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).

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
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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))

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), *Astrotoma xerophyllum*, *Hensmania turbinata*

Fauna: multiple and structured surveys by Western Australian Museum of Natural Science (How *et al.* 1996) and Dames and Moore (1993) for birds (56), native mammals (5), reptiles (19) and amphibians (4). 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 (*Rhinoplocephalus gouldii*)

Linkage: adjacent bushland to the north (BS245, across road), east (BS389), south and west; part of proposed Greenway 105 (Tingay, Alan & Associates 1997a); part of fragmented and potential bushland/wetland linkages (Volume 2A, Map 8)

SECTION 4: INTERNATIONAL AND NATIONAL SIGNIFICANCE

Interim List of the Register of the National Estate

SECTION 5: SELECTION CRITERIA AND RECOMMENDATIONS

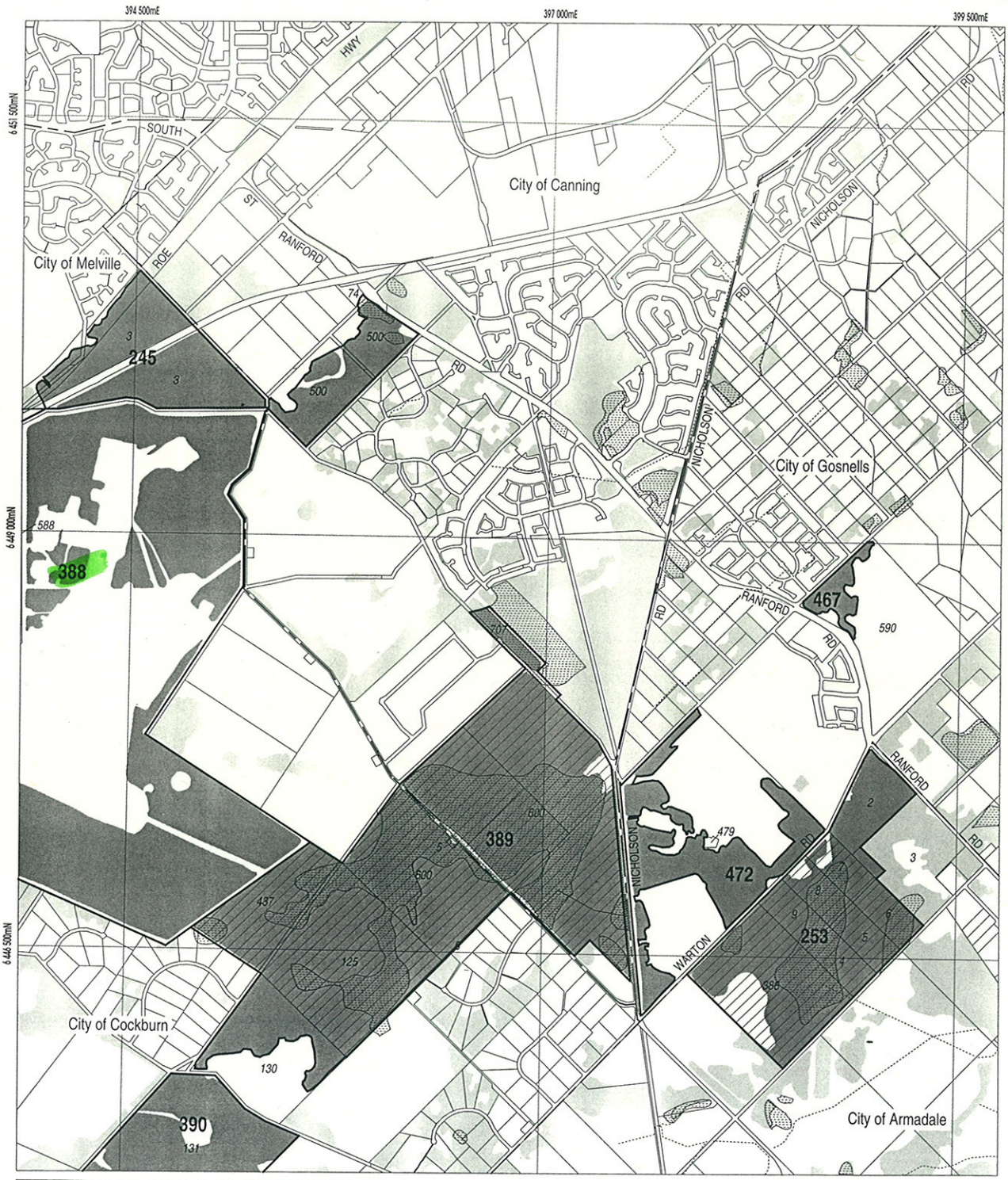
Criteria: Representation of ecological communities, Diversity, Rarity, Scientific or evolutionary importance, General criteria for the protection of wetland, streamline and estuarine fringing and coastal vegetation

Opportunities and/or Constraints

Opportunities: Bushplan Site/part Bushplan Site subject to Swan and Canning Rivers EPP; location of Scheduled Fauna; under TPS Landscape Zoning and Local Park and Recreation Area Zoning, Crown Reserve

Constraints: under MRD regional road requirements, Priority and General Mineral Resource Area (sand); requirements for domestic airport

Recommendation: The most appropriate mechanism for the protection of this Bushplan Site be considered through the public comment period in consultation with the land owners. This may include parts for which: The conservation values of the Bushplan Site to be protected through one or more of a range of complementary mechanisms to encourage and secure conservation management on private lands; The specific approach to be determined in consultation/negotiation with the land owner(s), but will generally include conservation covenants/management agreements.



LEGEND

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

2033 - I NE

IV	NW / NE (68) / SW / SE	
2033		
III		II

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

PERTH'S BUSHPLAN MAP INDEX

1	2								
3	4	5							
6	7	8	9	10	11				
12	13	14	15	16					
17	18	19	20		21	22	23		
24	25	26	27	28	29	30			
31	32	33	34	35	36				
37	38	39	40	41	42				
43	44	45	46	47	48				
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	60	61	62	63	64				
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78	79	80	81	82	83	84			
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		103	104	105	106				

N

SCALE

0 — 500 — 1000 Metres

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

ntw-map18//environ/bushplan//bushv2map2.dgn

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

Wetlands Data supplied by Water and Rivers Commission

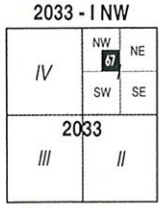
Native Vegetation Extent for Study Area supplied by Agriculture Western Australia

Bushplan Site Map

LEGEND

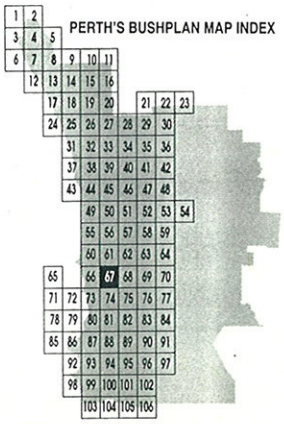
- 472 — Bushplan Sites With Regionally Significant Bushland
- Other Native Vegetation
- Conservation Category Wetlands
- Bushplan Sites With Some Existing Protection
- 696 — Lot Number, Location Number
- Channel Wetlands
- Local Government Boundary

2033 - I NW



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

PERTH'S BUSHPLAN MAP INDEX



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SCALE

0 500 1000

Metres

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

ntw-map18//environ/bushplan/bushv2_67.dgn

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

Wetlands Data supplied by Water and Rivers Commission

Native Vegetation Extent for Study Area supplied by Agriculture Western Australia

Bushplan Site Map

NAME Gavin Ion
ADDRESS Airport Environment Officer
ADDRESS PO Box 130
ADDRESS BELMONT WA 6984

ATT:

Dear Sir/Madam

JANDAKOT AIRPORT HOLDING PTY LTD - NEW SKIES NETWORK PTY LTD PROPOSAL FOR BUSH FOREVER SITE 388

Thank you for providing the Department of Environmental Protection with a copy of the New Skies Network Pty Ltd proposal prepared by Jandakot Airport Holding Pty Ltd in August 2001 and for the opportunity to discuss the proposal at the meeting at the Airport on the 21st August 2001. As discussed at the meeting we had not received the written proposal in sufficient time, previous to the meeting, to be able to address the detail of the proposal.

As a result of our consideration of the draft New Skies Network Pty Ltd proposal prepared by Jandakot Airport Holding Pty Ltd (2001) we have found that the proposal **does not**

- adequately describe the development
- describe the rationale for the selection of the development site, particularly in relation to other areas within the areas proposed for 'aviation and commercial development'
- describe the natural values of the development area (Area A, Map 1),
- adequately describe the natural values of the Jandakot Airport Bushland (Bush Forever Site 388) or
- adequately describe the nature of the impact of the proposal on the development area or the remainder of the Jandakot Airport Bushland and adjacent regionally significant bushland areas.

That is, at this stage, the impact of the proposal cannot be determined. Until this information is available comment on the required management to maintain the remaining natural values in the development area is not possible. The report attached to this letter details the basis for this position.

While it is noted that the development is proposed for the area of the Jandakot Airport Bushland identified in the Masterplan for possible 'aviation and commercial development' the proposal is for part of Bush Forever Site 388. Bush Forever Site 388 has very substantial national, state (regional) and local conservation significance. If this proposal was for non-Commonwealth owned land it would be required to be referred to the state Environmental Protection Authority for a determination of the level of assessment. On the basis of the information provided it is likely that the proposal should

be regarded as a major development in bushland of regional conservation significance and, as such, requires detailed environmental assessment.

Yours sincerely

R A D Sippe
Director
Policy Coordination Division

~~[Date]~~ 4/9/01

enc ~~[delete if no enclosure]~~ Comments on the Jandakot Airport Holdings Pty Ltd - News Ships Network ~~Ltd~~ Pty Ltd Proposal.

cc ~~[delete if no cc]~~
Tamsyn Ashburn - Airport Environment Officer (Perth Airport)
Sharon Millar - Environment Manager, Jandakot Airport Holdings.

NAME
ADDRESS
ADDRESS
ADDRESS

ATT:

Dear Sir/Madam

JANDAKOT AIRPORT HOLDING PTY LTD - NEW SKIES NETWORK PTY LTD PROPOSAL FOR BUSH FOREVER SITE 388

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As a result of our consideration of the draft New Skies Network Pty Ltd proposal prepared by Jandakot Airport Holding Pty Ltd (2001) we have found that the proposal **does not**

- adequately describe the development
- describe the natural values of the area proposed for development (Area A, Map 1),
- adequately describe the natural values of the Jandakot Airport Bushland (Bush Forever Site 388) or
- adequately describe the nature of the impact of the proposal on the development area or the remainder of the Jandakot Airport Bushland and adjacent regionally significant bushland areas.

That is, at this stage, the impact of the proposal cannot be determined. Until this information is available comment on the required management to maintain the remaining natural values in the development area is not possible. The report attached to this letter details the basis for this position.

While it is noted that the development is proposed for the area of the Jandakot Airport Bushland identified in the Masterplan for possible 'aviation and commercial development' the proposal is for part of Bush Forever Site 388. Bush Forever Site 388 has very substantial national, state (regional) and local conservation significance. If this proposal was for non-Commonwealth owned land it would be required to be referred to the state Environmental Protection Authority for a determination of the level of assessment. ~~A more detailed proposal (as outlined above and in the attached report) would be required to enable the level of assessment to be set.~~

On the basis of the information provided it is likely that such a proposal ~~for bushland~~ would be regarded as a major development in bushland of regional conservation significance and would ~~attract~~ require ~~formal~~ detailed environmental assessment.

Department for Planning and Infrastructure

Enquiries: Emma Bamforth – Bush Forever Senior Project Officer
Phone: (08) 9264 7772
Our Ref: G805/2/1/40P/388
Your Ref: Jandakot Airport Holdings

Mr Gavin Jones
Airport Environmental Officer
PO Box 130
BELMONT WA 6984

Dear Gavin

RE: New Skies Network Satellite Development – Bush Forever Site No. 388

Thank you for providing the Ministry for Planning's Bush Forever Office with a copy of the proposed Concept Plan for the New Skies Development project at Jandakot Airport for comment. As discussed at our meeting on 21st August 2001, the following advice is a consolidation of comments from both the Ministry for Planning Bush Forever Office and the Department of Environmental Protection.

As detailed in previous correspondence from the Bush Forever Office in regards to this issue (letter forwarded to Sharon Miller of Jandakot Airport Holdings dated 6th July 2001) the Ministry for Planning agreed in principle to the proposed New Skies Network satellite development east of Marriott Road subject to the following issues being addressed:

1. The submission of a detailed proposal which adequately addresses the proposed development and its potential environmental impacts. It is envisaged that this will include:

a X a site plan; Concept only
b X a development plan;
c X justification for the development; — most detail
d X a description of the options that have been considered; — not done
e X an environmental review of the site; — not done
f X demonstration that the location and design of the proposed development minimises the impact on the remnant vegetation; — concept
g X identification of vegetation buffers and corridors; and — not done
h X management of the vegetation to be retained. — concept

2. The submission of a botanical report for the proposed lease area for the development. This should include identification of the floristic communities, vegetation condition, significant flora species and any other significant conservation attributes such as wetlands. Not done

most not adequate

The Concept Plan report (JAH, August 2001) provides information on some of the issues listed above, however, not all the issues identified have been adequately addressed. From a review of the Concept Plan report (JAH, August 2001), the Ministry for Planning's Bush Forever Office acknowledges that the proposed satellite site has been located within the proposed Non Aviation Development area identified in the Master Plan and Environmental Strategy (SKM, 2000). It is also acknowledged that the proposed satellite development will retain approximately 50 per cent of the remnant vegetation within the proposed site (S. Miller pers comm.) and is therefore considered to be a relatively low impact development.

While the Ministry appreciates that the proposed development is at a concept stage only, both the Bush Forever Office and the Department of Environmental Protection are seeking additional information regarding the proposed development and the potential environmental impacts before the suitability of the proposal can be evaluated.

Specifically, the Concept Plan report does not provided a detailed description of the proposed development, in particular the separative distances required between each satellite dish that may influence the size of the building envelop required. The Concept Plan report also needs to consider the potential restrictions, if any, on future developments both within and outside of the Airport site from the satellite development should radiation or other emissions be identified as significant issues.

The Concept Plan does not describe the values of the proposed site and no specific floristic study to determine whether any Declared Rare Flora, Priority Flora or Threatened Ecological Communities occur or adequately addressed the issue of connectivity with Ken Hurst Park has been undertaken.

Not refer to info to be able to comment on.

The Concept Plan report does not provide any information on the assessment and evaluation process undertaken on site options within the Jandakot Airport which determined that the site east of Marriott Road was the preferred site for the proposed development.

As detailed in our previous correspondence (dated 6th July 2001) the above information will need to be provided to the Bush Forever Office before the proposed can be evaluated and conditions for the development can be recommended. However, as discussed at our meeting on 21st August 2001, in providing this additional information, consideration should be given to further consolidating the development envelope and associated road network to minimise the area of vegetation fragmentation.

I trust the above information satisfies your recent inquiry, however should you require any additional comments from the Bush Forever Office, please do not hesitate to contact Emma Bamforth on (08) 9264 7772.

Yours faithfully

Proposal is significant Large scale is the development located in an area of 'Pristine – V. Good' condition banksia recognised as regionally sig.
Noted this proposal is in the proposed 'Non Aviation Development' area in the Master Plan - but this does not mean that the development has approval.
Need to justify the location of this development in this area of high quality bushland relative to other possible sites of lower value.
Basis for

David Nunn
Manager
Environmental Planning
23rd August 2001

CC. Sharon Miller – Ja

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been adequately recognized by the draft New Skies proposal (JAH 2001) and the effects of further fragmentation on the reptile assemblage have not been addressed.

Mammal Fauna

The regional significance of the mammal assemblage in the Jandakot Airport bushland is considerably greater than that in most other remnants on the Swan Coastal Plain. This high regional conservation significance has not been addressed by the draft New Skies proposal (JAH 2001) and the effects of further fragmentation on the mammal fauna have not been assessed.

The Significance of the Impact of the New Skies Proposal

From the above discussion of natural values it can be seen that the report by JAH (2001)

- contains limited descriptions of the vegetation, flora and fauna of the Jandakot Airport Bushland (considerably more limited than the description in Bush Forever),
- understates the values the Bushland and
- does not describe the vegetation, flora and fauna of the proposed project area (Area A, Map 2).

As a consequence the report fails to:

- address the values of Area A;
- adequately consider the values of Area A in relation to the remainder of the bushland in the Jandakot Airport (most importantly to describe how this bushland is represented/not represented elsewhere in the Airport);
- adequately consider the values of Area A as part of a consolidated bushland block adjacent to Ken Hurst Park (see Map 2);
- outline why Area A is selected as more suitable than other areas within the total area proposed for 'aviation and commercial development' in the MP; and
- address the realistic impacts of the proposed development on the bushland in Area A.

Until this information is available comment on the required management of the natural values of the bushland retained within the development area is not possible. This can be illustrated by the consideration of two management issues, fragmentation and fire.

Fragmentation

Currently the Area A is a consolidated area of bushland in Pristine to Very Good Condition (Mattiske Consulting 2001). To minimise the impact of disturbance development should be consolidated in specific areas to minimise the edge to area ratio. The current proposal locates a large number of 'development envelopes' (satellite dish sites) throughout the bushland. In effect this development will expose all of the remaining bushland to disturbance as the created bushland corridors are all long and narrow with large edge to area ratios.

Vertebrate fauna on the Coastal Plain has undergone major declines as a consequence of habitat reduction, disturbance and other factors (How and Dell 1993, 1994, 2000). Much of the fauna now has fragmented distributions and only survives on remnant areas of bushland. The effects of further fragmentation of the Jandakot Airport bushland has not been addressed in the development proposal.

Fire

Under the current proposal development will occur throughout the bushland. The location of areas with reduced fuel loads to reduce the risk of loss of property is crucial. The current proposal locates the development areas between corridors of bushland, exposing the property to loss, any areas of reduced fuel will increase fragmentation.

REFERENCES

(Unlisted references can be found in Government of WA 2000b)

Clarke, K and Keighery, B 2001 *Bush Forever Vegetation Assessment. Part Bush Forever Site 388, Jandakot Airport Bushland, Jandakot.* An unpublished report prepared for the Department of Environmental Protection.

Dell, J. & How, R. 1995. Faunal Responses to Fire in Urban Bushland. pp 35-41. In: Burning our Bushland. Proceedings of a Conference about Fire and Urban Bushland. Urban Bushland Council (W.A.).

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

How, R. A. and Dell, J., 1993. Vertebrate fauna of the Perth metropolitan region: consequences of a changed environment. Pp. 28-47 *in:* Urban Bush Management ed by M. Hipkins. Australian Institute of Urban Studies, Western Australia.

How, R. A. and Dell, J., 1994. The zoogeographic significance of urban bushland remnants to reptiles in the Perth region, Western Australia. *Pacif. Cons. Biol.* **1**: 132-140.

How, R. A. and Dell, J., 2000. Ground vertebrate fauna of Perth's vegetation remnants: impact of 170 years of urbanisation. *Pacif. Cons. Biol* vol 6: 198-217.

Jandakot Airport Holdings Pty Ltd. 2001 *New Skies Network Pty Ltd Development at Jandakot Airport (Draft).* Unpublished report prepared for Jandakot Airport Holdings Pty Ltd in August 2001.

Saunders, D. A. 1980. Food and Movements of the Short-billed Form of the White-tailed Black Cockatoo. *Australian Wildlife Research*, **7**: 257-69.

Sinclair Knight Merz 1999 *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.

Western Australia (2000b) although the number referred to in Appendix F in draft New Skies proposal (JAH 2001) is only 46 species because recent literature was not consulted (see references).

This high species diversity reflects the large size of the area as well as the floral and vegetation diversity of the area. The extent of the contiguous vegetation is also of considerable value in reducing the impacts of disturbance such as habitat fragmentation and the effects of fire on bird populations. It has been well demonstrated by Dell and How (1995) that fire impacts severely on habitat specialist bird species. It is noteworthy that a number of those species highlighted by Dell and How (1995) as having declined severely on the Swan Coastal Plain are present in this site.

Significantly the Jandakot Airport bushland (Appendix F in draft New Skies proposal (JAH 2001) contains at least 17 species of those birds listed by Government of Western Australia (2000) as having special conservation significance on the Swan Coastal Plain as they are either habitat specialists with a reduced distribution on the Swan Coastal Plain or they are wide-ranging species with reduced populations on the Swan Coastal Plain.

Another significant value of the Jandakot Airport bushland is in facilitating the seasonal migration of small passerine birds. A number of species move northwards at the beginning of winter and move southwards in spring. These require native vegetation for food, shelter and roosting sites while in transit. The proposal does not consider the role of the Jandakot Airport bushland in facilitating this movement.

The Jandakot Airport bushland would also have long-term value in maintaining genetic movement between different areas on the Swan Coastal Plain and thus the area has a significant role in the conservation of Australia's biological diversity. The proposal does not consider the role of the Jandakot Airport bushland in conserving this biological diversity.

Carnaby's or Short-billed Black Cockatoo (*Calyptorhynchus latirostris*) is recorded in the Jandakot Airport bushland. This species is listed on Schedule 1 of the Wildlife Conservation Act and is listed as vulnerable under the Commonwealth "Environment Protection Biodiversity Conservation Act 1999". The significance of the Jandakot Airport bushland to this species has not been adequately addressed in the development proposal.

Seasonal movement patterns of the Short-billed Black Cockatoo have been studied in detail by Saunders (1980) who concluded that birds that breed in the wheatbelt spend the non-breeding season (i.e. January to July) on the coastal plain. There are a number of ~~food~~ plant species in the Jandakot Airport bushland that are used as foodplants by the Short-billed Black Cockatoo. The significance of the Jandakot Airport bushland as an autumn/winter feeding area for the Short-billed Black Cockatoo has not been addressed in the development proposal

In summary, the site has significant regional conservation value for bird fauna. Specifically its major bird values are:

- it has a rich and distinctive bird fauna. This distinctiveness is further emphasised by the number of species present which have declined elsewhere on the Swan Coastal Plain, and the number of species that are of regional conservation significance.
- the bushland facilitates bird movement in this part of the Swan Coastal Plain.

Reptile Fauna

The regional significance of the herpetofaunal assemblage in the Jandakot Airport bushland is recognized in Appendix F in draft New Skies proposal (JAH 2001). How and Dell (1994, 2000) and Government of Western Australia (2000b). This high regional conservation significance has not

ATTACHMENT 1

COMMENT ON THE JANDAKOT AIRPORT HOLDING PTY LTD - NEW SKIES NETWORK PTY LTD PROPOSAL

Background

The bushland/wetland areas within the boundaries of the Jandakot 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 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) and the present managers on many occasions.

The regional significance of the Jandakot Airport Bushland has been further recognised in Perth's Bushplan (Government of WA 1998) and the final report for the Bushplan project Bush Forever (see Appendix 1after Government of WA 2000a&b).

The Jandakot Airport Bushland meets all five of natural values selection criteria applied in Bush Forever (and 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 Bush Forever 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 bushland area.

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). 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 (Government of WA 2000b). 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.

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" (Preliminary Draft Environmental Strategy p 3-10). These values give the area significance at a regional and local level.

That is the Jandakot Airport Bushland has very substantial national, state (regional) and local significance.

The New Skies Proposal

The report prepared for the New Skies Network Pty Ltd proposal by Jandakot Airport Holding Pty Ltd (JAH) in August (2001) acknowledges that bushland at Jandakot Airport has significance but the values of the bushland area are seriously understated. Integral to this partial documentation of the values of the area is the limited use of the available information on the Jandakot Airport Bushland.

Over the past four years information collated and/or collected by the Deaprtment of Environmental Protection (DEP) for the System 6 Update and the Bushplan project describing the values of the bushland has been made available to the managers of the Jandakot Airport through a series of avenues. These include:

- meetings between Sinclair Knight Mertz and DEP in the System 6 Update data (see Appendix 1) and other information was discussed and supplied as requested;
- organising for Sinclair Knight Mertz to be supplied with a draft Bushplan Site description
- Perth's Bushplan and Bush Forever have been supplied to JAH;
- technical report to Sinclair Knight Mertz as part of the comment on the PDMP and PDEMP (DEP 1999);
- on site meetings and field work between Bush Forever officers (from both DEP and MfP) and JAH Environmental Officer; and
- preparation of technical report on the area proposed for 'aviation and commercial development', with particular reference to Area A, for the Bush Forever project (Clarke and Keighery 2001), supplied to JAH.

However it is apparent from the information and references in JAH (2001) that these have not been taken into account. In addition, recent studies of the vegetation condition and fauna of the Airport Bushland have not been used to assess the significance of the bushland. This is illustrated by the following omission and/or incorrect statements in this report.

Vegetation

This section does not refer to the most useful regional information sets on vegetation or the specific values of the plant communities in the Jandakot Airport Bushland.

Regional Information (see Appendix 1)

Information on the vegetation complexes (Heddle *et al.* 1980) and floristic community types (Gibson *et al.* 1994, DEP 1996) is considered by CALM, DEP, WRC and MfP as critical in determining regional significance (Government of WA 2000 a&b).

Plant Communities

Clarke and Keighery (2001) and DEP 1999 comment on the unrecognised variation in the vegetation in the Jandakot Airport Bushland at the plant community/vegetation association level. The inadequacy of the current mapping is illustrated in the following section from Clarke and Keighery (2001)

"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."

Vegetation Condition

A report on the vegetation condition of the Jandakot Airport Bushland by Mattiske Consulting is appended to the report as Appendix C. Mattiske (2001) maps the majority of the bushland in the Airport as Pristine to Very Good (the terminology used by Mattiske is here modified to reflect terminology used in Bush Forever). This vegetation condition mapped is comparable to that in Clarke and Keighery (2001) and the general condition described for the Bush Forever Site (Government of WA 2000b). **That is, the Jandakot Airport Bushland is of the highest quality to be found in the Perth Metropolitan Region, emphasizing the bushland's value as an outstanding representation of its type.** This further highlights the regional significance of the bushland in the Jandakot Airport.

Flora

Total Flora

The flora of the Airport has not been documented comprehensively. Bush Forever combined listings from several sources and JAH (2001) combines a different set in Appendix B. Combination of System 6 Update list (Appendix 2) and JAH (2001) gives a combined total of 243 native plant species (excluding possible duplicates and non-native taxa, reduces JAH list to 194). Forty nine species from Appendix 2 are not listed by JAH (2001). **This illustrates the inadequacy of the current list and level of flora survey.**

Significant Flora

Bush Forever identifies the significant taxa in the Jandakot Airport Bushland as being *Lysinema elegans, 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. These species are not discussed in JAH (2001). In addition the significant flora found in the adjacent Bush Forever Sites are not discussed in relation to their possible presence in the Airport Bushland.

Several other species (for example *Boronia busseliana*, *Lechenaultia biloba*) are listed by JAH (2001) should be discussed as they are not known from and/or are uncommon in bushland areas on the Swan Coastal Plain in the Perth Metropolitan Region. The most likely explanation is that these are listed as a result of the misapplication of names but this should be addressed. This is the case in regard to *Scaevola paludosa* discussed in JAH (2001. This species should be referred to as *Scaevola repens* which is not a priority taxon.

Fauna

This section does not refer to several recently published regional faunal surveys or specific fauna datasets of the vertebrate species that have been recorded in the Jandakot Airport bushland. Accordingly the data included in Appendix F in draft New Skies proposal (JAH 2001) is incomplete. The species numbers referred to in the report are therefore incomplete, and there are a number of errors. The regional significance of the Jandakot Airport bushland to vertebrate fauna is inadequately recognized.

Bird Fauna

The Jandakot Airport bushland has a significantly higher bird diversity than most other bushland remnants on the Swan Coastal Plain. A total of 56 species have been recorded (Government of

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 ——— x 15

Iridaceae
* Gladiolus caryophyllaceus
Patersonia occidentalis

Lamiaceae
Hemiandra pungens

Lauraceae
Cassytha flava ——— x 16
Cassytha sp. scps

Lobeliaceae
Lobelia tenuior ——— x 17

Loganiaceae
Mitrasacme paradoxa ——— x 18

Loranthaceae
Nuytsia floribunda

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

Myrtaceae
Astartea aff. fascicularis sthcst
Beaufortia elegans
Calytrix angulata ——— x 19
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 ——— x 20
Lyperanthus nigricans ——— x 21
Microtis media ——— x 22

* 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

142 Native Taxa

Total > to Jandakot 2001 = 54
including 5 weeds = (49) native

JANDAKOT
AIRPORT

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File Ref: D/PRO/347
Doc Ref: jteo/AEO/1028

RDS SECTION
17 AUG 2001
PB187 ?
6 WHISSON 9

16 August 2001

Copy with my brief comments!
John

Mr G Whisson
Department of Environmental Protection
PO Box K822
PERTH WA 6842

Dear Gary

NEW SKIES NETWORK DEVELOPMENT

Please find enclosed Development Plan for the New Skies Network satellite proposal at Jandakot Airport for your perusal and discussion at the meeting scheduled for Tuesday 21 August 2001 at 1pm at the JAH Management Centre.

Yours sincerely

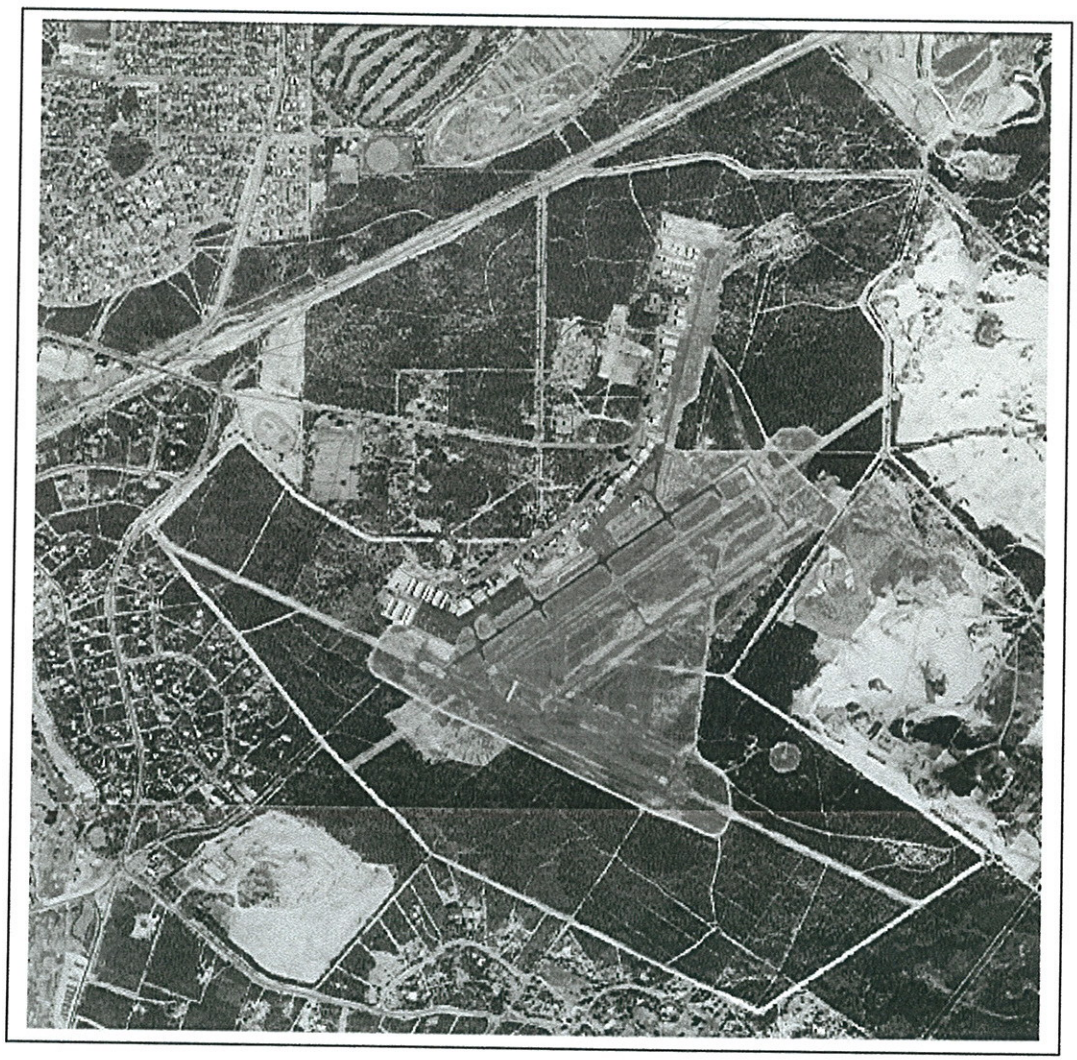
Sharon Miller
Environment Manager

Encl.

Gary.
So you have a file this goes to? Will it be the Jandakot file for PB? Thanks
Cal

172963

New Skies Network Pty Ltd Development at Jandakot Airport



Prepared by Jandakot Airport Holdings Pty Ltd August 2001

New Skies Networks Pty Ltd Development

Introduction:

Development at Jandakot Airport is vital to its survival. Jandakot Airport Holdings Pty Ltd (JAH), in taking a sustainable approach to development, are proposing to develop approximately 150ha for commercial development, while conserving 200ha of *Banksia* woodlands.

Partial revenue from this development will be used to fund active management of conservation precincts. Commercial development will also be conducted to ensure impacts on the Jandakot Airport environment are minimised.

This development proposal, while communicating the need for development at Jandakot Airport and JAH's commitment to sustainable development, focuses on the New Skies Networks Pty Ltd satellite development, which is proposed for the Jandakot Airport Commercial Development zone.

Background Information:

Jandakot Airport is situated 17km south of the Perth Central Business District in the suburb of Jandakot. Covering a total land area of 622ha, the airport lies within the Bassendean Dune System of the Swan Coastal Plain.

Jandakot Airport is Western Australia's primary General Aviation aerodrome and is the busiest airport in Australia. In July 1998 the Commonwealth Government sold a 50-year lease over Jandakot Airport to Jandakot Airport Holdings Pty Ltd (JAH), with an option for a 49-year lease extension.

As a requirement of the *Airports Act 1996*, which governs major Australian aerodromes, a Master Plan and Environmental Strategy were produced to act as functional guides to management and development of Jandakot Airport. These documents underwent a 3-month public consultation process and were approved by the Commonwealth Minister for Transport and Regional Services between 1999-2000.

Defined in the Master Plan and Environmental Strategy are areas proposed for aviation and commercial development, as well as a 200ha conservation precinct.

Need for Development:

Jandakot Airport was acquired by JAH for $6.7 million during the second phase of airport privatisation. Prior to this the airport operated at a loss of approximately $1.2 million per annum. Under the lease conditions with the Commonwealth Government Jandakot Airport has to operate as an aerodrome throughout the term of the lease. As the general aviation industry alone can not provide a profitable revenue, commercial development is necessitated.

Through the Jandakot Airport Environmental Strategy and the JAH Environmental Policy, there is a strong commitment to environmental issues at the airport. A full-time Environmental Manager is employed to ensure environmental issues are factored into airport operations and that there is an overall improvement in environmental management at Jandakot. Environmental issues coordinated at the airport include pollution control, contaminated site management, groundwater management, bushland management, revegetation and environmental education.

Many of these issues are costly, with little monetary return. A percentage of the revenue generated from commercial development will be dedicated to management of environmental issues, especially management of conservation precincts.

Development at Jandakot Airport will also have a beneficial impact from a regional perspective. With sites in surrounding areas becoming scarce, Jandakot Airport provides a location close to the CBD with good access networks. It will also increase employment opportunities within the community.

New Skies Networks Pty Ltd Development:

Overview of Proposal:

New Skies Networks Pty Ltd (NSN) is one of Australia's leading satellite service providers. They supply a broad range of integrated services to Government and enterprise users throughout Australasia, South East Asia, the Pacific and Indian Ocean regions.

Corporate headquarters is located in Sydney, New South Wales. The Parent Company, New Skies Satellites NV, controls 100% of the holding and is situated in The Hauge, Netherlands. Currently the Western Australian branch of NSN is located in Bayswater.

Due to the urban positioning of the site there is no room for expansion. NSN approached the Ministry for Planning in an attempt to determine a more suitable long-term location. A number of sites were investigated and Jandakot Airport was established as the most suitable.

The area required for the operation is 15.64ha. Of this, approximately 60% will be retained as remnant vegetation to act as a buffer around the site and provide protection for satellite dishes and other equipment.

The area chosen for the site in located east of Marriott Road. Other areas at the airport were also investigated but this area does not interfere with airport operations and is conducive with the topography required for the satellite operation. Concept plans are included in **Appendix A.**

The environmental impacts of this site have been considered and measures proposed to reduce the impacts. The main possible impacts involve remnant vegetation, fauna and groundwater. These have been expanded below.

Native Vegetation:

Jandakot Airport is located in the South-West Botanical Province of Western Australia, in the Darling Botanical District and the Bassendean System of the Drummond Botanical Subdistrict (Beard, 1981).

The Bassendean Vegetation System corresponds to the older leached sands of the Bassendean Dune System. This system extends discontinuously for the length of the Swan Coastal Plain, with the overall cover being *Banksia* woodland on the leached sands and *Melaleuca* swamps on poorly drained soils, typical of Jandakot Airport (Beard, 1990).

To date, 214 vascular plants have been recorded at Jandakot Airport. The number of species has been derived from the comparison and amalgamation of four separate flora lists for the airport. The four studies compared are;

- Milewski and Davidge (1981) – 122 species recorded
- Martinick & Associates (1989) – 95 species recorded
- Lammont (pers. comm, 1990) – 85 species
- Muir (1993) – 175 species

A combined species list from the above studies is contained in **Appendix B**.

The remnant vegetation at Jandakot Airport covers an area of approximately 400ha. Under Bush Forever, a Western Australian State Government initiative which attempts to achieve a minimum of 10% retention of each vegetation complex on the Swan Coastal Plain, Jandakot Airport is listed as site 388 (Government of WA, 2000). The conservation areas at Jandakot Airport are acknowledged as such in the Bush Forever document, while the development precinct is represented as a negotiated outcome. This process involves negotiation with the Ministry for Planning and the Department of Environmental Protection. This forms part of further negotiations with the Department of Transport and Regional Services and Environment Australia.

Condition of Vegetation:

According to a condition report prepared for JAH by Mattiske Consulting Pty Ltd (July 2001), the native vegetation at Jandakot Airport varies from excellent to very poor condition, with the majority described as good, very good or excellent.

The conservation and development zones both contain a mosaic of all condition types. The condition report has been included in **Appendix C.** Each vegetation association located in the development precinct is also represented in the conservation area. These associations are illustrated in **Appendix D**. It should also be noted that the NSN development does not impact on the dampland areas at the airport (see **Appendix E**)

Weed species are having an increasing impact on the condition of bushland areas at Jandakot Airport, especially where disturbance is high. The common weed species include *Ehrharta calycina (*veldt grass), *Avena fatua* (wild oats), *Ursinia anthemoides, Hypochaeris glabra* (flatweed) and *Gladiolus caryophyllaceus* (wild gladioli) (SKM, 1999). Other weed species that are becoming common are *Ricinus communis* (castor oil plants), *Solanum sp.* (deadly nightshade), *Carpobrotus edulis* (pigface) and *Myrsiphyllum asparagoides* (bridle creeper).

In order to preserve the condition of vegetation the following strategies will be factored into the NSN development.

- Clearing of vegetation will be minimised, wherever possible.
- Wherever practical, areas of excellent condition will be retained as vegetation.
- Earth moving equipment will be cleaned prior to entry on site, reducing infestation of weeds and spread of diseases such as dieback.
- All tracks to infrastructure will be hardstand to reduce weed growth and increase accessibility around the site. Road verges will undergo regular weed control.
- Weed control will be conducted in vegetated areas, in conjunction with conservation precinct weed management.
- A management plan will be prepared for the site.
- All landscaping will comprise of only native species.
- Fire management strategies will be in place to prevent fire impacting on vegetation and infrastructure.

Declared Rare, Priority and Regionally Significant Flora:

Previous studies conducted at Jandakot Airport have located no Declared Rare Flora (DRF) and only 2 priority species within the bushland. These two species are:

- *Conostephium minus* (Pink-tipped Pearl flower), Priority 4 species.
- *Scaevola paludosa,* Priority 2 species.

(SKM, 1999)

No DRF or priority species have been located within the boundaries of the NSN development precinct.

Plant Diseases:

At Jandakot Airport there are five sites identified as being infested with *Phytophthora cinnamomi* (dieback disease). Three of the five are associated with dampland areas, which provides a good medium for the pathogen. Positive identification of *Armillaria luteobubalina* has also been noted at one site within the development precinct, although it is highly likely that more sites exist throughout the area (Glevan, 2000).

In order to reduce the impact of disease on vegetation within the NSN development the following strategies will be implemented:

- Earth moving equipment will be cleaned prior to entry on site to reduce the spread of diseases and to reduce weed infestation.
- Disease mapping will occur in conjunction with mapping of the conservation precinct.
- In the event that infected areas are located within the NSN development during mapping, active treatment will occur in conjunction with conservation bushland treatment.

Davidge 1979
How et al 1996
How & Dell 2000

Fauna:

Information on the fauna in the Jandakot Airport area has been compiled by Martinick (1990) and also addressed by Muir Environmental (1993). According to Martinick (1989) three faunal habitats are present at the airport.

- *Banksia* woodland on deep sand, with a small component of Jarrah
- Low-lying sandy areas with *Eucalyptus rudis, Melaleuca preissiana* or *Banksia littoralis* over heaths and sedges
- Previously cleared areas now with sedges, grasses and other low plants, with some remnant taller native vegetation.

Jandakot is high in comparison to other areas on the CP

~~Seven~~ native mammal species have been observed in previous studies. It is thought that the frequency of fire and the presence of introduced species have contributed to the poor diversity of mammal species (D&M, 1993).

see Bush Forever

~~Forty-six~~ 56 bird species have been recorded at Jandakot Airport, although more are predicted to occur in the area (Martinick, 1989). These species include the Peregrine Falcon and Carnaby's Cockatoo, who are both occassional visitors to the area.

The reptile assemblage consists of four frog species, 17 lizard species and 5 snake species. It is probable that other reptile species exist that have not

been recorded during past surveys but are known in nearby areas with similar habitats (Martinick, 1990).

Pests in bushland areas can include escaped domestic animals, accidentally introduced species and native fauna that exists in unnaturally high numbers due to human disturbances (PPK, 2000). Six introduced bird and mammal species have been recorded at Jandakot Airport (D&M, 1993). These are:

- Laughing Kookaburra (*Dacelo novaeguineae)*
- Black Rat (*Rattus rattus)*
- House Mouse (*Mus musculus)*
- Cat (*Felis catus)*
- Fox (*Vulpes vulpes)*
- Rabbit (*Oryctolagus cuniculus)*

Appendix F contains a basic fauna list compiled for Jandakot Airport.

The main strategies implemented to reduce the impacts on native fauna include:

- Clearing of vegetation will be minimised, wherever possible.
- Wherever practical, areas of excellent condition will be retained as vegetation.
- Fencing will contain larger links at the bottom to allow movement of fauna such as retiles and small mammals. The exclusion on macropods, such as kangaroos and wallabies, will have a beneficial effect, reducing the pressure on native flora.
- Feral animal management on site will be conducted in conjunction with Jandakot Airport conservation zone management.

Groundwater:

Jandakot Airport is partially located on the northern margin of the Jandakot Groundwater Mound, with the crest of the mound located just south of the airport (Davidson, 1995).

The Perth Groundwater Atlas (WRC, 1997) indicates the maximum groundwater level for the aquifer is 1 to 7m below the surface. Seasonal fluctuations of the water table range from 1-3m, but is approximately 1m in the central sandy areas of the Bassendean Dune System experienced at Jandakot Airport (Davidson, 1995). The water table elevation is highest during September-October and lowest during April-May.

Groundwater flow within the airport is in a north and north-westerly direction. The eastern areas flow north towards the Canning River, while the western side of the airport is characterised by a north-westerly flow direction, towards Bibra Lake (D&M, 1993).

The NSN development has a low impact on groundwater. The major possible source of contamination is a diesel generator. The following will be implemented to reduce the risk of groundwater contamination:

- The diesel generator will be located in a bunded area
- Any fuel or chemicals stored will be bunded in accordance with AS-1940.
- A spill management procedure will exist for the site, with all relevant staff being aware of it.

Air Quality:

There are no major impacts on air quality from the NSN operations. Vehicles and the diesel generator may contribute some emissions and will undergo regular servicing to ensure emissions are reduced as much as possible.

As part of the operation, hot air is expelled from the air conditioning room. As this disperses promptly and vegetation will be at least 10m from the emission site, this is not seen as a major impact on air quality. It is hoped that this air will eventually be harvested as an alternative power source for the site, with any excess being injected into the grid.

Other Strategies to Reduce Impacts of Development:

- Prior to development vegetation will be salvaged, wherever possible. This can be used by community groups or on other areas of the airport.
- Topsoil will be stockpiled for use on restoration sites at the airport.
- If possible, a buffer zone will be retained between the NSN development site and the Jandakot Airport boundary. This will create a larger corridor between Jandakot Airport and the adjacent Ken Hurst Park.
- During construction every effort will be made to reduce noise and dust impacts.

Conclusion:

The New Skies Networks Pty Ltd development contributes to the commercial growth of Jandakot Airport, while retaining most of the remnant vegetation. It is in the best interests of both NSN and JAH to retain as much bushland as possible and every endeavour will be made to reduce the environmental impacts from development and operation of the site.

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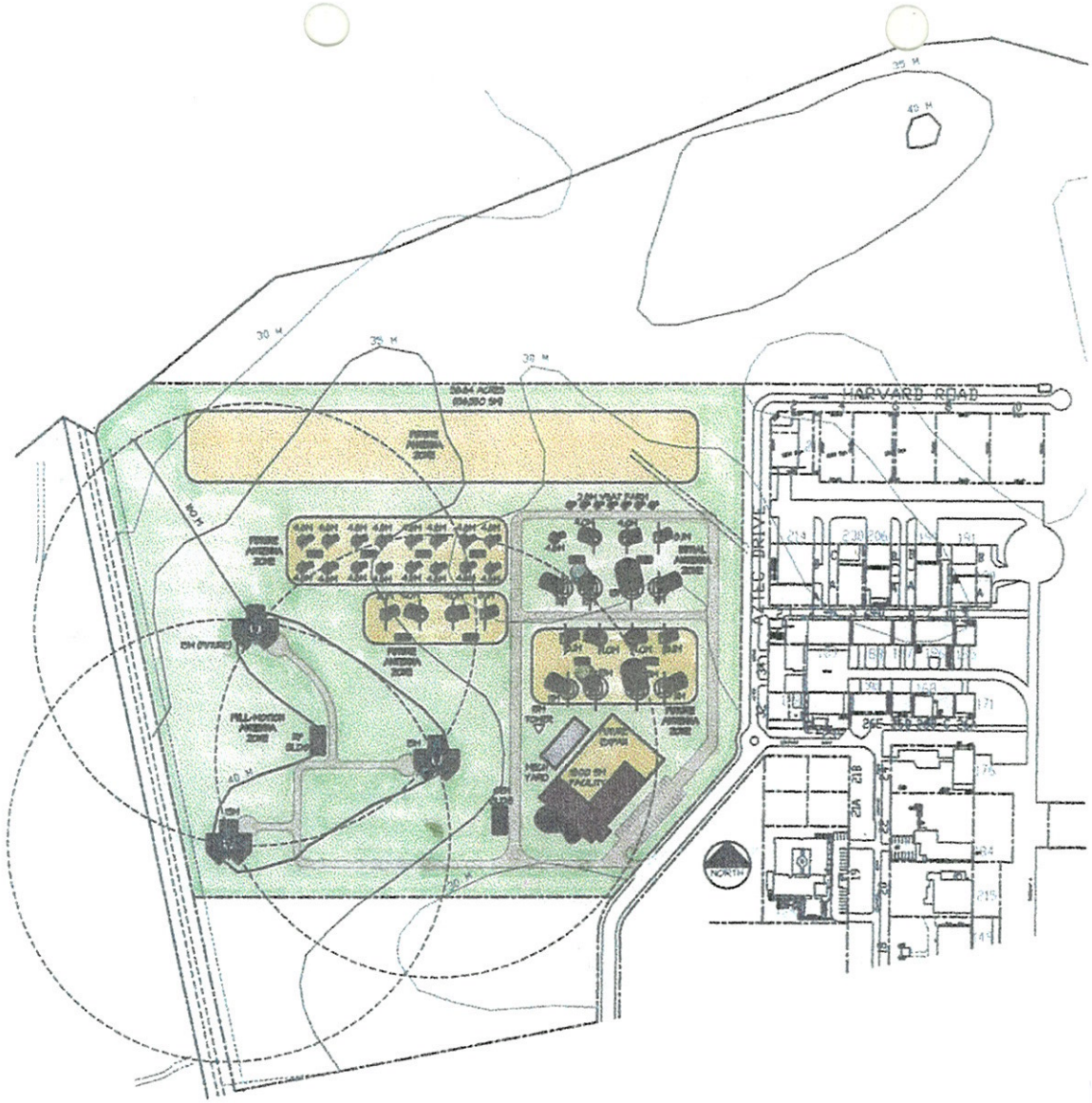
Appendix A



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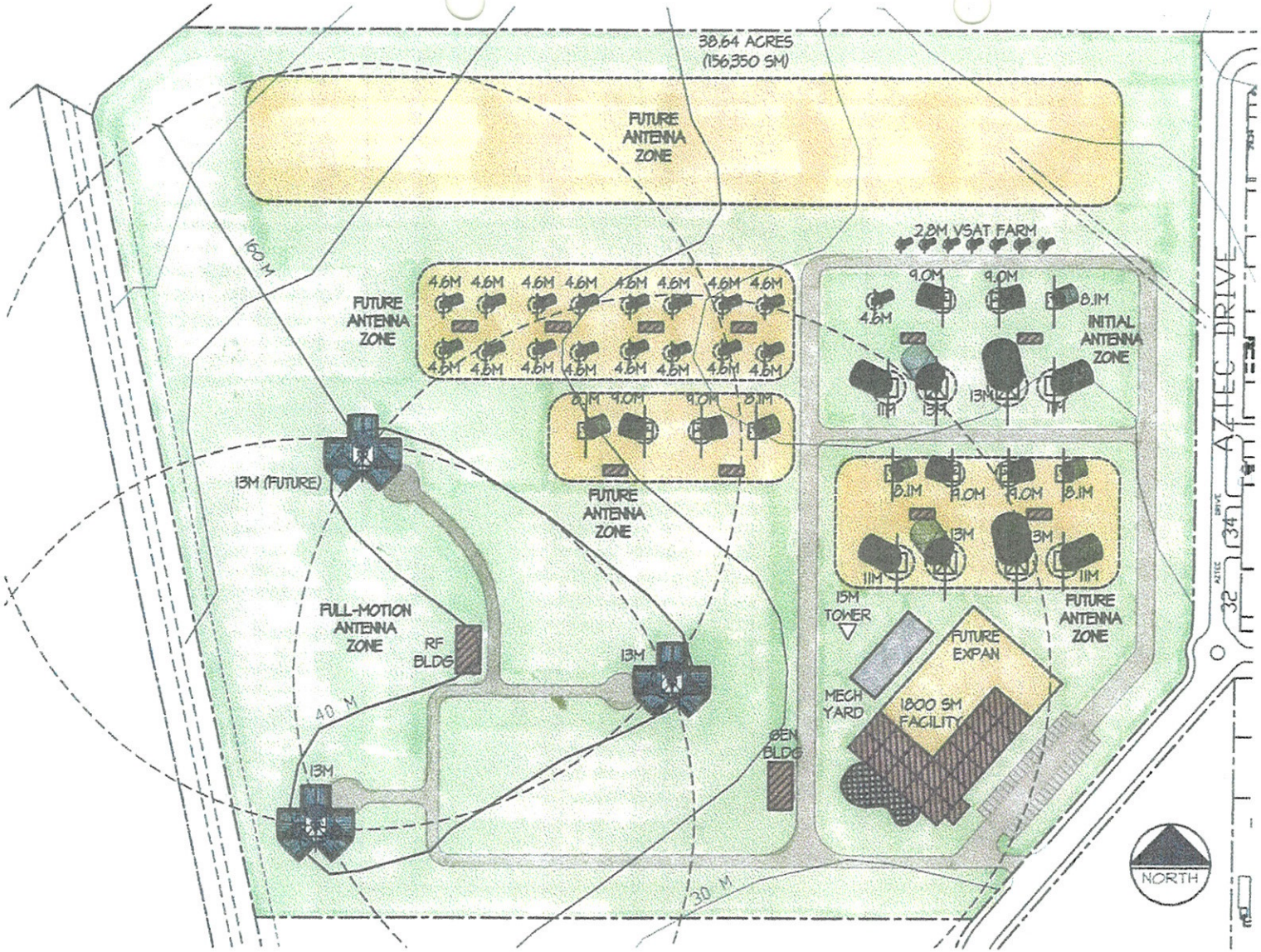
Perth Mediaport
Conceptual Site Plan

No Scale 062801



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Appendix B

Flora Recorded At Jandakot Airport

Acacia huegelii	*Conostephium minus*
Acacia pulchella	*Conostephium pendulum*
Acacia saligna	*Conostylis aculeata*
Acacia stenoptera	*Conostylis aurea*
Acacia willdenowiana	*Conostylis juncea*
Adenanthos cygnorum	*Conostylis setigera*
Adenanthos obovatus	*Crassula sp.*
**Aira caryophyllea*	*Cyperaceae sp.*
Allocasuarina fraseriana	*Cryptostylis ovata*
Allocasuarina humilis	*Dampieria linearis*
Amphipogon turbinatus	*Danthonia occidentalis*
Angiozanthos humilis	*Dasypogon bromeliifolius*
Angiozanthos manglesii	*Daviesia juncea*
Arnocrinum preissii	*Daviesia incrassata*
Astartea fasicularis	*Daviesia nudiflora*
Astroloma xerophyllum	*Daviesia physodes*
Banksia attenuata	*Daviesia triflora*
Banksia grandis	*Dianella revoluta*
Banksia ilicifolia	*Diuris emarginata*
Banksia littoralis	*Diuris laxiflora*
Banksia menziesii	*Diuris longifolia*
Baumea articulata	*Drosera erythrorhiza*
Beaufortia elegans	*Droseramacrantha*
Beaufortia squarrosa	*Drosera menziesii*
Boronia busseliana	*Drosera paleacea*
Boronia crenulata	*Drosera pulchella*
Bossiaea eriocarpa	*Dryandra nivea*
**Briza maxima*	**Ehrharta calycina*
Brachyloma preissii	*Eremaea asterocarpa*
Burchardia umbellata	*Eremaea pauciflora*
Burtonia conferta	*Eremaea sp.*
Burtonia scabra	*Eriostemon spicatus*
Caladenia flava	*Eucalyptus marginata*
Caladenia discoidea	*Eucalyptus rudis*
Caladenia gemmata gemmata	*Eucalyptus todtiana*
Caladenia patersonii longicauda	*Euchilopsis linearis*
Calectasia cyanea	**Galdiolus caryophyllaceus*
Calytrix flavescens	*Gastrolobium sp.*
Calytrix fraseri	*Gompholobium tomentosum*
Calytrix strigosa	*Haemodorum paniculatum*
**Carpobrotus edulis*	*Haemodorum spicatum*
Cassytha glabella	*Hardenbergia comptoniana*
Cassytha racemosa	*Hemiandra pungens*
Cassytha sp.	*Hensmania turbinata*
Centrolepis drummondii	*Hibbertia aurea*
Chamaescilla corymbosa	*Hibbertia huegelii*
Conospermum triplinervium	*Hibbertia hypericoides*
Hibbertia pachyrrhiza	*Melaleuca incana*
Hibbertia subvaginata	*Melaleuca preissiana*

Hovea trisperma	*Melaleuca scabra*
Hypocalymma angustifolia	*Melaleuca seriata*
Hypocalymma robustum	*Melaleuca thymoides*
**Hypochoeris glabra*	*Mesomelaena stygia*
Hypolaena exsulca	*Millotia tenuifolia*
Jacksonia furcellata	*Monotaxis grandiflora*
Jacksonia sternbergiana	*Neurachne sp.*
Juncus krausii	*Nuytsia floribunda*
Kennedia prostrata	*Oxylobium capitatum*
Kunzea ericifolia	*Patersonia occidentalis*
Laxmannia ramosa	*Pericalymma ellipticum*
Laxmannia squarrosa	*Persoonia saccata*
Lechenaultia biloba	*Petrophile linearis*
Lechenaultia floribunda	**Petrorhagia velutina*
Lepidosperma angustatum	*Phlebocarya ciliata*
Lepidosperma effusum	*Phlebocarya filifolia*
Lepidosperma scabrum	*Pimelea angustifolia*
Lepidosperma sp. B	*Pimelea rosea*
Lepidosperma sp. E	*Pimelea sulphurea*
Lepidosperma tenue	*Pithocarpa pulchella*
Leptocarpus canus	*Platysace compressa*
Leptocarpus tenax	*Platytheca galioides*
Leptomeria empetriformis	*Poaceae sp. 1*
**Leptospermum laevigatum*	*Poaceae sp. 2*
Lepyrodia muirii	*Podolepis sp.*
Leucopogon australis	*Podotheca chrysantha*
Leucopogon aff. conostephoides	*Prasophyllum sp.*
Leucopogon conostephoides	*Pterostylis nana*
Leucopogon kingianus	*Pterostylis recurva*
Leucopogon oxycedrus	*Pterostylis vittata*
Leucopogon pendulus	*Pultenaea reticulata*
Leucopogon polymorphus	*Regelia ciliata*
Leucopogon propinquus	*Regelia inops*
Leucopogon pulchellus	*Restio microcodon*
Leucopogon racemulosus	*Restio sp.*
Leucopogon strictus	*Restio stenostachyus*
Lomandra caespitosa	*Ricinocarpus glaucus*
Lomandra endlicheri	*Scaevola paludosa*
Lomandra micrantha	*Scaevola sp.*
Lomandra purpurea	*Schoenus brevisetis*
Lomandra preissii	*Schoenus curvifolius*
Lomandra suaveolans	*Schoenus globifer*
Loxocarya cinerea	*Scholtzia involucrata*
Loxycarya fasciculata	*Scirpus sp.*
Loxycarya flexuosa	*Sowerbaea laxiflora*
Loxocarya oubescens	*Stipa sp.*
Lyginia barbata	*Stirlingia latifolia*
Lysinema ciliatum	*Stylidium brunonianum*
Lysinema elegans	*Stylidium junceum*
Macrozamia riedlei	*Stylidium piliferum*
Melaleuca acerosa	*Stylidium repens*
Stylidium schoenoides	*Thysanotus triandrus*
Synaphea sp.	*Trachymene pilosa*

Synaphea spinulosa	*Tricoryne elatior*
Tetratheca setigera	**Ursinia anthemoides*
Thelymitra campanulata	*Verticordia drummondii*
Thysanotus manglesianus	*Xanthorrhoea preissii*
Thysanotus multiflorus	*Xanthosia huegelii*

* Indicates weed species

Appendix C

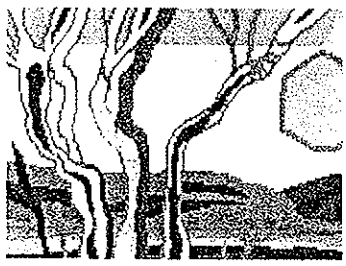
BUSHLAND CONDITION SURVEY OF

JANDAKOT AIRPORT LEASE AREA

Prepared for:
Jandakot Airport Holdings Pty Ltd

Prepared by:
Mattiske Consulting Pty Ltd

July 2001



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FIGURES

1: Bushland Condition Mapping of Jandakot Airport Lease Area, July 2001.

TABLES

1: Scale of Vegetation Condition Mapping (adapted from BJ Keighery (1994) and Connell (1995) after Trudgen (1991) in Government of Western Australia (2000)).

1. INTRODUCTION

Mattiske Consulting Pty Ltd was commissioned by Jandakot Airport Holdings Pty Ltd to undertake a bushland condition survey of the Jandakot Airport lease area. The area is located in the southern suburb of Jandakot in the Perth Metropolitan Area and consists of 410ha of remnant vegetation.

The survey area is located in the natural region of South Western Botanical Province of Western Australia within the Swan Coastal Plain Subregion of the Drummond Botanical Subdistrict (Beard 1990). The vegetation of this region is mainly *Banksia* low woodland on leached sands with *Melaleuca* swamps on poorly drained soils (Beard, 1990).

2. OBJECTIVES AND METHODS

The general objective was to undertake a survey of the remnant vegetation within the Jandakot Airport lease area, with a particular focus on identifying introduced species and defining condition of the vegetation in the survey area. The areas that have been disturbed for airport operations or cleared extensively were extracted from the condition mapping area.

A standard data collection form was used to ensure data was collected in a systematic and consistent manner. The recording sites were located at regular intervals on a grid spacing of 100m x 100m across the survey area. The specific data collected included a measure of the abundance and health of trees and understorey, the position in the landscape, potential causes of physiological stress in the plant communities and general information on the soils and site conditions. The condition of the native vegetation was assessed by utilizing a ranking scale adapted from B.J. Keighery (1994) and Connell (1995) after Trudgen (1991) in *Bush Forever* (Government of Western Australia 2000), Table 1.

Table 1: **Scale of Vegetation Condition Mapping (adapted from BJ Keighery (1994) and Connell (1995) after Trudgen (1991) in Government of Western Australia (2000))**

Scale	Description
1	**Excellent** Pristine or nearly so, no obvious signs of disturbance.
2	**Very Good** Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.
3	**Good** Vegetation structure altered, obvious signs of disturbance.
4	**Poor** Vegetation structure significantly altered by very obvious signs of multiple disturbance. Retains basic vegetation structure or ability to regenerate it.
5	**Very Poor** The structure of the vegetation is no longer intact and the area is completely or almost completely without native species.

3. RESULTS

The condition of the vegetation for the Jandakot Airport area varied from excellent (1) to very poor (5) (Figure 1). Vegetation condition was based on the abundance and aggressiveness of weed species relative to native species but did not take into consideration the occurrence of dieback. Of the 396 sites surveyed within the survey area, the greater majority of the area was of either good, very good or excellent condition with most areas which rated 4 (poor) being associated with disturbance either due to airport operations or human activities and the presence of aggressive introduced species such as *Gladiolus caryophyllaceus* and *Ehrharta calycina*.

The area contains no Declared or Pest Plants as defined by the Agriculture Protection Program (Agriculture WA 2001). Declared Plants (DP) are defined as weeds that are, or may become, a problem to agriculture or the environment. Declaration as a pest plant authorises the Shire Council to enforce control of that plant within its boundaries. The dominant introduced species recorded in the survey area were *Ehrharta calycina* (perennial veldt grass), *Hypochaeris glabra* (flatweed), *Ursinia anthemoides* and *Gladiolus caryophyllaceus* (pink gladiolus).

4. DISCUSSION

4.1. Local and Regional Significance of Vegetation

Jandakot Airport supports an area of native vegetation that is a very good representative of the structure and floristics of the Bassendean Dune System. Perth's *Bush Forever* (Government of Western Australia 2000) is a State Government incentive that identifies areas of the Perth Metropolitan Region that should be reserved for conservation purposes. The program aims to protect and retain at least 10% of each original complex within a region. *Bush Forever* (Government of Western Australia 2000) recognised the conservation value of the survey area and included the site as Bush Forever Site No. 388. The north and north-west area of the Jandakot Airport lease is listed as a negotiated outcome subject to Commonwealth Master Plan Process however the remaining 200ha has been listed as core conservation area. This site occurs in conjunction with Site No. 245 (Ken Hurst Park) to the north and Site No. 389 (Acourt Road Bushland) to the south-east.

The local and regional significance of the bushland was not assessed based on vegetation structure and presence/absence of Declared Rare or Priority Flora species. It is considered however, that the remnant bushland in this area is significant in a regional sense as it is a large, relatively undisturbed block of native vegetation within the metropolitan area. *Bush Forever* (Government of Western Australia 2000) also lists this site as "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".

4.2. Management

The majority of the core conservation area is considered "air side" and therefore not readily accessible to the public, however public access can be gained from adjacent roads and fringing rural properties to the south. It is considered that implementation of an environmental management strategy will need to at least address issues concerning appropriate fire regimes, track use, soil hygiene and weed control strategies, vehicle access, bushland fragmentation and dumping of garden refuse. Currently, Jandakot Airport has draft management plans addressing flora and vegetation, environmental weeds, fauna, feral animals, dieback, ecological restoration, fire management and cultural heritage (Miller 2000).

4.2.1. Fire

In most cases, fire is used as a management tool to reduce fuel and thereby protect life and property from the potential danger of bushfires. Grasses that dry off in the summer provide a fine fuel that will carry a fire easily (Hobbs 1995). However, after a burn and without management, these grasses generally return in even greater numbers, exacerbating the fire problem.

In the Metropolitan region, bush areas are generally burned (deliberate or accidental) every two to three years (Hobbs 1995). However, despite much of the vegetation being adapted to fire, this regime may not be conducive to the conservation of all bushland areas. Achieving a balance between fire protection and conservation requires adequate planning and local management. In particular, planning and management needs to be directed towards applying the appropriate frequency, timing, intensity and distribution (or patchiness) of the fire.

4.2.2. Introduced Species

A number of weeds recorded at Jandakot Airport are particularly aggressive and will require active management. Priority should be directed towards controlling major weeds, those encroaching on areas of high conservation value, and at isolated outbreak sites. Weed eradication methodology may include (after Hussey *et al.* 1997):

- Herbicide application
- Manual removal (e.g. hand pulling)
- Biological control agents
- Application of smokewater to stimulate germination of native and weed species, followed by intensive weed seedling control;
- Direct seeding and planting of green stock with no site disturbance;
- Whipper snipping existing alive and dead weed vegetation prior to direct seeding and planting of green stock; and
- Herbicide application prior to smokewater application.

4.2.3. Dieback and Tracks

The management of dieback, *Phytophthora cinnamomi,* is an important hygiene issue for the immediate and adjacent bushland areas. The susceptiblility of species in the lower-lying site-vegetation types is of particular concern. *Phytophthora cinnamomi* is a soil-borne pathogen readily dispersed by the movement of infected soil, roots or water and has been linked to watercourses, tracks and roads where human activity is frequent (Podger *et al.* 1996). The subsequent degradation of floristic and structural composition on the wider Swan Coastal Plain is well documented (e.g. Old *et al.* 1980, Shearer and Hill 1989, Podger *et al.* 1996, Shearer and Dillon 1996). However, such changes induced by the disease have yet to be quantified, and the associated effects on fauna are poorly understood (Shearer and Dillon 1996).

The impact of *P. cinnamomi* presents a major threat to the ecology and conservation of susceptible plant communities throughout Western Australia, the occurrence of which is not specific to land tenure, and effective control, i.e. detection, research and management, requires the combined efforts of the general public, industries and the federal, state and local government departments (Shearer 1990).

Mediating the possible occurrence and potential spread of both weeds and soil pathogens are tracks. Tracks need to be rationalized and managed to allow access, while minimising disturbance to both regenerating and established vegetation.

5. LIST OF PARTICIPANTS

The following personnel of Mattiske Consulting Pty Ltd were involved with this project:

Principal Ecologist:
- Dr E Mattiske

Botanists:
- Ms V Clarke
- Ms K Freeman
- Ms K Honczar

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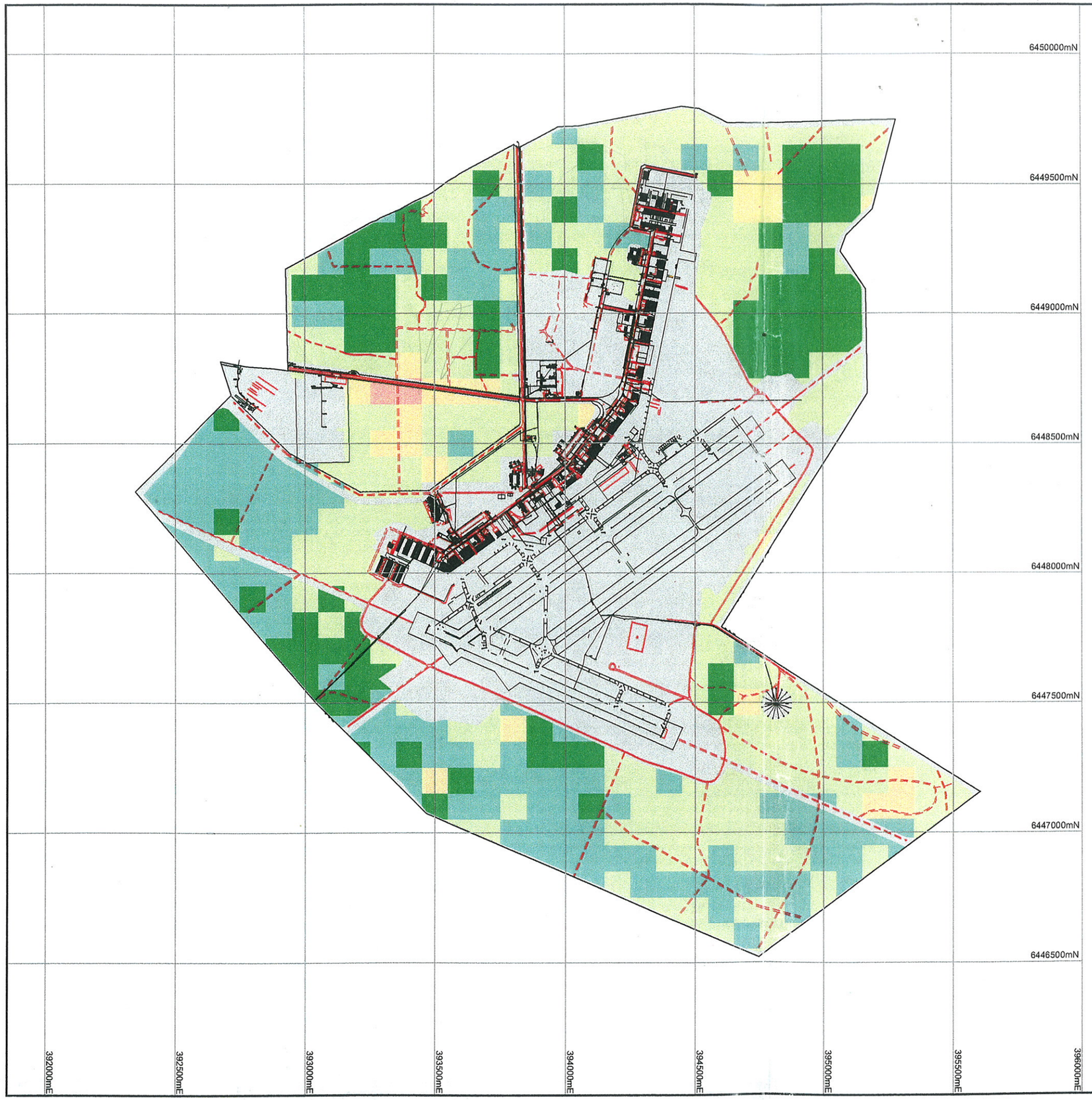
Appendix D



Legend

- Excellent
- Very Good
- Good
- Poor
- Very Poor
- Disturbed

Note

This map is to be read in conjuction with Mattiske Consulting Pty Ltd report number JAC0101/048/01

Mapping based on 100m x 100m grid survey

N

0 500m

Scale

JANDAKOT AIRPORT

JANDAKOT AIRPORT BUSHLAND CONDITION MAPPING JUNE 2001

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28 Central Road, Kalamunda ACN 063 507 175
Phone: 9257 1625 Fax: 9257 1640

Author: EMM, KF, KH	MCPL Ref: JAC0101	Scale: 1:15 000
Drawn: CAD Resources ~ www.cadresources.com.au Tel: (08) 9246 3242 ~ Fax: (08) 9246 3202		Figure: 1
CAD Ref: j713base.dgn	Date: Jul 2001	Rev: B A3

FIGURE 3.11 - VEGETATION ASSOCIATIONS AT JANDAKOT AIRPORT

Type 1. Jarrah - Banksia woodland
2. Banksia attenuata open low woodland
3. Mixed Banksia woodland
4. Mixed Banksia woodland over scrub
5. Eucalyptus rudis woodland
6. Melaleuca - Pericalymma wetland

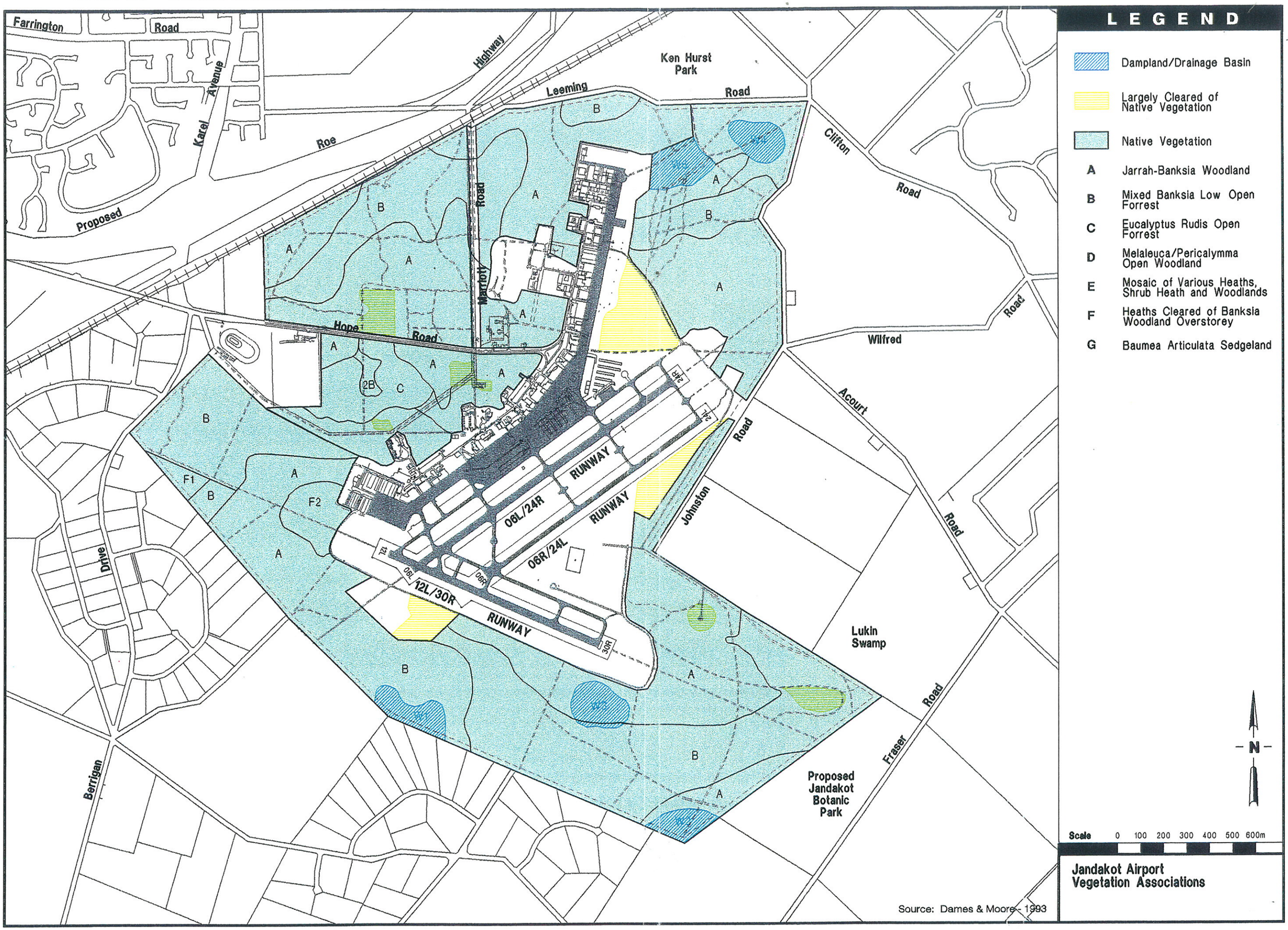
Note : Blank areas have little or no native vegetation

0 200 400m

NATIVE VEGETATION TYPES
OF JANDAKOT AIRPORT

Appendix E

FIGURE 3.9 - DAMPLAND LOCATIONS AT JANDAKOT AIRPORT



Appendix F

Fauna Recorded at Jandakot Airport

Amphibians and Reptiles

Frogs
Heleiporus eyrei
Limnodynastes dorsalis
Myobatrachus gouldii
Ranidella insignifera
Lizards
Legless Lizards
Delma fraseri
Lialis burtonis
Pygopus lepidopodus
Skinks
Cryptoblepharus plagiocephalus
Ctenotus lesueurii (australia)
Egernia napoleonis
Leiolopisma trilineatum
Lerista elegans
Lerista lineata
Menetia greyii
Morethia lineoocellata
Tiliqua occipitalis
Tiliqua rugosa
Dragon Lizards
Pogona minor
Tympanocryptis adelaidensis
Goannas
Varanus gouldii
Snakes
Demansia psammophis
Pseudonaja affinis
Rhinoplocephalus gouldii

{ Ramphotyphlops australis
Neelaps calonotus

Mammal Species

Mus musculus	House Mouse
Rattus rattus	Black Rat
Tarsipes rostratus	
Isoodon obesulus	
Macropus irma	
Nyctophilus geofroyi	
Vulpes vulpes	Fox

Bird Species

Common Name	Scientific Name
Collared Sparrowhawk	*Accipiter cirrhosephalus*
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*
Horsefield'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 Shirke-thrush	*Colluricincla harmonica*
Grey Fantail	*Rhipidura fuliginosa*
Willie Wagtail	*Rhipidura leucophrys*
Splendid Fairy-wren	*Malurus splendens*
Spotted Scrubwren	*Sericornis frontalis*
Webill	*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 Paradalote	*Pardalotus striatus*
Silvereye	*Zosterops lateralis*
Dusky Woodswallow	*Artamus cyanopterus*
Magie-lark	*Grallina cyanoleuca*
Grey Butcherbird	*Cracticus torquatus*
Australian Magpie	*Gymnorhina tibicen*
Australian Raven	*Corvus coronoides*

JANDAKOT AIRPORT

ENVIRONMENTAL APPRAISAL

prepared by

W.G. MARTINICK AND ASSOCIATES PTY LTD

for

FEDERAL AIRPORTS CORPORATION

March 1989

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1.0 SUMMARY

The Federal Airports Corporation anticipates various developments taking place at Jandakot Airport. Accordingly, an environmental appraisal has been prepared to describe the environment and to identify environmental issues which may affect these developments. The specific issues examined were terrain and soils, vegetation and flora, fauna, groundwater and Aboriginal sites.

The Airport is part of the Bassendean Complex of sand dunes arising from a sandplain with occasional swamps. This unit occurs from Gnangara to Bunbury.

The vegetation was divided into six units of various forms of Banksia woodland on the plains and dunes, and eucalypt and paperbark woodlands in the low lying areas. Regionally, these vegetation units are widespread, but they are poorly conserved. The vegetation within the Airport is in exceptionally good condition because it has been protected from recent and overly frequent fires and other disturbances. The shrub layers are particularly dense and diverse in species. The Airport now represents the best preserved remnant in the region, including those in conservation reserves.

The flora has been listed and one species of possible interest was found. This species is of uncertain status because its taxonomy is in doubt.

The fauna on the site is exceptionally rich, and this is in accordance with the good condition of the vegetation. Several gazetted rare species are present, including the Numbat which is the State emblem. Other gazetted rare species may be present.

Any development at the Airport will need to consider the high conservation value of the vegetation. The vegetation of the Airport is recommended for preservation in a review of conservation areas carried out by the Western Australian Government.

Groundwater is unlikely to affect any development. Regional lowering of the water table may have an effect on the vegetation, but this will be very small.

Sites of cultural significance to Aboriginal people and sites which contain artefacts are known to occur in the region but none have been recorded with the Western Australian Museum. It appears that no specific survey has been carried out at the Airport and consequently the possibility that such sites do occur there can not be dismissed.

The day to day management of the areas in the Airport which support native vegetation should take into account their high conservation value. This applies especially to fire management.

2.0 OBJECTIVES

The Federal Airports Corporation is planning to undertake additional developments at the Jandakot Airport property and consequently the Corporation commissioned this environmental appraisal of the area.

The specific objectives are to:

- describe and map vegetation types,
- list the flora and describe their rarity status,
- briefly describe the soils and terrain, and relate these parameters to the vegetation and its distribution,
- describe the fauna which is likely to live on the airport site or depend for their survival on that site,
- evaluate the local and regional conservation significance of the vegetation, flora and fauna,
- briefly describe the groundwater resources, and
- assess the potential for Aboriginal sites to occur on the site.

3.0 INTRODUCTION

Jandakot is the main General Aviation airport for the Perth Region in Western Australia. It is located 18km to the south of the city centre in the suburb of Jandakot and 23km to the south-west of Perth Airport (Figure 1). To the north and west of the airport there is a developing urban area, and to the south and east the area is mainly rural with some small hobby farms, quarry sites, Government Reserves and special industrial zones (Figure 2).

4.0 CLIMATE

The average annual rainfall at Jandakot is 880mm (Table 1a), with approximately 90% of the rain falling between April and October. Summer months are hot, averaging 29°C, and dry, resulting in high potential evaporation (Table 1b). The average annual potential evaporation is about 2,000mm which is more than twice the average annual rainfall.

5.0 TERRAIN AND SOILS

The terrain and soils of the study area are within the Bassendean Complex which consists of aeolian, or wind blown, sands. This Complex is made up of sandplains with low dunes and occasional swamps.

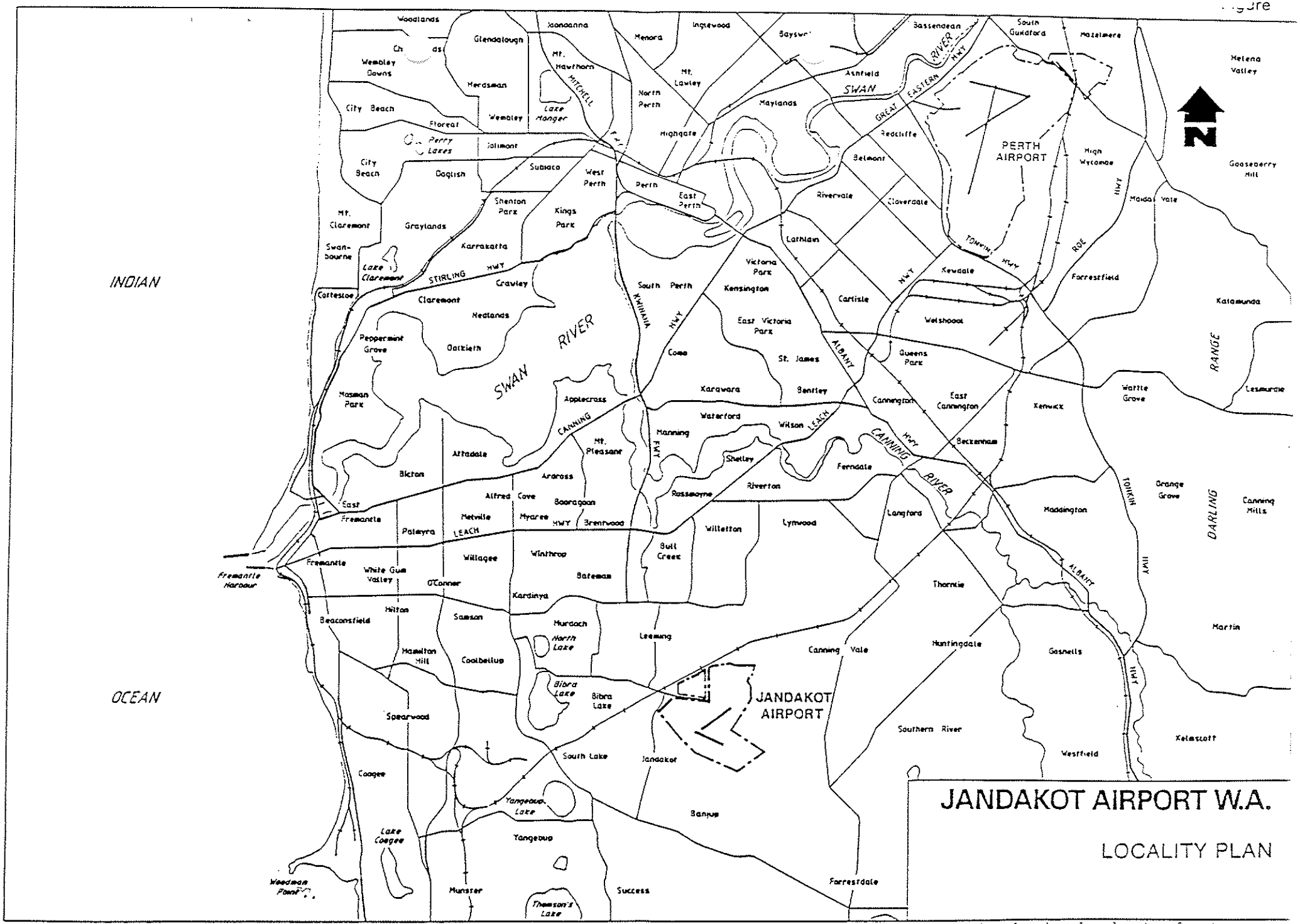

INDIAN
OCEAN
SWAN RIVER
CANNING RIVER
DARLING RANGE
PERTH AIRPORT
JANDAKOT AIRPORT
Fremantle Harbour
Lake Claremont
Lake Coogee
Herdsman Pond
Bibra Lake
North Lake
Yangebup Lake
Thomson's Lake
Woodlands
Glendalough
Joondanna
Menora
Inglewood
Bayswater
Bassendean
South Guildford
Mazelmere
Helena Valley
Wembley Downs
Mt. Hawthorn
Mt. Lawley
Herdsman
Wembley
Lake Monger
North Perth
Maylands
Ashfield
City Beach
Floreat
Perry Lakes
Jolimont
Highgate
Redcliffe
Belmont
Gooseberry Hill
Dog Lake
Subiaco
West Perth
Perth
East Perth
Rivervale
Cloverdale
High Wycombe
Mt. Claremont
Graylands
Shenton Park
Kings Park
Lathlain
Victoria Park
Kensington
Kewdale
Forrestfield
Karrakatta
Swanbourne
Cottesloe
Crawley
Claremont
Nedlands
South Perth
Cartisle
Welshpool
Kalamunda
Peppermint Grove
Dalkeith
Como
East Victoria Park
St. James
Queens Park
Maseman Park
Applecross
Karawara
Bentley
Cannington
East Cannington
Kenwick
Wattle Grove
Lesmurdie
Waterford
Wilson
Manning
Mt. Pleasant
Beckenham
Attadale
Shelley
Ferndale
Bicton
Ardross
Alfred Cove
Rossmoyne
Riverton
Orange Grove
Canning Mills
East Fremantle
Melville
Myaree
Brentwood
Booragoon
Maddington
Palmyra
Willetton
Lynwood
Langford
Fremantle
White Gum Valley
Willagee
Winthrop
Bull Creek
Thornlie
O'Connor
Bateman
Kardinya
Hilton
Beaconsfield
Samson
Murdoch
Leeming
Canning Vale
Huntingdale
Gosnells
Martin
Hamilton Hill
Coolbellup
Spearwood
Southern River
Ketterstt
Westfield
South Lake
Jandakot
Coogee
Banjup
Yangebup
Munster
Success
Forrestdale
JANDAKOT AIRPORT W.A.
LOCALITY PLAN
Department of Aviation
Scale in kilometres

Figure 2 JANDAKOT STUDY AREA
PROPOSED ZONING STRUCTURE

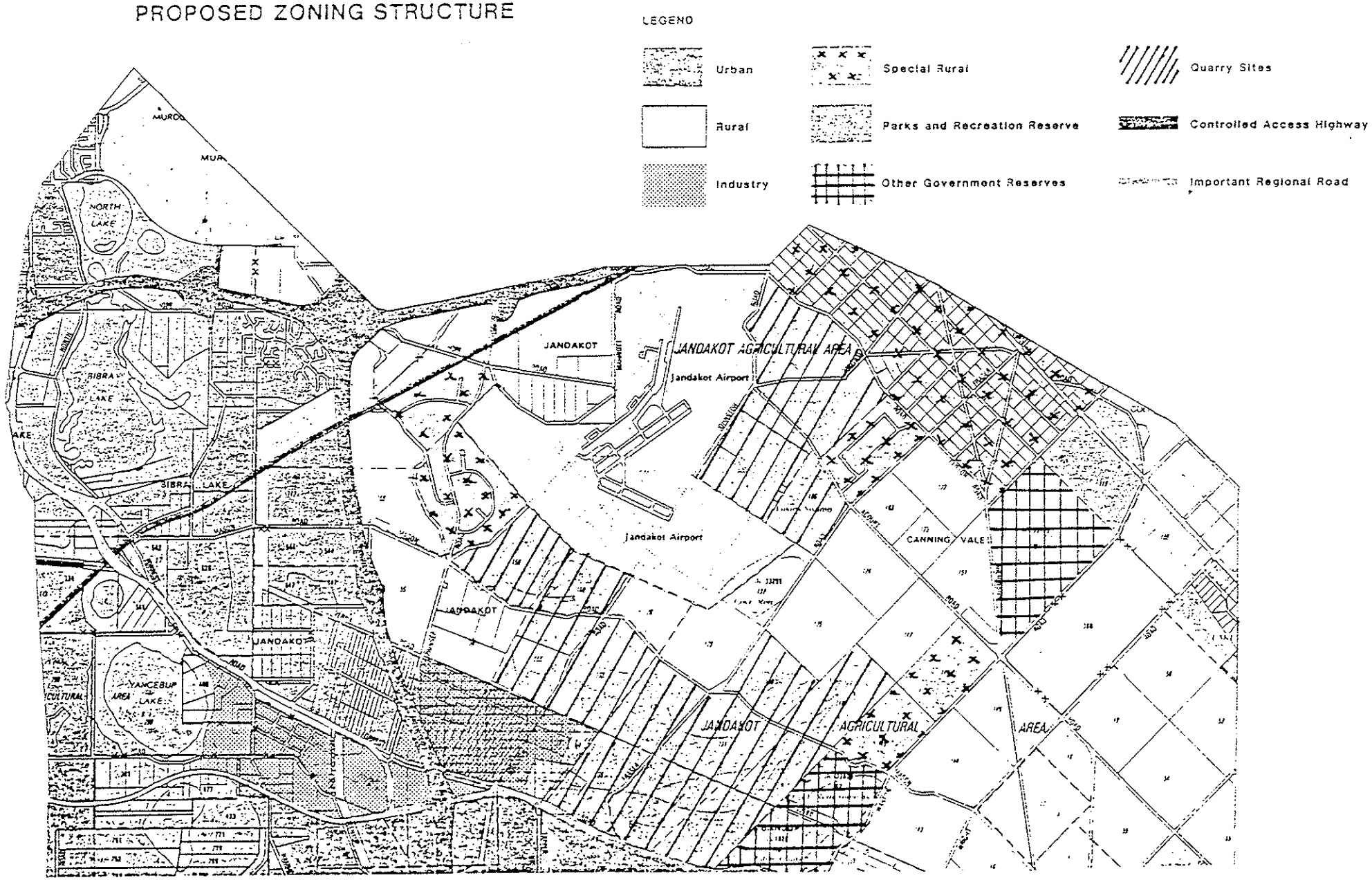


TABLE 1(a) RAINFALL (mm) JANDAKOT AIRPORT

	J	F	M	A	M	J	J	A	S	O	N	D	TOTAL
MEAN	14	16	11	45	122	180	191	136	81	44	29	11	880
HIGHEST	136	105	37	91	218	341	285	198	175	88	73	49	
LOWEST	0	0	0	0	34	76	76	41	32	13	2	0	

TABLE 1(b) TEMPERATURE DATA (^{o}C) PERTH

	J	F	M	A	M	J	J	A	S	O	N	D	YEARLY MEAN
MEAN MAX	29.6	30.0	28.0	24.6	20.8	18.2	17.4	18.0	19.5	21.4	24.6	27.4	23.3
MEAN MIN	17.8	18.0	16.7	14.2	11.2	10.1	9.0	9.2	10.2	11.6	14.0	16.2	13.2

The topography of Jandakot Airport is typical of the Bassendean Complex. There is a sandplain at about 30m above sea level. Low dunes approximately five metres high emerge from the sandplain, and on the periphery of the Airport there are larger dunes up to 20m high. The lowest areas between the dunes are as much as five metres below the level of the sandplain and are wet during the winter.

The soils of the Bassendean sands are white and grey podzols with darkening at the surface due to an accumulation of organic matter. To this organic matter accumulation is generally greatest in the valleys and least on the crest of dunes. In the swampy depressions the sandy soils are frequently overlain by a layer of peat. All of the soils are very leached and acidic.

Soils were sampled to a depth of 1m at sites throughout the airport property and classified into the three types on the basis of their location within the landforms. The boundaries between these three soil types are not clearly defined and there is a merging of soils between changes in landforms:

- The upper slopes consist of deep podzols of grey-white sands which are covered by a layer of surface litter which is up to 3cm deep. Accumulation of organic matter is apparent to a depth of 30cm and particularly in the surface 2cm which is dark grey in colour.

- Similar podzols occur on the lower slopes but these are distinguished from the soils of the upper slopes by a greater accumulation of organic matter which results in these soils being more dark-grey in their surface horizons.

- In the wetland areas a layer of peat overlies the podzols. This layer varies in thickness from 5 to 40cm.

6.0 VEGETATION

6.1 Introduction

The vegetation of Jandakot Airport falls within the Bassendean Complex - Central and South as described and mapped in the Atlas of Natural Resources (Department of Conservation and Environment, 1980). This vegetation complex occupies much of the eastern area of the Swan Coastal Plain and extends from Gnangara to Bunbury. The vegetation is characterised by a woodland overstorey of Banksia species on low undulating dunes, with seasonally wet interdunal areas supporting Eucalyptus species and Melaleuca species (paperbarks). Beard (1979) noted that although vegetation of the Bassendean Complex to the north of the Metropolitan Region has been documented, the southern areas have not been studied in detail. This observation still applies today. Part of the present site was studied in detail by Milewski and Davidge (1981).

6.2 Methods used for describing vegetation

The native vegetation on the Jandakot Airport was surveyed during February 1989 by mapping different vegetation and landform types from a 1:4000 colour aerial photograph of the area, and by field surveys. During the field surveys the vegetation was checked to ensure consistency within each type.

The vegetation of representative sites was described by noting the foliage cover and representative species of each stratum. Vegetation types were distinguished on the basis of dominant species composition in the upper stratum and differences in height and density of the different strata.

Most species were identified on site, but it was necessary for the identification of some specimens without flowers or fruit to be verified at the Western Australian State Herbarium.

6.3 Vegetation and flora

The vegetation was categorized into six different structural types. The distribution of these types is shown in Figure 3. The six types are described here and illustrated in the plates at the end of this report.

A list of the flora is given in Table 2.

Studies of the vegetation on the Airport were carried out by students at the Western Australian Institute of Technology in 1984. The results have not been published and were not available to us because Dr John Fox, who was in charge of these studies, is overseas and unavailable.

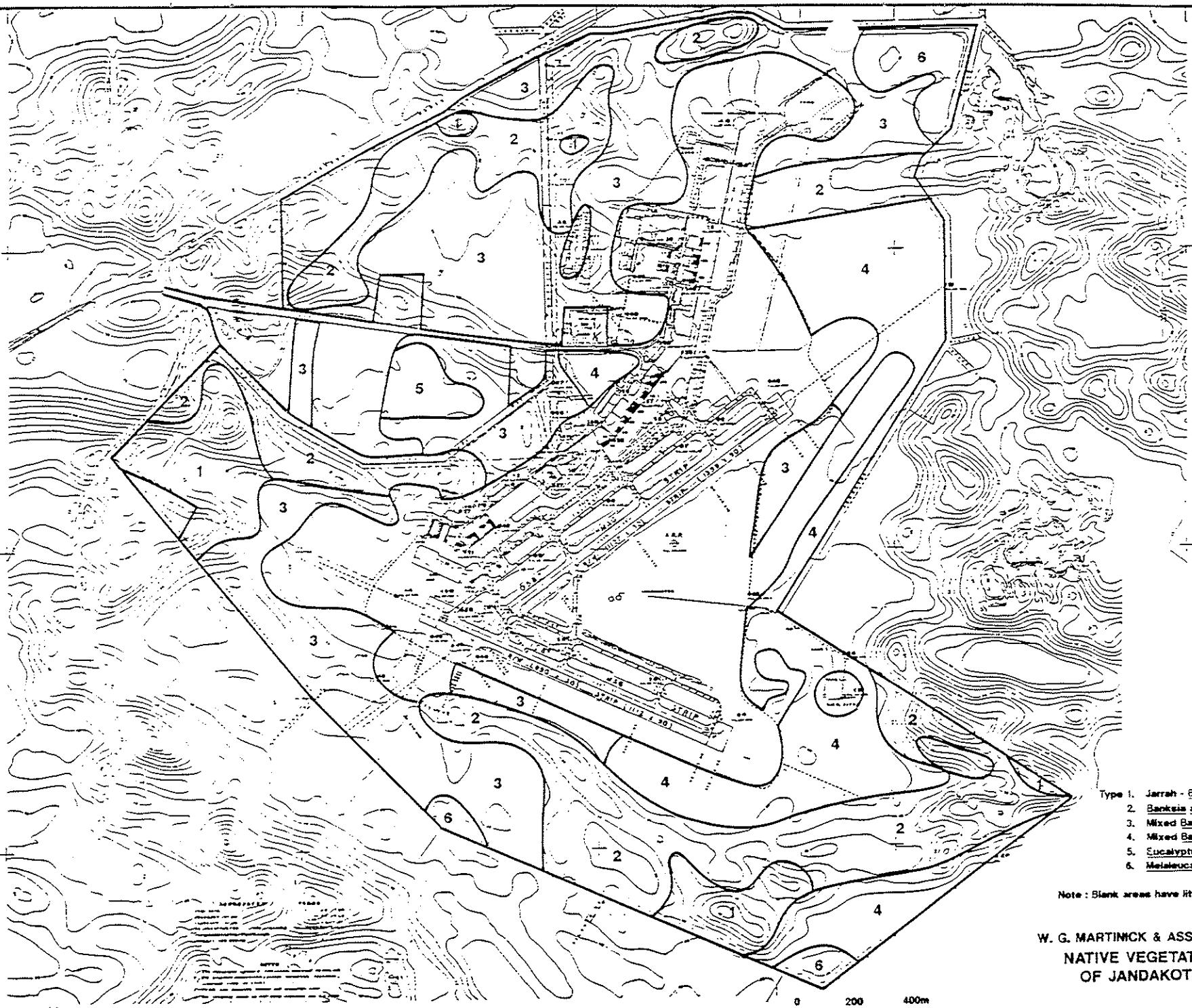

Type 1. Jarrah - Banksia woodland
2. Banksia attenuata open low woodland
3. Mixed Banksia woodland
4. Mixed Banksia woodland over scrub
5. Eucalyptus rudis woodland
6. Melaleuca - Pericalymma wetland
Note : Blank areas have little or no native vegetation
W. G. MARTINICK & ASSOCIATES PTY LTD
NATIVE VEGETATION TYPES
OF JANDAKOT AIRPORT
0 200 400m
Figure 3

Table 2. **Plant species identified at Jandakot Airport**
*Denotes introduced species

ZAMIACEAE
Macrozamia riedlei (Fischer ex Gaudich.) C. Gardner

POACEAE
Amphipogon turbinatus R.Br.
*Briza maxima L.
Danthonia ? occidentalis Vick.
*Ehrharta calycina Smith
Stipa sp.

CYPERACEAE
Lepidosperma angustatum R.Br.
Mesomelaena pseudostygia (Kuek.) K.L. Wilson
Schoenus curvifolius (R.Br.) Benth.

RESTIONACEAE
Leptocarpus tenax (Labill.) R.Br.
Loxocarya cinerea R.Br.
Lyginia barbata R.Br.

DASYPOGONACEAE
Dasypogon bromeliifolius R.Br.
Lomandra sp.

XANTHORRHOEACEAE
Xanthorrhoea preissii Endl. in Lehm.

ANTHERICACEAE
Thysanotus multiflorus R.Br.

COLCHICACEAE
Burchardia umbellata R.Br.

HAEMODORACEAE
Anigozanthos humilis Lindley
Conostylis aurea Lindley
Phlebocarya ciliata R.Br.

IRIDACEAE
*Gladiolus caryophyllaceus (Burm.f.) Poiret in Lam.
Patersonia occidentalis R.Br.

CASUARINACEAE
Allocasuarina fraseriana (Miq.) L. Johnson
Allocasuarina humilis (Otto & Dietr.) L. Johnson

PROTEACEAE
Adenanthos cygnorum Diels in Diels & E. Pritzel
Banksia attenuata R.Br.
Banksia grandis Willd.

Banksia ilicifolia R.Br.
Banksia littoralis R.Br.
Banksia menziesii R.Br.
Conospermum triplinervium R.Br.
Persoonia saccata R.Br.
Petrophile linearis R.Br.
Stirlingia latifolia (R.Br.) Steudel

OLACACEAE
Nuytsia floribunda (Labill.) R.Br. ex Fenzl in Endl., Fenzl, Benth. & Schott.

CARYOPHYLLACEAE
*Petrorhagia velutina (Guss.) P. Ball & Heyw.

LAURACEAE
Cassytha sp.

DROSERACEAE
Drosera erythrorhiza Lindley

MIMOSACEAE
Acacia pulchella R.Br. in W.T. Aiton
Acacia saligna (Labill.) H.L. Wendl.
Acacia willdenowiana H.L. Wendl.

PAPILIONACEAE
Bossiaea eriocarpa Benth. in Endl., Fenzl, Benth. & Schott
Daviesia incrassata Smith
Daviesia physodes Cunn. ex Don
Daviesia triflora M.D. Crisp
Gompholobium tomentosum Labill.
Jacksonia furcellata (Bonpl.) DC.
Oxylobium capitatum Benth. in Endl., Fenzl, Benth. & Schott

RUTACEAE
Eriostemon spicatus A. Rich

POLYGALACEAE
Comesperma calymega Labill.

EUPHORBIACEAE
Monotaxis grandiflora Endl. in Endl., Fenzl, Benth. & Schott
Ricinocarpus glaucus Endl. in Endl., Fenzl, Benth. & Schott

DILLENIACEAE
Hibbertia huegelii (Endl.) F. Muell.
Hibbertia hypericoides (DC.) Benth.
Hibbertia subvaginata (Steudel) F. Muell.

MYRTACEAE
Astartea fasicularis (Labill.) DC.
Beaufortia squarrosa Schauer

Calytrix flavescens Cunn.
Calytrix fraseri Cunn.
Eremaea pauciflora (Endl.) Druce
Eremaea sp. (undescribed species)
Eucalyptus marginata Donn ex Smith
Eucalyptus rudis Endl. in Endl., Fenzl, Benth. & Schott
Eucalyptus todtiana F. Muell.
Hypocalymma angustifolia Endl. in Endl., Fenzl, Benth. & Schott
Hypocalymma robustum Endl. in Endl., Fenzl, Benth. & Schott
Kunzea ericifolia (Smith) Heynh.
*Leptospermum laevigatum (Gaertner) F. Muell.
Melaleuca preissiana Schauer in Lehm.
Melaleuca seriata Lindley
Melaleuca thymoides Labill.
Pericalymma ellipticum (Endl.) Schauer in Lehm.
Regelia ciliata Schauer
Regelia inops (Schauer) Schauer in Lehm.
Scholtzia involucrata (Endl.) Druce
Verticordia drummondii Schauer

APIACEAE
Platysace compressa (Labill.) Norman

EPACRIDACEAE
Astroloma xerophyllum (DC.) Sonder in Lehm.
Conostephium minus Lindley.
Conostephium pendulum Benth. in Endl., Fenzl, Benth. & Schott
Leucopogon conostephioides DC.
Leucopogon aff. conostephoides DC.
Leucopogon kingianus (F. Muell.) C. Gardner
Leucopogon oxycedrus Sonder in Lehm.
Leucopogon polymorphus Sonder in Lehm.
Lysinema ciliatum R.Br.

LAMIACEAE
Hemiandra pungens R.Br.

GOODENIACEAE
Dampieria linearis R.Br.
Lechenaultia floribunda Benth. in Endl., Fenzl, Benth. & Schott
Scaevola paludosa R.Br.

STYLIDIACEAE
Stylidium piliferum R.Br.
Stylidium repens R.Br.

ASTERACEAE
*Hypochoeris glabra L.
Pithocarpa pulchella Lindley
Ursinia anthemoides (L.) Poiret in Lam.

Type 1. - Jarrah-Banksia woodland

Jarrah-Banksia woodland occurs on the highest slopes and crests of the study area, and is not extensive at the airport. Banksia attenuata is the most common tree species, with B. menziesii, Allocasuarina fraseriana and stunted Jarrah (Eucalyptus marginata) also occurring. These trees are typically 3-6m high and have a foliage cover of 15-35%.

The tall shrub stratum is 1-2m high and has 5-15% foliage cover. It includes Macrozamia riedlei, Beaufortia squarrosa, Melaleuca thymoides, Jacksonia furcellata and occasional Regelia inops.

There is typically a more diverse third stratum of up to 0.5m in height with 45-65% foliage cover. Common shrub species include Eremaea pauciflora, Hibbertia subvaginata, Eriostemon spicatus, Conostephium pendulum, Stirlingia latifolia, Scholtzia involucrata and Leucopogon polymorphus. Sedges are frequently common and they include Loxocarya cinerea, Patersonia occidentalis, Phlebocarya ciliata and Lyginia barbata.

Type 2. - Banksia attenuata open low woodland

Banksia attenuata open low woodland is typical on the gently undulating dune crests. This vegetation is characterised by an open low woodland which is 3-6m in height and has a foliage cover of 5-10%. Banksia attenuata is the principal tree and it is accompanied by occasional Banksia menziesii, Eucalyptus todtiana and Nuytsia floribunda.

There is a sparse second stratum of shrubs which are 1.0-1.5m high and have a foliage cover of 2-10%. Principal species in this layer include Allocasuarina humilis, Acacia pulchella, Stirlingia latifolia and Eremaea pauciflora.

There is a lower stratum of up to 0.5m and this has a foliage cover which is typically 60-70%. This stratum has many species in common with vegetation Type 1, particularly Stirlingia latifolia, Scholtzia involucrata and Leucopogon polymorphus.

Type 3. - Mixed Banksia woodland

Mixed Banksia woodland is found on the lower slopes and flats. Banksia menziesii, B. attenuata and B. ilicifolia are co-dominant in the upper stratum, and they are typically 3-6m in height and have a foliage cover of 15-35%. Allocasuarina fraseriana is at times important in the tree stratum.

A tall shrub layer of 1-2m in height and a canopy cover of 5-15% is usually present. Common plants are Xanthorrhoea preissii, Melaleuca thymoides and Jacksonia furcellata.

A lower stratum of up to 0.5m is present and has Calytrix flavescens, Gompholobium tomentosum, Bossiaea eriocarpa, Leucopogon polymorphus and Conostephium pendulum as common species.

Type 4. - Mixed Banksia woodland over scrub

Lowland dune areas typically support Banksia attenuata woodland with a heath or low scrub understorey which is dominated by Regelia inops. A dense foliage cover of this vegetation and a suite of understorey species which include Melaleuca preissiana, Astartea fascicularis and Hypocalymma angustifolium reflect the higher moisture conditions in the sub-soil than on more elevated areas.

The mixed Banksia canopy is 3-6m high and it is typically dense with a foliage cover of 35-50%. Banksia attenuata, B. menziesii and B. ilicifolia are present, and B. ilicifolia is dominant in some stands. Melaleuca preissiana, Nuytsia floribunda, B. grandis and Allocasuarina fraseriana are also occasionally present.

A second stratum of 1.5-2.0m high shrubs is present and it typically has a foliage cover of 30-60%. This stratum consists mainly of Regelia inops with Daviesia incrassata, Astartea fascicularis, Persoonia saccata, Jacksonia furcellata and Melaleuca thymoides. Xanthorrhoea preissii is present as unusually large plants.

There is a lower stratum of up to 0.5m in height and this consists of shrubs and sedges, and it typically forms a foliage cover of 60-90%. It is usually dominated by Dasypogon bromeliifolius, with Hypocalymma angustifolium, Lechenaultia floribunda, Oxylobium capitatum and Scholtzia involucrata being common.

Type 5. - Eucalyptus rudis woodland

In one interdunal areas which is associated with impeded drainage, there is a swamp depression which supports a varied wetland vegetation which is typified by Eucalyptus rudis.

This vegetation occurs only near Hope Road, where Eucalyptus rudis forms an overstorey of mixed age ranging from saplings of 1.5m in height to mature trees which are 12-14m high. The foliage cover is 10-25%. Also common are occasional trees of Melaleuca preissiana and Banksia littoralis.

There is a second stratum of shrubs which is 0.5-1.0m high and has a foliage cover of 60-80%. Astartea fascicularis predominates, with shrubs of M. preissiana and Acacia pulchella being present occasionally. Interwoven through the shrub layer there are dense mats of the creeper Cassytha sp..

Type 6. - Melaleuca - Pericalymma wetland

This type is typical of swamp depressions in the interdunal areas which are associated with impeded drainage.

Melaleuca preissiana is the dominant tree, with occasional Banksia littoralis. Tree height is 4-8m and the foliage cover is 5-30%.

A 1.0-1.5m shrub heath of Pericalymma ellipticum is typical with Hypocalymma angustifolium, Astartea fascicularis, Hibbertia subvaginata, Dasypogon bromeliifolius, Patersonia occidentalis, Xanthorrhoea preissii and Lyginea barbata forming a patchy lower stratum.

There is a clear correlation between vegetation and topography. Jarrah-Banksia woodland occurs only on the highest areas. Banksia attenuata open low woodland occurs on slightly lower slopes, while mixed Banksia woodland occurs on the flats. The lowest dune areas support mixed Banksia woodland over scrub. The eucalypt and paperbark woodlands occur in wet low-lying areas, and these could probably be separated by soil differences.

The vegetation types described here are widespread in the region, but the vegetation is unusual in the density and diversity of understorey species. This is due to the good fire control which has applied within the airport for many years, and the protection of the vegetation, provided by a good fence, from wood cutting, grazing and other activities. An excessive fire frequency eliminates some species and in particular causes a big reduction in the density of the understorey.

The flora could not be listed fully because the survey was carried out in late summer when no annual or ephemeral species were present, but most perennial species were identified and it is unlikely that a greater survey would change markedly the conclusions of this appraisal.

The only species of interest encountered during the survey was Leucopogon kingianus. This species is rare locally, but it is widespread. There is some doubt about the taxonomy of this species and it may in fact be several species.

It is possible that gazetted rare species occur on the Airport land, but these could not be surveyed in late summer.

6.4 Conservation status

The condition of the native vegetation at Jandakot Airport is generally pristine, and it is one of the best, if not the best, example of Banksia woodland to be seen in the Perth metropolitan area. There are no areas of comparable vegetation in any conservation reserve.

The level of weed invasion in the woodland is small. Introduced flora are generally restricted to disturbed areas and to the periphery of firebreaks. Ehrharta calycina (Veldt grass) is the most common introduced plant. Others identified include Ursinia anthemoides, Hypochoeris glabra, Briza maxima, Gladiolus caryophyllaceus and Petrorhagia velutina. The tall shrub Leptospermum laevigatum is established in some wetland areas.

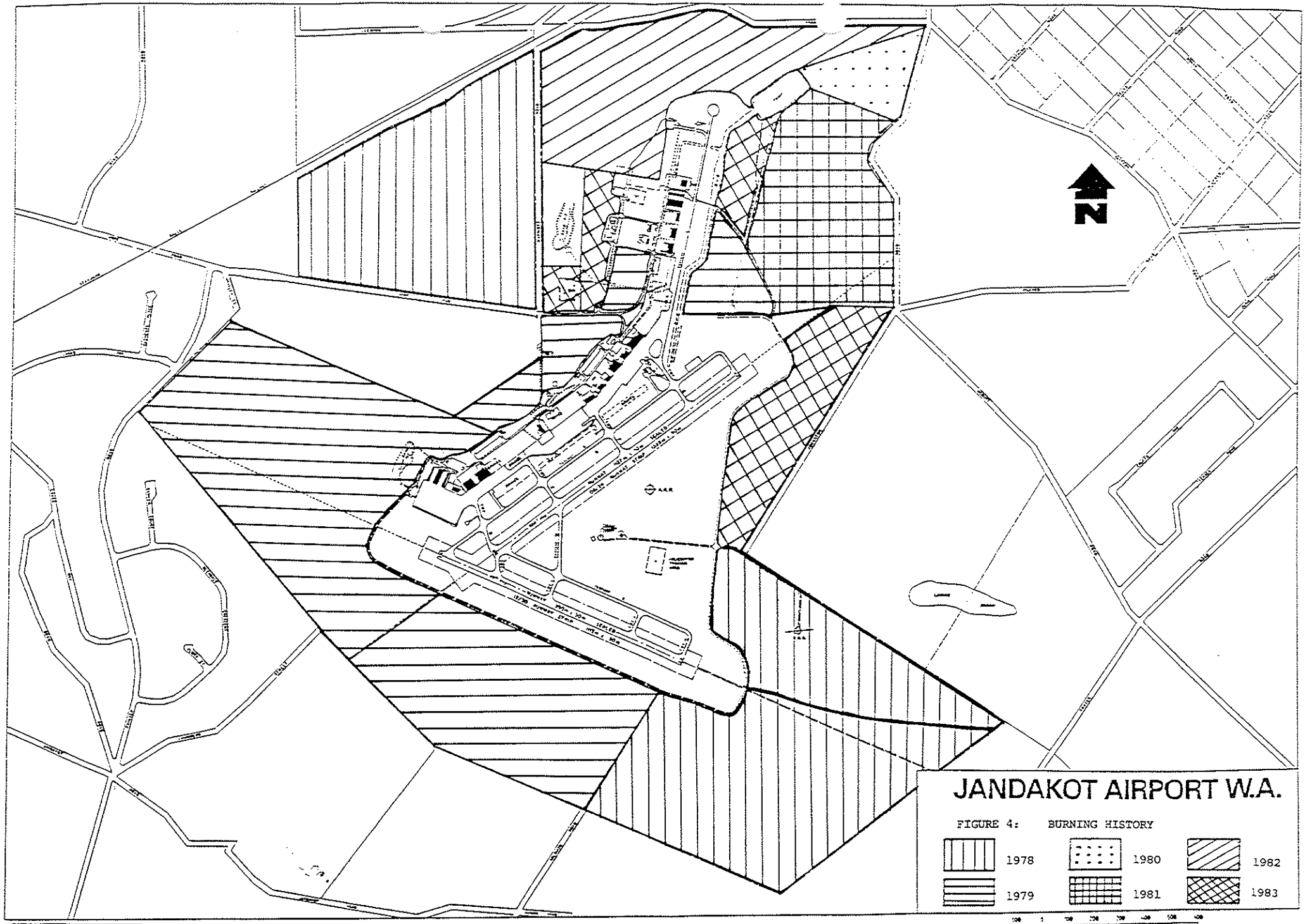
Fire has been controlled. A regulated burning programme was used until 1983, when burning ceased. Figure 4 shows the date of the last fire for each area. The shrub and tall shrub understorey is unusually dense and many fire sensitive species such as species of Calytrix, Verticordia and Ricinocarpus, which are commonly depleted in contemporary metropolitan Banksia woodlands, are still represented in the flora.

Dead Banksia trees were seen in several areas in a pattern suggesting the presence of dieback due to a Phytophthora species. This has not been confirmed but could be important in the future management of the area.

The vegetation at Jandakot Airport is outstanding in the Perth region because of the diversity and density of species in the lower strata. This applies equally to elevated and low lying areas. Banksia woodland is rarely so well-preserved and this gives the airport vegetation a high conservation value. This value will increase as more of the surrounding area is cleared for urban and industrial developments. Much of the surrounding area was similar until quite recently, but increasing urbanisation has let to an increased fire frequency and general disturbances.

The vegetation of the Central and Southern Bassendean Complex has been poorly conserved. Hopper and Burbidge (pers. comm.) estimate that only 1.6% of the original vegetation of 86,123 ha is contained within conservation reserves. This includes mainly low-lying areas and wetland vegetation such as at Thomsons Lake Nature Reserve which is not typical of the more upland areas seen at Jandakot. In recognition of the high conservation value of the area, The Darling System System 6 Report (Department of Conservation and Environment, 1983) recommended that wherever possible the vegetation and flora within the Airport should be conserved.

The present study shows that at the very least this conservation value has been maintained. It is more likely that, due to the good management of the area and the increased development of the surrounding areas, this conservation value has been increased. Over the years, the conservation value will considerably increase as the vegetation becomes more and more of a remnant.


N
JANDAKOT AIRPORT W.A.
FIGURE 4: BURNING HISTORY
1978
1979
1980
1981
1982
1983
Department of Aviation

6.5 Veldt grass and its control

Veldt grass Ehrharta calycinus, is present alongside roads and in fire breaks but does not occur in well-established bush. It readily invades areas that are burnt frequently to expose open ground.

E. calycinus dies back each year but the base survives perennially to produce lush new growth in autumn, and plants may be up to 40cm high in spring. Subsequently, with dry conditions in summer the grass dries off, and provides a fire risk in some situations.

Veldt grass may be readily controlled during the period of active growth in July and August by using "Fusilade" according to the label, i.e. at four litres per hectare in 350-400 litres of water. The effect increases with the use of a wetting agent. Although native vegetation is tolerant of the spray, well-directed spraying is preferable to a broad spectrum approach which could include native species.

6.6 Controlled burning of bush

Burning is often practised in a way which is in conflict with conservation values as it has little regard for the requirements of the flora and fauna affected. Usually burning is far too frequent and over too wide an area and consequently plant species may be lost while animal species that survive the burn, lack the habitat that is vital to their survival. While some plants benefit from occasional burns as it helps their regeneration, there are many other species where the impact of burning is not fully understood. It is recognised however that bush that has not been burned for a long time presents a potential hazard. In general it takes about 11 years for Banksia woodland to accumulate fallen logs, branches and other litter to a potentially hazardous level in relation to an unexpected fire. Accordingly, burning of some of the bush at Jandakot Airport is now due for reasons of safety and for protection of the bush from an uncontrolled burn. The conflict of interests must be compromised by introducing a burning regime which will prevent large accumulations of litter in some areas. The following regime has evolved from discussions with professional officers at the Department of Conservation and Land Management and the University of WA. It is recommended that:

- burning be conducted in late autumn,
- sectors of bush should be burned piecemeal in a chessboard pattern while the nearest sectors remain unburned for 4-5 years,
- burning frequency per sector be 8-10 years,

- larger sectors around the perimeter of the Airport should be sub-divided by four wheel drive vehicle tracks running approximately parallel with the perimeter so that fire tenders can control back-burning into one or other sub-divided sector, and

- veldt grass be controlled.

7.0 FAUNA

7.1 Introduction

Three fauna habitats are present:

- Banksia woodland on deep sand, with a small component of Jarrah,

- low lying sandy areas with trees of Eucalyptus rudis, Melaleuca preissiana or Banksia littoralis over heaths and sedges,

- previously cleared areas now with sedges, grasses and other low plants, and some remnant taller native vegetation.

A small area of the Banksia woodland in the airport has been trapped for small animals (Davidge, 1979). The other habitats have not been specifically studied and the fauna present must be inferred from regional studies.

7.2 Fauna recorded or expected

The terrestrial vertebrate species which are known to occur or are expected to occur on the Airport are listed according to habitat in Tables 3, 4 and 5. Specific records for the region have been taken from Crook and Evans (1981) for Thomsons Lake Nature Reserve, Department of Conservation and Land Management (1987) for Forrestdale Lake Nature Reserve, and an unpublished and continuing study of a small area of bushland in Kenwick which is reserved and vested in the University of Western Australia (How and Dell, pers. comm.). The total lists have been compiled from general fauna works on the basis of habitat.

Introduced animals on the site are restricted to the Laughing Kookaburra Dacelo novaequineae, the House Mouse Mus musculus, the Cat Felis catus, the Fox Vulpes vulpes, the Rabbit Oryctolagus cuniculus and the Black Rat Rattus rattus.

The areas which have been cleared or partially cleared have not been listed as a separate habitat because the frog, reptile and particularly native mammal species will be severely reduced in those areas when compared with the surrounding areas of intact native vegetation. Birds will be more common, but the species will be those typical of open places. The native fauna on these

areas consists mainly of species which are common and widespread, and which are tolerant of human disturbance. These species are not threatened and their habitat has much less conservation value than the intact native vegetation.

The bird species have not been divided into habitats because they are too mobile over such a small area. No species would be restricted to the low lying areas, although some, such as the Pipit, would be found there most commonly.

The invertebrate fauna has not been studied fully, but it is known that the ant Iridomyrmex conifer is present (Majer, pers. comm.). This ant is known to live in very large colonies, but only in areas of native vegetation which are substantially intact. It rapidly disappears from the near urban areas. This ant is widespread in south-western Western Australia, but is disappearing around Perth.

7.3 Conservation status

It is very unlikely that all of the species listed in Tables 3, 4 and 5 actually occur on the airport site at any one time. Some species are rare, such as the pythons Morelia spilota and Morelia stimsoni, while others would be rare because they are on the edge of their range, such as the goannas Varanus rosenbergi which is at about its northern limit, and V. tristis which is at its southern limit. Some species are relatively intolerant of human disturbance, such as the snake Demansia psammophis and the Grey Shrike-thrush. These tend to disappear very quickly as the surrounding area becomes urbanised.

The main determinant of the number of species present is probably the fire history. Banksia woodland around Perth has been affected by an excessive frequency of fires. The most obvious changes are the loss of the shrub layers, particularly the tall shrubs, the general loss of plant cover, and loss of ground litter. Dead logs and stumps are also important components of the habitat and these are rapidly lost if fires are too frequent.

As discussed in Section 6.4 the airport vegetation is in good condition when compared with other areas of Banksia woodland in the region.

Like all other near-urban areas, the bushland has been burnt too often for it to contain a diverse small mammal fauna (Bamford and Dunlop, 1984), but it contains a very rich reptile and bird fauna.

Table 3. Frogs and reptiles recorded or expected to occur at the airport, by habitat. Species actually recorded on the site are marked with an asterisk, and additional species recorded in similar habitat in the region are marked with a cross.

	Banksia woodland	Low lying areas
Frogs		
* Heleioporus eyrei	x	x
* Limnodynastes dorsalis	x	x
* Myobatrachus gouldii	x	x
* Pseudophryne guentheri		x
Geckoes		
+ Diplodactylus spinigerus		
Phyllodactylus marmoratus	x	
Legless Lizards		
+ Aprasia pulchella		
+ Aprasia repens	x	x
* Delma fraseri	x	x
+ Delma greyii	x	x
* Lialis burtonis	x	x
+ Pletholax gracilis	x	x
* Pygopus lepidopodus	x	x
Skinks		
* Cryptoblepharus plagiocephalus	x	x
+ Ctenotus fallens	x	x
Ctenotus gemmula	x	x
Ctenotus impar	x	x
* Ctenotus lesueuri	x	x
Egernia luctuosa		x
Egernia napoleonis	x	x
Hemiergis peronii	x	x
+ Leiolopisma trilineatum		x
* Lerista elegans	x	x
* Lerista lineata	x	x
Lerista praepedita	x	x
* Menetia greyii	x	x
* Morethia lineoocellata	x	x
+ Morethia obscura		x
+ Tiliqua occipitalis	x	x
* Tiliqua rugosa	x	x
Dragon Lizards		
* Pogona minor	x	x

*	Tympanocryptis adelaidensis	x	x
	Goannas		
+	Varanus gouldii	x	x
+	Varanus rosenbergi	x	x
	Varanus tristis	x	x
	Snakes		
*	Demansia psammophis	x	x
	Morelia spilota	x	x
	Morelia stimsoni	x	x
	Notechis coronatus	x	x
	Notechis curtus	x	x
+	Notechis scutatus		x
+	Pseudonaja affinis	x	x
+	Pseudonaja nuchalis	x	x
*	Ramphotyphlops australis	x	x
+	Rhinoplocephalus gouldii	x	x
	Rhinoplocephalus nigriceps	x	x
	Vermicella bertholdi	x	x
*	Vermicella bimaculata	x	x
*	Vermicella calanotos	x	x
	Vermicella semifasciata	x	x

Table 4. Bird species expected to occur at the airport in undisturbed vegetation.

White-faced Heron	Ardea novaehollandiae
Black-shouldered Kite	Elanus notatus
Whistling Kite	Haliastur spenurus
Australian Goshawk	Accipiter fasciatus
Collared Sparrowhawk	Accipiter cirrhocephalus
Peregrine Falcon	Falco peregrinus
Little Falcon	Falco longipennis
Brown Falcon	Falco berigora
Australian Kestrel	Falco cenchroides
Common Bronzewing	Phaps chalcoptera
Brush Bronzewing	Phaps elegans
White-tailed Black Cockatoo	Calyptorhynchus sp.
Galah	Cacatua roseicapilla
Purple-crowned Lorikeet	Glossopsitta porphyrocephala
Red-capped Parrot	Purpureicephalus spurius
Port Lincoln Parrot	Barnardius zonarius
Elegant Parrot	Neophema elegans
Pallid Cuckoo	Cuculus pallidus
Fan-tailed Cuckoo	Cuculus pyrrhophanus
Horsfield's Bronze-cuckoo	Chrysococcyx basalis
Shining Bronze-cuckoo	Chrysococcyx lucidus
Boobook Owl	Ninox novaeseelandiae
Barking Owl	Ninox connivens
Barn Owl	Ninox alba
Tawny Frogmouth	Podargus strigoides
Laughing Kookaburra	Dacelo novaeguineae
Sacred Kingfisher	Halcyon sancta
Rainbow Bee-eater	Merops ornatus
White-backed Swallow	Cheramoeca leucosternum
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
Red-capped Robin	Petroica goodenovii
Golden Whistler	Pachycephala pectoralis
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
Western Thornbill	Acanthiza inornata
Yellow-rumped Thornbill	Acanthiza chrysorrhoa

Varied Sittella	Daphoenositta chrysoptera
Red Wattlebird	Anthochaera carunculata
Little Wattlebird	Anthochaera chrysoptera
White-rumped Miner	Manorina flavigula
Singing Honeyeater	Lichenostomus virescens
Brown Honeyeater	Lichmera indistincta
New Holland Honeyeater	Phylidonyris novaehollandiae
White-cheeked Honeyeater	Phylidonyris nigra
Western Spinebill	Acanthorhynchus superciliosus
White-fronted Chat	Epthianura albifrons
Mistletoebird	Dicaeum hirundinaceum
Spotted Pardalote	Pardalotus punctatus
Striated Pardalote	Pardalotus striatus
Silvereye	Zosterops lateralis
Black-faced Woodswallow	Artamus cinereus
Dusky Woodswallow	Artamus cyanopterus
Magpie-lark	Grallina cyanoleuca
Grey Butcherbird	Cracticus torquatus
Australian Magpie	Gymnorhina tibicen
Australian Raven	Corvus coronoides

Table 5. Species of mammals recorded or expected to occur at the airport, by habitat. Species actually recorded are marked with an asterisk, and additional species recorded in similar habitat in the region are marked with a cross.

	Banksia woodland	Low lying areas
Native species		
+ Echidna (Tachyglossus aculeatus)	x	x
* Numbat (Myrmecobius fasciatus)	x	x
+ Grey Kangaroo (Macropus fuliginosus)	x	x
+ Brush Wallaby (Macropus irma)	x	x
+ Brush-tailed Possum (Trichosurus vulpecula)	x	x
Pygmy Possum (Cercartetus concinnus)	x	x
* Honey Possum (Tarsipes rostratus)	x	x
* Short-nosed Bandicoot (Isoodon obesulus)	x	x
Western Quoll (Dasyurus geoffroii)	x	x
Wambenger (Phascogale tapoatafa)	x	x
* Bush Rat (Rattus fuscipes)	x	x
Ashey-grey Mouse (Pseudomys albocinereus)	x	x
Introduced species		
* House Mouse (Mus musculus)	x	x
Black Rat (Rattus rattus)	x	x
* Rabbit (Oryctolagus cuniculus)	x	x
+ Cat (Felis catus)	x	x
+ Fox (Vulpes vulpes)	x	x

Despite the absence of the small mammal fauna, the airport site contains an exceptionally good fauna when compared with other near-urban areas. Species of interest which are present are:

- the Numbat Myrmecobius fasciatus, which is a gazetted rare species. The Numbat has been proven to be resident in the area from about Thornlie to Jandakot (Friend, pers. comm.), and this is the only known colony which is surviving on the coastal plain. The Numbat is rare and endangered, and has been the subject of an intensive research study for some years because of fears that it may become extinct,

- Lerista lineata, a small skink, which is a gazetted rare species. It is found only in Banksia woodland between the Swan and Serpentine Rivers. It is threatened by loss of habitat,

- Vermicella calonotos, a small snake, which is a gazetted rare species. It is found only on the coastal plain from Lancelin to Mandurah. It is threatened by loss of habitat, and

- the ant Iridomyrmex conifer.

Several other gazetted rare species may be present on the airport site.

No conservation reserve in the area has a comparable fauna and only limited areas have been conserved in and near the urban area.

8.0 HYDROGEOLOGY

Jandakot Airport lies within the southern end of the Dandaragan Trough, a structural unit within the Perth sedimentary basin. The sediments filling the basin have a maximum thickness of about 10,000 metres, and range from Permian to Quaternary in age.

Geologically the area is part of the Osborne Formation which is comprised of Cretaceous glauconitic shale and siltstone and is up to 150m thick. This formation unconformably overlies the Leederville Formation. Complex Quaternary units of superficial formations of sand, silt and clay unconformably overlie the Osborne Formation (Davidson, 1984).

The superficial formation contains groundwater which is near to the surface in depressions. This shallow groundwater originates from direct percolation of rainfall and it forms a regional mound of shallow, unconfined groundwater which has its centre situated some 6km to the south of Jandakot Airport. This is known as the Jandakot mound.

This Jandakot mound covers an area of about 500km^2 and it is the most important shallow groundwater resource in the southern Perth region. The mound has a saturated thickness of up to 40m in the centre.

The surface of the Jandakot mound follows changes in topography and its depth below ground level also varies. Over most of the area the watertable is at a shallow depth, often less than 6m. The watertable fluctuates seasonally by 1 to 2m and it is highest during September-October and lowest during April-May.

The groundwater flows mostly in a westerly direction, but also into the Swan-Canning River system to the north. There are also large groundwater losses due to evapotranspiration, especially from wetlands, discharges to field drains, by local downward seepage into the Osborne and Leederville Formations, and due to groundwater abstraction.

Throughout the area the quality of the groundwater is generally good, with its total dissolved salts content varying between 250mg/L and 1,000mg/L.

In April-May 1976 the water regime in the Jandakot mound was studied by Davidson of Geological Survey of Western Australia. Details of this study are published in Record 1984/9. This study measured rates of groundwater flow and groundwater levels and concluded that run-off from the runways contribute to the recharge of the groundwater mound and that it increased the rate of groundwater flow in select areas at the periphery of the runway. It is assumed that the channelled run-off from the runways and associated drains result in small increase in the recharge of the groundwater in this region relative to that which prevailed prior to the existance of the runway, and that in these sites of increased recharge there is a concomitant increase in the rate of ground-water flow.

Prior to the presence of the runways rain water would have infiltrated soil surfaces more evenly and some of this water would have been taken up by vegetation which is no longer present. Consequently, the runway resulted in an increase of recharge and probably in a decrease of abstraction from the groundwater by established trees.

A Research Group on Groundwater Management in the Perth Metropolitan area (Hollick et al., 1988) pointed out that wetlands and bush areas are affected by both groundwater quality and the water table regime. The group recommends that in making decisions about acceptable water table drawdown it is desirable to be able to predict what effect long-term changes to current water table regimes will have on wetlands and surrounding vegetation. This is described in detail in the Working Paper (Porter, in prep.).

Within a 1900ha zone centering on Jandakot Airport the Water Authority of Western Australia has licensed an abstraction of 1.08 million Kl/a for private use. A maximum abstraction for this area is projected at 1.4 million Kl/pa but this is currently under review, and may be reduced.

In a Working Paper on Groundwater Management in the Jandakot Area, (Hollick et al., 1986) commented that the Jandakot Airport does not appear to offer any special problems for groundwater management providing that adequate precautions are taken to prevent pollution. The paper further states that the presence of the Airport may serve to prevent an increase in other land uses in the area with higher water demands than that of the airport.

9.0 ABORIGINAL SITES

There are a number of Aboriginal sites in close proximity to the study area that are registered with the Department of Aboriginal Sites of the Western Australian Museum. A letter from that Museum did not specify whether these sites were archeological sites or sites of cultural significance. It appears that no detailed investigations have been carried out for the Airport site.

All sites are covered by the provisions of the Aboriginal Heritage Act, and sites which are known or discovered during operations cannot be disturbed without written permission from the Minister. Consequently, it would be advisable to survey for sites prior to any development.

10.0 CONCLUSIONS AND RECOMMENDATIONS

The native vegetation on the Jandakot Airport represents a remnant of the original vegetation and it has a high conservation value. This has come about because little of this vegetation has been placed in conservation reserves in the Jandakot region, and because most of the remaining areas with similar vegetation have been subjected to an excessive fire frequency and public access to these areas is not being controlled. The vegetation within the Airport has been managed by a well-controlled burning scheme and has been protected from other disturbances.

The conservation value derives from the quality of the vegetation, particularly the shrub understorey, and the fauna present. This value will increase over time as further development occurs in the region, unless the frequency of burning is increased substantially.

Any development within the Airport will need to consider the conservation value of the vegetation and the fauna. The land is the subject of a System 6 recommendation and any development which destroys the natural vegetation unnecessarily will be in conflict with this recommendation.

The impacts of proposed developments on the conservation value of the Airport land will be minimised if they are confined to areas which are disturbed as these areas have the least conservation value. Efforts should be made to prevent locating such developments on undisturbed Banksia woodland and especially on wetlands.

Within the Airport there are a number of disturbed areas. The most extensive of these areas is the land immediately to the south of Hope Road and some land immediately to the north of Hope Road. The disturbed area to the south of Hope Road also contains a wetland. The environmental impact of any development in this area to the immediate north and south of Hope Road will be minimised if this wetland is protected and especially if this wetland is upgraded by protecting it against disturbances, additions of fertilizers, and other chemicals, weed and pest control and by the additional planting vegetation.

Groundwater presents no problem to development of the land and no action is required.

Aboriginal sites may be present and it is advisable, but not necessary, that a survey be undertaken before any development is commenced.

The native vegetation should be managed so as to maintain the conservation values associated with this vegetation. This is particularly important in relation to fire management, vehicle and people movements.

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PLATE 1 - Vegetation Type 1: Jarrah-Banksia woodland.

PLATE 2 - Vegetation Type 2: Banksia attenuata open low woodland.

PLATE 3 - Vegetation Type 3: mixed Banksia woodland.

PLATE 4 - Vegetation Type 4: mixed Banksia woodland over scrub.

PLATE 5 - Vegetation Type 5: Eucalyptus rudis woodland.

PLATE 6 - Vegetation Type 6: Melaleuca-Pericalymma wetland.

JANDAKOT AIRPORT

FAUNA SURVEY

prepared by

W.G. MARTINICK AND ASSOCIATES PTY LTD

for

FEDERAL AIRPORTS CORPORATION

January 1990

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TABLE 1 Vegetation type and date of last fire for each trapping site
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MAP 1 Trapping locations

APPENDIX 1 Report on Numbat hairs

1.0 SUMMARY

A vertebrate fauna survey has been carried out to identify the fauna species present on the Jandakot Airport site, to identify the local and regional conservation values of the site for fauna, and to make recommendations for the management of the fauna. A total of four frog species, 22 reptiles, 46 birds and seven native mammals were found to be present or have been recorded previously. Other species are likely to be present. The fauna is rich in all groups except frogs because of the dryness of the site, and small mammals because these appear to be extinct locally.

Three species gazetted as rare or likely to become extinct are present, including the Numbat, a small lizard and a small snake. Introduced mammals are common and make up a large part of the mammal fauna. The Airport site has a valuable fauna and is the largest area of Banksia woodland which could be managed for the conservation of native fauna in the region. There are no large nature reserves of Banksia woodland near the southern side of Perth. As urbanisation proceeds, the habitat offered by the Jandakot Airport site will have increasing conservation values in both a local and regional context.

The fauna of interest is due to the Banksia woodland. The wetlands are a minor element. No single area of the Banksia woodland can be identified as more or less valuable than any other part.

Recommendations are made for the management of the fauna. These relate mainly to protection of the vegetation from disturbance and to fire control.

2.0 INTRODUCTION

The Federal Airports Corporation has proposed various developments at Jandakot Airport. An environmental appraisal was prepared for the site (W.G. Martinick and Associates, 1989). A literature review identified the presence of a rich fauna in a relatively large area of native vegetation in unusually good condition within the urban area, as well as the presence of rare species. These were identified as important environmental values.

The present work was carried out to confirm the fauna species present on the site, to discuss the local and regional conservation values attached to the fauna, and to discuss the management of the fauna.

3.0 METHODS

The fauna was surveyed using various methods from July to December 1989.

Most work was carried out by pit and cage trapping carried out in November and December. Eighteen lines of eight pit traps were set up to cover all the vegetation types identified on the site (Map 1). The sites were selected so that all habitats were trapped, there was replication of the vegetation units, there was a range of fire ages, and there was a good coverage of the geographic range of the Airport site (Map 1 and Table 1). The eight pits were in four pairs, each connected by 10m of fence. The pits were left open for one night in November and seven nights in December. This was necessary because of unseasonal cool weather in November.

Two cage traps were also set up at each pit line, and baited with apples and universal bait.

Frogs and cryptic reptiles were also surveyed by searching under leaf litter, in logs, under rubbish and by raking loose soil between July and December. These observation sites are also shown on Map 1. Large animals and birds were recorded by observation as the opportunity arose.

A specific search was made for Numbats by searching for their characteristic diggings and faeces, and by collecting hairs from logs which they might use as refuges.

4.0 RESULTS

The species recorded are listed in Table 2 (frogs and reptiles), Table 3 (birds) and Table 4 (mammals). The results from pit trapping and opportunistic collecting are distinguished in the

tables. Cage trapping is not distinguished from pit trapping because only bandicoots, rats, and the large lizards Tiliqua rugosa and T. occipitalis were caught in cage traps.

The results for the frogs, reptiles and mammals are given in relation to the pit trapping sites so that their abundance can be related to the vegetation and the date of the last fire (Table 1), but the birds are simply listed because they could not be counted in any useful way and are unlikely to be specific to the fine divisions of the vegetation used here.

In addition to the bird species listed in Table 3, the Silver Gull (Larus novaehollandiae) and the Sacred Ibis (Threskionis aethiopica) were observed flying overhead, and the Banded Plover (Vanellus tricolor) was common on grassed or cleared areas around the runways.

An unidentified quail was also seen. This was probably the Painted Button-quail (Turnix varia).

In addition to the mammal species listed in Table 4, the Grey Kangaroo (Macropus fuliginosus) was abundant in all areas. The Rabbit (Oryctolagus cuniculus) was also abundant. The Fox (Vulpes vulpes) was only seen once, but its tracks and faeces were common.

No diggings or faeces which could be definitely attributed to the Numbat were found, but hairs of the Numbat were extracted from one hollow log (Map 1). The hairs were confirmed as Numbat hairs by microscopic examination (Appendix 1).

The Ant Iridomyrmex conifer was identified as an important feature of the fauna. This species was found to be abundant throughout the Airport site, and occurred in all vegetation types.

5.0 DISCUSSION

5.1 Introduction

The terrestrial fauna of the southern Swan Coastal Plain is relatively poorly known, despite its close proximity to Perth.

Davidge (1979; 1980) carried out an intensive pit trapping study of small areas of the Jandakot Airport site. Crook and Evans (1981) list the fauna recorded at Thomsons Lake Nature Reserve, and CALM (1987) lists the fauna of Forrestdale Lake Nature Reserve. Harold (pers. comm.) carried out a small trapping programme near Murdoch.

These results were supplemented by obtaining a printout of all frog, reptile and mammal specimens held by the W.A. Museum from

between the Swan River and as far south as a line through Rockingham.

The bird fauna is relatively well known. Many studies give extensive bird records, and the bird fauna has been reviewed by Storr and Johnstone (1988).

5.2 Fauna species present

The frog fauna listed in Table 2 includes only four species. This results from the relatively dry nature of the site. The lowland units (Eucalyptus rudis woodland and Melaleuca-Pericalymma wetland) are small, poorly developed and rarely wet. There are probably no other frog species regularly present except possibly Pseudophryne guentheri. All these species require free water for breeding except Myobatrachus gouldii which breeds in damp burrows.

The reptiles are represented by 16 lizard and three snake species. Other species are likely to be present, particularly snakes. The following species were recorded on the site by Davidge (1978; 1979), and there is no reason to believe they are not still present.

Vermicella bimaculata
Vermicella calonotos
Pletholax gracilis

The gecko Phyllodactylus marmoratus is almost certain to be present, but would not have been caught by the pit trapping used here. Diplodactylus spinigerus may be present, but is more common towards the coast.

The legless lizards are diverse, with four species recorded. In addition, Aprasia repens and Delma grayii may well be present on the basis of local records.

The skinks are the most diverse reptile group present, with 10 species recorded. The small skink Hemiergis quadrilineata is also likely to be present, and Ctenotus fallens could occur although it occurs mainly to the west. Other species could be present, including Ctenotus gemmula and C. impar.

No other species of dragon lizards could be present, but both the goannas Varanus rosenbergi and V. tristis could be present. These species are large but scarce, and are difficult to trap. They have declined on the coastal plain and may be rare locally. They are common to the south and north respectively.

The snakes are represented by five species recorded on the site, but other species are almost certainly present. These include common species such as Notechis coronatus and N. scutatus (the Tiger Snake), Vermicella bertholdi, Vermicella semifasciata and

Ramphotyphlops australis. Other less common or well-known species may be present but their distributions or status are poorly known, such as Ramphotyphlops waitii and Morelia spilota. Morelia spilota was certainly present in the area but there are no recent records and it may be locally extinct or very rare. It is gazetted as in need of special protection (Hodge, 1988).

The snake species are poorly known because they are cryptic and difficult to trap. They appear to be scarce as individuals, but this apparent rarity may be more because they are difficult to trap or observe.

The bird species present (Table 3) are diverse and typical for Banksia woodlands. Forty-six species were recorded in the Banksia woodland. Other species are likely to be present, particularly birds of prey, parrots and nocturnal species which are scarce as individuals or difficult to see. A few common species were not recorded, but are certainly present. These include the Sacred Kingfisher, White-backed Swallow, Black-faced Woodswallow and Western Thornbill.

A few species, including the Banded Plover and the Pipit, were most common on cleared areas around the edges of the runway. These are not Banksia woodland species and are not considered as important features of the fauna. The Pipit is also found in some wetland fringing units within the Banksia woodland.

One species gazetted as in need of special protection may be present. This is the Peregrine Falcon, which is widespread but not common anywhere. It is threatened by pesticide residues and illegal destruction. It would make very little use of the Airport site as each pair of birds has a very large territory.

No other bird species of conservation interest is likely to be present.

The gazetted rare species the Red-eared Firetail (a finch) was probably present on the site within historical time, but is now locally extinct on the Coastal Plain.

The small mammal species present appear to be impoverished. The only native species recorded was the widespread and abundant Honey-possum, and this was not common. Only four individuals were collected. Davidge (1979) recorded the Bush rat (Rattus fuscipes), but it is not clear whether these are still surviving. The larger mammals are better represented. The Echidna Tachyglossus aculeatus is almost certainly present, although rarely seen. The status of the Numbat is uncertain, but it appears to be surviving on the basis of the present results and other local evidence including a road kill in 1982 on Forrest Road (Connel, 1985), and hairs from a fox faeces at Canning Vale in 1986 (Ninox, 1986).

The status of the Brush-tailed Possum is also unknown. This species has declined regionally but may be present. It was recorded in Thomsons Lake Nature Reserve in 1979 (Crook and Evans, 1981). If present, this species would be rare because it requires eucalypt trees to provide resting hollows.

The Chuditch (Dasyurus geoffroii) may also occur on the Airport site. This species is not typical of Banksia woodlands but has been recorded around the Metropolitan area. There are no recent records locally and the species has declined generally. It may be very rare or even extinct on the Coastal Plain. It is more common in the forested areas to the east.

The Short-nosed Bandicoot and the Grey Kangaroo are common, while the Brush Wallaby is present but not common. The Brush Wallaby is not common anywhere, and appears to be surviving well in the region. It is known from both Thomsons Lake and Forrestdale Lake.

Only one bat species was collected. This was Nyctophilus geoffroyi, which commonly roosts under the bark of dead Banksia trees. Other species are certainly present, but none are specific to Banksia woodlands. The species include Tadarida australis, Chalinolobus goudii, C. morio, Nyctophilus major, N. gouldii, Mormopterus planiceps and Eptesicus regulus.

Introduced species make up a considerable fraction of the mammal fauna. The mouse, rat, fox and rabbit are present, and the cat is certainly present. The ferret (Mustela putorius) may also be present. It was recorded at Oakford in 1987 (W.A. Museum records).

Given the difficulties of surveying the complete fauna present on any site, particularly where some species are rare, cryptic or require special techniques, it is likely that additional species would be detected by a long term study.

5.3 Local and regional conservation values

The Jandakot Airport site includes a large area of native vegetation which is in unusually good condition (DCE, 1983; Fox, pers. comm.; W.G. Martinick and Assoc., 1989). This value has come about as a result of the protection given to the site because of the Airport and because the site has been actively managed.

The present survey shows that the site has a rich fauna in all groups except small native mammals. Frogs are a minor element because wetlands are very limited. In addition to the large fauna present on the site, there are rare species of interest. The following species are known to occur on the Airport site:

- The Numbat, which is gazetted as rare or likely to become extinct. It is endangered everywhere in its range in the lower south-west and the population on the coastal plain is extremely vulnerable to increasing development of the land.

- The small skink Lerista lineata, which is gazetted as rare or likely to become extinct.

  This species is restricted to sandy Banksia woodlands between approximately the Swan and Serpentine Rivers. It appears to be common within this area, but is threatened by severe habitat loss due to urban and agricultural development. It is abundant on the Airport site.

- The small snake Vermicella calanotos, which is gazetted as rare or likely to become extinct.

  This species is found on the coastal plain between Lancelin and Mandurah. It is not common anywhere and is threatened by habitat loss due to urban and agricultural development.

The ant Iridomyrmex conifer is common and widespread in the south-west, but is being forced out of near urban areas. It is abundant on the Jandakot Airport site. Another species of interest that was found is the snake Demansia psammophis ssp. reticulata. This species is widespread, but this subspecies is almost extinct around Perth (Storr, pers. comm.). The W.A. Museum has only four records for the area from the Swan River to Rockingham in the last 35 years, and two of these are from Jandakot Airport.

The fauna of the Jandakot Airport includes no introduced frogs or reptiles, only two introduced birds (the laughing Turtle-dove and the laughing Kookaburra), but a large suite of introduced mammals (the mouse, rat, rabbit, cat and fox). The introduced birds are probably of little significance, but the mammals have probably had an important impact on both the native vegetation and fauna. The suite of introduced mammals is typical of most of the south-west of Western Australia.

The survival of the Numbat in the presence of the fox is of interest because the fox is thought to be now the single most important threat to the survival of the Numbat.

The fauna of the Jandakot Airport site is related primarily to the Banksia woodlands and not to the wetlands. The wetlands are a minor element and are poorly developed. The wetlands cannot be given a high conservation value, although they have some value because all wetlands are now regarded as of some value as a consequence of the extensive loss of wetlands regionally (Le Provost, Semeniuk and Chalmer, 1987).

The Banksia woodlands have very high conservation value for both vegetation (W.G. Martinick and Assoc., 1989) and fauna (this report). The fauna present is typical of the Banksia woodlands, and like other areas it has a substantially intact frog, reptile, bird and large mammal fauna but an impoverished small mammal fauna (How and Dell, 1989). The present survey has not identified all species present, but it has identified the gazetted rare species present. Further collecting would identify additional species, but the only possible additional gazetted rare species are the Chuditch and Carpet Snake. The Chuditch is not a Banksia woodland species and occurs primarily in the forested areas to the east. Both the Chuditch and the Carpet Snake may already be extinct locally.

The high conservation value of the Jandakot Airport site was recognised by the System 6 study (DCE, 1983) and by the State Planning Commission in a proposal for regional parks which included the "Jandakot Botanical Metropolitan Park", in which the Airport was a major component.

The System 6 study recommended that the native vegetation should be preserved as far as possible. The State Planning Commission proposals have no formal standing, but the significance of the proposals has been clearly stated, "Either, the environmental and planning recommendations are adhered to and development is restricted to the already established urban corridors, and therefore protect the wetlands and Banksia woodlands from urban development, or peripheral urban expansion is allowed, which will result in eventual destruction of the wetlands and woodlands." (State Planning Commission, 1989).

The conservation values of the natural environment of the Airport site can be expected to increase as urbanisation proceeds. Hopper and Burbidge (1989) found that 85% of the Bassendean Complex - Central and South had been cleared, and that there was little Banksia woodland remaining or conserved between Perth and Busselton where it was formerly extensive. The northern Banksia woodlands are better conserved with some major conservation reserves but the southern woodlands have been largely cleared.

There are no large conservation reserves of Banksia woodland on the southern side of Perth (DCE, 1981). The largest is Thomsons Lake, which includes up to 200ha of Banksia woodland (Crook and Evans, 1981). Other smaller reserves exist, but none are large enough to adequately conserve the Banksia woodlands. Various reserves have been proposed, but none have any security of vesting. For example, the proposed Casuarina Reserve of 173ha has been developed as a prison site.

The Airport site will acquire increasing conservation values in both a local and regional context as urbanisation proceeds. The Canning Vale-Jandakot area is currently undergoing a phase of rapid development as part of the continuing rapid expansion of

the urban area, and the Airport site will soon become an obvious and large remnant of native vegetation.

The high conservation values given to the Jandakot Airport site by the fauna will need to be considered in any development of the land.

5.4 Recommendations for management of the fauna

The results of the fauna survey show that the fauna of interest occurs in the Banksia woodlands and not in the small wetlands. There is no evidence in Tables 2 and 4 that any species are restricted to the wetlands. Several species may prefer the moister sites, such as Egernia napoleonis and Leilopisma trilineatum, and the bandicoot is probably more common there because the vegetation is more dense.

There is also no evidence that the fine divisions of the Banksia woodland (Table 1) are useful in identifying habitats of greater or lesser value (Tables 2 and 4). Similarly the different fire ages show no apparent correlation with the species present. This may be more a reflection of the low range of fire ages (six to 11 years since fire) than of a lack of impact due to fire age.

The single proven log inhabited by a Numbat was from a jarrah tree (Map 1). Jarrah trees are scarce on the Airport site, although more were probably present in the past. The Banksia trees probably do not form hollows suitable for Numbats. Numbats are dependent on the presence of termites, adequate shelter from foxes, and hollows for refuges.

To conserve and manage the fauna it is necessary to maintain the Banksia woodlands and not to remove all the hollow logs. The maintenance of the Banksia woodland was discussed in W.G. Martinick and Assoc. (1989).

No area of Banksia woodland can be identified as more or less important than other areas in relation to the fauna. The largest areas may be the most valuable, but the small areas also serve an important function in linking together all areas of uncleared vegetation. It is important that areas of uncleared vegetation are not isolated because they then become vulnerable to loss of species due to events such as fires.

The important aspects for fauna management are:

- as large an area as possible should be maintained as natural vegetation;

- the uncleared area should be divided only where necessary for safety, access or fire control;

- uncleared areas should not be isolated by wide cleared areas;

- ground disturbance should be restricted to existing tracks because this minimises weed invasion;

- fires should be restricted to a deliberate long rotation, and most importantly large areas should not be burnt in one fire;

- logs of the larger trees should not be removed from the site;

- fox control should be carried out to improve the survival of the Numbat. Advice should be sought from the Department of Conservation and Land Management which carried out a programme at Thomsons Lake.

Apart from the obvious impact of clearing and soil disturbance, fire is probably the single most important management option.

The impact of fire on Banksia woodlands is poorly known, and the impact on the fauna is almost completely unknown (Ford, 1985; Hopkins and Griffin, 1989). There is no doubt that most species of both plants and animals are relatively tolerant of fires, but different species show different responses to fires (Bamford, 1986). Although there is little definite evidence available, it is generally agreed that repeated and frequent fires are more likely to damage the vegetation and associated fauna than even extremely hot single fires.

There is no general agreement on the best fire regime to use for the optimal management of the fauna, but the following scheme was recommended for maintaining the quality of the vegetation (Martinick and Assoc., 1989) and is probably suitable:

- burning be conducted in late autumn,

- sectors of bush should be burned piecemeal in a chessboard pattern while the nearest sectors remain unburned for 4-5 years,

- burning frequency per sector to be 8-10 years,

- larger sectors around the perimeter of the Airport should be sub-divided by four-wheel-drive vehicle tracks running approximately parallel with the perimeter so that fire tenders can control back-burning into one or other sub-divided sector, and

- veldt grass be controlled.

For fauna management some patches could be left far longer than 8-10 years as there is evidence that some species such as the Lerista are favoured by very long fire rotations (Bamford, 1985). In practice very long fire rotations are difficult to achieve because many fires are caused by factors beyond the control of land managers. The area of the Airport may also be too small to permit numerous blocks of differing fire ages without an excessive number of firebreaks.

It is not known how many species present on the Jandakot Airport site will survive even with good management. There is a serious lack of information on the detailed management of small areas (Moore, 1984). The larger animals are the most likely to be lost because they have a requirement for larger areas. A Numbat, for example, might range over hundreds of hectares, while a small Lerista might range over only a few tens of metres. As the surrounding area becomes urbanised, the fauna will experience greater pressures. Good management of the habitats will be required to maintain as many species as possible. Bamford and Dunlop (1984) have discussed how species may be lost from good habitat if management is not appropriate.

Avoiding soil disturbance and achieving good fire control are the most important management actions. With good management it is likely that all or most of the smaller species could survive indefinitely. Some of the larger species may well be lost unless the site can be linked to adjacent areas of uncleared vegetation.

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TABLE 1 VEGETATION TYPE AND DATE OF LAST FIRE FOR EACH PIT TRAPPING SITE
(Source: W.G. Martinick and Assoc., 1989)

PIT TRAP SITE	VEGETATION	DATE OF LAST FIRE
1	5	?
2	3	1978
3	2	1978
4	2	1982
5	6	1982
6	3	1981
7	4	1981
8	4	1983
9	3	1983
10	4	1978
11	2	1978
12	6	1978
13	1	1978
14	6	1979
15	3	1979
16	1	1979
17	2	1979
18	4	1979

Vegetation Units

1 = Jarrah-Banksia woodland
2 = Banksia attenuata open low woodland
3 = Mixed Banksia woodland
4 = Mixed Banksia woodland over scrub
5 = Eucalyptus rudis woodland
6 = Melaleuca-Pericalymma wetland

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	OPPORT-UNISTIC	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	1
Ranidella insignifera	1											1							2	1	3
Lizards																					
Legless lizards																					
Delma fraseri				1			1								2				4	7	11
Lialis burtonis																			-	3	3
Pygopus lepidopodus						1									2				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										1									1	4	5
Leiolopisma trilineatum								2		1									3	-	3
Lerista elegans		1		1		2			6	5	3		2	3	4	9	1	3	40	6	46
Lerista lineata										1	2		3	1		1	4		12	-	12
Menetia greyii	9	7	1	6	4	3	4	1	1	1	2	1	1			3	1		45	8	53
Morethia lineoocellata			1										1						2	-	2
Tiliqua occipitalis															1				1	-	1
Tiliqua rugosa	1	1		2	4	2	1				3					1	1		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	-	1
Pseudonaja affinis			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	TOTAL
Mus musculus	1	3	2	10	1		3		1		1	2	3	1		3	5	2	38	-	38
Rattus rattus						3				1			3					1	8	-	8
Tarsipes rostratus	2	1				2			1					1	1				4	-	4
Isoodon obesulus																			5	1	6
Macropus irma																			-	2	2
Nyctophilus geofroyi																			-	3	3
Vulpes vulpes																			-	1	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

(1) Pit trapping site

(*) Fauna observation site

(N) Numbat hair site

Type 1. Jarrah - Banksia woodland
2. Banksia attenuata open low woodland
3. Mixed Banksia woodland
4. Mixed Banksia woodland over scrub
5. Eucalyptus rudis woodland
6. Melaleuca - Pericalymma wetland

Note : Blank areas have little or no native vegetation

0 200 400m

W. G. MARTINICK & ASSOCIATES PTY LTD

FAUNA TRAPPING AND OBSERVATION SITES

Map 1

Ninox Wildlife Consulting

K. Youngson, J. Henry 22 Civic Drive, Wanneroo 6065
Telephone 405 2730

W.G. Martinick and Associates
4/114 Churchill Ave
Subiaco WA 6008

ATTENTION: MR RAY HART

Dear Sir

RE: HAIR SAMPLES FROM JANDAKOT AIRPORT

I have examined your Jandakot hair samples using the cross-sectioning and hair profile techniques of Brunner and Coman. Scale-pattern casting was not warranted since the hair was found to be distinctive enough for a confident identification. Comparisons were made with a permanently mounted reference slide and Numbat hair preparations made in conjunction with the unknown sample.

In my opinion the hair is that of the Numbat *Myrmecobius fasciatus*. Most of the sample appears to correspond to the dorsal region, being short and robust, while the single long hair provided is consistent with fine underfur from the tail. The following points detail the structural features upon which this identification is based:

- the cross-sections of the overhair and guard hair samples show a typically very wide cortex, an indented medulla and a distinctive, granulated boundary between these regions;
- both the cross-sections and the total hair lengths are within the size range of the Numbat reference sample;
- the profiles along the hair shaft, including the shield area, match those of a Numbat.
- typical Numbat colour-banding (orange, black, white) is apparent on some hairs;

Other accessory information contributing to this identification are the discovery of the hairs within a log, the record of a Numbat road kill in the Jandakot - Canning Vale area and the dissimilarity of the sample hairs from any other native or introduced animal which could be present in the habitats represented at Jandakot airport.

Yours sincerely

Ken Youngson

W.K. Youngson

APPENDIX 1

REPORT ON NUMBAT HAIRS FROM JANDAKOT AIRPORT

JANDAKOT AIRPORT

PROPOSED MINING OF SILICON SAND

prepared by

W G MARTINICK AND ASSOCIATES PTY LTD

for

FEDERAL AIRPORTS CORPORATION

JUNE 1989

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1.0 SUMMARY AND COMMITMENTS

This report highlights and discusses the main environmental aspects which need to be considered in mining a silicon deposit in the south-east corner of the Jandakot Airport property. The deposit comprises the upper 2m to 6m of a dune profile which rises up to 20m above a surrounding plain which is about 30m above sea level. This silicon sand overlies yellow sand which is used in the building industry, and the proposal is to mine both down to 30m above sea level. There is scope for mining below this level, subject to the final level of 30m being achieved by backfilling.

The bushland vegetation at the Airport provides a buffer between the Airport activities and surrounding landuses. This bushland is noted for its conservation values and the System 6 Study by the Environmental Protection Authority has recommended that it be preserved if possible.

The silicon deposit supports this botanically interesting vegetation and the proposed mining will result in its destruction. The deposit is extensive and although it varies in grades, it is not possible to confine the mining to small areas or islands within the surrounding bushland, and then to rehabilitate the mined land so that these areas can be re-integrated with the remnants of intact vegetation.

An important consideration in determining a rehabilitation programme and schedule for a mining operation is to determine the final landuse of the affected areas. For the Airport land there are two landuse options, namely, to return the mined land to native vegetation or to use it for commercial developments. Both options are described in detail and while it will be possible to re-establish native vegetation on the restored landforms which will resemble the pre-mining vegetation, it will be a considerable time, if at all, before this vegetation will attain conservation values which will be comparable to those which existed prior to mining. On completion of mining the restored land will be level, possibly with slight undulations, and it will be suitable for commercial development. For these reasons it is concluded that this option be selected as a future landuse for the mined land.

Ideally, a master plan should be established for the restored land, so that appropriate landscaping can be commenced during the rehabilitation programme.

It is proposed that a land management programme, complete with management policy, is established for the entire Airport land. This will outline areas which will be required for future extensions to the Airport and for other commercial developments, as well as set aside areas of native vegetation, especially the wetlands, for landscaping and conservation purposes.

A number of commitments should be included in an agreement between the Federal Airports Corporation, hereafter referred to as FAC, and prospective companies who wish to mine the silicon deposit. These commitments vary depending on which final landuse option is selected for the mined land. The commitments are as follows:

1. Landuse option 1: Establishment of native vegetation

   (a) Land rehabilitation must be fully integrated with mining and rehabilitation must follow closely behind the mining front, probably of the order of 100m.

   (b) All mining must be undertaken in a continuous mining front rather than selective mining of various grades within the deposit.

   (c) The mining front must, as far as is possible, be in a direction which will ensure that the mining faces away from neighbours, and that for as long as is possible, the mining operations will be separated from the neighbours by undisturbed bushland.

   (d) All topsoil must be saved and used for rehabilitation.

   (e) Trees are to be removed from the deposit prior to topsoil stripping and stockpiled for subsequent replacement on restored and topsoiled landforms.

   (f) Topsoil is to be stripped in two separate operations. The first stripping should remove approximately the top 5cm complete with the remaining vegetation and the second stripping should remove the remaining topsoil to a depth of about 20cm.

   (g) Topsoil should be replaced on restored landforms in its original sequence.

   (h) Prior to topsoil spreading the mined landforms should be restored to their final contours according to a prepared rehabilitation plan.

   (i) Topsoil stripping and spreading should be undertaken in a single operation with the need for topsoil storage being minimised. At the commencement of mining there will be a need to store some topsoil. This must be minimised and should not exceed topsoil storage from more than about 2 hectares.

   (j) The stripping of vegetation and topsoil ahead of the mining should be kept to a minimum for dust suppression and aesthetic purposes.

(k) Where topsoil has to be stockpiled the top 5cm of topsoil must be kept separate from the deeper material.

(l) The establishment of vegetation must be integrated with seasonal variations. Land restoration and topsoil spreading can be undertaken on an all year round basis, but additional planting of seedlings and the spreading of seed must be undertaken during May-June of each year on areas restored since the previous planting and seeding.

(m) Banksia seedlings must be planted at a density and diversity which is similar to pre-mining densities and diversities. Understorey shrubs should be planted at a density of 2 plants per $10m^2$.

(n) Seeding should be undertaken carefully and, where possible, half of the seed should be pregerminated.

(o) The establishment of weeds and introduced grasses must be controlled.

(p) A 60g tablet of superphosphate complete with trace elements must be placed about 10cm to the side of each planted seedling and at a depth of about 5cm.

(q) The entire area must be fertilised by broadcasting with 300kg per hectare of a commercially available mixture of superphosphate and rock phosphate which is marketed specifically to minimise the leaching of plant nutrients from the applied fertiliser into the groundwater.

(r) The establishment of vegetation must be monitored and the need for additional planting and seeding must be established on the basis of this monitoring.

(s) The mining operations must be undertaken in a tidy manner. All rubbish must be removed from the site and no diesel, petrol or oil must be disposed of on the site.

(t) A report on mining progress, complete with rehabilitation, must be submitted annually to the FAC.

2. Landuse option 2: Establish land for commercial use.

(a) Land rehabilitation must be fully integrated with mining and rehabilitation must follow closely behind the mining front, probably of the order of 100m. Variations from this must be discussed with the FAC.

(b) All mining must be undertaken in a continuous mining front rather than selective mining of various grades within the deposit.

(c) The mining front must, as far as is possible, be in a direction which will ensure that the mining faces away from neighbours, and that as far as is possible, the mining operations will be separated from the neighbours by undisturbed bushland.

(d) All topsoil to a depth of about 25cm must be saved and used for rehabilitation. This topsoil can be stripped in a single operation, and it should be relatively free for vegetation.

(e) Prior to topsoil spreading the mined landforms should be restored to their final contours according to a prepared rehabilitation plan.

(f) The stripping of vegetation and topsoil ahead of the mining should be kept to a minimum for dust suppression and aesthetic purposes.

(g) The establishment of weeds and introduced grasses must be controlled.

(h) The mining operations must be undertaken in a tidy manner. All rubbish is to be removed from the site and no diesel, petrol or oil must be disposed of on the site.

(i) A report on mining progress, complete with rehabilitation, must be submitted annually to the FAC.

(j) An overall master plan of likely commercial developments must be established so that landscaping, especially the planting of trees and shrubs can be commenced.

(k) A cover crop must be established on restored and topsoiled areas during May-September of each year for dust suppression purposes. Rye corn and lupins are recommended.

(l) Areas being restored after September will become dust hazards during the summer. These areas must be stabilised by spraying them with soil protecting mulches or chemicals.

2.0 OBJECTIVES

The overall objectives of this study are to

- assess the likely impact on the environment of the proposed mining operations, and
- prepare a conceptual mining and environmental policy for this project.

The specific issues which this report addresses include:

- the conservation value of the affected land,
- the environmental issues in the proposal to mine,
- present and future landuse,
- mining path,
- land rehabilitation,
- the integration of rehabilitation with mining, and
- general environmental care and monitoring.

This information will assist the FAC in negotiating with prospective clients the potential to mine sand from the Jandakot property, with due consideration to conservation issues, environmental care and long-term landuse.

3.0 INTRODUCTION

The FAC has been instructed by the Federal Government that it must be financially self-sufficient. As part of this policy the FAC is considering giving an interested company the right to mine a deposit of silicon sand on the Jandakot Airport property. This is freehold property which together with all of the mineral rights belongs to the FAC.

A deposit of silicon sand has been identified to the immediate east of the east-west runway. This silicon sand is divided into four grades on the basis of particle size, namely super fine, fine, coarse and super coarse. The super fine is the most valuable component and it is used for ceramics and in the glass industry, whilst the super coarse is the least valuable and it is used in the foundry industry.

The silicon sand is located in a series of dunes which rise up to 20m above the surrounding terrain which is gently undulating and about 30m above sea level. Within the deposit the silicon sand is distributed across the deposit in a mosaic of grades. The

average depth of the deposit is about 6m, and it overlies yellow sand which is used as building sand and fill.

The proposal is to extract the silicon sand and the underlying yellow sand down to 30m above sea level. This can include mining to below an RL of 30m subject to a final RL of 30m being achieved by backfilling.

4.0 LANDUSE

The main landuse of the area which contains the silicon sand is to provide a buffer strip between the airport activities and development outside of the Jandakot Airport property. This buffer landuse does not preclude the area from being developed for other landuses, including extensions to the Airport activities, subject to these developments still providing a buffer. The land in question is also the subject of a System 6 recommendation by the authorities in Western Australia that the bushland be preserved if possible. Any development which destroys the natural vegetation unnecessarily will thus be in conflict with this recommendation. The land is not part of a nature conservation Reserve or a National Park and it is not recommended for inclusion into such a Reserve or National Park. It is recommended in Working Paper 17 of November, 1987 by the State Planning Commission for inclusion in a proposed regional parks system because of this System 6 recommendation.

The proposed mining operations are not in conflict with the existing landuse, but they are in conflict with the recommendation of the System 6 Study.

5.0 ENVIRONMENTAL DESCRIPTION

The terrain, soils, vegetation, flora, fauna and hydrogeology of the silicon sand deposit was described and evaluated by W G Martinick and Associates Pty Ltd in March 1989 as part of an environmental appraisal for the entire Jandakot Airport. The Airport is part of the Bassendean Complex of sand dunes arising from a sandplain with occasional swamps. This complex occurs on the Swan Coastal Plain from Gnangara to the north of Perth to Bunbury in the south.

The vegetation was divided into six types of Banksia woodlands on the plains and dunes, and eucalypt and paperbark woodlands in the low lying areas. Regionally, these vegetation types are widespread, but they are poorly conserved. The vegetation within the Airport is in exceptionally good condition because it has been protected from overly frequent fires and other disturbances. The shrub layers are particularly dense and diverse in species, and the Airport now represents the best preserved remnant in the region, including those in conservation reserves.

The flora has been listed and one species of possible interest was found. This species is of uncertain status because its taxonomy is in doubt.

The fauna on the site is exceptionally rich, and this is in accordance with the good condition of the vegetation. Several gazetted rare species are present, including the Numbat which is the State emblem. Other gazetted rare species may be present.

Groundwater is unlikely to affect any development. Any regional lowering of the water table may have an effect on the vegetation, but it is likely that this will be very small.

Sites of cultural significance to Aboriginal people and sites which contain artefacts are known to occur in the region but none have been recorded with the Western Australian Museum. It appears that no specific survey has been carried out at the Airport and consequently the possibility that such sites do occur cannot be dismissed.

The March 1989 evaluation concluded that any development at the Airport will need to consider the high conservation value of the vegetation.

The distribution of the vegetation types for the Airport is given in Figure 1. From this it can be seen that the silicon deposit is covered predominantly by **Banksia attenuata open low woodland** (type 2) and **Mixed Banksia woodland over scrub** (type 4) with a small area of **Jarrah-Banksia woodland** (type 1). There are also two small areas of **Melaleuca-Pericalymma wetlands** (type 6) on the periphery of the deposit and on the boundary of the Airport, as well as two areas on which the native vegetation has been cleared.

These vegetation types are typical for the Airport and its surrounds, and within the Airport these types are known for their quality. The woodlands make up a substantial portion of the native vegetation within the Airport property, and consequently mining of the silicon deposit will result in the destruction of a substantial portion of these woodlands which are noted for their botanical interests and the associated fauna.

If the State Environmental Protection Authority becomes involved in the process of evaluating a request to mine the silicon deposit then it is likely that they will insist that the conservation value of the vegetation is assessed in terms of the commercial benefits of the proposal. At the discretion of the Environmental Protection Authority this assessment process may include public participation, and the final outcome must at this stage be considered as uncertain.

6.0 MINING METHOD - ENVIRONMENTAL CONSIDERATIONS

Environmental management should become a fully integrated component of mine production and a number of environmental issues must be considered in determining the method of mining. This will facilitate efficient land restoration especially as it will minimise the need for double handling of sand during the restoration of landforms following mining and the subsequent stabilisation of these new landforms.

From an environmental point of view the most important consideration affecting mine planning is land rehabilitation during and following mining.

To determine the land rehabilitation programme it is essential to determine the final landuse following mining. Mining is essentially a short term landuse. Consequently, on completion of mining the land should be returned to a condition which will enhance the long term landuse. There are frequent instances where such long term landuses are not readily definable at the time of mine planning. In these instances it has become common practice to return the mined land to a landform which is compatible with the surrounding landscape, and to stabilise the surface of the new landforms with vegetation. Vegetation which is native to the area is frequently selected because it usually develops readily into self sustaining plant communities with no requirement for maintenance.

There are operations where such landform restoration is not practical or totally uneconomic, such as large pits from open cut mines as well as large overburden dumps and tailings dams. In these instances it has become common practice to abandon the remaining pits after their slopes have been made safe and to establish vegetation on the dumps and the tailings dam. Similarly, there are many instances where the final landuse is well defined and where mined areas have been restored to landuses such as recreational areas, urban and industrial land, freeways and farmland.

The firm establishment, prior to mining, of a long term landuse assists greatly in rehabilitation planning because the objectives of rehabilitation are clearly defined.

With respect to the silicon deposit of the Airport, there are two major options with respect to the long term landuse. These options affect the rehabilitation requirements and consequently the method of mining. These options are to:

- return the mined land to native vegetation and establish a green belt with aesthetic and conservation values, or
- use the land for commercial development.

These options are discussed below.

6.1 Option 1. Establishment of native vegetation

The objectives of this option are to stabilise the restored landforms with native vegetation which will provide an aesthetically pleasing green belt and with time will develop a conservation value. It must be appreciated that time is an important component in rehabilitation, and that the success of rehabilitation must be assessed over a long period. Monitoring will be required to:

- determine whether an environment has been created on the restored land which is suitable for the successful establishment of a self sustaining native vegetation,
- measure the progress of this establishment, and
- provide information on how this establishment can be further enhanced.

Rehabilitation is achieved readily if the objective is merely to establish a diversity of trees and some understorey. This will provide an aesthetically pleasing result. If the objectives are to establish vegetation communities with a high conservation value then the required effort must be increased greatly and patience is required because it may be several decades before suitable vegetation is established.

The removal of the silicon sand and the replacement of the dunes with a near level terrain will almost certainly result in soil and landform changes which will prevent the re-establishment of vegetation which will equal its pre-mining vegetation in terms of species diversity, quality and overall conservation values. Nevertheless, it will provide some resemblance.

To re-establish native vegetation on completion of mining it is essential that all topsoil is saved and returned to the restored landform as a final layer. This topsoil is a valuable source of seed, plant nutrients and soil micro-organisms. Most of these desirable properties are contained in the surface 5cm of the topsoil. Consequently, to optimise the benefits from the topsoil it will be necessary to strip the topsoil in a two strip operation, with the first stripping removing the surface 5cm of topsoil and the second stripping removing the balance of the topsoil, probably to a depth of 20cm. This is not always practical and consequently the practice is generally to remove topsoil in a single operation to a depth of 20-25cm. Where such separate stripping is essential and possible it is imperative that the top layer is replaced as the top layer.

The viability of seeds in topsoil is known to decrease rapidly with storage time, with even a storage period of 2 months having

adverse results. Consequently, it is desirable to minimise the storage of topsoil and to design an operation where topsoil stripping and respreading on restored land is undertaken in a single operation. This also has considerable cost advantages as it avoids the double handling of topsoil.

Prior to the stripping of topsoil it is essential to remove all large trees and to place them on a stockpile from where they can be respread over the restored landforms following topsoiling. These logs will provide a physical windbreak at the ground surface, thereby providing emergent seedlings with some protection, and they will also provide refuge areas for invading fauna.

After the large trees have been removed the topsoil should be stripped in a single operation complete with all remaining vegetation to a depth of 5cm. This can be done with an auger type scraper which will pick up the topsoil-vegetation mix, although depth control will be difficult. A second stripping should remove a further 20cm of topsoil. Experience with such methods at Minninup, to the south of Bunbury, has shown that the vegetation component in this mixture of soil and vegetation will give the topsoil considerable wind protection at ground surface. This decreases the need to stabilise topsoiled surfaces with brush or other methods during the critical period of plant establishment.

For topsoil stripping and spreading to be undertaken in a single operation it will be essential for rehabilitation to be fully integrated with other mining operations and to follow very closely behind the mining front. To commence operations it will be necessary to stockpile some topsoil. This should preferably be taken from an area which is already cleared or has a vegetation of poor quality, although this may not be possible for practical or commercial reasons.

The actual distance between the mining front and the rehabilitation work is determined by the mining operations and the space required for moving vehicles and machinery, but typically the rehabilitation should follow about 100m behind the mining front. This may appear to be a very short distance, but it is being attained in a number of well managed operations of this type.

To achieve the above it is important that the deposit is mined progressively with all the silicon sand and the yellow sand being removed from the mining front in a single advancement of this front. This will permit the land to be restored immediately behind the mining front. The silicon sand must not be mined selectively in various parts of the orebody over a number of years followed by the mining of yellow sand in years to come, as this would necessitate topsoil storage and prevent rehabilitation from following closely behind the mining front.

Mining and landform restoration, complete with topsoiling, should be undertaken progressively throughout the year. In addition to the natural establishment of vegetation from seed stored in the spread topsoil, this establishment of vegetation should be accelerated by hand planting and seeding. This should be undertaken in May - June of each year on areas which have been restored since the previous winter. Overstorey plants such as the Banksia trees should be hand planted as seedlings at a density which is approximately equal to that of a mature stand of vegetation prior to mining. In addition, some common understorey shrubs should be hand planted as seedlings at a density of about 2 per $10m^2$.

The seeds of native vegetation should be distributed throughout the area to ensure the rapid establishment of a good ground cover to provide stability. This should include shrubs and creepers, particularly species of Acacia, Hardenbergia and Kennedia.

This seed is expensive and consequently it must be used sparingly. A practical method of application is to dribble 3-4 seeds into small hand scratched furrows in the soil surface. For rapid establishment of the vegetation about half of this seed should be pregerminated and seeding should be undertaken preferably in the rain or shortly before a rain. The furrow can be scraped into the soil with a hand held tube, and seed can be placed into the soil by letting it drop through the tube. This is an efficient method and avoids time consuming bending down of labourers.

The seedlings which will be planted out should preferably be raised from seed collected from the Airport property. This will ensure the survival of this gene pool. From a practical point of view it is best if these are raised on contract in an established commercial nursery and transferred to the Airport as and when required. There may be a need for a small holding area for seedlings, but the proposed mining is too small to justify establishing an on site nursery.

Superphosphate in the form of a 60g tablet should be placed some 10cm to the side of each planted seedling, and preferably at a depth of about 5cm. In the sandy surface this is readily done by kicking a suitable hole into the sand, dropping the fertilizer tablet into it and pushing the soil over the tablet with a sweeping action of the foot. The total area should also be fertilised by broadcasting in the winter of the first year of vegetation establishment, 300kg per hectare of a commercially available mixture of superphosphate and rock phosphate which is marketed specifically for the purpose of minimising the leaching of nutrients from the applied fertiliser into the groundwater This should be a once only application. No nitrogenous fertilizers should be applied as these will stimulate weeds and grasses.

The purpose of the above is to establish as soon as possible the species which are required for the final overstorey and to establish a groundcover for protection against erosion. A greater diversity of species will become established in time from seed contained in the topsoil. This diversity may need to be supplemented in subsequent years by seeding or hand planting, with the final selection of species being determined by ongoing monitoring.

It is anticipated that within a five year period a diversity of species and a reasonable density of plants will have been established, which will provide the basis for the natural development of a self sustaining vegetation. A critical component during these early five years is the control of weeds and introduced grasses as these have the ability to become established readily and to compete with the establishing native vegetation for moisture and nutrients.

To avoid weeds becoming established it is important that the restored areas are inspected regularly and that weeds are removed in their early stages of establishment, probably by spot spraying.

6.2 Option 2. Establish land for commercial use

This option is far easier to attain during rehabilitation than option 1, with the main objective of rehabilitation being to provide stability to the restored soil surface until such time that buildings and other developments are established. An early outline of the proposed design of any proposed development will permit the establishment during rehabilitation of trees and shrubs for shelter and for local and regional landscaping purposes. Efforts should be made to save all topsoil and to return it as a final layer over restored landforms. The topsoil will be required purely for its favourable soil properties rather than its seed source, and consequently topsoil storage is acceptable. Unlike option 1, it will be desirable to remove most of the vegetation from the topsoil prior to mining, and the cleared topsoil can be stripped in a single operation to a depth of about 25cm.

Following topsoiling of restored landforms, trees, shrubs and lawns can be planted according to a landscape design and the balance of the land can be stabilised with grasses until such time that other developments take place.

The restored and topsoiled landforms will be prone to wind erosion as the soil will contain no brush. To minimise this these areas should be seeded with a cover crop such as rye corn or lupins during the months of May to September of each year to provide protection during the summer period. Grasses and other plants will become established with time.

The need for establishing a permanent grass vegetation depends mainly on the commencement of subsequent developments. If these commence within a year or two following the completion of mining than there will be no need to establish a permanent vegetation and temporary cover crops will be adequate.

Land which becomes available for establishing vegetation during the spring should be sown to rye corn only, and this establishment will require an application of about 450kg per hectare of an NPK fertilizer, complete with trace elements, such as is used for general garden purposes. All land which is available for planting during May - June should include some subterranean clover seed and especially lupins. The lupins will provide a dense cover crop up to 1m high, and this will provide protection as a dead crop during the coming summer period. Sufficient seed will be set to ensure its natural re-establishment in the next year. The establishment of clover and lupins will require an application of 400kg per hectare of superphosphate, complete with trace elements, and the seed will need to be inoculated with rhizobium bacteria.

Land which becomes available in the period of early to late summer will need some protection to avoid wind erosion and dust problems. On such areas rye corn can be established with two or three applications of water. If water is not available then the surface should be stabilised by spraying it with a soil binding material such as a bitumenised hay mulch, a paper mulch or a straight application of a film of bitumen or other soil binding or protecting chemicals.

This landuse option provides greater flexibility in mining selectively various grades within different locations of the deposit, but this should be minimised and preferably avoided as it has the potential to rapidly become an untidy operation with little attention being given to rehabilitation. It also has the potential to downgrade the deposit by removing the high grade material in preference to the low grade, and ultimately resulting in the low grade material becoming uneconomical to mine.

Ideally, rehabilitation should follow closely behind the mining front as for landuse option 1. This will facilitate dust control and it will give the immediate impression that mining is being undertaken in an orderly and well managed manner and with environmental awareness.

6.3 Direction of mining

Ideally mining should commence at the western side of the deposit, immediately opposite the eastern end of the east-west runway, and it should move in an arc to the north, the east and the south. This will ensure that the operations are for most of their life hidden from public view by the dunes into which they mine. If mining progresses from the opposite direction then the

moving mining front will be visible from neighbouring properties for most of the life of the operations. The high dune into which the mining will advance will also provide the operational area with some protection against inland winds, and it is these winds which have the potential to cause dust problems and wind erosion during the summer period.

The proposed direction of mining will also ensure that a noise barrier exists between the proposed mining operations and neighbouring land for most of the life of the operation. Similarly, it will prevent lights from the operation being a nuisance to nearby residents in the event that mining is undertaken on a 24 hour basis.

7.0 DISCUSSION

On completion of mining it will be possible to establish woodlands on the restored landforms. Within ten years these woodlands will provide aesthetically pleasing shelter belts and, given sufficient time and appropriate management, they will have the potential to develop into areas of high conservation value.

On completion of mining the restored land will be ideal for commercial development because it will be relatively level and have no conservation value. For these reasons it is probably appropriate that this landuse option is selected as an objective for the rehabilitation component of the proposed mining operation.

It is difficult to place a monetary value on the conservation value of the land which contains the silicon sand deposit but it is possible to place a commercial value on the land which will be established as a consequence of the mining. The conservation value of the land must thus be compared to the value of the silicon and the yellow sand resource plus the commercial value of the restored land.

Mining will destroy the conservation value of the affected land. It could be argued that this increases the conservation value of the remaining bushlands on the Airport property. Alternatively, it is also reasonable to conclude that it decreases the conservation value of the total bushland because it becomes too small and too fragmented. The loss in conservation value is thus not necessarily restricted only to the area which is to be mined, but it could also affect adversely the conservation value of the remaining bushland. Nevertheless, the remaining bushland still has high aesthetic values, both locally and regionally, and it will continue to provide valuable habitats for wildlife.

From a landuse point of view it is concluded that the land be used for commercial purposes following mining. This will probably fit in well with future needs by the FAC to expand its

operations and to develop land for other income generating purposes. It is uncertain whether the conservation value of the native vegetation will be judged as greater than the value of the sand deposits by the public or Government authorities in the event that they become involved in such an assessment.

To achieve these objectives it is appropriate that the selection of landuse option 2 is to be accompanied or followed by the preparation of an overall landuse management plan for all of the Airport property. This will identify areas which are suitable for further development as well as for conservation and landscape purposes, and provide an appropriate land management policy.

ENVIRONMENTAL APPRAISAL:

RUNWAY CONSTRUCTION AT

JANDAKOT AIRPORT

prepared by

W.G. MARTINICK AND ASSOCIATES PTY LTD

for

FEDERAL AIRPORTS CORPORATION

April 1989

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1.0 SUMMARY

The Federal Airports Corporation proposes to build a third runway at Jandakot Airport, parallel to and east of runway 06/24. An environment appraisal was prepared by W G Martinick and Associates Pty Ltd for the entire Airport area in March 1989. The present report specifically assesses the impact of the additional runway on the flora and fauna of the site and the adequacy of a noise assessment provided for this runway in a Jandakot Airport Master Plan.

The Airport property contains flora and fauna of high conservation value and the site is included in the System 6 study which recommended that the land be conserved as far as possible.

Building of the third runway requires the clearing of five hectares of mixed Banksia woodland to permit construction and a further five hectares to the north-east of the proposed runway to permit standard clearances. The woodland is of good quality and provides continuity between similar bush areas to the north and south for movement of ground dwelling animals. To protect this continuity it is desirable to retain a strip of vegetation, if necessary with a height limitation, between the northern and southern areas of native vegetation.

Noise, as discussed in the Jandakot Airport Master Plan, has been adequately covered.

2.0 OBJECTIVES

The Federal Airports Corporation proposes to construct a third sealed runway, taxiway and apron which is parallel to and 210m east of the existing east-west runway (06/24).

The specific objectives are to assess:

- the impact of the proposed development on flora and fauna, and

- the noise data presented in the Airport Master Plan.

3.0 INTRODUCTION

Jandakot is the main General Aviation Airport for the Perth Region in Western Australia and is controlled by the Federal Airports Corporation. It is located 18km to the south of the city centre in the suburb of Jandakot and 23km to the south-west of Perth Airport (Figure 1).

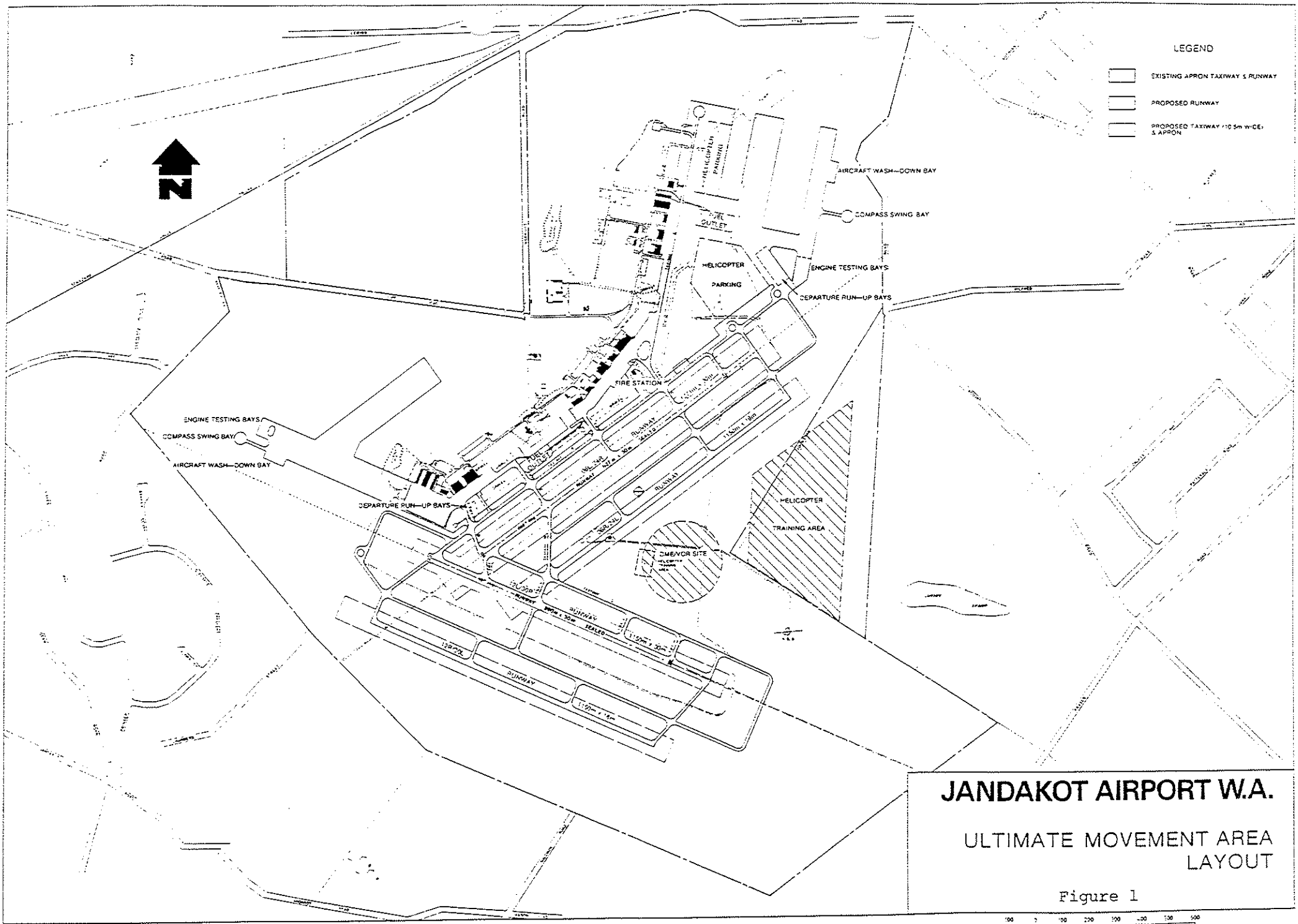
Aircraft operations are General Aviation which caters for fixed wing and rotary wing aircraft and include private flying, chartered flying, flying training (collectively 96%), and aerial work operations (4%). Jandakot Airport is primarily intended for use by light aircraft with a Maximum Take Off Mass below 5700kg. Nevertheless, operations by aircraft with a Maximum Take Off Mass above 5700kg may occur provided pavement concessions, and if applicable, operational dispensations, have been granted. Consequently, there is a heavy General Aviation use of Jandakot Airport on occasions.

The Airport has two sealed runways (Figure 1), one orientated 058° magnetic (06/24) and one 118° magnetic (12/30). The runway strips intersect at the 06/24 runway strip end, although the 06 threshold stops short of the 12/30 runway.

The proposed runway will be 1150m X 18m within a 90m runway strip. The siting of the runway makes best use of existing facilities and circuits under General Aviation Airport Procedures and will confine the noise exposure.

4.0 ENVIRONMENTAL APPRAISAL

The area which will be affected by the proposed runway was appraised for its conservation value by Martinick and Associates Pty Limited in March 1989. Much of the Airport property has native vegetation which has a high conservation value and probably harbours rare and endangered animal species. It was stated that any developments will need to consider this high conservation value of the vegetation and fauna. The land is the



JANDAKOT AIRPORT W.A.

ULTIMATE MOVEMENT AREA LAYOUT

Figure 1

DEPARTMENT OF Aviation

subject of a System 6 recommendation and any development which destroys the natural vegetation unnecessarily will be in conflict with this recommendation.

In the environmental appraisal it was also stated that Aboriginal sites are covered by the provisions of the Aboriginal Heritage Act, and sites which are known or discovered during operations cannot be disturbed without written permission from the Minister.

5.0 ENVIRONMENTAL IMPACTS AND MANAGEMENT

5.1 Flora and fauna

The vegetation types to be affected by the proposed runway are shown on Figure 2. The proposed runway, including a surrounding area cleared of permanent obstructions, the taxiways and aprons will mostly affect disturbed areas with little or no native vegetation and therefore of little conservation value. An area of mixed Banksia woodland and mixed Banksia woodland over scrub (Vegetation types 3 and 4) will also be affected.

The bulk of the runway will be over cleared areas either in grass or in regenerating bush. The Banksia woodland which will be affected occupies approximately 10ha, with half to be affected by runway construction and half by standard requirements for obstacle clearance. The woodland is of good quality but is well represented in nearby sectors of the Airport. The loss of this vegetation will not therefore be a crucial impact in terms of the total area of vegetation. However, this vegetation may be important as habitat by providing continuity of cover for movement of ground frequenting fauna between the southern and northern sections of native bush. Any burning policy should have regard for this intent.

While recognizing that the proposed development will not affect adversely the conservations values, it is recommended that the continuity of the Type 4 vegetation along the eastern perimeter of the Airport be maintained as much as possible. This approach also conforms with System 6 recommendation which stated that "the Commonwealth of Australia retain as much uncleared land as possible". It also conforms with the intent of the Master Plan, which is to retain as much uncleared land as possible.

5.2 Noise

5.2.1 Airport analysis

Construction of the parallel runway, adoption of the General Aviation Airport Procedures and a general increase in aircraft activity will increase the number of aircraft flying over the surrounding area and hence the level of aircraft noise.

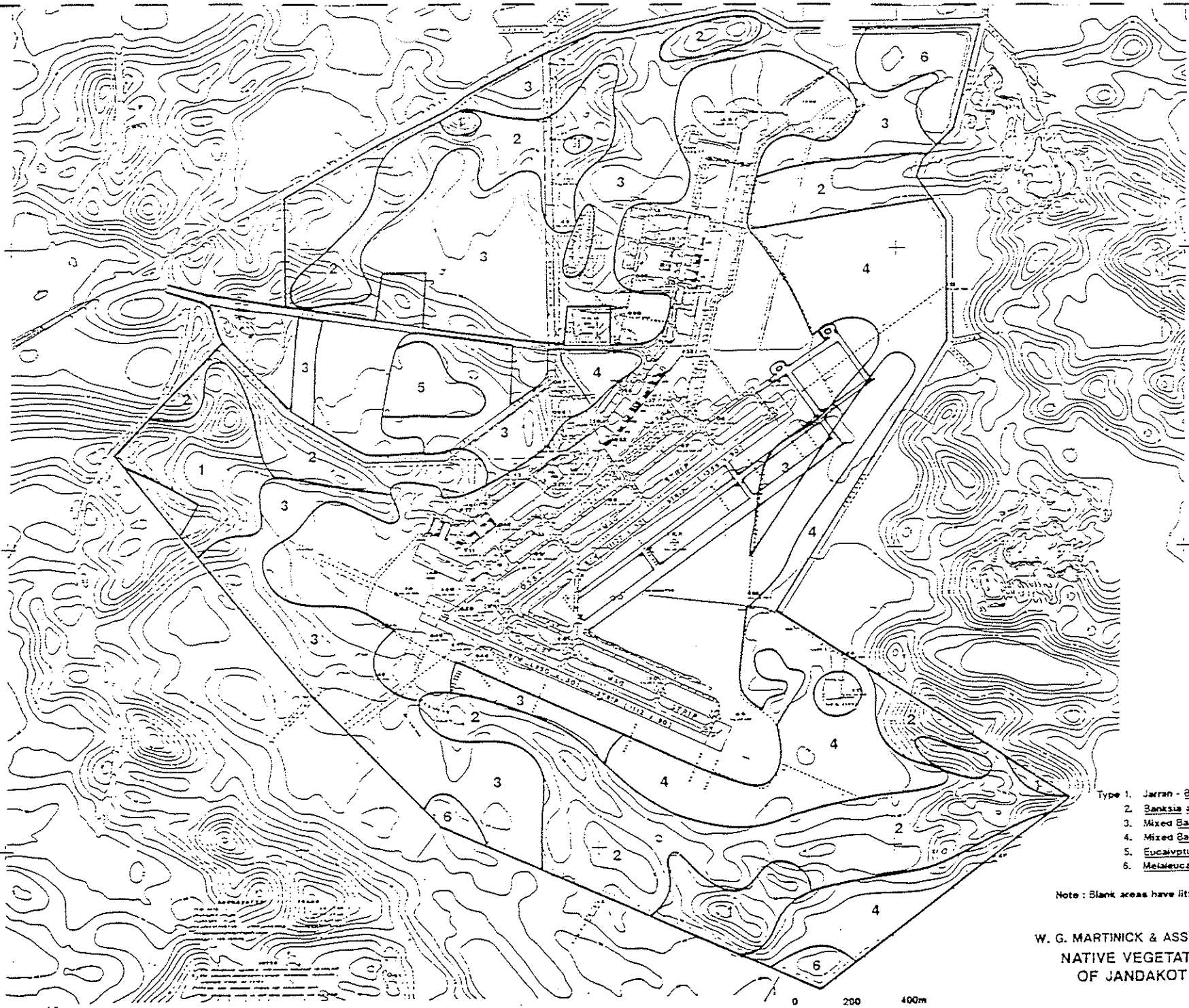

Type 1. Jarrah - Banksia woodland
2. Banksia attenuata open low woodland
3. Mixed Banksia woodland
4. Mixed Banksia woodland over scrub
5. Eucalyptus rudis woodland
6. Melaleuca - Pericalymma wetland
Note : Blank areas have little or no native vegetation
W. G. MARTINICK & ASSOCIATES PTY LTD
NATIVE VEGETATION TYPES
OF JANDAKOT AIRPORT
0 200 400m

Figure 2.

The Master Plan provides for a gradual increase in aircraft movements to an upper limit, which will be the maximum annual service volume. Thereafter, aircraft movements will either be suppressed or redirected to other airports such as Karnup.

The size and types of aircraft used at Jandakot Airport should not significantly alter.

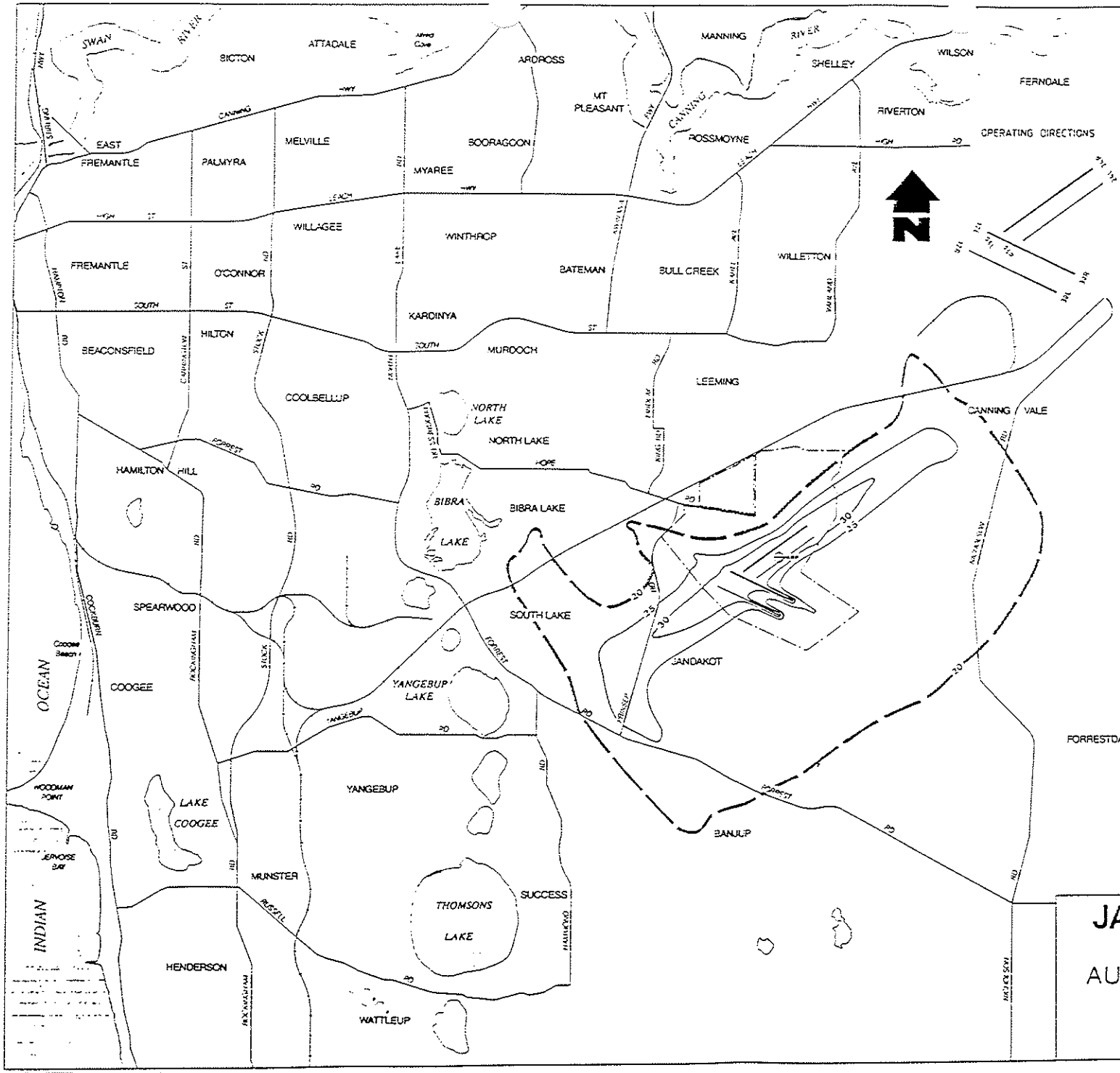
The Australian Standard AS 2021 1985 should be consulted for building site acceptability for noise reduction assessment.

The Australian Noise Exposure Forecast at year 2005 should be the basis for all external land use planning. Table 1 describes land use compatibility.

Existing and planned land use in areas surrounding the airport site should be compatible with the recommended land use limitations for areas affected by aircraft noise levels of 25 Australian Noise Exposure Forecast and above.

In the Master Plan, a diagram of the Airport showing three Australian Noise Exposure Forecast contours labelled 30, 25 and 20 delimits levels of decreasing noise with increasing distance from the runways and flight paths (Figure 3).

The Master Plan states that the Australian Noise Exposure Forecast shows the forecast noise exposure for some future time. It may be used for land use planning. It contains the best information available at the time about the future development of the airport, the likely numbers and types of aircraft, the likely noise levels of those aircraft and the flight paths that may be used.



EXPLANATION

This drawing shows the noise exposure around the airport's planned runway configuration for an average day taken over a specified year. The accompanying table gives the forecast number and type of each aircraft using each runway. The contour lines join points of equal noise exposure. Three contours are shown, they are labelled 20, 25 and 30. The higher the number of the contour the greater is the noise exposure.

The actual location of the 20 ANEF contour is difficult to define accurately, mainly because of variations in aircraft flight paths.

THIS DRAWING IS AN AUSTRALIAN NOISE EXPOSURE FORECAST

The Australian Noise Exposure FORECAST (ANEF) shows the forecast noise exposure at some future time. It may be used for land use planning. It contains the best information available at the time it was drawn about the future development of the airport, the likely numbers and types of aircraft, the likely noise levels of those aircraft and the flight paths that may be used.

COMPUTER REFERENCE NUMBER W 117

Further information about this drawing can be obtained from the Department of Aviation.

FORECAST DAILY NUMBER OF MOVEMENTS ON EACH RUNWAY

RUNWAY	TYPE OF AIRCRAFT	TAKE-OFF		LANDINGS		TOTAL
		7AM-7PM	7PM-7AM	7AM-7PM	7PM-7AM	
24L	Single	56.00	15.00	56.00	15.00	142.00
	Large Single	11.00	2.90	11.00	2.90	27.80
	Twin	3.50	1.00	3.88	1.00	9.60
	TOTALS	70.88	18.90	70.88	18.90	179.40
36R	Single	56.00	0.00	56.00	0.00	112.00
	Large Single	11.00	0.00	11.00	0.00	22.00
	Twin	3.88	0.00	3.88	0.00	7.60
	TOTALS	70.88	0.00	70.88	0.00	141.60
12L	Single	9.60	2.60	9.60	2.60	24.00
	Large Single	1.88	0.48	1.88	0.48	4.56
	Twin	0.64	0.17	0.64	0.17	1.62
	TOTALS	11.84	3.25	11.84	3.25	30.18
12R	Single	9.60	0.00	9.60	0.00	19.20
	Large Single	1.88	0.00	1.88	0.00	3.60
	Twin	0.64	0.00	0.64	0.00	1.28
	TOTALS	11.84	0.00	11.84	0.00	23.68
24L	Single	112.00	0.00	112.00	0.00	224.00
	Large Single	21.00	0.00	21.00	0.00	42.00
	Twin	7.60	0.00	7.60	0.00	15.20
	TOTALS	140.60	0.00	140.60	0.00	281.20
24R	Single	112.00	31.00	112.00	31.00	286.00
	Large Single	21.00	5.80	21.00	5.80	53.60
	Twin	7.60	2.10	7.60	2.10	19.40
	TOTALS	140.60	38.90	140.60	38.90	359.00
30L	Single	9.60	0.00	9.60	0.00	19.20
	Large Single	1.88	0.00	1.88	0.00	3.60
	Twin	0.64	0.00	0.64	0.00	1.28
	TOTALS	11.84	0.00	11.84	0.00	23.68
30R	Single	9.60	2.60	9.60	2.60	24.00
	Large Single	1.88	0.48	1.88	0.48	4.56
	Twin	0.64	0.17	0.64	0.17	1.62
	TOTALS	11.84	3.25	11.84	3.25	30.18
	GRAND TOTALS	470.16	66.30	470.16	66.30	1068.72

NOTES: 1. Twin denotes twin engine, propeller driven aircraft with a maximum take-off mass less than 5700 kg.
2. Single denotes single engine as in 1.

JANDAKOT AIRPORT W.A.

AUSTRALIAN NOISE EXPOSURE FORECAST — 2005

Figure 3

500 0 500 1000 1500 2000 2500 3000

Scale in metres

TABLE 1 LAND USE COMPATIBILITY ADVICE FOR AREAS IN THE VICINITY OF AUSTRALIAN AIRPORTS

ANEF = Australian Noise Exposure Forecast

BUILDING TYPE	ANEF ZONE		
	ACCEPTABLE	CONDITIONAL	UNACCEPTABLE
Houses, home units, flats	Less than 20 ANEF (Note 1)	20 to 30 ANEF (Note 2)	Greater than 25 ANEF
Hotels, motels hostels	Less than 25 ANEF	25 to 30 ANEF (Note 3)	Greater than 30 ANEF
Schools, Universities	Less than 20 ANEF (Note 1)	20 to 25 ANEF (Note 3)	Greater than 25 ANEF
Hospitals, nursing homes	Less than 20 ANEF (Note 1)	20 to 25 ANEF (Note 3)	Greater than 25 ANEF
Public buildings	Less than 20 ANEF (Note 1)	20 to 30 ANEF (Note 3)	Greater than 30 ANEF
Commercial buildings	Less than 25 ANEF	25 to 35 ANEF (Notes 3 and 4)	Greater than 35 ANEF (Note 4)
Light industrial buildings	Less than 30 ANEF	30 to 40 ANEF	Greater than 40 ANEF
Heavy industrial buildings	Acceptable in all ANEF zones		

NOTES:

1. The actual location of the 20 ANEF contour is difficult to define accurately, mainly because of variations in aircraft flight paths.

2. Within 20 ANEF to 25 ANEF, some people may find that the land is not compatible with residential use. Land use authorities may consider than the incorporation of noise control features in the construction of residences is appropriate.

3. An analysis of building noise reduction requirements by an acoustic consultant should be made and any necessary noise control features included in the design of the building.

4. If the 35 ANEF contour is not at present included in ANEF drawings produced by the Department of Aviation, this contour should be determined by interpolation.

5. This table is included in the Standards Association of Australia AS 2021.

5.2.2 Assessment of Airport analysis

The noise data as given in the Airport Master Plan has been viewed by a Gazetted Noise Officer. The basic noise parameters for the proposed upgrading of the Airport for extended General Aviation have been adequately covered in the Master Plan. To maintain adequate control of noise associated with the use of this airport it is recommended that:

- aircraft flight patterns on approach to the runway or on take off should be strictly controlled to ensure that all low level flying is conducted over less populated areas.

- for the activities of the Airport to continue to be compatible with the surrounding environment aircraft emitting high noise levels should not use the Airport.

- noise to the surrounding areas be kept to a minimum at night such as by controlling the frequency of night flights and limiting them to one runway between 1900 and 0700 hours. This will achieve minimum noise levels at a time when background noise levels are reduced.

6.0 CONCLUSIONS AND RECOMMENDATIONS

The Airport property contains a particularly good example of Banksia woodland in excellent condition and it is believed that this area contains rare and endangered animal species. For these reasons the Airport property is subject to a System 6 recommendation which recommends that the Commonwealth of Australia retain as much uncleared land as possible. In conflict with this is a need to extend the runway and taxiway facilities to accommodate the growth of the Airport in keeping with its planned use.

The construction of the proposed third runway and taxiways will have greatest impact on approximately 10 hectares of mixed Banksia woodland at the north-east extremity of the runway. This woodland is common within the Airport property. The impact of the clearing of this vegetation on the conservation value of the Airport land will be minimised if a strip of vegetation, preferably at least 50m wide, is retained along the eastern boundary. This vegetation will permit movement of ground dwelling animals between bush to the north and south.

The basic noise parameters for the proposed upgrading of the Airport for extended General Aviation has been reviewed by a Gazetted Noise Officer who considers that the parameters have been adequately covered in the Master Plan.

7.0 BIBLIOGRAPHY

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5266 WA 3169(C) METRO REGIONAL AREA & EXT. RUN 11 (5233-5311) 1:20000 15-DEC-92 920676

5055 WA 3169(C) METRO REGIONAL AREA & EXT. RUN 14 (5001-5081) 1:20000 15-DEC-92 920676