HENDERSON ROAD BUSHLAND, PEEL ESTATE

Boundary Definition: bushland (part taken to cadastre) boundary (Areas of bushland within the boundaries of the Site (i.) are not accurately mapped; (ii.) have been recently cleared. The boundary has been drawn to include cleared bushland; Boundary adjusted after vegetation survey and negotiations with land owner(s) in response to a submission to draft *Perth's Bushplan.*)

SECTION 1: LOCATION INFORMATION

Bush Forever Site no. 378
Area (ha): bushland 116.5 (Site also includes open water.)
Map no. 76, 81
Map sheet series ref. no. 2033–II SW
Other Names: Submission Area 220
Local Authorities (Suburb): Shire of Serpentine-Jarrahdale (Hopeland)

SECTION 2: REGIONAL INFORMATION

LANDFORMS AND SOILS
Bassendean Dunes
Bassendean Sands (Qpb: S8)
Bassendean Dunes/Pinjarra Plain
Bassendean Sands over Guildford Formation (Qpb/Qpa: S10)
Wetlands (within the Bassendean Dunes/Pinjarra Plain)
Holocene Swamp Deposits (Qhw: Cps)

VEGETATION AND FLORA
Vegetation Complexes
Bassendean Dunes
Bassendean Complex — Central and South
Combinations of Bassendean Dunes/Pinjarra Plain
Southern River Complex
Floristic Community Types
Supergroup 2: Seasonal Wetlands
4 *Melaleuca preissiana* damplands
Supergroup 3: Uplands centred on Bassendean Dunes and Dandaragan Plateau
23a Central *Banksia attenuata — B. menziesii* woodlands

WETLANDS
Wetland Types: sumpland, dampland, palusplain, artificial channel
Natural Wetland Groups
Bassendean—Pinjarra transition OR Bassendean with fluvial features
Bennett Brook (B/P.4)
Wetland Management Objectives: Conservation (41.5ha), Resource Enhancement, Multiple Use
Swan Coastal Plain Lakes EPP: 3.9ha + 1.3ha = 5.2ha (total)

THREATENED ECOLOGICAL COMMUNITIES
Not assessed

SECTION 3: SPECIFIC SITE DETAIL

Landscape Features: open water, vegetated wetland, vegetated uplands
Vegetation and Flora: limited survey (DEP 1996 (Kailis 01–03), DEP 1999; part Site — Hart Simpson & Associates 1990, Masters and Associates 1992)
Structural Units
Uplands: *Banksia attenuata* and *B. menziesii* Low Open Forest to Low Woodland at times with scattered *Eucalyptus marginata, Banksia ilicifolia* and/or *Allocasuarina fraseriana*; *Banksia attenuata, B. menziesii* and *B. ilicifolia* Low Woodland
Wetlands: *Melaleuca preissiana* Low Open Woodland; *Kunzea glabrescens* Closed Tall Scrub; *Regalia ciliata* Closed Heath
Scattered Native Plants: not assessed
Vegetation Condition: >50% Excellent to Very Good, <50% Good to Completely Degraded, with areas of severe localised disturbance
Total Flora: 89 native taxa (plot-generated list only)
Significant Flora: none recorded
Fauna: Significant mammal species: Quenda (Friend 1996 D)
Linkage: adjacent bushland to the north, south (across road) and east

SECTION 4: INTERNATIONAL AND NATIONAL SIGNIFICANCE

Not listed

SECTION 5: SELECTION CRITERIA AND RECOMMENDATIONS

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

Recommendation: Part A: Rural Complementary Mechanism. Part : Proposed Parks and Recreation Reservation. Part C: Other Government Land Mechanism (subject to vegetation assessment and Master Plan; see Table 3, Volume 1).

HENDERSON ROAD BUSHLAND, PEEL ESTATE

Boundary Definition: bushland (part taken to cadastre) boundary

SECTION 1: CADASTRAL INFORMATION

(Lots, locations and derived information to be updated in the public submission period)

Bushplan Site no. 378 **Map no.** 100 **Map sheet series ref. no.** 2033–II SW

Other Names
Submission Area 220

Local Authorities (Suburb)
Shire of Serpentine-Jarrahdale (Hopeland)

Ownership Categories
State Government

Area (ha): total 154.9 (includes open water); bushland 129.1

Zoning
MRS: Rural
TPS: Rural, Public Open Space, Landscape

Lot/Location/Reserve numbers (Purpose), Street name
2, 399, 400 Henderson Rd; 1 River Rd; 164 Yangedi Rd
Crown Reserve

SECTION 2: REGIONAL INFORMATION

LANDFORMS AND SOILS

Bassendean Dunes
Bassendean Sands (Qpb: S8)

Bassendean Dunes/Pinjarra Plain
Bassendean Sands over Guildford Formation (Qpb/Qpa:S10)

Wetlands (within the Bassendean Dunes/Pinjarra Plain)
Holocene Swamp Deposits (Qhw: Cps)

VEGETATION AND FLORA

Vegetation Complexes

Bassendean Dunes
Bassendean Complex — Central and South

Combinations of Bassendean Dunes/Pinjarra Plain
Southern River Complex

Floristic Community Types

Supergroup 2: Seasonal Wetlands
4 *Melaleuca preissiana* damplands

Supergroup 3: Uplands centred on Bassendean Dunes and Dandaragan Plateau
23a Central *Banksia attenuata — B. menziesii* woodlands

WETLANDS

Wetland Types: sumpland, dampland, palusplain, artificial channel

Natural Wetland Groups

Bassendean—Pinjarra transition OR Bassendean with fluvial features
Bennett Brook (B/P.4)

Wetland Management Objectives: Conservation (35.3ha), Resource Enhancement, Multiple Use

Swan Coastal Plain Lakes EPP: 3.9ha + 1.3ha = 5.2ha (total)

THREATENED ECOLOGICAL COMMUNITIES

Not assessed

SECTION 3: SPECIFIC SITE DETAIL

Landscape Features: open water, vegetated wetland, vegetated uplands

Vegetation and Flora: limited survey (DEP 1996 (Kailis 01–03), part Bushplan Site — Hart Simpson and Associates 1990, part Bushplan Site — Masters and Associates 1992)

Structural Units
Uplands: *Banksia attenuata* and *B. menziesii* Low Open Forest to Low Woodland
Wetlands: *Melaleuca preissiana* Low Open Woodland

Scattered Native Plants: not assessed

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

Total Flora: 89 native taxa (plot-generated list only)

Significant Flora: none recorded

Fauna: no systematic survey. Significant mammal species: Quenda (Friend 1996 D)

Linkage: adjacent bushland to the north, south and east; part of proposed Greenway 140 (Tingay, Alan & Associates 1997a)

SECTION 4: INTERNATIONAL AND NATIONAL SIGNIFICANCE

Not listed

SECTION 5: SELECTION CRITERIA AND RECOMMENDATIONS

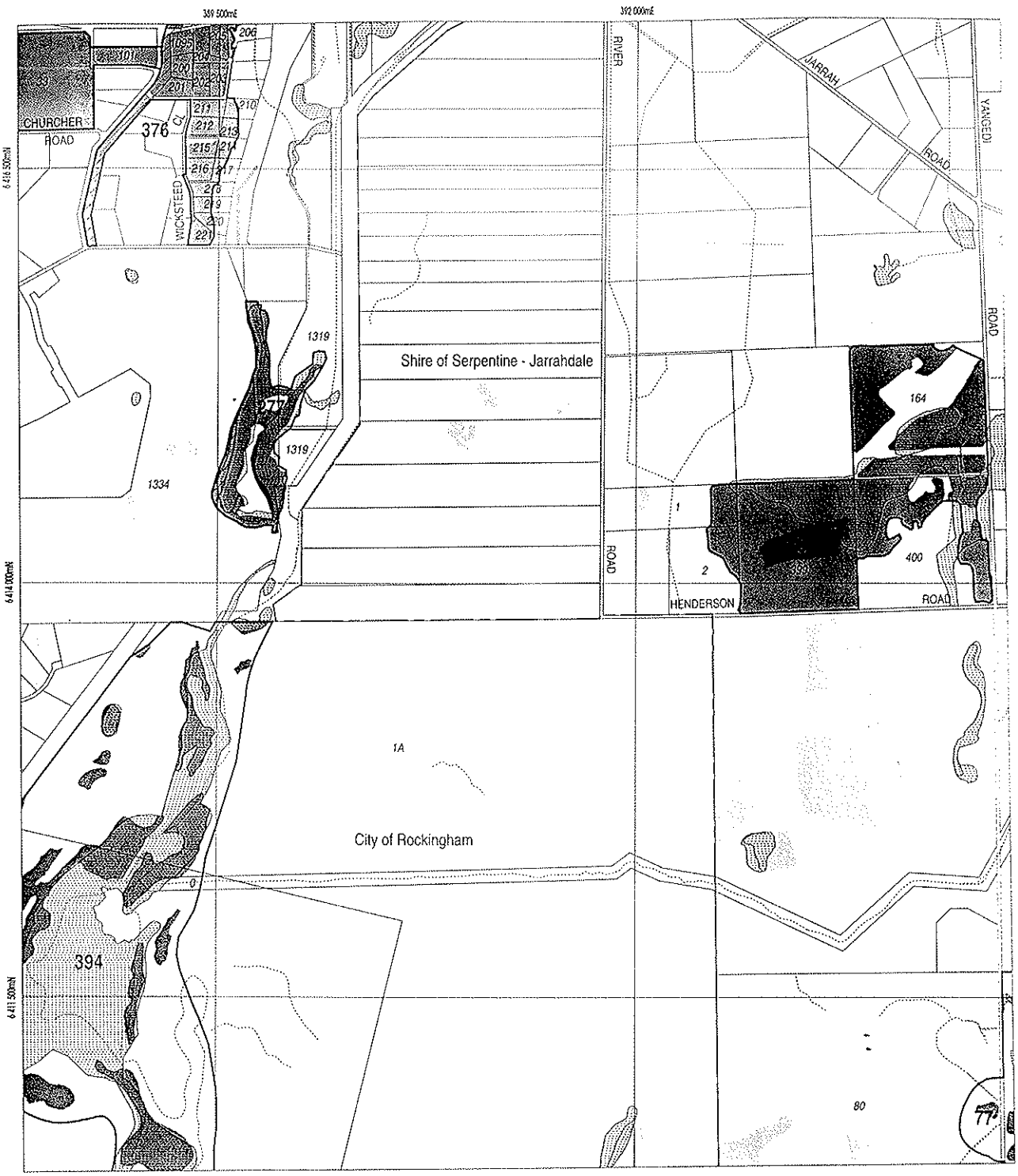
Criteria: Representation of ecological communities, Rarity, Scientific or evolutionary importance, General criteria for the protection of wetland, streamline and estuarine fringing and coastal vegetation

Opportunities and/or Constraints

Opportunities: Bushplan Site/part Bushplan Site subject to Peel-Harvey Estuary EPP/SPP, Swan Coastal Plain Lakes EPP; location of conservation category wetlands; under TPS Public Open Space Zoning and Landscape Zoning, Crown Reserve

Constraints: private land; Titanium mineralization subject to mining lease applications M70/729 and M70/740 and exploration licences E70/785 and E70/838 (Baxter joint venture)

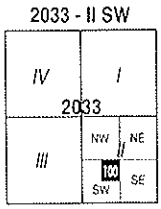
Recommendation: The most appropriate mechanism for the protection of this Bushplan Site be considered through the public comment period in consultation with the land owner(s).



LEGEND

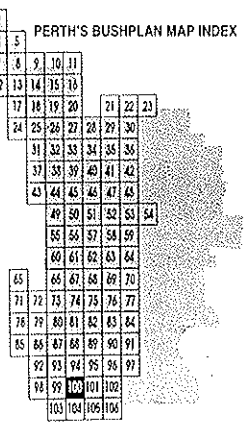
- 472 — Bushplan Sites With Regionally Significant Bushland
- Other Native Vegetation
- Conservation Category Wetlands
- Bushplan Sites With Some Existing Protection
- 696 — Lot Number, Location Number
- Channel Wetlands
- Local Government Boundary

2033 - II SW



1 : 25 000 AMG Reference Grid showing Perth's Bushplan Map Sheet Breakdown

PERTH'S BUSHPLAN MAP INDEX



N

SCALE

0 500 1000

Metres

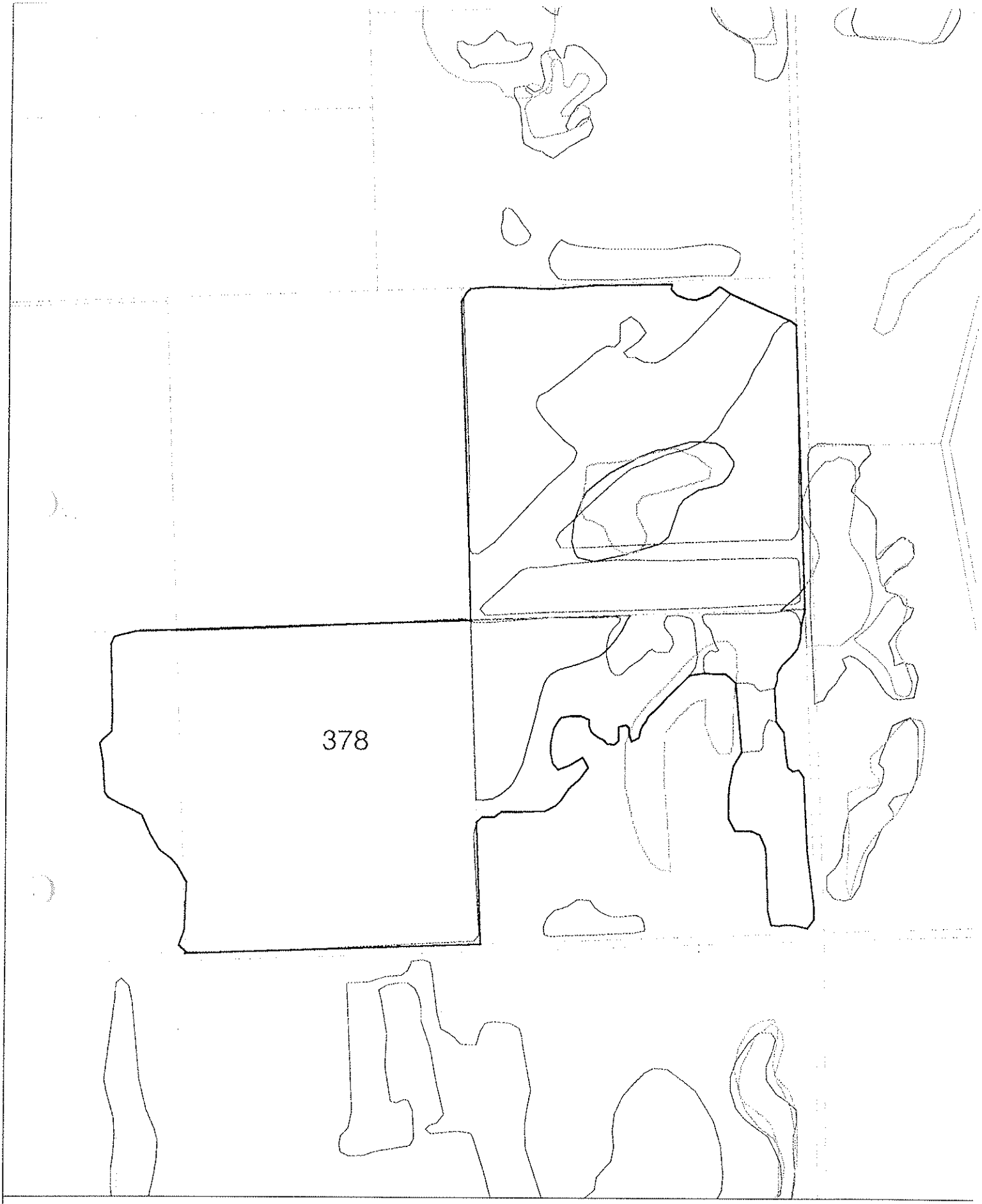
Produced by Project Mapping Section
Land Information Branch, Ministry for Planning, Perth W.A. November 1998

ntw_map17//environ/bushplan//bushv2_100.dgn

Cadastral Data supplied by Department of Land Administration, W.A.

Wetlands Data supplied by Water and Rivers Commission

Native Vegetation Extent for Study Area supplied by Agriculture Western Australia



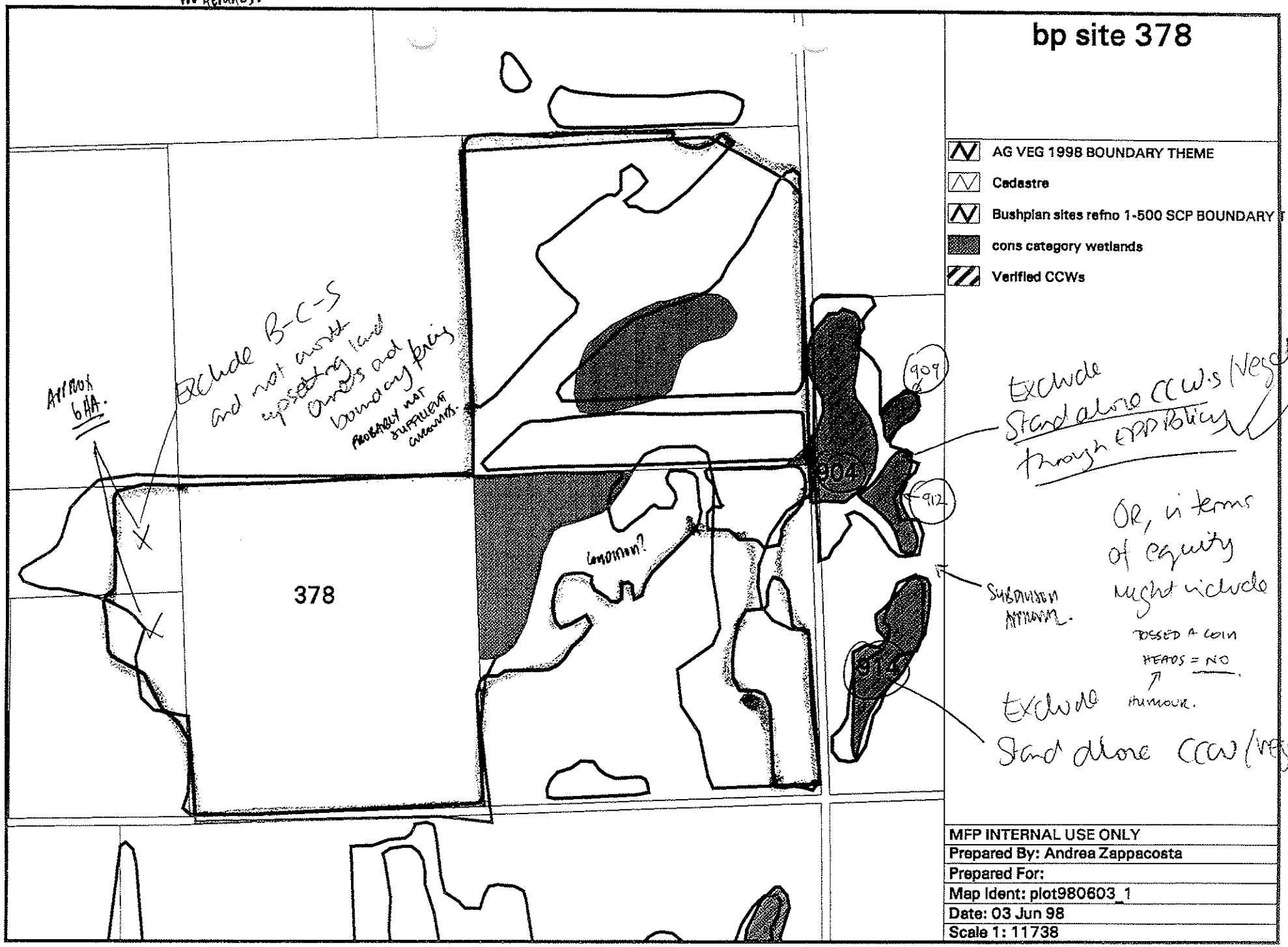
BUSHPLAN SITES CORRECTED

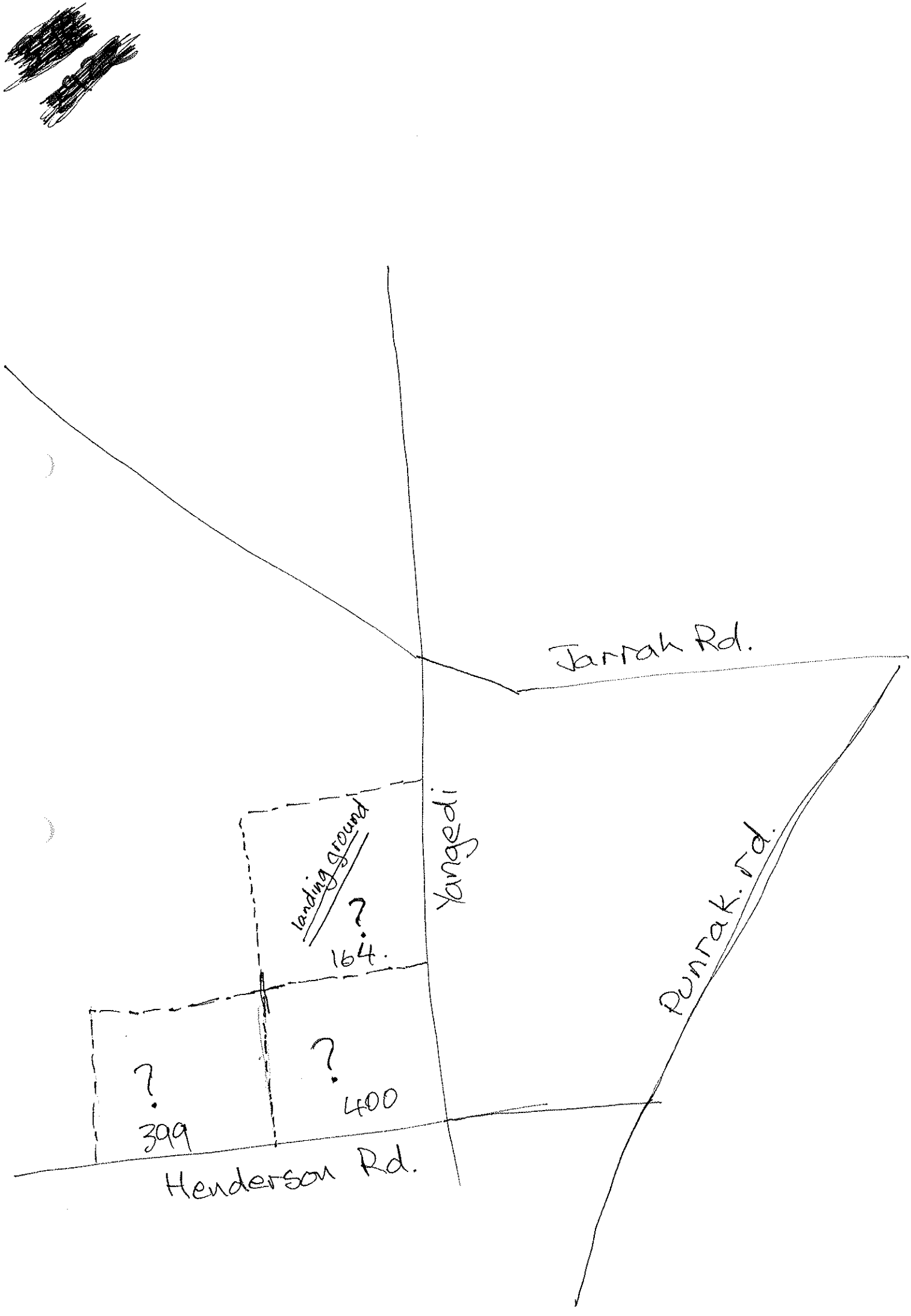
WESTERN AUSTRALIAN PLANNING COMMISSION

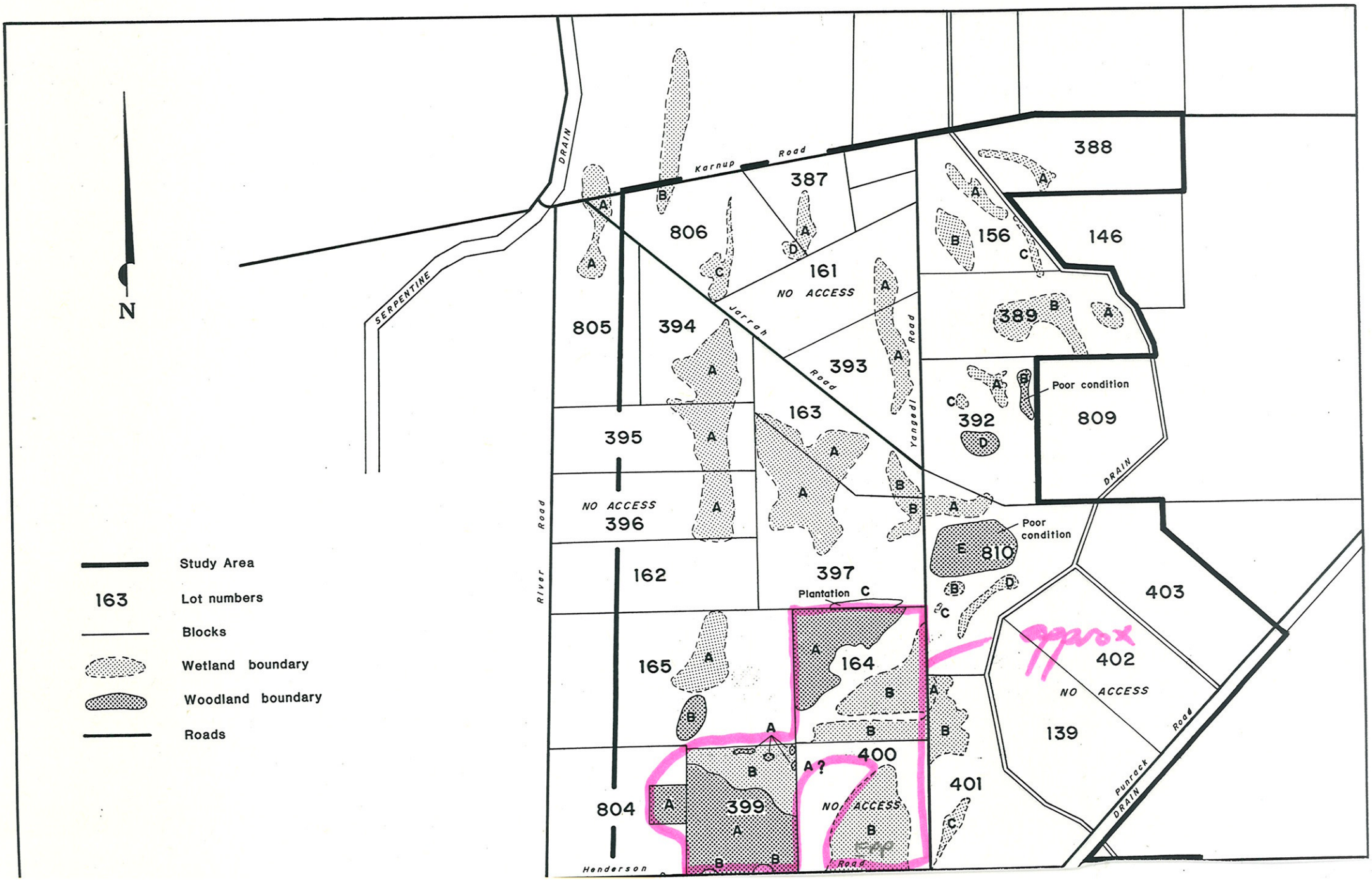
CUSTOMER FOCUS

N

D BK 20/10/98


NO AGMARKS.
bp site 378
AG VEG 1998 BOUNDARY THEME
Cadastre
Bushplan sites refno 1-500 SCP BOUNDARY T
cons category wetlands
Verified CCWs
Approx 6HA.
Exclude B-C-S and not worth upsetting land owners and boundary fence
PROBABLY NOT SUFFICIENT CANOPY.
378
909
904
912
911
Landform?
Exclude Standalone CCW's (Veg) due through EPP Policy
OR, in terms of equity might include
TOSSED A COIN HEADS = NO
HUMOUR.
SUBDIVISION APPROVAL.
Exclude Stand alone CCW (Veg)
MFP INTERNAL USE ONLY
Prepared By: Andrea Zappacosta
Prepared For:
Map Ident: plot980603_1
Date: 03 Jun 98
Scale 1: 11738


Jarrah Rd.
Yangedi
Runrak Rd.
landing ground
?
164.
?
399
?
400
Henderson Rd.


N
Study Area
163 Lot numbers
Blocks
Wetland boundary
Woodland boundary
Roads
DRAIN
Karnup Road
SERPENTINE
Jarrah Road
Yangedi Road
River Road
Henderson Road
Punrack DRAIN
DRAIN
NO ACCESS
Poor condition
Plantation
approx
388
387
806
161
156
146
389
805
394
393
392
809
395
163
396
162
397
810
403
165
164
402
139
400
399
401
804

Serpentine Aircraft Builders Association

John Bird –

525 2085.

leasing from Shire of Serpentine Jarrahdale

lot 164
Tangedi Rd

b.

SYSTEM 6 BUSHLAND SUBMISSION FORM
FOR CONSIDERATION IN THE UPDATE PROGRAMME

If you wish to submit more than one area for consideration in the System 6 update, please use a separate form for each area.

Please fill in each section giving as much information as possible.

LOCATION, OWNERSHIP AND ZONING OF THE AREA

1. Location

Please give as accurate and detailed a description as possible of the site location

Please include either a hand drawn or copied map showing the area of the area

a) Bordering Roads: ~~[redacted]~~ HENDERSON WEST RD AND RIVER RD AND YANGEDI RD

b) Nearest Corner: .....

c) Lot Number: ..... Street Number: .....

d) Town/Suburb/Location: South West from Sapphire.

e) Local Council: Sapphire Jarrahdale

f) Site Name (if any): NIL

g) Approximate size of the area (ha): 1 km x ½ km.

h) Please locate the area on a map and give us map references if possible:
Southern end of River Rd turn left onto Henderson West Rd and 1 KM on left.

i) Map: ..... Streetsmart /UBD/Other: .....

j) Map no.: .....

k) Grid Ref: .....

l) Please give any other information that may help us to find the location:
South west 2km of Sapphire Airfield As above

m) Are you aware of any development proposals that are likely to affect the area?
No

.....

NOTE: Areas that have already been given development APPROVAL should not be nominated

Table 2: Vegetation Condition Scale
Modified from Trudgen 1991 by B. J. Keighery for the Swan Coastal Plain Survey 1993.

1 = 'Pristine'
Pristine or nearly so, no obvious signs disturbance.

2 = Excellent
Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species
For example damage to trees caused by fire, the presence of non-aggressive weeds and occasional vehicle tracks.

3 = Very Good
Vegetation structure altered, obvious signs of disturbance.
For example disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.

4 = Good
Vegetation structure significantly altered by very obvious signs of multiple disturbance. Retains basic vegetation structure or ability to regenerate to it.
For example disturbance to vegetation structure caused by very frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback and grazing.

5 = Degraded
Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management.
For example disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.

6 = Completely Degraded
The structure of the vegetation is no longer intact and the area is completely or almost completely without native species.
These areas are often described as 'parkland cleared' with the flora composing weed or crop species with isolated native trees or shrubs.

Source: B Keighery. Bushland Plant Survey, September 1994

Please fill out those questions that you can answer

2. Who owns the area? (If owned by the person/s making the nomination please indicate) ..... Not known .....

.....

3. If you own the area, and may be interested in participating in conservation on private land initiatives please indicate (and leave your name and address at the end of this submission form) .....

4 .What is the area zoned? (please indicate whether zoning is Town Planning Scheme or Metropolitan Region Scheme) ..... Rural .....

CAN YOU TELL US A LITTLE ABOUT THE PHYSICAL CHARACTERISTICS OF THE AREA

5. Why do you consider this area important? (Refer to Guiding Issues paper) ..... coast / dense scrub with areas of swamp to north. .....

6. What is/are the soil type/s and colours ? .....

Type: Sand/Clay/Gravel/Loam/Silt
Colour: White/Grey/Brown/Orange/Yellow/Red/Black

7. Does the area have any special features such as unusual landforms / landscapes that still retain their natural vegetation? Yes/~~No~~

If yes, what are they? ..... large areas of bees and scrub typical of area .....

.....

8. Is the area a wetland or does it include a wetland? ..... Yes .....

If yes, what kind of a wetlands is it?

a) lake

b) river

c) stream

✓ d) swamp

e) estuary

✓ f) seasonally wet

g) other

9. What percentage of the wetland is open water in summer? .....

CAN YOU TELL US A LITTLE ABOUT THE VEGETATION /FAUNA ON THE NOMINATED AREA.

10. What percentage of the area is indigenous vegetation? ...quite high.....

11. If the area includes regions cleared of native bushland please indicate reasons for the inclusion. .....

.....

12. Has any previous flora or fauna survey work been done on the area?
...Mt Barren.

If yes, please give details of the work .....

.....

.....

13. How would you rate the condition of the native bushland? (see attached table)

a) pristine
b) excellent ✓
c) very good ✓
d) good ✓
e) degraded ✓
f) completely degraded
g) don't know

14. Please indicate the disturbances affecting the area and where appropriate the percentage of the area disturbed.

✓ a) Partial clearing
b) fragmentation
✓ c) Selective removal of species: timber cutting, wildflower picking, mowing dieback and other plant diseases
d) Fire regime, including intensity, season and frequency
e) 'Enrichment plantings' that is plantings of species not found in that community
✓ f) Weed invasion
g) Animal impact: horses, foxes, rabbits, cats, dogs, camels, goats etc
h) Soil movement, both removal and dumping
– i) Changes in water regimes; flooding, drainage and watering
j) Salinity
k) Fertiliser drift and along waterways nutrient influx
l) Mining, including that for road works

m) Grazing: stock, overgrazing by feral or native mammals

n) Proliferation of tracks, fire breaks and walk trails

o) Off-road vehicle use

p) Use as service corridors by the SEC, Main Roads, Water Authority.

(Source: B Keighery. Bushland Plant Survey, September 1994)

15. Does the area contain any plant species of special interest that you know of? (eg. declared rare flora, priority taxa, outlier populations) .....do not know.....

Do you know what they are? .....

.....

16. Do you know of any native animals that use the area? .....many.....

Can you list those you know of? (birds, mammals, reptiles, amphibians etc)

.....all above.....

17. Is the area used by any native animals of special interest? (eg. endangered species, large/important populations).....Yes.....

If yes, please name them and indicate source of information

.....

.....

CAN YOU TELL US A LITTLE ABOUT THE SURROUNDING AREA

18. Are there any bushland areas (including wetlands) near to this area?
..partial scrub and.... wetlands

If yes, how close are they ? .....to the west and east approx 1 KM.

.....

.....

Are they already conservation reserves? .....no.....

What is their approximate size? .....1 KM square.....

19. Does the submitted area link other bushland areas? .....Yes.....

.....

.....

Please attach any additional information about the area which may be of use when assessing it.

Department of Environmental Protection System 6 Update: Site Based Flora List for Lot 399 Henderson West Rd, Shire of Serpentine-Jarrahdale (Subm no.220)
(147 taxa, Kailis01-03, B.J. Keighery, 7/6/96)

Aizoaceae

* Carpobrotus edulis

Anthericaceae

Arnocrinum preissii
Chamaescilla corymbosa
Johnsonia pubescens
Laxmannia squarrosa
Thysanotus arbuscula
Thysanotus multiflorus
Thysanotus sp. manglesianus/patersonii scps
Tricoryne elatior
Tricoryne tenella

Apiaceae

Trachymene pilosa
Xanthosia huegelii

Asteraceae

* Hypochaeris glabra
Podotheca angustifolia
Quinetia urvillei
* Ursinia anthemoides

Casuarinaceae

Allocasuarina fraseriana
Allocasuarina humilis

Centrolepidaceae

Centrolepis drummondiana

Colchicaceae

Burchardia congesta

Cyperaceae

Evandra pauciflora
Lepidosperma angustatum
Lepidosperma scabrum
Schoenus clandestinus
Schoenus curvifolius
Schoenus rodwayanus

Dasypogonaceae

Calectasia cyanea
Dasypogon bromeliifolius
Lomandra hermaphrodita
Lomandra sericea

Dilleniaceae

Hibbertia ferruginea
Hibbertia huegelii
Hibbertia hypericoides
Hibbertia racemosa
Hibbertia vaginata

Droseraceae

Drosera paleacea
Drosera sp. scps

Epacridaceae

Conostephium pendulum
Conostephium preissii
Leucopogon conostephioides
Leucopogon gracillimus

Euphorbiaceae

Monotaxis occidentalis

Goodeniaceae

Dampiera linearis

Haemodoraceae

Anigozanthos humilis
Phlebocarya ciliata

Haloragaceae

Gonocarpus pithyoides

Iridaceae

Patersonia occidentalis

Lamiaceae

Hemiandra pungens

Lauraceae

Cassytha micrantha

Lobeliaceae

Lobelia tenuior

Loganiaceae

Mitrasacme paradoxa

Loranthaceae

Nuytsia floribunda

Mimosaceae

Acacia huegelii
Acacia pulchella
Acacia stenoptera

Molluginaceae

Macarthuria australis

Myrtaceae

Calytrix angulata
Calytrix fraseri
Eremaea asterocarpa
Eucalyptus calophylla
Hypocalymma angustifolium
Kunzea ericifolia
Melaleuca preissiana
Melaleuca thymoides
Pericalymma ellipticum
Regelia ciliata
Scholtzia involucrata

Papilionaceae

Aotus procumbens
Bossiaea eriocarpa
Daviesia triflora
Euchilopsis linearis
Eutaxia virgata
Gompholobium tomentosum
Hovea trisperma var. trisperma
Jacksonia furcellata
* Lotus angustissimus

Poaceae

* Aira caryophyllea
Amphipogon turbinatus
* Briza maxima
Danthonia occidentalis
Stipa compressa

Proteaceae

Adenanthos cygnorum
Adenanthos obovatus
Banksia attenuata
Banksia ilicifolia
Banksia menziesii
Petrophile linearis
Stirlingia latifolia

Restionaceae

Hypolaena exsulca
Loxocarya fasciculata
Loxocarya flexuosa
Lyginia barbata

Rutaceae

Eriostemon spicatus

Stylidiaceae

Levenhookia stipitata
Stylidium brunonianum
Stylidium piliferum

Stylidiaceae

Stylidium repens

Thymelaeaceae

Pimelea angustifolia

Zamiaceae

Macrozamia riedlei

FLORA SURVEY ON RESERVE No. 25911, 2 DECEMBER 1995

Survey undertaken by Stan and Margaret Telford of the Rockingham branch of the W.A. Naturalists Club.

Notes: Bushland on the reserve is in generally good condition. Sixty four species of flora were noted with an additional three species of introduced flora.

This survey was conducted on one day only and this fact plus the short time available for the survey means that many species would remain unidentified. Further surveys taken at intervals throughout the year would probably reveal the presence of many additional species - notably the orchids which would not be expected to be present in December.

FAMILIES AND SPECIES OF FLORA IDENTIFIED DURING THE SURVEY

ZAMIACEAE

Macrozamia riedlei	Macrozamia palm

CUPRESSACEAE

Actinostrobus acuminatus	Cypress

POACEAE

Stipa spp.	
Ehrharta calycina *	Perennial veldtgrass (some on cleared areas)
Briza maxima *	Blowfly grass

CYPERACEAE

Lepidosperma spp.	
Lepidosperma longitudinale	Common sword sedge

RESTIONACEAE

Hupolaena exsielca ?
Lyginia barbata ?
Loxocarya spp.

JUNCACEAE

Juncus spp. ?

COMMELINACEAE

Cartonema philydroides	PRIORITY FAUNA SPECIES

DASYPOGONACEAE

Dasypogon bromeliifolius	Pineapple bush

XANTHORRHOEACEAE

Xanthorrhoea (brunonis?)	Grasstree
Xanthorrhoea preissii	Blackboy

ANTHERICACEAE

Thysanotus sparteus	
Thysanotus spp.	
Laxmannia squarrosa	Paper lily
Tricoryne elatior	Yellow autumn lily

COLCHIACEAE

Burchardia umbellata	Milkmaids

HAEMODORACEAE

Haemodorum spicatum	
Conostylis aculeata	
Phleborcarya ciliata	
Anigozanthos manglesii	Mangle's Kangaroo Paw (various flower colours)
Anigozanthos humilis	Catspaw

IRIDACEAE

Patersonia occidentalis	Purple flags

ORCHIDACEAE

None identified at time of survey.

CASUARINACEAE

Allocasuarina fraseriana	Common sheoak
Allocasuarina humilis	Dwarf sheoak

PROTEACEAE

Banksia attenuata	Slender or Candle Banksia
Banksia menziesii	Menzie's Banksia
Banksia ilicifolia	Holly-leaved Banksia
Petrophile linearis	Pixie Mops
Adenanthos cygnorum	Woolly Bush
Adenanthos obovatus	Basket Flower
Stirlingia latifolia	Blueboy

LORANTHACEAE

Nuytsia floribunda	Western Australian Christmas Tree Abundant healthy specimens in undisturbed habitat. Age range from seedling to senescent.

DROSERACEAE

Drosera spp. (? D. bulbosa)	Rosette of leaves, white flower.
Drosera spp. (? D. menziesii)	Climbing plant with pink flower.

AZIOACEAE

Macarthuria australis	
Carpobrotus edulis *	Pigface

MIMOSACEAE

Acacia huegelii	
Acacia pulchella	Prickly Moses

PAPILIONACEAE

Hovea trisperma	Common hovea
Gompholobium tomentosum	Yellow pea
Bossiaea eriocarpa	Common brown pea
Burtonia conferta	
Jacksonia furcellata	
Daviesia spp.	
Eucolopsis linearis	

PAPILIONACEAE (Cont.)

Aotus procumbens	
Latrobea penella (?)	Low spreading shrub with small mainly yellov flowers.

RUTACEAE

Eristemon spicatus	Pepper and salt

POLYGALACEAE

Comesperma spp.	Blue flower

DILLENIACEAE

Hibbertia hypericoides	Common Hibbertia

MYRTACEAE

Calytrix (?angulata or ?flavescens)	
Kunzia ericifolia	Spearwood
Eucalyptus marginata	Jarrah
Eucalyptus calophylla	Marri
Eremaea spp.	Orange flower
Scholtzia involucrata	
Melaleuca preissiana	Paperbark
Regelia ciliata	
Astartea fascicularis	
Pericalymma ellipticum	
Hypocalymma angustifolium	White myrtle

EPACRIDACEAE

Astroloma spp.

LAMIACEAE

Hemeandra pungens

GOODENIACEAE

Dampiera linearis
Lechenaultia spp.

STYLIDIACEAE

Stylidium brunonianum	Pink fountain triggerplant
Stylidium repens	Matted triggerplant

ASTERACEAE

Angianthus (or Siloxerus) humifusus
Podotheca spp.

FAUNA SURVEY - SERPENTINE AIRFIELD - 7 DECEMBER, 1995 TO 7 JANUARY 1996

Black Swan	*Cygnus atratus*
White-faced Heron	*Egretta novaehollandiae*
Great Egret	*Ardea alba*
Swamp Harrier	*Circus approximans*
Nankeen Kestrel	*Falco cenchroides*
Buff-banded Rail	*Gallirallus philippensis*
Black-Cockatoo	*Calyptorhynchus ?latirostris/baudinii*
Spotted Turtle-Dove	*Streptopelia chinensis*
Common Bronzewing	*Phaps chalcoptera*
Crested Pigeon	*Ocyphaps lophotes*
Galah	*Cacatua roseicapilla*
Australian Ringneck	*Barnadius zonarius*
Red-capped Parrot	*Purpureicephalus spurius*
Elegant Parrot	*Neophema elegans*
Fan-tailed Cuckoo	*Cacomantis flabelliformis*
Southern Boobook Owl	*Ninox novaeseelandiae*
Laughing Kookaburra	*Dacelo novaeguineae*
Sacred Kingfisher	*Todiramphus sanctus*
Rainbow Bee-eater	*Merops ornatus*
Splendid Fairy-wren	*Malurus splendens*
White-browed Scrubwren	*Sericornis frontalis*
Brown Thornbill	*Acanthiza pusilla*
Western Thornbill	*Acanthiza inornata*
Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*
Red Wattlebird	*Anthochaera carunculata*
Brown Honeyeater	*Lichmera indistincta*
New Holland Honeyeater	*Phylidronyris novaehollandiae*
White-cheeked Honeyeater	*Phylidonyris nigra*
Western Spinebill	*Acanthorhynchus superciliosus*
Red-capped Robin	*Petroica goodenovii*
Rufous Whistler	*Pachycephala rufiventris*
Grey fantail	*Rhipidura fuliginosa*
Willie Wagtail	*Rhipidura leucophrys*
Black-faced Cuckoo-shrike	*Coracina novaeholandiae*
Dusky Woodswallow	*Artamus cyanopterus*
Grey Butcherbird	*Cracticus torquatus*
Australian Magpie (Western)	*Gymnorhina tibicen*
Australian Raven	*Corvus coronoides*
Richard's Pipit	*Anthus novaeseelandiae*
Welcome Swallow	*Hirundo neoxena*
Tree Martin	*Hirundo nigricans*
Silvereye	*Zosterops lateralis*
Western Warbler	*Gerygone fusca*

MAMMALS

Western Grey Kangaroo	*Macropus fuliginosus*
Short-nosed Bandicoot	*Isoodon obesulus fusciventer* (Trapped) **Endangered species**
Fox	*Vulpes vulpes*
Cat	
Rabbit	

REPTILES

Dugite	*Pseudonaja affinis*
Western Tiger Snake	*Notechis scutatus*
Black-tailed Monitor	*Varanus tristis*
Marbled gecko	*Phyllodactylus marmoratus*
	Ctenotus spp.

BS 378 8p PB177

Bruce S. Maloney
John L. Baxter
Stephen L. Thomas
A. John Simpson
Graeme B. Prior

P.O. Box 307, Belmont 6984
Phone: 9478 3987
Fax: 9478 3986

9 April, 1999

Perth Bushplan
Ministry of Planning
Albert Facey House
469 Wellington Street
Perth
WA 6000

Dear Sir,

BUSHPLAN SITE [redacted] - CORNER OF HENDERSON AND YANGEDI ROAD, BALDIVIS

I wish to register my concern at the inclusion of these three locations in Bushplan.

Since 1989 we have been exploring the area for heavy mineral sands and have identified a significant heavy mineral sand resource under these blocks of land on Exploration Licence 70/785 which is in the process of being turned into mining leases 70/729 and 70/740.

All drilling and resource calculations have been submitted to the Department of Minerals and Energy should independent confirmation of this matter be required.

The ground which has the most significant resources is covered by private land being lots 399 and 400, while the airstrip block, reserve 25911, is less significant with respect to the heavy mineral sand resources. According to our consultants report the reserve contains a winter wetland which is accompanied by very dense high quality native vegetation. We have no specific objection to the inclusion of the reserve 25911 in the Bushplan.

If you require further information please contact me with copies to:

Bruce Maloney
5 James Road
SWANBOURNE WA 6010

SUBMISSION NO 445

Yours sincerely

John Baxter
on behalf of the Syndicate

MINISTRY FOR PLANNING
12 APR 1999
805-2-1-32pt12
FILE

2

FACSIMILE TRANSMISSION

DEPARTMENT OF
MINERALS AND ENERGY
WESTERN AUSTRALIA

LAND ACCESS UNIT

BS 378

FB177

Mineral House
100 Plain Street (Cnr Adelaide Tce)
EAST PERTH WESTERN AUSTRALIA 6004

Telephone: (08) 9222 3810

Facsimile: (08) 9222 3808

TO:	KIERON BOARDMAN
FACSIMILE NO:	93211617 9264 7838

NO. OF PAGES: 8	SENT BY: TONY SMURTHWAITE	DATE: 30/06/99

KIERON

MINISTRY FOR PLANNING
03 MAY 1999
FILE POS-2-1-32P.12

BUSHPLAN SUBMISSION

PLEASE ACCEPT THIS FACSIMILE AS
ORIGINAL
HAND DELIVER COPY ON MONDAY

ROSARIO

Tony

MRF RECORDS
03 MAY 1999
RECEIVED

SUBMISSION NO. 1833

MINERALS & ENERGY

DEPARTMENT OF
MINERALS AND ENERGY
WESTERN AUSTRALIA

Mineral House
100 Plain Street
East Perth
Western Australia 6004

Telephone (08) 9222 3333
Facsimile (08) 9222 3430
www.dme.wa.gov.au

Your Ref: AJS:rm 824/97
Our Ref: A J Smurthwaite
Enquiries: 08 9222 3151
Telephone:
Facsimile: 08 9222 3808

Bushplan Coordinator
Perth's Bushplan
Ministry for Planning
Albert Facey House
469 Wellington Street
PERTH WA 6000

PERTH'S BUSHPLAN : DEPARTMENT OF MINERALS AND ENERGY'S SUBMISSION

As I requested I am providing the attached submission from the Department of Minerals and Energy (DME). It covers comments about the interactions between the bushland sites as outlined in Perth Bushplan (November 1998) and the Basic Raw Materials and Titanium Minerals deposits of the Perth Metropolitan Region.

If all of the bushland sites are implemented as proposed in these draft documents, then there are serious consequences for the region's and the State's economies. The current operations of the metropolitan extractive industries will be disrupted and access to resources constrained. Opportunities to develop major titanium mineral deposits could be foregone. Conversely, if appropriate measures are taken by the Ministry for Planning the outcome will be land-use decisions that are acceptable to the majority of stakeholders.

Should you wish to have clarification about any points made in DME's submission I suggested that you contact Mr W M Carr, General Manager Land Access Unit, Corporate Resources Division, DME on 9222 3261.

I look forward to being advised about the outcome of the Reference Group's review of submissions. I am keeping the Minister for Mines informed about Perth's Bushplan and Industry's concerns.

L C Ranford
DIRECTOR GENERAL

30 April 1999

Attach.

Copies:
J Aberdeen	CME
I Briggs	DRD
W Sashegyi	CCI
G Savell	AMEC
G Richards	WSL

GOLDEN GECKO
Awards for Environmental Excellence
Presentation of Awards 16th September

Approaches that could assist in reducing the impact of BRM extraction on Bushplan may include land transfers and land purchases. Post-quarrying rehabilitation, and research, albeit presently in a preliminary status, may also be relevant.

4. Bushplan and Titanium Mineral Resources

Bushplan has implications for three deposits: Bullsbrook (Site 292), Mundijong (Sites 354, 360) and Hopelands West (Site 378). They are held under Mining Act tenements. They represent high in-the-ground resource and downstream processing values to the region and the State. DME is not at liberty to provide detailed economic information because of commercial confidentiality. Suffice to state that individually, and collectively, the three deposits constitute enormously rich mineralisations.

Once again DME expects that there will be submissions from the two companies involved as well as the relevant industry associations.

From available evidence it is likely that close inspection of the sites on a block-by-block basis and discussions with the companies and DME will reveal opportunities for boundary adjustments, land transfers and probably assistance with purchases of alternative bushland sites. Not all of the bushland sites are of conservation value.

The titanium industry has an unsurpassed record when it comes to post-mining rehabilitation and it is likely the vegetation disturbed by mining can be rehabilitated and restored. The companies have ongoing research into the propagation of declared rare flora from the Mundijong sites.

5. Review Procedure Used by the Reference Group

DME is mindful of the difficult task to be carried out by the Reference Group in reviewing the competing demands of stakeholders. The 24 March workshop, which was attended by DME, while raising a series of new issues, helped place Bushplan in context. The opportunity for DME to brief the Reference Group on 31 March was appreciated.

It was noted that DEP and MfP members of the TAG were present at the 31 March briefing. Perhaps, in hindsight, DME and DRD, as members of the TAG, could have been given the opportunity to attend those briefings where key conservation or infrastructure tropics relevant to Bushplan were being reviewed. This type of liaison would have been beneficial to all concerned.

It is recommended that the Reference Group provides DME with the occasion to participate in the penultimate stage of its review. In other words, allow DME as a TAG member to comment on the Reference Group's recommendations before they go to the MfP's Executive and the WAPC. This would enable DME to provide, in confidence, relevant comments for consideration.

CONSERVATION BRANCH

Policy Division

Department of Environmental Protection

Westralia Square, 141, St Georges Terrace, Perth, Western Australia, 6000.

Facsimile: (08) 9322 1598 Telephone: (08) 9222 7000

Clydie
Please find attached DEP's comments on the resolution of the Bushplan Site boundary in Lot 400 Henderson Road.

I have referred to a series of Aerial photographs and maps. These are
Map 1 - map of all wetlands over orthophoto with conservation category wetlands and EPP Lakes distinguished. I have included a draft of this map from a 1998 aerial photo to show the boundary of the revised Bushplan Site.
Aerial Photo 1: 1997 image used by Agriculture WA/DEP/MfP
Aerial Photo 2 is attached (1992 image).

I will E-mail the text for your use in your report to Peter Woodward.

Regards Bronwen

INFORMATION ON THE FLORA AND VEGETATION OF LOT 400 BUSHPLAN SITE 378, HENDERSON ROAD BUSHLAND, PEEL ESTATE RELEVANT TO THE RESOLUTION OF THE LAND OWNER'S APPEAL

Background

The boundaries of Bushplan Site 378 for the draft Perth's Bushplan (November 1998) were determined from the native vegetation mapping (Agriculture WA 1998). Location of the boundaries took into account the

- information from a Submission to the System 6 and Part System 1 Update;
- protection of intact core areas of high conservation value in Lot 164 Yangedi Road and Lot 399 Henderson Road (Lot 399 was subject to on the ground botanical survey);
- mapped vegetated conservation category wetlands (see Map 1);
- location of Lakes identified in the Swan Coastal Plain Lakes Environmental Protection Policy;
- aerial photography interpretation (see Aerial Photo 1) and
- consolidation and connection of bushland in Lot 164 Yangedi Road and Lot 399 Henderson Road with native vegetation mapped in Lot 400 Henderson Road, Lot 1 River Road and Lot 2 River Road.

Vegetation in the Bushplan Site is generally typical of the Bassendean Vegetation Complex — Central and South with a lesser element of the Southern River Vegetation Complex (Heddle *et al.* 1980). The upland areas on the dunes are vegetated with *Banksia attenuata* and *B. menziesii* Low Open Forest to Low Woodland and the wetland areas (sumplands, damplands, palusplain) with *Melaleuca preissiana* Low Open Woodland. The Site description summarises the values of the Site (see Appendix 1).

The on ground botanical survey within Bushplan Site 378 prior to the release of Perth's Bushplan was confined to Lot 399 Henderson Road. Work on Lot 399 involved detailed inspection and the location of three permanent 10 X10m plots. Within these plots information on vegetation and total flora was collected and used to determine the regional floristic groupings present in the Bushplan Site (see Appendix 1). Some edge survey of Lots 164 and 400 was also done but the size of the Lots and the density of the vegetation on the boundary prohibited any detailed assessment.

The determination of the location extent of vegetation and in Lot 400 was difficult as it was evident from a series of aerial photographs that much of the native vegetation was regenerating native vegetation from past burning and/or clearing (see Aerial Photo 1 and Aerial Photo 2). In addition sections of the area of the Lake identified in the Swan Coastal Plain Lakes Environmental Protection Policy and the conservation category wetland had been altered by clearing, filling and excavation. Aerial photography from 1992 (see Aerial Photo 2) showed no obvious evidence of the filling and excavation. As a consequence the boundaries of native vegetation as mapped by in 1997 by Agriculture WA were used in draft Perth's Bushplan.

A field inspection of Road Lot 400 Henderson Road was made by Clydie Smith (MfP), Peter Woodward (WAPC), Bronwen Keighery (DEP) Adrian Parker (WRC), Melinda Reid (WRC), Reg Ellery (owner Lot 400) on 1/9/99. Approximately two hours was spent traversing the bushland by foot and vehicle. Being early September there were relatively

BS378 Henderson Rd Bushland, 1998

16/9/99
Approximate
will need to
follow wetland
boundary then
plus buffer

few plants flowering and annually renewed plants were immature. Vegetation condition assessments are subject to revision on a mid spring inspection.

Comments on Inspection of Lot 400 Henderson Road

Past History of the Vegetation on Lot 400

Inspection of Lot 400 confirmed that areas of upland and dampland areas of Lot had been cleared in the 1980's or early 1990's and much of the current native vegetation is regenerating from

- seed an/or rootstocks bulbs etc that remained in the soil after clearing and;
- patches of intact vegetation within the predominantly cleared areas.

Patches of uncleared native vegetation appear to have been left throughout the Lot.

Since 1992 clearing, filling and excavation has occurred in the sumpland (see Aerial Photo 1 and Aerial Photo 2). Patches of intact vegetation remain around the sumpland (see Aerial Photo 1) and vegetation is regenerating on the filled sections of the sumpland. The Bushplan Site description indicates that approximately four hectares of this sumpland are mapped as an EPP Lake under the Swan Coastal Plain Lakes Environmental Protection Policy.

Further clearing within the area of the Bushplan Site had occurred within the last month in the area of the Bushplan Site.

Vegetation on Lot 400

The quality (condition) of the vegetation is variable being related to the degree of clearing and regeneration since clearing. Within the area of the Bushplan Site in Lot 400 native vegetation varies from Degraded to Very Good with patches in a completely degraded condition. The vegetation can be described according to the position in the landscape:
Wetlands - Vegetation on the wetlands ranges form tall Scrubs to Heaths dominated by *Kunzea ericifolia* and/or *Regelia ciliata*. *Melaleuca preissiana* occurs as scattered clumps to individual low trees in this vegetation. There is an area dominated by large *Melaleuca preissiana* trees alongside one of the excavated wetland areas. In general vegetation on the wetlands is in a better condition than upland vegetation there being good regeneration *Kunzea ericifolia* Closed Tall Scrub and *Regelia ciliata* Closed Heath. The understorey layers of this scrub and heath vary from being almost entirely weeds to one of a limited variety of native sedges, rushes and herbs. The areas of other wetland vegetation beside the excavated sumplands are in Good to Very Good condition.
Uplands - Vegetation on the uplands was most likely *Banksia attenuata* and *B. menziesii* Low Open Forest to Low Woodland with scattered Jarrah (*Eucalyptus marginata*), *Banksia ilicifolia* and *Allocasuarina fraseriana*. The western area is now dominated by *Banksia ilicifolia* with scattered trees from the original community and the eastern area by Jarrah. The eastern upland area is generally in a Degraded condition, and western upland in a Degraded to Completely Degraded condition.

Comments on the boundary of Bushplan Site 378 in Lot 400

As the upland areas currently mapped within the Bushplan Site are Degraded the boundaries of the area included in the Bushplan Site are recommended to be modified to reflect the boundaries of the vegetated conservation category wetlands and an appropriate buffer (see Map 1). This boundary allows for the connection of the vegetated areas of Lot 399 and 164. The current area of the Bushplan Site facing Yangedi Road will the be outside the Bushplan Site.

Future management of the vegetation within Bushplan Site 378 in Lot 400
To maintain the current vegetation and allow for regeneration to a more natural community in Lot 400 there is a need to

- establish a strategic fire plan for the Bushplan Site and allow regeneration to occur on the fire breaks associated with the boundaries of the three Lots and the additional breaks in Lot 400;
- discontinue clearing, excavation and filling within the area of the of the Bushplan Site and
- manage any further expansion of the aquaculture to maintain the necessary hydrological regime for wetland vegetation maintenance within the Bushplan Site.

References

Agriculture WA 1998 *Native Vegetation Mapping of the Perth Metropolitan Area.* Spatial Resource Unit, Agriculture Western Australia, South Perth, Western Australia.

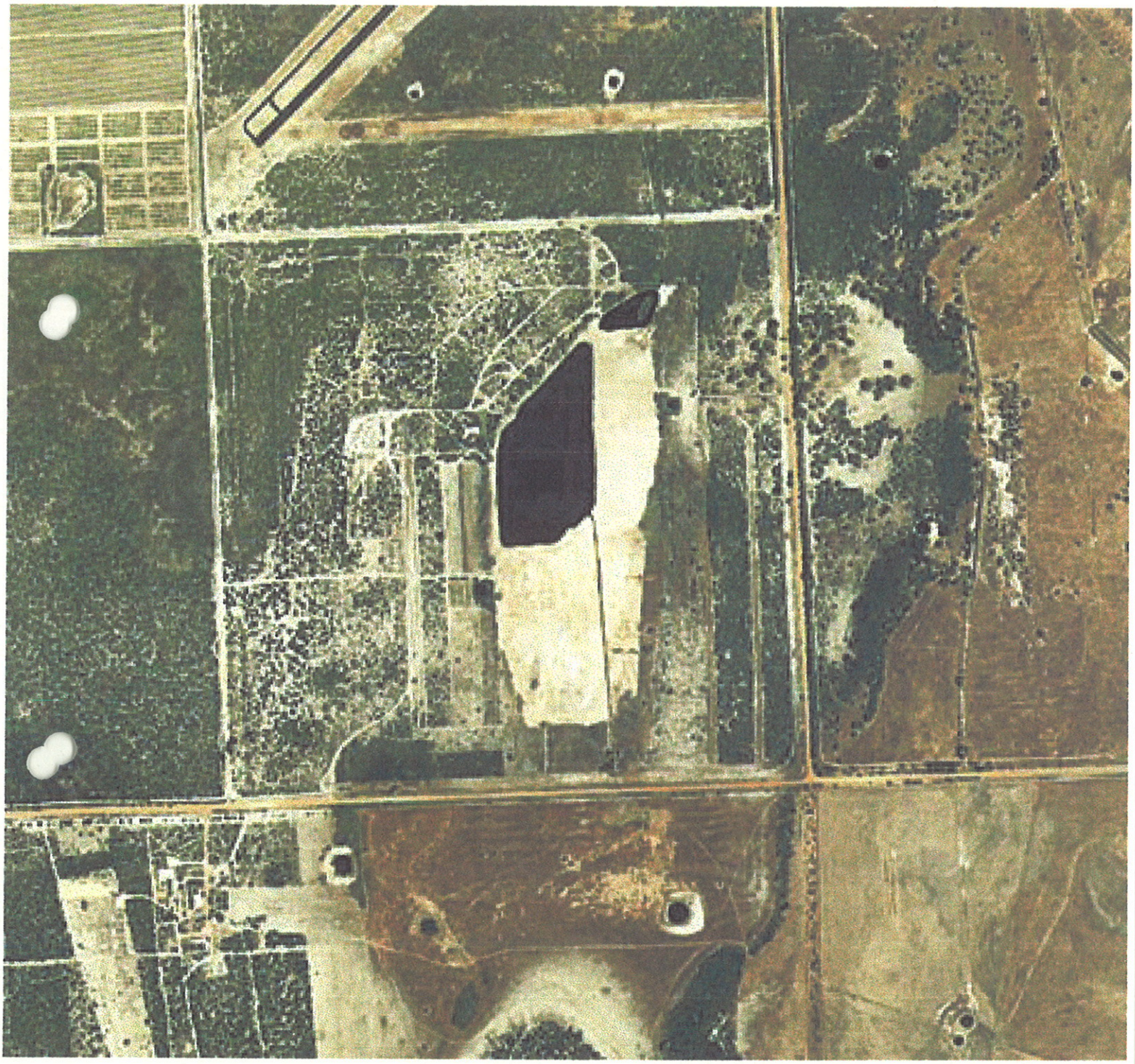
Heddle EM, Loneragan OW & Havel JJ 1980 Vegetation of the Darling System. IN: DCE 1980 *Atlas of Natural Resources, Darling System, Western Australia.* Department of Conservation and Environment, Perth, Western Australia.

AERIAL
PHOTO 2

15/12/1992
1:20 000
× 187 %

N

BS378 Henderson Rd Bushland, 1998



1996

1996

23
2/6

KAILIS CONSOLIDATED PTY. LTD.
ACN 008 676 453
14 NEIL STREET, OSBORNE PARK, WESTERN AUSTRALIA 6017
P.O. BOX 364, MT HAWTHORN, W.A. 6915
TELEPHONE: (08) 9443 8024 FAX: (08) 9443 8025

PB177

21st January, 1999.

SUBMISSION NO. 23

Mr. David Nunn,
Manager,
Environmental Planning Branch,
Albert Facey House,
469 Wellington Street,
PERTH, W.A. 6000.

BS 378

Dear Mr. Nunn,

Thank you for your letter regarding our land in Serpentine, namely Lot 399 Henderson Road, which is being considered in Perth's Bushplan.

Firstly, I must bring you up to date with our position.

We also own Lot 398 and Lot 165 which are attached to Lot 399.

Initially, we purchased Lot 398 and 165 for the purpose of developing a high-tech diversified horticultural project, in 1982. Lot 399 was purchased some years later for further expansion.

Over the past 16 years the following has been achieved:-

(1) Planted 10,000 avocado trees of various varieties.
(2) Planted 1,000 Tahitian seedless lime trees.
(3) We have 16,000 bearing vines for wine making and 50,000 vines in our nursery to cater for our expansion programme.
(4) We have approx. 1 hectare of table grapes under cover.
(5) We have planted 2,000 olive trees as stage one of a 10,000 tree project for the production of olive oil and processed olives.

MINISTRY FOR PLANNING
22 JAN 1999
805-2-1-32 pt 12.
FILE

(6) We have constructed a factory with all the necessary equipment to process the raw material we grow. The factory and equipment is valued in excess of $1,000,000. The entire growing area is serviced by Hi-Tech reticulation, which distributes water and fertilizer through a computerized programme.

When we first purchased Lots 398 & 165 they were virgin bush similar to Lot 399. We need Lot 399 for our future expansion programme and would be severely restricted if it was taken from us in your Bushland Plan.

We would be very happy to show you or your representative over our property so that you have a first hand knowledge of our position.

Please contact the writer to arrange a visit.

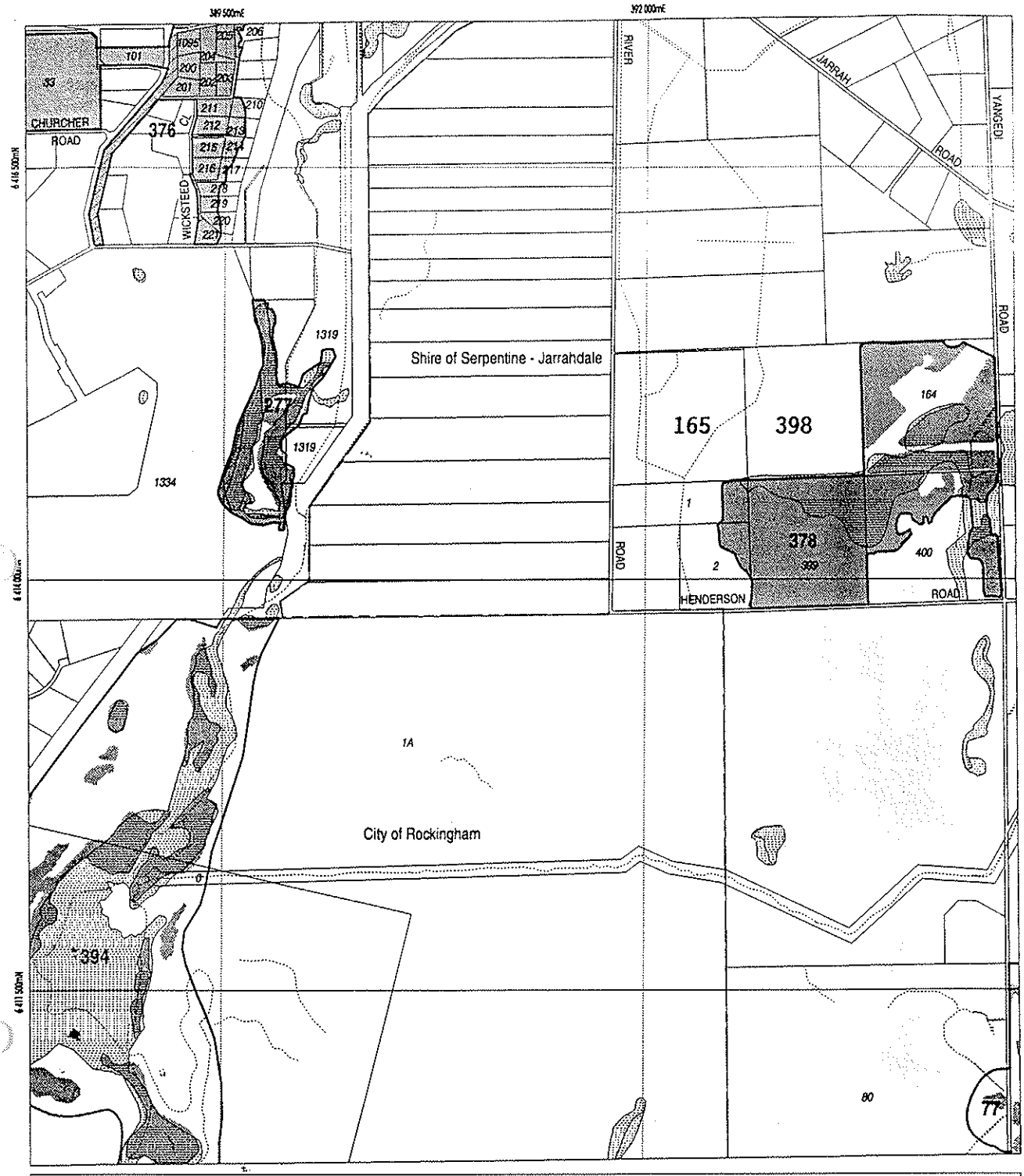
Thanking you,

FOR KAILIS CONSOLIDATED PTY LTD

Peter Kailis

PETER G. KAILIS
Executive Chairman

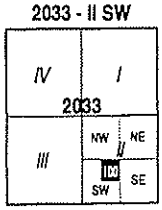
Encl.



LEGEND

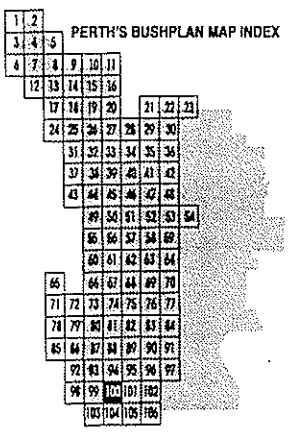
- 472 — Bushplan Sites With Regionally Significant Bushland
- Other Native Vegetation
- Conservation Category Wetlands
- Bushplan Sites With Some Existing Protection
- 696 — Lot Number, Location Number
- Channel Wetlands
- Local Government Boundary

2033 - II SW



1 : 25 000 AMG Reference Grid showing Perth's Bushplan Map Sheet Breakdown

PERTH'S BUSHPLAN MAP INDEX



N

SCALE

0 500 1000

Metres

Produced by Project Mapping Section
Land Information Branch, Ministry for Planning, Perth W.A. November 1998

ntw_map17//environ/bushplan/bushv2_100.dgn

Cadastral Data supplied by Department of Land Administration, W.A.

Wetlands Data supplied by Water and Rivers Commission

Native Vegetation Extent for Study Area supplied by Agriculture Western Australia

Bushplan Site Map

Map 100

KAILIS CONSOLIDATED PTY. LTD.
ACN 008 676 453
14 NEIL STREET, OSBORNE PARK, WESTERN AUSTRALIA 6017
P.O. BOX 364, MT HAWTHORN, W.A. 6915
TELEPHONE: (08) 9443 8024 FAX: (08) 9443 8025

BS 378

293

PB177

21st April 1999

Valerie Thompson
Bushplan Planner
Ministry of Planning
469 Wellington Street
PERTH WA 6000

RE: BUSHPLAN SITE NO. [redacted]
LOT 399 HENDERSON ROAD
HOPELAND

Dear Valerie,

Further to your meeting with our Mark Kailis on Wednesday 14th April, he has submitted that you may consider purchasing a block of land on the Northside of our land, and exchange it for Lot 399 Henderson Road, Hopeland.

The owner of this land is Mr Sidney Unobskey, a resident of San Francisco, U.S.A., and a friend of mine.

Some time ago he considered selling, and hired Russell Taylor & William Burrell to prepare a Land Assessment Report.

Of course this was in 1994, and the land value has now considerably increased.

However, the report is comprehensive and will give you substantial information, together with an environmental impact study.

As previously pointed out to you in my letter of the 21st January, 1999, Lot 399 is vital to our expansion programme. However, we could give favourable consideration to exchange It for 397 Yangedi North Road.

MINISTRY FOR PLANNING
23 APR 1999
805 2-1-32 pt 1 2
FILE

SUBMISSION NO. 44

P.O. BOX 201 SOUTH PERTH WESTERN AUSTRALIA 6151
P.G. KAILIS PRIVATE OFFICE: Telephone (09) 444 8055, Fax (09) 242 2305. SWANVIEW TIMBER: Telephone (09) 331 1188, Fax (09) 314 1699, After Hours (09) 291 6453.
BALDIVIS: Plantation & Winery Telephone (09) 525 2066, Fax (09) 525 2411, After Hours (09) 525 2066. A.C.N. 008 676 453

It is vital we receive your answer to this land problem, because it is holding up our Development plans for 1999/2000.

The enclosed Land Assessment plan is given to you in confidence, and can be used in conjunction with the authors, Messrs. Taylor & Burrell, only.

I look forward to hearing from you in the near future.

Please address any further correspondence to me personally at P O Box 364, Mt Hawthorn, W.A. 6915.

Kindest regards,

Pete Kains

PETER G. KAINS
Executive Chairman

Encl.

Sobm 1781 BS 378 PB177 107

to incorporating this area in the Shire's Conservation Zone Policy Area, through the Rural Strategy Review process.(Area 33.2 ha)

xiii. Serpentine National Park & adjacent bushland Site [redacted] Vol 2 115-116 CALM managed land. Major need for weed control in National Park and adjacent state government lands.

xiv. Kingsbury Drive Bushland Site [redacted] Vol 2 Pg 117 Council notes the importance of this vegetation and believes that protection and management of the site's vegetation is best achieved by working directly with the affected landowners. Consideration may be given to incorporating this area in the Shire's Conservation Zone Policy Area, through the Rural Strategy Review process. (Area 40.6 ha). One-to-one consultation with landowners is required.

xv. Myara Brook Bushland Site [redacted] Vol 2 pg 118 –119, known locally as the Myara Brook Reserve; currently undergoing vesting change to be vested with Local Authority for the purposes of protection of Indigenous Flora and Fauna. Active management by local authority and community with support of federal and state government grants. Council supports retention of reserve, with assistance from State Government to fund management.

xvi. Anketell Road Bushland Site [redacted] 47, Vol 2 Pg 213-214; Shire supports inclusion of land within Jandakot Botanical Park, except for cleared areas which should be assessed for alternative or complementary uses. Council proposes to site the Oakford voluntary Fire Brigade and a small meeting place on a 4000 m2 lot on the Pony Way frontage. This site is surrounded by a clearing of over 20 ha. Usage of this small portion of the clearing for community uses is complementary to the protection of the remaining 558.1 ha.

xvii. Modong Nature Reserve and adjacent bushland [redacted] Vol 2 pg 219 - Council notes the importance of this vegetation and the inclusion of private property.

xviii. Duckpond Bushland Site [redacted] Vol 2 pg 222. Council notes the importance of this vegetation. Council believes that protection and management of the site's vegetation is best achieved by working directly with the affected landowners. Consideration may be given to incorporating this area in the Shire's Conservation Zone Policy Area, through the Rural Strategy Review process (area: 23.5 ha). One-to-one consultation with landowners is required.

xix. Banksia Road Nature Reserve Site [redacted] Vol 2 pg 223-224. CALM estate.

xx. Lowlands Bushland Site [redacted] & [redacted] Vol 2 pg 224-227. Council notes the inclusion of this site in Perth's Bushplan. These sites are two of three properties currently before the Ministry for Planning for rezoning to Conservation. It is important that the rezonings be finalized as a matter of priority, so that an example is set for the Perth Metropolitan Area.

xxi. Henderson Road Bushland Site [redacted] Vol 2 pg 229-230. Council notes the importance of this vegetation. Assistance needs to be given to landowners to fence off vegetation from stock. Council believes that protection and management of the site's vegetation is best achieved by working directly with the affected landowners. Consideration may be given to incorporating this area in the Shire's Conservation Zone Policy Area, through the Rural Strategy Review process. One-to-one consultation with landowners is required.

xxii. Yangedi Swamp and adjacent Bushland, Site [redacted], pg 230-231, Council notes the importance of this vegetation. Assistance needs to be given to landowners to fence off vegetation from stock. Consideration will be given to incorporating this area in the Shire's Conservation Zone Policy Area, through the Rural Strategy Review process. One-to-one consultation with landowners is required. The site also includes one property currently before the Ministry for Planning for rezoning to Conservation. It is important that the rezoning be finalized as a matter of priority, so that an example is set for the Perth Metropolitan Area and other landowners. One-to-one consultation with landowners is required.

xxiii. Wungong Brook Site [redacted] Vol 2 pg 402-403 Council notes the importance of this vegetation. Protection of the vegetation should be achieved through its inclusion in the proposed public reserve.

DEP Natural Values Lot Survey 1999 - Version 3 March 1999

BUSHPLAN SITE LOT SURVEY SHEET 1: BOUNDARY /VEGETATION UNIT VERIFICATION

*Use a **Survey Sheet 1** for each Lot inspected.*

BUSHPLAN SITE 378 - Henderson Road

LOT INSPECTED Fenceline / roadside 164, 400

DATE TRIP 10/3/99 RECORDERS

VEGETATION UNITS *(Compare units observed with Bushplan Site description units. **Circle/complete** appropriate response)*

MATCHES DESCRIBED UNITS THAT IS:

4 ADDITIONAL VEGETATION UNITS DESCRIBED (*SEE RECORDING SHEET 2*)

BOUNDARY *(Compare boundary observed with mapped boundary. **Circle/complete** appropriate response)*

MATCHES CURRENT BOUNDARY

7 CHANGES RECOMMENDED (*OUTLINE EACH CHANGE BELOW AND NUMBER AND DRAW EACH CHANGE ON THE MAP*) Need to walk site, much regrowth after past clearing, should be assessed

General Changes	Lots	Photo No	NA
Rationale for change			

Change 1	Photo No
Rationale for change	

Change 2	Lot /Lot	Photo No
Rationale for change		

Change 3	Lot /Lot	Photo No
Rationale for change		

Change 4	Lot /Lot	Photo No
Rationale for change		

BUSHPLAN SITE LOT SURVEY SHEET 2 - ADDITIONAL VEGETATION UNITS 10/3/99

For each additional vegetation unit observed describe
- *each layer in the unit according to height and cover*
- *dominant species*
- *associated significant species*
- *condition of each unit.*

Indicate location of sample/description point for each units described on the map.

Unit 1
Trees and/or Mallees Banksia ohanaetes, B menz and
B. ilicifolia low Woodland
Shrubs
Herbs
Sedges
Grasses
Significant Flora
Vegetation Condition 1 2 (3) 4 5
Comment previously cleared, generally outside
current boundary, but may
warrant inclusion if inspected

Unit 2
Trees and/or Mallees
Shrubs Kunzea ericifolia Closed Tall Scrub
Herbs
Sedges
Grasses
Significant Flora
Vegetation Condition 1 2 (3) 4 5
Comment Fenceline inspection unable to
be more definitive

Unit 3	
Trees and/or Mallees	Eucalyptus calophylla Woodland
~~Shrubs~~	
~~Herbs~~	UNIT 4
	Mel. preissiana Low Open Forest
~~Sedges~~	
	Other species: Lepidosperma longitudinale
~~Grasses~~	Astartea aff. fascicularis)
~~*Significant Flora*~~	
Condition 1 2 3 4 5	
Comment	

GENERAL CONDITION of LOT NOT APPLICABLE - CURRENT DESCRIP.

Vegetation Condition - Keighery 1994 (Trudgen 1993) *Indicate range and %* in each class
1 = 'Pristine' (Excellent)
2 = Excellent (Very Good)
3 = Very Good (Good)
4 = Good (Poor)
5 = Degraded (Very Poor)
6 = Completely Degraded

Disturbance Describe observed disturbance eg partial clearing, weeds, soil movement, changes in water regimes etc

Partial clearing regenerated area (varying degree of intensity)

OTHER COMMENT.

• Site inspection from fence line 10/3/99 prior to giving evidence in Mining Warden's Court.
• Banksia L. woodland in Lot 164 (reserve) is equivalent to that in Lot 399 (Kulis) in both condition/structure/floristics
• Upright Verticordia penicillata (= Form collected in Perth Airport)

B378

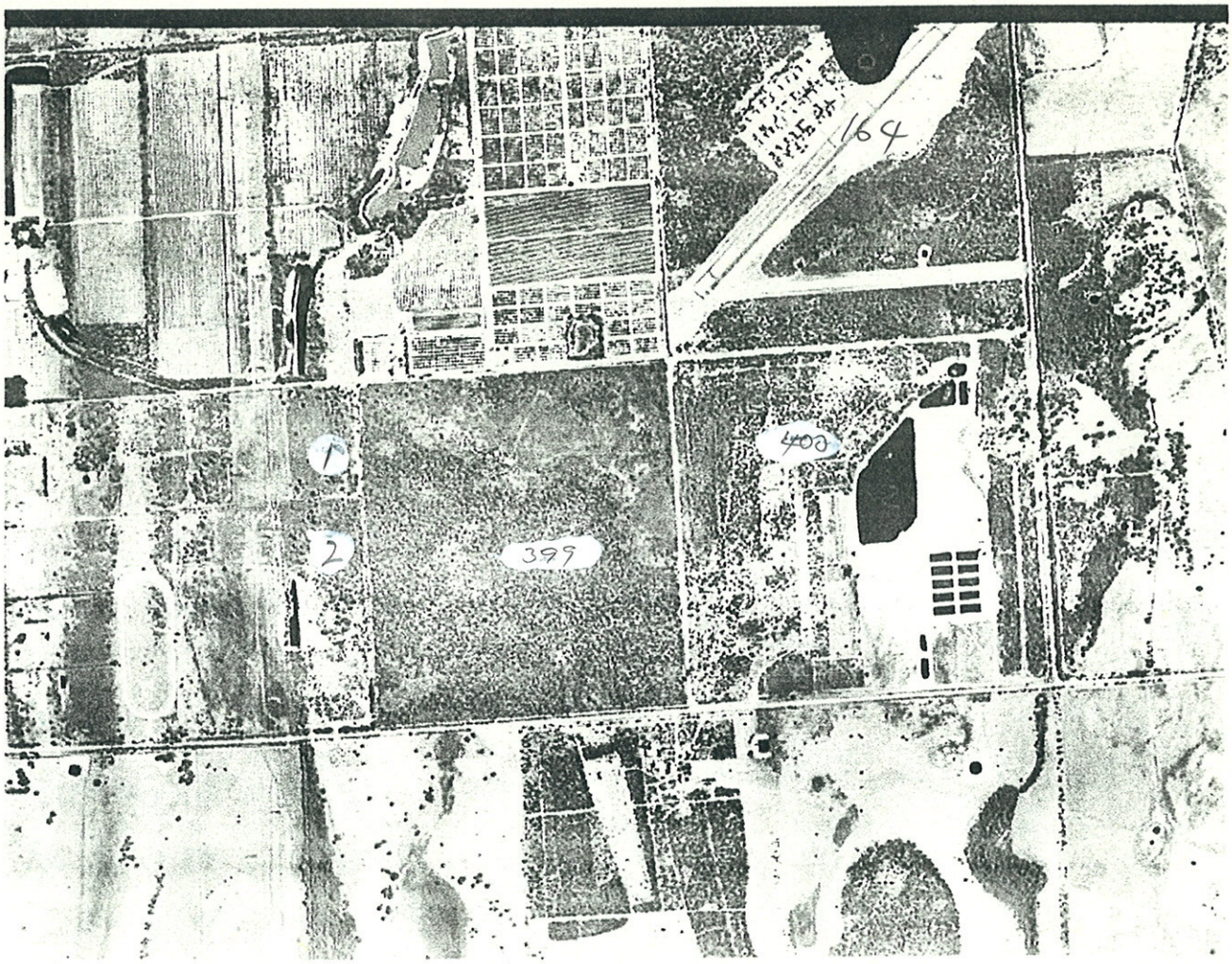
10/3/99

~~Bushplan~~ Bushplan Site 378

Site Inspection
30/6/99

N

BS378 Henderson Rd Bushland, 1998



Inspection 30/6/99
Lot 399 - Excellent to Very Good, as described is Sites Kaitis 1-3.

Lot 1 - Wetland with scattered Melaleuca preissiana, with Mosi margin Condition difficult to assess from boundary but Wetland appears Very Good, Mosi Degraded.

PTO

Lot 2: Banksia Low Woodland (= Lot 399) in Excellent to Very Good Condition, wetland portion not seen.

Lot 400 - Appears from edge inspection to have been cleared, all regrowth. Wetland areas better regeneration. Aquaculture industry that has cleared since mapping for Bushplan.
Lot 164 - Banksia Low Woodland / wetland remaining vegetation in Very Good to Excellent Condition.

Discussion

- Retain 399 in BS, core of the site.
- Lot 400 - retain sufficient to link to Lot 164 could exclude rest but should be inspection first
- Lot 164 - retain bushland in Bushplan
- Lots 1+2 - possible removal but do have values, could accomodate vegetation protection with other uses land.

PB177

BS378 Henderson Road Bushland

Inspection 30/6/99

Lot 399 - Excellent to Very Good, as described in sites Kailis 1 - 3.

Lot 1 - Wetland with scattered *Melaleuca presissiana*, with Marri margin. Condition difficult to assess from boundary but Wetland appears Very Good, Marri degraded.

Lot 2 - Banksia Low Woodland (= Lot 399) in Excellent to Very Good condition, wetland portion not seen.

Lot 400 - Appears from edge inspection to have been cleared, all regrowth. Wetland areas better regeneration. Aquaculture industry that has cleared since mapping for Bushplan.

Lot 164 - Banksia Low Woodland/wetland remaining vegetation in Very Good to Excellent condition.

Discussion

- Retain 399 in BS, care of the site.
- Lot 400 - retain sufficient to link to Lot 164 could exclude rest but should be inspection first.
- Lot 164 - retain bushland in Bushplan
- Lot 1 and 2 - possible removal but do have values, could accommodate vegetation protection with other uses of land.

BUSHLAND PLANT SURVEY RECORDING SHEET 1- use pencil only

BUSHLAND AREA GS 378 Lot 400 SITE NUMBER 1

DATE TRIP 4/9/99 RECORDERS

DATE TRIP RECORDERS

DATE TRIP RECORDERS

BOTANIST BJK

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

1. LOCATION of the QUADRAT

Mud Map Draw a sketch of the location of the site below.

N

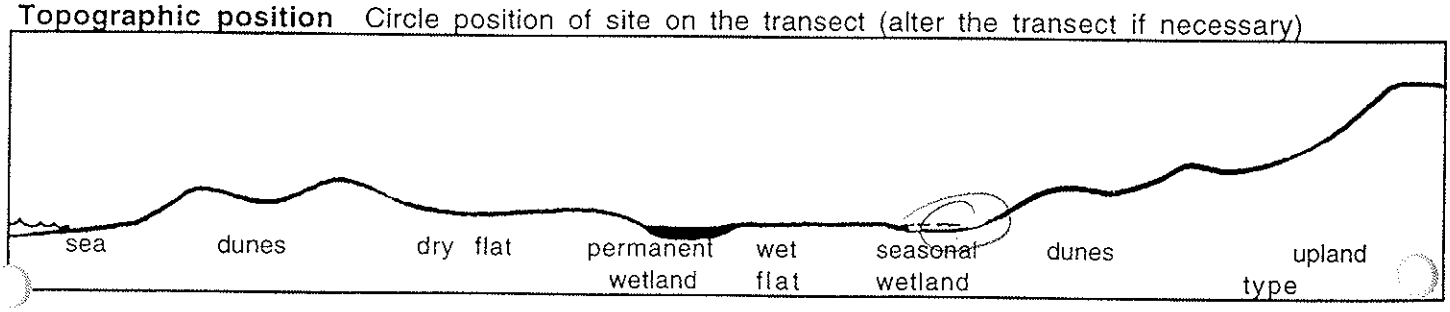
Road Location

Geographic Location Latitude S Longitude E **Altitude**

Reference Map

Photograph Photographer's Name BJK Photo No

Topographic position Circle position of site on the transect (alter the transect if necessary)



2. SITE DATA Circle the correct response.

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

Surface Soil Sand ***Colour*** white

Exposed rock ***type*** NA % surface

Sub-surface Soil ***Colour***

Rock ***type*** depth to rock

Drainage well mod poor depth water cm ***Wet*** all year winter/spring

Litter	% cover	***Bare Ground***	%cover
Depth	cm		

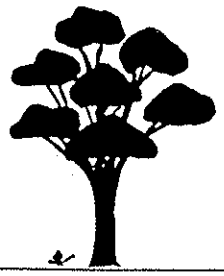
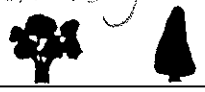
BUSHLAND PLANT SURVEY RECORDING SHEET 2 - use pencil only

3. VEGETATION STRUCTURE AND COVER

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

For each layer **record** - appropriate **life form**, **cover class** (see below),and **dominant species** in each layer.

Cover Class	2-10%	10-30%	30 - 70%	over 70%

	TREES			MALLEES	
	over 30m	10 - 30m	under 10m	over 8m	under 8m
LIFE FORM			Scattered to >70% depending on degree clearing 		30m 10m
COVER CLASS (%)					
DOMINANT SPECIES			Mel preissiana		

	SHRUBS		SHRUBS
	over 2m	2m - 1m	under 1m
LIFE FORM	only edge middle lake.	Thickets of Mel. incana on the edge	2m 1m
COVER CLASS (%)		Variable >70%	
DOMINANT SPECIES	Mel. rhaphiophylla	Kunz ericifolia Pultenaea Leg. ellipticus	Hypo. angust.

	GRASSES	HERBS	SEDGES	OTHER
LIFE FORM				1m
COVER CLASS (%)			30-70%	
DOMINANT SPECIES	Mix weeds	tepto long		

4. VEGETATION CONDITION

1 'PRISTINE'	
2 EXCELLENT	
3 VERY GOOD	
4 GOOD	
5 DEGRADED	

COMMENTS

Variable, old clearing, varying degrees of regrowth to full

Species: Acacia saligna, Acacia lasio 'Pinjarra', Jam, Melaleuca Cuticularis, Astroloma, Acacia pravissima, Gompholobium, Eriostemon spicatus, Hibbertia

BUSHLAND PLANT SURVEY RECORDING SHEET 1- use pencil only

BUSHLAND AREA BS 378 Lot 400 SITE NUMBER 2

DATE TRIP 4/9/99 RECORDERS

DATE TRIP RECORDERS

DATE TRIP RECORDERS

BOTANIST CJK.

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

1. LOCATION of the QUADRAT

Mud Map Draw a sketch of the location of the site below.

N

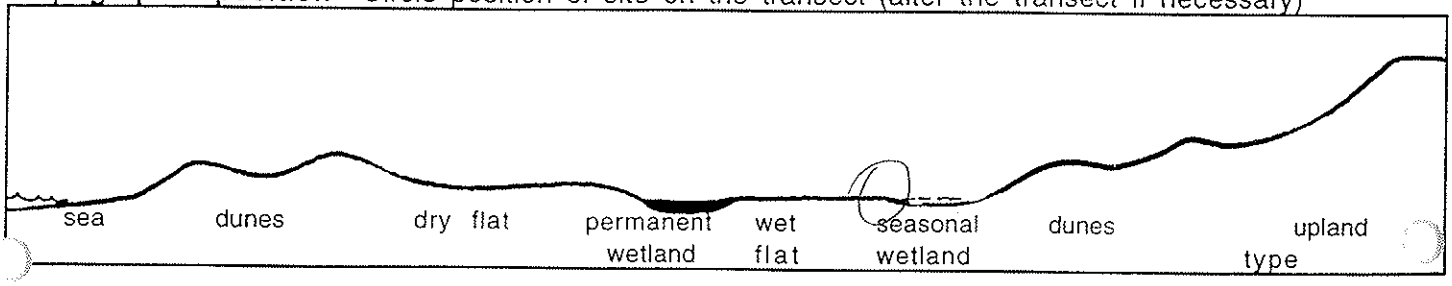
Road Location

Geographic Location Latitude S **Longitude** E **Altitude**

Reference Map

Photograph Photographer's Name Photo No

Topographic position Circle position of site on the transect (alter the transect if necessary)



2. SITE DATA Circle the correct response.

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

Surface Soil white ***Colour***

Exposed rock ***type*** % surface

Sub-surface Soil ***Colour***

Rock ***type*** depth to rock

Drainage well mod poor depth water cm ***Wet*** all year winter/spring

Litter 100 % cover — ***Bare Ground*** %cover

Depth cm

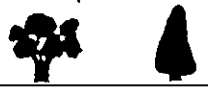
BUSHLAND PLANT SURVEY RECORDING SHEET 2 - use pencil only

3. VEGETATION STRUCTURE AND COVER

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

For each layer **record** - appropriate **life form**, **cover class** (see below),and **dominant species** in each layer.

Cover Class	2-10%	10-30%	30 - 70%	over 70%

	TREES			MALLEES	
	over 30m	10 - 30m	under 10m	over 8m	under 8m
LIFE FORM			Scattered Banksia 3m regrowth Lower scat Melaleuca 		30m 10m
COVER CLASS (%)					
DOMINANT SPECIES					

	SHRUBS over 2m	SHRUBS 2m - 1m	SHRUBS under 1m
LIFE FORM			Scattered 2m 1m
COVER CLASS (%)	30-70%		
DOMINANT SPECIES	Kunzea ericifolia		Schoenia incol Hibb. Veg

	GRASSES	HERBS	SEDGES	OTHER
LIFE FORM	Patches		Scattered clumps	Patches Lepto berg occ Ev. parvi Hypoxis Lyg. bark 1m
COVER CLASS (%)		2-10%		
DOMINANT SPECIES	Thrh. long	Podo. ichng Ura anth Carp yel.	Lyg bark	

4. VEGETATION CONDITION

1	'PRISTINE'	
2	EXCELLENT	
3	VERY GOOD	)
4	GOOD	)
5	DEGRADED	

COMMENTS

Difficult to assess K. ericifolia not see Keith for description

Cono. jone., Orth uni, Hakea procumbens, ½ many Asteraceae, Dros leuca, Cal flava, Ptero nana, occ Trans parvi

BUSHLAND PLANT SURVEY RECORDING SHEET 1- use pencil only

BUSHLAND AREA BS 378 Lot 400 SITE NUMBER 3

DATE TRIP 1/9/99 RECORDERS

DATE TRIP RECORDERS

DATE TRIP RECORDERS

BOTANIST BJK

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

1. LOCATION of the QUADRAT

Mud Map Draw a sketch of the location of the site below.

N

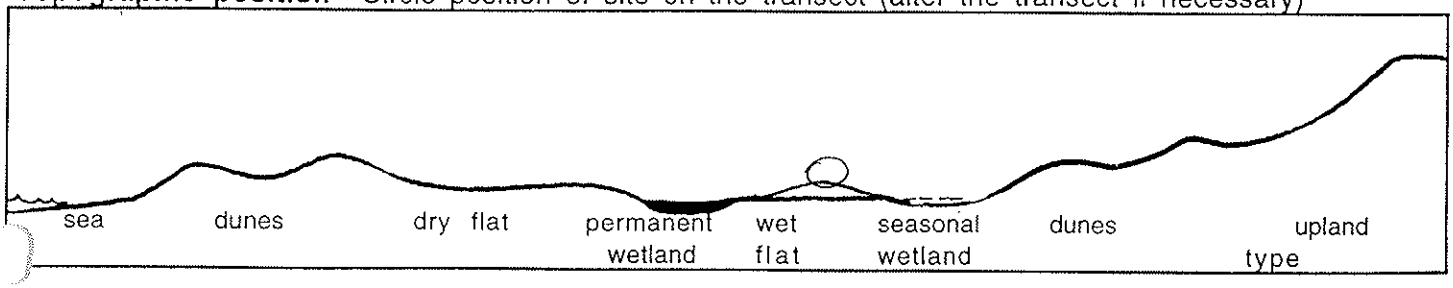
Road Location

Geographic Location Latitude S Longitude E **Altitude**

Reference Map

Photograph Photographer's Name Photo No

Topographic position Circle position of site on the transect (alter the transect if necessary)



2. SITE DATA Circle the correct response.

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

Surface Soil grey sand ***Colour***

Exposed rock ***type*** % surface

Sub-surface Soil ***Colour***

Rock ***type*** depth to rock

Drainage well mod poor depth water cm ***Wet*** all year winter/spring

Litter	% cover	***Bare Ground***	%cover
Depth	cm		

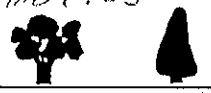
BUSHLAND PLANT SURVEY RECORDING SHEET 2 - use pencil only

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

3. VEGETATION STRUCTURE AND COVER

For each layer **record** - appropriate **life form**, **cover class** (see below).and **dominant species** in each layer.

Cover Class	2-10%	10-30%	30 - 70%	over 70%

	TREES			MALLEES	
	over 30m	10 - 30m	under 10m	over 8m	under 8m
LIFE FORM			Bank III C lower in landscape occ Allo Eras 		30m 10m
COVER CLASS (%)			2-10%		
DOMINANT SPECIES			Bank oth Bank mem2		

	SHRUBS over 2m	SHRUBS 2m - 1m	SHRUBS under 1m
LIFE FORM	① Dom upland/low ② ogue lower		Scattered 2m 1m
COVER CLASS (%)	10-30%		
DOMINANT SPECIES	Kunzea erici ① Acac cyg ②		Shr lef Schoe inund

	GRASSES	HERBS	SEDGES	OTHER
LIFE FORM			clumps	1m
COVER CLASS (%)	2-10%	2-10%		
DOMINANT SPECIES	Eh. ech	*Ursinia anthem Hyp globos	cyg. barb	

4. VEGETATION CONDITION

1	'PRISTINE'	
2	EXCELLENT	
3	VERY GOOD	
4	GOOD	
5	DEGRADED	

COMMENTS large area bare ground scattered weeds

Eastern dune Not intact, scattered Jarrah

Dun tor, Pletk cil, Lax Her, Hib racem Jacksonia, Pod. ebur, *Lupo, Quin ver Gompk Hov, Astroloma, Prost,

BS378 Henderson Rd Bushland 1998

1
2
3
} See Site plot Sheets

4 Photo only

5 " "

PITTSTON BLACK SANDS WA OF WA PTY LTD

HOPELANDS MINERAL SAND PROJECT

WETLAND SURVEY FOR WATERBIRD CONSERVATION VALUES

B K MASTERS AND ASSOCIATES
ENVIRONMENTAL AND EARTH SCIENCE CONSULTANTS
P O BOX 315
CAPEL
WA 6271

JANUARY 15, 1992

BS 77
BS 378
BASS S

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Appendix 1: Photographs of Selected Wetlands.	

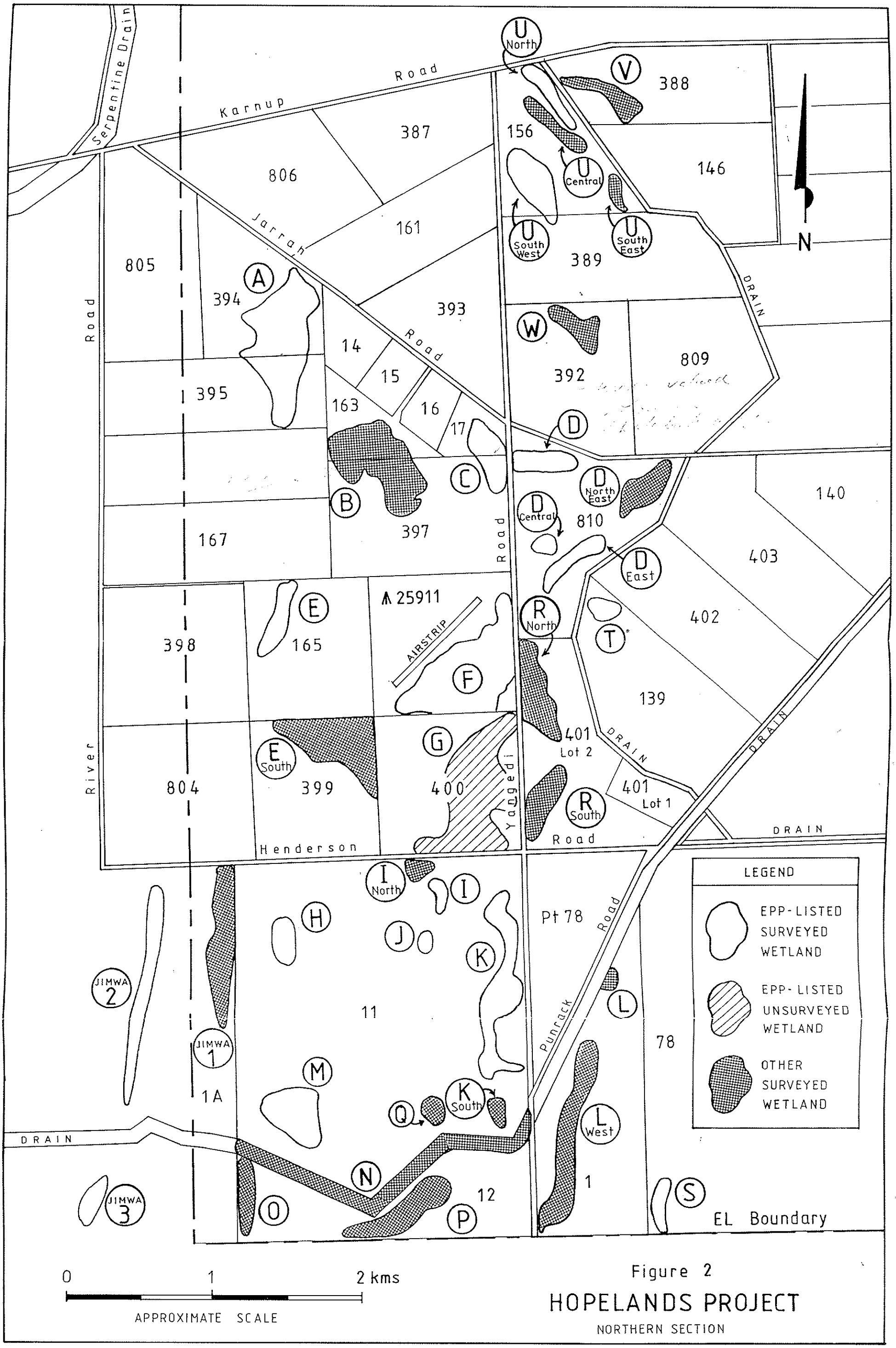

Figure 2

HOPELANDS PROJECT

NORTHERN SECTION

WETLAND JIMWA 18, Location 3

Wetland type: Lake
Water: up to 1.0 metres
Vegetation: dense sedge/heath with E. rudis on north edge and emergent M. rhaphiophylla, essentially ungrazed
Waterbirds:

Coot	1	
White-faced Heron	1	
Maned Duck	1	(on western dam)
Pacific Black Duck	2	(on western dam)
Black Swan	1	(on nest)

Other observations: healthy frog population
EPA EPP Wetland: YES
Importance for waterbirds: LOW
Management category: R

WETLAND 4, Location 4

Wetland type: Dampland
Water: less than 0.2 metres
Vegetation: open tall heath, heavily grazed
Waterbirds: none
EPA EPP Wetland: NO
Importance for waterbirds: LOW
Management category: M

WETLAND 5, Location 5

Wetland type: LAKE
Water: major central drain used for horticultural irrigation, possibly more than 1.0 metre
Vegetation: open to dense sedgeland
Waterbirds:

Pacific Black Duck	3	
Grey Teal	1	
Black Swan	1	(juvenile, observation made 17/10/91 by Ray Hart)

EPA EPP Wetland: NO
Importance for waterbirds: LOW
Management category: M

WETLAND 6, Location 6

Wetland type: Dampland
Water: wetland only viewed from adjoining property, up to 0.3 metres estimated, moderate to heavy grazing
Vegetation: pasture with a few remnants of heath
Waterbirds: White-faced Heron 1
EPA EPP Wetland: NO
Importance for waterbirds: LOW
Management category: M

WETLAND 76/1, western half of Location 76

Wetland type: Dampland
Water: not surveyed but likely to be up to 0.3 metres
Vegetation: closed heath to 1.5 metres, with emergent M. rhaphiophylla
Waterbirds: not surveyed
EPA EPP Wetland: NO
Importance for waterbirds: Likely to be LOW
Management category: Probably M

WETLAND 76/2, eastern half of Location 76

Wetland type: Dampland
Water: up to 0.1 metres
Vegetation: open heath, heavily grazed
Waterbirds: None
Other observations: no frogs heard calling
EPA EPP Wetland: NO
Importance for waterbirds: LOW
Management category: M

WETLAND 76/3, eastern half of Location 76

Wetland type: Dampland deepened to form dam (Lake?)
Water: up to 0.5 metres in centre
Vegetation: mostly cleared and pastured, some sedges and emergent trees, heavily grazed
Waterbirds: Pacific Black Duck 1
Australian Shelduck 3
Other observations: small frog population
EPA EPP Wetland: YES
Importance for waterbirds: LOW
Management category: M

WETLAND 76/4, eastern half of Location 76

Wetland type: Dampland/Sumpland
Water: mostly up to 0.3 metres but over 0.5 metres in drains
Vegetation: western fringe of M. rhaphiophylla, with tall heath on eastern side giving way to open heath and pasture over bulk of wetland in the east, much damage to understorey from grazing
Waterbirds:

Australian White Ibis	6	
Pacific Black Duck	18	(2 on adjoining flooded pasture)
Little Pied Cormorant	1	
Nankeen Night-heron	3	(1 immature)
Maned Duck	21	(17 on dam)
White-faced Heron	3	(1 on dam)
Grey Teal	2	
White-necked Heron	1	

Other observations: fox seen walking in 0.2 metres of water
several dead and partially eaten birds
small frog population
EPA EPP Wetland: YES
Importance for waterbirds: Likely to be MODERATE (higher usage than shown by the survey results is expected)
Management category: M

WETLAND 76/5, eastern half of Location 76 and extending on adjoining Lot 10 of Location 69

Wetland type: Dampland/Sumpland (dam on Lot 10?)
Water: mostly up to 0.3 metres but drains between 0.5 and 1.0 metres or deeper
Vegetation: pasture, with a few emergent N. floribunda, M. rhaphiophylla and M. preissiana, heavily grazed

Waterbirds:		
	Australian Shelduck	200+
	Straw-necked Ibis	200+
	White-faced Heron	10
	Grey Teal	3
	Pacific Black Duck	30+

Other observations: salt scalding seen on aerial photo
EPA EPP Wetland: YES
Importance for waterbirds: MODERATE
Management category: M (due to drains, lack of native vegetation and salt problem developing)

WETLAND 77/1, Location 77 (Yangedi Swamp)

Wetland type: Lake
Water: up to 1.5 metres
Vegetation: central core of M. preissiana, with E. rudis on road verge, heavily grazed understorey away from open water

Waterbirds:		
	Grey Teal	300+ (including 7 young)
	Coot	12
	Blue-winged Shoveler	6
	Australian Little Grebe	1
	Australian Shelduck	2
	White-faced Heron	1
	Chestnut Teal	1 (male)
	Pacific Black Duck	2
	Black Swan	1
	Hoary-headed Grebe	2
	Little Pied Cormorant	1
	Dusky Moorhen	1
	Blue-billed Duck	1
	Pink-eared Duck	1 (observation made by Ray Hart on 6/12/91)

EPA EPP Wetland: YES
Importance for waterbirds: MODERATE
Management category: C

WETLAND 77/2, Location 77

Wetland type: dampland
Water: less than 20% of wetland carries water, mostly less than 0.1 metres
Vegetation: remnant patches of heath to dense tall heath, heavily grazed and affected by some recent clearing
Waterbirds: Pacific Black Duck 2 (on adjoining flooded pasture)

EPA EPP Wetland: YES
Importance for waterbirds: LOW
Management category: R

WETLAND 77/3, Location 77

Wetland type: Dampland
Water: small patches up to 0.2 metres
Vegetation: patches of tall dense heath, with significant clearing and establishment of pasture; eastern edge is tall dense heath with emergent M. rhaphiophylla, moderate to heavy grazing
Waterbirds: None
EPA EPP Wetland: NO
Importance for waterbirds: LOW
Management category: R

WETLAND 80/1, Location 80

Wetland type: Sumpland
Water: normally up to 2.0 metres but owner is draining this western half of Yangedi Swamp and depth at time of survey was less than 0.2 metres in only a small part of wetland
Vegetation: M. rhaphiophylla forest in core, E. rudis on western fringe, heavily grazed understorey
Waterbirds:

Royal Spoonbill	2 (reported by owner)
Pacific Black Duck	6 (3 at start of drain, 3 loafing in shallow water)
Grey Teal	204+ (4 at start of drain, 200+ loafing in shallow water)
Australian Shelduck	2 (loafing in shallow water)

EPA EPP Wetland: YES
Importance for waterbirds: MODERATE
Management category: M in current condition, has potential for R

WETLAND 80/2, Location 80

Wetland type: Dampland
Water: up to 0.3 metres but more than 0.5 metres in central drain
Vegetation: mostly pasture with some sedge clumps, heavily grazed
Waterbirds:

Australian Shelduck	6
Pacific Black Duck	3
Grey Teal	2
Yellow-billed Spoonbill	1 (observation made by Ray Hart on 6/12/91)

EPA EPP Wetland: NO
Importance for waterbirds: LOW
Management category: M

WETLAND 80/3, Location 80
Wetland type: Dampland
Water: dry (very high level of drainage)
Vegetation: mostly pasture
Waterbirds: None
EPA EPP Wetland: NO
Importance for waterbirds: LOW
Management category: M

WETLAND 80/4, Location 80
Wetland type: Dampland
Water: dry
Vegetation: pasture
Waterbirds: none
EPA EPP Wetland: NO
Importance for waterbirds: LOW
Management category: M

WETLAND 80/5, Location 80
Wetland type: Dampland
Water: dry
Vegetation: pasture
Waterbirds: none
EPA EPP Wetland: NO
Importance for waterbirds: LOW
Management category: M

WETLAND 80/6, Location 80
Wetland type: Creek
Water: 0.3 metres at time of survey but possibly higher after heavy rain. Flow is about 0.5 meters/second (0.9 km/hour). Wetland is main drain from Yangedi Swamp.
Vegetation: Dense heath in remnants along both banks
Waterbirds: Pacific Black Duck 1
EPA EPP Wetland: NO
Importance for waterbirds: LOW
Management category: M

WETLAND 80/7A, B & C, Location 80
Wetland type: Damplands
Water: up to 0.4 metres in furrows between tree planting lines
Vegetation: E. globulus plantations, with heath regrowing (dense in places) and some emergent M. rhaphiophylla
Waterbirds: none
Other observations: healthy frog populations
EPA EPP Wetlands: YES (A & B), NO (C)
Importance for waterbirds: LOW
Management category: M

WETLAND 80/8, Location
Wetland type: Dampland
Water: up to 0.2 metres
Vegetation: pasture beneath E. rudis open woodland
Waterbirds: White-faced Heron 1
EPA EPP Wetland: NO
Importance for waterbirds: LOW
Management category: M

WETLAND 82/1, Location 82
Wetland type: Lake
Water: probably more than 1.0 metres
Vegetation: heath on east side, sedges within shallow water, emergent M. rhaphiophylla, western fringe of M. rhaphiophylla and E. rudis, light to moderate grazing
Waterbirds:

Grey Teal	4
Pacific Black Duck	6
Little Pied Cormorant	3
Maned Duck	1
Coot	4
Musk Duck	1
White-faced Heron	3
Large Egret	1

EPA EPP Wetland: YES
Importance for waterbirds: MODERATE (more than 5 of the above species are likely to use this wetland for breeding)
Management category: C

WETLAND 82/2, Location 82
Wetland type: Dampland
Water: mostly up to 0.1 metres but up to 0.3 metres in places and more than 1.0 metres in small dams
Vegetation: heath to tall dense heath, lightly grazed
Waterbirds:

Pacific Black Duck	3 (2 on dam, 1 on adjoining flooded pasture)
Little Pied Cormorant	1 (on dam)
White-faced Heron	2 (on edge of dam)

Other observations: healthy frog population
EPA EPP Wetland: NO
Importance for waterbirds: LOW
Management category: R

WETLAND 82/3, Location 82
Wetland type: Dampland
Water: up to 0.3 metres
Vegetation: dense heath to tall dense heath, lightly grazed
Waterbirds: none
Other observations: healthy frog population
EPA EPP Wetland: YES (part)
Importance for waterbirds: LOW
Management category: R

Photo 26: Dampland/sumpland 76/4 on Location 76, showing open scrub with pasture understorey. Salt build-up is evident by the presence of Soldier's Button plants (yellow flowering) and bare mud patches.

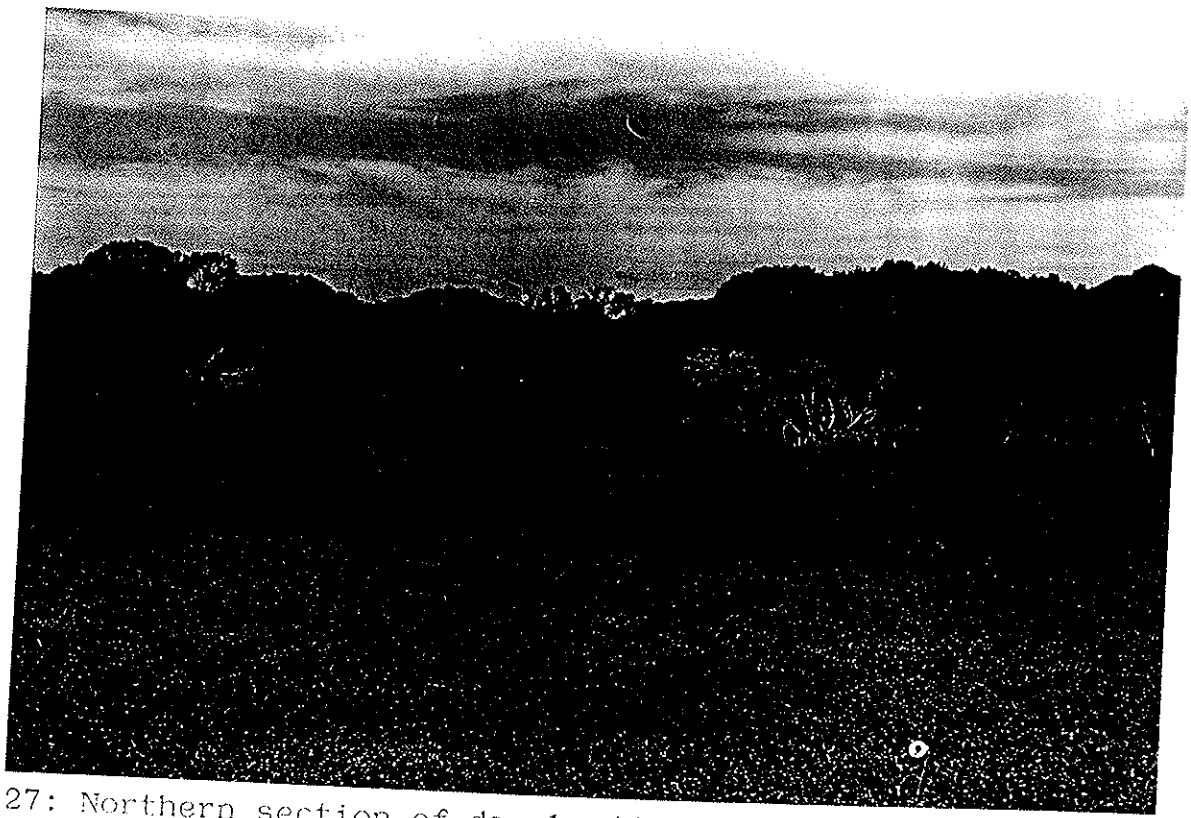

Photo 27: Northern section of dampland/sumpland 76/4 on Location 76, showing open to dense scrub, drains and Soldier's Button pasture.

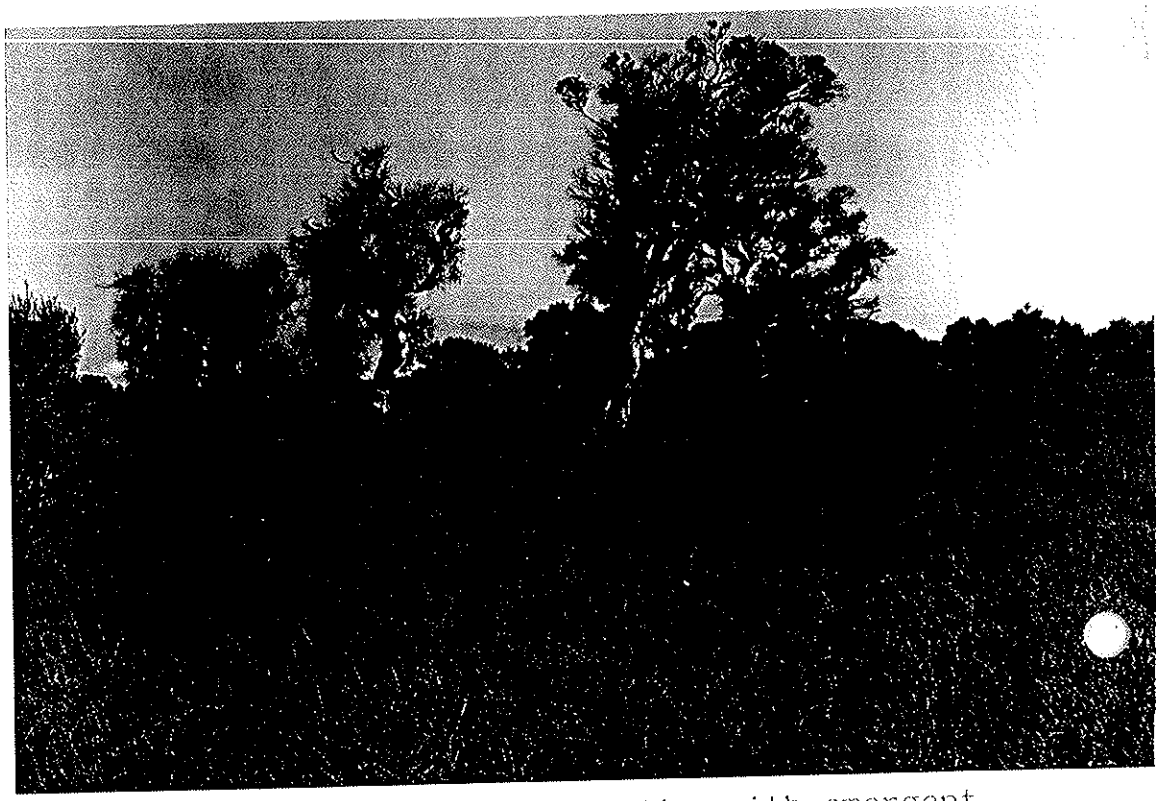

Photo 8: Low dense heath covered in Dodder with emergent Melaleuca rhaphiophylla within dampland F on reserve 25911.

Photo 9: Regrowth vegetation within sumpland H on Location 11, with grazing pressure preventing regrowth close to pasture.

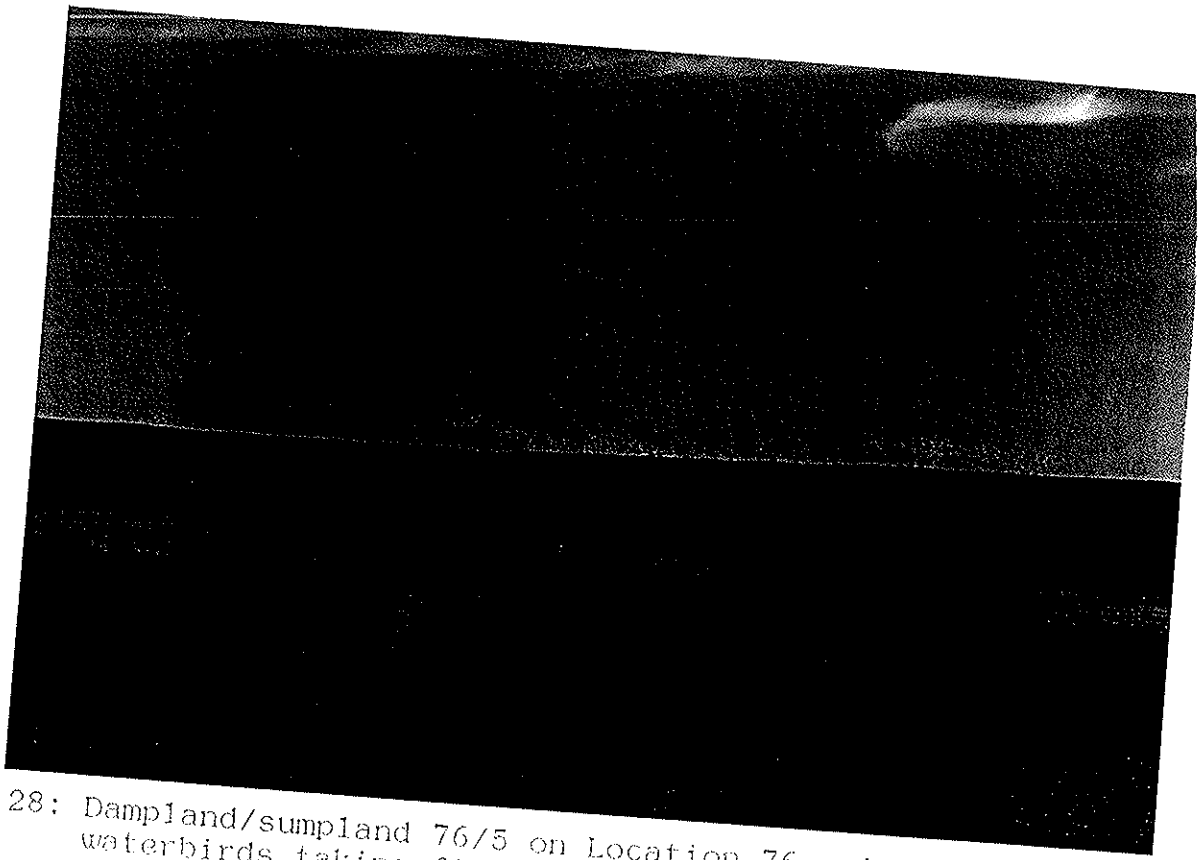

Photo 28: Dampland/sumpland 76/5 on Location 76, with 300+ waterbirds taking flight from roosting sites in flooded paddock.

Photo 29: Lake 77/1 (Yangedi Swamp) on Location 77 showing dense core of Melaleuca woodland.

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YANGEDI NORTH ROAD SUBDIVISION PROPOSAL

SHIRE OF SERPENTINE-JARRAHDALE

LAND ASSESSMENT REPORT

NOVEMBER 1994

REPORT NO. 9415/2

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1.0 INTRODUCTION

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This report and accompanying mapping has been prepared to assist in the assessment of land within the Shire of Serpentine-Jarrahdale (Figure 1).

The subject land comprises approximately 48 hectares in the south-west corner of the Serpentine Jarrahdale Townsite and is bounded to the south by Recreation Reserve 164 which contains the Serpentine River, to the west by Reserve 163 to the north by Nicholson Road and to the east by land which has been permitted to a limited extent for orcharding and grazing. The land is currently zoned for light grazing.

The property occurs on the Swan Coastal Plain, 48 km south of the Perth CBD. The land is currently zoned for rural purposes under the Shire's Town Planning Scheme No. 2 and is subject to various State Government planning policies including Western Australian Planning Commission's Statement of Planning Policy No. 2 - Environmental and Natural Resources Policy - Peel Inlet.

This report provides an assessment of the land in relation to its potential for rural residential development. Land use considerations have been identified in the Shire of Serpentine Jarrahdale Town Planning Scheme No. 2.

The report is based on a study of aerial photographs of the subject land and surrounding sites and the preparation of land capability mapping using stereoscopic aerial photographs and ground truthing. The land capability assessment has been undertaken in accordance with the Guidelines of the Western Australian Department of Agriculture (1988). The boundaries of land units (land systems) have been plotted on aerial photographs. The land units are as defined by the Department of Agriculture (1979) for the Swan Coastal Plain (Part 1 Perth, Western Australia).

1.0 INTRODUCTION

This report and associated mapping has been produced to assist planning and assessment of a rezoning/subdivision proposal for Location 397 Yangedi North Road, within the Shire of Serpentine-Jarrahdale. (Figure 1).

The subject land comprises approximately 67 ha centred 10.5 km west-south west of the Serpentine township. It is bounded to the east by Yangedi Road and to the south by Recreation Reserve 164 which contains a landing strip for light aircraft. Location 163 to the north is the Karnup Creek Farm Special Rural Zone where subdivision has been permitted to a minimum lot size of 8 ha. Land to the south west is used for orcharding and market gardening while other nearby properties appear to be used only for light grazing.

The property occurs within low dunes and sandplain of the Bassendean Dune System on the Swan Coastal Plain, 48 km south of the Perth CBD. The land is currently zoned for rural purposes and has been previously used for grazing. It occurs within the administrative 'legal' boundary of the Peel Harvey Coastal Catchment and is therefore subject to various State Government planning and environmental policies aimed at protecting and restoring the health of the Peel Harvey Estuary. (ie State Planning Commission - Statement of Planning Policy No 2; EPA Environmental Protection Policy - Peel Harvey Estuarine System).

This report presents a description of the landforms and soils of the property and provides an assessment of the land's capability to support rural-residential development. The proposal is then briefly discussed in relation to environmental issues identified in the Shire of Serpentine- Jarrahdale's Local Rural Strategy.

The report is based on a field survey investigation of soil and landform conditions at 12 sites over the property, supplemented with interpretation of 1:20,000 scale stereoscopic aerial photographs and a 1:5,000 scale enlargement. The land capability assessment has been conducted in general accordance with methods developed by the Western Australian Department of Agriculture. (Wells and King 1989). Associated land unit (landform/soil type) mapping is provided here at 1: 5,000 scale. The land units are as defined by the Department of Agriculture's land capability studies on the Swan Coastal Plain (van Gool 992, Wells 1989) or are subcomponents thereof.

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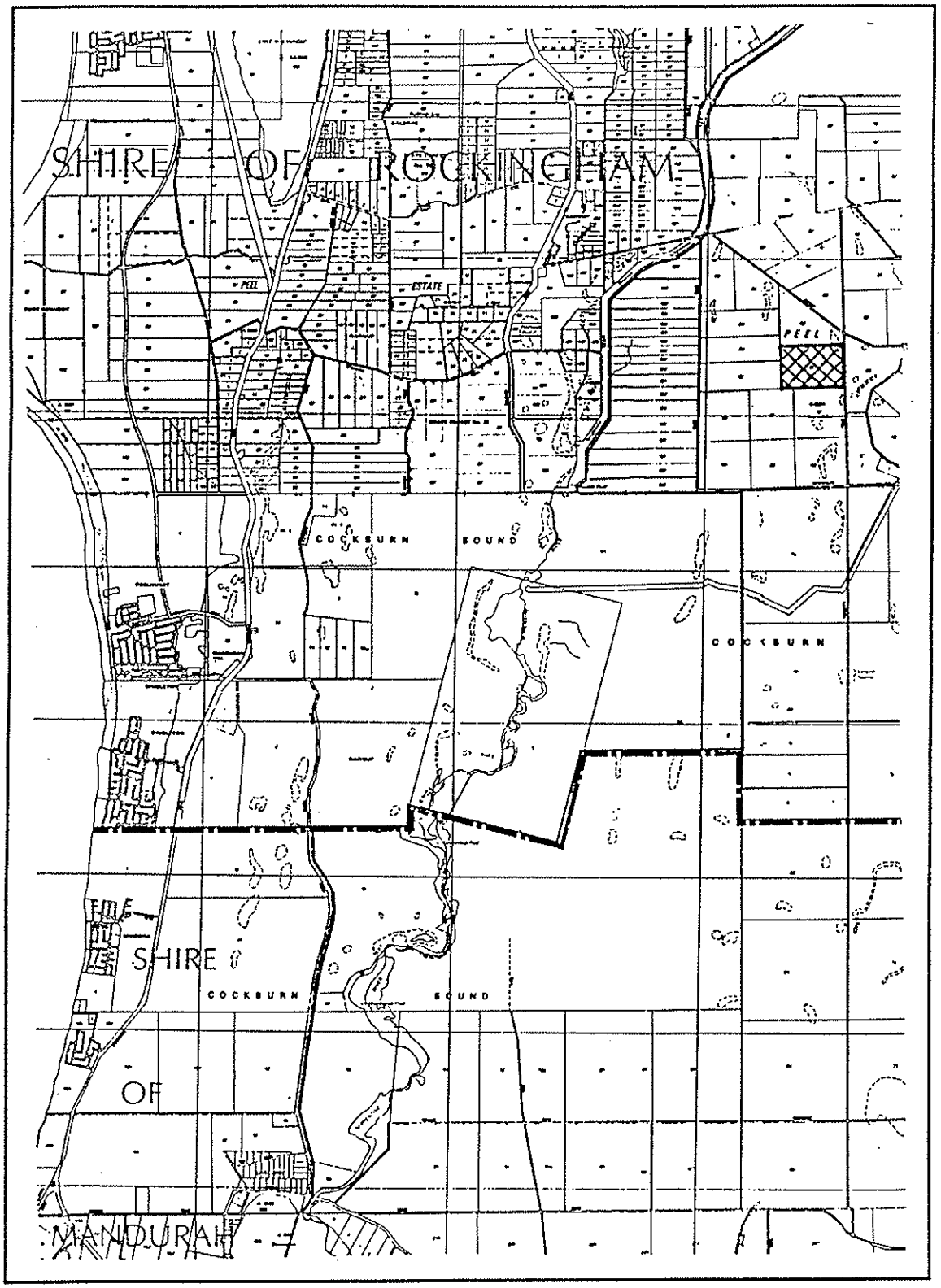
FIGURE 1. LOCATION PLAN



Scale 1:100 000

↑
N

Subject land

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2.0 NATURE OF THE LAND

2.1 Geology and Soils

The subject land occurs within Bassendean Dune and Sandplain System which overlies predominantly fluviatile sediments of Pleistocene age known as the Guildford geological formation. Figure 2 shows relatively broad-scale (1:50,000) environmental geology mapping (Gozzard 1983) for the locality and Table 1 summarises Geological Survey comments on potential environmental impacts relevant to the proposed rural - residential development.

The soils of the Bassendean System vary here in depth from 0.5 to 2 m or more. They are bleached grey siliceous sands, sometimes with a yellow-brown subsoil. From an agricultural perspective the soils are naturally infertile, have a low ability to store water and nutrients, and are prone to wind erosion.

On the higher terrain, soils are well drained and generally suitable for rural-residential use* where sufficiently elevated above seasonal watertable levels. In lower-lying, less well drained areas, there are podzols or sands with underlying hardpans or clays (buried Guildford formation).Rural-residential development in these areas is limited by the inability of natural soil conditions to provide an effective medium for the absorption and purification of septic tank effluent.

For grazing purposes, stocking rates on the Bassendean Sands need to be carefully managed to avoid wind erosion, and fertiliser application should be conservative to avoid nutrient losses to wetlands and drainage systems.

* providing alternative systems of on-site effluent disposal are used.

2.2 Land Unit Mapping

The property is covered by the relatively broad, 1:50,000 scale mapping by the Department of Agriculture (van Gool 1992) which is used within the Shire's Local Rural Strategy as a framework for consideration of some environmental issues. However for individual property subdivision and planning, more detailed survey and mapping is required. Current work has resulted in the delineation of six land units (landform/soil types) as shown in Figure 3. These units are as defined by the earlier Department of Agriculture mapping, or are subcomponents thereof. The salient features of each land unit are described in Table 2. A further appreciation of site conditions can be gained from the photographs in Appendix A.

FIGURE 2. ENVIRONMENTAL GEOLOGY

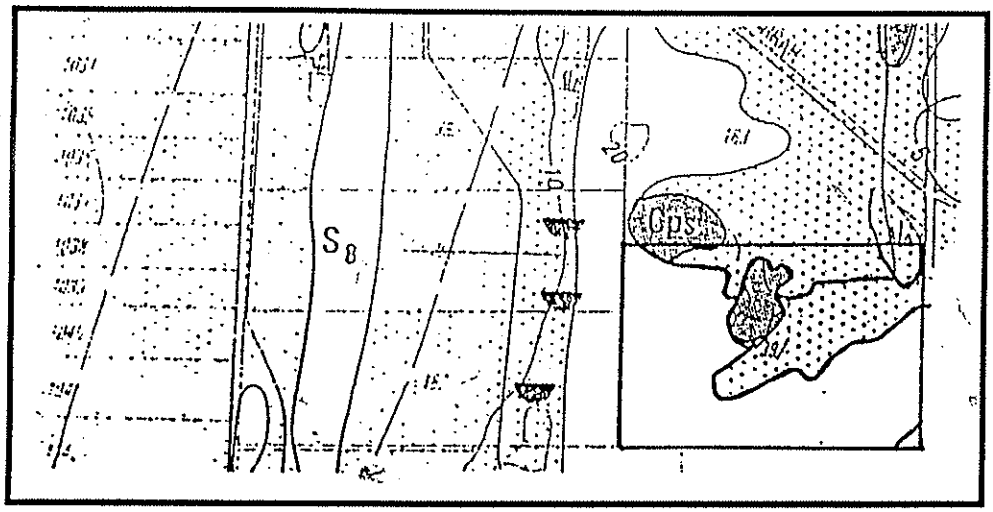

TABLE 1. ENVIRONMENTAL GEOLOGY	
MAP UNIT	**S8 - SAND**
GEOLOGY	Bassendean Sand (Qpb)
DESCRIPTION	Very light grey at surface, yellow at depth, fine to medium grained, sub-rounded quartz, moderately well sorted, of aeolian origin.
NOTES	Well drained, when dry and vegetation free it could be remobilised, drainage disposal is only a problem in areas of high water table.
SEPTIC TANKS	Possible problems for the environment
MAP UNIT	**S10 - SAND**
GEOLOGY	Thin Bassendean Sand over Guildford Formation (Qpb/Qpa)
DESCRIPTION	As S8 as relatively thin veneer over C2, M4 and Mc2
NOTES	Of variable thickness, the sand's physical properties are modified by the underlying material, generally high water table, prone to flooding in part.
SEPTIC TANKS	Activity undesirable for the environment
MAP UNIT	**Cps - PEATY CLAY**
GEOLOGY	Swamp deposit (Qhw)
DESCRIPTION	Dark grey and black, soft, variable organic content, some quartz sand in places, of lacustrine origin.
NOTES	High water table, prone to flooding, low bearing capacity, differential settlement may occur, most materials are compressible.
SEPTIC TANKS	Activity undesirable for the environment.

LAND UNITS
LOT 397 YANGEDI ROAD, BALDIVIS

FIGURE 3.

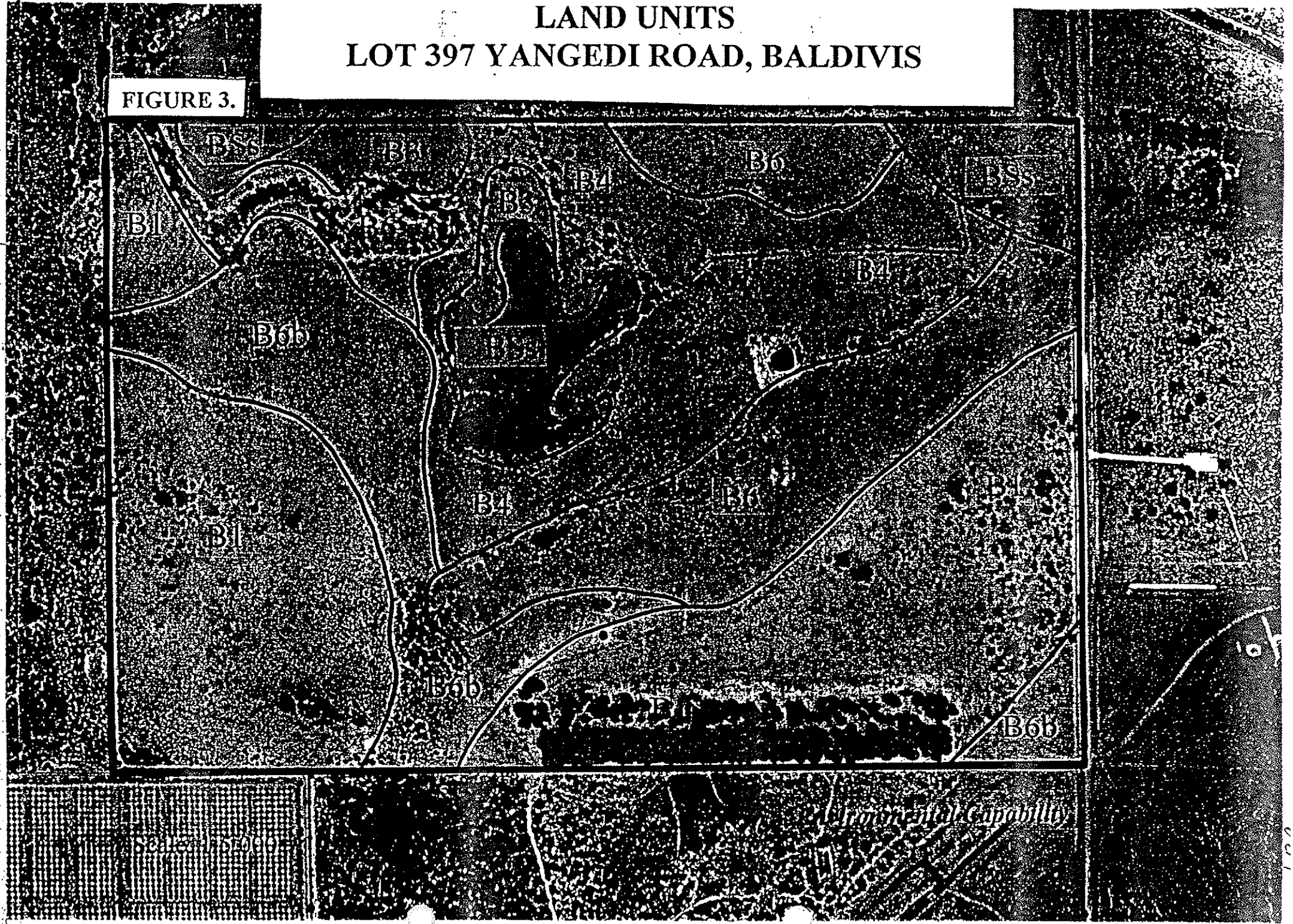

TABLE 2: LAND UNIT DESCRIPTIONS (Refer to Figure 3)

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Bassendean Dune and Sand Plain System- Low relief, leached grey siliceous Pleistocene dunes and sand plain.

B1 Very low relief dunes, undulating sand plain or discrete sand rises with deep bleached grey sands. These soils sometimes have a pale yellow subsoil (B) horizon or a weak iron-organic hardpan at depths generally greater than 2m.

B3 Closed depressions and non-incised drainage pathways with moderately deep (to deep), poorly to very poorly drained grey sands with an iron-organic pan, or clay subsoil; surfaces are dark grey sand or sandy loam. Dense reeds and occasional Melaleuca stands. Seasonal watertable levels are expected to be at the surface.

B4 Broad, poorly drained sand plain with deep grey siliceous sands or bleached sands, underlain at depths generally greater than 1.5 metres by clay or less often a strong iron-organic pan. Seasonal watertable levels are expected to be within 0.5m of the surface.

B6 Broad, imperfectly drained sand plain with deep grey siliceous sands or bleached sands, underlain at depths generally greater than 1.5 metres by clay or less often a strong iron-organic pan. Seasonal watertable levels are expected to be within 1m of the surface.

B6b Broad, moderately well drained sand plain with deep grey siliceous sands. Seasonal watertable levels are expected to be within 1m of the surface but for shorter periods than in unit B6.

BSs Seasonally inundated swamps and depressions with dark grey siliceous sands or bleached sands with a strong iron - organic hardpan at 0.8 - 1.5 metre depth and highly organic loamy sand or sandy loam surfaces. Vegetation is commonly dense stands of Melaleucas.

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2.3 Drainage

The major surface drainage features of the locality are shown in Figure 4. The property contains three wetlands (shown as land units BSs in Figure 3) into which the major part of any surface runoff and drainage to groundwater is likely to enter.

Given the regional groundwater contours (Figure 5) some subsurface drainage, upon reaching the unconfined superficial aquifer, can be expected to flow generally westwards. However recent work by Townley et al (1993), indicates that the 'capture zone' for wetlands can be up to twice the wetland diameter and that some recharge can also occur from the downgradient side of a wetland apparently against the regional trend of groundwater flow. As a result, most of the property can be considered to drain into the wetlands shown in Figure 4.

Figure 4 also shows that an agricultural drainage channel has been formed to link two of the wetlands and carry excess water northwards for approximately 1.6 km to meet a Water Authority drainage channel (No. 90104). From here, drainage flows a further 1.5 km until it reaches the Serpentine River just south of the Karnup Road Drain crossing. The Serpentine River then flows southwards into the Peel-Harvey Estuary, 6 km south-east of Mandurah.

An assessment of wetlands and their conservation value within the Shire of Serpentine-Jarrahdale has been conducted by students of Murdoch University (1992). In that work, at a relatively broad scale, the two wetlands in the north westerly portion of the property are shown as one and assigned a 'Resource Enhancement' category meaning;

"Wetlands that do not have a clearly recognised role to play in their rural and/or urban setting. Management objective:- to maintain and enhance the existing ecological functions."

The wetland partly encompassed by the north-eastern corner of the property was assigned a 'Multiple Use' category meaning;

"Significantly degraded wetland with little human interest. Management objectives should be considered in the context of catchment and land use planning in terms of the current value of the wetlands and the potential value to the community if rehabilitated."

Under policies of the Department of Environmental Protection (1994) a minimum set back for conventional septic tank and leach drain systems from water features on this portion of the Swan Coastal Plain is 100 m. For alternative on-site effluent disposal systems with amended soils, a 50 m minimum set back is required.

In relation to depth to watertable, Water Authority data which has been used to generate the regional picture of watertable contours (Figure 5), indicates that watertables will fluctuate seasonally and are likely to come within 2 m of the surface in lower-lying areas. More accurate data on a local scale is not available. The general unsuitability of these areas in terms of separation of septic tank leach drains from highest water table levels can however be reliably deduced from the soil survey observations.

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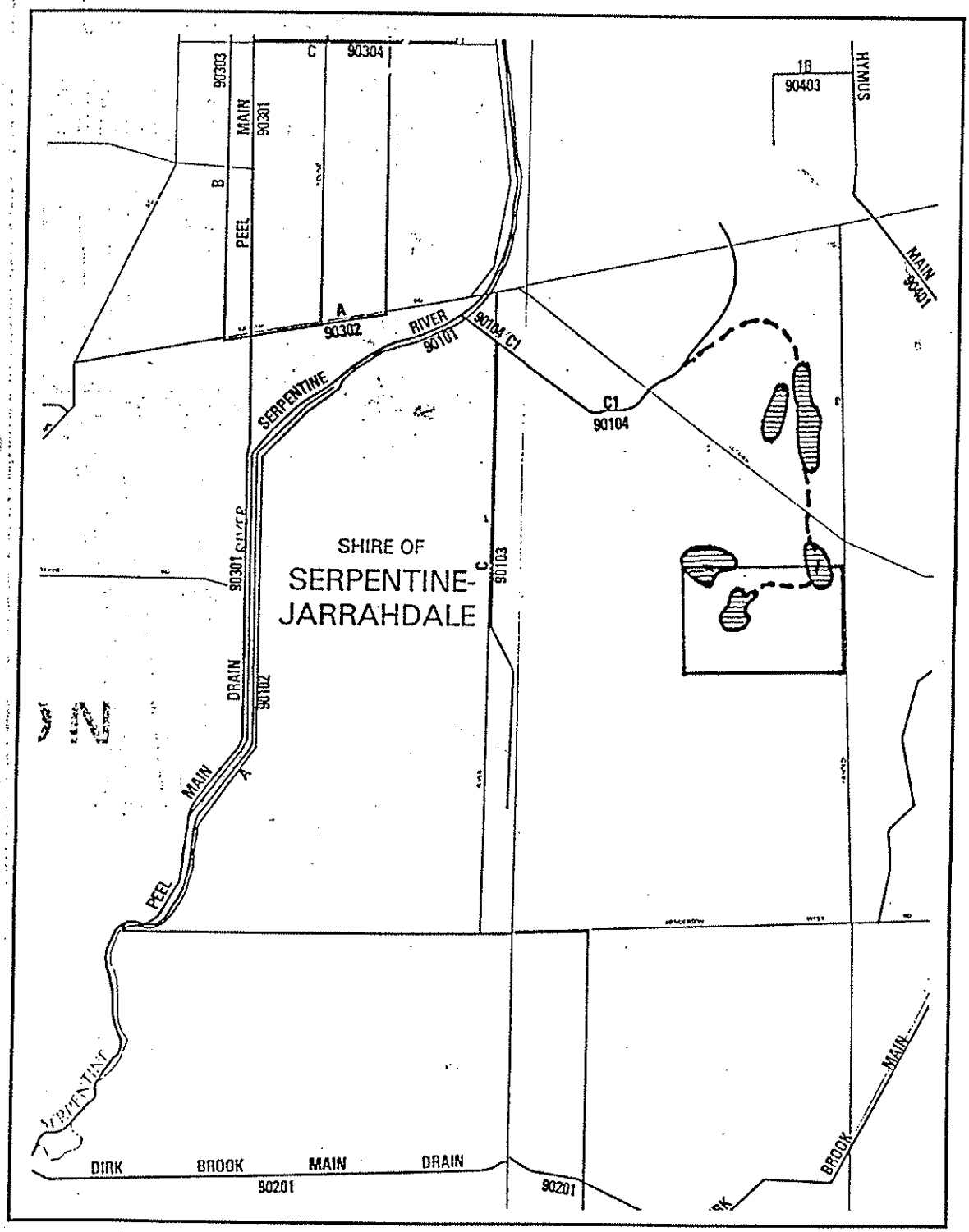
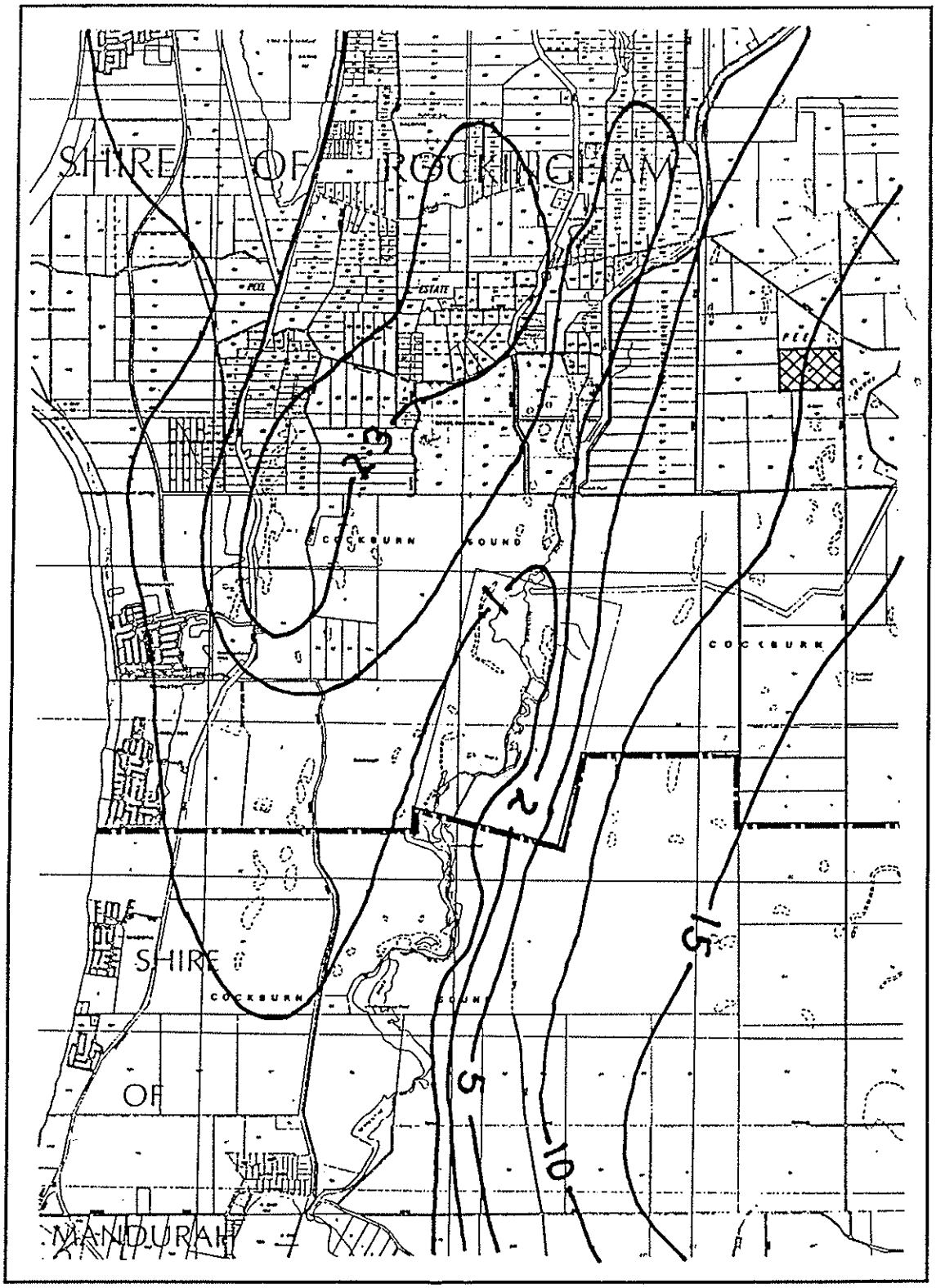
FIGURE 4. SURFACE DRAINAGE FEATURES



Agricultural Drain
WAWA Drain
Wetlands

Source: WAWA (1989) *Perth Metropolitan Drainage System Map*
Scale 1:40,000 - Serpentine and Murdoch sheets

FIGURE 5. WATER TABLE CONTOURS



Scale 1:100 000 ↑ N

Subject land

Water contour lines (m AHD)

* Source: Hirschberg, K. (1988) *Perth South Groundwater Contamination Sites.* 1:100 000 scale mapping. Department of Mines, Western Australia

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2.4 Groundwater Protection Area

The subject land occurs within the proposed Karnup - Dardanup Underground Water Pollution Control Area. Although not yet proclaimed, the effect of this designation will be to place greater responsibility on developers and landholders to minimise the risk of pollution to underground water resources. As a proposed Priority 2 Source area (Water Authority 1988) this will most likely translate to a Water Authority restriction of one single residential effluent disposal system per 4 ha (or maybe 2 ha) of gross area for rural residential or farmlet zones using conventional septic tanks and leach drain systems.

2.5 Vegetation

The original native vegetation of the property is likely to have ranged from a woodland of *Eucalyptus marginata* (Jarrah), *Allocasuarina fraseriana* (She-oak), *Banksia* spp. to a low woodland of *Melaleuca* spp. and sedgelands on moister sites (Heddle et al 1980).

The remaining vegetation cover is shown in the photographic background to Figure 3. It has also been mapped from 1993 aerial photography by the Department of Agriculture. (van Gool 1994). The relevant portion of that mapping is shown in Figure 6 and indicates that approximately 13% is covered with relatively dense natural vegetation, 20% has sparse tree cover, and the remainder is cleared or open water. The areas of relatively dense vegetation are shown around the wetland margins and on a portion of the upland sandy country (land unit B1) on the property's southern boundary.

Field work conducted for this report confirms the general accuracy of Figure 6. It should be noted however that the area of 'dense 'vegetation along the southern boundary of the property is a stand of *Pinus radiata* rather than original native vegetation cover.

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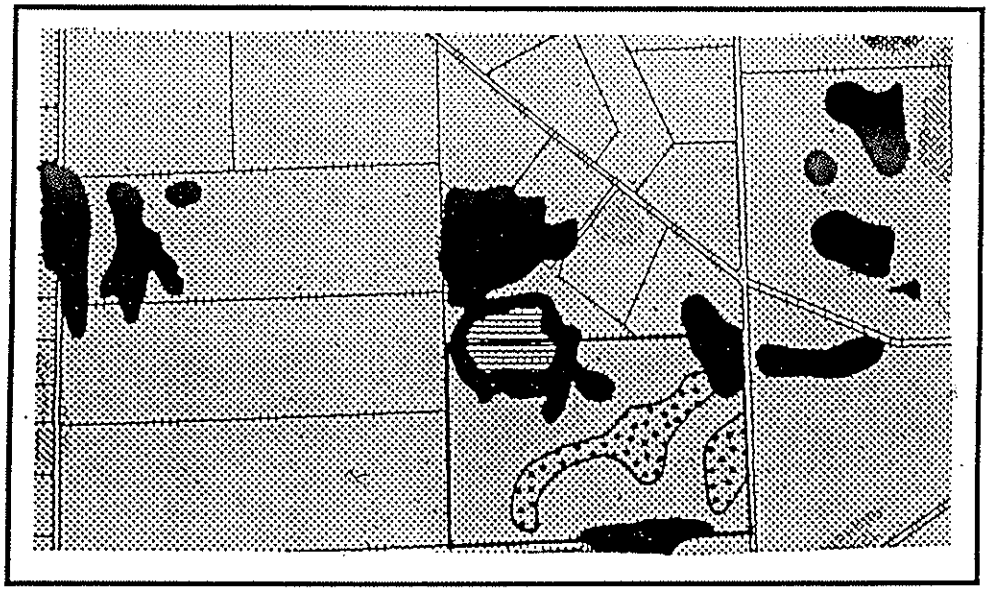
FIGURE 6. VEGETATION COVER



Map unit	% of area (65 ha)	Area in ha
Cleared areas	63	40.95
Water	4	2.6
Dense vegetation	13	8.45
Sparse trees	20	13

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3.0 LAND CAPABILITY ASSESSMENT

3.1 Rural Residential Activities

Land capability is a term used to express the ability of land to support a proposed form of land use with minimal risk of degradation to its soil and water resources. The proposed form of rural-residential development is likely to involve two additional land use activities to its previous use for grazing. These are, low density housing, and the installation and use of on-site effluent disposal systems. (usually conventional septic tanks and leach drains). For each land unit shown in Figure 3, an assessment has been made of the capability to sustain these land use activities.

The assessment has been undertaken using the methods and criteria developed by the Department of Agriculture (Wells and King 1989). This methodology involves a comparison of the physical requirements of proposed land use activities with the existing qualities of land.

Land qualities considered in relation to housing include subsoil conditions affecting house construction such as foundation soundness, slope instability and ease of excavation, but also include the risk of erosion, and waterlogging or inundation. In relation to on-site effluent disposal, the ability of soil to absorb effluent and to retain both nutrients and microbial pollutants is considered, along with ease of excavation, and the risk of any flooding, waterlogging or inundation.

Land capability rating tables defined the Department of Agriculture methodology have been used here to determine a capability class, from high to very low, for each land unit.

The capability assessment results are shown in Figures 7a & 7b, and in Table 3. The results are expressed as an over-all capability rating for rural-residential development, combining ratings for the component land use activities (housing and effluent disposal).

Two scenarios are considered, development using conventional septic tank and leach drain systems, and development with alternative domestic effluent disposal systems. In the latter, the irrigated disposal area (for Aerobic Treatment Units) or 'amended soils' surrounding leach drains (for Ecomax) comprises material which offers a better ability to retain pollutants (phosphorous in particular) than the existing natural soil conditions which would be used for conventional leach drain systems.

In their natural state, most soils of the Bassendean System have a low ability to retain nutrients and microbial contaminants within the soil profile. These pollutants are rapidly lost to the underlying groundwater system (unconfined superficial aquifer) and eventually find their way into surface drainage leading to the Peel Harvey Estuary. For this reason, alternative disposal systems which use 'amended' nutrient retentive material are recommended as a best management practice.

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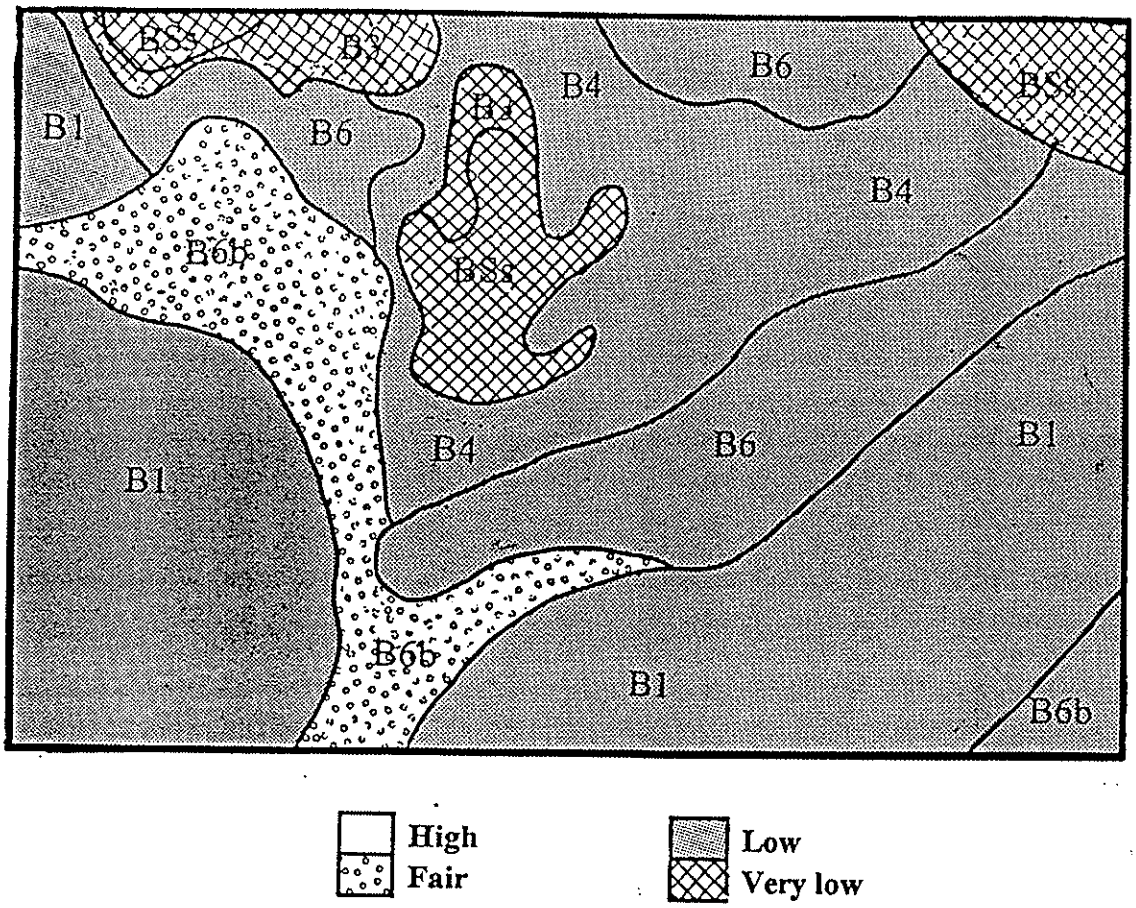
LAND CAPABILITY WITH CONVENTIONAL DOMESTIC EFFLUENT DISPOSAL SYSTEMS LOT 397 YANGEDI ROAD, BALDIVIS

FIGURE 7a



LAND CAPABILITY WITH ALTERNATIVE DOMESTIC EFFLUENT DISPOSAL SYSTEMS

FIGURE 7b

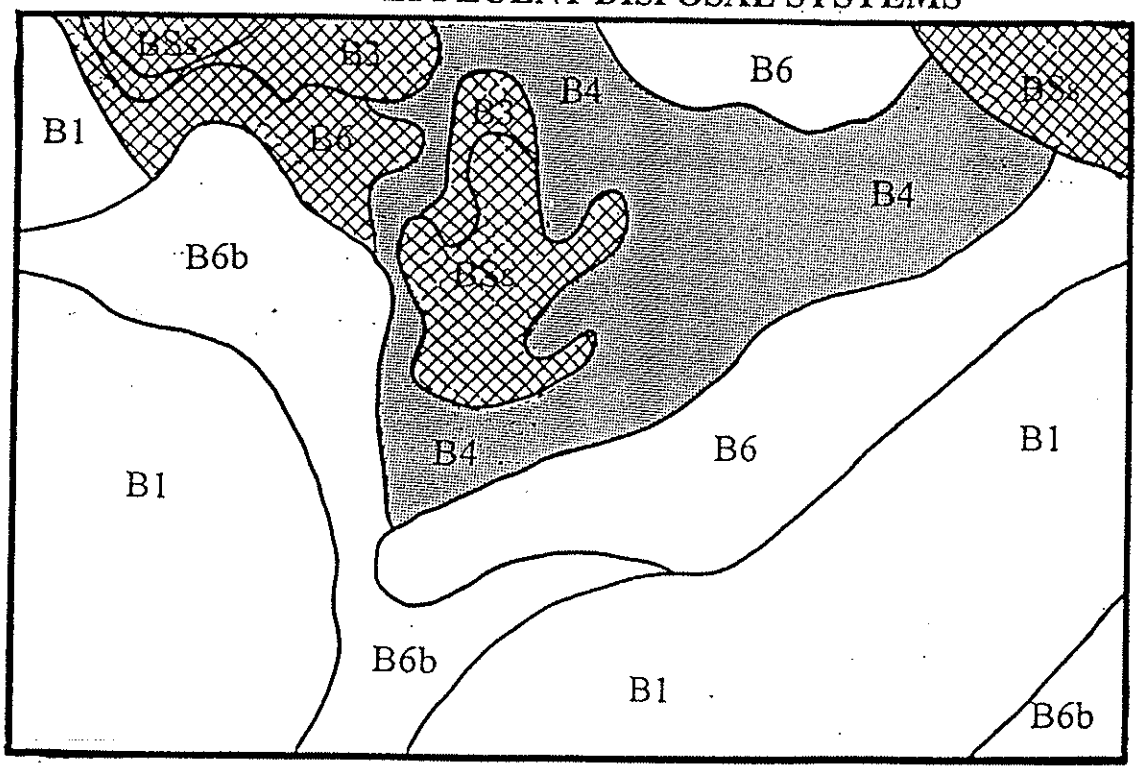


TABLE 3: LAND CAPABILITY SUMMARY

Land Unit	Land Capability with Conventional Domestic Effluent Disposal Systems	Land Capability with Alternative Domestic Effluent Disposal Systems
B1	Low	High
B3	Very low	Very low
B4	Low	Low
B6	Low	High
B6b	Fair	High
BSs	Very low	Very low

The assessment based on the use of conventional septic tank and leach drain systems confirms the earlier more broadscale assessment based on the mapping by van Gool (1992) that the majority of the property has a low to very low capability to support this use. However if alternative on-site effluent disposal systems are used, the capability of the land is substantially better and 68 % of the property has a high capability to sustain rural-residential development This is predominantly within the higher terrain of the Bassendean sands (land units B1, B6 and B6b) where the soils are well drained and sufficient vertical separation can be achieved between effluent disposal areas and seasonally high watertable levels with minimal use of elevated house pads.

Areas of 'low' capability for rural-residential land use activities (housing and alternative effluent disposal) occupy 20 % of the property. These are areas affected by poor drainage (land unit B4) where natural conditions, in winter months at least, are poorly suited for effective disposal and purification of domestic effluent and for locating houses without substantial fill material. The main concern here is the possibility of ineffective treatment of waste-water leading to wetland pollution and further degradation of Serpentine River and the Peel-Harvey Estuary.

Development constraints in 'low capability' areas can be overcome at cost. However it makes sense to 'design around' or accommodate land use pressures within larger lots rather than tackle these constraints within an intensive subdivision development.. Such an approach also minimises the risk of land degradation.

Areas of 'very low' capability for rural-residential land use (12 % of the property) are represented by the main functional components of the site's natural drainage system (land units B3 and BSs). Ineffective conditions for effluent disposal and degradation of landscape values are the main concerns here.

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3.2 Agricultural Activities

Rigorous assessment of the capability of the land for agricultural activities is not warranted in the absence of a 'commercial' farming proposal. The agricultural potential of the property is demonstrated by, and largely limited to, its previous use for grazing. In a regional perspective, the better quality grazing land has been identified within the Shire's Local Rural Strategy as occurring to the east. This land is within the Shire's Agricultural Protection Policy Area centred on the foothills to the Darling Scarp and the adjacent better drained components of the Pinjarra Plain.

Most of the property is, at best, only fair quality grazing land. For grazing purposes, pasture growth in the upland B1 land unit is poor and can only sustain low stocking rates. The lower-lying terrain represents better quality grazing land because the soils retain moisture for a longer period following rainfall. They are still however susceptible to nutrient losses to drainage. Under a farmlet zoning, the property would continue to have a 'productive' agricultural use, albeit on a small 'hobby farming' basis, providing the land is stocked according to seasonal conditions and pasture quality is maintained.

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4.0 ENVIRONMENTAL ISSUES & THE LOCAL RURAL STRATEGY

The Shire of Serpentine-Jarrahdale's Local Rural Strategy (April 1994) is a non-statutory document which acts as a guide to Council in relation to the planning, management and development of its rural areas.

The subject land is affected by an 'Environmental Repair Overlay Policy'. Effectively this recognises that, in common with much of the sandier lower-lying portions of the Shire, the subject property has a relatively low agricultural potential and is susceptible to various forms of land degradation. These include disintegration of wetlands and the adverse off-site effects of nutrient losses to drainage.

In these areas, the Local Rural Strategy encourages 'environmental repair' or rehabilitation to improve the condition of degraded lands and waters. One means by which this can be accomplished is by allowing environmentally responsible development to occur where it might otherwise not have been supported, provided that substantial and sustainable environmental repair is accomplished.

The means by which environmental repair can be affected for the subject development proposal, are outlined below. Various strategies are listed under the headings of the major relevant environmental issues identified by the Shire's Local Rural Strategy.

4.1 Reduction of nutrient losses, particularly phosphorus, to the Peel Harvey Estuarine System and to groundwater supply areas.

This is the primary environmental planning issue within the coastal plain catchment to the Peel-Harvey Estuarine System. Strategies to reduce nutrient losses commonly focus on drainage and on-site water balance, because it is water that moves nutrients around the landscape. For the subject development it is proposed to address drainage, however of equal importance is the need to tackle the likely source of nutrients - in this case, domestic waste-water disposal systems, fertilisers and stock excreta.

The better drained portions of the property have very permeable soils and hence are unlikely to contribute significantly to surface runoff. Nutrient losses from these areas will be through subsurface drainage to groundwater. To reduce such losses it is recommended that;

- all households be required to install approved alternative domestic waste-water disposal systems. (These offer a better ability to retain nutrients, particularly phosphorous, than conventional septic systems.)

- additional vegetation cover be established in strategic locations to increase on-site water use before it reaches groundwater, or before such groundwater possibly emerges in lower parts of the landscape. Strategic locations include;

  - upper parts of land unit B1, particularly the south-west corner

  - within the 'intergrade' area (land unit B6) between the higher and lower terrain - near its margin with land unit B4

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In relation to tree establishment in the latter area, this could possibly be best achieved through a subdivision design which placed either a property boundary, or the entrance road, in this location

In the lower-lying areas which are subject to poorer drainage conditions, the principal mechanism by which nutrients would leave the property is via surface or overland flow. To reduce nutrient losses from these areas the following strategies are recommended;

- modification of the wetland (unit BSs) with lowest conservation value in the north-western corner of the property to form a more functional drainage detention basin and pollution control pond. This would entail some minor excavation to increase its capacity. The establishment of further wetland vegetation around its margins would enhance the sediment trapping process and allow some biological uptake of nutrients to improve water quality. It would also increase the wetland's aesthetic and habitat value.

- a caveat be placed on the title of the land through which the existing agricultural drainage passes requiring the land-holder to maintain the channel in a functional condition and to prevent any filling.

- stormwater runoff from the access road to be directed into the modified wetland area.

- wetlands areas and the agricultural drain be fenced from grazing stock to prevent direct nutrient input from faecal material.

Further strategies relating to fertiliser use on either gardens or farmlet paddocks relate to land-holder education or awareness. Information is required on appropriate application methods, amounts and types of fertiliser. These education strategies are best undertaken, and are currently being pursued, by both State and Local Government bodies.

4.2. Management of surface and groundwater resources

Recommended strategies here are;

-in relation to surface water resources

- retention and enhancement of fringing wetland vegetation to reduce pollution risk

- in relation to groundwater

- adhere to Water Authority Guidelines for the proposed Karnup-Dandalup Underground Water Pollution Control Area (Priority 2) whereby minimum lot size would be greater than 4 ha.

- mandatory use of approved alternative domestic waste-water disposal systems

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4.3. Protection and management of wetlands

Recommended strategies here are;

- in view of its low conservation value, use the wetland in the north-eastern corner of the property as a drainage detention / pollution basin to assist nutrient control
- improve the habitat and aesthetic value of the remaining two wetlands by;
  - retaining fringing vegetation (through clearing controls)
  - additional planting of appropriate fringing wetland vegetation species
  - fencing from stock.

4.4. Protection and management of vegetation and habitat

Figure 6 and the photo background to Figure 2 show that there is relatively little remnant vegetation on the property. The native vegetation which does remain is concentrated around the low-lying wetland areas and is likely to provide a habitat for native fauna and avifauna. The largest area of vegetation on the upland terrain is a stand of pines which is of some aesthetic value and also has value in terms of acting as a windbreak and thus preventing soil erosion

Recommended strategies are;

- tree clearing controls for all areas of the proposed subdivision. Given the paucity of remaining vegetation cover there should be no need for additional clearing for housing following subdivision.
- supplementing existing vegetation with planting of appropriate species in the strategic locations identified above (Section 4.1).
- fencing off fringing wetland vegetation from grazing stock (also recommended in Sections 4.1 and 4.3).

4.5 Minimisation of land degradation processes such as soil erosion, tree decline and soil salinity

The major potential form of land degradation not directly addressed above (Sections 4.1 - 4.4) is soil erosion.

Given the proposed lot sizes, future land-holders will want to stock their properties with a small number of grazing animals, most likely horses. From a fire control perspective this is a desirable outcome. However such part-time, or 'hobby farmers' are likely to be less familiar with the nature of the land and its stock carrying capacity than more established, full-time farmers. There is therefore a potential for soil erosion to occur as a result of overstocking. In recognition of this, it is recommended that stocking rate controls or guidelines be applied to the subject land.

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Site-specific advice on appropriate stocking rates for land within the Peel-Harvey Coastal Plain Catchment can be obtained from Department of Agriculture officers within the Community Catchment Centre at Pinjarra. Alternatively, data provided in the environmental component of the Shire's Local Rural Strategy (AGC Woodward-Clyde 1991), also based on Department of Agriculture recommendations, can be used. This suggests conservative stocking rates ranging from 1 horse (or equivalent in other stock) per 5 ha on the poorest quality sand dune terrain (land unit B1) to 1 horse per 1 ha on low-lying winter-wet terrain (land unit B4). If pastures are irrigated, greater numbers of stock can be carried without risk of land degradation.

4.6 Minimising the risk to life and property from bushfires

In view of the relatively limited amount of 'bushland' on the property and in the surrounding locality, the risk of bushfire is not considered a significant environmental issue. As mentioned above, it is desirable that surface grass cover be kept down and this is best achieved by permitting a conservative number of grazing stock within each farmlet block.

4.7 Achieving an acceptable standard of effluent disposal and waste management.

The generic requirements of the Department of Environmental Protection (formerly EPA) in relation to the use of conventional septic tank and leach drain systems on the Swan Coastal Plain are;

- they should not be permitted on land of "low" or "very low " land capability;

- the base of the leach drain should be at least 2 metres above the highest known watertable or bedrock, and at least 100 metres from the nearest waterbody.

Under these criteria, the survey results indicate the use of **conventional** septic tank systems would be unlikely to gain approval within much of the study area. Even given the depth to watertable within the highest area of Bassendean Sands (land unit B1) the subsoil conditions here are often poorly suited to environmentally effective effluent disposal due to their low nutrient (P) retention.

To address this situation, the more environmentally acceptable solution is to avoid low-lying areas as far as possible for house location, and to use alternative domestic waste-water disposal systems.

The most common of these systems offer a better ability to retain nutrients (phosphorus in particular) either by using amended soil for surface irrigation of treated effluent (Aerobic Treatment Units) or within a modified leach drain environment (Ecomax). As a result they can be located in areas where the watertable is somewhat higher (DEP 1994).

Using such systems it is expected that environmentally acceptable on-site effluent disposal could be achieved in all Bassendean land units except BSs, B3 and B4 with only minor, if any, use of house pads.

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5.0 SUMMARY

Table 4 summarises the main land use considerations for each land unit. In addition, assessment of the property leads to the following conclusions;

- Given the mandatory use of approved alternative domestic waste-water disposal systems, and appropriate stocking rate controls, the majority of the land has a high capability to support farmlet development.

- The property is essentially self contained in terms of drainage, offering a relatively straightforward means of controlling nutrient losses through surface drainage. ie a drainage detention / pollution control pond at a single outlet.

- The land is not high quality farmland for which there is a need for protection from non-agricultural uses.

- The land types are generally susceptible to land degradation (wind erosion and nutrient losses to drainage systems in particular) and there is scope for 'environmental repair' through adoption of strategies which include;

  - mandatory use of alternative domestic waste-water disposal systems
  - increased vegetation cover in strategic areas
  - enhancement of the drainage detention and nutrient stripping function of an existing degraded wetland
  - fencing off wetland areas from grazing stock
  - implementation of stocking rate and vegetation clearing controls

- In combination with these recommended management strategies, the detailed land unit mapping herein provides a framework for environmentally sensitive subdivision and land development. It enables new land use activities to be focussed on areas of higher land capability and targets the key issue, prevention of nutrient losses, at its source (domestic waste-water disposal systems).

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TABLE 4: LAND USE CONSIDERATIONS

Land Unit	Comments
B1	Susceptible to wind erosion, hence it is desirable to retain and supplement natural vegetation cover. Stocking rate controls desirable for 'hobby farming' lots. Good clearance from underlying watertable is achieved but existing soils have a poor ability to prevent pollutants eventually entering groundwater system. Generally capable* of supporting smaller sized lots providing alternative domestic effluent disposal systems are used.
B4	Land is poorly drained and seasonal watertable levels are expected to be within 0.5 m of surface Drainage and/or elevated house pads incorporating leach drains, would be required to meet EPA criteria re separation of leach drain and water table, if conventional effluent disposal systems are used. Generally suited to grazing purposes (ie, larger sized 'farmlet' lots) with housing located on higher ground where possible.
B6, B6b	Soils are fairly well drained but still have a low ability to retain pollutants from conventional domestic effluent disposal systems Minor drainage or low house pads incorporating leach drains, may be required to meet EPA criteria re separation of leach drain and water table, if conventional effluent disposal systems are used. Alternative systems for the on-site disposal of domestic effluent are recommended and will improve capability of land* Soils have a low stock carrying capacity and are susceptible to wind erosion if overgrazed Slightly larger lots than those in B1 are suggested here.

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TABLE 4: LAND USE CONSIDERATIONS - Continued

B3, BSs	Very poorly drained, seasonally waterlogged or inundated areas These areas should be avoided in terms of direct impacts of development as they form part of the functional drainage system Wetland areas have wildlife habitat value and may require fencing from stock Larger lots encompassing these land units are preferable to smaller ones

*High capability only if alternative on-site effluent disposal systems are used. The irrigated disposal area (for Aerobic Treatment Units) or 'amended soils' surrounding leach drains (for Ecomax) comprise material which offers a better ability to retain pollutants (phosphorous in particular) than the existing natural soil which would be used for conventional septic lank and leach drain systems. If conventional systems are used, the capability of these areas is low.

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6.0 REFERENCES

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Department of Environmental Protection (1994) *Effluent (Sewerage) Disposal Guidelines.*

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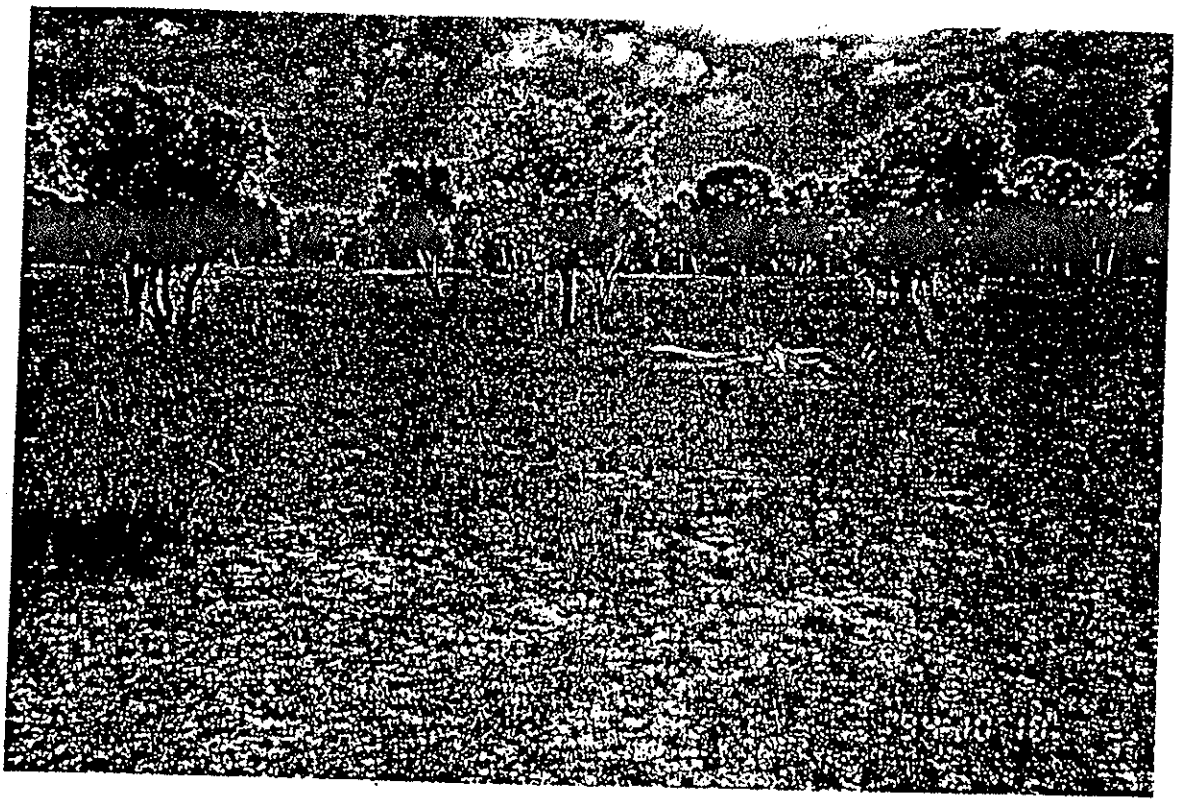
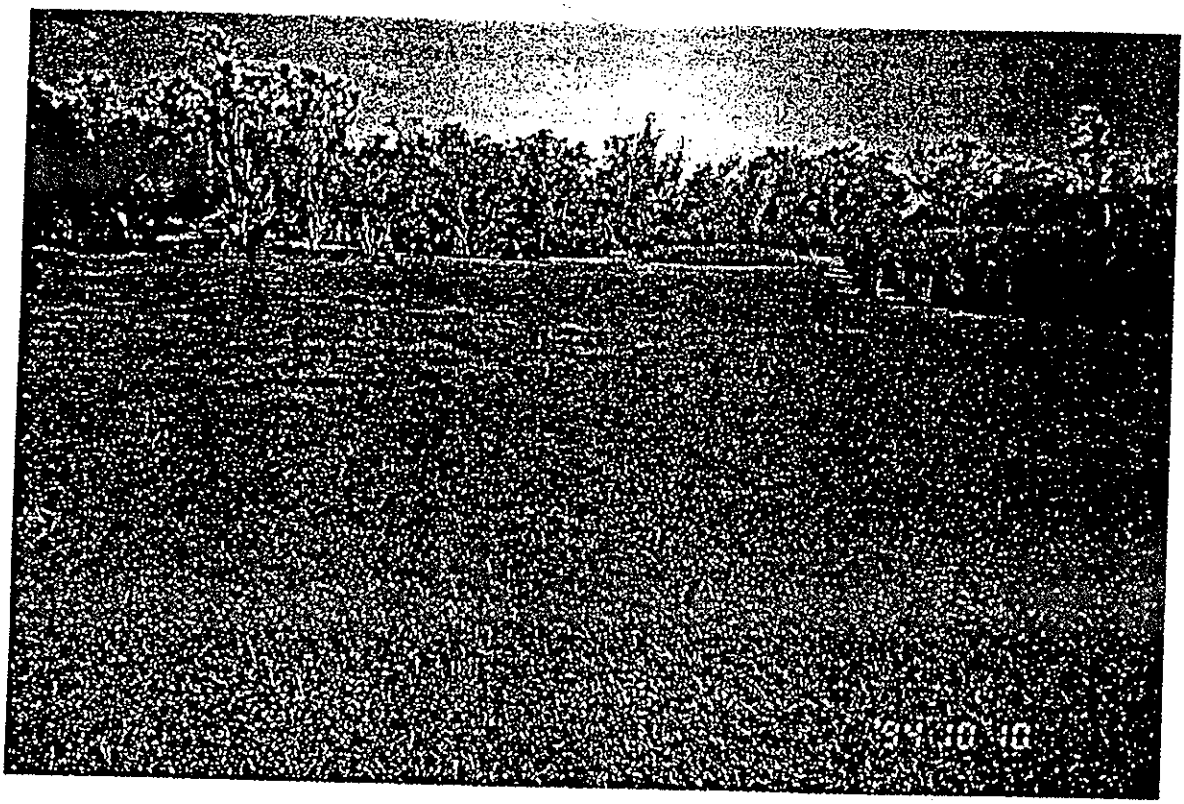
APPENDIX A. LAND UNIT PHOTOGRAPHS

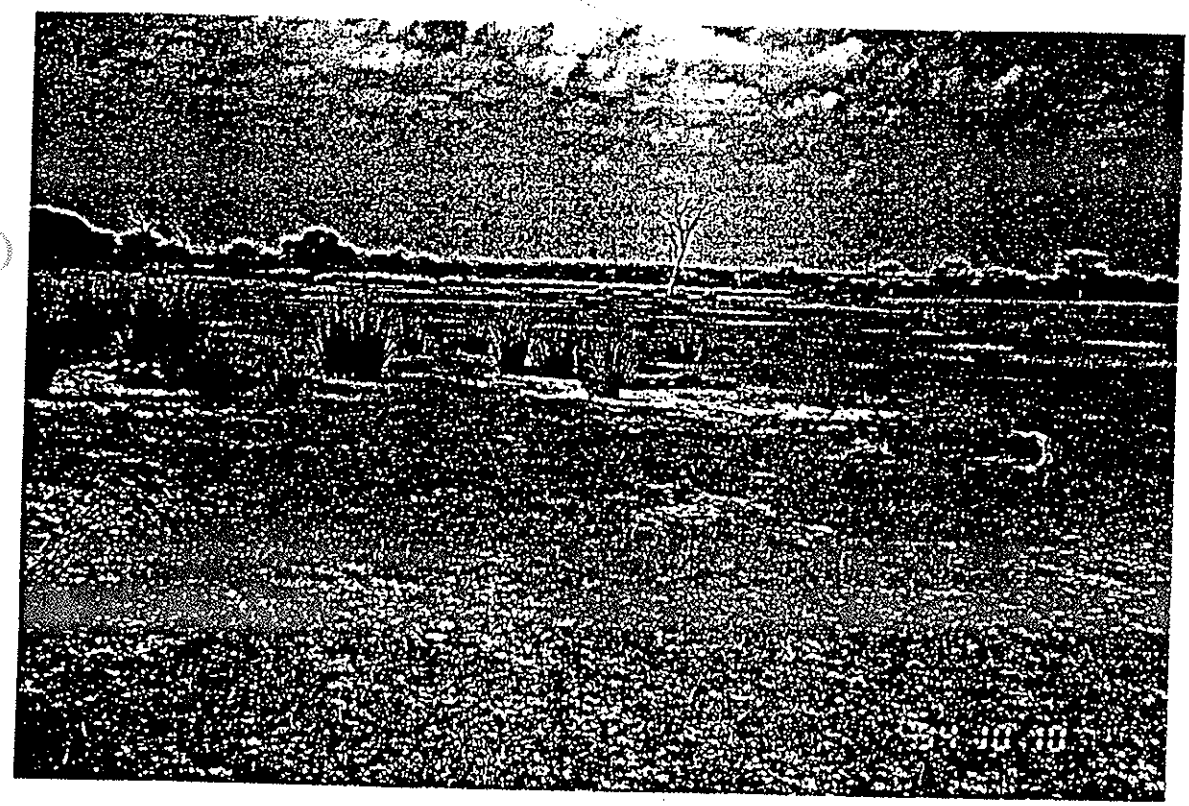


1. Land unit B1; (south eastern portion of property) a well drained, gently undulating sandy rise with deep grey siliceous sands, possibly with a pale yellow subsoil in some areas



2. Land unit B3; poorly drained, low lying margins to the swamp within the northern, central portion of the property

3. Land unit B4; poorly drained sandplain within the centre of the property



4. Land unit B6; imperfectly drained sandplain, marginally better than land unit B4

5. Land unit B6b; moderately well drained sandplain adjacent to land unit B1 (south eastern corner of property)

DRAFT PERTH'S BUSHPLAN -

VEGETATION ASSESSMENT OF PART BUSHPLAN SITE 378 – HENDERSON AIRFIELD, LOT 164 YANGEDI RD, PEEL ESTATE

Department of Environmental Protection
K. Clarke and B. Keighery
September 2000

3/4/01

BACKGROUND

Bushplan Site 378 covers 154.9 ha of which 129.1 ha has been mapped as remnant vegetation. It covers 5 lots, all of which are in private ownership except for Lot 164 Yangedi Rd which is state government land managed by the Shire of Serpentine-Jarrahdale. Lot 164 is currently leased to an aeronautics club and operated as an airfield for light aircraft. On Lot 164 there are two runways (one bitumen and one grass), a club house and a number of hangers. The demand for hangers is increasing with the size of the club and experience of club members and has led to plans for expansion. A site visit was requested to accurately map the boundaries of the regionally significant bushland on Lot 164.

A field inspection was made by Karen Clarke and Clydie Smith (MfP), Bridget Hyder-Griffiths (DEP) and Andrew Del Marco (Shire of Serpentine-Jarrahdale) on 23/12/99. Present at this inspection were two members of the aeronautics club, Howard Jones and Fred Long. Approximately two hours were spent traversing the bushland on foot and by vehicle. Being December there were relatively few plants flowering and annually renewed plants were dormant. Therefore, vegetation condition assessments are subject to revision on a mid/late spring inspection. Condition ratings were based on Keighery (1994).

COMMENTS ON SITE INSPECTION

Vegetation in this Bushplan Site is generally typical of the Bassendean Dunes and the transitional area between the Bassendean Dunes and the Pinjarra Plain. The Site lies on the boundary between the Bassendean Vegetation Complex – Central and South (to the west) and the Southern River Vegetation Complex (to the east) as mapped by Heddle *et al.* (1980). The areas of these complexes proposed for protection under Draft Perth's Bushplan are 13% and 11% respectively. Wetland mapping (WRC 1996a) shows a mosaic of sumpland, dampland and palusplain wetlands across this Site in combination with low lying uplands. The Site consists of vegetated uplands, vegetated wetlands and two areas of open water registered under the Environmental Protection (Swan Coastal Plain Lakes) 1992 Policy. The Site Description (see Appendix 1) summarises the values of the whole Bushplan Site. Map 1 shows the extent of remnant vegetation across the Site that is proposed for protection by Perth's Bushplan (based on 1998 aerial photography, AGWEST (1998)) and within this the wetland areas classed as Conservation Category (WRC 2000) or covered by the Swan Coastal Plain Lakes EPP (Government of Western Australia 1992).

Inspection of Lot 164 on 23/12/99 confirmed that the mapping of remnant vegetation (AGWEST 1998) was accurate. However, some areas have been cleared since early 1998 (see Maps 2 & 3). In particular, the EPP/Conservation Category wetland between the two runways has been extensively cleared and only tree cover remains in the now isolated western section (see Figure 1).

The inspection of Lot 164 confirmed the presence of *Banksia attenuata* and *B. menziesii* Low Open Forest to Low Woodland (Floristic Community Type 23a) and wetlands of *Melaleuca preissiana* Low Open Woodland (Floristic Community Type 4), as described in Appendix 1. The area north-west of the bitumen runway is primarily upland covered by *Banksia attenuata, B. menziesii* and *B. ilicifolia* Low Woodland over *Kunzea ericifolia* and *Melaleuca thymoides* and is in Excellent condition (Figure 2, Location 1 Appendix 2). The remainder of the lot is mainly wetland. The remnant vegetation between the two runways is *Melaleuca preissiana* Low Open Woodland but along the southern boundary there is regrowth of *Kunzea ericifolia* Tall Open Scrub over *Regelia ciliata* (Figure 2, Location 2 Appendix

NB:This is informal advice and should not be regarded as formal Section 38 advice under the Environmental Protection Act but represents DEP Bushplan advice subject to ratification through Coordination Group sign off.

2) due to "clearing" by slashing a number of years ago. This southern area is still in Very Good to Good condition with little weed invasion and fresh diggings of the Southern Brown Bandicoot were noted.

Since early 1998 a large section of the EPP/Conservation category wetland between the runways has been cleared to provide a line of sight to the grass runway for safety reasons. The understorey below the remaining *Melaleuca preissiana* trees near the intersection of the two runways has also been cleared to provide an uninterrupted view below the canopy. Introduced grasses now dominate these areas.

Incremental development of hangers for members of the club has also occurred since early 1998 resulting in loss of some of the *Banksia* Woodland (Map 2). A third line of hangers and new access road has been constructed parallel to the original two lines of hangers. The Woodland adjacent to the northern end of the bitumen runway has also been affected by repeated mowing. It now consists of *Banksia* trees over an understorey of the weed, veldt grass (**Ehrharta calycina*) with a few scattered native plants and plantings of non-indigenous trees (Figure 3, Location 3 Appendix 2). This area is in a Degraded to Good condition.

GENERAL COMMENT/CONCLUSION

The remnant vegetation present on Lot 164 is regionally significant and no modification of the Bushplan boundary is required. However, mapping of the remnant vegetation needs to be altered.

REFERENCES

(Unlisted references can be found in Draft Perth's Bushplan Volume 2B)

DEP (2000) Perth's Bushplan Survey 2000. Unpublished bushland plot and area records. Department of Environmental Protection, Perth Western Australia

WRC (2000) GIS *Wetland Management Category Database.* Water and Rivers Commission, Perth, Western Australia.

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APPENDIX 1: DESCRIPTION FOR BUSHPLAN SITE 378 - HENDERSON ROAD BUSHLAND, PEEL ESTATE

Boundary Definition: bushland (part taken to cadastre) boundary

SECTION 1: CADASTRAL INFORMATION

(Lots, locations and derived information to be updated in the public submission period)

Bushplan Site no. 378 **Map no.** 100 **Map sheet series ref. no.** 2033–II SW

Other Names
Submission Area 220

Local Authorities (Suburb)
Shire of Serpentine-Jarrahdale (Hopeland)

Ownership Categories
State Government

Area (ha): total 154.9 (includes open water); bushland 129.1

Zoning
MRS: Rural
TPS: Rural, Public Open Space, Landscape

Lot/Location/Reserve numbers (Purpose), Street name
2, 399, 400 Henderson Rd; 1 River Rd; 164 Yangedi Rd
Crown Reserve

SECTION 2: REGIONAL INFORMATION

LANDFORMS AND SOILS

Bassendean Dunes
Bassendean Sands (Qpb: S8)

Bassendean Dunes/Pinjarra Plain
Bassendean Sands over Guildford Formation (Qpb/Qpa:S10)

Wetlands (within the Bassendean Dunes/Pinjarra Plain)
Holocene Swamp Deposits (Qhw: Cps)

VEGETATION AND FLORA

Vegetation Complexes

Bassendean Dunes
Bassendean Complex — Central and South

Combinations of Bassendean Dunes/Pinjarra Plain
Southern River Complex

Floristic Community Types

Supergroup 2: Seasonal Wetlands
4 *Melaleuca preissiana* damplands

Supergroup 3: Uplands centred on Bassendean Dunes and Dandaragan Plateau
23a Central *Banksia attenuata — B. menziesii* woodlands

WETLANDS

Wetland Types: sumpland, dampland, palusplain, artificial channel

Natural Wetland Groups

Bassendean—Pinjarra transition OR Bassendean with fluvial features
Bennett Brook (B/P.4)

Wetland Management Objectives: Conservation (35.3ha), Resource Enhancement, Multiple Use

Swan Coastal Plain Lakes EPP: 3.9ha + 1.3ha = 5.2ha (total)

THREATENED ECOLOGICAL COMMUNITIES

Not assessed

SECTION 3: SPECIFIC SITE DETAIL

Landscape Features: open water, vegetated wetland, vegetated uplands

Vegetation and Flora: limited survey ([DEP, 1996 #100] (Kailis 01–03), part Bushplan Site [Hart Simpson & Associates Pty Ltd, 1990 #173], part Bushplan Site — [Masters BK & Associates Pty Ltd, 1992 #281])

Structural Units
Uplands: *Banksia attenuata* and *B. menziesii* Low Open Forest to Low Woodland
Wetlands: *Melaleuca preissiana* Low Open Woodland

Scattered Native Plants: not assessed

NB:This is informal advice and should not be regarded as formal Section 38 advice under the Environmental Protection Act but represents DEP Bushplan advice subject to ratification through Coordination Group sign off.

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

Total Flora: 89 native taxa (plot-generated list only)

Significant Flora: none recorded

Fauna: no systematic survey. Significant mammal species: Quenda [Friend, 1996 D #443]

Linkage: adjacent bushland to the north, south and east; part of proposed-Greenway [Tingay Alan & Associates, 1997 #378]

SECTION 4: INTERNATIONAL AND NATIONAL SIGNIFICANCE

Not listed

SECTION 5: SELECTION CRITERIA AND RECOMMENDATIONS

Criteria: 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

Opportunities: Bushplan Site/part Bushplan Site subject to Peel-Harvey Estuary EPP/SPP, Swan Coastal Plain Lakes EPP; location of conservation category wetlands; under TPS Public Open Space Zoning and Landscape Zoning, Crown Reserve

Constraints: private land; Titanium mineralization subject to mining lease applications M70/729 and M70/740 and exploration licences E70/785 and E70/838 (Baxter joint venture)

Recommendation: The most appropriate mechanism for the protection of this Bushplan Site be considered through the public comment period in consultation with the land owner(s).

NB:This is informal advice and should not be regarded as formal Section 38 advice under the Environmental Protection Act but represents DEP Bushplan advice subject to ratification through Coordination Group sign off.

APPENDIX 2: DESCRIPTIONS FOR LOCATIONS ASSESSED IN DETAIL ON 23/12/99

Location 1 (BW on Map 2, Figure 2) – *Banksia attenuata, Banksia menziesii* and *Banksia ilicifolia* Low Woodland over *Kunzea ericifolia* and *Melaleuca thymoides* Tall Open Shrubland over *Leucopogon sp.* and *Scholtzia involucrata* Open Low Heath over *Amphipogon turbinatus* Very Open Grassland, *Patersonia occidentalis* and *Dasypogon bromeliifolius* Very Open Herbland and *Desmocladus flexuosus* and *Lyginia imberbis* Open Sedgeland.
Condition: Excellent to 'Pristine', very little weed invasion, only **Briza maxima* observed in low numbers, burnt approx. 5-10 years ago.

Location 2 (KeS on Map 2, Figure 3) – *Kunzea ericifolia* Tall Open Scrub over *Regelia ciliata* Open Heath over *Dasypogon bromeliifolius* Very Open Herbland.
Condition: Very Good to Good, regrowth, originally slashed, little weed invasion, evidence of bandicoots (fresh diggings).

Location 3 (BW on Map 2, Figure 4) – *Banksia attenuata, Banksia menziesii* and *Banksia ilicifolia* Low Woodland over **Ehrharta calycina* Very Open Grassland.
Condition: Degraded to Good, has been repeatedly mown, some native understorey species still present. *Patersonia occidentalis*, *Dasypogon bromeliifolius* and *Desmocladus flexuosus*, enrichment plantings along access road.

Figure 1: Looking south from the Club House towards the EPP Lake/Conservation Category Wetland and dam (excavated area in background on right). The understorey has been removed by mowing to provide a clearer view of the grassed runway behind.

Figure 2: *Banksia attenuata, Banksia menziesii* and *Banksia ilicifolia* Low Woodland in the north-western section of Lot 164 (Location 1 on Map 2).

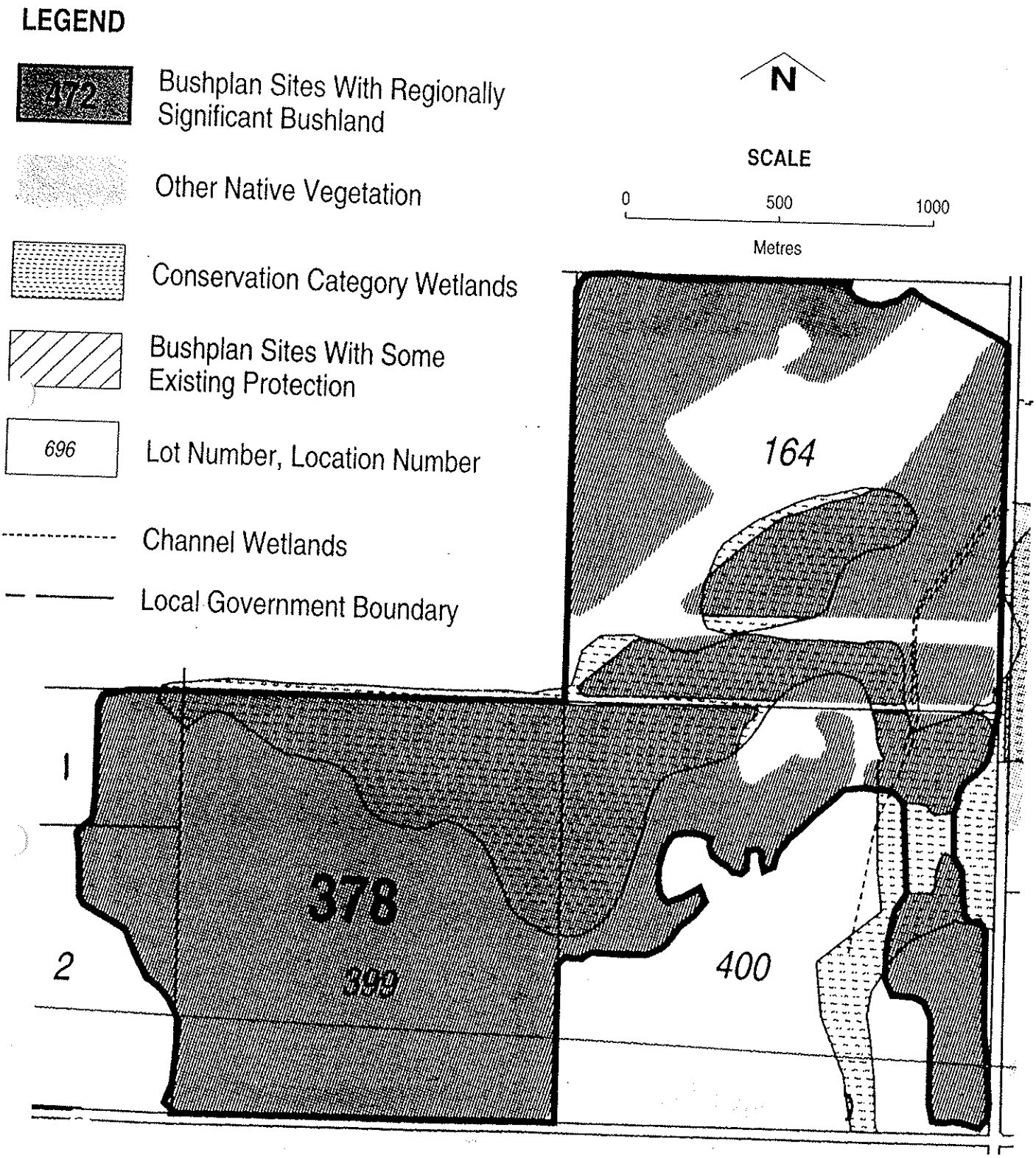
NB:This is informal advice and should not be regarded as formal Section 38 advice under the Environmental Protection Act but represents DEP Bushplan advice subject to ratification through Coordination Group sign off.

Figure 3: *Kunzea ericifolia* Tall Open Scrub on the southern side of the grass runway showing emergent *Nuytsia floribunda* (Christmas trees) with a patch of *Regelia ciliata* in the front (Location 2 on Map 2).

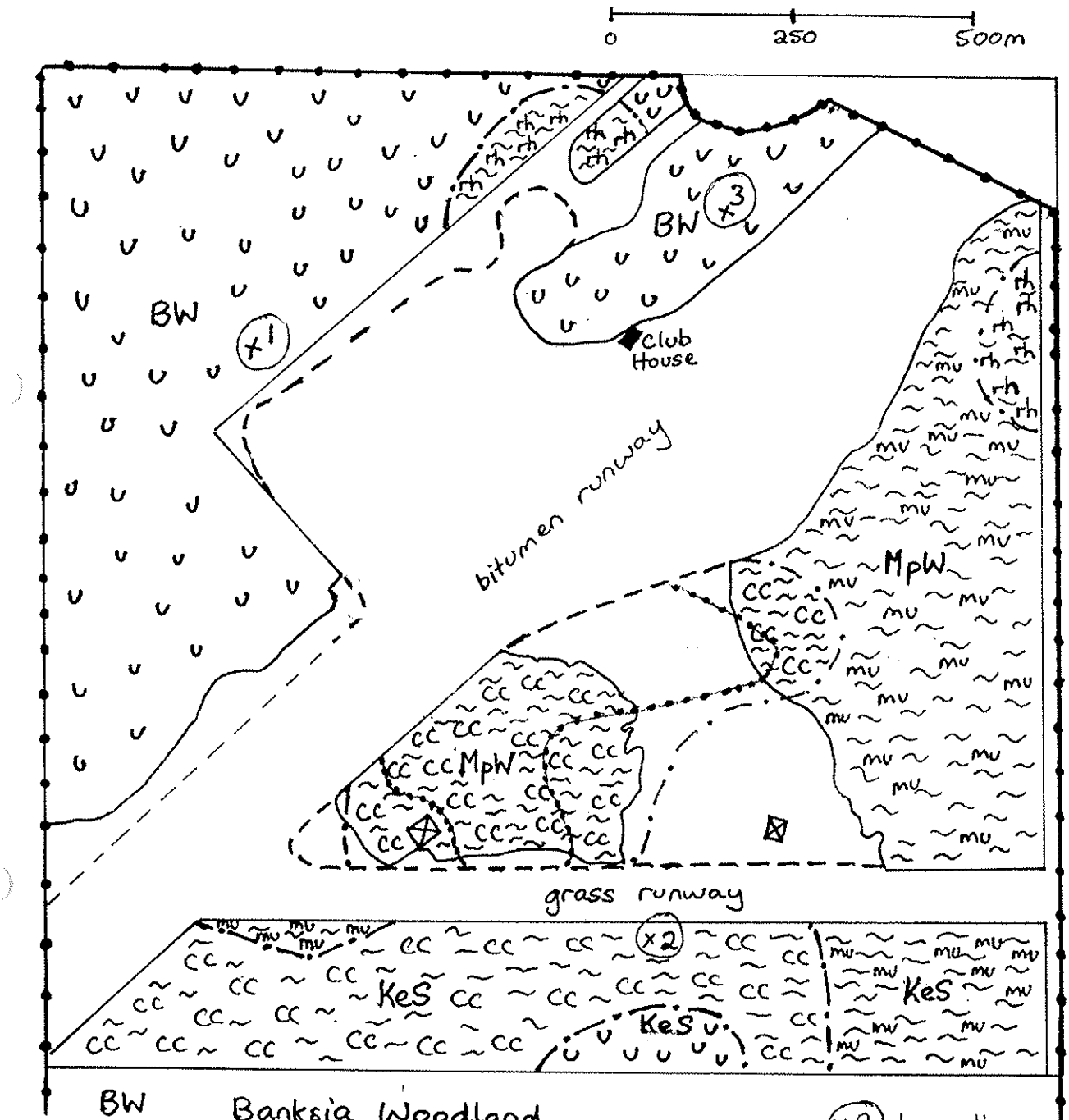
Figure 4: *Banksia attenuata, Banksia menziesii* and *Banksia ilicifolia* Low Woodland over **Ehrharta calycina* (Veldt Grass) just north of the Club House and hanger area (Location 3 on Map 2).

NB:This is informal advice and should not be regarded as formal Section 38 advice under the Environmental Protection Act but represents DEP Bushplan advice subject to ratification through Coordination Group sign off.

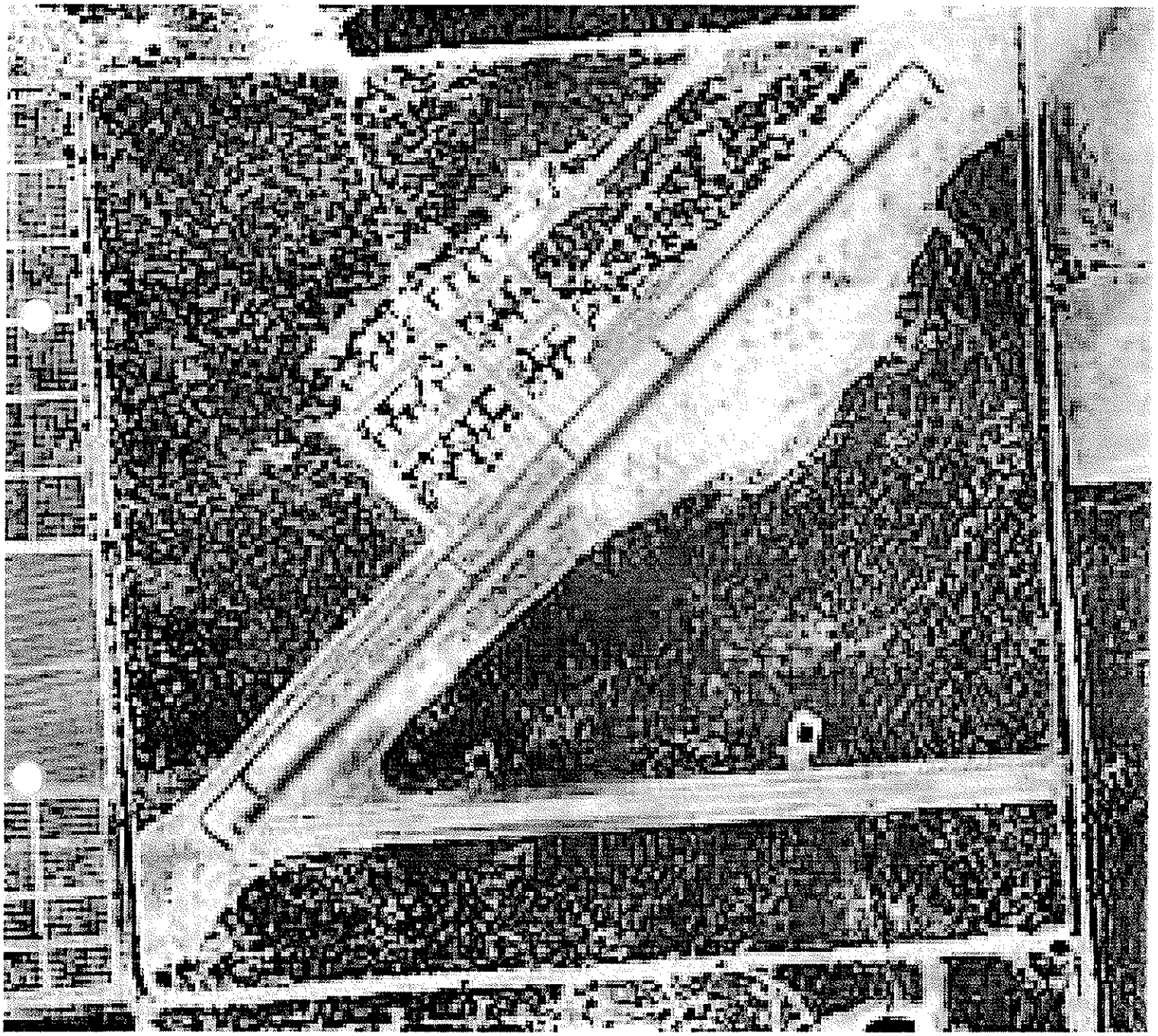
Map 1: Enlargement of Bushplan Site Map 100 (Government of WA 1998) to show the boundary of the mapped regionally significant vegetation and the Conservation Category wetlands.



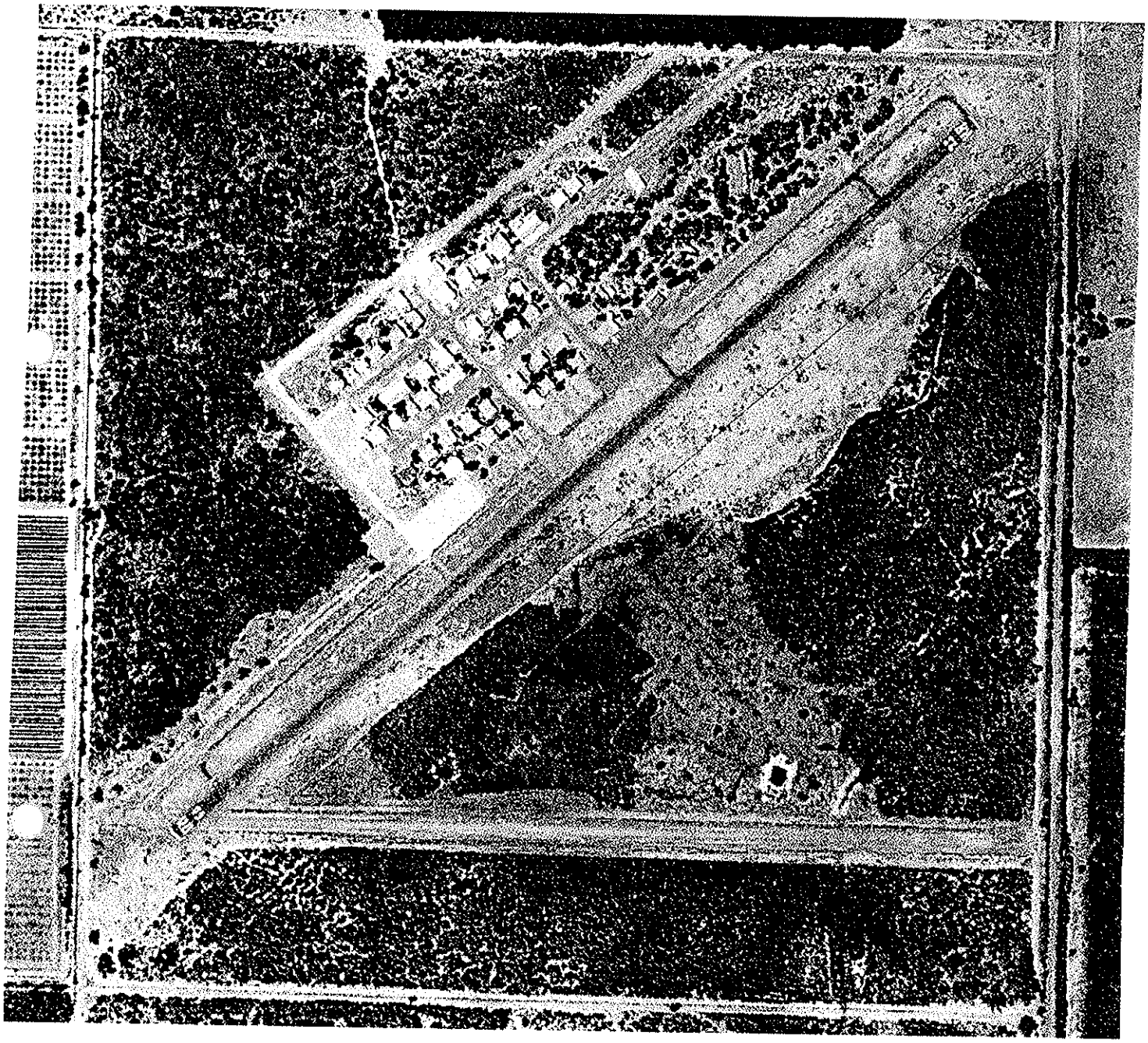
Map 2: Vegetation Map for Lot 164 Yangedi Rd showing the Wetlands and their Managment Categories (WRC 2000) and boundary of the EPP lake.



Map 3: 1998 Aerial Photo of Lot 164 Yangedi Rd used to Map Remnant Vegetation for Draft Perth's Bushplan.



Map 4: 1999 Aerial Photo of Lot 164 Yangedi Rd showing changes to extent of regionally significant vegetation.



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HOPELANDS
MINERAL SANDS PROJECT.

WETLAND VEGETATION.

Prepared by

Hart, Simpson and Associates Pty Ltd

for

Pittston Mineral Sands Joint Venture

December 1991

BS 77
YANGEDI
BASS S

BS 378
HENDERSON
BASS S

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1. SUMMARY.

The Pittston Mineral Sands Joint Venture proposes to develop the "Hopelands Project", which is a mineral sands mine in an area known as Hopelands between Baldivis and Serpentine. As part of the environmental studies for this proposal, a study of the wetland vegetation was commissioned.

Most of the study area is developed pasture but there are remnant wetlands and Banksia woodlands.

There are fifty four wetlands in the study area. One wetland and parts of two others could not be visited because the proponents do not have right of access, and six wetlands were too deep to be examined fully. These need to be examined later.

The vegetation has been degraded by burning, grazing and physical disturbance, and in most of the wetlands is extensively invaded by weed and pasture species. The flora was found to be impoverished because of extensive clearing and grazing. No Gazetted Rare Flora and only two Priority Three species were found, and it is unlikely that any Gazetted Rare Flora species occur in the wetlands.

The vegetation units are all widespread on the Swan Coastal Plain, but wetlands have been degraded over much of the region, and there is now an increasing awareness of the value of all wetlands.

The wetlands have been assessed according to recognised criteria which have been developed for assessing the use and conservation values of the wetlands of the region. All the wetlands in the prospect area are placed in the lower three of the five categories. The information on species diversity and the condition of the vegetation supports this conclusion.

None of the wetlands can be regarded as having a high conservation value in a local or regional context, but all have some values in a local and regional context and should be protected where possible.

Recommendations are made for how these wetlands could be managed during mining, including avoiding some wetlands, rehabilitating the wetlands either on or off the site and restoring important features of the wetlands.

2. INTRODUCTION.

The Pittston Mineral Sands Joint Venture proposes to develop the "Hopelands Project", which is a mineral sands mine in an area known as Hopelands between Baldivis and Serpentine (Figure 1).

As part of the environmental studies for this proposal, a study of the wetland vegetation was commissioned. This vegetation survey is reported here.

The study was carried out to:

- Describe the vegetation and flora of the wetlands,
- Identify any plants of conservation significance in the area,
- Review the local and regional significance of the vegetation and flora of the wetlands affected by the proposed mining.
- assess the significance of any possible impacts from the proposed development, and
- make recommendations for how the project should be managed in relation to the vegetation and flora.

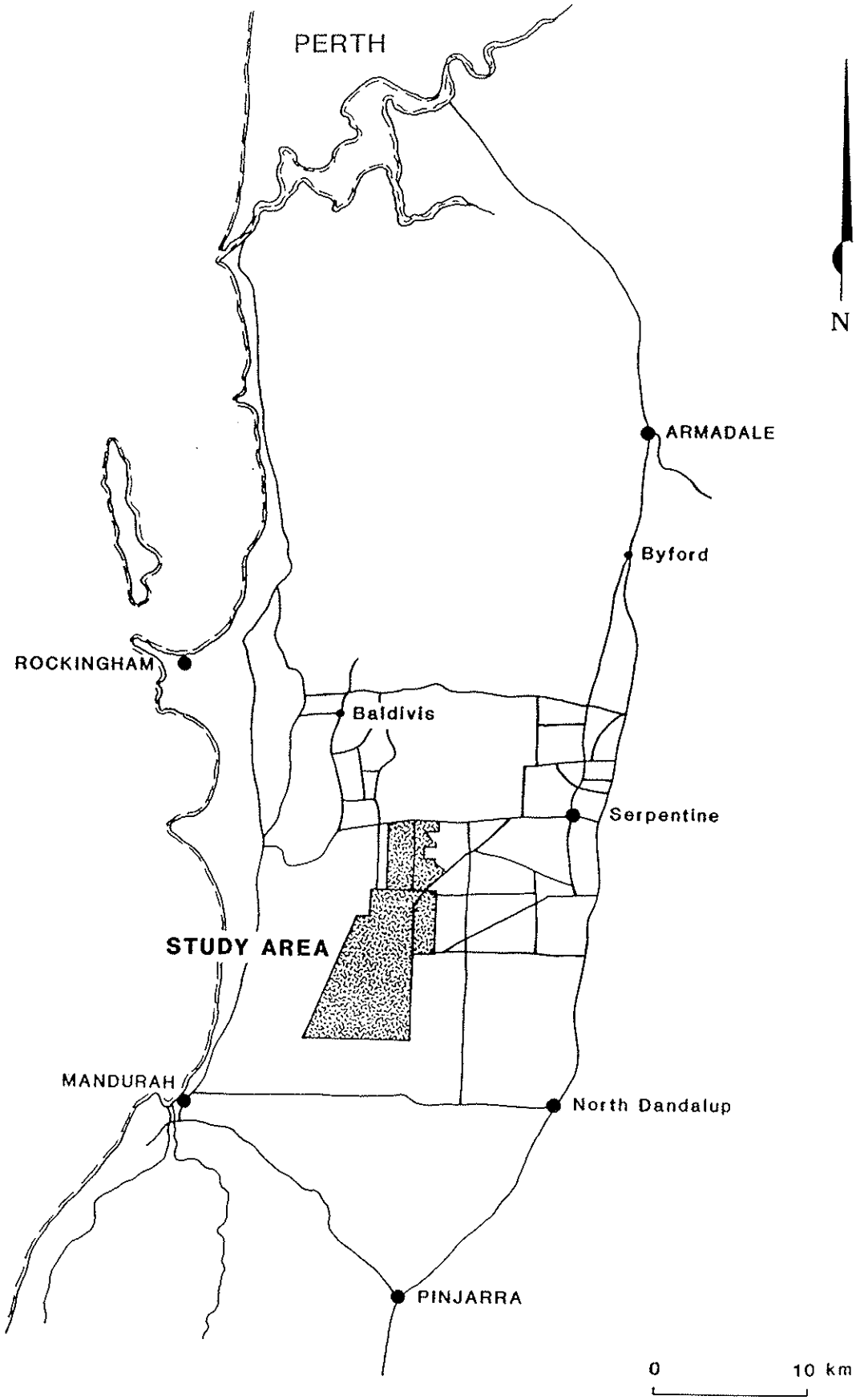

Figure 1

STUDY AREA LOCATION

HOPELANDS MINERAL SANDS PROJECT

Drawn: J.L. Montgomerie

HART, SIMPSON & ASSOCIATES PTY LTD

3. METHODS.

The wetlands were identified from air photos, and each site was visited where access was possible.

The vegetation was described by recording the most common species in each stratum after Muir (1977). The condition of the vegetation was also recorded by noting the degree of pasture and weed invasion, and the degree of physical disturbance. Other species present were also recorded. Where species could not be identified in the field they were pressed and identified in the W.A. Herbarium and with reference to various keys including Marchant et al. (1987).

Plant species of conservation interest are listed by the Department of Conservation and Land Management (CALM). The species are assigned to various categories depending on the state of knowledge about the species, their abundance and the extent of their range. Some species are formally declared as "Gazetted Rare Flora" while others are assigned to a series of "Priority" categories.

The species of conservation interest which might be present were identified from these lists and general information about the species and the habitats present, such as from Marchant et al. (1987).

Specific searches were made for all the species of conservation interest where it was thought that they might occur in the area.

The work described here was carried out between October and December 1991.

4. RESULTS.

The study area is mainly cleared pasture with little or no remaining native vegetation. The selection of which patches of vegetation were sufficiently intact to be regarded as remnants of native vegetation was somewhat arbitrary. Many of the patches were severely disturbed and their condition depended on the time of the most recent fire or other disturbance. Each remnant area of native vegetation which was substantially intact was identified by the Lot number and a letter code within the Lot. Fifty four wetlands were recognised in the study area including two mosaics in pasture (Map 1). In Map 1 wetlands are indicated by broken lines and terrestrial vegetation by solid lines. The terrestrial vegetation has been reported separately (Hart, Simpson and Associates 1991).

Detailed descriptions of the wetlands are given in Appendix 1.

A list of the flora is given in Appendix 2, and the occurrence of each species in each of the wetlands is given in Appendix 3. The species are listed for each wetland because the wetlands are so variable.

Access could not be obtained to all of wetlands in the survey area. Four properties with wetlands were not examined because the proponents do not have right of access (Lot 161, Lot 396, Lot 400, and Lot 6). These are marked on Map 1.

The water in six of the wetlands (Lot 11 D, Lot 77 D, Lot 77 E, Lot 82 F, Lot 83 F and Lot 163 B/Lot 397 B) was too deep to gain access to all sections. These wetlands need to be revisited when water levels are lower to examine the flora present.

A search of the CALM data base showed that no Gazetted Rare Flora are known to occur within several kilometres of the study area.

One species of Gazetted Rare Flora, Diuris purdiei (a small donkey orchid), is known to occur near Serpentine. This species has been recorded as growing in semi-swamps on the coastal plain. This plant only flowers in the spring following a fire in the previous year. It is very difficult to distinguish from other herbaceous ground covers unless it is flowering. This species could occur in the area.

Another Gazetted Rare Flora species, Diuris sp. (Kwinana) A. P. Brown 10.9.84 (an undescribed small donkey orchid), has been recorded as occurring amongst thick native sedges in a winter wet swamp near Medina. Although small (30 cm) this species would most likely have been observed if it was flowering. This species could occur in the area.

The following Priority species were recorded in the CALM database as occurring in the general area:

Acacia horridula
Anthotium junciforme
Eryngium sp. (Serpentine) G. Keighery 8757
Jacksonia sericea
Lasiopetalum glabratum
Lysinema elegans
Tetraria australiensis
Thysanotus glaucus
Verticordia lindleyi ssp. lindleyi
Verticordia plumosa var. ananeotes
Verticordia plumosa var. pleiobotrya
Villarsia submersa.

No Gazetted Rare Flora species were found during the field work. It is not possible to be completely confident that either Diuris purdiei or Diuris sp. (Kwinana) is not present, although they are unlikely to be present given the condition of the remnant vegetation.

Two Priority species were recorded for the study area. These were Cartonema philydroides and Jacksonia sericea which are both Priority Three species. Priority Three species are defined by CALM as "species which are known from several populations, at least some of which are not believed to be under threat (ie. not currently endangered)." These species have no specific legal protection.

Cartonema philydroides was observed in pasture on Lot 401 between wetlands B and C. This species has a wide distribution ranging from Kalbarri in the north through Midland, Bullsbrook and Harvey to Busselton in the south. This species appears to prefer disturbed areas.

Jacksonia sericea was observed on Lots 1A and 3 along the farm access tracks and occasionally through the pasture area, and on Lot 83 in the woodland C. The distribution of this species is far more restricted with a range from Wanneroo in the north to Mandurah-Pinjarra in the south. Marchant et al. (1987) considered this species to be endemic to the Perth region occurring on calcareous and sandy soils of the coastal plain.

Neither of these species can be regarded as primarily a wetland species.

5. DISCUSSION AND RECOMMENDATIONS.

The study area lies on the Swan Coastal Plain. The pre-European settlement vegetation of the immediate area has been described by Mulcahy (1980) as Bassendean Complex (Central-Southern) on the western side and Southern River Complex on the eastern side.

A range of vegetation associations occurs on the Bassendean Complex from woodland of jarrah-sheoak-banksia on the sand dunes to a low woodland of Melaleuca spp. and sedgelands on the low-lying depressions and swamps. Banksia ilicifolia, Banksia littoralis and Melaleuca preissiana are common on the low-lying more moist soils, where jarrah is replaced by marri as the dominant.

The Southern River Complex consists of an open woodland of marri-jarrah-banksia on the higher areas and a fringing woodland of Eucalyptus rudis and Melaleuca rhaphiophylla along streams.

Although the regional map of Mulcahy (1980) splits the study area in two, with the Bassendean Complex on the western half of the study area and the Southern River Complex on the eastern half, this was not apparent on the ground due to the extensive clearing that has occurred in the area. There are virtually no intact stands of the Southern River vegetation in the study area. There are, however, good remnants of the Bassendean Complex.

Despite the great variability in species composition between the wetlands (Appendix 1), the vegetation and flora of the wetlands is typical of similar habitats along the Swan Coastal Plain, from north of Perth to near Bunbury. Although these wetlands occur over this considerable distance they are not common because most have been altered by draining, filling or clearing for urban and agricultural purposes.

Over recent years the wetlands of the region have attracted a great deal of attention because it has become clear that their conservation status is poor and there has been an increasing awareness of their value. There have been several surveys of the wetlands along the Swan Coastal Plain, including the detailed studies of Le Provost, Semeniuk and Chalmer (1987) and Murray (1989).

The term wetland is used here to encompass the intergradational range of all areas which are water-inundated, water saturated or water affected, whether that water is fresh or saline, permanent, seasonal or temporary. This definition follows Le Provost, Semeniuk and Chalmer (1987).

Le Provost, Semeniuk and Chalmer (1987) based a classification system on the two major features which determine the existence of wetlands: the water and landform components. This results in seven categories of commonly occurring wetlands. Modifiers or descriptors are added to these categories. These cover scale, plan geometry and water properties.

Murray (1989) used this classification to describe all the larger wetlands (over 100m long) in the Serpentine-Jarrahdale Shire, which covers most of the present study area. The classification of each wetland under this system is included in the descriptions of the wetlands in Appendix 1. The survey of Murray (1989) did not cover all the south west corner of the present survey. Lots 1A, 3, 82 and 83 were not included.

Wetlands have been divided into five management categories which were defined by EPA (1987). These categories have a graded set of priorities for management and protection, based on the integrity of the natural systems, their role in the rural and urban settings, and their conservation importance.

The five categories are, in descending order of significance:

Category H: High priority conservation areas.

These wetlands possess a high degree of naturalness and there is a high level of interest in using the wetlands for various human purposes. This category is recognised as having the highest priority for the establishment and implementation of regional park wetlands.

Category C: Wetlands with conservation as primary function.

These wetlands possess relatively intact natural systems. The management objective is to maintain and enhance these natural attributes and functions.

Category O: Wetlands suitable for conservation and recreation values associated with regional and local open space.

Many of these wetlands have been highly modified but are considered to play important roles in their urban or rural settings.

Category E: Wetlands suitable for enhancement for conservation, recreation and development.

Many of these wetlands have been significantly modified or do not have clearly recognised roles in their urban or rural settings. Some of the wetlands in this group will be the focus for controversy if uncontrolled developments begin to impinge upon them.

Category M: Wetlands with potential for multiple use.

Wetlands in this category are significantly degraded, possess few natural attributes, and have limited human use attributes. Despite the lack of natural attributes, some of these wetlands may provide valuable water bird habitat.

Murray (1989), in reporting on the management of the wetlands in the Serpentine-Jarrahdale Shire, used the classification system of Le Provost, Semeniuk and Chalmer (1987) and categorised the larger wetlands (greater than 100m). The features used were:

- type - water catchment type.
- shape - outline of the wetland, and
- size - size of the wetland.

Murray (1989) also classified the wetlands into the management categories of EPA (1987). Table 1 lists the wetlands studied here and gives the management classification given by Murray.

Table 1. EPA management classifications for the wetlands studied here, from Murray (1989).

Wetland Lot		Classification
1	A	-
	B	M
1A	A,B	*
3	B,E	*
11	B,C,D,E,G	-
	H	M
11	I	-
12	A,C,,E	M
	F	-
77	B,C,F	M
	D	E
	E	O
80	G	M
	I	-
82	A,F	*
82	H	*
83	B,E,F	*
156	A,B	E
	C	M
161	A	M
163	A,B	M
164	B (part)	E
165	A	E (artificial wetland)
387	A	E
388	A	-
389	A,B	-
392	A,C	-
393	A	M
394/395/396	A	E
397	A,B	M
399	B	-
400	B	M (no access)
401	A,B	E
401	C	-
806	B,C,D	E
810	A	M
810	B,C,D	-

O = Open space.
E = Enhancement.
M = Multiple usage.
- = Not classified by Murray (1989).
* = Outside the study area of Murray (1989).

Table 1 shows that Murray (1989) classified all the wetlands of the present study area which he studied into only the lower three of the five management categories defined by EPA (1987). These were O (Open Space), E (Enhancement), and M (Multiple Use). Most wetlands were unclassified or classified into the lowest category. Only part of one wetland was classified into the higher O category.

There is one area of higher management category (C: Conservation) just outside the study area, in the south east corner of Karnup and River Roads (Murray 1989). This wetland is Lot 805 A and Lot 806 A on Map 1 and extends further north.

The EPA has recently released a draft report on the Environmental Protection of the Swan Coastal Plains Wetlands, dated March 1991. This report maps those wetlands that are considered environmentally, socially or economically significant. Permission from the EPA must be granted before any of these wetlands can be altered by:

- filling in of wetlands,
- mining and excavation of wetlands,
- pollution of wetlands, or
- drainage into or out of wetlands.

These restrictions apply to the following wetlands in the present study area:

Lot	Wetland
Lot 1A	parts of B
Lot 3	B and parts of E
Lot 11	B, C, D, E and G
Lot 77	B and E
Lot 80	G and I
Lot 82	parts of A
Lot 83	F
Lot 156	A and B
Lot 164	part of B
Lot 165	A
Lot 389	A
Lot 394	A
Lot 395	parts of A
Lot 400	B
Lot 810	A, B and D.

Note: Lot 395A wetland has since been scrub-rolled & burnt.

These wetlands will require clearance from the EPA before disturbance can occur.

An alternative method of assessing the condition of the wetlands is the number of native plant species growing there. This measure is the diversity of plants in the site, with a high diversity indicating good condition and low diversity a poor condition. Similarly the degree of weed and pasture encroachment into the wetland is a measure of condition.

Four of the wetlands (Lot 11 E, Lot 11 G, Lot 164 B (part)/Lot 401 A, and Lot 395 A) exhibited a moderate native plant diversity. The factor common to Lot 11 E, Lot 11 G and Lot 164 B/Lot 401 A was that all had a section of dense thicket. Grazing pressure on the sedge and heath associations were not as apparent as on the taller species. Wetland Lot 395 A produced a high diversity by encompassing a long narrow strip of several different associations, each of which was individually degraded.

All other wetlands were degraded by weed and pasture encroachment and grazing, and showed low species diversity.

The least degraded accessible wetlands were:

Lot 164 B (part)/401 A and

Lot 77 E (Yangedi Swamp, east).

Both these had minimal intrusion by weeds and had the greatest degree of "naturalness".

The apparent lack of any species of conservation interest is also an indication of the degraded state of the wetland vegetation. The total species list (Appendix 2) has only 108 species, of which only 86 are native. The species observed are all common and widespread. This total of 86 native species is much lower than would be expected from a survey of intact wetlands.

From the categories assigned by Murray (1989), there are no high priority wetlands in the study area. Open space (O), Enhancement (E) and Multiple use (M) are the only classifications present. The vegetation and flora survey results of condition given here confirm this conclusion. The wetland just outside the north west corner of the study area is classified "for Conservation as a primary function" (C) and any impact on this wetland will need to be considered in the environmental management of the proposed development.

Murray (1989) commented on the wetlands around Yangedi Swamp as having particular interest:

- The western part of Yangedi Swamp (80 G), which although significantly altered by drainage, provides a bird habitat of open water. This is categorised as M (Multiple Use).

- The eastern part of Yangedi Swamp (77 E), which is the least degraded part and is the only wetland classified as category O (Open Space).

- The nearby Sumpland (77 D) which is categorised as category E (Enhancement).

Despite the lack of high conservation values assigned to the wetlands, some of the wetlands (Lot 11 E, Lot 11 G, Lot 82 F, Lot 83 B, Lot 163 B, Lot 164 B, Lot 395 A, Lot 397 B and Lot 401 A) have fine examples of large old individuals of the paperbark tree Melaleuca preissiana. Some of these have a girth at breast height of several meters. Trees of this size are becoming uncommon on the Swan Coastal Plain, and they should not be destroyed unnecessarily.

Any wetlands in the path of the proposed mine will be destroyed. Although the wetlands are almost all on private property and the values attached to the wetlands of the study area are not high in a regional sense, the general values now being given to all wetlands of the region require that this impact is managed responsibly.

The management of the wetlands should have the basic aim of not causing any net loss of wetlands, and preferably of increasing the value of the existing remnant wetlands.

Appropriate responses could be:

- Avoiding wetlands completely where this is practical, such as by giving up small parts of the orebody. This will always be a balance between the value of the wetland and the value of the ore foregone.

- Removing the vegetation and soil from any wetlands which must be destroyed and using them to re-create the wetlands as part of normal rehabilitation during mining. These wetlands could be combined to produce fewer but larger wetlands which could be managed more easily after mining has been completed. This will depend on many factors, including whether the proponent owns the land or can protect the rehabilitated land by covenant.

- Removing the vegetation and soil from wetlands which must be destroyed and creating replacement wetlands on other sites. These new wetlands could for example be created adjacent to other wetlands off the mining area so that their joint values are increased, or adjacent to significant remnant vegetation which will not be destroyed during mining. Part of the poor values attached to the present wetlands is due to their fragmentation and lack of coordinated management.

- Ensuring during rehabilitation after mining that at least the same number of trees is planted so that in the long term there will be no loss of the significant large trees. This will need to be managed so that the trees receive protection after mining. For example, it might be necessary to consolidate the trees on a few locations which can be protected by covenant.

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Study Area

163 Lot numbers

Blocks

Wetland boundary

Woodland boundary

Roads

River Road

Yangedi

DRAIN

NO ACCESS

Poor condition

Plantation

Henderson Road

Punrack DRAIN Road

Note: The remainder of Lot 1A is a mosaic of mainly pasture with some remnant wetland

Note: The remainder of Lot 3 is a mosaic of mainly pasture with some remnant wetland

Limit of aerial photos

0 1 2 Km

Approximate Scale

Map 1

HOPELANDS MINERAL SANDS PROJECT

VEGETATION

Drawn: J.L. Montgomerie

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N

Study Area

163 Lot numbers

Blocks

Wetland boundary

Woodland boundary

Roads

SERPENTINE DRAIN

Karnup Road

Jarrah Road

Yangedi Road

River Road

Henderson Road

Punrack Road

DRAIN

NO ACCESS

Poor condition

Plantation

Note: The remainder of Lot 1A is a mosaic of mainly pasture with some remnant wetland

of aerial photos

378 →

378 →

e Br 77 in part

APPENDIX 1. DESCRIPTIONS OF THE WETLANDS.

The wetlands are identified by the Lot number and a letter code within the lots. The locations are given in Map 1.

WETLAND: Lot 1 A.

Location: North side of Lot 1, both sides of road verge.

Description by Murray (1989): Not classified.

Vegetation Description:

This wetland was made up of a single vegetation type. The upper stratum was Mixed Heath A and B with a canopy cover of 30-70% to 2m tall. No species dominated, but Grevillea densifolia, Melaleuca rhaphiophylla, Melaleuca viminea and Melaleuca incana were common. Below this was Dwarf Scrub D with a canopy cover of 10-30% to 0.5m tall. No species dominated. Below this was Open Herbs and Open Low Grass with a canopy cover of 10-30% to 0.3m tall. Again, no species dominated.

Condition:

This wetland was moderately disturbed with pasture to the west, a drain to the east and the road in the centre. However, the native species diversity was moderately high with only minimal intrusion of pasture and weed species except for several patches of Watsonia sp. which formed a monoculture.

WETLAND: Lot 1 B

Location: Western part of Lot 1.

Description by Murray (1989): Dampland, Mesoscale, Irregular (6.84).

Vegetation Description:

This wetland is adjacent to a large drain on Reserves 34948 and 2498. The dominant upper stratum was a mixed forest of Eucalyptus rudis 7-15m tall and Melaleuca rhaphiophylla 5-10m tall, with a combined canopy cover of 30-70%. Below this there was mixed scrub 1-3m tall with 10-30% canopy cover. The dominant species of this stratum was Astartea fascicularis. Below this was low grass to 0.5m tall, with 30-70% canopy cover. Pasture species dominated this stratum, including annual grasses and Paspalum.

Condition:

The wetland is in a cleared paddock which has been heavily grazed. The vegetation of this wetland has also been disturbed by grazing, resulting in a low native plant species diversity.

WETLAND: Lot 1A. A.

Location: Central east of Lot 1A.

Description by Murray (1989): Outside study area.

Vegetation Description:

This wetland was made up of three distinct vegetation associations. There was a fringe on the drier soils to the east and west of Low Woodland A . Centrally, on the damp soils, there was a Low Forest B. Although the fringes were not strictly wetland vegetation, they are treated as such here for convenience due to their small area.

The upper stratum of the western fringe of Low Woodland A was entirely Eucalyptus calophylla to 15m with a canopy cover of 10-30%. Below this stratum was Low Sedges with a canopy cover of 30-70% to 0.5m tall. The dominant species was Lepidosperma longitudinale.

The central association comprised Low Forest B dominated by Kunzea ericifolia and Melaleuca preissiana to 5m tall with a canopy cover of 30-70%. Below this stratum was Low Grasses and Open Herbs to 0.2m tall with 10-30% canopy cover. The dominants were pasture species.

The upper stratum of the eastern fringe was sparse emergent Eucalyptus marginata to 15m with a canopy cover less than 2%. Below this stratum was Low Woodland A which was a mixture of Banksia attenuata, Banksia menziesii and Allocasuarina fraseriana with a canopy cover of 10-30% and 5-8m tall. Below this stratum was Low Grasses and Open Herbs to 0.2m tall with 10-30% canopy cover. The dominants were pasture species.

Condition:

The wetland was in a cleared paddock which had been heavily grazed. All three vegetation associations had also been heavily grazed resulting in a low native plant species diversity.

WETLAND: Lot 1A B and Lot 3 E.

Location: All areas except those otherwise indicated.

Description by Murray (1989): Outside study area.

Vegetation Description:

Due to the extensive area involved, the difficulty of interpretation of the aerial photographs and the small sizes of the wetlands in this area, it has been treated as a mosaic.

The most common wetland was Open Tall Sedges with a canopy cover of 10-30% and a height of 0.5-2m. The dominant species was Juncus pallidus.

Less common was an association of Low Heath C with a canopy cover of 30-70% and a height of 0.5-1m. The dominant species was Astartea fascicularis. Mixed with this species were Open Tall Sedges with a canopy cover of 10-30% and a height of 0.5-1m. The dominant species was Juncus pallidus. Below this stratum was Low Grasses and Open Herbs to 0.2m tall with a 10-30% canopy cover. No species dominated.

The remainder of the area was pasture except where indicated on the map. There were scattered Melaleuca preissiana throughout the area.

Condition:

The wetlands are within cleared paddocks which have been heavily grazed. The wetlands have also been heavily grazed which has resulted in a low native plant species diversity and extensive intrusion by pasture species.

WETLAND: Lot 3 B.

Location: North of Lot 3.

Description by Murray (1989): Outside study area.

Vegetation Description:

The upper stratum of this wetland was woodland to 20m tall with 10-30% canopy cover. The dominant species was Melaleuca rhaphiophylla. Below this stratum were patches of Dense Heath A and B with a canopy cover of 70-100% with a height of 1-2m covering approximately 20% of the area. The dominant species were Astartea fascicularis and Xanthorrhoea preissii. Below this stratum was low heath with a canopy cover of 30-70% to a height of 1m. No species dominated but Hypocalymma angustifolium and Pericalymma ellipticum were common. Below this stratum there were very open herbs to 0.3m with a canopy cover of 10-30%. No species dominated. Pasture species were present but did not dominate.

Condition:

The wetland was in a cleared paddock which had been heavily grazed. There were signs of grazing within the wetland but the condition was still good.

WETLAND: Lot 3 E. See Lot 1A B above.

WETLAND: Lot 11 B and C.

Location: North east corner of Lot 11.

Classification by Murray (1989): not classified.

Vegetation Description:

These two wetlands were made up of a single vegetation type of low heath and sedges. The dominant species were Astartea fascicularis and Juncus pallidus both to 1m tall, with 30-70% canopy cover. Ground cover was pasture species dominated by Paspalum to 0.1m tall with 30-70% canopy cover. On the fringes there were occasional Melaleuca preissiana and Kunzea ericifolia to 3m tall.

Condition:

The wetlands were in a cleared paddock which has been heavily grazed. The vegetation of these wetlands has also been heavily disturbed by grazing, resulting in a low native plant species diversity.

WETLAND: Lot 11 D.

Location: North west part of Lot 11.

Classification by Murray (1989): Dampland, Microscale, Ovoid (6.100).

Vegetation Description:

This wetland comprised a central depression with water over 15cm deep and an outer band of low heath. The low heath was dominated by Astartea fascicularis to 1m tall, with 30-70% canopy cover. Open low sedges were common around the fringe of the wetland, dominated by Juncus pallidus to 0.5m tall, with 10-30% canopy cover. Beyond these were scattered Melaleuca preissiana to 5m tall. Where the soil was not excessively wet pasture species were the dominant ground cover.

The water in the centre of this wetland was too deep to gain access on the 15 October. There appeared to be a species of Triglochin growing in the centre.

Condition:

The wetland is in a cleared paddock which has been heavily grazed. The vegetation of this wetland has also been heavily disturbed by grazing, resulting in a low native plant species diversity.

WETLAND: Lot 11 E.

Location: North east corner of Lot 11.

Classification by Murray (1989): not classified.

Vegetation Description:

This wetland had three distinct vegetation associations. Dense low grasses and herbs occurred on the saturated and wet soils, with an abrupt change to a dense thicket on the drier soils and patches of dense low heath and sedges on the narrow sections of the wetland. The dense low grasses and herbs were 0.1m tall with 70-100% canopy cover, and dominated by pasture species where water logging was not a problem. Cotula coronopifolia was common. Dominants of the dense thicket were Melaleuca preissiana, M. rhaphiophylla and Kunzea ericifolia to 4m tall, with 70-100% canopy cover. There were several emergent Melaleuca to 10m tall. Very open herbs and very open low grasses were present below these dominants, to 0.2m tall with 3-10% canopy cover, and with no dominant species. The patches of dense low heath and sedges were dominated by Astartea fascicularis, 1-2m tall, and Juncus pallidus to 1m tall, with a 70-100% canopy cover. Below this was pasture to 0.1m tall.

Condition:

This wetland is in a cleared paddock which has been heavily grazed. The low vegetation in the saturated and wet areas is completely disturbed. The dense low heath and sedges are also extensively disturbed. The dense thicket, due to its density, does not appear to have been grazed as much as other areas, resulting in a moderate native plant diversity.

WETLAND: Lot 11 G.

Location: South west of Lot 11.

Classification by Murray (1989): not classified.

Vegetation Description:

This wetland had three distinct bands of vegetation, apparently dependent on the water table depth. Low sedges dominated by Juncus pallidus to 0.5m tall with a canopy cover of 30-70%, were growing on saturated soil on the eastern half in the lowest band. To the west, in the centre of the wetland, there was a band of dense low heath dominated by Astartea fascicularis to 1m tall with 70-100% canopy cover, growing in water up to 10cm deep.

In both these bands the ground cover was dominated by pasture species to 0.1m tall with 70-100% canopy cover. The western third was a dense thicket dominated by Melaleuca preissiana, M. rhaphiophylla and Kunzea ericifolia to 4m tall with a 70-100% canopy cover. Below this was very open herbs to 0.2m tall with 2-10% canopy cover, with no species dominating.

Condition:

The wetland is in a cleared paddock which has been heavily grazed. The vegetation of this wetland has also been heavily disturbed by grazing, resulting in a low native plant species diversity and a high degree of weed and pasture species penetration.

WETLAND: Lot 11 H and Lot 12 E.

Location: Drain Reserves 34984 and 2498 between Lots 11 and 12.

Description by Murray (1989): Drain, Microscale, Sinuous (6.96).

Vegetation Description:

This wetland is the remnant native vegetation along two drain Reserves. The native vegetation remaining was not a continuous band but was in small sections interrupted by clearing. The upper stratum was mixed open low woodland to 4m tall with 2-10% canopy cover. The dominants of this stratum were Banksia littoralis, Melaleuca preissiana and Nuytsia floribunda. Below this was mixed thicket to 2.5m tall with 30-70% canopy cover. The dominant of this was Regelia ciliata, with occasional Kunzea ericifolia, Agonis linearis and Melaleuca thymoides. Below this was open dwarf scrub to 0.5m tall with 2-10% canopy cover. Hypocalymma angustifolium was the dominant species. Below this was pasture species to 0.3m tall with 10-30% canopy cover. Annual grasses dominated this lowest stratum.

Where the native vegetation had been removed, pasture and alien species dominated. These were up to 0.5m tall with 30-70% canopy cover.

Condition:

The wetland is in a narrow reserve with only sections of native vegetation intact. Although grazing has occurred, the diversity of shrub species is still moderate. Very few native herbs were observed, presumably due to grazing pressures.

WETLAND: Lot 11 I.

Location: Western edge of Lot 11.

Description by Murray (1989): not classified.

Vegetation Description:

The upper stratum was Low Forest of Eucalyptus rudis 5-8m tall and with 30-70% cover. The understorey was Dwarf Scrub of Astartea fascicularis with 10-30% cover and to 1m, and Open Tall Sedges of Juncus pallidus with 10-30% cover and to 1m tall. There was a ground stratum dominated by pasture species.

Condition:

The wetland is in a cleared paddock which has been heavily grazed. The vegetation of this wetland has also been heavily disturbed by grazing, resulting in a low native plant species diversity and a high degree of weed and pasture species penetration.

WETLAND: Lot 12 A and C.

Location: Central and south east of Lot 12.

Description by Murray (1989): Lot 12 C not classified. Lot 12 A Dampland, Mesoscale, Irregular (6.95).

Vegetation Description:

These wetlands were made up of a single vegetation type, of low heath and sedges to 1m tall with 30-70% canopy cover. The dominant species in this stratum were Astartea fascicularis and Juncus pallidus. This stratum also contained occasional emergents of Astartea fascicularis and Regelia ciliata to 2m tall. Below this was open dwarf scrub to 0.5m tall with 2-10% canopy cover. The dominant of this stratum was Hypocalymma angustifolium. Below this was herbs to 0.3m tall with 30-70% canopy cover, dominated by pasture and alien species including Ornithopus compressus and annual grasses.

Condition:

The wetlands are in a cleared paddock which has been heavily grazed. The vegetation of these wetlands has also been disturbed by grazing, resulting in a low native plant species diversity.

WETLAND: Lot 12 E. See Lot 11 H above.

WETLAND: Lot 12 F.

Location: West of Lot 12.

Description by Murray (1989): not classified.

Vegetation Description:

The upper stratum of this wetland was open low woodland to 6m tall with 2-10% canopy cover. Dominant species were Eucalyptus rudis and Melaleuca preissiana, with occasional Kunzea ericifolia. Below this was very open tall sedges to 1.5m tall with 2-10% canopy cover, dominated by Juncus pallidus. Below this was low heath to 1m tall with 30-70% canopy cover. The dominant of this stratum was Astartea fascicularis. Below this was a ground cover dominated by pasture and alien species to 0.3m tall with 30-70% canopy cover. Common species in this stratum were clover, annual grasses and Ornithopus compressus.

Condition:

The wetland is in a cleared paddock which has been heavily grazed. The vegetation of this wetland has also been disturbed by grazing, resulting in a low native plant species diversity.

WETLANDS: Lot 77 B, C and F.

Location: Central north, north-east and south-east of Lot 77.

Description by Murray (1989):
Lot 77 B: Sumpland, Microscale, Round (6.75).
Lot 77 C: Dampland, Microscale, Irregular (6.76).
Lot 77 F: Dampland, Microscale, Irregular (6.74).

Vegetation Description:

These wetlands were made up of a single vegetation type. The upper stratum was Dense Thicket with a canopy cover of 70-100% and 2-4m tall. The dominant species was Kunzea ericifolia. Below this stratum was Open Low to Dwarf Scrub with a canopy cover of 2-10% and 0.5-1.5m tall. No species dominated. Below this stratum was Very Open Herbs with a canopy cover of 2-10% to 0.3m tall. No species dominated.

Condition:

These wetlands were partially surrounded by cleared paddocks which had been grazed. These wetlands were in good condition with only moderate weed and pasture species invasion.

WETLAND: Lot 77 D.

Location: Central west to south west corner, Lot 77.

Description by Murray (1989): Sumpland, Microscale, Round (6.86).

Vegetation Description:

This wetland was made up of a single vegetation type. The upper stratum comprised Open Low Woodland B with a canopy cover of 2-10% to 5m tall. The dominant species was Melaleuca preissiana. Below this stratum were frequent patches of Tall Sedges with a canopy cover of 30-70% to 1.5m tall. The dominant species were Juncus pallidus and an unnamed Leptocarpus. Below this were Open Herbs with a canopy cover of 10-30% to 0.3m tall. No species dominated.

Condition:

The condition of this wetland was good with a moderately high native species diversity. There had been some clearing of access tracks and the construction of a dam. Very few pasture or weed species were encountered except along the access tracks.

WETLAND: Lot 77 E. Yangedi Swamp. See also 80 G below.

Location: Central western boundary of Lot 77.

Description by Murray (1989): Lake Microscale, Round (6.85).

Vegetation Description:

This wetland was made up of two vegetation types - Scrub in the semi- permanent water and Woodland on the perimeter. The Scrub had a canopy cover of 10-30% to 2-4m tall. The dominant species was Melaleuca rhaphiophylla. The water was too deep to see if any ground cover species were present.

The surrounding vegetation was a mosaic of Low to Open Low Woodland A with a canopy cover of 2-10% and some patches to 30% with a height of 15m. The dominant species were Eucalyptus rudis to 15m and Melaleuca rhaphiophylla to 10m tall. Below this stratum were patches of Dense Thicket with a canopy cover of 70-100% to 1.5m tall. The dominant species was Astartea fascicularis. Below this stratum was Open Herbs and Open Grasses with a canopy cover of 10-30% to 0.3m tall. Pasture and weed species were common, in some places dominating.

Condition:

The surrounding area of the wetland was cleared pasture that had been heavily grazed. Most of the wetland and perimeter were in good condition with minimal weed or pasture invasion, however there were several sections of perimeter that were cleared pasture.

WETLAND: Lot 80 G. Yangedi Swamp. See also 77 E above.

Location: Central east boundary of Lot 80.

Description by Murray (1989): Lake, Microscale, Round (6.85).

Vegetation Description:

This wetland comprised two vegetation types, Dense Low Forest A in the centre with Tall Sedges and Herbs surrounding. The Dense Low Forest had a canopy cover of 70-100% and was up to 5m tall. The only species present was Melaleuca rhaphiophylla. Below this stratum was Very Open Herbs with a canopy cover of 2-10% to 0.1m tall. No species dominated.

The surrounding vegetation was a mosaic of Tall Sedges with a canopy cover of 30-70% to 1m tall. The dominant species was Juncus pallidus. The other component was Herbs with a canopy cover of 30-70% to 0.2m tall. The dominant species was Cotula coronopifolia with considerable invasion by pasture species.

Condition:

The wetland was in a cleared paddock which had been heavily grazed. The vegetation of this wetland had been heavily grazed resulting in a low native plant species diversity.

WETLAND: Lot 80 I.

Location: Central south boundary of Lot 80.

Description by Murray (1989): Not classified.

Vegetation Description:

This wetland was made up of a single vegetation type. The upper stratum was emergent Open Low Woodland A with a canopy cover of 2-10% to 10m tall. Below this stratum was Tall Sedges with a canopy cover 30-70% to 0.7m tall. The dominant species were Juncus pallidus in the wetter areas and Lepidosperma longitudinale on the less wet areas. Below this stratum were Very Open Herbs and Very Open Grass with a canopy cover of 2-10% to 0.2m tall. Pasture species dominated.

Condition:

The wetland was in a cleared paddock which had been heavily grazed. The vegetation of this wetland had been heavily grazed resulting in a low native plant species diversity.

WETLAND: Lot 82 A.

Location: Western portion of Lot 82.

Description by Murray (1989): Outside study area.

Vegetation Description:

This wetland was made up of a mosaic of occasional Low Woodland amongst the dominant Low Heath. Where present, the Low Woodland A and B had a canopy cover of 10-30%, 4-8m tall. The dominant species was Melaleuca preissiana.

The other component of the vegetation, which was always present, was Low Heath with a canopy cover of 30-70% to 1m tall. The dominant species varied from area to area and included Astartea fascicularis, Leptocarpus sp. (unnamed) and Pericalymma ellipticum. Below this was Open Herbs and Open Low Grass with a canopy cover of 10-30% to 0.3m tall. No species dominated.

Condition:

The surrounding area of the wetland was cleared pasture that had been moderately grazed. Some remnant native shrubs still survived. Most of this wetland was in reasonable to good condition with occasional areas badly degraded by grazing. Native species diversity was moderately high.

WETLAND: Lot 82 F.

Location: Central eastern portion of Lot 82.

Description by Murray (1989): Outside study area.

Vegetation Description:

This wetland had two distinct vegetation associations. The drier outer fringe was Low Heath and Tall Sedges with a canopy cover of 30-70% to 1m tall. The dominant species were Astartea fascicularis and Juncus pallidus. Below this stratum was Open Herbs and Open Low Grass with a canopy cover of 10-30% to 0.2m tall. No species dominated.

The damper central area comprised Low Woodland B with a canopy cover of 10-30%. The dominant species was Melaleuca preissiana to 6m with occasional emergents to 10m. Below this stratum was Scrub with a canopy cover of 10-30% to 3m tall. The dominant species were Kunzea ericifolia and Pericalymma ellipticum. Below this stratum was Open Herbs and Open Low Grasses with a canopy cover of 10-30% to 0.1m tall. No species dominated.

Condition:

The surrounding area of the wetland was cleared pasture that had been moderately grazed. Some remnant native shrubs still survived. Most of this wetland was in reasonable to good condition with occasional areas badly degraded by grazing. Native species diversity was moderately high.

WETLAND: Lot 82 H.

Location: South eastern part of Lot 82.

Description by Murray (1989): Outside of the study area.

Vegetation Description:

There were two components to this wetland, the more common being Low Heath with a canopy cover of 30-70% to 1m tall. The dominant species of this stratum was Astartea fascicularis. Below this stratum was Very Open Herbs with a canopy cover of 2-10% to 0.2m tall. No species dominated.

The other component was Open Low Woodland B with a canopy cover of 2-10% and 3-5m tall, which occurred on the wetter soils. The dominant species was Melaleuca preissiana. Below this stratum was Thicket 1-3m tall with 30-70% canopy cover. The dominant species of this stratum was Kunzea ericifolia. Below this was Open Dwarf Scrub D with 2-10% canopy cover to 0.5m tall. No species dominated. Below this stratum was Open Herbs with a canopy cover of 10-30% to 0.1m tall. No species dominated.

Condition:

Parts of this wetland were adjacent to a cleared paddock which had been heavily grazed resulting in degradation of the wetland. The parts away from this heavy grazing were in good condition. Overall, the native species diversity was moderate.

WETLAND: Lot 83 B.

Location: South-west corner to central Lot 83.

Classification by Murray (1989): Outside study area.

Vegetation Description:

This wetland was made up of emergent Open Low Woodland with a canopy cover of 2-10% to 3m tall. The only species was Melaleuca rhaphiophylla. Below this stratum was Low Heath C and D with a canopy cover of 30-70% to 0.5-1m tall. Dominant species were Astartea fascicularis and Regelia ciliata. Below this stratum were open herbs with a canopy cover of 10-30% to 0.3m tall. No species dominated.

Condition:

The wetland was in a partially cleared paddock which had been extensively grazed. Due to the extensive area and density of the wetland, the body of the wetland was in good condition with the margins degraded. A drainage line had been cleared through the centre of this wetland.

WETLAND: Lot 83 E.

Location: Central east boundary of Lot 83.

Description by Murray (1989): Outside study area.

Vegetation Description:

This wetland was made up of a single vegetation type, Low Forest A with a canopy cover of 30-70% to 10m tall. The dominant species were equally Eucalyptus rudis and Melaleuca preissiana. Below this stratum was Open Tall Sedges with a canopy cover of 10-30% to 1m tall. The dominant species was Juncus microcephalus. Below this stratum were very open herbs with a canopy cover of 2-10% to 0.2m tall. No species dominated.

Condition:

The wetland is in a cleared paddock which had been heavily grazed. The vegetation of this wetland had been moderately grazed and trampled, resulting in a low native plant species diversity.

WETLAND: Lot 83 F.

Location: Southern boundary of Lot 83.

Description by Murray (1989): Outside study area.

Vegetation Description:

This wetland comprised a central depression with water over 15cm deep and an outer band of Low Woodland to 2-5m in height with a canopy cover of 10-30%. The dominant species were Melaleuca rhaphiophylla and Melaleuca preissiana. Below this stratum there was occasional clumps of low sedges with a canopy cover of 30-70% covering 5% of the area. The only species present in this stratum was Juncus pallidus. The ground cover comprised open herbs with a canopy cover to 0.1m tall. The dominant species was Cotula coronopifolia with many pasture species present.

Condition:

The wetland was in a cleared paddock which had been moderately grazed. The vegetation of the wetland had been moderately grazed resulting in a low native plant species diversity.

The wetland appeared to have been deepened by bulldozing a channel through the centre.

WETLANDS: Lot 156 A, B and C.

Location: North, south west and south east of Lot 156.

Description by Murray (1989):
Lot 156 A: Dampland, Microscale, Elongate (5.114).
Lot 156 B: Dampland, Microscale, Elongate (5.116).
Lot 156 C: Dampland, Mesoscale, Elongate (5.107).

Vegetation Description:

These wetlands were made up of a single vegetation type. The upper stratum comprised patches of Low Woodland B with a canopy cover of 10-30% to 5m tall. The trees occurred in groups, mainly on the edges. The only species present was Melaleuca preissiana. Below this stratum was Low Scrub with a canopy cover of 10-30% and 1-2m tall. Again there was only one species present, Astartea fascicularis. Below this stratum were Open Tall Sedges with a canopy cover of 10 to 30% to 1m tall. The only species was Juncus pallidus. Below this was Open Herbs and Open Low Grass with a canopy cover of 10-30% to 0.1m to tall. This stratum was dominated by pasture species.

Condition:

The wetland was in a cleared paddock which had been heavily grazed. The vegetation of this wetland had been heavily grazed resulting in a low native plant species diversity.

WETLAND: Lot 161 A and Lot 393 A.

Location: South east corner of Lot 161 extending down the eastern side of Lot 393.

Description by Murray (1989): Dampland, Microscale, Linear (5.108).

Vegetation Description:

Access to Lot 161 had not been granted from the property owners. This wetland was made up of a single vegetation type. The upper stratum comprised Low Woodland A with a canopy cover of 10-30% to 6-10m tall with occasional emergents to 15m. The only species present in this stratum was Melaleuca preissiana. Below this were patches of Open Tall Sedges covering 30% of the area with a canopy cover of 10-30% to 1m tall. The dominant species was Juncus pallidus. Below this stratum was open herbs and open low grass with a canopy cover of 10-30% to 0.2m tall. This stratum was dominated by pasture species.

Condition:

The wetland was in a cleared paddock which had been heavily grazed. The vegetation of this wetland had been heavily grazed resulting in a low native plant species diversity.

WETLAND: Lot 163 A and Lot 397 A.

Location: South west edge of Lot 163 extending into the north west of Lot 397.

Description by Murray (1989): Dampland, Microscale and Irregular (5.110)

Vegetation Description:

This wetland was made up of two distinct vegetation associations. There is a low woodland on wet soils on the fringe and a low heath on the wetter areas in the centre. The upper stratum of the low woodland was entirely Eucalyptus rudis to 10m tall in a belt 10-20m wide with 10-30% canopy cover. Below this was open low sedges to 1.0m tall with 10-30% canopy cover and dominated by occasional clumps of Juncus pallidus. Ground cover was dominated by pasture to 0.2m tall, with 30-70% canopy cover.

The association of low heath 1-1.5m tall, with 30-70% canopy cover, was dominated by Astartea fascicularis. Ground cover was dominated by Paspalum and clover to 0.2m, with 30-70% canopy cover.

Condition:

The wetland is in a cleared paddock which has been heavily grazed. The vegetation of this wetland has also been heavily disturbed by grazing, resulting in a low native plant species diversity.

WETLAND: Lot 163 B and Lot 397 B.

Location: South east of Lot 163 and extending into the north east of Lot 397.

Description by Murray (1989): Sumpland, Microscale and Ovoid (5.106)

Vegetation Description:

This wetland was made up of two vegetation associations. On the drier fringes there was a heath, and in the central saturated area there was a low woodland. The heath was dominated by Astartea fascicularis 1-2m tall with 30-70% canopy cover. Below this was tall sedges to 1m tall, with 30-70% canopy cover. The dominant of this stratum was Juncus pallidus. On the fringes of the wetland this became the dominant stratum. Below this was low grass and open herbs to 0.2m tall with 30-70% canopy cover. The dominant species was Paspalum and other pasture plants.

The low woodland area had an upper storey dominated by Melaleuca preissiana 3-8m tall with 10-30% canopy cover. Below this was open tall sedges to 1m tall, with 10-30% canopy cover, dominated by Juncus pallidus. Due to the high water level in this area (greater than 20cm deep) the ground stratum could not be assessed.

Condition:

The wetland is in a cleared paddock which has been heavily grazed. The vegetation of this wetland has also been disturbed by grazing, resulting in a low native plant species diversity.

WETLAND: Lot 164 B and Lot 401 A.

Location: South and east of Lot 164 (Reserve 25911, Serpentine Airstrip), extending across the road to the north west corner of Lot 401.

Classification by Murray (1989) of part: Dampland, Microscale and Irregular (5.109).

Vegetation Description:

This wetland had two distinct vegetation types, but without distinct boundaries. The saturated and wet areas had low heath and sedges, and the drier areas were dominated by low forest and thicket. The low heath and sedges were dominated by Juncus pallidus and Lepidosperma longitudinale to 0.5m tall with 30-70% canopy cover. Below this was mixed open herbs to 0.2m tall, with 10-30% canopy cover, with no dominant species. The transition zone was dominated by Astartea fascicularis to 1m tall with 10-30% canopy cover.

The low forest and thicket was dominated by Melaleuca preissiana to 6m tall with 30-70% canopy cover, with occasional emergents to 12m tall. Below this was a thicket to 3m with a 30-70% canopy cover, dominated by Kunzea ericifolia. Below this was mixed dwarf scrub and open herbs to 0.5m tall, with a canopy cover of 10-30%, with no species dominating.

Condition:

This wetland is in fair condition with only a moderate amount of weed invasion around the edges and fire breaks. However it is bisected by Yangedi Road which has alienated a small section to the east of the main wetland. A small soak approximately 15m square has been dug in the wetland to provide a water source, and this detracts from the naturalness of the wetland.

WETLAND: Lot 165 A.

Location: Centre north of Lot 165.

Description by Murray (1989): Lake, Microscale and Irregular (5.111).

Vegetation Description:

This artificial wetland was constructed to provide water for an avocado plantation on the property. The original vegetation was low heath but this was totally removed. The original vegetation was seen on old aerial photo provided by the owner.

This property has a number of other artificial wetlands, none of significant size.

WETLANDS: Lot 387 A, Lot 806 C and D.

Locations: South western corner of Lot 387 and extending into the south eastern corner of Lot 806, south of Lot 806.

Description by Murray (1989): Not classified.

Vegetation Description:

Both these wetlands were made up of a single vegetation type. The upper stratum comprised emergent Open Low Woodland A with a canopy cover of 2-10% to 10m tall. The only species present was Eucalyptus rudis. Below this stratum was Open Low Woodland B with a canopy cover of 30-70% to 2m tall. The dominant species was Kunzea recurva. Below this stratum were very open herbs with a canopy cover of 2-10% to 0.3m tall. No species dominated.

Condition:

These wetlands are in a cleared paddock which had been heavily grazed. The vegetation of the wetlands had been moderately grazed and trampled, resulting in a low native plant species diversity.

WETLAND: Lot 388 A.

Location: South western part of Lot 388.

Description by Murray (1989): Not classified.

Vegetation Description:

This wetland was made up of a single vegetation type. The upper stratum was Low Woodland A with a canopy cover of 10-30% and 5-10m tall. The only species present were Eucalyptus rudis and patches of Melaleuca preissiana. Below this stratum was Mixed Tall Grass, Herbs and Tall Sedges to 1m tall. No species dominated but pasture species were most common.

Condition:

The wetland was in a cleared paddock which had been heavily grazed. The vegetation of this wetland had been heavily grazed resulting in a low native plant species diversity.

WETLAND: Lot 389 A.

Location: Eastern part of Lot 389.

Description by Murray (1989): Not classified.

Vegetation Description:

The upper stratum was patches of Open Low Woodland B with a canopy cover of 2-10% and 4-6m tall. The dominant species was Melaleuca preissiana. Below this was either Tall Sedges or Low Heath with a canopy cover of 30-70% to 1.5m tall. The dominant species were Juncus pallidus and Astartea fascicularis, respectively. Below this was Low Grass to 0.3m tall, with 30-70% canopy cover. Pasture species dominated this stratum, including annual grasses and Paspalum.

Condition:

The wetland was in a cleared paddock which had been heavily grazed. The vegetation of this wetland had also been disturbed by grazing, resulting in a low native plant species diversity.

WETLAND: Lot 389 B.

Location: Centre of Lot 389.

Description by Murray (1989): Not classified.

Vegetation Description:

The upper stratum was Open Low Woodland B with a canopy cover of 2-10% and 2-5m tall. The dominant species was Melaleuca preissiana. Below this was either Tall Sedges or Low Heath with a canopy cover of 30-70% to 1.5m tall. The dominant species were Juncus pallidus and Astartea fascicularis, respectively. Below this was Low Grass to 0.5m tall with 30-70% canopy cover. Pasture species dominated this stratum, including annual grasses and Paspalum.

Condition:

The wetland was in a cleared paddock which had been heavily grazed. The vegetation of this wetland had also been disturbed by grazing, resulting in a low native plant species diversity.

WETLAND: Lot 392 A.

Location: North of Lot 392.

Description by Murray (1989): Not classified.

Vegetation Description:

This wetland comprised emergent Open Low Woodland B with a canopy cover of 2-10%, 2-3m tall. The only species present was Melaleuca preissiana. Below this stratum was a mosaic of Dense Low Heath and Dense Tall Sedges both with a canopy cover of 70-100% to 1m tall. The dominant species were Astartea fascicularis and Juncus pallidus, respectively. Below this stratum was Mixed Open Herbs and Open Low Grass both with a canopy cover of 10-30% to 0.1m tall. The dominants were pasture and alien species.

Condition:

The wetland was in a cleared paddock which had been heavily grazed. The vegetation of this wetland had been heavily grazed resulting in a low native plant species diversity.

WETLAND: Lot 392 C.

Location: North-west part of Lot 392.

Description by Murray (1989): Not classified.

Vegetation Description:

The upper stratum was Thicket consisting only of *Kunzea ericifolia* 2-4m tall and with 30-70% cover. This was over a ground stratum of alien and pasture species.

Condition:

The wetland was in a cleared paddock which had been heavily grazed. The vegetation of this wetland had been heavily grazed resulting in a low native plant species diversity.

WETLAND: Lot 393 A. See Lot 161 A above.

WETLAND: Lot 394 A and Lot 395 A.

Location: East side of Lot 394, extending into the east of Lot 395.

Description by Murray (1989): Enhancement.

Vegetation Description:

This wetland is a series of isolated remnant small stands. The most common association was open sedges to 1m tall, with 10-30% canopy cover and patches to 30-70%. The dominant species was Lepidosperma longitudinale. Below this there were mixed herbs and low grass to 0.2m with 30-70% canopy cover, dominated by pasture species.

An association of low heath and heath was common on slightly raised drier areas. The dominant upper storey was a mixture of Regelia ciliata and Astartea fascicularis to 0.5-1.5m tall with 30-70% canopy cover. Below this there was open tall sedges to 1m tall with 10 30% canopy cover. The dominants of this stratum were Juncus pallidus and Lepidosperma longitudinale. Below this was mixed open herbs and open low grass to 0.2m tall with 10-30% canopy cover. The dominants of this stratum were pasture species.

Isolated and small groves of Melaleuca preissiana and Eucalyptus rudis 6-10m tall were scattered throughout the wetland. On Lot 395 most of the timber had recently been felled and placed in windrows, presumably in preparation for burning.

Condition:

The wetland is in a cleared paddock which has been heavily grazed. The vegetation of this wetland has also been disturbed by grazing, resulting in a low native plant species diversity. However, there were several small areas of wetland with higher native plant diversity. These species included Drosera gigantea, D. stolonifera and Utricularia multifida.

WETLAND: 396 A. See 394 A and 395 A above, but access has not been agreed to this property.

WETLAND: Lot 399 B.

Location: Northern part of Lot 399, and small areas on the south..

Description by Murray (1989): Not classified.

Vegetation Description:

This wetland comprised emergent Open Low Woodland with a canopy cover of 2-10% to 3m tall. The dominant species was Melaleuca preissiana. Below this was a mosaic of two vegetation types, Low Heath C and D and Tall Sedges both with a canopy cover of 30-70% to 1m tall. The dominant species were Pericalymma ellipticum and Schoenus benthamii, respectively. Below both these strata there was Open Herbs with a canopy cover of 10-30% to 0.3m tall. No species dominated.

Condition:

The wetland in Lot 399 was in good condition, being fenced off from any grazing. Native species diversity was high with no alien species present.

WETLAND: Lot 400 B.

Location: Centre and south of Lot 400.

Classification by Murray 1989: Dampland, Mesoscale and Irregular (5.104).

Access to this property has not been gained from the land owner.

WETLAND: Lot 401 A. See Lot 164 B above.

WETLAND: Lot 401 B.

Location: North western part of Lot 401.

Description by Murray (1989): Sumpland/Dampland, Mesoscale, Irregular (5.105).

Vegetation Description:

The upper stratum was a mosaic of Low Forest A and Low Heath both with a canopy cover of 30-70% and heights of to 10m and to 1.5m respectively. Below the Low Forest, which was dominated by Eucalyptus rudis, was Scrub with a canopy cover of 10-30% to 3m tall. The dominant species was Kunzea ericifolia. Below this stratum was Dwarf Scrub with a canopy cover of 2-10% to 1m tall. The dominant species were Regelia ciliata and Astartea fascicularis. Below this was low grass to 0.5m tall, with 30-70% canopy cover. Pasture species dominated this stratum, including annual grasses and Paspalum.

The other component of the mosaic had a lower stratum of mixed Herbs with a canopy cover of 30-70% to 0.3m tall. No species dominated.

Condition:

The Low Forest part of this wetland was in a cleared paddock which had been heavily grazed. The vegetation of this wetland had also been disturbed by grazing, resulting in a low native plant species diversity. However, the Low Heath part was in good condition with minimum disturbance.

WETLAND: Lot 401 C.

Location: South western corner of Lot 401.

Description by Murray (1989): Not classified.

Vegetation Description:

The upper stratum was a mosaic of Low Forest A and Thicket both with a canopy cover of 30-70% and heights of to 10m and 2-4m respectively. The dominant species were Eucalyptus rudis and Kunzea ericifolia, respectively. Below this stratum was Open Dwarf Scrub with a canopy cover of 2-10% to 1m tall. The dominant species were Regelia ciliata and Astartea fascicularis. Below this was low grass to 0.5m tall, with 30-70% canopy cover. Pasture species dominated this stratum, including annual grasses and Paspalum.

Condition:

The wetland was in a cleared paddock which had been heavily grazed. The vegetation of this wetland had also been disturbed by grazing, resulting in a low native plant species diversity.

WETLAND: Lot 806 B.

Location: Central northern part of Lot 806, and extending north outside study area.

Description by Murray (1989): Not classified.

Vegetation Description:

This wetland was made up of a single vegetation type. The upper stratum was Low Woodland A with a canopy cover of 10-30% and 5-10m tall. The only species present were Eucalyptus rudis and patches of Melaleuca preissiana. Below this stratum was Mixed Tall Grass, Herbs and Tall Sedges to 1m tall. No species dominated but pasture species were most common.

Condition:

The wetland was in a cleared paddock which had been heavily grazed. The vegetation of this wetland had been heavily grazed resulting in a low native plant species diversity.

WETLAND: Lot 806 C and D. See Lot 387 A above.

WETLAND: Lot 810 A.

Location: North west corner of Lot 810.

Description by Murray (1989): Dampland, Mesoscale and Elongate (5.102).

Vegetation Description:

This wetland was made up of two vegetation associations. On the drier fringes there was a low or dwarf scrub and in the central saturated area there was a low forest. The upper stratum of the low or dwarf scrub was dominated by Astartea fascicularis and Kunzea ericifolia, 0.5-2m tall, with 10-30% canopy cover. The stratum below this was open tall sedges which graded from 1m on the outer edges of the wetland to 1-2m tall on the damper areas with 10-30% canopy cover. The dominant species were Juncus pallidus and Lepidosperma longitudinale. Below this was a ground cover dominated by pasture species to 0.2m tall 10-30% canopy cover. The pasture included clover and Paspalum.

The low forest association was dominated by a mixture of Melaleuca preissiana, M. rhaphiophylla and Kunzea ericifolia 3-6m tall with 30-70% canopy cover. Below this was open herbs to 0.3m tall with 10-30% canopy cover, with no species dominating.

Condition:

The wetland is in a cleared paddock which has been heavily grazed. The vegetation of this wetland has also been disturbed by grazing, resulting in a low native plant species diversity.

WETLAND: Lot 810 B.

Location: Central west of Lot 810.

Description by Murray (1989): Not classified.

Vegetation Description:

The upper stratum was Low Heath D with a canopy cover of 30-70% to 0.5m tall. The dominant species was Astartea fascicularis. Below this stratum was Low Grasses to 0.1m tall, with 30-70% canopy cover. Pasture species dominated this stratum.

Condition:

The wetland was in a cleared paddock which had been heavily grazed. The vegetation of this wetland had been disturbed by grazing and slashing, resulting in a low native plant species diversity.

WETLAND: Lot 810 C.

Location: Central west of Lot 810.

Description by Murray (1989): Not classified.

Vegetation Description:

The upper stratum was Low Forest B with a canopy cover of 30-70% to 4m tall. The only species present was Melaleuca rhaphiophylla. Below this was Herbs and Low Grasses with a canopy cover of 30-70% to 0.1m tall. Pasture species dominated this stratum, including annual grasses and Paspalum.

Condition:

This wetland was in a cleared paddock which had been heavily grazed. The vegetation of this wetland had also been disturbed by grazing, resulting in a low native plant species diversity.

WETLAND: Lot 810 D.

Location: Central east of Lot 810.

Description by Murray (1989): Not classified.

Vegetation Description:

The upper stratum was Low Forest with a canopy cover of 30-70% and 4-8m tall. Dominant species were Melaleuca rhaphiophylla and Melaleuca preissiana. Below this stratum was Low Scrub with a canopy cover of 10-30% to 2.5m tall. The dominant species was Astartea fascicularis. Below this was Herbs and Low Grasses with a canopy cover of 30-70% to 0.1m tall. Pasture species dominated this stratum, including annual grasses and Paspalum.

Condition:

This wetland was in a cleared paddock which had been heavily grazed. The vegetation of this wetland had also been disturbed by grazing, resulting in a low native plant species diversity.

APPENDIX 2. ALPHABETICAL LIST OF THE PLANT SPECIES IDENTIFIED IN THE WETLANDS OF THE STUDY AREA.

Introduced species are marked with an asterisk. Nomenclature follows Green (1985 and supplements) and Marchant et al. (1987).

Acacia pulchella	Western Prickly Moses
Adenanthos meisneri	
Adenanthos obovatus	
Agonis linearifolia	
Alternanthera nodiflora	
Anigozanthos manglesii	Kangaroo Paw
Anigozanthos viridis	
*Arctotheca calendula	Cape Weed
Astartea fascicularis	
Banksia littoralis	Swamp Banksia
Boronia crenulata	
*Briza maxima	Blow-fly Grass
*Briza minor	
Burchardia umbellata	
Caladenia flava	Cowslip Orchid
Calothamnus hirsutus	
Calothamnus lateralis	
*Carpobrotus edulis	Pig-face
Chamaescilla corymbosa	
Conospermum ?capitatum	
Cotula coronopifolia	
Dampiera linearis	
Dasypogon bromeliifolius	
Dillwynia dillwynioides	
Drosera gigantea	
Drosera glanduligera	
Drosera menziesii	
Drosera stolonifera	
*Ehrharta sp.	Veldt Grass
Eriostemon spicatus	
Eryngium rostratum	
Eucalyptus calophylla	Marri
Eucalyptus marginata	Jarrah
Eucalyptus rudis	Flooded Gum
Euchilopsis linearis	
Evandra pauciflora	
Gompholobium tomentosum	
Goodenia filiformis	
Grevillea densifolia	
*Homeria miniata	Cape tulip
Hovea trisperma	
Hypocalymma angustifolium	
*Hypochaeris glabra	
Jacksonia furcellata	Stinkwood
Johnsonia pubescens	

Juncus pallidus	
*Juncus microcephalus	
Kennedia prostrata	
Kunzea ericifolia	
Kunzea recurva	
Lepidosperma longitudinale	Sword-grass
Leptocarpus sp. (un-named)	
Lobelia alata	
Lomandra maritima	
*Medicago sp.	Medics
Melaleuca incana	
Melaleuca lateriflora	
Melaleuca lateritia	
Melaleuca preissiana	Paperbark
Melaleuca rhaphiophylla	Paperbark
Melaleuca teretifolia	
Melaleuca thymoides	
Melaleuca viminea	
Melaleuca uncinata	Broom-bush
Microtis atrata	
Microtis unifolia	
*Monadenia bracteata	
*Monopsis simplex	
Nuytsia floribunda	Christmas Tree
Opercularia echinocephala	
*Ornithopus compressus	Yellow Serradella
*Paspalum sp.	Paspalum
Patersonia occidentalis	Purple Flag
*Pelargonium capitatum	
*Pennisetum clandestinum	
Pericalymma ellipticum	
Philydrella pygmaea	
Pimelea imbricata	
Podotheca gnaphalioides	
Pterostylis nana	Dwarf Greenhood
Pterostylis vittata	Banded Greenhood
Ranunculus muricatus	
Regelia ciliata	
*Romulea rosea	Guildford Grass
*Rumex sp.	
*Solanum nigrum	
Sowerbaea laxiflora	
Schoenus benthamii	
Stirlingia latifolia	Blue-boy
Stylidium brunonianum	
Stylidium dichotomum	
Stylidium divaricatum	
Stylidium guttatum	
Stylidium junceum	

Thelymitra canaliculata	
Thelymitra flexuosa	
Tricoryne elatior	
*Trifolium sp.	Clover
Triglochin procera	
*Ursinia anthemoides	
Utricularia inaequalis	
Utricularia multifida	
Utricularia violacea	
Verticordia ?drummondii	
Villarsia ?albiflora	
*Watsonia sp.	Watsonia
Xanthorrhoea preissii	Blackboy
*Zantedeschia aethiopica	Arum Lilly

APPENDIX 3. OCCURRENCE OF EACH PLANT SPECIES IN EACH WETLAND.

The wetlands are identified by the Lot number and a letter code within the lots. The locations are given in Map 1.

WETLANDS

SPECIES	LOT NUMBER / WETLAND	156 A	156 B	156 C	163 A	163 B	164 B	165 A	387 A	388 A	389 A	389 B	392 A	392 C	393 A	394 A	395 A	397 A	397 B	399 B	401 A	401 B	401 C	806 B	806 C	806 D	810 A	810 B	810 C	810 D	
Acacia pulchella								x																							17
Adenanthos meisneri																															1
Adenanthos obovatus																				x											1
Agonis linearifolia																															7
Alternanthera nodiflora																															4
Anigozanthos manglesii								x																							1
Anigozanthos viridis								x								x	x														4
*Arctotheca calendula		x	x	x	x	x				x					x	x	x	x	x								x				26
Astartea fascicularis		x	x	x	x	x	x				x	x	x			x	x	x	x		x	x	x	x			x	x	x	x	42
Banksia littoralis																															2
Boronia crenulata																															3
*Briza maxima		x	x	x	x		x	x	x	x					x	x	x	x			x	x	x		x	x	x	x		x	38
*Briza minor							x	x	x							x	x				x				x	x	x			x	23
Burchardia umbellata																															4
Caladenia flava																															2
Calothamnus hirsutus																															1
Calothamnus lateralis							x														x										7
*Carpobrotus edulis							x	x													x										4
Chamaescilla corymbosa																															3
Conospermum ?capitatum																				x											1
Cotula coronopifolia					x	x	x									x	x	x	x		x	x	x				x		x	x	34
Dampiera linearis							x	x												x	x	x									7
Dasypogon bromeliifolius																x	x			x		x									7
Dillwynia dillwynioides								x														x									3
Drosera gigantea							x									x	x				x										9
Drosera glanduligera					x													x				x									9
Drosera menziesii																															1
Drosera stolonifera																x	x														8
*Ehrharta sp.		x	x	x				x	x	x					x							x	x	x	x	x					16
Eriostemon spicatus																				x											4
Eryngium rostratum																x	x														3
Eucalyptus calophylla																x	x					x									6
Eucalyptus marginata																x	x														3
Eucalyptus rudis					x				x	x						x	x	x				x	x		x	x					22
Euchilopsis linearis																				x		x									4
Evandra pauciflora								x														x									3
Gompholobium tomentosum																															1

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WETLANDS

SPECIES	LOT NUMBER / WETLAND	156 A	156 B	156 C	163 A	163 B	164 B	165 A	387 A	388 A	389 A	389 B	392 A	392 C	393 A	394 A	395 A	397 A	397 B	399 B	401 A	401 B	401 C	806 B	806 C	806 D	810 A	810 B	810 C	810 D	
Goodenia filiformis								x														x	x						x	x	7
Grevillia densifolia																															1
*Homeria miniata																x	x														2
Hovea trisperma																				x											1
Hypocalymma angustifolium				x		x	x									x	x	x			x	x	x				x				26
*Hypochaeris glabra	x	x	x			x	x		x	x	x	x		x							x	x	x	x				x	x	x	34
Jacksonia furcellata							x													x											5
Jacksonia sericea																															2
Johnsonia pubescens																				x											1
*Juncus microcephlus																															2
Juncus pallidus	x	x	x	x	x	x	x			x		x		x	x	x	x	x			x	x	x	x			x	x			47
Kennedia prostrata															x	x															3
Kunzea ericifolia					x	x	x	x			x		x		x	x		x			x	x	x		x	x	x				35
Kunzea recurva																				x											1
Lepidosperma longitudinale						x									x	x					x	x	x				x				14
Leptocarpus sp. (un-named)																															2
Lobelia alata					x					x								x			x									x	11
Lomandra maritima							x																								1
*Medicago sp.								x	x					x											x	x					6
Melaleuca incana																															2
Melaleuca lateriflora																															1
Melaleuca lateritia																							x								10
Melaleuca preissiana	x	x	x		x	x		x	x	x				x	x	x		x	x	x		x	x	x	x	x	x				39
Melaleuca rhaphiophylla																					x	x					x		x	x	19
Melaleuca teretifolia																															1
Melaleuca thymoides																				x											2
Melaleuca viminea																															1
Melaleuca uncinata																							x								2
Microtis atrata				x	x	x												x	x		x						x				12
Microtis unifolia													x																		3
*Monadenia bracteata				x					x		x	x	x					x				x	x		x	x	x				25
*Monopsis simplex																															1
Nuytsia floribunda								x								x	x			x		x									14
Opercularia echinocephala																x	x														4
*Ornithopus compressus				x	x	x			x	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x		x		x	45
*Paspalum spp.	x	x	x	x	x	x			x	x	x	x			x	x	x	x	x		x	x	x	x	x	x	x	x			41
Patersonia occidentalis								x								x	x					x	x								12

HART, SIMPSON and ASSOCIATES

WETLANDS

SPECIES	LOT NUMBER / WETLAND	156 A	156 B	156 C	163 A	163 B	164 B	165 A	387 A	388 A	389 A	389 B	392 A	392 C	393 A	394 A	395 A	397 A	397 B	399 B	401 A	401 B	401 C	806 B	806 C	806 D	810 A	810 B	810 C	810 D	
*Pelargonium capitatum																x	x														4
*Pennisetum clandestinum								x				x		x								x	x	x	x	x					14
Pericalymma ellipticum							x									x	x			x		x									14
Philydrella pygmaea																															3
Pimelea imbricata							x																								1
Podotheca gnaphalioides																					x										2
Pterostylis nana																															1
Pterostylis vittata																															3
Ranunculus muricatus																															1
Regelia ciliata							x	x								x	x				x	x	x				x				20
*Romulea rosea				x	x	x										x	x	x	x		x	x	x				x				24
*Rumex sp.												x										x	x					x		x	7
*Solanum nigrum																						x	x							x	3
Sowerbaea laxiflora																x	x														3
Schoenus benthamii								x																							1
Stirlingia latifolia								x																							1
Stylidium brunonianum								x								x	x														4
Stylidium dichotomum								x																					x		1
Stylidium divaricatum																						x							x		4
Stylidium guttatum																						x	x								3
Stylidium junceum																															2
Thelymitra canaliculata																															1
Thelymitra flexuosa																															3
Tricoryne elatior																				x											2
*Trifolium spp.	x	x	x	x	x	x			x	x	x			x	x	x	x	x			x	x	x					x		x	38
Triglochin procera																															3
*Ursinia anthemoides					x		x					x	x					x				x	x				x				14
Utricularia inaequalis																															1
Utricularia multifida							x								x	x															5
Utricularia violacea																															1
Verticordia ?drummondii																				x											2
Villarsia ?albiflora							x																							x	3
Watsonia sp.																															1
Xanthorrhoea preissii							x	x													x										9
*Zantedeschia aethiopica				x							x	x				x	x	x													11
SPECIES COUNT	9	9	9	16	16	25	30	12	11	11	9	8	3	11	35	34	15	15	16	24	36	27	8	12	12	26	8	7	13	109	

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WETLANDS

LOT NUMBER	1	1	1A	1A	3	3	11	11	11	11	11	11	11	12	12	12	12	77	77	77	77	77	80	80	82	82	82	83	83	83
SPECIES WETLAND	A	B	A	B	B	E	B	C	D	E	G	H	I	A	C	E	F	B	C	D	E	F	G	I	A	F	H	B	E	F
Acacia pulchella	x		x								x														x					
Adenanthos meisneri																									x					
Adenanthos obovatus																									x					
Agonis linearifolia		x										x				x				x										
Alternanthera nodiflora				x		x																							x	x
Anigozanthos manglesii																														
Anigozanthos viridis	x																													
*Arctotheca calendula		x		x		x			x	x	x	x		x	x	x	x			x				x		x				
Astartea fascicularis		x		x	x	x	x	x	x	x	x		x	x	x		x	x	x	x	x	x			x	x	x	x	x	x
Banksia littoralis												x				x														
Boronia crenulata																						x			x		x			
*Briza maxima	x		x	x		x	x	x			x	x	x	x	x	x	x	x	x	x							x			
*Briza minor	x		x	x		x	x	x		x	x																x			
Burchardia umbellata					x						x																			
Caladenia flava											x																			
Calothamnus hirsutus	x																													
Calothamnus lateralis		x			x																	x			x					
*Carpobrotus edulis																														
Chamaescilla corymbosa	x	x																												
Conospermum ?capitatum																														
Cotula coronopifolia		x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x					x	x
Dampiera linearis					x																									
Dasypogon bromeliifolius			x																									x		
Dillwynia dillwynioides																						x								
Drosera gigantea					x						x							x	x						x					
Drosera glanduligera	x			x		x							x							x					x					
Drosera menziesii	x																													
Drosera stolonifera										x		x				x		x	x											
*Ehrharta sp.				x		x							x							x										
Eriostemon spicatus																														
Eryngium rostratum																														
Eucalyptus calophylla			x									x				x														
Eucalyptus marginata										x																				
Eucalyptus rudis		x		x	x	x						x	x			x	x			x	x					x			x	
Euchilopsis linearis																									x		x			
Evandra pauciflora																											x			
Gompholobium tomentosum										x																				

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WETLANDS

SPECIES	LOT NUMBER / WETLAND	1 A	1 B	1A A	1A B	3 B	3 E	11 B	11 C	11 D	11 E	11 G	11 H	11 I	12 A	12 C	12 E	12 F	77 B	77 C	77 D	77 E	77 F	80 G	80 I	82 A	82 F	82 H	83 B	83 E	83 F
Goodenia filiformis				x		x															x										
Grevillia densifolia		x																											x		
*Homeria miniata																															
Hovea trisperma																															
Hypocalymma angustifolium				x	x	x				x	x	x		x	x	x		x	x	x					x	x	x	x			
*Hypochaeris glabra			x	x	x	x				x	x	x	x	x	x	x	x	x	x	x					x	x	x	x			
Jacksonia furcellata				x		x																			x						
Jacksonia sericea				x		x																									
Johnsonia pubescens																															
*Juncus microcephlus			x																				x								
Juncus pallidus		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x
Kennedia prostrata																															
Kunzea ericifolia		x	x	x		x	x	x		x	x	x		x	x	x	x	x	x	x					x	x	x		x		
Kunzea recurva																															
Lepidosperma longitudinale			x	x	x	x						x				x								x						
Leptocarpus sp. (un-named)																							x						x		
Lobelia alata			x	x		x														x									x	x
Lomandra maritima																															
*Medicago sp.																													x		
Melaleuca incana	x									x																					
Melaleuca lateriflora	x																														
Melaleuca lateritia										x								x	x		x		x						x	x
Melaleuca preissiana	x	x		x	x	x	x	x	x	x	x	x				x	x							x	x	x	x		x	x
Melaleuca rhaphiophylla	x	x	x	x		x			x	x	x							x	x	x	x		x					x	x	x
Melaleuca teretifolia										x																					
Melaleuca thymoides																	x														
Melaleuca viminea	x																														
Melaleuca uncinata																							x								
Microtis atrata											x							x	x							x	x				
Microtis unifolia																							x			x					
*Monadenia bracteata				x		x						x				x		x	x	x					x		x	x			
*Monopsis simplex																							x								
Nuytsia floribunda				x		x						x				x		x	x				x			x					
Opercularia echinocephala			x		x																										
*Ornithopus compressus	x	x	x	x		x	x	x	x	x	x	x	x	x	x	x	x			x	x			x	x	x	x	x	x	x	x
*Paspalum spp.	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x			x	x							x			
Patersonia occidentalis	x									x		x					x								x		x	x			

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WETLANDS

SPECIES	LOT NUMBER / WETLAND	1 A	1 B	1A A	1A B	3 B	3 E	11 B	11 C	11 D	11 E	11 G	11 H	11 I	12 A	12 C	12 E	12 F	77 B	77 C	77 D	77 E	77 F	80 G	80 I	82 A	82 F	82 H	83 B	83 E	83 F
*Pelargonium capitatum													x				x														
*Pennisetum clandestinum					x	x	x							x							x	x								
Pericalymma ellipticum				x		x							x				x						x			x	x	x	x		
Philydrella pygmaea																			x	x						x					
Pimelea imbricata																															
Podotheca gnaphalioides																															
Pterostylis nana																							x								
Pterostylis vittata										x																					
Ranunculus muricatus																										x					
Regelia ciliata	x		x							x	x	x		x	x	x		x	x				x						x		
*Romulea rosea		x		x		x	x	x	x	x	x	x		x	x	x	x														
*Rumex sp.				x		x																								x	x
*Solanum nigrum			x																												
Sowerbaea laxiflora																															
Schoenus benthamii																															
Stirlingia latifolia																															
Stylidium brunonianum											x																				
Stylidium dichotomum																															
Stylidium divaricatum				x		x																							x		
Stylidium guttatum																													x		
Stylidium junceum					x																					x					
Thelymitra canaliculata																							x								
Thelymitra flexuosa										x																					
Tricoryne elatior																															
*Trifolium spp.		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x				x				x	x	x				
Triglochin procera	x																		x	x											
*Ursinia anthemoides				x		x															x						x				
Utricularia inaequalis	x																														
Utricularia multifida	x										x																				
Utricularia violacea	x																														
Verticordia ?drummondii																										x					
Villarsia ?albiflora																			x	x											
Watsonia sp.	x																														
Xanthorrhoea preissii			x		x					x	x												x			x				
*Zantedeschia aethiopica																															
SPECIES COUNT	23	18	21	29	19	29	13	14	16	27	25	28	12	16	16	27	18	18	18	21	7	17	4	7	26	13	16	17	12	10	

HART, SIMPSON and ASSOCIATES

Site Visit 1/9/99
BS 378 Lot 400

(1)

(2)

Site Visit 1/9/99
BS378 Lot 400

(2) again

Site Visit 1/9/99
BS378 Lot 400

(5)

220

(220) KAILIS01
Henderson Road,
Shire of Serpentine
Jarrahdale
28-11-95

(220) KAILIS02
Henderson Road,
Shire of Serpentine
Jarrahdale
28-11-95.

(220)
KAILIS 03
Henderson Road,
Shire of Serpentine
Jarrahdale
28-11-95

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