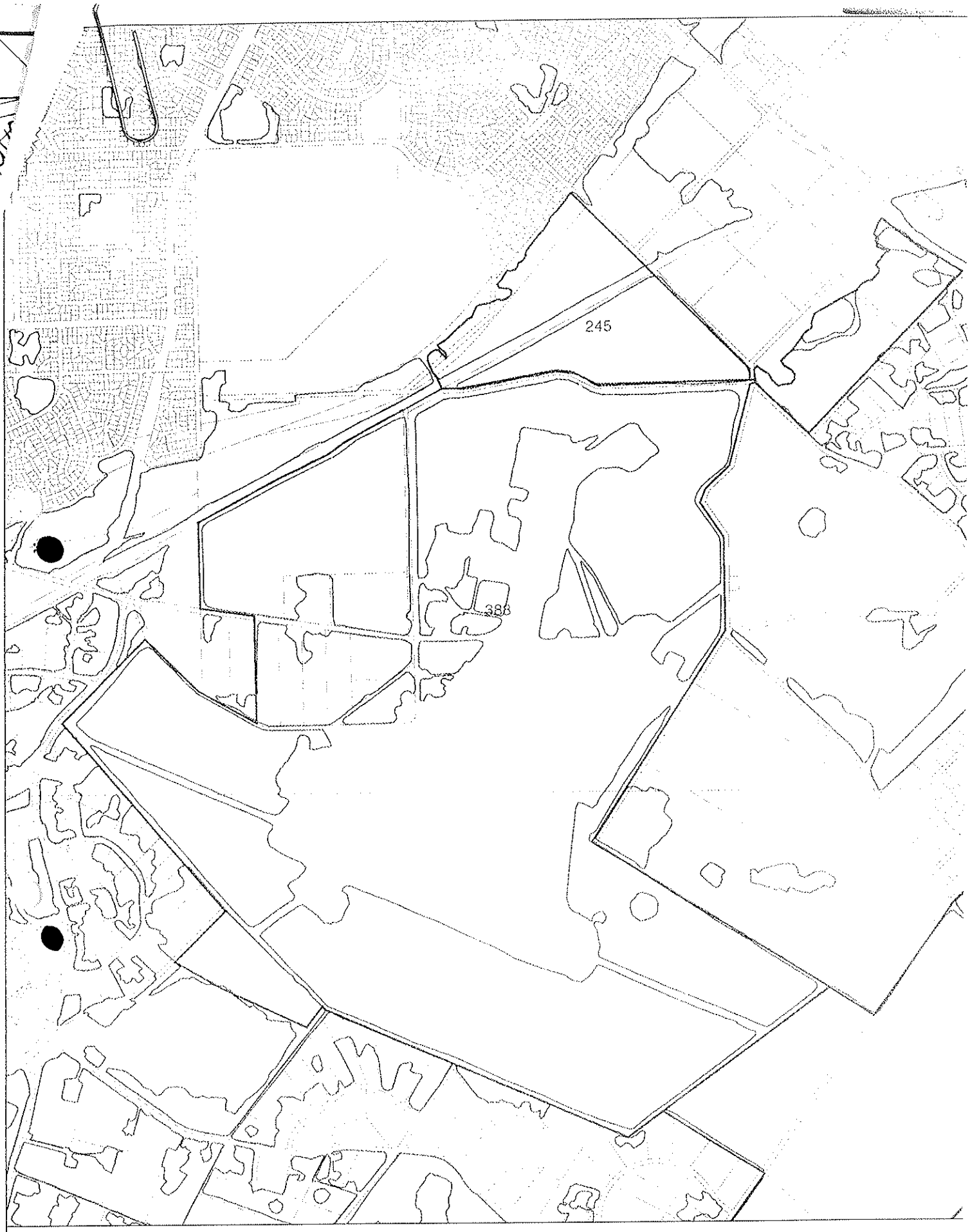


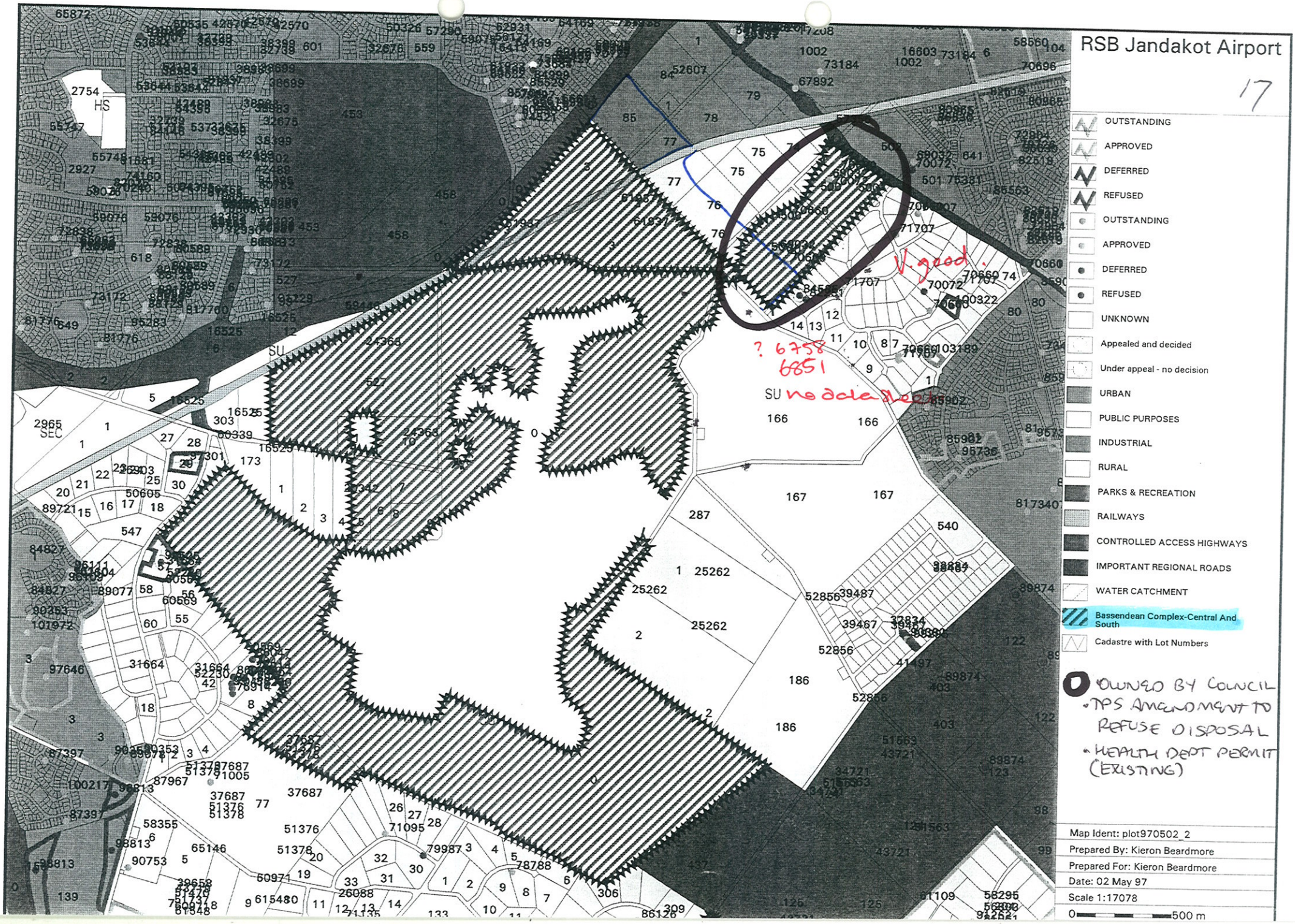
BUSHPLAN SITES CORRECTED

WESTERN AUSTRALIAN PLANNING COMMISSION

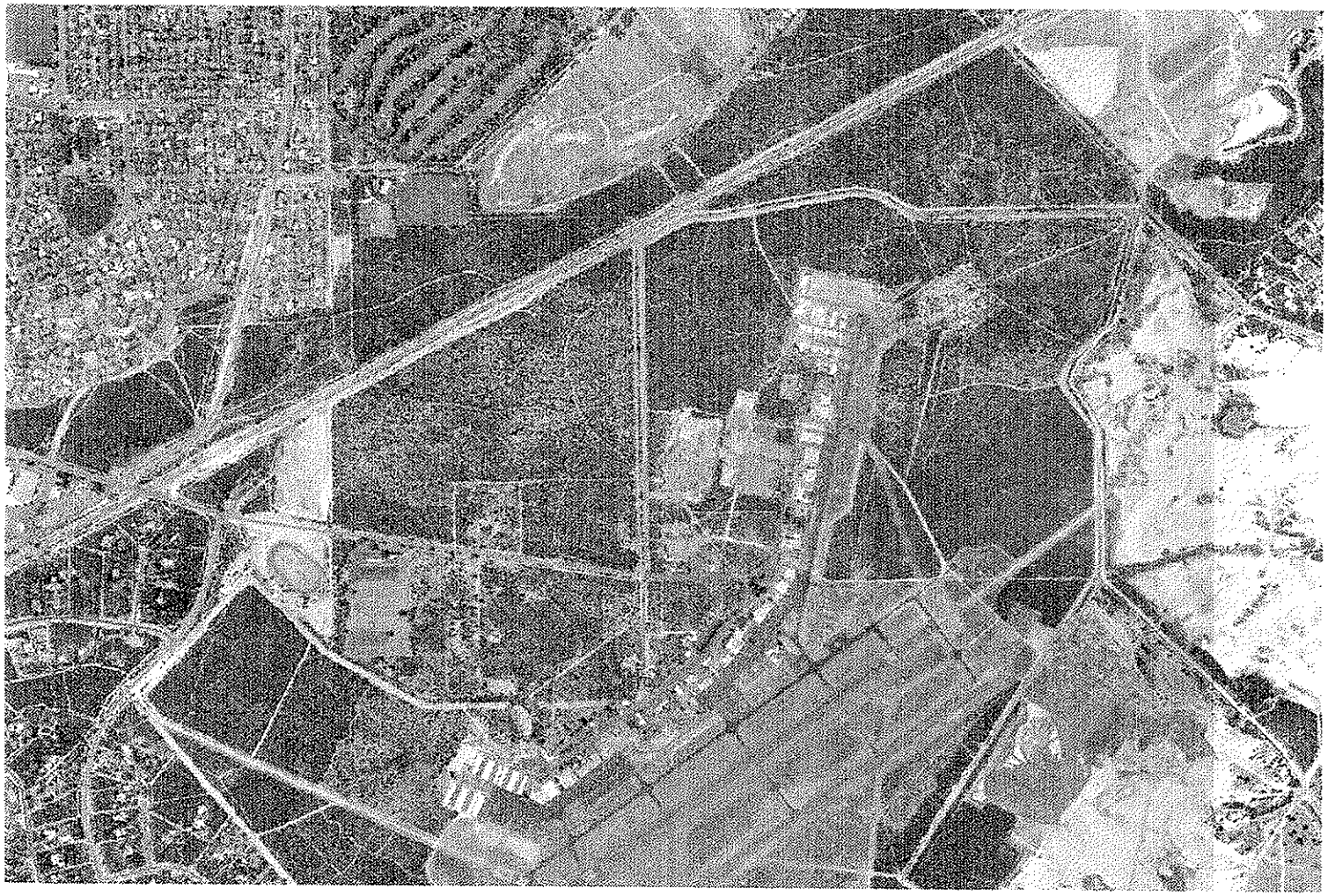
CUSTOMER FOCUS

N

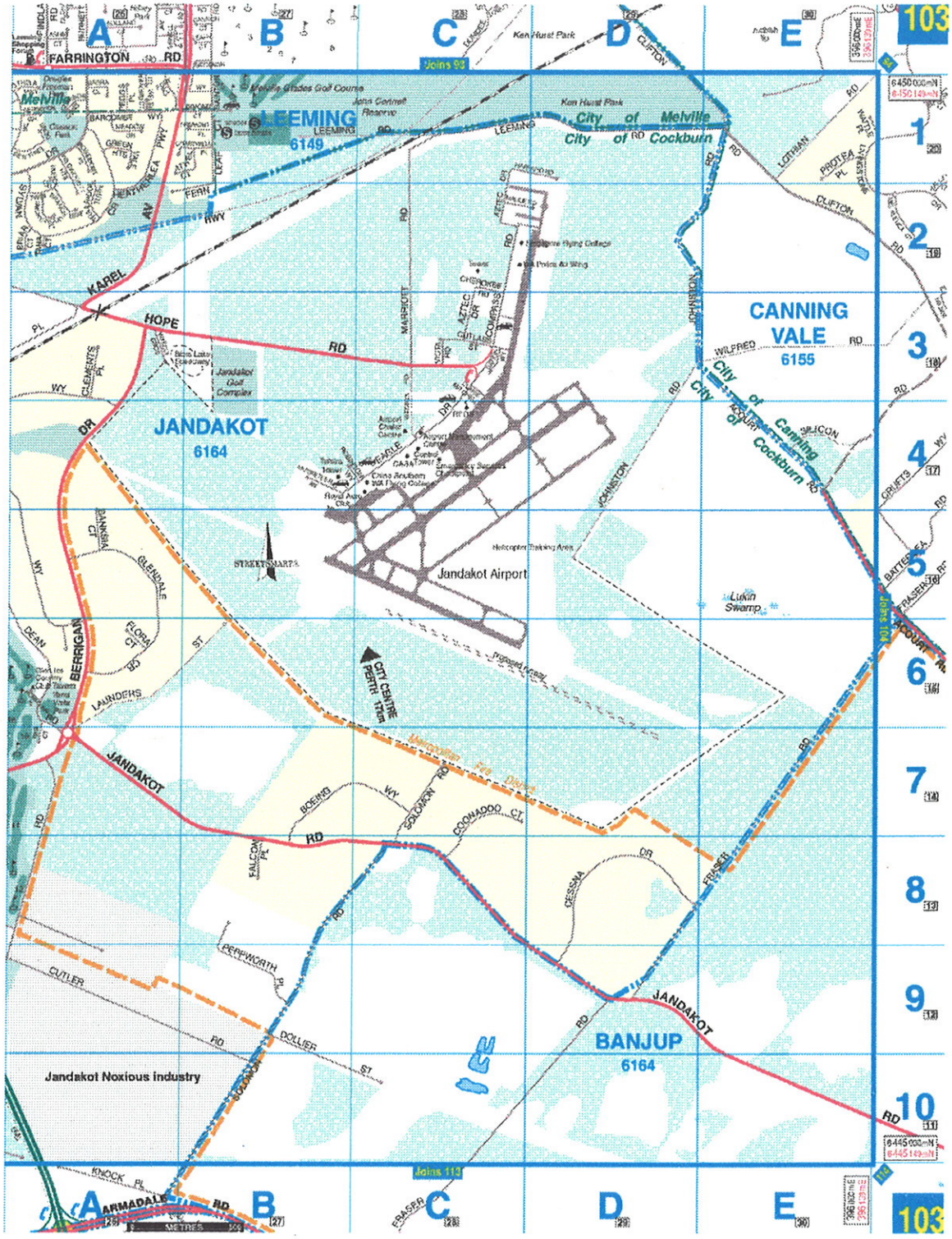
B BK 26/5/98

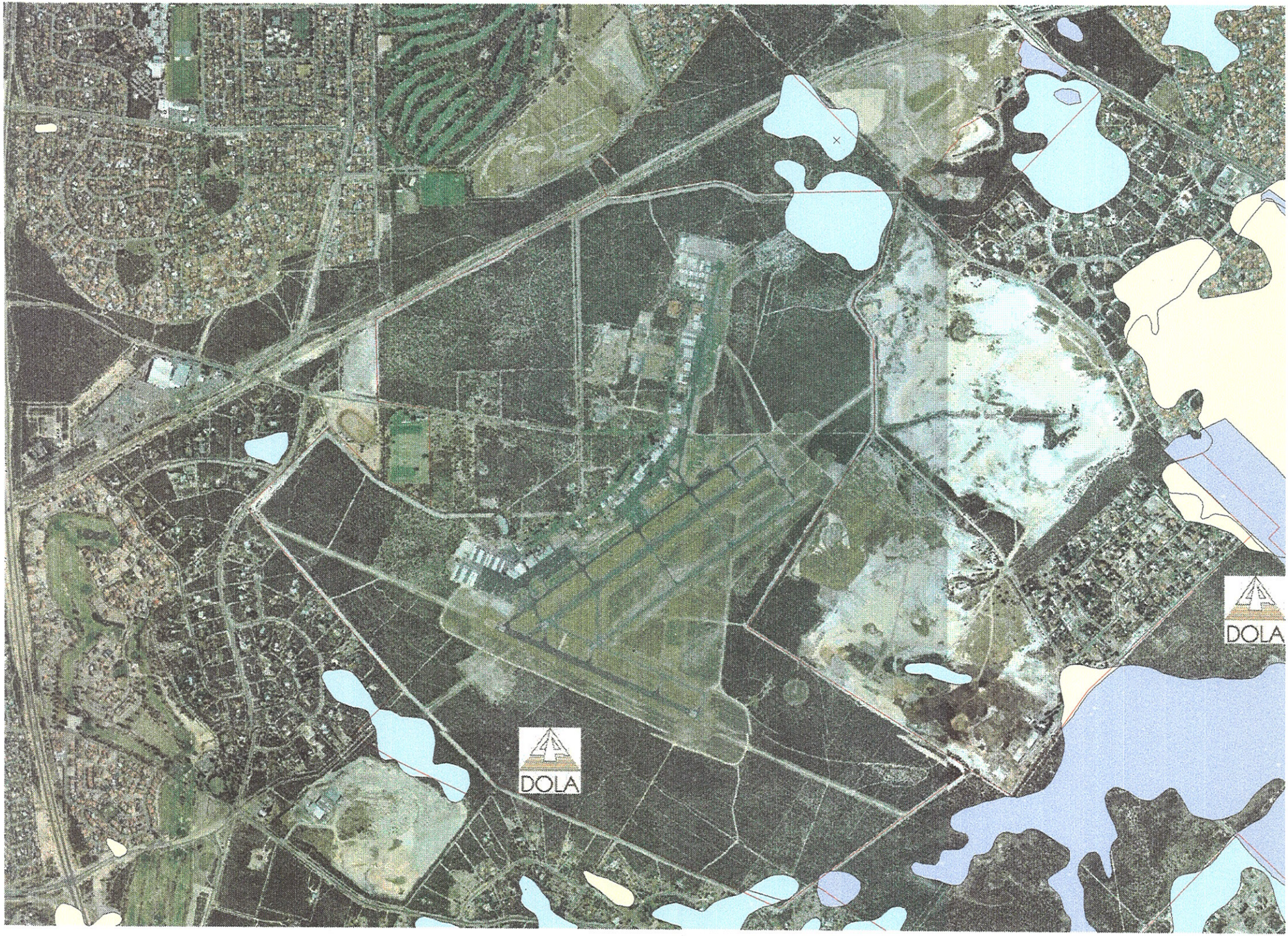

RSB Jandakot Airport
17
OUTSTANDING
APPROVED
DEFERRED
REFUSED
OUTSTANDING
APPROVED
DEFERRED
REFUSED
UNKNOWN
Appealed and decided
Under appeal - no decision
URBAN
PUBLIC PURPOSES
INDUSTRIAL
RURAL
PARKS & RECREATION
RAILWAYS
CONTROLLED ACCESS HIGHWAYS
IMPORTANT REGIONAL ROADS
WATER CATCHMENT
Bassendean Complex-Central And South
Cadastre with Lot Numbers
V. good.
? 6758
6851
SU no data sheet
OWNED BY COUNCIL
• TPS AMENDMENT TO REFUSE DISPOSAL
• HEALTH DEPT PERMIT (EXISTING)
Map Ident: plot970502_2
Prepared By: Kieron Beardmore
Prepared For: Kieron Beardmore
Date: 02 May 97
Scale 1:17078
0
500 m

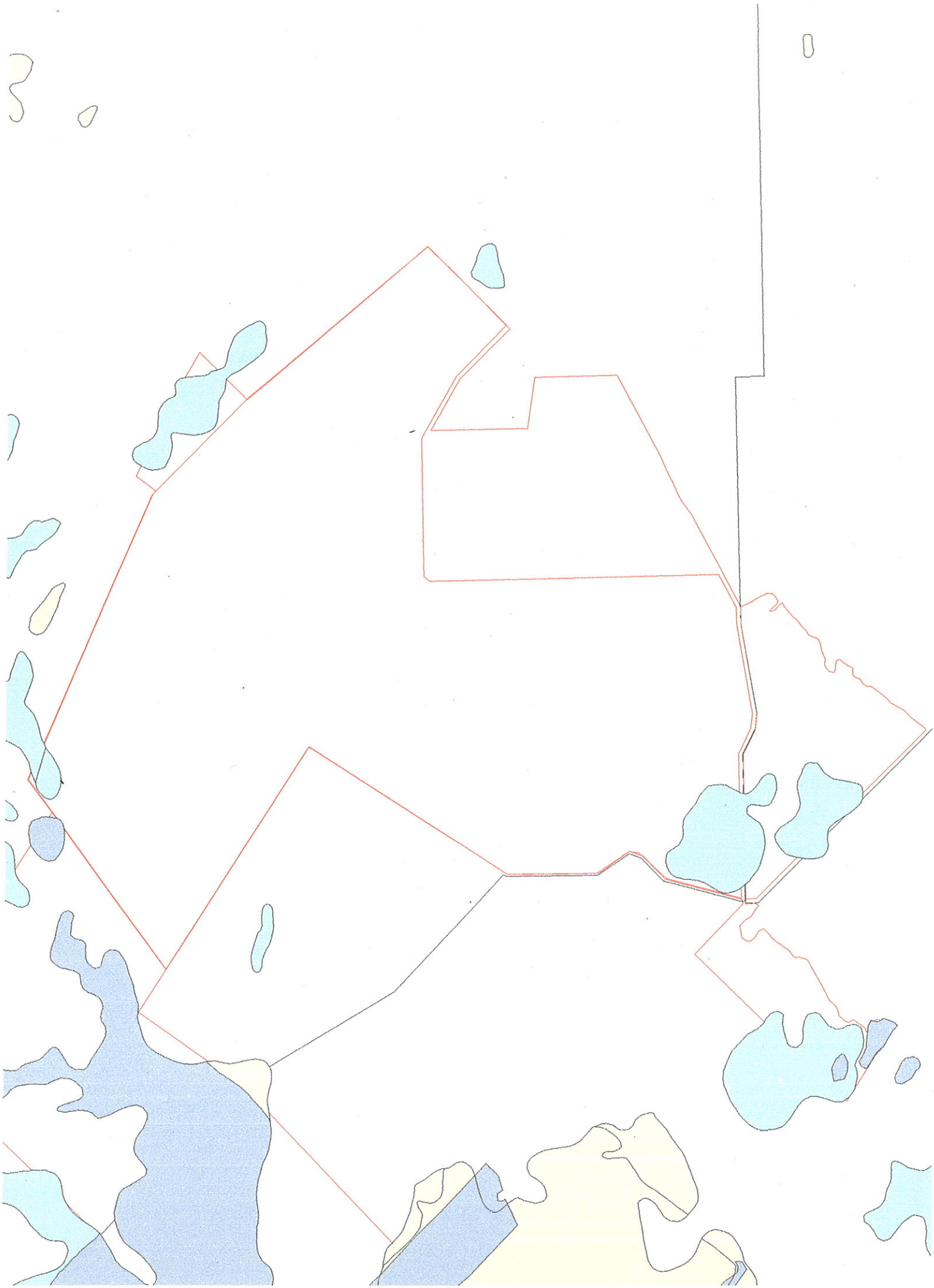
Street Express 2000

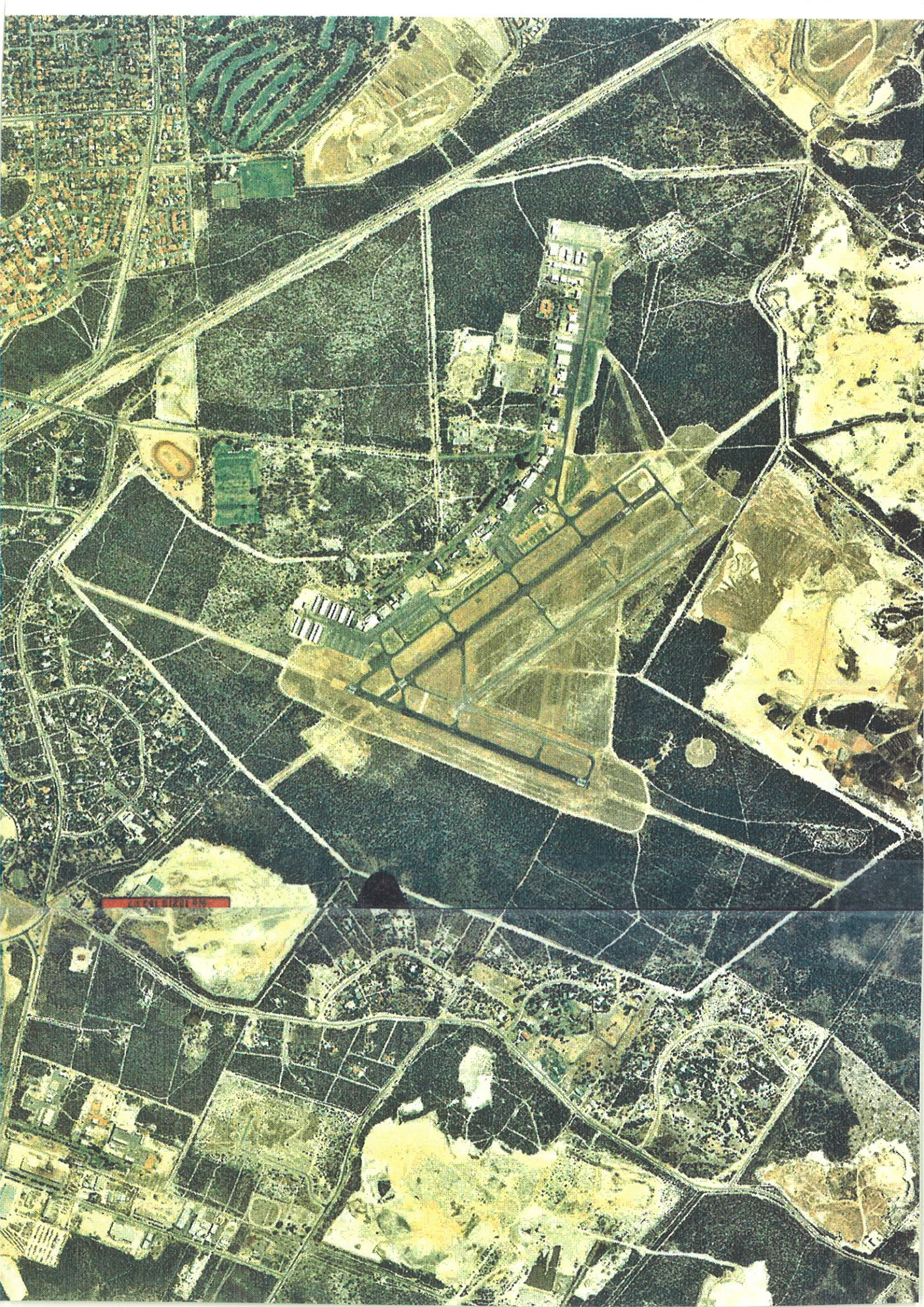


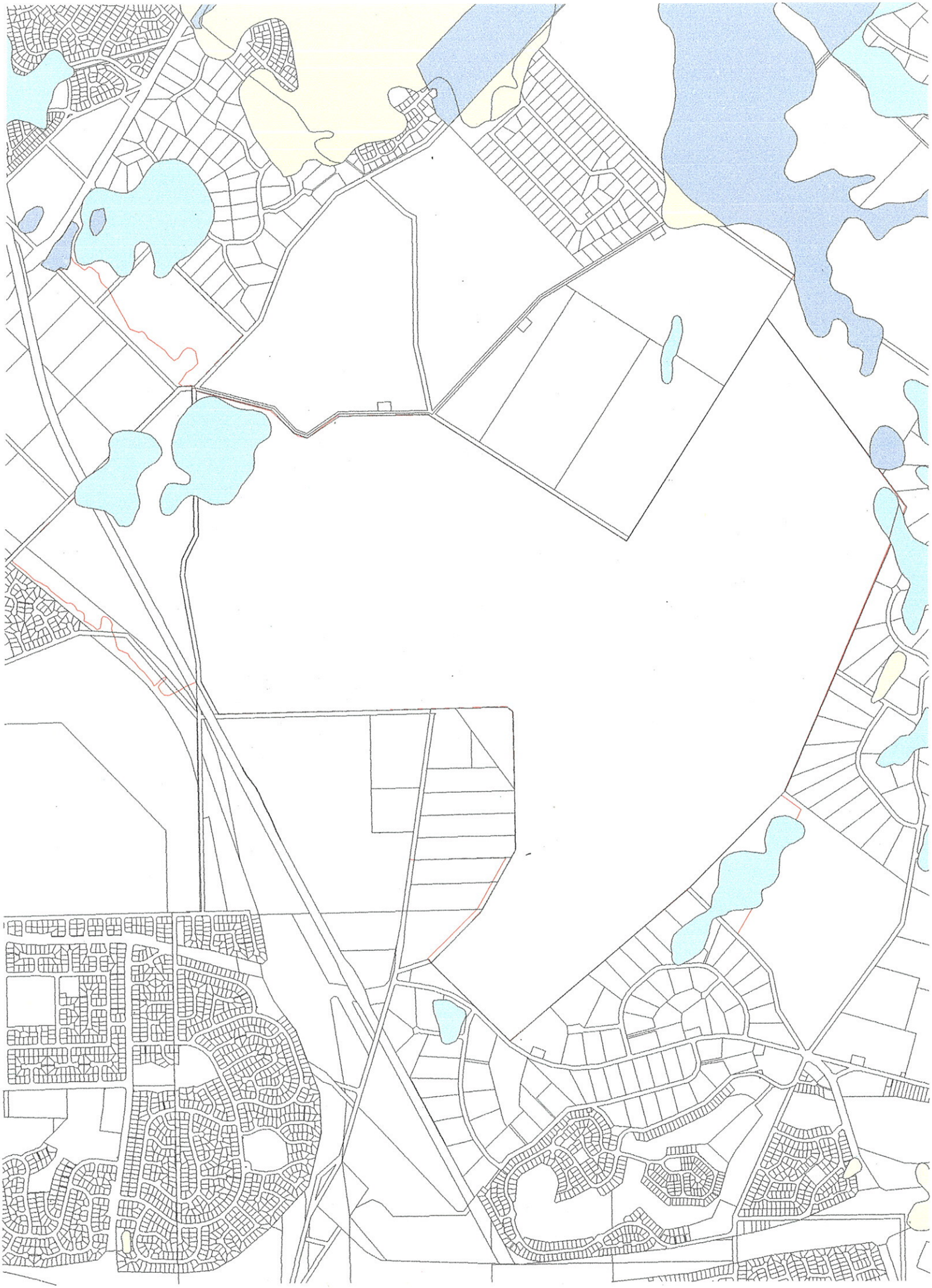
Street Express 2000



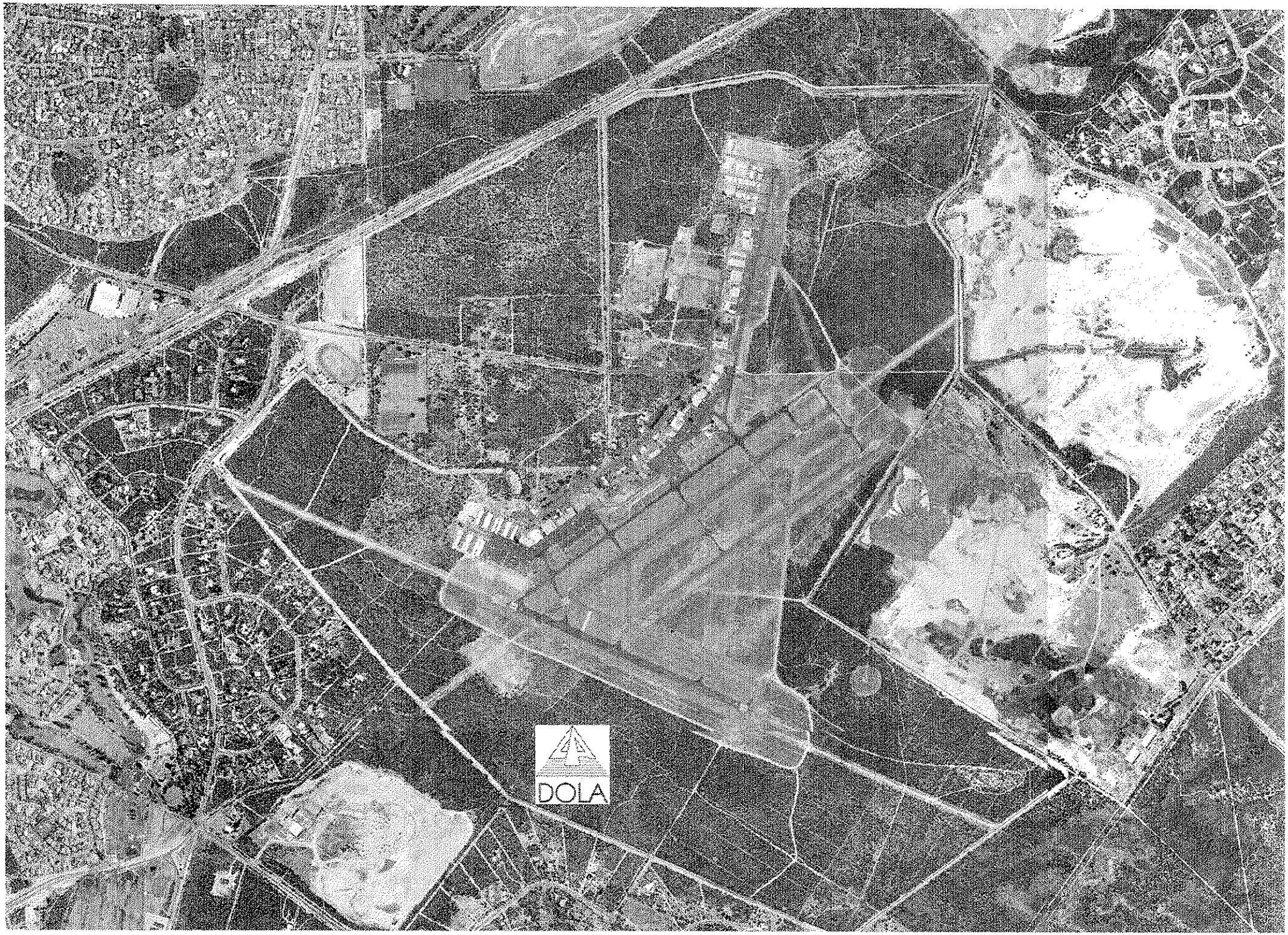

DOLA
DOLA

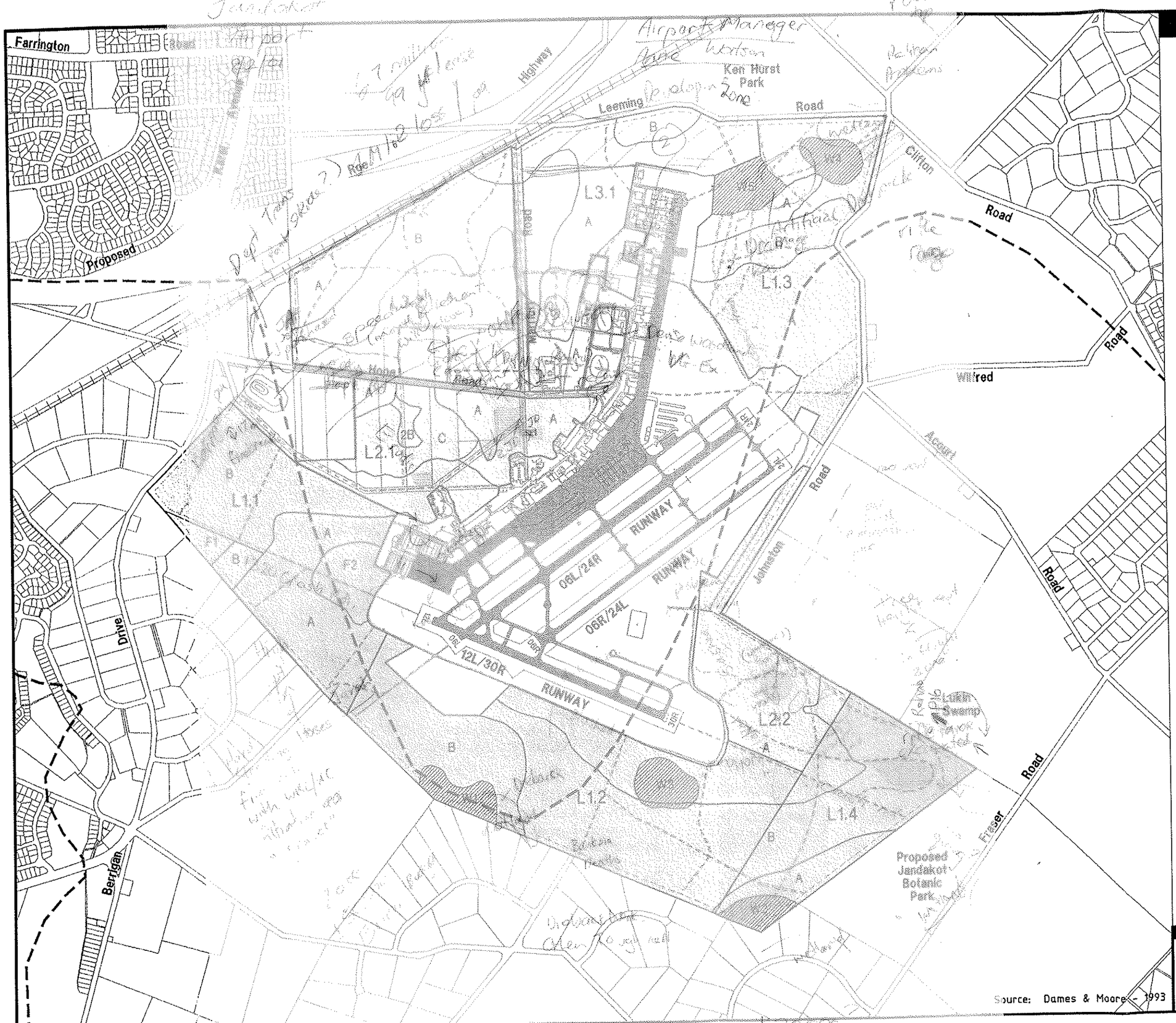






Jandakot Airport


DOLA



LEGEND

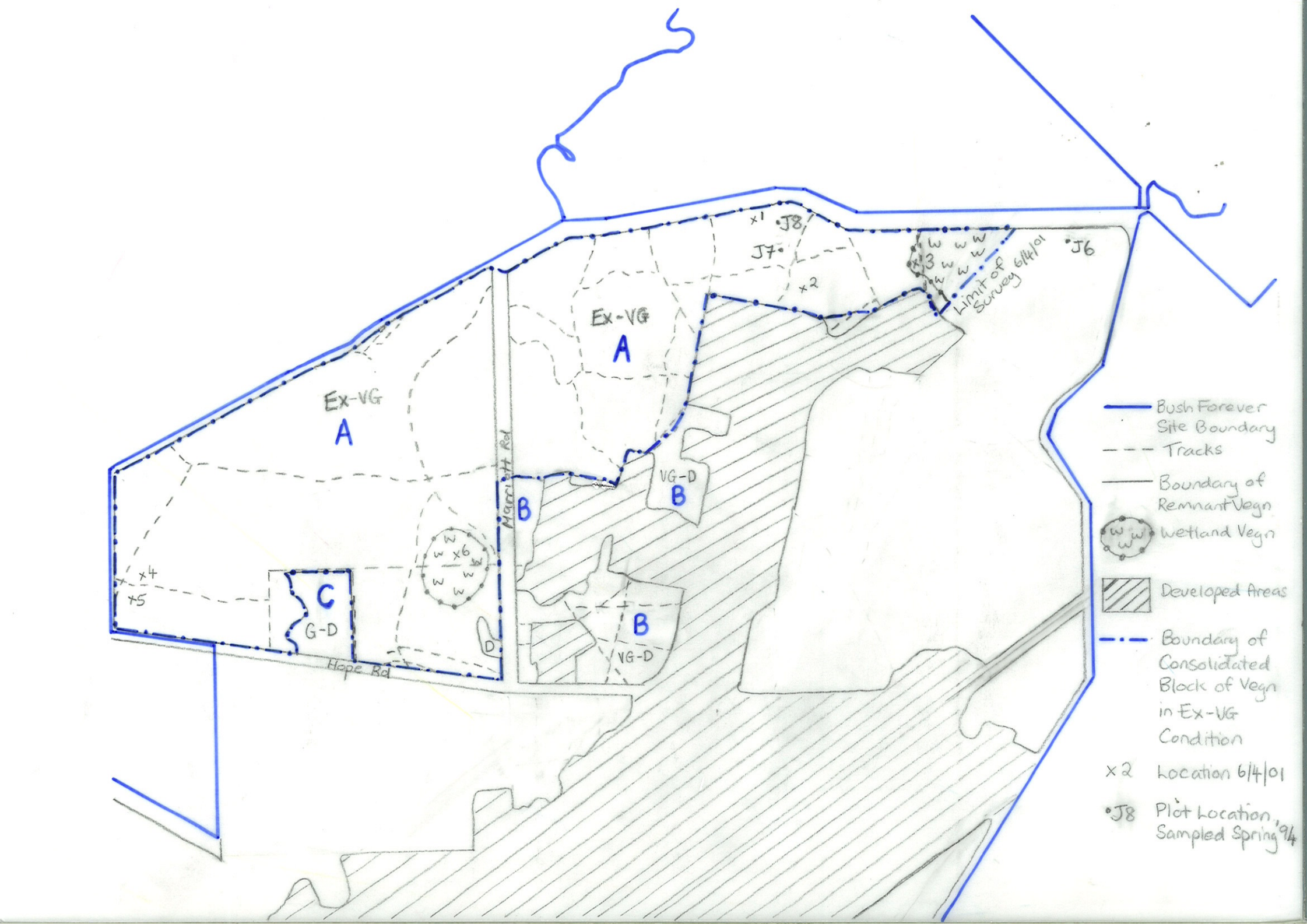
- Priority Area 1 Flora
- Priority Area 2 Flora
- Priority Area 3 Flora
- Dampland/Drainage Basin
- Largely Cleared of Native Vegetation
- A Jarrah-Banksia Woodland
- B Mixed Banksia Low Open Forrest
- C Eucalyptus Rudis Open Forrest
- D Melaleuca/Pericalymma Open Woodland
- E Mosaic of Various Heaths, Shrub Heath and Woodlands
- F Heaths Cleared of Banksia Woodland Overstorey
- G Baumea Articulata Sedgeland
- Proposed Jandakot UWPCA Boundary

N

Scale 0 100 200 300 400 500 600m

Jandakot Airport Priority Areas

Figure 3.9


Ex-VG
A
Ex-VG
A
B
VG-D
B
B
VG-D
C
G-D
D
Marriott Rd
Hope Rd
x1
J8
J7
x2
x3
J6
Limit of Survey 6/4/01
x4
x5
x6
Bush Forever Site Boundary
Tracks
Boundary of Remnant Vegn
Wetland Vegn
Developed Areas
Boundary of Consolidated Block of Vegn in Ex-VG Condition
x2 Location 6/4/01
J8 Plot Location, Sampled Spring '94

JT6
3x
JT7
x2
1x JT8
A
B
B
B
B
x6
A
C
x4
x5
H

BUSH FOREVER
SITE 388
2000 AERIAL PHOTOGRAPHY

Cadastre

Contours - 5m (DOLA)

Bush Forever 2000 - Site Boundaries

388

Map Ident: plot010207_1

Prepared By: Andrea Zappacosta

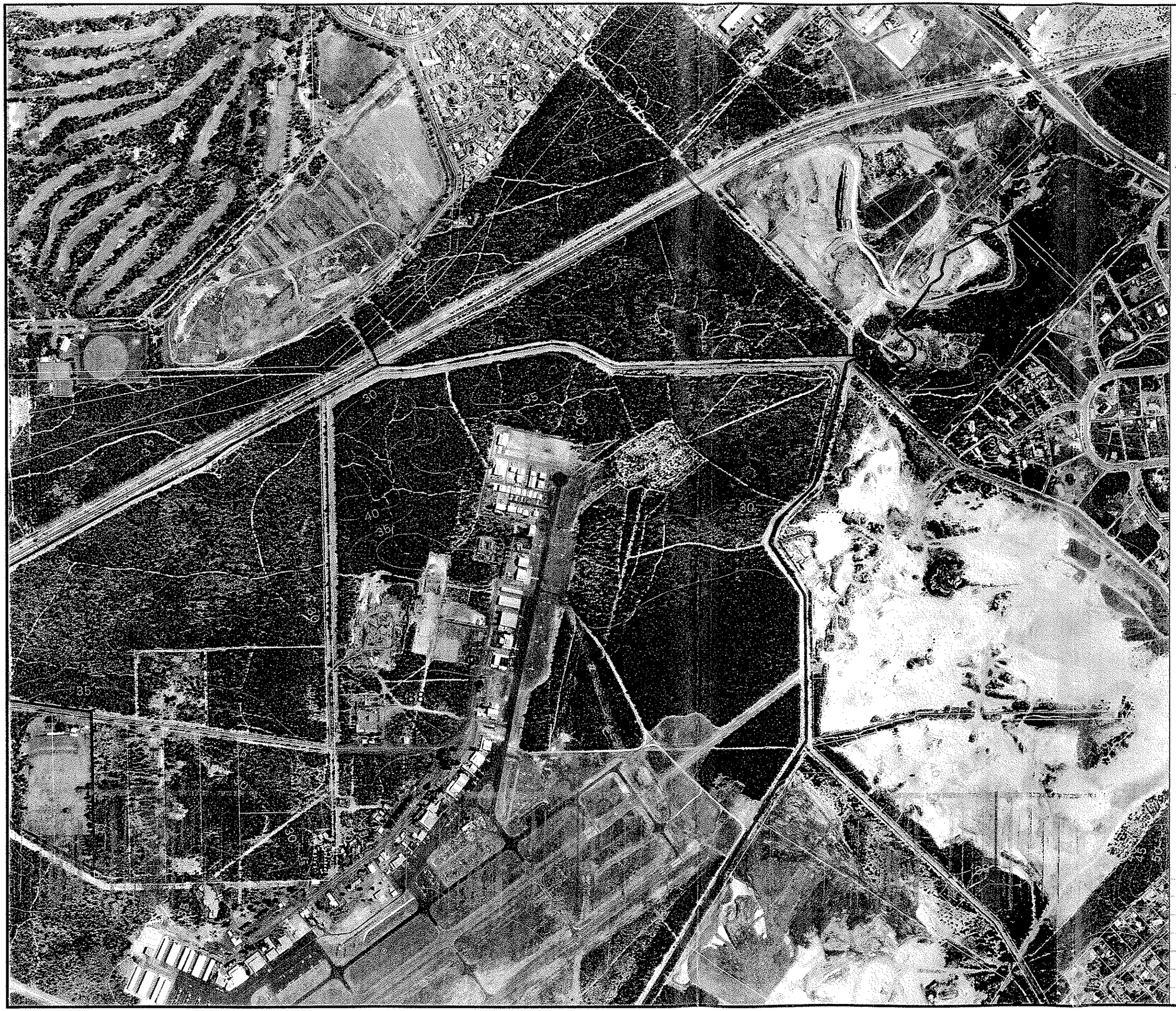
Prepared For: SEAN COLLINGWOOD

Date: 07 Feb 2001

Scale 1:10000

0 250 m

MFP INTERNAL USE ONLY



BUSH FOREVER
SITE 388
2000 AERIAL PHOTOGRAPHY

Cadastre

Contours - 5m (DOLA)

Bush Forever 2000 - Site Boundaries

Map Ident: plot010207_1

Prepared By: Andrea Zappacosta

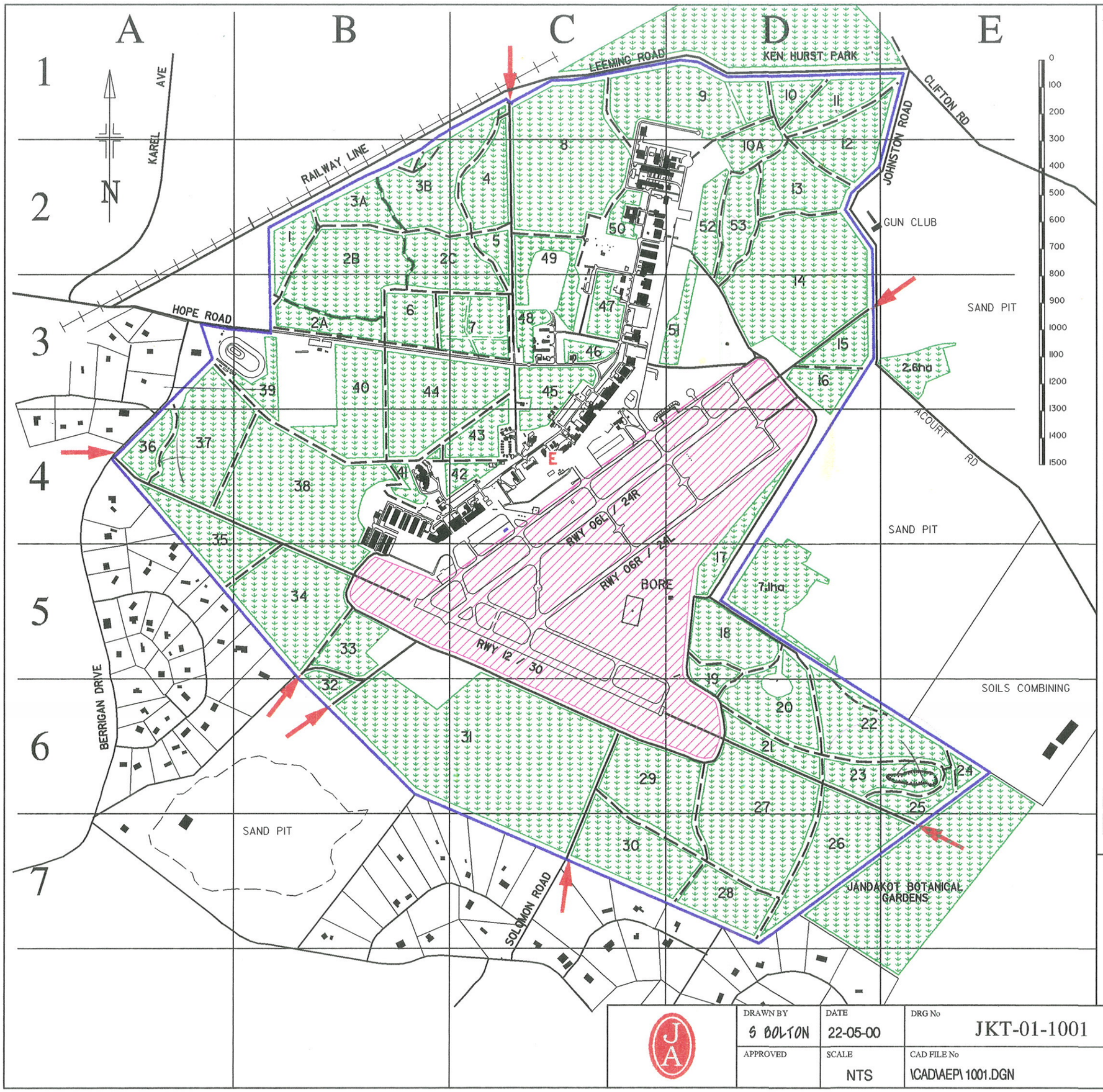
Prepared For: SEAN COLLINGWOOD

Date: 07 Feb 2001

Scale 1:10000

0 250 m

MFP INTERNAL USE ONLY



BASED ON STREET SMART GRID SYSTEM REFERENCING PAGE 103

AREA No	AREA Ha	FUEL AGE
1	2.1	10/97/C
2A	2.7	PRE 1980
2B	11.1	10/97/C
2C	5.6	10/97/C
3A	2.9	10/97/C
3B	8.4	10/97/C
4	4.4	10/97/C
5	1.3	10/97/C
6	3.3	PRE 1980
7	5.2	10/97/C
8	19.3	PRE 1980
9	11.4	PRE 1980
10	1.8	12/95/F
10A	2.6	PRE 1980
11	3.6	12/95/F
12	5.4	12/95/F
13	5.5	12/95/F
14	20.5	03/93/C
15	2.6	PRE 1980
16	2.5	PRE 1980
17	2.7	PRE 1980
18	5.4	PRE 1980
19	1.3	PRE 1980
20	6.3	PRE 1980
21	2.7	PRE 1980
22	8.2	03/93/C
23	4.1	PRE 1980

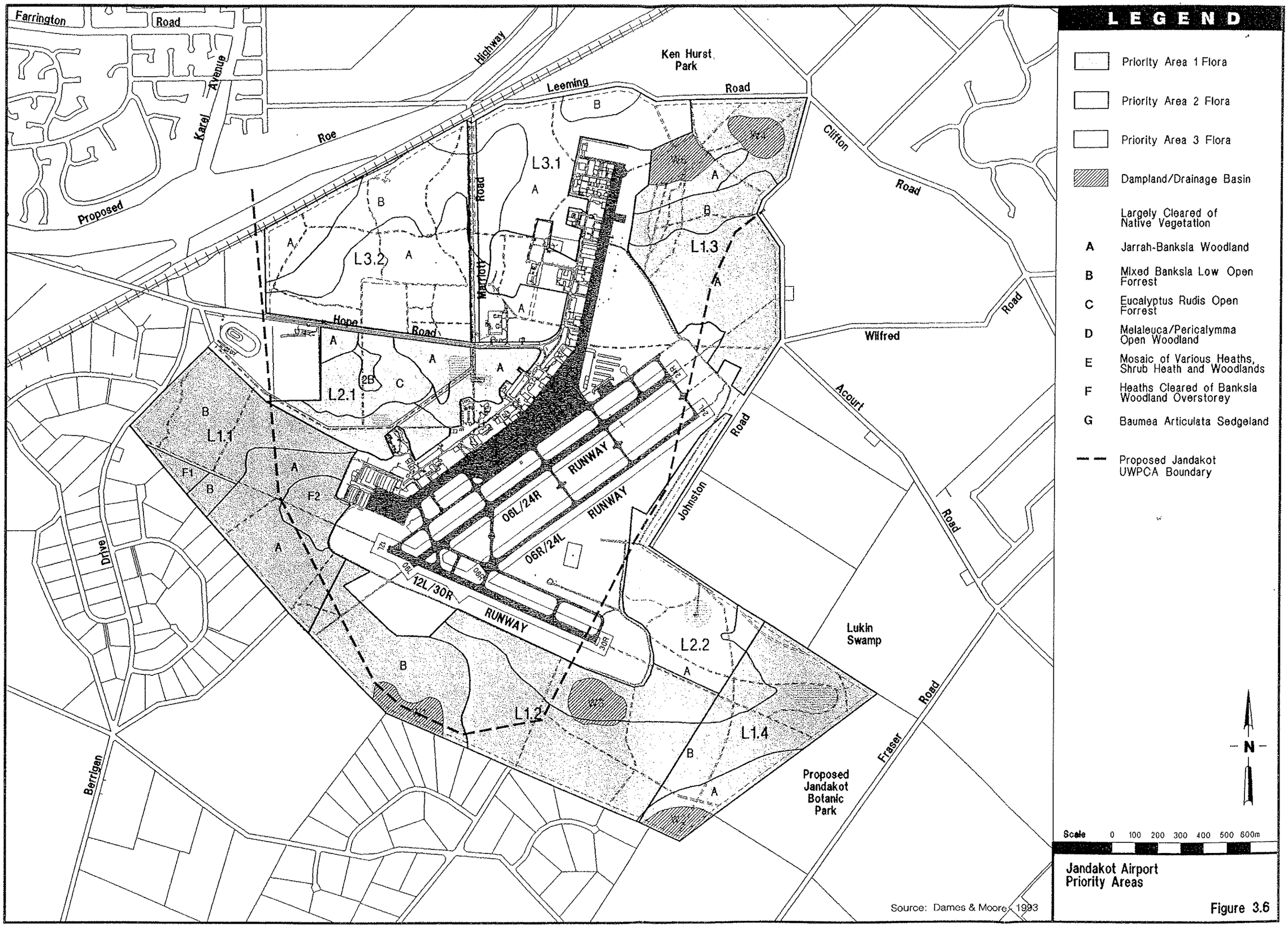
AREA No	AREA Ha	FUEL AGE
24	0.6	PRE 1980
25	1.8	PRE 1980
26	9.3	03/93/C
27	16.8	11/94/F
28	4.9	11/94/F
29	9.6	PRE 1980
30	8.8	PRE 1980
31	38.0	PRE 1980
32	1.0	PRE 1980
33	3.7	PRE 1980
34	11.1	PRE 1980
35	5.8	PRE 1980
36	2.1	PRE 1980
37	10.6	PRE 1980
38	19.5	03/97/F
39	1.9	PRE 1980
40	7.9	03/97/F
41	0.9	03/97/F
42	1.2	03/97/F
43	2.6	03/97/F
44	11.8	03/97/F
45	4.1	03/97/F
46	1.0	03/97/F
47	2.3	03/97/F
48	1.3	PRE 1980
49	3.8	PRE 1980
50	1.2	10/97/C
51	2.0	11/98/C
52	2.7	11/98/C
53	3.8	PRE 1980

MM/YY/C	'C' COLD BURN
MM/YY/F	'F' HOT FIRE

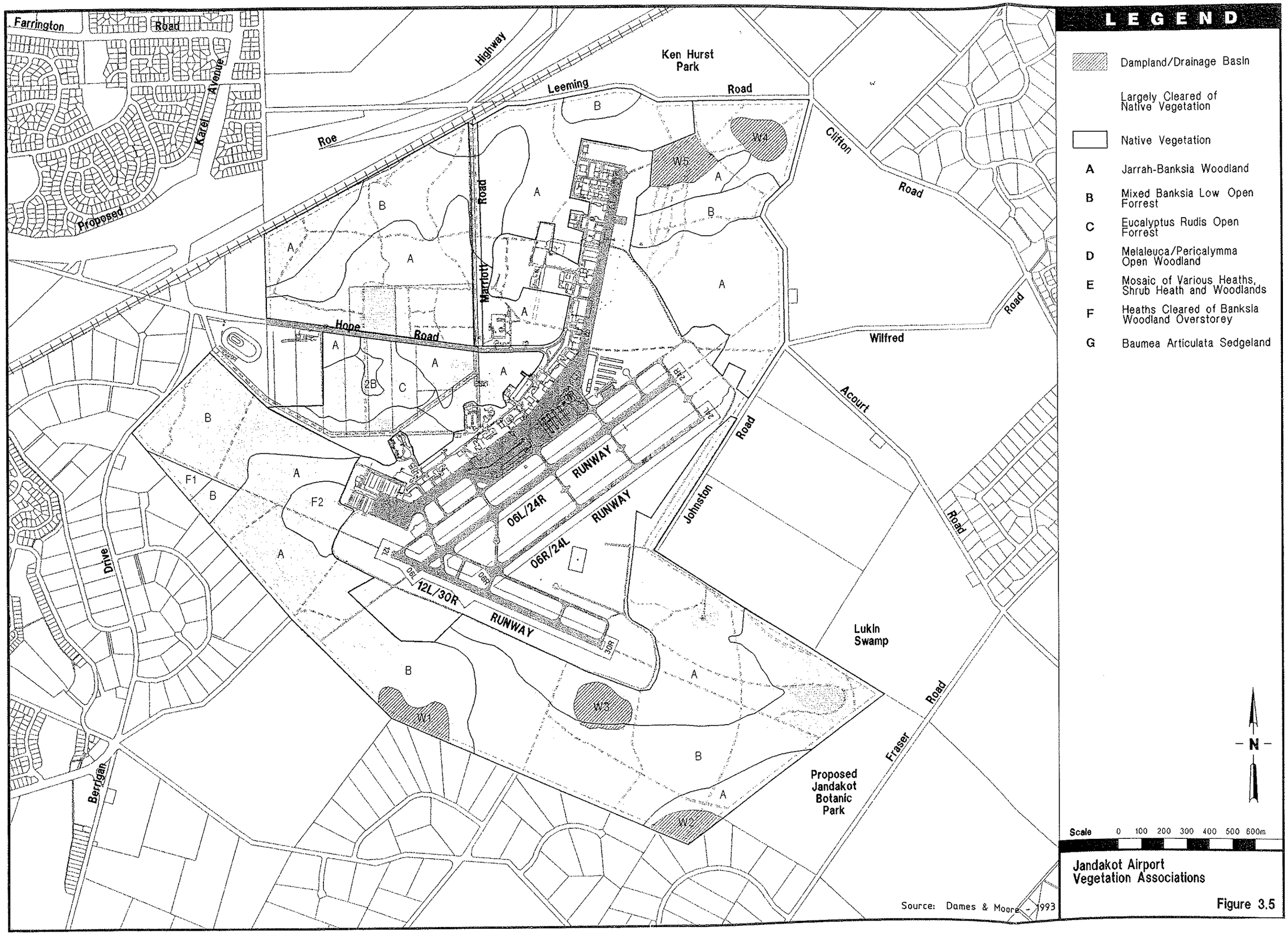
LEGEND

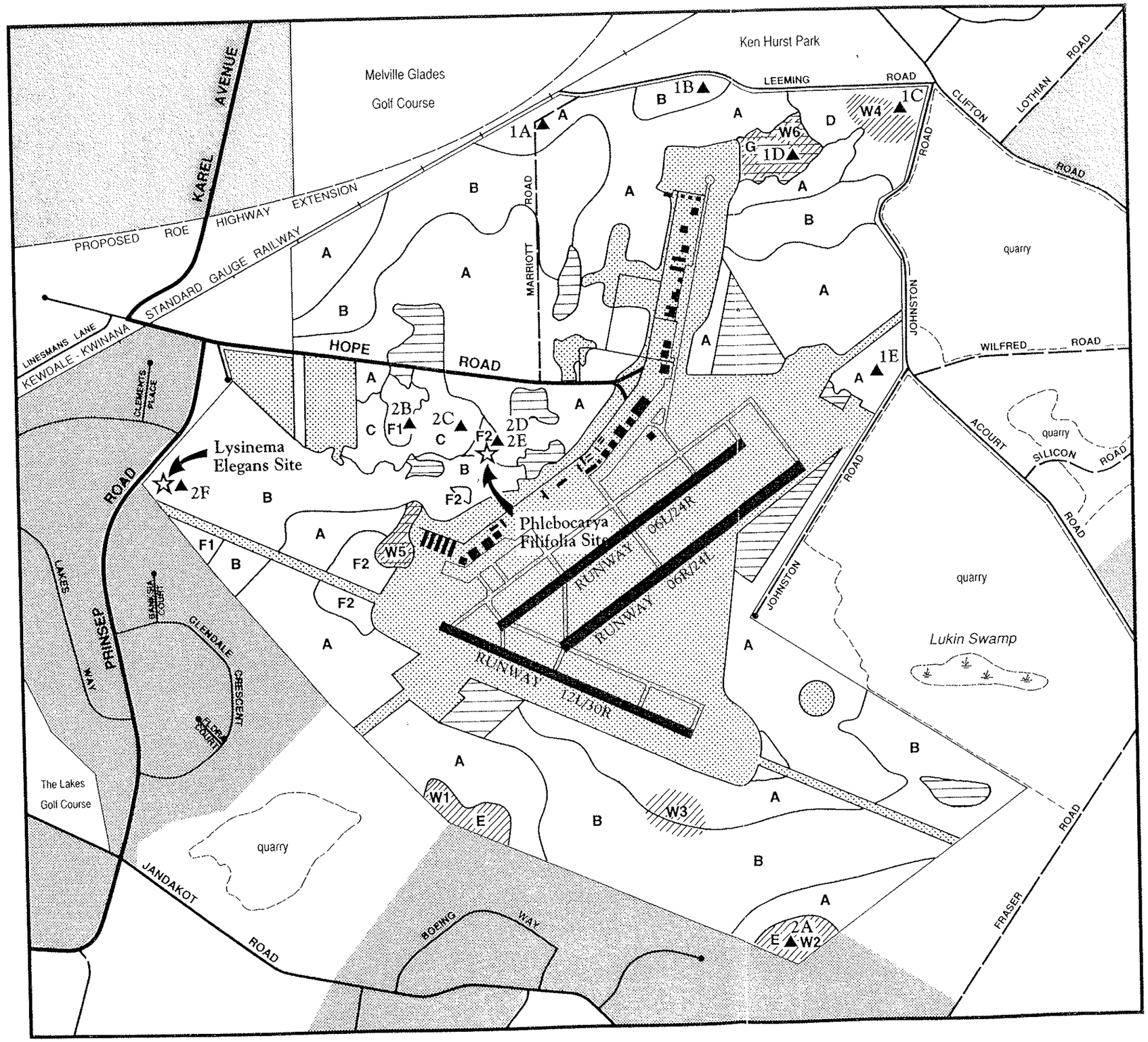
- EMERGENCY GATES
- E ESCP
- RESTRICTED AREA
- BUSH LAND
- JANDAKOT AIRPORT BOUNDARY (4×4 ONLY)
- TWO WHEEL DRIVE ACCESS
- FOUR WHEEL DRIVE ACCESS ONLY

DRAWN BY: S BOLTON	DATE: 22-05-00	DRG No: JKT-01-1001	TITLE: JANDAKOT AIRPORT
APPROVED:	SCALE: NTS	CAD FILE No: \CAD\AEP\ 1001.DGN	AEP / BUSHFIRE RESPONSE PLAN



SINCLAIR KNIGHT MERZ


Farrington Road
Karel Avenue
Proposed
Roe Highway
Leeming Road
Ken Hurst Park
Clifton Road
Marriott Road
Hope Road
Wilfred Road
Acourt Road
Johnston Road
Lukin Swamp
Fraser Road
Berrigan Drive
Proposed Jandakot Botanic Park
RUNWAY 06L/24R
RUNWAY 06R/24L
RUNWAY 12L/30R
W1
W2
W3
W4
W5
A
B
C
F1
F2
2B
Source: Dames & Moore - 1993
LEGEND
Dampland/Drainage Basin
Largely Cleared of Native Vegetation
Native Vegetation
A Jarrah-Banksia Woodland
B Mixed Banksia Low Open Forrest
C Eucalyptus Rudis Open Forrest
D Melaleuca/Pericalymma Open Woodland
E Mosaic of Various Heaths, Shrub Heath and Woodlands
F Heaths Cleared of Banksia Woodland Overstorey
G Baumea Articulata Sedgeland
N
Scale 0 100 200 300 400 500 600m
Jandakot Airport
Vegetation Associations
Figure 3.5



0 300 600m

SCALE 1 : 15 000

Totally cleared of all native vegetation

Largely cleared of native vegetation

W3 Wetland/Dampland (Number)

1F▲ Plate (photograph) number

Existing or Proposed Residential Area

Existing Airport Buildings

Native Vegetation Categories

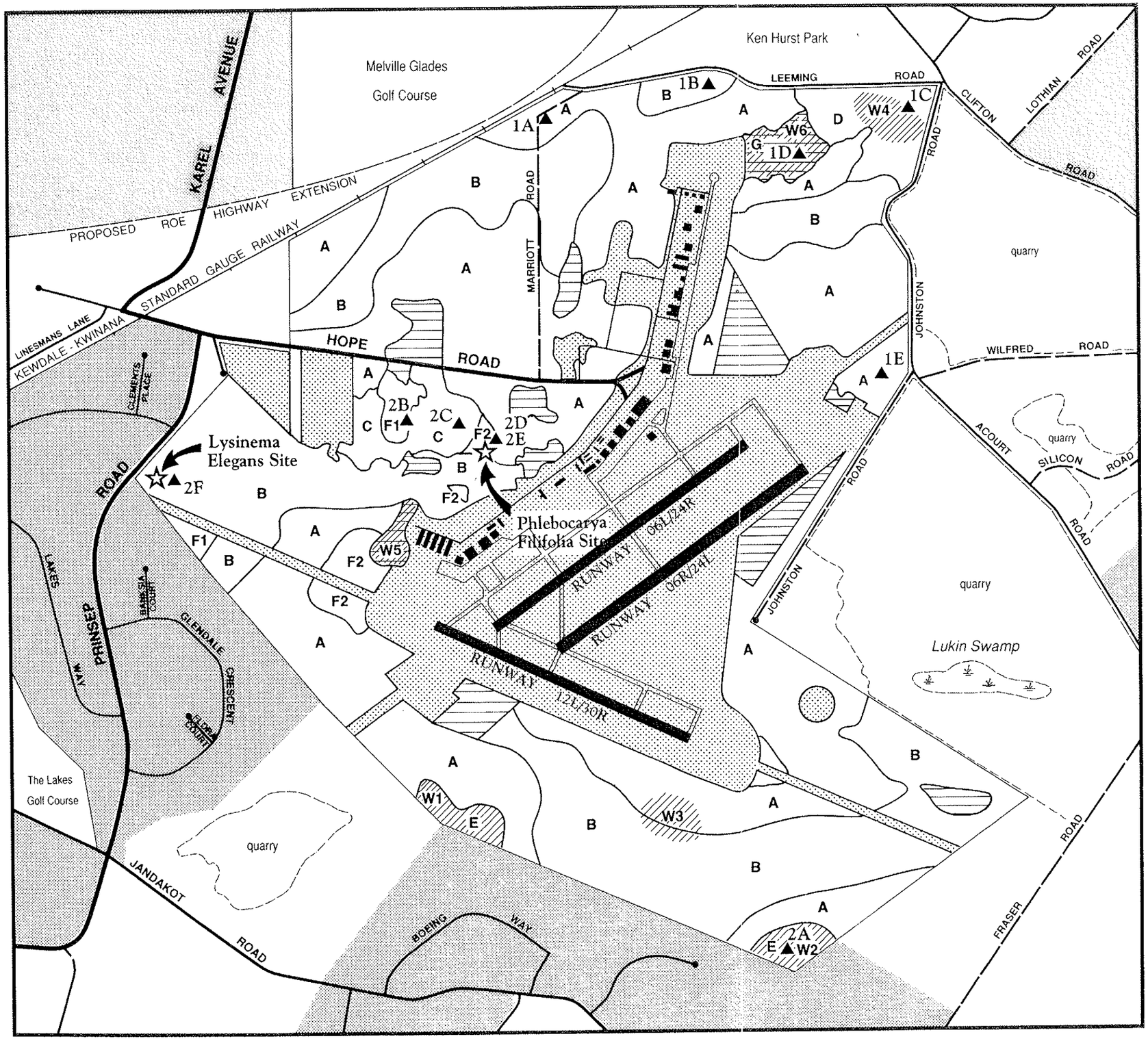
- **A** Jarrah-Banksia Woodland
- **B** Mixed Banksia low open forest
- **C** *Eucalyptus rudis* open forest/woodland
- **D** *Melaleuca/Pericalymma* open woodland/heath
- **E** Mosaic of various heaths, shrub heaths and woodlands
- **F** Heaths cleared of Banksia woodland overstorey
- **G** *Baumea articulata* sedgeland

For full description of Vegetation Categories see Appendix D.

JANDAKOT AIRPORT DEVELOPMENT - EIS

VEGETATION MAP

FIGURE 6.1



0 300 600m

SCALE 1 : 15 000

Totally cleared of all native vegetation

Largely cleared of native vegetation

W3 Wetland/Dampland (Number)

1F▲ Plate (photograph) number

Existing or Proposed Residential Area

Existing Airport Buildings

Native Vegetation Categories

- **A** Jarrah-Banksia Woodland
- **B** Mixed Banksia low open forest
- **C** *Eucalyptus rudis* open forest/woodland
- **D** *Melaleuca/Pericalymma* open woodland/heath
- **E** Mosaic of various heaths, shrub heaths and woodlands
- **F** Heaths cleared of Banksia woodland overstorey
- **G** *Baumea articulata* sedgeland

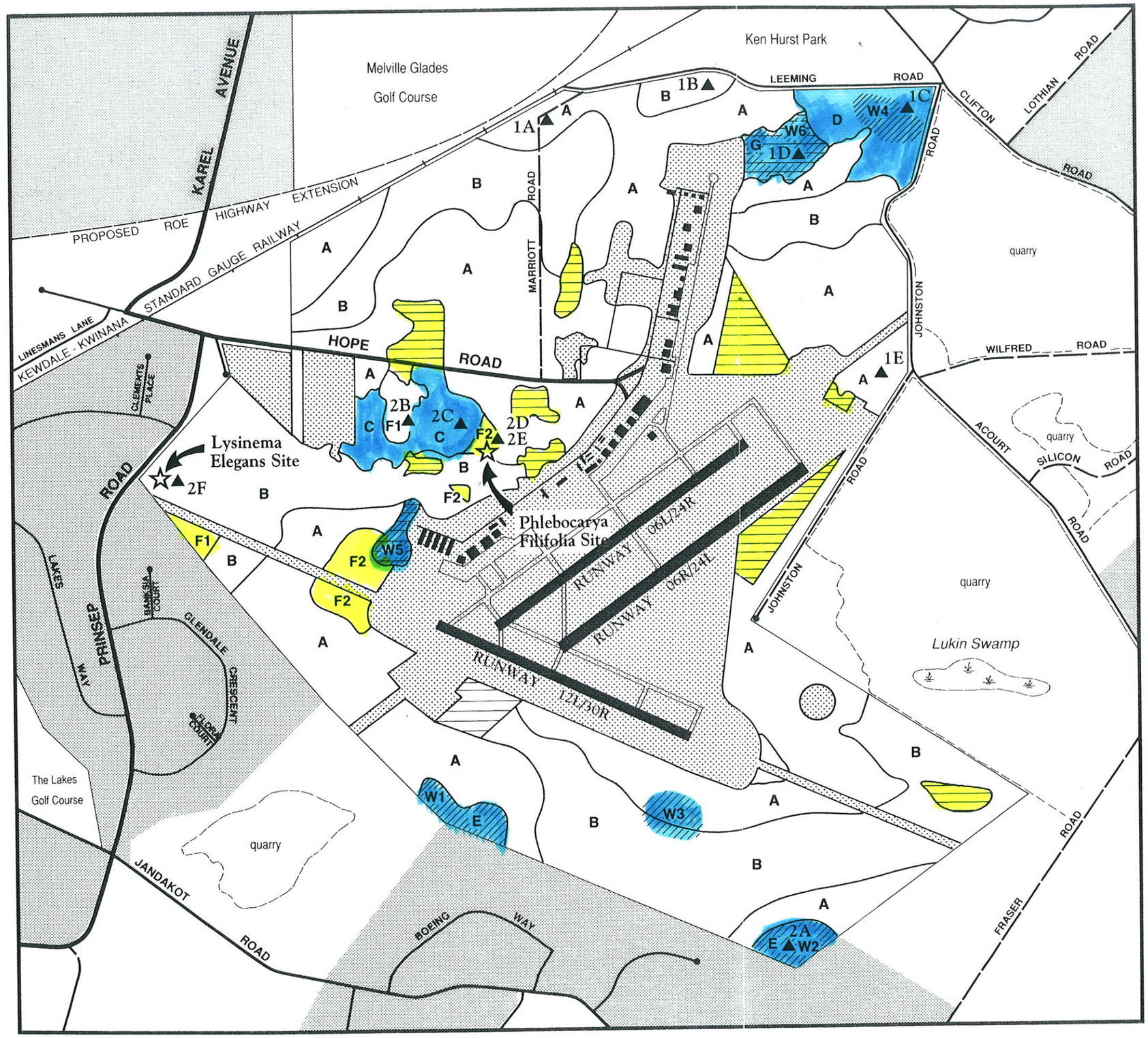
For full description of Vegetation Categories see Appendix D.

JANDAKOT AIRPORT DEVELOPMENT - EIS

VEGETATION MAP

DAMES & MOORE

FIGURE 6.1



0 300 600m

SCALE 1 : 15 000

Totally cleared of all native vegetation

Largely cleared of native vegetation

W3 Wetland/Dampland (Number)

1F▲ Plate (photograph) number

Existing or Proposed Residential Area

Existing Airport Buildings

Native Vegetation Categories

A Jarrah-Banksia Woodland

B Mixed Banksia low open forest

C *Eucalyptus rudis* open forest/woodland

D *Melaleuca/Pericalymma* open woodland/heath

E Mosaic of various heaths, shrub heaths and woodlands

F Heaths cleared of Banksia woodland overstorey

G *Baumea articulata* sedgeland

For full description of Vegetation Categories see Appendix D.

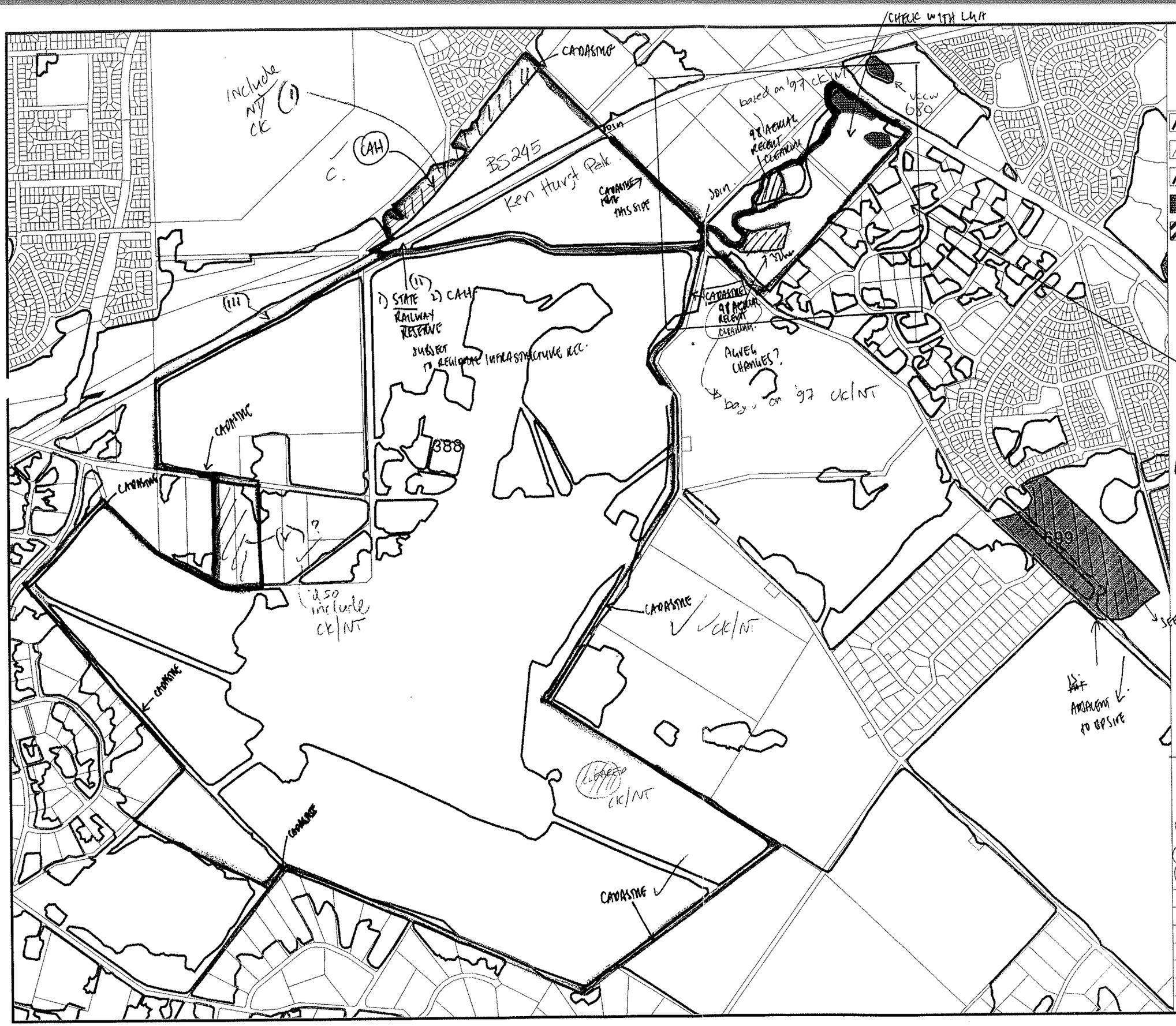
Vegn of W2?

JANDAKOT AIRPORT DEVELOPMENT - EIS

VEGETATION MAP

DAMES & MOORE

FIGURE 6.1


bp site 388
AG VEG 1998 BOUNDARY THEME
Cadastre
Bushplan sites refno 1-500 SCP BOUNDARY THI
cons category wetlands
Verified CCWs
Include NT CK (I)
CAH
BS245
Ken Hurst Park
CADASTRE
based on '97 CK/NT
CHECK WITH CH/T
VCCW 680
98 AGWAY RECENT CLEARING
388
1) STATE 2) CAH RAILWAY RESERVE
SUBJECT TO REGIONAL INFRASTRUCTURE REC.
(II)
(III)
(IV)
DEB, PLEASE REVISAL PLOT OF THIS AREA
ALVEG CHANGES?
by, on '97 CK/NT
(I) CAH in MRS SHOULD LEAVE OUT UNUSED VEG GOOD ONLY BASSENDEAN
(II) Rail reserve through (I) retain but discourage leave out PG (III)
(IV) Agreed as you're shown
(V) Subject to Veg Consultn possibly in Crown land not PD in MRS ??
Also include CK/NT
CK/NT
CK/NT
29/6/98 CK/NT
(1) include (V) above
(2) Separate 245 + 388
(3) include (1) in 245
(4) Note: based on '97 Aerial mapping ∴ can't use '98
Map Ident: plot980604_1 but is '98 aerial
Prepared By: Andrea Zappacosta
Prepared For:
Date: 04 Jun 98
Scale 1:15315
0 500 m
MFP INTERNAL USE ONLY

JANDAKOT AIRPORT 26/10/94

Several hill ridges, one to the NE other to SW site, SW area

Wetland on far corner (W2) burnt, several Euc. rudis

(W4) Scattered Jarrah to 20m in area like Site Ø3/2/04 dieback taking out Banksias to leave as a Mel.L. Woodland. Central disturbance photo tapes taken from cleared area

Banksia ridge along Ten Hurst Pk 2 sites

Site Ø7 similar to Slopes inter. of Banksia Woodland in the Park.

BS388 6/4/01

Phil fil-folia → Acourt red also

Location 3

Cyath aurom.
Lygimb/~~bar~~
Regcil (pink flws)
Hypoang
Lecflor
~~Hellard~~ Pulteraea reticulata pea
Cassyrac ?
Lepid squ ~~ang~~ ?
Nemret
Astfasc
Hibbrac ?/subu.
Gomtom
Acasten
Thysmult? ✓
~~Anarth~~ other are Lawry Scealand at base
Schgrand
Sch~~oe~~efol
Aotus sp ? (spindly ~~procum~~ ~~gracilli~~ red pea)
Leucspeng
Leuc sp ?
? 1 Aotus procumbens
? 2 Sedge. Baum sp.
? 3 Monocot (papery bases)

Lewaustr ?
- wetland
Leucopogon

Location 4 5

Petlin
Stirlat
Bosseri
Schinvol
Patocc
Hibhyp
Gomtom hueglii
Hibb longlus
Amphturb
Lygimb/bar
Agrostcr sp (purple lily)
Phil fil ? LS
~~Hypocal Rob~~ ✓
Lepid squ ang? ✓
Lax squarrosa ✓
Curly lus (Lonandra?) haem
Acapul
Desmoflex
Constpend.
Calnar
Schoenus sp?

Location 6

MelspB
Dasbrom
Hibbrac
Gomtom
Platcirr
Lepid squ ~~ang~~ ?
Regirl
Acasten
Maron Backeri ~~Daisy~~ White Daisy
Damlin
Compend
Lygimb/bar
Hypang
~~Conolongsmoothtus~~.

Pithocarpa pul ?
Conjunc

BS388

6/4/01

Location 1

Persacc
Hibhyp
Ereast
Kuneri
~~Erepau~~ hueg
Hib longlus
* Melsp B
Meslpseud
Dasbrom
Gomtom
Agrost (purple lily)
Bosseri
Lyg imb/bar
Plateir
Calfras
Hypoexs
Hib ~~sub~~/rac
Regil ~~inops~~
Allochum
Petlin
Hensturb
Amphturb
Melthym
Schaerv
Jacksorc

Calflav
Schinvol
Austrodsp
Scav rep?
Conacu
Leuconst ✓
Desmflex
Conpreissii ~~pend~~?
Stylsp. pil?
Hibsob?

Location 2

Lygb~~ar~~/imb
Allhum
Platycirr
Schinvol
Dasybrom
Stirlat
Opervag
Schefol? ✓
Regil
Lepidsqua
Desmflex
Petlin
Leuspreng? ?
Gomtom
Erepauc
Bosseric
Constpend? ?
Stirlat
Amphturb
Lepidsquam.
Lily? ~~Thysam~~?
~~Dam~~lin
Adenanthobov ✓
? 1(Sh) Calnarragarra?
? 2(Shrub) Melsp

* Carpedu
* Brizmax

C. minus thing
C preissii

Keighery May 1999 Tech. Rep.

Federal Airports Coorporation (Hope Rd)

City of Canning ~~6461.297 ha~~? Lot 500 Johnston Rd.

Whole. BF 6496 ~~7~~ ha. ~~11062.55~~ ~~8220.54~~

City of Melville - KH Park. Lot 3 Clifton Rd.

58.59 ~~22.66~~ ha.

PB 389 305.97 ha.

Preliminary Assessment due by 26 April '01

Based on Bushfire Response Plan Map.

Assess block Hope Rd – Marriot Rd – Leeming Rd

Areas 46, 47, 48, 49, 8 & 9.

2 Develop Proposals

1) Satellite areas 8 & 9

2) area 48 – Degraded BW – grassy weed understt & frequently burnt.

8/2/01 Jandakot
Airport site visit

Stage 1 ~~Re~~ Concept Design.

Satellite Dish - 11-12 dishes over ~ 8ha.

- 50-60% retention of bushland.

(1) Central Development Section 1 – "taxi ~~runway~~ way"

9 hangers

(2) Satellite Proposal –
- Before end of April –

EPBC Act. Access via Harvard Rd.

(3) Newdegate site.

Fig 5.1 *.

Fig 3.7 * Runway / Hanger Development.

* Env. Signif triggers Airport Act.
Major Development Plan – process

Neil Goldsborough's # for Sharron re plants.

Calhue(R) / WSWA Murdoch Br. Survey / 4 plots / Indicative Place of NEst

Ken Hurst Pk 214 native taxa (>85% expected) – EPBC Act
Jandakot 149 " (<50% ")
Acourt Rd 197 " (>75% ") – Clarke et al 2000

~~Interim List of~~ Register of Nat Est subject to EPBC Act 1999 – fauna??

Additional
~~SFCT expected for E. rudis (Keighery 1999)~~ Hooded Plover? see Table 15. p61 Vol 2

Linkage, TEC, Threatened Species DRF/P, signif.

RH → CCW's WRC 2000? or use Hill, Semeniuk.

~~Prelim Vegn Ass not including Fauna~~

Sign spp in Ken Hurst Pk likely c.f. Jandakot.

Ken Hurst Pk – nat conservation City of Melville
622 ha whole site
Reserve No. 33290 unvested crown reserve (J Bot Pk)
(Miller, 2000)

~~200 of the 410 ha Banksia Woodland proposed for conservation.~~

ie 210 ha in devel ~~precinct~~?

- PDES – 177 native flora (Martinick & Muir 1993)
(except > 200 Keighery 1999)
so far vascular plants

214 spp ↑ 206 native taxa (8 weeds)

(1981)
~~Milewski & Davidge – 122 sp~~
~~Martinick & Assoc – 95 sp~~
~~Lamont (pers comm 1990 – 85 sp~~
~~Muir (1993) – 175 sp~~

Dieback – Wetland in NE corner
Area W of Marriot Rd zoned Rural
rest Public Purpose

quotes *.

Mart & Assoc. – the condition of the native vegn is generally pristine.

EPA (1993) regarded as one of the best examples of Banksia woodland remaining in the Swan PMA.

Remnant is substantial size & one of larger remnant blocks in Perth Region.

DoM 1995 – AHC Interim List of Jandakot Airport. overall condition mainly "good to v. good." with a number of disturbed areas.

scale used?

NB Scare rep is Sca paludosa not priority taxon

Keighery 1999 — sign flora in BF assoc with species rich Banksia woodlands of B-C & S & assoc. FCT.

sign popn Lysinema elegans – only 2 large popns sth of Perth, both Jandakot Jandakot Airport prob largest. Not common sth of Perth.

Other Studies
Trudgen 1995

Hamont pers com (Curtin Uni students) 85 spp

* Milewski & Davidge 1981 117 122 sp (+5 weeds)
(over half study area inside airport)
Martinick & Ats 1989 89 95 sp (+6 weeds)

Weston 1990 — sp incl. 2 priority spp (Lyseleg & Phlfili)
other signi spp Leuking & Conminus

expected. > 200 , > 20 weeds

DRF/P flora sort (& Signif spp?). occur in a limited range of wetland habitats.

Trudgen 1995

** <5% of B-C&S remains uncleared. with signif ant in Jandakot area.

cf BF 13% → protection!
& __% left.

192 sp recorded (cited from? Dames & Moore 1995?)

Croninia kingana
Lys ele P2 } in 1995
Con min P4 }

* Stands of vegn with Leuking in common in understorey quite unusual

Calhue DRF Kenhurst Pk
Croking ✓
= Leuking? uncommon spp - locally abundant @ JAH.

NB: my field notes

Bank woodlands over
Plat cir herblands (eg NW corner.)

Adecyc >2m 30-70% with BW understorey
(scattered emergent Banatt <10m)

? Wetland mapped wrong WRC 2000
extends further west?

Check Miller's 2000 aerial for
veg mapping.

Wetland vs upland mapped for
prelim report - more work
needed to map variation in uplands
(give broad indic from aerial?)

(Add in spp list of 249 taxa?
(?do sp ff but spp list later?))

Sign spp < Hens turb L1?
Cyathaven L3
Phil filifolia. L5

Heritage Listing, Museum sites, plots

Priority Area L3.1 (Fig 3.6) Sinclair Knight Merz 2000b?

& L3.2 Proposed for non-aviation development (see Fig 10.1) (MP 2000a)

Ken Hurst Pk spp list - eg Calhue likely on JAH

Diupurd? (Clarke et al, 2000)

Drackelastica?

Forrestdale Lake

Most Dieback free (Miller 2000 report)

NB: Location/Site 3 site of a dieback sample #2 & ID'ed as dieback infested, much of RH wetland shown as dieback infested.

No DRF?

P Flora - Conostephium minus (P4?) P3?

Scaevola paludosa (repens?) (P2?)

Signif Flora - Lysinema elegans (used to be P2)

Phlebocarya filifolia. (used to be P3)

NB: Drainage Basin / Wetland

* Spp List Quadrats 6, 7, 8 Spp list whole site? cf spp list (Miller, 2000)

* Dieback mapping

Groundwater draw down?

Contours to map vegn?

NB 10 A Fire Cell = Artificial Drainage Basin = Wetland 5

NB Wetland 4 JAH / Dames & Moore = small area of RH Wetland (WRC 2000 a)

Appendix 1 - BJK's reports

2 - BF desc

3 - Locations

4 - Floristic Plots.

Map 1 - BF Site - show 200ha conserv zone.

Map 2 - JAH Priority Areas + ~210ha develop zone.

" 3 - Aerial - Plot Locations

" 4 - Vegn Map - Martinick/DoM

" 5 - WRC Wetlands

" 6 - Vegn Map DEP 2001

BUSHLAND PLANT SURVEY RECORDING SHEET 1- use pencil only

BUSHLAND AREA BS388 SITE NUMBER 6

DATE TRIP _____ RECORDERS _____

DATE TRIP _____ RECORDERS _____

DATE TRIP _____ RECORDERS _____

BOTANIST _____

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

1. LOCATION of the QUADRAT

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

N

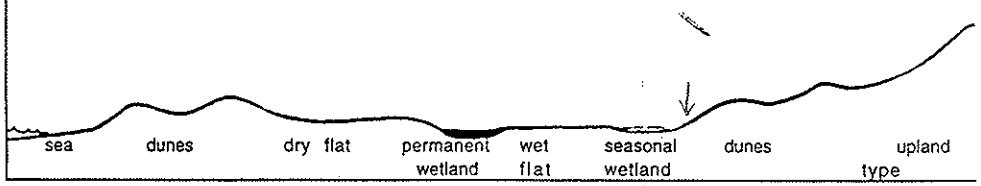
Road Location

Geographic Location Latitude S Longitude E Altitude

Reference Map

Photograph Photographer's Name S Sandiford Photo No 7

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 *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		

	TREES			MALLEES	
	over 30m	10 - 30m	under 10m	over 8m	under 8m
LIFE FORM					30m 10m
COVER CLASS (%)		10 - 30%			
DOMINANT SPECIES		Banksia Melaes (Banthem - same)			

	SHRUBS		SHRUBS
	over 2m	2m - 1m	under 1m
LIFE FORM			2m 1m
COVER CLASS (%)		10 - 30%	10 - 30%
DOMINANT SPECIES		Xanthoea	Melsp B Hibsubv

	GRASSES	HERBS	SEDGES	OTHER
LIFE FORM			1m	
COVER CLASS (%)		2 - 10%	2 - 10%	
DOMINANT SPECIES		Hypgog	Lepidosp	

4. VEGETATION CONDITION

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

COMMENTS Burnt 97? on NW side of track. Ex ~~VG~~ EX Lots of disturb. not Stirling side not due to rabbits

Lots of Rabbit diggings

Astfasc, Hypgog, Hibsubv?, Lepidesp, Daygram, Regcil, Phlcil, White daisy, Gomtom, Cono Schefol, MelspB, Jackfor, Boraspath Hyglear, Nytflor

BUSHLAND PLANT SURVEY RECORDING SHEET 1- use pencil only

BUSHLAND AREA BS 38 SITE NUMBER 5

DATE TRIP _____ RECORDERS _____

DATE TRIP _____ RECORDERS _____

DATE TRIP _____ RECORDERS _____

BOTANIST _____

From '*Bushland Plant Survey*' written B. Keighery (1994) and published by 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 6

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 *Colour*

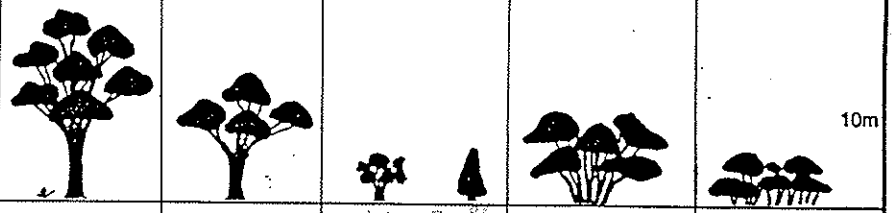
Exposed rock *type* % surface

Sub-surface Soil *Colour*

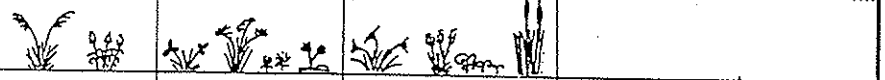
Rock *type* depth to rock

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

Litter	% cover	*Bare Ground*	%cover
Depth	cm		

	TREES			MALLEES	
	over 30m	10 - 30m	under 10m	over 8m	under 8m
LIFE FORM					30m / 10m
COVER CLASS (%)			10 - 30%		
DOMINANT SPECIES			Eucmar		
			Allfrae		

	SHRUBS		SHRUBS
	over 2m	2m - 1m	under 1m
LIFE FORM			2m / 1m
COVER CLASS (%)	2 - 10%	2 - 10%	30 → 70%
DOMINANT SPECIES	Melhyp	Xanthopres	Mixed

	GRASSES	HERBS	SEDGES	OTHER
LIFE FORM				1m
COVER CLASS (%)		2 - 10%		
DOMINANT SPECIES		Patorc		

4. VEGETATION CONDITION

1 'PRISTINE'		COMMENTS EX-VG
2 EXCELLENT	I	Not burnt in '97 (?)
3 VERY GOOD	I	
4 GOOD		
5 DEGRADED		

BUSHLAND PLANT SURVEY RECORDING SHEET 1- use pencil only

BUSHLAND AREA BS 388 SITE NUMBER 4

DATE TRIP 6/4/01 RECORDERS

DATE TRIP RECORDERS

DATE TRIP RECORDERS

BOTANIST

From '*Bushland Plant Survey*' written B. Keighery (1994) and published by 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

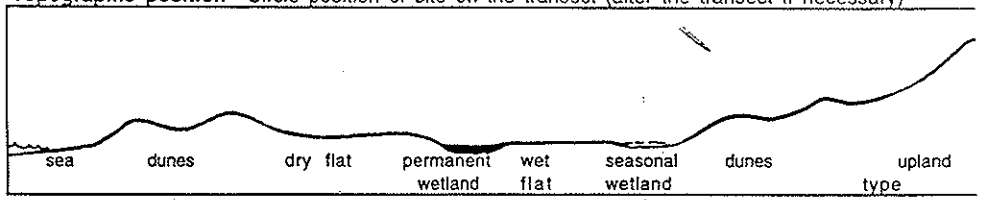
Road Location

Geographic Location Latitude S Longitude E Altitude

Reference Map

Photograph Photographer's Name S. Sandrock Photo No 5

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 ***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		

	TREES over 30m	TREES 10 - 30m	TREES under 10m	MALLEES over 8m	MALLEES under 8m
LIFE FORM					30m 10m
COVER CLASS (%)			2 - 10%		
DOMINANT SPECIES			Banatt		

	SHRUBS over 2m	SHRUBS 2m - 1m	SHRUBS under 1m
LIFE FORM			2m 1m
COVER CLASS (%)		30 - 70%	10 - 30%
DOMINANT SPECIES		Striat Athum	Hibbhyp

Scattered Banksman, Acacmar, Eucmar

	GRASSES	HERBS	SEDGES	OTHER
LIFE FORM				1m
COVER CLASS (%)			2 - 10%	
DOMINANT SPECIES			Lyabar	

4. VEGETATION CONDITION

		COMMENTS
1 'PRISTINE'		Ex-VG Regenerating v. well from a hot burn.
2 EXCELLENT	I	
3 VERY GOOD		
4 GOOD		
5 DEGRADED		* Gladcary 1 few.

Perssac, Athum, Petlin, Basceri, Calfhir, Lyabar, Gomtom, Dam, Amphturb, Hibb sp (aur?), Lax sp, Hibbhyp Acapul, Constephsp, Phlcil, Schinv, Ereast, Jackfurc, Nythor, Schcurv, Dawtrif,

BUSHLAND PLANT SURVEY RECORDING SHEET 1- use pencil only

BUSHLAND AREA [illegible] SITE NUMBER 3

DATE TRIP 6/6/01 RECORDERS K. Clarke

DATE TRIP _____ RECORDERS _____

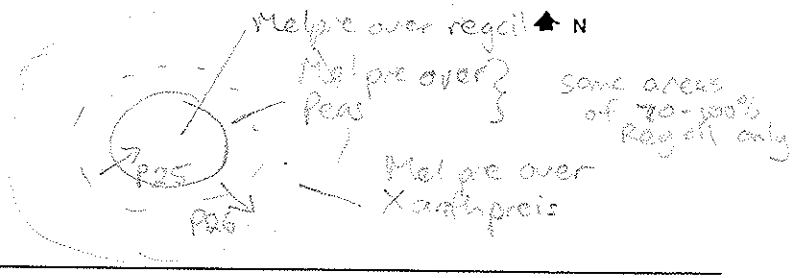
DATE TRIP _____ RECORDERS _____

BOTANIST _____

From *'Bushland Plant Survey'* written B. Keighery (1994) and published by 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.



Road Location _____

Geographic Location Latitude _____ S Longitude _____ E Altitude _____

Reference Map _____

Photograph Photographer's Name S. Santich Photo No 25

Topographic position Circle position of site on the transect (alter the transect if necessary) 26

2. SITE DATA Circle the correct response.

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

Surface Soil *Colour*

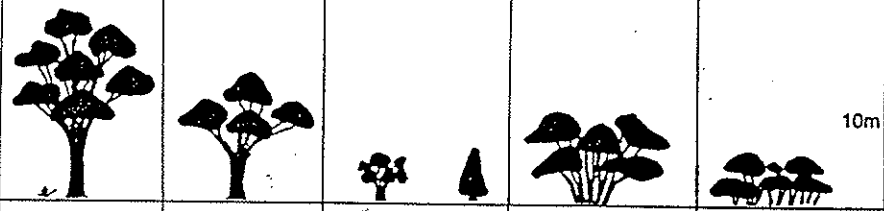
Exposed rock *type* % surface

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		

	TREES			MALLEES	
	over 30m	10 - 30m	under 10m	over 8m	under 8m
LIFE FORM					
COVER CLASS (%)			10-30		
DOMINANT SPECIES			Melpre		
			scatter - Rankit		

	SHRUBS over 2m	SHRUBS 2m - 1m	SHRUBS under 1m
LIFE FORM			
COVER CLASS (%)	30-70%	30-70%	
DOMINANT SPECIES	Pea sp1 (perimeter) Regrowth	Regrowth	

	GRASSES	HERBS	SEDGES	OTHER
LIFE FORM				
COVER CLASS (%)			2-10%	
DOMINANT SPECIES			Lepton (middle)	
			Lepton (lower outside zone)	30-70%

4. VEGETATION CONDITION

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

COMMENTS

Ex-VG (outer transect, some area bare patches due to past fire)

Astfas, Thysmult?, Kunoni, Regrowth, Jacksure, Acapul, Hibcuba?, Hypoang, Dasstrom outer

BUSHLAND PLANT SURVEY RECORDING SHEET 1- use pencil only

BUSHLAND AREA RK 038 SITE NUMBER 2

DATE TRIP 6/8/4/01 RECORDERS K Clarke

DATE TRIP _____ RECORDERS _____

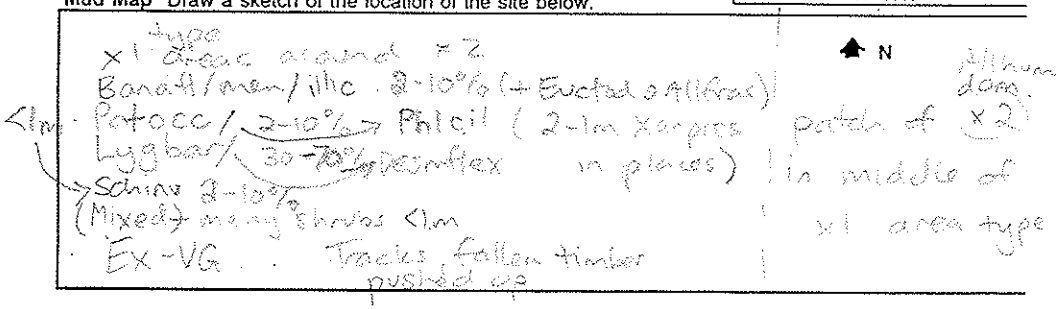
DATE TRIP _____ RECORDERS _____

BOTANIST _____

From '*Bushland Plant Survey*' written B. Keighery (1994) and published by 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.



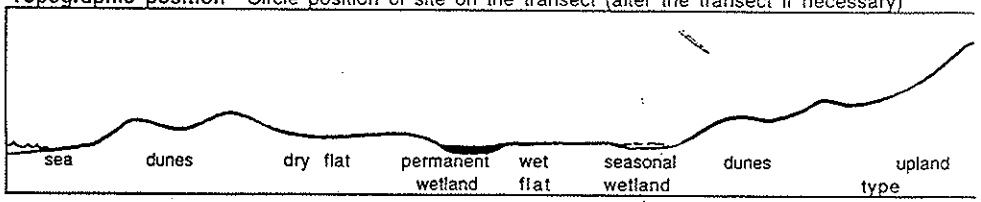
Road Location _____

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 **Colour**

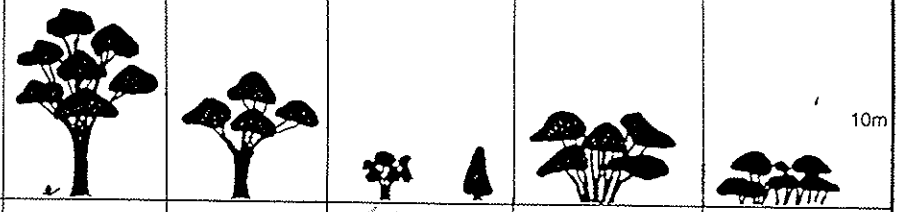
Exposed rock **type** % surface

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		

	TREES			MALLEES	
	over 30m	10 - 30m	under 10m	over 8m	under 8m
LIFE FORM					
COVER CLASS (%)			10 - 30 %		
DOMINANT SPECIES			Banatt Banmeo		

	SHRUBS over 2m	SHRUBS 2m - 1m	SHRUBS under 1m
LIFE FORM			
COVER CLASS (%)		30 - 70 %	10 - 30 %
DOMINANT SPECIES		Allnum	Schinv

	GRASSES	HERBS	SEDGES	OTHER
LIFE FORM				
COVER CLASS (%)	2 - 10 %	2 - 10 %	2 - 10 %	
DOMINANT SPECIES	Amaeri	Patarc	Desmoflex Lygbar	

4. VEGETATION CONDITION

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

COMMENTS

Ex-VG, tracks, some tree deaths.

BUSHLAND PLANT SURVEY RECORDING SHEET !- use pencil only

BUSHLAND AREA BS SITE NUMBER 1

DATE TRIP 6/11/01 RECORDERS K.Clarke

DATE TRIP _____ RECORDERS _____

DATE TRIP _____ RECORDERS _____

BOTANIST _____

From '*Bushland Plant Survey*' written B. Keighery (1994) and published by 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

more Schinus & Patoce down slope in Swales.

Banksia down slope.

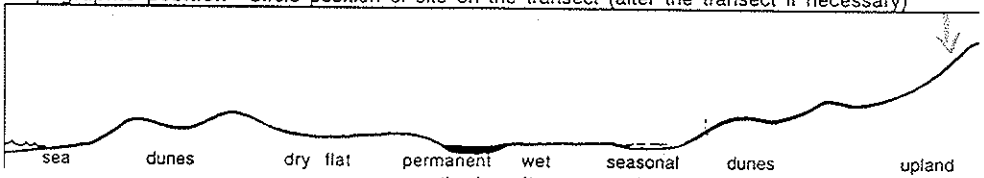
Road Location

Geographic Location Latitude S Longitude E Altitude

Reference Map

Photograph Photographer's Name S. Sarich Photo No 18 & 19 20 & 21

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* Light Grey

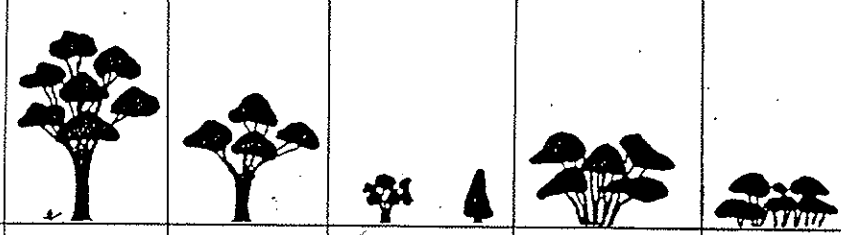
Exposed rock *type* % surface

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		

	TREES			MALLEES	
	over 30m	10 - 30m	under 10m	over 8m	under 8m
LIFE FORM					30m / 10m
COVER CLASS (%)			5 - 30%		
DOMINANT SPECIES			Banoth Banmenz		

Scott Mallees (mostly) (Sand)

	SHRUBS		SHRUBS
	over 2m	2m - 1m	under 1m
LIFE FORM			2m / 1m
COVER CLASS (%)			30 - 70 %
DOMINANT SPECIES			Hobnup Low Sp Cat-Haw

	GRASSES	HERBS	SEDGES	OTHER
LIFE FORM				1m
COVER CLASS (%)	5 - 10%		5 - 10%	
DOMINANT SPECIES	Amphibro		Mesoscendo	

4. VEGETATION CONDITION

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

COMMENTS

Ex-Var - rabbit diggings Basement diggings as groundwater drawdown man disturbance?

Native grasses present few & Gladeare

Patoce, Schinus, Allohum, Macrocd, Xanthor, Adenyo, Kangaroo (fresh droppings), Rabbit diggings (Late) No dieback? - see report, Nytflor, Conacut, Rossac, Ereast, Melhum, Melsp B, Dasbrom, Rostem, Arihum, Calflav, Hensturb, Calfras, Lygbar, Stirlat, Davtrif, Gomtom, Hibhug, Anabturb, Platgain, Acepul, Scalpal?, Lotlin,

C. *Eucalyptus rudis* open forest/woodland — interdunal area with impeded drainage
D. *Melaleuca-Pericalymma* open woodland/heath — some wetlands depression in interD areas with impeded drainage
E. Mosaic of various heaths, shrub heaths and woodlands
F. Heaths cleared of *Banksia* woodland overstorey — wetland depressions & marginal area no5 bounding
G. *Baumea articulata* sedgeland — quarry-sump area (Wetland 6)

(as cited in Dames and Moore 1993)

In 1994, eight 10 x 10m permanent plots were established at Jandakot Airport as part of the System 6 and Part System 1 Update Program (DEP 1996, see Map x). This allowed regional floristic community types to be determined across the Site (see Appendix 1) and further contributed to the species list.

In Bush Forever, based on DEP (1996), Dames and Moore (1993) and Martinick & Associates Pty Ltd 1989, the vegetation has been documented in more detail as the following structural units:

Uplands – (equating to units A & B, map x)

- Scattered *Eucalyptus marginata* over *Banksia attenuata*, *B. menziesii*, *Allocasuarina fraseriana* and *Eucalyptus todtiana* Low Woodland (Plot 7) = L1, L5
- *Banksia attenuata*, *B. menziesii* and *Nuytsia floribunda* Low Woodland
- *Banksia attenuata* and *B. menziesii* Low Woodland (Plot 8) = L2, L4

Wetlands -

- *Eucalyptus rudis* Forest to Woodland (equating to unit C, map x)
- *Melaleuca preissiana* Low Woodland (equating to unit d***, map x) (Plot 6) = L5
- scattered *Melaleuca preissiana* over *Banksia attenuata* and *B. ilicifolia* Low Open Forest (equating to units d & e***, map x) L6
- *Pericalymma ellipticum* Open Low Heath (equating to unit d***, map x).

Vegetation Condition was recorded as >85% Excellent to Very Good with <15 % in Very Good to Good Condition across the Site (Government of Western Australia 2000b). A species list was compiled from DEP (1996) and Martinick (1989) giving a total of 149 native taxa, estimated at <50% expected flora by Government of Western Australia (2000b). Of these species *Leucopogon kingianus*, *Lysinema elegans* (significant population), *Astroloma xerophyllum* and *Hensmania turbinata* were recorded as significant flora for the Site (Government of Western Australia 2000b).

A number of seasonal, vegetated wetlands occur on the Site, however, many of these are not well documented or mapped. The six vegetation types of Martinick & Associates Pty Ltd (1989) have been incorrectly attributed to four types of *Banksia* woodland and two types of wetland vegetation (as cited in Dames and Moore 1993). Martinick's Types A & B (plus the partially cleared F) are variations of *Banksia* woodland but C, D, E & G are all wetland vegetation. Thus, the vegetation map prepared by Martinick & Associates Pty Ltd (1989) records the presence of seven wetlands, not six (see Map x):

- Wetland 1 - Mosaic of various heaths, shrub heaths and woodlands
- Wetland 2 - Mosaic of various heaths, shrub heaths and woodlands
- Wetland 3 - shown as Jarrah-*Banksia* woodland & mixed *Banksia* low open forest
- Wetland 4 - *Melaleuca-Pericalymma* open woodland/heath
- Wetland 5 – vegetation type not shown
- Wetland 6 - *Baumea articulata* sedgeland
- plus a 7th wetland - *Eucalyptus rudis* open forest/woodland

NB: This is informal advice and should not be regarded as formal Section 38 advice under the Environmental Protection Act but represents DEP Conservation Branch advice subject to ratification through Bush Forever Inter-agency Co-ordination Group sign off.

A. Jarrah-*Banksia* woodland (low woodland and low open forest)
B. Mixed *Banksia* low open forest (to low woodland)
C. *Eucalyptus rudis* open forest/woodland
D. *Melaleuca-Pericalymma* open woodland/heath
E. Mosaic of various heaths, shrub heaths and woodlands
F. Heaths cleared of *Banksia* woodland overstorey
G. *Baumea articulata* sedgeland

(Dames and Moore 1993)

In Bush Forever, based on DEP (1996), Dames and Moore (1993) and Martinick & Associates Pty Ltd (1989), the vegetation is described in more detail as the following structural units (Government of Western Australia 2000b):

Uplands – (equating to units A & B, Map 4)
- Scattered *Eucalyptus marginata* over *Banksia attenuata, B. menziesii, Allocasuarina fraseriana* and *Eucalyptus todtiana* Low Woodland
- *Banksia attenuata, B. menziesii* and *Nuytsia floribunda* Low Woodland
- *Banksia attenuata* and *B. menziesii* Low Woodland

Wetlands -
- *Eucalyptus rudis* Forest to Woodland (equating to unit C, Map 4)
- *Melaleuca preissiana* Low Woodland (equating to unit D, Map 4)
- scattered *Melaleuca preissiana* over *Banksia attenuata* and *B. ilicifolia* Low Open Forest (equating to units D & E, Map 4)
- *Pericalymma ellipticum* Open Low Heath (equating to unit D, Map 4).

The *Baumea articulata* sedgeland was not listed as a major unit as it ~~only~~ occurs in a disturbed area previously excavated for drainage purposes (Wetland 6, Map 4). Vegetation condition was recorded as >85% Excellent to Very Good with <15 % in Very Good to Good Condition across the Site (Government of Western Australia 2000b). A species list was compiled from DEP (1996) and Martinick (1989) giving a total of 149 native taxa, estimated at <50% expected flora by Government of Western Australia (2000b). Miller (2000) documents 206 native taxa for Jandakot Airport based on an amalgamation of lists from Milewski & Davidge (1981), Martinick & Associates Pty Ltd 1989, Muir (1993) and Lammont (pers. comm. 1990). It was expected that over 200 native taxa are present because in the adjacent Ken Hurst Park, 214 native taxa have been recorded in remnant vegetation of similar type ~~but only 52.7 ha~~ (Government of Western Australia 2000b).

in a much larger area (52.7 ha)

It should be noted that previous records of *Scaveola repens* have been incorrectly called *Scaveola paludosa* (a Priority 2 species) (Keighery 1999). At present there are no currently listed Declared Rare Flora (DRF) or Priority species recorded at Jandakot Airport. However, a number of significant flora are present *Leucopogon kingianus, Lysinema elegans* (significant population), *Astroloma xerophyllum* and *Hensmania turbinata* occur on the Site (Government of Western Australia 2000b). The significant flora recorded for Ken Hurst Park may also be present at Jandakot Airport; *Caladenia huegelii* (Declared Rare Flora), *Drosera zonaria, Stylidium preissii* and *Stylidium squamellosum* (Government of Western Australia 2000b).

Cyathochaeta avenacea (possibly most western pop on the plain in Park)

A number of seasonal, vegetated wetlands occur on the Site but many of these are not well documented or mapped. The six vegetation units described in Dames and Moore (1993) were incorrectly attributed to four types of *Banksia* woodland and two types of wetland vegetation. The units A & B (plus the partially cleared F) are variations of *Banksia* woodland but C, D, E & G are all wetland vegetation. Thus, the vegetation map in Dames and Moore (1993) records the presence of seven wetlands, not six (see Map 4):
- Wetland 1 - Mosaic of various heaths, shrub heaths and woodlands
- Wetland 2 - Mosaic of various heaths, shrub heaths and woodlands
- Wetland 3 - (shown as Jarrah-*Banksia* woodland & mixed *Banksia* low open forest)
- Wetland 4 - *Melaleuca-Pericalymma* open woodland/heath
- Wetland 5 – vegetation type not shown
- Wetland 6 - *Baumea articulata* sedgeland (in drainage sump area)
- plus a 7th wetland - *Eucalyptus rudis* open forest/woodland

Department of Environmental Protection System 6 Update : Site based Flora List for M94 Jandakot Airport (B.J. Keighery 14/3/1995)

Anthericaceae
- Arnocrinum preissii
- Chamaescilla corymbosa
- Hensmania turbinata
- Laxmannia ramosa
- Laxmannia squarrosa
- Thysanotus arbuscula
- Thysanotus multiflorus
- Thysanotus patersonii
- Thysanotus sparteus
- Thysanotus thyrsoideus
- Tricoryne tenella

Apiaceae
- Homalosciadium homalocarpum
- Platysace compressa
- Trachymene pilosa
- Xanthosia huegelii

Asteraceae
- * Arctotheca calendula
- * Conyza sp. scps
- Gnaphalium sphaericum
- Hyalosperma cotula
- * Hypochaeris glabra
- Millotia tenuifolia
- Pithocarpa pulchella
- Podotheca angustifolia
- Podotheca chrysantha
- Podotheca sp. scps
- Quinetia urvillei
- Senecio lautus subsp. maritimus
- Siloxerus humifusus
- * Sonchus oleraceus
- * Ursinia anthemoides
- Waitzia suaveolens

Campanulaceae
- Wahlenbergia preissii

Casuarinaceae
- Allocasuarina fraseriana
- Allocasuarina humilis

Centrolepidaceae
- Centrolepis aristata
- Centrolepis drummondiana
- Centrolepis humillima

Colchicaceae
- Burchardia umbellata

Crassulaceae
- Crassula colorata

Cyperaceae
- Cyathochaeta avenacea
- Isolepis marginata
- Lepidosperma angustatum
- Lepidosperma longitudinale
- Mesomelaena pseudostygia
- Schoenus curvifolius
- Schoenus rodwayanus

Dasypogonaceae
- Dasypogon bromeliifolius
- Lomandra caespitosa
- Lomandra hermaphrodita
- Lomandra nigricans
- Lomandra suaveolens

Dilleniaceae
- Hibbertia aurea
- Hibbertia huegelii
- Hibbertia hypericoides
- Hibbertia subvaginata

Droseraceae
- Drosera menziesii subsp. penicillaris
- Drosera paleacea
- Drosera sp. scps

Epacridaceae
- Astroloma xerophyllum
- Conostephium pendulum
- Conostephium preissii
- Leucopogon conostephioides
- Leucopogon insularis
- Leucopogon kingianus
- Leucopogon nutans
- Leucopogon polymorphus
- Lysinema ciliatum

Euphorbiaceae
- Poranthera microphylla

Geraniaceae
- * Pelargonium capitatum

Goodeniaceae
- Dampiera linearis
- Goodenia pulchella
- Lechenaultia expansa
- Lechenaultia floribunda
- Scaevola repens
- Velleia sp. scsp

Haemodoraceae
- Anigozanthos humilis
- Conostylis aculeata
- Conostylis caricina
- Conostylis setigera
- Haemodorum paniculatum

Phlebocarya ciliata
Phlebocarya filifolia

Haloragaceae
Gonocarpus pithyoides

Iridaceae
* Gladiolus caryophyllaceus
Patersonia occidentalis

Lamiaceae
Hemiandra pungens

Lauraceae
Cassytha flava
Cassytha sp. scps

Lobeliaceae
Lobelia tenuior

Loganiaceae
Mitrasacme paradoxa

Loranthaceae
Nuytsia floribunda

Mimosaceae
Acacia "applanata" scps map
Acacia huegelii
Acacia pulchella
Acacia stenoptera

Myrtaceae
Astartea aff. fascicularis sthcst
Beaufortia elegans
Calytrix angulata
Calytrix flavescens
Calytrix fraseri
Eremaea asterocarpa
Eremaea pauciflora
Eucalyptus marginata
Eucalyptus todtiana
Hypocalymma angustifolium
Hypocalymma robustum
Melaleuca preissiana
Melaleuca sp. B FPR (BJK&NG 054)
Melaleuca thymoides
Pericalymma ellipticum
Regelia ciliata
Regelia inops
Scholtzia involucrata

Orchidaceae
Caladenia flava
Caladenia sp. scps
Leporella fimbriata
Lyperanthus nigricans
Microtis media

* Monadenia bracteata
Prasophyllum parvifolium
Thelymitra crinita
Thelymitra fuscolutea

Papilionaceae
Aotus procumbens
Bossiaea eriocarpa
Daviesia triflora
Euchilopsis linearis
Eutaxia virgata
Gompholobium confertum
Gompholobium tomentosum
Hovea trisperma
Jacksonia furcellata
Nemcia capitata

Poaceae
* Aira caryophyllea
Amphipogon laguroides
Amphipogon turbinatus
* Briza maxima
* Briza minor
Danthonia occidentalis
Danthonia pilosa
* Ehrharta calycina
Stipa compressa
* Vulpia sp. scps

Polygalaceae
Comesperma calymega

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

Restionaceae
Hypolaena exsulca
Loxocarya flexuosa
Lyginia barbata

Rutaceae
Boronia ramosa
Eriostemon spicatus

Solanaceae
* Solanum nigrum

Stackhousiaceae
Stackhousia monogyna
Tripterococcus brunonis

Stylidiaceae
Levenhookia stipitata

Stylidium brunonianum
Stylidium carnosum
Stylidium guttatum
Stylidium piliferum
Stylidium repens
Stylidium schoenoides

Thymelaeaceae
Pimelea imbricata
Pimelea sulphurea

Xanthorrhoeaceae
Xanthorrhoea preissii

Zamiaceae
Macrozamia riedlei

149 Native Taxa

Department of Environmental Protection System 6 Update: Site Based Flora List for M94 Jandakot Airport
(extracted from the CALM Swan Coastal Plain database, Jand07, 29/1/96)

Anthericaceae

Arnocrinum preissii
Hensmania turbinata
Laxmannia squarrosa
Thysanotus arbuscula

Apiaceae

Trachymene pilosa

Asteraceae

* Hypochaeris glabra
Podotheca chrysantha
Podotheca sp. scps
Quinetia urvillei
* Ursinia anthemoides
Waitzia suaveolens

Casuarinaceae

Allocasuarina fraseriana
Allocasuarina humilis

Colchicaceae

Burchardia umbellata

Cyperaceae

Schoenus curvifolius

Dasypogonaceae

Dasypogon bromeliifolius
Lomandra caespitosa
Lomandra hermaphrodita

Dilleniaceae

Hibbertia hypericoides
Hibbertia subvaginata

Epacridaceae

Conostephium pendulum

Department of Environmental Protection System 6 Update: Site Based Flora List for M94 Jandakot Airport
(extracted from the CALM Swan Coastal Plain database, Jand03, 29/1/96)

Apiaceae

Trachymene pilosa

Asteraceae

Hyalosperma cotula
* Hypochaeris glabra
Senecio lautus subsp. maritimus
Siloxerus humifusus
* Sonchus oleraceus

Centrolepidaceae

Centrolepis drummondiana

Crassulaceae

Crassula colorata

Cyperaceae

Schoenus rodwayanus

Dasypogonaceae

Dasypogon bromeliifolius

Dilleniaceae

Hibbertia subvaginata

Epacridaceae

Leucopogon conostephioides

Euphorbiaceae

Poranthera microphylla

Haloragaceae

Gonocarpus pithyoides

Iridaceae

* Gladiolus caryophyllaceus

Lauraceae

Cassytha flava

Lobeliaceae

Lobelia tenuior

Loganiaceae

Mitrasacme paradoxa

Myrtaceae

Astartea aff. fascicularis sthcst
Hypocalymma angustifolium
Melaleuca preissiana
Pericalymma ellipticum
Regelia ciliata
Scholtzia involucrata

Papilionaceae

Aotus procumbens
Euchilopsis linearis

Poaceae

* Aira caryophyllea
Amphipogon laguroides
* Vulpia sp. scps

Proteaceae

Banksia ilicifolia
Banksia menziesii
Petrophile linearis

Restionaceae

Hypolaena exsulca
Lyginia barbata

Stylidiaceae

Stylidium brunonianum
Stylidium repens

Leucopogon insularis
Leucopogon polymorphus

Euphorbiaceae

Poranthera microphylla

Goodeniaceae

Dampiera linearis

Haemodoraceae

Anigozanthos humilis
Conostylis aculeata
Haemodorum paniculatum
Phlebocarya filifolia

Iridaceae

* Gladiolus caryophyllaceus
Patersonia occidentalis

Lamiaceae

Hemiandra pungens

Loganiaceae

Mitrasacme paradoxa

Mimosaceae

Acacia pulchella
Acacia stenoptera

Myrtaceae

Calytrix angulata
Eremaea asterocarpa subsp. asterocarpa
Eucalyptus todtiana
Melaleuca thymoides
Scholtzia involucrata

Orchidaceae

Leporella fimbriata

Papilionaceae

Bossiaea eriocarpa
Gompholobium tomentosum

Flora list for M94 Jandakot Airport (extracted from Swan Coastal Plain database, Jand07, 29/1/96).

Hovea trisperma var. trisperma
Jacksonia furcellata

Poaceae

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

Proteaceae

Adenanthos cygnorum
Banksia attenuata
Petrophile linearis
Stirlingia latifolia

Restionaceae

Loxocarya flexuosa
Lyginia barbata

Rutaceae

Boronia ramosa
Eriostemon spicatus

Stylidiaceae

Levenhookia stipitata
Stylidium carnosum
Stylidium repens

System 6 Update - Floristic Community Type Mapping Information **DRAFT ONLY**

AREA INFORMATION

System 6 Area (C or M) or Update Area (Update) M94

Conservation Area	
Nature Reserve	
Reserve No	
National Park	
Reserve No	
Local Government	
Reserve No	
Other	
Proposed Conservation Areas	JANDAKOT AIRPORT
Local Government	
Reserve No	
Other	COMMONWEALTH OF AUSTRALIA

Conservation Area

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

AREA

Total Area	hectares
Completely Degraded	hectares
comments:	

AREA MAPPED FLORISTIC UNITS

Boundaries: System6 CALM

Units	Site (Condition) Code S6 : JANO	Bound	Area (ha)	Area(ha)
5	Ø6			
22	Ø5			
23a	Ø1, Ø2, Ø4, Ø5, Ø8			

Boundaries determined by use of

aerial photograph	Metro Street Directory map 9 5128 run 10 5063,65 5/1/91
orthophoto	2053 1 NE, NW Aug 1991
vegetation map	
soil map	

WETLANDS CONSERVATION SOCIETY (INC)

(6) a to t

c/- 14 Stone Court, Kardinya, WA 6163

16 July 1995

The System Six Study Team
Department of Environmental Protection
141 St George's Terrace
Perth WA 6000

Dear Sir,

System Six Review

The Wetlands Conservation Society wishes to make a submission to the System Six Review. This submission is in two parts. Firstly some comments on the general principles and secondly some specific nominations.

(1) General Principles

The original System Six Red Book, published in 1983, included 19 general recommendations. Many of these are now irrelevant or outdated. Recommendations 1 - 6 relate to the management of State Forests. These have been overtaken by events. It is now clear that the only effective way to conserve State Forest is to place it in national parks or nature reserves. There is an urgent need to set aside a comprehensive and representative system of forest reserves and this should be part of a new general recommendation.

Recommendations 7 - 12 have also been overtaken by events. Many of the areas recommended for protection as reserves have been destroyed (eg. Casuarina M98, Buckland Hill M55, Port Kennedy M106, etc.) Many others have not been established because of CALM's reluctance to take on new reserves without additional funding. Perhaps these reserves should be vested in other authorities (eg. local government, community groups, LCDCs, etc.) if CALM are unwilling to accept them. The Port Kennedy LCDC has done an outstanding job of managing that reserve, for example, at little cost to the WA Government.

Recommendations 13 and 14 are still relevant and they should be supplemented by a recommendation about how this process will be funded. A regional improvement fund like the MRIF should be established to facilitate the acquisition of land for parks and recreation in regional areas.

Recommendations 15 - 17 need very careful attention. Although the Ministry for Planning has done quite a good job of identifying and resuming land for Regional

Parks, CALM has failed to co-operate and so far we still do not have any legally established Regional Parks. The WCS believes that the Regional Park Concept is extremely important in the System Six Area because of the multiple uses of reserves. The concept of a regional park as an area for conservation, recreation and landscape protection is now well established. We have least confidence in CALM's willingness to manage these Parks and we have proposed that MFP should continue to manage them until all of the policy and management issues have been resolved. We believe that funding should come from local authority rates, land tax and development tax. Ultimately a Regional Parks Authority may be the best body to manage them. Because they are so different to national parks and nature reserves the RPA should be quite different from the NPNCA and have its own budget. It should work closely with CALM, MFP and the local authorities.

Recommendations 18 and 19 are still relevant and have been partially implemented. However recommendation 18 does not specify which agency should fund and coordinate this task. This should be addressed in the update.

The General Recommendations should include an additional set which relate to the funding and implementation of the specific recommendations. We believe that there is a need for an implementation committee which will set priorities and review progress. A major review or progress report should be required every three years. A funding mechanism for implementation and management of the System Six conservation estate should be clearly identified in the general recommendations. The failure to do this was one of the main reasons why the original System Six exercise was so unsuccessful.

(2) Specific Recommendations

I am aware that the DEP has provided a detailed nomination form. However, we wish to nominate so many areas that it is quite impracticable for us to fill in such detailed forms. Most of the areas we wish to nominate are already documented in official Government reports, so the degree of detail requested is unnecessary. However, I would be happy to supply any additional information you require for any of the nominations we have made. Please call me on 337 7113 (h) or 360 2274 (w) or 310 1711 (fax) if you need further information.

Our specific recommendations for new areas to be included in the System Six Report are :

(a) The Spectacles Swamps near Kwinana. These are part of the Beeliar Regional Park and are fully described in the Planning Report for that Park. They are also zoned P & R in the MRS.

(b) Long Swamp on Hope Valley Road, Kwinana. This is also included in the Beeliar Regional Park. It is the last of the wetlands in the western chain of the Cockburn Wetlands. It is privately owned.

(c) Bollard Bulrush Swamp in Wellard. This is also part of the Beeliar Regional Park

(d) Tamworth Hill Swamp in Baldivis. This is part of the proposed Rockingham Lakes Regional park. It is fully documented in the ecological study of the Rockingham lakes carried out by V and C Semeniuk for the Australian Heritage Commission. It is zoned for Parks and Recreation in the MRS and it is affected by a mining claim.

(e) Anstey Swamp, Baldivis. This is also a part of the proposed Rockingham Lakes Regional Park. It is owned by the MFP and is zoned for Parks and Recreation. It is fully documented in the Semeniuk study and by the EPA in its original report on the Secret Harbour project.

(f) Paganoni Swamp, Baldivis. This wetland is an outstanding conservation area. It is owned by the MFP and is zoned for Parks and Recreation. it is fully documented in the Semeniuk study and in the Wildflower Society's nomination of this reserve to the Register of the National Estate.

(g) Lark Hill wetlands. This area lies adjacent to Port Kennedy M106 and contains some important wetlands and parallel dune formations. It is fully described by the Australian Heritage Commission in its listing of the area. The land is owned by the MFP and is zoned for Parks and Recreation. It is intended for inclusion in the Port Kennedy Scientific Park.

(h) Jandakot Botanical Park. This area is fully documented by the MFP in its Planning study for the Jandakot Botanical Park. It includes some areas such as M97, M98, M99 and M100 which are already in the System Six Red Book. However, there are several other important reserves in this area which should be included in the System Six Report. All of this land is reserved for Parks and Recreation and most of it is owned by the State.

(i) Piney Lake, Winthrop. This wetland was not included in System Six. However, it is part of the Beeliar Regional park and supports a diverse range of waterfowl and has some remnant vegetation. The City of Melville recently completed a management plan for this reserve.

(j) Blue Gum Swamp, Mt Pleasant. This wetland is an important wildlife refuge. It is well managed by the City of Melville and is being rehabilitated by a local group. It has a management plan, prepared by the City of Melville. It could be incorporated into M73 as it is very close to Booragoon Lake.

(k) Brixton Street Wetlands, Gosnells. These important wetlands should be added to M69. Their importance is well documented in the EPA assessment of the housing proposals for this area.

(l) Ken Hurst Park. Leeming. This is an important area of wetland and banksia woodland adjacent to M94. It contains declared rare flora as indicated in the Floristic Study of the Swan Coastal Plain. The Murdoch Branch of the Wildflower Society has done a detailed flora survey of the site. Contact Diana Corbyn for details.

(m) Twin Bartram Swamp, Hird Road Swamp, Solomon Road Swamp and Gibbs / Russell Swamp in Jandakot. These small wetlands are the best remaining examples of the Jandakot suite of wetlands. They are reserved in the local open space system and are well documented by V. Semeniuk in the report to Gold Estates on Wetlands East of Thomsons Lake.

(n) Creery Wetlands. These important samphire marshes should be added to C50 (Peel Inlet). Their values are fully documented in the Bamford Report which was attached to the proposal for the Harbour City Canal Estate.

(o) Vasse - Wonnerup Regional park. The whole area of the Broadwater, Deadwater and the Vasse Wonnerup estuaries should become a regional park. This concept should be proposed in the System Six update.

(p) Cockburn Wetlands - Eastern Chain M93. The boundaries of this area should be modified to coincide with the boundaries of the Beeliar Regional Park.

(q) Folly, Maramanup, Duck and Beenyup Pools, Baldivis. These small pools on the Folly Drain are important breeding and feeding areas for wildlife. The Folly Drain is an important wildlife corridor and its conservation value should be recognised in the System Six Report.

(r) West Corio Swamp, Karnup. This is an important breeding area for the straw-necked ibis. It should be protected. The EPA did an assessment of it several years ago when sand mining was proposed.

(s) Serpentine River Valley. The entire length of the Serpentine River and its flood plain should be listed in the System Six Report. It is a major wildlife corridor and a habitat for many species. It should be recommended as a regional park.

(t) Wilbinga and Guilderton. Two large blocks of coastal heathland south of the mouth of the Moore River. The Wilbinga block was proposed as a land swap for M1 which has been approved for subdivision. These blocks are adjacent to C12 and together provide an outstanding opportunity to conserve the best remaining transect of coastal vegetation in the northern part of System Six.

If you require further information about any aspect of this submission, please contact me. I would like some feedback on your decision about these areas.

Yours faithfully,

Philip Jennings
President

That section together with a type of Greenways link through to the existing reserve would have merit bearing in mind that there is only a small ratio of bush reserves in the western portion of Cockburn. The area is also becoming heavily industrialised (general and light industry) and this section of bushland would create a type of breathing space for the long term future.

Vicinity of Site [redacted] - Map 67:

You will note several shaded areas abutting the Kwinana freeway along its western edge between South Street and the Roe Freeway/Kwinana Freeway interchange. Map 67 indicates that some of this bushland could have potential for being saved despite of the interchange connections. The bush in this area has a particularly good diversity of flora and Banksia Woodland. It provides a good background for commuters beyond the Freeway and enhances such areas as Leeming and Bibra Lake. ***I suggest you make some small Bushplan sites out of those remnant areas.***

Map 67 - Bushplan Site [redacted]:

I recommend that this be extended where practical to include any remnant bushland between the northern boundary of Jandakot Airport and the Roe Freeway reserve. Bush in this area is of a relatively good condition and mainly Banksia Woodlands.

Map 74 - Bushplan Site 391:

The above site contains Thomson's and Kogolup Lakes. It has omitted to include good quality diverse Banksia/Tuart Woodland in Section IV south-west of the new subdivisions in Beeliar (just north west of Thomson's Lake). Part of this land is held by Water Corporation for a reservoir and the balance is owned by Homeswest.

I recommend the site include the Water Corporation land and bushland mentioned.

Map 74 - North East - Jandakot Caravan Park Site & Hird Road Swamp:

Site [redacted] extends towards Hird Road Swamp but does not cross Hammond Road to the actual Swamp. Although Hird Road Swamp is now used partly for storm water treatment. the swamp and adjoining bush is worthy of preservation. The bushland varies from Banksia Woodland through to Malaleuca and rushes. The associated bushland encircles the Jandakot Caravan Park and fronts Hammond Road directly north of the Caravan Park. Approximately 15 hectares of bush in that northern position has particularly diverse flora including many species becoming very rare in the region e.g. pink trigger plants; white triggers; spider orchids; donkey orchids, cats paws and numerous other plants.

140

BS 388

PB187

THE City of CANNING

Enquiries : Mr G Ponton
Telephone : 9231 0742
Our Ref : TA/4/1

25 March 1999

Submission on Perth's Bushplan
Western Australian Planning Commission
469 Wellington Street
PERTH WA 6000

Dear Sir/Madam

SUBMISSION ON PERTH'S BUSHPLAN

Council considered the above matter at its Meeting held on 23.3.99, and resolved as follows:

(a) Council RESOLVE to forward a submission on the report "Perth's Bushplan", to the Ministry for Planning indicating the City's support for the overall concept of Bushplan but including recommendations outlining concerns relating to the following specific issues:

(i) The inclusion of Lot 500 Johnston Road, Canning Vale within Bushplan Site No [redacted] not supported given the isolation of the land from the remainder of Site 388, the current usage of the land as a landfill site and the future options for the development of the site. In this regard clarification is sought in relation to the extent and level of vegetation protection proposed under Bushplan and the resultant impact on the City's development options for the land.

(ii) The identification of Bushplan Site No. [redacted] is supported, however, the possible requirement for a future extension of Gerard Street within or in the vicinity of the Bushplan site needs to be acknowledged in the Bushplan Report.

(iii) The appropriate protection and management of land within identified Bushplan Site's within the City of Canning needs to be secured through the continued acquisition of privately owned land by the Ministry for Planning, in particular Lot 15 Bacon Street, Wilson, Lots 14, 18, 42 and 43 Woodloes Street, Cannington and privately owned land within Bushplan Site 224 adjacent to Castledare, in particular Lot 4, 501 (62, 63,64), Fern Road, Wilson.

SUBMISSION NO. 384

MINISTRY FOR PLANNING
29 MAR 1999
805-2-1-32pt12
FILE

Please address correspondence to:
Locked Bag 80, Welshpool 6986

1317 Albany Highway,
Cannington 6107
Western Australia
Telephone: (08) 9231 0606
Facsimile: (08) 9458 2353

BS 388
PB187 260

OVERVIEW OF SUBMISSION ON PERTH'S BUSHPLAN

Produced by Monica Holmes JP MLA
Member for Southern River

This Overview is a background of the attached "Perth's Bushplan Submission Paper."

The finalisation of the draft Bushplan has been welcomed, particularly by landowners in my electorate who want to subdivide and build on their land. This is because, up until now, there has been little or no certainty in the planning process, particularly regarding environmental issues.

The electorate of Southern River has a large number of landowners who have been identified in Perth's Bushplan. My office has received numerous telephone calls and inquiries regarding the draft document.

In order to satisfy my constituents' concerns, I have produced the attached submission, which encompasses the aspects of the draft of Perth's Bushplan that have been raised with me. The Submission Paper contains a number of recommendations listed separately in 'Appendix A'.

One of the main concerns raised is that if Perth's Bushplan is adopted in its current form, landowners and developers will be subjected to an unrealistic amount of extremely complicated procedures, which are to be further strengthened and expanded in the future.

Concern has also been expressed regarding the plans to conserve additional areas, outside the Perth Metropolitan Region, to compensate for any land that is removed from the draft Plan because it is unsuitable for inclusion as part of the 10% retention target.

This leads on to another are of grave concern. The intent of the draft Bushplan, via IUCN guidelines, is to retain at least 10% of the **original** extent of each vegetation complex, prior to European settlement. As there is no way to verify the original extent, other than by estimation, the basis for the inclusion of land identified in the draft Bushplan is unrealistic.

In its current form, the draft Bushplan will do nothing to create certainty for the future growth of our State.

The fact that the 10% target has been based upon estimation is borne out by the descriptions of the sites contained in Volume 2, Part 2, which are, at best, questionable. The facts behind their inclusion in the draft Bushplan were obtained some years ago and bear no relevance to the land as it is today.

.../2

SUBMISSION NO 42

PLANNING
23 APR 1999
805-2-1-32P+1
FILE

Other concerns raised which are dealt with in the Submission relate to:-

- The extremely high, undefined, cost to the State of future land acquisitions. Through the implementation of the current10% target, developers will be severely constrained. As such, acquisition cost will escalate severely and will be borne by the taxpayers.

- The proposed on-going retention of land via Parks and Reservations to boost the 10% goal and save money.

- The inclusion of land to help boost the 10% target that was identified under the recognition criteria of Agriculture Western Australia which did not meet Bushplan's definition.

- The intention to get local government to add to the 10% target by including areas regarded as being *"locally significant"* which are **not** identified for conservation through Perth's Bushplan

- The fact that Perth's Bushplan also took into consideration values relating to educational, or scientific study, cultural heritage, linkage, agricultural practice, urban development as well as Aboriginal and European historical values. The inclusion of these values removes credibility from the criteria used to put the draft Bushplan together. They bring a totally different dimension into the issue.

- The use of IUCN guidelines, produced in 1991, as the basis for the 10% minimum retention goal throughout the draft Bushplan. Concerns are that these guidelines should not be used to drive the future of our State.

- The protection of our environment we must be based upon what we have today. It should not be based upon an estimate of what we had prior to European settlement. To achieve this goal Bushplan must be changed to reflect the preservation of 10% of current day vegetation.

The above points are validated in the attached Submission Paper on Perth' Bushplan document.

6 April 199

Subm 987

246

Jandakot Airport - (p.188) BS396

This leased land is owned by the Commonwealth. As such the State has no jurisdiction over planning and environmental issues relating to the land. If it is included to bolster the IUCN's percentage guidelines, it should be remembered that it would not be possible for Bushplan's strategies to be implemented upon this land.

Gosnells Golf Course (p.191) BS467

The local authority in relation to the Gosnells Golf Course is incorrectly shown as being the City of Canning. This land comes under the jurisdiction of the City of Gosnells.

Once again, the zoning displayed in the Plan shows an inconsistency in the MRS and TPS zonings. Under "Opportunities and/or constraints" the TPS is shown as an opportunity and the MRS as a constraint.

This item shows that limited surveys were carried out in on the land in 1995/96. Under the heading of "Other Special Attributes" (p.192) the Plan states "*...majority Bushplan Site in Middle Canning Catchment Study - 'hydrological modelling assumes no urban development in this area".*

This land is now abutted by Ranford Road, Campbell Road, Warton Road and the newly developed, fast expanding, urban area of Brooklands Green Estate. As such the recommendations in Volume 2 Part B based upon information collected in 1995 relating to this land no longer applies.

Canning Vale Prison Wetland (p.192) BS472

Under Section 3: Specific Site Details it states that a roadside inspection was taken by the DEP in 1998 and that in 1995 the vegetation condition was very good. Linkage is also described as being adjacent bushland to the north, east and west.

The above is no longer correct. Canning Vale Prison is now abutted by Sanctuary Waters Estate to the north, Ranford Estate to the West, across Nicholson Road, and to the east by Warton Road. As such the vegetation identified in these locations no longer exists.

- **SUMMARY AND RECOMMENDATIONS**

Perth's Bushplan has come about as a result of an enormous amount of work being undertaken by numerous agencies over a considerable number of years.

The foundation for this work was to ensure adherence to target measures in accordance with guidelines set by the IUCN in 1991for the protection of at least10 per cent of the original extent of all pre-European settlement vegetation complexes.

JANDAKOT AIRPORT
Airport Management Centre,
16 Eagle Drive,
Jandakot, W.A. 6164
Telephone: (08) 9414 9400
Facsimile: (08) 9417 3777

BS 388
PB187

1/6

SUBMISSION ON PERTH'S BUSHPLAN

Submitted by:	Jandakot Airport Holdings Pty Ltd
Address:	16 Eagle Drive Jandakot Airport WA 6164
Subject:	Jandakot Airport, Jandakot
Bushplan Site No:	[redacted]
Map No:	67,68
Lot/Location/Reserve Numbers:	0, 1, 3, 4, 5, 6, 7, 8, 9, 10 588 Hope Road 2 Roe Highway 74, 500 Johnson Road 77 Jandakot Road

1. Introduction

The Commonwealth Government of Australia sold a 50-year lease, plus a 49-year option, over Jandakot Airport to Jandakot Airport Holdings Pty Ltd (JAH) in July 1998. Jandakot Airport is leased and operated in accordance with the *Airports Act 1996* (the Act), and as such must continue to operate as an airport. Jandakot Airport is Western Australia's major general aviation airport and the only one serving the Perth metropolitan region. It is the busiest airport in the State handling more than 6 times as many aircraft per annum than Perth International Airport.

The general aviation industry is a vital part of the infrastructure of this state and services the mining, agricultural and tourist industries as well as providing services for the population that live outside the Perth metropolitan area.

Jandakot Airport is the premier aviation-training airport in Western Australia with China Southern WA Flying College, Singapore Flying College and the Royal Aero Club all based at Jandakot with millions invested in infrastructure.

Under the previous operators, Federal Airports Corporation (FAC), the airport experienced trading losses in past years as follows:

1996 $1,728,658 loss
1997 $2,076,739 loss
1998 $1,405,000 loss

MINISTRY FOR PLANNING
03 MAY 1999
FILE 805-2-1-32P1R

MPP RECORDS
03 MAY 1999
RECEIVED

JAH is projecting a loss in excess of $1M for this financial year and to 31 March 1999 has experienced a loss of $910,066 for the first 9 months.

SUBMISSION NO. 1832

The viability of Jandakot Airport and therefore the general aviation industry in Western Australia is reliant on the development of land for business uses unrelated to airport operations. JAH's tender for the airport lease proposed to operate a profit-making airport business through the:

- Maintenance of a high standard of airport facilities; and
- Creation of new business opportunities.

In keeping with the Act, JAH has prepared a Master Plan that provides details of proposed development planned for the airport over the next 20 years. The Master Plan describes the facilities to meet the airport's ultimate development capacity. The principal proposals are as follows (see Attachment 1):

- Expansion of operational building areas and construction of a fourth runway;
- Development of land for commercial uses; and
- Establishment of conservation and heritage areas.

As outlined in the Master Plan, by the year 2015 the direct impact of the airport will be the employment of approximately 3100 full time jobs and an injection of $285 million into the West Australian economy.

The lease gives JAH the power to develop and operate the airport as it sees fit, (provided the Act is complied with) and therefore the airport land can be viewed as being privately owned.

2. Proposed Conservation Areas

In 1993 as the previous operators of the airport, FAC drew up a development plan for Jandakot Airport to enable the airport to become financially self-supporting while fulfilling Perth's general aviation needs to the year 2010 and beyond. The development plan set aside 96 ha of bushland to be managed for conservation. However, during the public review of the corresponding EIS, conservation groups, supported by the Commonwealth Environmental Protection Agency, expressed doubts that the designated conservation areas were, in fact, in the best locations. It was also argued that the designated conservation areas were too small. In response to public concern, Muir was commissioned to undertake an independent study to review potential conservation areas. The study used methodologies known as the Rapid Assessment Data System and the Rapid Habitat Assessment System (both different methodologies to that previously applied) and was also much more detailed and comprehensive.

The Muir study indicates that the conservation zones proposed in the 1993 EIS contain good representative samples of all the vegetation and habitat types found on the airport. They also indicate that there are no outstanding conservation features that had been inadvertently omitted in the original FAC zoning plan, perhaps with the exception of the floristically rich bushland in the south-west corner of the airport.

The current Master Plan prepared by JAH has accepted Muir's recommendations. Of the 622 ha that constitute Jandakot Airport (approximately two-thirds, 410 ha, is bushland) the ultimate development concept presented in the Master Plan calls for 272 ha to be used for aviation-related activities, 148 ha to be developed for non-aviation commercial activities and 200 ha to be retained as conservation areas.

The conservation areas represent half of the bushland remaining at the airport and have been chosen such that remnant bushland identified as being of high significance will be retained. Identification of relative conservation value is in accordance with Muir Environmental (1993).

The proposed area of bushland to be conserved has doubled from 96 to 200 ha, has been extended to include the floristically rich bushland in the south-west corner adjacent to Prinsep Road and has been consolidated into two interlinked conservation areas that are also linked to other Bushplan sites.

The two conservation areas proposed in the Master Plan are referred to as the Northern and Southern Conservation Area.

- Southern Conservation Area: Contains remnant Banksia woodland in good condition, a wide variety of habitats, is rich in flora and fauna and has a variety of dampland types on its southern edge. The area is connected to the proposed Jandakot Regional Park via Acourt Road Bushland (Bushplan Site No. 389, Map No. 68).

- Northern Conservation Area: Contains Banksia woodland in good condition, and good variety of dampland types (better than those found in other parts of the airport). The area is connected to the Southern Conservation Area via a narrow corridor and is adjacent to Ken Hurst Park (Bushplan Site No. 245, Map No. 68).

Bushland to the north and south of Hope Road that is included in Bushplan has been excluded from the conservation areas. The area to the north of Hope Road contains remnant Banksia woodland in good condition, but it contains no natural features that are not also found in other areas of the airport. The area south of Hope Road contains Flooded gum woodland with a badly degraded and disturbed understorey. It is adjacent to a commercial development with roads that are a major source of weeds. These areas will be developed for light and service industries, commercial/recreational activities and as a business park estate. Future planning of this area will recognise "best practice" planning principles to encourage grouping of development to minimise the impact on vegetation.

3. Management of Conservation Areas

The conservation areas will be managed in accordance with the principle of minimum interference. Management plans will be developed to address issues such as weed control, spread of dieback disease and fire management. However, the long-term aim is that the vegetation within the conservation areas will be as close to its original natural state as possible and be able to sustain itself with minimal intervention.

The commitment of JAH that the conservation zones remain intact and are appropriately managed is enforceable through the Act. Following approval of the Master Plan and Environment Strategy by the Minister of Transport and Regional Services, the Act requires that JAH takes all reasonable steps to ensure that the strategy, and therefore any commitments within that strategy, is complied with.

4. Conclusion

Jandakot Airport Holdings believe that the Master Plan strikes an excellent balance between preserving the significant environment at the airport, and meeting the projected operational and economic demands placed on the airport.

The planned retention of 32% of airport land within conservation areas represents a significant loss of potential economic gain to JAH, however, JAH recognises the importance of the remnant bushland at Jandakot Airport, and future development will be sited to minimise the direct impact of areas of high conservation priority.

JAH submit that the retention of the proposed conservation areas at Jandakot Airport satisfies the aims of the Bushplan in that:

- With the retention of 200 of the 400 ha of bushland remaining at Jandakot Airport, 5,713 ha of Bassendean Complex Central and South will be protected under Bushplan. This amounts to 12.3% of the vegetation complex, which is in excess of the 10% objective.

- Diversity of flora and fauna is maintained within the proposed conservation areas.

- Large remnant bushland areas, with links to other Bushplan sites, are maintained.

- Dampland are protected,

Environmental management plans will be developed and implemented for the two conservation areas, ensuring that the environmental values are maintained, and

- The ongoing protection of the conservation areas is enforceable under the Act.

JAH submit that the size of Bushplan Site No. 388 be reduced to coincide with the conservation areas proposed in the Jandakot Airport Master Plan.

As previously stated the viability of Jandakot Airport and the General Aviation Industry within Western Australia, is reliant on the commercial development as outlined in the Master Plan

For you information please find enclosed:

- Land use and layout plan of proposed airport development
- Copy of Master Plan.
- Copy of Environmental Strategy

Doug Green
Managing Director

? *

M94 Jandakot Airport
Bulletin 690 (Development)

Friends Advocate Management

Other Names:

Specific Study/studies Miscellaneous studies

? Flora

Vegetation Map 1 2 3

Flora list 1 2 3 4

Significant Taxa done / suitable / doubtful

? Fauna Museum 1994 (general area)

Mammals 1 2
Birds 1 2 RAOU
Reptiles and Amphibia 1 2
Invertebrates 1 2

Vegetation Condition Map Sites Comment

Disturbance Factors Comment Management

Swan Coastal Plain Floristic Survey → adjacent area

AHC: National Estate- Listed / Interim / Nominated / Notified NT (WA): Heritage Classification

Notes

M94 Jandakot Airport Bulletin 690 (Development)		
M94.1 The Commonwealth retain as much uncleared land as possible within Jandakot AA lots 127, 161 to 165, 295, 411, 438 and parts of Locations 126, 128, 129, 159, 160, 168, 439 and 440.	Unresolved Issues	EPA currently having discussions with the Commonwealth about use of the airport; and is liaising with DASETT to develop a mechanism for achieving the intent of the recommendation. Wetlands Conservation Society has an interest in this area.

- Neil Gibson for Jandakot Airport CARS Submission should be with EPA

- Mr Jackie Boyer EPA

SHEET 1: System 6 - REPORT Information Search Date 31/5/94 AW

Please circle the appropriate response or respond in the space provided.

Area M94 Name	Jandakot Airport
Title	Environmental Assessment documents
Published/(Unpublished)	Date
Author/s	
Location of Publication	
Purpose (why was the report prepared?)	
Government	
Corporate	
Community Group	
Management Plan	

Soils			
Units	mapped	described	referenced

Landscape		
Features	described	referenced

Flora					
Vegetation Map					
Units			Site based (no)		
Mapped					
Veg Units	Comparable Heddle *et al*		Compared Heddle *et al.*	Unit not mapped by Heddle *et al.*	
Flora list					
Timing	%completion			Significant Taxa	
	Trees	Shrubs Herbs Sedges	Weeds	DRF	CALM Priority Other

Fauna			
Timing	%completion		Significant Taxa
	Mammals	Birds	Sched1 Sched2 Other
	Reptiles	Invertebrates	

Vegatation Condition		
Site based	Mapped	Units
Disturbance Factors		
Phytophthora	observed	Other incidental
	tested	itemised

Notes	Three documents 1. Contact Ian Pound for 1990 document with vegetation map, flora (dominants and species of interest), condition map. 2. Morbinick - Flora and Fauna 3. Domes and Moore

SHEET 1: System 6 - REPORT Information Search Date 3/5/94 RH

Please circle the appropriate response or respond in the space provided.

Area M94 Name Jandakot Airport			
Title PER Muir			
Published/(Unpublished) Date			
Author/s			
Location of Publication			
Purpose (why was the report prepared?)			
Government			
Corporate Dames and Moore			
Community Group			
Management Plan			

Soils			
Units	mapped	described	referenced

Landscape		
Features	described	referenced

Flora						
Vegetation Map						
Units				Site based (no)		
Mapped						
Veg Units	Comparable Heddle *et al*		Compared Heddle *et al.*		Unit not mapped by Heddle *et al.*	
Flora list						
Timing	%completion				Significant Taxa	
	Trees	Shrubs Herbs	Sedges	Weeds	DRF	CALM Priority Other

Fauna (Data not used in Abbe and Bell)			
Timing	%completion		Significant Taxa
	Mammals	Birds	Sched1 Sched2 Other
	Reptiles	Invertebrates	

Vegatation Condition				
Site based	Mapped	Units		
Disturbance Factors				
Phytophthora	observed		Other	incidental
	tested			itemised

Notes

A

Report on the

Flora and Vegetation

of the Jandakot Mound area

and Conservation Issues affecting it

Prepared for Bowman Bishaw Gorham

as consultants to the

Department of Planning and Urban Development

by

Malcolm Trudgen

Consultant Botanist

With assistance from Bronwen Keighery

March 1991

TABLE 1

SUMMARY OF TERRAIN AND SOIL CHARACTERISTICS AT JANDAKOT AIRPORT

CHARACTER	BLOCKS			
	A	B	C	D
Topographic Position (% of Sites)				
Crest	4	3	9	19
Mid-slope	52	14	38	13
Lowland	44	79	47	62
Dampland	0	7	6	6
Soil Drainage (% of Sites)				
Very High	100	79	81	74
Moderate	0	7	18	9
Poor	0	14	1	17
Soil Profile (% of Sites)				
Uniform	100	97	98	85
Organic 'A' Horizon	0	3	2	15
Slope (Mean of Mid-slope Sites in Degrees)	5	5	3	5
Aspect of Sites (%)				
Northern Quadrant	35	21	36	15
Eastern Quadrant	0	0	0	17
Southern Quadrant	13	3	6	9
Western Quadrant	0	0	13	2
Flat	52	76	45	57
Soil Protection (% of Vegetation Cover)	87	75	78	88
Erosion (Water or Wind)	0	0	5*	2*

Note: * Water erosion from surface runoff after fire.
0 Indicates that none of the more or less randomised sample sites occurred on this type of situation.

It can be determined from the data in Table 1 and from the author's field experience that:

- Block A has few crest habitats and no damplands, the majority of sites being gently sloping dune sides. Soil drainage is very high at all soil sites and the soil profiles are uniform. Slopes are gentle at 5°. The data indicate that the dunes tend to run east-west, so it can be expected that north and south-facing aspects may have differing plant assemblages, the northern aspect being hotter and drier. The soils are well protected by vegetation and no wind or water erosion was apparent in any of the sites.

25/10/94 B. Muir

TABLE 5

DEFINITION OF DAMPLANDS ON JANDAKOT AIRPORT BY THE USE OF INDICATOR SPECIES

AIRPORT LOCATION	DAMPLANDS DEFINED BY THE PRESENCE OF		
	Melaleuca preissiana	***Pericalymma ellipticum***	***Eucalyptus rudis***
Block A:			
Sites numbered	16, 20		
Block B:			
Sites numbered	11, 12, 13a, 13b, 16, 28	11, 13a, 13b, 15, 21, 24, 26	28
Block C:			
Sites numbered	3, 4, 5, 18, 24, 29, 30, 21, 32, 33, 35, 41	4, 5, 18, 23, 28, 34	
Block D:			
Sites numbered	42, 46	21, 27, 28, 38	32, 34, 35, 40

Block A has almost no areas which could be defined as dampland using any of the key species. Areas A16 and A20 have a few *M. preissiana* trees, but are otherwise just lowland woodlands.

Blocks B and C contained the most sites with key species. Sites B11, B13a, B13b, C4, C5 and C18 were the only sites containing both *M. preissiana* and *P. ellipticum*. Site B11 is regrowth in an artificial drainage basin. Site B13 is quite small and was not recognised as a dampland in earlier broad-scale surveys. However, Sites C4, C5 and C18 were recognised as damplands by Weston (1990). The remaining areas defined by the key species include areas previously recognised as wetlands, for example, B15, B16 and C23 and C34. New areas which can be defined as damplands using these key species are B12, B28, B24, B26, C29, C30, C31 and C32. In addition, B28 is the only substantial area of *Eucalyptus rudis* woodland on Jandakot Airport which has not been cleared of understorey or damaged by stock grazing (see Plate 2A). Site D32 is also relatively undisturbed, but is only about 100 m across.

It is important, however, to view the dampland habitats defined in Table 5 in terms of their dominant species in Stratum 1. If this is done then only Sites C4, C23, C28, C34, D38, D40 and D46 can truly be considered damplands, the others all being dominated by lowland species such as *Banksia attenuata* and *B. ilicifolia*. Thus, as indicated by Muir (1983) for Melaleuca Park, the lowland woodlands grade imperceptibly into dampland vegetation at most sites.

25/10/94

B. Muir

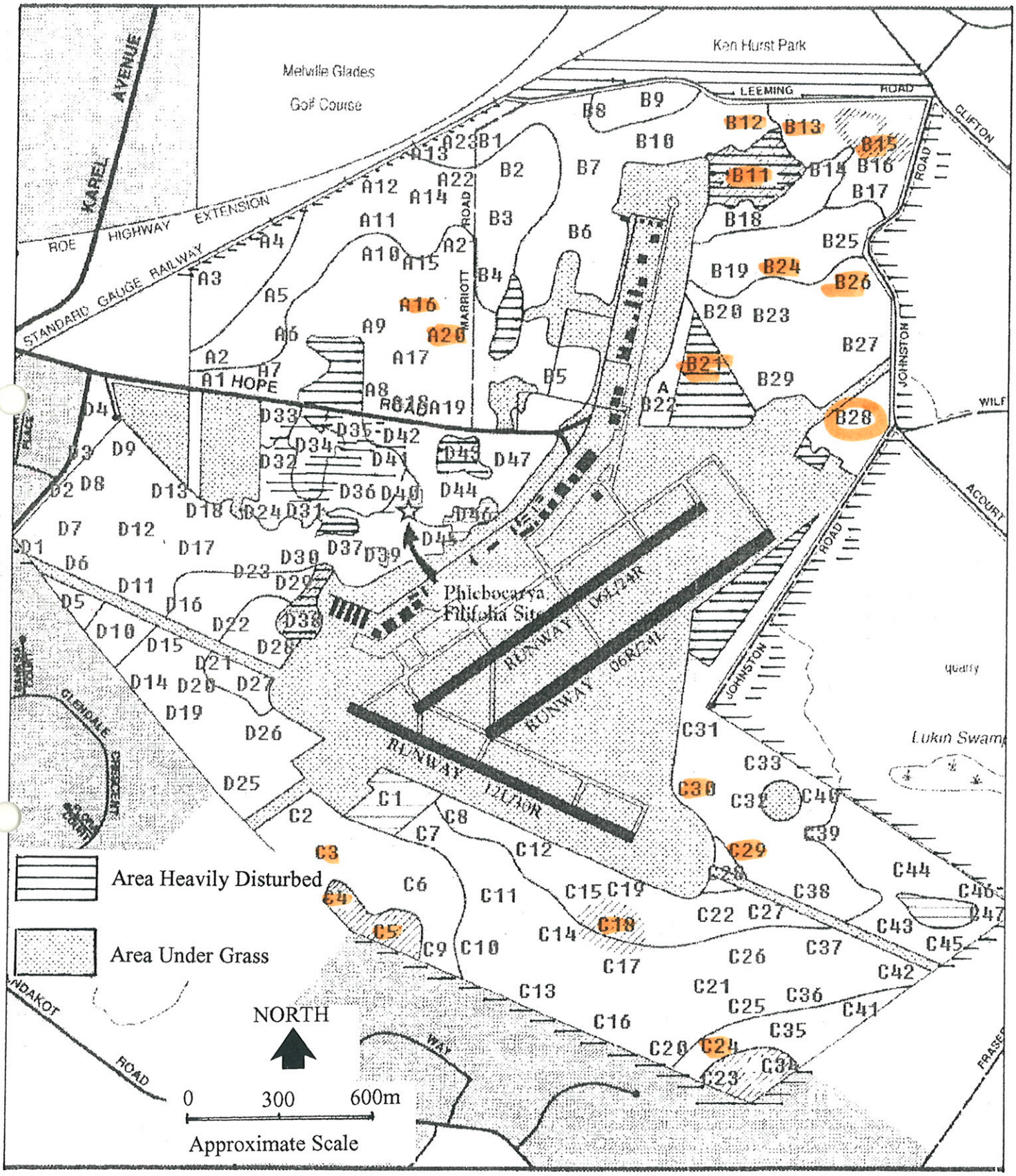


FIGURE 3
LOCATION OF STUDY SITES

25/10/9[illegible]

B. Muir

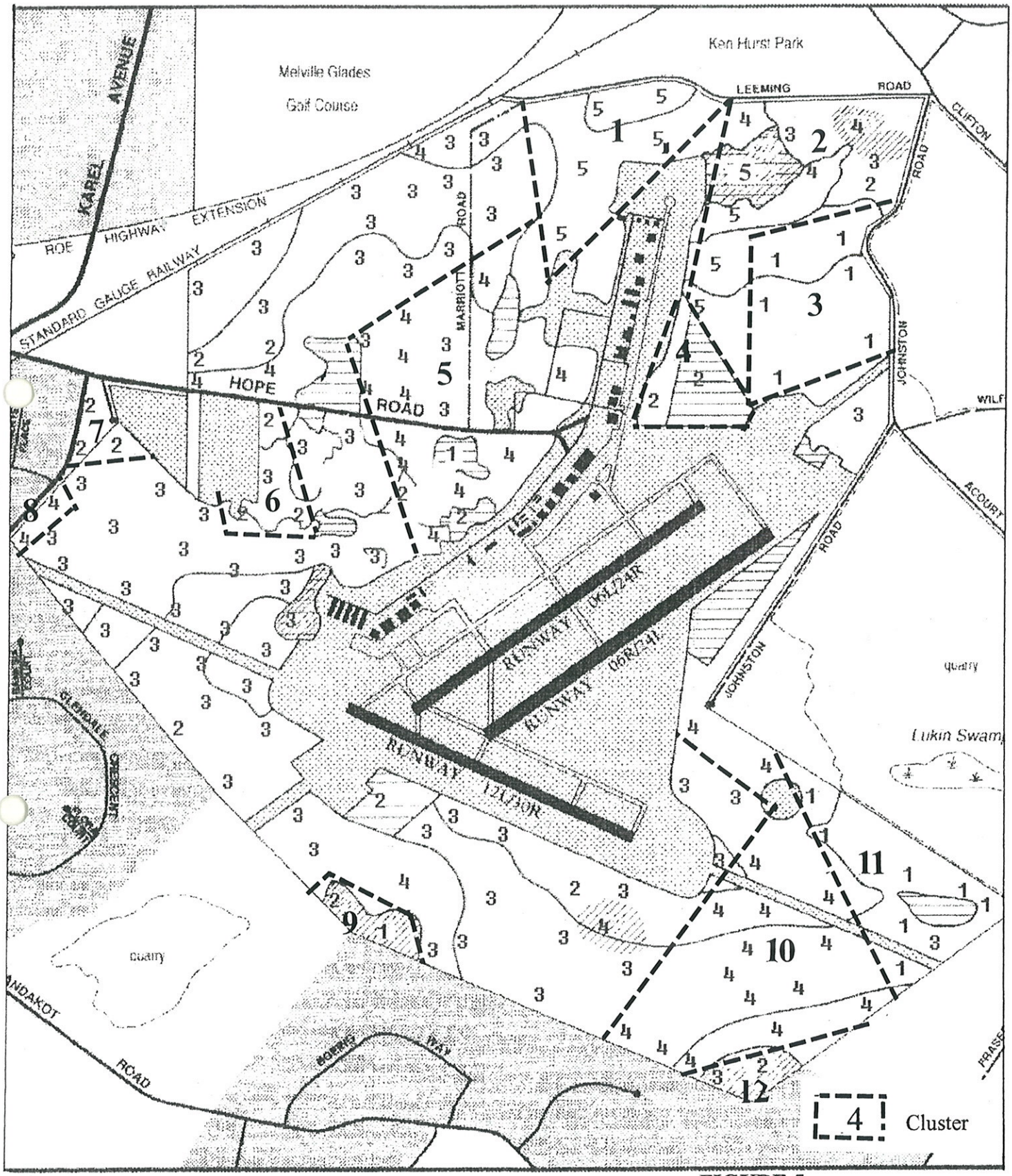


FIGURE 5
CLUSTERED RHAS SCORES

Facsimile Message

TO: Sharon Miller

FAX NO: 9417 3777

FROM: Karen Clarke

POLICY COORDINATION

DATE: 20/5/01

TELEPHONE: 92227093

OUR FAX: 94851187

PAGES: 22 (incl. cover sheet)

SUBJECT: Jandakot Airport - Vegetation Report

Hi Sharon,

Hot off the press. A hard copy is in the mail. A copy has also been mailed Robert Hoskin. I'm on leave now 'til 31st May. Ring Bronwen to discuss any issues before then.

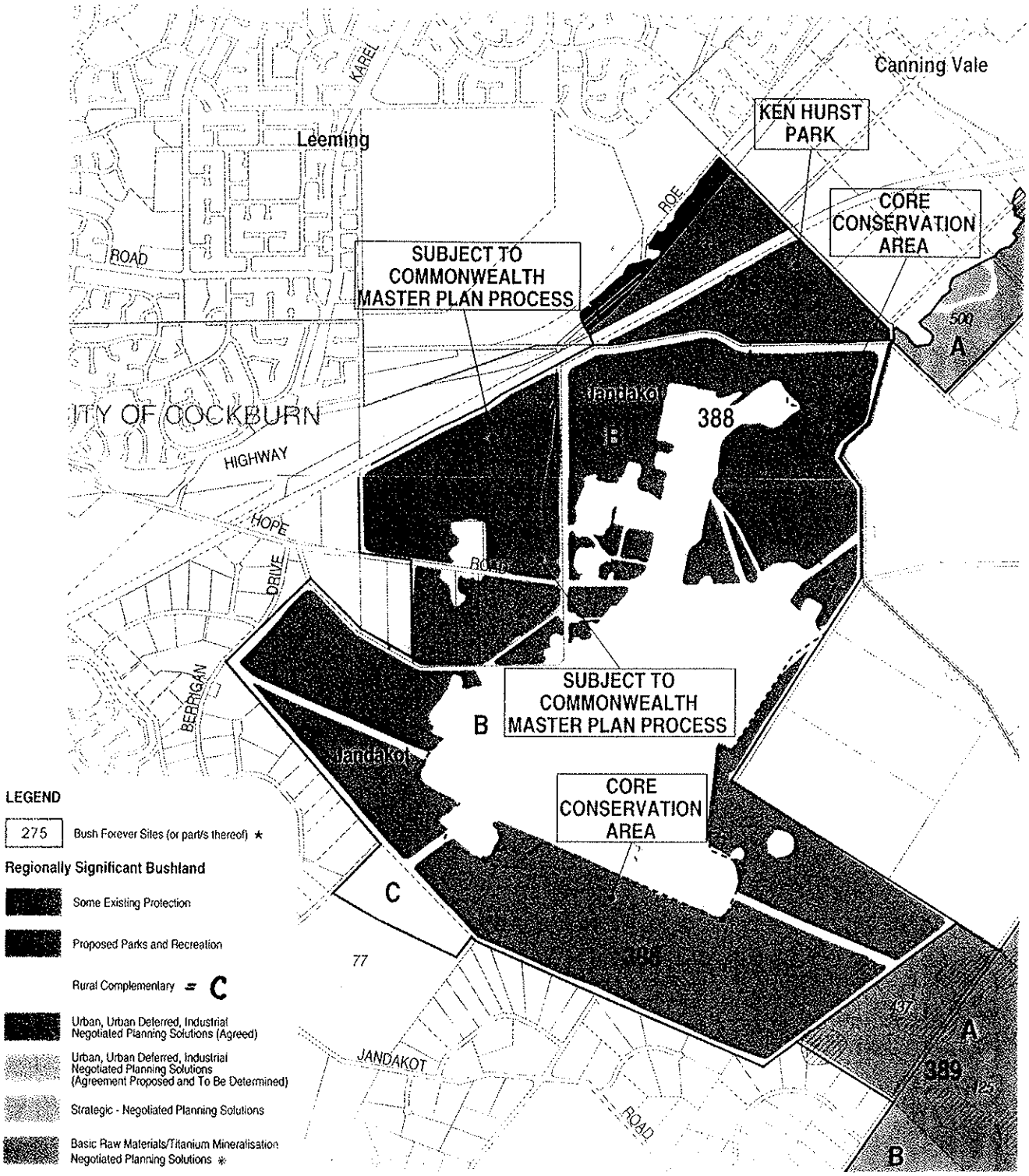
Cheers,
Karen.

Department of Environmental Protection
Westralia Square, 141 St. George's Terrace, Perth, Western Australia, 6000.
Telephone: (09) 9222 7000 Facsimile: (09) 9322 1598

APPENDIX 1: KEIGHERY (1999) TECHNICAL REPORT

Faxed previously

Map 1: Bush Forever Site 388 – Jandakot Airport (Government of Western Australia 2000a).



LEGEND

275 Bush Forever Sites (or part/s thereof) ★

Regionally Significant Bushland

- Some Existing Protection
- Proposed Parks and Recreation
- Rural Complementary = C
- Urban, Urban Deferred, Industrial Negotiated Planning Solutions (Agreed)
- Urban, Urban Deferred, Industrial Negotiated Planning Solutions (Agreement Proposed and To Be Determined)
- Strategic - Negotiated Planning Solutions
- Basic Raw Materials/Titanium Mineralisation Negotiated Planning Solutions *
- Cemeteries
- Other Government Lands (including existing and proposed public utilities) = B
- Local Town Planning Scheme Reserves (including existing and proposed public utilities) = A
- Major Road/Railway Reserves
- Regional Creeklines (with Mapped Vegetation)

Boundary Interpretations:

Agreed
- Area to be Protected for Conservation

Agreement Proposed
- Proposed Bush Forever Boundary
- Areas Proposed to be Protected for Conservation

- Other Native Vegetation
- Conservation Category Wetlands (both within and outside Bush Forever Sites)
- Channel Wetlands
- Local Government Boundary
- Perth Metropolitan Region Boundary
- Bush Forever Study Area Boundary

N

SCALE 1 : 35000

0 1

Kilometres

Produced by Project Mapping Section, Geographic & Planning Information Branch, from information supplied by Environmental Planning Branch, Ministry for Planning, Perth, W.A. Dec. 2000

nhw-map17\ lenviron\ \bushplan\ \bpf00_inset35.dgn

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

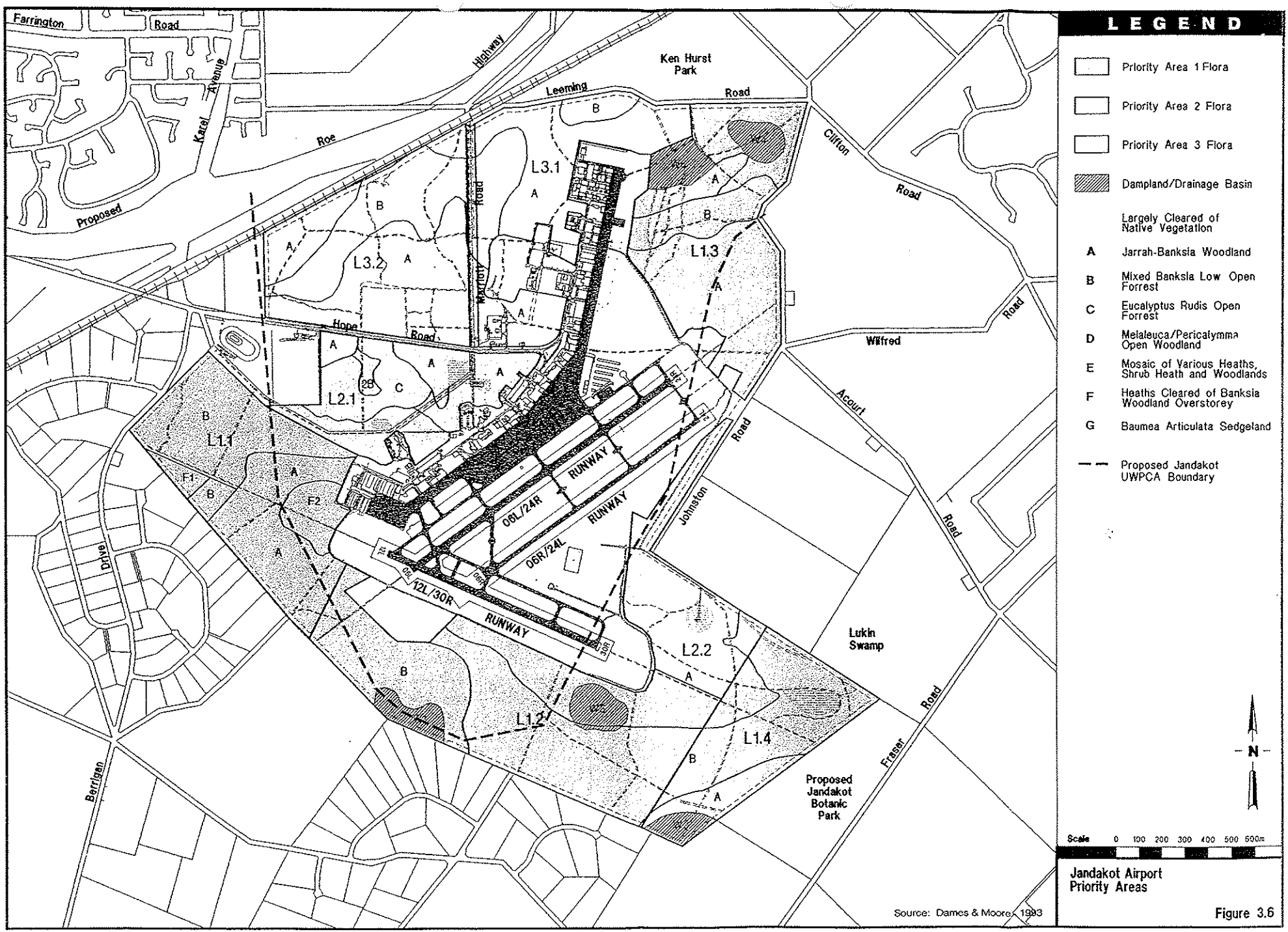
NB: Simplified cadastral detail shown due to map scale

Native Vegetation Extent for Study Area supplied by Agriculture, W.A.

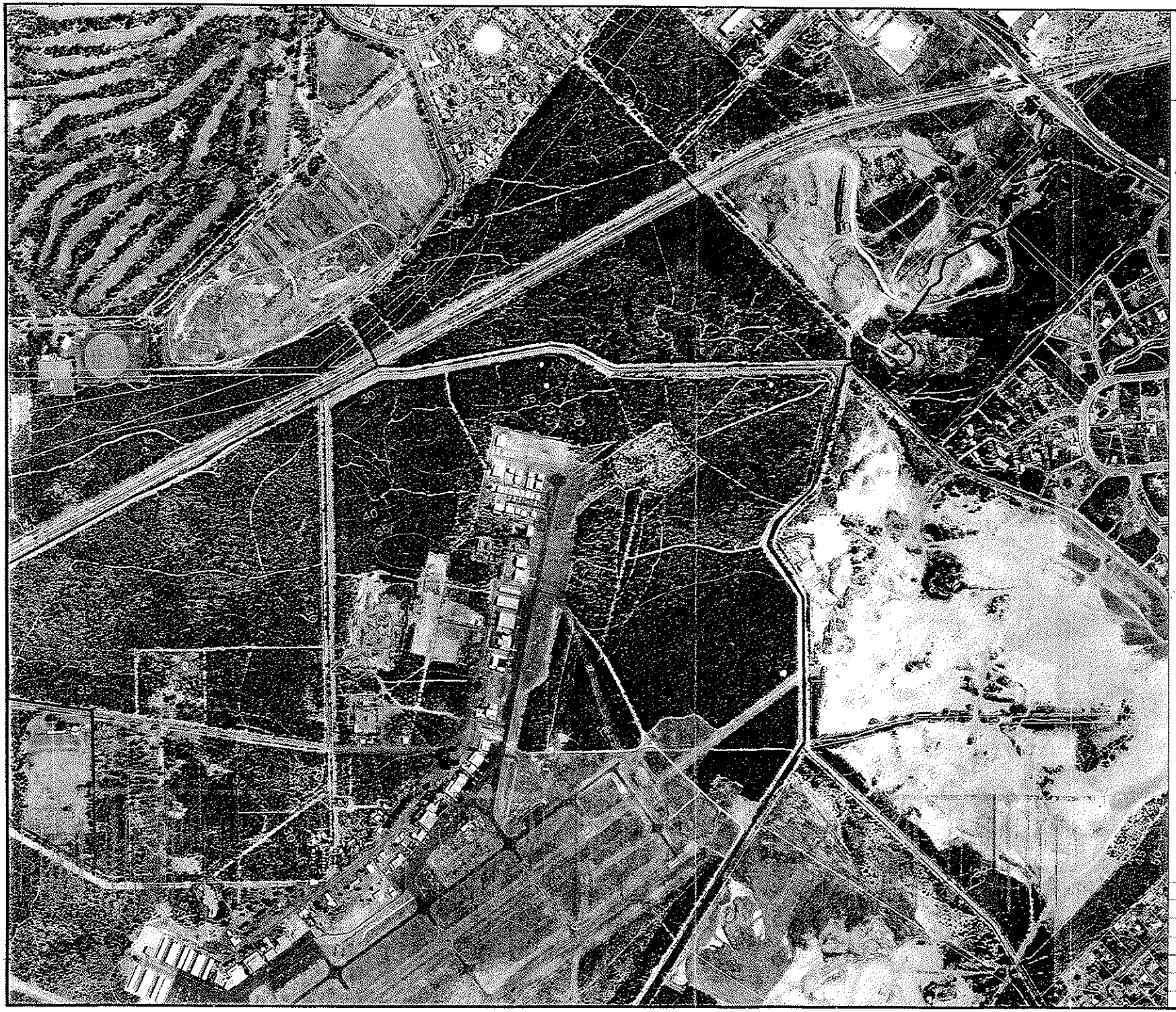
Wetland Data supplied by Water and Rivers Commission

Garden Island Vegetation Data supplied by McArthur, WM 1998

★ Where there is more than one implementation recommendation for a Bush Forever Site, each part has been assigned a letter (eg. A, B, C etc)



Map 2: Jandakot Airport Priority Areas (Sinclair Knight Merz 2000a).



BUSH FOREVER
SITE 388
2000 AERIAL PHOTOGRAPHY

Cadastre

Contours - 5m (DOLA)

Bush Forever 2000 - Site Boundaries

• J3 Plot Location Sampled Spring 1994

Map 3: Year 2000 Aerial Photograph of Jandakot Airport.

Map Ident: plot010207_1

Prepared By: Andrea Zappacosta

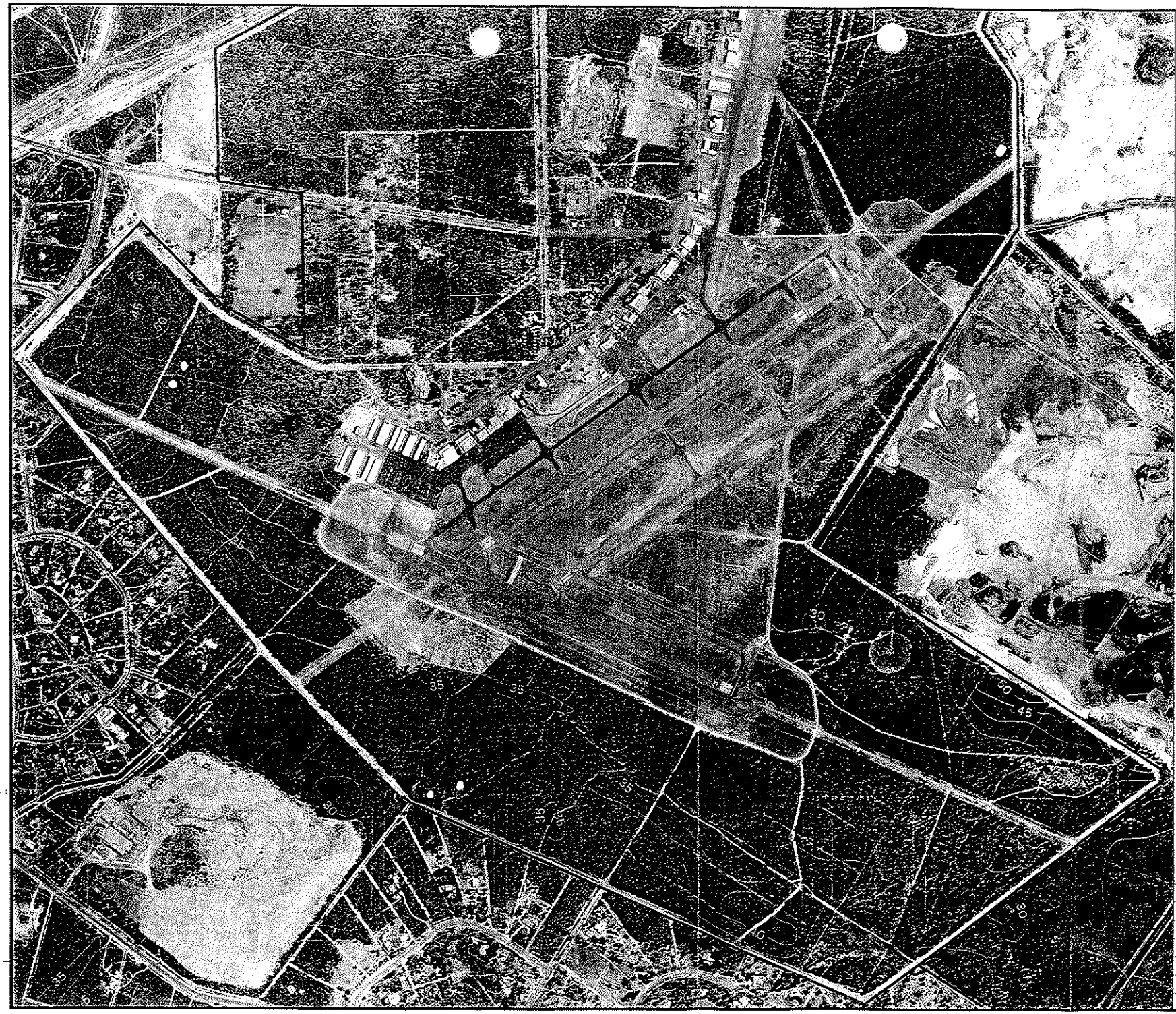
Prepared For: SEAN COLLINGWOOD

Date: 07 Feb 2001

Scale 1:10000

0 250 m

MFP INTERNAL USE ONLY



BUSH FOREVER
SITE 388
2000 AERIAL PHOTOGRAPHY

Cadastre

Contours - 5m (DOLA)

Bush Forever 2000 - Site Boundaries

• J3 Plot Location Sampled Spring 1994

Map 3: Year 2000 Aerial Photograph of Jandakot Airport.

Map Ident: plot010207_1

Prepared By: Andrea Zappacosta

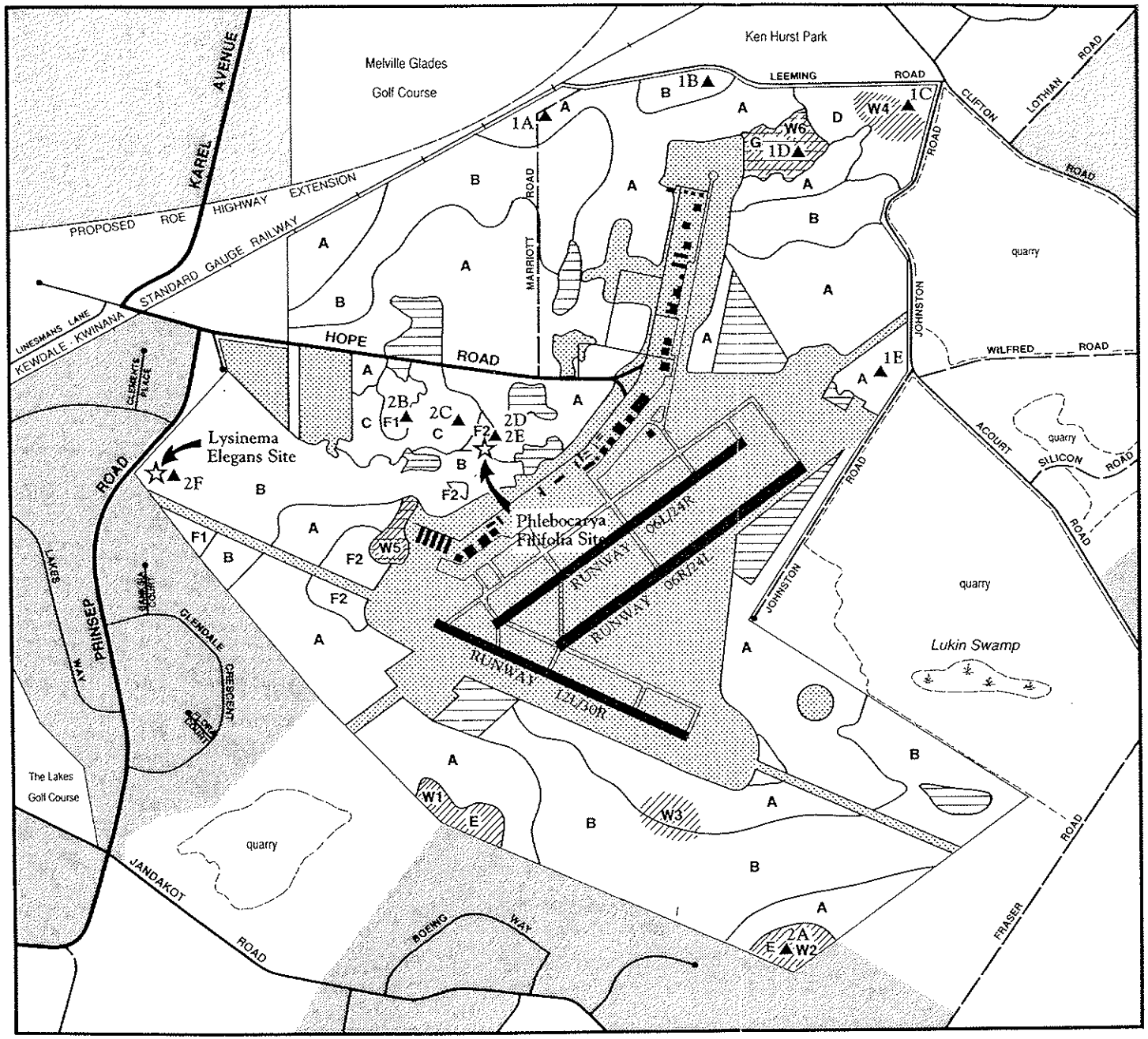
Prepared For: SEAN COLLINGWOOD

Date: 07 Feb 2001

Scale 1:10000

0 250 m

MFP INTERNAL USE ONLY



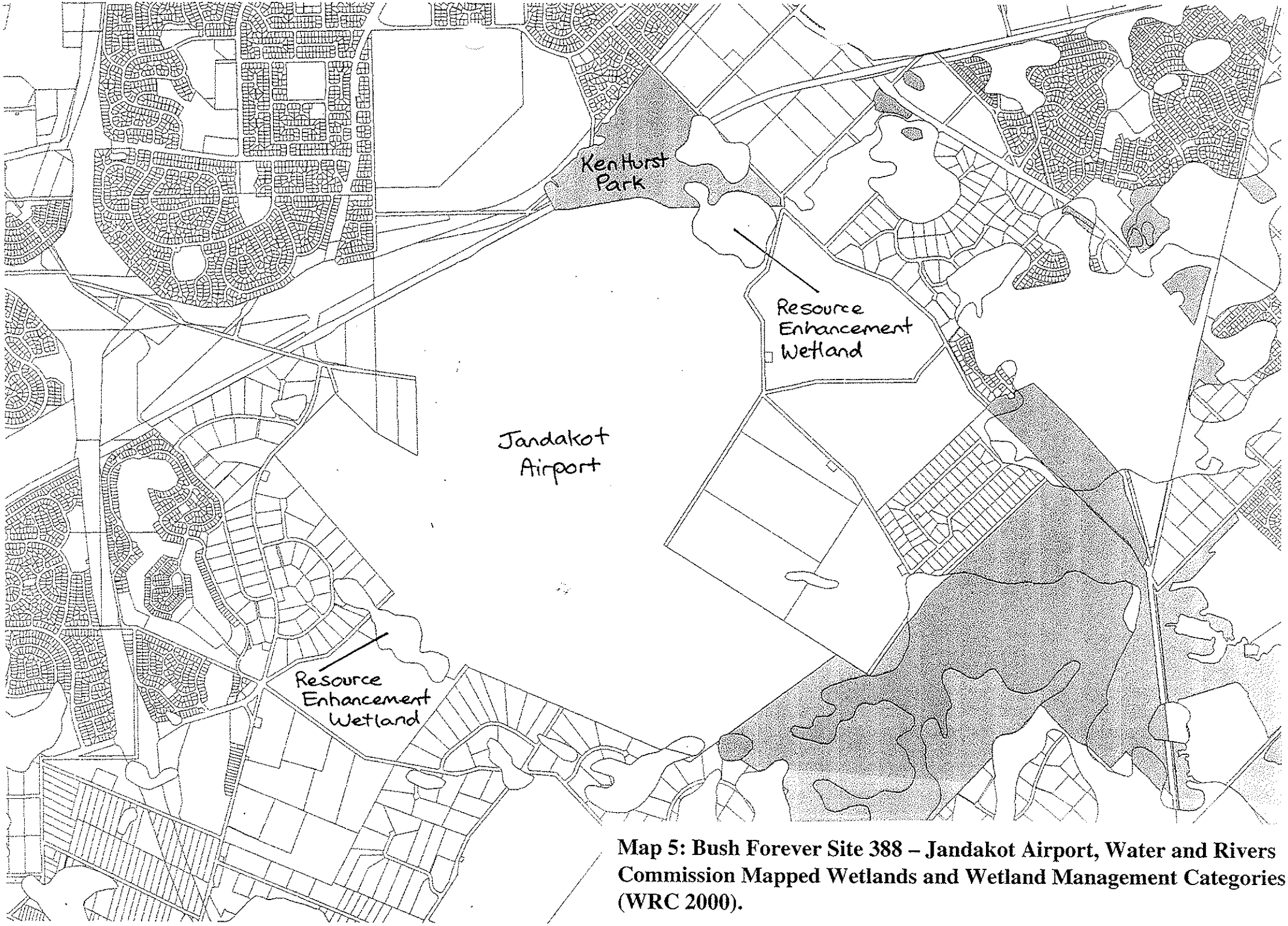
Map 4: Jandakot Airport Vegetation Map (Dames & Moore 1993)

JANDAKOT AIRPORT DEVELOPMENT - EIS

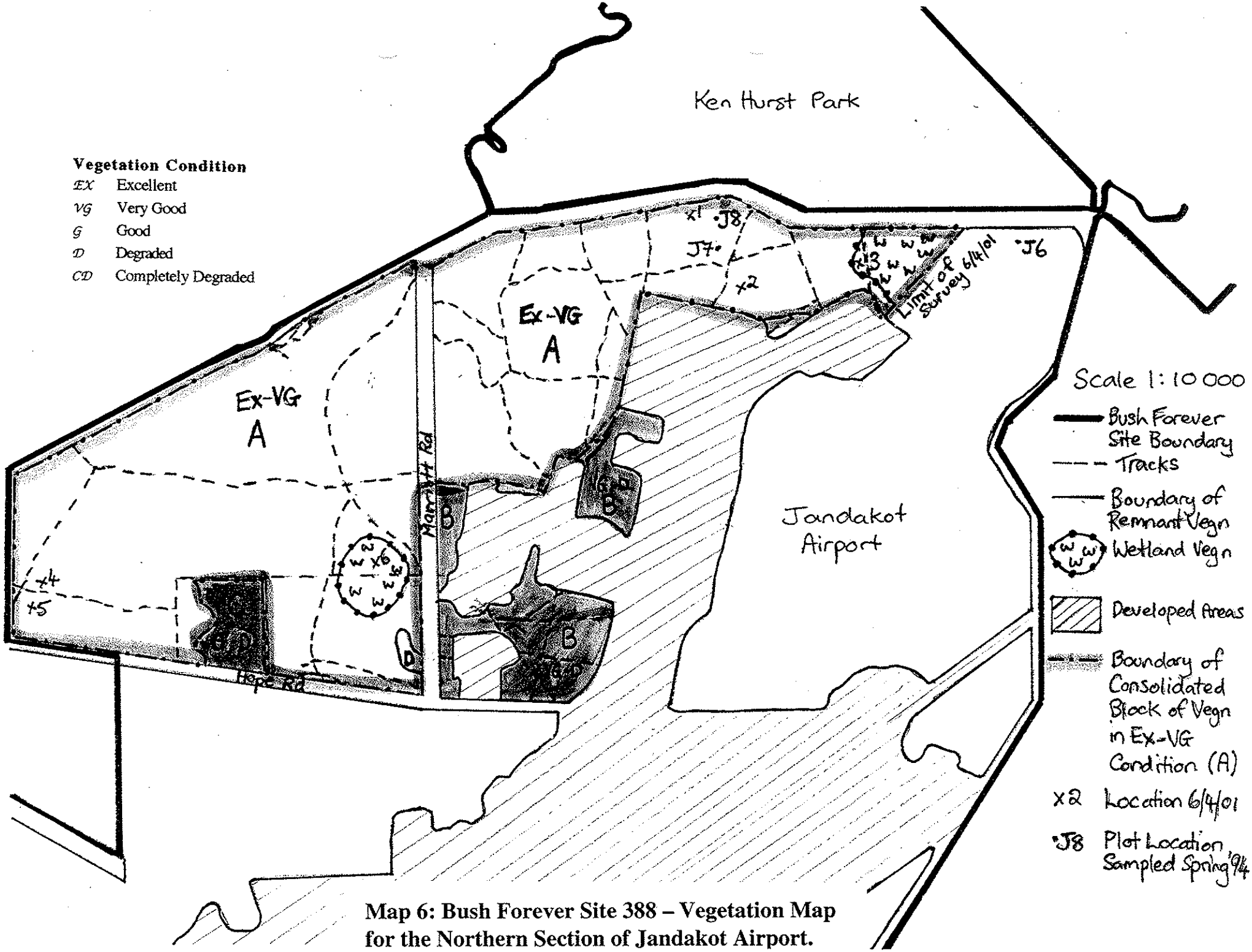
VEGETATION MAP

DAMES & MOORE

FIGURE 6.1



Map 5: Bush Forever Site 388 – Jandakot Airport, Water and Rivers Commission Mapped Wetlands and Wetland Management Categories (WRC 2000).



Map 6: Bush Forever Site 388 – Vegetation Map for the Northern Section of Jandakot Airport.

Department of Environmental Protection
- Technical Report

The natural values of bushland of the Jandakot Airport (Jandakot Airport Bushland, Bushplan Site 388) with particular reference to the Preliminary Draft Master Plan and Environment Strategy prepared for Jandakot Airport Holdings Pty Ltd.

May 1999

CONTENTS

1 Introduction

2 Identification and Description of the Values of Natural Areas in the Jandakot Airport

2.1 Introduction

2.2 Determination of Conservation Value of Natural Areas on the Swan Coastal Plain with special reference to natural areas in the Jandakot Airport
2.2.1 Regional and area specific natural value datasets
2.2.2 Datasets Available for Jandakot Airport Bushland
2.2.3 Use of the natural value datasets in the PDMP and PDES

2.3 Identification of the values of the Jandakot Airport Bushland at the national. state and local level

2.4 Identification of the "Priority Areas" at Jandakot Airport

2.5 Recommendations - Identification of Areas for Conservation

3 Management

3.1 Management and recognition of conservation areas

3.2 Recommendations - Management of Conservation Areas

4 Public consultation

5 References

APPENDIX 1: BUSHPLAN SITE DESCRIPTION

1 Introduction

The Preliminary Draft Master Plan (PDMP) and Environment Strategy (PDES) recognise that the bushland areas of Jandakot Airport have conservation value at the national, state and local level. The following underlying principles outlined in the PDMP and PDES that

- "Jandakot Airport contains areas of important remnant bushland" (PDES p 2-2)
- Jandakot Airport Holdings Pty Ltd (JAH) has a "..responsibility to maintain and protect the quality of the environment in and around its operations." (PDES p ES-1)
- Jandakot Airport Holdings Pty Ltd (JAH) will "Protect significant environmental sites within the airport." (PDES p 2-1)

are supported and commended.

However plans to develop much of the land at Jandakot Airport are not supported in light of the values of the land (PDES p 2-2)

2 Identification and Description of the Values of Natural Areas in the Jandakot Airport

2.1 Introduction

The PDMP and PDES recognise that substantial areas of the Jandakot Airport has conservation value at the national, state and local level. The description of the Airport's natural values is considered an essential step in identifying the constraints framework for the PDMP and the scope of the PDES..

2.2 Determination of Conservation Value of Natural Areas on the Swan Coastal Plain with special reference to natural areas in the Jandakot Airport

2.2.1 Regional and area specific natural value datasets

The Jandakot Airport lies on the Swan Coastal Plain in the Swan Coastal Plain Biogeographic region (Thackaway and Cresswell 1995). The identification of values of an area at the national and state level should refer to the region as this gives the context for a comparison.

The natural values of the Swan Coastal Plain are relatively well documented. Any consideration of regional significance of a natural area on the Plain should consider the standard, and generally widely available, sets of biological information on the Swan Coastal Plain outlined in Table 1. These are not 'new' information sets and should be used in the initial compilation of the determination of a bushland/wetland area's regional conservation values.

These data sets have been used in Perth's Bushplan (Volumes 1 and 2, Government of WA 1998) to describe the regional attributes of the bushland within the Jandakot Airport, described in Perth's Bushplan as Bushplan Site 388 (see Appendix 1)

The individual natural attributes of each area, according to the categories outlined in Table 2, to be compared with and compliment the regional information sets in the final determination of regional conservation value.

Table 1: National and Regional Information Sets for the Swan Coastal Plain used in Perth's Bushplan and other studies

Key
* datasets used in PDMP and PDES
# datasets given partial consideration in PDMP and PDES
• datasets not used in PDMP and PDES

* LANDFORM AND SOIL (various sources)

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

WETLANDS
* Wetland Types (Hill *et al.* 1996a, Hill *et al.* 1996b)
Consanguineous suite (Hill *et al.* 1996a, Hill *et al.* 1996b)
* Wetland Management Objective (Hill *et al.* 1996a, Hill *et al.* 1996b)
Lake EPP (not applicable at Jandakot Airport)

• THREATENED ECOLOGICAL COMMUNITIES (English and Blyth 1997)

* THREATENED SPECIES (* CALM current Declared Rare and Priority Flora and Fauna Lists, # reports, * own survey)

* INTERNATIONAL AND NATIONAL SIGNIFICANCE
* Listing on the Register of the National Estate etc.

Table 2: Specific Area Information (the limitations of any survey work should be clearly stated)

Key
* datasets used in PDMP and PDES
# datasets given partial consideration in PDMP and PDES
• datasets not used by PDMP and PDES

* Landscape features

Vegetation and Flora (# any existing information and * own survey)
* Structural units (should be mapped and related to on the ground descriptions)
# Vegetation Condition (should be mapped)
Total Flora, # including total flora (level of survey should be indicated), # significant flora (DRF, priority taxa, range extensions, species at geographic limits etc.)

Fauna (? any existing information and * own survey)

Linkage (adjacent bushland areas)

2.2.2 Datasets Available for Jandakot Airport Bushland

A series of studies have included the area of the Jandakot Airport Bushland (see References). All of the studies are available in a published format or from the relevant agency/individual. These datasets were used in describing the Jandakot Airport Bushland in Volume 2 of Perth's Bushplan released in December 1998 (see Appendix 1). In addition the Bushplan Site description for Jandakot Airport was supplied to the Jandakot Airport Holdings Pty Ltd through Robert Hoskings in December 1998.

2.2.3 Use of the natural value datasets in the PDMP and PDES

The PDMP and PDES consider the natural values of the Jandakot Airport in a national, state and local context. While many of the information sets outlined in Section 2.1 are used in the assessment for the PDMP and PDES there are some significant omissions in the datasets used (see Table 1 and 2). The following outline these omissions and comments on the datasets used.

Vegetation
No reference is made to vegetation complexes or floristic community types. Information on the vegetation complexes and floristic community types is considered by the CALM, DEP, WRC and MfP as critical in determining regional significance (Perth's Bushplan, Government of WA 1998 and Section 2.3 below).

The Airport contains areas of *Banksia* Woodlands on Bassendean Dunes. These *Banksia* Woodlands are mapped in the Bassendean Complex — Central and South vegetation complex. The Jandakot Airport Bushland is typical of and contains good examples of the regional floristic groupings typical of the Bassendean Complex — Central and South vegetation complex, containing floristic community types

- 21c (Low lying *Banksia attenuata* woodlands or shrublands, mean species richness 38.5)
- 22 (*Banksia ilicifolia* woodlands, mean species richness 30) and
- 23a (Central *Banksia attenuata* — *B. menziesii* woodlands, mean species richness 59).

All of these types are from Supergroup 3: Uplands centred on Bassendean Dunes and Dandaragan Plateau and are typical of the Bassendean Dunes. A further wetland floristic community type, type 5 (Mixed shrub damplands, mean species richness 38.4) is identified in the Jandakot Airport Bushland. An additional type could be identified in the *Eucalyptus rudis* woodland but this vegetation unit has not been sampled.

Vegetation Condition
The vegetation condition is described in very broad terms and no mapping of condition is supplied. However this very broad data is used in Table 3.1 (PDES p3-12) to describe priority areas. The use of condition should acknowledge that bushland blocks generally have areas in a variety of conditions. At the very lest an aerial image of the Jandakot Airport Bushland would convey the quality of the woodlands and wetlands.

Flora
The PDES refers to 177 native flora (Martinick 1989 and Muir 1993). Perth's Bushplan refers to 149 native taxa (from Martinick 1989 and DEP 1996). It would be expected that the combination of all three reports (Martinick 1989, Muir 1993 and DEP 1996) should show ~~more~~ well over 200 native taxa as suggested in the PDES. This is supported by the detailed work in the adjacent smaller Ken Hurst Park where 214 native taxa have been identified.

Perth's Bushplan identifies other significant taxa in the Jandakot Airport Bushland: *Leucopogon kingianus*, *Astroloma xerophyllum* and *Hensmania turbinata* (see Appendix 1). These taxa are associated with the species rich *Banksia* woodlands of the Bassendean Complex — Central and South and the associated floristic community types.

The population of *Lysinema elegans* in the Jandakot Airport Bushland is of significance. This species is endemic to the Swan Coastal Plain being confined to the Bassendean Dunes between Moore River National Park and Jandakot. Only two large populations of this taxa have been identified south of Perth, both in the Jandakot area. This is probably the largest population of these two populations. The removal of *Lysinema elegans* from the priority list is related to the size of populations north of Perth in Moore River National Park and State Forest 65, not to an abundance of populations in the Jandakot area. This population at Jandakot Airport remains a highly significant population.

It should be noted that *Scaevola repens* was incorrectly called *Scaevola paludosa* in the Flora of the Perth Region. *Scaevola repens* which is the taxon present in the Perth Metropolitan Area is not a priority taxon (PDES p3-4).

2.3 Identification of the values of the Jandakot Airport Bushland at the national, state and local level

The bushland/wetland areas within the boundaries of the Airport have been recognised as having regional conservation value (that is having national and state significance) for many years. In 1983 the System 6 Report (Department of Conservation and Environment 1983) recognised the values of the bushland within the Airport's boundaries. Work for the System 6 Update incorporated in Perth's Bushplan and national comparisons (Trudgen 1995) have further recognised the values and significance of the Jandakot Airport Bushland. The Department of Environmental Protection has

brought the values of the Airport's bushland to the attention of the past managers, the Federal Airports Corporation (FAC) on many occasions.

The datasets described in Section 2.2.1 (applied to Jandakot Airport Bushland in Appendix 1) have been used in the preparation of the update of the conservation area recommendations for the Swan Coastal (Swan coastal Plain portion of the Perth Metropolitan Region released as Perth's Bushplan). This set of information for each area was used to assess the area against the criteria established to determine regional significance in Perth's Bushplan. The regional significance of the Jandakot Airport Bushland was upheld (see Appendix 1 and Map 1).

The Jandakot Airport Bushland meets all five of natural values selection criteria applied in Perth's Bushplan, that is:

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

These criteria recognise that the Jandakot Airport Bushland contains a large area of the *Banksia* Woodlands and wetlands, generally in excellent condition, typical of the Bassendean Complex — Central and South vegetation complex. This complex is currently very poorly represented in lands considered to be protected in Perth's Bushplan and this area contributes significantly to the representation of this complex. In addition the Jandakot Airport Bushland is central to a larger area being linked to several other Bushplan Sites, Ken Hurst Park (Bushplan Site 245) to the north and Acourt Road Bushland (Bushplan Site 389, part of the Jandakot Regional Park). That is the Jandakot Airport Bushland has very significant value because of the quality of the bushland and the overall size of the remnant bushland area. Inclusion in the PDMP and PDES of an aerial image of the Jandakot Airport Bushland would well illustrate this aspect of the area's values.

These *Banksia* Woodlands are significantly different in respect to the *Banksia* Woodlands on Spearwood Dunes (Supergroup 4, Gibson *et al* 1994, DEP 1996, Perth's Bushplan Volume 2 1998). The PDES (PDES, p3-4) infers that *Banksia* Woodlands of the Bassendean Dunes can be grouped with the Spearwood Dunes woodlands. Gibson *et al* (1994) and other studies (Cresswell and Bridgewater 1985) have clearly established that there are very significant floristic differences between *Banksia* Woodlands of the Spearwood and Bassendean Dunes and significant differences between *Banksia* Woodlands within these dune systems at a regional level. Three *Banksia* Woodland regional floristic groupings are identified in the Jandakot Bushland, all associated with the Bassendean Dune System. One of these, floristic community type 23a (Central *Banksia attenuata — B. menziesii* woodlands) is confined to the Perth Metropolitan Region (Perth's Bushplan, Volume 2 1998). This floristic community type has a mean species richness of 59 taxa (less taxa found in only one plot), the highest species diversity of the woodlands on the Spearwood and Bassendean Dune Systems. In respect to this regional floristic grouping the statement in the PDES that "...(plant) associations occur elsewhere outside of the Perth region..." is not correct.

As a consequence of the overall size and quality of the Jandakot Airport Bushland the bushland provides a very significant habitat for fauna and supports ".... a great diversity of fauna" (PDES p 3-10). These values give the area significance at a regional and local level.

In addition to its national and state significance the bushland in Jandakot Airport has substantial local significance as outlined in the PDES (p 3-10).

That is the Jandakot Airport Bushland has very substantial national, state (regional) and local significance. The PDMP and PDES acknowledge that the area has national and state significance but the Jandakot Airport Bushland values are understated.

2.4 Identification of the "Priority Areas" at Jandakot Airport

Individual areas of bushland/wetland within the boundaries of the Jandakot Airport were prioritised for conservation purposes in the PDMP and PDES primarily with reference to " ...vegetation quality, as well as the presence of fauna and available habitat offered by the bushland" (PDES, p 3-11). While the designation of areas for conservation (Conservation Areas 2A, 2B and 2C) is supported the prioitisation of areas from the application of the attributes listed above is unclear. Table 3 (below) clearly illustrates that these attributes can be interpreted in a variety of ways. For example Area L3.1 is described in PDES Table3 (summarised in Table 3 below) as being in good condition, with a similar variety of habitats being found 'elsewhere' (except for damplands) but Table 3 below also shows that it connects to Ken Hurst Park to the north and L1.3 (a high priority area) to the east.

Table 3: Summary of attributes used to determine area prioritisation and other related factors

Priority Area (after PDES Table 3)	**L1.1**	**L1.2**	**L1.3**	**L1.4**	**L2.1**	**L2.2**	**L3.1**	**L3.2**
Description after PDES Table 3.1								
Condition	good	good	good	good	degraded to ?good	good	good	good
# Significant edge disturbance			north	east, south	road to north	east/west	internal disturbance	north
Diversity of Habits	good variety		good variety		unit not found elsewhere		same as elsewhere	same as elsewhere
Additional Information								
Mapped Vegetation Units (Dames and Moore 1993)	4 (2 mapped units described as having cleared overstorey)	4	4 (best variety of damplands)	4 (3 plus high dune)	3 (includes unit not found elsewhere)	1 (contains *Banksia ilicifolia* Woodland, not found elsewhere)	2	2
Significant Flora	3	large pop *Lysinema elegans*						
Linkage - in Airport - adjacent to Airport	L1.2	L1.1/L1.4/ L2.2	L3.1 BS 245 (north)	L1.2 BS 389 (east)	L1.1/L3.2	L1.3/L1.2/ L1.4	L3.2/L1.3 BS 245 (north)	L3.2

Application unclear as in some cases described as severe in relation to the disturbance created by a road but bushland may lie on the other side of the road.

In the case of the Jandakot Airport Bushland such a prioritsation is essentially flawed as the values of the Jandakot Airport Bushland relate to the large area of high quality *Banksia* Woodlands connected to other similar areas. Any reduction in area will significantly impact on the values of the area. To establish an agreed procedure for prioritisation Jandakot Airport Holdings Pty Ltd should consult with MfP (key agency for Perth's Bushplan) and other Bushplan agencies (DEP, CALM, and WRC) to determine an agreed prioritisation of bushland/wetland areas using all available information, in particular datasets relevant to Perth's Bushplan. The community conservation groups should be invited to participate.

The location of the areas proposed for development appear to be most closely related to accessibility rather than comparative conservation values. The areas proposed for non - airfield/terminal uses (non-essential airport functions) are located on the main access road to the Airport and the areas allocated to

airfield/terminal uses (essential airport functions) are alongside the current facilities (in areas allocated highest conservation values). This is not satisfactory. As discussed above these areas proposed for development have considerable natural value, complimentary to the above values that should be recognised and protected. Any developments in the lands identified in Perth's Bushplan should be subject to environmental assessment.

All areas recognised with conservation as there primary purpose should be given statutory recognition, through covenanting or another equivalent level of protection. At this stage this could be applied to Conservation Areas 2A, 2B and 2C. Covenanting of all conservation areas would make the future intentions clear.

2.5 Recommendations - Identification of Areas for Conservation

1. *That the area recognised as regionally significant in Perth's Bushplan be clearly identified in the PDMP and PDES.*

2. *Protection of the Conservation Areas (green in PDES Fig 5.4) be supported by statutory recognition of the conservation areas, through covenanting or another equivalent level of protection.*

3. *That Jandakot Airport Holdings Pty Ltd consult with MfP (key agency for Perth's Bushplan) and other Bushplan agencies (DEP, CALM, and WRC) to determine an agreed prioritisation of bushland/wetland areas using all available information, in particular datasets relevant to Perth's Bushplan. The community conservation groups should be invited to participate.*

4. *At the present time all bushland/wetland areas identified in Perth's Bushplan should be protected and managed for conservation. Such management should continue until bushland/wetland areas are deemed required to be essential airfield and terminal related uses after environmental assessment.*

3 Management

3.1 Management and recognition of conservation areas

The intention to manage all areas designated as having high priority for conservation (PDES, p4-6) to maintain "species diversity and remnant bushland" is supported. However all other areas identified in Perth's Bushplan should be similarly managed until it is determined, after environmental impact assessment, that they are needed for airfield and terminal uses or other developments.

The first priority management issues
- fire protection;
- weed control;
- track rationalisation and
- dieback control

are supported and endorsed.

Given the considerable value placed on the Jandakot Airport Bushland areas by the state and community Jandakot Airport Holdings Pty Ltd should be supported in its management by CALM, DEP, WRC, MfP and the interested community. The Murdoch Branch of the Wildflower Society have indicated an interest in forming a Friends Group for the adjacent Ken Hurst Park and could be approached to perform a similar role at Jandakot Airport.

3.2 Recommendations - Management of Conservation Areas

1. *Jandakot Airport Holdings Pty Ltd work with CALM, DEP, WRC, MfP and the interested community to manage all bushland areas.*

2. *The general management directions described for the bushland/wetland Conservation Area are supported and should be extended to all bushland recognised in Perth's Bushplan. These*

protection measures should be supported by statutory recognition of the conservation areas, through covenanting or another equivalent level of protection.

3. *Landscaping within the Jandakot Airport, outside bushland areas, should be designed to complement the natural landscape values and use local plants.*

4 Public consultation

The public consultation process at the government level is outlined in the PDMP and PDES however the participation of community groups is poorly addressed in the PDMP and PDES. No detail of the twenty one groups involved in the three workshops is given and this consultation process did not involve key regional conservation groups. The Jandakot Airport Bushland is of regional conservation values and it is essential that the regional groups be involved in consultation.

5 References

Key
• references not quoted in PDES

Atkins, K. 1998 Declared Rare and Priority List for Western Australia. Department of Conservation and Land Management, WA.

• Cresswell I and Bridgewater P 1985 Dune vegetation of the Swan Coastal Plain, Western Australia. Journal of the Royal Society of Western Australia 67:137-148.Department of Environmental Protection 1996 System 6 and part 1 Update Program. Unpublished bushland plot and area records and analysis.

Dames and Moore 1993 Draft Environmental Impact Statement Proposed Additional Developments at Jandakot Airport. Unpublished report (Job No. 18534-011-363) for the Federal Airports Corporation.

• Department of Environmental Protection 1996 System 6 and Part System 1 Update Programme. Unpublished bushland plot and area records and analysis.

• Gibson, N., Keighery, B.J., Keighery, G.J., Burbidge, A.H., and Lyons, M.N. 1994 A Floristic Survey of the southern Swan Coastal Plain. Unpublished report for the Australian Heritage Commission, prepared by the Department of Conservation and Land Management and the Conservation Council of WA (Inc.)

English VJ & Blyth J 1997 Identifying and Conserving Threatened Ecological Communities in the South West Botanical Province. Project Number N702, Final Report to Environment Australia. Department of Conservation and Land Management. Perth WA.

• Heddle, E.M., Loneragan, O.W. and Havel, J.J. 1980 Vegetation of the Darling System' in Atlas of Natural Resources, Darling System, Western Australia. Department of Conservation and Environment, Western Australia.

Hill AL, Semeniuk CA, Semeniuk V & Del Marco A 1996a Wetlands of the Swan Coastal Plain. Volume 1: Wetland Mapping, Classification and Evaluation - Main Report. Prepared for the Waters and Rivers Commission and the Department of Environmental Protection.

Hill AL, Semeniuk CA, Semeniuk V & Del Marco A 1996b Wetlands of the Swan Coastal Plain. Volume 2: Wetland Mapping Classification and Evaluation - Wetland Atlas. Prepared for the Waters and Rivers Commission and the Department of Environmental Protection.

How RA, Harvey MS, Dell J & Waldock J 1996 Ground Fauna of Urban Bushland Remnants in Perth. Report to the Australian Heritage Commission.

Keighery, B.J. 1995 Vegetation and Flora of . An unpublished report for the Department of Environmental Protection

Muir Environmental 1993 Evaluation of Proposed Conservation Areas Jandakot Airport. An unpublished report for Federal Airports Corporation.

• Thackway, R. and Cresswell, I.D. (eds), 1995. An Interim Biogeographic Regionalisation for Australia: a framework for setting priorities in the national system of reserves, Version 4. Australian Nature Conservation Agency, Canberra.

• Trudgen, M.E 1995 Objection Assessment for the Jandakot Airport flora values. An unpublished report for the Australian Heritage Commission.

APPENDIX 1: BUSHPLAN SITE DESCRIPTION
(See Perth's Bushplan Volume 2 for detail of datasets used)

JANDAKOT AIRPORT, JANDAKOT

Boundary Definition: bushland taken to cadastre boundary

SECTION 1: CADASTRAL INFORMATION

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

Bushplan Site no. 388 **Map no.** 67, 68 **Map sheet series ref. no.** 2033–I NE, 2033–I NW

System 6 (1983): M94 area of bushland goes beyond System area boundaries, all bushland described

Other Names
Part Submission Area 13

Area (ha): total 649.7; bushland 410.9

Local Authorities (Suburb)
City of Cockburn (Jandakot), City of Canning (Canning Vale)

Zoning
MRS: Public Purposes-Commonwealth Government, Rural, Rural-Water Protection, Railways, Public Purposes-Special Uses, Important Regional Roads
TPS: Landscape, Local Park and Recreation Area, Public Purposes

Ownership Categories
Commonwealth Government, Local Government, Private (commercial organisation)

Lot/Location/Reserve numbers (Purpose), Street name
0, 1, 3, 4, 5, 6, 7, 8, 9, 10, 588 Hope Rd; 2 Roe Hwy; 74, 500 Johnston Rd; 77 Jandakot 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) (Qrw: Sp1)

VEGETATION AND FLORA

Vegetation Complexes

Bassendean Dunes
Bassendean Complex — Central and South

Floristic Community Types

Supergroup 2: Seasonal Wetlands
5 Mixed shrub damplands

Supergroup 3: Uplands centred on Bassendean Dunes and Dandaragan Plateau
21c Low lying *Banksia attenuata* woodlands or shrublands
22 *Banksia ilicifolia* woodlands
23a Central *Banksia attenuata* — *B. menziesii* woodlands

WETLANDS

Wetland Types: dampland

Natural Wetland Groups

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

Bassendean Dunes
Jandakot (B.3)

Wetland Management Objectives: Resource Enhancement

Swan Coastal Plain Lakes EPP: none identified

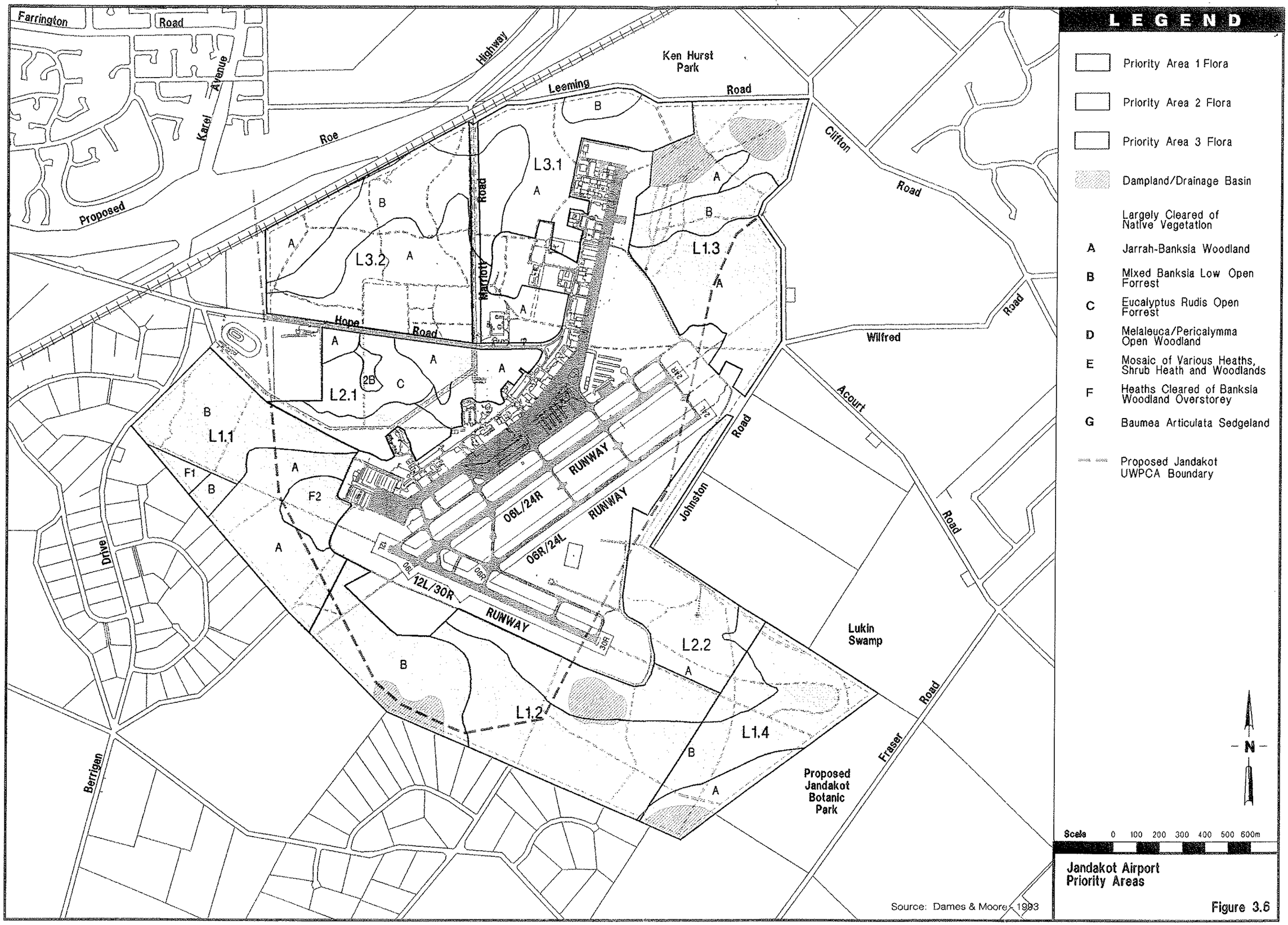
THREATENED ECOLOGICAL COMMUNITIES

Not assessed

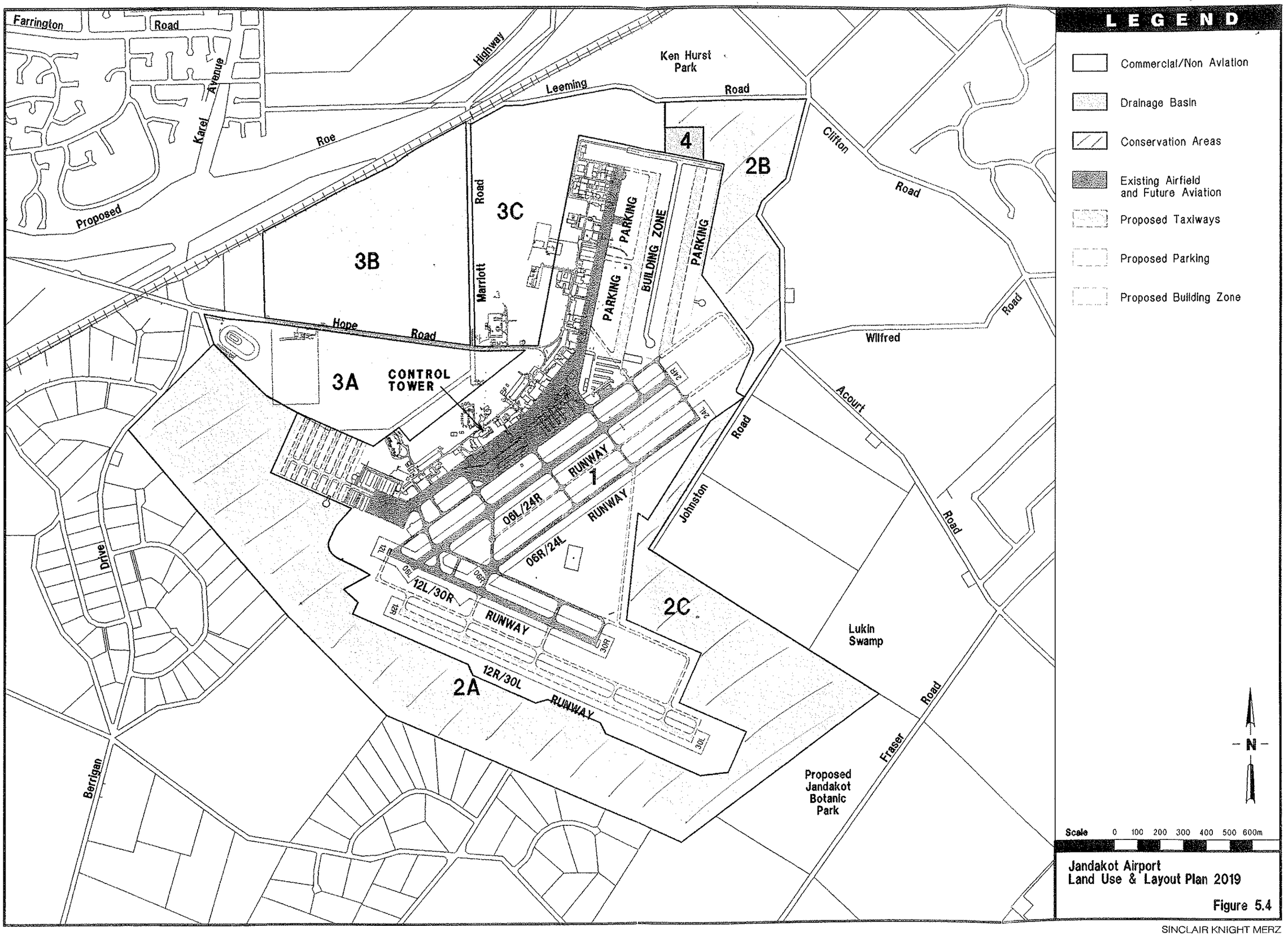
SECTION 3: SPECIFIC SITE DETAIL

Landscape Features: vegetated wetland, vegetated uplands

Vegetation and Flora: detailed survey (Dames and Moore 1993, Martinick 1989); limited survey (DEP 1996 (Jand 01–08))



SINCLAIR KNIGHT MERZ



Jandakot Airport
Land Use & Layout Plan 2019

Figure 5.4

SINCLAIR KNIGHT MERZ

BUSH FOREVER VEGETATION ASSESSMENT

PART BUSH FOREVER SITE 388 – JANDAKOT AIRPORT, JANDAKOT

Department of Environmental Protection
Karen Clarke and Bronwen Keighery
May 2001

BACKGROUND

In July 1998 a 50 year lease over Jandakot Airport was sold to Jandakot Airport Holdings Pty Ltd (JAH), with an option for a 49 year lease extension. As part of the privatisation process, a Master Plan and Environmental Strategy were produced (Sinclair Knight Merz 2000 a&b), acting as functional guides to the management and development of Jandakot Airport. Jandakot Airport covers a total area of 622 ha, 411 ha of which is remnant vegetation. Muir Environmental (1993) conducted an evaluation of proposed conservation areas for Jandakot Airport and this formed the basis of the JAH's Master Plan and Environment Strategy. The Master Plan and Environmental Strategy designated 200 ha of remnant vegetation as a conservation precinct and set aside approximately 200 ha for aviation and non-aviation development (see Map 1). Compatibility of development with aviation requirements and external transport routes (such as the railway and proposed Roe Hwy) were factors also taken into account.

At the time the airport was being privatised, the state government was in the process of finalising an updated conservation plan for the Swan Coastal Plain portion of the Perth Metropolitan Region. This plan, known as Perth's Bushplan, was released as a draft for public comment in December 1998. The remnant vegetation on Jandakot Airport had long been identified as of high conservation value and was recommended for protection under the EPA's recommendations for the System 6 region as site M94 (DCE 1983). Jandakot Airport was subsequently identified as a Site of regional conservation value and included as Site 388 in draft Perth's Bushplan. ~~Site 388 also included Lot 500 Johnston Rd, vested in the City of Canning~~. JAH made a submission on Perth's Bushplan stating that "for the airport to trade as a business and sustain appropriate management of high conservation areas, development of a non-aviation nature is required" (JAH letter, dated 19 May 2000). JAH asked for negotiation over the area of bushland incorporated into Bushplan.

During 1999 the Preliminary Draft Master Plan and Environment Strategy (Sinclair Knight Merz 1999 a&b) were also being reviewed by state and federal government agencies. The Department of Environmental Protection's response to the Preliminary Draft Master Plan and Environment Strategy (Keighery 1999, see Appendix 1) recommended that:

1. the area recognised as regionally significant in Perth's Bushplan be clearly identified in the Preliminary Draft Master Plan (PDMP) and Preliminary Draft Environment Strategy (PDES).
2. protection of the conservation areas (green PDES in Fig 5.4) be supported by statutory recognition of the conservation areas, through covenanting or another equivalent level of protection.
3. Jandakot Airport Holdings Pty Ltd consult with MfP (key agency for Perth's Bushplan) and other Bushplan agencies (DEP, CALM and WRC) to determine agreed prioritisation of bushland/wetland areas using all available information, in particular datasets relevant to Perth's Bushplan. The community conservation groups should be invited to participate.
4. at the present time all bushland/wetland areas identified in Perth's Bushplan should be protected and managed for conservation. Such management should continue until bushland/wetland areas are deemed required to be essential airfield and terminal related uses after environmental assessment.

Keighery (1999) highlighted that a number of key sources of information that had either not been considered adequately or had not been used in preparing the PDMP and PDES. The identification of "priority areas" at Jandakot Airport (see Map 2) was primarily based on one study, Muir

Environmental (1993). Keighery (1999) noted that it is unclear how the attributes assessed by Muir Environmental (1993) were used to determine the prioritisation of areas and that these attributes could be interpreted in a variety of ways.

Muir Environmental (1993) does not use a methodology that adequately assesses regional significance for the selection of protected areas to achieve a comprehensive representation of the original biological diversity of a Swan Coastal Plain. The criteria used in Bush Forever are based on a range of parameters assessed across the whole Swan Coastal Plain section of the Perth Metropolitan Region (Government of Western Australia 2000c). Muir Environmental (1993) uses the Muir Rapid Habitat Assessment System (MRHAS) which is biased towards scoring woodlands of highest value due to the emphasis it places on the provision of a range of habitats for fauna. While this in itself may be valid for assessing fauna conservation values it provides only a small amount of the information required to address regional conservation values. This is particularly evident in relation to shrub-dominated wetlands which often receive low scores under the MRHAS assessment method because they do not contain trees and, as such, their diversity of habitat is low.

Perth's Bushplan was finalised during 2000, endorsed by cabinet and released as state government policy as "Bush Forever" in December 2000. All of the remnant vegetation on Jandakot Airport was included in the finalised Bush Forever Site 388 (Map 1) but a commitment was made by the Bush Forever Office of the Ministry for Planning to review the Site and determine a prioritisation of bushland/wetland areas with regard to conservation value as previously proposed by Keighery (1999).

The further assessment of Jandakot Airport was commenced in February 2001 with a tour of the Site, conducted by Sharon Miller, Environmental Manager JAH, attended by Karen Clarke and Sean Collingwood (MfP) and John Dell (DEP). This report is part of the further assessment process but is only a preliminary vegetation assessment prepared at the special request of JAH to provide an indication of conservation values in part of the area identified in JAH's Master Plan (priority areas L3.1 and L3.2, see Map 2). Only vegetation and flora are addressed in this report, a more detailed report addressing other issues will subsequently be prepared for the whole Site.

A field inspection for preparation of this report was made of the northern sections of bushland by Karen Clarke (MfP) and Sandra Santich (DEP) on 6/4/2001. Approximately five hours were spent traversing the bushland on foot and by vehicle. JAH provided an off road vehicle and the Environmental Manager, Sharon Miller, attended throughout the site inspection. Being April there were relatively few plants flowering and annually renewed plants (annuals that grow from seed or perennials that die back in summer to a bulb or rhizome and grow back again in autumn/winter) were dormant. Therefore, vegetation condition assessments are subject to revision on a mid/late spring inspection. Condition ratings are based on Keighery (1994).

VEGETATION AND FLORA – PREVIOUS STUDIES

Vegetation on this Site is typical of the Bassendean Dunes and is mapped as the Bassendean – Central and South Vegetation Complex (Heddle *et al.* 1980). Of this complex 13% is proposed for protection under Bush Forever (5, 883 ha) and Jandakot Airport makes up nearly 10% of this area for protection. The Site Description (see Appendix 2) summarises the conservation values of this Bush Forever Site. The Site consists of vegetated uplands and vegetated wetlands (see Appendix 2 & Map 3). Detailed vegetation and floras surveys of the Site have been undertaken previously by

Dames & Moore (1993) and Martinick & Associates Pty Ltd (1989). Dames and Moore (1993) compiled information drawn from Martinick & Associates Pty Ltd 1989, Milewski & Davidge (1981), Weston (1990) and field work by students from Curtin University under the direction of Byron Lammont. Milewski & Davidge (1981) studied the floristics and phenology of an area of *Banksia* woodland near the corner of Hope Rd and Berrigan Dve to the south of the Bibra Lake Speedway. More than half of their study area is in Jandakot Airport. Weston (1990) reported on a rare flora search of Jandakot Airport.

After the work by Dames and Moore (1993), Muir Environmental (1993) conducted an "Evaluation of Proposed Conservation Areas, Jandakot Airport" which was then the main study used in preparation of the Master Plan and Environmental Strategy when the airport was privatised. In 1994, eight 10 x 10m permanent plots were established at Jandakot Airport as part of the System 6 and Part System 1 Update Program (DEP 1996, see Map 3). This allowed regional floristic community types (after Gibson *et al.* 1994) to be determined across the Site (see Appendix 2) and further contributed to documenting the flora and vegetation. In 1999 the DEP produced a Technical Report addressing the natural values of Jandakot Airport in response to the Draft Master Plan and Environmental Strategy process (Keighery 1999, Appendix 1). More recently, Sharon Miller, the Environmental Manager for JAH, has prepared a Conservation Management Plan for the proposed 200 ha conservation area of Jandakot Airport (Miller 2000).

The vegetation map in Dames and Moore (1993) is based largely on Martinick & Associates Pty Ltd (1989) and has been extensively used in subsequent studies of the airport's bushland (see Map 4). Six structural types of vegetation were described plus one category (F) termed "heath" for woodland cleared of its *Banksia* overstorey:

A. Jarrah-*Banksia* woodland (low woodland and low open forest)
B. Mixed *Banksia* low open forest (to low woodland)
C. *Eucalyptus rudis* open forest/woodland
D. *Melaleuca-Pericalymma* open woodland/heath
E. Mosaic of various heaths, shrub heaths and woodlands
F. Heaths cleared of *Banksia* woodland overstorey
G. *Baumea articulata* sedgeland

(Dames and Moore 1993)

In Bush Forever, based on DEP (1996), Dames and Moore (1993) and Martinick & Associates Pty Ltd (1989), the vegetation is described in more detail as the following structural units (Government of Western Australia 2000b):

Uplands – (equating to units A & B, Map 4)

- Scattered *Eucalyptus marginata* over *Banksia attenuata*, *B. menziesii*, *Allocasuarina fraseriana* and *Eucalyptus todtiana* Low Woodland
- *Banksia attenuata*, *B. menziesii* and *Nuytsia floribunda* Low Woodland
- *Banksia attenuata* and *B. menziesii* Low Woodland

Wetlands -

- *Eucalyptus rudis* Forest to Woodland (equating to unit C, Map 4)
- *Melaleuca preissiana* Low Woodland (equating to unit D, Map 4)
- scattered *Melaleuca preissiana* over *Banksia attenuata* and *B. ilicifolia* Low Open Forest (equating to units D & E, Map 4)
- *Pericalymma ellipticum* Open Low Heath (equating to unit D, Map 4).

The *Baumea articulata* sedgeland was not listed as a major unit as it occurs in a disturbed area previously excavated for drainage purposes (Wetland 6, Map 4). Vegetation condition was recorded as >85% Excellent to Very Good with <15 % in Very Good to Good Condition across the Site (Government of Western Australia 2000b). A species list was compiled from DEP (1996) and Martinick (1989) giving a total of 149 native taxa, estimated at <50% expected flora by Government of Western Australia (2000b). Miller (2000) documents 206 native taxa for Jandakot Airport based on an amalgamation of lists from Milewski & Davidge (1981), Martinick & Associates Pty Ltd 1989, Muir (1993) and Lammont (pers. comm. 1990). It was expected that over well 200 native taxa are present because in the adjacent Ken Hurst Park, 214 native taxa have been recorded in remnant vegetation of similar type but in a much smaller area (52.7 ha) (Government of Western Australia 2000b).

It should be noted that previous records of *Scaveola repens* have been incorrectly called *Scaveola paludosa* (a Priority 2 species) (Keighery 1999). At present there are no currently listed Declared Rare Flora (DRF) or Priority species recorded at Jandakot Airport. However, a number of significant flora are present *Leucopogon kingianus*, *Lysinema elegans* (significant population), *Astroloma xerophyllum* and *Hensmania turbinata* occur on the Site (Government of Western Australia 2000b). The significant flora recorded for Ken Hurst Park may also be present at Jandakot Airport; *Caladenia huegelii* (Declared Rare Flora), *Drosera zonaria, Stylidium preissii* and *Stylidium squamellosum* (Government of Western Australia 2000b).

A number of seasonal, vegetated wetlands occur on the Site but many of these are not well documented or mapped. Dames and Moore (1993) incorrectly attributed the six vegetation units described by Martinick & Associates Pty Ltd (1989) to four types of *Banksia* woodland and two types of wetland vegetation. The units A & B (plus the partially cleared F) are variations of *Banksia* woodland but C, D, E & G are all wetland vegetation. Thus, the vegetation map in Dames and Moore (1993) records the presence of seven wetlands, not six (see Map 4):

- Wetland 1 - Mosaic of various heaths, shrub heaths and woodlands
- Wetland 2 - Mosaic of various heaths, shrub heaths and woodlands
- Wetland 3 - shown as Jarrah-*Banksia* woodland & mixed *Banksia* low open forest
- Wetland 4 - *Melaleuca-Pericalymma* open woodland/heath
- Wetland 5 – vegetation type not shown
- Wetland 6 - *Baumea articulata* sedgeland (in drainage sump area)
- plus a 7th wetland - *Eucalyptus rudis* open forest/woodland

Some of these wetlands are currently mapped on the Water and Rivers Commission wetlands database (see Map 5). These wetlands are currently classified under the Resource Enhancement Management Category (WRC 2000).

The regional floristic community types (FCTs) occurring on the Site, as determined from the plots established by DEP in 1994, are:

Supergroup 2: Seasonal Wetlands

FCT5 Mixed shrub damplands

Supergroup 3: Uplands centred on Bassendean Dunes and Dandaragan Plateau

FCT21c Low-lying *Banksia attenuata* woodlands or shrublands

FCT22 *Banksia ilicifolia* woodlands

FCT23a Central *Banksia attenuata* — *B. menziesii* woodlands

(Government of Western Australia 2000b)

The *Eucalyptus rudis* Forest/Woodland is likely to represent FCT 11 but this has not been confirmed by sampling (Keighery 1999). None of these floristic community types are classed as Threatened Ecological Communities. However, FCT 23a is primarily confined to the Bassendean – Central and South Vegetation Complex and only occurs in the Perth Metropolitan Region (PMR). FCT 23a is the most diverse of the floristic community types occurring on the Bassendean Dunes. FCTs 5 and 21c are largely restricted to the PMR (Government of Western Australia 2000b). In addition, FCT 22 is recorded as being found in only one National Park or Nature Reserve in the PMR (Gibson *et al.* 1994).

The remnant vegetation on Jandakot Airport has particularly high conservation value and meets the following criteria for regional significance:

- Representation of ecological communities - it is representative of the Bassendean – Central and South Vegetation Complex of which only 13% has been able to be protected through Bush Forever.
- Diversity
- Rarity
- Scientific or evolutionary importance
- General criteria for the protection of wetland, streamline and estuarine fringing vegetation and coastal vegetation

SITE VISIT COMMENTS – NORTHERN PART OF JANDAKOT AIRPORT

The remnant vegetation in JAH's priority areas L3.1 and L3.2 consists of a mosaic of *Banksia* woodland communities, a previously undescribed wetland and the edge of the large wetland that extends north into Ken Hurst Park (see Appendices 2 & 3 and Map 6). At this stage the *Banksia* woodland communities have not been mapped but variation in the composition and density of the overstorey and understorey species closely relates to the topography and aspect of the dunes. As detailed in Appendices 3 & 4 the variation is structure and floristics of the *Banksia* woodlands in the northern section of the Site is considerable. Two permanent plots established by DEP in 1994 are located on the dune running between the airport and Ken Hurst Park, plots 7 & 8 (DEP 1996, see Maps 3 & 6 and Appendix 4). In addition, 4 locations were sampled in the upland vegetation on 6/4/01 (DEP 2001, see Map 6 and Appendix 3). The descriptions for all 6 areas show variations within the *Banksia* woodlands growing across the northern section of the airport.

In the lower lying areas, impeded drainage and proximity to the groundwater table favours the development of various types of wetland vegetation. The type of wetland vegetation present depends on depth to groundwater and the period and extent of moisture availability from groundwater and rainfall. Typically bands of vegetation occur in these wetlands changing from the centre of the wetland outwards in response to water availability. The large wetland extending from Jandakot Airport into Ken Hurst Park contains a variety of plant communities changing from *Melaleuca preissiana* Low Woodland over *Regelia ciliata* Open Heath at the deepest part in Jandakot Airport (Location 3, Appendix 3 and Map 6) to *Melaleuca preissiana* Low Woodland over *Pultenaea reticulata* Tall Open Scrub (see Location 3, Appendix 3) and then to *Melaleuca preissiana* Low Woodland over *Pericalymma eliptica* and *Xanthorrhoea preissii* Closed Heath in the shallower areas around the perimeter (Plot 6, Appendix 4 and Map 6). More variations may be noted with further study.

Almost all of the remnant vegetation in JAH's priority areas L3.1 and L3.2 is still part of a large intact area of Bassendean – Central and South Vegetation Complex. Map 6 shows the boundary of the consolidated block of remnant vegetation (Area A) that is in Excellent to Very Good condition with only minor weed invasion and disturbance associated with numerous tracks. **Ehrharta calycina* (Perennial Veldt Grass) occurs along the edges and tracks but only a few scattered **Gladiolous caryophyllaceous* (Pink Gladioli) occur within the bushland. There are isolated patches of severe localised disturbance within this area associated with activities such as rubbish dumping but this does not change the conservation value of the large consolidated area delineated in Map 6. It is very rare to find urban bushland without such disturbance factors. To date very few weeds have been recorded with the bushland areas (DEP 1996 and Miller 2000) reflecting the overall excellent condition of the vegetation.

The vegetation to the east of Marriot Rd has not been burnt recently and does not show any evidence of degradation due to frequent fire events. According to Sharon Miller (Environment Manager, JAH) a hot fire burnt the area to the west of Marriot Rd about 1997, except for the very southern boundary of area L3.2 on the southern side of the firebreak. This accounts for the appearance of the area west of Marriot Rd on aerial photographs which, without ground truthing, may be interpreted as in a lesser condition than the remainder of the Site.

The remnant vegetation outside the boundary of the consolidated block on Map 6 varies in condition from Very Good to Degraded (DEP 2001). The areas to the east of Marriott Rd around and to the south of the rubbish recycling depot have been degraded by fire, fragmentation and weed invasion (Area B, Map 6). While the vegetation in Very Good condition within Area B still has conservation value, its location and level of fragmentation mean that it is a lower priority area for conservation purposes. Similarly Area C (Map 6), adjacent to Hope Rd, is in variable condition due to previous land uses and is not a priority area for conservation.

GENERAL COMMENT/CONCLUSION

The large consolidated block of remnant vegetation in Excellent to Very Good condition in the northern section of Jandakot Airport shown on Map 6 as Area A, is part of the larger area of high quality remnant vegetation in Bush Forever Site 388. Area A is a high priority area for conservation at a regional level as it is part of the 400+ ha of remnant vegetation present at Jandakot Airport and compliments and expands on the values of the uplands and wetlands in the southern section of the airport. Area A is part of a very important contiguous bushland/wetland link with Bush Forever Site 245 - Ken Hurst Park immediately to the north. Area A contains an extension of the uplands and large wetland areas of Ken Hurst Park.

Jandakot Airport contains one of largest consolidated areas of Bassendean Dune vegetation in the Perth Metropolitan Region (PMR) with plant communities unique to the PMR and the Bassendean – Central and South Vegetation Complex. Area A (Map 6) is part of the regionally significant remnant vegetation present on Jandakot Airport and is an important component of Bush Forever Site 388.

REFERENCES
(Unlisted references can be found in Bush Forever 2000c)

DEP 2001 *Bush Forever Survey 2001*. Unpublished bushland plot and area records. Department of Environmental Protection, Perth, Western Australia.

Government of Western Australia 2000a *Bush Forever. Volume 1 Policies, Principles and Processes*. Western Australian Planning Commission, Perth, Western Australia.

Government of Western Australia 2000b *Bush Forever. Volume 1 Policies, Principles and Processes - Appendix 3: Site Implementation Guidelines - Practice Notes.* Western Australian Planning Commission, Perth, Western Australia.

Government of Western Australia 2000c *Bush Forever. Volume 2 - Directory of Bush Forever Sites.* Department of Environmental Protection, Perth, Western Australia.

Government of Western Australia 2000d *Bush Forever. Summary of Submissions on the Draft Perth's Bushplan 1998.* Western Australian Planning Commission, Perth, Western Australia.

Miller, S. 2000 *Jandakot Airport Conservation Management Plan (Draft).* December 2000. Unpublished report prepared for Jandakot Airport Holdings Pty Ltd.

?Sinclair Knight Merz 1999a *Jandakot Airport – Preliminary Master Plan and Environment Strategy. Volume 1 Preliminary Draft Master Plan.* February 1999. Unpublished report prepared for Jandakot Airport Holdings Pty Ltd.

Sinclair Knight Merz 1999b *Jandakot Airport – Preliminary Master Plan and Environment Strategy. Volume 2 Preliminary Draft Environment Strategy.*. February 1999. Unpublished report prepared for Jandakot Airport Holdings Pty Ltd.

Sinclair Knight Merz 2000a *Jandakot Airport – Master Plan and Environment Strategy. Volume 1 Master Plan (Final).* December 2000. Unpublished report prepared for Jandakot Airport Holdings Pty Ltd.

Sinclair Knight Merz 2000b *Jandakot Airport – Master Plan and Environment Strategy. Volume 2 Environmental Strategy.* May 2000. Unpublished report prepared for Jandakot Airport Holdings Pty Ltd.

WRC (2000) D *GIS Database of Wetland Management Categories.* Water and Rivers Commission.

APPENDIX 1: KEIGHERY (1999) TECHNICAL REPORT

Department of Environmental Protection
- Technical Report

The natural values of bushland of the Jandakot Airport (Jandakot Airport Bushland, Bushplan Site 388) with particular reference to the Preliminary Draft Master Plan and Environment Strategy prepared for Jandakot Airport Holdings Pty Ltd.

May 1999

CONTENTS

1 Introduction

2 Identification and Description of the Values of Natural Areas in the Jandakot Airport

2.1 Introduction

2.2 Determination of Conservation Value of Natural Areas on the Swan Coastal Plain with special reference to natural areas in the Jandakot Airport
2.2.1 Regional and area specific natural value datasets
2.2.2 Datasets Available for Jandakot Airport Bushland
2.2.3 Use of the natural value datasets in the PDMP and PDES

2.3 Identification of the values of the Jandakot Airport Bushland at the national. state and local level

2.4 Identification of the "Priority Areas" at Jandakot Airport

2.5 Recommendations - Identification of Areas for Conservation

3 Management

3.1 Management and recognition of conservation areas

3.2 Recommendations - Management of Conservation Areas

4 Public consultation

5 References

APPENDIX 1: BUSHPLAN SITE DESCRIPTION

1 Introduction

The Preliminary Draft Master Plan (PDMP) and Environment Strategy (PDES) recognise that the bushland areas of Jandakot Airport have conservation value at the national, state and local level. The following underlying principles outlined in the PDMP and PDES that

- "Jandakot Airport contains areas of important remnant bushland" (PDES p 2-2)
- Jandakot Airport Holdings Pty Ltd (JAH) has a "..responsibility to maintain and protect the quality of the environment in and around its operations." (PDES p ES-1)
- Jandakot Airport Holdings Pty Ltd (JAH) will "Protect significant environmental sites within the airport." (PDES p 2-1)

are supported and commended.

However plans to develop much of the land at Jandakot Airport are not supported in light of the values of the land (PDES p 2-2)

2 Identification and Description of the Values of Natural Areas in the Jandakot Airport

2.1 Introduction

The PDMP and PDES recognise that substantial areas of the Jandakot Airport has conservation value at the national, state and local level. The description of the Airport's natural values is considered an essential step in identifying the constraints framework for the PDMP and the scope of the PDES..

2.2 Determination of Conservation Value of Natural Areas on the Swan Coastal Plain with special reference to natural areas in the Jandakot Airport

2.2.1 Regional and area specific natural value datasets

The Jandakot Airport lies on the Swan Coastal Plain in the Swan Coastal Plain Biogeographic region (Thackaway and Cresswell 1995). The identification of values of an area at the national and state level should refer to the region as this gives the context for a comparison.

The natural values of the Swan Coastal Plain are relatively well documented. Any consideration of regional significance of a natural area on the Plain should consider the standard, and generally widely available, sets of biological information on the Swan Coastal Plain outlined in Table 1. These are not 'new' information sets and should be used in the initial compilation of the determination of a bushland/wetland area's regional conservation values.

These data sets have been used in Perth's Bushplan (Volumes 1 and 2, Government of WA 1998) to describe the regional attributes of the bushland within the Jandakot Airport, described in Perth's Bushplan as Bushplan Site 388 (see Appendix 1)

The individual natural attributes of each area, according to the categories outlined in Table 2, to be compared with and compliment the regional information sets in the final determination of regional conservation value.

Table 1: National and Regional Information Sets for the Swan Coastal Plain used in Perth's Bushplan and other studies

Key
* datasets used in PDMP and PDES
# datasets given partial consideration in PDMP and PDES
• datasets not used in PDMP and PDES

* LANDFORM AND SOIL (various sources)

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

WETLANDS
* Wetland Types (Hill *et al.* 1996a, Hill *et al.* 1996b)
Consanguineous suite (Hill *et al.* 1996a, Hill *et al.* 1996b)
* Wetland Management Objective (Hill *et al.* 1996a, Hill *et al.* 1996b)
Lake EPP (not applicable at Jandakot Airport)

• THREATENED ECOLOGICAL COMMUNITIES (English and Blyth 1997)

* THREATENED SPECIES (* CALM current Declared Rare and Priority Flora and Fauna Lists, # reports, * own survey)

* INTERNATIONAL AND NATIONAL SIGNIFICANCE
* Listing on the Register of the National Estate etc.

Table 2: Specific Area Information (the limitations of any survey work should be clearly stated)

Key
* datasets used in PDMP and PDES
# datasets given partial consideration in PDMP and PDES
• datasets not used by PDMP and PDES

* Landscape features

Vegetation and Flora (# any existing information and * own survey)
* Structural units (should be mapped and related to on the ground descriptions)
# Vegetation Condition (should be mapped)
Total Flora, # including total flora (level of survey should be indicated), # significant flora (DRF, priority taxa, range extensions, species at geographic limits etc.)

Fauna (? any existing information and * own survey)

Linkage (adjacent bushland areas)

2.2.2 Datasets Available for Jandakot Airport Bushland

A series of studies have included the area of the Jandakot Airport Bushland (see References). All of the studies are available in a published format or from the relevant agency/individual. These datasets were used in describing the Jandakot Airport Bushland in Volume 2 of Perth's Bushplan released in December 1999 (see Appendix 1). In addition the Bushplan Site description for Jandakot Airport was supplied to the Jandakot Airport Holdings Pty Ltd through Robert Hoskings in December 1998.

2.2.3 Use of the natural value datasets in the PDMP and PDES

The PDMP and PDES consider the natural values of the Jandakot Airport in a national, state and local context. While many of the information sets outlined in Section 2.1 are used in the assessment for the PDMP and PDES there are some significant omissions in the datasets used (see Table 1 and 2). The following outline these omissions and comments on the datasets used.

Vegetation
No reference is made to vegetation complexes or floristic community types. Information on the vegetation complexes and floristic community types is considered by the CALM, DEP, WRC and MfP as critical in determining regional significance (Perth's Bushplan, Government of WA 1998 and Section 2.3 below).

The Airport contains areas of *Banksia* Woodlands on Bassendean Dunes. These *Banksia* Woodlands are mapped in the Bassendean Complex — Central and South vegetation complex. The Jandakot Airport Bushland is typical of and contains good examples of the regional floristic groupings typical of the Bassendean Complex — Central and South vegetation complex, containing floristic community types

- 21c (Low lying *Banksia attenuata* woodlands or shrublands, mean species richness 38.5)
- 22 (*Banksia ilicifolia* woodlands, mean species richness 30) and
- 23a (Central *Banksia attenuata* — *B. menziesii* woodlands, mean species richness 59).

All of these types are from Supergroup 3: Uplands centred on Bassendean Dunes and Dandaragan Plateau and are typical of the Bassendean Dunes. A further wetland floristic community type, type 5 (Mixed shrub damplands, mean species richness 38.4) is identified in the Jandakot Airport Bushland. An additional type could be identified in the *Eucalyptus rudis* woodland but this vegetation unit has not been sampled.

Vegetation Condition
The vegetation condition is described in very broad terms and no mapping of condition is supplied. However this very broad data is used in Table 3.1 (PDES p3-12) to describe priority areas. The use of condition should acknowledge that bushland blocks generally have areas in a variety of conditions. At the very lest an aerial image of the Jandakot Airport Bushland would convey the quality of the woodlands and wetlands.

Flora
The PDES refers to 177 native flora (Martinick 1989 and Muir 1993). Perth's Bushplan refers to 149 native taxa (from Martinick 1989 and DEP 1996). It would be expected that the combination of all three reports (Martinick 1989, Muir 1993 and DEP 1996) should show more well over 200 native taxa as suggested in the PDES. This is supported by the detailed work in the adjacent smaller Ken Hurst Park where 214 native taxa have been identified.

Perth's Bushplan identifies other significant taxa in the Jandakot Airport Bushland: *Leucopogon kingianus*, *Astroloma xerophyllum* and *Hensmania turbinata* (see Appendix 1). These taxa are associated with the species rich *Banksia* woodlands of the Bassendean Complex — Central and South and the associated floristic community types.

The population of *Lysinema elegans* in the Jandakot Airport Bushland is of significance. This species is endemic to the Swan Coastal Plain being confined to the Bassendean Dunes between Moore River National Park and Jandakot. Only two large populations of this taxa have been identified south of Perth, both in the Jandakot area. This is probably the largest population of these two populations. The removal of *Lysinema elegans* from the priority list is related to the size of populations north of Perth in Moore River National Park and State Forest 65, not to an abundance of populations in the Jandakot area. This population at Jandakot Airport remains a highly significant population.

It should be noted that *Scaevola repens* was incorrectly called *Scaevola paludosa* in the Flora of the Perth Region. *Scaevola repens* which is the taxon present in the Perth Metropolitan Area is not a priority taxon (PDES p3-4).

2.3 Identification of the values of the Jandakot Airport Bushland at the national. state and local level

The bushland/wetland areas within the boundaries of the Airport have been recognised as having regional conservation value (that is having national and state significance) for many years. In 1983 the System 6 Report (Department of Conservation and Environment 1983) recognised the values of the bushland within the Airport's boundaries. Work for the System 6 Update incorporated in Perth's Bushplan and national comparisons (Trudgen 1995) have further recognised the values and significance of the Jandakot Airport Bushland. The Department of Environmental Protection has

brought the values of the Airport's bushland to the attention of the past managers, the Federal Airports Corporation (FAC) on many occasions.

The datasets described in Section 2.2.1 (applied to Jandakot Airport Bushland in Appendix 1) have been used in the preparation of the update of the conservation area recommendations for the Swan Coastal (Swan coastal Plain portion of the Perth Metropolitan Region released as Perth's Bushplan). This set of information for each area was used to assess the area against the criteria established to determine regional significance in Perth's Bushplan. The regional significance of the Jandakot Airport Bushland was upheld (see Appendix 1 and Map 1).

The Jandakot Airport Bushland meets all five of natural values selection criteria applied in Perth's Bushplan, that is:

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

These criteria recognise that the Jandakot Airport Bushland contains a large area of the *Banksia* Woodlands and wetlands, generally in excellent condition, typical of the Bassendean Complex — Central and South vegetation complex. This complex is currently very poorly represented in lands considered to be protected in Perth's Bushplan and this area contributes significantly to the representation of this complex. In addition the Jandakot Airport Bushland is central to a larger area being linked to several other Bushplan Sites, Ken Hurst Park (Bushplan Site 245) to the north and Acourt Road Bushland (Bushplan Site 389, part of the Jandakot Regional Park). That is the Jandakot Airport Bushland has very significant value because of the quality of the bushland and the overall size of the remnant bushland area. Inclusion in the PDMP and PDES of an aerial image of the Jandakot Airport Bushland would well illustrate this aspect of the area's values.

These *Banksia* Woodlands are significantly different in respect to the *Banksia* Woodlands on Spearwood Dunes (Supergroup 4, Gibson *et al* 1994, DEP 1996, Perth's Bushplan Volume 2 1998). The PDES (PDES, p3-4) infers that *Banksia* Woodlands of the Bassendean Dunes can be grouped with the Spearwood Dunes woodlands. Gibson *et al* (1994) and other studies (Cresswell and Bridgewater 1985) have clearly established that there are very significant floristic differences between *Banksia* Woodlands of the Spearwood and Bassendean Dunes and significant differences between *Banksia* Woodlands within these dune systems at a regional level. Three *Banksia* Woodland regional floristic groupings are identified in the Jandakot Bushland, all associated with the Bassendean Dune System. One of these, floristic community type 23a (Central *Banksia attenuata* — *B. menziesii* woodlands) is confined to the Perth Metropolitan Region (Perth's Bushplan, Volume 2 1998). This floristic community type has a mean species richness of 59 taxa (less taxa found in only one plot), the highest species diversity of the woodlands on the Spearwood and Bassendean Dune Systems. In respect to this regional floristic grouping the statement in the PDES that "...(plant) associations occur elsewhere outside of the Perth region..." is not correct.

As a consequence of the overall size and quality of the Jandakot Airport Bushland the bushland provides a very significant habitat for fauna and supports ".... a great diversity of fauna" (PDES p 3-10). These values give the area significance at a regional and local level.

In addition to its national and state significance the bushland in Jandakot Airport has substantial local significance as outlined in the PDES (p 3-10).

That is the Jandakot Airport Bushland has very substantial national, state (regional) and local significance. The PDMP and PDES acknowledge that the area has national and state significance but the Jandakot Airport Bushland values are understated.

2.4 Identification of the "Priority Areas" at Jandakot Airport

Individual areas of bushland/wetland within the boundaries of the Jandakot Airport were prioritised for conservation purposes in the PDMP and PDES primarily with reference to " ...vegetation quality, as well as the presence of fauna and available habitat offered by the bushland" (PDES, p 3-11). While the designation of areas for conservation (Conservation Areas 2A, 2B and 2C) is supported the prioitisation of areas from the application of the attributes listed above is unclear. Table 3 (below) clearly illustrates that these attributes can be interpreted in a variety of ways. For example Area L3.1 is described in PDES Table3 (summarised in Table 3 below) as being in good condition, with a similar variety of habitats being found 'elsewhere' (except for damplands) but Table 3 below also shows that it connects to Ken Hurst Park to the north and L1.3 (a high priority area) to the east.

Table 3: Summary of attributes used to determine area prioritisation and other related factors

Priority Area (after PDES Table 3)	**L1.1**	**L1.2**	**L1.3**	**L1.4**	**L2.1**	**L2.2**	**L3.1**	**L3.2**
Description after PDES Table 3.1								
Condition	good	good	good	good	degraded to ?good	good	good	good
# Significant edge disturbance			north	east, south	road to north	east/west	internal disturbance	north
Diversity of Habits	good variety		good variety		unit not found elsewhere		same as elsewhere	same as elsewhere
Additional Information								
Mapped Vegetation Units (Dames and Moore 1993)	4 (2 mapped units described as having cleared overstorey)	4	4 (best variety of damplands)	4 (3 plus high dune)	3 (includes unit not found elsewhere)	1 (contains *Banksia ilicifolia* Woodland, not found elsewhere)	2	2
Significant Flora	3	large pop *Lysinema elegans*						
Linkage - in Airport - adjacent to Airport	L1.2	L1.1/L1.4/ L2.2	L3.1 BS 245 (north)	L1.2 BS 389 (east)	L1.1/L3.2	L1.3/L1.2/ L1.4	L3.2/L1.3 BS 245 (north)	L3.2

Application unclear as in some cases described as severe in relation to the disturbance created by a road but bushland may lie on the other side of the road.

In the case of the Jandakot Airport Bushland such a prioritsation is essentially flawed as the values of the Jandakot Airport Bushland relate to the large area of high quality *Banksia* Woodlands connected to other similar areas. Any reduction in area will significantly impact on the values of the area. To establish an agreed procedure for prioritisation Jandakot Airport Holdings Pty Ltd should consult with MfP (key agency for Perth's Bushplan) and other Bushplan agencies (DEP, CALM, and WRC) to determine an agreed prioritisation of bushland/wetland areas using all available information, in particular datasets relevant to Perth's Bushplan. The community conservation groups should be invited to participate.

The location of the areas proposed for development appear to be most closely related to accessibility rather than comparative conservation values. The areas proposed for non - airfield/terminal uses (non-essential airport functions) are located on the main access road to the Airport and the areas allocated to

airfield/terminal uses (essential airport functions) are alongside the current facilities (in areas allocated highest conservation values). This is not satisfactory. As discussed above these areas proposed for development have considerable natural value, complimentary to the above values that should be recognised and protected. Any developments in the lands identified in Perth's Bushplan should be subject to environmental assessment.

All areas recognised with conservation as there primary purpose should be given statutory recognition, through covenanting or another equivalent level of protection. At this stage this could be applied to Conservation Areas 2A, 2B and 2C. Covenanting of all conservation areas would make the future intentions clear.

2.5 Recommendations - Identification of Areas for Conservation

1. *That the area recognised as regionally significant in Perth's Bushplan be clearly identified in the PDMP and PDES.*

2. *Protection of the Conservation Areas (green in PDES Fig 5.4) be supported by statutory recognition of the conservation areas, through covenanting or another equivalent level of protection.*

3. *That Jandakot Airport Holdings Pty Ltd consult with MfP (key agency for Perth's Bushplan) and other Bushplan agencies (DEP, CALM, and WRC) to determine an agreed prioritisation of bushland/wetland areas using all available information, in particular datasets relevant to Perth's Bushplan. The community conservation groups should be invited to participate.*

4. *At the present time all bushland/wetland areas identified in Perth's Bushplan should be protected and managed for conservation. Such management should continue until bushland/wetland areas are deemed required to be essential airfield and terminal related uses after environmental assessment.*

3 Management

3.1 Management and recognition of conservation areas

The intention to manage all areas designated as having high priority for conservation (PDES, p4-6) to maintain "species diversity and remnant bushland" is supported. However all other areas identified in Perth's Bushplan should be similarly managed until it is determined, after environmental impact assessment, that they are needed for airfield and terminal uses or other developments.

The first priority management issues
- fire protection;
- weed control;
- track rationalisation and
- dieback control

are supported and endorsed.

Given the considerable value placed on the Jandakot Airport Bushland areas by the state and community Jandakot Airport Holdings Pty Ltd should be supported in its management by CALM, DEP, WRC, MfP and the interested community. The Murdoch Branch of the Wildflower Society have indicated an interest in forming a Friends Group for the adjacent Ken Hurst Park and could be approached to perform a similar role at Jandakot Airport.

3.2 Recommendations - Management of Conservation Areas

1. *Jandakot Airport Holdings Pty Ltd work with CALM, DEP, WRC, MfP and the interested community to manage all bushland areas.*

2. *The general management directions described for the bushland/wetland Conservation Area are supported and should be extended to all bushland recognised in Perth's Bushplan. These*

protection measures should be supported by statutory recognition of the conservation areas, through covenanting or another equivalent level of protection.

3. *Landscaping within the Jandakot Airport, outside bushland areas, should be designed to complement the natural landscape values and use local plants.*

4 Public consultation

The public consultation process at the government level is outlined in the PDMP and PDES however the participation of community groups is poorly addressed in the PDMP and PDES. No detail of the twenty one groups involved in the three workshops is given and this consultation process did not involve key regional conservation groups. The Jandakot Airport Bushland is of regional conservation values and it is essential that the regional groups be involved in consultation.

5 References

Key
• references not quoted in PDES

Atkins, K. 1998 Declared Rare and Priority List for Western Australia. Department of Conservation and Land Management, WA.

• Cresswell I and Bridgewater P 1985 Dune vegetation of the Swan Coastal Plain, Western Australia. Journal of the Royal Society of Western Australia 67:137-148 Department of Environmental Protection 1996 System 6 and part 1 Update Program. Unpublished bushland plot and area records and analysis.

Dames and Moore 1993 Draft Environmental Impact Statement Proposed Additional Developments at Jandakot Airport. Unpublished report (Job No. 18534-011-363) for the Federal Airports Corporation.

• Department of Environmental Protection 1996 System 6 and Part System 1 Update Programme. Unpublished bushland plot and area records and analysis.

• Gibson, N., Keighery, B.J., Keighery, G.J., Burbidge, A.H., and Lyons, M.N. 1994 A Floristic Survey of the southern Swan Coastal Plain. Unpublished report for the Australian Heritage Commission, prepared by the Department of Conservation and Land Management and the Conservation Council of WA (Inc.)

English VJ & Blyth J 1997 Identifying and Conserving Threatened Ecological Communities in the South West Botanical Province. Project Number N702, Final Report to Environment Australia. Department of Conservation and Land Management. Perth WA.

• Heddle, E.M., Loneragan, O.W. and Havel, J.J. 1980 Vegetation of the Darling System' in Atlas of Natural Resources, Darling System, Western Australia. Department of Conservation and Environment, Western Australia.

Hill AL, Semeniuk CA, Semeniuk V & Del Marco A 1996a Wetlands of the Swan Coastal Plain. Volume 1: Wetland Mapping, Classification and Evaluation - Main Report. Prepared for the Waters and Rivers Commission and the Department of Environmental Protection.

Hill AL, Semeniuk CA, Semeniuk V & Del Marco A 1996b Wetlands of the Swan Coastal Plain. Volume 2: Wetland Mapping Classification and Evaluation - Wetland Atlas. Prepared for the Waters and Rivers Commission and the Department of Environmental Protection.

How RA, Harvey MS, Dell J & Waldock J 1996 Ground Fauna of Urban Bushland Remnants in Perth. Report to the Australian Heritage Commission.

Keighery, B.J. 1995 Vegetation and Flora of . An unpublished report for the Department of Environmental Protection

Muir Environmental 1993 Evaluation of Proposed Conservation Areas Jandakot Airport. An unpublished report for Federal Airports Corporation.

• Thackway, R. and Cresswell, I.D. (eds), 1995. An Interim Biogeographic Regionalisation for Australia: a framework for setting priorities in the national system of reserves, Version 4. Australian Nature Conservation Agency, Canberra.

• Trudgen, M.E 1995 Objection Assessment for the Jandakot Airport flora values. An unpublished report for the Australian Heritage Commission.

APPENDIX 1: BUSHPLAN SITE DESCRIPTION
(See Perth's Bushplan Volume 2 for detail of datasets used)

JANDAKOT AIRPORT, JANDAKOT

Boundary Definition: bushland taken to cadastre boundary

SECTION 1: CADASTRAL INFORMATION

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

Bushplan Site no. 388 **Map no.** 67, 68 **Map sheet series ref. no.** 2033–I NE, 2033–I NW

System 6 (1983): M94 area of bushland goes beyond System area boundaries, all bushland described

Other Names
Part Submission Area 13

Area (ha): total 649.7; bushland 410.9

Local Authorities (Suburb)
City of Cockburn (Jandakot), City of Canning (Canning Vale)

Zoning
MRS: Public Purposes-Commonwealth Government, Rural, Rural-Water Protection, Railways, Public Purposes-Special Uses, Important Regional Roads
TPS: Landscape, Local Park and Recreation Area, Public Purposes

Ownership Categories
Commonwealth Government, Local Government, Private (commercial organisation)

Lot/Location/Reserve numbers (Purpose), Street name
0, 1, 3, 4, 5, 6, 7, 8, 9, 10, 588 Hope Rd; 2 Roe Hwy; 74, 500 Johnston Rd; 77 Jandakot 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) (Qrw: Sp1)

VEGETATION AND FLORA

Vegetation Complexes
Bassendean Dunes
Bassendean Complex — Central and South

Floristic Community Types
Supergroup 2: Seasonal Wetlands
5 Mixed shrub damplands
Supergroup 3: Uplands centred on Bassendean Dunes and Dandaragan Plateau
21c Low lying *Banksia attenuata* woodlands or shrublands
22 *Banksia ilicifolia* woodlands
23a Central *Banksia attenuata* — *B. menziesii* woodlands

WETLANDS

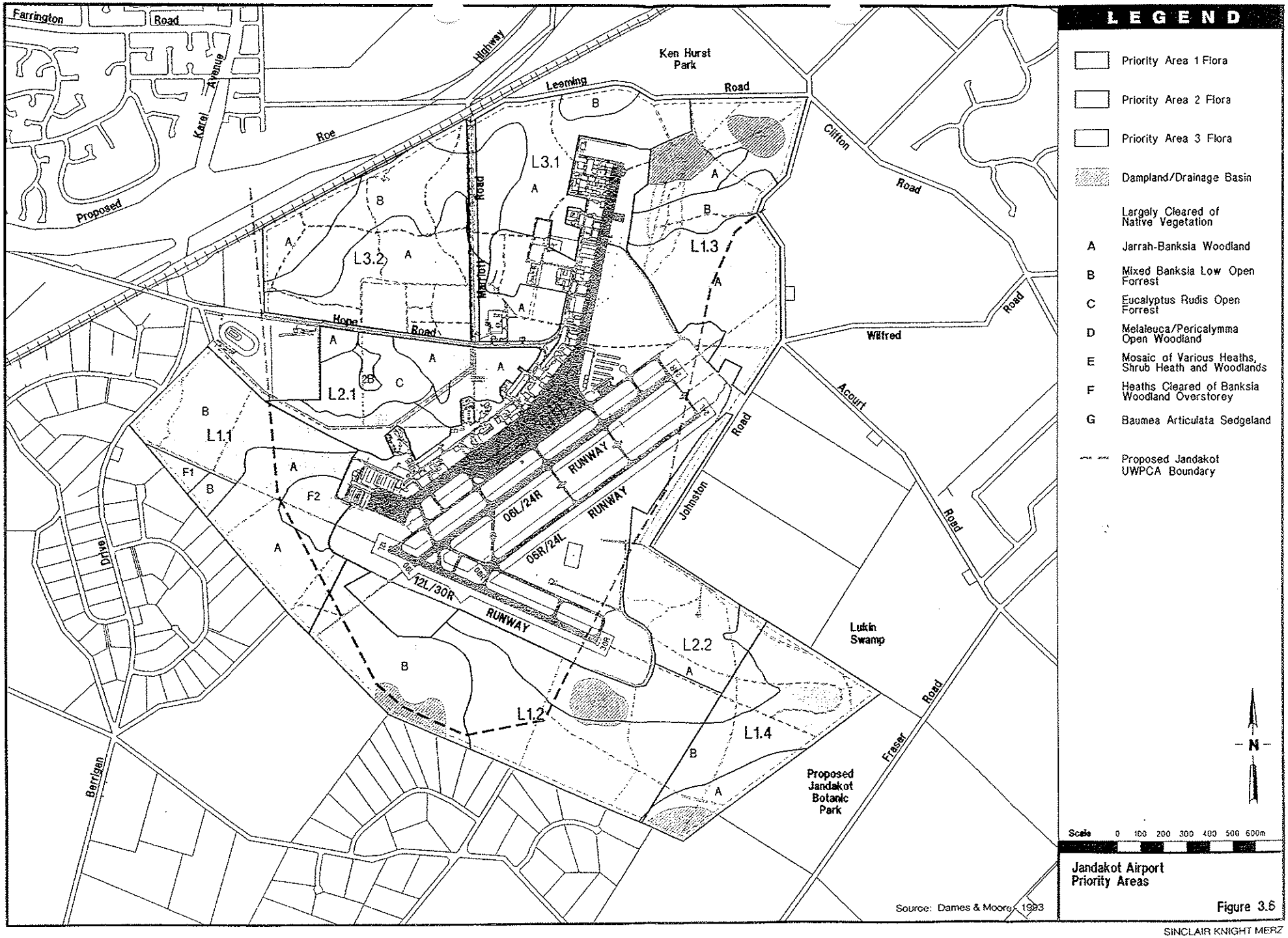
Wetland Types: dampland
Natural Wetland Groups
Bassendean — Pinjarra transition OR Bassendean with fluvial features
Bennet Brook (B/P.4)
Bassendean Dunes
Jandakot (B.3)
Wetland Management Objectives: Resource Enhancement
Swan Coastal Plain Lakes EPP: none identified

THREATENED ECOLOGICAL COMMUNITIES

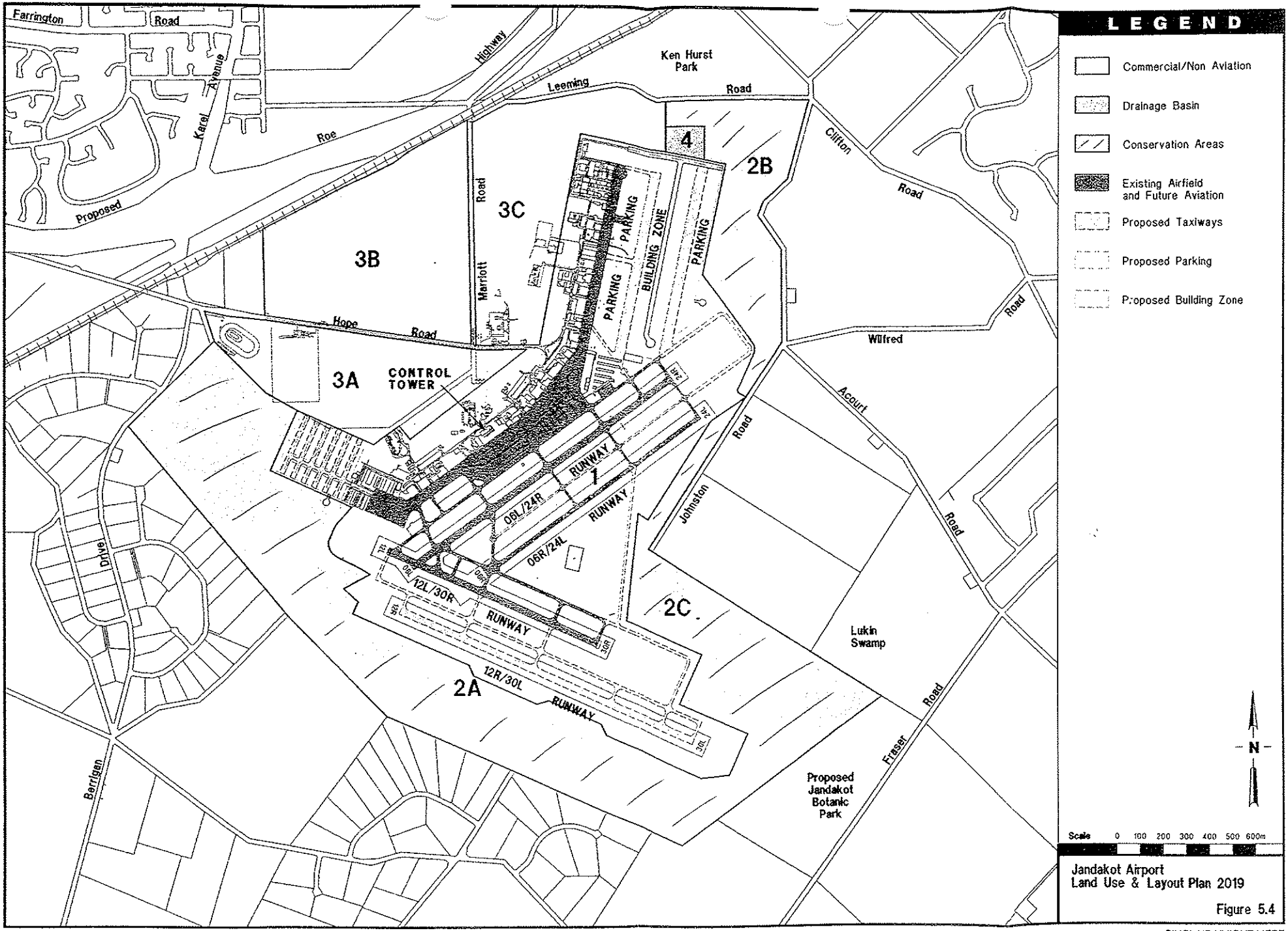
Not assessed

SECTION 3: SPECIFIC SITE DETAIL

Landscape Features: vegetated wetland, vegetated uplands
Vegetation and Flora: detailed survey (Dames and Moore 1993, Martinick 1989); limited survey (DEP 1996 (Jand 01–08))



SINCLAIR KNIGHT MERZ



SINCLAIR KNIGHT MERZ

APPENDIX 2: SITE DESCRIPTION FOR BUSH FOREVER SITE 388

JANDAKOT AIRPORT, JANDAKOT

Boundary Definition: bushland taken to cadastre boundary

SECTION 1: LOCATION INFORMATION

Bush Forever Site no. 388
Area (ha): bushland 410.9
Map no. 53, 54, 59
Map sheet series ref. no. 2033–I NE, 2033–I NW
Other Names: Part Submission Area 13
Local Authorities (Suburb): City of Cockburn (Jandakot), City of Canning (Canning Vale)
System 6 (1983): M94 area of bushland goes beyond System area boundaries, all bushland described

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) (Qrw: Sp1)

VEGETATION AND FLORA
Vegetation Complexes
Bassendean Dunes
Bassendean Complex — Central and South
Floristic Community Types
Supergroup 2: Seasonal Wetlands
5 Mixed shrub damplands
Supergroup 3: Uplands centred on Bassendean Dunes and Dandaragan Plateau
21c Low-lying *Banksia attenuata* woodlands or shrublands
22 *Banksia ilicifolia* woodlands
23a Central *Banksia attenuata* — *B. menziesii* woodlands

WETLANDS
Wetland Types: dampland
Natural Wetland Groups
Bassendean — Pinjarra transition OR Bassendean with fluvial features
Bennet Brook (B/P.4)
Bassendean Dunes
Jandakot (B.3)
Wetland Management Objectives: Resource Enhancement
Swan Coastal Plain Lakes EPP: none identified

THREATENED ECOLOGICAL COMMUNITIES
Not assessed

SECTION 3: SPECIFIC SITE DETAIL

Landscape Features: vegetated wetland, vegetated uplands
Vegetation and Flora: limited survey (DEP 1996 (Jand 01–08)); detailed survey (Dames and Moore, Martinick 1989)
Structural Units: mapping (Dames and Moore 1993, Martinick 1989)
Uplands: scattered *Eucalyptus marginata* over *Banksia attenuata*, *B. menziesii*, *Allocasuarina fraseriana* and *Eucalyptus todtiana* Low Woodland; *Banksia attenuata*, *B. menziesii* and *Nuytsia floribunda* Low Woodland; *Banksia attenuata* and *B. menziesii* Low Woodland
Wetlands: *Eucalyptus rudis* Forest to Woodland; *Melaleuca preissiana* Low Woodland; scattered *Melaleuca preissiana* over *Banksia attenuata* and *B. ilicifolia* Low Open Forest; *Pericalymma ellipticum* Open Low Heath
Vegetation Condition: >85% Excellent to Very Good, <15 % Very Good to Good
Total Flora: 149 native taxa (DEP 1996, Martinick 1989) (estimated <50% expected flora)
Significant Flora: *Leucopogon kingianus*, *Lysinema elegans* (significant population), *Astroloma xerophyllum*, *Hensmania turbinata*

Fauna: structured survey for birds (56 species), native mammals (5 species), reptiles (19 species) and amphibians (4 species) (How *et al.* 1996 and Dames and Moore 1993). Significant populations of Splendid Fairy-wren, Grey Shrike-thrush. Significant bird species: category 1 (1), category 3 (9) and category 4 (7). Significant mammal species: Honey Possum, Quenda and Western Brush Wallaby. Significant reptile species: skink lizards (*Lerista lineata* and *Acritoscincus trilineatum*) and Black-headed Snake (*Parasuta gouldii*)
Linkage: adjacent bushland to the north (Site 245, across road), east (Site 389), south and west; part of Greenway 92 (Tingay, Alan & Associates 1998a); part of fragmented potential bushland/wetland linkage (Part A, Map 7)

SECTION 4: INTERNATIONAL AND NATIONAL SIGNIFICANCE

Entered in the Interim List of the Register of the National Estate; subject to protection under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*

SECTION 5: SELECTION CRITERIA AND RECOMMENDATIONS

Criteria: Representation of ecological communities, Diversity, Rarity, Scientific or evolutionary importance, General criteria for the protection of wetland, streamline and estuarine fringing vegetation and coastal vegetation
Recommendation: Part A: Site with Some Existing Protection; Already Protected. Part B: Local Reserve Mechanism (see Table 3, Volume 1).

APPENDIX 3: DESCRIPTIONS FOR LOCATIONS ASSESSED IN DETAIL IN THE NORTHERN PART OF JANDAKOT AIRPORT ON 6/4/2001 (DEP 2001)

UPLAND VEGETATION

Location 1 (see Map x & Figure x) – *Banksia attenuata* and *B. menziesii* Low Woodland over *Hibbertia hypericoides, Leucopogon conostephioides* and *Calytirix flavescens* Open Low Heath over *Amphipogon turbinatus* Very Open Grassland and *Meslomeana psuedostygia* Very Open Sedgeland. Scattered *Allocasuarina fraseriana, Eucalyptus marginata* and *E. todtiana* present in overstorey.
Condition: Excellent to Very Good. Main disturbance factor rabbit burrowing and grazing, a few scattered **Gladiolous caryophyllaceous* present, evidence of tree and shrub deaths related to water stress. Bandicoot diggings present.

Location 2 (see Map x & Figure x) – *Banksia attenuata* and *B. menziesii* Low Woodland over *Allocasuarina humilus* Open Heath and *Schoeltzia involucrata* Low Shrubland over *Amphipogon turbinatus* Very Open Grassland and *Patersonia occidentalis* Very Open Herbland and *Desmocladus flexuosus* and *Lyginea barbata* Very Open Sedgeland. Scattered *Allocasuarina fraseriana* and *E. todtiana* present in overstorey.
Condition: Excellent to Very Good. A few scattered **Gladiolous caryophyllaceous* present, evidence of tree and shrub deaths related to water stress.

Location 4 (see Map x & Figure x) – *Banksia attenuata* Low Open Woodland over *Stirlingia latifolia* and *Allocasuarina humilis* Open Heath and *Hibbertia hypericoides* Low Shrubland over *Lyginea barbata* Very Open Sedgeland. Scattered *Banksia menziesii, Allocasuarina fraseriana* and *Eucalyptus marginata* present in overstorey.
Condition: Excellent to Very Good. Main disturbance factor a hot fire that occurred around 1997, regeneration of native vegetation is occurring very well, a few scattered **Gladiolous caryophyllaceous* present.

Location 5 (see Map x & Figure x) – *Banksia attenuata, Eucalyptus marginata* and *Allocasuarina fraseriana* Low Woodland over *Melaleuca thymoides* Tall Open Shrubland, *Xanthorrhoea preissii* Open Shrubland and mixed Open Low Heath over *Patersonia occidentalis* Very Open Herbland.
Condition: Excellent to Very Good. Not burnt in the hot fire that occurred around 1997.

WETLAND VEGETATION

Location 3 (see Map x & Figure x) – Centre of wetland: *Melaleuca preissiana* Low Woodland over *Regelia ciliata* Open Heath over *Lepidosperma longitudinale* Very Open Sedgeland. Perimeter of wetland - *Melaleuca preissiana* Low Woodland over *Pultenaea reticulata* Tall Open Scrub over *Lepidosperma longitudinale* Sedgeland. Scattered *Banksia litoralis* present in overstorey.
Condition: Excellent to Very Good in core area of wetland with severe localised disturbance associated with tracks around the perimeter.

Location 6 (see Map x & Figure x) – *Banksia attenuata* and *Melaleuca preissiana* Woodland over *Xanthorrhoea preissii* Shrubland and *Melaleuca sp. B.* and *Hibbertia subvaginata* Low Shrubland *Lyginea barbata* and *Lepidosperma longitudinale* Very Open Sedgeland. Scattered *Banksia menziesii* present in overstorey.

Condition: Very Good to Excellent. Main disturbance factor is a track through the middle of the wetland and rabbit burrowing and grazing which is worst north of the track due to the recent hot fire (1997?). The fire has opened up the understorey and drawn rabbits to the area to graze the new growth.

APPENDIX 4: DESCRIPTIONS FOR PERMANENT FLORISTIC PLOTS LOCATED IN THE NORTHERN PART OF JANDAKOT AIRPORT, ASSESSED ON 26/10/94 AND 30/11/94 (DEP 1996)

UPLAND VEGETATION

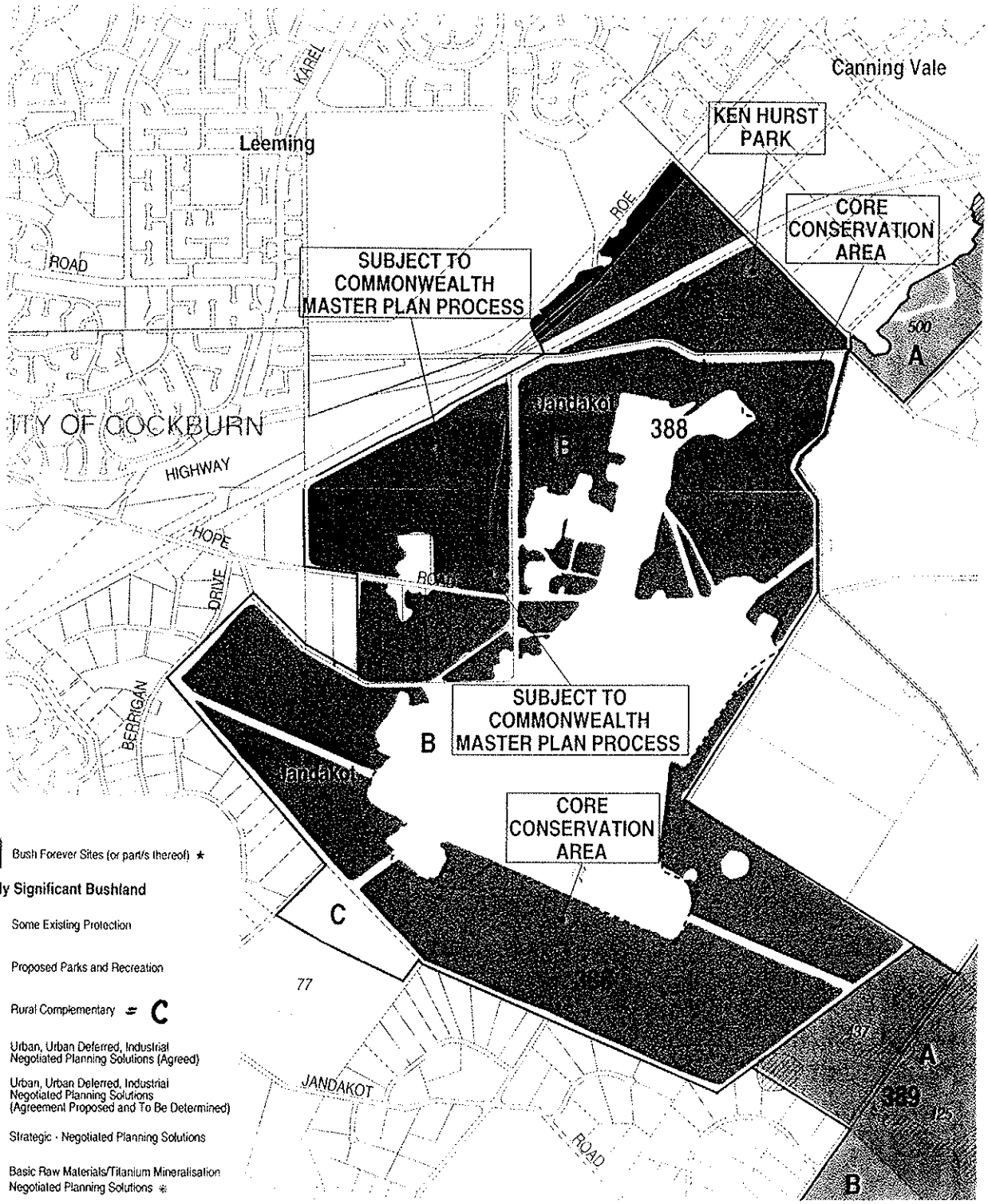
Plot 7 (see Map x) – *Banksia attenuata, Allocasuarina fraseriana* and *Eucalyptus todtiana* Low Woodland over *Allocasuarina humilis* and *Melaleuca thymoides* Open Shrubland and *Stirlingia latifolia* and *Scholtzia involucrata* Low Shrubland over *Patersonia occidentalis* Very Open Herbland and *Lyginea barbata* and *Desmocladus flexuosus* Very Open Sedgeland.
Condition: Excellent to Very Good. Large proportion of *Allocasuarina humilis* dead in the understorey (due to water stress?).

Plot 8 (see Map x) – *Banksia menziesii* and *B. attenuata* Low Woodland over *Beaufortia elegans* and *Allocasuarina humilus* Open Shrubland and *Astroloma xerophyllum* and *Conostephium preissii* Low Shrubland over *Meslomeana pseudostygia* Very Open Sedgeland.
Condition: Excellent. A few scattered **Ursinia anthemoides* present.

WETLAND VEGETATION

Plot 6 (see Map x) – *Melaleuca preissiana* Low Woodland over *Pericalymma eliptica* and *Xanthorrhoea preissii* Closed Heath and *Gompholobium tomentosum, Eutaxia virgata* and *Hibbertia subvaginata* Low Shrubland over mixed Herbland over *Cyathocheata avenacea* and *Lepidosperma squamatum* Sedgeland.
Condition: Excellent to Very Good. Few weed species present, affected by water stress?

Map 1: Bush Forever Site 388 – Jandakot Airport (Government of Western Australia 2000a).



LEGEND

275 Bush Forever Sites (or part/s thereof) ★

Regionally Significant Bushland

- Some Existing Protection
- Proposed Parks and Recreation
- Rural Complementary = C
- Urban, Urban Deferred, Industrial Negotiated Planning Solutions (Agreed)
- Urban, Urban Deferred, Industrial Negotiated Planning Solutions (Agreement Proposed and To Be Determined)
- Strategic - Negotiated Planning Solutions
- Basic Raw Materials/Titanium Mineralisation Negotiated Planning Solutions *
- Cemeteries
- Other Government Lands (including existing and proposed public utilities) = B
- Local Town Planning Scheme Reserves (including existing and proposed public utilities) = A
- Major Road/Railway Reserves
- Regional Creeklines (with Mapped Vegetation)

Boundary Interpretations:

Agreed
- Area to be Protected for Conservation

Agreement Proposed
- Proposed Bush Forever Boundary
- Areas Proposed to be Protected for Conservation

- Other Native Vegetation
- Conservation Category Wetlands (both within and outside Bush Forever Sites)
- Channel Wetlands
- Local Government Boundary
- Perth Metropolitan Region Boundary
- Bush Forever Study Area Boundary

N

SCALE 1 : 35000

0 1

Kilometres

Produced by Project Mapping Section, Geographic & Planning Information Branch, from information supplied by Environmental Planning Branch, Ministry for Planning, Perth, W.A. Dec. 2000

ntw-map17\ environ\ \bushplan\ \bpf00_inset35.dgn

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

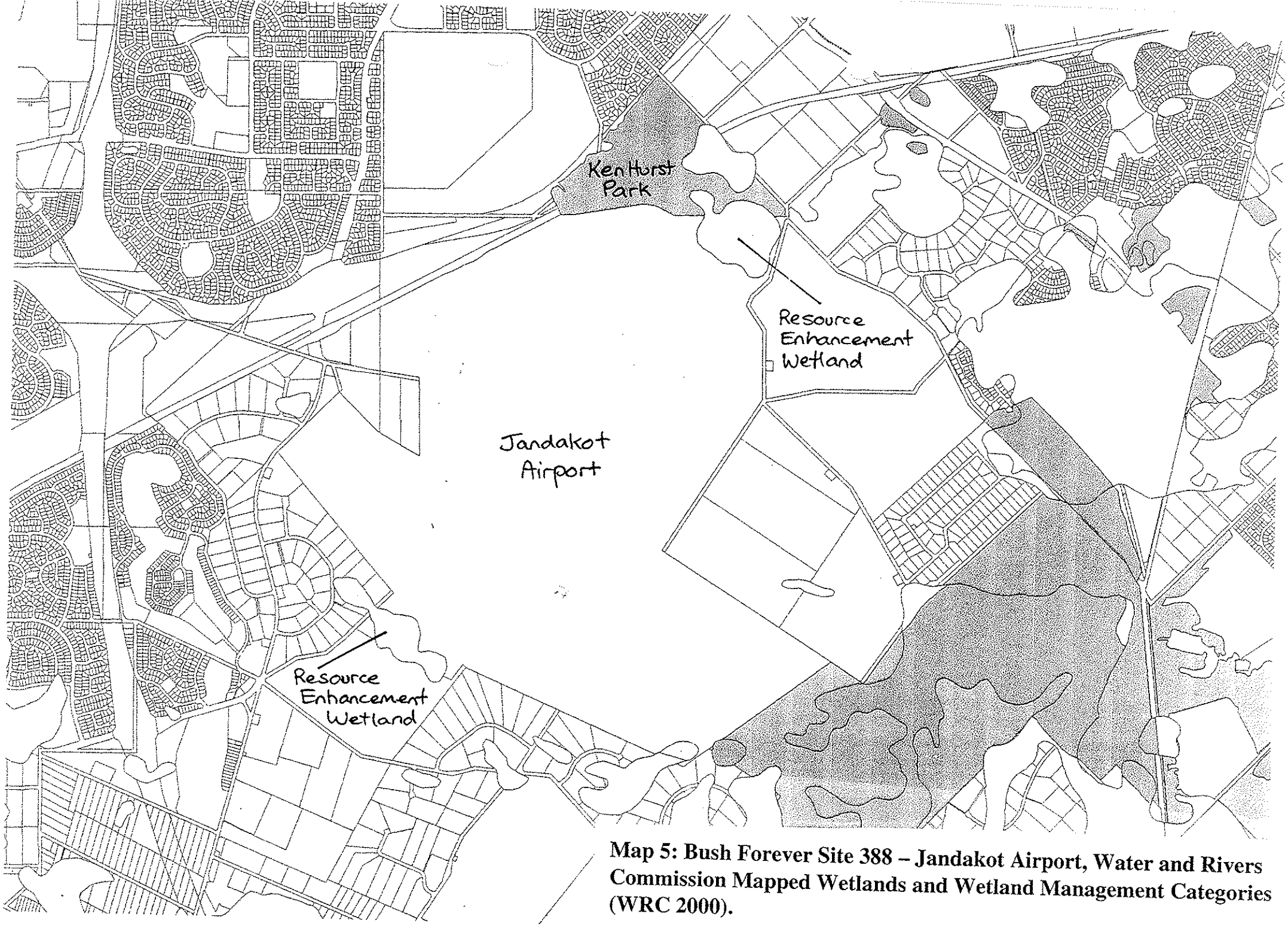
NB: Simplified cadastral detail shown due to map scale

Native Vegetation Extent for Study Area supplied by Agriculture, W.A.

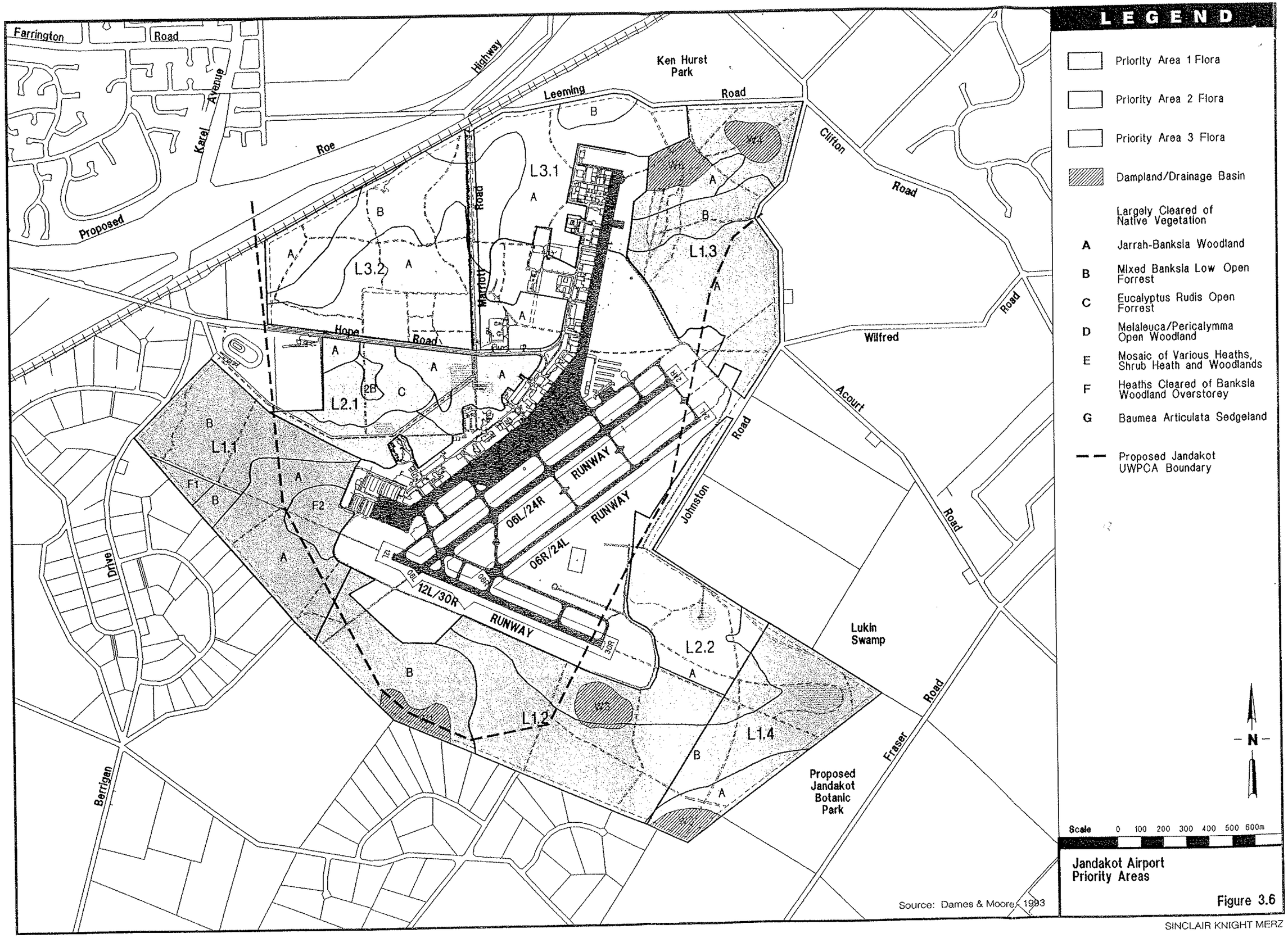
Wetland Data supplied by Water and Rivers Commission

Garden Island Vegetation Data supplied by McArthur, WM 1998

★ Where there is more than one implementation recommendation for a Bush Forever Site, each part has been assigned a letter (eg. A, B, C etc)



Map 5: Bush Forever Site 388 – Jandakot Airport, Water and Rivers Commission Mapped Wetlands and Wetland Management Categories (WRC 2000).



Map 2: Jandakot Airport Priority Areas (Sinclair Knight Merz 2000a).

BUSH FOREVER
SITE 388
2000 AERIAL PHOTOGRAPHY

Cadastre

Contours - 5m (DOLA)

Bush Forever 2000 - Site Boundaries

• J3 Plot Location Sampled Spring 1994

Map 3: Year 2000 Aerial Photograph of Jandakot Airport.

Map Ident: plot010207_1

Prepared By: Andrea Zappacosta

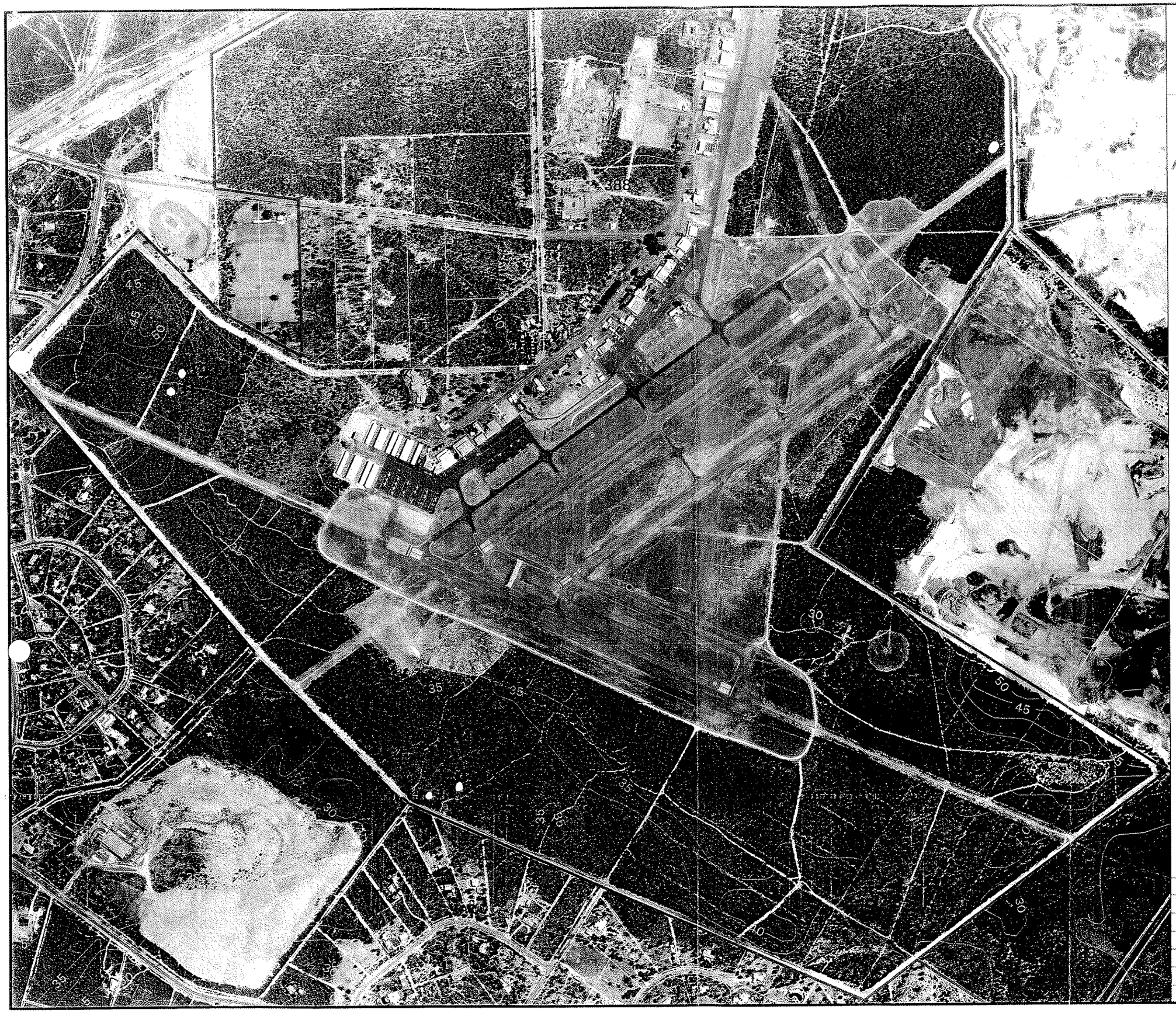
Prepared For: SEAN COLLINGWOOD

Date: 07 Feb 2001

Scale 1:10000

0 250 m

MFP INTERNAL USE ONLY



BUSH FOREVER
SITE 388
2000 AERIAL PHOTOGRAPHY

Cadastre

Contours - 5m (DOLA)

Bush Forever 2000 - Site Boundaries

• J3 Plot Location Sampled Spring 1994

Map 3: Year 2000 Aerial Photograph of Jandakot Airport.

Map Ident: plot010207_1

Prepared By: Andrea Zappacosta

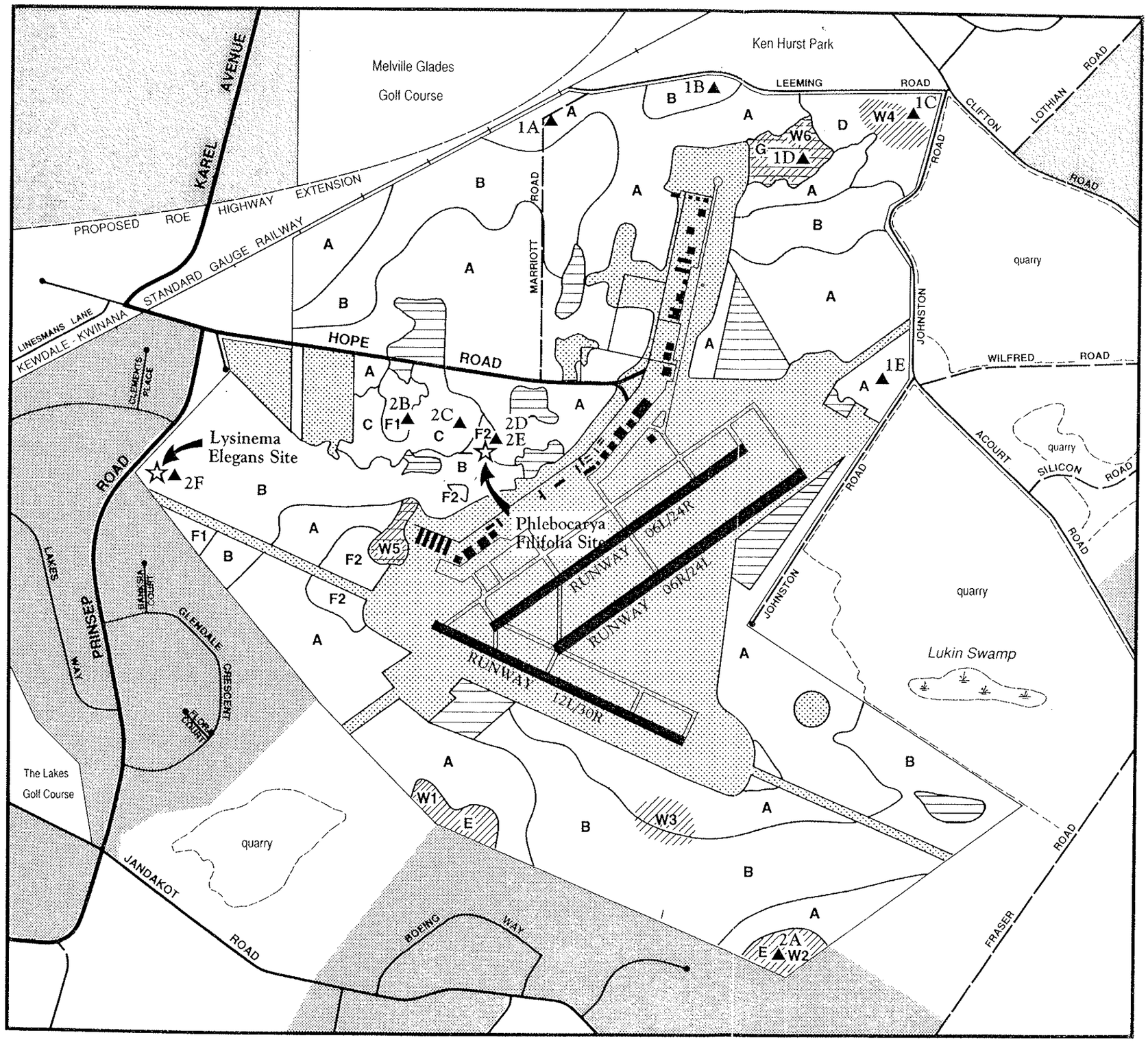
Prepared For: SEAN COLLINGWOOD

Date: 07 Feb 2001

Scale 1:10000

0 250 m

MFP INTERNAL USE ONLY



0 300 600m

SCALE 1 : 15 000

Totally cleared of all native vegetation

Largely cleared of native vegetation

W3 Wetland/Dampland (Number)

1F▲ Plate (photograph) number

Existing or Proposed Residential Area

Existing Airport Buildings

Native Vegetation Categories

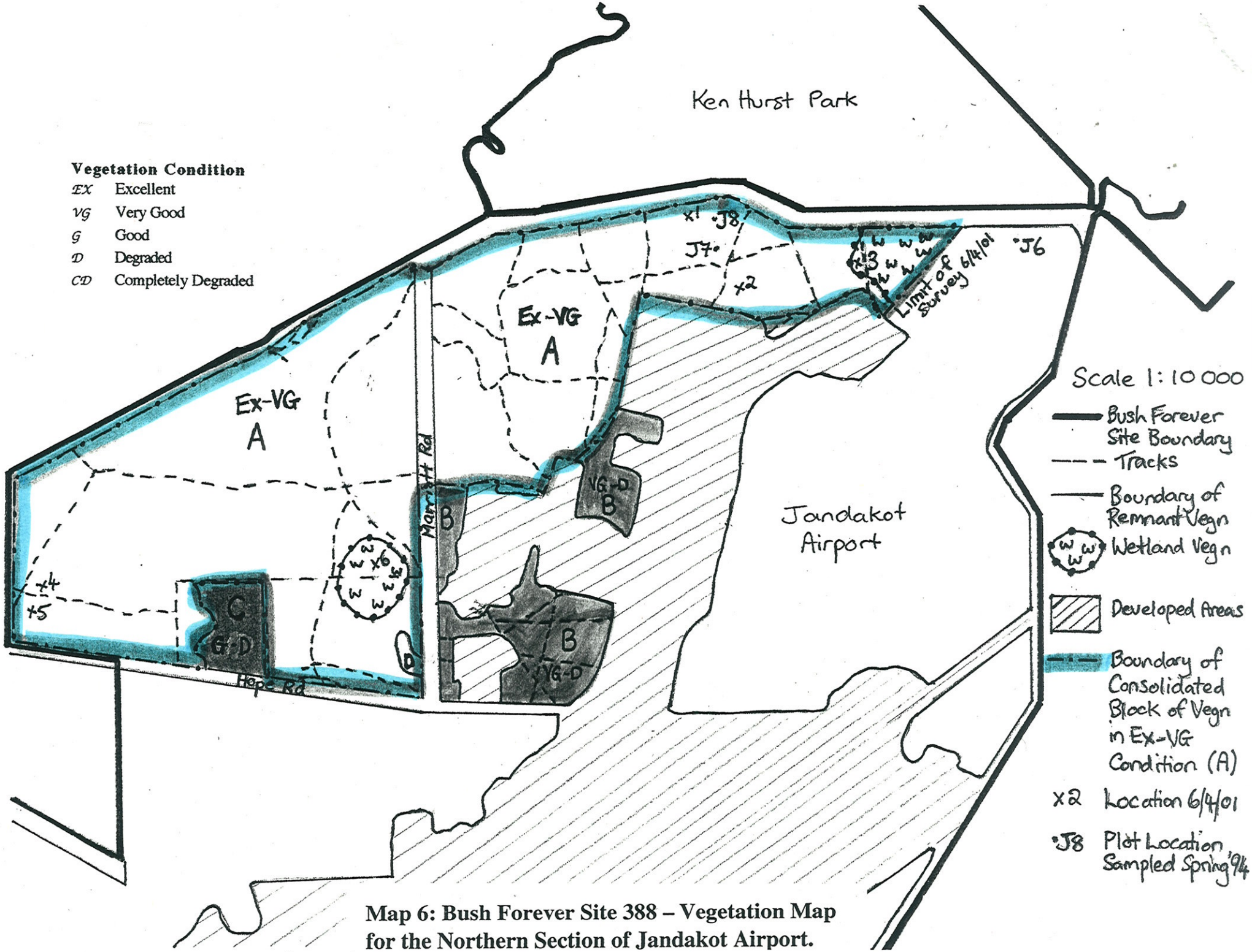
- **A** Jarrah-Banksia Woodland
- **B** Mixed Banksia low open forest
- **C** *Eucalyptus rudis* open forest/woodland
- **D** *Melaleuca/Pericalymma* open woodland/heath
- **E** Mosaic of various heaths, shrub heaths and woodlands
- **F** Heaths cleared of Banksia woodland overstorey
- **G** *Baumea articulata* sedgeland

For full description of Vegetation Categories see Appendix D.

Map 4: Jandakot Airport Vegetation Map (Dames & Moore 1993)

JANDAKOT AIRPORT DEVELOPMENT - EIS

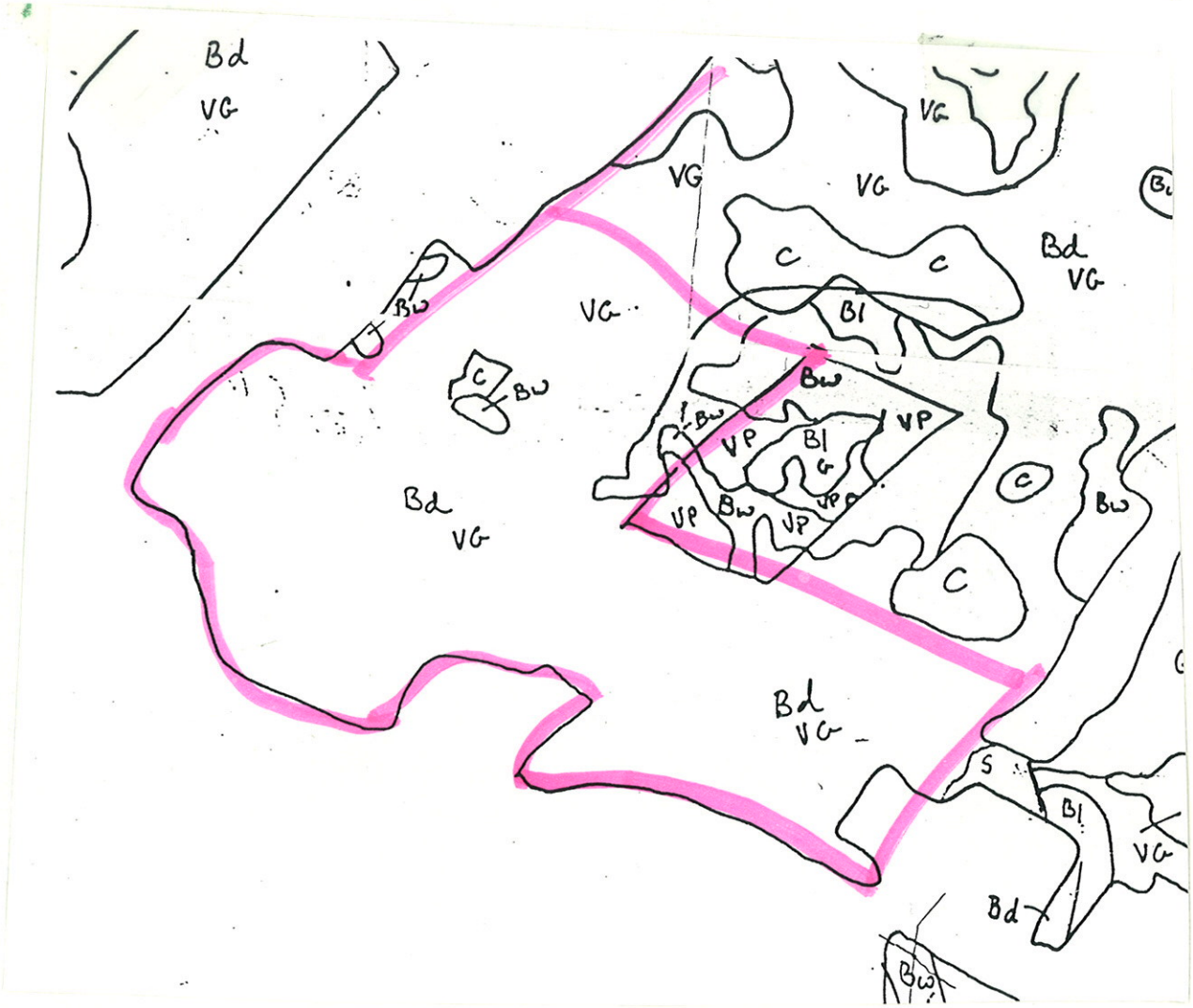
VEGETATION MAP



Map 6: Bush Forever Site 388 – Vegetation Map for the Northern Section of Jandakot Airport.

Bowman, Bishaw + Gorham, 1990, Proposed Jandakot Botanic Park

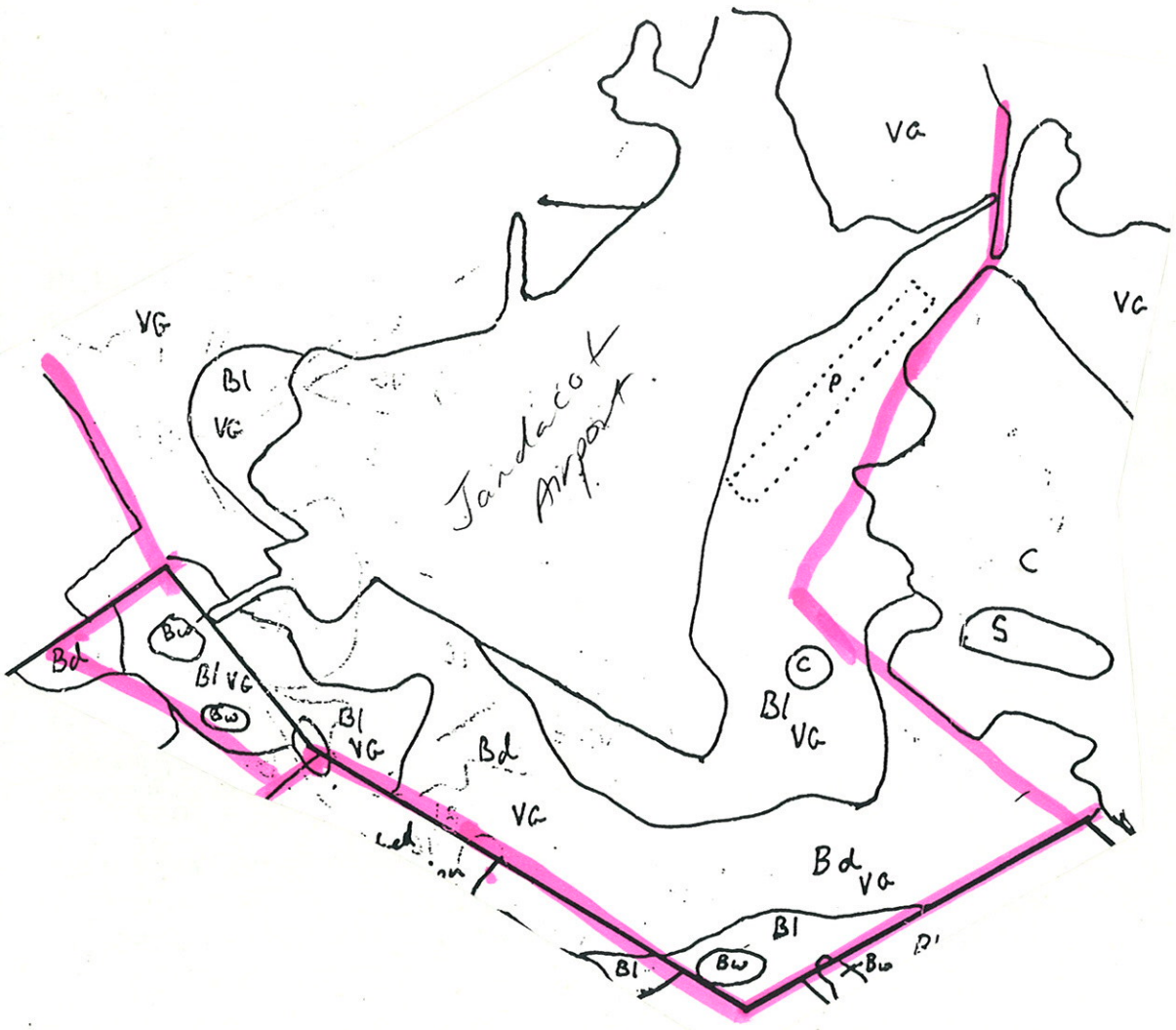
BS388
PB187



Forrest Rd, S of M94

BS390

Bowman, Bishaw + Gorham, 1990, Proposed Jandakot Botanic Park



M94 Jandakot Airport

MAP ONE: Significant Remnants of Native Vegetation

Sheet one : Northern Section of Study Area

KEY TO VEGETATION UNITS

Bassendean Complex-Central and Southern

Bd: Low woodland to low open forest of Banksia attenuata-Banksia menziesii with occassional Banksia ilicifolia, Allocasuarina fraseriana, Eucalyptus marginata and Nuytsia floribunda.

Bl: Low open forest of Banksia menziesii-Banksia ilicifolia-Eucalyptus marginata with occassional Banksia attenuata.

Bw: Low open woodland to closed heath dominated by species of Myrtaceae. The tree species are predominantly Melaleuca preissiana or Banksia ilicifolia. The understorey include Hypocalymma angustifolium, Pericalymma ellipticum and Astartea fascicularis.

Sw: Woodland of Melaleuca preissiana-Melaleuca rhaphiophylla with occassional Eucalyptus rudis and Banksia ilicifolia. With sedgelands of Baumea and Leptocarpus species and closed heaths dominated by Myrtaceae species.

L: Woodlands of Melaleuca rhaphiophylla-Eucalyptus rudis with the occassional Melaleuca preissiana and Banksia littoralis. The woodlands are interspersed with sedgelands of Baumea, Leptocarpus and Typha and areas of open water.

Karrakatta Complex-Central and South

K: Woodlands of Eucalyptus gomphocephala-Eucalyptus calophylla-Eucalyptus marginata with admixtures of Banksia attenuata-Banksia menziesii and Allocasuarina fraseriana.

KEY TO CONDITION RATING

E = Excellent
VG = Very Good
G = Good
P = Poor.
VP = Very Poor
C = Cleared
(See text for definitions)

SCALE: Approx. 1: 20,000

SOIL: Sp = Spearwood Sand; Gu = Guildford Formation
(All other areas Bassendean Sands)

Bronwen

Here is the Muir Report on Jandakot Airport as discussed.

cheers
Kevin

LIBRARY

MUIR
ENVIRONMENTAL

EVALUATION OF PROPOSED CONSERVATION AREAS JANDAKOT AIRPORT

FOR

FEDERAL AIRPORTS CORPORATION

BS 388
JANDAKOT
BASS 5

ME93-004-003
December 1993

TABLE OF CONTENTS

	Page
EXECUTIVE SUMMARY	
1.0 INTRODUCTION	**1**
1.1 BACKGROUND	1
1.2 HISTORY OF BIOLOGICAL RESEARCH AT JANDAKOT AIRPORT	2
2.0 METHODOLOGY	**4**
2.1 THE ORIGIN OF RADS AND RHAS	4
2.2 THE DEVELOPMENT OF THE MUIR CLASSIFICATION	5
2.3 PHILOSOPHY OF RADS	6
2.4 USE OF RADS DATA FOR FAUNAL HABITAT	6
2.5 SYSTEM COMPONENTS	7
2.5.1 Biophysical Components	7
2.5.2 Structural and Floristic Components	9
2.5.3 Structural Measurements Specifically for Fauna Evaluation	17
2.5.4 Bird Survey Methodology	19
2.6 APPLICATION AT JANDAKOT AIRPORT	19
3.0 RESULTS AND DISCUSSION	**20**
3.1 TERRAIN AND SOILS	20
3.2 VEGETATION STRUCTURE	23
3.2.1 Dune Systems	23
3.2.1.1 Introduction	23
3.2.1.2 Dune Systems on Jandakot Airport	26
3.2.2 Damplands	28
3.3 FLORISTICS	31
3.3.1 Floristic Assemblage and Distribution	31
3.3.2 Homogeneity	34
3.3.3 Rare Flora	35
3.3.4 Weeds and Dieback	37
3.4 FAUNAL HABITAT FEATURES	38
3.4.1 Fauna Scores and RHAS Totals	38
3.4.2 Carnaby's Cockatoo	39
3.4.3 Brown Bandicoot	41

Page

3.4.4 Numbat 41
3.4.5 Bird Populations 42
3.4.6 Rare or Significant Bird Species 44
3.4.7 Comparison with Previous Surveys 44
3.4.8 Comparison with Areas Outside the Airport 45
3.5 CONSERVATION VALUE BASED ON VEGETATION DATA 45
3.6 CONSERVATION VALUE BASED ON FAUNAL DATA 47
3.7 REGIONAL CONTEXT 48
3.7.1 Introduction 48
3.7.2 Physiognomy 48
3.7.3 Floristics 51

4.0 CONCLUSIONS 53

5.0 REFERENCES 56

LIST OF TABLES

1 Summary of Terrain and Soil Characteristics at Jandakot Airport

2 Summary of Dune Vegetation Physiognomy at Melaleuca Park

3 Summary of Dune Vegetation Physiognomy at Jandakot Airport

4 Summary of Whole of Dune Vegetation Physiognomy by Study Block at Jandakot Airport

5 Definition of Damplands on Jandakot Airport by the Use of Indicator Species

6 Summary of Vegetation Physiognomy of Damplands at Jandakot Airport

7 Surveyed Species - Distribution in Sites by Topographic Position

8 Distribution of Species by Airport Block

9 Average Number of Species and SMPs by Block

10 Regeneration and Spatial Organisation

11 Significant Flora which Might Occur on Jandakot Airport

12 Weeds and Dieback Disease

13 Bird Species and Abundance by Airport Block

14 Bird Species and Abundance by Topographic Position

15 Summary of Possible Conservation Value Based on Vegetation Data

16 Summary of Possible Conservation Value Based on Faunal Habitat and Fauna

17 Comparison of Dune Vegetation Physiognomy at Jandakot Airport with Other Areas

18 Floristic Numbers Comparison Between Jandakot Airport and Other Areas

EXECUTIVE SUMMARY

Jandakot Airport is located approximately 18 km south of the city of Perth, on the Swan Coastal Plain. The Airport is bordered on the north and west sides by intensive housing development. Large sand pits lie to the east and developed rural and residential lands to the south. As the land is used for airport purposes there is limited public access. This has resulted in some degree of protection for the bushland on the Airport, although illegal timber cutting, etc., does occur from time to time.

The presence of the bushland is of some interest for conservation purposes as it is in better condition than most similar bushland nearby. Further, with rapidly encroaching development, it will soon become an "island in a sea of development", as has occurred with several other remnant bushland areas within the Perth metropolitan region.

The protection and management of these remnant areas, or significant representative samples of them, is thus of scientific, educational, aesthetic and historical value. While it is an accepted ecological fact that a larger area of bushland is more sustainable, it is also true that the larger it is the more difficult and expensive it is to manage. This is especially true in an area being encroached upon by urban development, such as is occurring at Jandakot Airport.

The FAC has determined, in the case of Jandakot Airport, that it does not have the financial resources to manage all the Airport bushland for conservation. The FAC has determined that, in order to reduce running costs, it must develop part of the Airport for commercial purposes. As well as offsetting some of its operating costs, it aims to provide intensive management for a portion of the bushland in order to maintain the conservation values. The FAC commissioned a vegetation and habitat analysis of the Airport bushland. The aim of the study would be to create a scientific basis for a system of conservation areas rather than the application of field observations which led in 1986 to an earlier designation of conservation zones.

The conservation value of each Airport block was estimated by summarising 25 vegetation characteristics of the environment where a distinction between blocks was possible. Based on this method, it was apparent that Block D had the highest conservation value, followed by Blocks B and C. Block A had the least value.

The environmental characteristics of 15 habitat features and results of the bird field surveys suggest that Block A has the least conservation value and Block D the most. Blocks C and D were of intermediate value.

Comparisons were also made between the vegetation physiognomy of Jandakot Airport and Melaleuca Park, Ellenbrook, Whiteman Park (Mussel Pool), and Kwinana Freeway easement. The data indicate that Ellenbrook, Whiteman Park and Jandakot are very similar. The exception is that Jandakot has a poorer development of the scattered over-canopy of eucalypts found at the other locations. Life-forms, dominant species, height and Canopy Cover are very similar in all strata.

Similarly, if the actual dune topography is considered, it is again apparent that the vegetation along the Kwinana Freeway (where comparable data are available), and at Jandakot Airport have much in common. The Stratum 2 vegetation is denser at Jandakot Airport and there tends to be, except in the damplands, a fourth stratum of terrestrial sedges.

For areas close to the Airport, a sample of nine locations was selected at random from aerial photographs. These locations were selected on the basis of size, continuity with other undisturbed bushland and ease of access. On field examination it was found that the nine locations included one crest, five mid-slopes, two lowlands and one dampland. It was apparent that the sites outside but near the Airport were very similar to the Banksia woodlands on Jandakot Airport in all respects.

From analysis of the data presented herein, there are some generalisations possible, notably:

- **Block A** has lesser overall conservation value because it has less habitat types, almost no damplands, and appears to be floristically poorer. It seems to have an abundance of Brown Bandicoot, but these mammals are equally well represented in all other parts of the Airport. Block A has no outstanding features in terms of faunal habitat, or in number of bird species;

- **Block B**, western side, is similar to Block A and has no particular features of value. There is a small area of higher conservation value just north of the existing developments, but ultimately this will degrade because of the proximity to the existing Airport development and disturbed land to the north.

  On the eastern side of Block B there are good representatives of damplands. Almost all of these are located in the proposed conservation area. There is, unfortunately, a heavy infection of dieback at one location (B17), but careful management can probably prevent this from expanding.

  The burned area precludes detailed evaluation, but the observed structure and floristics suggest it was very similar to areas just to the west of the burn.

  The triangular area right on the junction of Johnston Road and Acourt Road (Site B28) is the only undisturbed stand of *Eucalyptus rudis* woodland on the Airport. It is included in the proposed conservation zone.

  The triangular area in the pocket between the developments and the runways (Site B21) has been cleared and is regrowing. It has limited value until regeneration is complete.

  Block B has intermediate value for fauna;

- **Block C** is fairly homogenous throughout. The extreme eastern corner has been burned and is hard to evaluate, but seems to be very similar to the vegetation in Block A. It probably has less value than the rest of Block C, because of its similarities to Block A.

The damplands in Block C, like those on the rest of the Airport, are of limited conservation value, both floristically and faunistically, but, nonetheless, are becoming a scarce resource on the Swan Coastal Plain. Block C can be considered typical of the Airport vegetation, but there are no outstanding features.

Block C has intermediate value for fauna except that the eastern end may be better than the western end; and

- **Block D** is similar to Block C. However, in its southern parts, it is the floristically richest block, has the best representation of topographic and aspect features, has the most birds, and is the only block in which Carnaby's Cockatoo (*Calyptorhynchus latirostris*) was recorded during this study. The northern side of Block D, adjacent to Hope Road, is badly degraded by past activities and has limited value in the long-term. This is also bounded by Hope Road on the north, developments on the south-east, and heavily degraded land on the west. The value of this northern portion of Block D, in the long-term, must be in doubt.

Based on the data generated in this study it is concluded that:

- **Development Zone 1** contains remnant Banksia woodland in good condition. While preservation of Banksia woodland *per se* is important, for example as a seasonal feeding area for Carnaby's Cockatoo, Development Zone 1 contains no natural features unique to this Zone. There are several areas of severe disturbance. There is no substantial scientific reason why Development Zone 1 should be preserved in preference to any other area;

- **Development Zone 2** contains remnant Banksia woodland in good condition. It contains no natural features unique to this Zone. There is a cleared area and an adjacent railway line and road which are ongoing sources of disturbance and weeds. There is no substantial scientific reason why Development Zone 2 should be preserved in preference to any other area;

- **Development Zone 3** contains Flooded Gum woodland with a badly degraded and disturbed understorey, and an adjacent commercial development and road which are sources of weeds. There is no substantial reason why it should be preserved other than that Flooded Gum is not well represented elsewhere on the Airport;

- **Development Zone 4** contains remnant Banksia woodland in good condition. It contains a good variety of habitats relative to the rest of the Airport and appears to be rich in flora and fauna species. There is sufficient scientific evidence, based on the present study, to support an argument for its protection as a Conservation Area;

- **Conservation Zone 5a** contains remnant Banksia woodland in good condition and a good variety of dampland types (better than any other part of the Airport). It is surrounded by severely disturbed land, but because of its damplands, should be retained for conservation purposes, although dieback disease management is essential;

- **Conservation Zone 5b** contains remnant Banksia woodland, although not in as good a condition as that in Development Zone 4. It is surrounded on its east and west sides by severely disturbed land. There are no substantial scientific reasons based on the data presented in this report, why Zone 5b should be preserved in preference to any other area. It should be noted, however, that it may provide a partial corridor leading north to Conservation Zone 5a;

- **Conservation Zone 5c** contains remnant Banksia woodland and a variety of dampland types on its southern edge. Some of its values are an eastern extension of those found in Development Area 4 of Block D, and it provides some continuity with Banksia woodlands to the south. It should be retained for conservation purposes; and

- **Sand Mining Area 6** contains remnant Banksia woodland in good condition. It contains no substantial area of dampland, but does include a high dune similar to that in Development Zone 4. This dune system appears to be of some value as a fauna habitat. It has severely disturbed areas on the east and south sides. There are no substantial scientific reasons why it should be preserved in preference to any other area apart from its slightly higher RHAS scores.

The above statements must be taken in context. The available data indicates that Development Zone 4 should be added to the proposed system of conservation areas. No other areas on the Airport are particularly outstanding, perhaps with the exception of Conservation Zone 5a, which has a good representation of damplands. Whether or not any of the other bushland areas, including the conservation zones and Sand Mining Area 6 are expanded, will need to be a socio-political decision. The study also indicates that the already proposed conservation areas contain good representative samples of all the vegetation and habitat types found on the Airport. They also indicate that there are no outstanding conservation features which have been inadvertently omitted in the original FAC zoning plan, perhaps with the exception of the floristically rich Development Zone 4.

* * * * * * * * * * * * * * * *

LIMITATIONS OF REPORT

This report has been prepared for the Federal Airports Corporation by Muir Environmental on behalf of Dames and Moore. The report is a technical and scientific evaluation of vegetation and habitats on Jandakot Airport and may not be in a format suitable for public review. The information contained herein is believed to be accurate within the limitations of interpretation of biological data and the conclusions drawn from the data are believed to be reliable.

It is recommended that any reviews or statements prepared from the information presented in this report be reviewed by Muir Environmental or Dames and Moore. This will ensure that interpretations are accurate and that the intent of the recommendations is preserved.

MUIR ENVIRONMENTAL

EVALUATION OF PROPOSED CONSERVATION AREAS JANDAKOT AIRPORT

1.0 INTRODUCTION

1.1 BACKGROUND

Jandakot Airport is located approximately 18 km south of the city of Perth, on the Swan Coastal Plain (Figure 1). The Airport is bordered on the north and west sides by intensive housing development. Large sand pits lie to the east and developed rural and residential lands to the south.

As the land is used for airport purposes there is limited public access. This has resulted in some degree of protection for the bushland on the Airport, although illegal timber cutting, etc., does occur from time to time.

The presence of the bushland is of some interest for conservation purposes as it is generally believed to be in better condition than most similar bushland nearby. Further, with rapidly encroaching development, it will soon become an `island in a sea of development', as has occurred with several other remnant bushland areas within the Perth metropolitan region, e.g. Kings Park and Bold Park.

Experience with other similar areas has shown that the Jandakot Airport vegetation will ultimately become degraded by fire, weed encroachment, dieback disease and feral animals. The vegetation remains, in the meantime, an important representative of a diminishing habitat. In the short term, such remnant areas are much less prone to disturbance than surrounding areas, and provide refuge for plants and animals.

The protection and management of these remnant areas, or significant representative samples of them, is thus of scientific, educational, aesthetic and historical value. The corollary to this situation is the obvious need for intensive management if their inherent importance is to be preserved for as long as possible.

While it is an accepted ecological fact that a larger area of bushland is more sustainable, it is also true that the larger it is the more difficult and expensive it is to manage. This is especially true in an area being encroached upon by urban development, such as is occurring at Jandakot Airport. The land manager, in this case the Federal Airports Corporation (FAC), must, therefore, include the cost of managing land for conservation purposes when considering the economic viability of the Airport.

The FAC has determined, in the case of Jandakot Airport, that it does not have the financial resources to manage all the Airport bushland for conservation. In fact, due to escalating costs, Jandakot Airport is unable to meet existing running costs, even without specific conservation management. The FAC has determined that, in order to reduce these running

costs, it must develop part of the Airport for commercial purposes. As well as offsetting some of its operating costs, it aims to provide intensive management for a portion of the bushland in order to maintain the conservation values.

The criteria used by the Department of Aviation (1986) in originally designating conservation zones were that:

- they should be land furthest from existing intensive development;
- they should be over the Jandakot water mound where development was undesirable anyway. This would also assist in protecting groundwater quality;
- they should contain the best representative areas of damplands on the Airport, as damplands in undisturbed condition are now scarce on the Swan Coastal Plain; and
- they should include land which appeared visually to be least disturbed.

Application of these criteria led to the designation of Areas 5a, 5b and 5c (Figure 2) as conservation areas.

The FAC prepared and presented for public review a Draft Environmental Impact Statement (EIS) (Dames and Moore, 1993) setting out its intentions for both commercial development and management of the conservation areas.

During that review, conservation groups, supported by the Commonwealth Environmental Protection Agency (CEPA), expressed doubts that the designated conservation areas were, in fact, in the best locations. It was also argued that the designated conservation areas were too small.

Enlargement of the conservation areas would partially defeat the FAC's aim of becoming self-supporting because of the additional cost involved. The FAC, therefore, requested that a further independent vegetation and habitat analysis be conducted of the Airport bushland. The aim of the study would be to create a scientific basis for a system of conservation areas rather than the application of field observations which had led to the original proposal.

This report presents the results of the most recent vegetation and habitat analysis. It is provided as a technical document and draws on information presented in the Draft EIS. That information is not repeated in this report, but is referred to in text.

1.2 HISTORY OF BIOLOGICAL RESEARCH AT JANDAKOT AIRPORT

The vegetation of Jandakot Airport has been mapped and described by Beard (1979) and Heddle *et al.* (1980). These projects, although broad-scale, included close examination of the Airport vegetation and habitat.

Milewski and Davidge (1981) studied the western end of the Airport in considerable detail. Soils, floristic composition, species-area curves, phenology, etc., were recorded for an area equivalent to Sites D1, D2, D3 and D7, D8, and D9 of the present study (an explanation of these site codes is presented in Section 2.6).

Martinick and Associates (1989, 1990) undertook a fauna survey of the Airport. This involved trapping and recording fauna and describing faunal habitat.

Martinick and Associates concluded:

- the Airport land was of high conservation value and rich in bird, mammal and reptile species, but poor in frogs, despite the presence of damplands;
- the abundance of some groups of animals was due to the presence of Banksia woodlands;
- mammals were common but were mostly feral species;
- no single area of Banksia woodland could be identified as more or less valuable than any other;
- the damplands were poor in species;
- there was no evidence of the damplands having any restricted species.

During preparations for the Draft EIS, Weston (1990, 1992) expanded upon Martinick's work and provided more detailed vegetation descriptions.

Basically, none of these studies produced any evidence to suggest that the 5a, 5b, and 5c conservation areas proposed by FAC should be changed. There were no obviously better areas for the position of the conservation zones.

The present independent study was commissioned, as stated in Section 1.1, primarily because the Martinick and Weston studies did not convince conservation groups that the selected areas were the best locations for the conservation zones.

The present study, therefore, uses a different methodology to that previously applied. It is also much more detailed and comprehensive.

Field work was carried out on 1, 3, 9, 10 and 14 September 1993, using methodologies known as the Rapid Assessment Data System (RADS) and the Rapid Habitat Assessment System (RHAS) described below.

2.0 METHODOLOGY

2.1 THE ORIGIN OF RADS AND RHAS

The Rapid Assessment Data System (RADS) evolved from a research programme which was commenced by the Western Australian Museum (WA Museum) in 1971. At that time, under the guidance of Dr D.J. Kitchener, a survey of mammal, bird and reptile fauna began in the Western Australian wheatbelt, an area of about 22 million hectares of which all but about 5 million hectares had been cleared for agriculture. Uncleared land was held in road, town, railway, recreation, water, and conservation reserves.

It had been noted that following the clearing of land in the wheatbelt, there had been a dramatic change in the mammals (Kitchener, 1973), birds (Serventy and Whittell, 1976), and reptiles (Storr, 1964). It is probable that many other groups of animals had also been greatly affected by these extensive alterations to the environment. The only chance for future persistence of many species of vertebrates in the wheatbelt depended on the haphazardly located conservation reserves in the area.

The field survey of wheatbelt reserves commenced with the aim of examining the remnant faunal populations. The general approach was to survey each reserve during autumn and spring. Mammal traps were set in lines to sample the major habitats on each of the selected reserves. In each of these habitats, birds were recorded by observation, and reptiles and frogs by opportunistic collection. Habitat descriptions of all traplines, and vegetation maps, were prepared for each reserve.

At the outset of the survey, it became apparent that the systems of vegetation mapping available, at that time, were not suitable for describing vegetation of the wheatbelt in terms thought relevant to the fauna. This was primarily because the available vegetation classification systems did not differentiate clearly between vegetation that was structurally quite different, both in its overall physiognomy and internal stratification. It was decided, nevertheless, to proceed with the faunal survey until a suitable system of vegetation classification was developed, and then retrospectively annotate the vegetation at those localities where traps had been set and fauna observed or collected. Barry Muir, an Ecologist, was appointed by the WA Museum in 1975 to develop a 'fine-tuned' system of vegetation classification and mapping that was more suitable for faunal studies.

The vegetation classification which resulted from these studies was published in 1977, and became known in Western Australia as the Muir Classification (Muir, 1977). During further studies in the wheatbelt, from 1976 to 1979, the Muir Classification was further modified. It was adopted by various agencies and researchers throughout Australia and overseas. Comments were fed back to Barry Muir.

In 1980, Muir commenced a process of examining fauna ecology data from any available source and comparing the findings with the Muir Classification. He also tested the Classification in any habitat type he encountered in Australia or overseas and gathered input from zoologists whenever possible.

The result of these ongoing studies has been that the original Muir Vegetation Classification diverged into two other systems:

- the Rapid Assessment Data System (RADS) - which was intended to allow meaningful vegetation classification over large areas or when study time was limited; and
- the Rapid Habitat Assessment System (RHAS) - which similarly was intended for large scale or rapid surveys, but with additional information which allows it to be of particular value in describing faunal habitats.

The two systems have much in common and are, therefore, largely inseparable in the text of this document.

2.2 THE DEVELOPMENT OF THE MUIR CLASSIFICATION

Two possible approaches to describing vegetation are most likely to distinguish the habitat preferences of vertebrate fauna. The first approach was that of Webb (1959, 1968) and Kikkawa and Webb (in Webb *et al.*, 1973). These researchers selected a group of animals and recorded in great detail the characteristics of the environment in which they were found. They then analysed the resultant data, obtaining a set of parameters to produce a vegetation classification. This approach requires a computerised data processing system and results in a habitat classification relevant only to a particular animal group. It is too slow and complex for a rapid approach to faunal survey, or for large area mapping and classification of vegetation.

The alternative approach was to develop a simple vegetation classification, useful to botanists, but detailed enough to describe habitats of fauna, particularly vertebrates. Systems based on floristics were not considered in the original study because there was not time to develop such a classification. Further, such classifications were generally more difficult to use. Structurally based classifications were easy to use. Several structural classification systems were already widely used in Australia for botanical and faunal survey work and could form a basis for the new system. Floristic components were included as the method developed.

The Muir (1977) Vegetation Classification adopted the Beard and Webb (1974) classification, with modifications based on the needs of scientists specialising in mammal, bird, reptile and amphibian studies. Consistent results have been obtained in its application, even from users with very little botanical background.

2.3 PHILOSOPHY OF RADS

To undertake fauna surveys in the field as part of an impact monitoring programme requires detailed, lengthy (sometimes several years), and costly field work. Further, because of the mobility of fauna, there is a high level of uncertainty in evaluating data. Absence of a species may mean, for example, that it was simply not detected, rather than that the impacts of a project had destroyed or displaced it.

To some extent this may be true of plant species. Small, ephemeral or particularly inconspicuous species may be overlooked and considered rare or scarce when, in fact, they are simply hard to find. Larger species are usually perennial, easily measured or evaluated and are the primary `building blocks' on which the habitat is constructed.

Using the philosophy that if the habitat is complex, floristically rich and `healthy' so will be the fauna populations which occupy it, it is possible to direct an examination at the vegetation and habitat rather than at the fauna.

Further to this philosophy, it is possible to adopt certain biological principles on which to evaluate the habitat. These are:

- the more structurally complex the habitat the more diverse will be the fauna;
- the more floristically rich the habitat the more diverse will be the fauna;
- the greater the level of protection from predators afforded by the habitat the more likely it is to be `useful' to fauna; and
- some easily measured special habitat characteristics (e.g. numbers of trees with hollow limbs, length of tree trunks, distance between strata, etc.) are a useful evaluation of habitat availability.

Based on these philosophies, modified from long experience with habitat studies, the following methodology has been developed for assessing faunal habitat.

2.4 USE OF RADS DATA FOR FAUNAL HABITAT

As RADS has been used more frequently to describe faunal habitat (i.e. as it evolved into RHAS) a number of specific applications of its various components have also consolidated. Some of these are directly related to RADS, e.g. the number of life-form/density classes (LFDC) (Kitchener, 1980a, 1980b, 1982). Others have been prepared independently, e.g. the abundance of hollow logs.

Data collected using these parameters is weighted to reflect the significance of the parameter for faunal habitat description. The weightings are a subjective decision made by Muir and based on observation, literature review and discussion with other researchers. They may

vary from one geographic location to another and are not applied to all characteristics noted. This is discussed further in Sections 2.5.1 to 2.5.3.

Because some of the data are subjective, e.g. abundance of food-generating plant species, while others may have actual numbers, e.g. numbers of plant species, the items with numbers are grouped and the groups scored. This is explained in further detail below. While this procedure tends to converge the end scores to a lower number, experience has shown that major differences in habitat are still obvious. It also reduces the error which results from using only approximate numbers such as the number of species in an area.

A further advantage of RADS and RHAS is that, because actual numbers are grouped, or ranges of numbers or characters clustered into categories, the minor errors which can creep into large, complex spreadsheets, or discrepancies between operators or measurements, are negated in the final scores. Absolute exactness in scoring or mathematical proceedings is not essential to generate meaningful conclusions.

The very high degree of homogeneity of vegetation and habitat on Jandakot Airport rendered some of the RHAS rating parameters of limited value. They gave identical figures in all habitats. These parameters were, therefore, excluded from the present analysis and only those which distinguished between habitats were used. Those used, or not used, are indicated in the descriptions of system components presented below. Those parameters not used were, however, considered closely in the interpretation of the data.

2.5 SYSTEM COMPONENTS

2.5.1 Biophysical Components

Number of Adjacent Associations

The number of associations per given area is a measure of gross habitat complexity. It is, therefore, a useful and easily obtained measure of gross habitat richness. An association in this study is described as a woodland formation (see below), which is dominated by certain species of plants in Stratum 1. A woodland formation is described as those vegetation types in which the dominant life-form of the upper stratum is trees, the total Canopy Cover of which is greater than 2%.

It can be distinguished from the same woodland formation elsewhere by a differing dominance of certain species in Stratum 1.

In the case of Jandakot Airport, almost the entire area is of a single formation, i.e. woodland, although the associations may differ, e.g. *Banksia menziesii* dominated woodland on the dune crests and *Banksia ilicifolia* dominated woodland on the lowlands. In most cases at Jandakot Airport these variations in dominance are so subtle they are almost indistinguishable. Thus, in this study the number of associations adjacent to the sample site under consideration has been recorded, but is, in reality, a measure of availability of an

entirely different nearby habitat type. Some birds and mammals, for example, live in one habitat type, e.g. woodland, and use an adjacent one, e.g. cleared grassland, for foraging for food. At Jandakot Airport, cleared and grassed road verges, edges of runways, etc. have been considered alternative habitats as well as, for example, dampland heaths adjacent to Banksia woodlands.

On Jandakot Airport, the actual number of adjacent associations (also formations in most cases) is recorded and given a weighting of 3 (quite high) in the RHAS rating. This is because the Jandakot Airport habitat is so homogeneous that the presence of adjacent habitat types of a very different structure may be very important for some species. This opinion is supported by the number of observations of parrots, Magpies (*Cracticus tibicen dorsalis*) and Brown Bandicoot (*Isoodon obesulus*) seen feeding in the grassed areas and then moving back into the adjacent bushland when disturbed.

Topographic Position

The terrain type at Jandakot Airport is undulating dunes. However, Muir (1983) and Cresswell and Bridgewater (1985) recognised the importance of topographic position in determining the type of vegetation on the Bassendean Dunes. The position on the dune has been recorded as crest, mid-slope, lowland or dampland to reflect these findings. This parameter is not used in the RHAS ratings but provides useful information on plant distribution.

Soil Drainage

Drainage is subjectively classified as very poor, poor, moderate, well drained and very well drained, and closely correlates with topographic position. These parameters are not used in the RHAS rating.

Soil Profile

At Jandakot Airport, soil profiles were not described as such because all dune sites were white or grey (Munsell, 1954) sands (Northcote, 1971). The damplands were occasionally peaty for the top few centimetres. Soil descriptions have, therefore, been kept to whether or not the profile was uniform (Northcote, *ibid.*), and whether or not a distinct 'A' Horizon of peat was present. For further detail of typical soil profiles on Jandakot Airport, see Milewski and Davidge (1981). This parameter is not used in the RHAS rating.

Slope

This was determined by a Suunto clinometer and presented as degrees of slope. Steep slopes on sand dunes usually indicate better drainage, on the crests and upper slopes, and greater availability of moisture at the dune toe. This parameter is not used in the RHAS rating.

Aspect

Observation on dune slopes at Melaleuca Park (Muir, 1983) and other locations in Western Australia showed that the south and east sides of dunes received less heat during summer than did the north and west sides. Consequently, the vegetation was often different. *Xanthorrhoea preissii*, for example, was often most abundant on the south sides of dunes. This parameter is not used in the RHAS rating.

Soil Protection
Soil protection is a combination of vegetation cover and leaf litter depth and cover. It is a measure of the possible incidence of water or wind erosion when the soil is in an undisturbed condition. The degree of protection is expressed as a percentage of the protected soil surface. This parameter is not used in the RHAS rating.

Erosion
Erosion is a derivative of the soil protection classification but refers to the disturbed condition. Any evidence of runoff erosion or wind-blowing of the soil is evaluated. Erosion is scored as: 0 = none; 1 = minor; 2 = moderate; and 3 = severe. This parameter is not used in the RHAS rating.

2.5.2 Structural and Floristic Components

Life-form and Height Class
Many botanical studies only describe (and map) climax formations, sub-climax stages being interpreted on their probable nature when climax is reached. In contrast, habitat classification must describe vegetation seral stage in its existing form, regardless of its climax. Such an approach requires the resolution of questions such as when does a tree, regrowing after fire, cease to be a shrub (sapling) and become a tree. Definitions of life-form that are fauna habitat-oriented hold the key to selection of terms in this situation. The problem then arises in habitat-oriented life-form classification that terms may vary between species of plants, the fauna sometimes utilising each plant species in a particular way.

The Muir Vegetation Classification attempts to define life-forms in a manner which will produce consistent vegetation descriptions meaningful to fauna utilisation. The adaptation of these vegetation descriptions to describe habitat may depend upon the plant species involved, the researcher's purpose, and the group of animals being studied. The life forms found at Jandakot Airport are listed and defined below. This parameter is not used in the RHAS rating.

Trees
Trees are defined as woody, usually perennial plants, generally erect, of variable outline, but commonly with a spherical or ovoid canopy raised well above the ground. The major part of the canopy from bottom to top is less than or equal to two thirds of the total height of the tree. Trees are generally single stemmed. However, if they are multi-stemmed they have fewer than five individual trunks that result from branching of a single trunk (which may be quite short). Trees do not usually arise from a fire-resistant lignotuber.

Tree height is variable but usually exceeds 2 m when the plant is mature. When dead, hollow tree limbs may be of sufficient size to provide habitats for vertebrates. Many trees in Western Australian and other arid areas are less than 5 m tall. However, because of their life-form, they are used by animals differently from shrubs of similar height. For example, the WA wheatbelt bird species White-browed Babbler (*Pomatostomus superciliosus*) commonly nests in *Allocasuarina acutivalvis* shrubs 2-5 m tall, but not in *Allocasuarina huegeliana* trees 2-5 m tall, because the latter will not support the nest effectively (B. Muir, pers. observ.).

Shrubs

These are defined as woody, usually perennial plants, generally erect but may be procumbent or of weeping habit. Commonly, they are broadly conical in form with the foliage occupying all or only part of the total height of the plant. Multiple stems and branches arise from a rootstock or very short common trunk. Lignotubers are usually, but not always, absent.

Shrubs may be of any height but are generally less than 5 m tall. Dead, hollow branches rarely reach sufficient size to provide habitats for vertebrates. Enlarged rootstocks may be present in some *Hakea* and *Melaleuca* species. Height classes in the classification were selected in order to separate all strata in shrub-dominated formations. This is thought to be particularly important with reference to bird utilisation of these formations.

***Xanthorrhoea* (Grass-trees)**

Xanthorrhoea spp, unique to Australia and known as "grass-trees" or "blackboys" have a unique life-form of a short, thick trunk and a spreading grass-like tuft of foliage. They are known to grow at about 1.3 cm/yr without fire (Lamont and Downes, 1979) in the Perth region. Thus, the length of the unburned portion of the skirt leaf bases can be used to estimate the period since the last fire. Grass-trees are also important habitats for fauna which live inside burned out trunks or in the dense old foliage at the top of the plant.

Mat Plants

These are herbaceous or woody plants, usually perennial, prostrate and cushion-like, with densely compacted foliage which may occupy the whole volume of the aerial portion of the plant, or may only occupy the outside surface of the cushion. They usually have numerous, very short stems and sometimes branches which may root to the soil surface where they touch.

Mat plants may vary from a few centimetres to several metres in diameter but rarely exceed 10-30 cm in height. They provide no hollow limbs. Mat plants are separated from shrubs and herbs because they provide a different habitat for vertebrates. They provide perches on their outside surface, but generally are not penetrated into by vertebrates, but may be burrowed under. Mat plants may be shrub-like woody species or herb-like species.

Grasses
Grasses are herbaceous or rarely woody plants of the family Poaceae (Graminae). Perennial or annual, generally erect or spreading, they usually have distinct individual shoots (tillers) arising from a single root system.

Canopy density of grass is sometimes overestimated because dead stems and leaves are invariably present, and these may have flattened out. Height division is normally set at 0.5 m, but all the grasses observed at Jandakot Airport were less than 0.5 m tall.

Sedges
Sedges, generally of tufted habit, are herbaceous, usually perennial, erect plants. They arise from stolons, tubers, bulbs, rhizomes or seeds. The term includes Cyperaceae, Juncaceae, Restionaceae, Typhaceae and Xyridaceae and, in terms of faunal utilisation, may occasionally include other plants of sedge-like form, excluding some grasses and bamboo.

The literature does not define the terms sedge, reed, or rush adequately. Where the terms do appear, they tend to refer only to semi-aquatic species. Plants of the families Restionaceae and Cyperaceae are common components of terrestrial sclerophyll habitats at Jandakot Airport and are not shrub, mat plant, bunch grass or herbaceous in character. The term sedge has been adopted to include all these plants. It also includes plants which will not fit into any other life-form and are of sedge-like character.

Top and Bottom Height
Top Height refers to the average and approximate height of the top of each stratum. This, and Bottom Height, are used as a measure of stratal organisation and spacing.

Bottom Height refers to the bottom of each stratum. The height of the bottom of Stratum 1, minus the height of the top of Stratum 2 gives an indication of the inter-canopy distance used by predators such as Harriers. There are also several other species such as Tree-creepers which use this open area between Strata 1 and 2. This measurement is given a weighting of 1. This parameter is used in the RHAS rating.

Canopy Cover
Canopy Cover is the total area encompassed within the circumference of individual foliage clumps, and expressed as a percentage of a given area, e.g. quadrat or association area. The term is used in this study in preference to the commonly used term 'Crown Cover' because it records the actual area of foliage more accurately. This is particularly so with some life forms (such as mallees). Visually estimated Canopy Cover divisions of 10% are used in the present study. A derivative of Canopy Cover, the Total Canopy Index (see below) is used in the RHAS rating.

A lower limit of 2% Canopy Cover has been set because experience has indicated that plants with less than 2% Canopy Cover are too widely spaced to be used as a stratum by fauna.

They do not appear in descriptions as a stratum but may be structure-modifying species (see below).

Average Foliage Density (AFD)
Average Foliage Density is measured with a Spherical Densiometer (Type A) as described in Lemmon (1956). Foliage density is determined by five readings for each species in the association, or, when there are too many species or the strata too complex, readings are taken from the dominants.

Figures are adjusted where necessary to give a more accurate representation of the foliage density of the stratum as a whole. Some formations (e.g. heath) may have a similar foliage density for most of the plant species present. Other species may individually have almost 100% foliage density. If such a species comprises several percent of the whole stratum, the foliage density figure is adjusted accordingly.

This parameter is not directly used in the RHAS rating, but is used in calculating the Total Canopy Index.

Total Canopy Index
Both individually, and in combination, Canopy Cover and Average Foliage Density (AFD) provide an indication of the degree of protection offered by the vegetation to both arboreal and ground-dwelling fauna. Again, the cover provided will vary with vegetation health and thus, indirectly, may be related to moisture availability.

An artificial Total Cover Index (TCI) provided by the taller strata (usually Strata 1, 2 and 3) can be generated by:

TCI = % Canopy Cover of Stratum 1 x % AFD of Stratum 1,
plus % Canopy Cover of Stratum 2 x % AFD of Stratum 2,
plus % Canopy Cover of Stratum 3 x % AFD of Stratum 3.

TCI is scored directly into the RHAS rating and the weighting is given as 1.

Health
Vegetation health is estimated by a simple scoring procedure. Plants visually in excellent health are rated 5. Plants which are comparatively healthy but with some tip dieback or yellowing are rated 4. These features are more pronounced with a rating of 3. Plants with very sparse foliage, yellowing and curling of leaves and considered almost dead are rated 2, and very poor or apparently freshly dead a rating of 1. A rating of 0 is only given if the plant is undeniably dead.

Stratum health is scored as: 0 = dead; 1 = very poor; 2 = poor; 3 = moderate; 4 = good; 5 = very good. A large number of plants are evaluated and an average taken, or it can be an overall visual estimate. In the present study the health rating for Strata 1 and 2 has been averaged as these are the strata believed to have the greatest influence on overall canopy health in Banksia woodland. This parameter is given a weighting of 2 and is used in the RHAS rating.

Dominance
These are the species which are most abundant in each stratum and serve to identify it. In Stratum 1 the dominants lend their name to the formation and serve to identify the association. This parameter is not used in the RHAS rating.

Life-form Density Classes (LFDCs)
Many botanical studies describe vegetation in terms of its character at climax; sub-stages after disturbance are interpreted on their probable nature when climax is eventually reached. In contrast, faunal habitat classification must describe vegetation in its existing form, regardless of its climax. Changes in vegetation structure will permit certain faunal species to take advantage of the newly-created ecological niche. Over time these niches will disappear and new ones will appear as the seedlings eventually grow to climax, or the vegetation recovers. Accompanying these changes will be an associated succession in faunal utilisation.

The use of LFDCs by Kitchener *et al.* (1982) has shown that there is a relationship, although imprecise, between the number of LFDCs and the abundance of certain passerine bird species.

Kitchener's habitat variable 'total number of Life-form Density Classes (LFDCs)' is generally considered to be the number of vegetation strata within each Canopy Cover class present in the sample area (i.e. 2-10%, 10-30%, 30-70%, or 70-100% Canopy Cover). At Jandakot Airport the overall total Canopy Cover is generally not sufficiently variable to make this of value. However, the number of strata present is variable, so the number of strata has been taken as equivalent to the number of LFDCs in this study. Weighting factor is 3. This parameter is used in the RHAS rating.

Number of Species
This is the total number of all plant species actually recorded at each site in a period of about 15-20 minutes observation. Any species not immediately recognised in the field were collected and returned to the laboratory for examination and identification. This parameter is used in the RHAS rating to estimate floristic diversity.

Floristic Diversity
As an actual number of plant species is available, as well as a site area, this can be directly applied as a measure of habitat richness. Scoring used here, and proven to be reliable in other studies, is: 0-20 species scores 0; 21-50 species scores 1; and 51-100 species scores 2. Weighting is 2. This parameter is used in the RHAS rating.

Number of Structure-modifying Perennials
Structure-modifying Perennials (SMPs) is the number of perennial (i.e. all year habitat) species which are so abundant as to significantly influence the structural makeup of the vegetation. If the number of SMPs is very similar to the total number of species in the sample, the vegetation may be considered to have very little internal heterogeneity in structure. If the number of SMPs is much lower than the total number of species, then the SMPs may be considered to have a significant role to play in creating local structural

variations which may be specifically used by fauna. The SMPs score is derived from the actual numbers of SMPs. Scoring is: 0-20 species scores 0; 21-50 species scores 1; and 51-100 species scores 2. Weighting is 2. This parameter is used in the RHAS rating.

Seedlings and Saplings
The abundance of seedlings and saplings provides a measure of the degree to which the habitat is self-sustaining. The absence of seedlings or saplings of the dominant tree species suggests that the level of occurrence of natural replacement might be low. Again, scores range from 0 = none, to 3 = very abundant. This parameter is not used in the RHAS rating.

Spatial Organisation
As with other faunal parameters examined in this study the principal philosophy is that floristic and structural diversity and canopy density are directly related to usefulness of the habitat to fauna. Therefore, the spatial relationships of the strata and between adjacent clumps of vegetation are relevant.

It is generally accepted that the usefulness of an area to support faunal species, or for fauna to use the vegetation as a corridor for movement, depends on the degree of cover offered by the habitat. The significance of roads and farmland as barriers to faunal movement is well documented (e.g. Barnett *et al.*, 1978; Dames & Moore, 1989; and Mader *et al.*, 1990). This is partly due to the foreign nature of the cleared area, but is also to exposure of the fauna to predators (especially raptors) while crossing the open areas.

Woodland vegetation at Jandakot Airport has been described as continuous or patchy in its distribution. The cleared areas are not classified. This parameter is only used for information, but is not used in the RHAS rating.

Horizontal View Distance
This is the average distance an observer can see horizontally, with the eyes held at approximately 1.5 m above the ground surface. It gives a measure of the lateral density of the vegetation. It is used in this study as a guide to spatial organisation (see above), but is not used in the RHAS rating. The measure is also useful to estimate visual screening effects of vegetation in development areas, although it was not used for that purpose in the present study.

Evidence of Logging
This is an assessment of the structural changes resulting from major disturbance by logging. Studies on the impacts of logging on fauna have demonstrated the following useful relationship for scoring:

- heavily logged long ago score 3;
- heavily logged recently score 0;
- moderately logged long ago score 3;

- moderately logged recently score 1;
- lightly logged long ago score 4;
- lightly logged recently score 3; and
- no evidence of logging ("pristine") score 5.

This parameter is used in interpretation but not in the RHAS rating.

Evidence of Disturbance
This is an evaluation of disturbance other than logging that includes adjacent clearing, firebreaks through the association, etc. Scoring is: 0 = no disturbance; or the type of disturbance is noted. This parameter is used in interpretation, but not in the RHAS rating.

Fire Age
The FAC has kept records of both fuel-reduction burns and wild fires on Jandakot Airport since 1977. Martinick and Associates (1990) recorded the dates and approximate locations of these fires and these data have been used in the present analysis. With the exception of a few areas, most of the vegetation on Jandakot Airport has been unburned for some time. This parameter, therefore, is not used in the RHAS rating directly (see below).

Stratal Recovery
This is a measure of the seral stage of vegetation after fire or total clearing, using the observed structure and floristics of the vegetation plus the known history and/or fire age data discussed above. If the full structure is present (be it heath or woodland), the vegetation is given a rating of 4. If, in the opinion of the observer, it is three-quarters restored to pre-disturbance condition, a rating of 3 is given; if half restored, a rating of 2; and if only one-quarter restored, a rating of 1. The weighting is 3. This parameter is used in the RHAS rating.

Weed Species and Dominance
Weed species (i.e. non-indigenous pest plants) which are either so abundant as to be modifying the structure of the vegetation, or are of agricultural significance (and therefore require control), are considered. The dominant species is recorded and an evaluation made of the degree of infestation: 0 = none or very few; 1 = significant numbers; 2 = many present - management should be considered if they are in an unsuitable location, or are of agricultural significance); and 3 = almost total dominance - immediate control is required if the species is of agricultural importance. This parameter is not used in the RHAS rating.

Dieback Indicators, Level of Infection and Dieback Status
Dieback Disease is a collective name given to several species of *Phytophthora* fungus which infect many Western Australian plants, especially Proteaceae and Myrtaceae. It can destroy all the plants in an area and may leave almost nothing alive except monocotyledonous species.

Plants which are showing clear and obvious visual signs of dieback are noted (usually *Banksia* species) and the level of infection was noted from: 0 = no obvious signs; 1 = some deaths or tip death which has the visual indication of dieback; 2 = well developed infection affecting several plant species and individuals; 3 = well developed infection affecting only a few species but over a fairly large area; 4 = well developed infection involving many or all species but over only a small area; 5 = severe infection with almost all susceptible species and individuals dead or dying over a fairly large area.

The dieback status serves to convert the level of infection to a scale suitable for inclusion into RHAS. Clearly, if the level of infection is severe the score might be, for example, 4. This would raise the habitat value score, rather than decrease it, if it were used directly. Thus, the dieback status is calculated by taking the maximum possible health score (5) and subtracting the level of infection score (4 in this example) to arrive at a status figure of 1. The figure 1 is then used in the RHAS analysis. Weighting is 1. This parameter is used in the RHAS rating.

RHAS Rating

The RHAS rating used in this study is the sum of the weighted scores of:

- number of adjacent associations;
- interstratal distance (bottom height of Stratum 1 minus top height of Stratum 2);
- Total Canopy Index for all strata;
- number of Life-form Density Classes (LFDCs);
- floristic diversity;
- SMP score;
- mean health of Strata 1 and 2;
- stratal recovery; and
- dieback status.

As indicated previously, RHAS is mostly used where actual fauna data are not available. In this study, the RHAS scores were not used directly because some information on fauna was available.

The present study summed the RHAS scores and the fauna scores. To simplify the results, to facilitate mapping, and to allow for the variations and inaccuracies inherent in such data, the total scores were clustered or grouped. Total scores of 0-50 were clustered as 1; 51-100 as 2; 101-150 as 3; 151-200 as 4; and so on.

2.5.3 Structural Measurements Specifically for Fauna Evaluation

In order to apply RHAS more accurately to the description of faunal habitat, some additional vegetation structural definitions and observations on faunal use of the habitat may be applied. These are discussed below.

The method was to score each parameter as indicated in the text, then to sum the scores and add the total to the RHAS rating determined from the vegetation study. This puts comparatively greater emphasis on the specific fauna evaluation components, but, considering the purpose of the evaluation is to examine the usefulness of the Airport habitat for fauna, this is considered to be an advantage.

Abundance of Nests
This is the observed abundance of bird nests in an area. It relies not only on large, conspicuous nests in trees, such as those of Ravens and Magpies, but also on searches for small nests in shrubs. It is scored as: 0 = none observed; 1 = one or two sighted; 2 = several present; 3 = abundant - numerous nests sighted, thus area appears to be of some importance to birds.

Abundance of Digs
This is a visual estimation of the abundance of invertebrate (e.g. scorpion holes, ant nests, spider burrows) and small vertebrate diggings (e.g. small reptile burrows), with the exception of larger mammal burrows and diggings. Score is: 0 = none; 1 = very few; 2 = fairly common, and so on.

Abundance of Mammal Burrows
This includes actual burrows such as residential burrows (e.g. rabbit and fox) and other diggings such as the funnel-shaped diggings of the Brown Bandicoot. This latter indicator has been included because the Brown Bandicoot (*Isoodon obesulus*) has been listed in the Western Australian list of Gazetted Rare Mammals, but is very common on Jandakot Airport.

Studies by Sanders and Ninox Wildlife Consulting (1992, pers. comms.) have suggested that there may be a vague relationship between numbers of diggings and the numbers of Bandicoots. Bandicoot diggings have a characteristic size and shape and are fairly easy to distinguish from rabbit diggings. Further, rabbit diggings are usually associated with characteristic droppings, whereas bandicoot diggings are not. Abundance of diggings was recorded as: 0 = none; 1 = very few; 2 = several; 3 = common; and 4 = very common.

If the diggings are clearly made by rabbits this is also recorded.

Hollow Limbs, Hollow Trunks and Availability of Logs
Many Australian bird species and some mammals, reptiles and invertebrates are dependent on hollow limbs or trunks of plants (usually trees), or the availability of hollow logs lying on the ground. Hollows can be used as refuges and breeding sites, and hollows high in trees

as vantage points for predators to view the habitat. The abundance of such hollows in a given area can provide an indication of the area's usefulness to fauna which use these habitats.

The degree of usefulness can change over time. Young plants grow to maturity and senesce, thereby increasing the number of hollows. Similarly, mature trees may die from such effects as a change in water table. This may increase the abundance of hollows for a period until decay causes the loss of the dead trees. Dead standing trees may then decrease in number and the number of hollow logs increase.

Determination in the field of the actual number of hollows for fauna is a lengthy and tedious process. The index of abundance of hollow limbs, hollow trunks or hollow logs was developed to provide a speedy method of evaluating hollow abundance.

The hollow size in fallen logs is recorded as either smaller or greater than 20 cm. Smaller logs (< 20 cm) would be suitable for reptiles and small mammals. Larger hollows (>20 cm) are considered suitable for such animals as Numbat (*Myrmecobius fasciatis*) which it is thought might possibly once have occurred on the Airport. Abundance of each size of hollow is scored as: 0 = none; 1 = very few; 2 = some present; 3 = many hollow logs, etc.

Litter Depth and Spacing

Average leaf litter depth in centimetres is recorded to indicate the availability of substantial cover for insects, reptiles and small mammals. Litter is rarely evenly distributed and occurs in clumps beneath bushes, or is blown into mounds by wind or washed into clumps by water. As well as the depth of available litter, the average distance between litter clumps is recorded because this may have a role for small animals in greater risk of predation.

Abundance of Mat Plants

This is a score of the abundance of plants which form dense mats on the soil surface. Mat plants are of particular value for ground-dwelling animals which are not suited to or do not prefer litter, but live beneath the dense canopy of ground-hugging plants. At Jandakot Airport almost the only significant mat plant was *Dasypogon bromiliaefolius*. Abundance is scored as: 0 = no mat plants; 1 = a few present; 2 = moderately common, and so on.

Abundance of Bunch Grass

As well as being a significant measure of habitat disturbance and modification on the Swan Coastal Plain, grasses provide dense cover on an annual basis, greatly increase the summer fire hazard, and provide an abundance of seed for granivorous species. Abundance is scored as: 0 = none; 1 = a few plants; 2 = many plants, and so on.

Abundance of Flowering and Seeding Species

It is assumed that floristically rich areas are capable of supporting more fauna than areas which are floristically less rich. Similarly, plant species which produce abundant pollen (e.g. *Acacia* spp), abundant nectar (e.g. *Eucalyptus* spp), or abundant large seeds (e.g. *Acacia* spp), are probably significant species in a habitat in comparison to less productive plants. The numbers and types of productive plants have, therefore, been

considered. Very low abundance scores 0; low abundance scores 1; moderate abundance scores 2; and high abundance scores 3. Weighting is 1.

Soil Burrowability and Availability of Moisture
These parameters are scored in case there are significant differences between sites. No significant differences were found at Jandakot Airport and so the data are presented for information only.

2.5.4 Bird Survey Methodology

Bird surveys within the Airport were carried out on 1, 3, 9 and 10 September 1993. They were undertaken by loop transects in which the majority of each block was examined (see below). Care was taken to ensure that all topographic positions were examined within each block.

The transects were commenced between 0600 and 0700 hrs, depending on the amount of available daylight for observation of the birds (dawn at the time of survey was at approximately 0600 hours). Transects continued until about 1700 hrs, when, because of airport security, it was necessary to leave the area. A single night traverse was also conducted in Block B. Transects were walked slowly to reduce disturbance to the birds, with periodic stops of 30 to 60 minutes to allow cryptic or shy species (e.g. cuckoos) to approach the observer.

The homogeneity of habitats was very high and weather conditions moderate and fairly consistent, so it is believed that variations in observer location at different times of day were not of major importance.

All species which could be positively identified from sightings or calls were recorded, together with information on their activities and how they were using the environment.

Bird surveys in areas outside the Airport were carried out on 14 September 1993. Similar methodology, to that used within the Airport, was applied at Sites E to H outside the Airport, but it was only possible to spend a maximum of 45 to 60 minutes at each site. The information presented on these areas is thus restricted to presence of species; counts of individuals are not used in the analysis of Sites E to H.

Bird nomenclature used in this survey follows Storr and Johnstone (1979).

2.6 APPLICATION AT JANDAKOT AIRPORT

For convenience, the Airport land was divided into four blocks (Figures 2 and 3), which were chosen to represent definable segments of the Airport, rather than the various proposed land uses, which were set out by the FAC in 1986 (Dept of Aviation, 1986). Each block was then surveyed using a series of sites as representative samples of the vegetation and habitat. There were 23 sites in Block A, 29 in Block B, 47 in Block C and 47 in Block D (Figure 3).

Thus, 146 samples were taken in the 237 ha of bushland, i.e. one sample for every 1.6 ha. Sites were roughly equally spaced apart, so they tended to form a randomised sample of the woodlands, as they did not necessarily relate to any particular topographic position. Each site consisted of an area 30 m in diameter in which the habitat information was averaged. Information was tabulated for analysis and the tables are presented in Appendix A.

3.0 RESULTS AND DISCUSSION

3.1 TERRAIN AND SOILS

Jandakot Airport lies on the Swan Coastal Plain on the eastern onshore edge of the Perth Sedimentary Basin. In this region the uppermost plain formations are of late Tertiary to Quaternary age. In the Jandakot region, the Quaternary sediments are known as the Bassendean Dune System. These dunes are deep, white to grey, highly-leached siliceous sands (Semeniuk and Glassford, 1989).

Topography of Jandakot Airport varies from 50 m Australian Height Datum (AHD) in Block C to a low of 26 m AHD in all blocks. The highest points are located in the eastern and western sides of the Airport.

No true wetlands occur on the Airport although there are several small, seasonally damp areas (damplands). These appear to be at about 25 m AHD as they are discrete from adjacent vegetation, although much of the Airport land is at about 26 m AHD, but is clearly not dampland.

In summary, therefore, the Jandakot Airport terrain comprises low, undulating, siliceous dunes in which the swales may approach the water table and become seasonally moist, but rarely or never contain free water. Observations of the water table at two pits on the Airport showed the water at the end of winter to be about 2 m below the surface.

Soils of Jandakot Airport, on a broad scale, comprise only two soil types. These are:

- Jandakot Soil Type: an iron podzol with grey surface, white subsurface and (usually) a yellow subsoil at 1-2 m depth. The soils are highly leached and acidic; and
- Joel Soil Type: a humus podzol with a very dark grey surface, grey subsurface and often a dark brown, indurated subsoil at 1-2 m depth. The water table is from 2 m to 5 m below the surface.

The Jandakot Soil Type, while being very homogeneous on a broad scale, has subtle variations within it. These variations are related to altitude (and hence distance to the water table), angle of slope of the dune, the presence of organic debris in the surface layer, and the depth of the yellow (iron-rich) sand below the surface (Milewski and Davidge, 1981). The soils have excellent infiltration characteristics and are very friable. Speck (1952) gave the following as typical Bassendean Sand soil characteristics:

- pH: 5.7-6.6 near the surface, 7.0-7.9 at depth;
- 85% coarse sand, 11% fine sand, and 1% clay and silt;
- calcium carbonate: 0.5-1.3% near the surface, decreasing to 0.2% at depth;
- organic carbon: 3.4-3.7% near the surface, decreasing to 1.2-1.8% at depth;
- phosphorus (as oxide): 0.001% near the surface;
- potassium (as oxide): 0.005% near the surface; and
- nitrogen: 0.005% near the surface.

The soils are, therefore, highly porous and nutrient deficient.

Milewski and Davidge (1981) described in considerable detail the soils adjacent to, and on, the western end of the Airport. Two of their study locations equate to sites D1 and D9 of the present study. Their findings supported the general descriptions of soils given by Speck (*ibid.*).

Muir (1983) found, in work at Melaleuca Park, as did Milewski and Davidge at Jandakot, that the position on the dune, and hence the drainage characteristics of the soil, were a key determinant of vegetation type. Moisture content of the soil in early summer increased progressively from dune crest, to mid-slope, to lowland adjacent to the swamps. The swamps at Melaleuca Park were seasonally wet and so moisture content was very high at these locations. At Jandakot Airport, by contrast, it could be expected that the damplands would have soils and vegetation assemblages not greatly different to the lowlands of the dunes.

Table 1 summarises the main terrain and soil characteristics presented in Appendix A for each of the blocks on Jandakot Airport. As there were so many (146) sample sites, and the sites were, more or less, randomly distributed over the area, it is possible to provide a semi-quantitive comparison of each block.

- Block B has few crest habitats and some damplands. The majority of sites are lowlands, but soil drainage is very high at most sites. However, Block B has a good representation of poorly drained sites. Soil profiles are mostly uniform and slopes are gentle. The majority of sites are flat and have no particular aspect. There were no sites showing erosion.

- Block C has few crest habitats but six dampland sites, the majority of sites being gently sloping dune sides. The majority of sites have very high soil drainage, but several sites have moderate drainage. Soil profiles are mostly uniform and slopes are gentle; west-facing slopes are moderately common, unlike Blocks A and B. Post-fire erosional surfaces were found in Block C, although most of the area has a good cover of vegetation.

- Block D has a good representation of crest habitats, and six dampland sites. The majority of sites are lowlands, but drainage is mostly very high. There is a good representation of poorly drained sites. Soil profiles are mostly uniform but organic soils are well represented. Slopes are gentle. East-facing sites are well represented in Block D and absent from the other Blocks. There is a good cover of vegetation and the only erosional surfaces were post-fire.

3.2 VEGETATION STRUCTURE

3.2.1 Dune Systems

3.2.1.1 Introduction

Dune systems constitute the majority of the vegetation on the Airport land. Vegetation of the Bassendean Dunes has been described at a broad geomorphic scale by Heddle *et al.* (1980). Havel (1968) examined in detail the relationships between vegetation aspect, soil depth, soil moisture, etc. on the northern Swan Coastal Plain using ordination techniques. The first evaluation of Bassendean Dune vegetation in relation to topography and soils at the middle-scale, readily applicable to habitat evaluations, was by Muir (1983). This work was in Melaleuca Park, a 3000 ha Banksia woodland reserve on Bassendean Dunes, 25 km north-north-east of Perth (Figure 1). Muir found that, at Melaleuca Park, there was the broad physiognomic structure summarised in Table 2. Dune crests, mid-slopes and swales, or the edges of damplands, carried distinctive structural types and plant assemblages (see Section 3.1). Studies by Cresswell and Bridgewater (1985) supported Muir's findings and further showed that topographic location had a major influence on vegetation in the very dry, nutrient poor Bassendean Sands.

TABLE 2

SUMMARY OF DUNE VEGETATION PHYSIOGNOMY AT MELALEUCA PARK (Adapted from Muir, 1983)

CHARACTER	TOPOGRAPHIC POSITION		
	DUNE CRESTS	MID-SLOPES	LOWLANDS
Stratum 1			
Life-form	Trees	Trees	Trees
Top Height (m)	7	10	10
Bottom Height (m)	4	2	2
Canopy Cover (%)	2-10	2-10	2-10
AFD (%)	50	50	45
Stratum 2			
Life-form	Shrubs	*Xanthorrhoea preissii* plus mixed shrubs	*Xanthorrhoea preissii*
Top Height (m)	4	1	1.5
Bottom Height (m)	0	0	0
Canopy Cover (%)	2-10	0-20	2-10
AFD (%)	10	15	15
Stratum 3			
Life-form	Shrubs	Shrubs	Shrubs
Top Height (m)	0.5	0.5	1
Bottom Height (m)	0	0	0
Canopy Cover (%)	30	2-30	30-70
AFD (%)	40	30	30

Note: AFD = Average Foliage Density.

At Jandakot Airport the physiognomic structure of the dune vegetation (derived from Appendix A) can be summarised as shown in Table 3.

TABLE 3

SUMMARY OF DUNE VEGETATION PHYSIOGNOMY AT JANDAKOT AIRPORT

CHARACTER	TOPOGRAPHIC POSITION		
	DUNE CRESTS	MID-SLOPES	LOWLANDS
Stratum 1			
Life-form	Trees	Trees	Trees
Top Height (m)	6.5	7	8
Bottom Height (m)	2.5	3	3
Canopy Cover (%)	28	32	50
AFD (%)	47	55	60
Stratum 2			
Life-form	Shrubs	Shrubs	Shrubs
Top Height (m)	1.2	2	1.8
Bottom Height (m)	0	0.3	0.4
Canopy Cover (%)	30	29	45
AFD (%)	35	36	29
Stratum 3			
Life-form	Shrubs	Shrubs	Shrubs & Sedges
Top Height (m)	0.3	0.6	0.4
Bottom Height (m)	0	0	0
Canopy Cover (%)	27	75	54
AFD (%)	23	56	33
Stratum 4			
Life-form	Sedges	Sedges	Sedges
Top Height (m)	0.1	0.3	0.1
Bottom Height (m)	0	0	0
Canopy Cover (%)	3	5	3

Note: AFD = Average Foliage Density.

Vegetation at Jandakot Airport is of similar height range in Stratum 1, but is generally denser (higher Canopy Cover) than at Melaleuca Park. Average Foliage Density (AFD) of Stratum 1 is comparable in both sites. Stratum 2 vegetation at Jandakot Airport is of similar height to Melaleuca Park, but is, again, with a higher Canopy Cover and higher AFD.

Stratum 3 is again comparable in height between Jandakot Airport and Melaleuca Park. Canopy Cover and AFD are also similar. At Jandakot Airport, a fourth stratum is present whereas it is absent at Melaleuca Park. It is, however, poorly developed, reaching 5% Canopy Cover only on mid-slopes. It is dominated by sparse, wiry sedges.

In summary, therefore, the vegetation of the two areas, Jandakot Airport and Melaleuca Park, is basically similar, but at Jandakot Airport it is denser. This higher level of total cover may decrease soil temperature and hence increase moisture retention. Perhaps these conditions have favoured the development of the sparse sedge stratum in the understorey at Jandakot Airport while it is absent at Melaleuca Park. It is believed that the vegetation of Melaleuca Park and Jandakot Airport is sufficiently similar to be useful for comparison in this study.

3.2.1.2 Dune Systems on Jandakot Airport

Within Jandakot Airport, the dune vegetation physiognomy may be summarised by Study Block (Table 4). The life form and other characteristics of Stratum 1 are similar in all blocks, although Blocks A and B had slightly greater development of Canopy Cover in Stratum 1. Block D contained some of the tallest trees.

A similar situation was found in Stratum 2, except that Blocks C and D had the highest Canopy Covers and highest AFD ratings. In Stratum 3 the Canopy Covers and AFDs were reversed, with Blocks A and B being densest in both features. This is normal, as a sparser middle stratum allows more light penetration and less competition for moisture. This allows a better development of Stratum 3. In Blocks C and D, the converse is true, demonstrating the role of Stratum 2 density in determining degree of Stratum 3 development. Stratum 4 was poorly developed in all blocks.

TABLE 4

SUMMARY OF WHOLE OF DUNE VEGETATION PHYSIOGNOMY BY STUDY BLOCK AT JANDAKOT AIRPORT

CHARACTER	AIRPORT BLOCK			
	A	B	C	D
Stratum 1				
Life-form	Trees	Trees	Trees	Trees
Top Height (m)	7.6	6.8	6.7	8
Bottom Height (m)	3.2	3	2.7	2.8
Canopy Cover (%)	51	57	35	37
AFD (%)	73	58	53	52
Health Rating (0 to 5)	4.8	4.6	4.5	5
Stratum 2				
Life-form	Shrubs	Shrubs	Shrubs	Shrubs
Top Height (m)	1.6	1.8	1.8	1.7
Bottom Height (m)	0.3	0.3	0.4	0.2
Canopy Cover (%)	18	24	51	48
AFD (%)	15	21	34	43
Health Rating(0 to 5)	5	4	4	5
Stratum 3				
Life-form	Shrubs	Shrubs	Shrubs	Shrubs
Top Height (m)	0.6	0.4	0.4	0.4
Bottom Height (m)	0	0	0	0
Canopy Cover (%)	70	50	46	39
AFD (%)	59	41	40	21
Health Rating (0 to 5)	5	3	4	4
Stratum 4				
Life-form	Sedges	Sedges	Sedges	Sedges
Top Height (m)	0.2	0.1	0.2	0.1
Bottom Height (m)	0	0	0	0
Canopy Cover (%)	4	6	2	2
Health Rating (0 to 5)	5	2	3	2

Note: AFD = Average Foliage Density.

3.2.2 Damplands

A major portion of the wetlands (i.e. those habitats where water lies above the surface in winter) on the Swan Coastal Plain has been lost to draining, landfill, housing, and other human activities. Many damplands, some of which contain similar species to the wetlands, have had a similar fate. The remaining damplands (and wetlands) are, therefore, becoming of increasing conservation value. This was recognised by the FAC when it designated conservation areas on the Airport in 1986. The importance of remnant damplands has also been recognised in the present study, and this is dealt with separately from the widespread dune vegetation.

McArthur and Mattiske (1985) recognise two types of seasonal swamp and poorly drained depression in the Bassendean Dune System: Joel (Type J) and Seasonal Swamp (Ws). The two types of vegetation differ markedly. Ws vegetation has reeds and sedges in the centre of the depression, which has free water during winter (i.e. a wetland). On the other hand, Joel "swamps" are less reedy and may simply be low-lying heathlands or woodlands. It is this latter type that is represented on Jandakot Airport; there are no Seasonal Swamps.

Another feature of Joel damplands (they cannot accurately be called wetlands as they are rarely, if ever, wet) is that the vegetation within them is highly variable spatially, usually because of minor variations in topography. This is noted by Muir (1983) who stated in reference to Melaleuca Park:

> "Deep swamps of small area all have a similar sequence of ecotone, *Melaleuca preissiana* and *Astartea fascicularis* passing into *Pultenaea reticulata* then passing into woodland...."
>
> "Broad shallow swamps, in contrast, provide a greater number of subtle variations in soil and drainage....Swamps of this type tend to have dominants or co-dominants not found elsewhere [in the deep swamps] such as *Eucalyptus rudis* in Stratum 1...."

The successional sequence of vegetation bands, such as those mentioned above for true wetlands, do not occur in any of the Jandakot Airport damplands. Some species do, however, occur in common. It is thus with difficulty that the damplands of Jandakot Airport are defined, even with the use of indicator species. For example, if the dampland species *Melaleuca preissiana*, *Pericalymma ellipticum* and *Eucalyptus rudis* are used as indicator species, the results are as listed in Table 5. If the physiognomic structure of the groups of sites defined, using these three indicator species by presence or dominance, is then examined, results are as shown in Table 6.

Having arrived at these two very different definitions of damplands, the physiognomy of the sites represented in both definitions can be compared (Table 6).

TABLE 6

SUMMARY OF VEGETATION PHYSIOGNOMY OF DAMPLANDS AT JANDAKOT AIRPORT

CHARACTER	DAMPLANDS DEFINED BY THE PRESENCE OF	
	KEY SPECIES REGARDLESS OF DOMINANCE	KEY SPECIES AS DOMINANTS
Stratum 1		
Life-form	Trees	Trees
Top Height (m)	8.4	8.2
Bottom Height (m)	2.8	2.4
Canopy Cover (%)	51.4	43.6
AFD (%)	60.3	61.4
Health Rating (0 to 5)	4.8	4.9
Stratum 2		
Life-form	Shrubs	Shrubs
Top Height (m)	1.7	1.4
Bottom Height (m)	0.38	0
Canopy Cover (%)	50.7	54.3
AFD (%)	27.4	30
Health Rating (0 to 5)	4.4	4.3
Stratum 3 (where present)		
Life-form	Sedges & Shrubs	Mostly absent
Top Height (m)	0.4	0.2
Bottom Height (m)	0	0
Canopy Cover (%)	32.8	12.9
AFD (%)	25.9	5.7
Health Rating (0 to 5)	5	5.7
Stratum 4	Stratum 4 is mostly absent in the damplands	Absent

Note : AFD = Average Foliage Density.

The data in Table 6 shows that, with either definition, there are close similarities in Strata 1 and 2. A third stratum is mostly absent where the key species are dominant or, where it is present, is sparse (13% Canopy Cover and 6% AFD). Stratum 4 is absent. By contrast, in

the more broadly defined damplands, shrubs and sedges frequently form a third and fourth (sparse) strata. Canopy Cover is higher (33%) as is AFD (26%). This is a consequence of the heathy third stratum of the dune woodlands being present, despite the presence of the dampland indicator species.

3.3 FLORISTICS

3.3.1 Floristic Assemblage and Distribution

Floristics of the various parts of the Airport land were examined to determine if there were any particularly rich areas not included in the proposed conservation zones.

To undertake a complete floristic audit of Jandakot Airport would take many years. The approach in the present analysis, therefore, is to examine the presence and distribution of a group of key species, some being common and others scarce. These key species are then supplemented with any other species, such as structure-modifying perennials or unusual species, found during the surveys. Selection of the key species was based on Melaleuca Park data (Muir, 1983). These key species are listed in Appendix B, together with the reason for their specific inclusion in the present survey.

A total of 145 species (including 35 key taxa) was surveyed during the present study. Results recorded by site are presented in Appendix C.

The number of species in each site can be summarised by topographic distribution from dune crests to damplands (refer Section 3.1). Results of this evaluation are presented in Table 7.

TABLE 7

SURVEYED SPECIES - DISTRIBUTION IN SITES BY TOPOGRAPHIC POSITION

TOPOGRAPHIC POSITION	MEAN NO. SPECIES	STANDARD DEVIATION	MAXIMUM NO. SPECIES RECORDED	MINIMUM NO. SPECIES RECORDED	NUMBER OF SITES
Crest of Dune	50	24	83	10	15
Mid-slope	41	21	74	13	54
Lower Slope	34	21	75	18	67
Dampland	34	21	65	5	10

The floristically richest habitats were the dune crests and mid-slopes, with a mean of 50, and 41 species in each sample site. This equates to about 0.8-1 surveyed species/m^2. The

lower slopes and dampland were the same in species number (34) per sample site, equivalent to about 0.7 species/m^2, not greatly different from the mid-slopes and crests.
It is of note that, in dampland sites with the least number of species (C34 and D38 respectively), seven species, *Banksia ilicifolia*, *Burchardia umbellata*, *Kunzea ericifolia*, *Leucopogon conostephioides*, *Melaleuca preissiana*, *Neurachne* sp and *Regelia inops*, were also found on lower, or even mid-slopes. Only one species was typically dampland flora; *Pericalymma ellipticum*.

This suggests that the damplands are simply slightly damper habitats than the lower slopes. They contain very few species of typical wetland nature, and cannot be considered wetlands in accordance with the definition applied by the Environmental Protection Authority (EPA, 1991) (Swan Coastal Plains Wetland Policy).

Distribution of species by Airport Block is summarised in Table 8, together with the proportion in sites in each topographic position.

TABLE 8

DISTRIBUTION OF SPECIES BY AIRPORT BLOCK

		MEAN NUMBER OF SPECIES IN EACH HABITAT TYPE			
BLOCK	MEAN NO. SPECIES	CREST	MID-SLOPE	LOWLAND	DAMPLAND
A	21	20	22	21	0
B	31	63	30	30	28
C	38	29	39	42	29
D	52	65	61	40	45

Overall, Block D is the richest floristically. This is probably explained by:

- the best representation of all topographic position types (crest, mid-slope, lowland and dampland) in Block D;
- the presence of sites with a peaty 'A' Horizon in Block D, i.e., the better representation of soil types; and
- the better representation of east-facing and west-facing sites in Block D (and C).

Blocks B and D had the best representation of dune crest species, and Block D the best representation of mid-slope species and dampland species. The other locations and blocks had similar numbers, except that Block A had a very poor representation of dampland species.

When the mean numbers of species per site is calculated to provide an estimate of species richness per block, results are as in Table 9.

TABLE 9

AVERAGE NUMBER OF SPECIES AND SMPs * BY BLOCK

BLOCK	SPECIES PER BLOCK	SMPs PER BLOCK	RATIO SMPs TO TOTAL SPECIES
A	21	20	0.95
B	31	16	0.52
C	38	17	0.45
D	52	15	0.29

Note: * = Structure-modifying Perennials - defined in Section 2.5.2.

There is little difference in species richness between Airport Blocks, although Blocks C and D (especially D) are slightly richer. Table 9 also gives the mean number of Structure-modifying Perennials (SMPs) per site. Block A has the most SMPs per site, with the other blocks having slightly lower but similar numbers.

The number of SMPs can then be considered as a proportion of total species. This number gives an impression of the relative significance of SMPs in the habitat. In Block A, almost all species were SMPs, indicating a homogeneous habitat type. In Block D, by contrast, the proportion of SMPs was small, indicating a basic habitat type with a considerable amount of localised structural modifications. These modifications would greatly increase the structural variation within the habitat and make it much more useful for fauna (refer Sections 2.5.2 and 2.5.3).

These findings can then be compared with the data in Table 10. Firstly, seedlings or sapling trees are scarce in all blocks, but especially Blocks C and D. This suggests that natural regeneration is subdued, but that sufficient is occurring to maintain the woodland in the long-term. The amount which is occurring is less in Blocks C and D, suggesting that they are, perhaps, more advanced in the post-fire succession. This is not reflected in the fire ages based on data provided by the FAC (presented for each site in Appendix A), but Blocks C and D have more lowland and dampland habitats, and successional development may be a little faster in these moister habitats.

TABLE 10

REGENERATION AND SPATIAL ORGANISATION

BLOCK	ABUNDANCE OF SEEDLINGS SAPLINGS	SPATIAL ORGANISATION	MEAN HORIZONTAL VIEW DISTANCE (m)
A	1.4	17 mostly patchy	95
B	1.5	10 mostly patchy	65
C	0.7	0 mostly continuous	53
D	0.9	17 mostly patchy	106

Table 10 also shows that the degree of patchiness (spatial organisation) within the habitat was similar in Blocks A, B and D, and mostly continuous in Block C. Similarly, horizontal view distance at 1.5 m above the ground was similar in Blocks A and D, slightly less in B, and least in C. These data contrast with those discussed above for the ratio of SMPs to total species. The SMP ratio indicates a high level of variability at the species scale in Block D, and the spatial organisation and view distance data indicates a low level of variability in Block D at the gross structural scale.

3.3.2 Homogeneity

Milewski and Davidge (1981) suggested that their primary study site of 1 ha appeared to represent a single plant community. This was determined from a species-area curve which rapidly reached a plateau after only 10 or 15 of their 2 m^2 plots. They decided that the very small variations in floristic composition may have been attributed to chance occurrence of locally scarce species in certain parts of the site.

This procedure has been reproduced using study sites (Figure 4). Similar results were found, with a plateau being reached after only about 8-10 sites, regardless of which group of sites was used. Cumulative species numbers then remained more or less constant until a significant change in habitat type was encountered. The example in Figure 4, uses the first few sites in Block A. Minor fluctuations occurred between groups of sites and between blocks, but the pattern was similar throughout. After crossing a major habitat, boundary numbers jumped, then rapidly stabilised again.

This result demonstrates that the extreme homogeneity of dune habitat mentioned by Milewski and Davidge is widespread throughout the bushland of Jandakot Airport, even at a larger scale.

3.3.3 Rare Flora

A full discussion of the term "Rare Flora" is presented in the Draft EIS (Dames and Moore, 1993) and will not be repeated here.

Previous studies at Jandakot Airport by Milewski and Davidge (1981), Martinick and Associates (1989, 1990), and Weston (1990, 1992), recorded only three significant flora species on the Airport. These species were:

- *Lysinema elegans* - a Priority 2 species;
- *Phlebocarya filifolia* - a Priority 3 species; and
- *Conostephium minus* - a Priority 3 species.

The definitions of Priority 2 and 3 species supplied by the Department of Conservation and Land Management (CALM) are:

- Priority 2 - known from only a few populations, but not believed to be under immediate threat; and
- Priority 3 - known from several populations, some of which are not under immediate threat.

Of the above-mentioned three species, it is of note that Weston (1990, 1992), in the most recent previous surveys, failed to re-locate *Conostephium minus* which had been recorded by Martinick and Associates. The present intensive survey also failed to find *C. minus* but *C. pendulum*, a very similar and highly variable species, was common and widespread. It is believed that the records of *C. minus* may have been in error.

Further, *Phlebocarya filifolia* has been removed from the Priority species list since Weston's (1990) survey. It has now been found to be widespread on the Swan Coastal Plain. The location of the original record of this species has been left in Figure 3 for reference.

The present survey concentrated on finding the species listed in Table 11, although any species not readily recognised in the field was collected and identified in the Western Australian Herbarium.

TABLE 11

SIGNIFICANT FLORA WHICH MIGHT OCCUR ON JANDAKOT AIRPORT

SPECIES	KNOWN POPULATIONS	KNOWN HABITAT	FLOWERING TIME
Aponogeton hexatepalus	Kenwick, Gosnells, Waterloo, Boyanup, Kirup	Submerged in claypans with mud substrates	Aug-Sep
Caladenia huegelii	Bullfinch, Leeming, Canning Vale, Jandakot, Yallingup, Ellenbrook	Amongst *Eucalyptus marginata* and *Allocasuarina fraseriana* on the edge of damplands and wetlands	Aug-Oct
Cartonema phylidroides	Midland, Harvey, Guildford, Maida Vale, Busselton, Bullsbrook, Pinjar, Kalbarri, Ellenbrook	Banksia woodland on deep white sand	Oct-Jan
Conostephium minus	Malaga, Beechboro, Dandaragan, Gnangara, Guildford, Belmont, Moore River, Forrestdale, Gingin, Yanchep	Banksia woodland on deep white sand	Jul-Sep
Diuris drummondii	Peel Estate, Manjimup	*Melaleuca raphiophylla* and *Eucalyptus rudis* dominated wetlands	Nov-Dec
Diuris micrantha	Jandakot	Amongst sedges in winter-wet swamps	Sep-Oct
Diuris purdiei	Kooljerrenup Nature Reserve	Amongst *Acacia pulchella* and *Hypocalymma angustifolium* in wetland	Sep-Oct
Dodonea hackettiana	Bibra Lake, Murdoch University, Lancelin, Kings Park	With *Dryandra floribunda* on limestone	July-Oct
Drakea elastica	Hopelands, Capel, Ravenswood, Pinjarra, Yanchep	Damplands	Oct-Nov
Drakea micrantha	Albany, Pinjarra, Mt Lindsay, Brunswick Junction, Porongorups, Forrestdale, Nannup, Canning Vale	*Banksia* and *Allocasuarina fraseriana* woodland on deep white sand	Sep-Oct
Dryandra mimica	Wicher Range, Wattle Grove, Mogumber, Orange Grove	Banksia woodland on deep white sand	Sep-Nov
Hydrocotyle lemnoides	Bolgart, Dobendery Swamp, Kenwick, Ellenbrook	Wetlands, floating under dense shrubs on sandy clay substrates	May-Oct
Lysinema elegans	Jandakot, Moore River National Park, Thomsons Lake Nature Reserve	Banksia woodland on deep white sand	Oct-Nov
Stylidium utricularioides	Serpentine, Armadale, Mundijong, Gosnells, Wattle Grove, Maddington	*Pericalymma* and *Hypocalymma* dampland	Oct-Dec

The searches for rare or significant flora failed to locate any species not previously found. The *Lysinema elegans* population (about 15 plants) was re-found. All are growing on a steep, artificial sandy cutting. None were found in undisturbed bushland.

With respect to the ephemeral orchids, a total of 11 species were found, none of which was amongst the Rare or Priority species, or was even relatively scarce.

To examine the possibility that the present survey may have failed to find significant flora because the flowering season was unusually early or late, a comparison was made of the present field study time to existing flowering data. Muir (Melaleuca Park) in June 1976 to February 1977, and Milewski and Davidge at Jandakot Airport in March 1977 to February 1979, collected flowering data. These were summarised and used for comparison. Results are presented in Appendix D.

Results suggest that the present survey may have been marginally early. However, the presence of 11 species of ephemeral orchids, plus the general acceptance by botanists at the Western Australian Herbarium (pers. comms.) that it had been an early season, suggests that most of the important ephemeral species should have been flowering if they were present.

3.3.4 Weeds and Dieback

Weeds and dieback data are summarised in Table 12. Introduced grasses, especially *Briza* spp and *Gladiolus caryophyllaceus*, are the commonest weeds. Levels of weed invasion in the bushland are low throughout the Airport.

TABLE 12

WEEDS AND DIEBACK DISEASE

BLOCK	DOMINANT WEEDS	LEVEL OF DOMINANCE	DIEBACK INFECTION	NUMBER OF INFECTED SITES
A	Grass *Gladiolus*	0.09	0.83	12
B	Grass	0.03	0.45	5
C	None	0.04	0.21	7
D	*Gladiolus*	0.4	0.23	6

The blocks with the greatest degree of weed invasion are Blocks A and D as these border Hope Road. Most of the weeds in Block D are on the northern side in the heavily disturbed areas of *Eucalyptus rudis* woodland around Sites D33, D35, etc.

Dieback infection is greatest in Block A (12 sites, mean level of infection 0.83) and least in Blocks C and D. Block B has least infected sites (five), but one is severe.

3.4 FAUNAL HABITAT FEATURES

3.4.1 Fauna Scores and RHAS Totals

The faunal habitat evaluation was based on the availability of key habitat features. Several of these have already been discussed as part of the vegetation evaluation. Other features were the availability of hollow limbs and trunks, abundance of observed bird nests, invertebrate burrows and mammal diggings, etc., as listed in Appendix A, and discussed in Section 2.5.3. Each of these features was scored for abundance with 0 being absent and 5 being most abundant.

Score averages, for all 13 features, on a block by block basis were as follows:

BLOCK A	15.8
BLOCK B	11.4
BLOCK C	11.8
BLOCK D	13.1

Block A has the highest and Blocks B and C the lowest values. Block D is of intermediate value, although all are much the same. Differences between blocks, based on habitat characteristics appear to be minor.

Total RHAS evaluation (based on the nine habitat features which varied between sites), plus the fauna scores, were summed to provide a total score for each site. These, presented as a mean total for each block, were:

BLOCK A	140
BLOCK B	143
BLOCK C	122
BLOCK D	155

There was not a great variation between blocks, but Block C was the poorest, Blocks A and B intermediate, and Block D, the highest in value.

The total RHAS scores for each site were plotted on a map of the Airport. The result is presented in Figure 5, with the scores clustered for simplicity as described in Section 2.5.2. Figure 5 visually illustrates the relative homogeneity of habitat values over the Airport, with very few distinguishing clusters of either high, or low, numbers.

Most of the Airport has scores of 2-4 (i.e. not exceptionally high in value or low in value). This again reflects the overall homogeneity of the habitat. An attempt has been made to distinguish the more obvious clusters and these are numbered on Figure 5. They are discussed below.

- Cluster 1 - an area of quite high habitat value. It is, however, located between Ken Hurst Park, which is highly degraded in terms of environmental condition, the railway line, and existing developments. Its long-term viability is in question, even without further development.
- Cluster 2 - an area of moderate to high value, but again surrounded on three sides by extensive disturbance.
- Cluster 3 - scores for this cluster are artificially low because of recent fire. When restoration is complete, this cluster is expected to have values similar to those of the land immediately to the west. Clusters 2 and 3 combined form a substantial area of moderately high value.
- Cluster 4 - an area of post-clearing regrowth and adjacent disturbed land. It is of limited long-term value.
- Cluster 5 - an area of moderately high conservation value but which has some areas of very low value, several adjacent areas of cleared or degraded land, and which is dissected by Hope Road. Its long-term value is questionable.
- Cluster 6 - an area of degraded land resulting from clearing, grazing, and adjacent disturbance.
- Cluster 7 - an area of degraded land resulting from adjacent disturbance.
- Cluster 8 - a small area of high value on the tall dune.
- Cluster 9 - dieback infected dampland.
- Cluster 10 - an area of quite high value on high dunes.
- Cluster 11- scores for this cluster are artificially low because of recent fire. When restoration is complete, this cluster is expected to have values similar to those of Cluster 10.
- Cluster 12 - an area of damplands of moderate to low value.

3.4.2 Carnaby's Cockatoo

Concern has been raised as to whether Carnaby's Cockatoo (*Calyptorhynchus latirostris*) may have some dependence on the Airport bushland. This species, and Baudin's Cockatoo

(*C. baudinii*) are listed under Schedule 2 - in need of special protection - under the Wildlife Conservation Act 1950.

Both Carnaby's and Baudin's Cockatoos are White-tailed Black Cockatoos, and difficult to distinguish from each other without close observation. The main difference is in the size of the upper mandible of the bill, that of Carnaby's Cockatoo being shorter than that of Baudin's Cockatoo.

The possible presence of Carnaby's Cockatoo on the Airport was recorded by Martinick (1990). The presence of one of the two species was also recorded during the present survey, in very low numbers, from isolated, distant calls heard on two occasions in the vicinity of Block D. It was not possible to determine from the call which species was present. However, it is extremely unlikely the species heard at the Airport during this study was *C. baudinii*, as the habitat is unsuitable (D. Saunders, CSIRO, pers. comm.). The species *C. baudinii* is found in humid and sub-humid forests of south-west Western Australia. It is considered, therefore, that the species heard was *C. latirostris*, as also reported by Martinick (*ibid.*)

Though not rare, Carnaby's Cockatoo is vulnerable. In the late 1960's Carnaby's Cockatoo was observed in huge numbers of over 3,000 near Jandakot, but since then its numbers have been declining as its breeding area north of Perth shrinks due to clearing. Over one third of its total breeding range is now gone (D. Saunders, pers. comm.).

Carnaby's Cockatoo breeds in drier areas north of Perth in the Hill River area, 120 kms north, and Manmanning, 100 kms to the north-east (Saunders, 1980). It does not breed in the Jandakot area.

At the end of the breeding season, the birds move to moister areas particularly with pine plantations (D. Saunders, pers. comm.). Birds from the Hill River area tend to wander locally within 50 km of the breeding area. Birds from Manmanning, by contrast, migrate to the coast where they feed on seeds of plants of the Proteaceae family, as well as Marri (*Eucalyptus calophylla*) and *Pinus* spp. Pine plantations north of Perth at Yanchep, Pinjar and Gnangara are especially favoured (Saunders, 1980).

Jandakot Airport, therefore, is not important to Carnaby's Cockatoo for breeding. The Airport's Banksia woodlands are, however, a seasonal summer/autumn foraging area, along with remaining pine plantations a short distance away at Murdoch. The species is then likely to be present in large numbers, but vagrant birds may be present at any time. As housing development increases around the Airport, the area of surrounding Banksia woodland decreases, thus increasing the value of the Banksia woodland on the Airport for Carnaby's Cockatoo (D. Saunders, pers. comm.).

3.4.3 Brown Bandicoot

The Brown Bandicoot (*Isoodon obesulus*) has been listed in the Western Australian Government list of Gazetted Rare Mammals. The inclusion is an error in that, while it is accepted that the Bandicoot is now rare or scarce in the Perth metropolitan area, it is very common elsewhere in the south-west of the State and reaches pest numbers in some areas. The inclusion was intended to indicate only the Perth metropolitan area, but this refinement was accidentally omitted when the list was prepared. Consequently, one of south-west Western Australia's most common animals is now listed as Rare and is causing some public concern as hundreds of private properties now are considered to harbour a Rare mammal.

Due to this unfortunate gazettal, the Brown Bandicoot has adopted an unwarranted value at Jandakot Airport. It is known to be common and frequently comes into buildings, is seen on Airport lawns, and is treated as a pet by some Airport employees.

Nonetheless, an evaluation of the abundance of diggings, which are believed to be primarily bandicoots in most locations (rather than rabbits) is as follows:

BLOCK A	2.4
BLOCK B	1.8
BLOCK C	1.7
BLOCK D	1.9

Despite the highly dubious nature of estimating abundance of animals by abundance of diggings (refer Section 2.5.3), it is a widely used method. By using this method, it would appear from the observations that Block A had the greatest numbers, with the other blocks somewhat similar, but with slightly fewer, numbers. This probably reflects the vegetation characteristics in Block A, which earlier observations (Sections 3.2 and 3.3) showed were somewhat sparser in character than the other blocks.

What is apparent, however, is that none of the blocks is outstanding in the abundance of diggings. The presence of large numbers of foxes on the Airport does not seem to be limiting Bandicoot numbers, probably because Bandicoots are so abundant there.

3.4.4 Numbat

Hairs attributed to Numbat (*Myrmecobius fasciatus*) were recorded by Martinick (1990) in a hollow log at a site near the present Sites D40 or D44. At the time of the present survey, both sites had been recently burned, and no hollow logs (or any logs) remained.

C40

C44 D

The mean qualitative value of large hollow logs, on which Numbat are moderately dependant, for each block was:

BLOCK A	0.17
BLOCK B	0.21
BLOCK C	0.38
BLOCK D	0.6

Thus, all scored well below a value of 1 (very few) and in most sites, logs of any size were entirely absent. This is to be expected as *Banksia* species do not form hollow logs very often. Eucalypt trees are few in number on the Airport and nowhere form a habitat likely to be of significance to Numbat.

In addition, fox burrows showing recent signs of activity were observed in sites A10, A20, D22, D29 and D38. Fox tracks were sighted on almost every firebreak on the Airport, and three foxes were seen in daylight during the course of the study. This is believed to indicate a high number of foxes present on the Airport and, as foxes are believed to predate on the Numbat, it is suggested that the likelihood of Numbat being on the Airport is very low.

3.4.5 Bird Populations

The results of bird surveys in each of the Jandakot Airport Blocks are presented in Appendix E and summarised in Table 13.

TABLE 13

BIRD SPECIES AND ABUNDANCE BY AIRPORT BLOCK

	BLOCK A	BLOCK B	BLOCK C	BLOCK D	ALL JANDAKOT AIRPORT
Numbers of All Species	18	27	22	30	39
Numbers of All Individuals	106	124	129	139	499
Numbers of Resident Species	12	16	14	19	20
Numbers of Resident Individuals	73	85	108	108	376

In terms of total number of all species, i.e. resident, migratory, nomadic, etc., numbers did not differ greatly between blocks. If the data are taken at face value, i.e. not accounting for the difficulties of surveying a mobile, cryptic fauna, it would appear that Block A is poorest in species, Block D richest, and Blocks B and C intermediate, with B slightly richer.

If number of individuals is compared, then again, Block A has the least number recorded, Block D the most, and B and C intermediate, with C having a few more individuals recorded.

Results of repeating these analyses using only resident species, i.e. those most likely to be affected by habitat disturbance, are also presented in Table 13. Block A had the least number of resident species, and Block D the most. Blocks B and C were intermediate with Block B being slightly richer. A comparison of numbers of individuals, while being less reliable, shows Block A as poorest, Blocks C and D equal best, and Block B fairly poor.

Based on these data, there seems to be substantial evidence that, in terms of bird populations, Block A is depauperate. Block D appears to be the best, although Block B also has considerable value.

To test this hypothesis, an analysis was made of the numbers of all birds, of resident birds, and of individuals, against topographic position alone. Topographic position is known to be a key determinant for vegetation. It could be expected that birds, being mobile (even the resident species), might not be closely tied to topography as a sole determinant of local distribution. If there was a close tie to topographic position it is probably reasonable to hypothesise that other habitat characteristics, themselves tied to topographic position, might be in play, rather than the topography itself. Results of the analysis are presented in Table 14.

TABLE 14

BIRD SPECIES AND ABUNDANCE BY TOPOGRAPHIC POSITION

	CREST	MID-SLOPE	LOWLAND	DAMPLAND
Numbers of All Species	19	19	35	15
Numbers of All Individuals	89	81	270-280	49
Numbers of Resident Species	14	13	19	9
Number of Resident Individuals	65	58	217	36

The data suggests that :

- lowlands were much richer in total species and higher in number of individuals than any other topographic type;
- damplands were exceptionally depauperate both in species and numbers of individuals;
- numbers of resident species had a less clear distinction in the dryland habitats although lowlands were a little richer. Perhaps this is because resident species may, by necessity, occupy habitats less favourable than the lowlands. Based on number of resident individuals, the data suggests that the ability of the habitat to sustain large numbers is much greater in lowlands; and
- again, damplands were exceptionally poor in resident species and numbers of individuals.

In conclusion it is argued that, based on available bird data, Block A has the least conservation value, and Block D the greatest. Block B is also significant, although less so than Block D.

Further, it appears that lowlands are by far the most important bird habitats, and that damplands are significantly depauperate in bird species and number of individuals.

The data also supports the conclusions independently reached by the RHAS analysis.

3.4.6 Rare or Significant Bird Species

The only Rare or significant bird species recorded during this study was Carnaby's' Cockatoo (*Calyptorhynchus latirostris*). Isolated calls were heard on two occasions in the vicinity of Block D. This species is included in Schedule 2 - in need of special protection - under the Wildlife Conservation Act 1950 (see Section 3.4.2).

3.4.7 Comparison with Previous Surveys

Martinick and Associates (1990) recorded 46 species of birds on Jandakot Airport, and the present survey recorded 40 species on the Airport. The Martinick and Associates survey was carried out on a number (unspecified) of site visits between July and December 1989. The present study was carried out on 1, 3, 9 and 10 September, 1993.

Of the 46 species recorded by Martinick and Associates (*ibid.*), 13 species were not recorded in the present survey. These were: Collared Sparrowhawk (*Accipiter cirrocephalus*); Wedge-tailed Eagle (*Aquila audax*); Pallid Cuckoo (*Cuculus pallidus*); Laughing Kookaburra (*Dacelo gigas*); Rainbow Bee-eater (*Merops ornatus*); Tree Martin (*Hirundo*

nigricans); White-winged Triller (*Lalage sueurii*); Weebill (*Smicrornis brevirostris*); Broad-tailed Thornbill (*Acanthiza apicalis*); Yellow-rumped Thornbill (*Acanthiza chrysorrhoa*); Spotted Scrubwren (named White-browed Scrub-wren in Storr and Johnstone, 1979) (*Sericornis frontalis*); Little Wattlebird (*Anthochaera chrysoptera*); and Dusky Woodswallow (*Artamus cyanopterus*).

The present survey recorded six species not recorded by Martinick and Associates. These were: Sacred Ibis (*Threskiornis aethiopicus*); Mountain Duck (*Tadorna tadornoides*); Marsh Harrier (*Circus aeruginosus*); Silver Gull (*Larus novaehollandiae*); *Neophema* sp (parrot); and Fan-tailed Cuckoo (*Cuculus flabelliformis*).

The difference between the two bird lists almost certainly reflects differences in study intensity, weather conditions, and time of year.

3.4.8 Comparison with Areas Outside the Airport

Examination of Sites E to H outside the Airport (Figure 6) on 14 September 1993 was, by necessity, much briefer and less intensive than that undertaken within the Airport. A total of 20 species was recorded, of which 18 were also found on Airport land, except for Pallid Cuckoo and Laughing Kookaburra which were recorded outside, but not within, the Airport (see Section 3.4.7).

3.5 CONSERVATION VALUE BASED ON VEGETATION DATA

The conservation value of each Airport block can be estimated by summarising the 25 vegetation characteristics of the environment where a distinction between blocks was possible. These characteristics are summarised in Table 15. Also presented is an evaluation, based on previous discussion, of whether each characteristic was considered to be very poor, poor, moderate, good, or very good in each block. To evaluate these opinions semi-quantitively, each value was scored, with very poor getting the lowest score (1), and very good, the highest (5). The scores were then summed to arrive at a value for the block as a whole.

Based on this method, subjective as it is, it was apparent that Block D had the highest conservation value, followed by Blocks B and C. Block A had the least value.

TABLE 15

SUMMARY OF CONSERVATION VALUE BASED ON VEGETATION DATA

	AIRPORT BLOCK AND SCORES							
CHARACTERISTIC	A	SCORE	B	SCORE	C	SCORE	D	SCORE
Representation of topographic positions	Poor	2	Poor	2	Good	4	V.Good	5
Representation of various soil drainage characteristics	Poor	2	Mod.	3	Mod.	3	Good	4
Representation of soil profile types	Poor	2	Poor	2	Poor	2	Good	4
Variability in slope	Poor	2	Poor	2	Poor	2	Poor	2
Representation of directional aspects of dune faces	Poor	2	Poor	2	Good	4	Good	4
Degree of stability from erosion	Good	4	Good	4	Good	4	Good	4
Contains tallest trees	Mod.	3	Poor	2	Poor	2	Good	4
Degree of development of Stratum 1	Good	4	Good	4	Poor	2	Poor	2
Degree of development of Stratum 2	Poor	2	Poor	2	Good	4	Good	4
Degree of development of Stratum 3	Good	4	Good	4	Poor	2	Poor	2
Degree of development of Stratum 4	Poor	2	Poor	2	Poor	2	Poor	2
Representation of damplands as defined by all indicator species	V. Poor	1	Good	4	V.Good	5	Mod.	3
Contain *Melaleuca preissiana* dampland	Poor	2	Mod.	3	V.Good	5	Poor	2
Contain *Pericalymma ellipticum* dampland	Poor	2	Good	4	Good	4	Mod.	3
Contain *Eucalyptus rudis* dampland	Poor	2	Mod.	3	Poor	2	V.Good	5
Contains damplands defined by dominance of key species	Poor	2	Poor	2	V.Good	5	Good	4
Greatest number of plant species	Poor	2	Poor	2	Mod.	3	Good	4
Greatest number of species in crest habitats	Poor	2	V.Good	5	Poor	2	V.Good	5
Greatest number of species in mid-slope habitats	Poor	2	Mod.	3	Mod.	3	V.Good	5
Greatest number of species in lowland habitats	Poor	2	Poor	2	Mod.	3	Mod.	3
Greatest number of species in dampland habitats	V. Poor	1	Mod.	3	Mod.	3	Good	4
Species richness (i.e. species number per given area)	Mod.	3	Good	4	Poor	2	Good	4
Abundance of significant flora	V. Poor	1	V. Poor	1	V. Poor	1	V. Poor	1
Ratio of SMPs to total species	Poor	2	Mod.	3	Mod.	3	V.Good	5
Adequacy of natural regeneration	Good	4	Good	4	Mod.	3	Mod.	3
Patchiness of spatial organisation	Good	4	Mod.	3	V. Poor	1	Good	4
Freedom from weed infestation	Poor	2	Mod.	3	Mod.	3	Poor	2
Freedom from dieback disease	V. Poor	1	Mod.	3	Good	4	Good	4
		64		**81**		**83**		**98**

Note: Mod. = Moderate; V. good = Very good; V. poor = Very poor;
1 = Very Poor; 2 = Poor; 3 = Moderate; 4 = Good; 5 = Very Good.

3.6 CONSERVATION VALUE BASED ON FAUNAL DATA

The environmental characteristics of 15 habitat features and results of the field surveys can be summarised to provide a table of conservation features (Table 16).

TABLE 16

SUMMARY OF CONSERVATION VALUE BASED ON FAUNAL HABITAT AND FAUNA DATA

	AIRPORT BLOCKS AND SCORES							
CHARACTERISTIC	A	SCORE	B	SCORE	C	SCORE	D	SCORE
Fauna Score	V. Good	5	Mod.	3	Mod.	3	Good	4
RHAS Score	Mod.	3	Mod.	3	Poor	2	Good	4
Carnaby's Cockatoo Breeding Habitat*	V. Poor	1	V. Poor	1	V. Poor	1	V. Poor	1
Brown Bandicoot Diggings	Good	4	Mod.	3	Mod.	3	Mod.	3
Hollow Logs Suitable for Numbat	V. Poor	1	V. Poor	1	Poor	2	Mod.	3
Total Number of Bird Species	Poor	2	Good	4	Mod.	3	Mod.	3
Total Number of Individuals	Poor	2	Good	4	Mod.	3	Good	4
Number of Resident Bird Species	Poor	2	Mod.	3	Mod.	3	Good	4
Number of Resident Individuals	Poor	2	Poor	2	Good/ Mod.	3	Good	4
		22		**24**		**23**		**30**

Note: Mod. = Moderate; V. Poor = Very Poor.
V. Poor = Very Poor; 1 = Very Poor; 2 = Poor; 3 = Moderate; 4 = Good; 5 = Very Good.
* This feature scores 1 because some large trees are present, but it should be noted that none are suitable for Carnaby's Cockatoo to breed in.

The faunal evaluation scores suggest that Block A has the least conservation value and Block D the most. Blocks B and C were of intermediate value.

3.7 REGIONAL CONTEXT

3.7.1 Introduction

The locations and approximate areas of Banksia woodlands in reserves has been presented in Dames and Moore (1993). These data have again been reviewed and have been found to be as accurate as available information can provide.

The conservation societies have requested additional information on Banksia woodland in the vicinity of Jandakot Airport, and for a structural and floristic comparison with other areas. Partially comparable structural data only exists for a few sites (Melaleuca Park, Whiteman Park (Mussel Pool), Kwinana Freeway, and Ellenbrook), so these locations have been used. Some additional floristic data are also available and have been used (see below). Some sites surrounding the Airport have been described in the same manner as the Airport vegetation using the techniques described herein.

3.7.2 Physiognomy

Comparisons between the vegetation physiognomy of Jandakot Airport and Melaleuca Park have been presented in Tables 2 and 3. Comparisons with Ellenbrook, Whiteman Park (Mussel Pool), and Kwinana Freeway are summarised in Table 17.

TABLE 17

COMPARISON OF DUNE VEGETATION PHYSIOGNOMY AT JANDAKOT AIRPORT WITH OTHER AREAS

	ELLEN-BROOK	WHITEMAN PARK	JANDAKOT AIRPORT	FREEWAY ON SOUTH STREET				JANDAKOT AIRPORT			
CHARACTER	GENERAL	GENERAL	GENERAL	DUNE CRESTS	MID-SLOPES	LOW-LANDS	DAMP-LANDS	DUNE CRESTS	MID-SLOPES	LOW-LANDS	DAMP-LANDS
Stratum 1											
Life-form	Trees	Trees	Trees	Trees	Trees	Trees	Trees	Trees	Trees	Trees	Trees
Dominant spp	*Banksia menzeisii, B. attenuata* + over-canopy of *Eucalyptus calophylla, E. marginata, E. todtiana,*	*Banksia menzeisii, B. attenuata* + over-canopy of *Eucalyptus calophylla, E. marginata, E. todtiana,*	*Banksia attenuata B. menzeisii*	*Banksia attenuata, B. menzeisii*	*Banksia attenuata, B. menzeisii*	*Banksia attenuata, B. ilicifolia*	*Melaleuca preissiana, B. ilicifolia*	*Banksia attenuata, B.menzeisii*	*Banksia attenuata, B. menzeisii*	*Banksia attenuata, B. ilicifolia*	*Melaleuca preissiana, B. ilicifolia*
Top Height (m)	7	7	7	7	8	10		7	7	8	8
Bottom Height (m)			3					3	3	3	2.5
Canopy Cover (%)	10-30	10-30	30-50	10-30	10-30	30-70		28	32	50	45
AFD (%)			54					47	55	60	60
Stratum 2											
Life-form	Shrubs and *Xanthorrhoea preissii*	Shrubs and *Xanthorrhoea preissii*	Shrubs	Shrubs	Shrubs and *Xanthorrhoea preissii*	*Xanthorrhoea preissii*	Shrubs	Shrubs	Shrubs	Shrubs	Shrubs
Dominant spp	*Jacksonia furcellata, Macrozamia reidlei, Xanthorrhoea preissii*	*Jacksonia furcellata*	*Melaleuca thymoides, Jacksonia furcellata*	*Jacksonia furcellata*	*Xanthorrhoea preissii*, mixed	*Xanthorrhoea preissii*	*Regelia* spp	*Jacksonia furcellata*	*Melaleuca thymoides, Jacksonia furcellata*	*Melaleuca thymoides, Jacksonia furcellata*	*Pericalymma ellipticum*
Top Height (m)	2	1	1.6	4	0.5-2	1.5		1.2	2	1.8	1.5
Bottom Height (m)			0.3					0	0.3	0.4	0

TABLE 17 (continued)

	ELLEN-BROOK	WHITEMAN PARK	JANDAKOT AIRPORT	KWINANA FREEWAY ON EASEMENT				JANDAKOT AIRPORT			
CHARACTER	GENERAL	GENERAL	GENERAL	DUNE CRESTS	MID-SLOPES	LOW-LANDS	DAMP-LANDS	DUNE CRESTS	MID-SLOPES	LOW-LANDS	DAMP-LANDS
Canopy Cover (%)	2-80	10-30	30-45	2-10	0-20	2-10		30	30	45	55
AFD (%)			30-35	35	36	29		35	35	30	30
Stratum 3											
Life-form	Shrubs	Shrubs	Shrubs	Shrubs	Shrubs	Shrubs	Shrubs	Shrubs	Shrubs	Shrubs and sedges	Mostly absent
Dominant spp	Mixed	Mixed	Mixed	Mixed	Mixed, *Dasypogon bromiliaefolius*	*Regelia inops*, *Kunzea* sp	*Hypocalymma angustifolium*	Mixed	Mixed	Mixed, *Dasypogon bromiliaefolius*	*Hypocalymma angustifolium*
Top Height (m)	0.5	0.5	0.5	0.5	0.5	1		0.3	0.6	0.4	0.2
Bottom Height (m)			0	0	0	0		0	0	0	0
Canopy Cover (%)	30-70	30-70	30-70	30	2-30	30-70		30	75	54	15
AFD (%)			37					25	55	30	6
Stratum 4 Present ?	No	Yes	Yes	No	No	No	No	Yes	Yes	Yes	No
Characteristics		Sedges	Sedges					Sedges	Sedges	Sedges	

Note: AFD = Average Foliage Density.

The data indicate that Ellenbrook, Whiteman Park and Jandakot are very similar. The exception is that Jandakot has a poorer development of the scattered over-canopy of eucalypts found at the other locations. Life-forms, dominant species, height and Canopy Cover are very similar in all strata.

Similarly, if the actual dune topography is considered, it is again apparent that the vegetation along the Kwinana Freeway (where comparable data are available) and Jandakot Airport have much in common. The Stratum 2 vegetation is denser at Jandakot Airport and there tends to be a fourth stratum of terrestrial sedges except in the damplands.

With regard to areas close to the Airport, a sample of nine locations were selected at random from aerial photographs. These locations were selected on the basis of size, continuity with other undisturbed bushland and ease of access. Locations are shown on Figure 6 and results are summarised in Appendix F.

On field examination it was found that the nine locations included one crest, five mid-slopes, two lowlands and one dampland. A full analysis of all the sites is not presented, but it is apparent from Appendix F that Sites E1 to E3, G1, H1, and I1 are very similar to the Banksia woodlands on Jandakot Airport in all respects.

Site F1 is dominated by *Eucalyptus rudis* and *Melaleuca preissiana* woodland and originally was probably similar to the sites around B28, D34, and D35 on the Airport.

3.7.3 Floristics

The total number of species recorded at Jandakot Airport during this study was 145. Table 18 presents a comparison between Jandakot Airport and other areas.

TABLE 18

FLORISTIC NUMBERS COMPARISON BETWEEN JANDAKOT AIRPORT AND OTHER AREAS

AREA COMPARED	TOTAL NO. OF SPECIES	SPECIES IN COMMON	PERCENTAGE IN COMMON(1)
Melaleuca Park(2)	143	114	78.6
Whiteman Park(3)	142	69	47.6
Kwinana Freeway Easement (South Street to Yangebup Road)(4)	97	60	41.4
University of WA Marsupial Breeding Station (Harry Waring Reserve)(5)	228	100	69
Jandakot Airport south-west corner(6)	122	75	51.7
Jandakot Airport Curtin University Study(7)	85	All	58.6
Jandakot Airport Fauna Study(8)	95	All	65.5

Note: (1) Or proportion of number recorded in present study where all species are in common.
(2) Muir (1993)
(3) Morris and Muir (1976)
(4) Dames and Moore (1987)
(5) Appendix A of Dames and Moore (1987)
(6) Milewski and Davidge (1981)
(7) Unpublished data from Curtin University
(8) Martinick and Associates (1990)

A number of features arise from this comparison. These are:

- Melaleuca Park and Jandakot Airport have about the same number of recorded species;
- about 80% of the Melaleuca Park species are also found at Jandakot Airport, indicating a very high level of floristic similarity.

After intense work at Jandakot in a very small area, Milewski and Davidge recorded 122 species, yet this sample contained only 52% of the number recorded in the present study. This suggests that on a very small scale there can be significant differences in species assemblage. Similar results were recorded by Curtin University (unpublished data) and Martinick and Associates (1990).

At a larger scale (Airport Block) these differences are much less apparent, and each block has (with the partial exception of damplands) very much the same species in common. The comparison of Airport blocks is, therefore, a reasonable basis for the study. Key features of the floristic comparison with areas outside the Airport are:

- there are 69 species in common between Jandakot Airport (Bassendean Dunes) and the University of Western Australia Marsupial Breeding Station (Harry Waring Reserve)

(Spearwood Dunes) and 48% in common with Whiteman Park (a heavily disturbed area on Bassendean Dunes); and

- by comparison with a closer area, e.g. Kwinana Freeway, the number of species in common is only 41% suggesting some localised differences in flora as mentioned by Milewski and Davidge (*ibid*).

It is concluded from these comparisons that, at a very small scale, there are significant differences between species composition of sites on Bassendean Dunes. At a larger scale, say one square kilometre blocks, these differences are much less apparent. At sites of very similar topography and soil type, such as Melaleuca Park, this commonality of species is even greater (80%) even though the sites are 45 km apart.

In terms of the general characteristics of the areas examined outside the Airport, Sites E1 to E3 are very similar in almost all features.

Site F1, a lowland outside the Airport, is very similar to the *Eucalyptus rudis* dominated lowlands around Sites D34 and D35 on the Airport. It has, however, been too frequently burned and the understorey is now almost completely replaced with exotic grasses.

Site F2, outside the Airport, differs from the Airport bushland in that it is dominated by eucalypts (*Eucalyptus marginata*), and the understorey differs both in species composition and the dominance of *Macrozamia reidlei* which is scarce on the Airport. These differences are because Site F2 is on the eastern margin of the Spearwood Dune System and is a little too far west to be truly representative of the Bassendean System, although it contains many of the same species.

Vegetation on Sites G, H and I, outside the Airport, are very similar to the vegetation on the Airport in every way. Site H, for example, even contained a substantial population of *Lysinema elegans*, the only Priority species found on the Airport.

It is concluded that, structurally and floristically, vegetation very closely similar to that at Jandakot Airport is widespread, both near the Airport and as far afield as Melaleuca Park 45 km north of the Airport. There are, at present, no data available to evaluate lands to the south of the Airport, although numerous areas with Banksia woodland exist (Figure 1).

4.0 CONCLUSIONS

From analysis of the data presented herein, there are some generalisations possible, notably:

- **Block A** has lesser overall conservation value because it has less habitat types, almost no damplands, and appears to be floristically poorer. It seems to have an abundance of Brown Bandicoot, but these mammals are equally well represented in all other parts of the Airport. Block A has no outstanding features in terms of faunal habitat, or in number of bird species;

- **Block B**, western side, is similar to Block A and has no particular features of value. There is a small area of higher conservation value just north of the existing developments, but ultimately this will degrade because of the proximity to the existing Airport development and disturbed land to the north.

  On the eastern side of Block B there are good representatives of damplands. Almost all of these are located in the proposed conservation area. There is, unfortunately, a heavy infection of dieback at one location (B17), but careful management can probably prevent this from expanding.

  The burned area precludes detailed evaluation, but the observed structure and floristics suggest it was very similar to areas just to the west of the burn.

  The triangular area right on the junction of Johnston Road and Acourt Road (Site B28) is the only undisturbed stand of *Eucalyptus rudis* woodland on the Airport. It is included in the proposed conservation zone.

  The triangular area in the pocket between the developments and the runways (Site B21) has been cleared and is regrowing. It has limited value until regeneration is complete.

  Block B has intermediate value for fauna;

- **Block C** is fairly homogenous throughout. The extreme eastern corner has been burned and is hard to evaluate, but seems to be very similar to the vegetation in Block A. It probably has less value than the rest of Block C, because of its similarities to Block A.

  The damplands in Block C, like those on the rest of the Airport, are of limited conservation value, both floristically and faunistically, but, nonetheless, are becoming a scarce resource on the Swan Coastal Plain. Block C can be considered typical of the Airport vegetation, but there are no outstanding features.

  Block C has intermediate value for fauna, except that the eastern end may be better than the western end; and

- **Block D** is similar to Block C. However, in its southern parts, it is the floristically richest block, has the best representation of topographic and aspect features, has the most birds, and is the only block in which Carnaby's Cockatoo (*Calyptorhynchus latirostris*) was recorded during this study. The northern side of Block D, adjacent to Hope Road, is badly degraded by past activities and has limited value in the long-term. This is also bounded by Hope Road on the north, developments on the south-east, and heavily degraded land on the west. The value of this northern portion of Block D, in the long-term, must be in doubt.

Based on the data generated in this study it is concluded that:

- **Development Zone 1** (Figure 2) contains remnant Banksia woodland in good condition. While preservation of Banksia woodland *per se* is important, for example as a seasonal feeding area for Carnaby's Cockatoo, Development Zone 1 contains no natural features unique to this Zone. There are several areas of severe disturbance (Figure 3). There is no substantial scientific reason why Development Zone 1 should be preserved in preference to any other area;

- **Development Zone 2** contains remnant Banksia woodland in good condition. It contains no natural features unique to this Zone. There is a cleared area and an adjacent railway line and road which are ongoing sources of disturbance and weeds. There is no substantial scientific reason why Development Zone 2 should be preserved in preference to any other area;

- **Development Zone 3** contains Flooded Gum woodland with a badly degraded and disturbed understorey, and an adjacent commercial development and road which are sources of weeds. There is no substantial reason why it should be preserved other than that Flooded Gum is not well represented elsewhere on the Airport;

- **Development Zone 4** contains remnant Banksia woodland in good condition. It contains a good variety of habitats relative to the rest of the Airport and appears to be rich in flora and fauna species. There is sufficient scientific evidence, based on the present study, to support an argument for its protection as a Conservation Area;

- **Conservation Zone 5a** contains remnant Banksia woodland in good condition and a good variety of dampland types (better than any other part of the Airport). It is surrounded by severely disturbed land, but because of its damplands, should be retained for conservation purposes, although dieback disease management is essential;

- **Conservation Zone 5b** contains remnant Banksia woodland, although not in as good a condition as that in Development Zone 4. It is surrounded on its east and west sides by severely disturbed land. There are no substantial scientific reasons based on the data presented in this report, why Zone 5b should be preserved in preference to any other area. It should be noted, however, that it may provide a partial corridor leading north to Conservation Zone 5a;

- **Conservation Zone 5c** contains remnant Banksia woodland and a variety of dampland types on its southern edge. Some of its values are an eastern extension of those found in Development Area 4 of Block D, and it provides some continuity with Banksia woodlands to the south. It should be retained for conservation purposes; and

- **Sand Mining Area 6** contains remnant Banksia woodland in good condition. It contains no substantial area of dampland, but does include a high dune similar to that in Development Zone 4. This dune system appears to be of some value as fauna habitat. It has severely disturbed areas on the east and south sides. There are no

substantial scientific reasons why it should be preserved in preference to any other area apart from its slightly higher RHAS scores.

The above statements must be taken in context. The available data indicate that Development Zone 4 should be added to the proposed system of conservation areas. No other areas on the Airport are particularly outstanding, perhaps with the exception of Conservation Zone 5a, which has a good representation of damplands. Whether or not any of the other bushland areas, including the conservation zones and Sand Mining Area 6 are expanded, will need to be a socio-political decision. The study also indicates that the already proposed conservation areas contain good representative samples of all the vegetation and habitat types found on the Airport. They also indicate that there are no outstanding conservation features which have been inadvertently omitted in the original FAC zoning plan, perhaps with the exception of the floristically rich Development Zone 4.

5.0 REFERENCES

Barnett, J.L., How, R.A. and Humphreys, W.F. (1978). The Use of Habitat Components by Small Mammals in Eastern Australia. Aust. J. Ecol. 3:277-185.

Beard, J.S. (1979). The Vegetation of the Pinjarra Area, Western Australia. Vegetation Survey of Western Australia. Vegmap Publications: Perth.

Beard, J.S. and Webb, M.J. (1974). Vegetation Survey of Western Australia - Great Sandy Desert. Part 1. Aims, Objectives and Methods. UWA Press: Perth.

Cresswell, I.D. and Bridgewater, P. (1985). Dune Vegetation of the Swan Coastal Plain, Western Australia. J.Roy. Soc. West. Aust. 67:137-148.

Dames and Moore. (1987). Flora and Fauna Study: Kwinana Freeway Extension (South Street to Yangebup Road and Suggestions for Rehabilitation. For Main Roads Dept. Job No. 11795-029-071.

Dames and Moore. (1989). A Study of Corridors for Native Fauna, Ludlow Tuart Forest. Unpubl. rept for Westralian Sands Limited. Job No. 14365-008-071.

Dames and Moore. (1992). Conservation Assessment: Ellenbrook Development. For Ellenbrook Management Pty Ltd. Job No. 21170-001-071.

Dames and Moore. (1993). Draft Environmental Impact Statement: Proposed Additional Developments at Jandakot Airport. For Federal Airports Corp. Job No. 18534-011-363.

Department of Aviation. (1986). Jandakot Airport Master Plan. AGPS: Canberra.

Environmental Protection Authority. (1991). Draft Environmental Protection (Swan Coastal Plain Wetlands) Policy. EPA: Perth.

Havel, J.J. (1968). The Potential of the Northern Swan Coastal Plain for *Pinus pinaster* Ait. Plantations. Bull. For. Dept. West. Aust. 76.

Heddle, E.M., Loneragan, O.W. and Havel, J.J. (1980). Pinjarra Sheet, Vegetation Complexes of the Darling System, Western Australia. In Atlas of Natural Resources Darling System Western Australia. Dept. Conserv. Environ.: Perth.

Kitchener, D.J. (1973). Vertebrate Faunal Survey of the Western Australian Wheatbelt. ANZAAS 45th Congress: Perth. Abstracts: 46.

Kitchener, D.J., Chapman, A., Dell, J., Muir, B.G. and Palmer, M. (1980a). Lizard Assemblage and Reserve Size and Structure in the Western Australian Wheatbelt - Some Implications for Conservation. Biol. Conserv. 17(1):25-62.

Kitchener, D.J., Chapman, A., Muir, B.G. and Palmer, M. (1980b). The Conservation Value for Mammals of Reserves in the Western Australian Wheatbelt. Biol. Conserv. 18(3):179- 208.

Kitchener, D.J., Dell, J., Muir, B.G. and Palmer, M. (1982). Birds in Western Australian Wheatbelt Reserves - Implications for Conservation. Biol. Conserv. 22(2):127-164.

Lamont, B.B. and Downes, S. (1979). The Longevity, Flowering and Fire History of the Grasstrees, *Xanthorrhoea preissii* and *Kingia australis*. J. Appl. Ecol. 16:893-899.

Lemmon, P.E. (1956). A Spherical Densiometer for Estimating Forest Overstorey Density. Forest. Sci. 2:314-320.

Mader, H.J., Schell, C. and Kornacker, P. (1990). Linear Barriers to Arthropod Movements in the Landscape. Biol. Conserv. 54:209-222.

Martinick, W.G. and Associates. (1989). Jandakot Airport Environmental Appraisal. Unpubl. rept for Federal Airports Corp.

Martinick, W.G. and Associates. (1990). Jandakot Airport Fauna Survey. For Federal Airports Corp.

McArthur, W.M. and Mattiske, E.M. (1985). The Gnangara Mound Groundwater Area. Landforms, Soils and Vegetation. Appendix C in Dames and Moore (1986). Gnangara Mound Groundwater Resources ERMP. For Water Authority of WA. Job No. 08076-024-071.

McDonald, R.C., Isbell, R.F., Speight, J.G., Walker, J. and Hopkins, M.S. (1985). Australian Soil and Land Survey Field Handbook. Inkata Press: Melbourne.

Milewski, A.V. and Davidge, C. (1981). The Physical Environment, Floristics and Phenology of a *Banksia* Woodland Near Perth, Western Australia. West. Aust. Herb. Res. Notes 5:29-48.

Morris, K. and Muir, B.G. (1976). Vegetation. In A Spring, 1975, Biological Survey of the Proposed Mussel Pool Complex and Recommendations for its Future Development. Rept for Metropolitan Region Planning Auth. pp.7-19.

Muir, B.G. (1977). Biological Survey of the Western Australian Wheatbelt. Part 2. Vegetation and Habitat of Bendering Reserve. Rec. West. Aust. Mus. Suppl. 3.

Muir, B.G. (1983). Drainage, Swamp Structure and Vegetation Succession at Melaleuca Park, Northern Swan Coastal Plain. West. Aust. Herb. Res. Notes 9:27-39.

Northcote, K.H. (1971). A Factual Key for the Recognition of Australian Soils. CSIRO/Rellim: Glenside.

Pizzey, G. (1980). A Field Guide to the Birds of Australia. Collins: Sydney.

Saunders, D.A. (1980). Food and Movements of the Short-billed Form of the White-tailed Black Cockatoo. Aust. Wildl. Res. 7:257-269.

Semeniuk, V. and Glassford, D.K. (1989). Bassendean and Spearwood Dunes: their Geomorphology, Stratigraphy and Soils as a Basis for Habitats of *Banksia* Woodlands. J.Roy. Soc. West. Aust. 71(4):87-88.

Serventy, D.L. and Whittell, H.M. (1976). Birds of Western Australia. UWA Press: Perth.

Simpson, K. and Day, N. (1989). Field Guide to the Birds of Australia: a Book of Identification. Viking O'Neil: Ringwood.

Speck, N.H. (1952). Plant Ecology of the Metropolitan Sector of the Swan Coastal Plain. MSc Thesis, Univ. West. Aust.

Storr, G.M. (1964). Some Aspects of the Geography of Australian Reptiles. Senck. Biol. 45:577-589.

Storr, G.M. and Johnstone, R.E. (1979). Field Guide to the Birds of Western Australia. West. Aust. Mus.: Perth.

Webb, L.J. (1959). A Physiognomic Classification of Australian Rain Forests. J. Ecol. 47:551-570.

Webb, L.J. (1968). Environmental Relationships of the Structural Types of Australian Rain Forest Vegetation. Ecology. 49:296-311.

Webb, L.J., Tracey, J.G., Kikkawa, J. and Williams, W.T. (1973). Techniques for Selecting and Allocating Land for Nature Conservation in Australia. In Nature Conservation in the Pacific. Costin, A.B. and Groves, R.H. (eds). ANU Press: Canberra. pp.39-52.

Weston, A.S. (1990). Declared Endangered Flora and Reserve List Flora: Spring Survey, Jandakot Airport. Ian Pound and Assoc. Pty Ltd.

Weston, A.S. (1992). Vegetation Descriptions. Appendix D in Dames and Moore (1993). Draft Environmental Impact Statement: Proposed Additional Developments at Jandakot Airport. For Federal Airports Corp. Job No. 18534-011-363.

* * * * * * * * * * * * * * * *

FIGURES

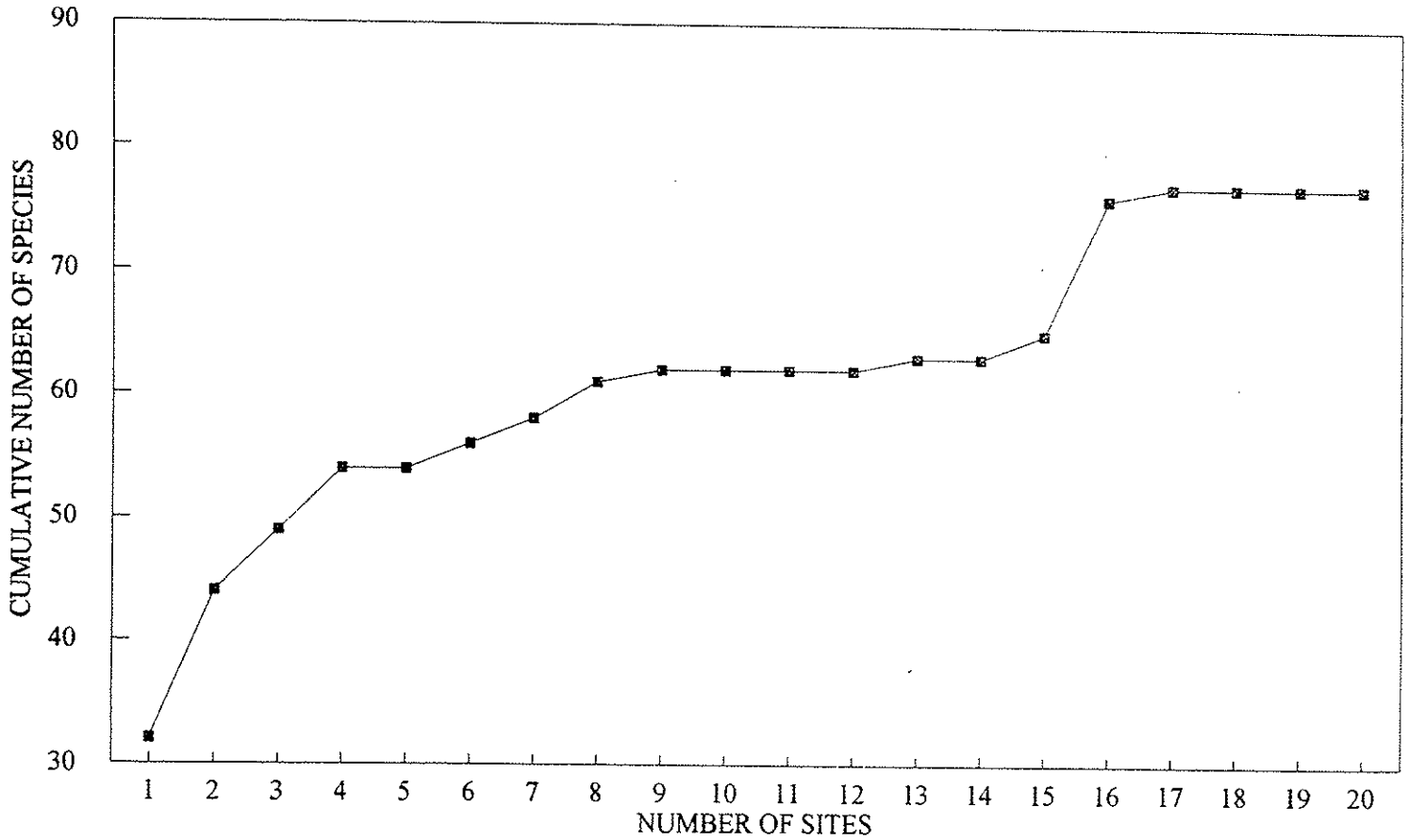


FIGURE 4
CUMULATIVE SPECIES NUMBER PLOTTED AGAINST NUMBER OF STUDY SITES

FIGURE 1
LOCATION PLAN

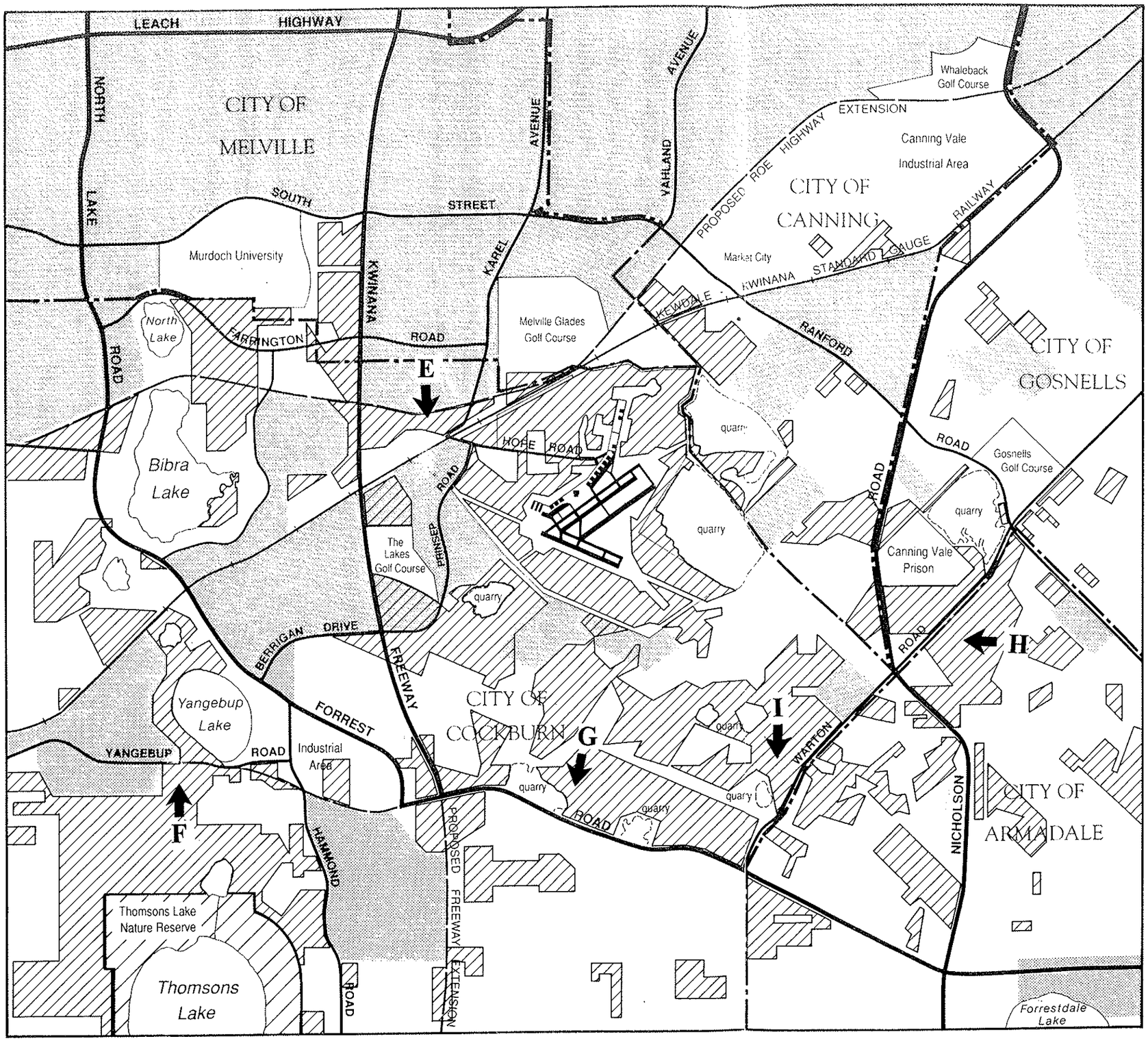


FIGURE 6
REMNANT BANKSIA WOODLAND AND LOCATION OF STUDY SITES OUTSIDE AIRPORT

Reproduced with Permission

PLATES

Plate 1A. Typical Banksia woodland in Location A6. This is a crest location with a well developed heathy understorey.

Plate 1B. Typical dampland at Location C23. A floristically-poor heathy understorey is dominated to varying degrees by *Melaleuca preissiana* trees.

Plate 2A. The only intact stand of *Eucalyptus rudis* woodland on Jandakot Airport, although the area as a whole is dominated by *Banksia ilicifolia*. This is in Location B28. The understorey is very dense and has not been burned for some time.

Plate 2B. *Lysinema elegans*, the only significant plant species found during the present study. It is growing in a highly disturbed road cutting.

APPENDICES

APPENDIX A

TABULATED RESULTS OF STUDY

KEY TO SPECIES CODES

Ac	Adenanthos cygnorum	Hh	Hibbertia hypericoides
Af	Allocasuarina fraseriana	Ha	Hypocalymma angustifolium
Afas	Astartea fascicularis	Jf	Jacksonia furcellata
Ah	Allocasuarina humilis	Llaevig	Leptospermum laevigatum
Ap	Acacia pulchella	Lep	Leptocarya sp.
Ba	Banksia attenuata	Lk	Leucopogon kingianus
Bi	Banksia ilicifolia	Ma	Melaleuca acerosa
Bm	Banksia menzeisii	Mp	Melaleuca preissiana
Briza	Briza maxima	Mr	Macrozamia reidlei
Cf	Calytrix fraseri	Mt	Melaleuca thymoides
Cp	Conostephium pendulum	Nf	Nuytsia floribunda
Db	Dasypogon bromiliaefolius	Pe	Pericalymma ellipticum
Dspp	Daviesia spp	Ps	Persoonia saccata
Ehrharta	Ehrharta calycina	Ri	Regelia inops
Em	Eucalyptus marginata	Rv	Regelia velutina
Erudis	Eucalyptus rudis	Si	Scholtzia involucrata
Et	Eucalyptus todtiana	Sl	Stirlingia latifolia
Glad	Gladiolus caryophyllaceus	Xp	Xanthorrhoea preissii
Gt	Gompholobium tomentosum		

JANDAKOT AIRPORT HABITAT SURVEY - BLOCK A

CHARACTER	Wgt	A1		A2		A3		A4		A5		A6		A7	
Numb. Adjacent Associations	3	1	3	0	0	0	0	0	0	0	0	0	0	1	3
Topographic Position		Mid-slope		Mid-slope		Mid-slope		Lowland		Mid-slope		Crest		Mid-slope	
Soil Drainage		VH		VH		VH		VH		VH		VH		VH	
Soil Profile		Uniform		Uniform		Uniform		Uniform		Uniform		Uniform		Uniform	
Slope (degrees)		12		9		5		6		2		9		3	
Aspect		S		N		NE		NE		0		N		S	
Soil Protection %		95		95		95		90		90		95		90	
Erosion		0		0		0		0		0		0		0	
St1 Life Form		T		T		T		T		T		T		T	
St1 Top Height		6		8		6		7		8		8		7	
St1 Bottom Height		2		4		2		2.5		3.5		4		2	
Top Ht - Bottom Ht		**4**		**4**		**4**		**4.5**		**4.5**		**4**		**5**	
St1 Canopy Cover (CC)		80		40		40		40		40		40		50	
St1 Mean AFD		70		70		60		70		60		70		60	
St1 Canopy Cover x AFD		**56**		**28**		**24**		**28**		**24**		**28**		**30**	
St1 Health		5		5		5		5		4		5		4	
St1 No spp		4		3		3		2		4		3		4	
St1 Dominants		Bm,Ba,Af		Ba,Af,Bm		Ba,Em		Ba,Bm		Ba,Em,Af		Ba,Af,Bm		Ba,Em,Af	
St2 Life Form		S + Xp		S		S				S		S		S	
St2 Top Height		1.5		2		1.5				1.5		2		1.5	
St1 bottom ht - St2 top ht	1	**0.5**	**0.5**	**2**	**2**	**0.5**	**0.5**	**2.5**	**2.5**	**2**	**2**	**2**	**2**	**0.5**	**0.5**
St2 Bottom Height		0		0.5		0				0		0.5		0.5	
St2 Canopy Cover		5		2		5				15		2		20	
St2 Mean AFD		10		10		10				8		10		10	
St2 Canopy Cover x AFD		**0.5**		**0.2**		**0.5**		**0**		**1.2**		**0.2**		**2**	
St2 Health		5		5		5				5		5		5	
St2 No spp		6		2		3				4		2		4	
St2 Dominants		Ku,Jf		Ku, Ah		Ku				Ku		Ku, Ah		Ku,Ah	
St3 Life Form		S		S		S		S		S		S		S	
St3 Top Height		1		0.5		0.5		0.5		1		0.5		0.5	
St3 Bottom Height		0		0		0		0		0		0		0	

JANDAKOT AIRPORT HABITAT SURVEY - BLOCK A - Page 2

CHARACTER	Wgt	A1		A2		A3		A4		A5		A6		A7	
St3 Canopy Cover		95		95		85		85		70		95		80	
St3 Mean AFD		60		50		60		60		60		50		70	
St3 Canopy Cover x AFD		**57**		**0**		**51**		**51**		**42**		**0**		**56**	
St3 Health		5		5		5		5		5		5		5	
St3 No spp		12		4		7		5		4		4		15	
St3 Dominants		Mixed		Sl		Cp,mix		Mix		Cp,Hh		Sl		Cp	
St4 Life Form		V + S		S + H				V		V		S + H		V	
St4 Top Height		0.3		0.2				0.3		0.3		0.2		0.3	
St4 Bottom Height		0		0				0		0		0		0	
St4 Canopy Cover		20		5				5		5		5		5	
Total Canopy Index for All Strata	**1**	**134**	**134**	**33.2**	**33**	**75.5**	**76**	**84**	**84**	**72.2**	**72**	**33.2**	**33**	**93**	**93**
St4 Health		5		5				5		5		5		5	
St4 No spp		8		3				3		3		3		5	
St4 Dominants		Sedges		Scaevola				Sedges		Sedges		Scaevola		Sedges	
Number of LFDCs	3	4	12	4	12	3	9	4	12	4	12	4	12	4	12
Number of Species		32		28		21		18		25		20		24	
Floristic Diversity	2	1	2	1	2	1	2	0	0	1	2	0	0	1	2
No SMPs		42		22		18		15		20		22		20	
SMP Score	2	1	2	1	2	0	0	0	0	0	0	1	2	0	0
Mean Health St 1 + 2	**2**	**5**	**10**	**5**	**10**	**5**	**10**	**2.5**	**5**	**4.5**	**9**	**5**	**10**	**4.5**	**9**
Seedlings/saplings		3		2		0		0		1		2		2	
Spatial Organization		Contin.		Contin.		Patchy		Contin.		Contin.		Contin.		Contin.	
Horizontal View Distance		50		100		100		150		100		100		50	
Evidence of Logging		0		0		0		0		0		0		0	
Disturbance		0		0		0		0		0		0		0	
Fire Age		15		15		15		15		15		15		15	
Stratal Recovery	3	4	12	4	12	4	12	4	12	4	12	4	12	4	12
Weed Species		0		0		0		0		0		0		Ursinea	
Weed Dominance		0		0		0		0		0		0		0	
Dieback Indicator		0		0		0		0		0		0		Ba	
Level Infection		0		0		0		0		0		0		1	
Dieback Status	1		5		5		5		5		5		5		4
RHAS RATING			181		78		114		121		114		76		136

JANDAKOT AIRPORT HABITAT SURVEY - BLOCK A - Page 3

CHARACTER	Wgt	A1		A2		A3		A4		A5		A6		A7	
FAUNA															
Hollow Limbs		0		0		0		0		1		0		0	
Hollow Trunks		0		0		1		0		1		0		0	
Abund. of Nests		0		0		0		0		0		0		0	
Abund. of Invertebr. Burrows		1		1		1		2		1		1		2	
Abund. Mamm. Burrows & Digs		0		2		2		3		1		2		2	
Logs <20cm		0		0		1		1		1		0		1	
Logs >20cm		0		0		1		0		0		0		0	
Litter Depth		3		5		0		2		2		5		5	
Litter Spacing		0		0		2		3		1		0		1	
Abund. Mat Plants		3		5		1		2		0		5		2	
Abund. Grass		0		0		0		0		0		0		0	
Abund. Flowering spp		5		3		1		2		2		3		2	
Abund. Seed spp		2		2		1		1		2		2		1	
TOTAL FAUNA SCORE			14		18		11		16		12		18		16
Soil Burrowability		VH		VH		VH		VH		VH		VH		VH	
Moisture		Very dry		Very dry		Very dry		Very dry		Very dry		Very dry		Very dry	
TOTAL SCORE ALL VALUES			195		96.2		125		137		126		94.2		152

JANDAKOT AIRPORT HABITAT SURVEY - BLOCK A - Page 4

CHARACTER	A8		A9		A10		A11		A12		A13		A14		A15	
Numb. Adjacent Associations	2	6	1	3	0	0	0	0	0	0	0	0	0	0	0	0
Topographic Position	Mid-slope		Mid-slope		Lowland		Mid-slope		Lowland		Mid-slope		Lowland		Lowland	
Soil Drainage	VH		VH		VH		VH		VH		VH		VH		VH	
Soil Profile	Uniform		Uniform		Uniform		Uniform		Uniform		Uniform		Uniform		Uniform	
Slope (degrees)	3		5		0		2		0		12		0		0	
Aspect	N		NE		0		0		0		S		0		0	
Soil Protection %	90		95		80		90		90		95		80		80	
Erosion	0		0		0		0		0		0		0		0	
St1 Life Form	T		T		T		T		T		T		T		T	
St1 Top Height	9		6		7		8		8		6		7		7	
St1 Bottom Height	4		2		3		3.5		4		2		3		3	
Top Ht - Bottom Ht	**5**		**4**		**4**		**4.5**		**4**		**4**		**4**		**4**	
St1 Canopy Cover (CC)	50		40		20		40		70		80		20		20	
St1 Mean AFD	70		60		80		64		85		70		80		80	
St1 Canopy Cover x AFD	**35**		**24**		**16**		**25.6**		**59.5**		**56**		**16**		**16**	
St1 Health	5		5		4.5		4		5		5		4.5		4.5	
St1 No spp	5		3		3		4		4		4		3		3	
St1 Dominants	Ba,Em		Ba,Em		Ba,Bm		Ba,Em,Af		Ba,Mp		Bm,Ba,Af		Ba,Bm		Ba,Bm	
St2 Life Form	S		S		S		S		S		S + Xp		S		S	
St2 Top Height	2		1.5		1		1.5		2		1.5		1		1	
St1 bottom ht - St2 top ht	**2**	**2**	**0.5**	**0.5**	**2**	**2**	**2**	**2**	**2**	**2**	**0.5**	**0.5**	**2**	**2**	**2**	**2**
St2 Bottom Height	1		0		0		0		0.5		0		0		0	
St2 Canopy Cover	2		5		1		15		60		5		1		1	
St2 Mean AFD	16		10		10		8		30		10		10		10	
St2 Canopy Cover x AFD	**0.32**		**0.5**		**0.1**		**1.2**		**18**		**0.5**		**0.1**		**0.1**	
St2 Health	5		5		5		5		5		5		5		5	
St2 No spp	3		3		2		4		3		6		2		2	
St2 Dominants	Ku,Jf		Ku		Ah		Ku		Ri,Xp		Ku,Jf		Ah		Ah,Xp,Ku	
St3 Life Form	S		S		S		S		S		s		S		S	
St3 Top Height	0.5		0.5		0.5		1		0.5		1		0.5		0.5	
St3 Bottom Height	0		0		0		0		0		0		0		0	

JANDAKOT AIRPORT HABITAT SURVEY - BLOCK A - Page 5

CHARACTER	A8		A9		A10		A11		A12		A13		A14		A15	
St3 Canopy Cover	90		85		80		70		10		95		80		80	
St3 Mean AFD	60		60		60		60		60		60		60		60	
St3 Canopy Cover x AFD	**54**		**51**		**48**		**42**		**6**		**57**		**48**		**48**	
St3 Health	5		5		5		5		5		5		5		5	
St3 No spp	19		7		5		4		5		12		5		5	
St3 Dominants	Hh,mix		Cp,mix		Eremaea		Cp,Hh		Db,Hh		Mix		Eremaea		Eremaea	
St4 Life Form	V				V		V		V		V + S		V		V	
St4 Top Height	0.3				0.2		0.3				0.3		0.2		0.2	
St4 Bottom Height	0				0		0				0		0		0	
St4 Canopy Cover	1				1		5				20		1		1	
Total Canopy Index for All Strata	**90.3**	**90**	**75.5**	**76**	**65.1**	**65**	**73.8**	**74**	**83.5**	**84**	**134**	**134**	**65.1**	**65**	**65.1**	**65**
St4 Health	5				5		5		5		5		5		5	
St4 No spp	3				5		3		2		8		5		5	
St4 Dominants	Sedges				Sedges		Sedges		Sedges		Sedges		Sedges		Sedges	
Number of LFDCs	4	12	3	9	4	12	4	12	3	9	4	12	4	12	4	12
Number of Species	41		16		18		14		12		17		14		26	
Floristic Diversity	1	2	0	0	0	0	0	0	0	0	0	0	0	0	1	2
No SMPs	16		18		12		20		16		42		12		12	
SMP Score	0	0	0	0	0	0	0	0	0	0	1	2	0	0	0	0
Mean Health St 1 + 2	**5**	**10**	**5**	**10**	**4.75**	**9**	**4.5**	**9**	**5**	**10**	**5**	**5**	**4.75**	**9**	**4.75**	**9**
Seedlings/saplings	2		0		0		1		2		3		0		0	
Spatial Organization	Patchy		Patchy		Contin.		Contin.		Contin.		Contin.		Contin.		Contin.	
Horizontal View Distance	150		100		175		100		30		50		175		175	
Evidence of Logging	0		0		1		0		0		0		1		1	
Disturbance	0		0		0		0		0		0		0		0	
Fire Age	15		15		15		15		15		15		15		15	
Stratal Recovery	4	12	4	12	4	12	4	12	4	12	4	12	4	12	4	12
Weed Species	Grass,Glad		0		0		0		0		0		0		0	
Weed Dominance	1		0		0		0		0		0		0		0	
Dieback Indicator	Ba		0		Ba		0		Ba		0		Ba		Ba	
Level Infection	1		0		3		0		1		0		3		4	
Dieback Status		4		5		2		5		4		5		2		1
RHAS RATING		138		115		102		114		121		171		102		103

JANDAKOT AIRPORT HABITAT SURVEY - BLOCK A - Page 6

CHARACTER	A8		A9		A10		A11		A12		A13		A14		A15	
FAUNA																
Hollow Limbs	1		0		0		1		0		0		0		0	
Hollow Trunks	1		1		0		1		0		0		0		0	
Abund. of Nests	0		0		0		0		0		0		0		0	
Abund. of Invertebr. Burrows	0		1		2		1		2		1		2		2	
Abund. Mamm. Burrows & Digs	2		2		3		1		4		0		3		3	
Logs <20cm	0		1		0		1		1		0		0		0	
Logs >20cm	0		1		0		0		0		0		0		0	
Litter Depth	5		0		3		2		1		3		3		3	
Litter Spacing	1		2		2		1		2		0		2		2	
Abund. Mat Plants	2		1		0		0		3		3		0		0	
Abund. Grass	1		0		0		0		0		0		0		0	
Abund. Flowering spp	1		1		1		2		5		5		1		1	
Abund. Seed spp	1		1		1		2		1		2		1		1	
TOTAL FAUNA SCORE		15		11		12		12		19		14		12		12
Soil Burrowability	VH		VH		VH		VH		H		VH		VH		VH	
Moisture	Very dry		Very dry		Very dry		Very dry		Moderate		Very dry		Very dry		Very dry	
TOTAL SCORE ALL VALUES		153		126		114		126		140		185		114		115

JANDAKOT AIRPORT HABITAT SURVEY - BLOCK A - Page 7

CHARACTER	A16		A17		A18		A19		A20		A21	
Numb. Adjacent Associations	0	0	0	0	1	3	1	3	0	0	0	0
Topographic Position	Lowland		Lowland		Mid-slope		Mid-slope		Lowland		Lowland	
Soil Drainage	VH		VH		VH		VH		VH		VH	
Soil Profile	Uniform		Uniform		Uniform		Uniform		Uniform		Uniform	
Slope (degrees)	0		0		10		3		0		0	
Aspect	0		0		F		N		0		0	
Soil Protection %	90		90		95		90		90		90	
Erosion	0		0		0		0		0		0	
St1 Life Form	T		T		T		T		T		T	
St1 Top Height	10		10		7		9		8		8	
St1 Bottom Height	4		4		3		4		4		4	
Top Ht - Bottom Ht	**6**		**6**		**4**		**5**		**4**		**4**	
St1 Canopy Cover (CC)	75		75		60		50		70		70	
St1 Mean AFD	85		85		70		70		85		85	
St1 Canopy Cover x AFD	**63.8**		**63.8**		**42**		**35**		**59.5**		**59.5**	
St1 Health	5		5		5		5		5		5	
St1 No spp	5		5		4		5		4		4	
St1 Dominants	Ba,Bm,Af		Ba,Bm,Af		Bm,Ba,Af		Ba,Em		Ba,Mp		Ba,Mp	
St2 Life Form	S		S		S + Xp		S		S		S	
St2 Top Height	1.5		1.5		1.5		2		2		2	
St1 bottom ht - St2 top ht	**2.5**	**2.5**	**2.5**	**2.5**	**1.5**	**1.5**	**2**	**2**	**2**	**2**	**2**	**2**
St2 Bottom Height	0.5		0.5		0		1		0.5		0.5	
St2 Canopy Cover	30		30		5		2		60		60	
St2 Mean AFD	20		20		10		16		30		30	
St2 Canopy Cover x AFD	**6**		**6**		**0.5**		**0.32**		**18**		**18**	
St2 Health	5		5		5		5		5		5	
St2 No spp	3		3		6		3		3		3	
St2 Dominants	Ri		RI		Ku,Jf		Ku,Jf		Ri,Xp		Ri,Xp	
St3 Life Form	S		S		S		S		S		S	
St3 Top Height	0.5		0.5		1		0.5		0.5		0.5	
St3 Bottom Height	0		0		0		0		0		0	

JANDAKOT AIRPORT HABITAT SURVEY - BLOCK A - Page 8

CHARACTER	A16		A17		A18		A19		A20		A21	
St3 Canopy Cover	60		60		95		90		10		10	
St3 Mean AFD	50		50		60		60		60		60	
St3 Canopy Cover x AFD	**30**		**30**		**57**		**54**		**6**		**6**	
St3 Health	5		5		5		5		5		5	
St3 No spp	12		12		6		19		5		5	
St3 Dominants	Si,Nf,Mp		Si,Nf,Mp		Mix		Hh,mix		Db,Hh		Db,Hh	
St4 Life Form	V		V		V + S		V		V		V	
St4 Top Height	0.3		0.3		0.3		0.3					
St4 Bottom Height	0		0		0		0					
St4 Canopy Cover	1		1		5		1					
Total Canopy Index for All Strata	**101**	**101**	**101**	**101**	**105**	**105**	**90.3**	**90**	**83.5**	**84**	**83.5**	**84**
St4 Health	5		5		5		5		5		5	
St4 No spp	2		2		8		3		2		2	
St4 Dominants	Sedges		Sedges		Sedges		Sedges		Sedges		Sedges	
Number of LFDCs	4	12	4	12	4	12	4	12	3	9	3	9
Number of Species	38		23		13		18		26		18	
Floristic Diversity	1	2	1	2	0	0	0	0	1	2	0	0
No SMPs	15		15		42		16		16		16	
SMP Score	0	0	0	0	1	2	0	0	0	0	0	0
Mean Health St 1 + 2	**5**	**10**	**5**	**10**	**5**	**10**	**5**	**10**	**5**	**10**	**5**	**10**
Seedlings/saplings	1		1		3		2		2		2	
Spatial Organization	Contin.		Contin.		Contin.		Patchy		Contin.		Contin.	
Horizontal View Distance	50		50		100		150		30		30	
Evidence of Logging	0		0		0		0		0		0	
Disturbance	0		0		0		0		0		0	
Fire Age	15		15		15		15		15		15	
Stratal Recovery	4	12	4	12	4	12	4	12	4	12	4	12
Weed Species	0		0		0		Grass,Glad		0		0	
Weed Dominance	0		0		0		1		0		0	
Dieback Indicator	Ba		Ba		0		Ba		Ba		Ba	
Level Infection	1		1		0		1		1		1	
Dieback Status		4		4		5		4		4		4
RHAS RATING		144		144		151		133		123		121

JANDAKOT AIRPORT HABITAT SURVEY - BLOCK A - Page 9

CHARACTER	A16		A17		A18		A19		A20		A21	
FAUNA	--											
Hollow Limbs	1		1		0		1		0		0	
Hollow Trunks	1		1		0		1		0		0	
Abund. of Nests	1		1		0		0		0		0	
Abund. of Invertebr. Burrows	4		4		1		0		2		2	
Abund. Mamm. Burrows & Digs	4		4		0		2		4		4	
Logs <20cm	1		1		0		0		1		1	
Logs >20cm	1		1		0		0		0		0	
Litter Depth	3		3		3		5		1		1	
Litter Spacing	4		4		0		1		2		2	
Abund. Mat Plants	1		1		3		2		3		3	
Abund. Grass	0		0		0		1		0		0	
Abund. Flowering spp	3		3		5		1		5		5.	
Abund. Seed spp	1		1		2		1		1		1	
TOTAL FAUNA SCORE		25		25		14		15		19		19
Soil Burrowability	H		H		VH		VH		H		H	
Moisture	Moderate		Moderate		Very dry		Very dry		Moderate		Moderate	
TOTAL SCORE ALL VALUES		169		169		165		148		142		140

JANDAKOT AIRPORT HABITAT SURVEY - BLOCK A - Page 10

CHARACTER	A22		A23		
Numb. Adjacent Associations	0	0	1	3	
Topographic Position	Mid-slope		Lowland		
Soil Drainage	VH		VH		
Soil Profile	Uniform		Uniform		
Slope (degrees)	6		0		
Aspect	NE		0		
Soil Protection %	90		90		Mean = 90.2
Erosion	0		0		
St1 Life Form	T		T		
St1 Top Height	7		8		Mean = 7.61
St1 Bottom Height	2.5		4		Mean = 3.22
Top Ht - Bottom Ht	**4.5**		**4**		Mean = 4.39
St1 Canopy Cover (CC)	40		70		Mean = 51.3
St1 Mean AFD	70		85		Mean = 73.2
St1 Canopy Cover x AFD	**28**		**59.5**		
St1 Health	5		5		
St1 No spp	2		4		Mean = 3.7
St1 Dominants	Ba,Bm		Ba,Mp		
St2 Life Form			S		
St2 Top Height			2		Mean = 1.4
St1 bottom ht - St2 top ht	**2.5**	**2.5**	**2**	2	
St2 Bottom Height			0.5		Mean = 0.31
St2 Canopy Cover			60		Mean = 18.4
St2 Mean AFD			30		Mean = 15.1
St2 Canopy Cover x AFD	**0**		**18**		Mean = 4.01
St2 Health			5		Mean = 5
St2 No spp			3		Mean = 3.33
St2 Dominants			Ri,Xp		
St3 Life Form	S		S		
St3 Top Height	0.5		0.5		Mean = 0.61
St3 Bottom Height	0		0		

JANDAKOT AIRPORT HABITAT SURVEY - BLOCK A - Page 11

CHARACTER	A22		A23			
St3 Canopy Cover	85		10		Mean =	70.2
St3 Mean AFD	60		60		Mean =	58.7
St3 Canopy Cover x AFD	**51**		**6**		Mean =	37
St3 Health	5		5		Mean =	5
St3 No spp	5		5		Mean =	7.91
St3 Dominants	Mix		Db,Hh			
St4 Life Form	V		V			
St4 Top Height	0.3				Mean =	0.24
St4 Bottom Height	0					
St4 Canopy Cover	5				Mean =	4.58
Total Canopy Index for All Strata	**84**	**84**	**83.5**	**84**		
St4 Health	5		5		Mean =	4.57
St4 No spp	3		2		Mean =	3.48
St4 Dominants	Sedges		Sedges			
Number of LFDCs	4	12	3	9		
Number of Species	16		13		Mean =	21.3
Floristic Diversity	0	0	0	0		
No SMPs	15		16		Mean =	19.9
SMP Score	0	0	0	0		
Mean Health St 1 + 2	**2.5**	**5**	**5**	**10**		
Seedlings/saplings	0		2		Mean =	1.35
Spatial Organization	Contin		Contin			
Horizontal View Distance	150		30		Mean =	95.4
Evidence of Logging	0		0			
Disturbance	0		0			
Fire Age	15		15		Mean =	15
Stratal Recovery	4	12	4	12		
Weed Species	0		0			
Weed Dominance	0		0		Mean =	0.09
Dieback Indicator	0		Ba			
Level Infection	0		1		Mean =	0.83
Dieback Status		5		4	Mean =	4.18
RHAS RATING		121		124		

JANDAKOT AIRPORT HABITAT SURVEY - BLOCK A - Page 12

CHARACTER	A22		A23			
FAUNA						
Hollow Limbs	0		0		Mean =	0.26
Hollow Trunks	0		0		Mean =	0.35
Abund. of Nests	0		0		Mean =	0.09
Abund. of Invertebr. Burrows	2		2		Mean =	1.61
Abund. Mamm. Burrows & Digs	3		4		Mean =	2.39
Logs <20cm	1		1		Mean =	0.57
Logs >20cm	0		0		Mean =	0.17
Litter Depth	2		1		Mean =	2.65
Litter Spacing	3		2		Mean =	1.61
Abund. Mat Plants	2		3		Mean =	1.96
Abund. Grass	0		0		Mean =	0.09
Abund. Flowering spp	2		5		Mean =	2.78
Abund. Seed spp	1		1		Mean =	1.3
TOTAL FAUNA SCORE		16		19	Mean =	18.8
Soil Burrowability	VH		H			
Moisture	Very dry		Moderate			
TOTAL SCORE ALL VALUES		137		143	Mean =	139.6

JANDAKOT AIRPORT HABITAT SURVEY - BLOCK B

CHARACTER	Wgt	B1		B2		B3		B4		B5		B6		B7	
Numb. Adjacent Associations		0		0		0		1		1		1		0	
Topographic Position		Lowland		Mid-slope		Mid-slope		Lowland		Mid-slope		Lowland		Lowland	
Soil Drainage		VH		VH		VH		VH		VH		VH		VH	
Soil Profile		Uniform		Uniform		Uniform		Uniform		Uniform		Uniform		Uniform	
Slope (degrees)		12		0		9		5		2 to 12		2		0	
Aspect		NE		0		N		NE		SE		NE		0	
Soil Protection %		90		80		95		90		90		95		95	
Erosion		0		0		0		0		0		0		0	
St1 Life Form		T		T		T		T		T		T		T	
St1 Top Height		7		7		8		7		7		7		8	
St1 Bottom Height		3		3		4		3		3		4		4	
Top Ht - Bottom Ht		**4**		**4**		**4**		**4**		**4**		**3**		**4**	
St1 Canopy Cover (CC)		50		20		30		40		40		80		80	
St1 Mean AFD		60		80		70		50		55		70		80	
St1 Canopy Cover x AFD		**30**		**16**		**21**		**20**		**22**		**56**		**64**	
St1 Health		4		4.5		5		4		4		5		5	
St1 No species		3		3		3		5		2		2		3	
St1 Dominants		Bm,Ba,Bi		Ba,Bm		Ba,Af,Bm		Ba		Ba,Bm		Ba,Bm		Ba,Af,Bi	
St2 Life Form		S		S		S				S		S		S + Xp	
St2 Top Height		2		1		2				2.5		1.5		2	
St1 Bottom Ht - St2 Top Ht	**1**	**1**	**1**	**2**	**2**	**2**	**2**	**3**	**3**	**0.5**	**0.5**	**2.5**	**2.5**	**2**	**2**
St2 Bottom Height		0.5		0		0.5				1		0.5		0.5	
St2 Canopy Cover		1		1		2				1		30		30	
St2 Mean AFD		10		10		10				10		30		40	
St2 Canopy Cover x AFD		**0.1**		**0.1**		**0.2**		**0**		**0.1**		**9**		**12**	
St2 Health		5		5		2				5		5		5	
St2 No species		3		2		2				3		5		5	
St2 Dominants		Mt,Cf		Cf		Mt, Ah				Mt,Ri		Ah,Xp,Mt		Xp,Mt	
St3 Life Form		S		S		S		S		S		S		S	
St3 Top Height		0.5		0.5		0.5		0.5		0.5		0.5		0.5	
St3 Bottom Height		0		0		0		0		0		0		0	

JANDAKOT AIRPORT HABITAT SURVEY - BLOCK B - Page 2

CHARACTER	Wgt	B1		B2		B3		B4		B5		B6		B7	
St3 Canopy Cover		80		80		95		80		80		80		80	
St3 Mean AFD		20		60		50		70		70		80		80	
St3 Canopy Cover x AFD		16		48		47.5		56		56		64		64	
St3 Health		5		5		5		5		5		5		5	
St3 No species		5		5		4		7		14		20		15	
St3 Dominants		Csml,Hh		Eremaea		Stirl		Melal sp		Leuc,Baek		Mix		Mix	
St4 Life Form		V		V		S + H		V		V		V		V	
St4 Top Height		0.3		0.2		0.2		0.3		0.2		0.3		0.3	
St4 Bottom Height		0		0		0		0		0		0		0	
St4 Canopy Cover		1		1		5		50		15		10		15	
Total Canopy Cover for All Strata	1	47.1	47	65.1	65	73.7	74	126	126	93.1	93	139	139	155	155
St4 Health		5		5		5		5		5		5		5	
St4 No species		3		5		3		4		4		7		4	
St4 Dominants		Sedge		Lomandra		Scaevola		Sedge		Sedge		Mesomel		Sedge	
Number of LFDCs	3	4	12	4	12	4	12	4	12	4	12	4	12	4	12
Number of Species		29		18		22		21		33		53		72	
Floristic Diversity	2	1	2	0	0	1	2	1	2	1	2	2	4	2	4
No SMPs		12		12		17		17		22		40		28	
SMP Score	2	0	0	0	0	0	0	0	0	1	2	1	2	1	2
Mean Health St 1 + 2	2	4.5	9	4.75	9.5	3.5	7	2	4	4.5	9	5	10	5	10
Seedlings/saplings		1		0		2		1		1		2		3	
Spatial Organization		Cont		Cont		Cont		Cont		Cont		Cont		Cont	
Horizontal View		100		175		100		150		50		100		50	
Evidence of Logging	2	4	8	3	6	4	8	4	8	4	8	4	8	3	6
Disturbance		0		0		0		Sand pit		Adj Dev		0		0	
Fire Age		11		11		11		11		11		11		11	
Stratal Recovery	3	4	12	4	12	4	12	4	12	4	12	4	12	4	12
Weed species		0		0		0		0		1		0		0	
Weed Dominance		0		0		0		0		Glad		0		0	
Dieback Indicator		0		Ba		0		Ba		Ba		0		0	
Level Infection		0		3		0		2		1		0		0	
Dieback Status			5		2		5		3		4		5		5
RHAS RATING			96		109		122		170		143		195		208

JANDAKOT AIRPORT HABITAT SURVEY - BLOCK B - Page 3

CHARACTER	Wgt	B1		B2		B3		B4		B5		B6		B7	
FAUNA															
Hollow Limbs		0		0		0		0		0		0		0	
Hollow Trunks		0		0		0		1		0		1		1	
Abundance of Nests		1		0		0		0		0		0		0	
Abundance of Invertebr. Burrows		0		2		1		1		1		0		0	
Abund. Mamm. Burrows & Digs		0		3		2		1		3		3		2	
Logs <20cm		0		0		0		0		0		0		1	
Logs >20cm		0		0		0		0		0		0		1	
Litter Depth		2		3		5		2		2		2		3	
Litter Spacing		1		2		0		1.5		1.5		2		1	
Abundance Mat Plants		1		0		5		2		1		1		3	
Abundance Grass		0		0		0		0		0		0		0	
Abund. Flower. Species		2		1		3		2		1		2		2	
Abund. Seed Species		1		1		2		1		2		2		2	
TOTAL FAUNA SCORE			8		12		18		12		12		13		16
Soil Burrowability		VH		VH		VH		VH		VH		VH		VH	
Moisture		Very dry		Very dry		Very dry		Very dry		Very dry		Medium		Medium	
TOTAL SCORE ALL VALUES			104		121		140		182		154		208		224

JANDAKOT AIRPORT HABITAT SURVEY - BLOCK B - Page 4

CHARACTER	B8		B9		B10		B11		B12		B13a		B13b		B14	
Numb. Adjacent Associations	0		0		1		1		2		2		2		2	
Topographic Position	Lowland		Crest		Lowland		Dampland		Lowland		Dampland		Dampland		Lowland	
Soil Drainage	VH		VH		VH		VH		VH/M		Poor-Mod		Poor-Mod		VH/M	
Soil Profile	Uniform		Uniform		Uniform		Uniform		Uniform		Uniform		Peaty		Uniform	
Slope (degrees)	2		0		0		2		0		0		0		0	
Aspect	NE		0		0		NE		0		0		0		0	
Soil Protection %	95		95		95		95		95		70		100		95	
Erosion	0		0		0		0		0		0		0		0	
St1 Life Form	T		T		T		T		T		S		T		T	
St1 Top Height	7		8		8		7		8		2.5		8		8	
St1 Bottom Height	4		4		4		4		3		0		4		3	
Top Ht - Bottom Ht	**3**		**4**		**4**		**3**		**5**		**2.5**		**4**		**5**	
St1 Canopy Cover (CC)	80		80		80		80		90		70		80		90	
St1 Mean AFD	70		80		80		70		70		90		90		70	
St1 Canopy Cover x AFD	**56**		**64**		**64**		**56**		**63**		**63**		**72**		**63**	
St1 Health	5		5		5		5		5		5		5		5	
St1 No species	2		3		3		2		4		1		2		4	
St1 Dominants	Ba,Bm		Ba,Af,Bi		Ba,Af,Bi		Ba,Bm		Bi,Ba		Ri		Mp,Bl		Bi,Ba	
St2 Life Form	S		S +Xp		S + Xp		S		S + Xp		V		S		S + Xp	
St2 Top Height	1.5		2		2		1.5		1.5		1		1.5		1.5	
St1 Bottom Ht - St2 Top Ht	**2.5**	**2.5**	**2**	**2**	**2**	**2**	**2.5**	**2.5**	**1.5**	**1.5**	**-1**	**1**	**2.5**	**2.5**	**1.5**	**1.5**
St2 Bottom Height	0.5		0.5		0.5		0.5		0.5		0		0.5		0.5	
St2 Canopy Cover	30		30		30		30		5		10		30		5	
St2 Mean AFD	30		40		40		30		20				10		20	
St2 Canopy Cover x AFD	**9**		**12**		**12**		**9**		**1**		**0**		**3**		**1**	
St2 Health	5		5		5		5		5		5		5		5	
St2 No species	5		5		5		5		3		4		1		3	
St2 Dominants	Ah,Xp,Mt		Xp,Mt		Xp,Mt		Ah,Xp,Mt		Mt,Xp		Lep		Afas		Mt,Xp	
St3 Life Form	S		S		S		S		V + S				V		V + S	
St3 Top Height	0.5		0.5		0.5		0.5		0.5				1		0.5	
St3 Bottom Height	0		0		0		0		0				0		0	

JANDAKOT AIRPORT HABITAT SURVEY - BLOCK B - Page 5

CHARACTER	B8		B9		B10		B11		B12		B13a		B13b		B14	
St3 Canopy Cover	80		80		80		80		90				30		90	
St3 Mean AFD	80		80		80		80		60						60	
St3 Canopy Cover x AFD	64		64		64		64		54		0		0		54	
St3 Health	5		5		5		5		5				5		5	
St3 No species	20		15		15		20		7				2		7	
St3 Dominants	Mix		Mix		Mix		Mix		Dasyp				As Col		Dasyp	
St4 Life Form	V		V		V		V									
St4 Top Height	0.3		0.3		0.3		0.3									
St4 Bottom Height	0		0		0		0									
St4 Canopy Cover	10		5		15		10									
Total Canopy Cover for All Strata	139	139	145	145	155	155	139	139	118	118	63	63	75	75	118	118
St4 Health	5		5		5		5									
St4 No species	7		4		4		7									
St4 Dominants	Mesomel		Sedge		Sedge		Mesomel									
Number of LFDCs	4	12	4	12	4	12	4	12	3	9	2	6	3	9	3	9
Number of Species	15		63		45		30		59		30		26		12	
Floristic Diversity	0	0	2	4	1	2	1	2	2	4	1	2	1	2	0	0
No SMPs	40		20		28		40		18		8		8		18	
SMP Score	1	2	1	2	1	2	1	2	0	0	0	0	0	0	0	0
Mean Health St 1 + 2	5	10	5	10	5	10	5	10	5	10	5	10	5	10	5	10
Seedlings/saplings	2		3		3		2		1		0		1		1	
Spatial Organization	Cont		Cont		Cont		Cont		Cont		Patchy		Cont		Cont	
Horizontal View	100		150		50		100		100		8		10		100	
Evidence of Logging	4	8	4	8	3	6	4	8	3	6	4	8	4	8	3	6
Disturbance	0		0		0		0		Firebreaks		0		0		Firebreaks	
Fire Age	11		11		11		11		11		11		11		11	
Stratal Recovery	4	12	4	12	4	12	4	12	4	12	4	12	4	12	4	12
Weed species	0		0		0		0		Briza		Hypochaer		Briza,Ursin		Briza	
Weed Dominance	0		0		0		0		0		0		1		0	
Dieback Indicator	0		Ba,Bm		0		0		0		0		0		0	
Level Infection	0		3		0		0		0		0		0		0	
Dieback Status		5		2		5		5		5		5		5		5
RHAS RATING		191		197		206		193		166		107		124		162

JANDAKOT AIRPORT HABITAT SURVEY - BLOCK B - Page 7

CHARACTER	B15		B16		B17		B18		B19		B20		B21		B22	
Numb. Adjacent Associations	1		1		0		1		1		2		1		2	
Topographic Position	Dampland		Lowland		Lowland		Lowland		Mid-slope		Lowland		Dampland		Lowland	
Soil Drainage	Poor-Mod		Poor-Mod		Mod		VH		VH		VH		VH		VH	
Soil Profile	Uniform		Uniform		Uniform		Uniform		Uniform		Uniform		Uniform		Uniform	
Slope (degrees)	0		0		0		0		0		0		0		0	
Aspect	0		0		0		0		0		0		0		0	
Soil Protection %	95		80		40		95		90		95		70		95	
Erosion	0		0		0		0		0		0		0		0	
St1 Life Form	T		S		S		T		T		T		S		T	
St1 Top Height	8		2		0.3		8		8		9		1		9	
St1 Bottom Height	3		0		0		4		4		4		0		4	
Top Ht - Bottom Ht	**5**		**2**		**0.3**		**4**		**4**		**5**		**1**		**5**	
St1 Canopy Cover (CC)	90		80		60		80		70		80		20		80	
St1 Mean AFD	70		80		40		80		56		70		30		70	
St1 Canopy Cover x AFD	**63**		**64**		**24**		**64**		**39.2**		**56**		**6**		**56**	
St1 Health	5		5		2		5		4		5		5		5	
St1 No species	4		1		3		3		4		3		2		3	
St1 Dominants	Bi,Ba		Pe		Lomanda		Ba,Af,Bi		Ba,Bm		Ba,Bi,Bm		Ri,Dspp		Ba,Bi,Bm	
St2 Life Form	S + Xp		V				S + Xp		S		S		S		S	
St2 Top Height	1.5		1				2		1		2		0.3		2	
St1 Bottom Ht - St2 Top Ht	**1.5**	**1.5**	**-1**	**1**	**0**	**0**	**2**	**2**	**3**	**3**	**2**	**2**	**-0.3**	**0.3**	**2**	**2**
St2 Bottom Height	0.5		0				0.5		0		0		0		0	
St2 Canopy Cover	5		10				30		60		80		70		80	
St2 Mean AFD	20						40		40		40		60		40	
St2 Canopy Cover x AFD	**1**		**0**		**0**		**12**		**24**		**32**		**42**		**32**	
St2 Health	5		5				5		5		5		5		5	
St2 No species	3		4				5		4		2		6		2	
St2 Dominants	Mt,Xp,Lep		Lep				Xp,Mt		Ah		Ri,Mr		Sedges		Ri,Mr	
St3 Life Form	V + S						S		S		S + V				S + V	
St3 Top Height	0.5						0.5		0.5		0.5				0.5	
St3 Bottom Height	0						0		0		0				0	

JANDAKOT AIRPORT HABITAT SURVEY - BLOCK B - Page 8

CHARACTER	B15		B16		B17		B18		B19		B20		B21		B22	
St3 Canopy Cover	90						80		70		70				70	
St3 Mean AFD	60						80		80		70				70	
St3 Canopy Cover x AFD	**54**		**0**		**0**		**64**		**56**		**49**		**0**		**49**	
St3 Health	5						5		5		5				5	
St3 No species	7						15		8		7				7	
St3 Dominants	Dasyp						Mix		Conost		Baek,Calytr				Baek,Calytr	
St4 Life Form							V		V + G							
St4 Top Height							0.3		0.3							
St4 Bottom Height							0		0							
St4 Canopy Cover							15		40							
Total Canopy Cover for All Strata	**118**	**118**	**64**	**64**	**24**	**24**	**155**	**155**	**159**	**159**	**137**	**137**	**48**	**48**	**137**	**137**
St4 Health							5		5							
St4 No species							4		6							
St4 Dominants							Sedge		Grass,Sedge							
Number of LFDCs	3	9	2	6	2	6	4	12	4	12	3	9	2	6	3	9
Number of Species	21		27		24		21		60		51		57		9	
Floristic Diversity	1	2	1	2	1	2	1	2	2	4	2	4	2	4	0	0
No SMPs	18		8		5		28		22		15		8		15	
SMP Score	0	0	0	0	0	0	1	2	1	2	0	0	0	0	0	0
Mean Health St 1 + 2	**5**	**10**	**5**	**10**	**1**	**2**	**5**	**10**	**4.5**	**9**	**5**	**10**	**5**	**10**	**5**	**10**
Seedlings/saplings	1		0		0		3		1		0		0		0	
Spatial Organization	Cont		Patchy		Patchy		Cont		Cont		Cont		Cont		Cont	
Horizontal View	100		5		-		50		150		10		N/A		10	
Evidence of Logging	3	6	4	8	4	8	3	6	4	8	4	8	4	8	4	8
Disturbance	Firebreaks		0		0		0		Firebreaks		Firebreaks		Cleared		Firebreaks	
Fire Age	11		11		11		11		11		11		11		11	
Stratal Recovery	4	12	4	12	4	12	4	12	4	12	4	12	4	12	4	12
Weed species	Briza		Hypochaer		0		0		0		0		0		0	
Weed Dominance	0		0		0		0		0		0		0		0	
Dieback Indicator	0		0		Ba,Xp,Ri		0		0		0		0		0	
Level Infection	0		0		5		0		0		0		0		0	
Dieback Status		5		5		0		5		5		5		5		5
RHAS RATING		164		108		54		206		214		187		93		183

JANDAKOT AIRPORT HABITAT SURVEY - BLOCK B - Page 9

CHARACTER	B15		B16		B17		B18		B19		B20		B21		B22	
FAUNA																
Hollow Limbs	0		0		0		0		0		0		0		0	
Hollow Trunks	1		0		0		1		0		0		0		0	
Abundance of Nests	0		0		0		0		0		0		0		0	
Abundance of Invertebr. Burrows	0		1		0		0		0		1		0		1	
Abund. Mamm. Burrows & Digs	1		3		0		2		0		3		0		3	
Logs <20cm	0		0		0		1		0		0		0		0	
Logs >20cm	0		0		3		1		0		0		0		0	
Litter Depth	5		0		3		3		3		5		0		5	
Litter Spacing	0		0		0		1		2.5		0		0		0	
Abundance Mat Plants	2		0		1		3		1		1		1		1	
Abundance Grass	0		0		0		0		0		0		0		0	
Abund. Flower. Species	2		3		2		2		2		4		1		4	
Abund. Seed Species	1		0		0		2		1		1		1		1	
TOTAL FAUNA SCORE		12		7		9		16		9.5		15		3		15
Soil Burrowability	VH		VH		H		VH		H		VH		H		VH	
Moisture	Medium		Dry-Mod		M		Medium		Very Dry		M		M		M	
TOTAL SCORE ALL VALUES		176		115		63		222		224		202		96.3		198

JANDAKOT AIRPORT HABITAT SURVEY - BLOCK B - Page 10

CHARACTER	B23	B24	B25	B26	B27	B28	B29
Numb. Adjacent Associations	0	0	0	0	1	1	2
Topographic Position	Lowland	Dampland	Lowland	Lowland	Lowland	Lowland	Lowland
Soil Drainage	VH	VH	VH	VH	VH	VH	VH
Soil Profile	Uniform	Uniform	Uniform	Uniform	Uniform	Uniform	Uniform
Slope (degrees)	0	0	0	0	0	0	0
Aspect	0	0	0	0	0	0	0
Soil Protection %	20	20	20	20	20	95	20
Erosion	0	0	0	0	0	0	0
St1 Life Form	T	T	T	T	T	T	T
St1 Top Height	7	7	7	7	7	8	7
St1 Bottom Height	3	3	3	3	3	4	3
Top Ht - Bottom Ht	4	4	4	4	4	4	4
St1 Canopy Cover (CC)	20	20	20	20	20	50	20
St1 Mean AFD	20	20	20	20	20	50	20
St1 Canopy Cover x AFD	4	4	4	4	4	25	4
St1 Health	4	4	4	4	4	5	4
St1 No species	3	3	3	3	3	3	3
St1 Dominants	Ba,Bi,Bm	Ba,Bi,Bm	Ba,Bi,Bm	Ba,Bi,Bm	Ba,Bi,Bm	Bi	Ba,Bi,Bm
St2 Life Form	S	S	S	S	S	S	S
St2 Top Height	2.5	2.5	2.5	2.5	2.5	2.5	2.5
St1 Bottom Ht - St2 Top Ht	0.5 0.5	0.5 0.5	0.5 0.5	0.5 0.5	0.5 0.5	1.5 1.5	0.5 0.5
St2 Bottom Height	0	0	0	0	0	0	0
St2 Canopy Cover	5	5	5	5	5	90	5
St2 Mean AFD	5	5	5	5	5	40	5
St2 Canopy Cover x AFD	0.25	0.25	0.25	0.25	0.25	36	0.25
St2 Health	1	1	1	1	1	5	1
St2 No species	?	?	?	?	?	2	?
St2 Dominants	Ri	Ri	Ri	Ri	Ri	Ri	Ri
St3 Life Form						V	
St3 Top Height						0.5	
St3 Bottom Height						0	

Mean = 75

Mean = 6.76

Mean = 3.03

Mean = 3.73

Mean = 57.4

Mean = 58.4

Mean = 2.87

Mean = 1.75

Mean = 0.26

Mean = 23.8

Mean = 21

Mean = 8.3

Mean = 3.9

Mean = 2.72

Mean = 0.35

JANDAKOT AIRPORT HABITAT SURVEY - BLOCI - Page 11

CHARACTER	B23		B24		B25		B26		B27		B28		B29		
St3 Canopy Cover											10				Mean = 49.8
St3 Mean AFD											0				Mean = 41
St3 Canopy Cover x AFD	0		0		0		0		0		0		0		Mean = 32.9
St3 Health											5				Mean = 3.33
St3 No species											4				Mean = 6.8
St3 Dominants											Sedge				
St4 Life Form															
St4 Top Height															Mean = 0.12
St4 Bottom Height															
St4 Canopy Cover															Mean = 6.4
Total Canopy Cover for All Strata	4.25	4	4.25	4	4.25	4	4.25	4	4.25	4	61	61	4.25	4	
St4 Health															Mean = 2.17
St4 No species															Mean = 2.07
St4 Dominants															
Number of LFDCs	2	6	2	6	2	6	2	6	2	6	3	9	2	6	
Number of Species	15		14		10		14		13		53		10		Mean = 30.9
Floristic Diversity	0	0	0	0	0	0	0	0	0	0	2	4	0	0	
No SMPs	5		5		5		5		5		15		5		Mean = 16.4
SMP Score	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Mean Health St 1 + 2	2.5	5	2.5	5	2.5	5	2.5	5	2.5	5	5	10	2.5	5	
Seedlings/saplings	3		3		3		3		3		0		3		Mean = 1.53
Spatial Organization	Cont		Cont		Cont		Cont		Cont		Cont		Cont		
Horizontal View	50		50		50		50		50		5		50		Mean = 65.8
Evidence of Logging	4	8	4	8	4	8	4	8	4	8	4	8	4	8	
Disturbance	Fire		Fire		Fire		Fire		Fire		Surr Fb		Fire		
Fire Age	11		11		11		11		11		11		11		Mean = 11
Stratal Recovery	4	12	4	12	4	12	4	12	4	12	4	12	4	12	
Weed species	0		0		0		0		0		0		0		
Weed Dominance	0		0		0		0		0		0		0		Mean = 0.03
Dieback Indicator	0		0		0		0		0		0		0		
Level Infection	0		0		0		0		0		0		0		Mean = 0.45
Dieback Status		5		5		5		5		5		5		5	Mean = 4.37
RHAS RATING		41		41		41		41		41		111		41	

JANDAKOT AIRPORT HABITAT SURVEY - BL(K B - Page 12

CHARACTER	B23		B24		B25		B26		B27		B28		B29		
FAUNA															
Hollow Limbs	0		0		0		0		0		0		0		Mean = 0.03
Hollow Trunks	1		1		1		1		1		1		1		Mean = 0.58
Abundance of Nests	0		0		0		0		0		0		0		Mean = 0.06
Abundance of Invertebr. Burrows	2		2		2		2		2		1		2		Mean = 0.7
Abund. Mamm. Burrows & Digs	2		2		2		2		2		1		2		Mean = 1.64
Logs <20cm	0		0		0		0		0		0		0		Mean = 0.15
Logs >20cm	0		0		0		0		0		0		0		Mean = 0.21
Litter Depth	0		0		0		0		0		8		0		Mean = 2.42
Litter Spacing	0		0		0		0		0		0		0		Mean = 0.62
Abundance Mat Plants	0		0		0		0		0		0		0		Mean = 1
Abundance Grass	0		0		0		0		0		0		0		Mean = 0.06
Abund. Flower. Species	2		2		2		2		2		4		2		Mean = 2.06
Abund. Seed Species	0		0		0		0		0		2		0		Mean = 0.91
TOTAL FAUNA SCORE		7		7		7		7		7		17		7	Mean = 10.5
Soil Burrowability	VH		VH		VH		VH		VH		VH		VH		
Moisture	M		M		M		M		M		M		M		
TOTAL SCORE ALL VALUES		47.5		47.5		47.5		47.5		47.5		128		47.5	Mean = 143.2

JANDAKOT AIRPORT HABITAT SURVEY - BLOCK C

CHARACTER	Wgt	C1		C2		C3		C4		C5		C6		C7	
Numb. Adjacent Associations	3	2	6	1	3	0	0	1	3	1	3	1	3	1	3
Topographic Position		Lowland		Mid-slope		Lowland		Dampland		Lowland		Lowland		Mid-slope	
Soil Drainage		VH		VH		Mod-High		Moderate		M		VH		VH	
Soil Profile		Uniform		Uniform		Uniform		Peaty		Uniform		Uniform		Uniform	
Slope (degrees)		2		4		0		0		0		2		4	
Aspect		NE		NE		0		0		0		S		NE	
Soil Protection %		80		90		90		90		80		95		90	
Erosion		0		0		0		0		0		0		0	
St1 Life Form		S		T		T		T		S		T		T	
St1 Top Height		1		7		9		8		1.5		8		7	
St1 Bottom Height		0		3		4		3		0		3		3	
Top Ht - Bottom Ht		**1**		**4**		**5**		**5**		**1.5**		**5**		**4**	
St1 Canopy Cover (CC)		60		40		40		10		40		60		40	
St1 Mean AFD		40		60		60		70		20		70		60	
St1 Canopy Cover x AFD		**24**		**24**		**24**		**7**		**8**		**42**		**24**	
St1 Health		5		5		5		4		2.5		5		5	
St1 No species		5		4		2		2		2		5		4	
St1 Dominants		Ah,Mt		Bm,Ba,Bi		Ba,Bi		Mp,Bi		Ri		Ba,Bi		Bm,Ba,Bi	
St2 Life Form		S		S		S + Xp		S		S + V		S		S	
St2 Top Height		0.3		2		1.5		2		0.5		2		2	
St1 Bottom Ht - St2 Top Ht	1	**-0.3**	**0.3**	**1**	**1**	**2.5**	**2.5**	**1**	**1**	**-0.5**	**0.5**	**1**	**1**	**1**	**1**
St2 Bottom Height		0		1		0		0		0		1		1	
St2 Canopy Cover		30		40		30		30		30		20		40	
St2 Mean AFD		40		40		30		30		30		30		40	
St2 Canopy Cover x AFD		**12**		**16**		**9**		**9**		**9**		**6**		**16**	
St2 Health		5		5		5		5		2		5		5	
St2 No species		12		3		5		3		4		5		3	
St2 Dominants		Mix		Ah,Mt		Jf, Xp		Ri		Db,Ha		Mt,Xp		Ah,Mt	
St3 Life Form				S		S		V				S		S	
St3 Top Height				1		0.5		0.3				1		1	
St3 Bottom Height				0		0		0				0		0	

JANDAKOT AIRPORT HABITAT SURVEY - BLOCK C - Page 2

CHARACTER	Wgt	C1		C2		C3		C4		C5		C6		C7	
St3 Canopy Cover				70		30		60				70		70	
St3 Mean AFD				60		30						60		60	
St3 Canopy Cover x AFD		**0**		**42**		**9**		**0**		**0**		**42**		**42**	
St3 Health				5		5		5				5		5	
St3 No species				8		6		8				10		8	
St3 Dominants				Ma		Cp + mix		Sedges				Ma,Gt		Macer	
St4 Life Form				V		V						V		V	
St4 Top Height				0.3		0.03						0.3		0.3	
St4 Bottom Height				0		0						0		0	
St4 Canopy Cover				5		20						10		5	
Total Canopy Index for all Strata	**1**		**36**		**87**		**62**		**16**		**8**		**100**		**87**
St4 Health				5		5						5		5	
St4 No species				4		4						6		4	
St4 Dominants				Sedges		Db						Sedges		Sedges	
Number of LFDCs	3	2	6	4	12	4	12	2	6	2	6	4	12	4	12
Number of Species		50		56		51		44		23		15		54	
Floristic Diversity	2	1	2	2	4	2	4	1	2	1	2	0	0	2	4
No SMPs		12		18		18		7		10		24		18	
SMP Score	2	0	0	0	0	0	0	0	0	0	0	1	2	0	0
Mean Health St 1+2	**2**	**5**	**10**	**5**	**10**	**5**	**10**	**4.5**	**9**	**2.25**	**4.5**	**5**	**10**	**5**	**10**
Seedlings/saplings		0		0		1		1		0		2		0	
Spatial Organization		Cont		Cont		Cont		Cont		Cont		Cont		Cont	
Horizontal View Distance		N/A		100		100		50		N/A		50		100	
Evidence of Logging		0		0		Heavy		0		0		0		0	
Disturbance		Clear adj		0		Logging		0		Firebreak		0		0	
Fire Age		15		15		15		14		14		15		15	
Stratal Recovery	3	4	12	4	12	4	12	4	12	4	12	4	12	4	12
Weed species		0		0		0		0		0		0		0	
Weed Dominance		0		0		0		0		0		0		0	
Dieback Indicator		0		0		0		Ba,Xp		Ba		0		0	
Level Infection		0		0		0		3		2		0		0	
Dieback Status			5		5		5		2		3		5		5
RHAS RATING			77		134		108		51		39		145		134

JANDAKOT AIRPORT HABITAT SURVEY - BLOCK C - Page 3

CHARACTER	Wgt	C1		C2		C3		C4		C5		C6		C7	
FAUNA															
Hollow Limbs		0		0		1		0		0		0		0	
Hollow Trunks		0		0		1		0		0		1		0	
Abundance of Nests		0		0		0		0		0		0		0	
Abundance of Invertebr. Burrows		0		0		1		0		1		1		0	
Abund. Mamm. Burrows & Digs		1		2		3		0		1		3		2	
Logs <20cm		0		0		2		2		0		1		0	
Logs >20cm		0		0		2		1		0		1		0	
Litter Depth		1		2		5		3		0		5		2	
Litter Spacing		2		1		1		1		0		0		1	
Abundance Mat Plants		0		0		2		1		3		2		0	
Abundance Grass		0		0		0		0		0		0		0	
Abund. Flower. Species		1		2		2		1		2		3		2	
Abund. Seed Species		0		2		2		1		0		3		2	
TOTAL FAUNA SCORE			5		9		22		10		7		20		9
Soil Burrowability		VH		VH		VH		VH		VH		VH		VH	
Moisture		Moderate		Very Dry		Moderate		Damp		Moderate		Very Dry		Very Dry	
TOTAL SCORE ALL VALUES			82.3		143		130		61		46		165		143

JANDAKOT AIRPORT HABITAT SURVEY - BLOCK C - Page 4

CHARACTER	C8		C9		C10		C11		C12		C13		C14		C15	
Numb. Adjacent Associations	2	6	1	3	0	0	0	0	1	3	0	0	1	3	1	3
Topographic Position	Lowland		Lowland		Mid-slope		Mid-slope		Lowland		Mid-slope		Mid-slope		Lowland	
Soil Drainage	Mod-High		Mod-High		VH		VH		Mod-High		VH		VH		Mod-High	
Soil Profile	Uniform		Uniform		Uniform		Uniform		Uniform		Uniform		Uniform		Uniform	
Slope (degrees)	0		0		6		6		0		6		6		0	
Aspect	0		0		N		N		0		N		N		0	
Soil Protection %	95		90		80		80		95		80		80		95	
Erosion	0		0		0		0		0		0		0		0	
St1 Life Form	T		T		T		T		T		T		T		T	
St1 Top Height	7		9		5		5		7		5		5		7	
St1 Bottom Height	3		4		2		2		3		2		2		3	
Top Ht - Bottom Ht	**4**		**5**		**3**		**3**		**4**		**3**		**3**		**4**	
St1 Canopy Cover (CC)	60		40		10		10		60		10		10		60	
St1 Mean AFD	60		60		70		70		60		70		70		60	
St1 Canopy Cover x AFD	**36**		**24**		**7**		**7**		**36**		**7**		**7**		**36**	
St1 Health	5		5		5		5		5		5		5		5	
St1 No species	3		2		2		2		3		2		2		3	
St1 Dominants	Ba,Bm,Bi		Ba,Bi		Bm, Ba		Bm, Ba		Ba,Bm,Bi		Bm, Ba		Bm, Ba		Ba,Bm,Bi	
St2 Life Form	S + Xp		S + Xp		S		S		S + Xp		S		S		S + Xp	
St2 Top Height	1		1.5		1.5		1.5		1		1.5		1.5		1	
St1 Bottom Ht - St2 Top Ht	**2**	**2**	**3.5**	**3.5**	**0.5**	**0.5**	**0.5**	**0.5**	**2**	**2**	**0.5**	**0.5**	**0.5**	**0.5**	**2**	**2**
St2 Bottom Height	0		0		0.5		0.5		0		0.5		0.5		0	
St2 Canopy Cover	60		30		60		60		60		60		60		60	
St2 Mean AFD	20		30		20		20		20		20		20		20	
St2 Canopy Cover x AFD	**12**		**9**		**12**		**12**		**12**		**12**		**12**		**12**	
St2 Health	5		5		5		5		5		5		5		5	
St2 No species	10		5		1		1		10		1		1		10	
St2 Dominants	Si, mix		Jf, Xp		Ah		Ah		Si, mix		Ah,Mt		Ah,Mt		Si, mix	
St3 Life Form	V		S		S		S		V		S		S		V	
St3 Top Height	0.2		0.5		0.5		0.5		0.2		0.5		0.5		0.2	
St3 Bottom Height	0		0		0		0		0		0		0		0	

JANDAKOT AIRPORT HABITAT SURVEY - BLOC[illegible] - Page 5

CHARACTER	C8		C9		C10		C11		C12		C13		C14		C15	
St3 Canopy Cover	1		30		80		80		1		80		80		1	
St3 Mean AFD			30		80		80				80		80			
St3 Canopy Cover x AFD	**0**		**9**		**64**		**64**		**0**		**64**		**64**		**0**	
St3 Health	5		5		5		5		5		5		5		5	
St3 No species	4		6		10		10		4		10		10		4	
St3 Dominants	Sedges		Cp,mix		Ma, Cp		Ma, Cp		Sedges		Ma, Cp		Ma, Cp		Sedges	
St4 Life Form			V		V		V				V		V			
St4 Top Height			0.03		0.3		0.3				0.3		0.3			
St4 Bottom Height			0		0		0				0		0			
St4 Canopy Cover			20		1		1				1		1			
Total Canopy Index for all Strata		**48**		**62**		**84**		**84**		**48**		**84**		**84**		**40**
St4 Health			5		5		5				5		5			
St4 No species			4		2		2				2		2			
St4 Dominants			Db		Sedges		Sedges				Sedges		Sedges			
Number of LFDCs	3	9	4	12	4	12	4	12	3	9	4	12	4	12	3	9
Number of Species	10		11		43		54		68		56		56		65	
Floristic Diversity	0	0	0	0	1	2	2	4	2	4	2	4	2	4	2	4
No SMPs	14		18		14		16		14		14		14		14	
SMP Score	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mean Health St 1+2	**5**	**10**	**5**	**10**	**5**	**10**	**5**	**10**	**5**	**10**	**5**	**10**	**5**	**10**	**5**	**10**
Seedlings/saplings	1		1		0		0		1		0		0		1	
Spatial Organization	Cont		Cont		Cont		Cont		Cont		Cont		Cont		Cont	
Horizontal View Distance	100		100		150		150		100		150		150		100	
Evidence of Logging	0		Heavy		0		0		0		0		0		0	
Disturbance	Airstrip		Logging		0		0		Airstrip		0		0		Airstrip	
Fire Age	15		15		15		15		15		15		15		15	
Stratal Recovery	4	12	4	12	4	12	4	12	4	12	4	12	4	12	4	12
Weed species	0		0		0		0		0		0		0		0	
Weed Dominance	0		0		0		0		0		0		0		0	
Dieback Indicator	0		0		0		0		0		0		0		0	
Level Infection	0		0		0		0		0		0		0		0	
Dieback Status		5		5		5		5		5		5		5		5
RHAS RATING		92		107		126		128		93		128		131		85

JANDAKOT AIRPORT HABITAT SURVEY - BLOC[illegible]C - Page 6

CHARACTER	C8		C9		C10		C11		C12		C13		C14		C15	
FAUNA																
Hollow Limbs	0		1		0		0		0		0		0		0	
Hollow Trunks	0		1		0		0		0		0		0		0	
Abundance of Nests	0		0		0		0		0		0		0		0	
Abundance of Invertebr. Burrows	0		1		0		0		0		0		0		0	
Abund. Mamm. Burrows & Digs	1		3		1		1		1		1		1		1	
Logs <20cm	0		2		0		0		0		0		0		0	
Logs >20cm	0		2		0		0		0		0		0		0	
Litter Depth	2		5		2		2		2		2		2		2	
Litter Spacing	1		1		2		2		1		2		2		1	
Abundance Mat Plants	1		2		0		0		1		0		0		1	
Abundance Grass	0		0		0		0		0		0		0		0	
Abund. Flower. Species	3		2		2		2		3		2		2		3	
Abund. Seed Species	2		2		2		2		2		2		2		2	
TOTAL FAUNA SCORE		10		22		9		9		10		9		9		10
Soil Burrowability	VH		VH		VH		VH		VH		VH		VH		VH	
Moisture	Moderate		Moderate		Very Dry		Very Dry		Moderate		Very Dry		Very Dry		Moderate	
TOTAL SCORE ALL VALUES		102		129		135		137		103		137		140		95

JANDAKOT AIRPORT HABITAT SURVEY - BLOCK C - Page 7

CHARACTER	C16		C17		C18		C19		C20		C21		C22		C23	
Numb. Adjacent Associations	0	0	1	3	1	3	2	6	0	0	0	0	1	3	1	3
Topographic Position	Mid-slope		Mid-slope		Lowland		Lowland		Mid-slope		Mid-slope		Mid-slope		Dampland	
Soil Drainage	VH		VH		VH		VH		VH		VH		VH		VH	
Soil Profile	Uniform		Uniform		Uniform		Uniform		Uniform		Uniform		Uniform		Uniform	
Slope (degrees)	2		6		0		0		2		2		2		0	
Aspect	NW		N		0		0		NW		NW		NW		0	
Soil Protection %	90		80		95		95		90		90		90		80	
Erosion	0		0		0		0		0		0		0		0	
St1 Life Form	T		T		T		T		T		T		T		T	
St1 Top Height	6		5		9		8		6		6		6		12	
St1 Bottom Height	3		2		3		3		3		3		3		3	
Top Ht - Bottom Ht	**3**		**3**		**6**		**5**		**3**		**3**		**3**		**9**	
St1 Canopy Cover (CC)	10		10		60		50		10		10		10		10	
St1 Mean AFD	40		70		70		70		40		40		40		80	
St1 Canopy Cover x AFD	**4**		**7**		**42**		**35**		**4**		**4**		**4**		**8**	
St1 Health	5		5		5		5		5		5		5		5	
St1 No species	2		2		4		4		2		2		2		1	
St1 Dominants	Bm,Ba		Bm, Ba		Bi,Ba		Ba,Bi		Bm,Ba		Bm,Ba		Bm,Ba		Mp	
St2 Life Form	S		S		S		S		S		S		S		S	
St2 Top Height	3		1.5		2.5		2		3		3		3		1.5	
St1 Bottom Ht - St2 Top Ht	**0**	**0**	**0.5**	**0.5**	**0.5**	**0.5**	**1**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**1.5**	**1.5**
St2 Bottom Height	0		0.5		1.5		1.5		0		0		0		0	
St2 Canopy Cover	60		60		85		90		60		60		60		95	
St2 Mean AFD	90		20		20		20		90		90		90		40	
St2 Canopy Cover x AFD	**54**		**12**		**17**		**18**		**54**		**54**		**54**		**38**	
St2 Health	5		5		5		5		5		5		5		5	
St2 No species	2		1		1		1		2		2		2		2	
St2 Dominants	Ac,Mt		Ah,Mt		Ri		Ri		Ri		Ac,Mt		Ac,Mt		Afas	
St3 Life Form	S		S		S		S		S		S		S			
St3 Top Height	0.5		0.5		0.5		0.5		0.5		0.5		0.5			
St3 Bottom Height	0		0		0		0		0		0		0			

JANDAKOT AIRPORT HABITAT SURVEY - BLOC C - Page 8

CHARACTER	C16		C17		C18		C19		C20		C21		C22		C23	
St3 Canopy Cover	80		80		70		10		80		80		80			
St3 Mean AFD	60		80		60		60		60		60		60			
St3 Canopy Cover x AFD	**48**		**64**		**42**		**6**		**48**		**48**		**48**		**0**	
St3 Health	5		5		5		5		5		5		5			
St3 No species	10		10		9		9		10		10		10			
St3 Dominants	Ah,Sl		Ma, Cp		Mix		Mix		Hh,Ah,Sl		Ah,Sl		Ah,Sl			
St4 Life Form	V		V		V		V		V		V		V			
St4 Top Height	0.3		0.3		0.3		0.3		0.3		0.3		0.3			
St4 Bottom Height	0		0		0		0		0		0		0			
St4 Canopy Cover	2		1		2		5		2		2		2			
Total Canopy Index for all Strata		**108**		**84**		**103**		**64**		**108**		**108**		**108**		**46**
St4 Health	5		5		5		5		5		5		5			
St4 No species	4		2		6		6		4		4		4			
St4 Dominants	Sedges		Sedges		Sedges		Sedges		Sedges		Sedges		Sedges			
Number of LFDCs	4	12	4	12	4	12	4	12	4	12	4	12	4	12	2	6
Number of Species	55		56		54		60		58		56		57		22	
Floristic Diversity	2	4	2	4	2	4	2	4	2	4	2	4	2	4	1	2
No SMPs	20		14		22		22		20		20		20		40	
SMP Score	0	0	0	0	1	2	1	2	0	0	0	0	0	0	1	2
Mean Health St 1+2	**5**	**10**	**5**	**10**	**5**	**10**	**5**	**10**	**5**	**10**	**5**	**10**	**5**	**10**	**5**	**10**
Seedlings/saplings	1		0		1		1		1		1		1		2	
Spatial Organization	Cont		Cont		Cont		Cont		Cont		Cont		Cont		Cont	
Horizontal View Distance	50		150		20		20		50		50		50		50	
Evidence of Logging	0		0		0		0		0		0		0		0	
Disturbance	Firebreak		0		Firebreaks		Firebreaks		Firebreak		Firebreak		Firebreak		0	
Fire Age	15		15		15		15		15		15		15		15	
Stratal Recovery	4	12	4	12	4	12	4	12	4	12	4	12	4	12	4	12
Weed species	0		0		0		0		0		0		0		0	
Weed Dominance	0		0		0		0		0		0		0		0	
Dieback Indicator	Ba		0		0		0		Ba		Ba		Ba		0	
Level Infection	1		0		0		0		1		1		1		0	
Dieback Status		4		5		5		5		4		4		4		5
RHAS RATING		150		131		152		116		150		150		153		88

JANDAKOT AIRPORT HABITAT SURVEY - BLOCK C - Page 9

CHARACTER	C16		C17		C18		C19		C20		C21		C22		C23	
FAUNA																
Hollow Limbs	0		0		1		1		0		0		0		1	
Hollow Trunks	0		0		1		1		0		0		0		3	
Abundance of Nests	0		0		1		1		0		0		0		2	
Abundance of Invertebr. Burrows	1		0		1		1		1		1		1		1	
Abund. Mamm. Burrows & Digs	2		1		3		3		2		2		2		2	
Logs <20cm	0		0		1		1		0		0		0		1	
Logs >20cm	0		0		1		1		0		0		0		1	
Litter Depth	5		2		5		5		5		5		5		0	
Litter Spacing	0		2		0		0		0		0		0		0	
Abundance Mat Plants	0		0		2		2		0		0		0		0	
Abundance Grass	0		0		0		0		0		0		0		0	
Abund. Flower. Species	3		2		2		1		3		3		3		3	
Abund. Seed Species	1		2		2		2		1		1		1		0	
TOTAL FAUNA SCORE		12		9		20		19		12		12		12		14
Soil Burrowability	VH		VH		VH		VH		VH		VH		VH		VH	
Moisture	Dry		Very Dry		Moderate		Moderate		Dry		Dry		Dry		Wet-Mod	
TOTAL SCORE ALL VALUES		162		140		172		135		162		162		165		102

JANDAKOT AIRPORT HABITAT SURVEY - BLOC C - Page 10

CHARACTER	C24		C25		C26		C27		C28		C29		C30		C31	
Numb. Adjacent Associations	1	3	0	0	0	0	1	3	2	6	1	3	1	3	1	3
Topographic Position	Lowland		Mid-slope		Mid-slope		Mid-slope		Dampland		Lowland		Lowland		Lowland	
Soil Drainage	Mod-High		VH		VH		VH		Mod-Poor		VH		VH		VH	
Soil Profile	Uniform		Uniform		Uniform		Uniform		Uniform		Uniform		Uniform		Uniform	
Slope (degrees)	0		2		2		2		0		0		0		0	
Aspect	0		NW		NW		NW		0		0		0		0	
Soil Protection %	95		90		90		90		95		95		95		95	
Erosion	0		0		0		0		0		0		0		0	
St1 Life Form	T		T		T		T		S		T		T		T	
St1 Top Height	7		6		6		6		1.5		9		8		8	
St1 Bottom Height	3		3		3		3		0		3		3		3	
Top Ht - Bottom Ht	**4**		**3**		**3**		**3**		**1.5**		**6**		**5**		**5**	
St1 Canopy Cover (CC)	60		10		10		10		95		60		70		50	
St1 Mean AFD	60		40		40		40		60		70		70		70	
St1 Canopy Cover x AFD	**36**		**4**		**4**		**4**		**57**		**42**		**49**		**35**	
St1 Health	5		5		5		5		5		5		5		5	
St1 No species	3		2		2		2		1		4		4		4	
St1 Dominants	Ba,Bm,Bi		Bm,Ba		Bm,Ba		Bm,Ba		Ri		Bi,Ba		Ba,Bi		Bi,Ba	
St2 Life Form	S		S		S		S		S		S		S		S	
St2 Top Height	1		3		3		3		0.5		2.5		3		2.5	
St1 Bottom Ht - St2 Top Ht	**2**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**-0.5**	**0.5**	**0.5**	**0.5**	**0**	**0**	**0.5**	**0.5**
St2 Bottom Height	0		0		0		0		0		1.5		1.5		1.5	
St2 Canopy Cover	60		60		60		60		20		85		80		90	
St2 Mean AFD	20		90		90		90		20		20		20		20	
St2 Canopy Cover x AFD	**12**		**54**		**54**		**54**		**4**		**17**		**16**		**18**	
St2 Health	5		5		5		5		5		5		5		5	
St2 No species	10		2		2		2		1		1		1		1	
St2 Dominants	Mt,Mr		Ac,Mt		Ac,Mt		Ac,Mt		Ha		Ri		Ri		Ri	
St3 Life Form	S		S		S		S				S		S		S	
St3 Top Height	0.5		0.5		0.5		0.5				0.5		1		0.5	
St3 Bottom Height	0		0		0		0				0		0		0	

JANDAKOT AIRPORT HABITAT SURVEY - BLOCK C - Page 11

CHARACTER	C24		C25		C26		C27		C28		C29		C30		C31	
St3 Canopy Cover	80		80		80		80				70		30		70	
St3 Mean AFD	60		60		60		60				60		60		60	
St3 Canopy Cover x AFD	**48**		**48**		**48**		**48**		**0**		**42**		**18**		**42**	
St3 Health	5		5		5		5				5		5		5	
St3 No species	10		10		10		10				9		9		9	
St3 Dominants	Mix		Ah,Sl		Ah,Sl		Ah,Sl				Mix		Ha,Mix		Si,Cp	
St4 Life Form	V		V		V		V				V		V		V	
St4 Top Height	0.3		0.3		0.3		0.3				0.3		0.3		0.3	
St4 Bottom Height	0		0		0		0				0		0		0	
St4 Canopy Cover	2		2		2		2				2		1		2	
Total Canopy Index for all Strata		**98**		**108**		**108**		**108**		**61**		**103**		**84**		**97**
St4 Health	5		5		5		5				5		5		5	
St4 No species	4		4		4		4				6		6		6	
St4 Dominants	Db		Sedges		Sedges		Sedges				Sedges		Sedges		Sedges	
Number of LFDCs	4	12	4	12	4	12	4	12	2	6	4	12	4	12	4	12
Number of Species	47		20		21		57		18		43		46		49	
Floristic Diversity	1	2	0	0	1	2	2	4	0	0	1	2	1	2	1	2
No SMPs	17		20		20		20		2		22		22		22	
SMP Score	0	0	0	0	0	0	0	0	0	0	1	2	1	2	1	2
Mean Health St 1+2	**5**	**10**	**5**	**10**	**5**	**10**	**5**	**10**	**5**	**10**	**5**	**10**	**5**	**10**	**5**	**10**
Seedlings/saplings	1		1		1		1		0		1		1		1	
Spatial Organization	Cont		Cont		Cont		Cont		Cont		Cont		Cont		Cont	
Horizontal View Distance	100		50		50		50		N/A		20		20		20	
Evidence of Logging	0		0		0		0		0		0		0		0	
Disturbance	0		0		0		Firebreak		0		Firebreaks		0		Firebreaks	
Fire Age	15		15		15		15		15		15		15		15	
Stratal Recovery	4	12	4	12	4	12	4	12	4	12	4	12	4	12	4	12
Weed species	Grass		0		0		0		0		0		0		0	
Weed Dominance	2		0		0		0		0		0		0		0	
Dieback Indicator	0		0		0		Ba		0		0		0		0	
Level Infection	0		0		0		1		0		0		0		0	
Dieback Status		5		5		5		4		5		5		5		5
RHAS RATING		144		147		149		153		101		150		130		144

JANDAKOT AIRPORT HABITAT SURVEY - BLOCK C - Page 12

CHARACTER	C24		C25		C26		C27		C28		C29		C30		C31	
FAUNA																
Hollow Limbs	0		0		0		0		0		1		1		1	
Hollow Trunks	0		0		0		0		0		1		1		1	
Abundance of Nests	0		0		0		0		0		1		1		1	
Abundance of Invertebr. Burrows	0		1		1		1		0		1		1		1	
Abund. Mamm. Burrows & Digs	1		2		2		2		1		3		3		3	
Logs <20cm	0		0		0		0		0		1		1		1	
Logs >20cm	0		0		0		0		0		1		1		1	
Litter Depth	2		5		5		5		1		5		5		5	
Litter Spacing	1		0		0		0		1		0		0		0	
Abundance Mat Plants	1		0		0		0		0		2		2		2	
Abundance Grass	3		0		0		0		0		0		0		0	
Abund. Flower. Species	3		3		3		3		1		2		2		2	
Abund. Seed Species	2		1		1		1		0		2		2		2	
TOTAL FAUNA SCORE		13		12		12		12		4		20		20		20
Soil Burrowability	VH		VH		VH		VH		VH		VH		VH		VH	
Moisture	Moderate		Dry		Dry		Dry		Moderate		Moderate		Moderate		Moderate	
TOTAL SCORE ALL VALUES		157		159		161		165		105		170		150		164

JANDAKOT AIRPORT HABITAT SURVEY - BLC[illegible] C - Page 13

CHARACTER	C32		C33		C34		C35		C36		C37		C38		C39	
Numb. Adjacent Associations	1	3	1	3	1	3	1	3	0	0	1	3	1	3	0	0
Topographic Position	Lowland		Lowland		Dampland		Lowland		Mid-slope		Mid-slope		Lowland		Lowland	
Soil Drainage	VH		VH		VH		VH		VH		VH		VH		VH	
Soil Profile	Uniform		Uniform		Uniform		Uniform		Uniform		Uniform		Uniform		Uniform	
Slope (degrees)	0		0		0		0		2		2		0		2	
Aspect	0		0		0		0		NW		NW		0		W	
Soil Protection %	95		95		80		95		90		90		95		10	
Erosion	0		0		0		0		0		0		0		Some Runoff	
St1 Life Form	T		T		T		T		T		T		T		T	
St1 Top Height	8		8		12		9		6		6		9		6	
St1 Bottom Height	3		3		3		3		3		3		3		3	
Top Ht - Bottom Ht	**5**		**5**		**9**		**6**		**3**		**3**		**6**		**3**	
St1 Canopy Cover (CC)	70		50		10		60		10		10		60		70	
St1 Mean AFD	70		70		80		70		40		40		70		40	
St1 Canopy Cover x AFD	**49**		**35**		**8**		**42**		**4**		**4**		**42**		**28**	
St1 Health	5		5		5		5		5		5		5		4	
St1 No species	4		4		1		4		2		2		4		3	
St1 Dominants	Ba,Bi		Bi,Ba		Mp		Bi,Ba		Bm,Ba		Bm,Ba		Bi,Ba		Ba,Bm	
St2 Life Form	S		S		S		S		S		S		S			
St2 Top Height	3		2.5		1.5		2.5		3		3		2.5			
St1 Bottom Ht - St2 Top Ht	**0**	**0**	**0.5**	**0.5**	**1.5**	**1.5**	**0.5**	**2.5**	**0**	**0**	**0**	**0**	**0.5**	**0.5**	**3**	**3**
St2 Bottom Height	1.5		1.5		0		1.5		0		0		1.5			
St2 Canopy Cover	80		90		95		85		60		60		85			
St2 Mean AFD	20		20		40		20		90		90		20			
St2 Canopy Cover x AFD	**16**		**18**		**38**		**17**		**54**		**54**		**17**		**0**	
St2 Health	5		5		5		5		5		5		5			
St2 No species	1		1		2		1		2		2		1			
St2 Dominants	Ri		Ri,Ac		Afas		Ri		Ac,Mt		Ac,Mt		Ri			
St3 Life Form	S		S				S		S		S		S			
St3 Top Height	1		0.5				0.5		0.5		0.5		0.5			
St3 Bottom Height	0		0				0		0		0		0			

JANDAKOT AIRPORT HABITAT SURVEY - BLOC C - Page 14

CHARACTER	C32		C33		C34		C35		C36		C37		C38		C39	
St3 Canopy Cover	30		70				70		80		80		70			
St3 Mean AFD	60		60				60		60		60		60			
St3 Canopy Cover x AFD	**18**		**42**		**0**		**42**		**48**		**48**		**42**		**0**	
St3 Health	5		5				5		5		5		5			
St3 No species	9		9				9		10		10		9			
St3 Dominants	Ha,Mix		Si,Cp				Mix		Ah,Sl		Ah,Sl		Mix			
St4 Life Form	V		V				V		V		V		V			
St4 Top Height	0.3		0.3				0.3		0.3		0.3		0.3			
St4 Bottom Height	0		0				0		0		0		0			
St4 Canopy Cover	1		2				2		2		2		2			
Total Canopy Index for all Strata		**84**		**97**		**46**		**103**		**108**		**108**		**103**		**28**
St4 Health	5		5				5		5		5		5			
St4 No species	6		6				6		4		4		6			
St4 Dominants	Sedges		Sedges				Sedges		Sedges		Sedges		Sedges			
Number of LFDCs	4	12	4	12	2	6	4	12	4	12	4	12	4	12	2	6
Number of Species	50		56		5		50		16		15		4		15	
Floristic Diversity	1	2	2	4	0	0	1	2	0	0	0	0	0	0	0	0
No SMPs	22		22		40		22		20		20		22		5	
SMP Score	1	2	1	2	1	2	1	2	0	0	0	0	1	2	0	0
Mean Health St 1+2	**5**	**10**	**5**	**10**	**5**	**10**	**5**	**10**	**5**	**10**	**5**	**10**	**5**	**10**	**2**	**4**
Seedlings/saplings	1		1		2		1		1		1		1		1	
Spatial Organization	Cont		Cont		Cont		Cont		Cont		Cont		Cont			
Horizontal View Distance	20		20		50		20		50		50		20		N/A	
Evidence of Logging	0		0		0		0		0		0		0		0	
Disturbance	0		Firebreaks		0		Firebreaks		0		0		Firebreaks			
Fire Age	15		15		15		15		15		15		15		1	
Stratal Recovery	4	12	4	12	4	12	4	12	4	12	4	12	4	12	0	0
Weed species	0		0		0		0		0		0		0		0	
Weed Dominance	0		0		0		0		0		0		0		0	
Dieback Indicator	0		0		0		0		0		0		0		0	
Level Infection	0		0		0		0		0		0		0		0	
Dieback Status		5		5		5		5		5		5		5		5
RHAS RATING		130		146		86		152		147		150		148		46

JANDAKOT AIRPORT HABITAT SURVEY - BLOC C - Page 15

CHARACTER	C32		C33		C34		C35		C36		C37		C38		C39	
FAUNA																
Hollow Limbs	1		1		1		1		0		0		1		0	
Hollow Trunks	1		1		3		1		0		0		1		1	
Abundance of Nests	1		1		2		1		0		0		1		0	
Abundance of Invertebr. Burrows	1		1		1		1		1		1		1		0	
Abund. Mamm. Burrows & Digs	3		3		2		3		2		2		3		0	
Logs <20cm	1		1		1		1		0		0		1		0	
Logs >20cm	1		1		1		1		0		0		1		0	
Litter Depth	5		5		0		5		5		5		5		0	
Litter Spacing	0		0		0		0		0		0		0		0	
Abundance Mat Plants	2		2		0		2		0		0		2		0	
Abundance Grass	0		0		0		0		0		0		0		0	
Abund. Flower. Species	2		2		3		2		3		3		2		1	
Abund. Seed Species	2		2		0		2		1		1		2		0	
TOTAL FAUNA SCORE		20		20		14		20		12		12		20		2
Soil Burrowability	VH		VH		VH		VH		VH		VH		VH		VH	
Moisture	Moderate		Moderate		Wet-Mod		Moderate		Dry		Dry		Moderate		Moderate	
TOTAL SCORE ALL VALUES		150		166		99.5		172		159		162		168		48

JANDAKOT AIRPORT HABITAT SURVEY - BLOCK C - Page 16

CHARACTER	C40		C41		C42		C43		C44		C45	
Numb. Adjacent Associations	1	3	0	0	1	3	1	3	1	3	1	3
Topographic Position	Lowland		Lowland		Crest		Crest		Crest		Crest	
Soil Drainage	VH		VH		VH		VH		VH		VH	
Soil Profile	Uniform		Uniform		Uniform		Uniform		Uniform		Uniform	
Slope (degrees)	2		0		6		6		6		6	
Aspect	W		0		S		W		W		S	
Soil Protection %	10		95		5		5		5		95	
Erosion	Some Runoff		0		Some Runoff		Some Runoff		Some Runoff		0	
St1 Life Form	T		T		T		T		T		T	
St1 Top Height	6		9		7		5		5		7	
St1 Bottom Height	3		3		3		3		3		3	
Top Ht - Bottom Ht	**3**		**6**		**4**		**2**		**2**		**4**	
St1 Canopy Cover (CC)	70		60		10		5		5		50	
St1 Mean AFD	40		70		10		10		10		50	
St1 Canopy Cover x AFD	**28**		**42**		**1**		**0.5**		**0.5**		**25**	
St1 Health	4		5		1		1		1		5	
St1 No species	3		4		4		3		3		4	
St1 Dominants	Ba,Bm		Bi,Ba		Bm,Ba		Bm,Et		Bm,Ba,Et		Bi,Bm,Et	
St2 Life Form			S		S						S	
St2 Top Height			2.5		1.5						1.5	
St1 Bottom Ht - St2 Top Ht	**3**	**3**	**0.5**	**0.5**	**1.5**	**1.5**	**3**	**3**	**3**	**3**	**1.5**	**1.5**
St2 Bottom Height			1.5		0						0	
St2 Canopy Cover			85		2						5	
St2 Mean AFD			20		5						10	
St2 Canopy Cover x AFD	**0**		**17**		**0.1**		**0**		**0**		**0.5**	
St2 Health			5		1						5	
St2 No species			1		2						2	
St2 Dominants			Ri		Mt						Mt	
St3 Life Form			S								S	
St3 Top Height			0.5								0.3	
St3 Bottom Height			0								0	

JANDAKOT AIRPORT HABITAT SURVEY - BLOCK C - Page 17

CHARACTER	C40		C41		C42		C43		C44		C45	
St3 Canopy Cover			70								80	
St3 Mean AFD			60								30	
St3 Canopy Cover x AFD	**0**		**42**		**0**		**0**		**0**		**24**	
St3 Health			5								5	
St3 No species			9								7	
St3 Dominants			Mix								Db,Mix	
St4 Life Form			V									
St4 Top Height			0.3									
St4 Bottom Height			0									
St4 Canopy Cover			2									
Total Canopy Index for all Strata		**28**		**103**		**1.1**		**0.5**		**0.5**		**50**
St4 Health			5									
St4 No species			6									
St4 Dominants			Sedges									
Number of LFDCs	2	6	4	12	2	6	2	6	2	6	3	9
Number of Species	17		44		28		14		17		52	
Floristic Diversity	0	0	1	2	1	2	0	0	0	0	2	4
No SMPs	6		22		3		4		5		18	
SMP Score	0	0	1	2	0	0	0	0	0	0	0	0
Mean Health St 1+2	**2**	**4**	**5**	**10**	**1**	**2**	**0.5**	**1**	**0.5**	**1**	**5**	**10**
Seedlings/saplings	1		1		0		0		0		1	
Spatial Organization			Cont		Cont		Cont		Cont		Cont	
Horizontal View Distance	N/A		20		N/A		N/A		N/A		100	
Evidence of Logging	0		0		0		0		0		0	
Disturbance			Firebreaks		Firebreaks		Firebreaks		Firebreaks		Firebreaks	
Fire Age	1		15		1		1		1		15	
Stratal Recovery	0	0	4	12	0	0	0	0	0	0	4	12
Weed species	0		0		0		0		0		0	
Weed Dominance	0		0		0		0		0		0	
Dieback Indicator	0		0		0		0		0		0	
Level Infection	0		0		0		0		0		0	
Dieback Status		5		5		5		5		5		5
RHAS RATING		49		147		21		19		19		94

JANDAKOT AIRPORT HABITAT SURVEY - BLOCK C - Page 18

CHARACTER	C40		C41		C42		C43		C44		C45	
FAUNA												
Hollow Limbs	0		1		0		0		0		0	
Hollow Trunks	1		1		0		0		0		0	
Abundance of Nests	0		1		0		0		0		0	
Abundance of Invertebr. Burrows	0		1		0		0		0		1	
Abund. Mamm. Burrows & Digs	0		3		1		1		0		1	
Logs <20cm	0		1		0		0		0		0	
Logs >20cm	0		1		0		0		0		0	
Litter Depth	0		5		0		0		0		3	
Litter Spacing	0		0		0		0		0		1	
Abundance Mat Plants	0		2		0		0		0		1	
Abundance Grass	0		0		0		0		0		0	
Abund. Flower. Species	1		2		1		1		1		2	
Abund. Seed Species	0		2		1		0		0		1	
TOTAL FAUNA SCORE		2		20		3		2		1		10
Soil Burrowability	VH		VH		VH		VH		VH		VH	
Moisture	Moderate		Moderate		Very Dry		Very Dry		Very Dry		Very Dry	
TOTAL SCORE ALL VALUES		51		167		23.6		20.5		19.5		104

JANDAKOT AIRPORT HABITAT SURVEY - BLOC C - Page 19

CHARACTER	C46		C47			
Numb. Adjacent Associations	1	3	1	3		
Topographic Position	Mid-slope		Mid-slope			
Soil Drainage	VH		VH			
Soil Profile	Uniform		Uniform			
Slope (degrees)	4		2			
Aspect	W		W			
Soil Protection %	10		10		Mean =	77.7
Erosion	Some Runoff		Some Runoff			
St1 Life Form	T		T			
St1 Top Height	5		6		Mean =	6.7
St1 Bottom Height	3		3		Mean =	2.74
Top Ht - Bottom Ht	**2**		**3**		Mean =	3.96
St1 Canopy Cover (CC)	10		10		Mean =	35
St1 Mean AFD	20		10		Mean =	53.2
St1 Canopy Cover x AFD	**2**		**1**			
St1 Health	2		2			
St1 No species	2		2		Mean =	2.83
St1 Dominants	Bm,Ba		Bm,Ba			
St2 Life Form						
St2 Top Height					Mean =	1.75
St1 Bottom Ht - St2 Top Ht	**3**	**3**	**3**	3		
St2 Bottom Height					Mean =	0.44
St2 Canopy Cover					Mean =	51.1
St2 Mean AFD					Mean =	33.5
St2 Canopy Cover x AFD	**0**		**0**		Mean =	19.8
St2 Health					Mean =	4.21
St2 No species					Mean =	2.6
St2 Dominants						
St3 Life Form						
St3 Top Height					Mean =	0.4
St3 Bottom Height						

JANDAKOT AIRPORT HABITAT SURVEY - BLOCK C - Page 20

CHARACTER	C46		C47			
St3 Canopy Cover					Mean =	46.2
St3 Mean AFD					Mean =	39.8
St3 Canopy Cover x AFD	0		0		Mean =	27.7
St3 Health					Mean =	3.72
St3 No species					Mean =	6.49
St3 Dominants						
St4 Life Form						
St4 Top Height					Mean =	0.18
St4 Bottom Height						
St4 Canopy Cover					Mean =	2.26
Total Canopy Index for all Strata		2		1		
St4 Health					Mean =	3.19
St4 No species					Mean =	2.81
St4 Dominants						
Number of LFDCs	2	6	2	6		
Number of Species	10		13		Mean =	37.9
Floristic Diversity	0	0	0	0		
No SMPs	0		0		Mean =	16.6
SMP Score	0	0	0	0		
Mean Health St 1+2	1	2	1	2		
Seedlings/saplings	0		0		Mean =	0.74
Spatial Organization	Cont		Cont			
Horizontal View Distance	N/A		N/A		Mean =	53.2
Evidence of Logging	0		0			
Disturbance	Firebreaks		Firebreaks			
Fire Age	1		1		Mean =	12.9
Stratal Recovery	0	0	0	0		
Weed species	0		0			
Weed Dominance	0		0		Mean =	0.04
Dieback Indicator	0		0			
Level Infection	0		0		Mean =	0.21
Dieback Status		5		5	Mean =	4.17
RHAS RATING		21		20		

JANDAKOT AIRPORT HABITAT SURVEY - BLOCK C - Page 21

CHARACTER	C46		C47			
FAUNA						
Hollow Limbs	0		0		Mean =	0.3
Hollow Trunks	0		0		Mean =	0.45
Abundance of Nests	0		0		Mean =	0.3
Abundance of Invertebr. Burrows	0		0		Mean =	0.55
Abund. Mamm. Burrows & Digs	1		1		Mean =	1.74
Logs <20cm	0		0		Mean =	0.4
Logs >20cm	0		0		Mean =	0.38
Litter Depth	0		0		Mean =	2.98
Litter Spacing	0		0		Mean =	0.49
Abundance Mat Plants	0		0		Mean =	0.74
Abundance Grass	0		0		Mean =	0.06
Abund. Flower. Species	0		0		Mean =	2.06
Abund. Seed Species	1		1		Mean =	1.34
TOTAL FAUNA SCORE		2		2		
Soil Burrowability	VH		VH			
Moisture	Dry		Dry			
TOTAL SCORE ALL VALUES		23		22	Mean =	122.0

JANDAKOT AIRPORT HABITAT SURVEY - BLOCK D

CHARACTER	Wgt	D1		D2		D3		D4		D5		D6		D7	
Numb. Adjacent Associations	3	0	0	1	3	1	3	1	3	1	3	1	3	0	0
Topographic Position		Crest		Crest		Lowland		Lowland		Crest		Lowland		Mid-slope	
Soil Drainage		VH		VH		VH		VH		VH		VH		VH	
Soil Profile		Uniform		Uniform		Uniform		Uniform		Uniform		Uniform		Uniform	
Slope (degrees)		1		1		0		0		4		0		12	
Aspect		NE		NE		0		0		NE		0		E	
Soil Protection %		95		95		95		95		80		90		95	
Erosion		0		0		0		0		0		0		0	
St1 Life Form		T		T		T		T		T		T		T	
St1 Top Height		8		8		6		6		4		6		7	
St1 Bottom Height		2		2		2		2		1.5		3		2.5	
Top Ht - Bottom Ht		**6**		**6**		**4**		**4**		**2.5**		**3**		**4.5**	
St1 Canopy Cover (CC)		60		60		20		20		2		20		50	
St1 Mean AFD		40		40		40		40		60		60		50	
St1 Canopy Cover x AFD		**24**		**24**		**8**		**8**		**1.2**		**12**		**25**	
St1 Health		4		4		5		5		5		5		5	
St1 No species		4		4		3		3		1		2		3	
St1 Dominants		Ba,Bm,Em		Ba,Bm,Em		Bi,Ba,Bm		Bi,Ba,Bm		Ba		Ba,Bm		Ba,Bm,Em	
St2 Life Form		S		S		S		S		S		S		S	
St2 Top Height		1		1		2.5		2.5		1		0.5		1.5	
St1 Bottom Ht - St2 Top Ht	1	**1**	1	**1**	1	**-0.5**	0.5	**-0.5**	0.5	**0.5**	0.5	**2.5**	2.5	**1**	1
St2 Bottom Height		0		0		0		0		0		0		0.5	
St2 Canopy Cover		80		80		80		80		80		80		10	
St2 Mean AFD		80		80		20		20		80		70		40	
St2 Canopy Cover x AFD		**64**		**64**		**16**		**16**		**64**		**56**		**4**	
St2 Health		5		5		5		5		5		5		5	
St2 No species		16		16		2		2		18		7		6	
St2 Dominants		Hh,mix		Hh,mix		Ri		Ri		Mix		Ah,Sl		Rv,Lk	
St3 Life Form		V		V						V		V		S	
St3 Top Height		0.3		0.3						0.3		0.3		0.5	
St3 Bottom Height		0		0						0		0		0	

JANDAKOT AIRPORT HABITAT SURVEY - BLOCK D - PAGE 2

CHARACTER	Wgt	D1		D2		D3		D4		D5		D6		D7	
St3 Canopy Cover		10		10						5		10		80	
St3 Mean AFD		1		1						1		1		30	
St3 Canopy Cover x AFD		**0.1**		**0.1**						**0.05**		**0.1**		**24**	
St3 Health		5		5						5		5		5	
St3 No species		4		4						4		4		4	
St3 Dominants		Sedges		Sedges						Sedges		Sedges		Mix	
St4 Life Form														V	
St4 Top Height														0.3	
St4 Bottom Height														0	
St4 Canopy Cover														5	
Total Canopy Index for All Strata	**1**	**88.1**	**88**	**88.1**	**88**	**24**	**24**	**24**	**24**	**65.3**	**65**	**68.1**	**68**	**53**	**53**
St4 Health														5	
St4 No species														4	
St4 Dominants														Sedges	
Number of LFDCs	3	3	9	3	9	2	6	2	6	3	9	3	9	4	12
Number of Species		82		83		36		36		50		65		69	
Floristic Diversity	2	2	4	2	4	1	2	1	2	1	2	2	4	2	4
No SMPs		28		28		7		7		23		15		18	
SMP Score	2	1	2	1	2	0	0	0	0	1	2	0	0	0	0
Mean Health St1 + 2	**2**	**4.5**	**9**	**4.5**	**9**	**5**	**10**	**5**	**10**	**5**	**10**	**5**	**10**	**5**	**10**
Seedlings/saplings		1		1		2		2		0		0		2	
Spatial Organization		Cont		Cont		Patchy		Patchy		Cont		Cont		Cont	
Horizontal View Distance		100		100		150		150		N/A		200		50	
Evidence of Logging	2	4	8	4	8	4	8	4	8	4	8	4	8	4	8
Disturbance		Firebreak		Firebreak		0		0		Firebreak		0		Firebreak	
Fire Age		14		14		14		14		14		14		14	
Stratal Recovery	3	4	12	4	12	4	12	4	12	4	12	4	12	4	12
Weed species		Glad		Glad		0		0		Glad		Glad		Glad	
Weed Dominance		1		1		0		0		1		0		1	
Dieback Indicator		Ba		Ba		0		0		Ba		0		0	
Level Infection		2		2		0		0		1		0		0	
Dieback Status			3		3		5		5		4		5		5
RHAS RATING			136		139		71		71		116		122		105

JANDAKOT AIRPORT HABITAT SURVEY - BLOCK D - PAGE 3

CHARACTER	Wgt	D1		D2		D3		D4		D5		D6		D7	
FAUNA															
Hollow Limbs		0		0		0		0		0		0		0	
Hollow Trunks		1		1		0		0		0		0		0	
Abundance of Nests		0		0		1		1		0		0		0	
Abundance of Invertebr. Burrows		1		1		1		1		0		1		2	
Abund. Mamm. Burrows & Digs		1		1		1		1		0		3		3	
Logs <20cm		1		1		0		0		0		1		1	
Logs >20cm		0		0		0		0		0		1		2	
Litter Depth		5		5		5		5		2		2		3	
Litter Spacing		1		1		0		0		2		2		1	
Abundance Mat Plants		2		2		0		0		2		1		1	
Abundance Grass		1		1		0		0		2		0		0	
Abund. Flower. Species		2		2		3		3		2		1		2	
Abund. Seed Species		1		1		1		1		1		1		1	
TOTAL FAUNA SCORE			16		16		12		12		11		13		16
Soil Burrowability		VH		VH		VH		VH		VH		VH		VH	
Moisture		Very Dry		Very Dry		Moderate		Moderate		Very Dry		Moderate		Very Dry	
TOTAL SCORE ALL VALUES			152		155		82.5		82.5		127		135		121

JANDAKOT AIRPORT HABITAT SURVEY - BLOCK D - PAGE 4

CHARACTER	D8		D9		D10		D11		D12		D13		D14		D15	
Numb. Adjacent Associations	0	0	1	3	2	6	1	3	0	0	1	3	0	0	1	3
Topographic Position	Mid-slope		Lowland		Crest		Lowland		Lowland		Mid-slope		Lowland		Lowland	
Soil Drainage	VH		VH		VH		VH		VH		VH		VH		VH	
Soil Profile	Uniform		Uniform		Uniform		Uniform		Uniform		Uniform		Uniform		Uniform	
Slope (degrees)	12		0		4		0		0		12		0		0	
Aspect	E		0		NE		0		0		E		0		N	
Soil Protection %	95		95		80		90		90		95		90		90	
Erosion	0		0		0		0		0		0		0		0	
St1 Life Form	T		T		T		T		T		T		T		T	
St1 Top Height	7		6		4		6		6		7		6		6	
St1 Bottom Height	2.5		2		1.5		3		3		2.5		3		3	
Top Ht - Bottom Ht	**4.5**		**4**		**2.5**		**3**		**3**		**4.5**		**3**		**3**	
St1 Canopy Cover (CC)	50		20		2		20		20		50		20		30	
St1 Mean AFD	50		40		60		60		60		50		60		60	
St1 Canopy Cover x AFD	**25**		**8**		**1.2**		**12**		**12**		**25**		**12**		**18**	
St1 Health	5		5		5		5		5		5		5		5	
St1 No species	3		3		1		2		2		3		2		2	
St1 Dominants	Ba,Bm,Em		Bi,Ba,Bm		Ba,Em		Ba,Bm		Ba,Bm		Ba,Bm,Em		Ba,Bm		Ba,Bm	
St2 Life Form	S		S		S		S		S		S		S		S	
St2 Top Height	1.5		2.5		1		0.5		0.5		1.5		0.5		0.5	
St1 Bottom Ht - St2 Top Ht	**1**	**1**	**-0.5**	**0.5**	**0.5**	**0.5**	**2.5**	**2.5**	**2.5**	**2.5**	**1**	**1**	**2.5**	**2.5**	**2.5**	**2.5**
St2 Bottom Height	0.5		0		0		0		0		0.5		0		0	
St2 Canopy Cover	10		80		80		80		80		10		80		30	
St2 Mean AFD	40		20		80		70		70		40		70		50	
St2 Canopy Cover x AFD	**4**		**16**		**64**		**56**		**56**		**4**		**56**		**15**	
St2 Health	5		5		5		5		5		5		5		5	
St2 No species	6		2		18		7		7		6		7		7	
St2 Dominants	Rv,Lk		Ri		Mix,Ps		Ah,Sl		Ah,Sl		Rv,Lk		Ah,Sl		Ah,Sl	
St3 Life Form	S				V		V		V		S		V		V	
St3 Top Height	0.5				0.3		0.3		0.3		0.5		0.3		0.3	
St3 Bottom Height	0				0		0		0		0		0		0	

JANDAKOT AIRPORT HABITAT SURVEY - BLOCK D - PAGE 5

CHARACTER	D8		D9		D10		D11		D12		D13		D14		D15	
St3 Canopy Cover	80				5		10		10		80		10		10	
St3 Mean AFD	30				1		1		1		30		1		1	
St3 Canopy Cover x AFD	**24**				**0.05**		**0.1**		**0.1**		**24**		**0.1**		**0.1**	
St3 Health	5				5		5		5		5		5		5	
St3 No species	4				4		4		4		4		4		4	
St3 Dominants	Mix				Sedges		Sedges		Sedges		Mix		Sedges		Sedges	
St4 Life Form	V										V				V	
St4 Top Height	0.3										0.3				0.3	
St4 Bottom Height	0										0				0	
St4 Canopy Cover	5										5				5	
Total Canopy Index for All Strata	**53**	**53**	**24**	**24**	**65.3**	**65**	**68.1**	**68**	**68.1**	**68**	**53**	**53**	**68.1**	**68**	**33.1**	**33**
St4 Health	5										5				5	
St4 No species	4										4				4	
St4 Dominants	Sedges										Sedges				Sedges	
Number of LFDCs	4	12	2	6	3	9	3	9	3	9	4	12	3	9	4	12
Number of Species	68		45		53		66		65		71		66		74	
Floristic Diversity	2	4	1	2	2	4	2	4	2	4	2	4	2	4	2	4
No SMPs	18		7		23		15		15		18		15		15	
SMP Score	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0	0
Mean Health St1 + 2	**5**	**10**	**5**	**10**	**5**	**10**	**5**	**10**	**5**	**10**	**5**	**10**	**5**	**10**	**5**	**10**
Seedlings/saplings	2		2		0		0		0		2		0		0	
Spatial Organization	Cont		Patchy		Cont		Cont		Cont		Cont		Cont		Cont	
Horizontal View Distance	50		150		N/A		200		200		50		200		100	
Evidence of Logging	4	8	4	8	4	8	4	8	4	8	4	8	4	8	4	8
Disturbance	Firebreak		0		Firebreak		0		0		Firebreak		0		Firebreak	
Fire Age	14		14		14		14		14		14		14		14	
Stratal Recovery	4	12	4	12	4	12	4	12	4	12	4	12	4	12	4	12
Weed species	Glad		0		Glad		Glad		Glad		Glad		Glad		Glad	
Weed Dominance	1		0		1		0		0		1		0		0	
Dieback Indicator	0		0		Ba		0		0		0		0		0	
Level Infection	0		0		1		0		0		0		0		0	
Dieback Status		5		5		4		5		5		5		5		5
RHAS RATING		105		71		121		122		119		108		119		90

JANDAKOT AIRPORT HABITAT SURVEY - BLOCK D - PAGE 6

CHARACTER	D8		D9		D10		D11		D12		D13		D14		D15	
Hollow Limbs	0		0		0		0		0		0		0		0	
Hollow Trunks	0		0		0		0		0		0		0		0	
Abundance of Nests	0		1		0		0		0		0		0		0	
Abundance of Invertebr. Burrows	2		1		0		1		1		2		1		2	
Abund. Mamm. Burrows & Digs	3		1		0		3		3		3		3		3	
Logs <20cm	1		0		0		1		1		1		1		1	
Logs >20cm	2		0		0		1		1		2		1		1	
Litter Depth	3		5		2		2		2		3		2		2	
Litter Spacing	1		0		2		2		2		1		2		2	
Abundance Mat Plants	1		0		2		1		1		1		1		1	
Abundance Grass	0		0		2		0		0		0		0		0	
Abund. Flower. Species	2		3		2		1		1		2		1		1	
Abund. Seed Species	1		1		1		1		1		1		1		1	
TOTAL FAUNA SCORE		16		12		11		13		13		16		13		14
Soil Burrowability	VH		VH		VH		VH		VH		VH		VH		VH	
Moisture	Very Dry		Moderate		Very Dry		Moderate		Moderate		Very Dry		Moderate		Moderate	
TOTAL SCORE ALL VALUES		121		82.5		132		135		132		124		132		104

JANDAKOT AIRPORT HABITAT SURVEY - BLOCK D - PAGE 7

CHARACTER	D16		D17		D18		D19		D20		D21		D22		D23	
Numb. Adjacent Associations	1	3	0	0	1	3	0	0	0	0	1	3	1	3	0	0
Topographic Position	Mid-slope		Lowland		Mid-slope		Lowland		Mid-slope		Lowland		Crest		Lowland	
Soil Drainage	VH		VH		VH		VH		VH		VH		VH		VH	
Soil Profile	Uniform		Uniform		Uniform		Uniform		Uniform		Uniform		Uniform		Uniform	
Slope (degrees)	12		1		12		0		3		0		5		1	
Aspect	N		E		E		0		SW		0		SE		E	
Soil Protection %	95		95		95		90		90		90		90		95	
Erosion	0		0		0		0		0		0		0		0	
St1 Life Form	T		T		T		T		T		T		T		T	
St1 Top Height	7		7		7		6		7		6		9		7	
St1 Bottom Height	2.5		3		2.5		3		2		3		3		3	
Top Ht - Bottom Ht	**4.5**		**4**		**4.5**		**3**		**5**		**3**		**6**		**4**	
St1 Canopy Cover (CC)	50		40		50		30		40		20		30		40	
St1 Mean AFD	50		60		50		40		30		60		60		60	
St1 Canopy Cover x AFD	**25**		**24**		**25**		**12**		**12**		**12**		**18**		**24**	
St1 Health	5		5		5		5		5		5		5		5	
St1 No species	3		4		3		2		3		2		3		4	
St1 Dominants	Ba,Bm,Et		Ba,Bm,Em		Ba,Bm,Em		Ba,Bm		Ba,Bm,Bi		Ba,Bm		Ba,Bm,Et		Ba,Bm,Em	
St2 Life Form	S		S		S		S		S		S		S		S	
St2 Top Height	1.5		3		1.5		0.5		1.5		0.5		2		3	
St1 Bottom Ht - St2 Top Ht	**1**	**1**	**0**	**0**	**1**	**1**	**2.5**	**2.5**	**0.5**	**0.5**	**2.5**	**2.5**	**1**	**1**	**0**	**0**
St2 Bottom Height	0.5		0		0.5		0		0		0		0		0	
St2 Canopy Cover	10		20		10		50		10		80		5		20	
St2 Mean AFD	40		80		40		50		30		70		20		80	
St2 Canopy Cover x AFD	**4**		**16**		**4**		**25**		**3**		**56**		**1**		**16**	
St2 Health	5		5		5		5		5		5		5		5	
St2 No species	6		2		6		7		3		7		2		2	
St2 Dominants	Rv,Lk		Ac		Rv,Lk		Ah,Sl		Ah		Ah,Sl,Ri		Ku,Jf		Ac	
St3 Life Form	S		S		S		V		S		V		S		S	
St3 Top Height	0.5		1		0.5		0.3		1		0.3		0.5		1	
St3 Bottom Height	0		0		0		0		0		0		0		0	

JANDAKOT AIRPORT HABITAT SURVEY - BLOCK D - PAGE 8

CHARACTER	D16		D17		D18		D19		D20		D21		D22		D23	
St3 Canopy Cover	80		70		80		10		80		10		70		70	
St3 Mean AFD	30		40		30		1		60		1		60		40	
St3 Canopy Cover x AFD	**24**		**28**		**24**		**0.1**		**48**		**0.1**		**42**		**28**	
St3 Health	5		5		5		5		5		5		5		5	
St3 No species	4		10		4		4		8		4		8		10	
St3 Dominants	Mix		Ma, mix		Mix		Sedges		Rv		Sedges		Hh,Ah		Ma, mix	
St4 Life Form	V		V		V				V				V		V	
St4 Top Height	0.3		0.3		0.3				0.3				0.3		0.3	
St4 Bottom Height	0		0		0				0				0		0	
St4 Canopy Cover	5		5		5				3				10		5	
Total Canopy Index for All Strata	**53**	**53**	**68**	**68**	**53**	**53**	**37.1**	**37**	**63**	**63**	**68.1**	**68**	**61**	**61**	**68**	**68**
St4 Health	5		5		5				5				5		5	
St4 No species	4		6		4				6				6		6	
St4 Dominants	Sedges		Sedges		Sedges				Sedges				Sedges		Sedges	
Number of LFDCs	4	12	4	12	4	12	3	9	4	12	3	9	4	12	4	12
Number of Species	70		75		70		71		70		65		67		73	
Floristic Diversity	2	4	2	4	2	4	2	4	2	4	2	4	2	4	2	4
No SMPs	18		23		18		15		20		15		24		23	
SMP Score	0	0	1	2	0	0	0	0	1	2	0	0	1	2	1	2
Mean Health St1 + 2	**5**	**10**	**5**	**10**	**5**	**10**	**5**	**10**	**5**	**10**	**5**	**10**	**5**	**10**	**5**	**10**
Seedlings/saplings	2		1		2		0		1		0		1		1	
Spatial Organization	Cont		Cont		Cont		Cont				Cont		Cont		Cont	
Horizontal View Distance	50		100		50		200		150		200		100		100	
Evidence of Logging	4	8	3	6	4	8	3	6	4	8	4	8	2	4	3	6
Disturbance	Firebreak		0		Firebreak		0		Firebreak		0		0		0	
Fire Age	14		14		14		14		14		14		14		14	
Stratal Recovery	4	12	4	12	4	12	4	12	4	12	4	12	4	12	4	12
Weed species	Glad		Glad		Glad		Glad		0		Glad		0		Glad	
Weed Dominance	1		0		1		0		0		0		0		0	
Dieback Indicator	0		0		0		0		0		0		0		0	
Level Infection	0		0		0		0		0		0		0		0	
Dieback Status		5		5		5		5		5		5		5		5
RHAS RATING		108		119		108		86		117		122		114		119

JANDAKOT AIRPORT HABITAT SURVEY - BLOCK D - PAGE 9

CHARACTER	D16		D17		D18		D19		D20		D21		D22		D23	
Hollow Limbs	0		0		0		0		0		0		0		0	
Hollow Trunks	0		1		0		0		1		0		2		1	
Abundance of Nests	0		0		0		0		0		0		1		0	
Abundance of Invertebr. Burrows	2		1		2		1		1		1		1		1	
Abund. Mamm. Burrows & Digs	3		3		3		3		2		3		3		3	
Logs <20cm	1		1		1		1		1		1		1		1	
Logs >20cm	2		1		2		1		1		1		1		1	
Litter Depth	3		3		3		2		2		2		2		3	
Litter Spacing	1		0		1		2		1		2		2		0	
Abundance Mat Plants	1		0		1		1		0		1		1		0	
Abundance Grass	0		0		0		0		0		0		0		0	
Abund. Flower. Species	2		2		2		1		2		1		3		2	
Abund. Seed Species	1		2		1		1		1		1		2		2	
TOTAL FAUNA SCORE		16		14		16		13		12		13		19		14
Soil Burrowability	VH		VH		VH		VH		VH		VH		VH		VH	
Moisture	Very Dry		Wet-Mod		Very Dry		Moderate		Dry		Moderate		Dry		Wet-Mod	
TOTAL SCORE ALL VALUES		124		133		124		98.6		129		135		133		133

JANDAKOT AIRPORT HABITAT SURVEY - BLOCK D - PAGE 10

CHARACTER	D24		D25		D26		D27		D28		D29		D30		D31	
Numb. Adjacent Associations	1	3	1	3	1	3	2	6	2	6	2	6	1	3	2	6
Topographic Position	Lowland		Lowland		Lowland		Crest		Lowland		Crest		Lowland		Lowland	
Soil Drainage	VH		VH		VH		VH		VH		VH		VH		VH	
Soil Profile	Uniform		Uniform		Uniform		Uniform		Uniform		Uniform		Uniform		Uniform	
Slope (degrees)	0		0		0		4		0		5		1		0	
Aspect	0		0		0		NE		0		SE		E		0	
Soil Protection %	95		90		90		80		85		90		95		95	
Erosion	0		0		0		0		0		0		0		0	
St1 Life Form	T		T		T		T		T		T		T		T	
St1 Top Height	6		6		6		4		6		9		7		6	
St1 Bottom Height	2		3		3		1.5		2		3		3		2	
Top Ht - Bottom Ht	**4**		**3**		**3**		**2.5**		**4**		**6**		**4**		**4**	
St1 Canopy Cover (CC)	20		30		30		2		10		30		40		20	
St1 Mean AFD	40		40		40		60		50		60		60		40	
St1 Canopy Cover x AFD	**8**		**12**		**12**		**1.2**		**5**		**18**		**24**		**8**	
St1 Health	5		5		5		5		5		5		5		5	
St1 No species	3		2		2		1		5		3		4		3	
St1 Dominants	Bi,Ba,Bm		Ba,Bm		Ba,Bm		Ba		Bi,Ba,Nf		Ba,Bm,Eu		Ba,Bm,Em		Bi,Ba,Bm	
St2 Life Form	S		S		S		S		S		S		S		S	
St2 Top Height	2.5		0.5		0.5		1		1.5		2		3		2.5	
St1 Bottom Ht - St2 Top Ht	**-0.5**	**0.5**	**2.5**	**2.5**	**2.5**	**2.5**	**0.5**	**0.5**	**0.5**	**0.5**	**1**	**1**	**0**	**0**	**-0.5**	**0.5**
St2 Bottom Height	0		0		0		0		0		0		0		0	
St2 Canopy Cover	80		50		50		80		20		5		20		80	
St2 Mean AFD	20		50		50		80		30		20		80		20	
St2 Canopy Cover x AFD	**16**		**25**		**25**		**64**		**6**		**1**		**16**		**16**	
St2 Health	5		5		5		5		2		5		5		5	
St2 No species	2		7		7		18		3		2		2		2	
St2 Dominants	Ri		Ah,Sl		Ah,Sl		Mix		Ri,Xp		Mt,Jf		Ac		Ri	
St3 Life Form			V		V		V		S		S		S			
St3 Top Height			0.3		0.3		0.3		0.5		0.5		1			
St3 Bottom Height			0		0		0		0		0		0			

JANDAKOT AIRPORT HABITAT SURVEY - BLOCK D - PAGE 11

CHARACTER	D24		D25		D26		D27		D28		D29		D30		D31	
St3 Canopy Cover			10		10		5		80		70		70			
St3 Mean AFD			1		1		1		60		60		40			
St3 Canopy Cover x AFD			**0.1**		**0.1**		**0.05**		**48**		**42**		**28**			
St3 Health			5		5		5		5		5		5			
St3 No species			4		4		4		5		8		10			
St3 Dominants			Sedges		Sedges		Sedges		Cp		Hh,Ah		Ma, mix			
St4 Life Form									V		V		V			
St4 Top Height									0.2		0.3		0.3			
St4 Bottom Height									0		0		0			
St4 Canopy Cover									20		10		5			
Total Canopy Index for All Strata	**24**	**24**	**37.1**	**37**	**37.1**	**37**	**65.3**	**65**	**59**	**59**	**61**	**61**	**68**	**68**	**24**	**24**
St4 Health									4		5		5			
St4 No species									4		6		6			
St4 Dominants									Db		Sedges		Sedges			
Number of LFDCs	2	6	3	9	3	9	3	9	4	12	4	12	4	12	2	6
Number of Species	10		63		66		65		62		72		24		29	
Floristic Diversity	0	0	2	4	2	4	2	4	2	4	2	4	1	2	1	2
No SMPs	7		15		15		23		12		24		23		7	
SMP Score	0	0	0	0	0	0	1	2	0	0	1	2	1	2	0	0
Mean Health St1 + 2	**5**	**10**	**5**	**10**	**5**	**10**	**5**	**10**	**3.5**	**7**	**5**	**10**	**5**	**10**	**5**	**10**
Seedlings/saplings	2		0		0		0		0		1		1		2	
Spatial Organization	Patchy		Cont		Cont		Cont		Patchy		Cont		Cont		Patchy	
Horizontal View Distance	150		200		200		N/A		N/A		100		100		150	
Evidence of Logging	4	8	4	8	4	8	4	8	4	8	3	6	3	6	4	8
Disturbance	0		0		0		Firebreak		Clearing		0		0		0	
Fire Age	14		14		14		14		14		14		14		14	
Stratal Recovery	4	12	4	12	4	12	4	12	4	12	4	12	4	12	4	12
Weed species	0		Glad		Glad		Glad		Grass		0		Glad		0	
Weed Dominance	0		0		0		1		2		0		0		0	
Dieback Indicator	0		0		0		Ba		Xp,Ri		0		0		0	
Level Infection	0		0		0		1		4		0		0		0	
Dieback Status		5		5		5		4		2		5		5		5
RHAS RATING		69		91		91		121		111		119		120		74

JANDAKOT AIRPORT HABITAT SURVEY - BLOCK D - PAGE 12

CHARACTER	D24		D25		D26		D27		D28		D29		D30		D31	
Hollow Limbs	0		0		0		0		0		0		0		0	
Hollow Trunks	0		0		0		0		0		2		1		0	
Abundance of Nests	1		0		0		0		0		1		0		1	
Abundance of Invertebr. Burrows	1		1		1		0		1		1		1		1	
Abund. Mamm. Burrows & Digs	1		3		3		0		2		3		3		1	
Logs <20cm	0		1		1		0		0		1		1		0	
Logs >20cm	0		1		1		0		0		1		1		0	
Litter Depth	5		2		2		2		2		2		3		5	
Litter Spacing	0		2		2		2		1		2		0		0	
Abundance Mat Plants	0		1		1		2		1		1		0		0	
Abundance Grass	0		0		0		2		1		0		0		0	
Abund. Flower. Species	3		1		1		2		1		3		2		3	
Abund. Seed Species	1		1		1		1		0		2		2		1	
TOTAL FAUNA SCORE		12		13		13		11		9		19		14		12
Soil Burrowability	VH		VH		VH		VH		VH		VH		VH		VH	
Moisture	Moderate		Moderate		Moderate		Very Dry		Moderate		Dry		Wet-Mod		Moderate	
TOTAL SCORE ALL VALUES		80.5		104		104		132		120		138		134		85.5

JANDAKOT AIRPORT HABITAT SURVEY - BLOCK D - PAGE 13

CHARACTER	D32		D33		D34		D35		D36		D37		D38		D39	
Numb. Adjacent Associations	2	6	2	6	3	9	2	6	1	3	2	6	2	6	1	6
Topographic Position	Lowland		Lowland		Lowland		Lowland		Lowland		Lowland		Dampland		Crest	
Soil Drainage	Poor		Poor		Poor		Poor		Poor		VH		Poor		VH	
Soil Profile	Peaty		Uniform		Peaty		Peaty		Peaty		Uniform		Peaty		Uniform	
Slope (degrees)	0		0		0		0		0		1		0		5	
Aspect	0		0		0		0		0		E		0		SE	
Soil Protection %	95		80		90		95		95		95		90		90	
Erosion	0		0		0		0		0		0		0		0	
St1 Life Form	T		T		T		T		T		T		T		T	
St1 Top Height	25		7		25		18		18		7		8		9	
St1 Bottom Height	6		3		4		6		6		3		5		3	
Top Ht - Bottom Ht	**19**		**4**		**21**		**12**		**12**		**4**		**3**		**6**	
St1 Canopy Cover (CC)	70		2		50		5		5		40		90		30	
St1 Mean AFD	40		60		30		60		60		60		30		60	
St1 Canopy Cover x AFD	**28**		**1.2**		**15**		**3**		**3**		**24**		**27**		**18**	
St1 Health	5		5		5		5		5		5		5		5	
St1 No species	3		3		1		1		1		4		1		3	
St1 Dominants	E.rudis		Mp,Bi		E rudis		Mp		Mp		Ba,Bm,Em		Mp		Ba,Bm,Et	
St2 Life Form	S		S		Grass		T		T		S		S		S	
St2 Top Height	1.5		2.5		0.5		6		6		3		2		2	
St1 Bottom Ht - St2 Top Ht	**4.5**	**4.5**	**0.5**	**0.5**	**3.5**	**3.5**	**0**	**0**	**0**	**0**	**0**	**0**	**3**	**3**	**1**	**1**
St2 Bottom Height	0		0.5		0		2		2		0		0		0	
St2 Canopy Cover	95		90		95		80		80		20		50		5	
St2 Mean AFD	20		30		50		30		30		80		50		20	
St2 Canopy Cover x AFD	**19**		**27**		**47.5**		**24**		**24**		**16**		**25**		**1**	
St2 Health	5		5		5		4		4		5		5		5	
St2 No species	2		2		2		2		2		2		2		2	
St2 Dominants	Afas,Ap		Ri		Grass, sedges		E rudis		E rudis		Ac		Ri		Ku,Jf	
St3 Life Form							S		S		S				S	
St3 Top Height							1.5		1.5		1				0.5	
St3 Bottom Height							0		0		0				0	

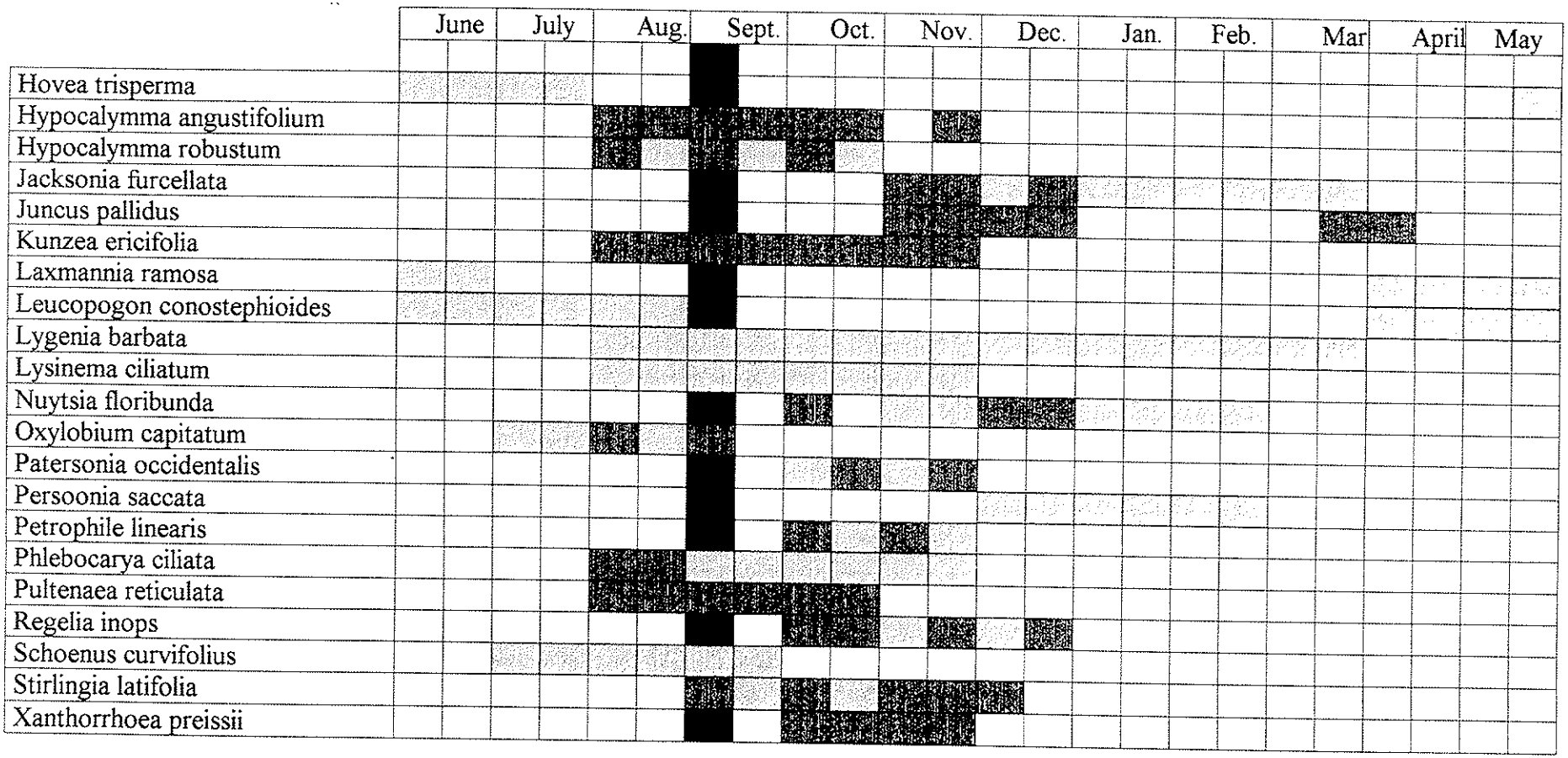
JANDAKOT AIRPORT HABITAT SURVEY - BLOCK D - PAGE 14

CHARACTER	D32		D33		D34		D35		D36		D37		D38		D39	
St3 Canopy Cover							90		90		70				70	
St3 Mean AFD							20		20		40				60	
St3 Canopy Cover x AFD			0		0		18		18		28		0		42	
St3 Health							5		5		5				5	
St3 No species							3		3		10				8	
St3 Dominants							Afas,Ap		Afas,Ap		Ma, mix				Hh,Ah	
St4 Life Form											V				V	
St4 Top Height											0.3				0.3	
St4 Bottom Height											0				0	
St4 Canopy Cover											5				10	
Total Canopy Index for All Strata	47	47	28.2	28	62.5	63	45	45	45	45	68	68	52	52	61	61
St4 Health											5				5	
St4 No species											6				6	
St4 Dominants											Sedges				Sedges	
Number of LFDCs	2	6	2	6	2	6	3	9	3	9	4	12	2	6	4	12
Number of Species	19		13		14		23		25		74		6		70	
Floristic Diversity	0	0	0	0	0	0	1	2	1	2	2	4	0	0	2	4
No SMPs	7		8		3		7		7		23		5		24	
SMP Score	0	0	0	0	0	0	0	0	0	0	1	2	0	0	1	2
Mean Health St1 + 2	5	10	5	10	5	10	4.5	9	4.5	9	5	10	5	10	5	10
Seedlings/saplings	2		1		0		2		2		1		0		1	
Spatial Organization	Patchy		Cont		Cont		Cont		Cont		Cont		Cont		Cont	
Horizontal View Distance	150		50		200		100		100		100		200		100	
Evidence of Logging	4	8	4	8	4	8	4	8	4	8	3	6	4	8	2	4
Disturbance	0		0		Pt Cleared		0		0		0		Pt Cleared		0	
Fire Age	14		14		14		14		14		14		14		14	
Stratal Recovery	4	12	4	12	4	12	4	12	4	12	4	12	4	12	4	12
Weed species	0		0		Ehrharta		0		0		Glad		L.laevig		0	
Weed Dominance	0		0		5		0		0		0		2		0	
Dieback Indicator	0		0		0		0		0		0		0		0	
Level Infection	0		0		0		0		0		0		0		0	
Dieback Status		5		5		5		5		5		5		5		5
RHAS RATING		99		76		116		96		93		125		102		117

JANDAKOT AIRPORT HABITAT SURVEY - BLOCK D - PAGE 15

CHARACTER	D32		D33		D34		D35		D36		D37		D38		D39	
Hollow Limbs	0		0		2		0		0		0		2		0	
Hollow Trunks	0		0		1		0		0		1		1		2	
Abundance of Nests	1		0		3		1		1		0		3		1	
Abundance of Invertebr. Burrows	1		1		1		1		1		1		1		1	
Abund. Mamm. Burrows & Digs	1		1		2		1		1		3		2		3	
Logs <20cm	0		0		0		0		0		1		0		1	
Logs >20cm	0		0		0		0		0		1		0		1	
Litter Depth	5		2		5		5		5		3		5		2	
Litter Spacing	0		1		0		0		0		0		0		2	
Abundance Mat Plants	0		0		0		0		0		0		0		1	
Abundance Grass	0		0		5		0		0		0		5		0	
Abund. Flower. Species	3		2		1		3		3		2		1		3	
Abund. Seed Species	1		0		0		1		1		2		0		2	
TOTAL FAUNA SCORE		12		7		20		12		12		14		20		19
Soil Burrowability	VH		VH		VH		VH		VH		VH		VH		VH	
Moisture	Moderate		Moderate		Wet-Mod		Moderate		Moderate		Wet-Mod		Wet-Mod		Dry	
TOTAL SCORE ALL VALUES		111		82.7		136		108		105		139		122		136

FLOWERING TIMES OF COMMON SPECIES



Time of the present study
Flowering period at Jandakot (Milewski and Davidge, 1981)
Flowering period at Melaleuca Park (Muir, 1983 unpublished data)
Shading alternates where the two studies overlap in time

APPENDIX E

BIRD OBSERVATIONS AT JANDAKOT AIRPORT

JANDAKOT AIRPORT BIRD LIST - BLOCKS

COMMON NAME	STATUS	RES.	BLOCK A				BLOCK B				BLOCK C				BLOCK D			
			C	M	L	D	C	M	L	D	C	M	L	D	C	M	L	D
THRESKIORNITHIDAE																		
Sacred Ibis *Threskiornis aethiopicus*	Mod. common	NR; Nomad							7T									
ANATIDAE																		
Mountain Duck *Tadorna tadornoides*	Common on SCP; Wide-spread	NR; Nomad												2T				
ACCIPITRIDAE																		
?Little Eagle *Aquila morphnoides*	Uncommon; Widespread	R							2B?				1				1	
?Marsh Harrier *Circus aeruginosus*	Mod. common	NR															1F	
FALCONIDAE																		
Australian Kestrel *Falco cenchroides*	Common	R; Part nomad										1					1	
Unidentified Raptor																	1, 1	
LARIDAE																		
Silver Gull *Larus novaehollandiae*	Very common	R; Part nomad		3T					15+T								3T	
COLUMBIDAE																		
Laughing Dove *Streptopelia senegalensis*	Common (introd.)	R								1T			2	2B			2, 1C	
Common Bronzewing *Phaps chalcoptera*	Mod. common	R; Part nomad							1							2?		

COMMON NAME	STATUS	RES.	BLOCK A				BLOCK B				BLOCK C				BLOCK D			
			C	M	L	D	C	M	L	D	C	M	L	D	C	M	L	D
PSITTACIDAE																		
Ring-necked Parrot *Platycercus zonarius*	Common; Widespread	R	xC	1, xC					xC			1T						
Red-capped Parrot *Platycercus spurius*	Common	R	xC, 2T	1C, 2B? xC				xC	xC				1C, 1	3, 1C		xC, 2F		
Parrot ?*Neophema* sp									2									
Carnaby's Cockatoo *Calyptorhynchus latirostris*	Mod. Common	NR; nomad															xC	
Galah *Cacatua roseicapilla*	Common on SCP; Wide-spread	R															2C	
CUCULIDAE																		
?Fan-tailed Cuckoo *Cuculus flabelliformis*	Uncommon on SCP	NR; Nomad							1									
Horsefield's Bronze Cuckoo *Chrysococcyx basalis*	Mod. common on SCP; Wide-spread	NR; Migrant								1								
MOTACILLIDAE																		
Richard's Pipit *Anthus novaeseelandiae*	Very common	R; Part nomad					1T				1F		1F, 3F		1T			
CAMPEPHAGIDAE																		
Black-faced Cuckoo-shrike *Coracina novaehollandiae*	Mod. common	NR; Part migrant	1; 1F	3					2				1C	2C	4		1C	

COMMON NAME	STATUS	RES.	BLOCK A				BLOCK B				BLOCK C				BLOCK D			
			C	M	L	D	C	M	L	D	C	M	L	D	C	M	L	D
PACHYCEPHALIDAE																		
Scarlet Robin *Petroica multicolor*	Mod. common; Widespread	R; Part nomad													1, 1F			
Rufous Whistler *Pachycephala rufiventris*	Mod. common on SCP; Wide-spread	R; Part nomad		1C	1			1, 1C	1C, 2				xC, 1	1C		1C	1, xC	
?Grey Shrike-thrush *Colluricincla harmonica*	Mod. common on SCP; Wide-spread	R													?2C		5, 1C	
MONARCHIDAE																		
Grey Fantail *Rhipidura fuliginosa*	Mod. common	R; Part migrant												1F			xF	
Willie Wagtail *Rhipidura leucophrys*	Mod. common	R; Part nomad							1C, 1F, 1				1F		1C, 2F			1C, 1F
ACANTHIZIDAE																		
Western Flyeater *Gerygone fusca*	Common	R; Part nomad	xC	xC	xC				xC				xC	xC	xC	1C	xC, xF	
MALURIDAE																		
Splendid Fairy-wren *Malurus splendens*	Very common	R		1									*ca*20+, 2B& 1imm xC	13+, xC			2?B+ 1?imm	

COMMON NAME	STATUS	RES.	BLOCK A				BLOCK B				BLOCK C				BLOCK D			
			C	M	L	D	C	M	L	D	C	M	L	D	C	M	L	D
DAPHOENOSITTIDAE																		
Australian Sittella *Daphoenositta chrysoptera*	Mod. common	R; Part nomad							10+F								*ca*12F	
PARDALOTIDAE																		
Striated Pardalote *Pardalotus striatus*	Uncommon on SCP	NR; Migrant	2B?															
ZOSTEROPIDAE																		
Grey-breasted White-eye *Zosterops lateralis*	Common	NR; Nomad	5+F	5+F	xC			xC	3, xC				xC, 1	xC, 4T, 1F	7+F	xC	xC	
MELIPHAGIDAE																		
Brown Honeyeater *Lichmera indistincta*	Very common on SCP; Wide-spread	NR; Nomad	xxC	xxC,	2F, xC, 3				xxC, xxF,			xC	6, xC,	xC, 4	xxC, 1F	xC	xC, xF, x	
Singing Honeyeater *Meliphaga virescens*	Mod. common; Widespread	R; Part nomad	xC	xC				xC	xC, 1F				5F, x, xC		2	xC	xC	
New Holland Honeyeater *Phylidonyris novaehollandiae*	Common on SCP	R; Part nomad		xC, 1					1F, xC				xC, 6, 1F		2F		xC, xxF, *ca*20T	
White-cheeked Honeyeater *Phylidonyris nigra*	Mod. common on SCP	R; Part nomad			1F				4, xxC, xF				x, x?B, xC,	3	xC, 1F	xC	1	
Western Spinebill *Acanthorhynchus superciliosus*	Mod. common on SCP	R; Part nomad							1				1					

COMMON NAME	STATUS	RES.	BLOCK A				BLOCK B				BLOCK C				BLOCK D			
			C	M	L	D	C	M	L	D	C	M	L	D	C	M	L	D
Red Wattlebird *Anthochaera carunculata*	Mod. common	NR; Migrant	xC, 1	xC, 6					xC, 1								xC, 1	
GRALLINIDAE																		
Magpie-lark *Grallina cyanoleuca*	Mod. common; Widespread	R; Part nomad		xC					xC, 6						1, xC	1C	xC	
CRACTICIDAE																		
Grey Butcherbird *Cracticus torquatus*	Mod. common	R	xC, *ca*6	xC, 1	2, xC			xC, 2	xC, 1				1C			xC	1, xC	
Australian Magpie *Cracticus tibicen dorsalis*	Very common on SCP	R	xC	xC				1T			4		1C	xC				
CORVIDAE																		
Australian Raven *Corvus coronoides*	Common; Widespread	R; Part nomad	xxC	xxC, 2B, 8+,	xxC, *ca*7T, 3, 4B		10T, xxT,	4T, xxC	6T, 6, xxC		xT		3, xC, 2T	xC, 1B& 1chick	5+T, 1, 4 chicks	xC, 1T	xC, xT, 1, 2B	

LEGEND:

Column Headings:

Res. = Residency Status
C = Crest
M = Mid-slope
L = Lowland
D = Dampland

Short Forms within Table:

B = Breeding
C = Calling only
F = Feeding
T = Transient
x = Present (number indeterminate)
xx = Abundant (number indeterminate)

STATUS: Short Forms:

Mod. common = Moderately common
SCP = Swan Coastal Plain (intro.) = introduced species

APPENDIX F

JANDAKOT AIRPORT HABITAT SURVEY - NEARBY AREAS

JANDAKOT AIRPORT HABITAT SURVEY - NEARBY AREAS - Page 2

CHARACTER	Wgt	E1		E2		E3		F1		F2	
St3 Canopy Cover		10		40		70		95		10	
St3 Mean AFD		60		60		60		1		20	
St3 Canopy Cover x AFD		**6**		**24**		**42**		**0.95**		**2**	
St3 Health		5		5		5		5		5	
St3 No spp		3		6		6		1		1	
St3 Dominants		Ma,Xp		Sl,Hh		Ma,Sl,Hh		Ehrh		Js	
St4 Life Form		V								S	
St4 Top Height		0.5								0.5	
St4 Bottom Height		0								0	
St4 Canopy Cover		80								80	
Total Canopy Index for All Strata	1	**129**	**129**	**102**	**102**	**87**	**87**	**31**	**31**	**94**	**94**
St4 Health		5								5	
St4 No spp		6								6	
St4 Dominants		Sedges								Hh,Mr	
Number of LFDCs	3	4	12	3	9	3	9	3	12	4	12
Number of Species		36		40		39		37		18	
Floristic Diversity	2		2	1	2	1	2	1	2	0	0
No SMPs		9		22		16		5		18	
SMP Score	2	0	0	1	2	0	0	0	0	0	0
Mean Health St 1 + 2	2	**4.5**	**9**	**5**	**10**	**4.5**	**10**	**5**	**10**	**4.5**	**9**
Seedlings/saplings		0		1		0		1		1	
Spatial Organization		Contin.		Contin.		Contin.		Contin.		Contin.	
Horizontal View Distance		50		150		100		100		100	
Evidence of Logging		0		0		0		0		2	
Disturbance		0		0		0		0		2	
Fire Age		25		20		25		2		5	
Stratal Recovery	3	4	12	4	12	4	12	1	3	1	3
Weed Species		Glad.		Glad.		Glad.		Ehrh		Grass	
Weed Dominance		0		0		0		5		4	
Dieback Indicator		0		0		0		0		0	
Level Infection		0		0		0		0		0	
Dieback Status	1		5		5		5		5		5
RHAS RATING			172		143		126		66		123

JANDAKOT AIRPORT HABITAT SURVEY - NEARBY AREAS - Page 3

CHARACTER	Wgt	E1		E2		E3		F1		F2	
FAUNA											
Hollow Limbs		0		0		0		2		1	
Hollow Trunks		0		0		0		1		3	
Abund. of Nests		0		1		0		0		1	
Abund. of Invertebr. Burrows		0		1		1		0		1	
Abund. Mamm. Burrows & Digs		0		3		2		1		3	
Logs <20cm		0		1		0		0		0	
Logs >20cm		0		0		0		0		1	
Litter Depth		2		5		3		6		2	
Litter Spacing		1		2		2		0		2	
Abund. Mat Plants		2		0		0		0		1	
Abund. Grass		0		0		0		5		3	
Abund. Flowering spp		2		2		2		2		3	
Abund. Seed spp		1		2		1		0		3	
TOTAL FAUNA SCORE			8		17		11		17		24
Soil Burrowability		VH		VH		VH		VH		VH	
Moisture		Very dry		Very dry		Very dry		Moder		Very dry	
TOTAL SCORE ALL VALUES			179.5		159.5		136.5		82.95		147

JANDAKOT AIRPORT HABITAT SURVEY - NEARBY AREAS - Page 4

CHARACTER	G1		H1		H2		I1	
Numb. Adjacent Associations	0	0	0	0	0	0	1	3
Topographic Position	Mid-slope		Mid-slope		Wetland		Mid-slope	
Soil Drainage	VH		VH		M-P		VH	
Soil Profile	Uniform		Uniform		Uniform		Uniform	
Slope (degrees)	2		0		0		0	
Aspect	SW		0		0		0	
Soil Protection %	95		95		95		90	
Erosion	0		0		0		0	
St1 Life Form	T		T		T		T	
St1 Top Height	8		6		16		7	
St1 Bottom Height	4		3		6		3	
Top Ht - Bottom Ht	**4**		**3**		**10**		**4**	
St1 Canopy Cover (CC)	40		50		10		60	
St1 Mean AFD	40		40		80		60	
St1 Canopy Cover x AFD	**16**		**20**		**8**		**36**	
St1 Health	5		5		5		5	
St1 No spp	4		3		1		2	
St1 Dominants	Ba,Bm		Ba,Bm		Mp		Ba,Bm	
St2 Life Form	S		S		S		S	
St2 Top Height	1		2		1.5		1.5	
St1 bottom ht - St2 top ht	**3**	**3**	**1**	**1**	**4.5**	**4.5**	**1.5**	**1.5**
St2 Bottom Height	0		0		0		0	
St2 Canopy Cover	50		70		90		5	
St2 Mean AFD	60		20		20		20	
St2 Canopy Cover x AFD	**30**		**14**		**18**		**1**	
St2 Health	5		5		5		5	
St2 No spp	2		4		1		3	
St2 Dominants	Ah,Mt		Ri,Cf		Pe		Mt,Jf	
St3 Life Form	S		S				S	
St3 Top Height	0.5		1				1	
St3 Bottom Height	0		0				0.5	

JANDAKOT AIRPORT HABITAT SURVEY - BLOCK D - PAGE 16

CHARACTER	D40		D41		D42		D43		D44		D45		D46		D47	
Numb. Adjacent Associations	0	0	1	3	1	3	2	6	2	6	2	6	2	6	2	6
Topographic Position	Dampland		Lowland		Lowland		Cres		Lowland		Lowland		Dampland		Lowland	
Soil Drainage	Poor		VH/M		VH/M		VH		VH/M		VH/M		Poor		VH/M	
Soil Profile	Peaty		Uniform		Uniform		Uniform		Uniform		Uniform		Peaty		Uniform	
Slope (degrees)	2		0		0		3		0		0		0		0	
Aspect	0		0		0		W		0		0		0		0	
Soil Protection %	70		95		95		10		95		95		30		95	
Erosion	0		0		0		Some Runoff		0		0		0		0	
St1 Life Form	T		T		T		S		T		T		T		T	
St1 Top Height	10		9		8		2		8		8		6		8	
St1 Bottom Height	3		3		3		1		3		3		0		3	
Top Ht - Bottom Ht	**7**		**6**		**5**		**1**		**5**		**5**		**6**		**5**	
St1 Canopy Cover (CC)	10		60		90		10		90		90		80		90	
St1 Mean AFD	50		70		70		30		70		70		60		70	
St1 Canopy Cover x AFD	**5**		**42**		**63**		**3**		**63**		**63**		**48**		**63**	
St1 Health	5		5		5		5		5		5		5		5	
St1 No species	3		4		4		4		4		4		1		4	
St1 Dominants	Bl,Mp,Erudis		Bi,Ba		Bi,Ba		Ps,mix		Bi,Ba		Bi,Ba		Mp		Bi,Ba	
St2 Life Form	S		S		S + Xp				S + Xp		S + Xp				S + Xp	
St2 Top Height	2.5		2.5		1.5				1.5		1.5				1.5	
St1 Bottom Ht - St2 Top Ht	**0.5**	**0.5**	**0.5**	**0.5**	**1.5**	**1.5**	**1**	**1**	**1.5**	**1.5**	**1.5**	**1.5**	**0**	**0**	**1.5**	**1.5**
St2 Bottom Height	0		1.5		0.5				0.5		0.5				0.5	
St2 Canopy Cover	90		85		5				5		5				5	
St2 Mean AFD	30		20		20				20		20				20	
St2 Canopy Cover x AFD	**27**		**17**		**1**		**0**		**1**		**1**		**0**		**1**	
St2 Health	5		5		5				5		5				5	
St2 No species	2		1		3				3		3				3	
St2 Dominants	Ri,Mp		Ri		Mt,Xp				Mt,Xp		Mt,Xp				Mt,Xp	
St3 Life Form	S		S		V + S				V + S		V + S				V + S	
St3 Top Height	1		0.5		0.5				0.5		0.5				0.5	
St3 Bottom Height	0		0		0				0		0				0	

JANDAKOT AIRPORT HABITAT SURVEY - BLOCK D - PAGE 17

CHARACTER	D40		D41		D42		D43		D44		D45		D46		D47	
St3 Canopy Cover	30		70		90				90		90				90	
St3 Mean AFD	40		60		60				60		60				60	
St3 Canopy Cover x AFD	**12**		**42**		**54**		**0**		**54**		**54**		**0**		**54**	
St3 Health	5		5		5				5		5				5	
St3 No species	1		9		7				7		7				7	
St3 Dominants			Mix		Db				Db		Db				Db	
St4 Life Form			V													
St4 Top Height			0.3													
St4 Bottom Height			0													
St4 Canopy Cover			2													
Total Canopy Index for All Strata	**44**	**44**	**101**	**101**	**118**	**118**	**3**	**3**	**118**	**118**	**118**	**118**	**48**	**48**	**118**	**118**
St4 Health			5													
St4 No species			6													
St4 Dominants			Sedges													
Number of LFDCs	3	9	4	12	3	9	2	6	3	9	3	9	2	6	3	9
Number of Species	12		24		58		42		64		64		21		64	
Floristic Diversity	0	0	1	2	2	4	1	2	2	4	2	4	1	2	2	4
No SMPs	8		22		18		6		18		18		1		18	
SMP Score	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0
Mean Health St1 + 2	**5**	**10**	**5**	**10**	**5**	**10**	**2.5**	**5**	**5**	**10**	**5**	**10**	**2.5**	**5**	**5**	**10**
Seedlings/saplings	1		1		1				1		1		0		1	
Spatial Organization	Cont		Cont		Cont				Cont		Cont		Cont		Cont	
Horizontal View Distance	20		20		100		N/A		100		100		N/A		100	
Evidence of Logging	4	8	4	8	3	6	4	8	3	6	3	6	4	8	3	6
Disturbance	0		Firebreaks		Firebreaks		Cleared		Firebreaks		Firebreaks		Cleared		Firebreaks	
Fire Age	14		14		14		14		14		14		14		14	
Stratal Recovery	4	12	4	12	4	12	4	12	4	12	4	12	4	12	4	12
Weed species	0		0		Briza		0		Briza		Briza		0		Briza	
Weed Dominance	0		0		0		0		0		0		0		0	
Dieback Indicator	0		0		0		0		0		0		0		0	
Level Infection	0		0		0		0		0		0		0		0	
Dieback Status		5		5		5		5		5		5		5		5
RHAS RATING		89		156		169		48		172		172		92		172

JANDAKOT AIRPORT HABITAT SURVEY - BLOCK D - PAGE 18

CHARACTER	D40		D41		D42		D43		D44		D45		D46		D47	
Hollow Limbs	0		1		0		0		0		0		0		0	
Hollow Trunks	0		1		1		0		1		1		0		1	
Abundance of Nests	0		1		0		0		0		0		0		0	
Abundance of Invertebr. Burrows	0		1		0		0		0		0		0		0	
Abund. Mamm. Burrows & Digs	0		3		1		0		1		1		0		1	
Logs <20cm	0		1		0		0		0		0		0		0	
Logs >20cm	0		1		0		0		0		0		0		0	
Litter Depth	1		5		5		0		5		5		0		5	
Litter Spacing	0		0		0		0		0		0		0		0	
Abundance Mat Plants	0		2		2		0		2		2		0		2	
Abundance Grass	0		0		0				0		0		0		0	
Abund. Flower. Species	2		2		2		1		2		2		1		2	
Abund. Seed Species	0		2		1		1		1		1		0		1	
TOTAL FAUNA SCORE		3		20		12		2		12		12		1		12
Soil Burrowability	VH		VH		VH		VH		VH		VH		VH		VH	
Moisture	Moderate'		Moderate		Moderate		Very Dry		Moderate		Moderate		Damp		Moderate	
TOTAL SCORE ALL VALUES		91.5		176		181		50		184		184		93		184

JANDAKOT AIRPORT HABITAT SURVEY - BLOCK D - PAGE 19

CHARACTER		
Numb. Adjacent Associations		
Topographic Position		
Soil Drainage		
Soil Profile		
Slope (degrees)		
Aspect		
Soil Protection %	Mean =	88.2
Erosion		
St1 Life Form		
St1 Top Height	Mean =	7.98
St1 Bottom Height	Mean =	2.81
Top Ht - Bottom Ht	Mean =	5.17
St1 Canopy Cover (CC)	Mean =	37
St1 Mean AFD	Mean =	52.3
St1 Canopy Cover x AFD		
St1 Health		
St1 No species	Mean =	2.77
St1 Dominants		
St2 Life Form		
St2 Top Height	Mean =	1.7
St1 Bottom Ht - St2 Top Ht		
St2 Bottom Height	Mean =	0.22
St2 Canopy Cover	Mean =	47.7
St2 Mean AFD	Mean =	43.2
St2 Canopy Cover x AFD	Mean =	23
St2 Health	Mean =	4.68
St2 No species	Mean =	5.02
St2 Dominants		
St3 Life Form		
St3 Top Height	Mean =	0.43
St3 Bottom Height		

JANDAKOT AIRPORT HABITAT SURVEY - BLOCK D - PAGE 20

CHARACTER		
St3 Canopy Cover	Mean =	38.6
St3 Mean AFD	Mean =	21.4
St3 Canopy Cover x AFD	Mean =	16.2
St3 Health	Mean =	3.83
St3 No species	Mean =	4.19
St3 Dominants		
St4 Life Form		
St4 Top Height	Mean =	0.1
St4 Bottom Height		
St4 Canopy Cover	Mean =	2.23
Total Canopy Index for All Strata		
St4 Health	Mean =	1.68
St4 No species	Mean =	1.74
St4 Dominants		
Number of LFDCs		
Number of Species	Mean	52.6
Floristic Diversity		
No SMPs	Mean =	15.1
SMP Score		
Mean Health St1 + 2		
Seedlings/saplings	Mean =	0.91
Spatial Organization		
Horizontal View Distance	Mean =	106
Evidence of Logging		
Disturbance		
Fire Age	Mean =	14
Stratal Recovery		
Weed species		
Weed Dominance	Mean =	0.4
Dieback Indicator		
Level Infection	Mean =	0.23
Dieback Status	Mean =	4.78
RHAS RATING		

JANDAKOT AIRPORT HABITAT SURVEY - BLOCK D - PAGE 21

CHARACTER		
FAUNA		
Hollow Limbs	Mean =	0.11
Hollow Trunks	Mean =	0.43
Abundance of Nests	Mean =	0.38
Abundance of Invertebr. Burrows	Mean =	0.91
Abund. Mamm. Burrows & Digs	Mean =	1.89
Logs <20cm	Mean =	0.53
Logs >20cm	Mean =	0.6
Litter Depth	Mean =	3.17
Litter Spacing	Mean =	0.85
Abundance Mat Plants	Mean =	0.81
Abundance Grass	Mean =	0.4
Abund. Flower. Species	Mean =	1.94
Abund. Seed Species	Mean =	1.04
TOTAL FAUNA SCORE		
Soil Burrowability		
Moisture		
TOTAL SCORE ALL VALUES	Mean =	155.2

APPENDIX B

KEY SPECIES USED IN THE PRESENT STUDY AND REASONS FOR THEIR INCLUSION

APPENDIX B

KEY SPECIES USED IN THE PRESENT STUDY AND THE REASON FOR THEIR INCLUSION

SPECIES	REASON FOR INCLUSION
Acacia pulchella	Mid-stratum structure-modifying shrub, nitogen fixer, one of the few *Acacias* present, important pollen species
Adenanthos obovata	Important nectar species, indicator species for dampland periphery
Adenanthos sericea	Provides dense nesting habitat for birds, indicator of coarse, extremely well-drained soils but where there is adequate water
Allocasuarina humilis	In combination with *Stirlingia latifolia* is an indicator of well drained mid-slope habitats
Anigozanthos humilis	Ephemeral herb of aesthetic and commercial importance, indicator of very open, dry, habitats
Anigozanthus manglesii	Ephemeral herb of aesthetic and commercial importance
Astartea fascicularis	Indicator of dampland which is very moist for extended periods but not so wet as to be inundated for any length of time
Banksia ilicifolia	Indicator of lowland habitats, especially where there is adequate seepage from adjacent high ground but where the soils do not become saturated
Banksia menzeisii	Important nectar and pollen species, indicator of dry upland soils, important structure-modifing species, very sensitive to dieback disease
Baumea articulata	Common sedge of very wet areas and indicating seasonally flooded or near flooded conditions
Caladenia flava	Representative of ephemeral herbs, a search for orchid species specifically would increase the chances of finding any rare species
Caladenia gemmata gemmata	Representative of ephemeral herbs, a search for orchid species specifically would increase the chances of finding any rare species
Caladenia patersonii	Representative of ephemeral herbs, a search for orchid species specifically would increase the chances of finding any rare species
Cassytha racemosa	Representative of semi-parasitic species, often an indicator of vegetation which is under stress or has not experienced fir for long periods
Cassytha glabella	Representative of semi-parasitic species, often an indicator of vegetation which is under stress or has not experienced fir for long periods
Conostephium pendulum	Common structure-modifying species on Bassendean Dunes, very similar to the Priority species *Conostephium minus* and so a search for *C. pendulum* would assist in the finding of the scarcer species
Dasypogon bromiliaefolius	Common structure-modifying species on Bassendean Dunes, important for ground-dwelling fauna because of its dense ground cover
Diuris emarginata	Representative of ephemeral herbs, a search for orchid species specifically would increase the chances of finding any rare species
Diuris longifolia	Representative of ephemeral herbs and a search for orchid species specifically would increase the chances of finding any rare species
Drosera spp	Representative of insectivorous plants and ephemeral herbs
Dryandra nivea	Very similar to *Dryandra mimica*, a Priority species, so a search for *D. nivea* would increase the chances of finding *D. mimica*

Eucalyptus marginata	Uncommon tree species on the Bassendean Dunes, whereas it is common on the Spearwood Dunes to the west. This species could therefore be used as an indication of whether the western end of the airport lay on a soils or regional vegetation boundary
Eucalyptus todtiana	Not rare, but an uncommon in reserves on the Bassendean Dunes
Hibbertia hypericoides	An important structure-modifying species and an indicator for drier soils on dune crests
Hypocalymma angustifolium	Indicator of dampland margins or areas where seepage from higher ground is exposed at the base of dunes, important pollen and nectar producer
Jacksonia furcellata	Important structure modifying species on mid-slopes, important for insects when flowering, common representative of Fabaceae (nitrogen fixers) on the Bassendean Dunes
Juncus pallidus	Common sedge in wetlands and therefore an indicator of areas which may get wetter than other damplands
Lepidosperma ? tenue	Important structure-modifying species on lower slopes, representative of perennial sedges which occur outside damplands
Lomandra spp	Common structure-modifying species which, on Bassendean Dunes, often form a sedge-like lower stratum with much greater ground cover than do shrubs
Lysinema ciliatum	Similar to the Priority species *Lysinema elegans* and so searched for as an aid to finding the latter species
Melaleuca preissiana	The swamp paperbark is an indicator species of damplands and swamps where the water table approaches or is higher than the soil surface for a substantial part of the year, important structure-modifying species, important nesting tree and source of nectar when flowering
Pterostylis nana	Representative of ephemeral herbs and a search for orchid species specifically would increase the chances of finding any rare species
Pterostylis recurva	Representative of ephemeral herbs and a search for orchid species specifically would increase the chances of finding any rare species
Pterostylis vittata vittata	Representative of ephemeral herbs and a search for orchid species specifically would increase the chances of finding any rare species
Stirlingia latifolia	In combination with *Allocasuarina humilis* is an indicator of well drained mid-slope habitats

APPENDIX C

SPECIES RECORDED IN EACH LOCATION - JANDAKOT AIRPORT

SPECIES RECORDED IN EACH LOCATION - JA[illegible] AKOT AIRPORT

	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16	A17	A18	A19	A20
	MS	MS	MS	L	MS	C	MS	MS	MS	L	MS	L	MS	L	L	L	L	MS	MS	L
Acacia pulchella	x	x	x	x	x	x	x	x	x		x	x	x	x	x		x	x	x	x
Acacia saligna																				
Adenanthos cygnorum																				
Adenanthos obovatus																				
Allocasuarina fraseriana	x	x	x	x	x	x	x	x	x	x			x		x	x				
Allocasuarina humilis		x	x		x	x	x	x	x		x		x					x	x	
Anigozanthos humilis	x		x		x		x	x			x			x	x			x	x	x
Anigozanthus manglesii	x				x			x			x				x			x	x	
Astartea fascicularis																				
Astroloma xerophyllum																				
Banksia attenuata	x	x	x	x	x	x	x	x	x		x		x		x		x	x	x	x
Banksia ilicifolia				x	x			x		x		x		x	x	x	x		x	x
Banksia littoralis																				
Banksia menzeisii	x	x	x		x	x	x	x	x		x				x			x		
Baumea articulata																				
Beaufortia micrantha																x				
Boronia busseliana																				
Boronia crenulata																x				
Bossiaea eriocarpa	x	x			x	x	x	x			x	x		x		x		x		x
Brachyloma preissii																				
Burchardia umbellata	x	x			x	x		x		x	x	x	x	x	x	x	x			x
Burtonia scabra	x	x		x			x	x	x	x			x	x		x			x	
Caladenia flava	x	x	x			x	x		x		x		x	x	x	x		x		x
Caladenia gemmata gemmata				x						x					x	x				
Caladenia patersonii longicauda																				
Calectasia cyanea						x		x					x							
Calytrix flavescens	x	x			x	x		x			x		x					x	x	x
Calytrix fraseri		x			x	x		x												
Calytrix strigosa																				
Carpobrotus inequilaterus																				

SPECIES RECORDED IN EACH LOCATION - JANDAKOT AIRPORT - Page 2

	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16	A17	A18	A19	A20
	MS	MS	MS	L	MS	C	MS	MS	MS	L	MS	L	MS	L	L	L	L	MS	MS	L
Cassytha glabella																				
Cassytha racemosa																				
Chamaescilla corymbosa	x						x									x				
Conostephium pendulum	x	x	x		x		x	x	x	x			x			x	x			x
Conostylis aculeata		x			x	x														
Conostylis aurea																				
Conostylis juncea																				
Conostylis setigera							x													
? Cryptostylis ovata				x	x		x			x		x			x			x		
Dampiera linearis			x	x																
Dasypogon bromiliaefolius	x			x				x						x		x	x	x		x
Daviesia aff. incrassata		x									x									
Daviesia aff. nudiflora		x					x				x			x		x				
Daviesia aff. preissii			x																	
Daviesia physodes																				
Dianella revoluta																				
Diuris emarginata																				
Diuris laxiflora																				
Diuris longifolia																				
Drosera erythrorhiza	x						x		x	x				x	x			x	x	
Drosera macrantha								x					x			x	x			
Drosera menziesii	x							x							x		x			
Drosera pulchella																				
Dryandra nivea																				
Eremaea asterocarpa																				
Eriostemon spicatus	x			x			x	x		x		x	x							
Eucalyptus marginata	x	x	x			x		x							x	x				
Eucalyptus rudis																				
Eucalyptus todtiana						x														
Euchilopsis linearis															x	x				

SPECIES RECORDED IN EACH LOCATION - JANAKOT AIRPORT - Page 3

	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16	A17	A18	A19	A20
	MS	MS	MS	L	MS	C	MS	MS	MS	L	MS	L	MS	L	L	L	L	MS	MS	L
Gastrolobium sp		x																		
Gompholobium tomentosum		x		x	x	x	x	x		x			x		x		x		x	x
Haemodorum paniculatum	x																			
Haemodorum spicatum																				
Hardenbergia comptoniana																				
Hemiandra pungens									x											
Hibbertia huegelii							x													
Hibbertia hypericoides	x				x	x		x												x
Hibbertia racemosa																				
Hibbertia subvaginata	x		x			x		x	x							x	x			x
Hovea pungens																x				x
Hypocalymma angustifolium																x	x			
Hypocalymma robustum	x		x		x			x												
Jacksonia furcellata	x							x								x				x
Jacksonia sternbergiana																				
Juncus krausii																				
Kennedia prostrata																				
Kunzea ericifolia																				
Laxmannia ramosa		x						x						x						
Lepidosperma aff. angustatum																x				
Lepidosperma effusum	x																			
Lepidosperma scabrum																x				
Lepidosperma sp B																				
Lepidosperma sp E.																				
Lepidosperma ? tenue																				
Leptocarpus canus																				
Lepyrodia muirii	x	x	x	x	x				x	x			x		x	x	x		x	
Leucopogon aff. racemulosus																				
Leucopogon australis																				
Leucopogon conostephioides	x			x	x	x			x		x			x	x	x	x		x	

SPECIES RECORDED IN EACH LOCATION - JAN[illegible]KOT AIRPORT - Page 4

	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16	A17	A18	A19	A20
	MS	MS	MS	L	MS	C	MS	MS	MS	L	MS	L	MS	L	L	L	L	MS	MS	L
Leucopogon kingianus																				
Leucopogon polymorphus	x	x	x		x			x	x	x		x			x	x			x	x
Leucopogon propinquus																				
Leucopogon racemulosus																				
Leucopogon sp																				
Lomandra micrantha	x																			
Lomandra purpurea																				
Lomandra sp																				
Lomandra suaveolans																				
Loxocarya fasciculata	x							x								x				
Loxocarya flexuosa																x				
Loxocarya pubescens																x	x			
Lygenia barbata	x							x								x	x			
Lysinema ciliatum			x	x																x
Lysinema elegans																				
Macrozamia reidlei		x						x								x				
Melaleuca acerosa			x					x		x						x	x			x
Melaleuca incana																				
Melaleuca preissiana																x				x
Melaleuca seriata																				
Melaleuca thymoides	x	x			x		x	x		x		x	x	x	x	x	x		x	x
Mesomelaena pseudostygia			x	x		x		x	x		x		x		x				x	x
Neurachne sp		x					x	x							x					
Nuytsia floribunda				x				x				x				x				
Oxylobium capitatum	x		x		x		x		x	x		x			x		x			
Patersonia occidentalis		x						x		x				x	x	x				x
Pericalymma ellipticum																				
Persoonia saccata																x	x			
Petrophile linearis	x	x	x				x	x										x	x	
Phlebocarya ciliata				x	x		x	x		x		x			x		x			x

SPECIES RECORDED IN EACH LOCATION - JANDAKOT AIRPORT - Page 5

	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16	A17	A18	A19	A20
	MS	MS	MS	L	MS	C	MS	MS	MS	L	MS	L	MS	L	L	L	L	MS	MS	L
Pimelia rosea																				
Pimelia ? angustifolia													x							
Platytheca galioides																			x	x
Prasophyllum sp																				
Pterostylis nana																				
Pterostylis recurva																				
Pterostylis vittata vittata																				
Pultenaea reticulata																				
Regelia ciliata																				
Regelia inops		x								x										
Restio aff. microcodon																				
Restio stenostachyus																				
Scaevola sp								x												
Schoenus aff. globifer																	x			
Schoenus curvifolius	x																x			
Schoenus spp	x																			
Scholtzia involucrata																x				x
Sowerbaea laxiflora																				
Stirlingia latifolia	x	x	x	x	x	x	x	x				x							x	
Stylidium sp								x												
Stylidium ? piliferum																				
Synaphaea spinulosa																				
Tetratheca setigera																				
Thysanotus manglesianus																				
Thysanotus triandrus	x																			
Xanthorrhoea preissii															x	x				x
	32	28	21	18	25	20	24	41	16	18	14	12	17	14	26	38	23	13	18	26

SPECIES RECORDED IN EACH LOCATION - JANGAKOT AIRPORT - Page 6

	A21	A22	A23	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13a	B13b	B14	B15	B16
	L	MS	L	L	MS	MS	L	MS	L	L	MS	C	L	L	L	D	D	L	L	L
Acacia pulchella		x			x	x	x	x	x	x		x	x	x	x		x	x		
Acacia saligna														x						
Adenanthos cygnorum				x										x						
Adenanthos obovatus																x		x		x
Allocasuarina fraseriana							x		x	x		x	x		x		x			
Allocasuarina humilis		x			x	x	x	x	x	x	x	x								
Anigozanthos humilis										x	x	x	x		x					
Anigozanthus manglesii								x				x								
Astartea fascicularis																	x			
Astroloma xerophyllum																x		x		
Banksia attenuata	x	x		x	x	x	x	x	x	x	x	x	x		x		x	x	x	x
Banksia ilicifolia	x		x	x		x	x	x	x	x	x		x	x	x	x	x	x	x	x
Banksia littoralis									x	x		x			x	x	x			
Banksia menzeisii		x	x		x	x		x			x	x	x							
Baumea articulata														x						
Beaufortia micrantha																				
Boronia busseliana																				
Boronia crenulata	x									x			x		x					x
Bossiaea eriocarpa	x		x			x	x		x	x	x	x	x		x			x	x	x
Brachyloma preissii	x																			
Burchardia umbellata	x			x	x	x		x	x	x	x	x	x		x	x	x			x
Burtonia scabra			x	x		x	x	x	x	x	x	x			x					x
Caladenia flava		x		x			x	x	x	x		x	x		x	x	x			x
Caladenia gemmata gemmata	x		x													x		x	x	x
Caladenia patersonii longicauda																				
Calectasia cyanea		x								x		x			x					
Calytrix flavescens				x	x	x	x		x	x	x	x	x		x					
Calytrix fraseri				x								x								
Calytrix strigosa																				
Carpobrotus inequilaterus														x		x				

SPECIES RECORDED IN EACH LOCATION - JANDAKOT AIRPORT - Page 7

	A21	A22	A23	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13a	B13b	B14	B15	B16
	L	MS	L	L	MS	MS	L	MS	L	L	MS	C	L	L	L	D	D	L	L	L
Cassytha glabella																				x
Cassytha racemosa																				
Chamaescilla corymbosa									x	x					x				x	x
Conostephium pendulum		x		x	x	x	x	x	x	x		x	x		x					
Conostylis aculeata	x						x		x	x		x	x		x					
Conostylis aurea																				
Conostylis juncea															x					
Conostylis setigera		x				x				x		x		x	x					
? Cryptostylis ovata			x		x															
Dampiera linearis									x	x		x	x	x	x					
Dasypogon bromiliaefolius	x		x	x					x	x		x	x	x	x	x		x	x	x
Daviesia aff. incrassata							x		x	x	x		x	x						
Daviesia aff. nudiflora						x	x		x	x				x						
Daviesia aff. preissii		x																		
Daviesia physodes																				
Dianella revoluta																				
Diuris emarginata																				x
Diuris laxiflora																				
Diuris longifolia	x														x		x			x
Drosera erythrorhiza		x	x		x		x	x	x	x	x		x	x				x	x	x
Drosera macrantha		x			x			x	x	x	x	x			x					
Drosera menziesii		x			x			x	x	x		x			x				x	
Drosera pulchella														x						
Dryandra nivea																		x		x
Eremaea asterocarpa										x										
Eriostemon spicatus	x	x		x	x	x		x	x	x		x	x	x	x					
Eucalyptus marginata			x	x		x	x		x	x		x	x		x					x
Eucalyptus rudis																				
Eucalyptus todtiana												x								
Euchilopsis linearis			x											x		x	x			x

SPECIES RECORDED IN EACH LOCATION - JANDAKOT AIRPORT - Page 8

	A21	A22	A23	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13a	B13b	B14	B15	B16
	L	MS	L	L	MS	MS	L	MS	L	L	MS	C	L	L	L	D	D	L	L	L
Gastrolobium sp									x	x		x	x		x					
Gompholobium tomentosum				x	x	x		x	x	x		x			x	x	x		x	
Haemodorum paniculatum									x	x		x			x				x	
Haemodorum spicatum										x		x					x		x	
Hardenbergia comptoniana															x					
Hemiandra pungens																				
Hibbertia huegelii										x										
Hibbertia hypericoides							x	x				x								
Hibbertia racemosa									x	x		x	x							
Hibbertia subvaginata	x			x					x	x		x	x	x	x		x		x	x
Hovea pungens										x		x	x		x					
Hypocalymma angustifolium															x	x	x			x
Hypocalymma robustum					x			x		x			x						x	
Jacksonia furcellata								x		x		x					x			
Jacksonia sternbergiana																				
Juncus krausii														x						
Kennedia prostrata																				
Kunzea ericifolia														x						
Laxmannia ramosa										x	x		x		x					
Lepidosperma aff. angustatum				x						x		x	x		x	x	x			
Lepidosperma effusum																	x			
Lepidosperma scabrum	x			x					x	x					x	x				
Lepidosperma sp B	x																			
Lepidosperma sp E.														x					x	
Lepidosperma ? tenue	x			x																
Leptocarpus canus														x						
Lepyrodia muirii	x				x		x		x	x		x	x		x	x				
Leucopogon aff. racemulosus														x						
Leucopogon australis									x	x					x					
Leucopogon conostephioides				x	x	x		x	x	x		x	x		x				x	x

SPECIES RECORDED IN EACH LOCATION - JANDAKOT AIRPORT - Page 9

	A21	A22	A23	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13a	B13b	B14	B15	B16
	L	MS	L	L	MS	MS	L	MS	L	L	MS	C	L	L	L	D	D	L	L	L
Leucopogon kingianus																				
Leucopogon polymorphus		x				x	x	x		x					x					
Leucopogon propinquus	x																			
Leucopogon racemulosus														x						
Leucopogon sp																				
Lomandra micrantha									x	x		x	x		x	x			x	
Lomandra purpurea									x	x		x			x	x	x			
Lomandra sp																				
Lomandra suaveolans									x	x		x	x		x	x				
Loxocarya fasciculata				x				x	x	x		x								
Loxocarya flexuosa				x				x				x								
Loxocarya pubescens								x		x		x	x			x			x	
Lygenia barbata				x					x	x		x	x						x	
Lysinema ciliatum	x								x	x		x	x							
Lysinema elegans																				
Macrozamia reidlei															x					
Melaleuca acerosa									x	x	x	x								
Melaleuca incana														x						
Melaleuca preissiana														x	x	x	x			x
Melaleuca seriata																				
Melaleuca thymoides		x				x			x	x				x	x				x	
Mesomelaena pseudostygia		x		x		x			x	x		x	x	x		x				x
Neurachne sp			x			x			x	x		x	x		x					
Nuytsia floribunda				x				x	x			x			x					
Oxylobium capitatum			x	x		x		x	x	x		x	x							
Patersonia occidentalis			x	x				x	x	x		x	x	x	x	x	x			x
Pericalymma ellipticum														x		x	x		x	
Persoonia saccata				x										x						
Petrophile linearis				x	x	x		x		x		x	x		x					
Phlebocarya ciliata				x			x	x	x	x	x		x					x		x

SPECIES RECORDED IN EACH LOCATION - JANL..KOT AIRPORT - Page 10

	A21	A22	A23	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13a	B13b	B14	B15	B16
	L	MS	L	L	MS	MS	L	MS	L	L	MS	C	L	L	L	D	D	L	L	L
Pimelia rosea																				
Pimelia ? angustifolia										x					x				x	
Platytheca galioides										x		x			x					
Prasophyllum sp																x	x			
Pterostylis nana																				
Pterostylis recurva																				
Pterostylis vittata vittata								x								x				x
Pultenaea reticulata																x	x			
Regelia ciliata										x										
Regelia inops														x	x	x				
Restio aff. microcodon																				
Restio stenostachyus									x	x		x								
Scaevola sp									x											
Schoenus aff. globifer									x	x		x	x		x					
Schoenus curvifolius									x	x		x	x			x				
Schoenus sp										x		x				x	x			
Scholtzia involucrata				x				x							x			x		
Sowerbaea laxiflora																				
Stirlingia latifolia					x		x		x			x								
Stylidium sp								x	x	x		x	x		x					
Stylidium ? piliferum								x		x		x			x					
Synaphaea																				
Tetratheca setigera										x		x	x		x					
Thysanotus manglesianus										x			x		x					
Thysanotus triandrus												x				x				
Xanthorrhoea preissii							x	x	x	x		x	x		x		x			x
	18	16	13	29	18	22	21	33	53	72	15	63	45	30	59	30	26	12	21	27

SPECIES RECORDED IN EACH LOCATION - JAN[illegible]KOT AIRPORT - Page 11

	B17	B18	B19	B20	B21	B22	B23	B24	B25	B26	B27	B28	B29	C1	C2	C3	C4	C5	C6	C7
	L	L	MS	L	L	L	L	L	L	L	L	L	L	L	MS	L	D	L	L	MS
Acacia pulchella			x		x			x		x		x	x	x	x			x		x
Acacia saligna																				
Adenanthos cygnorum																				
Adenanthos obovatus	x																			
Allocasuarina fraseriana			x																	
Allocasuarina humilis			x												x					x
Anigozanthos humilis			x	x	x							x		x	x					x
Anigozanthus manglesii			x	x	x									x	x	x		x		x
Astartea fascicularis					x									x	x		x			x
Astroloma xerophyllum			x		x							x		x	x			x		
Banksia attenuata	x	x	x	x	x	x	x	x	x			x		x	x	x	x	x	x	x
Banksia ilicifolia	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Banksia littoralis			x	x	x							x								
Banksia menzeisii			x					x		x		x			x	x		x		x
Baumea articulata																				
Beaufortia micrantha	x																			
Boronia busseliana																				
Boronia crenulata			x		x							x		x				x		
Bossiaea eriocarpa		x	x	x	x		x	x		x		x		x	x	x	x			x
Brachyloma preissii	x	x																		
Burchardia umbellata	x		x		x	x	x	x		x		x		x	x					x
Burtonia scabra		x	x	x		x			x		x			x	x	x	x			x
Caladenia flava	x	x	x	x	x	x			x		x	x	x	x	x	x	x	x		x
Caladenia gemmata gemmata		x		x			x						x						x	
Caladenia patersonii longicauda																				
Calectasia cyanea															x					x
Calytrix flavescens			x	x										x	x	x	x			x
Calytrix fraseri					x															
Calytrix strigosa																				
Carpobrotus inequilaterus																				

SPECIES RECORDED IN EACH LOCATION - JAN..KOT AIRPORT - Page 12

	B17	B18	B19	B20	B21	B22	B23	B24	B25	B26	B27	B28	B29	C1	C2	C3	C4	C5	C6	C7
	L	L	MS	L	L	L	L	L	L	L	L	L	L	L	MS	L	D	L	L	MS
Cassytha glabella																				
Cassytha racemosa														x				x		
Chamaescilla corymbosa			x	x											x	x			x	x
Conostephium pendulum			x		x									x	x	x	x			x
Conostylis aculeata	x	x	x	x	x							x		x	x	x	x			x
Conostylis aurea	x																			
Conostylis juncea																				
Conostylis setigera			x											x	x		x	x		x
? Cryptostylis ovata							x										x			
Dampiera linearis					x							x			x		x			x
Dasypogon bromiliaefolius	x		x	x	x		x	x	x	x	x		x			x	x	x	x	
Daviesia aff. incrassata					x							x		x		x	x	x		
Daviesia aff. nudiflora					x	x	x					x		x		x	x	x		
Daviesia aff. preissii		x																		
Daviesia physodes																x				
Dianella revoluta																				
Diuris emarginata																				
Diuris laxiflora																				
Diuris longifolia				x																
Drosera erythrorhiza	x	x	x	x		x	x			x			x		x	x			x	x
Drosera macrantha		x	x	x	x							x			x	x	x			x
Drosera menziesii	x	x	x	x			x	x			x	x			x	x			x	x
Drosera pulchella																				
Dryandra nivea																				
Eremaea asterocarpa																				
Eriostemon spicatus	x	x	x	x	x					x		x	x	x	x	x	x			x
Eucalyptus marginata		x	x			x	x	x							x	x	x			x
Eucalyptus rudis												x								
Eucalyptus todtiana															x					
Euchilopsis linearis					x							x	x					x		

SPECIES RECORDED IN EACH LOCATION - JANDAKOT AIRPORT - Page 13

	B17	B18	B19	B20	B21	B22	B23	B24	B25	B26	B27	B28	B29	C1	C2	C3	C4	C5	C6	C7
	L	L	MS	L	L	L	L	L	L	L	L	L	L	L	MS	L	D	L	L	MS
Gastrolobium sp			x	x	x							x		x	x	x				x
Gompholobium tomentosum	x	x	x	x	x					x		x		x	x		x			x
Haemodorum paniculatum			x	x	x							x		x	x	x	x			x
Haemodorum spicatum				x										x		x				
Hardenbergia comptoniana																				
Hemiandra pungens														x						
Hibbertia huegelii					x							x								
Hibbertia hypericoides					x															
Hibbertia racemosa			x																	
Hibbertia subvaginata			x		x											x	x	x		
Hovea pungens				x								x								
Hypocalymma angustifolium					x							x						x		
Hypocalymma robustum		x			x					x		x							x	
Jacksonia furcellata			x		x							x					x			
Jacksonia sternbergiana																				
Juncus krausii																				
Kennedia prostrata																				
Kunzea ericifolia																				
Laxmannia ramosa			x	x	x										x	x				x
Lepidosperma aff. angustatum			x	x	x							x		x		x	x			
Lepidosperma effusum																				
Lepidosperma scabrum				x													x	x		
Lepidosperma sp B																				
Lepidosperma sp E.																				
Lepidosperma ? tenue																	x			
Leptocarpus canus																				
Lepyrodia muirii	x	x	x	x	x					x	x	x		x	x	x	x			x
Leucopogon aff. racemulosus																				
Leucopogon australis	x	x	x	x								x		x	x					x
Leucopogon conostephioides			x		x							x	x	x	x					x

SPECIES RECORDED IN EACH LOCATION - JAN[illegible]AKOT AIRPORT - Page 14

	B17	B18	B19	B20	B21	B22	B23	B24	B25	B26	B27	B28	B29	C1	C2	C3	C4	C5	C6	C7
	L	L	MS	L	L	L	L	L	L	L	L	L	L	L	MS	L	D	L	L	MS
Leucopogon kingianus														x						
Leucopogon polymorphus			x		x							x		x	x				x	x
Leucopogon propinquus																				
Leucopogon racemulosus																				
Leucopogon sp																				
Lomandra micrantha	x		x	x	x							x		x	x	x	x			x
Lomandra purpurea	x		x	x	x							x					x			
Lomandra sp		x																		
Lomandra suaveolans			x									x			x	x	x			x
Loxocarya fasciculata														x	x					x
Loxocarya flexuosa				x								x		x	x		x			x
Loxocarya pubescens				x											x	x				x
Lygenia barbata	x		x	x	x							x		x	x	x	x	x		x
Lysinema ciliatum					x													x		
Lysinema elegans																				
Macrozamia reidlei			x	x												x				
Melaleuca acerosa			x	x	x									x	x	x				x
Melaleuca incana																				
Melaleuca preissiana												x				x	x	x		
Melaleuca seriata																				
Melaleuca thymoides	x		x	x										x	x	x	x			x
Mesomelaena pseudostygia			x	x	x		x		x		x	x		x	x	x			x	x
Neurachne sp			x	x				x	x	x	x						x			
Nuytsia floribunda				x										x	x	x				x
Oxylobium capitatum			x	x	x	x			x		x	x		x	x	x				x
Patersonia occidentalis	x	x	x	x	x		x			x		x		x	x	x	x	x		x
Pericalymma ellipticum					x			x		x							x	x		
Persoonia saccata												x								
Petrophile linearis			x		x									x	x	x				x
Phlebocarya ciliata			x	x	x			x	x			x	x	x	x	x	x		x	x

SPECIES RECORDED IN EACH LOCATION - JAN[illegible]KOT AIRPORT - Page15

	B17	B18	B19	B20	B21	B22	B23	B24	B25	B26	B27	B28	B29	C1	C2	C3	C4	C5	C6	C7
	L	L	MS	L	L	L	L	L	L	L	L	L	L	L	MS	L	D	L	L	MS
Pimelia rosea																				
Pimelia ? angustifolia			x	x																
Platytheca galioides					x							x								
Prasophyllum sp																				
Pterostylis nana																				
Pterostylis recurva																				
Pterostylis vittata vittata																				
Pultenaea reticulata																				
Regelia ciliata					x		x	x				x								
Regelia inops	x			x	x							x			x	x	x	x	x	
Restio aff. microcodon																				
Restio stenostachyus			x		x							x		x	x	x				x
Scaevola sp																				
Schoenus aff. globifer			x	x	x						x	x		x	x	x	x			x
Schoenus curvifolius			x	x	x						x						x			
Schoenus sp				x	x							x		x		x	x			
Scholtzia involucrata	x						x	x	x		x	x		x		x	x			
Sowerbaea laxiflora																				
Stirlingia latifolia			x								x			x	x				x	x
Stylidium sp			x	x								x		x	x	x				x
Stylidium ? piliferum			x	x	x									x	x	x				x
Synaphaea																				
Tetratheca setigera				x	x									x	x	x				x
Thysanotus manglesianus				x												x	x			
Thysanotus triandrus			x												x					x
Xanthorrhoea preissii	x		x		x							x				x	x		x	
	24	21	60	51	57	9	15	14	10	14	13	53	10	50	56	51	44	23	15	54

SPECIES RECORDED IN EACH LOCATION - JANDAKOT AIRPORT - Page 16

	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19	C20	C21	C22	C23	C24	C25	C26	C27
	L	L	MS	C	L	MS	MS	L	MS	MS	D	L	MS	MS	L	D	MS	MS	MS	L
Acacia pulchella			x	x	x	x	x	x	x	x	x	x	x	x	x		x			x
Acacia saligna																				
Adenanthos cygnorum						x	x			x				x						
Adenanthos obovatus											x						x			
Allocasuarina fraseriana			x	x	x	x	x	x	x	x		x	x	x	x					x
Allocasuarina humilis			x	x		x	x		x	x			x	x	x				x	x
Anigozanthos humilis			x	x		x	x		x	x			x	x	x					x
Anigozanthus manglesii				x		x	x		x	x			x	x	x					x
Astartea fascicularis																				
Astroloma xerophyllum			x	x		x	x		x	x	x		x	x	x		x			x
Banksia attenuata	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Banksia ilicifolia	x	x	x		x	x	x	x		x	x	x	x	x	x		x			x
Banksia littoralis																				
Banksia menzeisii			x	x	x	x	x	x	x	x		x	x	x	x	x		x	x	x
Baumea articulata																				
Beaufortia micrantha		x																		
Boronia busseliana																				
Boronia crenulata	x																			
Bossiaea eriocarpa			x	x	x	x	x	x	x	x		x	x	x	x	x				x
Brachyloma preissii																				
Burchardia umbellata				x	x	x	x	x	x	x	x	x	x	x	x		x			x
Burtonia scabra			x	x	x	x	x	x	x	x		x	x	x	x	x		x		x
Caladenia flava	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x			x
Caladenia gemmata gemmata					x										x					
Caladenia patersonii longicauda																				
Calectasia cyanea			x	x	x	x	x	x	x	x		x	x	x	x					x
Calytrix flavescens	x		x	x	x	x	x	x	x	x		x	x	x	x	x				x
Calytrix fraseri																				
Calytrix strigosa																				
Carpobrotus inequilaterus					x			x				x				x				

SPECIES RECORDED IN EACH LOCATION - JANDAKOT AIRPORT - Page 17

	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19	C20	C21	C22	C23	C24	C25	C26	C27
	L	L	MS	C	L	MS	MS	L	MS	MS	D	L	MS	MS	L	D	MS	MS	MS	L
Cassytha glabella																				
Cassytha racemosa																				
Chamaescilla corymbosa		x		x	x	x	x	x	x	x	x	x	x	x	x		x			x
Conostephium pendulum			x	x	x	x	x	x	x	x		x	x	x	x			x	x	x
Conostylis aculeata				x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x
Conostylis aurea																				
Conostylis juncea																				
Conostylis setigera			x	x		x	x		x	x			x	x	x					x
? Cryptostylis ovata																x				
Dampiera linearis	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x		x
Dasypogon bromiliaefolius		x			x			x			x						x			x
Daviesia aff. incrassata					x			x				x								
Daviesia aff. nudiflora					x			x	x			x				x				
Daviesia aff. preissii	x																			
Daviesia physodes																				
Dianella revoluta																				
Diuris emarginata																				
Diuris laxiflora																				
Diuris longifolia																				
Drosera erythrorhiza		x		x	x	x	x	x	x	x	x	x	x	x	x		x			x
Drosera macrantha			x	x	x	x	x	x	x	x	x	x	x	x	x		x	x		x
Drosera menziesii			x	x	x	x	x	x	x	x	x	x	x	x	x		x		x	x
Drosera pulchella																				
Dryandra nivea																				
Eremaea asterocarpa																				
Eriostemon spicatus	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x			x
Eucalyptus marginata			x	x		x	x		x	x			x	x	x	x	x	x		x
Eucalyptus rudis																				
Eucalyptus todtiana				x		x	x		x	x			x	x	x		x			x
Euchilopsis linearis																				

SPECIES RECORDED IN EACH LOCATION - JANDAKOT AIRPORT - Page 18

	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19	C20	C21	C22	C23	C24	C25	C26	C27
	L	L	MS	C	L	MS	MS	L	MS	MS	D	L	MS	MS	L	D	MS	MS	MS	L
Gastrolobium sp			x	x	x	x	x	x	x	x	x	x	x	x	x		x			x
Gompholobium tomentosum		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x
Haemodorum paniculatum			x	x		x	x		x	x	x		x	x	x		x			x
Haemodorum spicatum					x			x			x	x					x			
Hardenbergia comptoniana																	x			
Hemiandra pungens																				
Hibbertia huegelii					x			x				x								
Hibbertia hypericoides					x								x			x		x	x	
Hibbertia racemosa																				
Hibbertia subvaginata					x			x			x	x					x			
Hovea pungens													x				x			
Hypocalymma angustifolium																				
Hypocalymma robustum					x															
Jacksonia furcellata					x			x				x				x		x	x	
Jacksonia sternbergiana																				
Juncus krausii																				
Kennedia prostrata																				
Kunzea ericifolia																				
Laxmannia ramosa	x		x	x	x	x	x	x	x	x	x	x	x	x	x		x			x
Lepidosperma aff. angustatum					x			x				x								
Lepidosperma effusum																				
Lepidosperma scabrum					x			x			x	x					x			
Lepidosperma sp B																				
Lepidosperma sp E.																				
Lepidosperma ? tenue																		x		
Leptocarpus canus																				
Lepyrodia muirii				x	x	x	x	x	x	x	x	x	x	x	x		x			x
Leucopogon aff. racemulosus																				
Leucopogon australis			x	x	x	x	x	x	x	x		x	x	x	x					x
Leucopogon conostephioides			x	x	x	x	x	x	x	x	x	x	x	x	x	x				x

SPECIES RECORDED IN EACH LOCATION - JANL..KOT AIRPORT - Page 19

	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19	C20	C21	C22	C23	C24	C25	C26	C27
	L	L	MS	C	L	MS	MS	L	MS	MS	D	L	MS	MS	L	D	MS	MS	MS	L
Leucopogon kingianus																				
Leucopogon polymorphus			x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x
Leucopogon propinquus																				
Leucopogon racemulosus								x												
Leucopogon sp																				
Lomandra micrantha				x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x
Lomandra purpurea					x			x			x	x					x	x	x	
Lomandra sp																				
Lomandra suaveolans			x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x
Loxocarya fasciculata			x	x		x	x		x	x	x		x	x	x		x			x
Loxocarya flexuosa			x	x	x	x	x	x	x	x		x	x	x	x	x				x
Loxocarya pubescens				x	x	x	x	x	x	x	x	x	x	x	x		x			x
Lygenia barbata				x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Lysinema ciliatum																				
Lysinema elegans																				
Macrozamia reidlei																	x			
Melaleuca acerosa			x	x	x	x	x	x	x	x		x	x	x	x	x				x
Melaleuca incana																				
Melaleuca preissiana											x						x			
Melaleuca seriata																				
Melaleuca thymoides			x	x	x	x	x	x	x	x	x	x	x	x	x		x	x		x
Mesomelaena pseudostygia		x	x	x	x	x	x	x	x	x	x	x	x	x	x		x		x	x
Neurachne sp					x			x				x				x				
Nuytsia floribunda			x	x	x	x	x	x	x	x		x	x	x	x					x
Oxylobium capitatum			x	x	x	x	x	x	x	x	x	x	x	x	x		x			x
Patersonia occidentalis			x	x	x	x	x	x	x	x	x	x	x	x	x		x			x
Pericalymma ellipticum											x					x				
Persoonia saccata					x			x				x								
Petrophile linearis			x	x	x	x	x	x	x	x		x	x	x	x					x
Phlebocarya ciliata	x			x	x	x	x	x	x	x	x	x	x	x	x		x	x		x

SPECIES RECORDED IN EACH LOCATION - JANDAKOT AIRPORT - Page 20

	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19	C20	C21	C22	C23	C24	C25	C26	C27
	L	L	MS	C	L	MS	MS	L	MS	MS	D	L	MS	MS	L	D	MS	MS	MS	L
Pimelia rosea																				
Pimelia ? angustifolia					x			x				x								
Platytheca galioides					x			x				x								
Prasophyllum sp																				
Pterostylis nana																				
Pterostylis recurva																				
Pterostylis vittata vittata																				
Pultenaea reticulata																				
Regelia ciliata												x								
Regelia inops											x	x	x				x			
Restio aff. microcodon																				
Restio stenostachyus			x	x	x	x	x	x	x	x		x	x	x	x	x			x	x
Scaevola sp																				
Schoenus aff. globifer			x	x	x	x	x	x	x	x	x	x	x	x	x		x			x
Schoenus curvifolius					x			x				x								
Schoenus sp					x			x			x	x					x			
Scholtzia involucrata					x										x			x		x
Sowerbaea laxiflora																				
Stirlingia latifolia			x	x		x	x		x	x			x	x	x	x		x	x	x
Stylidium sp			x	x	x	x	x	x	x	x	x	x	x	x	x		x			x
Stylidium ? piliferum			x	x	x	x	x	x	x	x	x	x	x	x	x		x			x
Synaphaea																				
Tetratheca setigera			x	x	x	x	x	x	x	x		x	x	x	x					x
Thysanotus manglesianus					x			x			x	x					x		x	
Thysanotus triandrus				x	x	x	x	x	x	x		x	x	x	x					x
Xanthorrhoea preissii					x			x			x	x					x	x	x	
	10	11	43	54	68	56	56	65	55	56	54	60	58	56	57	22	47	20	21	57

SPECIES RECORDED IN EACH LOCATION - JANDAKOT AIRPORT - Page 21

	C28	C29	C30	C31	C32	C33	C34	C35	C36	C37	C38	C39	C40	C41	C42	C43	C44	C45	C46	C47
	D	L	L	L	L	L	D	MS	C	MS	L	MS	MS	MS	MS	MS	MS	C	C	C
Acacia pulchella		x	x	x	x	x		x				x	x	x				x		
Acacia saligna																				
Adenanthos cygnorum																				
Adenanthos obovatus		x	x	x	x	x		x						x				x		
Allocasuarina fraseriana								x		x						x	x	x		
Allocasuarina humilis								x				x	x	x	x		x	x		x
Anigozanthos humilis									x			x						x	x	
Anigozanthus manglesii								x		x				x	x	x				
Astartea fascicularis																				
Astroloma xerophyllum		x	x	x	x	x		x						x				x		
Banksia attenuata	x	x	x	x	x	x		x	x	x		x	x	x	x		x	x	x	x
Banksia ilicifolia		x	x	x		x	x	x						x	x	x	x			
Banksia littoralis																				
Banksia menzeisii	x								x	x		x	x				x	x	x	x
Baumea articulata																				
Beaufortia micrantha																				
Boronia busseliana																				
Boronia crenulata																				
Bossiaea eriocarpa			x	x				x			x		x		x	x	x	x		x
Brachyloma preissii	x																			
Burchardia umbellata		x	x	x	x	x	x	x						x	x	x	x	x		
Burtonia scabra	x				x	x			x	x	x	x			x	x		x		x
Caladenia flava		x	x	x	x	x		x						x	x			x		
Caladenia gemmata gemmata				x	x	x				x					x					
Caladenia patersonii longicauda																				
Calectasia cyanea								x						x		x	x	x		
Calytrix flavescens								x	x	x			x	x	x	x		x		x
Calytrix fraseri																				
Calytrix strigosa																				
Carpobrotus inequilaterus																				

SPECIES RECORDED IN EACH LOCATION - JANDAKOT AIRPORT - Page 22

	C28	C29	C30	C31	C32	C33	C34	C35	C36	C37	C38	C39	C40	C41	C42	C43	C44	C45	C46	C47
	D	L	L	L	L	L	D	MS	C	MS	L	MS	MS	MS	MS	MS	MS	C	C	C
Cassytha glabella																				
Cassytha racemosa																				
Chamaescilla corymbosa		x	x	x	x	x		x						x						
Conostephium pendulum	x			x		x												x		
Conostylis aculeata		x	x	x	x	x		x						x	x					
Conostylis aurea										x						x				
Conostylis juncea	x																			
Conostylis setigera	x									x					x		x	x		
? Cryptostylis ovata									x											
Dampiera linearis		x	x	x	x	x		x						x	x					
Dasypogon bromiliaefolius		x	x	x	x	x		x						x	x			x		
Daviesia aff. incrassata																		x		
Daviesia aff. nudiflora						x			x			x	x					x		
Daviesia aff. preissii																				
Daviesia physodes																				
Dianella revoluta																				
Diuris emarginata																				
Diuris laxiflora																				
Diuris longifolia																				
Drosera erythrorhiza		x	x	x	x	x		x						x	x	x	x	x		
Drosera macrantha	x	x	x	x	x	x		x						x				x		
Drosera menziesii		x	x	x	x	x		x	x					x				x		
Drosera pulchella																				
Dryandra nivea																				
Eremaea asterocarpa																				
Eriostemon spicatus		x	x	x	x	x		x						x				x		
Eucalyptus marginata	x		x		x	x					x	x						x		
Eucalyptus rudis																				
Eucalyptus todtiana																		x		
Euchilopsis linearis					x	x														

SPECIES RECORDED IN EACH LOCATION - JANDAKOT AIRPORT - Page 23

	C28	C29	C30	C31	C32	C33	C34	C35	C36	C37	C38	C39	C40	C41	C42	C43	C44	C45	C46	C47
	D	L	L	L	L	L	D	MS	C	MS	L	MS	MS	MS	MS	MS	MS	C	C	C
Gastrolobium sp		x	x	x	x	x		x						x				x		
Gompholobium tomentosum		x	x	x	x	x		x						x				x	x	x
Haemodorum paniculatum		x	x	x	x	x		x						x	x			x		
Haemodorum spicatum		x	x	x	x	x		x						x				x		
Hardenbergia comptoniana																				
Hemiandra pungens	x																			
Hibbertia huegelii									x											
Hibbertia hypericoides	x								x	x		x	x					x	x	x
Hibbertia racemosa																				
Hibbertia subvaginata		x	x	x	x	x		x						x	x					
Hovea pungens																		x		
Hypocalymma angustifolium			x	x	x	x														
Hypocalymma robustum					x	x														
Jacksonia furcellata	x								x								x	x		
Jacksonia sternbergiana																				
Juncus krausii																				
Kennedia prostrata																				
Kunzea ericifolia																				
Laxmannia ramosa		x	x	x	x	x		x						x				x		
Lepidosperma aff. angustatum																				
Lepidosperma effusum																				
Lepidosperma scabrum		x	x	x	x	x		x						x	x			x		
Lepidosperma sp B																				
Lepidosperma sp E.																				
Lepidosperma ? tenue																				
Leptocarpus canus																				
Lepyrodia muirii		x	x	x	x	x		x						x		x	x	x		
Leucopogon aff. racemulosus																				
Leucopogon australis																				
Leucopogon conostephioides	x				x	x	x		x	x	x				x	x		x		

SPECIES RECORDED IN EACH LOCATION - JANDAKOT AIRPORT - Page 24

	C28	C29	C30	C31	C32	C33	C34	C35	C36	C37	C38	C39	C40	C41	C42	C43	C44	C45	C46	C47
	D	L	L	L	L	L	D	MS	C	MS	L	MS	MS	MS	MS	MS	MS	C	C	C
Leucopogon kingianus																		x		
Leucopogon polymorphus		x	x	x	x	x		x						x				x		
Leucopogon propinquus																				
Leucopogon racemulosus						x														
Leucopogon sp																				
Lomandra micrantha		x	x	x	x	x		x		x		x	x	x					x	x
Lomandra purpurea		x	x	x	x	x		x		x		x	x	x	x				x	x
Lomandra sp																				
Lomandra suaveolans		x	x	x	x	x		x		x		x	x	x	x			x	x	x
Loxocarya fasciculata		x	x	x	x	x		x						x	x			x		
Loxocarya flexuosa	x																			
Loxocarya pubescens		x	x	x	x	x		x						x			x			
Lygenia barbata		x	x	x	x	x		x						x	x			x		
Lysinema ciliatum																				
Lysinema elegans																				
Macrozamia reidlei																				
Melaleuca acerosa				x		x				x			x	x		x				
Melaleuca incana																				
Melaleuca preissiana		x	x	x	x	x		x						x						
Melaleuca seriata									x											
Melaleuca thymoides		x	x	x	x	x		x						x				x		
Mesomelaena pseudostygia		x	x	x	x	x		x						x	x			x		
Neurachne sp					x	x	x						x	x	x					
Nuytsia floribunda																	x			
Oxylobium capitatum		x	x	x	x	x		x						x			x	x		
Patersonia occidentalis		x	x	x	x	x		x					x	x		x		x		
Pericalymma ellipticum	x						x													
Persoonia saccata																				
Petrophile linearis								x				x	x	x			x	x		
Phlebocarya ciliata	x	x	x	x	x	x		x	x					x						

SPECIES RECORDED IN EACH LOCATION - JANDAKOT AIRPORT - Page 25

	C28	C29	C30	C31	C32	C33	C34	C35	C36	C37	C38	C39	C40	C41	C42	C43	C44	C45	C46	C47
	D	L	L	L	L	L	D	MS	C	MS	L	MS	MS	MS	MS	MS	MS	C	C	C
Pimelia rosea																				
Pimelia ? angustifolia																				
Platytheca galioides																				
Prasophyllum sp																				
Pterostylis nana																				
Pterostylis recurva																				
Pterostylis vittata vittata																				
Pultenaea reticulata																				
Regelia ciliata																				
Regelia inops		x	x	x	x	x		x						x						
Restio aff. microcodon																				
Restio stenostachyus																				
Scaevola sp																				
Schoenus aff. globifer	x	x	x	x	x	x		x						x	x			x		
Schoenus curvifolius																		x		
Schoenus sp		x	x	x	x	x		x						x	x					
Scholtzia involucrata				x		x														
Sowerbaea laxiflora																				
Stirlingia latifolia	x									x		x	x				x	x	x	x
Stylidium sp		x	x	x	x	x		x						x				x		
Stylidium ? piliferum		x	x	x	x	x		x						x				x		
Synaphaea																				
Tetratheca setigera																				
Thysanotus manglesianus		x	x	x	x	x		x						x						
Thysanotus triandrus																				
Xanthorrhoea preissii		x	x	x	x	x		x		x		x	x	x	x				x	x
	18	43	46	49	50	56	5	50	16	15	4	15	17	44	28	14	17	52	10	13

SPECIES RECORDED IN EACH LOCATION - JANDAKOT AIRPORT - Page 26

	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13	D14	D15	D16	D17	D18	D19	D20
	C	C	MS	MS	C	MS	MS	MS	MS	C	MS	L	MS	MS	MS	MS	L	MS	MS	MS
Acacia pulchella	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Acacia saligna																				
Adenanthos cygnorum	x	x															x			
Adenanthos obovatus																				
Allocasuarina fraseriana		x	x	x					x				x	x			x	x	x	
Allocasuarina humilis	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Anigozanthos humilis	x	x			x	x			x	x	x	x		x	x		x		x	x
Anigozanthus manglesii	x	x			x	x			x	x	x	x		x	x		x		x	x
Astartea fascicularis																				
Astroloma xerophyllum						x					x	x		x	x					
Banksia attenuata	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Banksia ilicifolia			x	x		x	x		x		x	x	x	x	x	x	x		x	x
Banksia littoralis																				
Banksia menzeisii	x	x	x	x		x	x	x	x		x	x	x	x	x	x	x	x	x	x
Baumea articulata																				
Beaufortia micrantha																				
Boronia busseliana																				
Boronia crenulata	x	x																		
Bossiaea eriocarpa	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Brachyloma preissii																				
Burchardia umbellata	x	x	x			x	x	x	x		x	x	x	x	x	x	x	x	x	x
Burtonia scabra	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x	x
Caladenia flava	x	x			x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Caladenia gemmata gemmata												x								
Caladenia patersonii longicauda															x					
Calectasia cyanea	x	x		x		x	x	x	x		x	x	x	x	x	x	x	x	x	x
Calytrix flavescens	x	x	x		x	x	x	x		x	x	x	x	x	x	x	x	x	x	x
Calytrix fraseri	x	x																		
Calytrix strigosa																				
Carpobrotus inequilaterus																				

SPECIES RECORDED IN EACH LOCATION - JANL..KOT AIRPORT - Page 27

	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13	D14	D15	D16	D17	D18	D19	D20
	C	C	MS	MS	C	MS	MS	MS	MS	C	MS	L	MS	MS	MS	MS	L	MS	MS	MS
Cassytha glabella																				
Cassytha racemosa					x					x										
Chamaescilla corymbosa	x	x				x	x	x			x		x	x	x	x		x		
Conostephium pendulum	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Conostylis aculeata	x	x			x	x	x	x		x	x	x	x	x	x	x	x	x	x	x
Conostylis aurea																				
Conostylis juncea			x						x											
Conostylis setigera	x	x		x	x	x					x	x		x			x		x	x
? Cryptostylis ovata																				
Dampiera linearis	x	x			x		x	x	x	x			x		x	x	x	x	x	x
Dasypogon bromiliaefolius	x	x			x	x	x	x		x	x	x	x	x	x	x	x	x	x	x
Daviesia aff. incrassata	x	x		x	x	x	x	x		x	x	x	x	x	x	x	x	x	x	x
Daviesia aff. nudiflora	x	x			x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Daviesia aff. preissii			x								x									
Daviesia physodes																				
Dianella revoluta																				
Diuris emarginata																				
Diuris laxiflora																				
Diuris longifolia																				
Drosera erythrorhiza	x	x	x	x		x	x	x	x		x	x	x	x	x	x	x	x	x	x
Drosera macrantha	x	x			x	x	x	x		x	x	x	x	x	x	x	x	x	x	x
Drosera menziesii	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Drosera pulchella																				
Dryandra nivea																				
Eremaea asterocarpa	x	x					x	x					x		x	x		x		
Eriostemon spicatus	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Eucalyptus marginata	x	x				x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Eucalyptus rudis																				
Eucalyptus todtiana										x					x	x				
Euchilopsis linearis												x								

SPECIES RECORDED IN EACH LOCATION - JANDAKOT AIRPORT - Page 28

	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13	D14	D15	D16	D17	D18	D19	D20
	C	C	MS	MS	C	MS	MS	MS	MS	C	MS	L	MS	MS	MS	MS	L	MS	MS	MS
Gastrolobium sp	x	x			x	x	x	x		x	x	x	x	x	x	x	x	x	x	x
Gompholobium tomentosum	x	x	x			x	x	x	x		x	x	x	x	x	x	x	x	x	x
Haemodorum paniculatum	x	x				x	x	x	x		x	x	x	x	x	x	x	x	x	x
Haemodorum spicatum	x	x		x		x	x	x	x		x	x	x	x	x	x	x	x	x	x
Hardenbergia comptoniana	x	x															x		x	x
Hemiandra pungens	x	x			x	x			x	x	x	x		x					x	x
Hibbertia huegelii	x	x			x	x	x	x	x	x	x		x	x	x	x	x	x	x	x
Hibbertia hypericoides	x	x	x	x	x		x	x	x	x			x		x	x	x	x		
Hibbertia racemosa	x	x																		
Hibbertia subvaginata	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		
Hovea pungens	x	x					x	x					x		x	x		x		
Hypocalymma angustifolium																				
Hypocalymma robustum	x	x	x		x		x	x		x			x		x	x		x	x	x
Jacksonia furcellata	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Jacksonia sternbergiana																				
Juncus krausii																				
Kennedia prostrata																				
Kunzea ericifolia	x	x				x	x	x			x	x	x	x	x	x	x	x	x	x
Laxmannia ramosa	x	x			x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Lepidosperma aff. angustatum	x	x			x	x	x	x		x	x	x	x	x	x	x	x	x	x	x
Lepidosperma effusum																				
Lepidosperma scabrum	x	x					x	x					x		x	x	x	x	x	x
Lepidosperma sp B			x																	
Lepidosperma sp E.																				
Lepidosperma ? tenue				x					x											
Leptocarpus canus																				
Lepyrodia muirii	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Leucopogon aff. racemulosus																				
Leucopogon australis			x	x					x											
Leucopogon conostephioides	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

SPECIES RECORDED IN EACH LOCATION - JANDAKOT AIRPORT - Page 29

	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13	D14	D15	D16	D17	D18	D19	D20
	C	C	MS	MS	C	MS	MS	MS	MS	C	MS	L	MS	MS	MS	MS	L	MS	MS	MS
Leucopogon kingianus	x	x			x		x	x		x			x		x	x	x	x		
Leucopogon polymorphus	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Leucopogon propinquus																				
Leucopogon racemulosus																				
Leucopogon sp				x																
Lomandra micrantha	x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Lomandra purpurea	x	x			x	x	x	x		x	x	x	x	x	x	x	x	x	x	x
Lomandra sp																				
Lomandra suaveolans	x	x					x	x					x		x	x	x	x	x	x
Loxocarya fasciculata	x	x	x		x	x	x	x		x	x	x	x	x	x	x	x	x	x	x
Loxocarya flexuosa	x	x		x	x	x	x	x		x	x	x	x	x	x	x	x	x	x	x
Loxocarya pubescens	x	x			x	x	x	x		x	x	x	x	x	x	x	x	x	x	x
Lygenia barbata	x	x			x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Lysinema ciliatum						x					x	x		x			x		x	x
Lysinema elegans	x																			
Macrozamia reidlei	x	x																		
Melaleuca acerosa	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x	x
Melaleuca incana																				
Melaleuca preissiana																				
Melaleuca seriata					x															
Melaleuca thymoides		x	x	x						x			x					x		
Mesomelaena pseudostygia	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Neurachne sp	x	x				x	x	x			x	x	x	x	x	x	x	x	x	x
Nuytsia floribunda	x	x	x							x							x			
Oxylobium capitatum	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	x	x	x	x	x	x	x	x	x
Pericalymma ellipticum																				
Persoonia saccata	x	x					x	x		x			x		x	x		x	x	x
Petrophile linearis	x	x			x		x	x	x	x			x		x	x	x	x	x	x
Phlebocarya ciliata	x	x			x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

SPECIES RECORDED IN EACH LOCATION - JANDAKOT AIRPORT - Page 30

	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13	D14	D15	D16	D17	D18	D19	D20
	C	C	MS	MS	C	MS	MS	MS	MS	C	MS	L	MS	MS	MS	MS	L	MS	MS	MS
Pimelia rosea																				
Pimelia ? angustifolia																	x			
Platytheca galioides	x	x	x				x	x					x		x	x	x	x	x	x
Prasophyllum sp																				
Pterostylis nana																				
Pterostylis recurva				x																
Pterostylis vittata vittata																				
Pultenaea reticulata	x	x																		
Regelia ciliata	x																			
Regelia inops																	x			
Restio aff. microcodon																				
Restio stenostachyus	x	x			x	x	x	x		x	x	x	x	x	x	x	x	x	x	x
Scaevola sp																				
Schoenus aff. globifer	x	x			x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Schoenus curvifolius	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Schoenus sp	x	x			x	x	x	x		x	x	x	x	x	x	x	x	x	x	x
Scholtzia involucrata			x						x											
Sowerbaea laxiflora	x	x																		
Stirlingia latifolia	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Stylidium sp	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Stylidium ? piliferum	x	x				x	x	x			x	x	x	x	x	x	x	x	x	x
Synaphaea						x					x	x		x			x		x	x
Tetratheca setigera	x	x	x	x		x	x	x	x		x	x	x	x	x	x	x	x	x	x
Thysanotus manglesianus	x	x	x			x	x	x			x	x	x	x	x	x	x	x	x	x
Thysanotus triandrus	x	x		x		x	x	x			x	x	x	x	x	x	x	x	x	x
Xanthorrhoea preissii	x	x				x	x	x			x	x	x	x	x	x		x		
	82	83	36	36	50	65	69	68	45	53	66	65	71	66	74	70	75	70	71	70

SPECIES RECORDED IN EACH LOCATION - JANDAKOT AIRPORT - Page 31

	D21	D22	D23	D24	D25	D26	D27	D28	D29	D30	D31	D32	D33	D34	D35	D36	D37	D38	D39	D40
	D	C	L	L	MS	MS	D	L	C	MS	L	L	L	L	L	L	L	D	C	L
Acacia pulchella	x	x	x		x	x	x		x	x	x	x			x		x		x	
Acacia saligna														x						
Adenanthos cygnorum			x										x				x			
Adenanthos obovatus																				
Allocasuarina fraseriana		x				x				x										
Allocasuarina humilis	x	x	x		x	x	x		x	x	x						x		x	
Anigozanthos humilis	x	x	x		x	x	x		x								x		x	
Anigozanthus manglesii	x		x		x	x	x										x			
Astartea fascicularis												x			x					
Astroloma xerophyllum	x				x	x	x	x												
Banksia attenuata	x	x	x		x	x	x	x	x	x	x	x			x	x	x		x	
Banksia ilicifolia	x		x	x				x			x	x	x	x	x	x	x	x		x
Banksia littoralis		x							x										x	x
Banksia menzeisii	x	x	x	x	x	x	x	x	x	x	x						x		x	
Baumea articulata																				
Beaufortia micrantha																				
Boronia busseliana																				
Boronia crenulata																x				
Bossiaea eriocarpa	x	x	x	x	x	x	x	x	x								x		x	
Brachyloma preissii										x	x									
Burchardia umbellata	x	x	x	x	x	x	x	x	x				x			x	x	x	x	
Burtonia scabra	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x		x	
Caladenia flava			x	x		x		x	x	x	x				x		x		x	
Caladenia gemmata gemmata			x	x								x	x	x	x	x	x			x
Caladenia patersonii longicauda																				
Calectasia cyanea	x	x	x		x	x	x		x								x		x	
Calytrix flavescens	x	x	x		x	x	x	x	x	x	x					x	x		x	
Calytrix fraseri																				
Calytrix strigosa																				
Carpobrotus inequilaterus												x		x	x					

SPECIES RECORDED IN EACH LOCATION - JANDAKOT AIRPORT - Page 32

	D21	D22	D23	D24	D25	D26	D27	D28	D29	D30	D31	D32	D33	D34	D35	D36	D37	D38	D39	D40
	D	C	L	L	MS	MS	D	L	C	MS	L	L	L	L	L	L	L	D	C	L
Cassytha glabella												x			x					
Cassytha racemosa																				
Chamaescilla corymbosa		x			x	x			x										x	
Conostephium pendulum	x	x	x		x	x	x	x	x								x		x	
Conostylis aculeata	x	x	x		x	x	x	x	x	x	x						x		x	
Conostylis aurea																				
Conostylis juncea						x														
Conostylis setigera	x	x	x		x	x	x	x	x					x		x	x		x	
? Cryptostylis ovata																				
Dampiera linearis		x	x					x	x								x		x	
Dasypogon bromiliaefolius	x		x	x	x	x	x	x			x	x	x		x		x			x
Daviesia ? divaricata	x	x	x		x	x	x	x	x								x		x	
Daviesia aff. nudiflora	x	x	x		x	x	x	x	x								x		x	
Daviesia aff. preissii																				
Daviesia physodes																x				
Dianella revoluta																				
Diuris emarginata														x						
Diuris laxiflora															x					
Diuris longifolia																				
Drosera erythrorhiza	x		x	x	x	x	x	x			x				x		x		x	x
Drosera macrantha	x	x	x		x	x	x	x	x	x						x	x		x	
Drosera menziesii	x	x	x		x	x	x	x	x							x	x		x	
Drosera pulchella																				
Dryandra nivea																				
Eremaea asterocarpa		x							x										x	
Eriostemon spicatus	x	x	x		x	x	x		x	x							x		x	
Eucalyptus marginata	x	x	x		x	x	x		x								x		x	
Eucalyptus rudis												x		x	x					x
Eucalyptus todtiana		x							x										x	
Euchilopsis linearis								x				x			x					x

SPECIES RECORDED IN EACH LOCATION - JANI KOT AIRPORT - Page 33

	D21	D22	D23	D24	D25	D26	D27	D28	D29	D30	D31	D32	D33	D34	D35	D36	D37	D38	D39	D40
	D	C	L	L	MS	MS	D	L	C	MS	L	L	L	L	L	L	L	D	C	L
Gastrolobium sp	x	x	x		x	x	x	x	x	x	x						x		x	
Gompholobium tomentosum	x	x	x		x	x	x	x	x	x	x					x	x		x	x
Haemodorum paniculatum	x	x	x		x	x	x	x	x								x		x	
Haemodorum spicatum	x	x	x		x	x	x	x	x								x		x	
Hardenbergia comptoniana		x	x						x								x		x	
Hemiandra pungens	x				x	x	x			x							x		x	
Hibbertia huegelii			x		x	x			x											
Hibbertia hypericoides		x	x						x	x				x			x		x	
Hibbertia racemosa																	x		x	
Hibbertia subvaginata	x		x		x	x	x				x					x	x			
Hovea pungens				x						x	x									
Hypocalymma angustifolium												x			x					x
Hypocalymma robustum		x							x							x			x	
Jacksonia furcellata	x	x	x		x	x	x		x	x							x		x	
Jacksonia sternbergiana														x						
Juncus krausii												x		x	x					
Kennedia prostrata												x						x	x	x
Kunzea ericifolia	x	x			x	x	x		x											
Laxmannia ramosa	x	x	x		x	x	x	x	x	x	x					x	x		x	
Lepidosperma aff. angustatum	x	x	x		x	x	x	x	x			x			x		x		x	
Lepidosperma effusum																				
Lepidosperma scabrum		x	x					x	x								x		x	
Lepidosperma sp B																				
Lepidosperma sp E.											x				x					
Lepidosperma ? tenue																				
Leptocarpus canus																				
Lepyrodia muirii	x	x	x		x	x	x	x	x							x	x		x	
Leucopogon aff. racemulosus																				
Leucopogon australis																				
Leucopogon conostephioides	x	x	x		x	x	x	x	x								x		x	

SPECIES RECORDED IN EACH LOCATION - JANDAKOT AIRPORT - Page 34

	D21	D22	D23	D24	D25	D26	D27	D28	D29	D30	D31	D32	D33	D34	D35	D36	D37	D38	D39	D40
	D	C	L	L	MS	MS	D	L	C	MS	L	L	L	L	L	L	L	D	C	L
Leucopogon kingianus		x	x						x								x		x	
Leucopogon polymorphus	x	x	x		x	x	x		x	x						x	x		x	
Leucopogon propinquus																x				
Leucopogon racemulosus	x											x								
Leucopogon sp																				
Lomandra micrantha	x	x	x		x	x	x	x	x		x						x		x	
Lomandra purpurea	x	x	x		x	x	x	x	x								x		x	
Lomandra sp																x				
Lomandra suaveolans		x	x					x	x								x		x	
Loxocarya fasciculata	x	x	x		x	x	x	x	x								x		x	
Loxocarya flexuosa	x	x	x		x	x	x	x	x							x	x		x	
Loxocarya pubescens	x	x	x		x	x	x	x	x								x		x	
Lygenia barbata	x	x	x		x	x	x	x	x	x	x					x	x		x	
Lysinema ciliatum	x		x		x	x	x										x			
Lysinema elegans																				
Macrozamia reidlei																				
Melaleuca acerosa	x	x	x		x	x	x		x	x	x					x	x		x	
Melaleuca incana																				
Melaleuca preissiana	x							x				x	x		x			x		x
Melaleuca seriata																				
Melaleuca thymoides							x	x												
Mesomelaena pseudostygia	x	x	x		x	x	x	x	x		x						x		x	
Neurachne sp	x	x	x		x	x	x	x	x		x						x		x	
Nuytsia floribunda		x	x					x	x	x							x		x	
Oxylobium capitatum	x	x	x		x	x	x	x	x								x		x	
Patersonia occidentalis	x	x	x		x	x	x	x	x				x	x	x		x		x	
Pericalymma ellipticum	x						x	x										x		
Persoonia saccata									x										x	
Petrophile linearis		x	x						x							x	x		x	
Phlebocarya ciliata	x	x	x		x	x	x	x	x				x	x			x		x	

SPECIES RECORDED IN EACH LOCATION - JANDAKOT AIRPORT - Page 35

	D21	D22	D23	D24	D25	D26	D27	D28	D29	D30	D31	D32	D33	D34	D35	D36	D37	D38	D39	D40
	D	C	L	L	MS	MS	D	L	C	MS	L	L	L	L	L	L	L	D	C	L
Pimelia rosea																				
Pimelia ? angustifolia			x														x			
Platytheca galioides		x	x						x								x		x	
Prasophyllum sp																				
Pterostylis nana																x				
Pterostylis recurva												x			x					
Pterostylis vittata vittata																				
Pultenaea reticulata											x									
Regelia ciliata							x				x	x	x							
Regelia inops			x				x	x			x	x	x		x		x	x		x
Restio aff. microcodon													x							
Restio stenostachyus	x	x	x		x	x	x	x	x								x		x	
Scaevola sp								x												
Schoenus aff. globifer	x	x	x		x	x	x	x	x		x		x				x		x	
Schoenus curvifolius	x	x	x		x	x	x	x	x		x						x		x	
Schoenus sp	x	x	x		x	x	x	x	x								x		x	
Scholtzia involucrata								x		x				x	x	x				
Sowerbaea laxiflora																				
Stirlingia latifolia	x	x	x		x	x	x		x	x							x		x	
Stylidium sp	x	x	x		x	x	x		x								x		x	
Stylidium ? piliferum	x		x		x	x	x	x			x						x			
Synaphaea	x	x	x		x	x	x		x								x		x	
Tetratheca setigera	x	x	x		x	x	x		x								x		x	
Thysanotus manglesianus	x	x	x		x	x	x		x								x		x	
Thysanotus triandrus	x		x		x	x	x										x			
Xanthorrhoea preissii	x	x			x	x	x	x	x										x	
	65	67	73	10	63	66	65	62	72	24	29	19	13	14	23	25	74	6	70	12

SPECIES RECORDED IN EACH LOCATION - JANDAKOT AIRPORT - Page 36

	D41	D42	D43	D44	D45	D46	D47	E1	E2	E3	F1	F2	G1	H1	H2	I1
	L	L	C	L	L	L	L	L	MS	C	L	MS	MS	MS	D	MS
Acacia pulchella		x	x	x	x		x	x	x					x	x	
Acacia saligna												x				
Adenanthos cygnorum													x	x	x	x
Adenanthos obovatus															x	
Allocasuarina fraseriana		x		x	x		x				x			x	x	x
Allocasuarina humilis			x						x	x			x	x		x
Anigozanthos humilis		x	x	x	x		x		x	x			x	x	x	x
Anigozanthus manglesii			x						x	x			x	x	x	x
Astartea fascicularis											x					
Astroloma xerophyllum																
Banksia attenuata		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Banksia ilicifolia	x	x		x	x	x	x	x					x	x	x	
Banksia littoralis		x														
Banksia menzeisii	x	x	x	x	x	x	x		x	x	x	x	x	x		x
Baumea articulata																
Beaufortia micrantha																
Boronia busseliana														x		
Boronia crenulata		x													x	
Bossiaea eriocarpa		x	x	x	x	x	x	x	x	x			x	x		x
Brachyloma preissii																
Burchardia umbellata	x	x		x	x		x	x	x	x		x	x	x	x	x
Burtonia scabra	x	x		x	x		x	x	x	x		x	x	x	x	x
Caladenia flava		x	x	x	x		x		x	x	x		x	x	x	x
Caladenia gemmata gemmata		x			x	x		x			x					
Caladenia patersonii longicauda											x				x	x
Calectasia cyanea		x							x							
Calytrix flavescens		x	x	x	x		x			x			x	x		x
Calytrix fraseri														x		
Calytrix strigosa													x			
Carpobrotus inequilaterus			x								x	x				

SPECIES RECORDED IN EACH LOCATION - JANDAKOT AIRPORT - Page 37

	D41	D42	D43	D44	D45	D46	D47	E1	E2	E3	F1	F2	G1	H1	H2	I1
	L	L	C	L	L	L	L	L	MS	C	L	MS	MS	MS	D	MS
Cassytha glabella																
Cassytha racemosa			x													
Chamaescilla corymbosa		x		x	x		x						x			
Conostephium pendulum		x	x	x	x		x	x					x	x		x
Conostylis aculeata	x	x	x	x	x		x	x	x		x	x	x	x		x
Conostylis aurea																
Conostylis juncea	x															
Conostylis setigera		x	x	x	x	x	x	x	x	x	x	x		x	x	x
? Cryptostylis ovata									x	x			x	x		x
Dampiera linearis		x	x					x		x						
Dasypogon bromiliaefolius		x		x	x		x	x						x	x	
Daviesia aff. incrassata				x	x		x			x						x
Daviesia aff. nudiflora	x			x	x		x			x						x
Daviesia aff. preissii																
Daviesia physodes																
Dianella revoluta											x	x				
Diuris emarginata																
Diuris laxiflora																
Diuris longifolia		x														
Drosera erythrorhiza				x	x	x	x	x	x				x	x	x	x
Drosera macrantha		x		x	x	x	x	x	x	x			x	x	x	x
Drosera menziesii		x		x	x		x	x			x		x	x	x	x
Drosera pulchella																
Dryandra nivea																
Eremaea asterocarpa								x								
Eriostemon spicatus	x	x	x	x	x		x	x	x	x			x	x		
Eucalyptus marginata	x	x				x			x		x	x	x			x
Eucalyptus rudis											x					
Eucalyptus todtiana																
Euchilopsis linearis															x	

SPECIES RECORDED IN EACH LOCATION - JANDAKOT AIRPORT - Page 38

	D41	D42	D43	D44	D45	D46	D47	E1	E2	E3	F1	F2	G1	H1	H2	I1
	L	L	C	L	L	L	L	L	MS	C	L	MS	MS	MS	D	MS
Gastrolobium sp		x		x	x		x			x			x	x		x
Gompholobium tomentosum	x	x	x	x	x		x		x	x	x		x	x		x
Haemodorum paniculatum		x	x	x	x	x	x			x	x		x	x		
Haemodorum spicatum				x	x	x	x		x		x		x		x	x
Hardenbergia comptoniana		x		x	x		x				x	x				
Hemiandra pungens			x													
Hibbertia huegelii									x							
Hibbertia hypericoides								x		x	x	x	x	x	x	x
Hibbertia racemosa	x									x	x					
Hibbertia subvaginata	x	x		x	x		x	x	x						x	
Hovea pungens		x		x	x		x				x					
Hypocalymma angustifolium		x				x										
Hypocalymma robustum			x							x		x				x
Jacksonia furcellata			x	x	x		x				x					x
Jacksonia sternbergiana											x					
Juncus krausii												x				
Kennedia prostrata																
Kunzea ericifolia			x	x	x		x									
Laxmannia ramosa		x	x	x	x		x	x		x	x		x			x
Lepidosperma aff. angustatum			x	x	x		x									
Lepidosperma effusum																
Lepidosperma scabrum		x		x	x	x	x								x	x
Lepidosperma sp B	x										x					
Lepidosperma sp E.																
Lepidosperma ? tenue																
Leptocarpus canus																
Lepyrodia muirii		x	x	x	x		x	x		x	x		x	x	x	x
Leucopogon aff. racemulosus																
Leucopogon australis		x								x			x			x
Leucopogon conostephioides	x	x	x	x	x		x				x			x	x	x

SPECIES RECORDED IN EACH LOCATION - JANDAKOT AIRPORT - Page 39

	D41	D42	D43	D44	D45	D46	D47	E1	E2	E3	F1	F2	G1	H1	H2	I1
	L	L	C	L	L	L	L	L	MS	C	L	MS	MS	MS	D	MS
Leucopogon kingianus																
Leucopogon polymorphus		x	x	x	x	x	x						x	x		
Leucopogon propinquus																
Leucopogon racemulosus																
Leucopogon sp														x		
Lomandra micrantha	x	x	x	x	x		x	x					x			x
Lomandra purpurea		x	x	x	x		x				x		x		x	
Lomandra sp											x					
Lomandra suaveolans		x		x	x		x		x							x
Loxocarya fasciculata			x			x				x						x
Loxocarya flexuosa	x		x							x			x	x		x
Loxocarya pubescens				x	x		x						x	x		x
Lygenia barbata			x	x	x	x	x	x	x	x			x	x	x	
Lysinema ciliatum									x					x		
Lysinema elegans														x		
Macrozamia reidlei		x							x		x	x				
Melaleuca acerosa	x		x					x		x				x		
Melaleuca incana																
Melaleuca preissiana		x				x					x					
Melaleuca seriata																
Melaleuca thymoides		x							x				x			x
Mesomelaena pseudostygia			x	x	x		x	x	x	x	x	x		x	x	x
Neurachne sp		x		x	x		x			x			x	x		x
Nuytsia floribunda		x		x	x		x	x								
Oxylobium capitatum			x	x	x		x		x	x			x	x		x
Patersonia occidentalis		x	x	x	x		x	x	x		x		x			
Pericalymma ellipticum															x	
Persoonia saccata									x							
Petrophile linearis	x	x	x	x	x	x	x		x				x	x		x
Phlebocarya ciliata			x	x	x		x	x			x		x	x		x

SPECIES RECORDED IN EACH LOCATION - JANDAKOT AIRPORT - Page 40

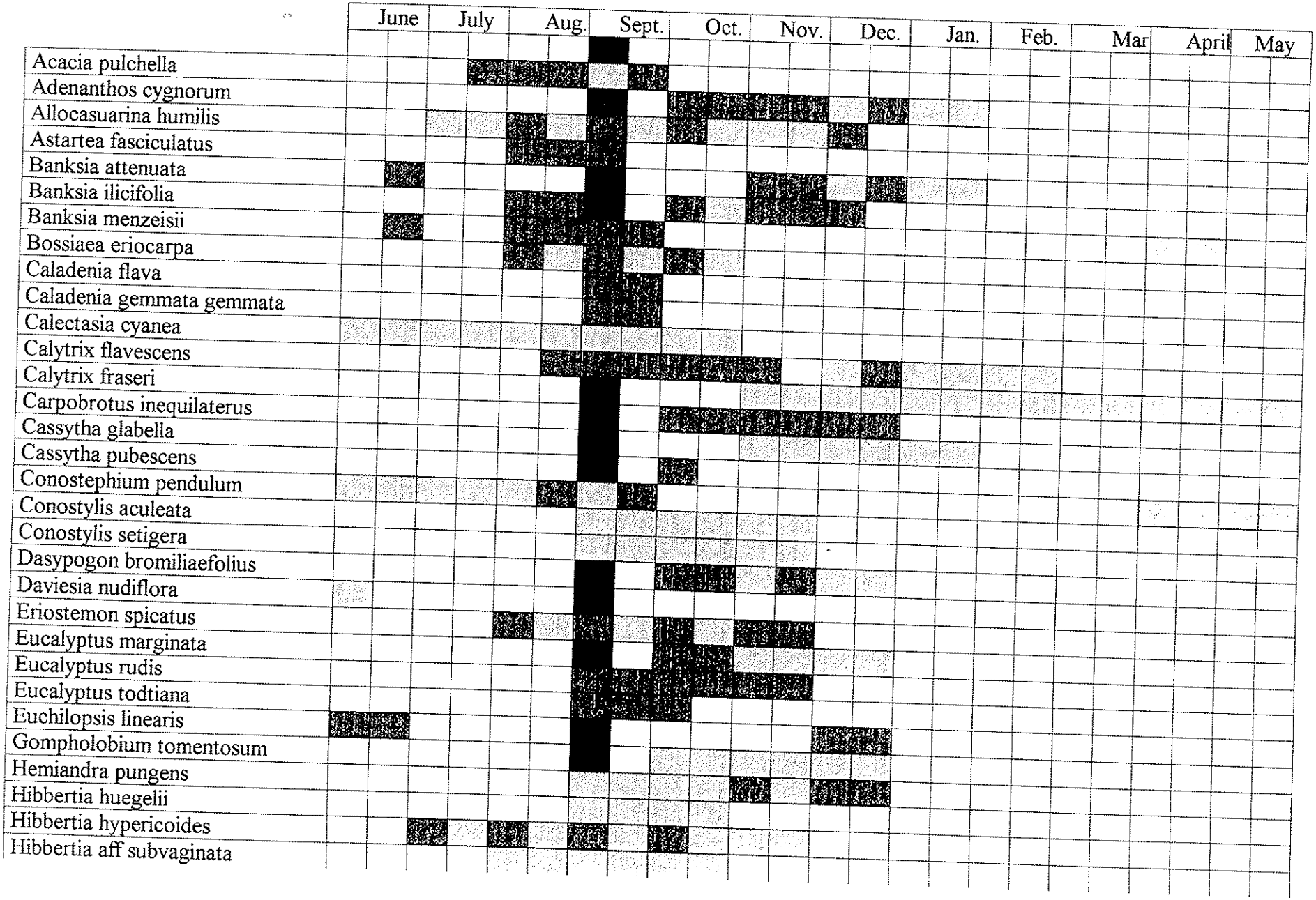
	D41	D42	D43	D44	D45	D46	D47	E1	E2	E3	F1	F2	G1	H1	H2	I1
	L	L	C	L	L	L	L	L	MS	C	L	MS	MS	MS	D	MS
Pimelia rosea																
Pimelia ? angustifolia		x		x	x		x		x							
Platytheca galioides		x		x	x		x									
Prasophyllum sp																
Pterostylis nana																
Pterostylis recurva																
Pterostylis vittata vittata																
Pultenaea reticulata																
Regelia ciliata				x		x	x									
Regelia inops		x		x	x		x	x	x					x	x	
Restio aff. microcodon																
Restio stenostachyus	x		x	x	x		x	x		x			x			
Scaevola sp																
Schoenus aff. globifer	x	x	x	x	x		x	x		x				x	x	x
Schoenus curvifolius	x			x	x		x	x	x				x		x	x
Schoenus sp				x	x		x	x	x	x			x			x
Scholtzia involucrata	x			x	x	x	x	x	x				x	x	x	x
Sowerbaea laxiflora											x	x				
Stirlingia latifolia	x		x			x			x	x				x		x
Stylidium sp		x		x	x		x		x	x			x	x		x
Stylidium ? piliferum		x		x	x		x	x					x			
Synaphaea																
Tetratheca setigera	x	x		x	x		x							x	x	x
Thysanotus manglesianus		x		x	x		x						x			
Thysanotus triandrus			x	x	x		x							x		x
Xanthorrhoea preissii		x		x	x		x	x				x	x			
	24	58	42	64	64	21	64	36	40	39	37	18	50	50	34	53

APPENDIX D

FLOWERING TIMES OF COMMON SPECIES

APPENDIX D

FLOWERING TIMES OF COMMON SPECIES



AUSTRALIAN HERITAGE
COMMISSION

Dear Bronwen

Malcolm's report as discussed. I'd prefer the FAC objection bits were not used/ available to anyone else - I expect no one would be interested anyway!

Regards Melinda

MTA HOUSE 39 BRISBANE AVENUE BARTON ACT 2600 GPO BOX 1567 CANBERRA ACT 2601 AUSTRALIA
PHONE (06) 217 2111 MTA FAX (06) 217 2095 IBM FAX (06) 217 2000

DEPARTMENT OF
ENVIRONMENTAL PROTECTION

31 JUL 1997

File No 1 _____ Name _____
File No 2 _____ Name _____
File No 3 _____ Name _____

Objection

Assessment

for

Jandakot Airport,

flora values

Prepared for the Australian Heritage Commission

by

Malcolm Trudgen

Consultant Botanist

November 1995

1.0 INTRODUCTION
3
1.1 Purpose of this assessment 3
1.2 Objection assessment process 3
1.3 Potentially relevant criteria for listing the Jandakot Airport bushland 4
1.4 General arguments in the report 'AHC Interim List of Jandakot Airport' (Dames & Moore 1995) against listing 5
1.5 Specific objections raised by the Federal Airport Corporation in the report AHC Interim List of Jandakot Airport', Dames & Moore 1995 6
1.6 Limited scope of objections raised by the FAC 9
1.7 Definitions of rare and unusual flora communities (vegetation) and of rare ecosystems 9

2.0 GEOMORPHOLOGY AND SOILS 11
3.0 FLORA OF THE REGION INCLUDING JANDAKOT AIRPORT 12
4.0 VEGETATION OF THE REGION INCLUDING JANDAKOT AIRPORT 13
4.1 Introduction 13
4.2 Vegetation complexes 13
4.2.1 Concept of vegetation complexes 13
4.2.2 Distribution of vegetation complexes 14
4.2.3 Vegetation complex present in Jandakot Airport 14
4.3 Floristic Community Types 15
4.3.1 Concept of Floristic Community Types 15
4.3.2 Results of floristic community type approach 15
4.4 Comparison of vegetation complexes and floristic community types 17

5.0 AMOUNT REMAINING AND IMPLICATIONS FOR HERITAGE STATUS, OF THE NATIVE VEGETATION TYPES FOUND AT JANDAKOT AIRPORT 18
5.1 Introduction 18
5.2 Amount remaining of the original vegetation of the Swan Coastal Plain south of the Swan River and implications for nationa estate value 18
5.3 Amount remaining of the Bassendean Complex Central and South 19

6.0 NATIONAL ESTATE VALUES OF THE FLORA AND VEGETATION AT JANDAKOT AIRPORT 21
6.1 Introduction 21
6.2 Flora and vegetation national estate values present at Jandakot Airport 21
6.2.1 Criterion A: Its importance in the course, or pattern, of Australia's natural or cultural history. 21
6.2.2 Criterion B: Its possession of uncommon, rare or endangered aspects of Australia's natural or cultural history. Criterion B.1 23
6.2.3 Criterion C: Its potential to yield information that will contribute to an understanding of Australia's natural or cultural history 27

7.0 DETAILED OBJECTION ASSESSMENT FOR FLORA VALUES OF THE BUSHLAND AREAS AT JANDAKOT AIRPORT CURRENTLY ON THE INTERIM LIST OF THE NATIONAL ESTATE 28
7.1 Introduction 28
7.2 Adequacy of Commission database 28
7.3 Objection assessment of Development Zone 1 29

7.3.1 Grounds for objection which relate to the national estate significance of Development Zone 1 28
7.3.2 Appropriateness of the boundaries given the significance of Development Zone 1 29
7.3.3 Significance of Development Zone 1 in relation to the definition of the national estate 29
7.3.4 Comments on the integrity of Development Zone 1, or other comments of a technical nature 29
7.4 Objection assessment of Development Zone 2 29
7.4.1 Grounds for objection which relate to the national estate significance of Zone 2 29
7.4.2 Appropriateness of the boundaries given the significance of Development Zone 2 30
7.4.3 Significance of Development Zone 2 in relation to the definition of the national estate 30
7.4.4 Comments on the integrity of Development Zone 2, or other comments of a technical nature 30
7.5 Assessment of Development Zone 3 31
7.5.1 Grounds for objection which relate to the national estate significance of Development Zone 3 31
7.5.2 Appropriateness of the boundaries given the significance of Development Zone 3 31
7.5.3 Significance of Development Zone 3 in relation to the definition of the national estate 32
7.5.4 Comments on the integrity of Development Zone 3 or other comments of a technical nature 32
7.6 Objection assessment of Development Zone 4 32
7.7 Objection assessment of Conservation Zones 5a, 5b and 5c 32
7.7.1 Grounds for objection which relate to the national estate significance of part of Conservation Zone 5b 33
7.7.2 Appropriateness of the boundaries given the significance of Conservation Zone 5b 33
7.7.3 Significance of area Conservation Zone 5b in relation to the definition of the national estate 33
7.7.4 Comments on the integrity of Conservation Zone 5b or other comments of a technical nature 33
7.8 Objection assessment of Sand Mining Area 6 33
7.8.1 Grounds for objection which relate to the national estate significance of Sand Mining Area 6 34
7.8.2 Appropriateness of the boundaries given the significance of Sand Mining Area 6 34
7.8.3 Significance of Sand Mining Area 6 in relation to the definition of the national estate 34
7.8.4 Comments on the integrity of Sand Mining Area 6 or other comments of a technical nature 34
8.0 BUSHLAND AREAS AREAS ADJACENT TO JANDAKOT AIRPORT WITH NATIONAL ESTATE VALUE 35

9.0 REFERENCES 37
FIGURES ONE TO THREE

1.0 INTRODUCTION

1.1 Purpose of this assessment

The purpose of this assessment is to assist and advise the Australian Heritage Commission in the assessment of the national estate significance of the bushland area of Jandakot Airport on the Interim Register of the National Estate (after Australian Heritage Commission 1995, Schedule 1 paragraph A).

1.2 Objection assessment process

The relevant part of the objection assessment process for this report is as follows:

"Assessors are asked to address the following five points in their reports:

(i) is the database information produced by the Commission accurate and comphrehensive?;

(ii) comment on those grounds for objection which relate to the national estate significance of the place. These grounds are identified in the 'Terms of Reference' for the contract for the assessment;

(iii) are the boundaries of the proposed area appropriate, given the significance of the place? What adjustments to the boundary, if any, are needed to define the significant area accurately and closely?

(NB. The answer to this question may involve deletion or addition of areas, however substantial proposed additions will be dealt with separately by the Commission and must not be dealt with in the assessment report. Any such proposed additions must be the subject of a separate report);

(iv) Given the definition of the "National Estate" contained in the *Australian Heritage Commission Act* and the criteria illuminating that definition, does the place, in your opinion, warrant entry in the Register?;

(v) do you have any comments on the integrity of the place, or other views of a technical nature, which may assist the Commission in deciding whether the

place should be entered in the Register of the National Estate." (Australian Heritage Commission 1995, attachment 1, paragraph 2).

In relation to section (ii), it should be noted that there is no section entitled 'Terms of Reference' in the contract for this assessment. In a letter dated the tenth of January 1995, the General Manager - Technical and Construction of the Federal Airports Corporation submitted that a report ('AHC Interim List of Jandakot Airport', Dames & Moore 1995) supported "the Federal Airports Corporation's objection to the Interim listing on the Register of the National Estate, of areas of Jandakot Airport.".

1.3 Potentially relevant criteria for listing the Jandakot Airport bushland

Not all the criteria (Australian Heritage Commission 1995, attachment 2) for listing on the Register of the National Estate, are potentially relevant to the bushland at Jandakot Airport for the values of the flora (flora is interpreted here as being used by the Australian Heritage Commission in the broad sense of individual species and of vegetation) found in and making up that bushland.

The criteria that seem potentially relevant (for those parts of them relating to flora and including in this vegetation) are:

Criterion A: Its importance in the course, or pattern, of Australia's natural or cultural history. (Particularly, A.2 Importance in maintaining existing processes or natural systems at the regional or national scale. Possibly also criterion A.1 Importance in the evolution of Australian flora, fauna landscapes or climate.)

Criterion B: Its possession of uncommon, rare or endangered aspects of Australia's natural or cultural history. (Particularly, B.1 Importance for rare, endangered or uncommon flora, fauna, communities, ecosystems, natural landscapes or phenomena, or as a wilderness.)

Criterion C: Its potential to yield information that will contribute to an understanding of Australia's natural or cultural history. (Particularly, C.1 Importance for information contributing to a wider understanding of Australian

natural history, by virtue of its use as a research site, teaching site, type locality, reference or benchmark site.)

Criterion D: Its importance in demonstrating the principal characteristics of : (I) A class of Australia's natural or cultural places; or (II) A class of Australia's natural or cultural environments. (Particularly, D.1 Importance in demonstrating the principal characteristics of the range of landscapes, environments or ecosystems, the attributes of which identify them as characteristic of their class.)

1.4 General arguments in the report 'AHC Interim List of Jandakot Airport', Dames & Moore 1995 against listing

While they do not relate to specific objections, there are general arguments in the report 'AHC Interim List of Jandakot Airport' (Dames & Moore 1995) that are used to justify the approach to objections in that report.

The first is an approach to the discussion that contrasts the different parts of the bushland at Jandakot Airport to each other, implying that the listing of different parts of the airport is a matter of choice between them rather than the real question being whether or not the airport bushland as a whole deserves listing, or whether or not each part has sufficient value to deserve listing (whether individually or as part of the whole). This is a misconception and a misdirection of analysis. An example of this is argument is the statement: "There is no substantial scientific reason why Development Zone 2 should be preserved in preference to any other area." (Dames & Moore 1995, page 19). A major flaw of this line of reasoning is that the overall size of the vegetation remnant at Jandakot Airport contributes significantly to its heritage value.

The second is a view that the FAC is being treated unfairly in its land being potentially listed. For example: "Given the the extent of bushland that remained until relatively recently, it is probable that other sites in the Jandakot area could have been nominated for listing in the register of the National Estate even as late as 1989,.... Furthermore, the responsibility for preserving the remnants of a now diminished ecosystem would have been shared more equitably." (Dames & Moore

1995, page 3, third paragraph). This argument is based on a failure to put the diminuition of the ecosystem referred to (the Bassendean Vegetation Complex - Central and South), into a proper time frame and a failure of analysis of the rarity of the ecosystem as a whole, which is the most compelling argument for listing of remnant parts of it on the Register of the National Estate. See section 5.3 below for a discussion of the status of the the Bassendean Vegetation Complex - Central and South but, note that the majority of loss of the ecosytem occurred well before 1989.

Thirdly, there is an over-emphasis on the presence of what are (mostly) relatively minor areas of degradation, dieback and clearing. For example the statement: "It is therefore important to establish the true value of a site listed on the Register, and to ensure that the area included accurately reflects that value and does not include degraded land areas or portions that are sub-standard to the stated quality criteria of the Interim List." (Dames & Moore 1995, page 2). While in a general sense this is obviously true, it should not be taken to a point that ignores the impracticality of excluding small areas of degradation, or clearing, from an area of national estate value. Also, it ignores aspects of heritage value, such as processes of movement of biological material, a proportion of which can continue through small areas of degradation when these are a minor component of a larger area.

1.5 Specific objections raised by the Federal Airport Corporation in the report AHC Interim List of Jandakot Airport', Dames & Moore 1995

In several places in the report 'AHC Interim List of Jandakot Airport' (Dames & Moore 1995), the Federal Airports Corporation makes objections to the interim listing of bushland at Jandakot Airport. These are summarised in figure six (Suggested Modifications to AHC List) of Dames & Moore 1995 which is reproduced as figure one of this report. The most detailed objections relate to a series of zones (page 19 and figure five of Dames & Moore 1995, and in turn are quoted from Muir Environmental 1993). They are quoted in full here (even though some zones are not objected to):

"**Development Zone 1** contains remnant Banksia woodland in good condition. While preservation of Banksia woodland per se is important, for example as a

feeding area for Carnaby's Cockatoo. Development Zone 1 Contains no natural features unique to this Zone. There are several areas of severe disturbance. There is no substantial scientific reason why Development Zone 1 should be preserved in preference to any other area.

Development Zone 2 contains remnant Banksia woodland in good condition. It contains no natural features unique to this zone. There is a cleared area and an adjacent railway line and road which are ongoing sources of disturbance and weeds. There is no substantial scientific reason why development Zone 2 should be preserved in preference to any other area.

Development Zone 3 contains Flooded Gum woodland with a badly degraded and disturbed understorey, and an adjacent commercial development and road which are sources of weeds. There is no substantial reason why it should be preserved other than that Flooded Gum is not well represented elswhere on the Airport.

Development Zone 4 contains remnant Banksia woodland in good condition. It contains a good variety of habitats relative to the rest of the the Airport and appears to be rich in flora and fauna species. There is sufficient scientific evidence, based on the present study to support an argument for its protection as a Conservation Area.

Conservation Zone 5a contains remnant Banksia woodland in good condition and a good variety of dampland types (better than any other part of the Airport). It is surrounded by severely disturbed land, but because of its damplands, should be retained for conservation purposes, although dieback disease management is essential.

Conservation Zone 5b contains remnant Banksia woodland, although not in as good condition as that in Development Zone 4. It is surrounded on its east and west sides by severely disturbed land. There are no substantial scientific reasons based on the data presented in this report, why Zone 5b should be preserved in

preference to any other area. It should be noted, however, that it may provide a partial corridor leading north to Conservation Zone 5a.

Conservation Zone 5c contains remnant Banksia woodland and a variety of dampland types on its southern edge. Some of its values are an eastern extension of those found in Development Area 4 of Block D, and it provides some continuity with Banksia woodlands to the south. It should be retained for conservation purposes.

Sand Mining Area 6 contains remnant Banksia woodland in good condition. It contains no substantial area of dampland, but does include a high dune similar to that in Development Zone 4. This dune system appears to be of some value as fauna habitat. It has severely disturbed areas on the east and south sides. There are no substantial scientific reasons why it should be preserved in preference to any other area apart from its slightly higher Rapid Habitat Assessment System scores." (Dames & Moore 1995).

This detailed commentary led to the following conclusion: "On the basis of Muir's work and other subsequent investigations, we do not believe there is sufficient justification to support inclusion of Development Zones 1, 2, 3 and part of Development Zone 5b (Figure 5) on the Register of the National Estate (Figure 6)." (Dames & Moore 1995). (There is no development Zone 5b, I think it should read Conservation Zone 5b.) The overall objections (and the acceptance of a much reduced area being listed) was shown in a figure and summarised in the following way: "In our opinion a more appropriate definition of areas to be included in the Register of the National Estate are illustrated in Figure 6." (Dames & Moore 1995, page 21).

Figures 5 and 6 of Dames & Moore 1995 are Figures 2 and 1 respectively of this report.

1.6 Limited scope of objections raised by the FAC

While it has raised the specific objections noted above, the FAC has at the same time accepted that there are national estate values at Jandakot Airport. For example, the report presented by the FAC as detailing the Corporations objections to listing of parts of Jandakot Airport (Dames & Moore 1995) includes the following statements:

- "The environmental quality of portions of Jandakot Airport is such that the listing of some areas on the Register of the National Estate is supported in general." (Page 1, paragraph 3.)

- "In general this report supports the listing of areas of Jandakot Airport on the Register of the National Estate but recommends that the Interim List be altered before final entry on the Register to excise areas that do not meet the National Estate Criteria." (Page 18, paragraph 4.)

1.7 Definitions of rare and unusual flora communities (vegetation) and of rare ecosystems

Some of the criteria by which national estate value is to be judged (particularly Criterion E1) involve the presence of "rare, endangered or unusual flora, fauna, communities, natural landscapes or phenomena". This immediately raises the question of the definition of rarity.

However, there are no accepted definitions of rare flora communities (vegetation types) and ecosystems and no simple definition is practical. For the purposes of this analysis, the following definition is advanced: an ecosystems or vegetation type (whether plant community, association, vegetation complex or floristic community type) should be considered rare when:

- its original extent was less than 2,000 hectares, irrespective of what proportion of its original extent survives; or

- its original extent was 2,000 to 20,000 hectares and less than 2,000 hectares or less than 30% of its original extent survives; or

- its original extent was 20,000 to 100,000 hectares or more and the portion of the original extent remaining is less than 30% for an original extent of 20,000 ha declining to less than 20% for an original extent of 50,000 ha declining to less than 10% for an original extent of 100,000 ha or more.

The thrust of this definition is to define vegetation as rare when its original extent was very small (2,000 ha or less) and, for larger areas, as having become rare compared to an original extent when the original distribution has been reduced by clearing or other activities below the areas or proportions suggested above. The end of this sliding scale has been take as ten percent for areas of 100,000 hectares or more, as ten percent is the minimum area recommended for protection of an ecosystem by the International Union for the Conservation of Nature (IUCN). However, this would obviously not be appropriate for vegetation types (or ecosystems) with very small original extents. Therefore, a sliding scale was chosen to link small areas through intermediate sized areas to the general standard. Obviously this is somewhat arbitrary but, a vegetation type with an original extent of only 2,000 hectares is rare or at least unusual on a national scale and a vegetation type that originally had an extent of more than 100,000 hectareas and has been reduced to 10,000 hectares or less is certainly uncommon compared to its original extent. The scale attempts to provide a resolution of a problem that is partly absolute (for small original extents) and partly relative (for large original extents) and should be taken as a guide.

2.0 GEOMORPHOLOGY AND SOILS

Jandakot Airport lies on the Swan Coastal Plain, the plain between the Darling Scarp and the coastline. It is a fairly narrow but, quite long, plain that has been developed by the deposition of material washed down from the plateau above the scarp and in more recent times from material that has blown in from the coastline.

On the eastern side of the Swan Coastal Plain the soils are predominantly alluvial deposits washed down from the plateau and are mostly clayey although, there are areas of sands. On the western side of the plain the soils are mostly sands blown in from the coast. The easternmost of the sand types is the Bassendean Sands, which form a discontinuous band along the centre of the Swan Coastal Plain. The taller dune field formed by these sands has been separated as a soil/geomorphological unit known as the Bassendean Dunes (Churchward et al. 1980) and is the soil/ geomophological unit present at Jandakot Airport.

The soil/geomorphological units of Churchward et al. (1980) are the ecological basis for the vegetation complexes discussed below (which have names derived from the names of the soil/geomophological unit they are on) and generally have the same distribution. However, there may be more than one vegetation complex on a soil/geomorphological unit due to climate changes along the plain. For example, there are two vegetation complexes on the Bassendean Dunes. These are the Bassendean Vegetation Complex - Central and South (which occurs from Gnangarra Lake southwards) and the Bassendean Vegetaion Complex- North. The soil, geomorphology and water relations factors (interacting with climatic factors) unique to the the Bassendean Dunes southwards from Gnangara Lake are what cause the Bassendean Vegetation Complex - Central and South to be different from the other vegetation complexes on the Swan Coastal Plain.

3.0 FLORA OF THE REGION INCLUDING JANDAKOT AIRPORT

The flora of the region including Jandakot Airport is now moderately well known. There is a flora (Marchant et al 1987) that includes the region (it also covers part of the adjacent Darling Plateau) and records 1510 native plant species (flowering plants, ferns, fern allies and gymnosperms). This is a reasonably diverse flora for the size of the region covered (10,500 square kilometres) but, is not particularly diverse when compared to other parts of the South West Botanical Province. The later study by Gibson et al (1994) of the southern Swan Coastal Plain (mostly in the area covered by the flora) recorded 1313 taxa (species, subspecies, varieties) of native flowering plants.

Gibson et al (1994) also give information on undescribed species, which made up 8.7% of there records, indicating that there is still a significant deficit in our knowledge. They also give a figure of 61 species recorded by them as being endemic to their study area, with a significant proportion of these (28 species) restricted to the eastern side of the Swan Coastal Plain. They consider that a further 13 taxa not encountered by them are also endemic to the southern Swan Coastal Plain.

4.0 VEGETATION OF THE REGION INCLUDING JANDAKOT AIRPORT

4.1 Introduction

There are many levels at which, and ways in which, vegetation can be described and analysed. There are two broadscale descriptions of the vegetation of the region including the Jandakot Airport that it is most useful to discuss here as tools for assessing the national estate value of the vegetation of Jandakot Airport. These are the "vegetation complexes" of Heddle et al (1980) and the "floristic community types" of Gibson et al (1994). While both are broad scale interpretations of vegetation, they differ very significantly in their approaches and it is worthwhile discussing them to enable a better appreciation of their use in assessing national estate value.

4.2 Vegetation complexes

4.2.1 Concept of vegetation complexes

It was noted in the section above dealing with geomorphology that on the Swan Coastal Plain a number of units have been described, each with a range of soil and geomorphic characteristics. Each of these units also has a particular range of vegetation types developed on them, in response to the particular soil and geomorphic characteristics of the unit. The range of vegetation types on each of the units is referred to as a "vegetation complex", to reflect the fact that they contain a variety of vegetation types. As noted one of the geomorphic units of the Swan Coastal Plain is called the Bassendean Dunes (Churchward and McArthur 1980) and the vegetation on it south from Gnangara Lake is called the "Bassendean Vegetation Complex - Central and South" (Heddle et al 1980).

A vegetation complex is a grouping of vegetation types. However, it is not a hierarchical grouping, that is, the different vegetation types (vegetation communities or vegetation associations) found in a vegetation complex are grouped by where they occur rather than than by having some characteristic such as the same dominant species in common. An extension of this is that a plant community (the lower level of vegetation classification) may occur in more than one vegetation complex but, the overall grouping of plant communities and the relative amounts of different plant communities in a vegetation complex will be different. For example, a close comparison of the vegetation of the Southern River Vegetation Complex and of the

Bassendean Vegetation Complex - Central and South (the latter lying to the west of the former on the Swan Coastal Plain) would show that while both have a plant community with Banksia woodland over Stirlingia latifolia, Allocasuarina humilis shrubland there is much more of this community in the latter vegetation complex. The reason for this is that this community occurs on dune crests in these complexes and the Southern River soil unit has much lower dunes than the Bassendean unit and so has fewer and smaller crests. To look at the other side of this example, the Southern River Vegetation Complex has more extensive areas of lower slope vegetation types due to having low, gently sloping dunes, that often are not thick enough to have vegetation types characteristic of crests. The differences go beyond this however, as the Southern River unit has the dunes separated by clayey flats or sandy-clayey flats and these can have quite different vegetation to that found in the Bassendean Vegetation Complex - Central and South.

Vegetation complexes can be viewed as broad ecosystems or sub-systems, that contain a range of habitats for both flora and fauna species, each particular vegetation complex being unique in the mix and relative abundance of the plant communities found in it. This means that they can be a useful guide to assessment of conservation value or heritage value.

4.2.2 Distribution of vegetation complexes

The development of the geomorphology/soil units on the Swan Coastal Plain has tended to be parallel to the coast (although those associated with the rivers cut across this). Therefore, it is not surprising that the predominant distribution pattern of the vegetation complexes is also north-south. However, they generally occur in discrete blocks rather than as continuous strips.

4.2.3 Vegetation complex present in Jandakot Airport

Only one vegetation complexes is present in Jandakot Airport, the Basssendean Vegetation Complex - Central and South.

4.3 Floristic Community Types

4.3.1 Concept of Floristic Community Types

Recently (Gibson et al 1994), a different approach (to vegetation complexes) has been used to study the vegetation of the Swan Coastal Plain although, similar approaches have been used for parts of the Plain in the past (e.g. Weston, Griffin and Trudgen 1992; Griffin and Trudgen 1994). This second approach is based on an underlying concept that flora species occur in groups as a response to environmental factors and that defining such groups of species over the Swan Coastal Plain would then enable individual stands of vegetation to be assigned to a group of sites with similar flora composition. These groups of sites with similar flora composition are referred to as "floristic community types" by some authors. In other words, they have groups of species that consistently occur together. Such groups are not absolutely consistent, since some species have environmental tolerances that are broader than the groups and others will occur too infrequently to be useful.

The methodology used by Gibson et al was to sample a large number of plots (five hundred and nine, each ten by ten metre squares) on publicly owned land in different vegetation types, to determine what species were present and then to compare the species present using computer programmes. More than thirteen hundred species were recorded in the plots and used in the analysis.

4.3.2 Results of floristic community type approach

Using the methodology described (briefly) above, Gibson et al (1994) looked at two levels of analysis, a four group level (supergroups) and a thirty group level. At the four group level the groups reflected "major geomorphological elements" and seasonal wetlands, the later occurring "across all geomorphological groups". The thirty group level "best reflected the scale of pattern seen in the field.

The four supergroups are:

1. Sites "almost entirely restricted to the Pinjarra Plain and the Ridge Hill Shelf" (i.e. the eastern part of the Swan Coastal Plain);

2. Sites "the almost entirely seasonal wetlands group": the largest and most diverse group occurring across all geomorphic units. That is within the major geomorphological groups, the seasonal wetland habitat occurs in appropriate places and the water relations determine the flora and vegetation;

3. Sites "centred on but not exclusive to the Bassendean Dunes. There are also significant occurrences on the Pinjarra Plain and Spearwood Dune Systems." (and also some on the Whicher Scarp);

4. "Group 4 is almost exclusively a Spearwood and Quindalup Dunes group."
Within the four supergroups, thirty floristic community types were recognised (the thirty group level referred to above), some with distinct subunits, giving a total of forty-three floristic community types and subtypes. These were grouped under the four group headings in the following way:

- Floristic community types of heavy soils: types 1a, 1b, 2, 3a, 3b, 3c;

- Floristic community types of the seasonal wetlands: types 4 to 19;

- Floristic community types centred on the Bassendean System: types 20 to 23;

- Floristic community types centred on the Spearwood and Quindalup Systems: types 24 to 30c.

The individual floristic community types are discussed in Gibson et al (1994) on pages 29 to 46, where maps of the distribution of sites recorded in each floristic community type are also given. The delineation of the floristic community types provides a regional framework for the assessment of floristic variation on the Swan Coastal Plain and thus an can enable assessment of the value for flora, at a broad level, of a specific area. However, for some of the floristic community types with more restricted distribution a more specific assessment of value for flora can be made if the floristic community type is known. However, it should be realised that this is a different approach to describing plant communities and that these are mostly broad

units of a scale similar to plant associations or formations rather than plant communities. From the discussion, it is apparent that knowing what floristic community type is present in an area can help to establish the values of an area for assessment of conservation or national estate value. (All quotations in this section are from Gibson et al 1994.)

4.4 Comparison of vegetation complexes and floristic community types

Floristic community types can be though of as equivalent to somewhere between the more traditional vegetation association and vegetation formation. They are mostly quite broad units and, are fairly variable in the diversity found in them. Unlike vegetation complexes, the individual plant communities found in them are fairly closely related in terms of species composition although, struture can still vary considerably. As a result, their distribution is somewhat different to that of the vegetation complexes. For example, wetland floristic community types tend to occur across several vegetation complexes. In some cases, there is good correspondence between floristic communitiy type and vegetation complex. In others, such as the Soutern River Vegetation Complex, the complex is made up of a mosaic of different floristic community types.

5.0 AMOUNT REMAINING AND IMPLICATIONS FOR HERITAGE STATUS, OF THE NATIVE VEGETATION TYPES FOUND AT JANDAKOT AIRPORT

5.1 Introduction

The amount remaining overall of the different native vegetation types found at Jandakot Airport obvously has important implications for the assessment of the national estate value of the remnants of native vegetation found there. The amount of these vegetation types remaining can be assessed in different ways: as a proportion of the original cover of the Swan Coastal Plain; as a proportion of the original extent of the vegetation complex represented; or as a proportion of the floristic community types represented. The latter is difficult to do as these units have not been mapped and there are not areas available for them. It would also be possible to look in detail at other mapping of the vegetation of the Swan Coastal Plain by Beard (1979) but, this is unlikely to add much to the analysis.

The conservation status of the Bassendean Vegetation Complex - Central and South is discussed below but, it is currently very difficult to obtain accurate figures on the remaining extent of the vegetation complexes throughout their ranges (figures are available for the Metropolitan Area, but in isolation these are nearly meaningless).

5.2 Amount remaining of the original vegetation of the Swan Coastal Plain south of the Swan River and implications for nationa estate value

This area is reviewed because it is the part of the Swan Coastal Plain the Jandakot Airport lies on and, there are significant changes in the vegetation of the Swan Coastal Plain at or near the Swan River.

The Swan Coastal Plain south of the Swan River is more than ninety percent cleared for agriculture, industrial and urban development. Consequently, most of the vegetation complexes and floristic community types in this area are also more than ninety percent cleared. It is worth while examining this in the broader perspective of the south-west of Western Australia. Beard and Sprenger (1984) have computed figures on the clearing of different vegetation types and areas of the south-west of the state, based on vegetation mapping (by Beard) and overlays of alienation of land provided by the Lands Department. In arriving at their figures Beard and Sprenger

have made the assumption for land alienated from the Crown "that alienated means cleared as it does for practical purposes." However, they note that "By no means all alienated land has been cleared, though the proportion remaining untouched diminishes annually." They give the following figures, that are of particular interest to the present study: Southwest Botanical Province (309,840 km2), 65% cleared; Drummond subdistrict (approximately the same as the Swan Coastal Plain, 14,637 km2) 78% cleared, "but south of Perth, virtually 100%" cleared; Beards unit 30 (Banksia low woodland with scattered Jarrah on the Swan Coastal Plain south of Perth, before clearing 680 km2) virtually "100%" cleared.

While Beard and Sprenger's approach has some problems (and thus overstates the situation slightly), it underscores the fact that clearing on the Swan Coastal Plain south of the swan River has been very extensive and that the remnants of vegetation in the Perth Metropolitan Area are very significant not just in the context of urban conservation but, in a regional and national estate context. It should also be noted, that their work is now more than ten years old and that there has been substantial clearing in that time.

The extent of clearing on the Swan Coastal Plain means that the national estate value of the remaining areas of vegetation in the Jandakot Airport are likely to be high or very high. Factors such as the condition of the vegetation and the diversity of types found would alter a final determination.

5.3 Amount remaining of the Bassendean Complex Central and South

The original extent of the Bassendean Complex - Central and South (which extended between Lake Gnangara and the Bunbury area) on the area covered by the vegetation maps in the Atlas of the Darling System (Heddle 1980) was in the order of 87,329 hectares and of this some 3,567 hectares (or 4.1%) may be in reserves in the CALM Central Forest and Swan Regions with possibly a similar area in State Forest (P. Hanley pers comm.). However, much of the area in State Forest appears to have been cleared for pine plantations. (Note, that the Atlas of the Darling District covers most of the original extent of the complexes concerned.)

In contrast to Hanley's figures, Burbidge and Hopper (1989) have stated that 1.6% of the original extent of the Bassendean Complex - Central and South is protected in reserves and the general opinion among botanists familiar with the complex is that somewhat less than 5% of the complex remains uncleared, with a significant amount of this in the Jandakot area. As an indication of the amount of clearing, the Lowlands block, which is on this complex, is "very valuable since it is the only large area of its type between Perth and Bunbury" (D.C.E 1981)

Whichever figures are more accurate, it is obvious that the the Bassendean Complex - Central and South has been extensively cleared and remaining areas of it have very significant heritage and conservation value, with the degree of this value for any block depending on its size, its condition and the particular flora, vegetation and fauna present.

6.0 NATIONAL ESTATE VALUES OF THE FLORA AND VEGETATION AT JANDAKOT AIRPORT

6.1 Introduction

It would be extremely repetitive to discuss individually the national estate values for flora and vegetation of each of the areas at Jandakot Airport defined by the FAC and their consultants (Dames & Moore 1995, figure 5). The approach that will be taken is to discuss these values for the Airport area as a whole, and then to refer to the values present in each area as necessary when the individual areas are discussed. It should be noted that although the criteria include aspects other than flora (including vegetation as a broad sense of flora) that this report is centred on flora values and the fact that other values are not discussed does not mean they are not present.

6.2 Flora and vegetation national estate values present at Jandakot Airport

6.2.1 Criterion A: Its importance in the course, or pattern, of Australia's natural or cultural history.

Criterion A.1: Importance in the evolution of Australian flora, fauna, landscapes or climate.

The physical environment of the Swan Coastal Plain on which Jandakot Airport is situated is relatively young compared to that on the adjoining plateau and is quite different in the soils and landforms developed.

This different physical environment has allowed the development of vegetation assemblages (vegetation complexes) which are unique to the Swan Coastal Plain (Heddle et al 1980) and floristic community types which are either unique to the Swan Coastal Plain or are found only on it and adjacent areas with most of their occurrence on the Swan Coastal Plain (Gibson et al 1994). Thus in the broader sense of the term "flora", of including the development of flora as vegetation, the remnants of vegetation at Jandakot Airport are important examples that demonstrate the evolution of flora in response to a new environment. Thus, the national estate value of the flora remnants at Jandakot Airport for Criterion A.1 is very high because:

- the vegetation complex present has been reduced to less than ten percent of its

original extent (and thus can be classified as rare vegetation);

- the total area of bushland at Jandakot Airport is relatively large compared to many other remnants of the Bassendean Complex - Central and South;

- while the FAC and its consultants have chosen to discuss the bushland at Jandakot Airport as a series of small blocks, it is in fact effectively one large block (or at worst two large blocks with short distances between them) with the firebreaks and roads having impacts on but not removing, the heritage value of the overall bushland present ;

- a significant proportion of the remnant is in good, very good or excellent condition, with other parts maintaining some national estate value.

As an example of the landscape developed on the Swan Coastal Plain, that is the landform (geomorphological component) with the vegetation naturally developed on them then the bushland remnants Jandakot Airport also have high national estate value under Criterion 1.A for landscape. In the course of Australia's natural history these landscapes have only developed on the Swan Coastal Plain and, the examples at Jandakot Airport are rare remainders of these landscapes in having both the geomorphological component and the biological component relatively intact.

Criterion A.2: Importance in maintaining existing processes or natural systems at the regional or national scale.

The bushland at Jandakot Airport maintains a variety of ecological processes or natural systems, particularly those found on sandunes although, there are small areas of damplands. While from one point of view these processes may be found in all such environments, the particular natural systems developed in the bushland at Jandakot Airport are either restricted to the Swan Coastal Plain or are found there and also found in other parts of the South West Botanical Province adjacent to the Swan Coastal Plain.

The maintenance of these processes at Jandakot Airport has high to very high

national estate significance because, the extent of clearing of the Swan Coastal Plain is so high that loss of these processes at Jandakot Airport would have a significant impact on the extent of the continued existence of these processes.

A very important aspect of the National Estate value of the bushland at Jandakot Airport relevant to criterion A.2, is the overall size of the bushland area there and it's generally good to excellent condition. The size and condition of the bushland at Jandakot Airport means that the scale and quality of the maintenance of national estate processes there would be better than in smaller more disturbed remnants of vegetation.

Criterion A3: Importance in exhibiting unusual richness or diversity of flora, fauna, landscapes or cultural features.

The FAC's consultants have discussed the heritage value of Jandakot Airport at some length. They concluded that "This confirms the National Estate Criteria (A.3) supporting Statement 4 in the Interim Listing." The particular attribute worthy of listing was considered to be the diversity of flora species recorded, with 192 species recorded although, there has been no systematic flora survey. Estimates of a total flora of 250 and 300 species have been made by CALM officers and Dr. B. Muir respectively (Dames & Moore 1995, pages 7 & 8). Certainly the 192 species seems noteworthy and significant on a regional scale while 250 to 300 would be quite unusual.

The number of floristic community types present (see discussion in 6.2.2) also seems noteworthy but, needs confirmation and may be a reflection of the size of the remnant rather than unusual richness per se.

6.2.2 Criterion B: Its possession of uncommon, rare or endangered aspects of Australia's natural or cultural history.

Criterion B.1: Importance for rare, endangered or uncommon flora, fauna, communities, ecosystems, natural landscapes or phenomena, or as a wilderness.

As noted above, the flora of Jandakot Airport has not been thoroughly studied. The following summary of relevant flora is taken from Dames & Moore 1995. Lysinema

elegans (a priority two species) and Conostephium minus (a priority four species) have been recorded from the airport although, the record for the latter species may be based on a mis-identification. Caladenia huegelii (Declared Rare Flora) has been recorded from Ken Hurst Park (an area adjoining the airport). Stylidium preissii - northern form (apparently rare but not yet officially recognised as such) has also been recorded from Ken Hurst Park. Croniniana kingiana (an uncommon species) has been recorded in the airport (where it is fairly common) and also in Ken Hurst Park. There is suitable habitat in the airport for other rare orchid species but, searches for them have not found them.

Priority two (P2), or poorly known taxa are defined as "Taxa which are known from one or a few (generally < 5) populations, at least some of which are not believed to be under immediate threat (i.e. not currently endangered)." They are "under consideration for declaration as 'rare flora' but are in need of further survey." (Atkins 1992).

Priority four (P4) are rare taxa which are "Taxa which are considered to have been adequately surveyed and which whilst being rare (in Australia), are not currently threatened by any identifiable factors." (Atkins 1992).

Consequently, Jandakot Airport has national estate value for uncommon flora although, the number of such species present is not large.

The national estate value of the bushland at Jandakot Airport for "Importance for rare, endangered or uncommon .... communities, ecosystems..." is more significant.

The vegetation complex present, the Bassendean Vegetation Complex - Central and South, has had more than 90% of it's original extent cleared. This vegetation complex had an original area within the area covered by the Atlas of the Darling System of about 87,329 ha and has been reduced to about 5% of its original extent. It is clear from this, that at the vegetation complex/ecosystem level the bushland at Jandakot Airport has high national estate value. If the total area of bushland at Jandakot Airport was larger, or did not have the airfield within it, this value would

have to be assessed as very high.

At a similar level of assessment to the vegetation complexes, from examination of the maps and descriptions in Gibson et al (1994) and from information provided by B.J. Kleghery (pers comm, 11/95), there are three floristic community types confirmed as present at Jandakot Airport and possibly two others. Those confirmed as present are floristic community types 5, 22 and 23a. The others are floristic community types 11 and 4. The conservation and reservation status of these is given by Gibson et al (1994) as:

- fct 5. Low risk/Well reserved (mixed shrub damplands);

- fct 22. Susceptible/Poorly reserved (Banksia ilicifolia woodland);

- fct 23a. Low risk/Well reserved. (Central Banksia attenuata - Banksia menziesii woodlands).

- fct 11 Low risk/Well reserved (Wet forest and woodland, often with Eucalyptus rudis).

- fct 47. Low risk/Well reserved (Melaleuca preissiana damplands);

There is an apparent contradiction between the assessment of heritage value based on the vegetation complexes and the heritage value that might be deduced from the conservation/reservation status levels ascribed to most of the floristic community types listed above for Jandakot Airport. However, Gibson et al (1994) define the term "well reserved" in the following way "known from two or more A class National Parks or Nature Reserves". That is, their use of the term is a very relative one and does not imply that a floristic community type is well reserved in the sense of having an adequate proportion of its original extent in National Parks or Nature Reserves or, that the areas reserved are strategically placed. In fact, their use of "well reserved" is quite misleading, as many of the floristic community types they describe in this way are certainly not well reserved when criteria such as meeting the IUCN

minimum standard of 10% of original extent in secure reserves or other biologically desirable criteria such as large size of reserves and reservation occurring at various parts of the original range are applied (it should be noted, that they recognise some of these problems on page 59 of their report). Putting these problems with the terminology of Gibson et al aside, there are some other problems assessing the heritage value of Jandakot Airport using the floristic community type concept. One is that there are no areas available for the floristic community types (either original extent or portion remaining). This means that assessing heritage value on the remaining area as a proportion of the original cannot currently be carried out. However, Gibson et al have made guestimates of which floristic community types have "range contractions likely to be > 90%" (their table 23). Of the floristic community types known or inferred for Jandakot Airport (4, 5, 11, 22, 23a), they rate none as being in this category. Their guestimates for remaining areas of at least some of the floristic community types may be somewhat generous. For example: floristic community type 5 is known from Gingin to Harvey, with most records (and two thirds of its range) south of Perth. The area south of Perth is more than 90% cleared and even if there are significant areas of this floristic community type north of Perth it seems unlikely that much more than 10% of the original extent of this type could be extant, if that much. Similar arguments could be put forward for floristic community types 4 and 11.

From this discussion, it is obviously difficult to make a definite assessment of the rarity of the floristic community types present at Jandakot Airport. However, it seems likely that some of them are now at least uncommon compared to their original extent and thus the Jandakot Airport bushland has significant national estate value for them.

At the more detailed plant community level of description of vegetation, there is insufficient information currently available to fully assess the rarity of stands of vegetation at Jandakot Airport. However, those stands with Croninia kingiana common in the understorey are certainly quite unusual and have heritage value for rare vegetation.

6.2.3 Criterion C: Its potential to yield information that will contribute to an understanding of Australia's natural or cultural history.

Criterion C.1: Importance for information contributing to a wider understanding of Australian natural history, by virtue of its use as a research site, teaching site, type locality, reference or benchmark site.

The bushland at Jandakot Airport has been used for research by a number of workers, and the value of this is acknowledged in the FAC's objection document, as well as the value for future work, in the following way: "The site undoubtedly provides opportunities for more research. Further flora study of the Airport would be valuable for research and would be valuable for comparison with other areas." (Dames & Moore 1995, page 15).

As a result of the work already carried out (see Dames & Moore 1995, page 15) and the potential for further work, the Bushland at Jandakot Airport has significant national heritage value under criterion C.1.

7.0 DETAILED OBJECTION ASSESSMENT FOR FLORA VALUES OF THE BUSHLAND AREAS AT JANDAKOT AIRPORT CURRENTLY ON THE INTERIM LIST OF THE NATIONAL ESTATE

7.1 Introduction

As is evident from the titles of this and the next section, it is proposed to deal with the bushland areas at Jandakot Airport currently on the Interim Register of the National Estate in this section and areas not on the register in the next section. It is proposed to deal with item (i) of the five points defined in Attachment 1 of Australian Heritage Commission 1995 first (see section 1.2 above) and then deal with the other items (ii, iii, iv and v) separately for the areas used to discuss the Airport bushland in the FAC's objection document (Dames & Moore 1995). As there are a number of these areas and the national estate values of the Airport as a whole have been discussed above the discussion for each one will be brief.

7.2 Adequacy of Commission database

The Commission database in relation to the flora and vegetation at Jandakot Airport is limited both in scope and quality. It is limited in scope in that the descriptions given of the vegetation are very general and for the flora in that only a few species are mentioned. It is limited in quality in that the standard of the vegetation descriptions is poor and that the selection of flora species cited is only those used in the description of the vegetation.

7.3 Objection assessment of Development Zone 1

7.3.1 Grounds for objection which relate to the national estate significance of Development Zone 1

"While preservation of Banksia woodland per se is important, ..., Development Zone 1 contains no natural features unique to this Zone. There are several areas of severe disturbance. There is no substantial scientific reason why Development Zone 1 should be preserved in preference to any other area." (Dames & Moore 1995, page 19). Figure six of Dames & Moore 1995 (Suggested Modifications to AHC List) indicates that the FAC's objection as quoted above should mean, in their view, that Development Zone 1 should be removed from the Register of the National Estate.

7.3.2 Appropriateness of the boundaries given the significance of Development Zone 1

Given the significance of area Development Zone 1 (and adjoining areas) for flora and vegetation, the boundaries of the interim listing are mostly appropriate in that they include areas of Banksia woodland of national estate significance. However, they should be modified slightly to include some areas of Banksia woodland outside the boundaries of the area on the interim list that have national estate value. Figure 3 shows the recommended boundary for the bushland at Jandakot Airport.

7.3.3 Significance of Development Zone 1 in relation to the definition of the national estate

Development Zone 1 has significance for flora communities (vegetation) of the Bassendean Vegetation Complex - Central and South, processes found in the vegetation communities found in dunes in that complex and as an area where research can be carried out. While Development Zone 1 has national estate value in it's own right, it also contributes to the national estate value of the whole area of bushland at Jandakot Airport and should be viewed as part of the whole rather than in isolation. Consequently, in my opinion, Development Zone 1 deserves inclusion on the Register of the national estate.

7.3.4 Comments on the integrity of Development Zone 1, or other comments of a technical nature

The boundary recommended in the vicinity of Development Zone 1 will include some areas of disturbance but, this is unavoidable in a situation such as that that exists at Jandakot Airport and is necessary to include areas of national estate value without having an unduly contorted boundary. The proportion of the disturbed areas as a total of the whole is not significant. This problem is discussd in the introduction to this report as is the issue of considering subsets of the airport in isolation.

7.4 Objection assessment of Development Zone 2

7.4.1 Grounds for objection which relate to the national estate significance of area B

"Development Zone 2 contains remnant Banksia woodland in good condition. It

contains no natural features unique to this Zone. There is a cleared area and an adjacent railway line which are ongoing sources of disturbance and weeds. There is no substantial scientific reason why Development Zone 2 should be preserved in preference to any other area." (Dames & Moore 1995, page 19). Figure six of Dames & Moore 1995 (Suggested Modifications to AHC List) indicates that the FAC's objection as quoted above should mean, in their view, that Development Zone 2 should be removed from the Register of the National Estate.

7.4.2 Appropriateness of the boundaries given the significance of Development Zone 2

Given the significance of area Development Zone 2 (and adjoining areas) for flora and vegetation, the boundaries of the interim listing are mostly appropriate in that they include areas of Banksia woodland of national estate significance. However, they should be modified slightly to include some areas of Banksia woodland outside the boundaries of the area on the interim list that have national estate value. Figure 3 shows the recommended boundary for the bushland at Jandakot Airport.

7.4.3 Significance of Development Zone 2 in relation to the definition of the national estate

Development Zone 2 has significance for flora communities (vegetation) of the Bassendean Vegetation Complex - Central and South, processes found in the vegetation communities found in dunes in that complex and as an area where research can be carried out. While Development Zone 2 has national estate value in it's own right, it also contributes to the national estate value of the whole area of bushland at Jandakot Airport and should be viewed as part of the whole rather thn in isolation. Consequently, in my opinion, Development Zone 2 deserves inclusion on the Register of the national estate.

7.4.4 Comments on the integrity of Development Zone 2, or other comments of a technical nature

The boundary recommended in the vicinity of Development Zone 2 will include some areas of disturbance but, this is unavoidable in a situation such as that that exists at Jandakot Airport and, is necessary to include areas of national estate value

without having an unduly contorted boundary. The proportion of the disturbed areas as a total of the whole is not significant. This problem is discussd in the introduction to this report as is the issue of considering subsets of the airport in isolation.

7.5 Assessment of Development Zone 3

Most of Development Zone three is not on the Interim List of the National Estate however, in the text of Dames & Moore 1995 it is treated as if it all is. In fact, based on the figures in Dames & Moore 1995 none of Development Zone 3 appears to be interim listed but, an area next to it is, this will be treated as part of Zone 3 for this discussion as appears to have been done in Dames & Moore 1995. The "Zone" lies between the two larger parts of the bushland at Jandakot Airport and the portion included on the Interim List forms a link between these larger parts.

7.5.1 Grounds for objection which relate to the national estate significance of Development Zone 3

"Development Zone 3 contains Flooded Gum woodland with a badly degraded and disturbed understorey, and an adjacent commercial development and road which are sources of weeds. There is no substantial reason why it should be preserved other than that Flooded Gum is not well represented elsewhere on the Airport." (Dames & Moore 1995, page 19). Figure six of Dames & Moore 1995 (Suggested Modifications to AHC List) indicates that the FAC's objection as quoted above should mean, in their view, that Development Zone 3 should not be placed on the Register of the National Estate (it is not interim listed).

7.5.2 Appropriateness of the boundaries given the significance of Development Zone 3

Given the significance of Development Zone 3 and adjoining areas for plant communities (and probably flora but, insufficient detail is available) and processes, the boundaries of the part of Development Zone 3 which is interim listed appear appropriate (Due to the scale of the maps it is difficult to be precise, there may be minor changes on the aerial photographs used to indicate the recommended boundaries).

7.5.3 Significance of Development Zone 3 in relation to the definition of the national estate

The portion of Development Zone 3 included in the recommended area has significant heritage value as it provides a linkage between larger parts of the bushland at Jandakot Airport, enabling processes (movement of biological material such as seeds and pollen) of national heritage value that enable the overall processes of the bushland to continue with a higher level of integrity. It should be viewed as part of the whole rather than in isolation. It has some national estate value in it's own right, in the presence of areas of *Eucalyptus rudis*, although, these are degraded. The contribution of the parts of development Development Zone 3 recommended for inclusion on the permanent list to the national estate value of the whole area of bushland at Jandakot Airport in my opinion means it deserves inclusion on the Register of the National Estate.

7.5.4 Comments on the integrity of Development Zone 3 or other comments of a technical nature

The boundary recommended in Development Zone 3 will include areas of significant disturbance but, this is unavoidable in a situation such as that that exists at Jandakot Airport and, is necessary to include areas of national estate value without having an unduly contorted boundary.

7.6 Objection assessment of Development Zone 4

The FAC has acknowledged that "There is sufficient scientific evidence, ..., to support an argument for its (Development Zone 4) protection as a Conservation Area" (Dames & Moore 1995, page 19).

7.7 Objection assessment of Conservation Zones 5a, 5b and 5c

The FAC has explicity accepted the national estate value of Conservation Zones 5a, 5c (Dames & Moore 1995, page 20) and most of 5b, marking most of 5b as "retain in Interim List" on figure 6 but, excluding the narrow part.

7.7.1 Grounds for objection which relate to the national estate significance of part of Conservation Zone 5b

"There are no substantial scientific reasons...., why Zone 5b should be preserved in preference to any other area." (Dames & Moore 1995, page 20).

7.7.2 Appropriateness of the boundaries given the significance of Conservation Zone 5b

Given the national estate significance of Conservation Zone 5b for plant communities and processes, the boundaries of the interim listed areas are appropriate.

7.7.3 Significance of area Conservation Zone 5b in relation to the definition of the national estate

Conservation Zone 5b has significance for flora communities (vegetation) of the Bassendean Vegetation Complex - Central and South, processes found in the vegetation communities found in dunes in that complex and as an area where research can be carried out. While Conservation Zone 5b has national estate value in it's own right, it also contributes to the national estate value of the whole area of bushland at Jandakot Airport and should be viewed as part of the whole rather thn in isolation. This latter point aspplies particularly to the narrow part of the Zone which acts as a (at least partial) linkage between Zones 5aand the larger part of 5b and in doing so helps to maintain processes of national estate value. Consequently, in my opinion, Conservation Zone 5b deserves inclusion on the Register of the national estate, including the narrow portion of it.

7.7.4 Comments on the integrity of Conservation Zone 5b or other comments of a technical nature

The narrow part of Conservation Zone 5b is apparently somewhat degraded, while retaining value as a linkage. The value as a linkage (which is not complete) could be improved by rehabilitation of suitable areas.

***7.8* Objection assessment of Sand Mining Area 6**

While on the face of the report, the FAC has not objected to Sand Mining Area 6 (it is

marked for "Retain in Interim List" on figure 6 of Dames & Moore 1995) what is being proposed is that the area should be available for sand mining and then rehabilitated. As this would effectively remove the national estate values of the listing of this area I have treated this as an objection.

7.8.1 Grounds for objection which relate to the national estate significance of Sand Mining Area 6

"There are no substantial scientific reasons why it (Sand Mining Area 6) should be preserved in preference to any other area apart from its slightly higher Rapid Habitat Assessment Score." (Dames & Moore 1995, page 20).

7.8.2 Appropriateness of the boundaries given the significance of Sand Mining Area 6

Given the significance of Sand Mining Area 6 the boundaries are appropriate in that they include the area. However, it would be desirable to extend the area listed to the south-east (outside the boundary of the Airport)

7.8.3 Significance of Sand Mining Area 6 in relation to the definition of the national estate

"Sand Mining Area 6 contains remnant Banksia woodland in good condition. It contains no substantial area of dampland, but does contain a high dune similar to that in Development Zone 4." (Dames & Moore 1995, page 20). The Banksia woodland has national estate value for plant communities of the Bassendean Vegetation Complex - Central and South. Consequently, I believe the area has sufficient national estate value to warrant listing on the Register of the National Estate.

7.8.4 Comments on the integrity of Sand Mining Area 6 or other comments of a technical nature

The concept that is being advanced by the FAC for Sand Mining Area 6 (albeit not explicitly) that it can be mined and then rehabilitated to return its national estate values for flora is fallacious. While post mining rehabilitation can return some values (a proportion of cover/structure and floristic diversity) it does not return the pre-existing values of an area for flora.

8.0 BUSHLAND AREAS AREAS ADJACENT TO JANDAKOT AIRPORT WITH NATIONAL ESTATE VALUE

In section 6.0 of this report ("National estate values of the flora and vegetation at Jandakot Airport", see above), the overall national estate values of the vegetation and flora of Jandakot Airport are discussed. Examination of aerial photographs of the areas of vegetation adjoining Jandakot Airport show that the national estate values for flora and vegetation present in the Airport extend out of it as well. This includes Ken Hurst Park (which has more flora species recorded for it than the Airport) an area to the north of the railway line, an area on the south-west of the Airport adjacent to a sandmine and an area to the south-east of the Airport.

While these areas have similar values to the areas within the Airport boundary (all are within the Bassendean Vegetation Complex - Central and South), the increase in size will mean a better representation of different flora communities, particularly more dampland areas.

The fact that the railway line separates some of the area recommended to be listed from the areas within the Airport is unfortunate but, the additions will recognise that the combined size of the individual blocks and their near proximity to each other allows the continuation of processes with heritage value and that a reduction of this area would result in loss of national estate values.

It is important to recognise that maintaining the highest level of national estate values at Jandakot Airport and adjoining areas necessarily means including areas of lower national estate value in listed areas becuase of their role in maintaining natural processes such as the movement of biological material from one high value area to another. It is also imporftant to remember that the overall size of the combined blocks of vegetation is a significant contributor to the level of the national estate values present.

Consideration of these factors, and the full extent of national estate values for flora (in the widest sense, including related processes) present at Jandakot Airport and adjoining areas has led me to recommend that the interim listed areas and some

adjoining areas, as shown on figure 3, should be entered on the Permanent Register of the National Estate.

10.0 REFERENCES

Atkins, K.J. (1992). The Department of Conservation and Land Management Declared Rare and priority Flora List for Western Australia.

Australian Heritage Commission (1995). Agreement between (the) Australian Heritage Commission and Malcom Trudgen in relation to Consultancy services for Objection Assessment for Perth and Jandakot Airports - Flora values.

Beard, J.S. (1979). The vegetation of the Perth area, Western Australia. Vegetation Survey of Western Australia. Vegmap publications. Applecross. (Second printing 1982)

Beard, J.S. and Sprenger, B.S. (1984). Geographical data from the Vegetation Survey of Western Australia. Vegetation Survey of Western Australia occassional paper no. 2. Vegmap publications. Applecross.

Churchward, H.M. and W.M. McArthur (1980). Landforms and soils of the Darling System, Western Australia. In: Atlas of natural resources, Darling System, Western Australia. Maps and explanatory text. Department of Conservation and Environment, Western Australia.

Dames & Moore (1995). AHC interim List of Jandakot Airport. Prepared for the Federal Airports Corporation.

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

Griffin, E.A. and M.E. Trudgen (1994). Variation in the floristic composition of the vegetation growing on the Holocene dunes between Whitfords and Lancelin, south-western Western Australia, and recommendations for reservation to conserve the variation present. Unpublished report prepared for Bowman

Bishaw Gorham, Environmental Management Consultants.

Heddle, E.M., Loneragan, O.W. & Havel, J.J. (1980). Vegetation complexes of the Darling System, Western Australia. In atlas of natural resources. Darling System Western Australia. Maps and explanatory text. Department of Conservation and environment, Western Australia.

Marchant, N.G., Wheeler, J.R., Rye, B.L. Bennett, E.M., Lander, N.S. & Macfarlane, T.D. (1987) Flora of the Perth Region. Western Australian Herbarium, Department of Agriculture, Western Australia.

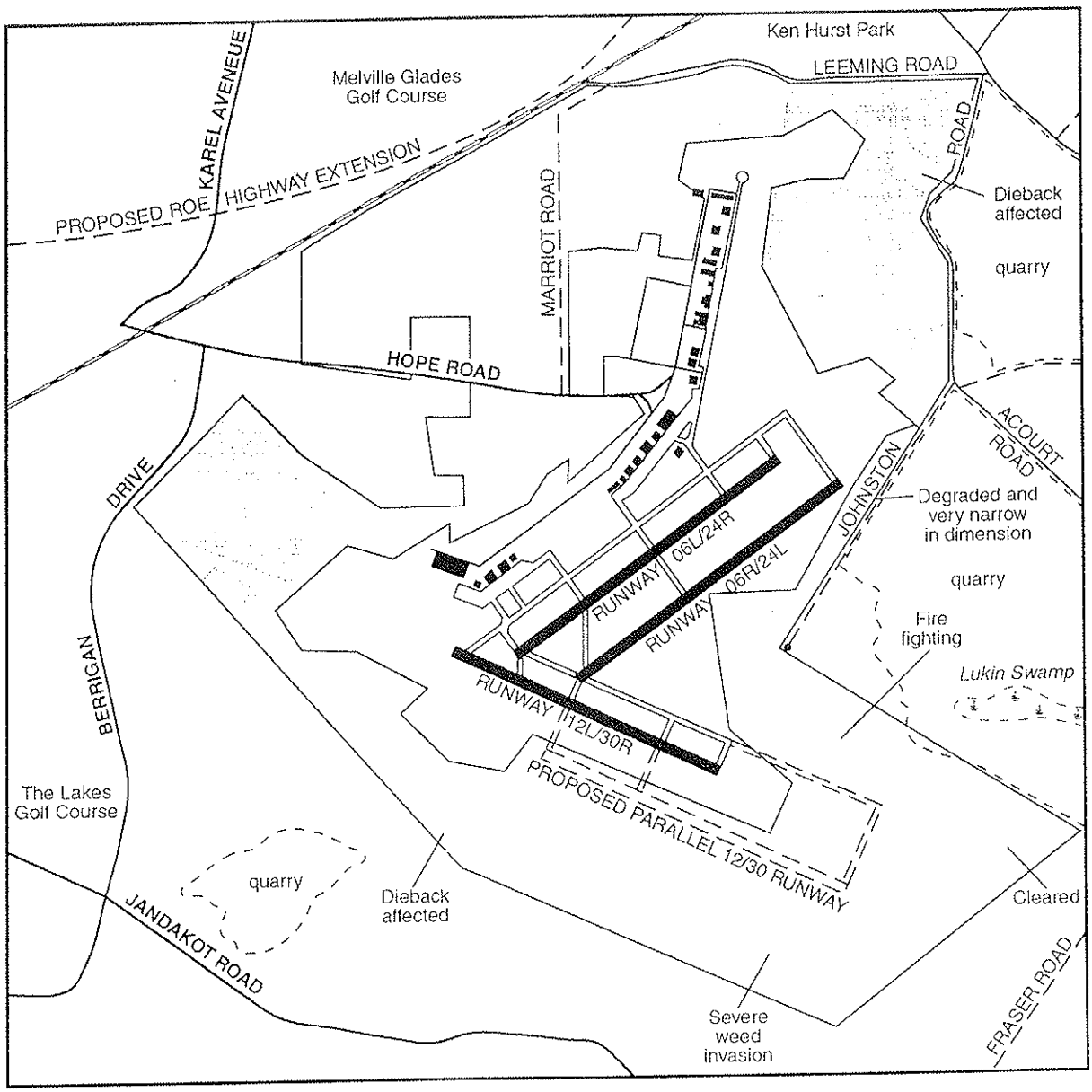
Trudgen, M.E. (1988). A report on the flora and vegetation of the Port Kennedy area. Prepared for Bowman - Bishaw and Associates.

Weston, A.S., E.A. Griffin and M.E.Trudgen (1992). Flora and Vegetation Conservation Values of the Ellenbrook Estate. Unpublished report prepared for Bowman Bishaw Gorham Environmental Management Consultants.

100 ACKNOWLEDGMENT

Bronwen Keighery kindly gave details of floristic community types recorded by her at Jandakot Airport

Figure 2



RETAIN IN INTERIM LIST

REMOVE FROM INTERIM LIST

0 300 600m

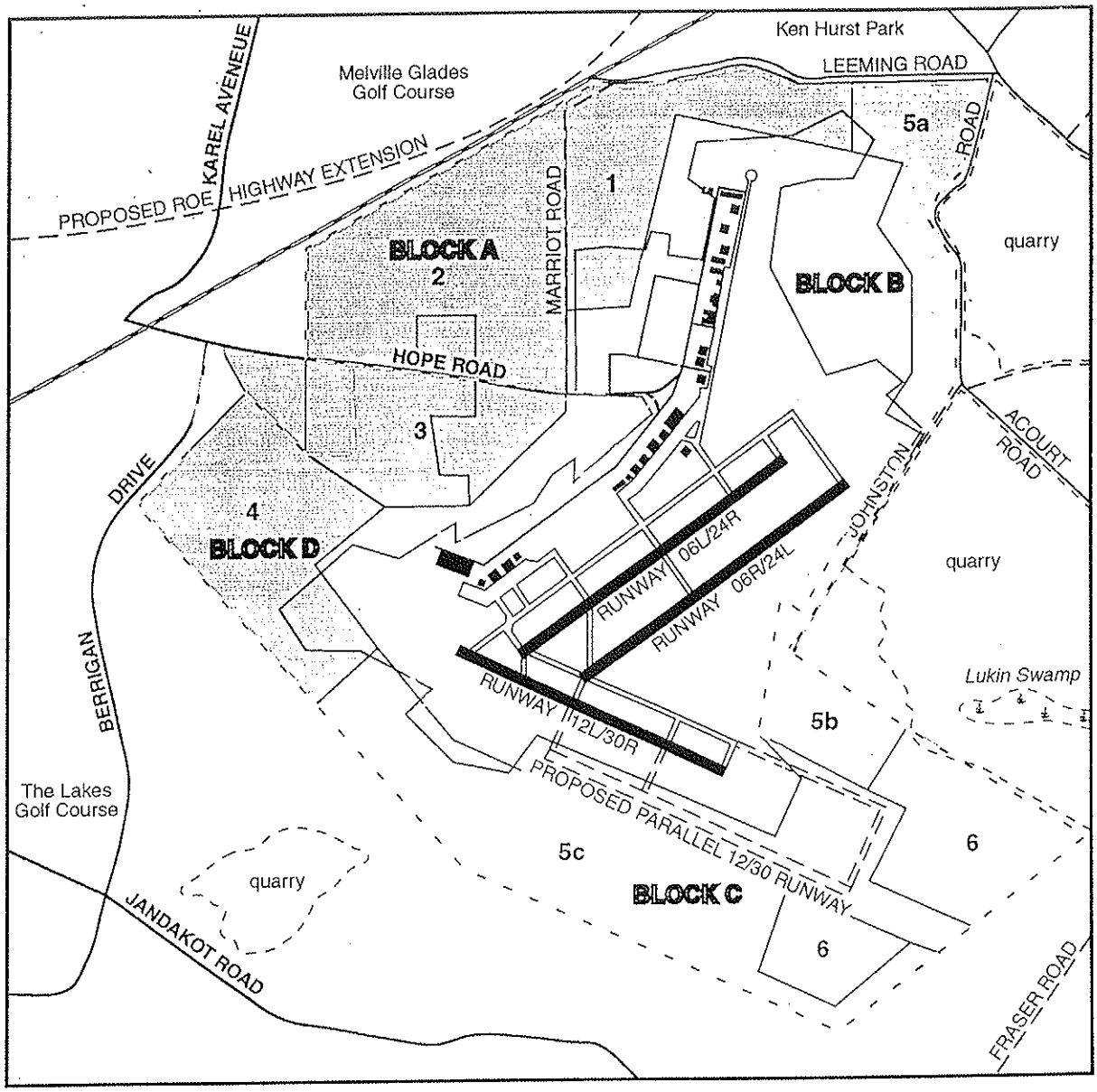
JANDAKOT AIRPORT

SUGGESTED MODIFICATIONS TO AHC LIST

JOB No. 18534-014-0363		DATE
PREPARED BY	J.S.	21/12/94
APPROVED BY	JS.	6/1/95

FIGURE 6
DAMES & MOORE (1995)

Figure 2.



1-4	COMMERCIAL DEVELOPMENT
5	CONSERVATION AREA
6	SAND MINING FOLLOWED BY REHABILITATION
7	AVIATION
A to D	VEGETATION BLOCKS

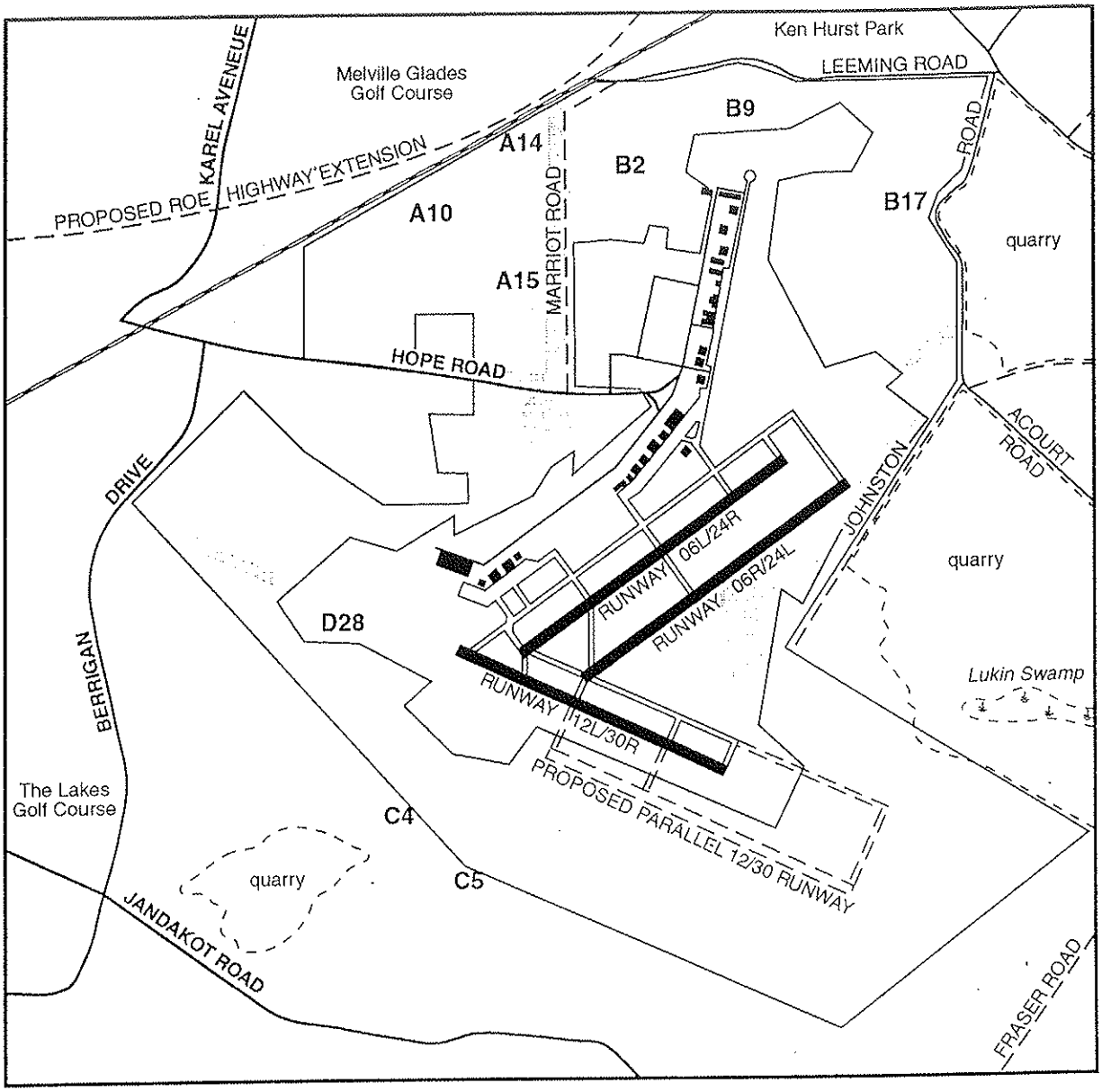
0 300 600m

JANDAKOT AIRPORT

DEVELOPMENT ZONES, CONSERVATION AREAS AND VEGETATION BLOCKS

JOB No. 18534-014-0363		DATE
PREPARED BY	J.S.	21/12/94
APPROVED BY	TS.	6/1/95

FIGURE 5
DAMES & MOORE (1995)



CLEARED

WEEDS

DIEBACK

SURVEY LOCATIONS:
A10,14,15 B2,9,17 C4,5 D28
SEE SECTION 3.5
SOURCE: MUIR ENVIRONMENTAL (1993)

0 300 600m

JANDAKOT AIRPORT

DEGRADED LAND (CLEARED, WEED INVASION, DIEBACK INFECTION) WITHIN AHC LIST

JOB No. 18534-014-0363		DATE
PREPARED BY	J.S.	21/12/94
APPROVED BY	J.S.	6/1/95

FIGURE 4
DAMES & MOORE

SINCLAIR KNIGHT MERZ

7th Floor, Durack Centre
263 Adelaide Terrace
PO Box H615
Perth WA
Australia 6001
Telephone: +61 8 9268 4400
Facsimile: +61 8 9268 4488
http://www.skm.com.au

Ms Bronwen Keighery
Department of Environmental Protection
Westralia Square Building
141 St Georges Terrace
PERTH WA 6000

23 February 1999
DE01238.3:L10SDMLV.DOC

Dear Ms Keighery

JANDAKOT AIRPORT PRELIMINARY DRAFT MASTER PLAN AND ENVIRONMENT STRATEGY

Please find enclosed, 0 copies of the Preliminary Draft Master Plan and 1 copy of the Preliminary Draft Environment Strategy, for your information and comment.

We would draw your attention to the date for closure of public comments on 24th May 1999. It would be appreciated if these documents could be reviewed and any comments or submission be received prior to that date. All submissions must be made in writing to the address shown in the report.

Yours faithfully

Peter Oliver
Principal

Enclosure

DEPARTMENT OF ENVIRONMENTAL PROTECTION
25 FEB 1999
File No 1 122/79 Name
File No 2 CTL/1994 Name
File No 3 Name

Quality System
Quality Endorsed Company
ISO 9001 Lic 0500
Standards Australia

137357

Conostephium minus was only found in the Martinick (1989) survey, and was not redetected in any subsequent surveys. However, a common and morphologically similar species *C. pendulum* was found to be widespread at the airport, and is likely to have been mistaken for *C. minus* (Muir, 1993).

Two other species found at the airport have been formerly listed as priority flora:

- *Lysinema elegans*
- *Phlebocarya filifolia*

These species are no longer regarded as rare or endangered, and have been deleted from the priority flora list (Dr Ken Atkins, Principal Botanist, CALM, pers. comm., 1998).

Dieback disease is caused by various species of the fungal genus *Phytopthera*, most commonly *P. cinnamomi*. Dieback was observed by Martinick (1989), and assessed as part of the intensive vegetation survey carried out by Muir (1993). Small outbreaks of dieback were observed at many different locations across the Jandakot Airport bushland. Muir (1993) found that the north-west corner of the bushland was most severely affected by dieback, with 12 sites of infection observed, while the southern half of the airport bushland was least affected.

Fauna

Compare with adjacent Bushland PK

Dames and Moore (1993) summarised the fauna surveys that have been carried out at Jandakot Airport. The most comprehensive study was carried out by Martinick (1990). The airport fauna is poor in frog species because of the dryness of the site, and small mammals due to fires and predation by feral animals, but it contains a relatively rich bird and reptile fauna (Dames & Moore, 1993).

A total of 4 frog species, 22 reptile species, 46 bird species and 7 native mammal species have been observed at the Airport during the surveys. Six introduced bird and mammal species have also been recorded at the airport:

- Laughing Kookaburra *Dacelo novaeguineae*
- Black Rat *Rattus rattus*
- Cat *Felis catus*
- Fox *Vulpes vulpes*
- House Mouse *Mus musculus*
- Rabbit *Oryctolagus cuniculus*

The invertebrate fauna has not been studied in any detail, but one locally rare species of ant, *Iridomyrmex conifer* is listed as present (Martinick, 1989). This ant is known to live in large colonies in areas where the native vegetation is largely undisturbed. It is widespread in the south west of Western Australia, but is relatively rare in the Perth region (Martinick, 1989).

Martinick (1990) found evidence of numbats at the Airport, in the form of hairs in a hollow log that were positively identified as belonging to a numbat. However, subsequent surveys have failed to find any traces, and it is now considered unlikely that numbats are present in the area (CALM, 1998b).

Carnaby's Cockatoo is included on the 1997 gazetted list a species declared "Rare or likely to become extinct" (Schedule 1). Its numbers have been shrinking since the late 1960s, when its breeding habitats to the north and north-east of Perth were cleared for agricultural purposes. After breeding, many of the birds move south to bushlands including Jandakot Airport for seasonal foraging (Dames & Moore, 1995b).

The Peregrine Falcon is an occasional visitor to areas of open woodland that support populations of feral pigeons (CALM, 1998b). This may include Jandakot Airport bushland, though no sightings have been made during any faunal surveys.

The Quenda, or Southern Brown Bandicoot is moderately common in the Jandakot area, and occurs in *Banksia* woodland and low heath communities in the absence of predators (CALM, 1998b). There have been a number of recordings of Quenda at Jandakot Airport (Martinick, 1989 & 1990; Dames & Moore, 1993).

Beneath the airport, at or below the level of the watertable, an iron-enriched hardpan, known locally as "coffee rock" occurs over most of the Jandakot Airport area, except in the north eastern end, where it is poorly developed or absent (Dames & Moore, 1993). This hardpan has a low permeability, and can form a semi-confining layer, which may inhibits vertical groundwater movement and contaminant migration.

The quality of the groundwater of the Jandakot Mound is highly variable, and requires treatment before use as a public water supply. In the superficial formations, the groundwater salinity of the Jandakot Mound varies from below 250 mg/L Total Dissolved Solids (TDS) near the crest of the mound to over 1000 mg/L TDS near the coast (Dames & Moore, 1993). Under the Bassendean Dune system and near the wetlands, the groundwater is acidic, with a pH of 5 to 6.5. The groundwater tends to be coloured by organic acids and to have a high turbidity. Davidson (1995) suggests the age of the superficial groundwater ranges from the present, at the watertable, to about 2,000 years at the base of the aquifer.

Vegetation

The natural vegetation of Jandakot Airport is described as Banksia woodland and covers approximately 400 ha of airport land. The vegetation associations within the Jandakot bushland are shown in **Figure 3.5**. Much of the vegetation is in a relatively undisturbed state, and is regarded as one of the best examples of Banksia woodland remaining in the Southern Perth region (EPA, 1993). Although "Banksia woodland" occurs most abundantly on the Bassendean Dune System in the central section of the Swan Coastal Plain, it is also present on other terrain types, such as the Spearwood Dune System. This association occurs from near Jurien Bay south to near Busselton (Beard, 1989).

The relative importance of the bushland has been elevated by urban expansion and intensification of land use, which have had significant impacts on other Banksia woodlands in the areas surrounding the airport (Dames & Moore, 1995b). The bushland of Jandakot Airport was the subject of an EPA System Six Recommendation (M94), and has been entered in the Interim List of the Register of National Estate by the Australian Heritage Commission.

The vegetation of the Jandakot Airport has been surveyed by Martinick (1989) and more recently by Muir (1993). Martinick (1989) recorded 95 vegetation species, including 6 exotic species. Muir (1993) recorded 151 species, of which 84 were new recordings for the airport, while 26 species recorded by Martinick (1989) were not recorded by Muir (1993). Combined there have been 177 flora species recorded at Jandakot Airport. There are likely to be at least 200 native species present in the airport bushland (Dames & Moore, 1993), and more than 50 weed species (Rod Randall, Agriculture Western Australia, pers. comm., 1998).

Common weeds at the airport include veldt grass (*Ehrharta calycina*), wild oats (*Avena fatua*) and *Austrostipa spp.* These weeds are having an increasing impact on the bushland at Jandakot Airport, with some areas of the bushland significantly degraded by weed invasion. Weeds of particular concern to Agriculture Western Australia which are or may be present at the Airport include the wild gladiolus (*Gladiolus caryophyllaceus*), wild watsonia (*Watsonia bulbillifera*), the arum lily (*Zantedeschia aethiopica*) and bridal creeper (*Myrsiphyllum asparagoides*) (Rod Randall, Agriculture Western Australia, pers. comm., 1998).

Despite several intensive searches for Declared Rare Flora (DRF) over a number of years and during a variety of seasons, no DRF have been found in the Jandakot Airport bushland (Dames & Moore, 1993), and there are only two priority species known to occur. The two priority species are:

- *Conostephium minus* (Pink-tipped Pearl flower), Priority 4 species; and
- *Scaevola paludosa*, Priority 2 species.

INCORRECT

The Western Brush Wallaby may still occur in the Jandakot Airport bushland, where its usual habitats are the tall shrub-heath communities and *Banksia* woodlands (CALM, 1998b). It has been recorded at the Airport during previous faunal surveys, both through trapping and from evidence of diggings (Martinick, 1989 &1990; Dames & Moore, 1993; Muir, 1993).

The native brush cricket *Throscodectes xiphos* has only been recorded from one site near Jandakot Airport, and has not been collected since 1983 (CALM, 1998b). The Airport bushland also supports a number of habitat specific invertebrate-eating birds which are now largely absent from the Perth region, including the Grey Shrike-thrush, Scarlet Robin, Splendid Fairy-wren and the Inland Thornbill (Dames & Moore, 1995b).

Damplands

A large portion of the Swan Coastal Plain area experiences seasonal, semi-permanent or permanent inundation that form wetlands (Hill et al., 1996). Many of these wetlands are interconnected with other wetlands to provide an extensive mosaic of habitats for a variety of flora and fauna. The only wetland type present at Jandakot Airport is a series of seasonally waterlogged basins of varying sizes, referred to as damplands (Hill et al., 1996).

The wetland mapping, classification and evaluation report for the Swan Coastal Plain (Hill et al. 1996) identified three damplands occurring within the Jandakot Airport, and another two just outside the boundaries of the airport. Previous reports (Dames & Moore, 1993) have referred to 6 damplands in the Airport. One "dampland" is in reality a drainage sump and largely devoid of natural vegetation (Dames & Moore, 1993). Another, has since been lost through extension to the south west hangar facilities. A third dampland was not included in the Swan Coastal Plain report. The omission of this dampland is probably due to the use of aerial photography in identification of wetlands, as damplands are sometimes not evident on aerial photographs (Michael Allen, WRC, pers. comm. 1998).

Two of the damplands (in the north east and south east corners) identified by Hill et al. (1996) are classified as Conservation Wetlands, where the management priority is to preserve natural attributes and functions of the wetland (Hill et al. 1996). Only one of the damplands within the Airport boundary (in the south west) and the wetland just outside the northern boundary were identified as Resource Enhancement Wetlands. The management priority for Resource Enhancement wetlands is to the restore the wetland through maintenance and enhancement of the wetland functions and attributes, which is achieved through protection and sustainable management (Hill, et al., 1996).

The dampland within the airport that was not included by Hill et. al. (1996) was classified by Dames and Moore (1993) under the assessment procedures in Environmental Protection Authority Bulletin 374 (EPA, 1990a) as Resource Enhancement.

Indigenous Heritage

Six applications of Native Title covering Jandakot Airport have been lodged with the National Native Title Tribunal as of October 1998. These claims are:

- WC95/081
- WC95/085
- WC95/086
- WC96/103
- WC98/055
- WC98/067

All claims cover broad areas (between 3,000 and 98,000 km^2), generally centred on the Perth metropolitan region and expanding south towards Albany. WC95/081 and WC95/086 have been referred to the Federal Court. All other applications are at various stages of the Native Title process.

It is important to note that additional claims continue to be lodged for areas throughout

Australia, and future applications may be lodged that include Jandakot Airport.

An extensive ethnographic and archaeological survey for Aboriginal sites was carried out at Jandakot Airport in 1990 (O'Connor et al., 1990). The ethnographic survey reviewed the existing ethnographic database, consulted with Aboriginal people with traditional and current links with the Jandakot region, and visited the site with Aboriginal spokespersons. The conclusions of the study were that there were no previously recorded sites and no new sites of significance to aboriginal people at Jandakot Airport (O'Connor et al., 1990).

The archaeological survey involved a review of the existing archaeological information for the site, and then an extensive site survey, involving access to all sections of the Airport. The results of the investigation were the identification of one new site and one previously recorded site (O'Connor et al., 1990). The sites were both small artefact scatters.

A register of Aboriginal heritage sites is kept by the Western Australian Department of Aboriginal Affairs (AAD). The two sites identified by O'Connor et al. (1990) have been entered into this register. A review of the register in October 1998 indicated that no new sites have been found in the Jandakot Airport.

European Heritage

Prior to the development of Jandakot Airport, the area was settled in 1867 for grazing, and was gazetted as the Jandakot Agricultural Area in 1899 (Dames & Moore, 1993). There are no visible signs of European heritage currently in existence at the Airport, and no heritage sites are registered with the National Trust, Western Australian Heritage Commission, or local City councils.

Areas of High Natural Conservation Value

Item 3.07 of the Airports (Environmental Protection) Regulations outlines the requirements for identifying areas of environmental significance. This states:

"An airport-lessee company, in specifying in an Environment Strategy the areas within the airport site that, under paragraph 116(2)(b) or 3(b) of the Act, it identifies as environmentally significant, must address:

a. Any relevant recommendation of the Australian Heritage Commission

b. Any relevant recommendation of the Department of the Environment, Sport and Territories regarding biota, habitat, heritage or kindred matters

c. Any relevant recommendation of a body established in the State in which the airport is located, having responsibilities in relation to conservation of biota, habitat, heritage or kindred matters"

There is no definition or description of what is considered "environmentally significant" in the regulations, and no methodology is supplied for determining significance. The policies and recommendations of relevant Commonwealth and State agencies may provide some indication of the environmental significance of areas at the Jandakot Airport. Those policies and recommendations that relate to the Airport are summarised in this section.

International

Australia is a signatory to two international agreements that provide protection for migratory birds:

- Japan-Australia Migratory Bird Agreement, 1981 (JAMBA)
- China-Australia Migratory Bird Agreement, 1988 (CAMBA)

There are no bird species recorded at Jandakot Airport that are protected by these two agreements.

National

Jandakot Airport is on Commonwealth land, and so is covered by Commonwealth environmental legislation and regulations,

rather than by those of State or local government. The *Airports Act, 1996* and *Airport Regulations* proscribe the management of pollution (including air, water and soil pollution) and aircraft noise at Australian airports.

Other Commonwealth laws that also apply to Jandakot Airport include:

- *Commonwealth Environmental Protection (Impact of Proposals) Act, 1974*
- *Australian Heritage Commission Act, 1975*
- *Endangered Species Protection Act, 1992*
- *Aboriginal and Torres Strait Islander Heritage Protection Act 1984*
- *Native Title Act 1993*

All bushland at Jandakot Airport, as well as some bushland to the north in Ken Hurst Park has been placed on the interim list of the Register of National Estate by the Australian Heritage Commission. The *Australian Heritage Commission Act, 1975* allows places considered to have aesthetic, historical, scientific or social significance or other special value for present and future generations to be listed on the Register of National Estate. When a place is entered on the Interim List of the Register of National Estate, and in the Register itself, it has some protection under section 30 of the Act.

The Commonwealth Government is the only body whose actions are directly constrained as a result of entering a place in the Register. Under section 30 of the Act, Commonwealth ministers, departments and authorities are required not to take any action that would adversely affect a place listed on the Interim List or the Register, unless there is no feasible and prudent alternative. If there is no such alternative, then all reasonable measures must be taken to minimise any damaging effect, and the Australian Heritage Commission must be given an opportunity to comment on the proposal.

The Australian Heritage Commission has no power of veto over a Commonwealth action that might damage a registered place. It can only advise on the potential impacts on national estate values. It is up to the Commonwealth authority proposing to take the action, or the Government, to decide whether the action will proceed.

The Australian Heritage Commission nominated the Jandakot Bushland for interim listing on the Register of National Estate based on the following National Estate Criteria (NEC):

- NEC A.2: Importance in maintaining existing processes or natural systems at the regional or national scale
- NEC A.3: Importance in exhibiting unusual richness or diversity of flora, fauna, landscapes or cultural features
- NEC B.1: Importance for rare, endangered or uncommon flora, fauna, communities, ecosystems, natural landscapes or phenomena, or as a wilderness
- NEC C.1: Importance for information contributing to a wider understanding of Australian natural history, by virtue of use as a research site, teaching site, type locality, reference or benchmark

State

State laws related to the environment do still apply at Jandakot Airport even though the airport is on Commonwealth land, with the exception of laws that deal with environmental pollution and noise. State laws that still apply include waste management, motor vehicle pollution, storage of certain chemicals and occupational health and safety matters. State laws dealing with protection of flora and fauna, habitat, heritage sites and sites indigenous significance also still apply, so long as they are not inconsistent with Commonwealth laws dealing with these matters.

The Western Australian Environmental Protection Authority coordinated a study to identify areas of land to be set aside for conservation or recreation purposes (DCE,

1983). Twelve regions, or "systems" were identified on the basis of human use and natural systems. Jandakot Airport falls into System Six, which is also referred to as the Darling System. This system covers the Darling Range and the Swan Coastal Plain, and includes the major metropolitan centres of Perth and Bunbury.

The System Six study identified that the vegetation on the Jandakot Airport land is dense and largely undisturbed, contains some unusual species, and is of regional significance. The bushland of Jandakot Airport the subject of a System Six recommendation (M94), which states that:

"the Commonwealth of Australia (should) retain as much uncleared land as possible".

Retaining and encouraging the growth of local indigenous flora is identified as an important management consideration (DCE, 1983).

The System Six study is currently being updated as a part of Bushplan (1998). This document was released for comment in November 1998, and will undergo review to incorporate public feedback before being released in its final form. The Bushplan aims to retain and protect a target of at least 10% of the 26 vegetation types in the Swan Coastal Plain section of Perth . The draft version has been considered in this Environment Strategy, and as this and other policies and regulations are released, the Environment Strategy for Jandakot Airport will be revised and updated as required.

Bushplan (1998) lists the bushland at Jandakot Airport as "Regionally Significant Bushland", and recommends that it be protected. Selection criteria include representation of ecological communities, diversity, rarity scientific or evolutionary importance. The Bushplan proposes that the conservation values of the site be protected through a range of complementary mechanisms to encourage and secure conservation. The expectation of the Bushplan is that the conservation intent will be fully met, though some limited conservation-compatible development may be permitted.

The Water and Rivers Commission of Western Australia (WRC) manages Western Australia's water resources including the Jandakot Mound. The WRC has the power to protect the mound and to restrict land uses that may pose a threat to the quantity or quality of water available from the mound for public water supply.

The Jandakot Mound is gazetted as a Public Water Supply Area (PWSA) and an Underground Water Pollution Control Area (UWPCA). These place restrictions on what types of activities can be carried out over the mound, and restrict groundwater abstraction from the mound. The WRC has also defined Source Protection Priority areas within UWPCAs, which were updated for the Jandakot Mound in 1998 (WA Planning Commission, 1998).

Within UWPCAs, the WA Planning Commission (1998) has defined three priority-protection levels:

- **Priority 1**: These areas are the most important for public water supplies. Water resource protection has the highest priority in land management and planning. These areas are usually publicly owned and are either undeveloped or under a well-managed land use that does not pose any greater threat to water quality than an undeveloped catchment. Urban developments, agriculture and industry are regarded as unacceptable land uses in these areas. Use of this land for protection of the public water supply outweighs virtually all other considerations and the object is to ensure that there is no degradation of water resources in this area
- **Priority 2**: Water protection in Priority 2 areas has a high priority, but this is not necessarily the primary consideration for land use planning. These normally include private rural few buildings, and low risk, low intensity land uses. These areas have a priority for public water supply use. The management objective is to ensure that there is increased risk of pollution to the water source. Restricted development may take place under specific guidelines

- **Priority 3**: These are areas where water supply needs to co-exist with other land uses such as housing, commercial sites and light industry. Priority 3 areas usually cover existing urban areas or areas planned for urban development. Management controls, rather than land use restrictions dominate the water management and protection policy for these areas. The areas are defined to minimise the risk of pollution to the water source

Previously, Jandakot Airport was on the boundary between Priority 2 and Priority 3 source protection areas. However, following the revision of the UPWCA boundaries, much of the airport is now outside of the UPWCA boundary, with only bushland to the south-west and south-east of the airport remaining in the Jandakot UWPCA (**Figure 3.6**). The status of the bushland within the UWPCA has been upgraded to Priority 1, as has the other remaining bushland over the Jandakot Mound (**Figure 3.6**). The rural and urban developments to the west and south of the airport have been reclassified as Priority 2 areas.

The WRC and Western Australian Department of Environmental Protection (DEP) have classified wetlands in the Swan coastal plain, and assigned a management category and objectives to each of the wetlands identified (Hill et al., 1996). The only wetlands identified in the Jandakot airport are damplands. There are three damplands identified within the airport. Two of the damplands are designated as "Conservation" wetlands, and one as "Resource Enhancement" wetlands (Hill et al., 1996).

The *Wildlife Conservation Act, 1950* provides protection for the flora and fauna of Western Australia. Flora and fauna species may be given further protection under the provisions of this Act. Flora may be declared rare, and listed on the Schedule of Protected Flora. Threatened fauna may be declared in need of special protection" and listed on Schedules 1 to 4 of this Act.

There are no DRF recorded at Jandakot Airport. Two Priority flora species have been identified at the Airport:

- *Conostephium minus* (Priority 4 species)
- *Scaevola paludosa* (Priority 2 species)

However, *Conostephium minus* was only recorded in 1 survey, and it is thought that the plant identified as *C. minus* in that survey was actually the common species *Conostephium pendulum* (Muir, 1993).

Two species of fauna on Schedule 1 have been recorded at Jandakot Airport – the numbat and Carnaby's cockatoo. Carnaby's cockatoo is an occasional visitor to the Jandakot Airport bushland. However, the last confirmed record of the numbat was hairs found during a survey in 1990 (Martinick, 1990), and CALM (1998b) state that:

"it is now unlikely that this species persists in the area in question".

Local

As a result of increasing urban development in Jandakot and surrounding areas, the bushland at Jandakot Airport has become one of the few remaining areas of relatively undisturbed *Banksia* woodland in the Perth metropolitan area. While the individual plant species and associations occur elsewhere outside of the Perth region, and are not regarded as rare or endangered, they are very scarce on a local scale.

The Jandakot bushland also supports a great diversity of vertebrate fauna. Many of these have a wide spread distribution throughout the state, and are not regarded as rare. However, they are now known from only a few areas within the Perth metropolitan area, and so they can be regarded as rare on a local scale.

Jandakot Airport bushland connects on the south-eastern border of the airport with the Jandakot Regional Botanic Park (Tim Bower, CALM Regional Parks Group, pers. comm. 1998). This regional park runs south from the

airport, connecting a suite of large bushlands, including many that are the subject of System 6 recommendations in the Jandakot area (MFP, 1995).

Priority Areas – Natural Environment

Rationale

Selection of priority areas with higher conservation values at Jandakot Airport was based on a number of site specific surveys, as well as consideration of the various policies and recommendations of relevant agencies as outlined in the previous section. However many of the policies or recommendations of the Commonwealth and State agencies are at a broad or general scale, and do not identify individual areas of higher or lower conservation value. In order to develop a planning strategy for the Jandakot Airport, the environmental values of areas need to be determined at a much finer scale than the various policies and recommendations offer.

There are no ultimate criteria for rating the conservation significance of bushland areas in environmental or heritage terms. The surveys considered here have used a number of different methodologies to allocate priority. The assessments are largely based on vegetation quality, as well as the presence of fauna, and available habitat offered by the bushland. The visual amenity and presence and condition of wetlands are also considered.

Conservation of bushland is promoted by retaining larger areas rather than small isolated areas, by providing buffers, by minimising the perimeter to area ratio, and by providing corridors to connect areas and facilitate the movement of fauna between areas. Therefore it may be beneficial to protect lower priority areas that will provide linkages to, or which supplement high priority areas.

Levels of Importance

Based primarily on the vegetation assessment carried out by Muir (1993), areas within the Jandakot Airport boundary have been assigned a Level of Importance, reflecting their relative value for conservation purposes (**Figure 3.6**). Areas are ranked as follows:

Level 1 – A rating of Level 1 is assigned to areas with slightly disturbed vegetation, with a variety of habitats and a rich flora and fauna, or with a richness of dampland habitats.

Level 2 - Areas of slightly to moderately disturbed vegetation, with a smaller variety of flora and fauna, or with no unique natural features are designated as Level 2.

Level 3 - Areas with moderately to highly disturbed vegetation, with a smaller variety of flora and fauna, and no unique natural features are designated as Level 3.

No Rating - Areas with severely degraded, cleared or developed areas are not given a rating.

A summary of the values and attributes of each of the Level 1, 2 and 3 areas is presented in **Table 3.1**. Each area has been numbered for identification; this numbering does not indicate any ordering or ranking of the sites. It is important to note that each of the areas identified have different and sometimes unique habitats, characteristics or suites of flora or fauna. They are not replicates, but are considered complementary.

The most notable area in terms of conservation values are Area L1.1, which contains a wide variety of habitats, including a large dune system that appears to provide habitats for a range of fauna, and Area L1.3, which contains the best variety of damplands. Areas L1.4 and L1.2 are in good condition, and they provide connectivity between airport bushland and the Jandakot Regional Park, to the south of the airport. Similarly, Area L2.2 has a lower level of importance, primarily because of its high boundary to area ratio, but it provides a connection to Area L1.3 at the north-east end of the airport.

Table 3.1: Level 1, 2 & 3 Areas at Jandakot Airport

Priority Area	Description*
L1.1	This area is on the western boundary of the Airport. It contains *Banksia* woodland in good condition. It contains a good variety of habitats relative to the rest of the Airport, and appears to be rich in flora and fauna species.
L1.2	This area is a large strip of bushland almost 500 m wide running for approximately 2 km along the south-west boundary of the Airport. It contains remnant *Banksia* woodland in good condition, and a variety of dampland types on its southern edge. Some of its values are an eastern extension of those found in L1.1, and it provides some continuity with the *Banksia* woodlands to the south of the Airport.
L1.3	This area is in the north-eastern corner of the Airport, and includes a 200 m corridor of bushland running for almost 1 km down the eastern boundary of the Airport. It contains *Banksia* woodland in good condition, and good variety of dampland types (better than any other part of the Airport). It is surrounded by severely disturbed land, including a rubbish tip just to the north of the Airport, and there are some outbreaks of dieback disease that must be managed.
L1.4	This area is in the south-eastern corner of the Airport. It contains *Banksia* woodland in good condition. It contains no substantial area of dampland, but does include a high dune similar to that in L1.1. This dune system appears to be of some value as a fauna habitat. However, it has severely disturbed areas outside the eastern and southern boundaries, which are a significant source of weed invasion.
L2.1	This area is on the western side of the Airport, to the south of Hope road, the main entrance to Jandakot Airport. It contains a flooded gum woodland with a degraded and disturbed understorey. It is adjacent to a commercial development and road that are major sources of weeds. There is no substantial scientific reason why it should be protected other than that Flooded Gum is not well represented elsewhere in the Airport.
L2.2	This is a relatively small area on the eastern boundary of the Airport. It contains remnant *Banksia* woodland in good condition, though not in as good a condition as that in L1.1. It is surrounded on its east and west sides by severely disturbed land, and weed invasion is a significant issue. There are no substantial reasons why L2.2 should be preserved in preference to any other area, except that it may provide a corridor leading north to L1.3.
L3.1	This area is located on the northern border of the Airport. It contains remnant *Banksia* woodland in good condition, but it contains no natural features that are not also found in other areas of the Airport. There are several areas of severe disturbance. There is no substantial scientific reason why L3.1 should be preserved in preference to any other area.
L3.2	This area is located in the north-west corner of the Airport, to the north of Hope road, the main entrance to the Airport. It contains remnant *Banksia* woodland in good condition, but has no natural features that do not occur in other parts of the Airport. There is a cleared area and an adjacent railway line and road that are ongoing sources of disturbance and weeds. There is no substantial scientific reason why L3.2 should be preserved in preference to any other area.

* From Muir (1993).

Areas L3.1 and L3.2 on the northern border of the airport were given the lowest Level of Importance, due to their relatively high levels of disturbance, lower species richness and absence of dampland.

Sites of High Indigenous Conservation Value

Ethnographic and archaeological surveys for significant aboriginal sites were carried out by O'Connor et al. (1990). The Airports (Environment Protection) Regulations in force under the Airports Act 1966 define a site of indigenous significance as:

"a site that has value:

a. Of customary significance to Aboriginal or Torres Strait Islander people; or

b. Of significance to anthropological or archaeological understanding of Australian Aboriginal history and society"

The requirements for identification of sites of indigenous significance is stated in Item 3.03 of these Regulations:

"For paragraphs 116 (2) (j) and (3) (j) of the Act, a matter that must be specified in an environment strategy is any area, within the airport site to which the strategy applies, that the airport-lessee company for the airport has identified as being a site of indigenous significance, following consultation with:

a. Any relevant indigenous communities and organisations

b. Any relevant Commonwealth or State body"

Consultation with Aboriginal groups and individuals connected with the Jandakot Airport has been previously carried out to identify areas of indigenous significance. The policies and recommendations of relevant Commonwealth and State agencies have also been reviewed to identify areas of the indigenous significance at the Jandakot Airport. The results of these consultations and reviews are summarised in this section.

required by the airport in 2019. As described above, the plan shows well-defined operational building areas.

The plan also shows the facilities required to meet the airport's ultimate development capacity potential. The maximum capacity of annual aircraft movements is anticipated to be in excess of 500,000 aircraft.

Following is a brief description of each of the primary airport systems:

Runways, Taxiways and Navigational Aids

Runway improvements are proposed to avoid delays and congestion when weather conditions force operations off the parallel 06/24 runways and onto single 12/30 runway. Improvements to the existing taxiway system have been proposed. Airport navigation aids and airfield lighting will be provided as required by international and national standards. The existing NDB importance is lessening as greater emphasis is placed on the new Global Positioning System (GPS) technology. The helipad in the helicopter training area will be lit to avoid conflicts between fixed wing and rotary operations at night.

Support Facilities

Aviation-related facilities needed to support the growth of the airport, such as flying training schools, outlet for aircraft spare parts and instrument repairs, will generally be located in the area just to the north-west of the building areas with access from service roads connecting to Hope Road.

Ground Transportation

The existing access road system will be greatly improved with the proposed extension of Roe Highway along an east-west alignment to the north of the airport. Current planning by MRWA proposes that the extension will be constructed west to the Kwinana Freeway by the Year 2003. This will result in an access to the regional road network located immediately west of the airport.

Longer term there is potential to provide a road access from the airport to the east, at Ranford Road. This would supplement the existing access and provide good links to the Canning Vale area.

These improvements are expected to provide more convenient and direct access to the airport.

Potential Environmental Impacts

The primary on-site impacts arising from the proposed development at Jandakot Airport are vegetation clearance and the subsequent loss of flora and fauna habitat. There is also the indirect impact of potential contamination of the Jandakot Mound. The major off-site impact is the generation of noise due to flight operations (not covered within this strategy).

Much of the proposed development, for example the fourth runway, is not forecast to be required until well beyond the 5 year period addressed by this Environment Strategy. However, the period prior to development provides an opportunity to implement environmental management to minimise the impacts on the natural environment.

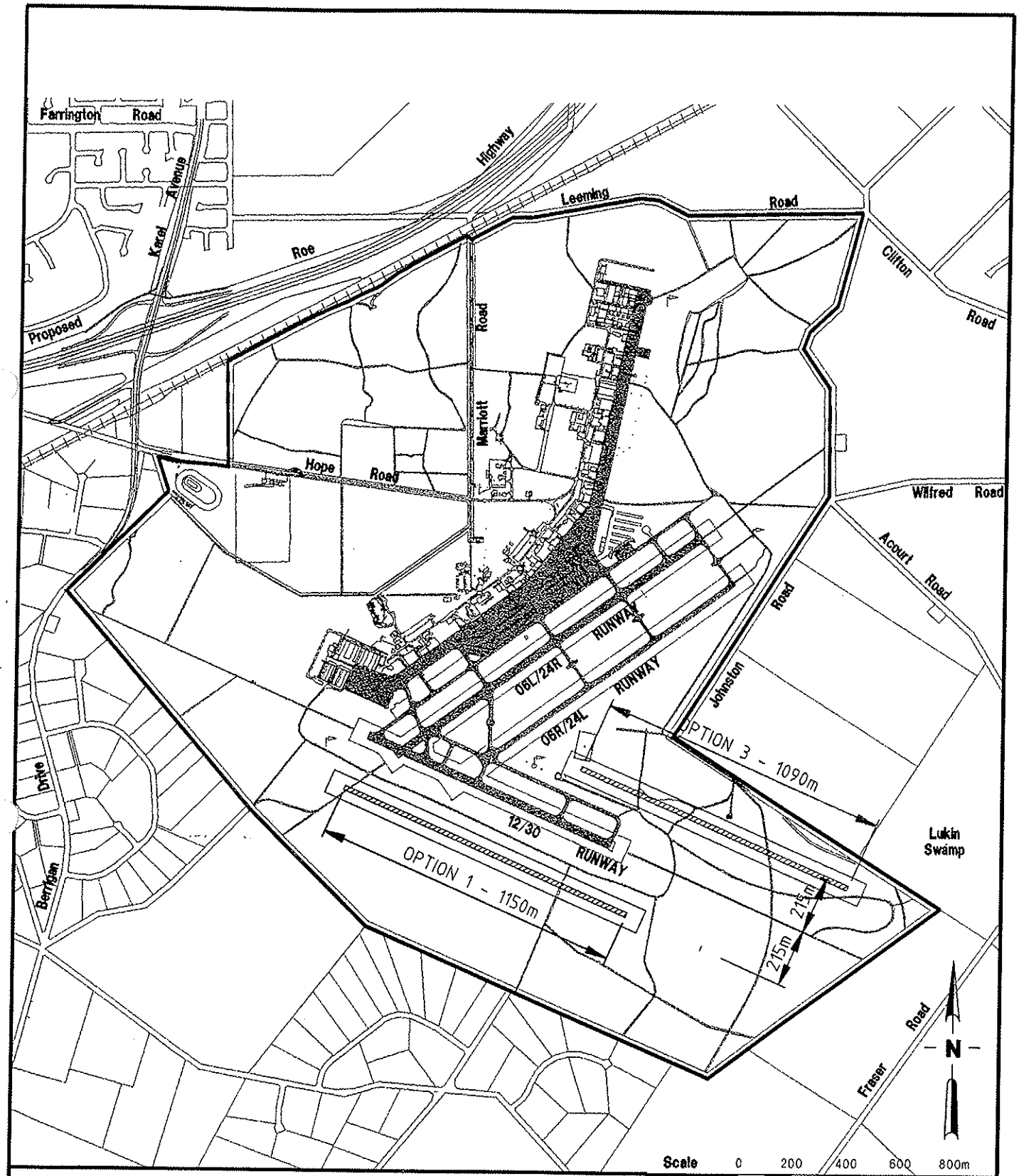
It is proposed to mitigate on-site potential impacts by:

- Identifying and prioritising areas within the airport precinct that have natural conservation value
- Optimal siting of development to minimise disturbance to areas identified as having high conservation value
- Developing and implementing Environmental Management Plans for various land use precincts

Management of Potential Environmental Impacts

Sites of High Conservation Priority

Identification of the high priority conservation areas within Perth International Airport with



Jandakot Airport
Alternative Concepts
Runway Locations
Options 1 & 3

Figure 5.2

regard to the natural environment and sites of indigenous importance is discussed in **Section 3.**

Of the 622 ha that constitutes Jandakot Airport, the ultimate development concept presented in the PDMP calls for approximately 272 ha to be used for aviation related activities, 148 ha to be developed for non-aviation commercial activities and 200 ha to be retained as conservation areas.

Of the approximately 400 ha of natural vegetation within Jandakot Airport, 60% has been classified as being of Level 1 importance, 15% of Level 2 importance and the remainder as Level 3. Areas of Level 1 importance will either be retained for conservation or developed for necessary aviation purposes. No areas of Level 1 importance will be cleared for non-aviation facilities.

Development within areas identified as being of Level 2 and Level 3 importance will be strictly controlled to ensure that natural bushland and damplands are preserved. Future planning of these areas will recognise "Best Practice" planning principles in retaining areas of natural bushland. Future development guidelines will encourage grouping of development to minimise the impacts on the areas.

Development has been sited to minimise the direct impact (ie clearing of land) on areas of high conservation priority. It is JAH's intent that these areas, where possible, will remain undeveloped and appropriate environmental management implemented.

Optimal siting of Development

Where possible, proposed development has been located outside areas identified as having high natural significance. It is JAH's intention to have such areas preserved and implement appropriate management to minimise disturbance.

The process involved in finalising the Jandakot Airport land use and layout plans included the consideration of a range of development options. The preferred option was developed based on the following criteria:

- Lowest aircraft noise external to the airport
- Conservation of significant bushland
- Operation benefit
- Capital Cost
- Safety

A range of development options was considered for Jandakot Airport.

Fourth Runway

Four options (1,2,2A and 3) were considered for the siting of the fourth runway. These include (see **Figures 5.2 and 5.3**):

- 'Do-nothing' option
- Option 1 – New parallel 12/30 runway (1150 m in length) south west of the existing 12/30 runway
- Option 2 – New parallel 12/30 runway (1150 m in length) south east of the existing 12/30 runway. Following discussions with stakeholders a sub-option 2A was developed. This variation is for a new parallel 12/30 runway (1390 m) in length south of the existing 12/30 runway
- Option 3 – New parallel 12/30 runway (1060 m in length) north of the existing 12/30 runway

This 'Do-nothing" option does not require development of Jandakot Airport but requires the development of another aerodrome with at least one runway aligned similarly to the 12/30 runway at Jandakot.

Option 3 is discarded on the basis of safety issues and high capital cost.

Options 1 and 2 are similar in most regards with Option 2 being marginally better in relation to aircraft noise.

Option 2A is also similar to Options 1 and 2 in relation to conservation, operational benefit and costs but is much better in relation to likely

noise impacts on the basis of the above evaluation.

For the purposes of this master plan option 2A will be adopted as the preferred location for the fourth runway.

Land Use and Environmental Management Plans

Within one year of approval of the environment strategy, draft environmental management plans will be prepared for each of the land use precincts shown in **Figure 5.4**, including the conservation precincts, land identified for essential aviation related development and land earmarked for potential commercial development. The plans will provide a systematic approach to land use and management of all peripheral land around Jandakot Airport outside the operational areas. The plans will be finalised and implemented during the 5-year life of this strategy.

Table 5.1 shows the four proposed precincts at Jandakot Airport and the management strategy proposed for these areas.

The areas already cleared will not be subject to any management of the natural environment other than that required for safety, aesthetic or weed control requirements.

The management plan for each precinct will be developed with consideration given to the proposed future uses of the land, as well as current or past uses. Each precinct has different management prescriptions based on their conservation value, current status, future development potential and special management requirements. All management plans will be prepared in consultation with the appropriate regulatory authorities.

Precinct 1 - Airport Movement Area and Facilities

The construction of the fourth runway, associated taxiways and expanded hangar facilities require the areas to be cleared, levelled and fully developed. There is little opportunity to mitigate the direct impacts on local flora. However:

The clearing for the proposed fourth runway will be kept to the minimum required for safety and fire prevention

- Strict obligations will be placed on developers regarding clearing procedures and the introduction of dieback and weeds to uncleared areas
- Areas of bush containing significant species will be retained where possible

Proposed aviation development such as the fourth runway and associated taxiways will occur within Priority 1 source protection area for Jandakot Groundwater Mound. As such, there may be the potential for hydrocarbon contamination of the groundwater.

In areas that may be sources of surface hydrocarbon contamination, runoff will be routed through oil/water separation pits before being allowed to soak into the ground. Such areas include all paved areas located within the Priority 1 Source Protection Area for the mound. Aircraft washdown bays will be situated away from the groundwater source protection area.

Precinct 2 – Conservation Areas

Precinct 2 consists of land within Priority Areas L1.1, L1.2, L1.3 and L1.4 with a Priority 2 Area (L2.2) as a corridor link between the last two priority areas. The area includes land from all Priority 1 areas and a significant section of Priority 1 source protection area for Jandakot Groundwater Mound.

Table 5.1: Proposed Precincts at Jandakot Airport

Development Precinct	Development Principles	Management Principles	Management Activities
1	Areas of essential infrastructure, such as runway, taxiways and support facilities, will be subject to separate environmental assessment, and will completely alter the current environment.	The areas destined for development of essential infrastructure at some future time will be subject to minimal management with progressive clearing/disturbance to encourage the translocation of faunal species to other areas.	Installation of monitoring bores upstream of public water supply bore (Number J150) Prepare development guidelines that clearly define design approach to prevent hydrocarbon contamination soaking into the ground above the Priority 1 Source Protection area for Jandakot Mound.
2	Areas of high natural value where the intent is to retain as much remnant vegetation as possible for conservation.	These areas will be the primary sites of conservation within Jandakot Airport and will be managed to maintain species diversity and remnant bushland wherever possible. These areas will receive first priority for fire protection; and weed, pest and disease control.	Preparation of Bush Fire Management Plans Preparation of Management Plans for the control of exotic species Tracks and trails which are not necessary for fire protection or other access purposes will be closed Management of dieback disease in order to prevent the further spread of the disease.
3a,b,c	Area to be developed for light and service industries, commercial/recreational activities and business park where conditions will be imposed for the developments to proceed only after environmental assessment.	The areas subject to development would be managed so that the developments are designed to minimise adverse impacts, to retain as much vegetation and habitat as feasible and to be in sympathy with the local environment.	Prepare development guidelines for commercial developers that clearly define approach to design of site layout, provision of buffers, retention of selected portions of uncleared sections of vegetation and large trees. Prevent dieback. Manage firebreaks.
4	Area to be developed as a drainage basin to accommodate increased storm water runoff from increased pavement.	Area will be subject to minimal management prior to development	Minimal management activities

The airport conservation areas will form part of a regional network of remnant vegetation including Banksia woodland. The airport lies immediately north of the northern end of the proposed Jandakot Botanical Park and borders the proposed Canning Vale Estate. Thus the southwest conservation area will provide continuity with areas of remnant vegetation to the south and east of the airport.

The area will be managed in accordance with the principle of minimum interference. Management plans will be developed to address issues such as weed control and fire management. However, the long term aim is that the vegetation within the conservation areas will be as close to its original natural state as possible and be able to sustain itself with minimal intervention. Access to the conservation areas will be restricted in order to maintain the ecological values of the bushland.

Non-aviation areas are most likely to be developed for light and service industries, commercial/recreational activities and as a business park estate.

Precinct 3a. Commercial/Recreational

Precinct 3a includes Priority 2 (L2.1) land and areas already developed as car race track and golf driving range. The Priority 2 area contains flooded gum woodland with a degraded and disturbed understorey. It is adjacent to the current commercial operations.

Future planning of this area should recognise "best practice" planning principles in retaining areas of significant vegetation. Future development guidelines will encourage grouping of development to minimise the impacts on these areas and reduce infrastructure costs.

Precinct 3b. Business Park

Precinct 3b consists of Priority L3.2 land that contains remnant Banksia woodland in good condition, but has no natural features that do not occur in other parts of the airport. There is cleared area and an adjacent railway and road that are ongoing sources of disturbance and weeds.

Precinct 3c. Light and Service Industrial Estate

Precinct 3c consists of land within Priority Area L3.1. It contains remnant Banksia woodland in good condition, but it contains no natural features that are not also found in other areas of the airport. There are several areas of severe disturbance.

Development will proceed in accordance with the broad principles expressed above (ie retain as much vegetation as feasible, to sympathetically develop the area, provide landscaping using species native to the airport).

Precinct 4 – Drainage Basin

A drainage basin exists in the northwest corner of the airport. Currently this rarely holds any water, and then for brief periods of time before the water soaks away.

The proposed airport development increases the area likely to be made impervious due to the construction of airfield movement areas, roads, car parks and buildings. The existing drainage basin will be relocated clear of future aviation developments. The drainage basin will cater for the increased storm water runoff.

Section 6

Environmental Management System

An Environmental Management Plan was developed and implemented for the airport by the previous owner, the Federal Airports Corporation in 1995. This document has been adopted by JAH and will continue to be used as the interim document prior to the implementation of the proposed Environmental Management System (EMS). The EMS will incorporate and refine existing policies, systems and plans from the EMP to ensure a smooth transition from the old to the new.

The proposed EMS will provide the management, administrative and monitoring framework to ensure that JAH has a sound approach to the environment and that its environmental policy together with associated objectives and targets are achieved. Elements of the EMS, based on the ISO 14000 series, will comprise:

- Implementation of the Environmental Policy
- Planning that includes evaluation of relevant regulatory framework, setting objectives and targets to manage potentially significant impacts, establishing and maintaining a management programme
- Implementation of environmental management by development of capabilities and support mechanisms to achieve the objectives and targets of the environmental policy. These mechanisms include organisational structure and responsibilities, training, communication, documentation, identification and planning of activities associated with significant environmental aspects, and emergency response and preparedness
- Monitoring operations and activities that have the potential to have a significant impact on the environment. This includes the identification and investigation of any nonconformance, and implementation of corrective and preventative action
- Management of environmental records and documents
- Regular reviews and audits of the Environmental Management System

The objective in developing the EMS is to support the overall goal of the Environment Strategy that is to "achieve environmental health of the airport by protecting areas of environmental significance, while maintaining the economic and social development of the airport.

Environmental Policy

JAH's Environment Policy is shown in the front of this document. The EMS is being developed in the spirit of the policy.

Environmental Objectives

The environmental objectives are shown in Section 3. These objectives will be adopted by JAH and used as the basis of the EMS.

The FAC Environmental Management Plan (EMP) will be reviewed an incorporated into the EMS. Individual EMPs will be developed for al airport activities that affect or have the potential to affect the environment at the airport.

Management and Responsibility

The implementation of environment policy requires a clearly defined delegation of responsibilities, accountabilities and authorities. Position descriptions will be reviewed and updated to include a definition of the general environmental responsibilities of each position.

JAH management and staff will have specific responsibilities and duties. The primary responsibility for implementation of JAH's Environment Policy and Environmental Management System rests with the Managing Director. The Operations and Technical Manager will continue with the role as the Environment Manager and will perform the day to day operations to ensure compliance with the EMS and applicable legislation. Suitably qualified environmental personnel will be appointed to assist with the development, implementation and maintenance of the EMS.

The Airport Environmental Officer (AEO) employed by the Department of Transport and Regional Services will be consulted and appraised of the operations of the airport. The AEO will ensure compliance with the EMS and all relevant State and Federal laws.

Tenants

Each airport tenant will be required to appoint their own Environmental Delegate. JAH will liaise with the delegates to ensure that:

- Tenants are aware of their environmental obligations at the airport
- Tenants have in place an Environmental Policy and procedures. Tenants whose activities have the potential to cause environmental harm, such as fuel companies, will be encouraged to have a JAH approved environmental management system

Contractors and Tenant Contractors

Contractors working within the airport are required to comply with JAH Environment Policy. Contractors performing major works or works with the potential to cause environmental harm may be required to prepare an Environmental Management Plan for their works.

Contractors will be subject to regular audits by JAH for compliance with their Environmental Management Plan and good environmental practice.

Environmental Management Teams and Committees

An airport environment and ground safety committee will be formulated which will comprise the AEO, JAH environmental representatives and tenant environmental delegates. The committee will meet quarterly to discuss environmental and ground safety issues at the airport.

Training and Awareness

Successful environmental management depends upon the commitment of JAH's employees; however, unless they are provided with proper training and are aware of their environmental responsibilities, the system may fail. All JAH personnel will be provided with awareness training with respect to JAH's Environment Policy, Environment Strategy and the EMS. Furthermore, all JAH personnel required to undertake specific activities for the purpose of preventing potential environmental accidents and incidents will receive appropriate technical training. Appropriate JAH personnel will be trained on how to assess environmental hazards and to be able to take action to prevent or reduce environmental harm.

All tenant environmental delegates will be made aware of their obligations for compliance with the JAH Environment Policy and the EMS. All airport users will be made aware of the approved Environment Strategy.

Reporting

The EMS will require that the Environment Manager submit monthly and annual environmental reports to the AEO.

The monthly environmental report will include the following:

- Environmental incidents/accidents from the previous month
- Overview of results of environmental monitoring programmes
- New/amended legislation or guidelines
- Current status of environmental projects
- Details of environmental studies commissioned during the past month
- Requirement for future capital or recurrent funding to address environmental deficiencies
- A summary of the findings of recently completed environmental studies

The annual report will contain the following:

- Summary of environmental incidents/accidents over the past year and analysis of trends
- Overview of results of environmental monitoring programmes and a review of their effectiveness
- New/amended legislation or guidelines and assessment of environmental trends
- Progress on environmental projects over the last year
- Progress reporting on environmental improvement plans in relation to targets set
- Environmental training of staff undertaken in relation to targets set in the environment strategy
- Environmental awareness initiatives undertaken over the past year
- Summary of any environmental studies undertaken over the past year
- Requirements for future capital or recurrent funding to address environmental deficiencies

Contingency Plans

Contingency Plans will be reviewed for all airport operations that have the potential to cause serious environmental harm. This applies to operations controlled by JAH, tenants or contractors.

Relevant staff will be trained on contingency plans in case of an emergency.

Audits and Corrective Action

Programmed and random audits and monitoring programmes will be conducted by the AEO. Where the AEO identifies non compliance, the AEO will notify JAH.

Pollution Monitoring Programmes

Details of proposed monitoring to be conducted within the airport are presented in **Table 4.2.**

It is proposed to install a ground water monitoring bore upstream of the Water Corporation's production bore number J150.

Baseline monitoring of flora and fauna will be undertaken as part of the approval process for any major development at the airport that requires the clearing of native vegetation.

Ongoing Review

The EMS will be subjected to ongoing annual review to ensure its continuing suitability, adequacy and effectiveness. The EMS will be adapted to accommodate operational changes at the airport, new airport developments and changing or new legislation.

The review will also compare actual performance against objectives to determine if the EMS is resulting in improvement of environmental performance.

Executive Summary

The Draft Environment Strategy

On 1 July 1998, the Commonwealth Government of Australia sold a 50 year lease over Jandakot Airport to Jandakot Airport Holdings Pty Ltd with an option for a 49 year lease extension.

Under the terms of the lease agreement, JAH is required to prepare a preliminary Draft Master Plan (PDMP) and Environment Strategy (PDES) within 12 months of the commencement of the lease.

This PDES is the policy framework to guide the management of environmental impacts due to operations at Jandakot Airport for the next five years.

The strategy has been prepared in accordance with the Airports Act 1996 and Airports (Environment Protection) Regulations which were created to govern the development and operations of Commonwealth airports leased to private organisations. It is the basis upon which the Commonwealth will measure the environmental performance of JAH and is the document by which airport users will determine their environmental responsibilities.

This PDES is being released for public review and comment for a period of 90 days. The final draft version of the strategy will be submitted to the Minister for Transport and Regional Services for approval.

Environmental Management Approach

JAH recognises its responsibility to maintain and protect the quality of the environment in and around its operations. The foundation of environmental management at the airport will be the implementation of an Environmental Management System based on ISO 14001 series that will be subject to continual improvement. Specific environmental management plans will be developed to manage each aspect of the environment that is currently or has the future potential to be affected by airport operations. The environmental management system developed to address current pollution is designed to identify and rectify non-compliance well within the five year strategy period.

Existing Environment

Jandakot Airport which is located approximately 18 km south of the Perth City Centre, covers a total area of 622 ha.

Jandakot Airport and its surrounding areas form part of the Swan Coastal Plain and is located within the Bassendean Dunes. These relatively flat dunes consist mostly of poor, grey sands, and generally sustain a low scrub with Banksia species dominant. Much of the Banksia woodland is in a relatively undisturbed state. The vegetation at the airport is widely regarded as being one of the best-preserved areas of Banksia woodland remaining in the southern Perth region and is on the Interim List of the Register of the National Estate. However, the Banksia woodland at Jandakot Airport represents only a small percentage of the total Banksia woodland resource in the general Jandakot area, some of which has been included in the proposed Jandakot Botanical Park

The airport is situated on the northern margin of the Jandakot Groundwater Mound which is a public water supply resource for the Perth region.

Areas within Jandakot Airport have been assigned a Level of Importance rating from 1 (highest) to 3 (lowest) in relation to retention of areas for conservation purposes. A rating of Level 1 is assigned to areas with slightly disturbed vegetation, with a variety of habitats and a rich flora and fauna, or with a richness of dampland habitats. Areas of slightly to moderately disturbed vegetation with a smaller variety of flora and fauna, or with no unique natural features are designated as Level 2. Level 3 areas include all other remaining natural vegetation.

It is the intent of JAH that as much of the Level 1 remnant vegetation on Jandakot Airport as feasible be conserved. This will be achieved through the creation of distinct conservation areas. Approximately 32% of the land within the airport will be retained in its natural state. These areas will receive first priority for fire protection; and weed, pest and disease control.

Areas of natural vegetation subject to non-aviation development will be managed so that the developments are designed to minimise adverse impacts, to retain as much vegetation and habitat as feasible and so be in sympathy with the local environment.

Environmental Management Plans will be proposed for various land use precincts. The plans will be developed with consideration given to the proposed future uses of the land, as well as current or past uses.

Consultation Process

The Airport Act 1996 (the Act) specifies that a full consultation programme is required prior to submission of the draft Environment Strategy to the Minister. This should include (as a minimum):

- Newspaper advertisements
- Circulation of draft plans for inspection and/or purchase
- 90 day comment period
- Summary of how comments have addressed

To encourage the participation of a wide range of stakeholders, three workshops were held in January 1999. Each of these focussed on organisations with similar interests.

Environmental Impacts from Current Operations and Proposed Management

In 1997 the then owners of the airport, Federal Airports Corporation, conducted an environmental review of past and present operations on site. The findings of this review have been used to assess the potential impacts associated with tenant and JAH operations.

Jandakot Airport has operated since 1963 and currently has three runways. Approximately 100 businesses operate within the boundary of the airport. The majority of these businesses are associated with the aviation industry including refuelling depots, maintenance services, training schools, and aircraft supplies. The non-aviation businesses include a golf driving range, speedway and food supplier.

A range of operations and work practices at the airport have the potential to impact on the environment. These include:

- Fuel and oil storage (including fuel tanks, waste oil tanks, drums and containers)
- Fuel and oil usage
- Chemical storage and usage
- Domestic wastewater production
- Aircraft washdown
- Landfilling and solid waste disposal
- Fire control
- Painting stripping and spraying
- Aircraft ground movement.

Management plans will be developed and implemented to control the risk associated with each of the above work practices.

Environmental Impacts from Future Development and Proposed Management

JAH's mission statement for Jandakot Airport is to manage, maintain and develop the airport in a safe and environmentally sustainable manner in order to enhance the economic vitality and community service needs of Western Australia. The vision will be achieved through the creation of new business opportunities and the development of a high standard of airport facilities.

The principal development proposals are:

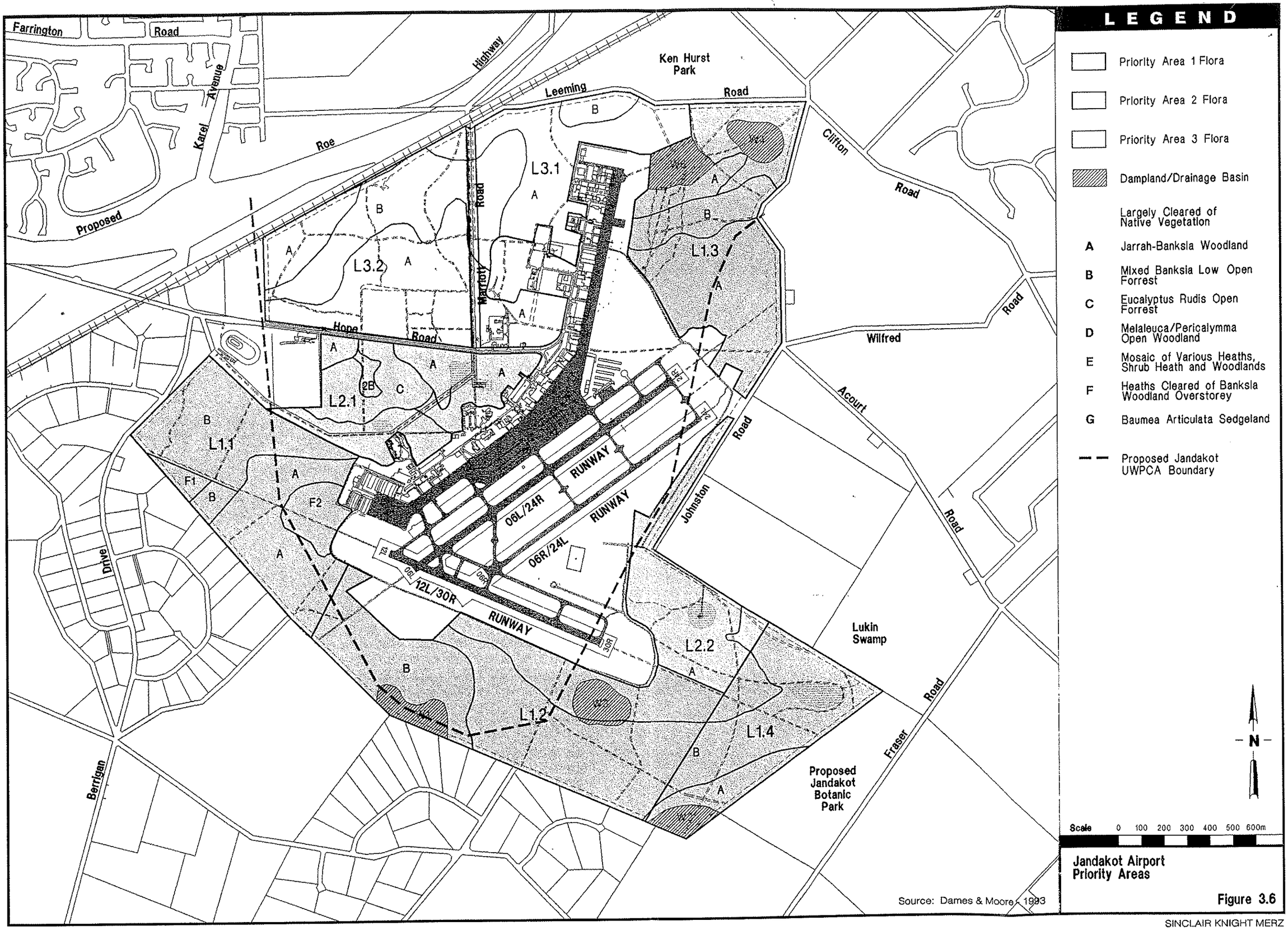
- Extension of operational building areas towards the north-eastern and south-western sectors of the airport
- Provision of a fourth runway and associated improvements to the taxiway system
- Development of non-aviation areas for light and service industries, commercial/ recreational activities and as a Business Park Estate

Primary on-site impacts resulting from the proposed development at Jandakot Airport are vegetation clearance and the subsequent loss of floral and fauna habitat. The major off-site impacts are noise-related due to flight operations which are not covered within this PDES.

Much of the proposed development, for example the fourth runway, is forecast not to be required until well beyond the five year period addressed in the PDES. However, the period prior to development provides an opportunity to undertake baseline studies and to implement environmental management to minimise the impacts on the environment.

It is proposed to manage potential on-site impacts by:

- Identifying areas within the airport precinct that have conservation value
- Optimal siting of development to minimise disturbance to areas identified as having high conservation value
- Developing and implementing Environmental Management Plans for various land use categories.

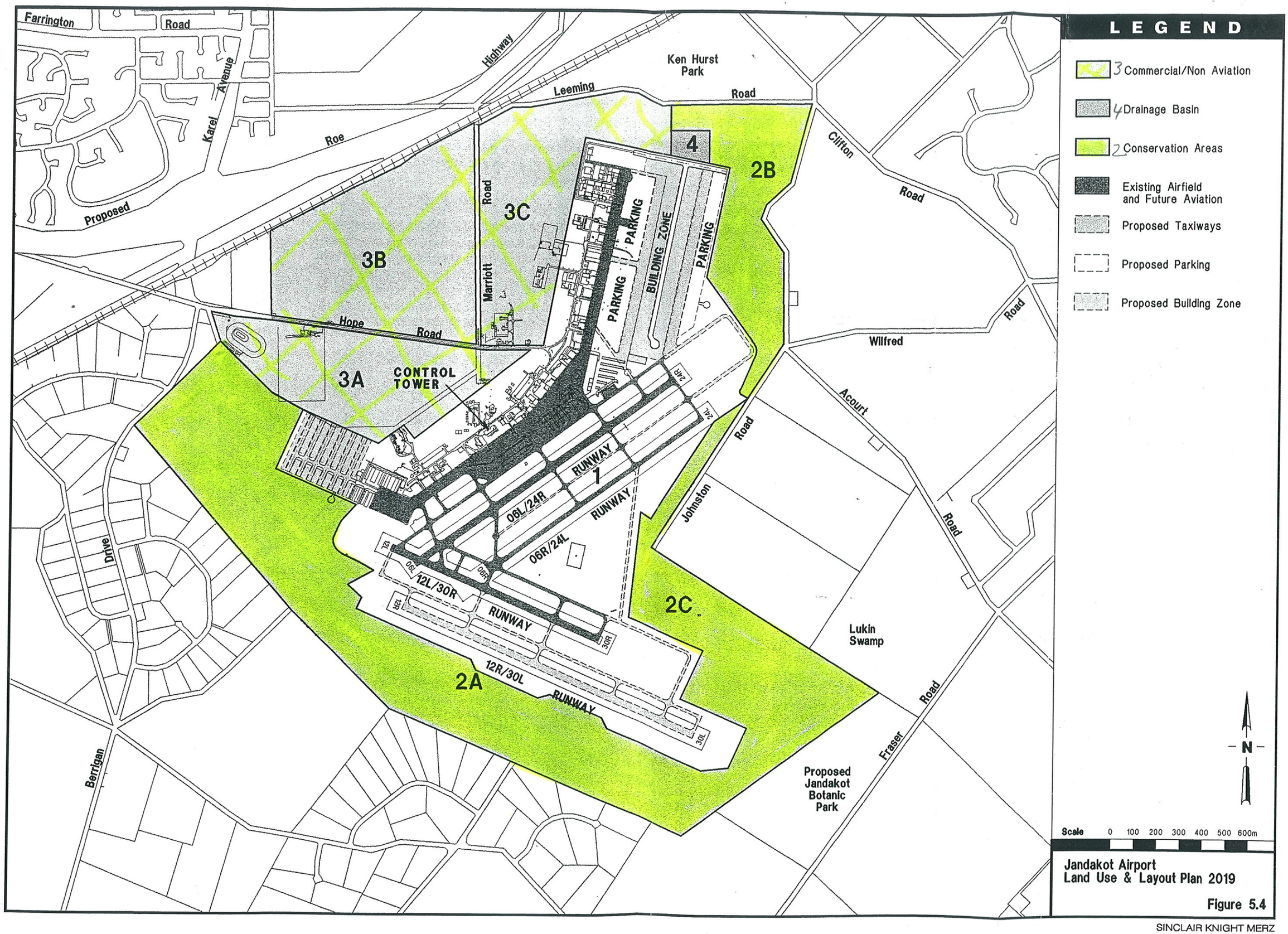


Source: Dames & Moore 1993

Jandakot Airport Priority Areas

Figure 3.6

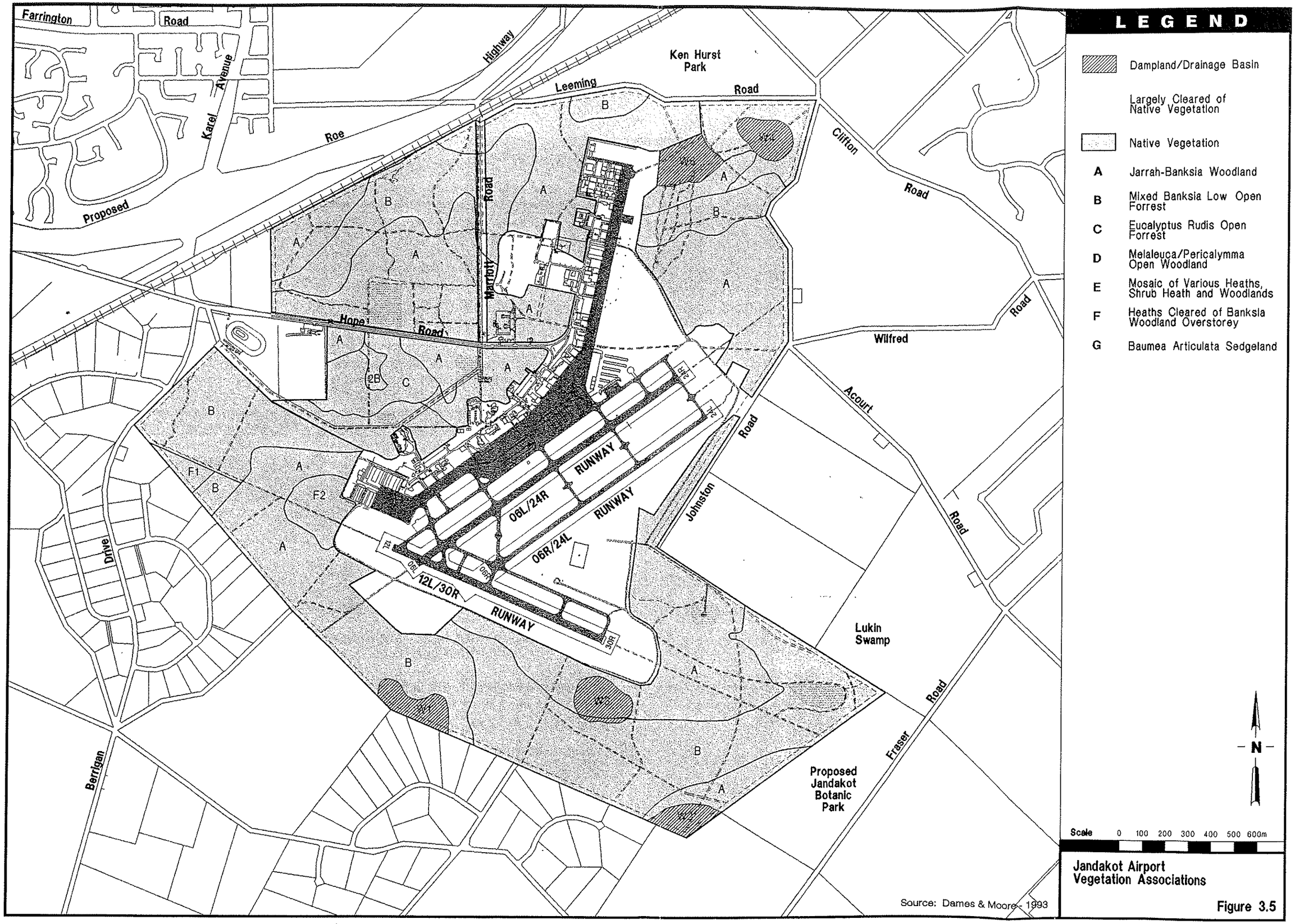
SINCLAIR KNIGHT MERZ



Jandakot Airport
Land Use & Layout Plan 2019

Figure 5.4

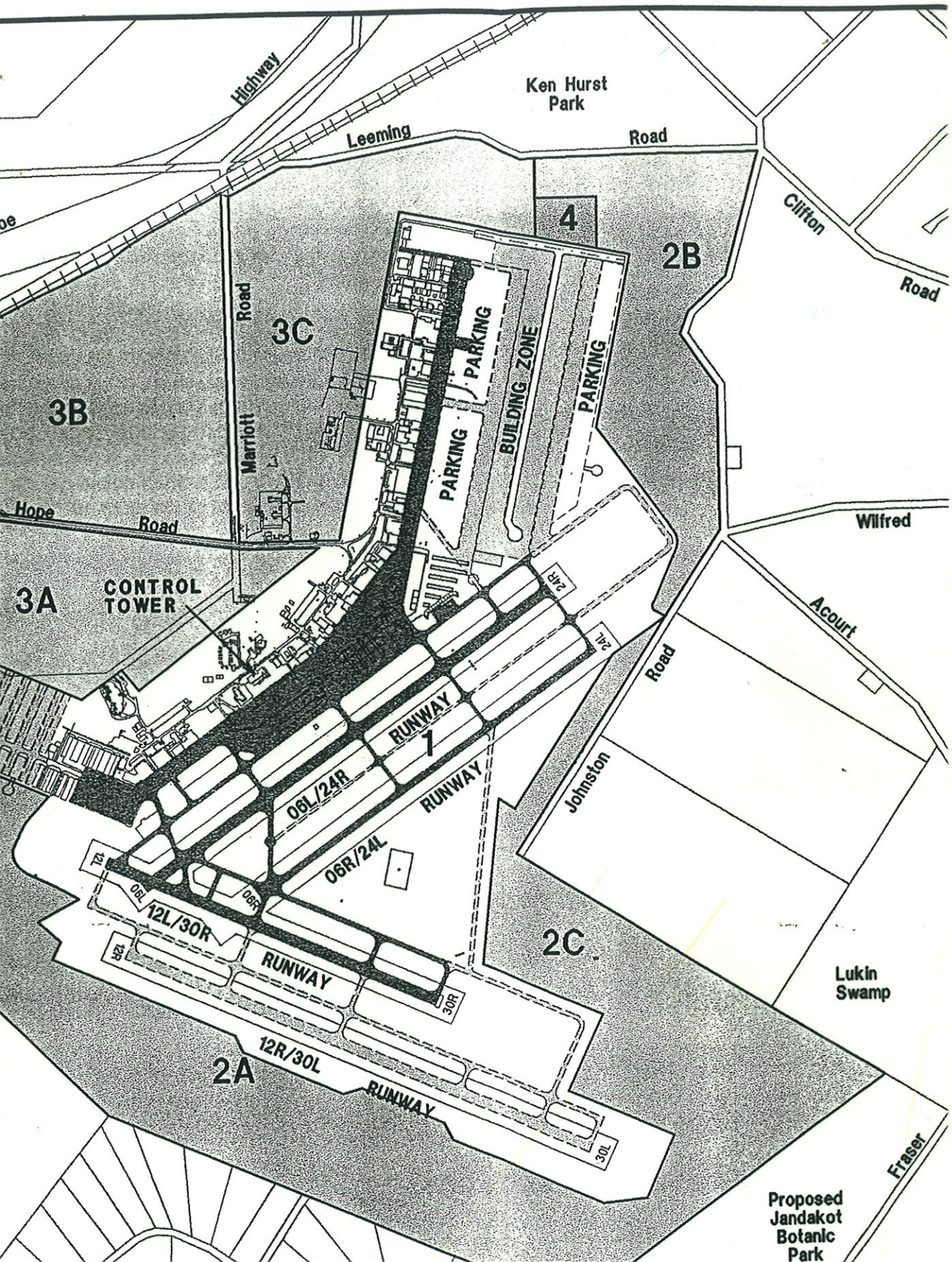
SINCLAIR KNIGHT MERZ

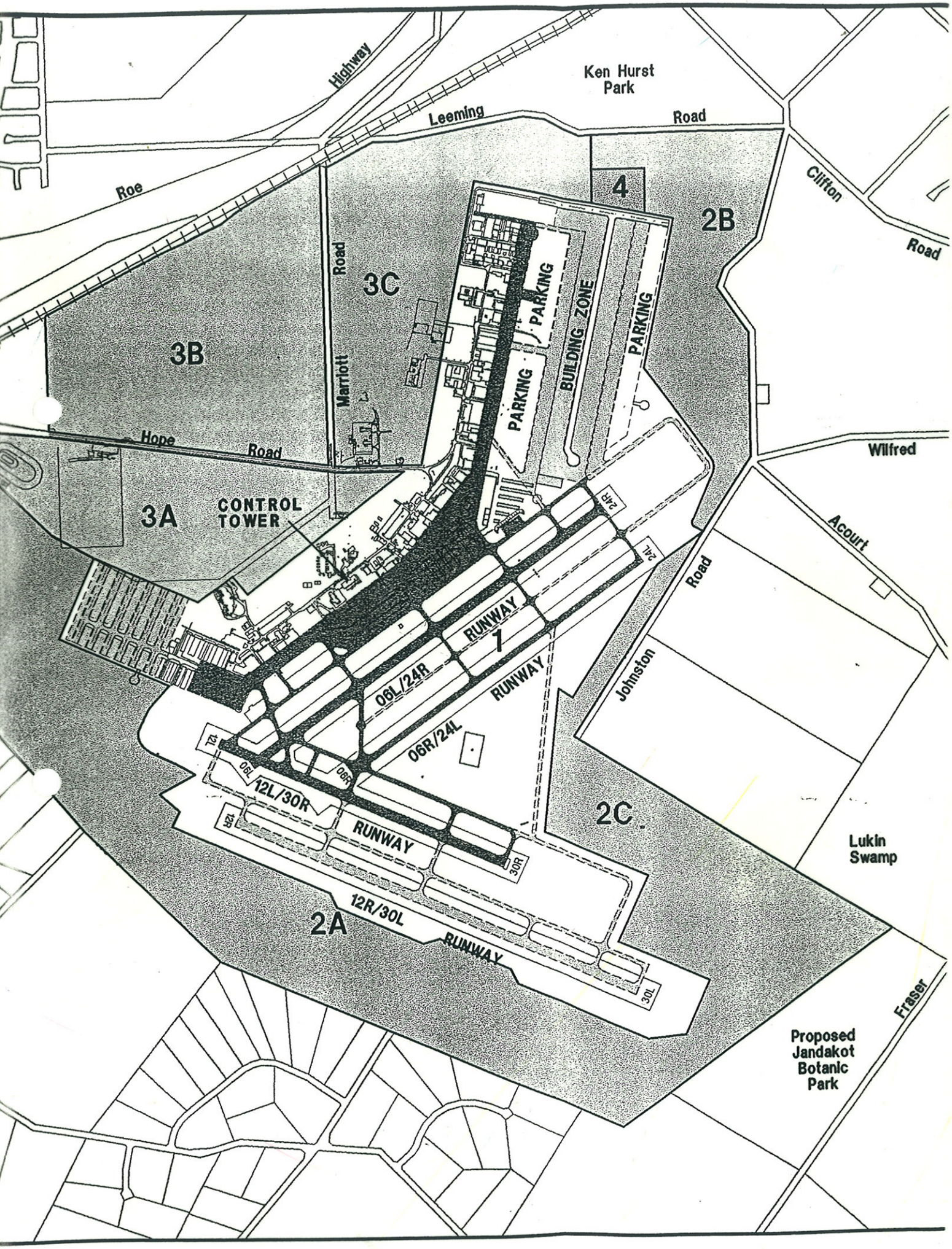


Jandakot Airport
Vegetation Associations

Figure 3.5

SINCLAIR KNIGHT MERZ


Highway
Ken Hurst Park
Leeming
Road
4
2B
Clifton
Road
3C
Road
Marriott
3B
PARKING
PARKING
BUILDING ZONE
PARKING
Hope
Road
Wilfred
3A
CONTROL TOWER
24R
24L
Acourt
Road
RUNWAY
1
06L/24R
RUNWAY
Johnston
06R/24L
12L
06L
06R
12L/30R
12R
RUNWAY
2C
Lukin Swamp
30R
12R/30L
2A
RUNWAY
30L
Fraser
Proposed Jandakot Botanic Park


Highway
Ken Hurst Park
Leeming
Road
Roe
4
2B
Clifton
Road
3C
Road
3B
Marriott
PARKING
PARKING
BUILDING ZONE
PARKING
Hope
Road
Wilfred
3A
CONTROL TOWER
24R
24L
Acourt
Road
RUNWAY
1
06L/24R
RUNWAY
06R/24L
Johnston
12L/30R
RUNWAY
2C
Lukin Swamp
12R/30L
RUNWAY
2A
Fraser
Proposed Jandakot Botanic Park

M94
·2

ファイル

DRAFT ENVIRONMENTAL IMPACT STATEMENT

Proposed Additional Developments at Jandakot Airport

Federal Airports Corporation

DAMES & MOO

APRIL 19

172/79

LIBRARY
DEPARTMENT OF ENVIRONMENTAL PROTECTION
WESTRALIA SQUARE
141 ST. GEORGE'S TERRACE, PERTH

DRAFT ENVIRONMENTAL IMPACT STATEMENT
PROPOSED ADDITIONAL DEVELOPMENTS
AT JANDAKOT AIRPORT

for

Federal Airports Corporation

BS 388
JANDAKOT
BASS S

Dames & Moore Job No. 18534-011-363

April 1993

TABLE OF CONTENTS

		Page No.
1.0	INTRODUCTION	1
1.1	BACKGROUND	1
1.2	LOCATION OF THE PROJECT AREA	1
1.3	THE PROPONENT	1
1.4	HISTORY OF THE PROPOSAL	2
1.5	DEFINITION AND OBJECTIVES OF THE PROPOSAL	2
1.5.1	Additional Aviation Facilities	3
1.5.2	Silica Sand Extraction	3
1.5.3	Commercial Estate	3
1.5.4	Conservation Areas	4
1.6	STATUTORY REQUIREMENTS	4
1.7	THE ENVIRONMENTAL ASSESSMENT PROCESS	6
2.0	NEED FOR THE PROPOSAL	7
2.1	FINANCIAL SELF-SUFFICIENCY	7
2.2	AVIATION FACILITIES	7
2.2.1	Movement Areas	9
2.2.2	Other Aviation Facilities	12
2.3	SILICA SAND EXTRACTION OPERATION	13
2.3.1	Optimum Siting of Proposed Parallel 12/30 Runway	13
2.3.2	Continuation of Silica Sand Export	13
2.3.3	Basic Raw Materials Resource Protection Strategy	14
2.4	COMMERCIAL ESTATE	15
2.5	CONSERVATION AREAS	17
3.0	EVALUATION OF ALTERNATIVES	19
3.1	ALTERNATIVE AIRPORT SITES	19
3.2	ALTERNATIVE USES FOR THE JANDAKOT AIRPORT LAND	20
3.2.1	Nutrient Inputs from Various Land Uses	21
3.3	ALTERNATIVE DEVELOPMENT SCENARIOS	22
3.4	ALTERNATIVE LAYOUTS FOR DEVELOPMENT	23
3.5	THE "NO-ACTION" ALTERNATIVE	25

3.6	REASONS FOR SELECTION OF PREFERRED ALTERNATIVE		26
3.7	COST-BENEFIT ANALYSIS		26
	3.7.1	Financial Costs/Benefits	26
	3.7.2	Environmental Costs/Benefits	29
	3.7.3	Social Costs/Benefits	30
4.0	DESCRIPTION OF THE PROPOSAL		33
4.1	DEVELOPMENT STRATEGY		33
	4.1.1	Aviation Facilities	33
		4.1.1.1 Proposed Parallel 12/30 Runway	33
		4.1.1.2 Other Aviation Facilities	34
		4.1.1.3 Roads	34
	4.1.2	Sand Extraction Operation	34
		4.1.2.1 Introduction	34
		4.1.2.2 Extraction Method	35
	4.1.3	Commercial Estate	36
		4.1.3.1 Introduction	36
		4.1.3.2 Zones	36
		4.1.3.3 Development Strategy	38
		4.1.3.4 Staging of Development	39
	4.1.4	Conservation Areas	39
4.2	INFRASTRUCTURE		40
	4.2.1	Power and Gas Supply	40
	4.2.2	Water Supply	41
	4.2.3	Telecommunications	41
	4.2.4	Drainage	42
	4.2.5	Sewerage	42
	4.2.6	Waste Treatment and Disposal	43
	4.2.7	Fuelling Facilities	43
	4.2.8	Washdown Bays	43
4.3	CONSTRUCTION		44
	4.3.1	Standards, Techniques and Site Management	44
	4.3.2	Material Requirements and Sources	44
	4.3.3	Transport and Storage of Materials	45
		4.3.3.1 General	45
		4.3.3.2 Potential Contaminants	45

	4.3.4	Size and Source of Construction Workforce	45
	4.3.5	Temporary Facilities for Workers	46
	4.3.6	Disposal of Construction Wastes	46
	4.3.7	Pollution Control	46
4.4		TOTAL LAND AREA REQUIRED	47
	4.4.1	Aviation Facilities	47
	4.4.2	Silica Sand Extraction	47
	4.4.3	Commercial Estate	47
	4.4.4	Conservation Areas	48
4.5		TERRAIN ALTERATIONS REQUIRED	48
	4.5.1	Aviation Facilities	48
	4.5.2	Silica Sand Extraction	48
	4.5.3	Commercial Estate	48
	4.5.4	Conservation Areas	49
4.6		ACCESS FOR CONSTRUCTION WORKERS	49
4.7		EXCLUSION AREAS	49
4.8		BUFFER ZONES	49
	4.8.1	Aviation Activities	49
	4.8.2	Silica Sand Extraction	50
	4.8.3	Commercial Estate	50
4.9		TIME SCHEDULE	51
	4.9.1	Timing of Developments	51
5.0		PHYSICAL ENVIRONMENT	53
5.1		REGIONAL SETTING	53
5.2		GEOLOGY AND GEOMORPHOLOGY	53
5.3		TOPOGRAPHY	54
5.4		SOILS	54
	5.4.1	Jandakot Soil Type	55
	5.4.2	Joel Soil Type	55
5.5		CLIMATE	56
	5.5.1	Introduction	56
	5.5.2	Wind Speed and Direction	56
	5.5.3	Temperature and Humidity	57
	5.5.4	Rainfall	57
5.6		SURFACE HYDROLOGY	57

5.7 HYDROGEOLOGY 58
5.7.1 Regional Hydrogeology 58
5.7.2 Local Hydrogeology 60
5.7.3 Public Water Resources 61
5.8 LAND CAPABILITY 63
5.8.1 Classification 63
5.8.2 Erosion Potential 64
5.8.3 Compactability and Drainage 66

6.0 BIOLOGICAL ENVIRONMENT 67
6.1 VEGETATION 67
6.1.1 Plant Communities 67
6.1.2 Flora 68
6.1.3 Rare Flora 68
6.2 FAUNA 70
6.2.1 General 70
6.2.2 Fauna Recorded or Expected 70
6.3 SIGNIFICANT HABITATS 72
6.3.1 REMNANT BUSHLAND 73
6.3.1.1 Introduction 73
6.3.1.2 Banksia Woodland on the Swan Coastal Plain 74
6.3.1.3 Banksia Woodland in the Jandakot Area 76
6.3.1.4 Value as Bushland 77
6.3.2 Wetlands 78
6.3.2.1 Assessment of Wetland Values 79
6.3.3 Significant Habitats for Biological and Research Purposes 80
6.3.4 Conservation Areas and Values 81
6.3.5 Register of the National Estate 83
6.3.6 Jandakot Botanical Park 84
6.4 THE ROLE OF FIRE 87
6.5 CURRENT MANAGEMENT PRACTICES 87

7.0 SOCIO-ECONOMIC ENVIRONMENT 89

7.1 REGIONAL SETTING 89

7.2 LAND USE, ZONING AND PROPOSALS FOR FUTURE USE 89

7.2.1 Urban Residential Development 90

7.2.1.1 Leeming 90

7.2.1.2 South Lake 90

7.2.1.3 Livingston Estate 90

7.2.1.4 City of Canning - Future Developments 90

7.2.2 Special Rural/Rural-Residential 90

7.2.2.1 City of Cockburn 91

7.2.2.2 City of Canning 91

7.2.3 Rural/Quarrying 91

7.2.4 Industrial/Commercial 92

7.2.5 Public/Special Purposes 92

7.2.6 Recreation and Leisure 92

7.3 SOCIO-ECONOMIC STRUCTURE 93

7.3.1 Demographic Profile 93

7.3.1.1 Area A - South Lake/Bibra Lake 93

7.3.1.2 Area B - Leeming 94

7.3.1.3 Area C - Canning Vale 94

7.3.1.4 Area D - Jandakot 94

7.3.2 Demographic Predictions 94

7.4 SERVICES, FACILITIES AND INFRASTRUCTURE 95

7.4.1 Local and Regional Transport System 96

7.4.1.1 Regional and Local Road Access 96

7.4.1.2 Kewdale - Kwinana Standard Gauge Railway 97

7.4.1.3 Traffic Volumes 97

7.4.1.4 Public Transport 98

7.4.2 Education 98

7.4.3 Health 99

7.4.4 Recreation Facilities 99

7.4.4.1 Ken Hurst Park 100

7.4.5 Retail Outlets 100

7.5 COMMUNITY LIFESTYLES 101

7.6 ABORIGINAL HERITAGE 101
7.6.1 Ethnography and Archaeology 101
7.6.2 Aboriginal Community Liaison 103
7.7 EUROPEAN HERITAGE 104
7.8 LANDSCAPE AND VISUAL QUALITIES 104

8.0 IMPACTS ON THE PHYSICAL AND BIOLOGICAL ENVIRONMENTS 105
8.1 IMPACTS ON SOIL, LANDSCAPE AND VIEWSCAPE 105
8.2 IMPACTS ON AIR QUALITY 105
8.2.1 Atmospheric Emissions and Odours 105
8.2.2 Dust 107
8.3 NOISE 108
8.3.1 The Australian Noise Exposure Forecast System 108
8.3.2 Noise Exposure Threshold Levels 109
8.3.3 Public Response to Aircraft Noise 110
8.3.4 Jandakot Aircraft Noise Complaints 111
8.3.5 Jandakot Airport Noise Modelling 113
8.4 IMPACTS ON SURFACE WATER 116
8.5 IMPACTS ON GROUNDWATER 116
8.5.1 Groundwater Flow and Levels 117
8.5.2 Groundwater Quality 117
8.5.2.1 Fuel Storage 119
8.5.2.2 Solvents 120
8.6 BIOLOGICAL IMPACTS 120
8.6.1 Impacts on Flora 120
8.6.1.1 Vegetation Associations 120
8.6.1.2 Rare and Significant Flora 121
8.6.1.3 Dieback Disease 121
8.6.1.4 Weeds 122
8.6.2 Impacts on Fauna 122
8.6.2.1 General 122
8.6.2.2 Rare Fauna 123
8.6.2.3 Introduced and Feral Animals 124
8.6.3 Impacts on wetlands 124

9.0 MANAGEMENT AND MONITORING OF THE PHYSICAL AND BIOLOGICAL ENVIRONMENTS 125

9.1 SOIL, LANDSCAPE AND VIEWSCAPE 125

9.1.1 Erosion Control 125

9.1.2 Landscape and Viewscape 125

9.2 AIR QUALITY 126

9.2.1 Atmospheric Emissions and Odours 126

9.2.2 Dust 126

9.2.3 Noise 126

9.2.3.1 Aircraft Noise 126

9.2.3.2 Response to Noise Complaints 128

9.2.3.3 Ground Running of Aircraft 129

9.2.3.4 Other Noise 129

9.3 SURFACE WATER 129

9.4 GROUNDWATER 130

9.4.1 Groundwater Recharge and Abstraction 130

9.4.2 Groundwater Quality and Contamination 130

9.4.3 Specific Groundwater Protection Measures 131

9.4.3.1 Fuel Storage Facilities 131

9.4.3.2 Aircraft and Vehicle Washdown Bays 131

9.4.3.3 Aircraft Maintenance Facilities 132

9.4.3.4 Paint Stripping Facility 132

9.4.3.5 FAC Maintenance Compound 132

9.4.3.6 Hazardous Materials 133

9.4.3.7 Waste Disposal 133

9.4.3.8 Accidental Spills 133

9.4.4 Protection of the Jandakot Mound 134

9.5 FLORA AND FAUNA 134

9.5.1 Vegetation Clearing 134

9.5.2 Conservation Areas 135

9.5.2.1 Management 135

9.5.2.2 Access 135

9.5.2.3 Relationship to Nearby Conservation Areas 135

9.5.3 Protection of Damplands 136

9.5.4 Dieback and Weeds 137

9.5.5 Education of Workforce 138

10.0 IMPACTS AND MANAGEMENT IN THE SOCIO-ECONOMIC ENVIRONMENT 139
10.1 POTENTIAL SOCIAL IMPACTS 139
10.2 DISTURBANCE 139
10.2.1 Noise 139
10.2.2 Other Disturbance 140
10.3 PUBLIC RISK 140
10.3.1 Introduction 140
10.3.2 Fatalities Resulting From Australian Aviation 142
10.3.3 Involuntary Public Risk at Jandakot Airport 143
10.3.4 Public Risk Management 144
10.4 ECONOMIC IMPACTS 145
10.4.1 Direct Impacts 145
10.4.2 Indirect Impacts 146
10.4.3 Induced Impacts 146
10.4.4 Multipliers 146
10.4.5 Future Projections 147
10.5 EMPLOYMENT 148
10.5.1 Present Workforce 148
10.5.2 Future Employment 149
10.5.3 Employment Multiplier Effects 149
10.6 HEALTH 150
10.7 RECREATION 151
10.8 VISUAL AMENITY 151
10.9 LAND USE 151
10.10 ABORIGINAL HERITAGE SITES 152
10.11 SERVICES, FACILITIES AND INFRASTRUCTURE 152
10.11.1 Traffic Volumes 152
10.11.2 Access/Road Construction 152
10.11.3 Education 153
10.11.4 Health Services 153
10.12 PUBLIC CONSULTATION PROGRAMME 153
10.12.1 Introduction 153
10.12.2 Public Concerns 155
10.12.3 Future Public Consultation 156

10.13 INTEGRATION OF THE DEVELOPMENT WITH SURROUNDING LAND USES 157
10.13.1 Industrial and Commercial 157
10.13.2 Residential and Special Rural 158

11.0 COMMITMENTS 159
11.1 DEVELOPMENT CONTROLS 159
11.2 GROUNDWATER PROTECTION 160
11.3 ENVIRONMENTAL PROTECTION 162
11.4 PUBLIC AMENITY 163
11.5 SOCIO-ECONOMIC COMMITMENTS 163

12.0 CONCLUSION 165

13.0 REFERENCES 167

14.0 GLOSSARY 177

APPENDIX D

VEGETATION DESCRIPTIONS

APPENDIX D

VEGETATION DESCRIPTIONS

Beard (1979) and Heddle *et al.* (1980) map the native vegetation potential (i.e. what native vegetation would be there if it had not been cleared) of the Jandakot region, including the airport, at a scale of 1:250,000. Beard (1980) maps it also at a scale of 1:1,000,000. A large proportion of the region has been cleared and no longer supports unaltered native vegetation.

Beard's 1:250,000 scale map shows the native vegetation potential of the region which includes the airport as being Casuarina (Sheoak)-Banksia low woodland with scattered jarrah (e_2Mb.cbLi) and numerous ti-tree and paperbark swamps.

Heddle *et al.* (1980) show the native vegetation potential of the region as being in the Bassendean Vegetation Complex - Central and South (44): vegetation ranging from woodland of *Eucalyptus marginata* - *Allocasuarina fraseriana* - *Banksia* spp. to low woodland of *Melaleuca* spp., with sedgelands on the moister sites. There is a transition of *Eucalyptus marginata* to *Eucalyptus todtiana* in the area.

6.1.1 Plant Communities

Milewski and Davidge (1981) described an Airport Banksia woodland that straddles the western end of the airport's southern boundary, and Martinick and Associates (1989a) described and mapped the woodlands and most other native vegetation of the airport. Weston (1990) enlarged upon some of the Martinick and Associates descriptions.

Martinick and Associates (1989, 1990) map and describe the vegetation of the airport as six structural types, four of them being Banksia woodlands and two wetlands (in the broad sense) dominated by flooded gums (*Eucalyptus rudis*), Moonah paperbarks (*Melaleuca preissiana*) and *Pericalymma ellipticum*. Their vegetation descriptions give information about habitats, species compositions and ranges of height and foliage cover for each stratum in each vegetation type. The Martinick and Associates descriptions also list up to two dozen typical, common and associated species for each type.

The vegetation description summaries given below and the vegetation boundaries shown on Figure 6.1 are based upon the Martinick and Associates vegetation descriptions and maps and modifications of them proposed by Weston (1990) supplemented by 1992 fieldwork. For the purpose of description and mapping, the plant communities of Jandakot Airport are grouped into seven categories, which are based partly upon dominant species and partly upon structural

differences. Examples of the airport plant communities are illustrated on Plates 1 and 2. Dominant and characteristic species shown in the plates are listed in the captions to the plates.

The scale of the vegetation map is approximately 1:12,000, the same scale as the Martinick and Associates (1990) map and a 1990 enlarged aerial photograph used in producing the map. Letter symbols on the map (A through G) indicate the category of native vegetation, mostly uncleared, while "X" indicates that native vegetation has been totally cleared and "Y" indicates that it has been largely, though not totally, cleared.

The following vegetation descriptions give names for seven categories, along with dominant species and heights and densities of vegetation strata. A mapping symbol or symbols (A-G), the plate in which an example of its vegetation is illustrated and the Martinick and Associates (1989, 1990) corresponding type or types of vegetation are given for each category.

A. Jarrah-Banksia woodland (to low woodland and low open forest)
E.g. Plate 1B B) (Martinick and Associates Types 1 and 2)
On gently undulating dune crests and the highest slopes and crests in the Airport

Banksia attenuata, with *B. menziesii*, *Allocasuarina fraseriana*, *Nuytsia floribunda*, *Eucalyptus todtiana* and stunted jarrah (*Eucalyptus marginata*).

Tree stratum	4-6 (-10m)	(<5%-) 15% - 35% (->50%)
Tall shrub stratum	1-2m	2% - 15%
Low shrub and herb stratum	<0.5m	45% - 70%

B. Mixed Banksia low open forest (to low woodland)
E.g. Plates 1A, 1E, 1F (Martinick and Associates Types 3 and 4)
Lower slopes and flats and lowland dune areas

Banksia menziesii, *B. attenuata* and *B. ilicifolia* are codominant but vary widely in relative importance, with *Allocasuarina fraseriana* at times important:

B1. no prominent tall shrub understorey present (M and A Type 3).

B2. there is a prominent, dense tall shrub understorey, generally of *Regelia ciliata* or *Regelia inops* (M and A Type 4).

Tree stratum	6-8 (-10m)	15% - 50% (->65%)
Tall shrub stratum	1-2m	B1: 5% - 15%
		B2: 30% - >90%
Low shrub and herb stratum	<0.5m	10% - 90%

C. *Eucalyptus rudis* open forest/woodland

E.g. Plates 2B, 2C (Martinick and Associates Type 5)

In one interdunal area which is associated with impeded drainage.

There are two distinct, contiguous, though overlapping, types of *Eucalyptus rudis* open forest and woodland:

C1. overstorey of saplings and tall mature *Eucalyptus rudis* trees, with an understorey principally of veldt grass (*Ehrharta calycina*) and very few shrubs.

C2. mostly sapling *Eucalyptus rudis* trees (flooded gum) with a generally dense, diverse shrub understorey, wetland species and paperbark - swamp Banksia vegetation.

Tree stratum	3-14m	25% - >60%
Low shrub and herb stratum	0-1m	10% - 90%

D. *Melaleuca - Pericalymma* open woodland/heath

E.g. Plates 1C, 2C (Martinick and Associates Type 5, in part)

In some wetland depressions in the interdunal areas which are associated with impeded drainage.

Generally zoned vegetation with a flat, relatively broad area of *Pericalymma ellipticum* heath in the centre surrounded by concentric, overlapping bands of (1) *Melaleuca preissiana*, (2) *Astartea fascicularis* and *Hypocalymma angustifolium* and (3) *Xanthorrhoea preissii*. *Eucalyptus patens*, *Kunzea ericifolia*, *Banksia littoralis*, *Leptospermum laevigatum* and *Eucalyptus rudis* sapling woodland/forest with a predominantly *Astartea fascicularis* shrub understorey. Two types of D vegetation can be distinguished in some aerial photographs:

D1. *Melaleuca preissiana*, with shrubs of *Pericalymma ellipticum* and *Hypocalymma angustifolium*.

D2. *Pericalymma ellipticum* heath.

Tree stratum	4-8m	5% - 30%
Lower stratum (shrub heath)	1.0-2.0m	patchy, but often dense

E. Mosaic of various heaths, shrub heaths and woodlands
E.g. Plate 2A
In wetland depressions and marginal areas on the airport's southern boundary.

Melaleuca preissiana woodland, *Astartea ? fascicularis* shrub heath, *Lepidosperma ? rudis, Pericalymma ellipticum, Hypocalymma angustifolium, Carpobrotus* sp., veldt grass and other established alien plants.

F. Heaths cleared of Banksia woodland overstorey
E.g. Plate 2D
Banksia woodland which has been cleared of trees, leaving sedges, low shrubs and heaths which were previously understoreys in the woodlands.

F1. low shrubland and heath high in the landscape.
F2. sedge heath low in the landscape.

G. *Baumea articulata* sedgeland
E.g. Plate 1D
In 1990, when the jointed sedge, *Baumea articulata*, was very rare in the airport but still surviving there, there were two patches of the sedge in the quarry-sump area, along with *Leptospermum laevigatum* (a non-native ti-tree), *Hypocalymma angustifolium, Melaleuca preissiana* and areas bare of vegetation.

The diversity of wetland vegetation appears to be greater than the diversity of woodland vegetation, although the former occupies a much smaller area.

6.1.2 Flora

The flora of the airport, or parts of it, has been listed by Lamont (pers. comm.), Milewski and Davidge (1981), Martinick and Associates (1989) and Weston (1990). Martinick and Associates have described it in terms of vegetation components.

An incomplete list of airport plant species compiled by Lamont and Curtin University students has 85 native species.

The 1989 Martinick and Associates report lists 95 plant species found growing naturally in the airport. Six of the species are established aliens.

The Milewski and Davidge article describes the flora and flowering times of species in an area of Banksia woodland that straddles the western end of the airport's southern boundary, with over half of the study area being inside the airport and the rest being outside. Most of the Banksia woodland in the outside part has since been fragmented, cleared and converted into a low density housing development. The article lists 122 species recorded during the study, of which seven are in the tree stratum, 90 are in the shrub stratum and 25 are herbaceous plants. Five of the herbaceous plants are established aliens.

Although the three lists referred to above have many species in common, there are also some species on each list that the others do not have. The Weston (1990) survey also recorded some species not on any of the three lists, including two Priority species.

The total number of native species at the airport undoubtedly exceeds 200, and there are estimated to be in excess of 20 established alien species.

6.1.3 Rare Flora

The meaning of the terms "rare flora", "significant flora", "Priority Species" and "Declared Rare Flora", what these terms encompass, methods employed in searching for rare and significant flora and limitations of flora searches are discussed in Appendix E. The Appendix also contains two current lists of significant flora, a computer printout from the Dames & Moore Rare Flora Database of significant species recorded at Jandakot and nearby localities and the Department of Conservation and Land Management (CALM) list of Priority and Declared Rare Flora recorded in the Swan (Northern Forest and Metropolitan) management region.

There are, in addition, species which are widespread or common elsewhere but rare o otherwise significant in the Jandakot area. Such species include *Stylidium imbricatum* an *Verticordia nitens*.

Background

The species searched for during the Weston (1990) late spring rare flora survey of the airport are those on two sets of unpublished lists, plus others highlighted during discussions with CALM botanists. The lists are:

- Gazetted Rare Flora (Government Gazette, WA, of 1 June 1990), particularly those of the Metropolitan Region; and
- Priority Taxa of the Metropolitan Region (July 1990, provided by CALM), parti arly Priority One, Two and Three Species.

The Declared Rare Flora and Priority species searched for in 1990 are, essentially, the same species that would be searched for now. In 1990 there were ten metropolitan region Declared Rare Flora (DRF) species which were thought to have ranges and habitats that might include the airport. This number has since been reduced to eight species, which are listed in Table 6.1. Additional information about these species is given in Rye and Hopper (1981), Patrick and Hopper (1982), Hopper *et al.* (1990), Hoffman and Brown (1984), Jones (1988) and the Perth Regional Flora (Marchant *et al.*, 1987). The two species removed from the list of ten are *Diuris drummondii*, which is now not believed to occur as far north as the metropolitan region, and *Drosera occidentalis*, which is now a Priority species and no longer a DRF species.

TABLE 6.1

METROPOLITAN REGION DECLARED RARE FLORA (DRF) SOUGHT AT JANDAKOT AIRPORT (Government Gazette, WA, 17 May 1991)

Species and Family	*Localities and Distribution*[1]	*Habitat*[1]	*Flowering Times*[1]
Aponogeton hexatepalus APONOGETONACEAE	Kenwick-Darradup-Augusta	Shallow winter pools on clayey soils	(May-) Aug-Sept
Caladenia huegelii (=*C.* sp. (coastal Plain)) ORCHIDACEAE	Gnangara-Yallingup-Margaret River	Sandy soils in Banksia and eucalypt woodlands, often with *Allocasuarina fraseriana* and usually low on the landscape	Aug-Oct (-Nov)
Diuris purdiei ORCHIDACEAE	southern Perth area - Harvey	Seasonal semi-swamp on sand-over-clay soils, usually in *Regelia* and *Pericalymma* shrublands, flowers in habitats which were burnt the previous dry season	Sept-Oct (-Nov)
Diuris micrantha ORCHIDACEAE	Kwinana	Small shallow winter-wet swamps amongst short sedgeland, predominantly of *Lepidosperma ? longitudinale* on sandy clayey soils	Aug-Sept
Drakaea elastica (=*D. jeanensis*) ORCHIDACEAE	Gingin-Busselton	Sandy soils, often firm and very white, in *Kunzea ericifolia* tall shrubland and Banksia woodland, low on the landscape	(Sept-) Oct-Nov
Drakaea "micrantha" ORCHIDACEAE	Canning Vale, Yarloop, Mowen, Bakers Junction, Albany	Sandy soils in scrub and woodlands low in the landscape, often near swamps	Sept-Oct
Dryandra mimica (=*D.* sp. A in Flora of the Perth Region) PROTEACEAE	Mogumber-Wattle Grove (-Whicher Range)	Flowers bright yellow; low sandy flat, in heath or scrub in Banksia woodland or with *Kingia* and *Byblis*	(Sept- [Type: Dec 17]) Jan-Feb
Hydrocotyle lemnoides APIACEAE	Kenwick-Upper Swan-Bolgart, Darling Range	Shallow winter pools on clayey soils	Sept-Oct

[1] The information in this table was compiled from Rye and Hopper (1981), Hoffman and Brown (1984), Sainsbury (1985), Marchant *et al.* (1987), Hopper *et al.* (1990), information provided by L. Mutter and botanists of the Western Australian Herbarium and the WAWRC, and fieldwork by A.S. Weston during 1989, 1990 and 1991. There may be a few more localities for some of the species than the number given in the table, but some of the species are no longer found in some of the localities where they were previously recorded. *Drosera occidentalis* and *Diuris drummondii* were also looked for in the 1990 rare flora surveys but are no longer metropolitan region DRF species.

During the 1990 airport late spring survey, emphasis was placed on finding the ten DRF species listed and described in Table 6.1. Most of them are species of low-lying areas and seasonal wetlands, and most of them are herbaceous plants which flower in the period between August and November.

The flowering times given in Table 6.1 suggest the period when a survey for the DRF species could be undertaken most productively. In the case of some species which are not in flower during that period, leaves may be sufficient for identification. For instance, the *Dryandra* and the *Drakaeas* have leaves that are distinctive enough for identification of the species before they flower. Consequently, the surveys done in mid-October and early November 1990, a year in which flowering of many species was delayed by extended winter weather, should have been able to identify any of the species in Table 6.1 except, possibly, the early-flowering *Diuris micrantha*, if any populations of them had been found.

Diuris micrantha is an orchid known only from one swamp in Wellard and is very unlikely to occur in the airport. If it were in the airport, it probably would have been found, since in 1990 it flowered later than usual. In mid-November the Wellard plants still had flowers that were identifiable, though dry.

It should be noted that many native species which are conspicuous when in flower are easily overlooked when not in flower. A good example of this in the airport is *Lysinema elegans*, which was found in late November and December but not in October or early November, before it flowered.

Significant Plant Species Found at the Airport

No Declared Rare Flora (DRF) species were found at the airport. However, two Priority Flora species were found during the survey, and a third is on one of the species lists for the airport. These three species are described below. The descriptions are based upon field notes, field records and observations, upon information in Marchant *et al.* (1987) and upon information from Western Australian Wildlife Research Centre and Western Australian Herbarium botanists. The Priority (P) numbers and Plate numbers of each species are given in brackets.

Lysinema elegans - P2 - Plate 2F

Lysinema elegans is a shrub to 0.6m tall which can be distinguished from *Lysinema ciliatum* by its later flowering time, its narrower bracts and sepals and its pale yellow or cream-coloured buds. The species is recorded from one or two southern suburbs, including the Jandakot area, and north of Regans Ford but nowhere in between.

Lysinema elegans was found during the 1990 surveys, but not until mid-November, mainly on road banks near the gate onto Prinsep Road. It was also found, by Hislop (pers. comm.) and Kelly (pers. comm.) in December 1990, on private properties further south off Prinsep Road.

Phlebocarya filifolia - P3 - Plate 2E

Phlebocarya filifolia is a tufted sedge-like relative of the kangaroo paw with inconspicuous flowers. It looks similar to its common, widespread relative *Phlebocarya ciliata* but has narrower leaves and an anther connective which is prolonged beyond the anther cells. Marchant *et al.* (1987) note that in the Perth Region it is known from only two localities.

Phlebocarya filifolia was found at one site at the airport, in low heath in the south-west corner of two firebreaks.

Other Significant Species

Two other significant species recorded at the airport are also worth discussing: *Leucopogon kingianus* and *Conostephium minus*. Both are on the Martinick and Associates (1989) species list.

Leucopogon kingianus was found by Weston (1990) scattered through a broad area of Banksia woodland, and with *Lysinema elegans* near the western boundary. The species is neither a DRF nor a Priority species, but it does not appear to be common in the Perth area. It (or a close relative that is currently treated taxonomically as *Leucopogon kingianus*) does, however, have a wide range outside the Perth Region.

No specimens of *Conostephium minus*, a Priority Three species, from Jandakot Airport are in the Western Australian Herbarium collections, but the species has been recorded close to the airport. Also, as mentioned above, it is on the Martinick and Associates (1989) list of plant species identified at Jandakot Airport.

The species was not listed by Milewski and Davidge (1981) in their 1978 floristic study of Jandakot Airport Banksia woodland, but one of their field herbarium specimens (lodged in the Curtin University Herbarium) identified as *Conostephium pendulum* may be *Conostephium minus*. However, some *Conostephium pendulum* plants, having small flowers and unusually short leaves with recurved margins, may be mistaken for *Conostephium minus*. One apparently consistent difference between the two species is the conspicuous (with a hand lens) presence of cilia on the margins of flower bracts and sepals of *Conostephium pendulum* and the fuzzy, non-ciliate appearance of bracts and sepals of *Conostephium minus*.

Significant Flora Habitats at the Airport

A majority of the DRF and Priority species sought during the 1990 survey of the airport occur in a limited range of wetland habitats which have a restricted occurrence, such as the clay-based, seasonally inundated swamps represented in the Cannington and Kenwick areas. Low-lying Banksia woodlands and seasonal swamps and other low-lying areas characterised by paperbarks and other species of *Melaleuca* and species of *Astartea, Pericalymma* and restionaceous sedges are potential habitats for most of the DRF species searched for at the airport.

TABLE 2

FROG AND REPTILE SPECIES RECORDED

	TRAPLINE 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	TOTAL TRAPPING	OPPORTUNISTIC	TOTAL
Frogs																					
Heleiporus eyrei	4	2	2	4	6	2	2	2	9	3	5	6	5	7	6				65	-	65
Limnodynastes dorsalis	4		1		4				3	1		3			2	1	1		20	-	20
Myobatrachus gouldii												1							2	1	3
Ranidella insignifera	1																			1	1
Lizards																					
Legless lizards																					
Delma fraseri				1			1								2				4	7	11
Lialis burtonis						1									2				-	3	3
Pygopus lepidopodus																			3	-	3
Skinks																					
Cryptoblepharus plagiocephalus		2	5	3	1	3				2	1		1					1	19	17	36
Ctenotus lesueurii			2		1				1		2		5	4	3	2	4		24	-	24
Egernia napoleonis								2		1									1	4	5
Leiolopisma trilineatum		1		1		2			6	5	3		2	3	4	9	1	3	3	-	3
Lerista elegans										1	2		3	1		1	4		40	6	46
Lerista lineata	9	7	1	6	4	3	4	1	1	1	2	1	1			3	1		12	-	12
Menetia greyii			1										1						45	8	53
Morethia lineoocellata											3				1				2	-	2
Tiliqua occipitalis	1	1		2	4	2	1									1	1		1	-	1
Tiliqua rugosa																			18	1	19
Dragon Lizards																					
Pogona minor	1		2	2		2				1	2	1	1	2		1	2		17	1	18
Tympanocryptis adelaidensis			1	3				1							1				6	-	6
Goannas																					
Varanus gouldii		1																	1	-	1
Snakes																					
Demansia psammophis																			1	-	1
Pseudonaja affinis			1											1					1	-	1
Rhinoplocephalus gouldii				1															1	3	4

TABLE 3 **BIRD SPECIES RECORDED**

Collared Sparrowhawk	Accipiter cirrhocephalus
Little Eagle	Hieraaetus morphnoides
Wedge-tailed Eagle	Aquila audax
Australian Kestrel	Falco cenchroides
Common Bronzewing	Phaps chalcoptera
Laughing Turtle-dove	Streptopelia senegalensis
White-tailed Black Cockatoo	Calyptorhynchus funereus latirostris
Galah	Cacatua roseicapilla
Red-capped Parrot	Purpureicephalus spurius
Port Lincoln Parrot	Barnardius zonarius
Pallid Cuckoo	Cuculus pallidus
Horsfield's Bronze-cuckoo	Chrysococcyx basalis
Shining Bronze-cuckoo	Chrysococcyx lucidus
Laughing Kookaburra	Dacelo novaeguineae
Rainbow Bee-eater	Merops ornatus
Welcome Swallow	Hirundo neoxena
Tree Martin	Cecropis nigricans
Richard's Pipit	Anthus novaeseelandiae
Black-faced Cuckoo-shrike	Coracina novaehollandiae
White-winged Triller	Lalage sueurii
Scarlet Robin	Petroica multicolor
Rufous Whistler	Pachycephala rufiventris
Grey Shrike-thrush	Colluricincla harmonica
Grey Fantail	Rhipidura fuliginosa
Willie Wagtail	Rhipidura leucophrys
Splendid Fairy-wren	Malurus splendens
Spotted Scrubwren	Sericornis frontalis
Weebill	Smicrornis brevirostris
White-tailed Warbler	Gerygone fusca
Broad-tailed Thornbill	Acanthiza apicalis
Yellow-rumped Thornbill	Acanthiza chrysorrhoa
Varied Sittella	Daphoenositta chrysoptera
Red Wattlebird	Anthochaera carunculata
Little Wattlebird	Anthochaera chrysoptera
Singing Honeyeater	Lichenostomus virescens
Brown Honeyeater	Lichmera indistincta
New Holland Honeyeater	Phylidonyris novaehollandiae
White-cheeked Honeyeater	Phylidonyris nigra
Western Spinebill	Acanthorhynchus superciliosus
Striated Pardalote	Pardalotus striatus
Silvereye	Zosterops lateralis
Dusky Woodswallow	Artamus cyanopterus
Magpie-lark	Grallina cyanoleuca
Grey Butcherbird	Cracticus torquatus
Australian Magpie	Gymnorhina tibicen
Australian Raven	Corvus coronoides

TABLE 4

MAMMAL SPECIES RECORDED

	TRAPLINE 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	TOTAL TRAPPING	OPPORT-UNISTIC
Mus musculus	1	3	2	10	1		3		1		1	2	3	1		3	5	2	38	-
Rattus rattus						3				1			3					1	8	-
Tarsipes rostratus						2			1					1	1				4	-
Isoodon obesulus	2	1													1				5	1
Macropus irma																			-	2
Nyctophilus geofroyi																			-	3
Vulpes vulpes																			-	1

Mus musculus	House Mouse
Rattus rattus	Black Rat
Tarsipes rostratus	Honey-possum
Isoodon obesulus	Short-nosed Bandicoot
Macropus irma	Brush Wallaby
Nyctophilus geofroyi	Lesser long-eared Bat
Vulpes vulpes	Fox

Jandakot Airport - Milewski M194

WESTERN AUSTRALIAN HERBARIUM RESEARCH NOTES

No. 5, 1981: 29-48

PHYSICAL ENVIRONMENT, FLORISTICS AND PHENOLOGY OF A *BANKSIA* WOODLAND NEAR PERTH, WESTERN AUSTRALIA

By A.V. Milewski and Christine Davidge

Environmental & Life Sciences, Murdoch University, Murdoch, 6153, Western Australia.

ABSTRACT

The physical environment and floristic composition of 10 ha of mature, undisturbed Banksia *woodland on deep, leached sand are described. The study area covered part of a siliceous dune under a mediterranean climate on the southern outskirts of Perth, Western Australia. The 6 m high tree stratum consisted mainly of* Banksia attenuata *(Proteaceae). The 1 m high shrub stratum comprised 90 perennial species in 25 families. Slight variations in the composition of both strata were found among four study sites in association with small differences in substrate. The period of maximum flowering was October, although a few species flowered in winter or in summer. The times of appearance of an additional 25 species of annuals and herbs, apparent only in winter and spring, are recorded.*

INTRODUCTION

This paper presents data on the physical environment, floristics and phenology of an area of *Banksia* woodland at Jandakot Airport (32°05'S, 115° 53'E) on the southern outskirts of the Perth metropolitan area, Western Australia. The main aim of the study was to provide environmental and floristic data as a counterpart of an intensive study on the reptile, frog and bird communities of this area (Davidge 1979a, 1979b, Milewski unpublished). These data also provide a detailed description of an Australian mediterranean area. It is intended that this description will permit future comparisons of plant and animal communities in Australia with those of other continents with a similar mediterranean climate.

DATA COLLECTION

An area was i

Full document available on request

ide all plant and animal members of same time, included only one such com sen on the basis of the apparent gross egetation, the maturity of the vegetation or invasion by weedy

690

M94

EPA – POLLUTION CONTROL OFFICE
P.O. BOX 156
BUNBURY W.A. 6230
Ph. (097) 21 4814 Fax (097) 22 0481

Proposed additional developments, Jandakot Airport

Federal Airports Corporation

Advice of the Environmental Protection Authority to the Commonwealth Environment Protection Agency

Full document available on request

Environmental Protection Authority
Perth, Western Australia
Bulletin 690
July 1993

JAND Ø1

JAND Ø2

JAND Ø3

JAND 04

JAND 05

JAND 06

JANDOY