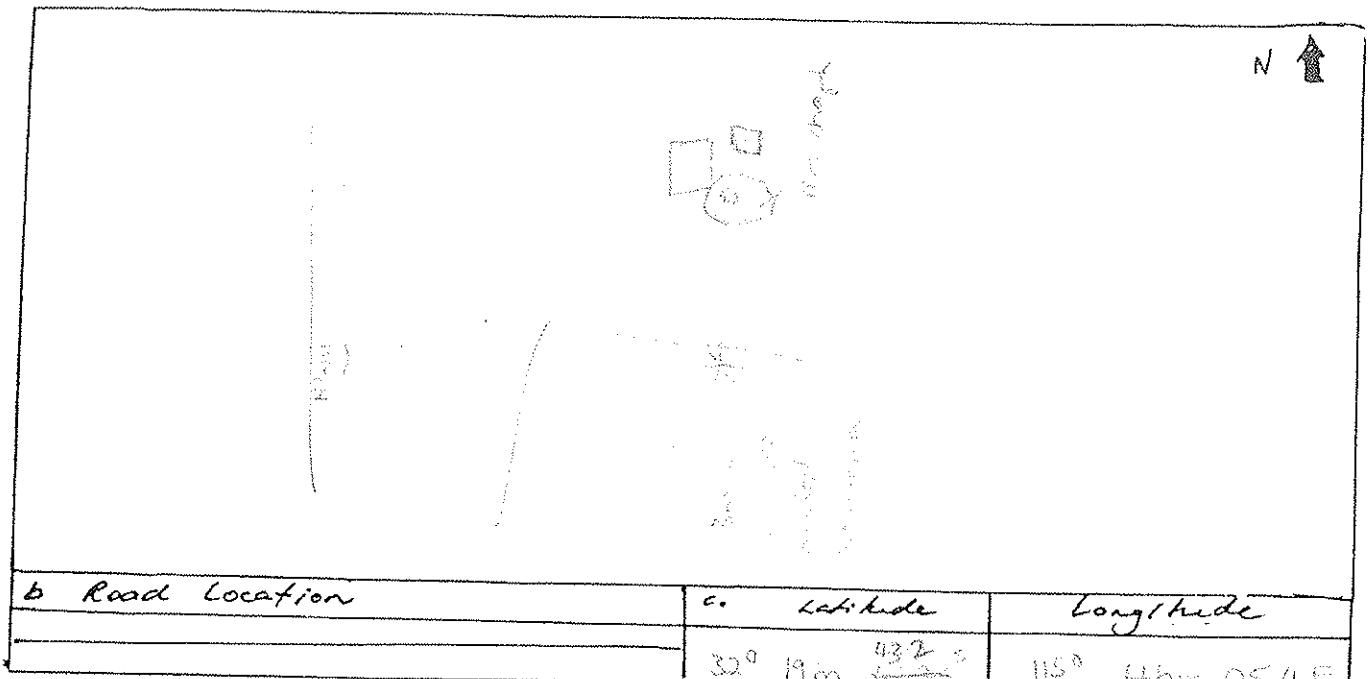






a. Mud Map Draw a sketch of the location of the quadrat

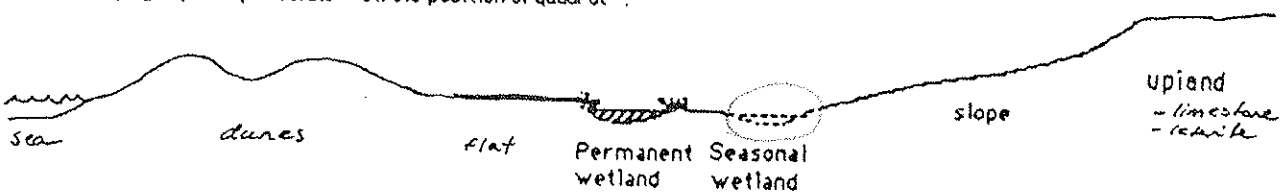
Cool 11



b Road Location	c. Latitude	Longitude
	30° 19m 432" S	115° 46m 05.4E
		Altitude 10m ± 300

d. Photograph Photographer's name _____ Photo No _____

e. Topographic position - Circle position of quadrat



2. SITE DATA - Circle the correct response

Slope (flat) gentle steep

Aspect | N | NE | E | SE | S | SW | W | NW |

Surface soil _____ black sand peat

Sub-surface soil _____ black sand peat

Drainage well mod (poor)

Wet All year (winter/spring)

Litter (% cover) 30

% Bare ground 0

4. VEGETATION CONDITION

		Comments
EXCELLENT		Very low scrub
VERY GOOD		
GOOD		
POOR	✓	
VERY POOR		

1. SPECIES PRESENCE

- **work systematically through the vegetation**, start with the tallest stratum, i.e. trees
- within each stratum try to record the **most common species first** and the most uncommon last.
- as each species is collected **label** it with a numbered tag and use this number on your recording sheet
- indicate if the species is in **flower**

QUADRAT No.

Keighery and Keighery, 1990
Adapted from Griffin and Keighery, 1989
MOORE RIVER to JURIEN SANDPLAIN
SURVEY. WILDFLOWER SOCIETY of WA

Trees

	No	ID
[illegible]	[illegible]	X

Mallees

SHRUBS

	No	ID
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

SHRUBS

	No	ID
Adriana quadripartita		

Bunch Grasses

	No	ID
[illegible] sp. Swanbank ?	10	✓

Herbs

	No	ID
Senecio [illegible]	✓	
Stylidium sp. Lobelia alata	✓	✓
Pultenaea sp. hispidula	✓	✓
Phyllanthus calycina	✓	X
Trachymene [illegible]	✓	X
Tetratheca [illegible]	✓	?
Ptilotus [illegible]	✓	✓
Poranthera		

→ Swanbank lac

Herbs

10/10/93

	No	ID
Lobelia alata	✓	X
Hibbertia quadripartita	✓	X
Rhodanthe battardiana insularis		X

Sedges

	No	ID
[illegible]	✓	X
Burmannia [illegible] juncea (long)	✓	X
[illegible]	✓	X
Stylidium ? [illegible]	✓	X
Drosera [illegible]	✓	X
→ Tetraria capillaris		
= Baumea rubiginosa		

- SURVEY RECORDING SHEET Please use pencil

QUADRAT No. TAMT 01 VEGETATION TYPE Bush Mallee Low Open Woodland

DATE FIRST TRIP 29/10/01 VOLUNTEERS

DATE SECOND TRIP 11/12/02 VOLUNTEERS

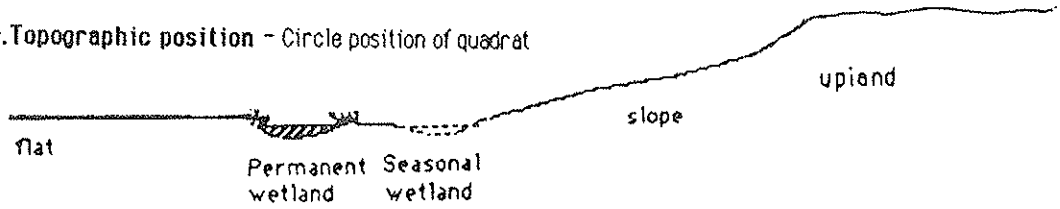
BOTANIST

1. LOCATION of the QUADRAT

a. Mud Map Draw a sketch of the location of the quadrat the back of this sheet →

b. Photograph Photographer's name

c. Topographic position - Circle position of quadrat



Keighery and Keighery, 1990
Adapted from Griffin and Keighery, 1989
MOORE RIVER to JURIEN SANDPLAIN SURVEY. WILDFLOWER SOCIETY of WA

2. SITE DATA - Circle the correct response

Slope flat gentle steep **Aspect** N NE E SE S SW W NW

% Bare ground____ **Drainage** well mod poor **Wet** All year winter/spring

Litter (% cover)____ **Surface soil**____ **Sub-surface soil**____

3. VEGETATION STRUCTURE AND COVER. Record appropriate cover class

Cover Class - percentage classes: over 70% | 50-70% | 30-50% | 20-30% | 10-20% | 2-10% | under 2% | 0%

LIFE FORM					
TREES	>15m or 5-15m	under 5m	MALLEES	MALLEE SHRUB less than 8m	MALLEE TREE 8m or more
COVER CLASS (%)	>15m 5-15m 20-30				

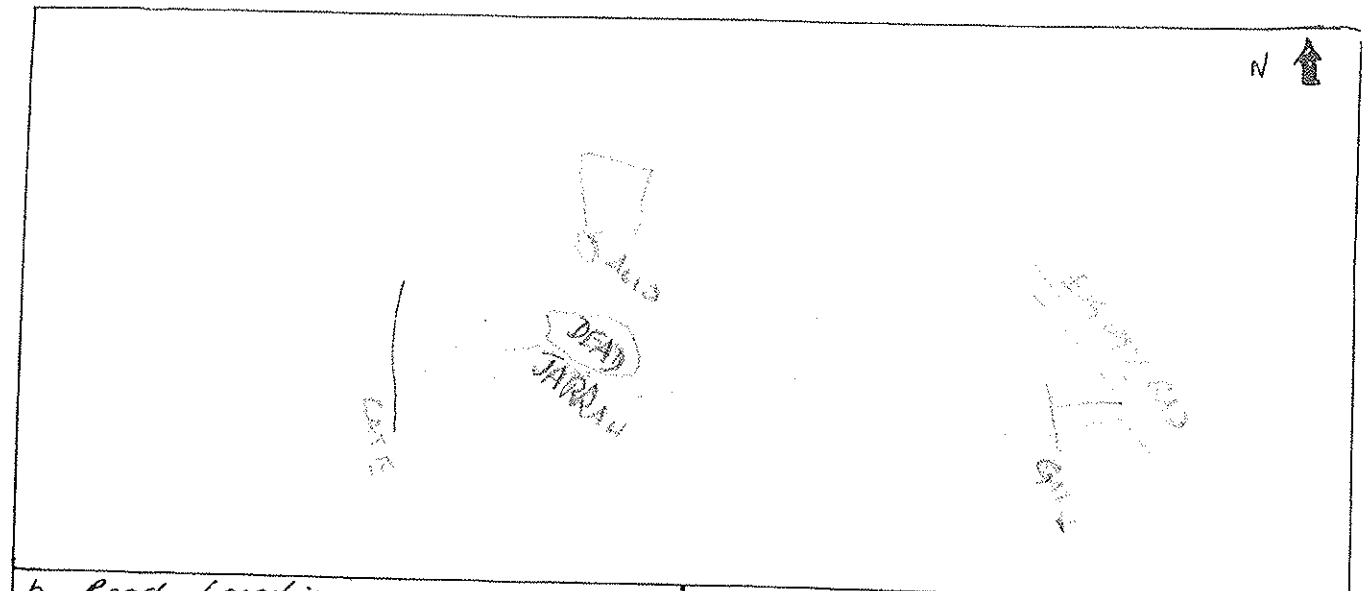
LIFE FORM					
SHRUBS	over 2m	2.0-1.5m	1.5-1.0m	1.0m - .5m	under 5m
COVER CLASS (%)				30-50	

LIFE FORM				
BUNCH GRASSES	under .5m	HERBS	under .5m (except creepers)	SEDGES	over .5m	under .5m
COVER	30-50			20-30

Height (metres): 15m, 10m, 5m; 3m, 2m, 1m; 2.0m, 1.5m, 1.0m, .5m

1. LOCATION OF THE QUADRAT

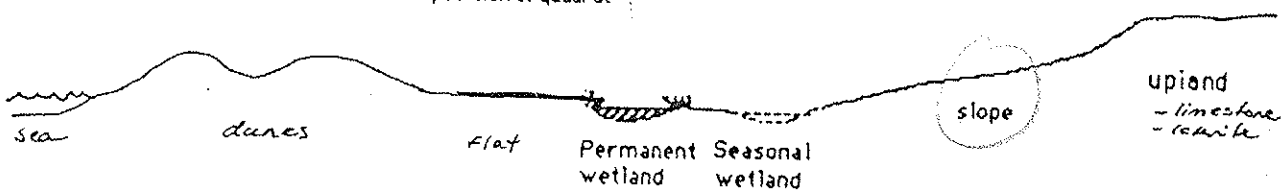
a. **Mud Map** Draw a sketch of the location of the quadrat : TAM-1



b Road Location	c. Latitude	Longitude
	32 19 10.4	115 48 26.9

d. **Photograph** Photographer's name _____ Photo No _____ Altitude 30 ± 10m

e. **Topographic position** – Circle position of quadrat



2. SITE DATA – Circle the correct response

Slope flat gentle (steep)

Aspect (N) NE E SE S SW W NW

Surface soil Brown Sand

Sub-surface soil Brown Sand

Drainage (well) mod poor

Wet All year winter/spring

Litter (% cover) 70

% Bare ground 10

4. VEGETATION CONDITION

EXCELLANT	
VERY GOOD	
GOOD	✓
POOR	
VERY POOR	

Comments

OPEN QUINT - LOT WEEDS
- LOW DIVERSITY
STRUGGLING IN PARTS

SPECIES PRESENCE

QUADRAT No.

- **work systematically through the vegetation**, start with the tallest stratum, i.e trees
- within each stratum try to record the **most common species first** and the most uncommon last.
- as each species is collected **label** it with a numbered tag and use this number on your recording sheet
- indicate if the species is in **flower**

Keighery and Keighery, 1990
Adapted from Griffin and Keighery, 1989
MOORE RIVER to JURIEN SANDPLAIN
SURVEY. WILDFLOWER SOCIETY of WA

Trees

	No	ID
B. ATTE		
E. MEL		

Mallees

SHRUBS

SHRUBS

	No	ID

Bunch Grasses

Herbs

Herbs

	No	ID

Sedges

- SURVEY RECORDING SHEET **Please use pencil**

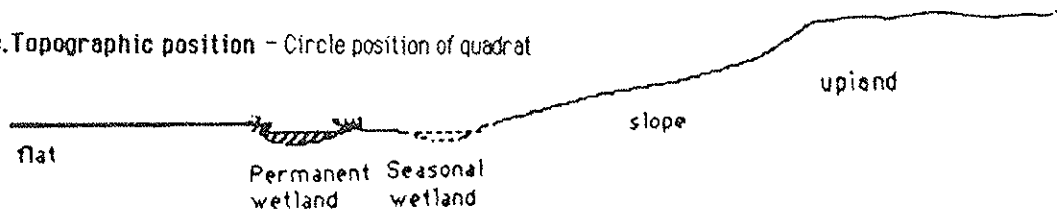
QUADRAT No. WORS 01 **VEGETATION TYPE** Mixed wodd Low
DATE FIRST TRIP 7/10/94 **VOLUNTEERS** Gordon
DATE SECOND TRIP 9/11/94 **VOLUNTEERS** M Mc Lee
BOTANIST: NS/ML/SL

1. LOCATION of the QUADRAT

a. Mud Map Draw a sketch of the location of the quadrat the back of this sheet →

b. Photograph Photographer's name _____

c. Topographic position – Circle position of quadrat



Keighery and Keighery, 1990
Adapted from Griffin and Keighery, 1989
MOORE RIVER to JURIEN SANDPLAIN
SURVEY. WILDFLOWER SOCIETY of WA

2. SITE DATA – Circle the correct response

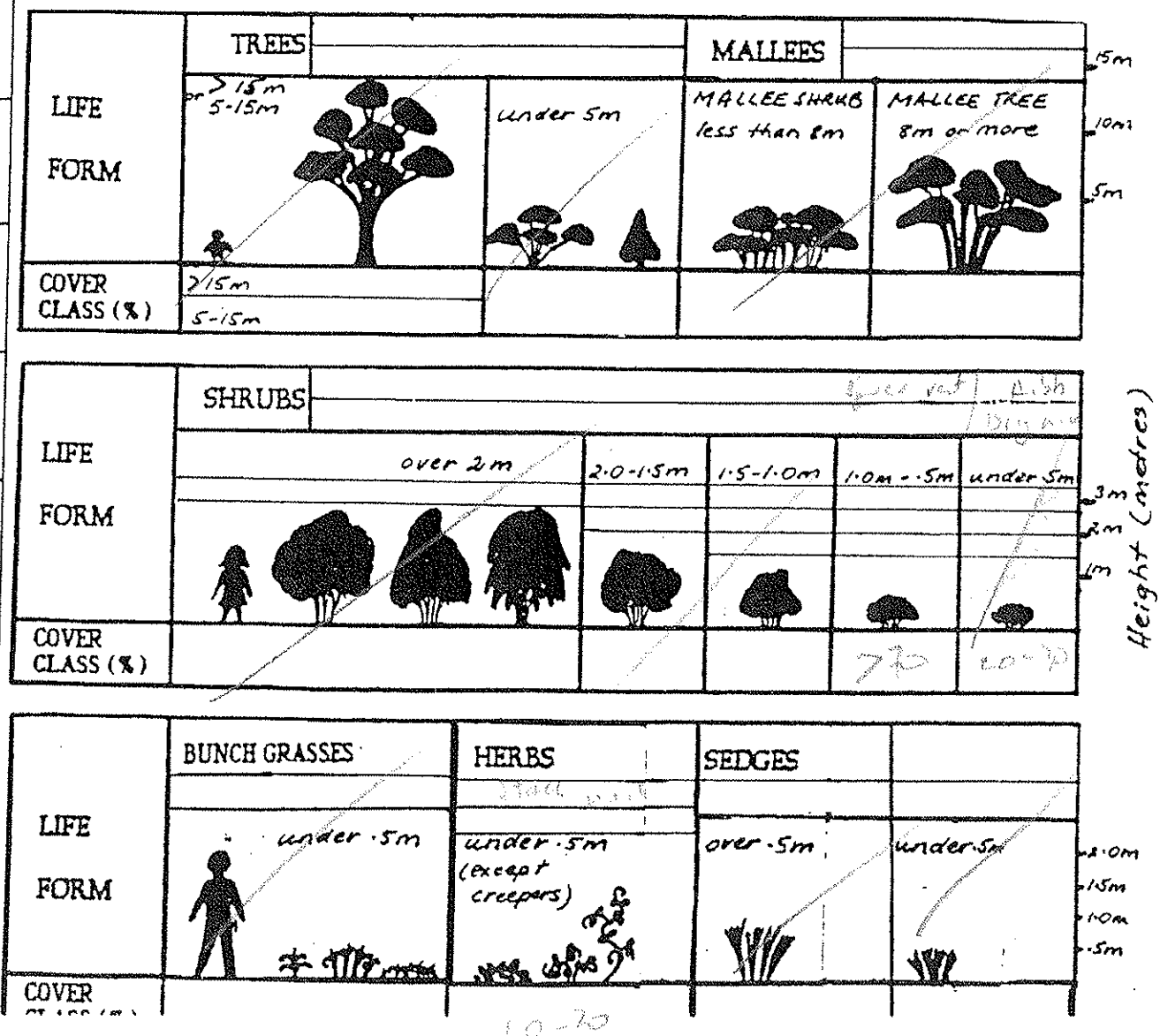
Slope flat gentle steep **Aspect** N NE E SE S SW W NW

% Bare ground____ **Drainage** well mod poor **Wet** All year winter/spring

Litter (% cover)_____ **Surface soil**_____ **Sub-surface soil** _____

3. VEGETATION STRUCTURE AND COVER. Record appropriate cover class

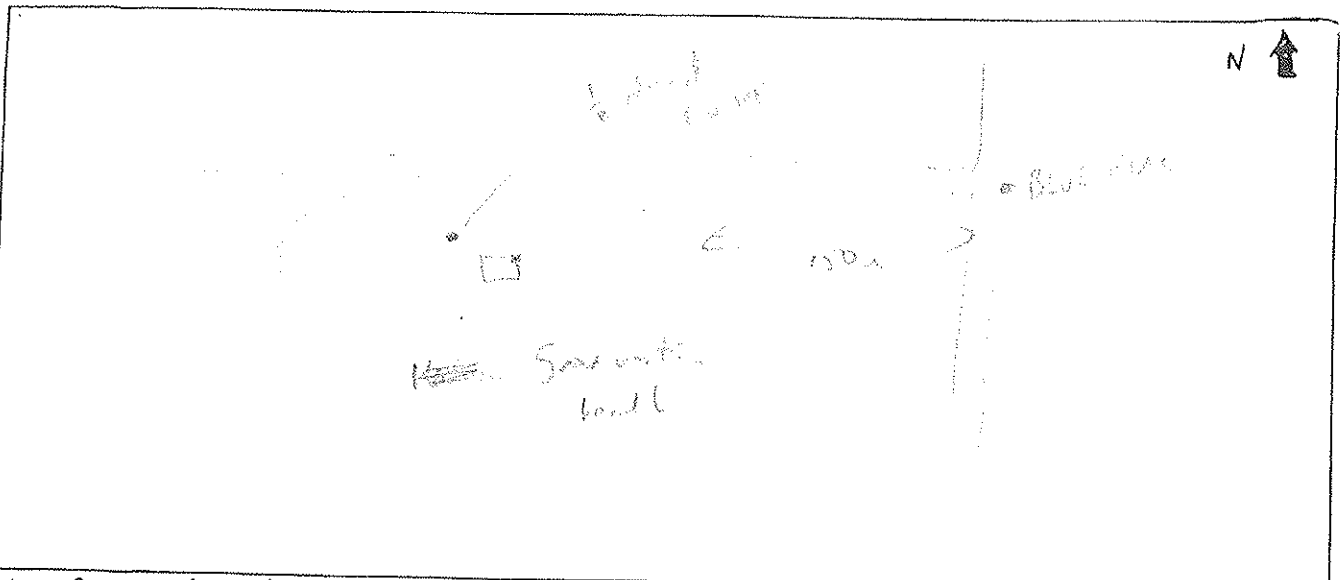
Cover Class – percentage classes: 0% | under 2% | 2–10% | 10–20% | 20–30% | 30–50% | 50–70% | over 70%



1. LOCATION of the QUADRAT

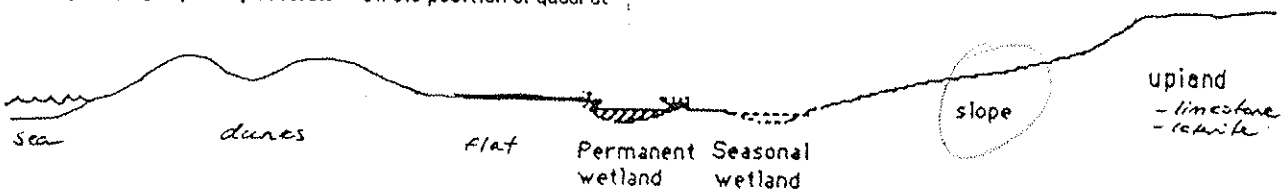
KERO-1

a. Mud Map Draw a sketch of the location of the quadrat :



b Road Location	c. Latitude	Longitude
	32 19 42.6	116 47 19.2
d. Photograph Photographer's name NP	Photo No 18	Altitude 22 120 m

e. Topographic position – Circle position of quadrat



2. SITE DATA – Circle the correct response

Slope flat (gentle) steep

Aspect (N) NE E SE S SW W NW

Surface soil Dry Sand

Sub-surface soil Orange Sand / limestone outcropping

Drainage (well) mod poor

Wet (All year) winter/spring

Litter (% cover) 30

% Bare ground 30

4. VEGETATION CONDITION

		Comments
EXCELLENT		add herbs, weeds, Banana rabbit intest
VERY GOOD		
GOOD		
POOR	✓	
VERY POOR		

SPECIES PRESENCE

QUADRAT No. 2 10/92
KWO 01

- **work systematically through the vegetation**, start with the tallest stratum, i.e. trees
- within each stratum try to record the **most common species first** and the most uncommon last.
- as each species is collected **label** it with a numbered tag and use this number on your recording sheet
- indicate if the species is in **flower**

Keighery and Keighery, 1990
Adapted from Griffin and Keighery, 1989
MOORE RIVER to JURIEN SANDPLAIN SURVEY. WILDFLOWER SOCIETY of WA

Trees

No	ID

Mallees

No	ID

SHRUBS

No	ID

SHRUBS

4/11/92

No	ID
X	✓
	✓
	X
	✓

Bunch Grasses

No	ID
	X

Herbs

No	ID
	✓
	✓
*	
*	

Herbs

No	ID

Sedges

No	ID
	✓
	✓

- SURVEY RECORDING SHEET Please use pencil

QUADRAT No. KOS 02 VEGETATION TYPE TUARTINA SWAMP

DATE FIRST TRIP 2/10/01 VOLUNTEERS KG ME

DATE SECOND TRIP 4/11/01 VOLUNTEERS BUK KG

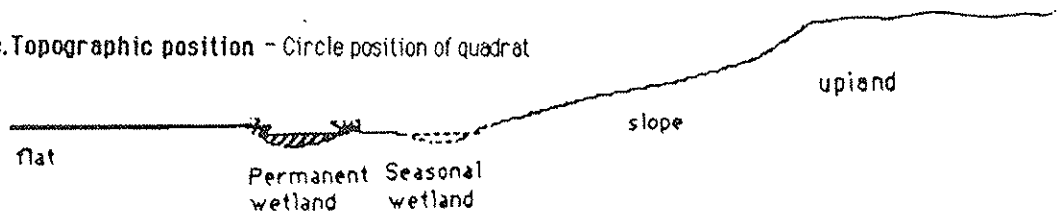
BOTANIST

1. LOCATION of the QUADRAT

a. Mud Map Draw a sketch of the location of the quadrat the back of this sheet →

b. Photograph Photographer's name

c. Topographic position – Circle position of quadrat



Keighery and Keighery, 1990
Adapted from Griffin and Keighery, 1989
MOORE RIVER to JURIEN SANDPLAIN SURVEY. WILDFLOWER SOCIETY of WA

2. SITE DATA – Circle the correct response

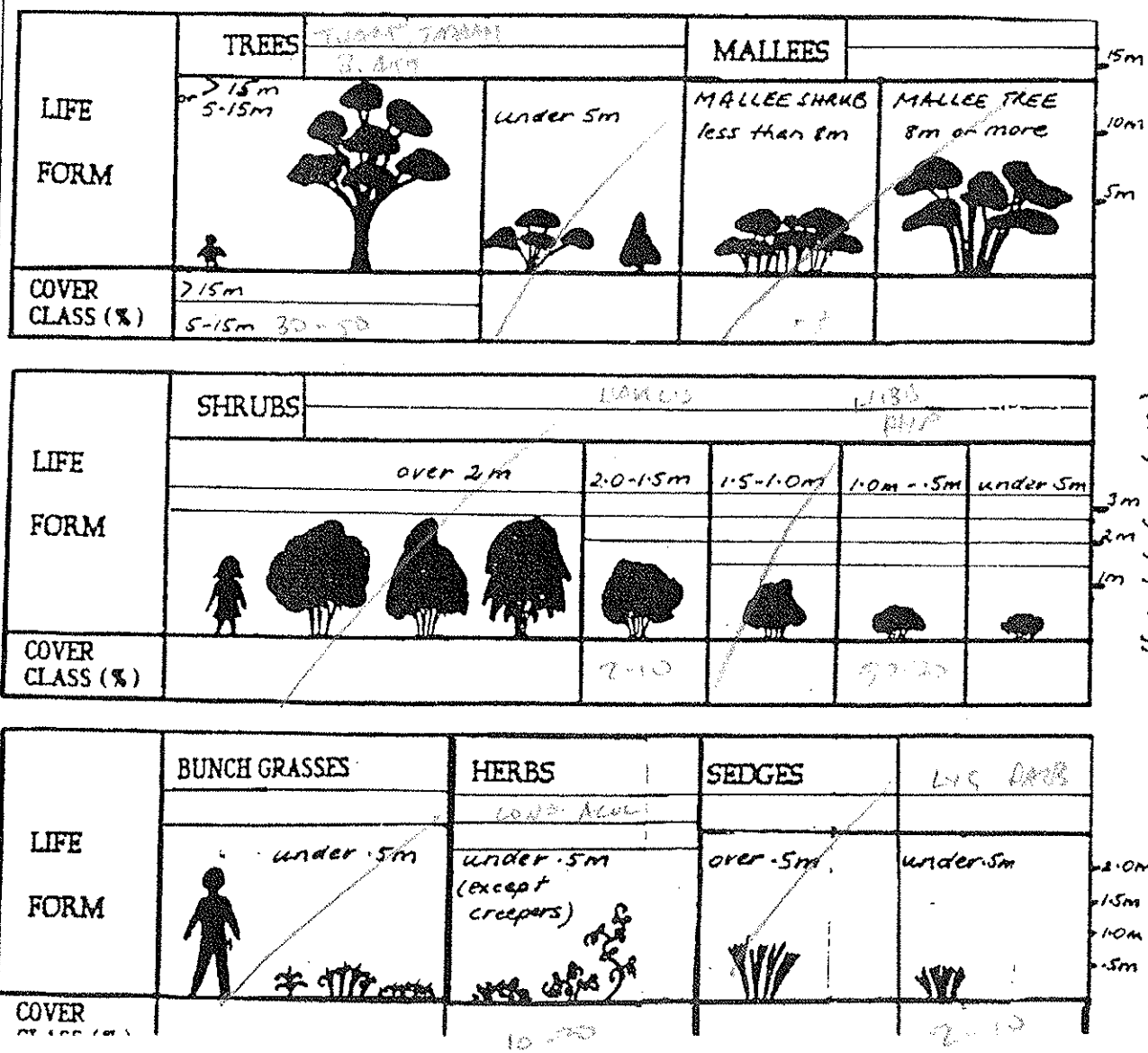
Slope flat gentle steep Aspect N NE E SE S SW W NW

% Bare ground____ Drainage well mod poor Wet All year winter/spring

Litter (% cover)____ Surface soil____ Sub-surface soil____

3. VEGETATION STRUCTURE AND COVER Record appropriate cover class

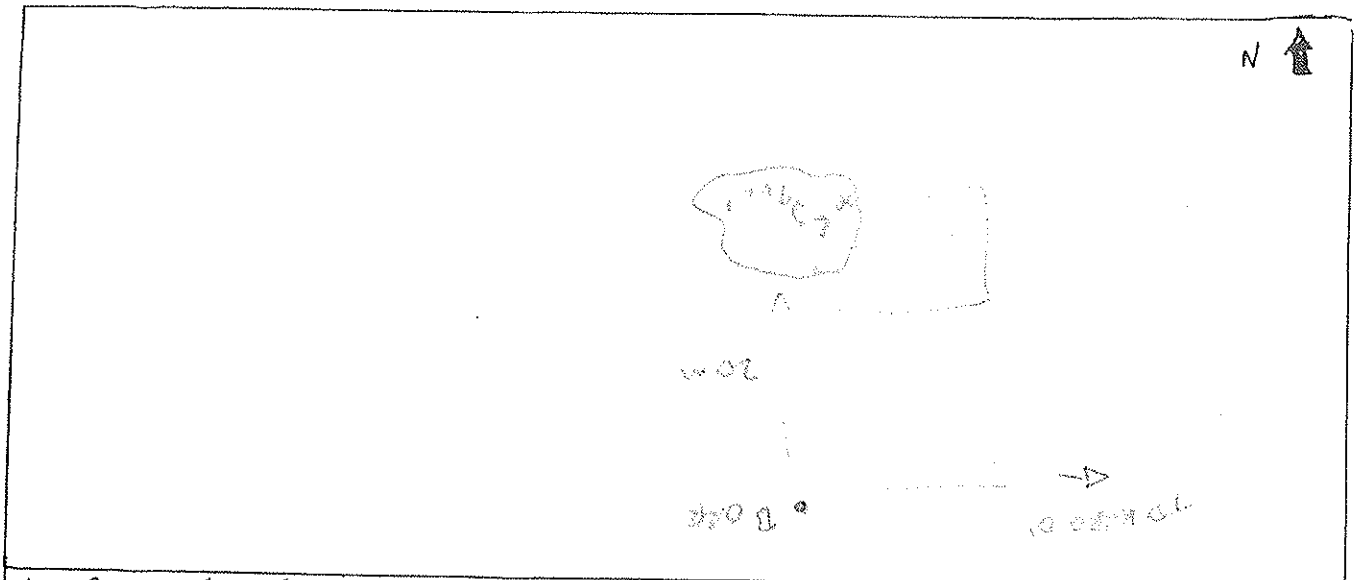
Cover Class – percentage classes: 0% | under 2% | 2–10% | 10–20% | 20–30% | 30–50% | 50–70% | over 70%



1. LOCATION of the QUADRAT

KERO-2

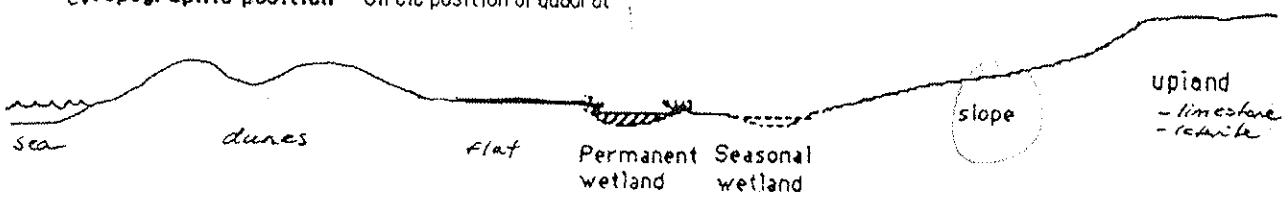
a. **Mud Map** Draw a sketch of the location of the quadrat :



b Road Location	c. Latitude	Longitude
	32 17 40.1	115 42 52.9

d. **Photograph** Photographer's name _____ Photo No _____ Altitude 70 m ± 100

e. **Topographic position** – Circle position of quadrat



2. SITE DATA – Circle the correct response

Slope flat gentle steep

Aspect N NE E SE S SW W NW

Surface soil BLACK SAND

Sub-surface soil ORANGE SAND

Drainage well mod poor

Wet All year winter/spring

Litter (% cover) 70

% Bare ground 10

4. VEGETATION CONDITION

		Comments
EXCELLANT		Small Patch -
VERY GOOD		Grazed by rabbits
GOOD	✓	& Ornamental plants
POOR		very 20-30%
VERY POOR		

SPECIES PRESENCE

QUADRAT No.

- **work systematically through the vegetation**, start with the tallest stratum, i.e. trees
- within each stratum try to record the **most common species first** and the most uncommon last.
- as each species is collected **label** it with a numbered tag and use this number on your recording sheet
- indicate if the species is in **flower**

Keighery and Keighery, 1990
Adapted from Griffin and Keighery, 1989
MOORE RIVER to JURIEN SANDPLAIN SURVEY. WILDFLOWER SOCIETY of WA

Trees

	No	ID

Mallees

	No	ID

SHRUBS

	No	ID

SHRUBS

	No	ID

Bunch Grasses

	No	ID

Herbs

	No	ID

Herbs

	No	ID

Sedges

	No	ID

BUSHLAND PLANT SURVEY RECORDING SHEET 3 - use pencil only

5. SPECIES PRESCENCE

SITE No COOL 14

Date

Label each plant with plants number, site code, date and plant's name or working name if required

Record on Sheet

- Column 1 plant name.
- Column 2 plant number
- Column 3 flowering time- TICK if species flowering
- Column 4 identification check

From *'Bushland Plant Survey'* written by B. Keighery (1994) and published by the Wildflower Society of WA (Inc.), PO Box 64 Nedlands WA 6008.

TREES	No	Fl	ID
Euc gomph			
Acacia saligna			
MALLEES			
SHRUBS			
Acacia anchoria			
Templetonia retusa			
Acanthocarpus preissii			
Hard Leaf			
Acacia rostellata			
Trymalium albicans			
Leptospermum sp.			
Melaleuca adpressa			0
			0
			0
			1
			0
			0
			1
			0
			0
			1

SHRUBS (cont.)	No	Fl	ID
GRASSES			
HERBS			
Sporobolus virginicus			0
Paspalum distichum			0
Cakile maritima			0
Anagallis arvensis			1
Euphorbia peplis			0
Trachymene coerulea			0
Centella cordifolia			1
Zantedeschia aethiopica			0
Calocasia taitensis			0
Hydrocotyle bonariensis			1

HERBS (cont.)	No	Fl	ID
SEDGES			
Gahnia trifida			0
Lepidosp. gracile			0
Baumea juncea			1

BUSHLAND PLANT SURVEY RECORDING SHEET 3 - use pencil only

5. SPECIES PRESCENCE

SITE No Cool 15

Date

Label each plant with plants number, site code, date and plant's name or working name if required

Record on Sheet

- Column 1 plant name-
- Column 2 plant number
- Column 3 flowering time- TICK if species flowering
- Column 4 identification check

From *'Bushland Plant Survey'* written by B. Keighery (1994) and published by the Wildflower Society of WA (Inc.), PO Box 64 Nedlands WA 6008.

TREES	No	Fl	ID
Eucalyptus			
MALLEES			
			0
SHRUBS			
Acacia truncata			
Acacia cochlearis			
Templetonia retusa			
Acacia saligna			
Hardenbergia comptoniana			
Kennedia coccinea			
Xanthorrhoea preissii			
Trymalium ledifolium			0
Anthocercis littorea			0
Clematis linearifolia			0
Dodonaea inaequifolia			0
			0
			0
			0
			0
			0
			0
			0
			0

SHRUBS (cont.)	No	Fl	ID
			0
GRASSES			
Stipa flavescens			
HERBS			
Tricoryne elatior			
Comesperma virgatum			
Caladenia latifolia			
Pterostylis barbata			
Trachymene coerulea			
Anagallis arvensis			
Hydrocotyle diantha			
Conyza albanensis			
Isotoma scapigera			
Solanum nigrum			
Euphorbia peplus			
Cerastium glomeratum			
Trifolium campestre			

HERBS (cont.)	No	Fl	ID
Sonchus oleraceus			
SEDGES			
Lepidosperma angustatum			
Cyperus laevigatus			

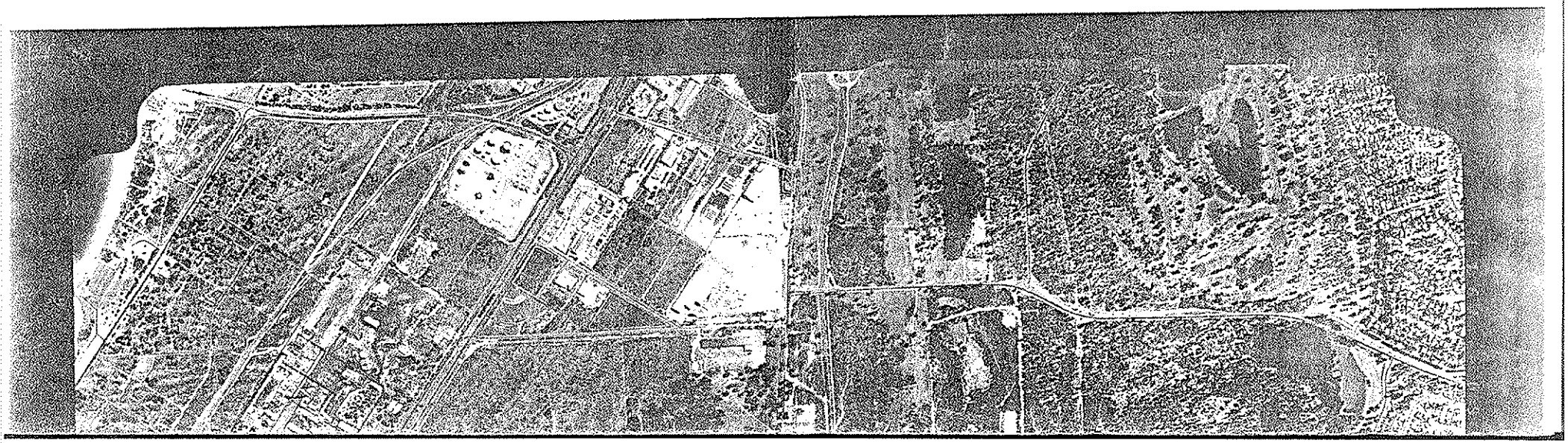
25/10/92
Approx locations
Sites

Lake Cooloongup

1.

Planned Sites

1. Lake edge
2. Tuart – V. open woodland (+) ? Greg's sites
3. Tuart open woodland (+)
4. Sand ridge
5. Steep valley – Tuart Forest
6. Banksia Littoralis Woodland
7. Mel. raphiophylla Woodland
8. Sandheath
9. ? Shrubland/Grassland
10. ? Mel raphio Woodland



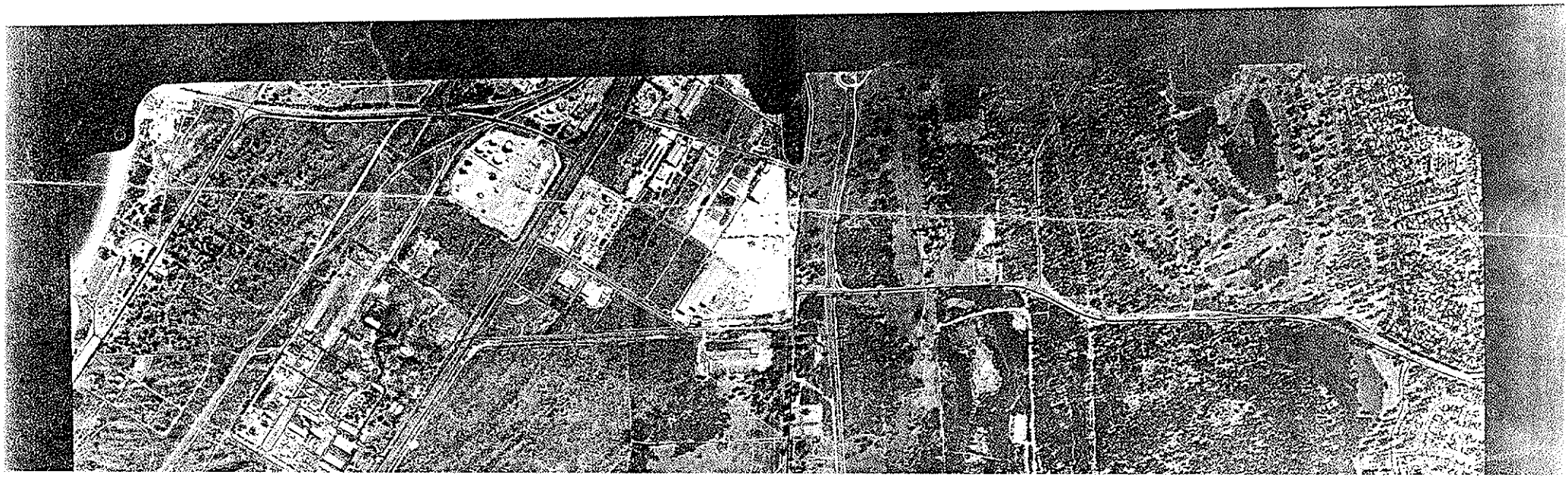

3
2
1
5153 WA 2939(C) METRO STREE DIRECTORY & EXT. RUN 7 (5102-520 1:20000 5.1.91 910400

Cool Map Aii

Lake Coolongup

1
2
3
4
5
6
7
8
9
10

Greg's site

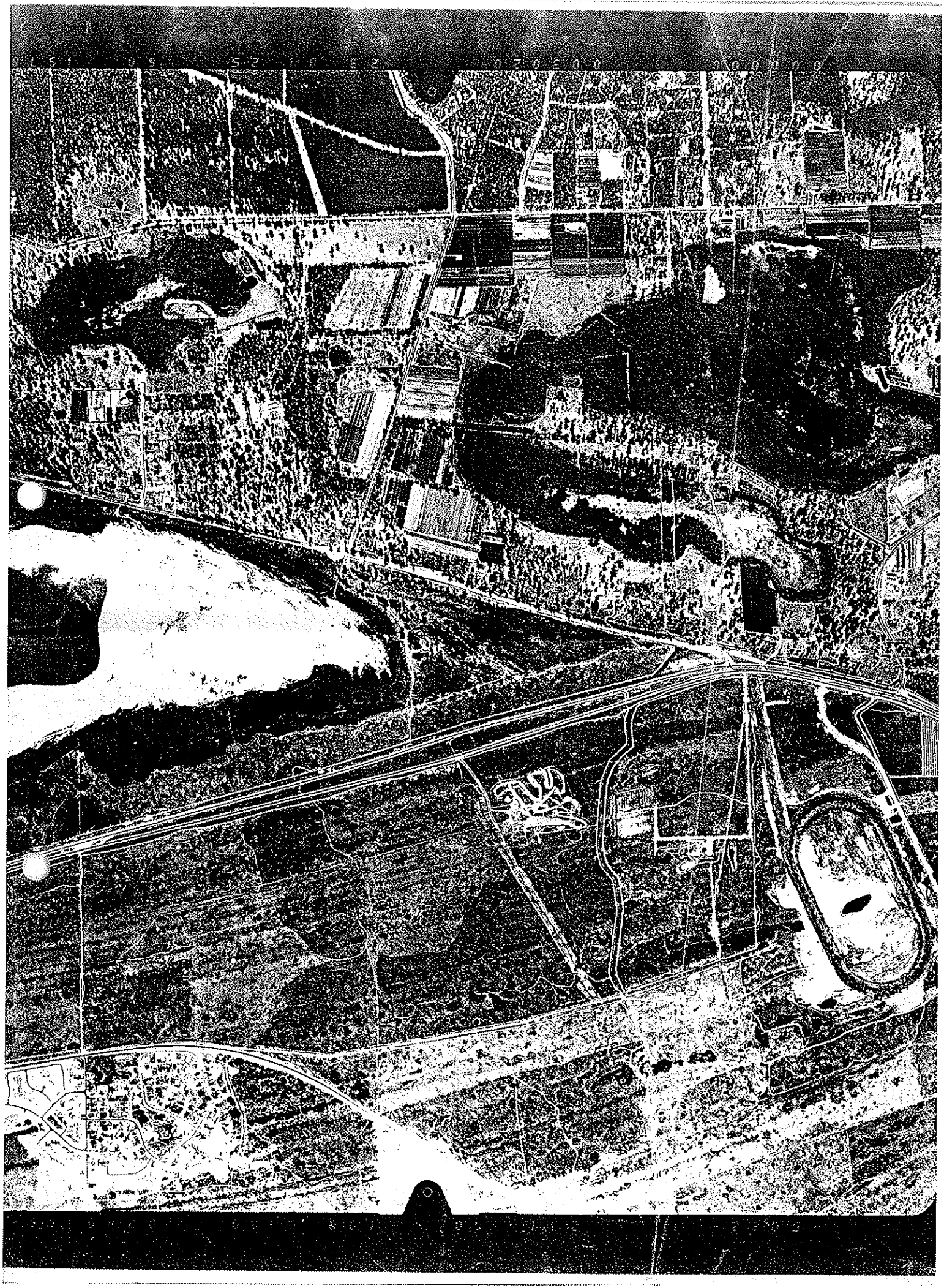


Cool Hab 8

Cool Map Bii

cool Map Biii

cool Map Biv



Cool Map By

 by Species

Plotorsource	Family	Na	Genus	Species	InfraspRank	InfraspName	Informal	ConsvCode
cool14	Mimosaceae		Acacia	cochlearis				
cool15	Mimosaceae		Acacia	cochlearis				
cool 08	Mimosaceae		Acacia	lasiocarpa				
cool14	Mimosaceae		Acacia	pulchella				
cool 02	Mimosaceae		Acacia	rostellifera				
cool 08	Mimosaceae		Acacia	rostellifera				
cool 09	Mimosaceae		Acacia	rostellifera				
cool 02	Mimosaceae		Acacia	saligna				
cool 03	Mimosaceae		Acacia	saligna				
cool 08	Mimosaceae		Acacia	saligna				
cool 09	Mimosaceae		Acacia	saligna				
cool 11	Mimosaceae		Acacia	saligna				
cool14	Mimosaceae		Acacia	saligna				
cool15	Mimosaceae		Acacia	saligna				
cool15	Mimosaceae		Acacia	truncata				
cool 02	Dasypogonacea		Acanthocarpus	preissii				
cool 03	Dasypogonacea		Acanthocarpus	preissii				
cool 04	Dasypogonacea		Acanthocarpus	preissii				
cool 08	Dasypogonacea		Acanthocarpus	preissii				
cool 04	Euphorbiaceae		Adriana	quadripartita				
cool 09	Euphorbiaceae		Adriana	quadripartita				
cool 11	Euphorbiaceae		Adriana	quadripartita				
cool 02	Primulaceae	*	Anagallis	arvensis				
cool 03	Primulaceae	*	Anagallis	arvensis				
cool 04	Primulaceae	*	Anagallis	arvensis				
cool 08	Primulaceae	*	Anagallis	arvensis				
cool 09	Primulaceae	*	Anagallis	arvensis				
KERO-1	Primulaceae	*	Anagallis	arvensis				
KERO-2	Primulaceae	*	Anagallis	arvensis				
cool14	Primulaceae	*	Anagallis	arvensis var. arvensis FPR				
cool15	Primulaceae	*	Anagallis	arvensis var. arvensis FPR				
cool14	Solanaceae		Anthocercis	littorea				
cool15	Solanaceae		Anthocercis	littorea				
cool 01	Apiaceae		Apium	prostratum	var.	prostratum		
cool 08	Poaceae		Austrodanthonia	occidentalis				
KERO-2	Poaceae		Austrodanthonia	occidentalis				
cool 08	Poaceae		Austrostipa	flavescens				
cool15	Poaceae		Austrostipa	flavescens				
KERO-1	Poaceae		Austrostipa	flavescens				
TAM-1	Poaceae		Austrostipa	flavescens				
cool 02	Poaceae	*	Avellinia	michelii				
cool 08	Poaceae	*	Avena	fatua				
KERO-2	Poaceae	*	Avena	fatua				
KERO-2	Proteaceae		Banksia	attenuata				
TAM-1	Proteaceae		Banksia	attenuata				
cool 09	Proteaceae		Banksia	littoralis				
TAM-1	Proteaceae		Banksia	menziesii				
cool 04	Cyperaceae		Baumea	juncea				
cool 09	Cyperaceae		Baumea	juncea				
cool 11	Cyperaceae		Baumea	juncea				
cool14	Cyperaceae		Baumea	juncea				
cool 11	Cyperaceae		Baumea	vaginalis				
TAM-1	Papilionaceae		Bossiaea	eriocarpa				
KERO-2	Poaceae	*	Briza	maxima				
TAM-1	Poaceae	*	Briza	maxima				
cool 02	Poaceae	*	Briza	minor				
KERO-2	Poaceae	*	Briza	minor				
TAM-1	Poaceae	*	Briza	minor				
cool 02	Poaceae	*	Bromus	diandrus				
cool 03	Poaceae	*	Bromus	diandrus				
KERO-2	Poaceae	*	Bromus	diandrus				

Plotorsource	Family	Na	Genus	Species	InfraspRank	InfraspName	Informal	ConsvCode
KERO-1	Colchicaceae		Burchardia	congesta				
KERO-2	Colchicaceae		Burchardia	congesta				
TAM-1	Colchicaceae		Burchardia	congesta				
TAM-1	Anthericaceae		Caesia	micrantha				
cool 04	Orchidaceae		Caladenia	latifolia				
cool14	Orchidaceae		Caladenia	latifolia				
cool15	Orchidaceae		Caladenia	latifolia				
cool 03	Portulacaceae		Calandrinia	calyptrata				
cool 02	Portulacaceae		Calandrinia	sp. (Gibson et al. 1994)				
cool 03	Cyperaceae		Carex	preissii				
cool 01	Lauraceae		Cassytha	racemosa				
cool 02	Gentianaceae	*	Centaurium	erythraea				
cool 03	Gentianaceae	*	Centaurium	erythraea				
cool 04	Apiaceae		Centella	asiatica				
cool14	Apiaceae		Centella	asiatica				
KERO-1	Centrolepidacea		Centrolepis	drummondiana				
KERO-2	Centrolepidacea		Centrolepis	drummondiana				
cool 02	Caryophyllaceae	*	Cerastium	glomeratum				
cool 03	Caryophyllaceae	*	Cerastium	glomeratum				
cool15	Caryophyllaceae	*	Cerastium	glomeratum				
KERO-1	Caryophyllaceae	*	Cerastium	glomeratum				
KERO-2	Caryophyllaceae	*	Cerastium	glomeratum				
cool 04	Anthericaceae		Chamaescilla	corymbosa	var.	corymbosa		
cool 03	Asteraceae	*	Cirsium	vulgare				
cool 04	Ranunculaceae		Clematis	linearifolia				
cool15	Ranunculaceae		Clematis	linearifolia				
cool15	Polygalaceae		Comesperma	virgatum				
cool 02	Haemodoraceae		Conostylis	aculeata				
cool 03	Haemodoraceae		Conostylis	aculeata				
cool 08	Haemodoraceae		Conostylis	aculeata				
KERO-1	Haemodoraceae		Conostylis	aculeata				
KERO-2	Haemodoraceae		Conostylis	aculeata				
TAM-1	Haemodoraceae		Conostylis	aculeata				
cool 01	Asteraceae	*	Conyza	sumatrensis				
cool15	Asteraceae	*	Conyza	sumatrensis				
TAM-1	Anthericaceae		Corynotheca	micrantha	var.	micrantha		
cool 02	Crassulaceae		Crassula	colorata	var.	colorata		
cool 03	Crassulaceae		Crassula	colorata	var.	colorata		
cool 08	Crassulaceae		Crassula	colorata	var.	colorata		
KERO-1	Crassulaceae		Crassula	colorata	var.	colorata		
KERO-2	Crassulaceae		Crassula	colorata	var.	colorata		
cool 02	Crassulaceae	*	Crassula	glomerata				
cool 03	Crassulaceae	*	Crassula	glomerata				
cool 08	Crassulaceae	*	Crassula	glomerata				
KERO-1	Crassulaceae	*	Crassula	glomerata				
KERO-2	Crassulaceae	*	Crassula	glomerata				
KERO-2	Cuscutaceae	*	Cuscuta	epithymum				
cool 04	Poaceae	*	Cynodon	dactylon				
cool 09	Poaceae	*	Cynosurus	echinatus				
TAM-1	Goodeniaceae		Dampiera	linearis				
KERO-2	Papilionaceae		Daviesia	triflora				
cool 02	Restionaceae		Desmocladus	fasciculatus				
cool 08	Restionaceae		Desmocladus	fasciculatus				
KERO-2	Restionaceae		Desmocladus	fasciculatus				
TAM-1	Restionaceae		Desmocladus	fasciculatus				
cool 02	Phormiaceae		Dianella	revoluta	var.	divaricata		
cool 08	Phormiaceae		Dianella	revoluta	var.	divaricata		
KERO-1	Phormiaceae		Dianella	revoluta	var.	divaricata		
KERO-2	Phormiaceae		Dianella	revoluta	var.	divaricata		
TAM-1	Phormiaceae		Dianella	revoluta	var.	divaricata		
KERO-2	Anthericaceae		Dichopogon	capillipes				

Plotorsource	Family	Na	Genus	Species	InfraspRank	InfraspName	Informal	ConsvCode
TAM-1	Anthericaceae		Dichopogon	capillipes				
cool 03	Scrophulariacea	*	Dischisma	arenarium				
cool 08	Scrophulariacea	*	Dischisma	arenarium				
TAM-1	Droseraceae		Drosera	erythrorhiza	subsp.	erythrorhiza		
TAM-1	Droseraceae		Drosera	macrantha	subsp.	macrantha		
TAM-1	Droseraceae		Drosera	menziesii	subsp.	penicillaris		
KERO-1	Proteaceae		Dryandra	lindleyana				
KERO-2	Proteaceae		Dryandra	lindleyana				
TAM-1	Poaceae	*	Ehrharta	calycina				
KERO-1	Poaceae	*	Ehrharta	longiflora				
KERO-2	Poaceae	*	Ehrharta	longiflora				
cool 11	Onagraceae		Epilobium	billardiereanum				
cool 03	Myrtaceae		Eucalyptus	gomphocephala	var.	gomphocephala		
cool 04	Myrtaceae		Eucalyptus	gomphocephala	var.	gomphocephala		
cool14	Myrtaceae		Eucalyptus	gomphocephala	var.	gomphocephala		
cool15	Myrtaceae		Eucalyptus	gomphocephala	var.	gomphocephala		
KERO-2	Myrtaceae		Eucalyptus	gomphocephala	var.	gomphocephala		
KERO-2	Myrtaceae		Eucalyptus	marginata	subsp.	marginata		
TAM-1	Myrtaceae		Eucalyptus	marginata	subsp.	marginata		
cool14	Euphorbiaceae	*	Euphorbia	peplus				
cool15	Euphorbiaceae	*	Euphorbia	peplus				
cool 03	Euphorbiaceae	*	Euphorbia	terracina				
cool 08	Euphorbiaceae	*	Euphorbia	terracina				
cool 08	Santalaceae		Exocarpos	sparteus				
cool 09	Cyperaceae		Ficinia	nodosa				
cool 01	Cyperaceae		Gahnia	trifida				
cool 04	Cyperaceae		Gahnia	trifida				
cool 09	Cyperaceae		Gahnia	trifida				
cool 11	Cyperaceae		Gahnia	trifida				
cool14	Cyperaceae		Gahnia	trifida				
cool15	Cyperaceae		Gahnia	trifida				
cool 02	Rubiaceae	*	Galium	murale				
cool14	Rubiaceae	*	Galium	murale				
KERO-2	Iridaceae	*	Gladiolus	caryophyllaceus				
cool 02	Papilionaceae		Gompholobium	tomentosum				
TAM-1	Papilionaceae		Gompholobium	tomentosum				
KERO-1	Proteaceae		Grevillea	vestita	subsp.	vestita		
KERO-1	Proteaceae		Hakea	lissocarpha				
KERO-2	Proteaceae		Hakea	lissocarpha				
TAM-1	Proteaceae		Hakea	lissocarpha				
cool 09	Proteaceae		Hakea	prostrata				
cool 02	Papilionaceae		Hardenbergia	comptoniana				
cool 03	Papilionaceae		Hardenbergia	comptoniana				
cool 04	Papilionaceae		Hardenbergia	comptoniana				
cool 08	Papilionaceae		Hardenbergia	comptoniana				
cool 09	Papilionaceae		Hardenbergia	comptoniana				
cool14	Papilionaceae		Hardenbergia	comptoniana				
cool15	Papilionaceae		Hardenbergia	comptoniana				
KERO-2	Papilionaceae		Hardenbergia	comptoniana				
cool 02	Brassicaceae	*	Heliophila	pusilla				
KERO-2	Brassicaceae	*	Heliophila	pusilla				
TAM-1	Brassicaceae	*	Heliophila	pusilla				
KERO-1	Dilleniaceae		Hibbertia	hypericoides				
KERO-2	Dilleniaceae		Hibbertia	hypericoides				
TAM-1	Dilleniaceae		Hibbertia	hypericoides				
cool 02	Dilleniaceae		Hibbertia	racemosa				
KERO-1	Dilleniaceae		Hibbertia	racemosa				
KERO-2	Dilleniaceae		Hibbertia	racemosa				
TAM-1	Dilleniaceae		Hibbertia	racemosa				
TAM-1	Apiaceae		Homalosciadium	homalocarpum				
KERO-2	Papilionaceae		Hovea	trisperma	var.	trisperma		

Plotorsource	Family	Na	Genus	Species	InfraspRank	InfraspName	Informal	ConsvCode
TAM-1	Papilionaceae		Hovea	trisperma	var.	trisperma		
cool 02	Violaceae		Hybanthus	calycinus				
KERO-1	Violaceae		Hybanthus	calycinus				
cool14	Apiaceae		Hydrocotyle	diantha				
cool15	Apiaceae		Hydrocotyle	diantha				
cool 11	Apiaceae		Hydrocotyle	hispidula				
TAM-1	Myrtaceae		Hypocalymma	robustum				
cool 02	Asteraceae	*	Hypochaeris	glabra				
cool 03	Asteraceae	*	Hypochaeris	glabra				
KERO-1	Asteraceae	*	Hypochaeris	glabra				
KERO-2	Asteraceae	*	Hypochaeris	glabra				
TAM-1	Asteraceae	*	Hypochaeris	glabra				
cool 01	Cyperaceae		Isolepis	cernua				
cool15	Cyperaceae		Isolepis	cernua				
cool 03	Cyperaceae	*	Isolepis	marginata				
KERO-1	Cyperaceae	*	Isolepis	marginata				
KERO-2	Cyperaceae	*	Isolepis	marginata				
cool 08	Papilionaceae		Jacksonia	furcellata				
cool 01	Juncaceae		Juncus	kraussii	subsp.	australiensis		
cool 09	Papilionaceae		Kennedia	coccinea				
cool15	Papilionaceae		Kennedia	coccinea				
TAM-1	Asteraceae		Lagenophora	huegelii				
cool 02	Poaceae	*	Lagurus	ovatus				
cool 03	Poaceae	*	Lagurus	ovatus				
cool 08	Poaceae	*	Lagurus	ovatus				
cool 09	Cyperaceae		Lepidosperma	gladiatum				
cool 01	Cyperaceae		Lepidosperma	longitudinale				
cool 09	Cyperaceae		Lepidosperma	longitudinale				
cool 11	Cyperaceae		Lepidosperma	longitudinale				
TAM-1	Cyperaceae		Lepidosperma	scabrum				
cool 02	Cyperaceae		Lepidosperma	squamatum				
cool 03	Cyperaceae		Lepidosperma	squamatum				
cool 08	Cyperaceae		Lepidosperma	squamatum				
cool14	Cyperaceae		Lepidosperma	squamatum				
cool15	Cyperaceae		Lepidosperma	squamatum				
TAM-1	Cyperaceae		Lepidosperma	squamatum				
cool 02	Epacridaceae		Leucopogon	parviflorus				
cool 04	Epacridaceae		Leucopogon	parviflorus				
cool 08	Epacridaceae		Leucopogon	parviflorus				
KERO-2	Epacridaceae		Leucopogon	propinquus				
TAM-1	Epacridaceae		Leucopogon	propinquus				
cool 01	Lobeliaceae		Lobelia	alata				
cool 04	Lobeliaceae		Lobelia	alata				
cool 11	Lobeliaceae		Lobelia	alata				
cool14	Loganiaceae		Logania	vaginalis				
cool 08	Poaceae	*	Lolium	perenne				
cool 08	Poaceae	*	Lolium	rigidum				
KERO-2	Dasypogonacea		Lomandra	caespitosa				
TAM-1	Dasypogonacea		Lomandra	caespitosa				
cool 02	Dasypogonacea		Lomandra	maritima				
cool 08	Dasypogonacea		Lomandra	maritima				
KERO-2	Juncaceae		Luzula	meridionalis				
KERO-2	Restionaceae		Lyginia	barbata				
TAM-1	Restionaceae		Lyginia	barbata				
KERO-1	Zamiaceae		Macrozamia	riedlei				
KERO-2	Zamiaceae		Macrozamia	riedlei				
TAM-1	Zamiaceae		Macrozamia	riedlei				
cool 01	Myrtaceae		Melaleuca	rhaphiophylla				
cool 04	Myrtaceae		Melaleuca	rhaphiophylla				
cool 11	Myrtaceae		Melaleuca	rhaphiophylla				
cool 04	Myrtaceae		Melaleuca	teretifolia				

Plotorsource	Family	Na	Genus	Species	InfraspRank	InfraspName	Informal	ConsvCode
KERO-2	Poaceae		Microlaena	stipoides				
cool 01	Polygonaceae		Muehlenbeckia	adpressa				
cool 09	Polygonaceae		Muehlenbeckia	adpressa				
cool 11	Polygonaceae		Muehlenbeckia	adpressa				
cool14	Polygonaceae		Muehlenbeckia	adpressa				
cool 08	Asteraceae		Olearia	axillaris				
cool15	Rubiaceae		Opercularia	hispidula				
cool 11	Urticaceae		Parietaria	debilis				
cool14	Poaceae	*	Paspalum	distichum				
cool 08	Geraniaceae	*	Pelargonium	capitatum				
cool15	Geraniaceae		Pelargonium	littorale	subsp.	littorale		
KERO-2	Geraniaceae		Pelargonium	littorale	subsp.	littorale		
KERO-2	Proteaceae		Petrophile	linearis				
TAM-1	Proteaceae		Petrophile	linearis				
cool 02	Caryophyllaceae	*	Petrorhagia	dubia				
cool 03	Caryophyllaceae	*	Petrorhagia	dubia				
TAM-1	Caryophyllaceae	*	Petrorhagia	dubia				
TAM-1	Haemodoraceae		Phlebocarya	ciliata				
cool 02	Euphorbiaceae		Phyllanthus	calycinus				
cool 03	Euphorbiaceae		Phyllanthus	calycinus				
cool 08	Euphorbiaceae		Phyllanthus	calycinus				
KERO-1	Euphorbiaceae		Phyllanthus	calycinus				
cool 03	Poaceae		Poa	porphyroclados				
TAM-1	Asteraceae		Podolepis	gracilis				
KERO-2	Euphorbiaceae		Poranthera	microphylla				
cool 03	Chenopodiaceae		Rhagodia	baccata	subsp.	baccata		
cool 01	Primulaceae		Samolus	repens				
TAM-1	Goodeniaceae		Scaevola	repens	var.	repens		
cool 11	Cyperaceae		Schoenus	brevisetis				
cool 03	Caryophyllaceae	*	Silene	gallica				
cool 08	Caryophyllaceae	*	Silene	gallica				
cool 04	Solanaceae	*	Solanum	nigrum				
cool15	Solanaceae	*	Solanum	nigrum				
cool 01	Asteraceae		Sonchus	hydrophilus				
cool 04	Asteraceae	*	Sonchus	oleraceus				
cool 08	Asteraceae	*	Sonchus	oleraceus				
cool 11	Asteraceae	*	Sonchus	oleraceus				
cool14	Asteraceae	*	Sonchus	oleraceus				
cool15	Asteraceae	*	Sonchus	oleraceus				
KERO-2	Asteraceae	*	Sonchus	oleraceus				
TAM-1	Asteraceae	*	Sonchus	oleraceus				
TAM-1	Anthericaceae		Sowerbaea	laxiflora				
cool 01	Poaceae		Sporobolus	virginicus				
cool 11	Poaceae		Sporobolus	virginicus				
cool14	Poaceae		Sporobolus	virginicus				
cool 02	Caryophyllaceae	*	Stellaria	media				
TAM-1	Caryophyllaceae	*	Stellaria	media				
TAM-1	Proteaceae		Synaphea	spinulosa	subsp.	spinulosa		
cool 04	Papilionaceae		Templetonia	retusa				
cool 09	Papilionaceae		Templetonia	retusa				
cool14	Papilionaceae		Templetonia	retusa				
cool15	Papilionaceae		Templetonia	retusa				
cool 08	Anthericaceae		Thysanotus	arenarius				
TAM-1	Anthericaceae		Thysanotus	manglesianus				
cool 08	Anthericaceae		Thysanotus	sparteus				
KERO-2	Asphodelaceae	*	Trachyandra	divaricata				
cool14	Apiaceae		Trachymene	coerulea	subsp.	coerulea		
cool15	Apiaceae		Trachymene	coerulea	subsp.	coerulea		
TAM-1	Apiaceae		Trachymene	pilosa				
cool 08	Anthericaceae		Tricoryne	elatior				
cool 09	Anthericaceae		Tricoryne	elatior				

Plotorsource	Family	Na	Genus	Species	InfraspRank	InfraspName	Informal	ConsvCode
cool15	Anthericaceae		Tricoryne	elatior				
cool15	Papilionaceae	*	Trifolium	campestre	var.	campestre		
TAM-1	Papilionaceae	*	Trifolium	campestre	var.	campestre		
cool 11	Juncaginaceae		Triglochin	linearis				
cool14	Rhamnaceae		Trymalium	ledifolium	var.	ledifolium		
cool15	Rhamnaceae		Trymalium	ledifolium	var.	ledifolium		
TAM-1	Asteraceae	*	Ursinia	anthemoides				
KERO-1	Poaceae	*	Vulpia	bromoides				
cool 02	Poaceae	*	Vulpia	myuros				
cool 08	Poaceae	*	Vulpia	myuros				
cool 02	Xanthorrhoeacea		Xanthorrhoea	preissii				
cool 03	Xanthorrhoeacea		Xanthorrhoea	preissii				
cool 08	Xanthorrhoeacea		Xanthorrhoea	preissii				
cool 09	Xanthorrhoeacea		Xanthorrhoea	preissii				
cool15	Xanthorrhoeacea		Xanthorrhoea	preissii				
KERO-1	Xanthorrhoeacea		Xanthorrhoea	preissii				
KERO-2	Xanthorrhoeacea		Xanthorrhoea	preissii				

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Plotorsource	Family	Na	Genus	Species	InfraspRank	InfraspName	Informal	ConsvCode
cool 01	Apiaceae		Apium	prostratum	var.	prostratum		
cool 01	Lauraceae		Cassytha	racemosa				
cool 01	Asteraceae	*	Conyza	sumatrensis				
cool 01	Cyperaceae		Gahnia	trifida				
cool 01	Cyperaceae		Isolepis	cernua				
cool 01	Juncaceae		Juncus	kraussii	subsp.	australiensis		
cool 01	Cyperaceae		Lepidosperma	longitudinale				
cool 01	Lobeliaceae		Lobelia	alata				
cool 01	Myrtaceae		Melaleuca	rhaphiophylla				
cool 01	Polygonaceae		Muehlenbeckia	adpressa				
cool 01	Primulaceae		Samolus	repens				
cool 01	Asteraceae		Sonchus	hydrophilus				
cool 01	Poaceae		Sporobolus	virginicus				

Plotorsource	Family	Na	Genus	Species	InfraspRank	InfraspName	Informal	ConsvCode
cool 02	Mimosaceae		Acacia	rostellifera				
cool 02	Mimosaceae		Acacia	saligna				
cool 02	Dasypogonacea		Acanthocarpus	preissii				
cool 02	Primulaceae	*	Anagallis	arvensis				
cool 02	Poaceae	*	Avellinia	michelii				
cool 02	Poaceae	*	Briza	minor				
cool 02	Poaceae	*	Bromus	diandrus				
cool 02	Portulacaceae		Calandrinia	sp. (Gibson et al. 1994)				
cool 02	Gentianaceae	*	Centaurium	erythraea				
cool 02	Caryophyllaceae	*	Cerastium	glomeratum				
cool 02	Haemodoraceae		Conostylis	aculeata				
cool 02	Crassulaceae		Crassula	colorata	var.	colorata		
cool 02	Crassulaceae	*	Crassula	glomerata				
cool 02	Restionaceae		Desmocladus	fasciculatus				
cool 02	Phormiaceae		Dianella	revoluta	var.	divaricata		
cool 02	Rubiaceae	*	Galium	murale				
cool 02	Papilionaceae		Gompholobium	tomentosum				
cool 02	Papilionaceae		Hardenbergia	comptoniana				
cool 02	Brassicaceae	*	Heliophila	pusilla				
cool 02	Dilleniaceae		Hibbertia	racemosa				
cool 02	Violaceae		Hybanthus	calycinus				
cool 02	Asteraceae	*	Hypochaeris	glabra				
cool 02	Poaceae	*	Lagurus	ovatus				
cool 02	Cyperaceae		Lepidosperma	squamatum				
cool 02	Epacridaceae		Leucopogon	parviflorus				
cool 02	Dasypogonacea		Lomandra	maritima				
cool 02	Caryophyllaceae	*	Petrorhagia	dubia				
cool 02	Euphorbiaceae		Phyllanthus	calycinus				
cool 02	Caryophyllaceae	*	Stellaria	media				
cool 02	Poaceae	*	Vulpia	myuros				
cool 02	Xanthorrhoeacea		Xanthorrhoea	preissii				

Plotorsource	Family	Na	Genus	Species	InfraspRank	InfraspName	Informal	ConsvCode
cool 03	Mimosaceae		Acacia	saligna				
cool 03	Dasypogonacea		Acanthocarpus	preissii				
cool 03	Primulaceae	*	Anagallis	arvensis				
cool 03	Poaceae	*	Bromus	diandrus				
cool 03	Portulacaceae		Calandrinia	calyptrata				
cool 03	Cyperaceae		Carex	preissii				
cool 03	Gentianaceae	*	Centaurium	erythraea				
cool 03	Caryophyllaceae	*	Cerastium	glomeratum				
cool 03	Asteraceae	*	Cirsium	vulgare				
cool 03	Haemodoraceae		Conostylis	aculeata				
cool 03	Crassulaceae		Crassula	colorata	var.	colorata		
cool 03	Crassulaceae	*	Crassula	glomerata				
cool 03	Scrophulariacea	*	Dischisma	arenarium				
cool 03	Myrtaceae		Eucalyptus	gomphocephala	var.	gomphocephala		
cool 03	Euphorbiaceae	*	Euphorbia	terracina				
cool 03	Papilionaceae		Hardenbergia	comptoniana				
cool 03	Asteraceae	*	Hypochaeris	glabra				
cool 03	Cyperaceae	*	Isolepis	marginata				
cool 03	Poaceae	*	Lagurus	ovatus				
cool 03	Cyperaceae		Lepidosperma	squamatum				
cool 03	Caryophyllaceae	*	Petrorhagia	dubia				
cool 03	Euphorbiaceae		Phyllanthus	calycinus				
cool 03	Poaceae		Poa	porphyroclados				
cool 03	Chenopodiaceae		Rhagodia	baccata	subsp.	baccata		
cool 03	Caryophyllaceae	*	Silene	gallica				
cool 03	Xanthorrhoeacea		Xanthorrhoea	preissii				

Plotorsource	Family	Na	Genus	Species	InfraspRank	InfraspName	Informal	ConsvCode
cool 04	Dasypogonacea		Acanthocarpus	preissii				
cool 04	Euphorbiaceae		Adriana	quadripartita				
cool 04	Primulaceae	*	Anagallis	arvensis				
cool 04	Cyperaceae		Baumea	juncea				
cool 04	Orchidaceae		Caladenia	latifolia				
cool 04	Apiaceae		Centella	asiatica				
cool 04	Anthericaceae		Chamaescilla	corymbosa	var.	corymbosa		
cool 04	Ranunculaceae		Clematis	linearifolia				
cool 04	Poaceae	*	Cynodon	dactylon				
cool 04	Myrtaceae		Eucalyptus	gomphocephala	var.	gomphocephala		
cool 04	Cyperaceae		Gahnia	trifida				
cool 04	Papilionaceae		Hardenbergia	comptoniana				
cool 04	Epacridaceae		Leucopogon	parviflorus				
cool 04	Lobeliaceae		Lobelia	alata				
cool 04	Myrtaceae		Melaleuca	rhaphiophylla				
cool 04	Myrtaceae		Melaleuca	teretifolia				
cool 04	Solanaceae	*	Solanum	nigrum				
cool 04	Asteraceae	*	Sonchus	oleraceus				
cool 04	Papilionaceae		Templetonia	retusa				

Plotorsource	Family	Na	Genus	Species	InfraspRank	InfraspName	Informal	ConsvCode
cool 08	Mimosaceae		Acacia	lasiocarpa				
cool 08	Mimosaceae		Acacia	rostellifera				
cool 08	Mimosaceae		Acacia	saligna				
cool 08	Dasypogonacea		Acanthocarpus	preissii				
cool 08	Primulaceae	*	Anagallis	arvensis				
cool 08	Poaceae		Austrodanthonia	occidentalis				
cool 08	Poaceae		Austrostipa	flavescens				
cool 08	Poaceae	*	Avena	fatua				
cool 08	Haemodoraceae		Conostylis	aculeata				
cool 08	Crassulaceae		Crassula	colorata	var.	colorata		
cool 08	Crassulaceae	*	Crassula	glomerata				
cool 08	Restionaceae		Desmocladus	fasciculatus				
cool 08	Phormiaceae		Dianella	revoluta	var.	divaricata		
cool 08	Scrophulariacea	*	Dischisma	arenarium				
cool 08	Euphorbiaceae	*	Euphorbia	terracina				
cool 08	Santalaceae		Exocarpos	sparteus				
cool 08	Papilionaceae		Hardenbergia	comptoniana				
cool 08	Papilionaceae		Jacksonia	furcellata				
cool 08	Poaceae	*	Lagurus	ovatus				
cool 08	Cyperaceae		Lepidosperma	squamatum				
cool 08	Epacridaceae		Leucopogon	parviflorus				
cool 08	Poaceae	*	Lolium	perenne				
cool 08	Poaceae	*	Lolium	rigidum				
cool 08	Dasypogonacea		Lomandra	maritima				
cool 08	Asteraceae		Olearia	axillaris				
cool 08	Geraniaceae	*	Pelargonium	capitatum				
cool 08	Euphorbiaceae		Phyllanthus	calycinus				
cool 08	Caryophyllaceae	*	Silene	gallica				
cool 08	Asteraceae	*	Sonchus	oleraceus				
cool 08	Anthericaceae		Thysanotus	arenarius				
cool 08	Anthericaceae		Thysanotus	sparteus				
cool 08	Anthericaceae		Tricoryne	elatior				
cool 08	Poaceae	*	Vulpia	myuros				
cool 08	Xanthorrhoeacea		Xanthorrhoea	preissii				

Plotorsource	Family	Na	Genus	Species	InfraspRank	InfraspName	Informal	ConsvCode
cool 09	Mimosaceae		Acacia	rostellifera				
cool 09	Mimosaceae		Acacia	saligna				
cool 09	Euphorbiaceae		Adriana	quadripartita				
cool 09	Primulaceae	*	Anagallis	arvensis				
cool 09	Proteaceae		Banksia	littoralis				
cool 09	Cyperaceae		Baumea	juncea				
cool 09	Poaceae	*	Cynosurus	echinatus				
cool 09	Cyperaceae		Ficinia	nodosa				
cool 09	Cyperaceae		Gahnia	trifida				
cool 09	Proteaceae		Hakea	prostrata				
cool 09	Papilionaceae		Hardenbergia	comptoniana				
cool 09	Papilionaceae		Kennedia	coccinea				
cool 09	Cyperaceae		Lepidosperma	gladiatum				
cool 09	Cyperaceae		Lepidosperma	longitudinale				
cool 09	Polygonaceae		Muehlenbeckia	adpressa				
cool 09	Papilionaceae		Templetonia	retusa				
cool 09	Anthericaceae		Tricoryne	elatior				
cool 09	Xanthorrhoeacea		Xanthorrhoea	preissii				

Plotorsource	Family	Na	Genus	Species	InfraspRank	InfraspName	Informal	ConsvCode
cool 11	Mimosaceae		Acacia	saligna				
cool 11	Euphorbiaceae		Adriana	quadripartita				
cool 11	Cyperaceae		Baumea	juncea				
cool 11	Cyperaceae		Baumea	vaginalis				
cool 11	Onagraceae		Epilobium	billardiereanum				
cool 11	Cyperaceae		Gahnia	trifida				
cool 11	Apiaceae		Hydrocotyle	hispidula				
cool 11	Cyperaceae		Lepidosperma	longitudinale				
cool 11	Lobeliaceae		Lobelia	alata				
cool 11	Myrtaceae		Melaleuca	rhaphiophylla				
cool 11	Polygonaceae		Muehlenbeckia	adpressa				
cool 11	Urticaceae		Parietaria	debilis				
cool 11	Cyperaceae		Schoenus	brevisetis				
cool 11	Asteraceae	*	Sonchus	oleraceus				
cool 11	Poaceae		Sporobolus	virginicus				
cool 11	Juncaginaceae		Triglochin	linearis				

Plotorsource	Family	Na	Genus	Species	InfraspRank	InfraspName	Informal	ConsvCode
cool14	Mimosaceae		Acacia	cochlearis				
cool14	Mimosaceae		Acacia	pulchella				
cool14	Mimosaceae		Acacia	saligna				
cool14	Primulaceae	*	Anagallis	arvensis var. arvensis FPR				
cool14	Solanaceae		Anthocercis	littorea				
cool14	Cyperaceae		Baumea	juncea				
cool14	Orchidaceae		Caladenia	latifolia				
cool14	Apiaceae		Centella	asiatica				
cool14	Myrtaceae		Eucalyptus	gomphocephala	var.	gomphocephala		
cool14	Euphorbiaceae	*	Euphorbia	peplus				
cool14	Cyperaceae		Gahnia	trifida				
cool14	Rubiaceae	*	Galium	murale				
cool14	Papilionaceae		Hardenbergia	comptoniana				
cool14	Apiaceae		Hydrocotyle	diantha				
cool14	Cyperaceae		Lepidosperma	squamatum				
cool14	Loganiaceae		Logania	vaginalis				
cool14	Polygonaceae		Muehlenbeckia	adpressa				
cool14	Poaceae	*	Paspalum	distichum				
cool14	Asteraceae	*	Sonchus	oleraceus				
cool14	Poaceae		Sporobolus	virginicus				
cool14	Papilionaceae		Templetonia	retusa				
cool14	Apiaceae		Trachymene	coerulea	subsp.	coerulea		
cool14	Rhamnaceae		Trymalium	ledifolium	var.	ledifolium		

Plotorsource	Family	Na	Genus	Species	InfraspRank	InfraspName	Informal	ConsvCode
cool15	Mimosaceae		Acacia	cochlearis				
cool15	Mimosaceae		Acacia	saligna				
cool15	Mimosaceae		Acacia	truncata				
cool15	Primulaceae	*	Anagallis	arvensis var. arvensis FPR				
cool15	Solanaceae		Anthocercis	littorea				
cool15	Poaceae		Austrostipa	flavescens				
cool15	Orchidaceae		Caladenia	latifolia				
cool15	Caryophyllaceae	*	Cerastium	glomeratum				
cool15	Ranunculaceae		Clematis	linearifolia				
cool15	Polygalaceae		Comesperma	virgatum				
cool15	Asteraceae	*	Conyza	sumatrensis				
cool15	Myrtaceae		Eucalyptus	gomphocephala	var.	gomphocephala		
cool15	Euphorbiaceae	*	Euphorbia	peplus				
cool15	Cyperaceae		Gahnia	trifida				
cool15	Papilionaceae		Hardenbergia	comptoniana				
cool15	Apiaceae		Hydrocotyle	diantha				
cool15	Cyperaceae		Isolepis	cernua				
cool15	Papilionaceae		Kennedia	coccinea				
cool15	Cyperaceae		Lepidosperma	squamatum				
cool15	Rubiaceae		Opercularia	hispidula				
cool15	Geraniaceae		Pelargonium	littorale	subsp.	littorale		
cool15	Solanaceae	*	Solanum	nigrum				
cool15	Asteraceae	*	Sonchus	oleraceus				
cool15	Papilionaceae		Templetonia	retusa				
cool15	Apiaceae		Trachymene	coerulea	subsp.	coerulea		
cool15	Anthericaceae		Tricoryne	elatior				
cool15	Papilionaceae	*	Trifolium	campestre	var.	campestre		
cool15	Rhamnaceae		Trymalium	ledifolium	var.	ledifolium		
cool15	Xanthorrhoeacea		Xanthorrhoea	preissii				

Plotorsource	Family	Na	Genus	Species	InfraspRank	InfraspName	Informal	ConsvCode
KERO-1	Primulaceae	*	Anagallis	arvensis				
KERO-1	Poaceae		Austrostipa	flavescens				
KERO-1	Colchicaceae		Burchardia	congesta				
KERO-1	Centrolepidacea		Centrolepis	drummondiana				
KERO-1	Caryophyllaceae	*	Cerastium	glomeratum				
KERO-1	Haemodoraceae		Conostylis	aculeata				
KERO-1	Crassulaceae		Crassula	colorata	var.	colorata		
KERO-1	Crassulaceae	*	Crassula	glomerata				
KERO-1	Phormiaceae		Dianella	revoluta	var.	divaricata		
KERO-1	Proteaceae		Dryandra	lindleyana				
KERO-1	Poaceae	*	Ehrharta	longiflora				
KERO-1	Proteaceae		Grevillea	vestita	subsp.	vestita		
KERO-1	Proteaceae		Hakea	lissocarpha				
KERO-1	Dilleniaceae		Hibbertia	hypericoides				
KERO-1	Dilleniaceae		Hibbertia	racemosa				
KERO-1	Violaceae		Hybanthus	calycinus				
KERO-1	Asteraceae	*	Hypochaeris	glabra				
KERO-1	Cyperaceae	*	Isolepis	marginata				
KERO-1	Zamiaceae		Macrozamia	riedlei				
KERO-1	Euphorbiaceae		Phyllanthus	calycinus				
KERO-1	Poaceae	*	Vulpia	bromoides				
KERO-1	Xanthorrhoeacea		Xanthorrhoea	preissii				

Plotorsource	Family	Na	Genus	Species	InfraspRank	InfraspName	Informal	ConsvCode
KERO-2	Primulaceae	*	Anagallis	arvensis				
KERO-2	Poaceae		Austrodanthonia	occidentalis				
KERO-2	Poaceae	*	Avena	fatua				
KERO-2	Proteaceae		Banksia	attenuata				
KERO-2	Poaceae	*	Briza	maxima				
KERO-2	Poaceae	*	Briza	minor				
KERO-2	Poaceae	*	Bromus	diandrus				
KERO-2	Colchicaceae		Burchardia	congesta				
KERO-2	Centrolepidacea		Centrolepis	drummondiana				
KERO-2	Caryophyllaceae	*	Cerastium	glomeratum				
KERO-2	Haemodoraceae		Conostylis	aculeata				
KERO-2	Crassulaceae		Crassula	colorata	var.	colorata		
KERO-2	Crassulaceae	*	Crassula	glomerata				
KERO-2	Cuscutaceae	*	Cuscuta	epithymum				
KERO-2	Papilionaceae		Daviesia	triflora				
KERO-2	Restionaceae		Desmocladus	fasciculatus				
KERO-2	Phormiaceae		Dianella	revoluta	var.	divaricata		
KERO-2	Anthericaceae		Dichopogon	capillipes				
KERO-2	Proteaceae		Dryandra	lindleyana				
KERO-2	Poaceae	*	Ehrharta	longiflora				
KERO-2	Myrtaceae		Eucalyptus	gomphocephala	var.	gomphocephala		
KERO-2	Myrtaceae		Eucalyptus	marginata	subsp.	marginata		
KERO-2	Iridaceae	*	Gladiolus	caryophyllaceus				
KERO-2	Proteaceae		Hakea	lissocarpha				
KERO-2	Papilionaceae		Hardenbergia	comptoniana				
KERO-2	Brassicaceae	*	Heliophila	pusilla				
KERO-2	Dilleniaceae		Hibbertia	hypericoides				
KERO-2	Dilleniaceae		Hibbertia	racemosa				
KERO-2	Papilionaceae		Hovea	trisperma	var.	trisperma		
KERO-2	Asteraceae	*	Hypochaeris	glabra				
KERO-2	Cyperaceae	*	Isolepis	marginata				
KERO-2	Epacridaceae		Leucopogon	propinquus				
KERO-2	Dasypogonacea		Lomandra	caespitosa				
KERO-2	Juncaceae		Luzula	meridionalis				
KERO-2	Restionaceae		Lyginia	barbata				
KERO-2	Zamiaceae		Macrozamia	riedlei				
KERO-2	Poaceae		Microlaena	stipoides				
KERO-2	Geraniaceae		Pelargonium	littorale	subsp.	littorale		
KERO-2	Proteaceae		Petrophile	linearis				
KERO-2	Euphorbiaceae		Poranthera	microphylla				
KERO-2	Asteraceae	*	Sonchus	oleraceus				
KERO-2	Asphodelaceae	*	Trachyandra	divaricata				
KERO-2	Xanthorrhoeacea		Xanthorrhoea	preissii				

Plotorsource	Family	Na	Genus	Species	InfraspRank	InfraspName	Informal	ConsvCode
TAM-1	Poaceae		Austrostipa	flavescens				
TAM-1	Proteaceae		Banksia	attenuata				
TAM-1	Proteaceae		Banksia	menziesii				
TAM-1	Papilionaceae		Bossiaea	eriocarpa				
TAM-1	Poaceae	*	Briza	maxima				
TAM-1	Poaceae	*	Briza	minor				
TAM-1	Colchicaceae		Burchardia	congesta				
TAM-1	Anthericaceae		Caesia	micrantha				
TAM-1	Haemodoraceae		Conostylis	aculeata				
TAM-1	Anthericaceae		Corynotheca	micrantha	var.	micrantha		
TAM-1	Goodeniaceae		Dampiera	linearis				
TAM-1	Restionaceae		Desmocladus	fasciculatus				
TAM-1	Phormiaceae		Dianella	revoluta	var.	divaricata		
TAM-1	Anthericaceae		Dichopogon	capillipes				
TAM-1	Droseraceae		Drosera	erythrorhiza	subsp.	erythrorhiza		
TAM-1	Droseraceae		Drosera	macrantha	subsp.	macrantha		
TAM-1	Droseraceae		Drosera	menziesii	subsp.	penicillaris		
TAM-1	Poaceae	*	Ehrharta	calycina				
TAM-1	Myrtaceae		Eucalyptus	marginata	subsp.	marginata		
TAM-1	Papilionaceae		Gompholobium	tomentosum				
TAM-1	Proteaceae		Hakea	lissocarpha				
TAM-1	Brassicaceae	*	Heliophila	pusilla				
TAM-1	Dilleniaceae		Hibbertia	hypericoides				
TAM-1	Dilleniaceae		Hibbertia	racemosa				
TAM-1	Apiaceae		Homalosciadium	homalocarpum				
TAM-1	Papilionaceae		Hovea	trisperma	var.	trisperma		
TAM-1	Myrtaceae		Hypocalymma	robustum				
TAM-1	Asteraceae	*	Hypochaeris	glabra				
TAM-1	Asteraceae		Lagenophora	huegelii				
TAM-1	Cyperaceae		Lepidosperma	scabrum				
TAM-1	Cyperaceae		Lepidosperma	squamatum				
TAM-1	Epacridaceae		Leucopogon	propinquus				
TAM-1	Dasypogonacea		Lomandra	caespitosa				
TAM-1	Restionaceae		Lyginia	barbata				
TAM-1	Zamiaceae		Macrozamia	riedlei				
TAM-1	Proteaceae		Petrophile	linearis				
TAM-1	Caryophyllaceae	*	Petrorhagia	dubia				
TAM-1	Haemodoraceae		Phlebocarya	ciliata				
TAM-1	Asteraceae		Podolepis	gracilis				
TAM-1	Goodeniaceae		Scaevola	repens	var.	repens		
TAM-1	Asteraceae	*	Sonchus	oleraceus				
TAM-1	Anthericaceae		Sowerbaea	laxiflora				
TAM-1	Caryophyllaceae	*	Stellaria	media				
TAM-1	Proteaceae		Synaphea	spinulosa	subsp.	spinulosa		
TAM-1	Anthericaceae		Thysanotus	manglesianus				
TAM-1	Apiaceae		Trachymene	pilosa				
TAM-1	Papilionaceae	*	Trifolium	campestre	var.	campestre		
TAM-1	Asteraceae	*	Ursinia	anthemoides				

System 6 Update - Floristic Community Type Mapping Information DRAFT ONLY

AREA INFORMATION

System 6 Area (C or M) or Update Area (Update) M108

Conservation Area	
Nature Reserve	
Reserve No	
National Park	
Reserve No	A22441, A23780
Local Government	Shire of Rockingham
Reserve No	A18452
Other	
Proposed Conservation Areas	
Local Government	
Reserve No	
Other	DOLA not assigned M22439, private, MRPA

Conservation Area

Nature Reserve	
Reserve No	
National Park	
Reserve No	
Local Government	
Reserve No	
Other	

TOTAL AREA

Bushland Area	2597.5	hectares
Completely Degraded	284.437 ha	
lake	787.438	

AREA MAPPED FLORISTIC UNITS

Units	Site (Condition) Code G COOL	Bound	Area (ha)
17	11 (1) Ø1 (5) Ø4 (2)	B	470.368
19"a"	Ø9 (2) G/K : COOL 14, 15 19"b"	B	20.625
24	Ø8 (2.5) Ø2 (-) Ø5 (3.5)	B	593.257
	G TAM		
21a	Ø1 (3)	B	162.188
	G KERO		
24	Ø1 (4) Ø2 (3)	B	See above
276	extrapolated from Point Becher	B	24625
19'b'			32.937

Boundaries determined by use of

aerial photograph	MRA Run 8 5105 - 5110 11/12/92
orthophoto	2033 II NW Aug 1991
vegetation map	Tingay AAS 1977 (not strictly, interaction)
soil map	Cozzaro 1983.

PTO

CONTACT DR N. GIBSON CALM WOODVALE for further information.
Flora list for M103 Lakes Cooloongup and Walyungup (extracted from Swan Coastal Plain database, Cool 1-4, 8-11, Tam1, Kero 1-2, 146 taxa, 9/5/1995).

Department of Environmental Protection System 6 Update: Site Based Flora List M103 Lakes Cooloongup and Walyungup
(extracted from the CALM Swan Coastal Plain database, Cool 1-4, 8-11, Tam 1, Kero 1-2, 146 taxa, 9/5/95)

Anthericaceae
- Caesia micrantha
- Chamaescilla corymbosa
- Corynotheca micrantha
- Dichopogon capillipes
- Sowerbaea laxiflora
- Thysanotus arenarius
- Thysanotus manglesianus
- Thysanotus sparteus
- Tricoryne elatior

Apiaceae
- Apium prostratum
- Centella cordifolia
- Homalosciadium homalocarpum
- Hydrocotyle hispidula
- Hydrocotyle sp. scps
- Trachymene pilosa

Asphodelaceae
- * Trachyandra divaricata

Asteraceae
- * Cirsium vulgare
- * Conyza albida
- * Hypochaeris glabra
- Lagenifera huegelii
- Olearia axillaris
- Podolepis gracilis
- Sonchus hydrophilus
- * Sonchus oleraceus
- * Ursinia anthemoides

Brassicaceae
- * Heliophila pusilla

Caryophyllaceae
- * Cerastium glomeratum
- * Petrorhagia velutina
- * Silene gallica
- * Stellaria media

Centrolepidaceae
- Centrolepis drummondiana

Chenopodiaceae
- Rhagodia baccata subsp. baccata

Colchicaceae
- Burchardia umbellata

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Flora list for M103 Lakes Cooloongup and Walyungup (extracted from Swan Coastal Plain database, Cool 1-4, 8-11, Tam1, Kero 1-2, 146 taxa, 9/5/1995).

Crassulaceae
Crassula colorata
* Crassula glomerata

Cuscutaceae
* Cuscuta epithymum

Cyperaceae
Baumea juncea
Baumea vaginalis
Carex preissii
Gahnia trifida
Isolepis cernua
* Isolepis marginata
Isolepis nodosa
Isolepis sp. scps
Lepidosperma angustatum
Lepidosperma gladiatum
Lepidosperma longitudinale
Lepidosperma scabrum
Schoenus brevisetis

Dasypogonaceae
Acanthocarpus preissii
Lomandra caespitosa
Lomandra maritima

Dilleniaceae
Hibbertia hypericoides
Hibbertia racemosa

Droseraceae
Drosera erythrorhiza
Drosera macrantha
Drosera menziesii subsp. penicillaris

Epacridaceae
Leucopogon parviflorus
Leucopogon propinquus

Euphorbiaceae
Adriana quadripartita
* Euphorbia terracina
Phyllanthus calycinus
Poranthera microphylla

Gentianaceae
* Centaurium erythraea

Geraniaceae
* Pelargonium capitatum
Pelargonium littorale

Goodeniaceae
Dampiera linearis
Scaevola repens var. repens

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Flora list for M103 Lakes Cooloongup and Walyungup (extracted from Swan Coastal Plain database, Cool 1-4, 8-11, Tam1, Kero 1-2, 146 taxa, 9/5/1995).

Haemodoraceae
- Conostylis aculeata
- Phlebocarya ciliata

Iridaceae
- * Gladiolus caryophyllaceus
- * Romulea rosea

Juncaceae
- Juncus kraussii
- Luzula meridionalis

Juncaginaceae
- Triglochin procerum

Lauraceae
- Cassytha racemosa

Lobeliaceae
- Lobelia alata

Mimosaceae
- Acacia lasiocarpa
- Acacia rostellifera
- Acacia saligna

Myrtaceae
- Eucalyptus gomphocephala
- Eucalyptus marginata
- Hypocalymma robustum
- Melaleuca rhaphiophylla
- Melaleuca teretifolia

Onagraceae
- Epilobium billardierianum

Orchidaceae
- Caladenia latifolia
- Cyrtostylis sp. scps
- Prasophyllum sp. scps

Papilionaceae
- Bossiaea eriocarpa
- Daviesia triflora
- Gompholobium tomentosum
- Hardenbergia comptoniana
- Hovea trisperma var. trisperma
- Jacksonia furcellata
- Kennedia coccinea
- Templetonia retusa
- * Trifolium campestre
- * Trifolium sp. scps

CONTACT DR N. GIBSON CALM WOODVALE for further information.
Flora list for M103 Lakes Cooloongup and Walyungup (extracted from Swan Coastal Plain database, Cool 1-4, 8-11, Tam1, Kero 1-2, 146 taxa, 9/5/1995).

Phormiaceae
- Dianella revoluta
- Dianella revoluta var. divaricata

Poaceae
- * Avellinia michelii
- * Avena fatua
- * Briza maxima
- * Briza minor
- * Bromus diandrus
- Cynodon dactylon
- * Cynosurus echinatus
- Danthonia occidentalis
- * Ehrharta calycina
- * Ehrharta longiflora
- Eragrostis sp. scps
- * Lagurus ovatus
- * Lolium perenne
- * Lolium rigidum
- Microlaena stipoides
- Poa porphyroclados
- Sporobolus virginicus
- Stipa flavescens
- * Vulpia bromoides
- * Vulpia myuros

Polygonaceae
- Muehlenbeckia adpressa

Portulacaceae
- Calandrinia calyptrata
- Calandrinia sp. scps

Primulaceae
- * Anagallis arvensis
- Samolus repens

Proteaceae
- Banksia attenuata
- Banksia littoralis
- Banksia menziesii
- Dryandra nivea
- Grevillea vestita
- Hakea lissocarpha
- Hakea prostrata
- Petrophile linearis
- Synaphea spinulosa

Ranunculaceae
- Clematis microphylla

Restionaceae
- Loxocarya flexuosa
- Lyginia barbata

Rubiaceae

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Flora list for M103 Lakes Cooloongup and Walyungup (extracted from Swan Coastal Plain database, Cool 1-4, 8-11, Tam1, Kero 1-2, 146 taxa, 9/5/1995).

* Galium murale

Santalaceae
Exocarpos sparteus

Scrophulariaceae
* Dischisma arenarium

Solanaceae
* Solanum nigrum

Urticaceae
Parietaria debilis

Violaceae
Hybanthus calycinus

Xanthorrhoeaceae
Xanthorrhoea preissii

Zamiaceae
Macrozamia riedlei

DEPARTMENT OF CONSERVATION AND LAND MANAGEMENT

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Your Ref:
Our Ref:
Enquiries:
Phone:

SUB (5)

The Chairman
Environmental Protection Authority
8th Floor, Westralia Square
141 St Georges Terrace
PERTH WA 6000.

Attention: Adrian Vlok

CER: RESIDENTIAL/COMMERCIAL SUBDIVISION, PT LOT 402 RAE ROAD, COCKBURN SOUND LOCATION 16, ROCKINGHAM (1077)

I refer to your letter of 2 July 1997 requesting comments on the above CER.

Groundwater Drawdown And Groundwater Quality

There is virtually no discussion in the CER of the implications for the thrombolite community of potential drawdown of groundwater by abstraction from private bores within the proposed development area. Local knowledge indicates groundwater levels already decline in the area in summer (B. Goodale pers comm), and the CER itself refers to an overall reduction of height of the water table having occurred already in the central part of Cape Peron (section 3.1.4.2, page 12). Reference to private groundwater abstraction being responsible for the drawdown is made at section 3.1.4.4, page 13 in the CER. The potential impact of increased drawdown from the proposed development needs to be addressed. Potential impacts of the development on groundwater include upconing of the saltwater interface by 40 metres for every metre groundwater is drawn down; alteration to patterns of groundwater flow; and decline of groundwater quality through pollution.

The depth to the saltwater interface is approximately 40 times the height of the freshwater above sea level (Ghyben-Hertzberg equation; Davidson, 1995). As Lake Richmond is approximately 1.5 metres above sea level, the saltwater interface should be 60 metres below the lake. Relatively small falls in the height of the freshwater table due to drawdown could cause very large effects in upconing of saltwater. For example, a decline in the freshwater level of 0.5 m will cause an approximate increase in upconing of saltwater of 20 m; and a 1 m decline will cause upconing of the saltwater interface of around 40 m in height. The ability of the flow-through of groundwater from the lake to counteract this upconing is unlikely to be significant as the groundwater mound to the west of Lake Richmond (the likely source direction of saltwater intrusion) is small and has little outflow (A. Davidson pers comm; Passmore, 1970). Should the lake become saline as a result of this upconing, the thrombolite community is unlikely to survive (L. Moore, pers comm).

The radius of impact, where drawdown will cause upconing of saltwater is likely to be within about 500 m of the lake (A. Davidson pers comm). Water abstraction should be minimised or preferably completely eliminated in this zone through regulations imposed by the Water and Rivers Commission. This area is already a declared Groundwater Protection Zone which only prevents abstraction of groundwater for non-domestic uses. As restrictions only apply to licensed bores, such restrictions should be extended to all domestic bores in this zone, given the significance of the ecological community.

The growth of the thrombolite structures is probably dependent upon continuing supply of fresh water rich in calcium, bicarbonate and carbonate (L. Moore pers comm). Calcium carbonate is precipitated out by the biological activity of the microbes. These microbes are likely to include photosynthetic bacteria and cyanobacteria that depend on light and fresh water for growth and survival (L. Moore pers comm). The source of the calcium in the waters of Lake Richmond is probably groundwater that has passed through sand dunes that surround the lake (L. Moore pers comm). The catchment for this groundwater is not precisely known, although the likely catchment can be interpolated from summer and winter groundwater contours - height of the shallow aquifer above sea level in the Safety Bay sands. Groundwater contours were mapped by Passmore (1970) for the Lake Richmond area, and groundwater flow occurs approximately at right angles to the contour gradient.

Interpolation of Passmore's data indicates that a significant proportion of the likely groundwater recharge zone lies within the proposed development area. This indicates any groundwater pollution caused by overuse of fertilisers, use of toxic chemicals etc within the development area is likely to impact the groundwater quality of Lake Richmond. Such pollution is likely to impact the thrombolites. Restrictions therefore need to be applied to the site to prevent groundwater pollution.

There is potential for the proposed development to impact the quality and quantity of groundwater supplying the thrombolites, however, there is no mention of ongoing monitoring, developing ameliorative strategies if necessary, and who is responsible for funding. There needs to be a commitment in these areas.

Buffer Zones

In section 5.1.2.2 of the CER document, the authors quote a Davies and Lane (1995) report "An adequate buffer zone for maintenance of ecological processes and major food webs is recommended at 20-50m measured from the outer edge of open water and will therefore include wetland dependent vegetation." This quote actually refers to the width of vegetation required to supply sufficient detritus to "drive" ecological processes associated with detrital material, and relates to estimated rates of consumption of such material by fauna in upland streams (refer page 20 of the Davies and Lane, 1995 report). This buffer width of 20-50m is likely to be of much less relevance to the maintenance of biological systems in Lake Richmond than other buffer widths recommended in the Davies and Lane report, as discussed below.

Davies and Lane (1995) recommend a buffer width of 200 m to prevent excessive nutrients and eutrophication of wetlands on the Swan Coastal Plain. Nutrient input is likely to be of particular significance to maintaining the thrombolites in Lake Richmond, as such structures can be smothered by macro algae in eutrophic conditions. This problem has been noted in another lake which contains thrombolites - Lake Clifton, near Mandurah. Lake Clifton has recently suffered eutrophication of groundwater and subsequent growth of smothering macro-algae as a result of human induced nutrient enrichment of the catchment (Moore and Turner, 1988).

Davies and Lane (1995) recommend a buffer width of two kilometres for protection of groundwater. The relationship between the survival of the Lake Richmond thrombolites and groundwater level or quality has not been investigated. Given that a portion of the catchment of Lake Richmond is already urbanised, the ideal buffer for groundwater is clearly unachievable, but an adequate compromise needs to be determined. Therefore, a conservative approach should be taken to an appropriate buffer width.

The thrombolites are under some threat of smothering from sediment, as noted in the CER, section 3.2.3.2 (page 20), but this threat is not discussed further in the document. A buffer width of 100m measured from the outer edge of the seasonally inundated zone is recommended by Davies and Lane (1995) to minimise sedimentation.

Based on buffer widths as recommended by Davies and Lane (1995), the likely zone where groundwater drawdown will cause significant upconing of saltwater under Lake Richmond, and to prevent pollution of groundwater as a result of the development, a reasonable compromise would be:

- a minimum 200 m buffer of native vegetation to be conserved where remnant vegetation exists adjacent to Lake Richmond;
- to preclude abstraction of groundwater for any purposes over the entire development area; and
- to prevent pollution of the groundwater recharge zone - which includes the proposed development area, to avoid pollution of Lake Richmond.

Significant Vegetation

There is no vegetation map for the proposed development site. The vegetation map provided (figure 15 in the CER document) only includes the proposed Parks and Recreation area around the lake. This is a significant omission.

The community "sedgelands in Holocene dune swales" as identified by Gibson *et al*, 1994 (community type 19) is regarded as critically endangered (English and Blyth, 1997). There is also a draft Interim Recovery Plan for the community, written by the Recovery Team for the type (Walker *et al*, 1997). The plan notes the existence of the community adjacent to Lake Richmond.

Section 3.2.3.3 of the CER indicates this sedgeland community exists in the south east portion of the proposed Parks and Recreation reserve, but there is no discussion of whether the Holocene sedgeland community occurs in the proposed development area. This community is usually very obvious when viewed on aerial photographs, as it occurs as dark parallel banding adjacent to shorelines. There is noticeable banding of this type in the northern portion of the development area on the aerial photograph, Figure 2 in the CER. It appears extremely likely this indicates the presence of the Holocene sedgeland community, as the site is within a Holocene dune deposit (Woods and Searle, 1983). This should be checked in the field by a competent botanist.

The limited vegetation description provided for the proposed development area in section 3.2.1 (page 13 of the CER) notes the presence of a Xanthorrhoea shrubland in the northern sector, which is likely to correspond to this significant sedgeland. There is also reference to "limited stands of Xanthorrhoea and sedgeland dominated by *Gahnia trifida* with occasional *Isolepis nodosa*" in the southern sector (also section 3.2.1 of the CER), which also may correspond to the Holocene sedgeland.

There is no commitment to identifying, mapping or conserving significant plant communities in the CER document. These omissions need to be rectified.

Flora and Fauna Surveys

The CER document only refers to flora or fauna survey undertaken for the proposed Parks and Recreation area (section 3.2.3.3, page 18-19 of the CER document), and not to survey done in the area proposed for development. This appears to indicate that no survey of the proposed development area has been undertaken. This is another significant omission. While it is noted that no Declared Rare Flora or other significant flora or threatened fauna from the proposed development site itself are recorded on CALM's databases (section 3.2.1-3.2.2 of the CER), the site would not necessarily have been surveyed. This lack of survey data for the site needs to be rectified.

Public Open Space - Useable Areas

The CER document refers to the provision of the required 10% of the area of the development being dedicated as open space (section 4.1.2). However, most if not all of this area is for the purpose of drainage, which will effectively be unuseable for recreation. Consequently, residents of the planned development area would reasonably expect to use alternative areas of open space in adjacent areas for the purpose of recreation.

The closest public reserve area to much of the proposed development site is that surrounding Lake Richmond, and this area would be expected to receive additional physical impacts from residents in the area. The residents of the proposed development area will clearly impact the lake and thrombolites in terms of visitor impacts. However, there is no commitment to help manage either Lake Richmond itself, or the thrombolites in terms of signage, information, fencing or walkways; or, as mentioned above, to any monitoring of such impacts; or alternatively, to provide useable space for recreation within the proposed development area. The developer therefore needs to give a commitment to provide for such management and also provide space within the development that residents within the development site can use.

Overall the proposal is deficient in terms of evaluation and protection of environmental values.

Syd Shea
EXECUTIVE DIRECTOR

5 August 1997
KMCHESC LETTERSVCLK

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Sub (7)

CITY OF ROCKINGHAM

Civic Boulevard, Rockingham,
Western Australia

OUR REF:
YOUR REF: 97/03

ENQUIRIES: [illegible] Road

DEPARTMENT OF ENVIRONMENTAL PROTECTION

0 4 AUG 1997

File No 1 TP 97.03 Name A. VLOK 6
File No 2 _____ Name _____
File No 3 _____ Name _____

30th July 1997

Chairman
Department of Environmental Protection
8th Floor, Westralia Square
141 St George's Terrace
PERTH WA 6000

ATT: Mr A Vlok

Received previously by fax.

Dear Sir/Madam

Re: Consultative Environmental Review - Residential/Commercial Subdivision - Pt Lot 402 Rae Road, Rockingham

I refer to your correspondence dated the 2nd July 1997 inviting submissions on the abovementioned CER. The document has been reviewed by Council and the following comments are provided:-

(i) The DEP should be aware that Council has only supported a Structure Plan dated 1990 for the site, not a Comprehensive Development Plan or the proposed Development Plan listed as Figure 16 in the CER. The proposed plan has not been supported by Council and there are various issues relating to this Plan which remain to be resolved, including the location of the commercial area, the lack of higher density residential sites in the estate, the extent of the water bodies shown within the respective open space areas and the interface between the residential lots and the Parks and Recreation Reserve.

Any approval by the EPA for the CER should not restrict Council's or the Western Australian Planning Commission's ability to negotiate modifications to the proposed Development Plan.

(ii) Not all the land is appropriately zoned in Town Planning Scheme No. 1. A portion of the site is currently unzoned in Town Planning Scheme No.1 and a portion is inappropriately zoned (Fisher Street - Local Major Road). The applicant has been advised of the need for an amendment to the Town Planning Scheme prior to any development in the unzoned portions of the site.

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(iii) A railway reservation is noted as existing, on Page 6. This reservation was deleted, however, in an MRS Omnibus Amendment finalised at the end of 1996.

(iv) The acquisition of the Parks and Recreation Reservation by the Western Australian Planning Commission should be pursued as a priority by the Commission to facilitate the implementation of a Management Plan for the overall Reserve.

(v) It is agreed that the Management Plan for the Reserve should be expanded to include specific provisions relating to protection of Thrombolites, fencing and rehabilitation of sensitive areas, provision of pathways, timing of implementation, destruction of pampas grass, protection of sedgeland vegetation and protection of grass trees.

(vi) Page 36 states that the landowners will liaise with Council and the Ministry for Planning in regard to the implementation of management mechanisms within that part of the Reserve in its ownership for the period prior to acquisition by the Western Australian Planning Commission. In addition, the applicant states in Committment 6 that Allied Land Pty Ltd will put into place the necessary management features (such as fencing, pathways etc) to control access to the Reserve "at the appropriate stage". Council considers that it is appropriate that these works occur as part of the next stage of the subdicision of the site and will be seeking the imposition of a condition to this effect on the next application for subdivision approval.

(vii) Identified Aboriginal Heritage sites discovered during construction should also be referred to the Department of Aboriginal Affairs (sites register).

Council is encouraged by the survey undertaken by Anthropologists and Aboriginal Elders to identify possible Aboriginal sites, however, evidence of this is not provided in the document.

(viii) Council is pleased to note that drainage is no longer proposed to take place in constructed wetlands within the Parks and Recreation area as originally proposed.

(ix) Council has been requesting details from the applicant for some time, on the management implications for the drainage lakes within the proposed public open space areas within the subdivision. Details are sought on the treatment and subsequent management implications for the infiltration and retention basin proposed, to help it consider whether it is prepared to assume responsibility for the maintenance of these facilities.

(x) The POS provision and its purpose for drainage and/or active/passive recreation will be assessed in further detail at the Structure Plan amendment and subdivision stages as a result of detailed design and evidence in the form of a POS Schedule from the applicant. Council is mindful of the need for useable areas of POS to not be dominated by water features.

(xi) Council supports the development of a Construction Management Plan prior to the commencement of works to ensure the development of land on the boundary of the Reserve does not result in the destruction of areas of the reserve itself.

(xii) Council questions whether a 3m PAW is considered to be a sufficient interface between the lots and Reserve and will further consider this issue in its assessment of the proposed Development Plan.

(xiii) The critical issue to be resolved in any consideration of the CER is the effect the modifications to the stormwater drainage system have on water quality in Lake Richmond and the impact of this upon the thrombolites within the lake.

In this regard, Council notes the conclusions of the CER that maintaining the 1 in 10 year stormwater drainage flow on site and treating the overflow prior to it entering the lake will not alter the existing quality of the water within the lake. Furthermore, the modifications to be made to the Peters Street drain will actually reduce the amount of stormwater entering the lake than at present.

Council also notes the conclusion that if the water quality does not change in the lake then the thrombolites will not be affected.

Should these conclusions be correct, then the proposal could be supported. Council, however, queries the number of assumptions referred to in the CER that lead to these conclusions and seeks confirmation from the EPA that the information presented is satisfactory to lead to these conclusions. Lake Richmond and the thrombolite community are of immense significance and it is important that the environmental implications of the existing situation and the effect of any additional demands upon the lake are understood prior to decisions being made that may impact upon the sustainability of the lake ecosystem.

Council will consider the CER at its ordinary Meeting to be held on the 26th August 1997, and additional comments may be provided to you after this date.

Yours faithfully

J R BRADBURY
PRINCIPAL PLANNER

SUB (8)

WATER AND RIVERS
COMMISSION

YOUR REF
OUR REF
ENQUIRIES
DIRECT TEL

The Chairman
Environmental Protection Authority
8th Floor, Westralia Square
141 St George's Tce
PERTH WA 6000

Attn: Adrian Vlok

Dear Adrian

RESIDENTIAL / COMMERCIAL SUBDIVISION, PT LOT 402 RAE RD, ROCKINGHAM (1077)

Thank you for referring the above development proposal to the Water and Rivers Commission for comment, and apologies for the somewhat delayed response.

Commission staff have reviewed the proposed amendment and provide the following advice for your information.

The proposed subdivision is located to the immediate east of Lake Richmond. Lake Richmond has been evaluated as a Conservation management category wetland by the Wetlands of the Swan Coastal Plain study (volume 2), is protected by the Swan Coastal Plain Lakes Environmental Protection Policy and is included in the System 6 Report having been identified as having significant conservation values. Lake Richmond also supports a threatened community of thrombolites with a Recovery Plan currently being developed.

The locating of a high density urban development adjacent to wetlands having significant conservation value such as Lake Richmond is generally not considered appropriate by the Water and Rivers Commission. However, in the case of the proposed development there is already considerable urban development encroaching upon the wetland. To ensure that this development does not result in adverse environmental impacts upon Lake Richmond (and its Thrombolite community) will require careful planning and commitment to a range of best management practices.

BUFFER ZONES

The proposed buffer width between the development and Lake Richmond is inadequate and the buffer referenced from Davis and Lane (1995) is not appropriate. Given the recognised high conservation value of the thrombolites and the need to protect wetland water quality, a more appropriate buffer would be 200 metres from the boundary of the wetland. This is consistent with the Water and Rivers Commission management objectives for Conservation management category wetlands identified in Wetlands of the Swan Coastal Plain (volume 2, 1996).

To protect the conservation values of the wetland, this buffer are should be rehabilitated using appropriate native species in consultation with CALM and the City of Rockingham. The boundary area between the development and the Parks and Recreation reserve should

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Managing and Protecting Western Australia's Most Vital Resource

be fenced with the provision for public access maintained (consistent with the Draft Management Plan).

IMPACTS UPON GROUNDWATER QUALITY AND QUANTITY

The CER does not consider the potential for drawdown of the water table resulting from private groundwater abstraction in the proposed development. The CER should address the potential for, and implications of, watertable drawdown upon the saltwater interface, Lake Richmond and the thrombolite community. There is also potential for urban development to impact upon groundwater quality through the use of chemicals such as fertilisers and pesticides. The proponent should make a commitment to the monitoring of groundwater quality and quantity and propose management strategies to ameliorate any adverse impacts upon groundwater (and ultimately Lake Richmond and the thrombolites) that may occur.

DRAINAGE

Stormwater detention basin design should include the use of wetland plant species to increase nutrient uptake, sedimentation and create a habitat for local fauna. Advice on the design and construction of detention basins can be obtained from Howard Tan on (08) 9278 0300.

The following general comments are from the Resources Investigation Division of the Commission:

- **Section 3.1.4.2 (p 11)**: In light of the following statements "Passmore (1967)....to the north" and "A comparison....Cape Peron", it needs to be established whether groundwater levels are still higher to the east, south and west of Lake Richmond in order to identify the area from where groundwater discharges to the lake, because it has significant relevance in water balance of the lake.

- **Section 4.2.2. (p 28)** : "Construction...aquifer", and **section 4.1.2 (p 26)** "The remaining....drainage requirements": The landscaped lakes, mentioned in the above statements , in addition to acting as retention and infiltrating basins, also allows evaporation to occur. Due to the shallow watertable, infiltration may not be effective, thus incurring retention and evaporation. These basins will act as throughflow lakes, capturing some of the groundwater throughflow to Lake Richmond, as these basins are located (see Fig 16) along the flow path of groundwater throughflow to the lake. This process will reduce the groundwater flow to the lake in the area of the thrombolites (see Fig 15) and, consequently, will reduce the supply of calcium and bicarbonate ions required by the thrombolites (mentioned in **section 5.2.2.2, p 44**). The effect of these basins on the water balance of Lake Richmond and the continuing health of the thrombolites needs to be established.

- **Section 5.2.2.1 (p 39)**: Water balance to Lake Richmond tabulated in Table 2 has omitted two elements of the water balance. One element is the flow from Lake Richmond via outlet drains to Mangles Bay to the north-west (mentioned in **Section 3.1.3 p 10, Fig 7**). The second element is the discharge from the lake to the aquifer to the north (mentioned in **Section 3.1.4.2, p 11**).

- Appendix (ii): Drainflow to Lake Richmond is calculated as 75% of rainfall (850 mm/yr) over 20% (paved area) of the surface water catchment (1,102 ha) of the drainage system discharging to the lake, and is 1.4×10^6 m^3 /annum. This is the generated flow from the catchment, some of which is lost along the flow path by evaporation and seepage to groundwater (in case of groundwater level below the drain

level). Volume of drain flow into the lake needs to be measured at the point of discharge into Lake Richmond.

- Appendix G (iv): In the calculation of groundwater inflow to Lake Richmond, throughflow is calculated across 1000 metre long section of the lake (full length of the lake). However, groundwater flow to the lake is indicated from east, south and west of the lake (mentioned in **section 3.1.4.2 p 11**). Therefore, the length of the lake across which groundwater flows into the lake is longer than 1000m and consequently calculated groundwater throughflow to Lake Richmond will be higher than 275,000 m^3 /year (in Table 5.2.2.1).

The Commission supports the proposed subdivision of Pt Lot 402 Rae Rd, Rockingham, subject to the abovementioned details being addressed prior to the setting of the final conditions of development.

Should you have any queries of a technical nature, please do not hesitate to contact Rezina Shams of the Commission's Resource Appraisal section. General queries may be directed to Heidi Schaper of the Commission's Statutory Referrals section.

Yours sincerely

Rod Banyard
Manager, Strategic Projects

11 August, 1997

EVB (4)

Remind previously by fax.

WATER CORPORATION

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Our Ref
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The Chairman
Environmental Protection Authority
8th Floor Westralia Square
141 St George's Terrace
PERTH 6000

Attention: Mr Adrian Vlok

Dear Sir

RE: CONSULTATIVE ENVIRONMENTAL REVIEW (CER) FOR RESIDENTIAL/COMMERCIAL SUBDIVISION, PT LOT 402 RAE ROAD, COCKBURN SOUND LOCATION 16, ROCKINGHAM (1077)

Thank you for your letter dated 2 July 1997 with a copy of the CER for the above project for comment by the Water Corporation. Our submission on the CER is detailed below.

Groundwater and Stormwater

Analysis of some of the environmental factors set by the EPA and addressed by this CER is based on the premise that Lake Richmond's hydrology is dominated by surface water inflows from the existing drainage system. The Water Corporation considers ground water inflows to Lake Richmond are much greater than indicated by the CER and the effects of this with regard to EPA objectives for this development may need further investigation.

Water balance

The statement made in the CER that Lake Richmond's hydrology is dominated by surface water inflows from the main drainage system is challenged. Groundwater inflow into Lake Richmond are considered to be substantial and there is not the order of magnitude difference between groundwater and drainage volumes as suggested in Appendix G of the report.

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The Water Corporation's estimates of drainage inputs and groundwater inflow into lake Richmond using the broad assumptions made in Appendix G indicates the following:

1 Drainage Inputs

The surface water catchment of the drainage system is 1 102ha as stated in the report. It is estimated that only 10% of the catchment (not 20% as suggested by the CER) should be considered as being paved as roof drainage is connected to soakwells plus there is a degree of compensation in both the local authority and main drainage systems and not all roads are kerbed.

Taking the runoff from this paved area as 90% (75% is suggested by the CER) and the annual rainfall as 850mm gives a volume of 843 000cu m/annum of drainage inflow into Lake Richmond (1 400 000 is suggested by the CER).

2 Groundwater Inflow

As stated in the CER, groundwater flow around lakes is complex and requires sophisticated mathematical analysis to gain a reasonably accurate estimate of throughflow. However using the broad assumptions provided in the CER to estimate the volume of groundwater flow into Lake Richmond, the coefficient of permeability should be 86m/day which is more applicable to the sandy soils found at the proposed development site. The coefficient of permeability of 30 m/day used in the CER is more applicable to silty soils.

Using this new coefficient and taking all other parameters presented in Appendix G for groundwater inflow as being correct gives a volume of 785 000 cu m (275 000 is suggested by the CER).

Comparison of these new volumes shown in 1 and 2 above shows that the values are approximately equal and not the magnitude of difference stated in the report. The proposed infiltration system for this development would close this gap further.

Drainage

The propose drainage system for the development does attempt to incorporate the principles of Water Sensitive Urban Design. While, full details of the drainage system still have to be addressed at the design stage, the following points should be noted:

1 The CER would seem to indicate that the proposed detention basins for this development will treat nutrients in the stormwater runoff by soakage alone. If this is the case, nutrients from the proposed development will be transmitted through the groundwater to Lake Richmond unless efficient and effective nutrient attenuation is achieved by the infiltration/detention basins.

2 The fluctuation in water table levels between summer and winter as indicated by Lake Richmond (Figure 11) and Water and Rivers Commission Bore T280 (Figure 9) will have an influence on the effectiveness of property soakwells and the proposed detention basins within the development. Storage requirements available at these basins may be insufficient at maximum groundwater levels in winter time such that overflows into the main drainage system may occur during storm events of less that 1 in 10 year ARI. Basin sizes should be sized accordingly at the design stage to avoid this occurrence.

Sewerage

The proponent should ensure the detailed design is in accordance with the Corporation's overall wastewater scheme planning. The proponent should ensure this prior to finalising matters with the EPA.

The commitments made by the proponent regarding emergency power generation are greater than the maximum requirements of the Corporation and therefore the proponent will be expected to fund these extra commitments.

Sewers are in the vicinity of this development and it is expected that sewerage will be a condition of subdivision clearance.

Existing and proposed pressure mains are to be located in Public Land. Pedestrian Access Ways are unsuitable for this purpose.

Proponents Commitments

The commitments in Section 6 of the report does not list the Corporation as a body which is consulted and/or to whose satisfaction various items are designed or constructed. If the Corporation is to take over and operate these works they should be listed in commitments 2, 3 and 4 at least.

Conclusion

Thank you for the opportunity to make a submission on this proposal. If you require further assistance please do not hesitate to contact me.

Yours faithfully

Frank Kroll

FRANK KROLL
A/Senior Strategic Land Planning Officer
Land Development Branch
4 August 1997
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AUSTRALIAN HERITAGE COMMISSION

Sub (6)

16 July 1997

Mr Adrian Vlok
Department of Environment Protection
Westralia Square 141 St Georges Terrace
PERTH WA 6000

CER Guidelines for the Proposed Residential/Commercial Subdivision Pt Lot 402 Rae Road, Cockburn Sound Location 16, Rockingham

Thank you for your referral to the Australian Heritage Commission of the CER Guidelines for the Proposed Residential/Commercial Subdivision Pt Lot 402 Rae Road, Cockburn Sound Location 16, Rockingham. I apologise for the delay in providing these comments.

The Australian Heritage Commission has an interest in this proposal as it is adjacent to Lake Richmond which is listed in the Register of the National Estate. From the information provided there is no current involvement by any Commonwealth agency in the proposed action, therefore the Commission's comments should be regarded as providing advice only.

The Commission regards the extremely unusual phenomenon of well developed stromatolites (thrombolites) growing in fresh water at Lake Richmond as being of very high heritage value. The Commission's information on other heritage values of the lake is largely based on information provided as part of the System 6 Conservation Reserves Report No 13, 1983.

It is the Commission's understanding that central to the maintenance of the heritage values of this place is the quality of the water in Lake Richmond. Residential and commercial subdivisions typically have adverse effects on the quality of stormwater leaving sites. The Commission advises that an erosion and sediment control plan should be prepared as part of the preparation of an environmental management plan for the area as a condition of consent to construction.

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GPO BOX 1567 CANBERRA ACT 2601 AUSTRALIA

Consideration should also be given to defining special conditions which attach to separate development approvals for each premises in relation to the use of chemicals and the disposal of liquid waste on site.

The Commission considers that its concerns are not sufficiently covered by the "Specific Issues" section of the guideline with respect to the full range of pollutants which are likely to emanate from the proposed development. The range of potential pollutants should be expanded to include (for example) detergents, oils, garden chemicals including fertilisers and suspended sediments.

The Guidelines should be amended to ensure that there is the potential for the proponent to properly address these matters within the CER.

The Commission also has some concerns in relation to the Aboriginal heritage values of the area. The summary presented in the report indicates that archaeological and ethnographic surveys were undertaken. The Commission is unable to assess this aspect of the work without reviewing the full reports. However, neither survey resulted in the identification of any Aboriginal values. Of immediate concern is the statement that only one Aboriginal community group has been consulted. The group that was consulted, Winjan Aboriginal Corporation, is based in Mandurah, south of Rockingham. Not only are there likely to be additional Aboriginal interests from the Mandurah region, but it is highly likely that Aboriginal people based in Rockingham, Perth, Pinjarra, and surrounding areas will also have a direct interest in the proposed development.

The Commission is concerned that proposals to subdivide adjacent to this Registered place are likely to adversely affect its heritage values and suggests that the matters raised above be given due consideration and acted on where possible.

Jonathan Miller
A/Deputy Executive Director
Identification and Conservation Branch

SUB (2)

Ministry for Planning
WESTERN AUSTRALIA

Your Ref:
Enq:
Tel:

DEPARTMENT OF ENVIRONMENTAL PROTECTION

11 AUG 1997

File No 1 1997.03 Name AVL
File No 2 _____ Name _____
File No 3 _____ Name _____

The Chairman
Environmental Protection Authority
8th floor, Westralia Square
141 St George's Tce
PERTH WA 6000

ATTENTION: Adrian Vlok

RESIDENTIAL/COMMERCIAL SUBDIVISION, PT LOT 402 RAE ROAD, COCKBURN SOUND LOCATION 16, ROCKINGHAM

The Ministry for Planning wishes to make a number of comments on the Consultative Environmental Review for the above property.

The EPA guidelines directed the proponent to address a number of specific issues including the appropriateness of the Parks and Reservation as a satisfactory ecological buffer for Lake Richmond.

Parks and Recreation Reservation

The area has been reserved for Parks and Recreation in the Metropolitan Region Scheme since 1963 although some adjustments have been made to the boundaries since that time. An area to the north-east has now been urbanised while the reservation was extended in the south-east corner. As explained in the Consultative Environmental Review, the Garden Island Expressway may not be built which would provide for a greater buffer to urban development in the south west portion of the lake. The total reservation area around the lake is now about the same as that in 1963 and is unlikely to be increased any further.

As the last remaining area to be developed within the close vicinity of Lake Richmond, the Cape Peron Estate has the potential of having a major impact on the conservation values of the lake and surrounds through increased accessability and use. Currently, there is considerable impact on the lake surrounds through numerous tracks enabling inappropriate activity to occur. This impact comes largely from existing surrounding development. With a population of 2,500 to 3,000 in the new development alone, the use of the open space will need to be very carefully controlled so that negative impacts are minimised.

In assessing the impacts the development will have on the Parks and Recreation reservation area, the proponent has taken the attitude that methods of mitigating potential impacts such as fire, weeds invasion, littering, animal pests, trampling and destruction of vegetation should be undertaken by the future management body and incorporated in the Management Plans.

This is not sufficient provision for the conservation of such an important scientific asset and

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ALBERT FACEY HOUSE
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TTY (09) 264 7535

valuable wildlife habitat as Lake Richmond, however, and adequate planning should be addressed in the subdivision which will assist in the management of the adjacent area. Such planning should, for example, include a sound interface between the reservation area and the development. The argument for a row of double frontage lots to be located north of the Rockingham Central Branch Drain is not logical as there is no sound reason why the road reserve should not be extra wide along this edge so as to ensure a road frontage with the area reserved for Parks and Recreation.

The Ministry for Planning constantly encourages the use of road frontage differentiation between region open space and subdivisions because of management problems. These problems are well known and include matters such as disposal of rubbish on to the open space and active discouragement of members of the public legitimately using the open space facilities. It is therefore of paramount importance that a road frontage be provided in this locality so as to prevent those problems occurring.

The management plan for Lake Richmond contained in the *Port Kennedy and Rockingham Lakes Management Framework* (released 6 August 1997 for public comment) indicates the need for car parking in the eastern locality and, if the area is to be residential with lots fronting the recreation reserve, this opportunity will be lost with only the privileged few being allowed to overlook this part of the lake.

Consultation does not appear to have taken place with the Kwinana Rockingham Mandurah Branch of the WA Naturalists Club, the body which manages the lake and whose management plans for the lake were built upon by the Department of Conservation and Land Management in developing the management framework. This management framework should be taken into consideration and consultation with the WA Naturalists Club and CALM should occur so that proposals for the Parks and Recreation reservation can be appropriately managed.

The commitment by the proponent to establish management control boundaries and access to the reserve is demonstratively inadequate given the potential impact the development will have on Lake Richmond. A financial contribution towards the management in terms of interpretative advice, education, walk trails, car parks, and controlled access should be regarded as a minimum.

Water Quality and Quantity

The proponent concludes that the water quality of the lake will be improved because the Peter Street Drain will be upgraded by directing the current open drain flow to a new stormwater infiltration basin. If this does occur, and it is unlikely that all 78 ha will drain into this drainage basin, 6 % is a very small improvement on the water quantity.

In Section 3.2.3, the difference in calcium concentrations between the lake waters and groundwater have been attributed to the activities of algae and lime-secreting organisms including the thrombolites. The cyanobacteria that form the thrombolites are not lime-secreting. The calcium carbonate deposition that forms the thrombolites is a precipitation process not secretion. The report does not indicate what, if any, lime-secreting organisms are

present in Lake Richmond.

Section 5.2.2.2 on the water quality requirements of the thrombolites compares the nutrient status of Lake Richmond with that of lakes in the metropolitan area claiming that the levels are lower. This is the case, however, these other lakes do not support thrombolites. The cyanobacteria that form thrombolites do not require nutrient inputs for growth, in fact, thrombolites and stromatolites generally occur in nutrient poor environments. Significant blooms of macroalgae have been observed in the drains.

The proponent claims that maintaining the water quality at present levels will limit any impact on the thrombolite community, however the report does not adequately demonstrate that the proposed development will not alter the present water quality regime.

Protection of thrombolites

The section on the thrombolites contains a number of errors. The reference to Moore 1993 has been misquoted. Carbonate precipitation has not been attributed to the diatoms present in the benthic microbial community. *Dichothix* spp. is the cyanobacteria thought to be involved in the precipitation process. Note that the spelling of this organism is incorrect in the report. The fact that the thrombolites are located around the periphery of the lake is not a function of the carbonate precipitation process but rather related to the intrusion of groundwater along the margins of the lake.

It is clear that the consultant has not undertaken a serious investigation of the thrombolites. Information has been quoted from Kenneally et al. (1987) regarding a 'connecting crust' between the domes. More recent studies have shown that this is a rare occurrence. It should also be noted that nutrient enrichment is one of the potential threatening processes (see last paragraph). Figure 15 incorrectly refers to 'thromatolites' rather than thrombolites.

Drainage Management

It is not adequately demonstrated that the increased run-off from the new subdivision will be completely contained in the new detention basins. The CER document also does not adequately address or detail how the drainage system will be in accord with water sensitive design principles. There is no indication that the detention basins will be landscaped with tree planting to create an attractive feature and wildlife habitat, control flooding and filter nutrients.

The current Northern Branch Drain is visually unattractive, will impede movement between the various parts of the subdivision as well as be a danger to children. A catchment detention basin should be located on the Northern Branch drain before the entry to the lake to filter nutrients from the entire catchment area and ensure all events are catered for not just 1 in 10 year ones. An opportunity to design a new water sensitive detention basin with appropriate planting to enhance the public open space appearance and function in conjunction with the Water Corporation exists and should be examined. This should improve the quantity as well as the quality of the water entering Lake Richmond.

Remnant native vegetation

The CER guidelines directed the proponent to look at a number of issues associated with impacts outside the development site. There are, however, areas of remnant native vegetation which have not been adequately addressed in the proposal. These have not been identified as having regional significance in Perth's Bushplan, however, they may have local significance and should be investigated to determine whether some of this can be retained within public open space. The area is in the southern part of lot 402 where the land rises slightly and has good stands of casuarina and melaleuca trees.

Thank you for the opportunity to comment on the report.

Yours sincerely

David Nunn
Manager
Environmental Planning Branch

11 August 1997

BJK August 1997

Conservation Branch Comments on the CER for Cape Peron Estate, Rockingham

General Issues

(1) Biological Information Necessary to Address Regional Significance on the Swan Coastal Plain
A set of standard biological information needs to be provided to enable consideration of regional significance. This information can then be assessed against the criteria established to determine regional significance in Draft Perth's Bushplan. These are not 'new' information sets and need to be collated to do a comprehensive determination of an area's regional values.

REGIONAL INFORMATION
LANDFORM AND SOIL

VEGETATION AND FLORA
Vegetation Complex (Heddle et al 1980)
Floristic Community Types (Gibson *et al* 1994, DEP 1996)

WETLANDS
Wetland Types (Hill *et al* 1996a, Hill *et al* 1996b)
Consanguineous suite (Hill *et al* 1996a, Hill *et al* 1996b)
Wetland Management Objective (Hill *et al* 1996a, Hill *et al* 1996b)
Lake EPP

SPECIFIC SITE DETAIL (the limitations of any survey work should be clearly stated)
Landscape features

Vegetation and Flora (any existing information and own survey)
Structural units (should be mapped and related to on the ground descriptions)
Remnant Vegetation (in this context refers to non bushland areas with scattered natives, may be trees, shrubs, herbs, grasses or sedges)
Vegetation Condition (should be mapped)
Total Flora, including total flora, significant flora (DRF, priority taxa, range extensions, species at geographic limits etc.)

Fauna (any existing information and own survey)

Linkage (adjacent bushland areas)

Special Attributes (including recommendations from previous studies on significance)

INTERNATIONAL AND NATIONAL SIGNIFICANCE
Reference to international treaties, listing on the register of the National Estate etc.

The Lake Richmond Bushplan Site description is attached.

(2) Area of Cape Peron Estate included in the CER
Only that section of the Estate with current P&R Reservation is described. Current MfP mapping of bushland for the Perth Environmental Project and mapping by Van Gool (1991) for the Department of Agriculture shows the entire area of the Estate as bushland/remnant vegetation . Neither of these mapping projects are referred to nor are the boundaries of bushland as mapped considered. Considering that the System 6 Update (DEP 1996) has identified the wetlands floristic community type 19 (as defined by Gibson *et al.* 1994) adjacent to the lake body it is likely that this community occurs within the Estate (see (3) below). In addition the wetlands of the Becher Suite are all considered to be 'regionally significant' (V & C Semeniuk Research Group 1992).

The total area of the Estate should have been considered according to the headings in (1).

(3) Threatened Ecological Communities
The System 6 Update (DEP 1996) has identified the wetlands floristic community type 19 (as defined by Gibson *et al.* 1994) adjacent to the lake body and the CER considers that the "..*Xanthorrhoea* and associated vegetation corresponds to Community type 19...". Survey of the wetland communities identified in the CER indicates that all are likely to be floristic community type 19 (as defined by Gibson *et al.* 1994, see Map 1 attached). This floristic community type is Critically Endangered (English and Blyth 1997) as is the Stromatalite-like microbialite community of coastal freshwater lakes found in Lake Richmond. These communities are subject to recovery plans (V. English pers.

comm.) and both of these should be referred to in the CER (recommendations in regard to the area of the CER in these plans should be incorporated in the CER). While there are references to these communities and their status in the CER the references are disjointed and inconclusive.

(4) **Buffers** (5.1.2.2, p33)
The treatment of buffer width is inadequate and misleading. While the CER refers to the current synopsis on buffer width on the Plain by Davies and Lane (1995, Table 4 attached) **only one of twelve buffer functions is referred to** in boundary determination. At least **seven** of the buffer functions should be considered in determining the recommended buffer (indicated on attached Table 4 from Davies and Lane).

The buffer function selected for use in the CER is very specific and has limited application to the area of the CER. The buffer considered is 'Carbon flow through food webs' (6.2 in Davies and Lane 1995) which is based on " estimated rates of consumption of terrestrial detrital material by the fauna of upland streams in the Northern jarrah Forest (Davies 1993, 1994), it has been estimated that a 20 to 50m buffer of dense vegetation would be adequate to supply sufficient detritus to 'drive' ecological processes associated with detrital material. In the absence of similar studies in lentic systems, this value is considered appropriate to lentic systems on the Swan Coastal Plain." The quotation in the CER concerning this buffer function is from the summary text which refers to "ecological processes", which in the context of the CER is misleading.

On conservative estimates a buffer of at least 200m from the outer edge of 'wetland dependant vegetation/hydric soils' (Table 4, distance Y) is required (see Map 1). This very conservative buffer width goes beyond the current P&R reservation area in most cases. A more detailed buffer determination should be made on consideration each of the buffer functions. This is the approximate area considered under Bushplan (see attached description of the Bushplan Site).

Specific Comments

3.2.1, p13 2nd last paragraph
While the area is identified as being typical of the Becher Plain Dune sequence, reference is not made elsewhere to the values of this landform and the wetlands within it.

3.2.3.3, p18, 1st paragraph *Flora*
A "detailed vegetation survey' cannot be done in February.
Appendix F incorrectly refers to natives as weeds an vice versa. A series of plant observed in the area that would be evident in February are not listed.
p19, 4th paragraph *Fauna*
Source of the bird information should be referenced.

Appendix C, WAHERB Inquiry
Two of the taxa identified are not within the metropolitan area, one is from near Harvey and the other the Gardner River (lats and longs are incorrect).

References
not listed, will supply if required

LAKE RICHMOND

Boundary Definition: management boundary

SECTION 1: CADASTRAL INFORMATION

Bushplan site no.: 358 **Map no.:** **Map sheet series ref. no.:** 2033-III NW

System 6 (1983): M102 Area of bushland goes beyond System area boundaries, all bushland described

Other Names:

Area (ha): Total 95.891 (includes open water), Bushland 47.703

Local Authorities (Suburb)

City of Rockingham (Rockingham)

Zoning

MRS: Parks and Recreation, Urban, Important Regional Roads

TPS: Residential-SR3, Public Purposes, Public Open Space, Local Major Roads, Rural

Lot/Location numbers, Street name	Ownership Categories (Purpose)
402 Broughton Wy, 402 Rae Rd	Commercial Organisation
1238 Fisher St, 1530 Lake St, 1531 Lake St, 1596 Fisher St, 1597 Lake St, 1598 Fisher St, 17 Safetybay Rd, 18 Richmond Av	Multiple Ownership
3 Rae Rd	State Government
?	Vacant Crown Land

SECTION 2: REGIONAL INFORMATION

LANDFORM AND SOILS

Quindalup Dunes (Holocene dunes)

Safety bay sands (Qhs: S13)

Lagoonal and estuarine Deposits (within the Quindalup)

Lagoonal and estuarine deposits (Vasse) (Qhg: M5)

VEGETATION AND FLORA

Vegetation Complex

Quindalup Dunes

Quindalup Complex

Floristic Community Types:

Supergroup 2: Seasonal Wetlands

19a Sedgelands in Holocene dune swales

Supergroup 4: Uplands centred on Spearwood and Quindalup Dunes

29a Coastal shrublands on shallow sands

WETLANDS

Wetland Types: lake, artificial channel

Consanguineous suite

Quindalup

Cooloongup (Qu.1)

Becher (Qu.2)

Wetland Management Objective: Conservation (54.658 ha)

Lake EPP: 42.603 ha

THREATENED COMMUNITIES/SPECIES

Not assessed, Critically Endangered (floristic community type 19 as defined by Gibson *et al.* 1994, Stromatalite-like microbialite community of coastal freshwater lakes)

SECTION 3: SPECIFIC SITE DETAIL

Landscape features: permanent freshwater lake, oceanic limestone cliffs

Vegetation and Flora: detailed survey (Keating and Trudgen 1986), limited survey (DEP 1994 (Rich 01 - 02))

Structural units: mapping (Keating and Trudgen 1986)

Quindalup Dunes: *Acacia rostellifera, Leucopogon parviflorus* and *Jacksonia furcellata* Shrubland, *Olearia axillaris* Shrubland, *Acacia saligna* and *Jacksonia furcellata* Shrubland, *Lomandra maritima* Sedgeland

Wetlands: *Melaleuca rhaphiophylla* Low Woodland to Low Forest; *Acacia saligna* and *Xanthorrhoea preissii* Shrubland; Closed Sedgelands dominated by *Juncus pallidus, Scirpus nodosa* and *Juncus kraussii, Lepidosperma gladiatum, Typha ?domingensis* and *Baumea juncea* and combinations of some of these (occasional *Gahnia trifida*).

Remnant Vegetation: areas with scattered native species

Vegetation Condition: >50% Very Good to Excellent with <50% Good to Degraded with areas of severe localised disturbance

Total Flora: 51 native taxa, 23 weeds (estimated >60% expected flora, Keating and Trudgen 1986 and site based list DEP 1994)
DRF/Priority and significant flora: none identified

Fauna
Bushplan Site surveyed by RAOU one visit for birds (32). Significant bird species: category 2 (1), cat 4 (1).
Linkage: adjacent bushland to west (BS377 Point Peron) recognised and east available

Special Attributes:
• Meets five specific coastal reserve criteria:
(i) Quindalup Dune types: beach ridge plain
(ii) Continuing natural processes: 47.703ha Quindalup Dunes extending to XX kms inland
(iv) Linkage: links to coast, roads and developments fragment Bushplan Site
(v) Vegetation: wetland and upland units, rare communities
(vi) Habitats: see Fauna above
• contains 'regionally and nationally to internationally significant' wetlands (V & C Semeniuk research group)

SECTION 4: INTERNATIONAL AND NATIONAL SIGNIFICANCE
Register of the National Estate, location for JAMBA/CAMBA species

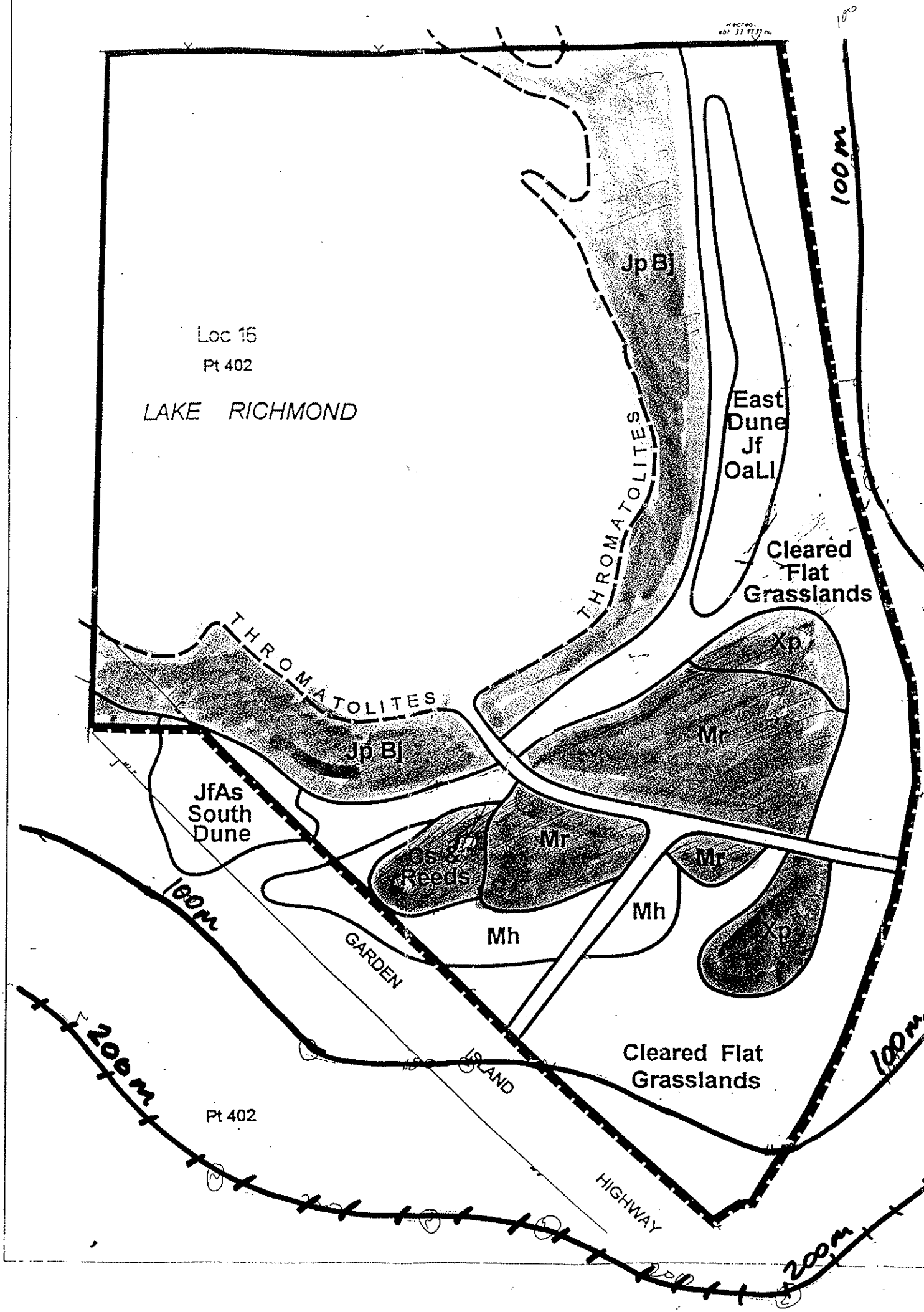
SECTION 5: INCLUSION CRITERIA AND RECOMMENDATIONS
Criteria met for inclusion: Representation of ecological communities, Rarity, Scientific or evolutionary importance, General criteria for the protection of wetland, streamline and estuarine fringing and coastal vegetation
Opportunities and/or Constraints: MRS Urban zoning, Lakes Environmental Protection Policy (EPA 1992)
Recommendation: The existing vesting and management intent of the Reserve/s (number/s) is/are endorsed. Long-term security and support for conservation management of the Bushplan Site be enhanced by; amending the purpose of the reserve to include conservation; and applying appropriate mechanisms in consultation with the vested authority.

Table 4. A summary of recommended widths for adequate buffer zones for different issues on wetlands of the Swan Coastal Plain. Note, these values are an estimate of adequate widths for each major buffer "issue". To more accurately determine appropriate buffer widths, relevant research would need to be conducted for each "issue" on an individual wetland basis.

BUFFER FUNCTIONS	*MEASUREMENTS MADE FROM THE OUTER EXTENT OF:*	*RECOMMENDED BUFFER WIDTH (see Figure 2 for the position of X,Y etc)*
6.1 Carbon flow	Permanent water	X + Y=20-50m
6.2 Nutrients[5]	Wetland dependent vegetation	Y=200m on sandy soils Y=100m on non-sandy soils
6.3 Salinity	Wetland dependent vegetation	Y=250m
6.4 Nuisance insects	Permanent water	X + Y=100-800m
6.5 Sediment	Seasonally inundated zone	X_2 + Y=100m
6.6 Rising water levels (Tidal wetlands only)	Depending on slope of adjacent land. Estimate using a sea-level rise from 0.2 to 1.4m[6] (Australian Marine Sciences Association 1990).	
6.7 Groundwater protection	Wetland dependent vegetation	Y=2000m
6.8 Disturbance	Wetland dependent vegetation	Y= 0-400m
6.9 Water temperature	Seasonally inundated zone	X_2 + Y=20m
6.10 Heavy metals	Wetland dependent vegetation	Y=100-200m
6.11 Scientific values	Depends on the specific scientific issue of interest	
6.12 Aesthetic values	Wetland dependent vegetation	Depending on slope of land, orientation of development and vegetation density

An adequate buffer zone for maintenance of ecological processes associated with carbon flow is recommended at 20 to 50m. This is measured from the outer edge of permanent water (Table 4). Recommended buffer zones for protection from nutrient inputs range from 100m in non-sandy soils to 200m on sandy soils. These zones are measured from the wetland dependent vegetation. Excessive nutrient inputs can adversely impact on both the aquatic and wetland dependent vegetation component of a wetland. Excessive nutrients in the water result in enhanced algal growth and associated problems with ahoxia, odour, botulism *etc.* Increased nutrient inputs into the wetland dependent vegetation can result in increased weed growth which leads to increased fire and, in turn, increased weed growth.

[5] Note, this is assuming the nutrients are not entering the wetland *via* a drain.
[6] In this case, a 1.4m vertical plus the horizontal component is recommended


Loc 16
Pt 402
LAKE RICHMOND
Jp Bj
THROMATOLITES
East Dune Jf OaLl
Cleared Flat Grasslands
Xp
Mr
Jp Bj
THROMATOLITES
JfAs South Dune
Mr
Os & Reeds
Mr
Mh
Mh
Xp
100m
60m
GARDEN
ISLAND
Cleared Flat Grasslands
100m
200m
Pt 402
HIGHWAY
200m

CONSULTATIVE ENVIRONMENTAL REVIEW

CAPE PERON ESTATE, ROCKINGHAM

JULY 1997

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Report No: MA7010
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FLORISTICS of RESERVES and BUSHLAND AREAS

of the

PERTH REGION (SYSTEM 6)

PARTS XI - XV

by

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February 1997

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Forrestdale Lake Nature Reserve

Draft Management Plan 2003

GOVERNMENT OF WESTERN AUSTRALIA

DEPARTMENT OF Conservation AND LAND MANAGEMENT
Conserving the nature of WA

Thomsons Lake Nature Reserve

Draft Management Plan 2003

Full document available on request

GOVERNMENT OF WESTERN AUSTRALIA

DEPARTMENT OF Conservation AND LAND MANAGEMENT

Conserving the nature of WA

5105 WA 3165 (C) METRO REGIONAL AREA & EXT. RUN 8 (5079-5160) 1:20000 11-DEC-92 920676

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5191 WA 3165 (C) METRO REGIONAL AREA & EXT. RUN 9 (5161-5244) 1:20000 11-DEC-92 920676