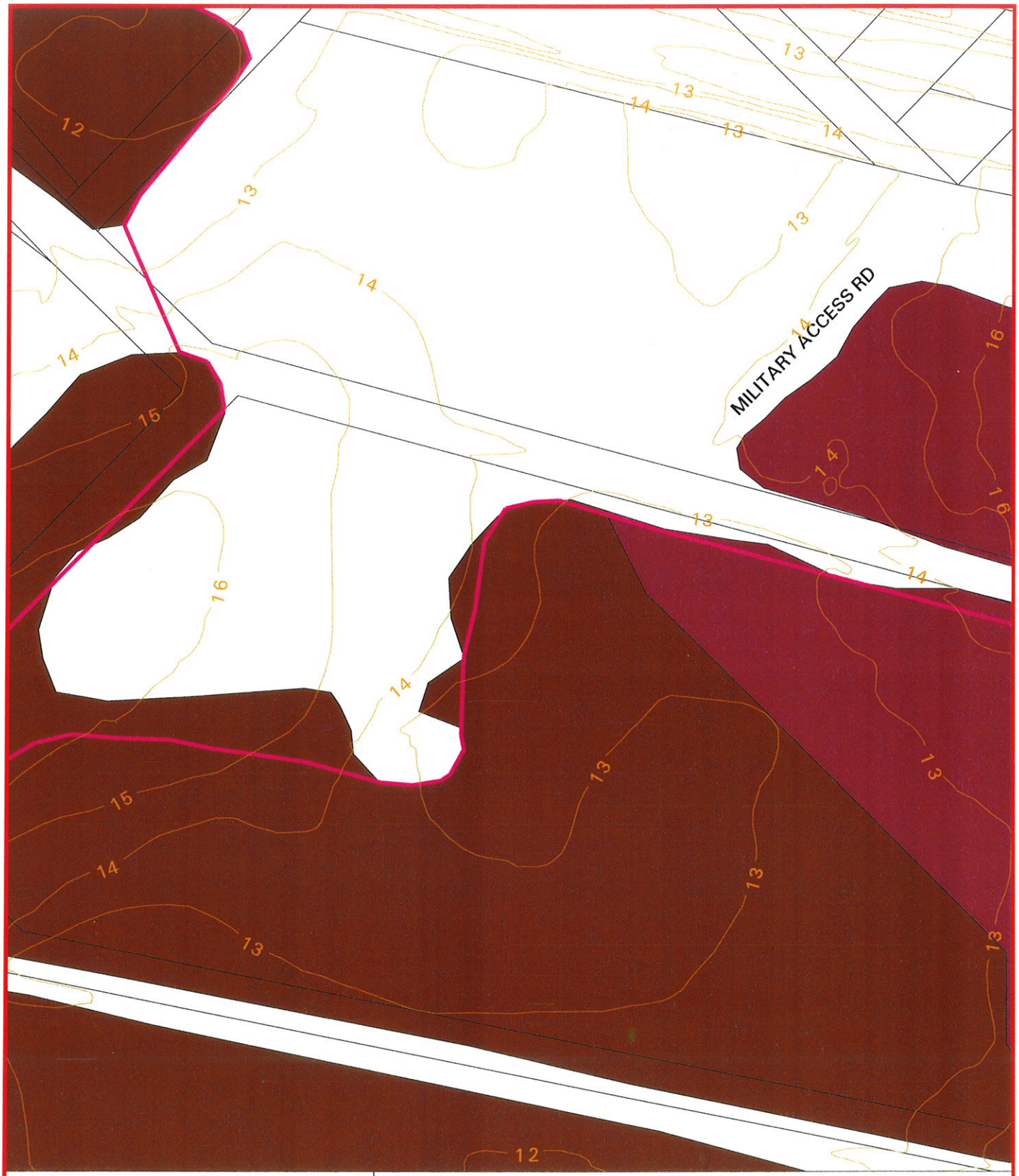


BS 386
Guildford Cemetery
Car Park Proposal
Veg

MFP INTERNAL USE ONLY
Prepared By: Sean Collingwood
Prepared For: SPC
Map Ident: plot010216_2
Date: 16 Feb 2001
Scale 1:2500

- Guildford Complex
- Southern River Complex
- Contours - 1m (DOLA)
- Cadastre
- Bush Forever Sites - Boundaries

BUSHPLAN SITES CORRECTED

THE GOVERNMENT OF WESTERN AUSTRALIA

CUSTOMER FOCUS WESTERN AUSTRALIA

N

386

Too much + over below

386

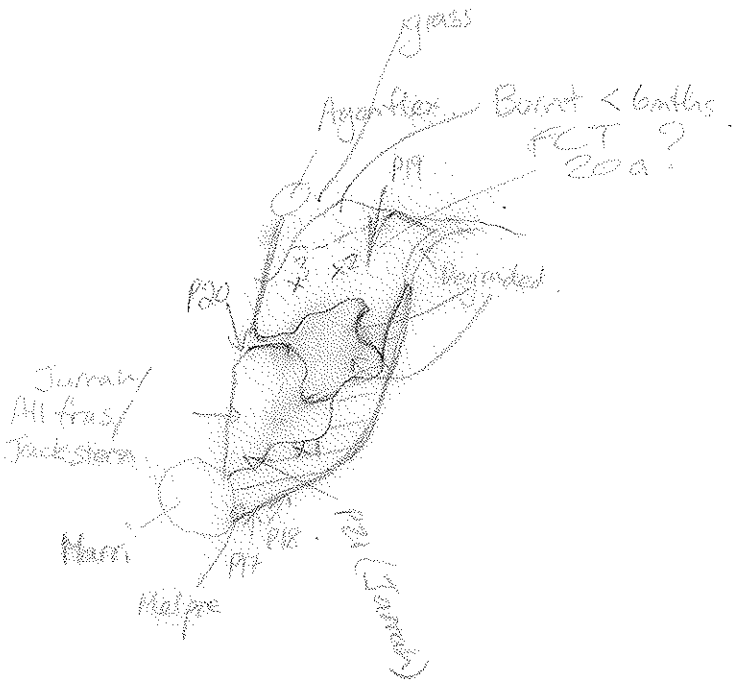
Too much + over below

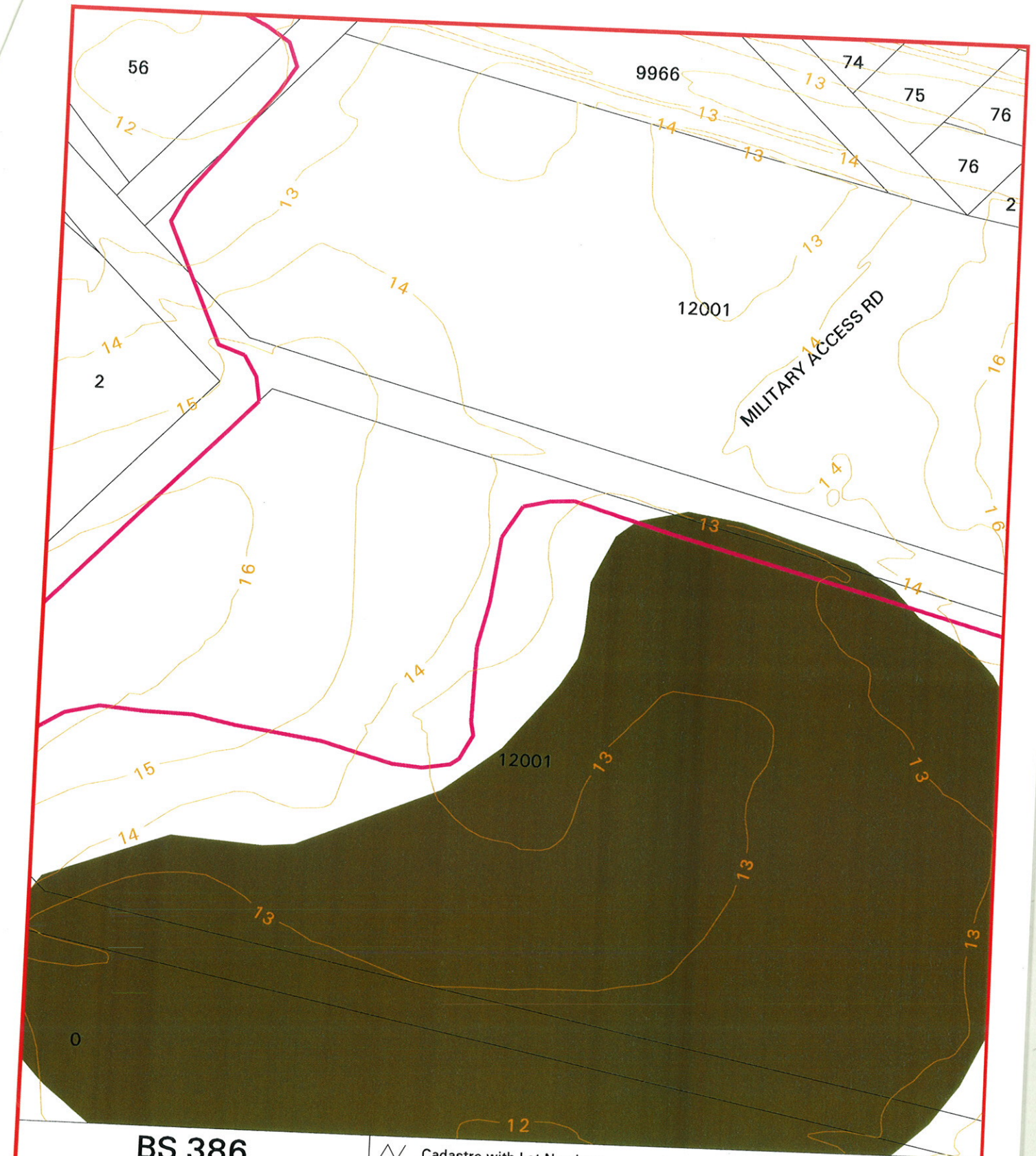
386

Site Visit
16/2/01

KC & SC.

(*) Talk to WRC, Melissa re Crew & boundary



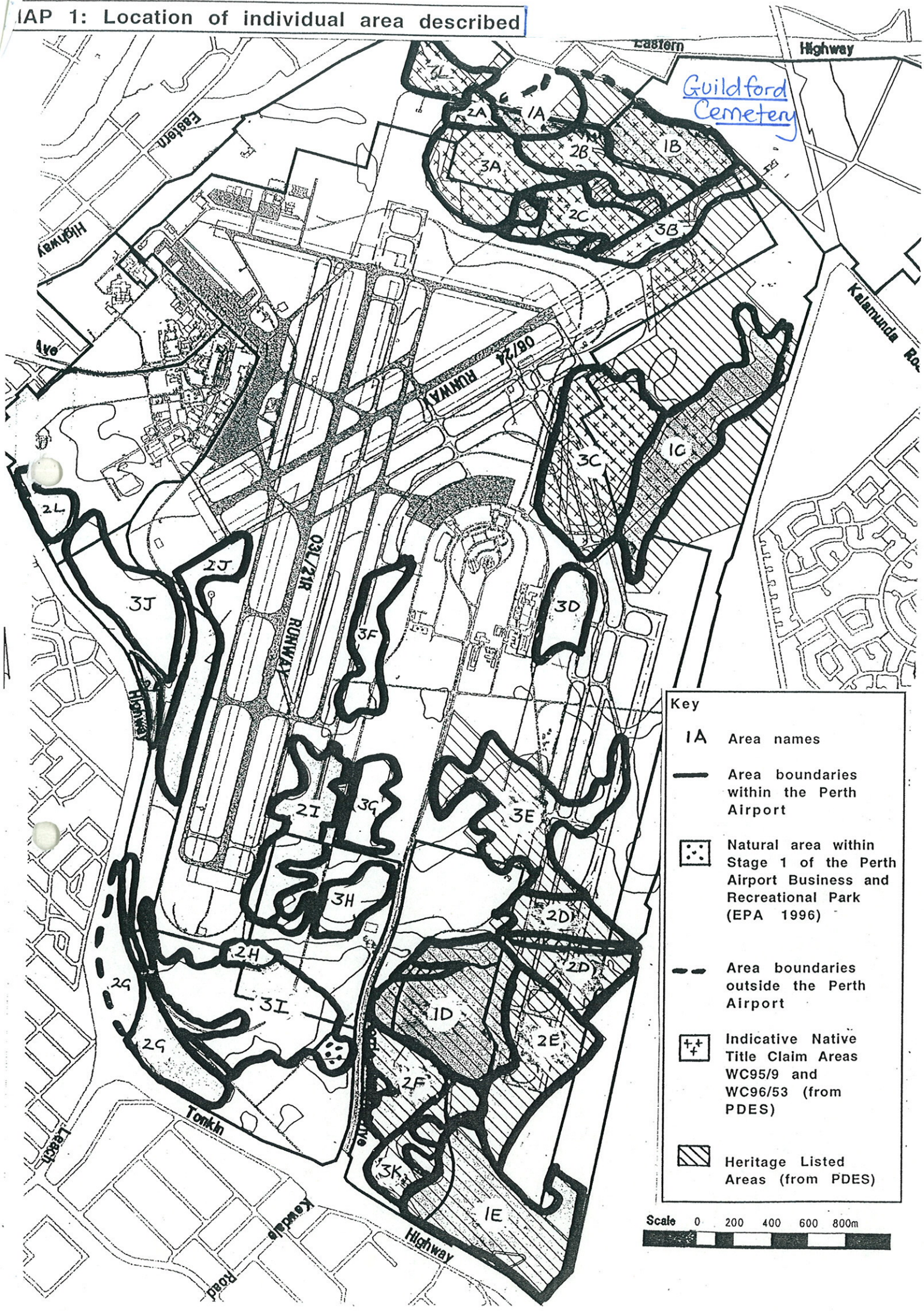


BS 386
Guildford Cemetery Car Park Proposal
Wetlands

MFP INTERNAL USE ONLY
Prepared By: Sean Collingwood
Prepared For: SPC
Map Ident: plot010216_2
Date: 16 Feb 2001
Scale 1:2500

- Cadastre with Lot Numbers
- Contours - 1m (DOLA)
- Conservation
- Bush Forever Sites - Boundaries

MAP 1: Location of individual area described



EXCLUDE
LOT 13 ADELAIDE ST

642

646

647

648

649

650

651

652

653

654

(H) = Holes in vegetation (cleared) from DEP rem veg mapping (May 1998)

include aerial pic indicated very good

check air photos

bp site 386

BJK has environmental approvals to develop

JA/NT 2-10

don't try + join us pieces just show as they are

Dujores goes reading Subject to vegetation condition.

Introducing 'dotted' lines at this point is inconsistent only the bushland in the boundaries is protected

Map Ident: plot980604_1	DATE: 04 Jun 98
Prepared By: Andrea Zappacosta	Prepared For:
Scale 1:AUTO	MFP INTERNAL USE ONLY

0 1.25 Km

- AG VEG 1998 BOUNDARY THEME
- Cadastre
- Bushplan sites refno 1-500 SCP BOUNDARY THEME
- cons category wetlands
- Verified CCWs

Figure 9.1

See System 6 File C76/M52 for Master Plan

HIGH WYCOMBE

FORRESTFIELD

ROE FREEWAY

Forrestfield Marshalling Yard

RUNWAY 03R 21L

30m

TAXIWAYS

APRON

HIAL LLZ MIDDLE MARKER

EASTERN TERMINAL AREA

CONTROL TOWER

MAINTENANCE ZONE

ROAD RESERVE

FREIGHT ZONE

COMMERCIAL ZONE

Receiver Site

DME

1758m x 45m Runway

2163m x 45m Runway

3444m x 45m

A.R.P.

Taxiway B

Taxiway H

Taxiway E

T/WY

Apron

Terminal

DME VOR

T.A.R.

Sewage Treatment

Transmitter Site

Kewdale Freight Terminal

KEWDALE

CLOVERDALE

REDCLIFFE

BASSENDEAN

SOUTH GUILDFORD

GUILDFORD

ASHFIELD

Helena River

Swan River

GREAT EASTERN HIGHWAY

BREARLEY AV.

LEACH HIGHWAY

HARDEY ROAD

SWAN RIVER

NORTHERN GENERAL AVIATION AREA

250 0 250 500 750 1000 1250 1500

Scale in metres

DEPARTMENT OF Aviation

PERTH AIRPORT W.A.

MASTER PLAN

ULTIMATE AIRPORT LAYOUT

Bushplan Site 386
(southern extent)

- Bushplan Sites (boundaries)
- Cadastre with Lot Numbers
- Contours - 1m & 2m (DOLA)
- Conservation Category Wetlands Boundary

Map Ident:	plot000110_4
Prepared By:	Andrea Zappacosta
Prepared For:	CATHERINE THOMSON
Date:	10 Jan 2000
Scale	1:6500
0	250 m

MFP INTERNAL USE ONLY

Bushplan Site 386
(southern extent)

- Bushplan Sites (boundaries)
- Cadastre with Lot Numbers
- Southern River Complex
- Bassendean Complex-Central And South
- Proposed Greenway

Map Ident: plot000110_3
Prepared By: Andrea Zappacosta
Prepared For: CATHERINE THOMSON
Date: 10 Jan 2000
Scale 1:6500
0 250 m
MFP INTERNAL USE ONLY

BS 386

PBS/07 JEMJW
MAR4

Our Ref : PBS/07 JEMJW

Your Ref :

Enquiries : Ms Egan

18 March 1999

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

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

Dear Sir/Madam

SUBMISSION ON PERTH'S BUSHPLAN

Thank you for the opportunity to comment on Perth's Bushplan.

The following two sites nominated for conservation by Perth's Bushplan are located within the City of Belmont:

1. Perth Airport and adjacent Bushland (Bushplan Site No. [redacted]), which is under Commonwealth government control; and

2. Swan River Saltmarshes, Bayswater/Maylands (Bushland Site No [redacted]), which is under State government control.

Whilst neither sites are under the City of Belmont's control, we wish to offer the following comments in respect to these sites as well as some more general comments on the overall Perth Bushplan document.

COMMENTS ON SPECIFIC AREAS

1. PERTH AIRPORT AND ADJACENT BUSHLAND

Background

During 1997, the Commonwealth Government of Australia supported the acquisition of a 50 year lease, plus 49 year option, of the Perth International Airport by Westralia Airports Corporation (WAC). In accordance with *The Airports Act, 1996* (the Act), WAC was required to prepare a Draft Master Plan and Environmental Strategy for the Perth International Airport. A Draft Master Plan and Environmental Strategy have now been prepared which is soon to be referred to the Federal Minister for Transport and Regional Development for final approval. The Master Plan covers a 20 year planning period and the Environmental Strategy is to guide environmental management for the Perth International Airport for the next five years.

SUBMISSION NO. 163

City of Belmont 215 Wright Street (Locked Mail Bag 379), Cloverdale, Western Australia 6105
Telephone: (08) 9478 0222 Facsimile: (08) 9478 1473 TTY (Hearing Impaired) (08) 9479 5145
All communications to be addressed to: The Chief Executive Officer, Locked Mail Bag 379, Cloverdale, Western Australia 6105

Draft Master Plan

The Draft Master Plan includes a development strategy for 1041 hectares of land within the Perth International Airport site which is regarded as being surplus to aviation requirements. The development strategy identifies five development and two conservation precincts (refer to Attachment A for copy of Development Plan).

It is of some concern that the nominated development precincts overlap with areas identified by Bushplan as having regionally significant bushland. Some of the development precincts also overlap with areas which are either registered with the Australian Heritage Commission or which are being considered for registering.

The Draft Master Plan indicates that these broad precincts will be subjected to more detailed structure planning which will be undertaken in consultation with State and local government. The detailed structure planning of these precincts would provide an ideal opportunity to ensure that, where possible, the Bushplan site is protected from development and set aside for conservation.

Draft Environmental Strategy

The Draft Environmental Strategy for the Perth International Airport classifies areas as having a priority rating from one (highest) to three (lowest) in relation to the management or retention of areas for conservation purposes (refer to Attachment B for Perth International Airport – Natural Environment Priority Zones Plan). Areas which have been categorised only Priority 2 or 3 by the Draft Environmental Strategy have been nominated by Bushplan as significant regional bushland areas that should be conserved.

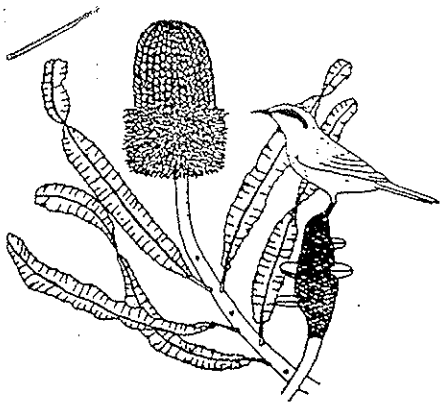
The inconsistencies between the two documents should be raised for discussion with WAC during future consultation/negotiations.

Memorandum of Understanding

A Memorandum of Understanding (MOU) is being developed between WAC and relevant State government agencies, including the Ministry for Planning and Department of Environmental Protection, to clearly define procedures for addressing State and local issues regarding land use, development and environmental matters pertaining to Perth Airport land. It would be worthwhile for steps to be taken to ensure that the MOU has regard to the objectives and recommendations of Perth's Bushland.

ATTACHMENT TO PERTH'S BUSHPLAN SUBMISSION

1/5



Friends of Perth Airport Bushland

402 Berwick Street,
St James, W.A. 6102
telephone 361 0373

Kevin McLean
Assistant Secretary
Friends of Perth Airport Bushland

12 May, 1998

Perth Airport Preliminary Draft Master Plan
Attention Jonathan Riley
c\o Sinclair Knight Merz
7th Floor Durack Center
263 Adelaide Terrace
Perth, WA 6000

Here follows a submission on behalf of the Friends of Perth Airport Bushland (FOPAB) regarding the *Perth Airport - Preliminary Draft Master Plan (PDMP)*, and the *Preliminary Draft Environment Strategy (PDES)*. The Friends of Perth Airport Bushland has lobbied for the conservation and appropriate environmental management of the remnant natural areas at Perth Airport for some years and will continue to do so in the years to come. The bushland and wetlands at Perth Airport, and their associated ecosystems, are of major significance at the local, state, and national level. Accordingly it is appropriate that the community should be conscious of the outstanding environmental values of the remnant natural areas at the Airport, and that it should register its concern about the protection of those values through a representative community group.

We address the task of commenting on the released documents conscious of the fact that environmental issues are occupying the hearts and minds of ordinary citizens to an unprecedented extent, and that this breadth and depth of concern represents a cultural shift which has been remarkable in terms of the rapidity of its development and the pervasiveness of its influence. The community's grasp of environmental issues and its sensitivity to the processes by which they are dealt with, becomes more acute with every passing year. Accordingly, the community expects environmental issues to be approached seriously and with a view to finding solutions which can be seen to produce genuinely favorable outcomes for the environment. An increasingly demanding, sophisticated, and discerning community will not be satisfied with superficial environmental assessments and glib assurances.

The Friends of Perth Airport Bushland, as representative community group, is obliged to object to environmental processes, approaches, plans, and strategies which it believes fall short of the standards the community is entitled to expect.

SUBMISSION NO 522

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Given these considerations, the Friends of Perth Airport Bushland feels compelled to state that it is dissatisfied with the *Preliminary Draft Master Plan* and the *Preliminary Draft Environment Strategy* in terms of their environmental implications. The Friends group had a representative present at workshops held by WAC prior to the release of the documents and developed strong misgivings about the approach being taken to their production at that early stage. Representatives of bodies with a special interest in the protection of the environment felt that there were very unsubtle attempts to involve them in environmental prioritizations and decisions which they had not been given time to consider, which would have had serious implications, and which they were never likely to find acceptable as part of a purported consultation process in the first place. Crude efforts to railroad participants into choosing between odious environmental options within a framework of assumptions and assessments they did not necessarily accept, and indeed to which they were bound to object, did not augur well for the final content of the documents to be released for public comment. After objections from participants, however, some improvements in the consultation process, and in the proposed environmental outcomes was observed. Nevertheless, it remains the view of the Friends of Perth Airport Bushland that the *PDMP* and the PDES are fundamentally flawed in their failure to recognise the actual environmental significance of the natural remnant areas at the Airport This denies them a credible base from which to proceed and skews environmental responses and strategies towards unsatisfactorily unfavorable outcomes.

The Friends of Perth Airport Bushland and other participants in the *PDMP* and *PDES* workshops formed something of a common view that the means by which WAC and its consultants had arrived at their decisions regarding the conservation value of the Airport's natural areas as a whole, and of the various constituent natural areas, was not entirely clear. Even in the released documents, the prioritization of remnant natural areas, presumably according to perceived conservation values, is not explained in terms of reference to any detailed schedule of environmental criteria. However, the significance of the remnant areas of Perth Airport as a whole is the issue we wish to address first as it is this crucial evaluation which should inform the overall response of the owner and land manager to the Airport's natural environment.

Perth Airport has been the subject of flora and fauna surveys, and has been recognized by the Australian Heritage Commission, and the National Trust. The question of the Airport's environmental significance requires an appreciation of both the ecological attributes of the site itself, and an appreciation of the context in which it exists, so that comparisons and relative evaluations can be made. It is the view of the Friends of Perth Airport Bushland that the Airport's natural areas warrant greater protection than is likely to flow from the *PDMS* and the *PDES* for many reasons, not the least of which is that so much bushland and so many wetlands have been cleared in their bio-geographic context that they represent a precious and irreplaceable fragment of a very badly depleted natural landscape.

Locating Perth Airport bushland within its landscape context is a reasonable starting point in evaluating its environmental significance.

Given that the Airport is only about 9 kilometers from the Perth Central Business District, its location and immediate environs can be said to be urban. This fact is in itself significant as there has been a great upsurge in the community's interest in conserving remnant city bushland in the past decade. Large numbers of community conservation groups have sprung up to lobby for the protection of bushland remnants throughout the Perth metropolitan area, and many have become involved in the environmental management of these bushland areas. At one time, governments and bureaucrats tended to dismiss this interest in urban remnants on the grounds that the bush blocks were deemed to be of "social" rather than real "environmental" significance. Underpinning this official response, however, was an implicit assumption that there remained on the outskirts of the metropolitan area and beyond, large areas of uncleared bushland which could be reserved if necessary at some future time. But in the case of remnant areas like those at Perth Airport, lying as it does on the eastern side of the Swan Coastal Plain and to south of the Swan River, clearing for agriculture had already destroyed most of the bushland of its type south of Perth.

Recent studies associated with the WA ministry for Planning's *Perth Environment Project* have brought to light the poor conservation status of the *Southern River Vegetation Complex*, of which Perth Airport is part, in the metropolitan area. Even before these studies, of course, Perth Airport was recognized as being regionally significant in the WA EPA's *System 6 Report* - this document being published as far back as 1983. Land clearing for agriculture and urbanization since this time has inevitably increased the relative importance of the remnant areas at the Airport, as they have not diminished significantly in size for many years.

Within the inner metropolitan area, data from the *Perth Environment Project* clearly shows Perth Airport as one of the city's largest natural remnant areas. Other areas on a similar scale include Kings Park, Bold Park, and Whiteman Park. In terms of biodiversity and conservation value, Perth Airport compares very favorably with each of these sites. It has, for example, wetland areas which are entirely absent from Kings Park and Bold Park, and which are far more substantial than those at Whiteman Park. Perth Airport also has much larger natural areas which can be said to be in good condition than either Bold Park or Kings Park.

At a local level, Perth Airport's natural areas appear to be largely surrounded by urban development. However, if one adopts a regional perspective, the Airport's bushland can be seen to form part of a very significant corridor consisting of remnants which actually

link the Canning River vegetation corridor and the Swan River vegetation corridor, on the eastern side of the Coastal Plain. That linkage is not recognized in the *PDMP*, and it ought to be. What must be understood is that the city of Perth forms an urbanized barrier across the Swan Coastal Plain, virtually from the coast to the foothills. Any remnant corridor which can serve as a natural thread across that urbanized expanse is of very great significance, both in heritage terms and as a route for indigenous avian fauna which travels north and south long the Coastal Plain. If the corridor were to be enhanced with bushland regeneration and the provision of wildlife tunnels under roads etc., it could serve as a means of linking terrestrial fauna populations. This would allow for the natural re-population of areas where local extinctions had occurred due to such factors as fire or predation, and would allow for a healthy genetic exchange.

Late last year a document entitled *A Strategic Plan for Perth's Greenways,* prepared by Alan Tingay and Associates for a number of State Government agencies and community groups, was released in draft form for public comment. The *Greenways* report contains some excellent maps of proposed greenways, and recommendations. The Friends of Perth Airport Bushland was most delighted to find recognition of the potential of Perth Airport's bushland to be included in a remnant vegetation corridor running along the eastern side of the Coastal Plain, just to the east of the heavily urbanized inner metropolitan area (We would refer you to *Map 1* of the *Greenways* document). The vegetation corridor proposed runs along the Canning River, up into the Brixton Street - Yule Brook reserve in Kenwick, up into Hartfield Park in Forrestfield, through to System 6 Area M53, also in Forrestfield, and then to Perth Airport, which in turn connects loosely to the Swan River to the north, which then forms a vegetation and wildlife corridor heading north from the city. This corridor is a fortuitous remnant but it is one we cannot afford to lose. Indeed, it presents a wonderful opportunity to bring local and regional planning, environmental rehabilitation skills, and environmentally sympathetic engineering design together, to enhance the biodiversity potential of the existing belt of bushland remnants by linking the component parts to create one unbroken ecosystem. The PDMP should recognize this eco-link or "greenway" potential of Perth Airport in evaluating its environmental significance. Much of the corridor between the two river systems referred to (the Swan and the Canning) is relatively narrow. Running as it does for a distance of more than 10 kilometers, the attenuation of the remnant strip diminishes its capacity to provide a safe haven for wildlife and its capacity to resist environmental degradation because of the general proximity of margins susceptible to "edge effects." A large expanse of bushland such as currently exists at Perth Airport increases the biological potential of the corridor markedly by providing more secure habitat in which fauna can avoid perdition, feed and breed.

It is worth noting that *Map 1* of the *Greenways* document, a map produced by the WA Ministry for Planning's Land Information Branch and dated 28 November, 1997, charts among other things, what are described as *Conservation Category Wetlands.* It should be noted virtually the whole of the remnant natural area at Perth Airport is presented as *Conservation Category Wetland.* It is certainly one of the larger areas so categorized in the metropolitan region. This recognition of the Airport as an area of high conservation

value because it is almost entirely classified as wetland, is not acknowledged in the *PDMP*. It ought to be. Over a period of some years, environmental review documents and studies produced for Perth Airport's managers have failed to give sufficient weight to wetland mapping data produced by the WA Water and Rivers Commission which attributes high conservation value to the Airport's natural areas because they constitute uncleared and relatively undrained wetlands in a highly urbanized setting. Perth Airport always stands out in mapping of this nature and there is little to rival it for size as a wetland area in the inner metropolitan region. This omission of important environmental data, or merely fleeting reference thereto, is unacceptable and is again indicative of the tendency of Airport land managers to present environmental reviews and reports which downplay the environmental significance of the Airport's natural areas.

In considering the environmental value of the bushland and wetlands at Perth Airport and the recognition they have been accorded, it should be borne in mind that the WA Government is soon to release for public examination, its urban bushland conservation initiative known as *Bushplan*. This project is aimed at protecting as much as possible of the regionally significant bushland remaining in the Perth metropolitan area. The Friends of Perth Airport Bushland group has no doubt whatsoever that *Bushplan* will attribute high conservation value to virtually all of the remnant bushland and wetlands at Perth Airport and recommend their conservation. While the *PDMP* could not be expected to anticipate the contents of *Bushplan* in detail, we would argue that the WA Ministry for Planning's *Perth Environment Project* data, which has been available for some time, provides a good indication of the conservation values likely to be attributed to the Airport's natural areas. Accordingly, the evaluation of the bushland areas in the *PDMP* could have been brought more into line with the *PEP's* ratings and evaluations so that the reading public might have developed a more positive impression of the ecological value of the Airport than the *PDMP* tends to reflect.

A serious shortcoming of the *PDMP* is that it does not contain any particular map which assigns conservation values to the natural areas at the Airport from a regional perspective. The *PDMP* merely rates the Airport's natural areas against each other. This internal prioritization process does not address the key issue of the environmental significance of the natural areas in the wider context such as the city, or the region, or the state. The "Vegetation Quality" mapping of Alan Tingay and Associates shown in *Figure 3.2* of the *PDES* is inappropriately titled. The mapping merely assigns "Vegetation Condition" ratings, using rather negative designations centering on perceived degrees of "Disturbance." Regrettably, rating the "condition" of bushland is not the same as rating its conservation value. Vegetation can have high conservation value despite being in poor condition if; it forms part of a poorly conserved Vegetation Complex; it lies in a transition zone between two Vegetation Complexes; it contains rare plant communities; it contains large numbers of uncommon species or CALM Priority Species; it contains Declared Rare Flora; it spans several landscape transitions from dry ridges to wetland basins; or if it is particularly species rich. In any case, the vegetation is only one element of an ecosystem. To assign an area a conservation value, one could not rely entirely on an assessment of the vegetation, let lone a mere assessment of the "condition" of the

vegetation. To make a reasonably accurate evaluation of the conservation values of a natural area, it would obviously be necessary to take into account its fauna values. It cannot simply be assumed that vegetation in the best condition has the highest fauna conservation values. A patch of bushland consisting of relatively common species and communities of flora, and in relatively poor condition, for example, may have high conservation values if it forms the only link between larger fauna habitat areas. Similarly, bushland or wetlands which do not have flora or species or communities of particular note, can have very high conservation values if they provide habitat for Rare and Endangered fauna.

In the *PDMP*, it is clear that the prioritization of remnant areas according to their perceived conservation value, as is shown in *Figure 12.5* of the *PDMS* (*Figure 3.5* of the *PDES*), is derived in large measure from Tingay and Associates'(1994) attribution of vegetation condition ratings, as seen in *Figure 3.2* of the *PDES* (to our amazement the *PDMP's* assessments of the bushland are actually even more negative than the Tingay and Associates "Quality" ratings shown in *Figure 3.2*). However, as we have already argued, the condition of the vegetation of a natural area is not necessarily indicative of its real conservation value. This is well illustrated in the Airport context when the recommendations of the *Survey of the Western Swamp Tortoise and its Habitat at the Perth Airport* (1996: Kuchling, Burbidge) are taken into account. *Figure 47* of the said document is a *Map of Perth Airport with the groups of swamps proposed for Western Swamp Tortoise habitat conservation and rehabilitation.* Six large bushland\wetland areas are delineated on the map and it is clear that the prioritization method adopted for *Figure 12.5* of the *PDMS* (*Figure 3.5* in the *PDES*) is not really consistent with *Figure 47* of the *Survey of the Western Swamp Tortoise* document. There are large areas proposed as habitat for the Western Swamp Tortoise which the *PDES* assigns the lowest conservation priority, *Priority 3*. Given the critically endangered status of the Western Swamp Tortoise, and the fact that Perth Airport constitutes one of the last remaining suitable habitats for building up its numbers in the wild, this ungenerous allocation of conservation priorities is unacceptable. If scarce suitable habitat for one of the world's rarest reptiles can be assigned a relatively low conservation priority in the internal allocation of conservation priorities in the *PDMS*, surely this tends to illustrate the very high conservation values of the remnant areas at Perth Airport as a whole in the regional, state, and national context.

Although we have argued that using vegetation condition ratings alone is not a suitable basis for assigning conservation values to remnant areas, as appears to have been the methodology employed in the *PDMS*, we would point out that we do not even accept the accuracy of the vegetation condition assessments from which the conservation priorities appear to have been misguidedly derived. With reference to *Figure 3.2* of the *PDES*, entitled *Vegetation Quality*, we state our objection to the use of the term "quality" when the legend centres on the term "disturbance." Members of the public who are not familiar with the bushland in situ should not be lead to believe that descriptions of degrees of disturbance is an accurate reflection of the "value" or "quality" of the vegetation. The

Figure should be entitled "Vegetation Disturbance," or perhaps "Vegetation Condition." It is also, in our view, unacceptable to present the bushland in as unfavorable a light as possible in a document for public release and comment by referring only to degrees of "disturbance" in a purported evaluation of the quality of the vegetation.

But apart from the terminology employed, the Friends of Perth Airport Bushland also dispute some of the ratings assigned. For example, a large area of bushland west of Zante Road, opposite Broadacres riding school, is described in *Figure3.2* of the *PDES* as "Severely Disturbed." It is true that some areas within the larger area so described are "severely disturbed", but there are also substantial areas in good condition which should be presented as such. It is also clear that large areas were distinguished form the highest category of "Slightly Disturbed," by the designation "Obvious Disturbance" for no other reason than the visibility of some degree of Veldt Grass infestation. This latter sign of "disturbance," however, can be quite misleading as many if not most bush blocks around Perth have a moderate degree of Veldt Grass infestation, but manage to maintain their normal diversity of indigenous plant species. Veldt Grass is also one of our easiest weeds to selectively control with herbicides. An otherwise undisturbed area of bushland can acquire occasional clumps of this unsightly weed simply through the intervention of a fire. Its presence alone is not a good measure of bushland condition.In any case, Tingay and Associates' rating of much of the bushland at Perth Airport as showing "Obvious Disturbance" is not as damning as it might seem. In the explanation of the terminology "Obvious Disturbance" in *The Flora and Vegetation of Perth Airport* (1994: Alan Tingay and Associates), the text, in part, reads; "Vegetation structure slightly altered but able to regenerate" (p. 9). From our knowledge of bushland conservation , "able to regenerate" is about favorable a description as could be given to given to most of the remnant bushland left on the Swan Coastal Plain. We notice the same areas are frequently assigned *Priority 3* ratings in the *PDMP*, a terminology meaning " fragmented and in poorer condition" (*PDES p. 3.9*) - a far more dismissive and negative description. Indicative of the very poor preparation of these documents, and their obscurantic nature, is the fact that despite much usage of Tingay and Associates' "levels of disturbance" terminology, notably in the *Tables* describing *Priority Areas*, there is no actual explanation of this terminology in either the *PDMP* or the *PDES*.

As we have previously stated, it is the view of the Friends of Perth Airport Bushland that there is little evidence to suggest the allocation of conservation priorities in the *PDMP* is based on much more than Tingay and Associates' "Vegetation Quality" mapping, shown in *Figure 3.2* of the *PDES* - except that the *PDMP* shows even less acceptance of the bushland's conservation values. We would have expected conservation priorities to have been worked out using a much more extensive range of criteria and in consultation with relevant agencies like the WA Department of Environmental Protection, the Water and Rivers Commission, and the WA Museum. We would also have expected reference to independently derived data such as that associated with the WA Ministry for Planning's *Perth Environment Project.*

It is our view that the WA Ministry for Planning's *PEP* data is an essential resource for evaluating the conservation significance of the Airport and that it should have had more bearing on the preparation of the *PDMP*. The data we refer to provides a more objective assessment of the environmental values of the Airport's remnant areas and places them in a wider regional context. The *PEP* data gives weight to our argument that the *PDMS* and the *PDES* have not shown sufficient regard for the conservation values of the Airport's natural areas and that they have failed to make adequate provision for their protection.

As far as the condition of the bushland at Perth Airport is concerned, almost all of it has been rated as being in "Good Condition." This rating obviously takes into account the relative condition of other remnant areas in the Perth metropolitan area. It is all very well to describe bushland as being "disturbed," as long as one is informed that there is probably no bushland in the entire south west of Western Australia which shows no signs of having been "disturbed."

The *PEP* data also attributes "Ecological Ratings" to bushland areas. Well over 90% of the bushland at Perth Airport is assigned an "Ecological Rating" which puts it in the top 10% of bushland remnants in the metropolitan area. Around 50% of the bushland at Perth Airport is assigned an "Ecological Rating" which puts it in the top 5% of bushland remnants in the metropolitan area. It should be noted that large areas assigned "Top 5%" "Ecological Ratings" in the *PEP* are assigned *Priority 2* and even *Priority 3* ratings in the *PDMP*. Again even larger areas assigned "Top 10%" "Ecological Ratings" in the *PEP* are assigned *Priority 2*, and lowly *Priority 3* ratings in the *PDMP*. The inconsistency is glaring. We regard the *PEP* data as credible and accurate and we see the problem as lying with the compilation of the *PDMP*. It is our understanding that the WA Ministry for Planning was well informed as to the attributes of the bushland at Perth Airport when the *PEP* data was being prepared (neither our group, nor any associated groups provided any information to the *PEP* to our knowledge).

Another data set from the *PEP* of particular significance is that which relates to the mapping of "Vegetation Complexes." The mapping shows Perth Airport as having 3 Vegetation Complexes within its boundaries; the Guildford Complex; the Southern River Complex; and the Bassendean Complex - Central and South. The significance of these Vegetation Complexes occurring at Perth Airport is that in each of the 3 cases, the Vegetation Complexes represented have less then 10% of the original area they occupied in the metropolitan area held inside the conservation estate. Ten percent is the minimum area recommended for protection of an ecosystem by the Union for the conservation of Nature.

The Guilford Complex, in particular is very poorly conserved according to *PEP* data. There is only 345 ha in the conservation estate, while an 1086 additional ha is required to bring the conservation estate percentage to 10% of the original area. Given that only 1086 ha remains outside the conservation estate, the Guildford Complex is of very special environmental significance. One does not see any reference to the importance of the remnant Guildford Complex vegetation lying at the northern end of the Airport in the

PDMP or *PDES*. In fact, *Priority Areas 1.1*, and *2.1*, and a *Priority 3* area, are erroneously described as being representative of the Southern River Vegetation Complex in Table 12.7 *Priority 1 Areas*, and *Table 12.8 Priority 2 Areas* in the *PDMP*, when *PEP* data we have indicates that these areas are actually representative of the Guildford Vegetation Complex.

The Southern River Vegetation Complex occupies the greatest area at the Airport and again less than 10 % of the original area occupied by the Complex in the metropolitan area is presently in the conservation estate. According to *PEP* data there is only 1788 ha inside the conservation estate, with an additional 1327 ha required to make up the 10% figure. The Environment Assessment Branch of the Commonwealth Environment Protection Agency in its *Environment Assessment Report - Perth Airport Business and Recreation Park Stage 2* (1996) contains the following paragraph;

> The PER indicates only 8.6% of the original 58,343 ha of the Southern River Complex remains uncleared. A report by Bowman, Bishaw and Gorham (1994) indicates that less than 5% of the Bassendean Complex - Central and South remains on the Swan Coastal Plain and that the conservation status of this complex is very poor.

This information does not appear in the *PDMP*, but would help members of the public and relevant bodies to gain a better appreciation of the outstanding conservation values of the Airport.

The final Vegetation Complex to consider, the Bassendean Complex - Central and South, has already been referred to in terms of its poor conservation status as a vegetation type on the Swan Coastal Plain. The *PEP* also identifies it as having less than 10% of its originally occupied area within the metropolitan region held in the conservation estate. It identifies 2849 ha as being within the conservation estate, with an additional 1779 ha required to make up the 10% target figure.

Clearly, all this information points to the high conservation values of the remnant bushland at Perth Airport. Once again we quote from the *Environment Assessment Report - Perth Airport Business and Recreation Park Stage 2* (1996), produced by the Environment assessment Branch of the Commonwealth Environment Protection Agency;

> The WA Department of Environment Protection comments that the vegetation complexes at Perth Airport are now recognized as being seriously under threat. The Department comments further that it is highly likely that the Urban Bushland\ System 6 Update will recommend protection of almost all the remnant vegetation at Perth Airport. Poor condition will be balanced by the large total area of remnants. The Department states that Perth Airport supports one of the largest areas of contiguous remnant vegetation in the Perth region. Its location at the juncture of three complexes is probably unique. It contains a very diverse array of plant communities and structures. Habitat value is therefore considered very high.

Once again, this information is not alluded to in the *PDMP*, either directly or indirectly. It is difficult to escape the conclusion that the WA Department of Environmental

Protection rates the conservation value of the bushland at Perth Airport far more highly than does the *PDMP*, given the latter document's unfavorable assessment of large areas of the bushland and its anticipation of extensive clearing for development.

Yet another body with what appears to be a higher estimation of the conservation values of Perth Airport than has been exhibited by successive land managers (the FAC and WAC), is the Australian Heritage Commission. It is our understanding that WAC has lodged objections to the current Interim Listing of two large areas at the Airport on the Register of the National Estate. The Friends of Perth Airport strongly supports the Interim Listings and in fact hopes the heritage Commission will move to Interim List a similarly large area on the western side of the Airport, as was recommended by consultant botanist Malcolm Trudgen in his *Objection Assessment for Perth Airport, flora values and advice on flora values of bushland not currently listed* (1995), prepared for the Australian Heritage Commission. The western side of the Airport is part of the Bassendean Vegetation Complex - Central and South, and this poorly conserved vegetation complex is not represented in the current Airport Interim Listings.

The Heritage Commission's interest in Perth Airport is long standing and it has a good deal of scientific and anthropological advice to back up its Interim Listings. The Friends of Perth Airport Bushland is primarily an environmental group, but in the process of studying the bushland and wetlands at Perth Airport for many years we have noted many Aboriginal archeological sites. These sites are in the form of artifact scatters. Our concern is that not all of these sites may have been recorded. Indeed, it is likely that any significant ground disturbance at the Airport will expose new clusters of artifacts. Because we have found the artifacts distributed over such a wide area, it is our view that it would make more sense if much larger areas at the Airport were designated as Aboriginal sites. We have noted isolated artifacts and small clusters of artifacts over a wide area in the bushland east of Horrie Miller Drive, for example. This is in addition to the more obvious scatters which have probably been recorded. These artifact scatters are a precious reminder of pre-European settlement around Perth, and they should not be treated with the disgraceful indifference which has seen so many of them obliterated in the region. We would concede that even if they could be protected from further disturbance by development and careless usage, it would probably be difficult to protect them from vandals or determined collectors if their location and reserved purpose was well known. Nevertheless, we regard the protection of Aboriginal sites as a serious issue, and the difficulties that may be encountered in protecting archeological sites are no excuse for destroying them in anticipation. If they can be protected, Aboriginal sites in bushland settings so close to the center of Perth have great heritage value and educational potential. They are not solely of interest to the Aboriginal community and we regard it as a great shame that so many archeological sites in our local region have been destroyed without the wider community's knowledge or approval. The Friends of Perth Airport Bushland has limited knowledge of Aboriginal claims regarding the contemporary cultural significance of areas at the Airport, but strongly supports, in principle,

Aboriginal groups wanting to protect natural areas at the Airport so that they can maintain their cultural links thereto.

To return to our group's primary focus - the implications of the *PDMP* and the *PDES* for the Airport's natural environment - we note that the following paragraph appears in the *PDMP* on page 12.9;

> Flora surveys at Perth Airport by Dickson (1983) and Alan Tingay and Associates (1994) have recorded a total of 227 native plant species. Although diverse, the flora is typical of equivalent vegetation elsewhere in the Perth Metropolitan Region and on the Swan Coastal Plain and the majority of species are considered common.

We have no doubt that the 227 native plant species recorded at Perth Airport by Dixon, and Tingay and Associates, is well short of the actual number of native plant species actually occurring at the Airport. This is not a reflection on the competence of the consultant botanists as the Airport is very large and surveys are not always carried out in the most appropriate season. Dixon actually states in the summary of his report *Existence and Significance of Flora and Vegetation in the Perth Airport International Terminal Building Site* (1983: K.W Dixon) that his survey was carried out at an "unfavorable time of the year." The Friends of Perth Airport Bushland has had a long association with the bushland through its members and can readily name numerous native plants occurring at the Airport, including large shrubs, which do not appear in these records. It is surprising, for example, that a common pea plant like Kennedia prostrata does not appear in the flora lists of *The Flora and Vegetation of Perth Airport* (1994: Alan Tingay and Associates) which lists the 227 species cited in the *PDMP*. Nor does it record the common shrub Conospermum triplinervium. Nor does it record Conospermum undulatum, which is referred to in the *PDMP* as a Declared Rare Flora species occurring at the Airport. Nor does it record Conospermum densiflorum, identified by botanist Malcolm Trudgen. In short, the list of native plants recorded at the Airport referred to in *PDMP* from whence the 227 species figure was derived, is far from complete.

The *PDMP's* assertion, previously quoted, that "although diverse, the [Airport's] flora is typical of equivalent vegetation elsewhere in the Perth Metropolitan Region and on the Swan Coastal Plain," is simplistic to say the least. It is pitched at the level of people who would regard bushland in Perth as being pretty much the same as bushland in Sydney. The FAC's own consultant, in *The Flora and Vegetation of Perth Airport* (1994: Alan Tingay and Associates), when assessing the significance of the vegetation of the airport as a whole, refers to the paltry figure of 8.6% of the Southern River Vegetation Complex still in existence and then states; "Furthermore, of the three main System 6 areas which include this complex (Whiteman Park, Perth Airport, and Jandakot Airport) only Whiteman Park could be considered securely protected." (*p.16*). The *PDMP* does not show sufficient evidence of recognizing the high conservation values of the Airport as a whole, and it is reflected in the unsatisfactorily small area of bushland and wetland allocated specifically for Conservation, and the lack of commitment to conserve the rest of the bushland and wetlands lying outside the designated Conservation areas. We regard

the assumptions and assessments behind the approach of allocating "priorities" to various natural areas and portions of natural areas as seriously defective and unsatisfactory. We regard all the bushland as being important. The "priority" system shows little evidence of being anything other than a very crude and unworthy attempt to draw stakeholders into playing bushland remnant areas off against each other so that the debate shifts from "how to save" to "what to save" as if there was some imperative other than leaseholder's bottom line to clear as much vegetation as possible. The Friends of Perth Airport Bushland is very wary of getting into the business of debating the relative merits of the many components associated with the highly artificial prioritization system employed in the *PDMP*, for the simple reason that we object to the compartmentalizing methodology and its application. It is the expansive size and the continuity of the bushland at Perth Airport which is its greatest conservation attribute. This is particularly so in respect of its value as fauna habitat.

It is axiomatic that larger areas are preferable for the preservation of biological diversity than smaller isolated areas which, when added together, would amount to the same total size. This is easily observed when the fauna populations of small suburban bushland remnants are compared to the fauna populations of larger areas like Perth Airport or Whiteman Park. Fauna populations in smaller areas are simply more vulnerable to such pressures as total coverage by fires, predation by feral animals, and the lack of suitable habitat areas. Our group has seen the results of many fauna surveys of bushland remnants around Perth, through our affiliation with the Urban Bushland Council, and it is obvious that in areas subject to similar degrees of urbanization, the smaller and more isolated remnants generally do not sustain the faunal biodiversity of the larger bushland sites. In large areas like Perth Airport, for example, a fire may kill most of the terrestrial fauna in a portion of the bushland, but it will eventually be re-colonized by fauna from unburned adjoining or adjacent bushland. Similarly, a family of foxes in a bushland area may drastically reduce the population of bandicoots in the vicinity, but once the foxes have moved on the area can again be re-colonized from adjoining or adjacent bushland. Habitat variations are important. While populations of some reptile species are likely to be decimated by fire, for example, others benefit because of their need of open areas for basking, and through their apparent preference for food types more likely to be available in the years immediately following a fire. In a large area, there is likely to be a mosaic of smaller connected areas with different fire histories, and hence a range of different habitats available for fauna. Large areas are more likely to have habitat variations due to landforms. There will probably be some ridge habitat, for example, and some wetland habitat, each with different habitat attributes. Fauna such as bandicoots are known to move between these habitat areas seasonally.

Another very important reason why large areas are better for maintaining biodiversity than smaller remnants comprising the same total area is associated with the conservation problem known as "edge effects." It is an established fact, which soon becomes apparent to anybody involved in bushland management, that the perimeters of bushland remnants are particularly vulnerable to degradational pressures. Partly because there is inevitably some ground disturbance near the edges of bushland areas, weed invasion usually begins

from the margins. Weeds blow in from roadsides, nearby gardens, landscaping, or vacant lots. Garden rubbish, often loaded with weed propagules, is usually dumped by a perimeter track. Fires lit through carelessness or arson usually start near a perimeter track or road. In a more direct sense, it is also the case that around the edges of bushland remnants, particularly in urban areas, fauna is at greatest risk from hazards like road traffic, domestic animals, children, and simply straying out of the bushland. The relevance of question of the preferrability of one large block over a number of small blocks in regards to "edge effects" is that many small remnants, despite having the same total area as the larger block, have a much greater total perimeter. In other words, a great deal more of the bushland is actually exposed to degradational "edge effects." The *PDMP* virtually dismisses 50% of the bushland at the Airport by designating it *Priority 3*, which is described as "generally fragmented and in poorer condition" (*PDMP p. 12.11*). Neither the *PDMP* nor the *PDES* makes any specific reference to the conservation status of *Priority 3* areas vis-a-vis development plans so we can only assume their *Priority 3* rating means they have no "priority" at all. *"Priority 3"* is a misleading and nonsensical designation we find totally unacceptable. We totally oppose the effective dismissal of bushland areas designated *Priority 3*, and expect their conservation value to be properly acknowledged and provided for in the final *Master Plan* and in the *Environment Strategy*.

Having argued strongly that the division and isolation of natural areas is ecologically deleterious, we would like to make it clear that we deplore the *PDMP's* strategy of playing down the environmental significance of a very large total proportion of the existing natural remnant area at Perth Airport on the convenient but specious grounds that it is "fragmented." However badly "fragmented" the bushland and wetlands at Perth Airport may be at present, it would be nonsensical in the extreme to claim the *PDMP* offers anything approximating a solution to that problem. Perhaps the *PDMP* is proposing that the "fragmented" bushland should be euthenased to relieve its condition. While is true that one cannot argue bushland is "fragmented" if it no longer exists, it is our perfectly reasonable point of view that the bushland and wetlands at Perth Airport, as they presently exist, form a reasonably continuous bushland/wetland system which must be maintained as a reasonably continuous bushland/wetland system so as to maintain the high conservation values of the system as a whole and that of its component parts. To quote from the *PDMP* again; "*Priority 3* areas include all other remaining vegetation or wetlands at the airport which is generally fragmented and contain vegetation and wetlands in poorer condition" (*p.12.11*). The incongruity of failing to make any commitment to preserving bushland and wetlands designated *Priority 3* in the *PDMP* is that if those areas are not protected, then most of the areas presently designated *Priority 1* and *Priority 2* will become isolated "fragments" themselves. As such, the future for these areas, and thus the Airport bushland as a whole, as habitat for terrestrial fauna in particular, is very bleak.

It is very disturbing to find that the *PDMP* does not include any assurance that provision will be made for the re-introduction of the Western Swamp Tortoise at the Airport. To quote from the document;

> The development which is proposed to occur at the Perth International Airport over the next 20 years will be accommodated by significant changes to drainage patterns and surface hydrology, therefore it is not feasible to provide a guarantee that suitable habitat for the Western Swamp Tortoise could be developed and maintained to ensure successful re-introduction (12.16).

It is our understanding that the potential re-introduction site most preferred by the Western Swamp Tortoise Recovery Team lies at the north-eastern end of the 06/24 Runway. Given that Local Government Authorities, particularly the City if Belmont, have protested fiercely against any extension to the 06/24 Runway, it is surprising that it was included as a possibility in the *PDMP*. Assuming that the extension is unlikely to go ahead, it is surprising and disappointing that the *PDMP* has not made some form of commitment to keep the area for the re-introduction of the Western Swamp Tortoise. Alternatively, if the South-eastern Conservation Area were enlarged further to take in more of the area designated *Priority Area 1.5*, and some of the area designated *Priority 3* in the vicinity, then the "South East Group" area proposed for a possible re-introduction site in *Figure 47* of the *Survey of the Western Swamp Tortoise and its Habitat at the Perth Airport* (1996: Kuchling, Burbidge), would be largely available. In any case, the Friends of Perth Airport Bushland regard the *PDMP*'s lack of commitment to the re-introduction of the Western Swamp Tortoise at the Airport as unsatisfactory. Setting aside a suitable site, or sites, is the least WAC could do to fulfill its obligation to be a good corporate citizen. The protection of species from extinction is a matter of international significance and Australia's reputation is diminished by its appalling record of failing to take appropriate action to prevent the extinction of many animal species. This problem needs attending to and endangered species recovery programs need appropriate support.

The number of fauna vertebrate species at Perth Airport (119) compares favorably with other large bushland areas in the Perth Metropolitan Region like Whiteman Park, Bold Park, and Ellenbrook, according to the *Report of a Fauna Survey of the Perth Airport* (1994: Alan Tingay and Associates *p.23*). It is a stronghold for the Southern Brown Bandicoot, which has only recently been removed from the "Rare" classification under the Western Australian Wildlife Conservation Act, 1950-1979. The Bandicoot has only increased in numbers in the south-west because of fox baiting - a practice which is generally impractical in urban bushland remnants. Accordingly, while the species may become more common outside of the city, it will still be threatened in urban bushland remnants like the Airport. It is a surprising fact that the Bandicoot appears to thrive at Perth Airport, even in areas which are badly infested with foxes. It suggests very strongly that the size and continuity of the habitat area available, and the protection and sustenance which it can provide, are the key to the species' success on the site. Further fragmentation of the bushland at the Airport caused by developments proposed in the *PDMP* will almost certainly diminish and contract the Bandicoot population.

Carnaby's Black Cockatoo, a species listed in Schedule 2 of the Wildlife Conservation Act, 1950-1979, is a frequent visitor to the Airport, where it shows a particular liking for

feeding in Banksia trees. The availability of natural food in areas like Perth Airport is important for this species, and it is doubtless one of the reasons it is a familiar sight in the suburbs around the Airport. Extensive clearing will greatly diminish the natural food supplies available for this threatened species at the Airport.

We note that neither in the *PDMP* nor the *PDES* is there any mention of the Freckled Duck (Stictonetta naevosa) having been recorded at Perth Airport. However, in data released by the Australian Heritage Commission relating to the heritage value of the Airport, which we must assume has been seen by FAC/ WAC, we find the following paragraph;

> The Freckled Duck (Stictonetta naevosa) has been recorded at Munday Swamp on two occasions (early in Winter 1989 and at the same time in 1991). In each case the ducks remained at Munday Swamp for about 2 months (Holze, pers comm, 1992). This species is classified as "rare or likely to become extinct" under the WA Wildlife Conservation Act, and as threatened by the International Council of Bird Preservation (Collar and Andrew, 1988).

We have no reason to believe this information is incorrect. It once again illustrates the conservation value of Perth Airport, and Munday Swamp in particular. The same AHC data points out that the Airport " contains the only known population of the Crowned Snake (Notechis coronatus) in the Perth region (How 1995)." Moreover, it states that; "Perth Airport is only one of two locations on the Swan Coastal Plain in the Perth region where the skink *Ctenotus impar*, has been recorded in recent times."

The bird life at Perth Airport is quite outstanding, particularly relative to that in the nearby suburbs. It provides abundant shelter, food supplies and nesting sites. This is in stark contrast to the urbanized areas around the Airport which are losing their larger trees and their indigenous trees at an alarming rate. The Airport is clearly used as a habitat corridor by nomadic and migratory birds, which is yet another reason why the bushland is valuable in conservation terms. The Poison Gully\ Munday Swamp area is a particularly valuable breeding habitat for water birds. In the Spring, ducklings are a common sight in the wetlands, with some of the breeding species, like the Pink Eared Duck, being relatively uncommon.

The Friends of Perth Airport Bushland welcome the setting aside of designated Conservation Areas at the Airport. It is our strong view, however, that these areas are not of sufficient size. There is also a need for additional designated Conservation Areas. There is a need for a large designated Conservation Area to the west of Horrie Miller Drive, taking in the areas which are described as *Priority Area 2.7*, *Priority Area 2.8*, and *Priority Area 2.9* in the *PDMP*, as well as the *Priority 3 Area* in the general vicinity. There is also a need for a large designated Conservation Area on the western side of the Airport, taking in the areas described as *Priority Areas 2.10 2.11, 2.12,* and the large *Priority 3 Area* in the vicinity. We do not accept the *PDMP*'s claims that the so called *Priority 3 Areas* are of lesser conservation value than the adjoining areas assigned a higher priority. The whole remnant intact is of major conservation value and

compartmentalizing the bushland with a highly problematic rating system offers the prospect of a greatly diminished conservation resource. Western Conservation Areas we propose would save a far greater proportion of the poorly conserved Bassendean Vegetation Complex - Central and South than is currently in prospect in the *PDMP*. While discussing this western side of the Airport, we wish to make it quite clear that we strongly oppose the proposal to extend Leach Highway through the area described as *Priority Area 2.7* in the *PDMP*. We have made known to Main Roads our high regard for the conservation value of the land immediately to the north of the intersection of Leach and Tonkin Highways, and this bushland forms a continuum with *Priority Area 2.7*. If it is not apparent by now, our group values what some might describe as small and apparently degraded patches of remnant bushland; indeed we value individual remnant trees - and make no apology for doing so. Every tree provides additional habitat, and every patch of bushland has its own indigenous genetic resource; its own complement of indigenous flora, fauna, and microfauna We have had sufficient experience in urban bushland conservation to have observed that even when the bulldozer teams can be held off, our indigenous plants and animal populations frequently die the death of a thousand cuts.

The proposed Northern Conservation Area is probably the best conservation proposal in the *PDMP*. The conservation value of Munday Swamp is almost universally recognized and the northern bushland area towards Kalamunda Road is an outstanding vegetation remnant. However, while it is certainly essential from the point of view of conservationists, and presumably the Aboriginal native title claimants, to see Munday Swamp preserved, it has occurred to us that having a runway directly aligned with, and in close proximity to, a large wetland which attracts a variety of water birds, might be deemed, at some future time, to pose too great a threat to aircraft safety. We presume WAC and its consultants have considered this question carefully, but our concern is that the alignment of the runway with Munday Swamp may actually pose a threat to its long-term security as a conservation area. The Friends of Perth Airport Bushland is very firm in its view that Munday Swamp must be conserved, but the mechanisms by which the wetland is secured as a conservation area, once it has been agreed to set it aside, are of great importance. Because it is our view that if WAC commits itself to setting Munday Swamp aside as a conservation area, it should not then, at some future time, be able to modify its commitment to the conservation of the wetland, as opposed to its usage of the relevant runway, to address any bird hazard problems which might be seen to arise. In other words, it would be unacceptable for WAC to drain or clear Munday Swamp at some future time on the grounds that it posed a hazard to aviation, when the possibility of such a situation arising in the future was not out of the question when the commitment to conserve the wetland was made. It is our view that if WAC is committed to securing Munday Swamp as a conservation area, and we fully support such a commitment, then a covenant or some such similar arrangement should be set in place to prevent their commitment to conserve the wetland being dropped at some time in the future. Similar covenants, or binding agreement with the Commonwealth, should apply to other designated conservation areas, once they have been finally agreed upon.

Northern Conservation Area, at 234 ha - if it is one and the same as the "Kalamunda Road Conservation Area" referred to in *Figure 11.2* of the *PDMP*, is somewhat smaller than the 286 ha "Munday Swamp Bushland" site Interim Listed on the Register of the National Estate by the Australian Heritage Commission. It must also be said that there is a proportionately greater area of remnant bushland and wetlands in the AHC's 286 ha Interim Listed site, than is the case with the 234 ha WAC Northern Conservation Area. That is to say, besides being a smaller area in absolute terms, a smaller proportion of the proposed 234 ha WAC Northern Conservation Area actually conserves remnant bushland and wetlands - as opposed to areas already cleared. Obviously we have no objection to buffers and links, but remnant bushland and wetlands are preferable to cleared paddocks. The assignment of *Priority 3* status to the bushland west of Munday Swamp underrates both the bushland and the obvious value in its ecological context. The AHC Interim Listed areas lying at the northern end of the 03L/21R Runway which are not included in the Northern Conservation Area should be so included. If and when the 06/24 Runway extension is ruled out, we would expect the Northern Conservation Area to be expanded to take in the bushland area no longer required for runway development. Thus the Friends of Perth Airport Bushland are of the strong view that the proposed Northern Conservation Area should be extended to take in more of the bushland and wetlands in the northern area of the Airport, so as to more closely match the "Munday Swamp Bushland" AHC Interim Listing.

The South-Eastern conservation Area, at 77 ha - if it is one and the same as the "Eastern Conservation Area" referred to in *Figure 11.2* of the *PDMP*, is woefully small compared to the 224 ha "Forrestfield Bushland" area Interim Listed on the Register of the National Estate by the Australian Heritage Commission. This South-Eastern Conservation Area is much too small and it need not be. To make our position clear on this issue, the Friends of Perth Airport Bushland is not convinced that the parallel runway proposed in the *PDMP*, or any other parallel runway proposed for Perth Airport, is ever going to be constructed. It has long been our position that Perth Airport is badly located and should have been moved to a suitable site well outside the periphery of the city many years ago. We have long believed that the Airport will create more noise than it is worth in the longer term and that it is unacceptable for a utility which is supposed to be serving the needs of a city, to be actually lowering the quality of life of many of its citizens, and depressing real estate values over a wide area. We also believe it would be safer to have the Airport located outside of the city in case of plane crashes. It is our understanding, though only through anecdotal accounts, that Perth Airport is susceptible to a hazardous wind condition for aircraft known as "wind sheer."

It is our perception that the proposed parallel runway, wherever it might be located east of runway 03L/21R, will be opposed very vigorously by potentially noise-affected residents if and when they believe the runway is a serious proposition. The proposed runway may not even draw much opposition during this *PDMP* public comment period, but as the construction looms as a real possibility, it is our perception that communities which feel they are likely to be affected by increased noise, or significant noise for the first time, will be lobbying very hard to protect their quality of life and their real estate

investments. This is a complicated problem and we do not see the proposed runway's construction as a foregone conclusion because the final decisions could depend on the vagaries of the political process.

Obviously our group's opposition to a parallel runway centers on the impact it would inevitably have on the Airport's natural environment. However, if a parallel runway must be included in the *PDMP*, then, without wavering from our view that such a runway should not be constructed and that the Airport should be re-located, we would nevertheless prefer to see any parallel runway mooted in such a draft planning document to be sited in drawings with such consideration as to indicate the least ecological impact possible. In other words, notwithstanding the Friends of Perth Airport Bushland's, opposition to the construction of a parallel runway, we would greatly prefer any runway proposed in the *PDMP* to be sited in such a way as to produce the minimum impact on bushland and wetlands. Having very little technical knowledge of airport design, we cannot be sure if the runway options presented in the *PDMP* are the only options which could be presented. If there are runway options not presented in the *PDMP* which would result in less environmental impacts on natural areas, then we would obviously favour such options. We can put the very strong view that we would much prefer a parallel runway option which did not impact on bushlands and wetlands to the extent that the *PDMP*'s preferred parallel runway option shown in *Figure 5.6* obviously does. That being said, of the options presented in *Figures 5.4,5.5* and *5.6* of the *PDMP*, we would accept that the preferred option shown in *Figure 5.6* appears to entail the least impact on bushland and wetlands. We would, however, much prefer that Runway 06/24 was not extended to the north-east because of the impact on natural areas - especially as they have been recommended for re-introduction of the Western Swamp Tortoise. We would also much prefer that the proposed parallel runway (Runway 03R/21L) did not include what we assume is an optional southern extension shown in broken red lines. The abandonment of this southern extension option would clearly save a good deal of bushland on the eastern side of the Airport. We would make the comment that the *PDMP*'s exposition of the Airport's purported aviation requirements for the future, and the runway options, is not particularly clear. It is not helped by the error at the top of page *5.9* which refers the reader to the wrong illustration (*"Figure 5.5"* should read *"Figure 5.4")*. We stress once again our view that if there is a possible parallel runway option that has not been explored properly, and is therefore not presented in the *PDMP*, which could avoid significant impacts on remnant bushland and wetlands, then that would be greatly preferable to any of the options presented in the preliminary draft document. The preferred option in the *PDMP* impacts very severely on the bushland and wetlands on the eastern side of the Airport. A number of wetlands would simply be obliterated and at least 2 of the 6 areas proposed for re-introduction of the Western Swamp Tortoise in the *Survey of the Western Swamp Tortoise and its Habitat at the Perth Airport* (1996: Kuchling, Burbidge) would be destroyed.

In light of the destruction of very large bushland and wetland areas on the eastern side of the Airport which could be anticipated if the parallel runway were to be constructed, the South-Eastern Conservation Area's 77 ha size is extremely disappointing. Put simply, it

is the very strong view of the Friends of Perth Airport Bushland that this South-Eastern Conservation Area is unsatisfactorily, and unnecessarily small. A great deal of bushland east of Horrie Miller Drive could and should have been included in this Conservation Area, but has instead been targeted for what we regard as non-essential non-aviation developments. It is clear from *Figure 5.1* in the *PDMP* that those bushland areas east of Horrie Miller Drive which are not required for aviation, and which are not included in the South-Eastern Conservation Area, are proposed for "Commercial Developments." The situation is even worse west of Horrie Miller Drive, where virtually the whole of the western side of the Airport is proposed for "Commercial Developments," with no Conservation Area even proposed.

Referring to *Figure 12.6* in the *PDMP*, it is evident that, even leaving aside the bushland area purported to be required for aviation, the South-Eastern Conservation Area leaves out adjoining bushland rated as *Priority 1* (*in Priority Areas 1.4* and *1.5*) and bushland rated as *Priority 2* (*Priority Area 2.6*), in addition to bushland rated *Priority 3* (which we regard as having high conservation value in any case). It is particularly disturbing, and indeed unacceptable, to find that two excellent wetland areas, which are part of *Priority Area 1.4*, have been excluded form the South-Eastern Conservation Area. One of these seasonally inundated wetlands is an elongated area lying just to the north of the northern boundary of the South-East Conservation Area. In *Figure 12.6* of the *PDMP*, the elongated wetland is partly separated from the South-Eastern Conservation Area by what is referred to as "*Link Area,*" marked in red. This wetland is exceptionally beautiful and is generally in very good condition. Its vegetation is dense and it would be excellent habitat for the Western Swamp Tortoise. It contains a large volume of water in the Winter and Spring and overflows into the Airport Drain. The fact that this swamp was not trapped by the team behind the *Survey of the Western Swamp Tortoise* (1996: Kuchling, Burbidge), is just one of the reasons why we think it would have been quite possible for Western Swamp Tortoises which may currently exist at the Airport to have avoided detection during that survey. The possibility that the Western Swamp Tortoise may actually still exist at the Airport is virtually ignored in the *PDMP*, despite the fact that finding any of a small number of existing animals would be difficult in the extreme in such a large area as Perth Airport, in only one season's trapping. An individual who sub-leases a property at the Airport has told us he watched a small tortoise, which he insists was not the common and easily identified Long-Necked Tortoise, swimming about in the Airport Drain one late Spring afternoon several years ago. He claims he watched the tortoise for about twenty minutes and contacted CALM a few days later thinking it might be a rare species. He believes it may have been a Western Swamp Tortoise. Another individual has told us, from her personal experience, that there were definitely two kinds tortoises to be found in the swamps on the western side of the Airport during the 1960's. The simple fact is the possibility that the Western Swamp Tortoise still occurs at Perth Airport cannot be ruled out. But if the South-Eastern Conservation Area is to provide suitable habitat for the re- introduction of the Western Swamp Tortoise, then the *PDMP* should definitely not be excluding wetlands like the portion of *Priority Area 1.4*, to which we have referred. Nor should it exclude another excellent wetland, in this case just south of the Mint but on the eastern side of Horrie

Miller Drive. Both of these wetlands are part of *Priority Area 1.4*, and both fall within an area recommended for the re-introduction of the Western Swamp Tortoise in *Figure 47* of the *Survey of the Western Swamp Tortoise and its Habitat at the Perth Airport* (1996: Kuchling, Burbidge). The wetland we have described as being just to the south of the Mint, but adjacent to the eastern side of Horrie Miller drive, was actually trapped by the Western Swamp Tortoise Recovery Team and is referred to in the aforementioned document as " Five Mile East Swamp 3" (*p.17*). The *PDMP* should be committed to the protection of wetlands like those described. We would make the point that it is a serious shortcoming of the *PDMP* that seasonally inundated wetlands are not identified by some means in the document. Our group has a very good knowledge of the natural areas at the Airport, but most people and representatives of interested bodies reading the *PDMP* would have little idea of the location and nature of the wetlands scattered throughout the Airport. Even from our point of view, despite knowing the location of the seasonal wetlands on the ground, it is difficult to specify their exact location in our comments because the *PDMP* does not contain suitable dedicated maps or diagrams of wetlands, let alone a system of identifying them. We should not have to point out that wetlands are of crucial significance in considering the conservation values of the Airport's natural areas. We note that Perth Airport's wetlands are recognised and described in *A Directory of Important Wetlands in Australia* 2nd Ed, published by the Australian Nature Conservation Agency (1996: Australian Nature Conservation Agency *p. 896*).

Having made the point that we deplore the non-inclusion of superb wetlands in the South-Eastern Conservation Area - instead allocating the relevant land areas for "Potential Commercial" (*Figure 5.1, PDMP)* purposes - we are no less appalled by the same fate being reserved for bushland east of Horrie Miller Drive. To put it bluntly, the Friends of Perth Airport Bushland values all the remnant bushland and wetlands east of Horrie Miller Drive, and, for that matter, west of Horrie Miller Drive. The bushland around the old sand quarries east of Horrie Miller Drive is generally in fair to good condition. It would be quite possible to rehabilitate the quarries themselves. The reason that they have not regenerated naturally to a great extent has probably got a lot to do with the unfettered access that 4WD vehicles, trail bikes, dune buggies, and horses have had to those areas over the past decades. We note that one quarry is included in the South-Eastern Conservation Area. In and of itself the inclusion of a quarry is not exceptionable. Indeed, we would like to see the other quarry areas included. But it is not a particularly good choice as a linking area between bushland remnant areas of the highest quality, like those designated as *Priority Area 1.5* and *Priority Area 1.4*. We are of the strong view that the South-East Conservation Area should be greatly expanded so as to take in; more of *Priority Area 1.4*; more of *Priority Area 1.5*; all of *Priority Area 2.6*; and all of the area in the vicinity described as *Priority 3*. This is not a ridiculous ambit claim. We are quite familiar with the area's flora and fauna. The vegetation around the more southerly quarries is particularly attractive to bird life; being dominated by Banksias and Adenanthos sp. There are many Southern Brown Bandicoots in the area. We have seen large Racehorse Goannas in the area. In a small area beside Horrie Miller Drive given a *Priority 3* rating, there is a patch of a very attractive Smokebush, which

botanist Malcolm Trudgen has described as C. densiflorum. To our knowledge it does not occur elsewhere at the Airport. Towards the western end of the remnant described as *Priority Area 1.5*, we have seen the unusual insectivorous plant Byblis gigantea. The soil in some areas immediately east of Horrie Miller Drive and not far from Tonkin Highway appears to be somewhat different to that found in most other areas at the Airport, in that it is of a more yellowish color - even on unquarried higher ground. This variation in coloration is indicative of a variation in actual soil type and is visible in some aerial photographs. It can not be attributed solely to excavation. We would expect this area to have a slightly different floral composition to other areas at the Airport and believe it may explain why the unusual Smokebush occurs in the vicinity. We definitely do not believe these areas should be sacrificed for commercial developments. We believe the South-Eastern Conservation Area should include all bushland and wetlands not required for aviation purposes. We would also like to know what mechanisms would be employed to guarantee that the bushland proposed for conservation would be secure and not periodically threatened by development proposals.

We would like to be in the position of being able to comment on a proposed "Western Conservation Area," but no such area is put forward in the *PDMP*. This is very regrettable and should be rectified in the final *Master Plan*. Bushland on the western side of Horrie Miller Drive, and on the whole western side of the Airport, is treated most unsatisfactorily in the *PDMP*, being underrated and under-conserved. The assignment of priorities to the bushland is quite unsatisfactory. A very large proportion of the bushland on the western side of the Horrie Miller Drive, and on the western side of the Airport generally is given a *Priority 3* rating. This inferior rating is most unacceptable. In studying Alan Tingay and Associates' "Vegetation Quality" mapping, shown in *Figure 3.2* of the *PDES*, most of the areas assigned a *Priority 3* in the *PDMP* are rated as showing "Obvious Disturbance" or as being "Disturbed." As negative as these terminologies may sound, in explanation they are good deal more positive than is reflected in a *Priority 3* rating. *Priority Area 2.7*, is an excellent remnant and should have a *Priority 1* rating. The bushland is in very good condition, there are many superb trees, and there is a vegetation succession following the landform through ridge, slope, inter-dunal depression habitat. It is also habitat for the Southern Brown Bandicoot. Furthermore, there is no real reason to assign a lowly *Priority 3* rating to the bushland lying to the north and north-east of *Priority Area 2.7*. That large remnant area rated as *Priority 3* contains substantial areas of bushland in good to very good condition. It should have at least a *Priority 2* rating and should in fact form part of a large "Western Conservation Area." We stress once again that even Tingay and Associates' "Vegetation Quality" mapping, shown in *Figure 3.2* of the *PDES* and which we consider ungenerous, assigns most of the bushland west of Horrie Miller Drive, and on the western side of the Airport, no lower a rating than that of "Obvious Disturbance" - a terminology which means the "vegetation structure [is] slightly altered but able to regenerate," as defined in *The Flora and Vegetation of Perth Airport* (1994: Alan Tingay and Associates). If bushland can regenerate with the assistance of a little appropriate environmental management, the grounds for dismissing its conservation value are very flimsy indeed. It is our strong view that virtually all of the bushland assigned a *Priority 3* rating west of

Horrie Miller Drive, and on the western side of the Airport generally, in the *PDMP*, should have been given at least a *Priority 2* rating. Furthermore, we believe there should be one "Western Conservation Area" stretching through the *Priority 3 Area* between, and including, *Priority Area 2.7 and Priority Area 2.9*, and another "Western Conservation Area" stretching through the *Priority 3 Area* between, and including, *Priority Area 2.10* and *Priority Area 2.12.*

Among the many concerns the Friends of Perth Airport Bushland have regarding proposed developments in the *PDMP* is the likely impact of the envisaged road infrastructure referred to in the document as the "Ground Access System" (*p. 9.1*). Our concern about the grade separated interchange off Tonkin Highway near the domestic terminal is that it could impact on bushland in very good condition, referred to as *Priority Area 2.12* in the *PDMP*. Our group has previously expressed these concerns to consultants working for Main Roads. Given that it is WAC's hope to consolidate the International and Domestic terminals elsewhere at the Airport, the proposal to build such a major access road off Tonkin Highway would seem an incongruously large project. The Brealey Avenue access would seem quite satisfactory for the time being and we do not see the need for the grade separated interchange. It concerns us that the real motive for proposing major road developments of this nature is to attract and justify more commercial land use.

The provision of a public link road between the Domestic and International terminals is again inconsistent with the plan to consolidate the terminals. It would appear the real aim behind such a proposal is to improve links between proposed commercial developments.

We object strongly to the proposal to connect the Airport link road to Leach Highway at its intersection with Tonkin Highway. An extension of Leach Highway into the Airport at that point would impact very badly on high conservation value bushland, referred to as *Priority Area 2.7* in the *PDMP*. The road would; fragment the bushland; create a barrier to fauna movement; lead to fauna road kills; create "edge effects;" and involve the clearing of quite large areas of bushland.

The Kalamunda road realignment is a development we have objected to on environmental grounds and it is to be the subject of a Public Environmental Review. We consider it a disgraceful state of affairs that this project was not referred to the Environmental Protection Authority by the proponents. The work on realignment which took place before the project was halted has already been fairly destructive and we hope the project proceeds no further. It is disappointing that the *PDMP* makes no mention of the fact that the Kalamunda Road realignment is the subject of a Public Environmental Review. Surely this is relevant information if public comment is being sought.

An extension of Dundas Road running west of the existing railway line would run very close to Munday Swamp's northern end and would thus be environmentally unacceptable.

We would expect that whatever "utilities and special systems" (*p. 10.1*) might be envisaged for the Airport, their planning and proposed methods of installation would be as environmentally sensitive as possible. Drainage is obviously a major environmental issue which we cannot comment on in detail at this stage. We simply make the point that we expect drainage systems to make provision for the protection of existing wetlands. If major runway developments are given final approval, we would insist that drainage systems did not adversely affect nearby wetlands. We certainly would not accept wetlands being drained for commercial developments.

As a more general comment, it is our view that proposed Airport developments must not be brought forward or accelerated with the intention, whether stated or unstated, of securing environmental approvals in advance of what might be expected or feared in terms of the tide of public opinion. Put simply, it has been our observation and experience that public concern about environmental issues has been growing steadily over the past couple of decades. In other words, the general public's knowledge and concern regarding environmental issues appears to be trending upwards. One implication of this pattern might be an anticipation that gaining public approval for development projects with serious environmental implications could prove more difficult in ten years time, for example, than it might in two years time. Our concern in this regard is that development approval processes should not occur until they are really necessary. It seems to us that particularly optimistic future growth forecasts are one means by which development approval processes might be artificially brought forward. It is our humble view that the future growth forecasts for Perth Airport's passenger movements in the *PDMP*, for example, are pretty optimistic - particularly in light of the Asian economic crisis. One would expect what might be described as a very positive commercial outlook in a document like the *PDMP* but we have reservations about the likely need for runways and other developments in the time frames suggested. Our concern, clearly, is that developments proposals be assessed in a context where their "necessity" can be proven rather than "guesstimated."

It is, of course, the view of the Friends of Perth Airport Bushland that the environmental management of the Airport's natural areas is a matter of great importance. Without appropriate environmental management, the Airport's natural areas will almost certainly deteriorate with the passage of time. In some areas natural regeneration is occurring after past environmental disturbance, but there are also pressures on the environmental health and condition of bushland and wetlands from a range of factors which require the attention of the land manager.

As is no doubt already apparent, the Friends of Perth Airport Bushland wish to see as much as possible of the natural remnant area at the Airport protected. A good starting point is to prevent natural remnants areas being destroyed through such activities as clearing and draining for development purposes. Impacts like clearing have a relatively sudden, obvious, and devastating affect on remnant bushland. Similarly, the construction of major new drains, for example, is a fairly obvious process and its affect on wetland areas may be noticeable almost immediately. But bushland and wetlands need to be

protected from more insidious impacts to maintain viable ecosystems. These less obvious impacts need to be dealt with at the level of active environmental management. We are referring here to impacts like weeds, feral animals, plant diseases, and nutrient loading.

Without adequate environmental management, it is likely that important natural areas at the Airport will gradually deteriorate in condition and lose biodiversity. The contents of the *Preliminary Draft Environment Strategy* are of great interest to the Friends of Perth Airport Bushland, as it is in this document that WAC's intended approach to the task of environmental management is meant to be set out. It has long been our view that the Airport's natural areas have suffered badly form a dearth of environmental management over the past decades. Indeed, the matter has probably only emerged as a serious issue for discussion and action within the past decade. It is fair to say that when work on the Airport first began in the 1940's, virtually nobody would have taken an interest in the environmental impact of the construction of runways and other infrastructure. "Environmental management' would not have been heard of and any thought of acting to rehabilitate bushland, or even to protect it from adverse environmental impacts, would not have been taken seriously. Perth was at that time so well endowed with bushland and wetlands that concerns about protecting such natural features in and around Perth Airport would have seemed unnecessary. The limited farming and horticultural activities being undertaken around the Airport were probably bringing additional weeds, additional feral animals, additional fires, and the impacts of grazing stock, to bear on the bushland - even then. There is also little doubt that all kinds of waste materials and substances would have been dumped around the site by Airport operators and primary producers, with no thought whatsoever of the environmental harm they may have caused. It was simply a different time with different perspectives. In those earlier decades, a great deal of environmental damage was done at the Airport and we can still see its legacy in terms of the stark absence of large areas of bushland and wetlands, and in terms of the environmental disturbance visible in some remaining bushland and wetlands. We are aware that there were even liquid waste dumping sites in operation for years in areas that are now part of the Airport. We have been very concerned for years about the abuse of the bushland and wetlands at the Airport by irresponsible members of the public. Sustained pressure from off-road vehicles has caused considerable environmental damage over a long period. The dumping of garden rubbish has been a factor in the introduction of weeds, and arson has exacerbated weed invasion. We can cite many more problems which could, and probably should, have been addressed by means of environmental management plans and strategies for the Airport, but we have not seen any such documents to date.

The Perth Airport's natural areas have suffered considerably from a lack of environmental management and it was our hope that the *PDES* would indicate a sea change was in the offing. With respect to the environmental management of the natural areas at the Airport, however, our overall assessment of the *PDES* is that it is a document which has been framed and written with a view to avoiding solid commitments.

The Friends of Perth Airport Bushland can readily identify environmental problems in natural areas at the Airport which call for remedial action. The *PDES* ought to be a document which specifies the key environmental management tasks facing the land manager in order to remedy or prevent environmental problems, and which then makes a clear commitment to carry out those tasks. But the *PDES* does not appear to have much to offer the Airport's natural areas in terms of commitments to practical on-the-ground solutions. The "*Strategy*" just proposes more "strategies."We can provide basic examples of the kind of environmental problems which affect the bushland and wetlands at the Airport, and the kinds of commitment to action we see as being essential to a credible *Preliminary Draft Environment Strategy.*

On of the problems of most concern in relation to the on-going environmental integrity of the natural areas at Perth Airport is that of weed invasion. Most bushland remnants on the Swan Coastal Plain show some signs of an environmental weed problem. It has become increasingly apparent to scientists and bushland mangers alike that the key to defeating environmental weed problems is early intervention. Almost by definition, weeds have a tremendous capacity to reproduce. Once weeds have established a small foothold, their potential for seriously damaging ecosystems begins to grow. A great deal of environmental disturbance and consequent control operations can be avoided by eliminating invasive weeds while their populations are still relatively small.

At Perth Airport there are some good examples of relatively small weed infestations which have the potential to become very serious. As a case in point, in the Poison Gully Creek system, on either side of Grogan Road, there has been an infestation of the weed Bridal Creeper (Asparagus asparagoides) for some years. In a recent publication on the State's weeds *Western Weeds - A Guide to the Weeds of Western Australia* (1997: Hussey, B., Keighery, G., Cousens, R., Dodd, J., Lloyd, S.), Bridal Creeper is described as "one of the State's most urgent environmental weed problems" (*p. 20*). The weed is very invasive and difficult to control. Our concern is that it will spread in the near term into the Munday Swamp area, and in the longer term into bushland throughout the Airport. At the moment, the weed is confined to a fairly small area. It needs urgent action to prevent it providing a greater and greater seed bank for the invasion of other areas. It is in a case like this where we would expect the Airport land manager to move, in a practical way, to control the problem before it becomes very difficult to manage.

There are some weed problems around Munday Swamp which should be addressed. Arum Lily (Zantedeschia aethiopica) is becoming more widespread around the edges of the Swamp, and there are also problems with various grass weeds like Couch - a legacy of many years of grazing activity. A tree weed, Japanese Pepper (Schinus terebinthifolia) is increasing in numbers at the north-eastern end of the Swamp.

In other areas at the Airport Victorian ti-tree (Leptospermum laevigatum) is spreading, as is Tree Lucerne (Chamaecytisus palmensis). Another weed with the potential to become a major problem is Watsonia (Watsonia bulbillifera). Patterson's Curse (Echium

plantagineum) and Cape Tulip (Homeria flaccida) are beginning to spread from cleared paddocks into the bushland. Veldt Grass is very widespread.

At present these weeds are not out of control. Some of the species mentioned have the potential to become very difficult to control if action to deal with them does not commence reasonably soon. Accordingly, the Friends of Perth Airport Bushland would expect that the approved *Environmental Strategy* will contain unequivocal commitments to undertake appropriate environmental weed control programs. The *PDES* is, from our point of view, rather vague in its references to weed strategies. In the Executive summary of the *PDES,* the following statement appears:

> Approximately15% of the land within the Airport precinct will be retained in its natural state. These areas will receive first priority for fire protection; weed, pest and disease control; and for rehabilitation and revegetation (ES-4).

Here there is clearly reference to weed "control." However, elsewhere in the *PDES* the word "control" appears to be avoided. In *Table ES1 Current Operations - Actions Required within 5 Year Strategy Period*, the only reference to weeds occurs under the heading of *"Management Actions"* and is rendered as follows; "Prevent spread or introduction of weed species and fungal diseases by controlling access to bushland areas. Ensure vehicles and machinery are "clean" prior to mobilization into areas" (*ES - 8*). In the *PDES* Section *Current Airport Operations*, under the line "Specific Actions that will be undertaken..." (p. 4.4), the only reference to weeds is rendered as follows; " Restriction of access to bushland to control weed and fungal disease introduction or spread." In the *PDES* Section *Proposed Airport Developments*, under the heading *Land Use and Environmental Management Plans* (p. *5.5*), the only reference to weeds is rendered as such; "The prevention of weed species and fungal diseases such as dieback." There are references to weed "control" in the text of the *PDES* on page *5.8* in relation to the Northern and the South-eastern Conservation areas, and in *Table 5.2 Land Use Zones* (p. *5.8*). But our overall perception is that the *PDES* is not making a commitment to weed" control" as such, but rather to "weed prevention," a poor substitute for the active on-ground action needed to at least hold the condition and the ecological integrity of the Airport's natural areas at current levels. The priority given to designated conservation areas for weed "control," if "control" is indeed what is being proposed, may actually require the control of infestations of weeds outside of those areas, so as to limit the possibility of invasive weeds colonizing the "prioritized" bushland or wetlands from without.

From the *PDES* it is clear that it is the intention of WAC to base environmental management priorities on proposed land uses. *Figure 5.3 Perth International Airport - Ultimate Land Use and Environmental Management Zones*, in the *PSES* shows the three major proposed Land Use Zones; those being the Airfield and Terminal Support Zone; the Non- Aviation Zone (referred to as the Potential Commercial Area in *Figure 5.1* of the *PDMP*); and the Conservation Zone. It is our recollection that in previous meetings with the FAC (the previous land manager) we were advised that while it would be the policy of the then land manager (the FAC) to identify areas which it perceived as being

required for the development of essential Airport infrastructure in the medium to longer term, the land manager would nevertheless maintain the ecological integrity of the said areas at the then current status. It has been a concern the Friends of Perth Airport Bushland for some time that areas might not be subject to any environmental management to the extent that environmental approvals for development might be obtained more readily at some future time owing to an historical reluctance on the part of the land manger to commit any resources to the environmental management of areas it saw as eventually being required for development. The problem with such an approach is that the assumption that development will occur in the future pre-empts approval processes, including environmental approval processes. The other problem is that with a total lack of environmental management, the areas proposed for development become subject to more and more environmental disturbance. Then when the environmental assessment process eventually takes place, the land manager is in a position to capitalize on his own negligence, because the areas in question have become degraded. Whether such a process is deliberate and pre-meditated, or something the land manager might simply accept as serendipity, it is not acceptable. Put simply, we would expect a degree of environmental management in areas proposed for eventual infrastructure developments, which would at least prevent those areas' ecological integrity and condition from declining. In the *Perth Airport Draft Planning Strategy* (1996: Federal Airports Corporation), in relation to natural environment, heritage listings, and native title issues, the following statement occurs;

> To address these matters the FAC will continue to comply with the stated legislative requirements and to develop comprehensive environmental management plans.
>
> This will establish a systematic approach to land use, management and development that will ensure the continued viability of areas until development is necessary (p. 11).

In the later *Perth Airport Planning Strategy* (1997: Federal Airports Corporation) the following statement appears;

> Those areas of remnant bushland and wetlands not required for possible future aviation or non-aviation development will be protected. Those remaining areas will be adequately maintained and protected prior to being required for development (p. 29).

Here we find assurances that areas proposed for development will not be allowed to become degraded prior to the commencement of their planned utilization. This is something lacking in the *PDES*. In the aforementioned document, "Zone 3" areas, described as "areas of essential infrastructure, such as runways, taxiways, aprons, terminals, roads and navigational aids" (*Table 5.2)*, are ungenerously treated, to say the least;

> The areas destined for development of essential infrastructure at some future time will be subject to minimal management with progressive clearing/disturbance of habitats to encourage the translocation of faunal species to other areas (*Table 5.2).*

There are substantial natural areas of high conservation value which fall within the "Zone 3" classification, and we are of the view that if it is possible to avert degradation of those areas with some practical environmental management actions, then those actions should be taken. Environmental management strategies must take account of conservation values - not simply projected land uses- for the simple reason that the projected land uses may be a long way from receiving official approval. In the meantime, such problems as the appearance of potentially devastating environmental weed species, feral animal proliferation, or simply irresponsible public usage, in high conservation value bushland and wetlands, must not be allowed to go unchecked. There are currently, for example, a few bad Watsonia infestations in the natural area bound by Clayden Road, Newburn Road, Phillips Road, and the Airport Drain. This areas is proposed for the parallel runway but it should not be left to become overrun with a controllable weed like Watsonia.

The "Zone 2" areas, which are described in the *PDMP* as "potential commercial" areas (*Figure 5.1)*, are again hardly the subject of firm management commitments:

> The areas subject to development would be so managed that the developments are designed to minimize adverse impacts (eg. cluster developments), to retain as much vegetation and habitat as feasible and to be in sympathy with the local environment (*Figure 5.2 Land use Zones [PDES]).*

We accept that some commercial developments may proceed in "Zone 2," though we would prefer that the bushland in "Zone 2" was not infringed upon by development. If development proposals are put forward for "Zone 2" areas, we would expect minimal clearing and fauna protection to be priorities. As with the other natural areas at the Airport, we would expect some commitment to active management in the form of weed control especially. Another potential problem is that of disease. It would be particularly appropriate if a commitment to carrying out a Dieback Survey of the whole Airport was made in the *PDES.* We occasionally observe patches of tree deaths at the Airport, for which we do not have an explanation. Dieback, by which we mean the fungal disease Phytopthora cinnamomi, is a devastating disease in Banksia woodlands such as occur at Perth Airport. We do not know if there are any areas at the Airport affected by the disease but any serious environment strategy would involve a survey to determine the existence or non-existence of the disease at the Airport, and then, should the disease be found, the locations and extent of the affected areas would have to be ascertained for hygiene and control measures to be carried out. The disease can be arrested with treatment.

As would be expected, the *PDES* makes a greater commitment to manage the "Zone1" Conservation Areas. We are encouraged by references to "weed, pest and disease control; and for rehabilitation and revegetation" (*Table 5.2).* By "control" we assume it is meant that direct action will be taken to eradicate problem weeds, pests and diseases. Feral animal control is needed at the Airport but we concede it may not be an easy task. There is a large rabbit population, and this impacts on native vegetation through the animals

eating various herbaceous native plants and seedlings. The fox population is probably more of a concern, although it undoubtedly helps keep the rabbit population down. Their numbers are large and they are very destructive. We have seen tortoises killed by foxes, waterfowl killed by foxes, and bandicoots killed by foxes. No doubt they take many other kinds of fauna as well. CALM has carried out very successful baiting programs throughout the south west of the State, and it may be possible to carry out similar programs at the Airport, as long as leaseholders and members of the public are alerted to the dangers for their pets and so forth. We are aware some fox control has been carried out inside the main security fence at the Airport but this would need to be extended to areas outside the main security fence to have a significant impact on the total population. There are also feral cats in the Airport's natural areas, and we would assume they are damaging to bird and reptile populations in particular.

There are numerous other environmental management issues which relate to the natural areas at the Airport. Obviously it is vital for the health of wetlands that pollution does not occur through chemical spillages and dumping, for example. Another issue of particular relevance to the health of wetlands is that of nutrient enrichment. We have some reason to believe, for example, that algal blooms we have observed in Munday Swamp may have been caused, in part, by the runoff from the fertilized pastures of leaseholders at the Airport whose properties lie in the Swamp's catchment area. One has told us Superphosphate is used on pastures to improve green feed supplies. We would request that people running livestock or such animal enclosures as kennels at the Airport be advised of the environmental consequences of nutrient excesses in wetlands and that they be required to keep nutrient runoff to a minimum.

The Friends of Perth Airport Bushland would also strongly suggest that WAC consider employing a full-time bushland/wetland manager at the Airport. It is difficult to see how environmental management at the Airport can be planned, carried out, and monitored, appropriately without a suitably qualified person being employed on a full time basis to see that these tasks are achieved. We suspect WAC may be reluctant to employ some one on the basis of the expense. We would suggest that the Federal Government could be approached to contribute to this cost if it was deemed to be beyond the resources of WAC. A bushland/ wetland manager would have additional value as a relatively mobile security presence.

In the *Executive Summary* of the *PDES*, it is stated that it is "currently not WAC's intent to seek accreditation for the Environmental Management System" (*ES-5*) at Perth Airport. The Friends of Perth Airport Bushland are of the view that the seeking of accreditation for the Environmental Management System would help identify problems and improve the quality of the System. Accreditation is usually a good objective means of evaluating a System's design, implementation and integrity.

An concept that the Friends of Perth Airport bushland have proposed for Perth Airport in the past is that of an Eco-Tourism Park. A reserve of this nature would serve the purpose of conserving bushland and wetlands, while helping to promote Western Australian

wildlife and landscapes among tourists. If there is going to be major growth in tourism to Western Australia, the only substantial drawcard we can identify would be the State's natural environment. The development of a sophisticated Eco-Tourism Park at the Airport could serve as an introduction to Western Australian flora and fauna, and as an introduction to advanced environmental management in Australia. Of course a project like this would require a good deal of planning and capital outlay for vermin-proof fencing and facilities but it would seem a worthwhile concept for consideration. A park of this kind could be used for the re-introduction of mammal species which have become locally extinct at the Airport, as well as for the re-introduction of the Western Swamp Tortoise. We regard the provision of suitable habitat for re-introduction for the Western Swamp Tortoise as a matter of vital concern. First World countries like Australia cannot condemn Third World environmental practices leading to extinctions without demonstrating their own bona fides. It is known that Perth Airport presents the best opportunity for securing the safety of the Western Swamp Tortoise as a wild species and it will become internationally embarrassing for Australia if provision for re-introduction of the Tortoise to the Airport is not made.

The Friends of Perth Airport Bushland expects its views to be given due consideration in this public consultation process and we will be very dissatisfied if it becomes apparent that our views have not been taken into account.

Yours faithfully

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Kevin McLean
Assistant Secretary
Friends of Perth Airport Bushland

Guildford : Connolly – proposed Car Park area . 16/2/01

Eucmar subsp eleyanthella ✓

Site 1 – Wetland FCT 5 ? Wetland Mapping Keighery '98

	June, long bracted bath in the	Dominants
Con ~~sp~~	short pasture.	Vert dens
Sty ~~leptostachyum~~ dicho ?		Dasbrom
Mel ~~sp~~ (sp B)		Lyg bar
Austrodanth sp acicid?		Hypoxis
Gramphotam.		

Site 2 – Bank ilic area ~~Part of FCT~~ Wetland .

Lepid squa
Astroloma pallida
Mel sp P2 ?

Site 3 – Upland . FCT 20a/20b

Acca
Nemcap.

– Wetland – high priority for Western Swamp Tortoise

No
BJK Report Appendix.

Nick Alice O'Connor for File ✓ Kalamunda Rat Assessment File

Maps for report
Western Swamp Neck Tortoise.

PERTH REPORT 20/10/94

Swamps 1 & 2

Jarrah has been felled,
Clearing only occurs in
Bank Wood

Mel rhapk

Mel Rhapk
Mel Rhapk

Mel Rhapk
Mel Rhapk

Schoenus ebeadest
Site Ø1 Add Pol cap (centre)
Site Ø5 – Add Cassytha sp (Sth)
Adj (NW) Swamp
Mondy

Mel Rhapk
Mel Rhapk

Asterton / Patchily
or singly Closed
Shrubs 2-15m
over scattered
Herbs / Sedges
= Ø5
Scattered
Mel rhapk
Bank lit.

All Ø2 Ø3 Ø4 Ø5 Ø6 Ø7 Ø8 Ø9 Ø10 Ø11 Ø12 Ø13 Ø14 Ø15 Ø16 Ø17 Ø18 Ø19 Ø20 Ø21 Ø22 Ø23 Ø24 Ø25 Ø26 Ø27 Ø28 Ø29 Ø30 Ø31 Ø32 Ø33 Ø34 Ø35 Ø36 Ø37 Ø38 Ø39 Ø40 Ø41 Ø42 Ø43 Ø44 Ø45 Ø46 Ø47 Ø48 Ø49 Ø50 Ø51 Ø52 Ø53 Ø54 Ø55 Ø56 Ø57 Ø58 Ø59 Ø60 Ø61 Ø62 Ø63 Ø64 Ø65 Ø66 Ø67 Ø68 Ø69 Ø70 Ø71 Ø72 Ø73 Ø74 Ø75 Ø76 Ø77 Ø78 Ø79 Ø80 Ø81 Ø82 Ø83 Ø84 Ø85 Ø86 Ø87 Ø88 Ø89 Ø90 Ø91 Ø92 Ø93 Ø94 Ø95 Ø96 Ø97 Ø98 Ø99 Ø100 Ø101 Ø102 Ø103 Ø104 Ø105 Ø106 Ø107 Ø108 Ø109 Ø110 Ø111 Ø112 Ø113 Ø114 Ø115 Ø116 Ø117 Ø118 Ø119 Ø120 Ø121 Ø122 Ø123 Ø124 Ø125 Ø126 Ø127 Ø128 Ø129 Ø130 Ø131 Ø132 Ø133 Ø134 Ø135 Ø136 Ø137 Ø138 Ø139 Ø140 Ø141 Ø142 Ø143 Ø144 Ø145 Ø146 Ø147 Ø148 Ø149 Ø150 Ø151 Ø152 Ø153 Ø154 Ø155 Ø156 Ø157 Ø158 Ø159 Ø160 Ø161 Ø162 Ø163 Ø164 Ø165 Ø166 Ø167 Ø168 Ø169 Ø170 Ø171 Ø172 Ø173 Ø174 Ø175 Ø176 Ø177 Ø178 Ø179 Ø180 Ø181 Ø182 Ø183 Ø184 Ø185 Ø186 Ø187 Ø188 Ø189 Ø190 Ø191 Ø192 Ø193 Ø194 Ø195 Ø196 Ø197 Ø198 Ø199 Ø200 Ø201 Ø202 Ø203 Ø204 Ø205 Ø206 Ø207 Ø208 Ø209 Ø210 Ø211 Ø212 Ø213 Ø214 Ø215 Ø216 Ø217 Ø218 Ø219 Ø220 Ø221 Ø222 Ø223 Ø224 Ø225 Ø226 Ø227 Ø228 Ø229 Ø230 Ø231 Ø232 Ø233 Ø234 Ø235 Ø236 Ø237 Ø238 Ø239 Ø240 Ø241 Ø242 Ø243 Ø244 Ø245 Ø246 Ø247 Ø248 Ø249 Ø250 Ø251 Ø252 Ø253 Ø254 Ø255 Ø256 Ø257 Ø258 Ø259 Ø260 Ø261 Ø262 Ø263 Ø264 Ø265 Ø266 Ø267 Ø268 Ø269 Ø270 Ø271 Ø272 Ø273 Ø274 Ø275 Ø276 Ø277 Ø278 Ø279 Ø280 Ø281 Ø282 Ø283 Ø284 Ø285 Ø286 Ø287 Ø288 Ø289 Ø290 Ø291 Ø292 Ø293 Ø294 Ø295 Ø296 Ø297 Ø298 Ø299 Ø300 Ø301 Ø302 Ø303 Ø304 Ø305 Ø306 Ø307 Ø308 Ø309 Ø310 Ø311 Ø312 Ø313 Ø314 Ø315 Ø316 Ø317 Ø318 Ø319 Ø320 Ø321 Ø322 Ø323 Ø324 Ø325 Ø326 Ø327 Ø328 Ø329 Ø330 Ø331 Ø332 Ø333 Ø334 Ø335 Ø336 Ø337 Ø338 Ø339 Ø340 Ø341 Ø342 Ø343 Ø344 Ø345 Ø346 Ø347 Ø348 Ø349 Ø350 Ø351 Ø352 Ø353 Ø354 Ø355 Ø356 Ø357 Ø358 Ø359 Ø360 Ø361 Ø362 Ø363 Ø364 Ø365 Ø366 Ø367 Ø368 Ø369 Ø370 Ø371 Ø372 Ø373 Ø374 Ø375 Ø376 Ø377 Ø378 Ø379 Ø380 Ø381 Ø382 Ø383 Ø384 Ø385 Ø386 Ø387 Ø388 Ø389 Ø390 Ø391 Ø392 Ø393 Ø394 Ø395 Ø396 Ø397 Ø398 Ø399 Ø400 Ø401 Ø402 Ø403 Ø404 Ø405 Ø406 Ø407 Ø408 Ø409 Ø410 Ø411 Ø412 Ø413 Ø414 Ø415 Ø416 Ø417 Ø418 Ø419 Ø420 Ø421 Ø422 Ø423 Ø424 Ø425 Ø426 Ø427 Ø428 Ø429 Ø430 Ø431 Ø432 Ø433 Ø434 Ø435 Ø436 Ø437 Ø438 Ø439 Ø440 Ø441 Ø442 Ø443 Ø444 Ø445 Ø446 Ø447 Ø448 Ø449 Ø450 Ø451 Ø452 Ø453 Ø454 Ø455 Ø456 Ø457 Ø458 Ø459 Ø460 Ø461 Ø462 Ø463 Ø464 Ø465 Ø466 Ø467 Ø468 Ø469 Ø470 Ø471 Ø472 Ø473 Ø474 Ø475 Ø476 Ø477 Ø478 Ø479 Ø480 Ø481 Ø482 Ø483 Ø484 Ø485 Ø486 Ø487 Ø488 Ø489 Ø490 Ø491 Ø492 Ø493 Ø494 Ø495 Ø496 Ø497 Ø498 Ø499 Ø500 Ø501 Ø502 Ø503 Ø504 Ø505 Ø506 Ø507 Ø508 Ø509 Ø510 Ø511 Ø512 Ø513 Ø514 Ø515 Ø516 Ø517 Ø518 Ø519 Ø520 Ø521 Ø522 Ø523 Ø524 Ø525 Ø526 Ø527 Ø528 Ø529 Ø530 Ø531 Ø532 Ø533 Ø534 Ø535 Ø536 Ø537 Ø538 Ø539 Ø540 Ø541 Ø542 Ø543 Ø544 Ø545 Ø546 Ø547 Ø548 Ø549 Ø550 Ø551 Ø552 Ø553 Ø554 Ø555 Ø556 Ø557 Ø558 Ø559 Ø560 Ø561 Ø562 Ø563 Ø564 Ø565 Ø566 Ø567 Ø568 Ø569 Ø570 Ø571 Ø572 Ø573 Ø574 Ø575 Ø576 Ø577 Ø578 Ø579 Ø580 Ø581 Ø582 Ø583 Ø584 Ø585 Ø586 Ø587 Ø588 Ø589 Ø590 Ø591 Ø592 Ø593 Ø594 Ø595 Ø596 Ø597 Ø598 Ø599 Ø600 Ø601 Ø602 Ø603 Ø604 Ø605 Ø606 Ø607 Ø608 Ø609 Ø610 Ø611 Ø612 Ø613 Ø614 Ø615 Ø616 Ø617 Ø618 Ø619 Ø620 Ø621 Ø622 Ø623 Ø624 Ø625 Ø626 Ø627 Ø628 Ø629 Ø630 Ø631 Ø632 Ø633 Ø634 Ø635 Ø636 Ø637 Ø638 Ø639 Ø640 Ø641 Ø642 Ø643 Ø644 Ø645 Ø646 Ø647 Ø648 Ø649 Ø650 Ø651 Ø652 Ø653 Ø654 Ø655 Ø656 Ø657 Ø658 Ø659 Ø660 Ø661 Ø662 Ø663 Ø664 Ø665 Ø666 Ø667 Ø668 Ø669 Ø670 Ø671 Ø672 Ø673 Ø674 Ø675 Ø676 Ø677 Ø678 Ø679 Ø680 Ø681 Ø682 Ø683 Ø684 Ø685 Ø686 Ø687 Ø688 Ø689 Ø690 Ø691 Ø692 Ø693 Ø694 Ø695 Ø696 Ø697 Ø698 Ø699 Ø700 Ø701 Ø702 Ø703 Ø704 Ø705 Ø706 Ø707 Ø708 Ø709 Ø710 Ø711 Ø712 Ø713 Ø714 Ø715 Ø716 Ø717 Ø718 Ø719 Ø720 Ø721 Ø722 Ø723 Ø724 Ø725 Ø726 Ø727 Ø728 Ø729 Ø730 Ø731 Ø732 Ø733 Ø734 Ø735 Ø736 Ø737 Ø738 Ø739 Ø740 Ø741 Ø742 Ø743 Ø744 Ø745 Ø746 Ø747 Ø748 Ø749 Ø750 Ø751 Ø752 Ø753 Ø754 Ø755 Ø756 Ø757 Ø758 Ø759 Ø760 Ø761 Ø762 Ø763 Ø764 Ø765 Ø766 Ø767 Ø768 Ø769 Ø770 Ø771 Ø772 Ø773 Ø774 Ø775 Ø776 Ø777 Ø778 Ø779 Ø780 Ø781 Ø782 Ø783 Ø784 Ø785 Ø786 Ø787 Ø788 Ø789 Ø790 Ø791 Ø792 Ø793 Ø794 Ø795 Ø796 Ø797 Ø798 Ø799 Ø800 Ø801 Ø802 Ø803 Ø804 Ø805 Ø806 Ø807 Ø808 Ø809 Ø810 Ø811 Ø812 Ø813 Ø814 Ø815 Ø816 Ø817 Ø818 Ø819 Ø820 Ø821 Ø822 Ø823 Ø824 Ø825 Ø826 Ø827 Ø828 Ø829 Ø830 Ø831 Ø832 Ø833 Ø834 Ø835 Ø836 Ø837 Ø838 Ø839 Ø840 Ø841 Ø842 Ø843 Ø844 Ø845 Ø846 Ø847 Ø848 Ø849 Ø850 Ø851 Ø852 Ø853 Ø854 Ø855 Ø856 Ø857 Ø858 Ø859 Ø860 Ø861 Ø862 Ø863 Ø864 Ø865 Ø866 Ø867 Ø868 Ø869 Ø870 Ø871 Ø872 Ø873 Ø874 Ø875 Ø876 Ø877 Ø878 Ø879 Ø880 Ø881 Ø882 Ø883 Ø884 Ø885 Ø886 Ø887 Ø888 Ø889 Ø890 Ø891 Ø892 Ø893 Ø894 Ø895 Ø896 Ø897 Ø898 Ø899 Ø900 Ø901 Ø902 Ø903 Ø904 Ø905 Ø906 Ø907 Ø908 Ø909 Ø910 Ø911 Ø912 Ø913 Ø914 Ø915 Ø916 Ø917 Ø918 Ø919 Ø920 Ø921 Ø922 Ø923 Ø924 Ø925 Ø926 Ø927 Ø928 Ø929 Ø930 Ø931 Ø932 Ø933 Ø934 Ø935 Ø936 Ø937 Ø938 Ø939 Ø940 Ø941 Ø942 Ø943 Ø944 Ø945 Ø946 Ø947 Ø948 Ø949 Ø950 Ø951 Ø952 Ø953 Ø954 Ø955 Ø956 Ø957 Ø958 Ø959 Ø960 Ø961 Ø962 Ø963 Ø964 Ø965 Ø966 Ø967 Ø968 Ø969 Ø970 Ø971 Ø972 Ø973 Ø974 Ø975 Ø976 Ø977 Ø978 Ø979 Ø980 Ø981 Ø982 Ø983 Ø984 Ø985 Ø986 Ø987 Ø988 Ø989 Ø990 Ø991 Ø992 Ø993 Ø994 Ø995 Ø996 Ø997 Ø998 Ø999 Ø1000

Mel Rhapk
Mel Rhapk

Mel Rhapk
Mel Rhapk

Mel Rhapk
Mel Rhapk

Database addition

7/12/94

Perth Airport

Swamps all have large to small Mel p. on margins, Mel rhopt in gutts.

Site Ø4 B.W Cyatt. eland, throughout woodlands in area

Site Ø6 BW no Cyatt eland seen.

Sites located on Tinjarra Vg map Southern - east

A Mel rhopt area

Burned area / Mel retention / Epid low

B1 thick vanes Mel rhopt, Ast. eff basii, rich leaf.

B2 Mr (T.) but = B1

C Trees been cleared, regrowth

(C) Photo

Pond edge Mats apparently wetter than sites done, combination Ø5 & Ø2

& mid more richer Ø2

Podotepis gracilis = Ø5 similar

P1 & 2, 3, 4 & 5

Lotus edge in Mats

(D) Shrubs 1 - 0.5m 30-70%

Kunzea recurva Jack Sand

Hyp angust, Vet leuc, Xanth?p

Vet elongata, Dry mod, Styl.

Stylid. adnat (pink) Lasiopetalum Tephrosia, Lepto.

= CaSN Lasiopetalum sp. Silky over lep. mm 30-70%

Note single Calytrix area.

Site in D and to W

Photo 6 & 7

Lepto. arsteta

(E) Banksia Woodland = Ø6
Photo 8

(E) Burnt Pe
Bybaylis, Leveillodiscus
9×10×12 Across burnt area
P11 = Leveillodiscus

(H) Sandy ridge, cleared but understorey regrown
Cyno. tryphi, one spec each
bush shrubs undulate to EB
*EB suggested possibly hybrids
Candidata
Heavy soil flats to either side, condition very variable.

(G) Heavy soil Mod Vim, disturb
P15 & P16
Mod Vim over Dawsonia
Dawsonia >70% >0.5m over
Cotula coryn.
appears to be salt affected —
Couch Cynodon dactylon
Patches Bulb. caeld.
Mixed Heaths (like Ø5)
Leg. stricta Hot Heaviest
(brown soils) cleared
Mel. (Leptocladia) south coast aff Paucifloria

Western N → S 70% 15m
(I) Mel. varia Mel. laxa, Eucal. virg
Pet base, Mod lot, Cal late.
Lepyrod. Lepidosperma Tglauca
Scattered Mallee, Mel p &
& a mulch

*Lepid laxa invasion edges, low grass.
COND Excellent with several localised disturb dense Pe. all p edges.

Mp area to S
Mp and Hyp. cryst mixed heath.

Banksia mac/gar (lyr)

(J) Bm, Ba x Bi over 30-70%
Phleb cil, Gompk 30-70%
Sedges Lyg bab Schoen cur
Scattered shrubs 2-10 0-5m
Bas. ens, Pet. lin, Eremp,
Gom. tom., Lec cin, Jac dem,
Mel sp B,
Cand ?
Fir, ? petrol clearing,
structure inspected Ehrh. brac
10-30%

(K) p 17 along
Mp / Pe / Af. Swamp.

(L) Bank Bm / Ba / Em,
very like Dianella =
Bas ridge
(Como area)
P18.

On side slope to S Billie
Platysace ? juncea

Excellent - V. Good
along road Veldt / Tone Grass.

Entrance for 4x4
at Homie Milan
entrance.

Cole 4 - 478 8425 24/8/95

AIRPORT PERTH

Site 1 'Burnt Summer 1994/95

Site flooded to 10cm, washed through & area collected - Callitriche (USP), Villarsia (USP) also Triglochin procera

Edges inundated / waterlogged

Dros. het., Poly tenella, Poly malti, Trib aust, Dros menz menz, Chori erects, Burch multi, Drig viridis.

Additional sites W side

Site 8, 9, 10 on

Mani on edges Hats (10) and in Hats with Mel. prei. missing presently at 10 ? fire as several young Manis.

Different entities

CTG Cons. Three Rooms Sign b

Branch

Permanent Files

TPS Planning Files

Cons. Branch Files

Bush Forever.

Guildford Cemetery - Carpark Proposal

Possible TEC [illegible] area previously

Bulldozed proposal for Kalamunda Rd to go [illegible] of Guildford Cemetery - Shan not developed (TPRD district town planning scheme) before negated) planning approval so Maintaining Kalamunda [illegible] Cemetery

Bushland to Sth of Kalamunda Rd [illegible] wide. Hte (Aust. Heritage Comm.)

Munday Swamp & registered site.
Bushland, Kalamunda Rd.

NB: Past Adelaide St Clearing - Guildford Cemetery

Meeting Notes

Name

Folio No.

Branch

File No.

Subject: RS 286 Guildford Cemetery Car Park

Date: 2 / 3 / 01

Time

People in attendance: Karen Clarke, telephone call to

→ Grant MacKinnon, 92679000

Items	Action required	Action by
City of Swan		
lease 1990 or → Swan Animal Haven — 31 Dec 2008 CR 25246 ? indust area.		
lease >30yrs Perth Pistol Club — 30 Aug 2010 CR 32002 → Whiteman	CR vested in Shire	
6 wks when to Council – resolution = agreed to transfer land when Leases expire.	Expire 8yrs 10yrs. = revesting of reserves in Cemeteries Board	
Cemetery to find some area for relocation. assist in finding new home.		
Gravel Surface :- Needs to be non dieback & weed free		
Engineer has provided quote.		
Talbot Midland Rd Bushland	✱ Land acquired 100 yrs ago.	
Meeting next wk. re. Challoc CR	Should ask to refer to anyone to clear	

Perth Airport

Condition - Remnant

Site 1/Photo 1 P1 — Bank ilic, B. att, B. nem, X preis, Dasy brom, Bossiaea, Schinu, Phlbail? Lep squa? Acapul, Adecyg, Veld grass, Gladcary, Pelarg, couch/kikuyu, African love Grass, Euphorbiac, Castor oil, Patocc, hygtour, Calfra, Bandicoots?

Soil dumping, tracks, weeds - lots.
Cond - Degraded - Good.
MP35 - Looking SE to - Banksia upland at P1
MP34 - Edge Hennie Miller Drive looking NE.

Geraldton wax, Victoriatree on Estn boundary.

Site 2/Photo 2 P2 — See field sheets. Bgrand also on NWhn edge.

Site 2/Photo 3 P3 — See field sheets.

Site 3/Photo 4 P4 — See field sheets.

DEP SYSTEM 6/BUSHPLAN – SURVEY SHEET B.J. KEIGHERY 6/97

BUSHLAND AREA Perth Airport SITES 2 YES/NO

DATE 11/12/2000 RECORDERS K. Charles

Observations edge (transects)

Geographic Location	Latitude	S Longitude	E
Reference Map			

Photograph	Photographer's Name	B.H. Griffiths	Photo No	P2 / MP55

Transect of landscape units (draw in transect incorporating features listed and any other relevant unit)

dunes
dry/wet flats
sumplands
uplands
type

Soil - surface			sub -soil
Exposed rock	type	% area	

FLORA/VEGETATION (list dominant and significant plants below, see over for vege association descriptions)

Eucalypts	*E. calophylla*	*E. wandoo*	*E. marginata*	*E. todtianna*	*E. rudis*	
	E. decipiens	*E. drummondii*	*E. haematoxylon*	*E. lanepoolei*	*E. gomphocephala*	
	E. accedens	*E. patens*	*E. laeliae*	*E. megacarpa*		
Sheoaks	*Allocasuarina fraserana*		*Casuarina obesa*			
Banksia	*B.attenuata*	*B. menziesii*	*B. prionotes*	*B. illicifolia*	*B. grandis*	*B. littoralis*
Melaleuca	*M. preissii*	*M. rhaphiophylla*	*M. lanceolata*		*M. cuticularis*	
Others	*Callitris preissii.*					
Mallees	Eucalypts	*E. argutifolia*	*E. petrensis*	*E. decurva*	*E. foecunda*	*E. latens*

SIGNIFICANT SPECIES / DOMINANT SPECIES

As for P1 / Site 1
Pedline Shrub

(see over for vegetaion descriptions)

Vegetation Condition - Keighery 1994 (Trudgen 1993) (show range and indicate predominant class)

1 = 'Pristine' (Excellent)
2 = Excellent (Very Good)
3 = Very Good (Good)
4 = Good (Poor) see field sheet
5 = Degraded (Very Poor)
6 = Completely Degraded

Specific aspects of disturbance

partial clearing

weeds (list): See field sheet

selective removal of species: timber cutting mowing fire grazing dieback %area
fire frequency: many yrs ago - Adenanthos w. old & tall.
'enrichment plantings' (list) margins of edges where lush shrubs died.
animal impact: horse foxes rabbits cats dogs goats pigs overgrazing by native mammals
soil movement: mining dumping rubbish dumping roadworks ? / soil movement
changes in water regimes: flooding drainage watering nutrient influx

Tracks: fire breaks walk trails off road vehicle use animal tracks
Service corridors: SEC ? Main Roads Water Authority. Telecom ?
Other

VEGETATION (describe each unit of vegetation using dominants and life form/height class and canopy cover according to the Muir/Keith codes above)

See field sheets

Fauna comments

Evidence of Bandicoots - diggings, runnels

Adjacent bushland (refer to aerial photograph)

OTHER COMMENTS

Wetland

BUSHLAND PLANT SURVEY RECORDING SHEET 1- use pencil only

BUSHLAND AREA Perth Airport SITE NUMBER 3

DATE TRIP _____ RECORDERS KC

DATE TRIP _____ RECORDERS _____

DATE TRIP _____ RECORDERS _____

BOTANIST _____

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

1. LOCATION of the QUADRAT

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

N

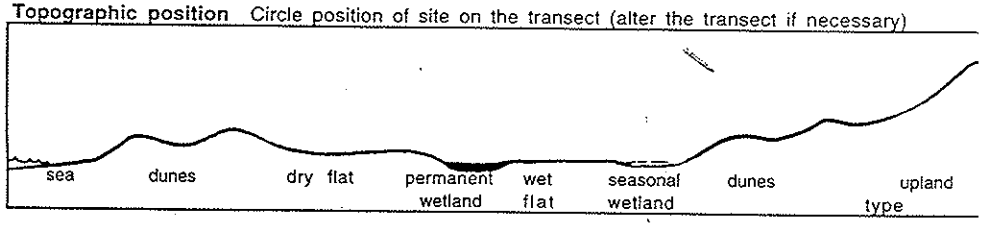
Road Location

Geographic Location Latitude S Longitude E Altitude

Reference Map MPBT

Photograph Photographer's Name SHG Photo No P4

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



2. SITE DATA Circle the correct response.

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

Surface Soil *Colour*

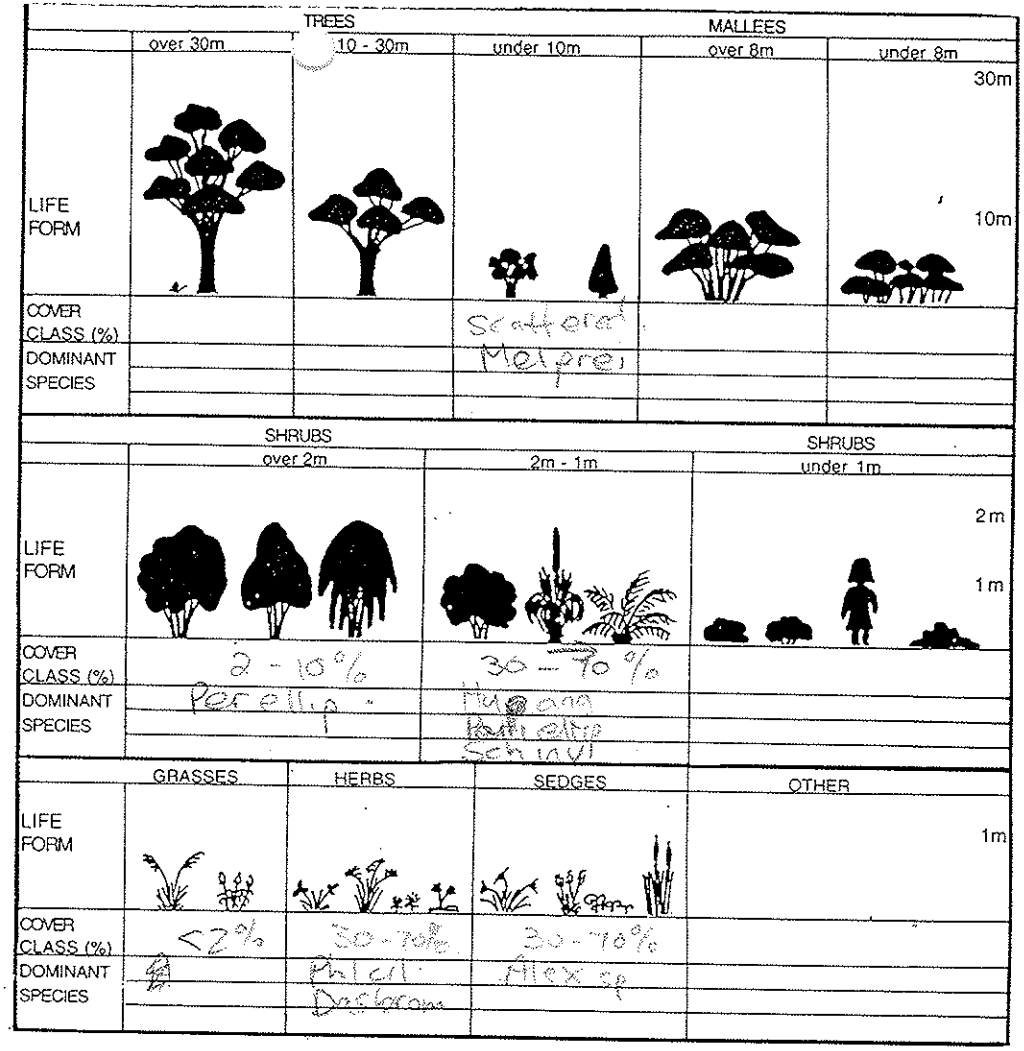
Exposed rock *type* % surface

Sub-surface Soil *Colour*

Rock *type* depth to rock

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

Litter	% cover	*Bare Ground*	%cover
Depth	cm		



4. VEGETATION CONDITION

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

COMMENTS

Scattered rubbish, tracks
V. good
Scattered
Some weeds - Ursinia, Watsonia, Veld Grass, rabbit droppings
Jacdens, Acapul, Hypexe, Schtubofol, Xanpae? Calflav, Gramtam, Trivela, Adecyl, Lomsp., Ere, Thyspa.

Looks like 20a TEC? Banksia upland

BUSHLAND PLANT SURVEY RECORDING SHEET 1- use pencil only

BUSHLAND AREA Perth. Airport SITE NUMBER 2

DATE TRIP _____ RECORDERS _____

DATE TRIP _____ RECORDERS _____

DATE TRIP _____ RECORDERS _____

BOTANIST _____

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

1. LOCATION of the QUADRAT

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

N

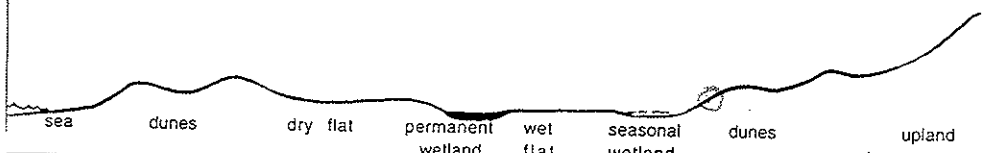
Road Location

Geographic Location Latitude S Longitude E Altitude

Reference Map

Photograph Photographer's Name Photo No P2 P3

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



2. SITE DATA Circle the correct response.

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

Surface Soil Grey Bassendean Sand *Colour*

Exposed rock *type* % surface

Sub-surface Soil *Colour*

Rock *type* depth to rock

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

Litter	% cover	*Bare Ground*	%cover
Depth	cm		

	TREES over 30m	TREES 30m	TREES under 10m	MALLEES over 8m	MALLEES under 8m
LIFE FORM					30m 10m
COVER CLASS (%)		30-70%	10-30%		
DOMINANT SPECIES		Banksia B. men E. mar/Allic	Adenan		

	SHRUBS over 2m	SHRUBS 2m - 1m	SHRUBS under 1m
LIFE FORM			2m 1m
COVER CLASS (%)		30-70%	30-70%
DOMINANT SPECIES		Xanthorr.	Shr ind

	GRASSES	HERBS	SEDGES	OTHER
LIFE FORM			1m	
COVER CLASS (%)	<2%	2-10%	10-30%	
DOMINANT SPECIES		Patersonia	Mesomelaena sp	

4. VEGETATION CONDITION

		COMMENTS
1 'PRISTINE'		
2 EXCELLENT		
3 VERY GOOD		V Good - Excellent
4 GOOD		no obvious weed invasion.
5 DEGRADED		

(Bandicoot diggings)

NB Site 1 same community but condition Degraded - Good (Photo 1)

BUSHLAND PLANT SURVEY RECORDING SHEET 1- use pencil only

BUSHLAND AREA Guildford Cemetery SITE NUMBER 1

DATE TRIP _____ RECORDERS 16/2/01

DATE TRIP _____ RECORDERS _____

DATE TRIP _____ RECORDERS _____

BOTANIST _____

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

1. LOCATION of the QUADRAT

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

N

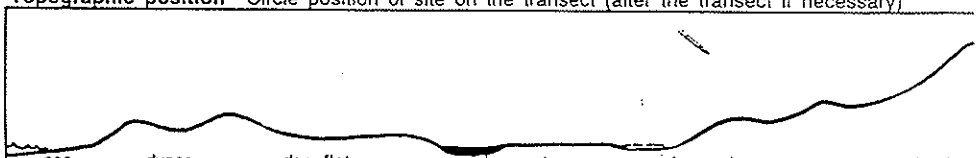
Road Location

Geographic Location Latitude S Longitude E Altitude

Reference Map

Photograph Photographer's Name Photo No

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



2. SITE DATA Circle the correct response.

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

Surface Soil ***Colour***

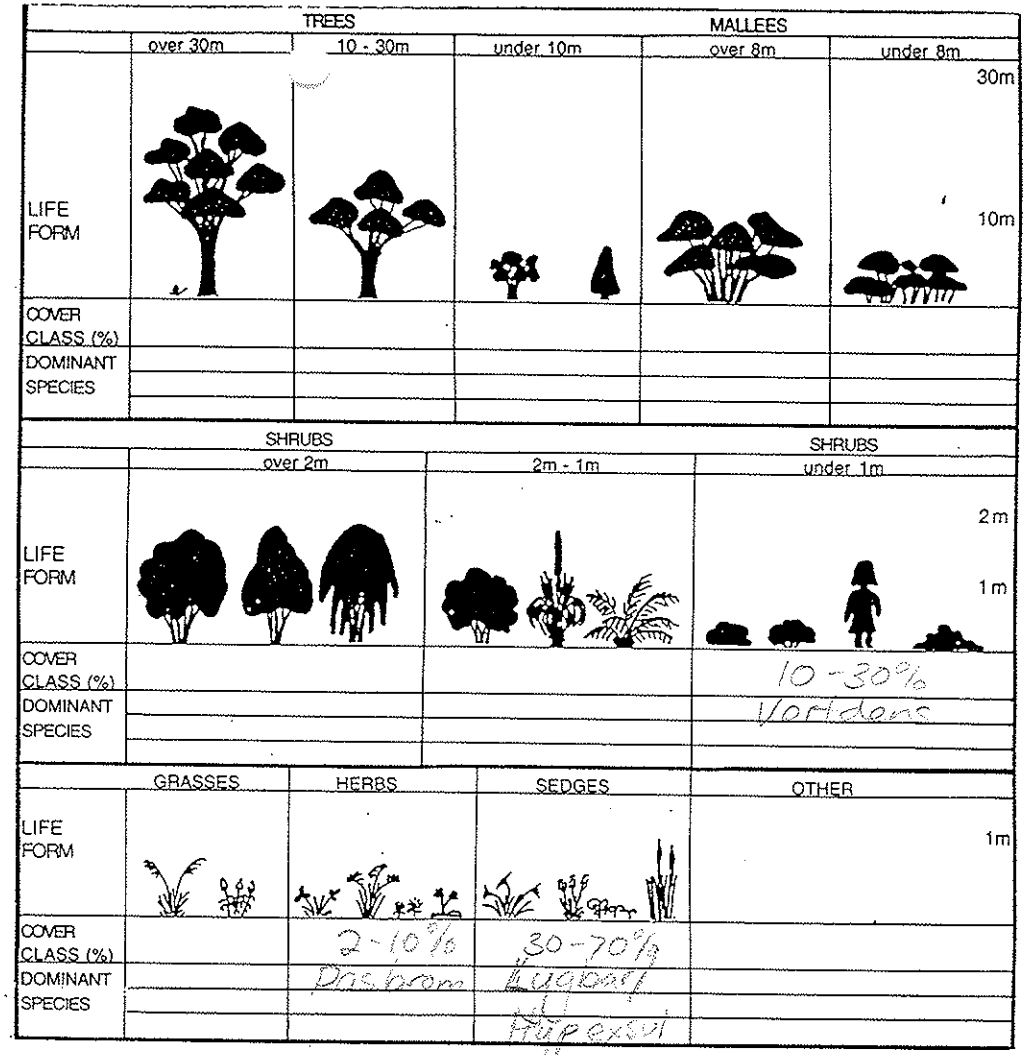
Exposed rock ***type*** % surface

Sub-surface Soil ***Colour***

Rock ***type*** depth to rock

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

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



4. VEGETATION CONDITION

		COMMENTS
1 'PRISTINE'		VG - Ex
2 EXCELLENT	I	Patches of bare ground, * Vertdens
3 VERY GOOD	I	Bandicoot diggings
4 GOOD		
5 DEGRADED		

Vertdens, Hypersole, Lygconfine, Dasbrom, Constaur?, Melspa, Gomphfam, Austrodarth?, Stylongit,

BUSHLAND PLANT SURVEY RECORDING SHEET 1- use pencil only

BUSHLAND AREA Guildford Cemetery SITE NUMBER 2

DATE TRIP 16/2/01 RECORDERS K. Clarke

DATE TRIP _____ RECORDERS _____

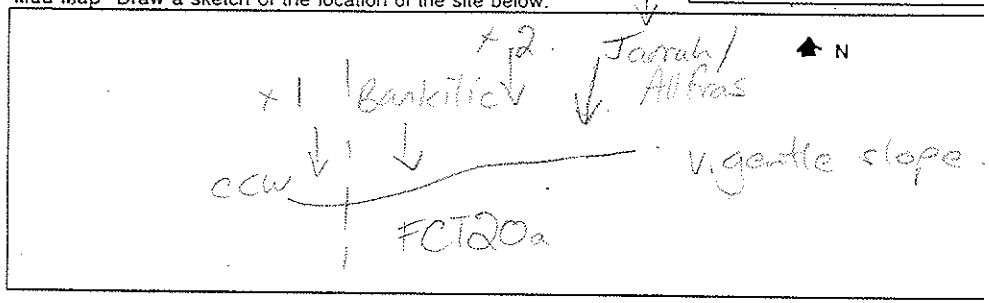
DATE TRIP _____ RECORDERS _____

BOTANIST _____

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

1. LOCATION of the QUADRAT

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



Road Location

Geographic Location Latitude S Longitude E Altitude

Reference Map

Photograph Photographer's Name Photo No

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

2. SITE DATA Circle the correct response.

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

Surface Soil *Colour*

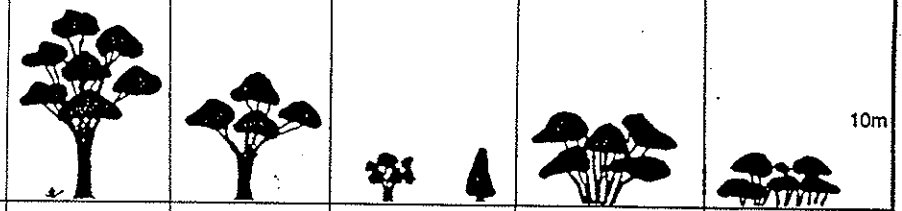
Exposed rock *type* % surface

Sub-surface Soil *Colour*

Rock *type* depth to rock

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

Litter	% cover	*Bare Ground*	%cover
Depth	cm		

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

	SHRUBS		SHRUBS
	over 2m	2m - 1m	under 1m
LIFE FORM			
COVER CLASS (%)			10-30
DOMINANT SPECIES			Mal spp.

	GRASSES	HERBS	SEDGES	OTHER
LIFE FORM				
COVER CLASS (%)		30-70%		
DOMINANT SPECIES		Phl cil		

4. VEGETATION CONDITION

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

COMMENTS

V. good - Excellent.
Roger occuring, esp in burnt area
Rabbit activity, Rubbish dumping,
Degraded edge effects

Banksia/Jacksonia/Hardenbergia, Bossiaea, Melspk, Schinus, Dasybasis
Stirlat, Gompholobium, Lyginia/imberbis, Phl cil, Conniferae
Xanthorrhoea, Eucalyptus, Alexnit (upslope), Adecug (upslope),
* Rabbit Grass, * Gladiolus, Acaspl, Lepiaggygium

BUSHLAND PLANT SURVEY RECORDING SHEET 1- use pencil only

BUSHLAND AREA Guildford Cem SITE NUMBER 3

DATE TRIP 16/2/01 RECORDERS

DATE TRIP RECORDERS

DATE TRIP RECORDERS

BOTANIST

1. LOCATION of the QUADRAT

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

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

N

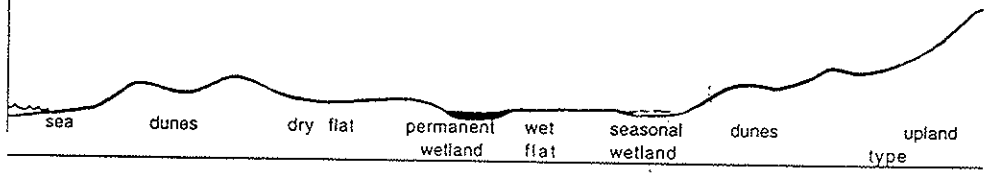
Road Location

Geographic Location Latitude S Longitude E Altitude

Reference Map

Photograph Photographer's Name Photo No

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



2. SITE DATA Circle the correct response.

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

Surface Soil *Colour*

Exposed rock *type* % surface

Sub-surface Soil *Colour*

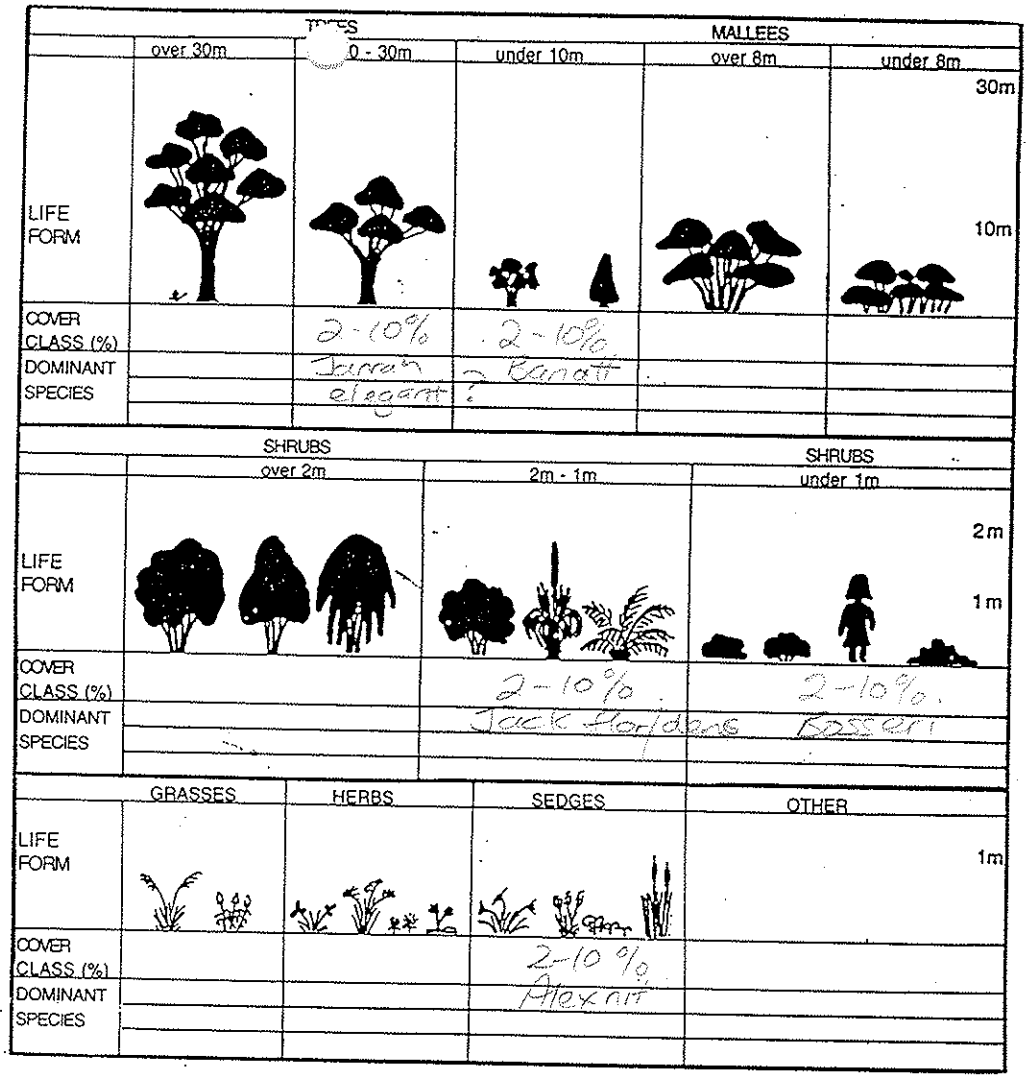
Rock *type* depth to rock

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

Litter % cover

Depth cm

Bare Ground %cover



4. VEGETATION CONDITION

1 'PRISTINE'		COMMENTS V.G-Ex. Regeneration occurring * Eragrostis or Western edge * Weed grass
2 EXCELLENT	I	
3 VERY GOOD		
4 GOOD		
5 DEGRADED		

Banksia, Acacia sp, Bossiaea, Dasbrom, Milkmaids
Few dead banksias, tracks, edge effects

Petlin, Acapul, Gomfon, Bossiaea, Kangaroo Acapul, Stirlat, Hypoxis, Thysanot, Conostyl?

BUSHLAND PLANT SURVEY RECORDING SHEET 1- use pencil only

BUSHLAND AREA _____ SITE NUMBER _____

DATE TRIP _____ RECORDERS _____

DATE TRIP _____ RECORDERS _____

DATE TRIP _____ RECORDERS _____

BOTANIST _____

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

1. LOCATION of the QUADRAT

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

N

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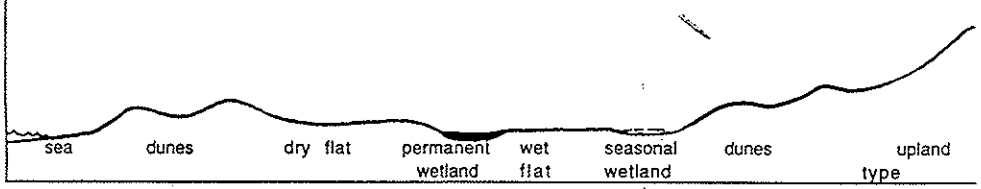
Geographic Location Latitude S Longitude E Altitude

Reference Map

Photograph Photographer's Name Photo No

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



2. SITE DATA Circle the correct response.

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

Surface Soil *Colour*

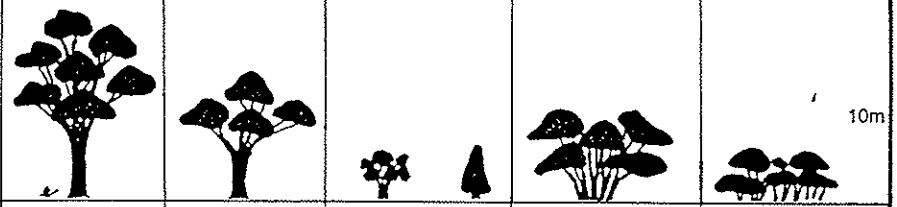
Exposed rock *type* % surface

Sub-surface Soil *Colour*

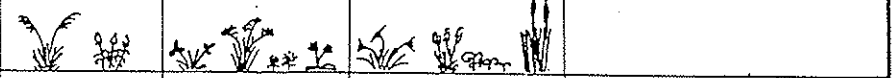
Rock *type* depth to rock

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

Litter	% cover	*Bare Ground*	%cover
Depth	cm		

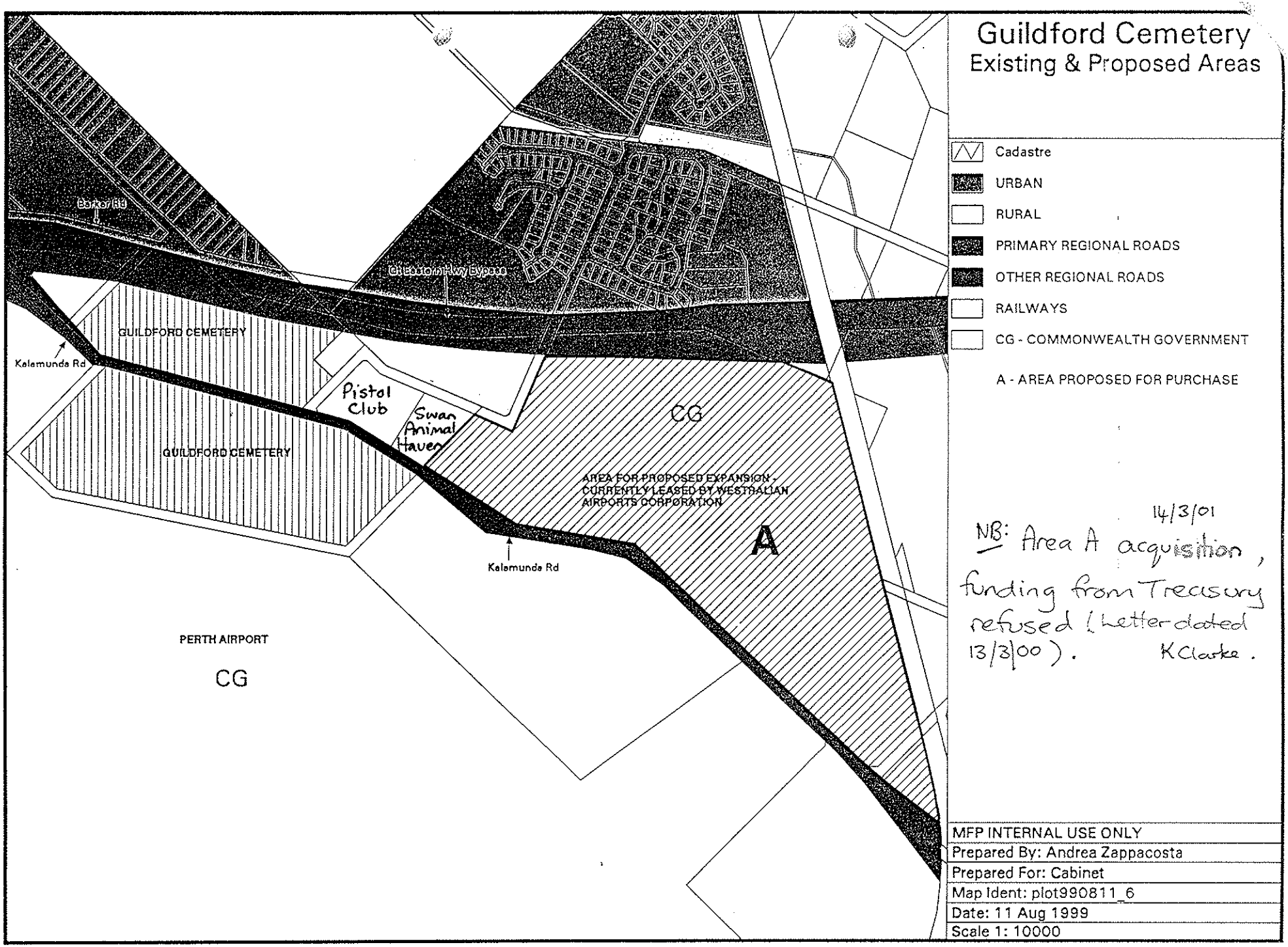
	TREES			MALLEES	
	over 30m	30m	under 10m	over 8m	under 8m
LIFE FORM					
COVER CLASS (%)					
DOMINANT SPECIES					

	SHRUBS		SHRUBS
	over 2m	2m - 1m	under 1m
LIFE FORM			
COVER CLASS (%)			
DOMINANT SPECIES			

	GRASSES	HERBS	SEDGES	OTHER
LIFE FORM				
COVER CLASS (%)				
DOMINANT SPECIES				

4. VEGETATION CONDITION

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


Guildford Cemetery
Existing & Proposed Areas
Cadastre
URBAN
RURAL
PRIMARY REGIONAL ROADS
OTHER REGIONAL ROADS
RAILWAYS
CG - COMMONWEALTH GOVERNMENT
A - AREA PROPOSED FOR PURCHASE
Boxer Rd
Great Eastern Hwy Bypass
GUILDFORD CEMETERY
Kalamunda Rd
Pistol Club
Swan Animal Haven
GUILDFORD CEMETERY
CG
AREA FOR PROPOSED EXPANSION - CURRENTLY LEASED BY WESTRALIAN AIRPORTS CORPORATION
A
Kalamunda Rd
PERTH AIRPORT
CG
14/3/01
NB: Area A acquisition, funding from Treasury refused (letter dated 13/3/00). K Clarke.
MFP INTERNAL USE ONLY
Prepared By: Andrea Zappacosta
Prepared For: Cabinet
Map Ident: plot990811_6
Date: 11 Aug 1999
Scale 1: 10000

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

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

Area M52 Name Perth Airport (? Eastern portion)

Title Report to the Australian Heritage (AHC) Commission

Published/Unpublished Date 1992

Author/s A. Weston

Location of Publication AHC

Purpose (why was the report prepared?)

Government

Corporate

Community Group

Management Plan

Soils

Units mapped described referenced

Landscape

Features described referenced

Flora

Vegetation Map

Units Broad Site based (no)

Mapped ✓

Veg Units Comparable Heddle *et al* Compared Heddle *et al.* Unit not mapped by Heddle *et al.*

Flora list

Timing %completion 50% Significant Taxa

Trees Shrubs Herbs Sedges Weeds DRF CALM Priority Other

Fauna

Timing %completion Significant Taxa

Mammals Birds Sched1 Sched2 Other

Reptiles Invertebrates

Vegatation Condition detailed, related to vegetation units

Site based Mapped Units

Disturbance Factors

Phytophthora observed Other incidental

tested itemised

Notes

REFERENCES

Attems, C.G. 1911. Myriapoda exkl. Scolopendridae. In: Michaelsen, W. and Hartmeyer, R. (eds), *Die Fauna Südwest-Australiens*, vol. **3**: 145-204. G. Fischer, Jena.

Biodiv 1993. *Program for Calculating Biological Diversity Parameters, Similarity, Niche Overlap and Cluster Analysis*. Pensoft, Sofia.

Dell, J. and How, R.A. 1988. Mammals of the Darling Scarp. *West. Aust. Nat.* **17:** 86-93.

Dell, J. and How, R.A. 1996. Painted Button-quail on the Swan Coastal Plain. *West. Aust. Nat.* **21**: 87-88.

Gibson, N., Keighery, B.J., Keighery, G.J., Burbidge, A.H. and Lyons, M.N. (1994). *A Floristic Survey of the Southern Swan Coastal Plain*. Unpublished Report for the Australian Heritage Commission.

Harvey, M.S., Waldock, J.M., How, R.A., Dell, J. and Kostas, E. (1997). Biodiversity and biogeographic relationships of selected invertebrates from urban bushland remnants, Perth, Western Australia. *Memoirs of the Museum of Victoria* **56**: 275-280.

Harvey, M.S. and Yen, A.L. 1989. *Worms to Wasps: an Illustrated Guide to Australia's Terrestrial Invertebrates*. Oxford University Press: Melbourne. 201 pp.

AIRPORT STUDIES OF FAUNA

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., Harvey, M.S., Dell, J. and Waldock, J. (1996). Ground Fauna of Urban Bushland Remnants in Perth. Rept. Australian Heritage Commission, 103pp.

Keighery, G.J., Harvey, J. and Keighery, B.J. 1990. Vegetation and flora of Bold Park, Perth. *West. Aust. Nat.* **18**: 100-121.

Keighery, G.J. and Keighery, B.J. 1991. *Floristics of Reserves and Bushland Areas of the Perth Region (System 6). Parts II- IV*. Wildflower Society of Western Australia, Perth.

Keighery, G.J. and Keighery, B.J. 1993. *Floristics of Reserves and Bushlands of the*

SITE LOCATION

Suggested name of area (1996)

System 6 (1984): M52 Part System area bushland, only bushland described

Some Other Commonly used Names:
Perth Airport

Area (ha):
Total 2070+, bushland 653 (GIS)

Local Authorities (Suburb)
Shire of Swan, Shire of Kalamunda, City of Belmont

Zoning (MRS & town planning)
PP- Commonwealth

Ownership categories: Street name, Lot number

LANDFORM AND SOIL

Landscape features: vegetated wetland, vegetated uplands

Geomorphology and soils

Pinjarra Plainπ
Guildford formation (Qpa: FS, Ms2, Mgs1, Cs, Sc, C2, S11) (Qha: Cp, S14, Msc1)

Bassendean Dunes
Bassendean sands (Qpb: S8)

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

Wetlands (within the Quindalupß Spearwood Bassendean Dunes Pinjarra Plain)
Holocene swamp deposits (Qhw: Cps, Scp, Spc, Spm, Ms5) (Qrw: Sp1, Sp2)

REGIONAL VEGETATION AND FLORA

Vegetation Complex

Pinjarra Plain
Guildford Complex

Bassendean Dunes
Bassendean Complex - Central and South

Combinations of Bassendean Dunes/Pinjarra Plain/Spearwood Dunes
Southern River Complex

Floristic Community Types:

Supergroup 2 - Seasonal Wetlands

4 *Melaleuca preissiana* damplands
5 Mixed shrub damplands
7 Herb rich saline shrublands in clay pans
12 *M. teretifolia* and / or *Astartea* aff. *fascicularis* shrublands

Supergroup 3 - Uplands, centred on Bassendean Dunes and the Dandaragan Plateau

20a *Banksia attenuata* woodlands over species rich dense shrublands
20b Eastern *Banksia attenuata* and / or *E. marginata* woodlands
23a Central *Banksia attenuata* - *B. menziesii* woodlands

REGIONAL WETLANDS

Wetland Types: lake, sumpland, dampland, palusplain, artificial channel

Consanguineous suite

Bassendean - Pinjarra transition OR Bassendean with fluvial features
Mungala (B/P.2)

Wetland Management Objective: Conservation, Resource Enhancement, Multiple Use

Lake EPP: 38ha

THREATENED COMMUNITIES

Endangered (floristic community type 20a, 20b), Vulnerable (floristic community type 7)

AREA DESCRIPTION

Vegetation and Flora

Structural units: detailed survey (mapping, Tingay and Associates 1994b and DEP sites)
Eucalyptus calophylla Woodland, *E. marginata*.Woodland, *E. rudis* Woodland, *Banksia attenuata*, *B. menziesii*. and *Allocasuarina fraseriana* Woodland, *Banksia attenuata*, *B. menziesii*. and*B. ilicifolia* Woodland, *B. littoralis* Woodland, *Melaleuca preissiana* Woodland, *M. raphiophylla* Woodland, *M. raphiophylla* and *E. rudis* Forest, *Jacksonia* Shrubland,*Adenanthos* Shrubland,*Regelia* Shrubland, *Hakea* Shrubland, *Kunzea* Shrubland, *Astartea Shrubland, Pericalymma* Shrubland, *Melaleuca* Shrubland, Mixed Shrubland, *Acacia* Shrubland, *Leptocarpus* Sedgeland, *Baumea* Sedgeland,*Typha* Sedgeland

Vegetation Condition: >60% Excellent to Very Good with <40% Good to Degraded

Total Flora: 230 (Tingay and Associates 1994b, estimated >50% expected flora)

DRF/Priority - GIS: 4 ID 6012, 6009, 5996

DRF/Priority and significant flora from survey - *Eucalyptus marginata* subsp. *elegantella* (1), *Myriophyllum echinatum* (3), *Stylidium longitubum* (3), *Haemodorum loratum* (3), *Conostephium minus* (4), *Villarsia submersa* (4), *Verticordia lindleyi* subsp. *lindleyi* (4)
Platysace juncea, *Byblis gigantea*, *Conospermum triplinervium*(hybrids with *C. undulatum*).

Fauna
Mammals: Honey Possum (*Tarsipes rostratus*) 2324, Quenda (*Isoodon obesulus*)
Survey (How and Dell 1993, 1994, Tingay and Associates 1994a, Dell 1995): 8 frog species (typical assembalge of the eastern side of the Plain); 87 bird species (7 of which are uncommon on the Plain, only two 2 other areas match the species richness in the PMA, in top 6% of wetlands for breeding species); 2 species of native freshwater fish; 22 reptiles and a 1970 record of Western Swamp Tortoise (*Pseudemydura umbrina*); Echidna (*Tachyglossus aculeatus*) sighted, large populations of Quenda.
Linkage: Fragmented bushland linkage to north west to Swan and south east to M53. Bushland in System area fragmented linkage opportunities available within System area boundary trough revegetation.

Special Attributes:
Register of the National Estate Interim List. Munday Swamp and adjacent lands and lands to the north are considered to be of Aboriginal heritage value (Australian Archaeological Survey Consultants 1995), a series of wetlands are suitable for Western Swamp Tortoise release (Kuchling 1995).

INTERNATIONAL AND NATIONAL SIGNIFICANCE
Not listed

CONSERVATION RECOMMENDATIONS
Criteria met for inclusion: Representation of ecological communities, Diversity, Rarity, Maintaining ecological systems or natural processes, Scientific or evolutionary importance, General criteria for the protection of wetland, streamline and estuarine fringing and coastal vegetation, Criteria not relevant to determination of conservation value, but which may be applied when evaluating areas having similar values
Constraints: Private land, MRS Urban zoning, Mineral Resource Area, Mineral Lease,
Recommendation:

Draft Only

Robert Hosking
Airport Environment Officer
Perth Airport
PO Box 130, Belmont, WA 6984
Ph. 9479 5160 Fx. 9479 5180

Your Ref	E60 114 (& 4-10-2000)
Our Ref	PB185
Enquiries	Mr Gary Whisson

Dear Robert,

PERTH INTERNATIONAL AIRPORT –
Development Proposals to complement freight area developments to the south-east of the junction of Grogan Road & Horrie Millar drive.

Summary

Much of the area is degraded and of limited conservation value; however the wetland through the centre has a core which has species richness and habitat structure. The wetland's values and the connectivity of habitat across this area would be lost with clearing of the whole area. In addition the area is part of the southern rivers vegetation complex, and which is not adequately protected (a point which is not mentioned by Bennett Consulting). The presence of a range of vegetation from the Southern Rivers Complex and the Bassendean Central & South is one of the important features of the Airport vegetation.

The values in this part of the proposed development area must be balanced against the nature of the proposed development. If it is a secondary function to airfield and terminal operations there is less justification for diminishing biodiversity further.

In those areas where only scattered trees remain the DEP urges that the WAC attempt to incorporate most of them into design. They are likely to be used by birds for movement and feeding.

The DEP urges that a management plan and program for all the Airport bushland is developed in consultation with DEP and CALM is implemented as a matter of priority.

In terms of the bushland at the airport, the W.A.C. needs to be constantly mindful that it is custodian of a significant repository of biodiversity, and that it is in a position to safeguard it within its structure for the future of the area and the state.

The area to the south-east of the junction of Grogan Rd & Horrie Millar Drive

In terms of Perth's Bushplan this is a non-core area at Perth Airport which appears to have had no specific scrutiny (Dept. of Environmental Protection 1998; Alan Tingay & Assoc. 1994; Trudgen 1995). It is one of the most insular parts of the total area. It does not consolidate a larger block of vegetation.

Rather its main function is to conserve the wetlands to the south of Grogan Road near the Horrie Millar Drive intersection. The three wetlands examined by Bennett Environmental Consulting Pty Ltd (2000) were identified for conservation in 1996 (Hill et al 1996a, 1996b) and verified in 1997 (Semeniuk 1997 – using field & aerial checks). The 1997 mapping matches that of Bennett Consulting and does not include the two completely degraded areas ("disturbed1" & the orchard). While the "orchard" is mapped as cleared and thus not an area proposed to be protected in Bushplan (even though it is within the boundary of the site) the vegetation mapping in Bushplan incorrectly maps Bennett's Disturbed Area 1 as bushland. It is accepted that degraded area 1 does not have significant conservation values. "Disturbed area 1" now features pasture weeds and some Melaleuca preissiana trees. It may be possible to categorise this area as dampland, but it is not a repository for biodiversity or significant habitat. Similarly the orchard is little more than olives and grasses. **The two completely degraded parts amount to over half the area.**

The main feature of the area surveyed by Bennett Environmental Consulting Pty Ltd (2000) is a dampland with low shrubland (wetland 2) and an adjacent Banksia woodland. The condition was given as degraded; which means most of the understorey is replaced by weeds. The number of species found at the wetland in early August was 46.

Following a site visit on 23/11/2000 the DEP was able to find an additional 17 species in the shrubland/wetland area, making a total of 63 species. This was with limited searching of a third of the core wetland vegetation. **An intensive search would have been likely to find more, which would have put the diversity in this area higher than that at wetland 1** (in terms of species richness).

Native species totals

On the basis of Appendix B (Bennett Consulting Pty Ltd 2000) there are 142 plant species listed of which 102 are natives (this compares with the erroneous 140 and 97 tallied in the discussion). Taking these base figures it is possible to estimate that the area potentially has 131 native species. This would be a relatively high number for a small area. It represents a significant proportion of the 295 species found at the airport to date (DEP 1998).

In terms of condition it was clear that much of the periphery to the wetland was in a degraded condition with thick invasive weeds. However, the core wetland area with the shrubland had relatively few weeds (about 5% cover of *Eragrostis* and minor *Erhartia*) and virtually all the elements of the original communities appeared to be present. This included annual species. **The DEP found that the condition rating for this core would at least have been good** (the basic vegetation structure or the ability to regenerate it was retained).

Clearly wetland 2:

- **contains significant biodiversity and most of the original genetic stock.**
- **has good condition in the core.**
- **forms a link to the wetland on the other side of Horrie Millar Drive:**
  - **by pollination by honeyeaters, wasps and other species. (honeyeaters are highly mobile and utilise vegetation corridors) possibly also hydrologically.**
- **is connected to the body of the wetland to the south-east (as mapped by Semeniuk) and this:**
  - **compensates for the small size of the core good area, and**
  - **enhances its value as a corridor.**

It is the conservation values in the wetland that would be lost with the development of this area.

The two wetlands immediately adjacent to the area are significant to conservation. The one to the south-west of the intersection (wetland 1) is in good condition which imparts conservation significance to it within the airport. The other to the south of the area (wetland 3) is well reserved but vulnerable (Gibson et al 1994; English & Blythe 1997). (This is according to Bennett Environmental Consulting Pty Ltd (2000), who place it in community 15. This community type is saline and has saltbush and fewer of the dominants. However, it does have dominants more typical of Community Type 14 (*Melaleuca rhaphiophylla*, *Eucalyptus rudis*, *M. preissiana*, which is listed as unreserved and has a conservation status of insufficiently known (Gibson et al 1994; English & Blyth 1999)). Gibson et al (1994) have undertaken the most extensive work on the coastal plain to date; so that the fact that this vegetation type has been hard to find and remains data deficient indicates that it is potentially of high conservation significance.

The majority of the bushplan site

Perth Airport has the largest area of bushland in the local area of Belmont and several adjacent municipalities. It is one of the largest remnant areas in the the inner metropolitan area. The bushland in the airport has been recognised for the habitat it contains since 1983 (System 6, Dept. of Conservation & Environment). This has been elaborated in a series of subsequent studies, some of which sampled select areas (Alan Tingay & Associates 1994*; Connell 1995; Keighery, 1995*; Kulching & Burbidge 1996; ANCA 1996; Trudgen 1995*; DEP 1996*, 1997*, 1998; [* - contain vegetation mapping]). In short there is sufficient quantification from a range of groundwork to outline the range of vegetation and plant species present at the airport, and the values that need to be conserved. However, the small-scale detail of mapping needs to be improved.

References

Australian Nature Conservation Authority (1996) A directory of important wetlands in Australia, second edition. Canberra.

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Department Of Environmental Protection (1997) Survey records. Unpublished notes.

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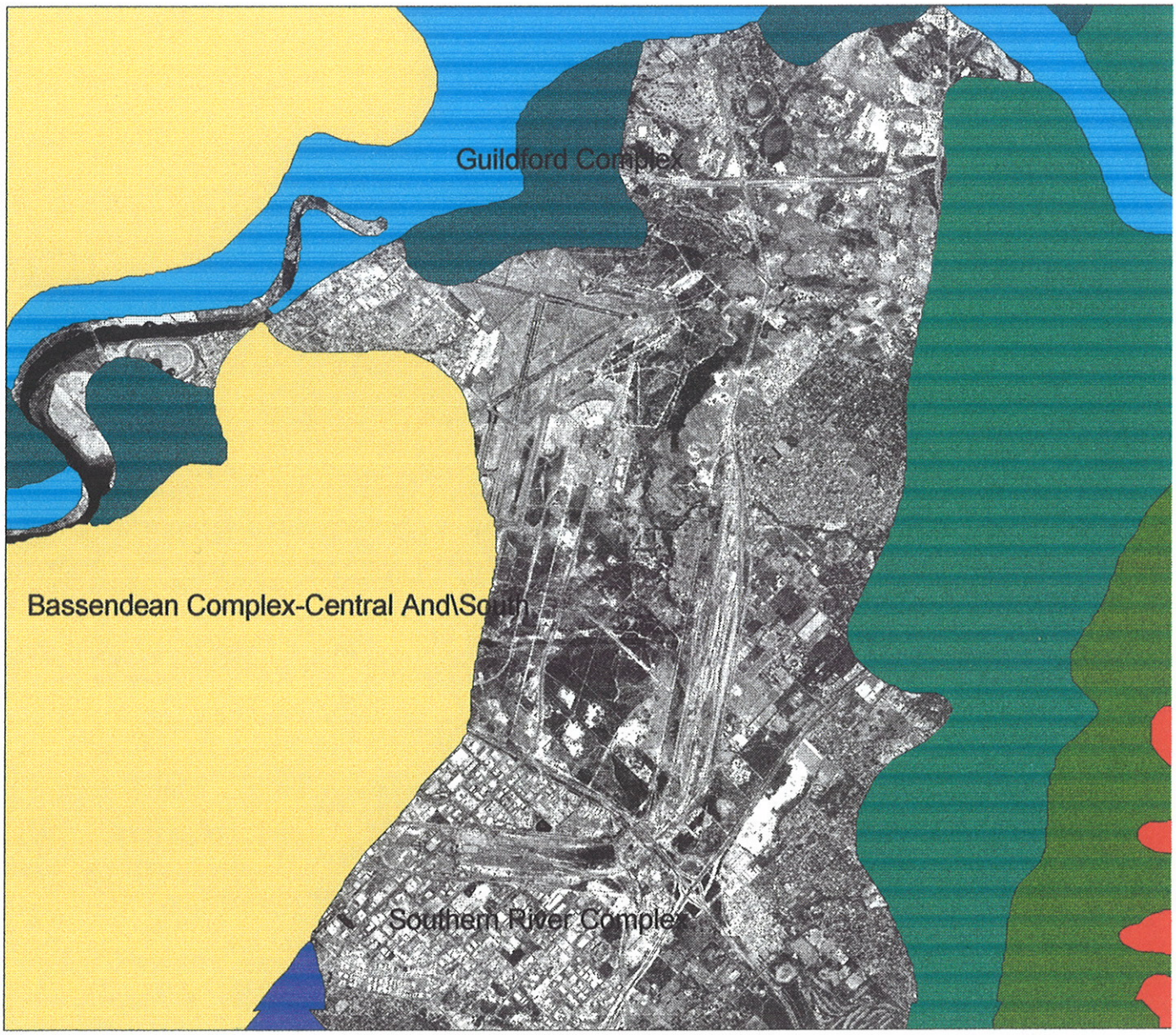
D) A position needs to be created which has responsibility for day to day management of the bushland at Perth Airport. Particularly at the stage where the restoration and reservation of the main body of bushland is occurring. In short there needs to be someone to take ownership of bushland issues and to promote conservation.

EXAMPLE OF CONSTRAINTS IN DATA

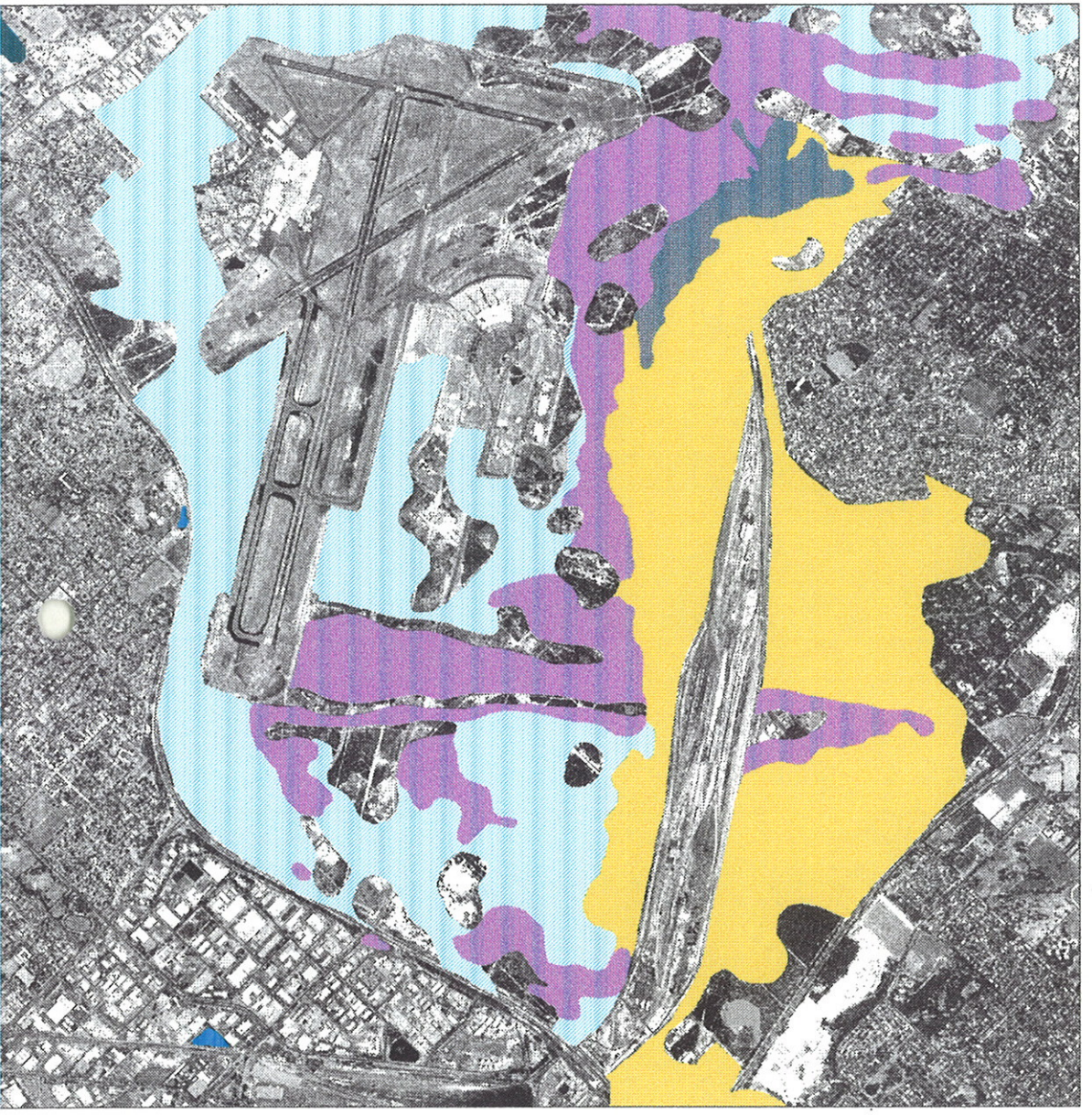
Trudgen 1995 emphasizes the presence of flora from the eastern side of the plain, indicatiing alluvial soils in the area. These are floristically allied to the Bassendean Sands, Pinjarra Plain and eastern sands. (N.B. His work was constrained by limited sampling time and a dry year. So only a few sites, 7, were installed, and a minority of vegetation types were sampled. Only 60% of taxa were believed to be sampled.)



Heddle Vegetation ~~Complexes~~

Perth Airport.

Southern River Complex is clear.



SEMENIUK'S BASIN WETLANDS

Semeniuk's 2000 Basin Wetland Types
- Artificial Lake
- Creek
- Dampland
- Estuary, shoreline
- Estuary, waterbody
- Floodplain
- HOLE
- Lake
- NA
- Not Classified
- Paluslope
- Paluplain
- River
- Sumpland
- Highland

DEP Internal Use Only

0 900 1800 Meters

1:41566

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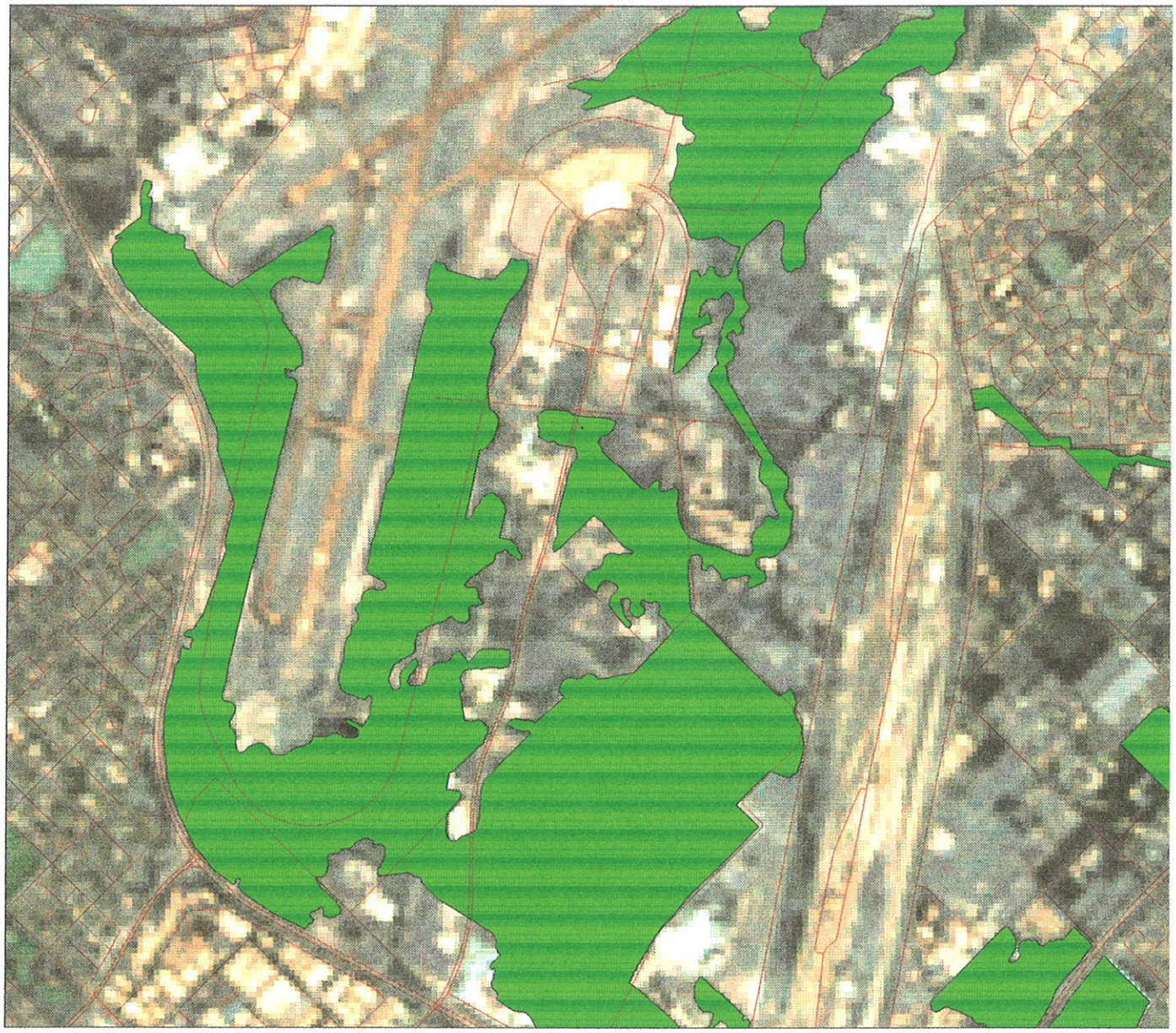
Department of Environmental Protection, Western Australia



N

0 600 1200 Meters

1:29189

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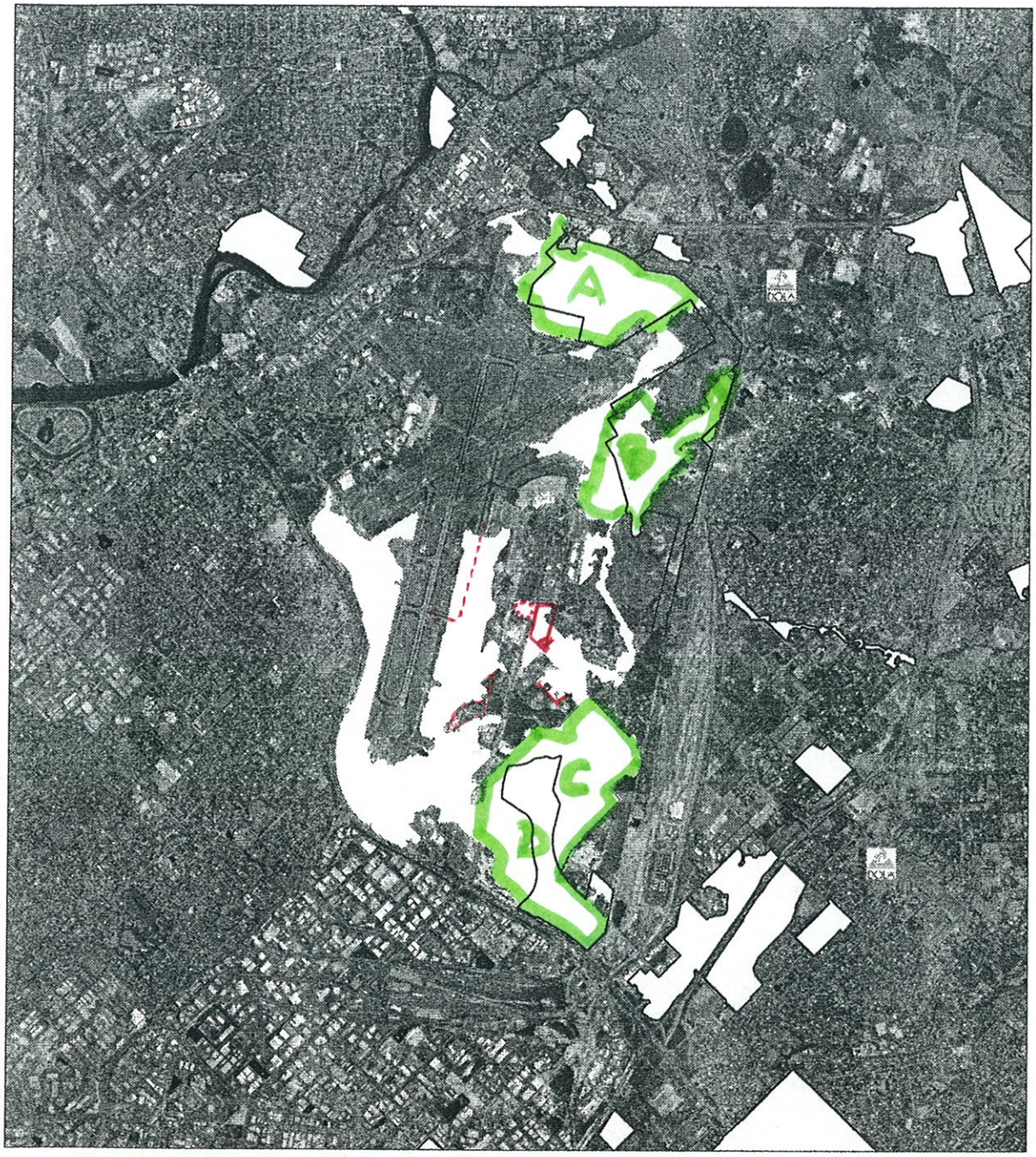
outside DEP without consultation

Projection: Australian Map Grid

BUSHPLAN BOUNDARIES FROM GIS.

(2000)



Key

Perth Airport Master Plan boundary

Draft Perth's Bushplan boundaries

DOLA Orthophotos 1999

PRECINCTS A - D
NOTE MUCH LESS THAN BUSHPLAN

N

0 1 2 Kilometers

Projection: Australian Map Grid

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This map has been produced using various data from other agencies. No responsibility is accepted for any error or omission.

Department of Environmental Protection, Western Australia

28 TOT

*6 WEED

22 NATIVE

○ ← ADDITIONAL SPECIES FOUND BY DEP VISIT 23/11/2000

Count of PRESENCE	AREA							
SPECIES	Banksia	Disturbed 1	Disturbed 2	Orchard	Wetland 1	Wetland 2	Wetland 3	Total
Acacia applanata						1		1
Acacia huegelii	1							1
Acacia pulchella var. *pulchella*	1					1		2
Acacia saligna					1			1
Adenanthos cygnorum	1		1			1		3
Alexgeorgia nitens	1				1			2
Allocasuarina humilis	1					(1)		1
**Amaryllis belladonna*							1	1
Amphipogon turbinatus	1					(1)		1
Anigozanthos humilis	1					(1)		1
Aotus procumbens	1						1	2
**Arctotheca calendula*		1						1
Arthropodium sp.					1			1
**Asparagus asparagoides*					1			1
Astartea fascicularis					1		1	2
**Aster subulatus*					1			1
**Avena barbata*						1		1
Banksia ilicifolia	1			1				2
Banksia littoralis							1	1
Banksia menziesii				1				1
Boronia ramosa subsp. *anethifolia*	1				1	1		3
**Briza maxima*					1	1	1	3
Burchardia ~~umbellata~~ congestata	1					(1)		1
Burtonia eriocarpa	1							1
Caladenia flava	1							1
Calytrix flavescens	1							1
Calytrix fraseri	1				1	1		3
Cassytha racemosa					1	(1)		1

Anigozanthos manglesii

A viridus ~~ssp?~~

? (Cartonema phyllidoides)

(1)

+6

Count of PRESENCE	AREA							
SPECIES	Banksia	Disturbed 1	Disturbed 2	Orchard	Wetland 1	Wetland 2	Wetland 3	Total
*Chamelaucium uncinatum	1							1
Chordifex sinuosus	1							1
Conostephium minus (P4)	1							1
Conostephium pendulum	1							1
Conostylis aurea	1							1
Conostylis serrulata	1				1			2
*Conyza bonariensis					1			1
*Conyza parva							1	1
*Cortaderia sellooana					1			1
Corymbia calophylla		1			1			2
*Cotula coronopifolia		1						1
Crassula colorata	1							1
Cyathochaeta avenacea						1	1	1
*Cynodon dactylon		1	1		1	1	1	5
*Cyperus congestus					1			1
Cytogonideum leptocarpoides	1				1	1		3
Dampiera linearis	1				1	1		3
Dampiera trigona					1			1
Dasypogon bromeliifolius	1				1	1		3
Daviesia hakeoides	1							1
Daviesia triflora	1							1
Drosera menziesii	1							1
Drosera platystigma							1	1
Drosera zonaria	1		1					2
Dryandra lindleyana						1		1
*Ehrharta calycina		1	1	1	1	1	1	6
*Ehrharta longiflora	1		1			1	1	4
*Pennisetum clandestimun					1			1
*Eragrostis curvula	1	1	1	1		1	1	6
Eragrostis elongata					1		1	2

Count of PRESENCE	AREA							
SPECIES	Banksia	Disturbed 1	Disturbed 2	Orchard	Wetland 1	Wetland 2	Wetland 3	Total
Eremaea pauciflora	1					1		2
**Eucalyptus citriodora*						1		1
**Eucalyptus grandis*						1		1
**Eucalyptus macrandra*						1		1
Eucalyptus rudis						1		1
Eucalyptus todtiana	1						1	2
Euchilops linearis	1				1	1		3
**Gladiolus caryophyllaceus*	1		1		1	1	2	6
Glischrocaryon flavescens							1	1
Gompholobium tomentosum	1		1		1	1		4
Haemodorum sparsiflorum					1			1
Haemodorum spicatum					1	1		2
Hakea varia					1	(1)		1
Hemiandra pungens	1							1
Hibbertia huegelii	1							1
Hibbertia hypericoides	1							1
Hibbertia subvaginata	1							1
**Homeria flaccida*		1						1
Hovea trisperma	1							1
Hypocalymma angustifolia	1				1	1		3
**Hypochoeris radicata*	1	1	1		1	1		3
Hypolaena exsulca	1				1	1	1	6
Jacksonia densiflora	1				1	1	1	4
Jacksonia furcellata	1							1
Johnsonia pubescens	1				1	1		3
**Juncus microcephalus*					1			2
Juncus pallidus		1			1		1	2
Kunzea vestita	1				1			2
Laxmannia ramosa	1							1
Lechenaultia floribunda					1	1		3
Lepidosperma longitudinale						1		1
					1			1

32 *15 17

Count of PRESENCE	AREA							
SPECIES	Banksia	Disturbed 1	Disturbed 2	Orchard	Wetland 1	Wetland 2	Wetland 3	Total
*Leptospermum laevigatum					1	1		1
Leucopogon conostephioides	1							1
Lomandra caespitosa	1							1
*Lupinus angustifolia			1			1	1	3
*Lupinus consentinii							1	1
Lyginia barbata	1					1	1	3
Macrozamia riedlei	1							1
*Medicago sp.		1						1
Meeboldina cana					1			1
*Melaleuca nesophylla					1			1
Melaleuca preissiana		1			1	1	1	4
Melaleuca rhaphiophylla							1	1
Melaleuca seriata	1				1	1		2
Melaleuca teretifolia							1	1
*Narcissus tazetta							1	1
Nuytsia floribunda	1					1		2
*Ornithopus compressus		1						1
*Oxalis pes-caprae	1						1	2
*Paspalum dilatatum					1			1
Patersonia occidentalis	1				1	1	1	4
*Pelargonium capitatum					1			1
*Pennisetum curvula					1			1
Pericalymma ellipticum					1	1	1	3
Petrophile linearis	1							1
Philotheca spicata	1					1		2
Phlebocarya ciliata					1	1		2
*Plantago lanceolata					1			1
Pterostylis vittata	1					1		1
Quinetia urvillei	1				1	0		2
*Romulea rosea	1		1			1	1	4
*Rumex crispus		1			1			2
*Sagina apetala							1	1

Pterostylis sp.
Restio leptocarpoides

+4

21 *1 20

Count of PRESENCE	AREA							
SPECIES	Banksia	Disturbed 1	Disturbed 2	Orchard	Wetland 1	Wetland 2	Wetland 3	Total
Scheonus efoliatus					1			1
**Schinus terbinthifolia*	1				1			2
Schoenus curvifolius	1							1
Schoenus efoliatus						1	1	1
Scholtzia involucrata	1					1	1	3
Sochus oleraceus					1			1
Solanum nigrum	1				1			2
Sparaxis bulbifera					1			1
Stirlingia latifolia	1					1		2
Stylidium repens	1					1		1
Synaphaea spinulosa	1							1
Thysanotus arenarius					1			1
Thysanotus manglesii	1							1
Thysanotus multiflorus					1	1		2
Thysanotus sparteus	1							1
Tribonanthes longipetala					1	1		1
Triglochin procera					1			1
Ursinia anthemoides	1		1		1	1		4
Verticordia densiflora					1	1	1	3
Watsonia bulbillifera	1	1			1	1		3
Xanthorrhoea preissii	1				1	1		3
Grand Total	74	14	12	4	66	46	35	251

? +P3 Schoenus sp

Siloxerus humifusus

Stylidium brunonianum

T. australis

P3 V. lindleyi ssp. lindleyi

142 TOTAL

102 NATIVES

+17 total

63

~28% not found

+5

MEMORANDUM

PLANNING
WESTERN AUSTRALIA
Ministry for Planning

TO: Bridget Hyder-Griffiths

FROM: Sean Collingwood - Bushplan

SUBJECT **Bushplan Site No. 386 - Rationalisation of Bushplan Site Boundary at Guildford Cemetery**

FILE NUMBER/S: BPS No. 386
805/2/1/32PV3

DATE: 2 March 2000

As part of strategic negotiations with the Metropolitan Cemeteries Board, I have been asked to investigate the possibility of rationalising the boundary for Bushplan Site No. 386 where it affects the Guildford Cemetery, north of Kalamunda Road (refer Attachment 1).

Bushplan mapping indicates that this area of the Bushplan site:

- is affected by a transitional zone between the Guildford and Southern River Vegetation Complexes;
- the vegetation is identified as the Southern River Complex;
- recent aerial photography indicates that a large portion of this mapped area has been cleared for cemetery uses (leaving approximately 1.5 hectares of vegetation) and is separated from the remainder of the Bushplan site by Kalamunda Road; and
- wetland mapping suggests that this area does not form a part of any significant wetlands.

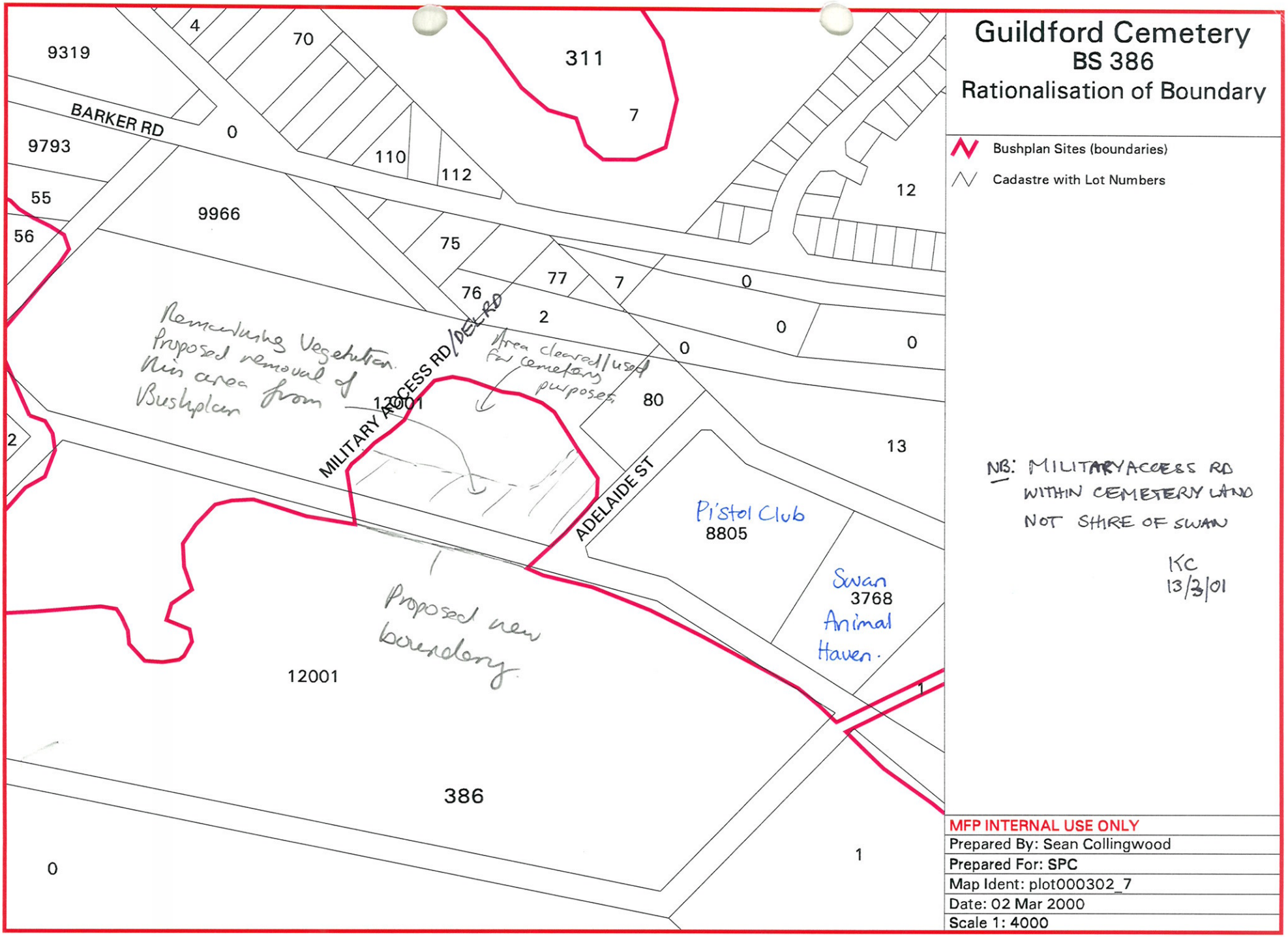
Please find attached mapping indicating the above.

Could you please advise your position on removing this section from the Bushplan site taking into consideration our strategic negotiations with the MCB and the ability to effectively manage the long term viability of this area of vegetation as part of the entire Bushplan site.

You can contact me on 9264 7773 to discuss.

DEPARTMENT OF ENVIRONMENTAL PROTECTION
- 8 MAR 2000
File No 1 PB185 Name B HYDER-GRIFFITHS
File No 2 _____ Name _____
File No 3 _____ Name _____

157685



Guildford Cemetery
BS 386
Rationalisation of Boundary

Bushplan Sites (boundaries)

Cadastre with Lot Numbers

NB: MILITARY ACCESS RD WITHIN CEMETERY LAND NOT SHIRE OF SWAN

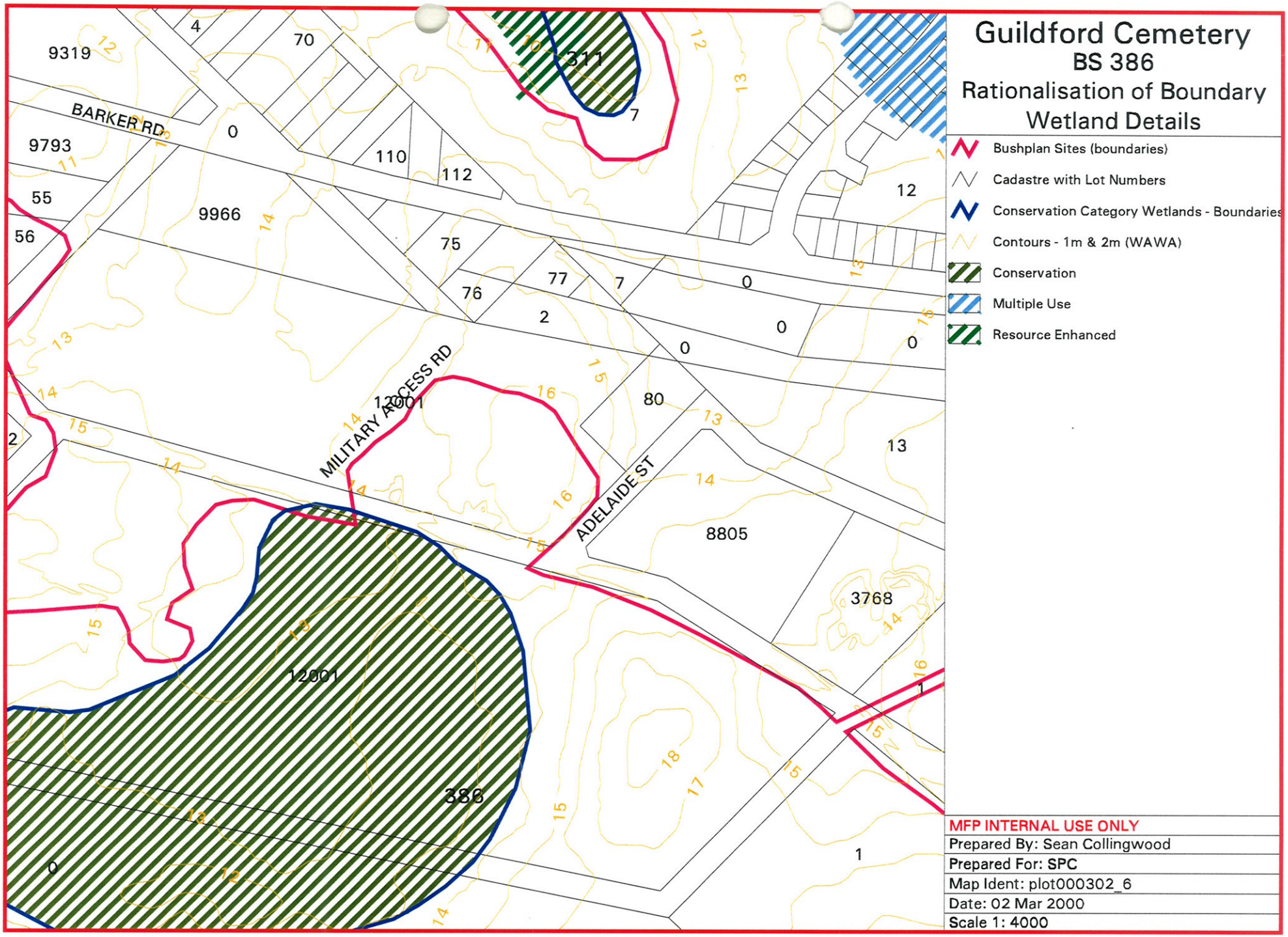
KC
13/3/01

MFP INTERNAL USE ONLY
Prepared By: Sean Collingwood
Prepared For: SPC
Map Ident: plot000302_7
Date: 02 Mar 2000
Scale 1: 4000

Guildford Cemetery
BS 386
Rationalisation of Boundary

- Bushplan Sites (boundaries)
- Cadastre with Lot Numbers Blue - Overlay Ima
- Conservation Category Wetlands - Boundaries
- Contours - 1m & 2m (WAWA)

MFP INTERNAL USE ONLY
Prepared By: Sean Collingwood
Prepared For: spc
Map Ident: plot000302_4
Date: 02 Mar 2000
Scale 1: 4000


Guildford Cemetery
BS 386
Rationalisation of Boundary
Wetland Details
Bushplan Sites (boundaries)
Cadastre with Lot Numbers
Conservation Category Wetlands - Boundaries
Contours - 1m & 2m (WAWA)
Conservation
Multiple Use
Resource Enhanced
BARKER RD
MILITARY ACCESS RD
ADELAIDE ST
9319
4
70
311
7
9793
0
110
112
12
55
9966
56
75
76
77
7
0
2
0
0
0
80
13
8805
3768
1
1
12001
386
0
MFP INTERNAL USE ONLY
Prepared By: Sean Collingwood
Prepared For: SPC
Map Ident: plot000302_6
Date: 02 Mar 2000
Scale 1: 4000

CONSERVATION BRANCH
DEPARTMENT of ENVIRONMENTAL PROTECTION

Memorandum

ATTENTION:	Sean Collingwood/Kieron Beardmore
FROM:	Karen Clarke/Bronwen Keighery/Gary Whisson/Nick Woolfrey
DATE:	22 March 2001
SUBJECT:	BS 386, Guildford Cemetery Car Park Proposal
FILE NO:	PB185/1

N Woolfrey 27/3/01

Due to the widening of Kalamunda Rd the Metropolitan Cemeteries Board (MCB) is proposing to build a car park at Guildford Cemetery, on the southern side of Kalamunda Rd, for the safety of patrons. Guildford Cemetery is part of Bush Forever Site 386. The area proposed for the car park is a triangle of remnant vegetation to the south of Kalamunda Rd bounded by the existing graveyard to the west and a fire-break to the east (see Figure 1). This triangle is approximately 4000 m^2 and contains regionally significant vegetation identified in Bush Forever for protection.

The conservation values of Bush Forever Site 386 are detailed in Appendix 1. The mapping of Heddle *et al.* (1980) shows the area as Southern River Vegetation Complex. Keighery (1998) has previously documented the high conservation value of the Guildford Cemetery part of Site 386 (see Appendix 2). Six plant communities were identified by Keighery (1998), 3 upland and 3 wetland communities. These communities are representative of the following Floristic Community Types (FCT): 5, 12, 20a and 20b. The latter two FCT's occur as upland communities and are Threatened Ecological Communities (TEC) classed as Endangered. Nine significant taxa were also recorded which are associated with plant communities typical of the eastern side of the Swan Coastal Plain (Keighery 1998). The Guildford Cemetery is entered on the Register of the National Estate. The wetland communities have also been proposed as an important translocation site for the critically endangered Western Swamp Tortoise.

A field inspection of the area proposed for the car park was made by Karen Clarke and Sean Collingwood (MfP) on 16/2/01. Approximately one hour was spent traversing the bushland on foot. Being February there were relatively few plants flowering and annually renewed plants were dormant. Therefore, vegetation condition assessments are subject to revision on a mid/late spring inspection.

Most of this triangle of land is vegetated upland which has been previously described by Keighery (1998) as *Eucalyptus marginata* subsp. *elegantella, Banksia menziesii* and *Banksia attenuata* Low Woodland. The site visit on 16/2/01 confirmed the presence of this community in the upland area and found that it was generally in Very Good to Excellent condition (see Figure 2). This community represents either Floristic Community Type 20a or 20b, most likely the latter. The FCT cannot be further determined without computer analysis of plot based data. Weed invasion was minimal and mainly limited to the edges abutting Kalamunda Rd and the cleared areas of the Cemetery. The northern corner of the remnant had been recently burnt and a central area has been cleared for the installation of several sheds. The latter is shown as Completely Degraded on Figure 2 as no remnant vegetation remains.

The remainder of this triangle of land is a vegetated wetland of *Pericalymma ellipticum, Verticordia densiflora* and *Melaleuca* sp. B Open Low Heath bordered by a transitional zone of wetland vegetation consisting of *Banksia ilicifolia* Low Open Woodland. These wetland communities are also in Very Good to Excellent condition with minimal weed invasion. The existing boundary of the Conservation Category wetland needs to

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be amended as it does not fully encompass the wetland vegetation which is of Conservation Category type and condition (see Figure 2). This matter will be referred to the Water and Rivers Commission.

Two species of significant flora were recorded in the triangle of land on 16/2/01. They were *Eucalyptus marginata* subsp. *elegantella* (Priority 2 taxon) and *Stylidium dichotomum* both of which have significance as species associated with plant communities of the eastern side of the Swan Coastal Plain. All remnant vegetation on the eastern side of the Swan Coastal Plain that has its basic vegetation structure intact is of high conservation value, despite the size of the remnant, due to heavy clearing in this area in the past (Keighery and Trudgen 1992). In addition, small areas of Floristic Community Type 20a and 20b are capable of retaining their condition due to their diverse understorey.

In conclusion, this remnant vegetation meets the criteria for regional significance and is of very high conservation value. The vegetation is generally in Very Good to Excellent condition with only small areas of severe localised disturbance at the edges and where several sheds have been installed. The upland areas are a Threatened Ecological Community and the wetland areas are a Conservation Category Wetland.

The potential for an alternative location for the car park needs to be considered at a location that does not require clearing of remnant vegetation. For example, a car park parallel to Kalamunda Rd along the verge (if space is still available after the road widening) or along internal roads within the Cemetery, both these areas are where parking currently occurs. Only if an alternative is not possible should a site that requires clearing of bushland be considered.

The remnant vegetation at the Guildford Cemetery has previously been subject to EPA assessment as part of the MCB's proposal to deviate the alignment of Kalamunda Road around the southern perimeter of the Guildford Cemetery (EPA 1999). The EPA concluded that the proposal "could not meet the EPA's objectives in relation to vegetation communities, specially protected (threatened) fauna, and wetlands, and thus should not be implemented." The MCB subsequently appealed this decision but the appeal was dismissed by the Minister for the Environment. The Ministry for Planning subsequently prepared a Road Reservation Review plan of Kalamunda Rd addressing issues such as safe access to the Guildford Cemetery on both sides of Kalamunda Rd (Letter dated 11 July 2000 from Imre Szito/ Sarkis Petrossian, MfP to Alice O'Connor, DEP: MfP Ref. No. 402/2/1/182P2V7).

The Shire of Swan and the MCB are negotiating to make land to the east of the cemetery available in the future to the MCB (see Appendix 3). The aim of these negotiations is to facilitate protection of the remnant vegetation within the existing cemetery boundary while allowing the cemetery to expand. The DEP encourages the consideration of this proposal as part of the development of an overall agreement for the protection of the bushland at Guildford Cemetery.

If the car park proposal in its existing form were to be progressed further and is considered likely to be approved by WAPC then this proposal must be referred to the EPA for consideration. If an alternative proposal is put forward that requires clearing of bushland this must also be referred to the EPA.

REFERENCES
(Unlisted references can be found in Bush Forever Volume 2)

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

EPA (1999) Kalamunda Road Realignment, Guildford Cemetery, South Guildford. Metropolitan Cemeteries Board. Report and Recommendations of the Environmental Protection Authority. Bulletin No. 933. April, 1999. (EPA, Perth, Western Australia)

Keighery, BJ (1998) Vegetation and Significant Flora Values of the Guildford Cemetery Bushland Remnant. Unpublished report for the Ministry for Planning.

Government of Western Australia (2000). Bush Forever. Volume 2 – Directory of Bush Forever Sites. (Published by the Department of Environmental Protection, Perth, Western Australia).

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

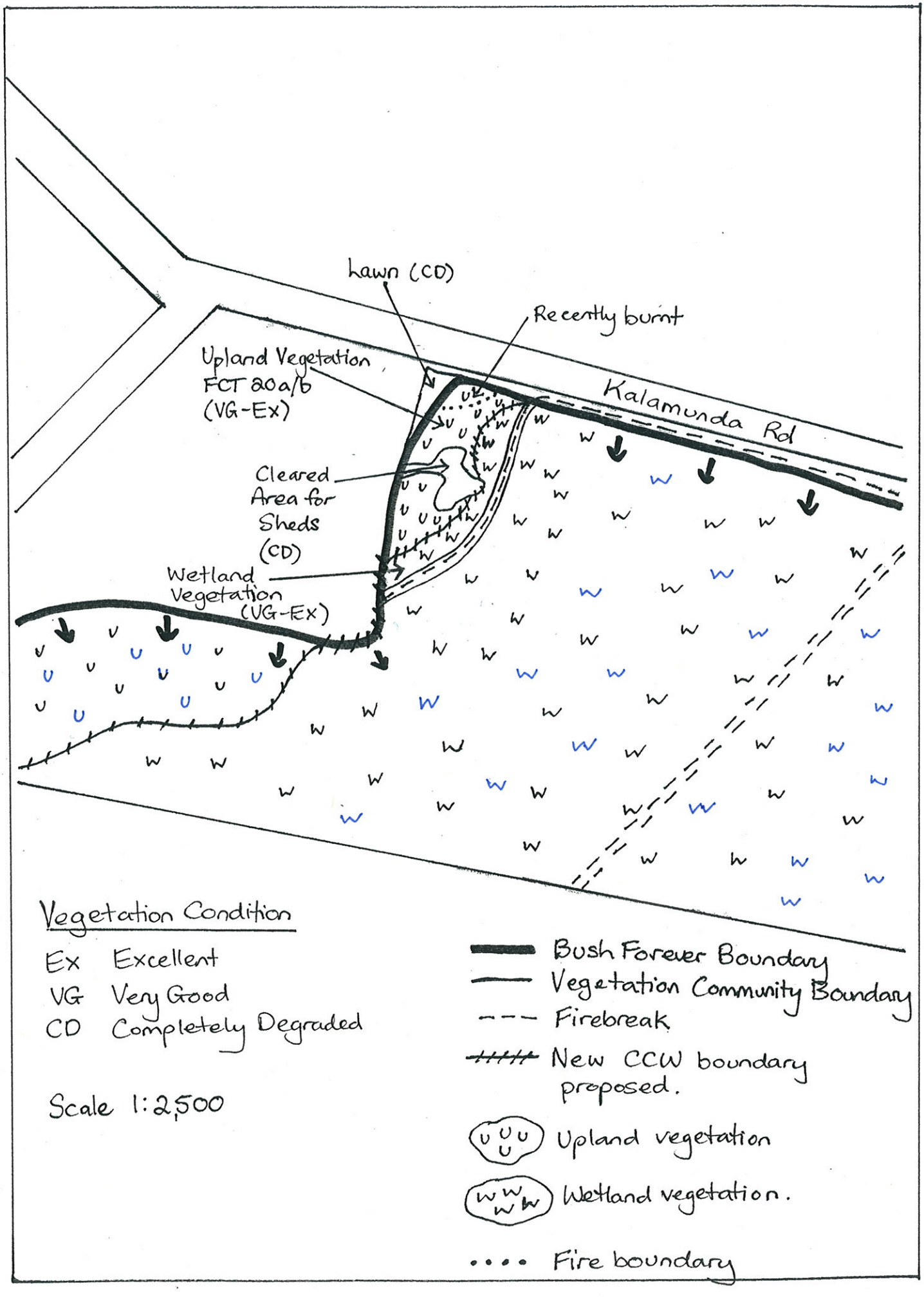
Figure 1: Location of the BS 386 Guildford Cemetery Car Park Proposal.
DEP Conservation Branch Advice to Bush Forever Inter-agency Coordination Group, March 2001. File No. 185/1.

BS 386
Guildford Cemetery
Car Park Proposal
Aerial 2000

MFP INTERNAL USE ONLY
Prepared By: Sean Collingwood
Prepared For: SPC
Map Ident: plot010216_1
Date: 16 Feb 2001
Scale 1:2500

- Cadastre with Lot Numbers
- Contours - 1m (DOLA)
- Conservation Category Wetlands
- Bush Forever Sites - Boundaries

Figure 2: Vegetation Assessment of BS 386 Guildford Cemetery Car Park Proposal. DEP Conservation Branch Advice to Bush Forever Inter-agency Coordination Group, March 2001. File No. 185/1.



PERTH AIRPORT AND ADJACENT BUSHLAND

Boundary Definition: bushland (part taken to cadastre) boundary (Boundary adjusted in response to a submission to draft *Perth's Bushplan*.)

SECTION 1: LOCATION INFORMATION

Bush Forever Site no. 386
Area (ha): bushland 629.5 (Site also includes open water.)
Map no. 43, 48, 49
Map sheet series ref. no. 2034–II SE
Other Names: not known
Local Authorities (Suburb): Shire of Swan (Perth Airport, South Guildford), Shire of Kalamunda (High Wycombe), City of Belmont (Forrestfield, Perth Airport)
System 6 (1983): M52 Part System area bushland, only bushland described

SECTION 2: REGIONAL INFORMATION

LANDFORMS AND SOILS

Pinjarra Plain
Guildford Formation (Qpa: Mgs1)
Bassendean Dunes
Bassendean Sands (Qpb: S8)
Bassendean Dunes/Pinjarra Plain
Bassendean Sands over Guildford Formation (Qpb/Qpa: S10)
Wetlands (within the Bassendean Dunes and Pinjarra Plain)
Holocene Swamp Deposits (Qhw: Cps)

VEGETATION AND FLORA

Vegetation Complexes

Pinjarra Plain
Guildford Complex
Bassendean Dunes
Bassendean Complex — Central and South
Combinations of Bassendean Dunes/Pinjarra Plain
Southern River Complex

Floristic Community Types *not sampled, types inferred

Supergroup 2: Seasonal Wetlands
4 *Melaleuca preissiana* damplands
5 Mixed shrub damplands
7 Herb-rich saline shrublands in clay pans
*11 Wet forests and woodlands
12 *Melaleuca teretifolia* and/or *Astartea* aff. *fascicularis* shrublands
*15 Forests and woodlands of deep seasonal wetlands

Supergroup 3: Uplands centred on Bassendean Dunes and Dandaragan Plateau
20a *Banksia attenuata* woodlands over species-rich dense shrublands
20b Eastern *Banksia attenuata* and/or *Eucalyptus marginata* woodlands (most northern occurrence)
23a Central *Banksia attenuata* — *B. menziesii* woodlands

WETLANDS

Wetland Types: lake, sumpland, dampland, palusplain, artificial channel, creek
Natural Wetland Groups

Bassendean—Pinjarra transition OR Bassendean with fluvial features
Mungala (B/P.2)

Wetland Management Objectives: Conservation (22ha), Resource Enhancement, Multiple Use
Swan Coastal Plain Lakes EPP: 30.4ha

THREATENED ECOLOGICAL COMMUNITIES

Not assessed, Endangered (floristic community types 20a, 20b), Vulnerable (floristic community types 7, 15)

SECTION 3: SPECIFIC SITE DETAIL

Landscape Features: open water, vegetated wetlands, vegetated uplands

Vegetation and Flora: limited survey (DEP 1996 (Perth 01–10), Keighery, BJ, 1995e, DEP 1998, DEP 1999); detailed survey (Tingay, Alan & Associates 1994c)

Structural Units: mapping (Tingay, Alan & Associates 1994c)

Uplands: *Eucalyptus calophylla* Woodland; *Eucalyptus marginata* Woodland; *Eucalyptus rudis* Woodland; *Banksia attenuata*, *B. menziesii* and *Allocasuarina fraseriana* Woodland; *Banksia attenuata*, *B. menziesii* and *B. ilicifolia* Woodland

Wetlands: *Banksia littoralis* Low Woodland to Forest; *Melaleuca preissiana* Low Woodland; *Melaleuca rhaphiophylla* Low Woodland; *Melaleuca rhaphiophylla* and *Eucalyptus rudis* Forest; *Jacksonia sternbergiana* Closed Tall Scrub to Tall Shrubland; *Jacksonia furcellata* Open Shrubland; *Adenanthos cygnorum* Shrubland; *Kunzea glabrescens* Tall Shrubland; *Hakea varia* Closed Heath; *Regelia ciliata* Shrubland; *Astartea* aff. *fascicularis* Closed Heath; *Pericalymma ellipticum* Shrubland; *Melaleuca teretifolia* Open to Closed tall Scrub; *Melaleuca viminea* Open Heath; Mixed Open Heath; *Acacia saligna* Shrubland to Open Tall Scrub; Sedgelands of *Leptocarpus* species, *Baumea articulata* and *Typha domingensis*

Scattered Native Plants: not assessed

Vegetation Condition: >60% Excellent to Very Good, <40% Good to Degraded (mapping Tingay, Alan & Associates 1994c)

Total Flora: 295 native taxa (Tingay, Alan & Associates 1994c, DEP 1996) (estimated >70% expected flora)

Significant Flora: *Conospermum undulatum* (R), *Macarthuria keigheryi* (R); *Eucalyptus marginata* subsp. *elegantella* (1), *Tripterococcus paniculatus* ms (1), *Myriophyllum echinatum* (3), *Stylidium longitubum* (3), *Haemodorum loratum* (3), *Conostephium minus* (4), *Villarsia submersa* (4), *Verticordia lindleyi* subsp. *lindleyi* (4); *Platysace juncea*, *Byblis lindleyana*, *Conospermum triplinervium* (hybrids with *C. undulatum*), *Levenhookia preissii* (rarely recorded on the Swan Coastal Plain), *Cheilanthes austrotenuifolia* (Tingay, Alan & Associates 1994; DEP 1996, uncommon on the Plain, associated with communities that are heavily cleared), *Verticordia nitens* (Tingay, Alan & Associates 1994; DEP 1996, only currently recorded population south of Gnangara in the Perth Metropolitan Region), *Villarsia violifolia* (uncommon on Plain); 34 taxa associated with eastern side of the Plain

Fauna: structured survey for birds (87 species) (How and Dell 1994; RAOU 1996 D; Tingay, Alan & Associates 1994b), native mammals (2 species), reptiles (20 species) and amphibians (8 species) (How and Dell 1994; Tingay, Alan & Associates 1994b). Significant bird species: category 3 (2) and category 4 (7). Munday Swamp is in the top 6% of wetlands for breeding waterbirds (Jaensch *et al.* 1993). Significant mammal species: Quenda and Echidna. Significant reptile species: 1970 record of Western Swamp Tortoise. Rich frog assemblage typical of the eastern side of the Swan Coastal Plain. Only two other areas match the vertebrate species richness in the Perth Metropolitan Region. The only significant populations of two WA-endemic fish, the Western Pygmy Perch (*Edelia vittata*) and Western Minnow (*Galaxis occidentalis*) in the PMR (Robson and Charter 1989). Munday Swamp has an unusually rich and diverse invertebrate fauna (82 species), including several rare species

Linkage: no adjacent bushland; part of Greenways 26, 99, 109, 110 (Tingay, Alan & Associates 1998a); part of a regionally significant fragmented bushland/wetland linkage (Part A, Map 7)

Other Special Attributes: Munday Swamp and adjacent lands and lands to the north are considered to be of Aboriginal heritage value (Australian Archaeological Survey Consultants 1995); a number of uplands and wetlands are suitable for Western Swamp Tortoise release (Kuchling and Burbidge 1996); Munday Swamp, Runway Swamp, Link Road Swamp and sumplands east of the main runway are wetlands of national importance (ANCA 1996); National Trust of Australia (WA) Classification; contains a substantial sweep of soils and communities from eastern to central Plain (Bassendean Sands); contains plant communities representative of the eastern side of the Swan Coastal Plain

SECTION 4: INTERNATIONAL AND NATIONAL SIGNIFICANCE

Entered in the Register of the National Estate; Directory of Important Wetlands in Australia; 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: Cemetery Mechanism. Part B: Other Government Land Mechanism (see Table 3, Volume 1).

Vegetation and Significant Flora Values of the Guildford Cemetery Bushland Remnant

prepared by

Bronwen Keighery
Conservation Branch
Department of Environmental Protection

November 1998

b) *Eucalyptus calophylla* Woodland Forest over *Allocasuarina fraseriana* Open low Woodland *Hibbertia hypericoides, Baeckea camphorosmae* and *Acacia sessilis* Low Shrubland over *Mesomelaena tetragona* and *Alexgeorgea nitens* Sedgeland.
Condition: Very good to excellent.

2. The dune to the east of wetland (ie., on the eastern boundary of the remnant, adjacent to and extending intot eh Perth Airport remnant) has *Allocasuarina fraseriana , Banksia menziesii, Banksia attenuata* Low Woodland over *Stirlingia latifolia, Hibbertia hypericoides, Eremaea pauciflora* Open Low Heath over *Conostylis aurea, Patersonia occidentalis* Open Herbland and *Alexgeorgea nitens* Open Sedgeland.
Condition: Very Good to Excellent.

3. The dune to the west of the wetland (the western part of the remnant, near the cemetery area) has *Eucalyptus marginata* subsp. *elegantella , Banksia menziesii* and *Banksia attenuata* Low Woodland over *Baeckea camphorosmae, Hibbertia hypericoides, Daviesia triflora* Open Low Heath over *Conostylis juncea*, Patersonia *occidentalis* Open Herbland and *Tetraria octandra , Mesomelaena pseudostygia* Sedgeland.
Condition: Very Good to Excellent.

4. An area adjacent to the wetland was dominated by *Jacksonia sternbergiana* suckering shrubs in response to fir approximately 3-4 years previously. Low woodlands dominated by *Jacksonia sternbergiana occur* when areas are not burnt for many years and which was apparently more widespread on the Swan Coastal Plain in the past (Keighery and Trudgen 1992).

Flora of interest: eastern side of the Plain species
A group of species in the remnant are of particular interest, as they are associated with the plant communities typical of the eastern side of the Swan Coastal Plain. They are:

Trees: *Eucalyptus marginata* subsp. *elegantella*
Shrubs: *Baeckea camphorosmae*
Herbs: *Stylidium dichotomum, Conostylis aurea, Stylidium longitubum*
Sedges: *Mesomelaena pseudostygia, Mesomelaena tetragona Cyathochaeta avenacea*
Grasses: *Neurachne alopecuroidea*

Floristic Community Types present
The presence of these taxa commented on above and the combinations of other taxa in the plant communities present in the remnant indicate that the area contains the following regional floristic supergroups and floristic community types described by Gibson *et al.* (1994) for the Swan Coastal Plain:

Supergroup 2 - Seasonal Wetlands

Floristic Community Type 5:	Mixed shrub damplands
Floristic Community Type 12:	*Melaleuca teretifolia* and/or *Astartea* aff. *fascicularis* shrublands

Supergroup 3 - Uplands centred on Bassendean Dunes and the Dandaragan Plateau

Floristic Community Type 20a:	*Banksia attenuata* woodlands over species rich dense shrublands
Floristic Community Type 20b	Eastern *Banksia attenuata* and/or *Eucalyptus marginata* woodlands (most northerly occurrence)

- two 'threatened ecological communities' (after English and Blyth 1997) have been identified in the area (Endangered (floristic community type 20a, 20b;);

- the area would be expected to have a rich fauna as studies in the adjacent Perth Airport bushlands have identified 8 frog species (typical assemblage of the eastern side of the Plain); 87 bird species (7 of which are uncommon on the Plain, only 2 other areas match the species richness in the Perth Metropolitan Area, in top 6% of wetlands for breeding species); 22 reptiles); Echidna (*Tachyglossus aculeatus*) and large populations of Quenda (*Isoodon obesulus*) in similar habitat assemblages.

- there is a 1970 record of the critically endangered Western Swamp Tortoise from the Perth Airport land and the wetland area in the remnant has been identified as having suitable habitat for the Western Swamp Tortoise (*Pseudemydura umbrina*) (Kuchling and Burbidge 1996).

The Guildford Cemetery Bushland is part of the broader area of the Perth Airport Bushland which is an excellent example, both structurally and floristically, of the Bassendean Central and South and Southern River Vegetation Complex. The Guildford Cemetery remnant is one of the few areas representing the intergrade of these two complexes in the Perth Metropolitan Area.

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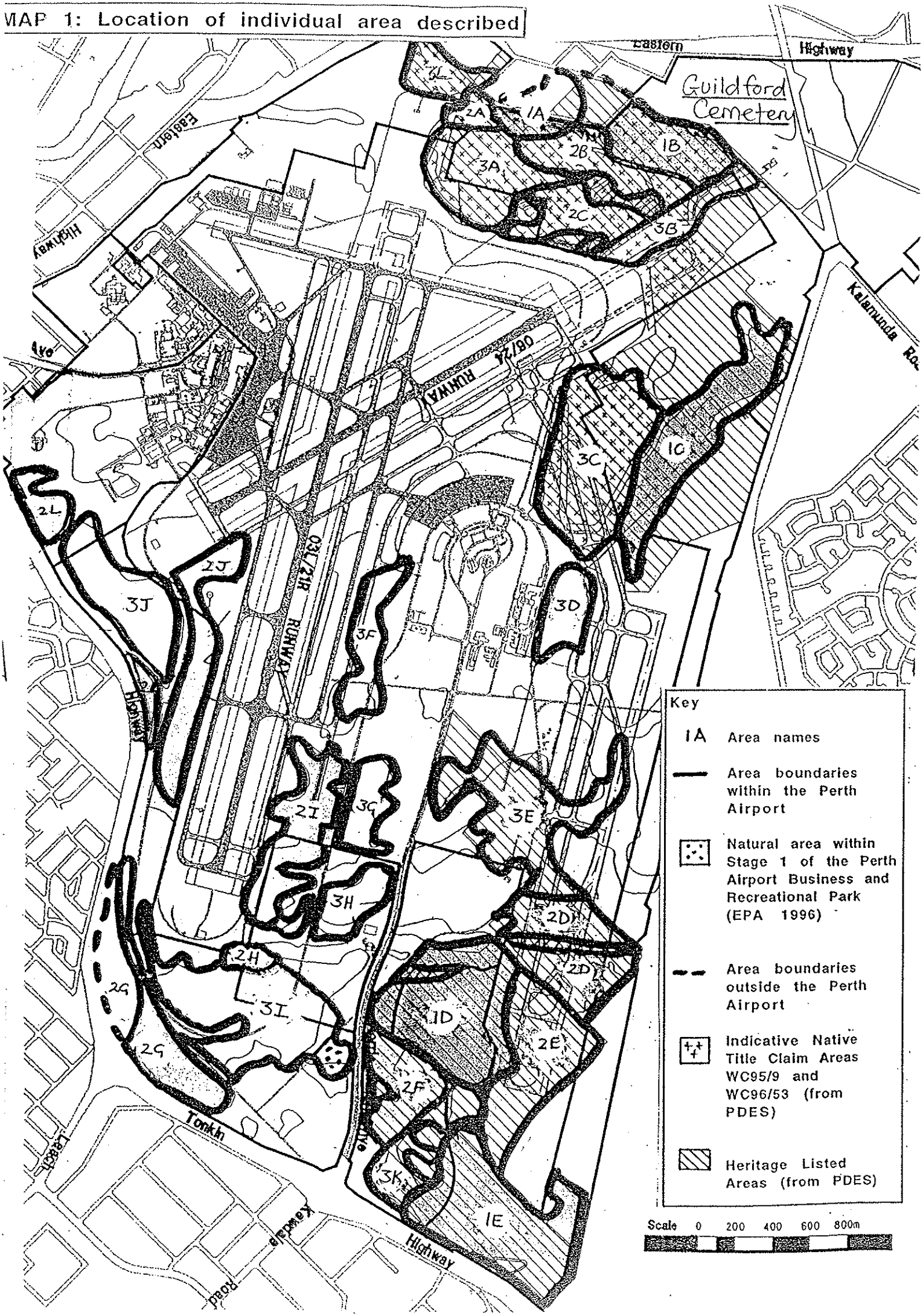
Interim List National Estate	50%	
Suitable for National Estate		
Nationally significant wetland		
System 6	yes	
Masterplan - conservation - conservation	40%	NE Conservation Area (7), 60% Category 1 outside airport
Bushland Patch Rank %	top 5%	
Perth's Bushplan	100%	

AREA 1B (1.2 plus area in Guildford Cemetary as Map 1)

Value	**Score**	**Comment**
Natural Attributes		
Bushland/Vegetation Condition		
bushland	90%	
range vegetation condition	2-3-4	
Vegetation Complex	SR	
Mapped Vegetation Units		
wetland and/or upland units	upland	100% area
number of vegetation assoc.	1 (2)	Ba and Bm Ba
Floristic Community Types with Threatened Ecological Communities in BOLD		
expected no	1	
types	20a	plot 7
Flora		
Declared Rare Flora		
Priority Flora	1	Haemodorum loratum
significant staxa	>10	taxa associated with the eastern side of the SCP
diversity	52	
Fauna ?Echidna		
Birds	diverse	plot records 33/25
Western Swamp Tortoise habitat		upland adjacent to suitable wetlands
Quenda habitat		upland adjacent to suitable wetlands
Wetland Classification		
diversity types	no	
% conservation category		
% verified resource enhancement category		
% verified conservation category		
National/Regional Significance		
Interim List National Estate	100%	
Suitable for National Estate		
Nationally significant wetland		
System 6	yes	
Masterplan - conservation - conservation	100%	NE Conservation Area (7), Category 1
Bushland Patch Rank	top 5%	

MAP 1: Location of individual area described



Ordinary Meeting of Council (City of Swan)
6 December 2000

2 COMMUNITY PLANNING AND POLICY

2.1 GUILDFORD CEMETERY LAND REQUIREMENTS – (GUILDFORD WARD) (CSU)

PURPOSE

The purpose of this report is to consider a request from the Metropolitan Cemeteries Board for a commitment from the City in respect of the future vesting and use of Crown Reserves 25246 and 32002 both located in Kalamunda Road, South Guildford.

KEY ISSUES AND RECOMMENDATION

- "C" Class Crown Reserves 25246 and 32002 are both vested in the City and leased to Swan Animal Haven Association (Inc) and Perth Pistol Club (Inc) responsibility
- The Metropolitan Cemeteries Board has requested a commitment from the City that upon expiration of current lease arrangements both reserves be re-vested in the Board in order to appropriately accommodate future cemetery requirements in the region

Recommend that having regard to considerations associated with the wider community interest the City agree to the Board's request and work with the two affected associations in order to identify and assist to meet their future accommodation needs

BACKGROUND

Current lease arrangements concerning Crown Reserve land vested in the City in the vicinity of the Guildford Cemetery be summarised thus:-

Crown Reserve 25246 Kalamunda Road, South Guildford

Lease Agreement dated 29 April 1990 between the City and Swan Animal Haven Association (Inc). Term of current lease expires on 31 December 2008.

Between 1978 and 1990 the Association leased another Crown Reserve in Kalamunda Road from the City. The Association's operations were relocated because of noise nuisance concerns.

Crown Reserve 32002 Kalamunda Road/Adelaide Street, South Guildford

Lease Agreement dated 19 February 1990 between the City and Perth Pistol Club (Inc). Term of current lease expires on 30 August 2010.

Under the current and previous lease arrangements, the Club has leased this reserve continuously for over 30 years.

A sketch plan showing the location of both of the affected reserves is attached.

The Metropolitan Cemeteries Board has requested that the City enter into a commitment to relinquish its current vesting arrangements in respect of both reserves at the expiration of the current lease terms.

2.1 Cont'd 2

The Board advises that it is its intention that the Guildford Cemetery would play a pivotal role in catering for future demands of the community, especially the community of the Eastern Corridor, thus relieving the pressure placed on Karrakatta which has a limited operational lifespan for burials:

> *We believe that by addressing this issue now, we will be in a position to provide additional burial land that will ensure the long term sustainability of the Guildford Cemetery. Concurrently, this course of action will provide ample notice to the existing tenants of the City of Swan's intention and provide sufficient time for alternative arrangements to be made prior to expiry of the existing leases.*
>
> *It is our desire to enter into a "Heads of Agreement" between the City of Swan and the Metroplitan Cemeteries Board confirming that these two parcels of land will be vested with the Board for the purpose of cemetery management upon expiry of the lease agreements currently in place with the City of Swan.*

REPORT

Having regard to the wider community interest, it is recommended that the City enter into an agreement with the Board in the manner proposed. The long lead up time before the current lease arrangements expire will enable the City to work with both organisations in order to identify and address future accommodation needs. It is appreciated that this could be a challenging task because of noise nuisance considerations and limited availability of public land for use by community based groups and organisations in the region.

It should be noted that the future use and vesting of both reserves is ultimately a discretionary matter for the Minister for Lands.

ATTACHMENT

Sketch Plan showing locations of affected Crown Reserves.

APPENDIX

Nil

STRATEGIC IMPLICATIONS

The proposal is consistent with Key Result Area 4 of the City's Strategic Plan – "the quality of our social, built, natural and cultural environment" and particularly Objective 4 – "we need to plan the quality of our social, built, natural and cultural environment".

FINANCIAL IMPLICATIONS

Nil.

2.1 Cont'd 3

RECOMMENDATION

That the Council resolve to:

(1) Agree "in principle" to the re-vesting of Crown Reserves 25246 and 32002 in the Metropolitan Cemeteries Board.

(2) Authorise the negotiation of an appropriate agreement with the Board and Minister for Lands.

(3) Advise the two affected lessees of the City's position and request staff to work with both associations in order to identify and assist to meet their future accommodation needs.

MOTION that the Council resolve to:

(1) Agree "in principle" to the re-vesting of Crown Reserves 25246 and 32002 in the Metropolitan Cemeteries Board at the expiration of current lease arrangements with Swan Animal Haven Association (Inc.) and Perth Pistol Club (Inc.) respectively subject to:

1. identification of alternative sites upon which both Associations can re-locate and obtaining the necessary approvals from those public authorities concerned (if applicable);

2. receipt of undertakings from the Metropolitan Cemeteries Board that it will assist to identify alternative sites for both Associations and if appropriate materially assist the re-location process.

(Cr Oma - Cr Congerton)

RESOLVED UNANIMOUSLY TO:

(1) Agree "in principle" to the re-vesting of Crown Reserves 25246 and 32002 in the Metropolitan Cemeteries Board at the expiration of current lease arrangements with Swan Animal Haven Association (Inc.) and Perth Pistol Club (Inc.) respectively subject to:

1. identification of alternative sites upon which both Associations can re-locate and obtaining the necessary approvals from those public authorities concerned (if applicable);

2. receipt of undertakings from the Metropolitan Cemeteries Board that it will assist to identify alternative sites for both Associations and if appropriate materially assist the re-location process.

File 1187/01

Rachael Mercy

9222 7078

Main Roads Western Australia
2 Adams Drive
WELSHPOOL WA 6106

ATTENTION: PAUL WEST

ABERNETHY ROAD – PROPOSED ON RAMP

Thank you for your correspondence of 4 December 2002 and the opportunity to meet with officers of the Environmental Protection Authority (EPA) Service Unit onsite on 8 January 2002. I apologise for the delay of this response to your queries.

At the on site meeting in January this year attended by yourself and representatives from the Bush Forever Office of the Department for Planning and Infrastructure, officers from Perth International Airport, Airport Environment Protection and a representative from Biota Environmental Sciences, informal discussions were held as to the likely assessment procedure and documentation required by a referral of the proposal to the EPA.

Given the significance of the site and the number of issues involved, preliminary advice has been sought from the Terrestrial Section of the Department of Environmental Protection and the Wetlands Section of the Water and Rivers Commission on the specific vegetation, flora, fauna and wetlands information that the EPA is likely to require in a referral from Main Roads WA.

The following advice is therefore provided by officers of the EPA Service Unit, however, it should be noted that once referred, the EPA may determine that the environmental impacts associated with the proposal are likely to be significant and therefore decide to progress the proposal through a formal assessment process. If this occurs, the following advice and requirements may be subject to change.

Summary of significant environmental issues

- Regionally significant vegetation
- Declared Rare Flora (DRF), Threatened Ecological Communities (TEC), Priority and Significant Flora
- Conservation Category Wetlands
- Fauna – potentially Declared Specially Protected (Threatened) Fauna, Priority Fauna Species, and "Significant Bird Species of the Swan Coastal Plain Portion of the Perth Metropolitan Region".

Site Description
The project area is part of *Bush Forever* Site 386 - Perth Airport and Adjacent Bushland. The area contains regionally significant vegetation of the Southern River Vegetation complex and is part of a mosaic of wetland and upland plant communities. The larger area of bushland, of which the project area is a part has previously been described by Keighery (1995). This larger area is in Excellent to Very Good condition, contains 5 different vegetation associations and 5 expected floristic community types (Keighery 1995e). Two of the expected floristic community types are TEC's, FCT 7 (wetland type) and FCT 20a (upland type). One DRF taxon, *Conospermum undulatum*, two Priority Flora taxa, *Schoenus benthamii* and *Verticordia lindleyi* and three taxa documented as significant in the Perth Metropolitan Region, *Levenhookia preissii, Byblis gigantea* and *Dasypogon obliquifolius*, were all recorded in this area (Keighery 1995e). A number of taxa associated with plant communities on the eastern side of the Swan Coastal Plain were also noted (Keighery 1995e). Subsequently ecologia (1999) recorded the DRF taxon, *Macarthuria keigheryi*, adjacent to the project area.

The 1.4 ha project area is also documented as containing seasonally damp Melaleuca low woodlands (ecologia 1999). This has since been confirmed by a site inspection as well as the presence of at least two distinct plant communities that would be directly impacted by the on ramp proposal,

- ·*Pericalymma ellipticum* Closed Heath and
- ·Mixed Open Low Heath representing a transitional gradient between wetland and upland plant communities.

The former has been mapped as CCW and the latter as a Resource Enhancement Wetland. Both areas are in Excellent condition and advice provided by the Resource Management Branch of the WRC indicates that both areas warrant classification as CCW's.

Required Investigations

Vegetation and Flora
Any assessment of the project area will need to document impacts on the larger area of bushland of which it is an integral part. Each of the criteria used to assess regional conservation value in *Bush Forever* will need to be addressed.

Detailed vegetation and flora survey work will need to be documented. A map of plant communities, full species list (indicating occurrence by mapped plant community), location of sample sites, and vegetation condition map should be presented. The occurrence and distribution, which should be mapped, of any Declared Rare or Priority Flora, Threatened Ecological Communities or Significant Flora present on the site. Survey work will need to be undertaken in seasons with maximum flowering periods appropriate to the particular plant species expected and an appropriate management plan needs to be developed if any Declared Rare, Priority or Significant Flora are located.

A weed survey should be conducted and an assessment of other potential weed species should be undertaken and an appropriate management plan for control of current and potential weed species

needs to be prepared. Current areas of dieback need to be assessed and an appropriate management plan for control of dieback should be prepared.

Fauna

A field survey needs to be conducted to identify the presence of any Declared Specially Protected (Threatened) Fauna (as listed under the *Wildlife Conservation Act 1950*), Priority Fauna Species (as listed by CALM) or "Significant Bird Species of the Swan Coastal Plain Portion of the Perth Metropolitan Region" (as listed in Table 15 in *Bush Forever*) on site and how these species will be impacted by the proposal. If identified, an appropriate management plan will be required to be developed.

The detailed terrestrial fauna survey should identify and map fauna habitats and identify significant and preferential fauna habitats. It should include appropriate systematic sampling relevant to the specific faunal group being sampled and should involve trapping and structured observations. It should also include an assessment of potential feral animal issues.

The significance of the area as an ecological linkage also needs to be addressed in terms of the criteria outlined in Section 3.5.5 of *Bush Forever* and should address how the proposal is likely to impact the movement of fauna in the greater area.

Wetlands

Given that CCW's are considered the highest category wetlands, supporting a high level of ecological attributes and functions and that the EPA generally recommends a minimum buffer distance of 50 metres to any proposed development, a detailed investigation should be undertaken to examine the likely impacts of this proposal on the wetland and hydrology of the area.

Furthermore, the excellent condition of the wetland and the transitional nature of the Mixed Open Low Heath, make it likely that this area provides a habitat for the DRF taxon *Macarthuria keigheryi* and therefore needs to be investigated further.

Planning Issues

This is a significant issue as other planning decisions may have been made that were contingent on this area remaining for conservation under the Perth Airport Master Plan. Therefore, this proposal should not be considered in isolation, but should be considered in the context of mitigation measures to off-set the loss of the conservation values of the area through protection of additional areas of at least equivalent conservation value.

Similarly this proposal appears to be part of staged plans for upgrading road infrastructure in the area, which are expected to involve areas of high conservation value. The EPA needs to be aware of the final plans for infrastructure in the area and of the implications of the on ramp proposal progressing (or not) on subsequent decisions that may have significant environmental impacts.

Public Interest

There has been significant public opposition to this proposal in the past by the Conservation Council of WA (Inc.) and the Friends of Perth Airport Bushland. It is therefore recommended that MRWA address this issue in consultation with relevant agencies or community groups when referring the proposal to the EPA.

Finally, while it is understood that the required approvals have been sought from the Australian Heritage Commission and they do not object to the transfer of ownership of the land from Commonwealth to the State, it should be noted that this does not preclude or set a precedent for the required state approvals process or outcomes.

Should you have any queries, please contact the person cited above.

Yours sincerely

KJ Taylor
DIRECTOR
ENVIRONMENTAL IMPACT ASSESSMENT

28 March 2002

Cc
Water and Rivers Commission – Sharon Stratico
Biota – Garth Humphreys
Perth International Airport – Dan Seketa
Airport Environment Protection and Building Control Office – Tanya Astbury

TECHNICAL BACKGROUND
SYSTEM 6 UPDATE BY B.K.

(A) (PRECEDES (B))

FULL SPECIES LIST (INCL. TINGAYS)

Appendix 1 p 3

VEGETATION

Appendix 2 p 9

Additional taxa from 1995 sites

1 = Thy
2 = Dip
3

Appendix 1: Department of Environmental Protection System 6 Update : Site based Flora List for M52, Perth Airport (B.J. Keighery 21/2/1995)

Native vascular plants are listed alphabetically in families and genera, as are weeds but these are listed alphabetically in genera at the end of the family list.

Key
Column 1 H taxa associated with heavy inundated soils on the eastern side of the Plain
E taxa associated with the eastern side of the Plain, generally on sands
U Uncommon taxa in the region

Column 2 Conservation Code (Atkins 14/9/1994)

ADIANTACEAE
H 1 Chiel arsho

Anthericaceae
2 Arnocrinum preissii 1,2 Cory mic 2
H 3 Borya scirpoidea
4 Johnsonia pubescens
5 Laxmannia ramosa
6 Sowerbaea laxiflora
7 Thysanotus multiflorus 1 Thy. thyr 3
8 Thysanotus patersonii
9 Thysanotus sparteus 1 Thy. triand 4
10 Tricoryne elatior
1 Tricoryne tenella

Apiaceae
5 Homalosciadium homalocarpum H Actinotus forrestianus 20
6 H Hydrocotyle alata
7 E Platysace juncea
8 Trachymene pilosa
9 Xanthosia huegelii

Asteraceae
1 Brachyscome iberidifolia Actin. pulch. 2
2 Cotula coronopifolia 1 Ang sp 3
3 Hyalosperma cotula
4 Lagenifera huegelii 1 Brach. ?macrocarpa 4
5 Olearia elaeophila
6 H Podolepis gracilis swamp (GJK 13126) 2 Craspedia canescens 5
7 Podotheca angustifolia
8 Pogonolepis stricta 1 Podolep lessonii 6
9 Quinetia urvillei
10 Siloxerus humifusus
1 Waitzia suaveolens
* Hypochaeris glabra
* Ursinia anthemoides
* Vellereophyton "candisimum"

Byblidaceae
7 U Byblis gigantea

Campanulaceae
8 Wahlenbergia preissii

Caryophyllaceae
* Spergula arvensis

x Silene gallica

Casuarinaceae
9 Allocasuarina fraseriana
40 Allocasuarina humilis

Centrolepidaceae
Aphelia cyperoides
H Centrolepis alepyroides
Centrolepis aristata
Centrolepis drummondiana
H Centrolepis glabra
H Centrolepis mutica

Colchicaceae
Burchardia ~~umbellata~~ congesta

Crassulaceae
Crassula colorata
Crassula pedicellosa

Cyperaceae
Baumea articulata
Baumea juncea
Bolboschoenus caldwellii
H Cyathochaeta avenacea
E Cyathochaeta clandestina
Isolepis marginata
Isolepis oldfieldiana
Lepidosperma angustatum
Lepidosperma longitudinale
Lepidosperma scabrum
Mesomelaena pseudostygia
E Mesomelaena tetragona
Schoenus brevisetis
Schoenus clandestinus
Schoenus curvifolius
Schoenus sp. 2 (GJK 5739)
Schoenus tenellus
Tetraria octandra
Cyperus tenellus

Dasypogonaceae
Calectasia cyanea
Dasypogon bromeliifolius
H Kingia australis
Lomandra hermaphrodita
Lomandra preissii

Dilleniaceae
E Hibbertia aurea
Hibbertia huegelii
Hibbertia hypericoides

Droseraceae
Drosera erythrorhiza
Drosera gigantea
Drosera glanduligera
Drosera macrantha ssp macr
Drosera paleacea

6

80 Drosera pulchella
1 Drosera stolonifera

2 Epacridaceae
Astroloma pallidum
3 E Astroloma stomarrhena
4 Conostephium pendulum
5 Conostephium preissii
6 Leucopogon conostephioides
7 Lysinema ciliatum
8 E Styphelia tenuiflora

Euphorbiaceae
1 Monotaxis grandiflora
2 Poranthera microphylla

Gentianaceae
* Cicendia filiformis

7 Goodeniaceae
Dampiera linearis
4 H Goodenia micrantha

9 Haemodoraceae
Anigozanthos humilis
100 E Conostylis aurea
1 H Conostylis festucacea
2 Conostylis juncea
3 Conostylis setigera
4 E 3 Haemodorum loratum
5 Phlebocarya ciliata
6 Phlebocarya filifolia
7 H Tribonanthes australis

5 Haloragaceae
H 1 Myriophyllum echinatum
6 2 Myrs. amph

7 Iridaceae
Patersonia occidentalis
* Gladiolus caryophyllaceus

Isoetaceae
8 H Isoetes drummondii

Juncaceae
* Juncus capitatus

Juncaginaceae
9 Triglochin centrocarpum
120 Triglochin procerum

1 Lamiaceae
Hemiandra pungens

2 Lauraceae
Cassytha racemosa
3 1. Cassytha sp. Haca

Lentibulariaceae
H Polypompholyx tenella
H Utricularia violacea

Lobeliaceae
Lobelia tenuior
Monopsis simplex

Loranthaceae
Nuytsia floribunda

Menyanthaceae
Villarsia capitata
Villarsia submersa

Mimosaceae
Acacia pulchella
Acacia sessilis
Acacia willdenowiana

Myrtaceae
Astartea aff. fascicularis
Baeckea camphorosmae
E Calytrix aurea
Eremaea pauciflora
Eucalyptus calophylla
Eucalyptus marginata
Eucalyptus todtiana
Melaleuca lateritia
H Melaleuca pauciflora
Melaleuca rhaphiophylla
Melaleuca sp. B FPR (BJK&NG 054)
Melaleuca teretifolia
H Melaleuca viminea
Pericalymma ellipticum
Scholtzia involucrata
Verticordia densiflora
H 4 Verticordia lindleyi subsp. lindleyi
* Lepidospermum laevigatum

Orchidaceae
Caladenia flava
Caladenia ?georgii ms
Caladenia paludosa ms
Caladenia spp
Diuris carinata
Microtis media
Pterostylis vittata
Thelymitra sp.
* Monadenia bracteata

Papilionaceae
Aotus gracillima
Bossiaea eriocarpa
Daviesia decurrens
Daviesia triflora
Euchilopsis linearis
Eutaxia virgata
Gompholobium tomentosum

only recorded once

2 Hovea trisperma
3 Jacksonia densiflora
4 Jacksonia sternbergiana
5 Kennedia prostrata
* Lotus angustissimus
* Trifolium.

Pittosporaceae
Pronaya fraseri

Poaceae
4 Agrostis plebeia
5 Amphipogon turbinatus
6 Cynodon dactylon
7 Eragrostis elongata
8 Neurachne alopecuroidea
9 Stipa compressa
* Aira caryophyllea
* Briza maxima
* Briza minor
* Ehrharta calycina
* Eragrostis curvula
* Vulpia myuros

Portulacaceae
2 H Calandrinia sp. swamp

Primulaceae
* Anagallis minor

Proteaceae
4 Adenanthos cygnorum
5 Banksia attenuata
6 Banksia ilicifolia
7 Banksia menziesii
8 E Banksia telmatiaea
9 Conospermum ?triplinervium
230 Dryandra nivea
1 Hakea sulcata
2 Hakea varia
3 Petrophile linearis
4 Stirlingia latifolia
5 Synaphea spinulosa

Restionaceae
6 Alexgeorgea nitens
7 Hypolaena exsulca
8 Leptocarpus aristatus
9 Leptocarpus canus
240 Leptocarpus roycei ms
1 Lepyrodia muirii
2 Loxocarya fasciculata
3 Loxocarya flexuosa
4 Lyginia barbata
5 Restio leptocarpoides
6 Restio stenostachyus

Rubiaceae
7 Opercularia vaginata

Rutaceae
5 Eriostemon spicatus Boronia ramosa 270

Santalaceae
Leptomeria cunninghamii 1 Exo spat 1
Leptomeria empet.

STACKHOUSIACEAE
1 Stack pubes 2
1 Trip breviaris 3

Scrophulariaceae
Gratiola peruviana

Stylidiaceae 1 Levan. pusilla 4
U Levenhookia preissii
260 Levenhookia stipitata Stylid. bruns. 5
Stylidium calcaratum
2 H Stylidium dichotomum 2 Stylid. bulb. 6 (11)
3 H 3 Stylidium longitubum
Stylidium obtusatum 1 Stylo pil 2 TREMANDRACEAE
Stylidium repens 1 Platy graminifolia 9
Stylidium schoenoides 2 Stylid. alt. rept 1

TYPHACEAE 2 Typha orien. 280

Xanthorrhoeaceae
Xanthorrhoea preissii

THYMELAEACEAE
Zamiaceae 1 Pim. angust 1
Macrozamia riedlei 1 Pim. sull 2

Violaceae
9 Hyb. calycinum

282

+ 10

272

295

Appendix 2: Department of Environmental Protection System 6 Update : vegetation Descriptions for M52, Perth Airport

See Map (Figure 9B Tingay 1994) for site locations.

Floristic Sites (1- 7)

Site 1: *Melalueca rhaphiophylla* Thicket over Very Open Low Grass, *Villarsia capitata* and mixed natives and exotic Open Herbs and *Lepidosperma longitudinale* and annual Sedges.
Condition: Very Good to Good

Adjacent area: Site was located on the edge of a well defined ephemeral wetland or sumpland (Semeniuk 1983). The central area of the wetland is dominated by *Melaleuca lateritia* and had contained free water. When sampled in November *Gratiola peruviana* was the dominant herb but the area could contain native aquatic herbs, some of which are Declared Rare Flora (Atkins 1994). Survey would need to be done in early spring to find these. The ground flora contains a significant percentage of weed taxa.and a more accuate assessment of condition wolud need to be made in early spring when the proportion of annually renewed native and weed taxa could be assessed.

There is another sumpland to the north east and this appears to contain similar vegetation.

Site 2: *Melalueca rhaphiophylla* Thicket over *Verticordia densiflora* and *Eichilopsis linearis* Heath B over *Leptocarpus roycei* Tall Sedges.
Condition: Excellant to Very Good.

Adjacent Area: The *Banksia* Woodland to the south of this wetland obviously impacted by dieback see photo 17 and 18. To the south east there is an area that is Completely Degraded and was reported to be (Security Guard pers comm) the site where fire training is performed.

Site 3: *Eucalyptus calophylla* Forest over *Xanthorrhoea preissii, Jacksonia sternbergiana* and *Stirlingia latifolia* LowScrub B and *Hibbertia hypericoides, Bossiaea eriocarpa* and*Conostylis pendulum* Dwarf Scrub C over *Droser stolonifera* and *Lagenifera huegelii* Very Open Herbs and *Mesomelaena tetragona, Cyathochaeta clandestina* and *Tetraria octandra* Tall Sedges and *Loxocarya flexuosa* and *Loxocarya fasciculata* Very Open Low Sedges.
Condition: Excellent.

Site 4: *Banksia menziesii* and *Banksia attenuata* Low Forest A over *Jacksonia densiflora* and *Allocasuarina humilis* Open Low Scrub A and *Petrophile linearis, Stirlingia latifolia, Baeckea camphorosmae* and *Bossiaea eriocarpa* Low Heath C over *Conostylis aurea, Drosera stolonifera, Drosera erythrorhiza* and *Drosera macrantha* Very Open Herbsand *Loxocarya flexuosa* Very Open Low Sedges.
Condition: Very Good to Excellent.

Adjacent area: Between sites 3 &4 was an area dominated by *Jacksonia sternbergiana* low trees, vegetation structural unit observed when areas are not burnt for many years and which was apparently more widespread on the Swan Coastal Plain in the past (keighery and Trudgen 1992). There is evidence of Jarrah being removed from the area , the Jarrah in the area being coppice growth from felled trees.

Site 5: *Pericalymma ellipticum, Banksia telmatiaea* and *Hakea varia* Heath B and *Verticordia densiflora* and *Dryandra nivea* Dwarf Scrub D over *Drosera gigantea, Conostylis festucacea* and *Tribonanthes australis* Herbs and Low Sedges.
Condition: Excellent.

Adjacent area: Site 5 is charcteristic of the depressed area of the sumpland in which it falls the edges are charcterised by scattered Marri over *Melaleuca preissii* Low Open Woodland A. Of interest in the understorey are: *Stylidiun dichotomun, Borya scirpoidea , Helipterum cotula* and

Restio leptocarpoides. A clump of *Kingias* were observed in this sumpland. The adjacent upland is characterised by Site 6. To the north is another sumpland (not mapped by Tingay) with a similar fringing vegetation but *Melaleuca rhaphiophylla* was also present and the depressed area of the sumpland was *Astartea* aff. *fascicularis* and *Pericalymma ellipticum* Heath A over scattered Herbs and Sedges like those found in Site 5. *Melaleuca rhaphiophylla* and *Banksia littoralis* are scattered through the Heath.

Site 6: *Banksia menziesii, Banksia attenuata* and *Nuytsia floribunda* Low Woodland A over *Acacia pulchella* and *Jacksonia floribunda Open Low Scrub B and Gompholobium tomentosum, Eremaea pauciflora* and *Stirlingia latifolia* Low Heath C and *Hemiandra pungens* Open Dwarf Scrub D over *Amphipogon turbinaus* and *Ehrharta calycina* Very Open Grass and *Patersonia occidentalis, Conostylis juncea* and *Johnsonia pubescens* Open Herbs and *Loxocarya flexuosa* Very Open Low Sedges.
Condition: Very Good to Excellent.

Site 7: *Eucalyptus marginata* Open Woodland and *Banksia menziesii* Low Woodland A over *Allocasuarina humilis* and *Jacksonia densiflora* Low Scrub B and *Stirlingia latifolia* , *Gompholobium tomentosum* and *Leucopogon ? squarrosus* Low Heath C and *Petrophile linearis* and *Hibbertia hypericoides* Low Heath D over *Amphipogon turbinatus* Very Open Grass and *Waitzia suaveolens, Conostylis aurea* and *Patersonia occidentalis* Open Herbs and *Mesomelaena pseudostygia* and *Lyginia barbata, Loxocarya fasiculata , Loxocarya flexuosa* and *Alexgeorgia nitens* Open Sedges.
Condition: Excellent.

General Sites (A - L)

Munday Swamp: fringed with *Melaleuca rhaphiophylla* and *Eucalyptus rudis* Forest over *Baumea articulata* Tall Sedges.

Site A: *Melaleuca rhaphiophylla* Low Forest over scattered *Melaleuca lateritia* over *Baumea articulatea* Tall Sedgeland and *Lepidosperma longitidinale* Low Sedges.

Site B: Mixed Thicket. Dominant species in Thicket include *Hakea varia, Melaleuca rhaphiophylla* and *Astartea* aff. *fascicularis*. *Melaleuca rhaphiophylla* occurs as a tree in the centre of the wetter areas.

Site C: Heath A.and Low Scrub A. *Pericalyma ellipticaum* is the dominant in much of the Heath and Low Scrub. This area of Heath and Low Scrub are similar to Sites 2 and 5 being more complex in general than 2 but less than 5.

Site D: *Kunzea recurva, Jacksonia* aff. *sericea, Xanthorrhoea preissii, Verticordia lindleyi* subsp. *lindleyi, V. densiflora* and *Dryandra nivea* Low Heath C over *Stylidium dichotomum* Herbs and *Restio leptocarpoides* Low Sedges.
Condition: Excellent.

Site E: *Banksia* Low Woodland, equivilant to Site 6.

Site F: This area was recently burnt (?summer 1993/94) and there were several herbs in the area which occur more conspicuously after fire; *Byblis gigantea* and *Levenhookia preissii* . Both taxa are uncommon in the Perth Metropolitan Region, known from very few collections on the Swan Coastal Plain and were not encountered by Gibson et. al. (1994). These are significant populations of both of these taxa.

Site G: *Melaleuca viminea* Low Scrub A over *Baumea juncea* Tall Closed Sedges This general area was very disturbed and in someplaces completely cleared. Scatterred occurrences of late flowering (*Podolepis gracilis* 'swamp') or perennial taxa associated with the heavy soils

of the Pinjarra Plain (*Leptocarpus aristatus, Melaleuca pauciflora, Bolboschoenus caldwellii*). Areas of vegetation similar to Site 5 occur on the sandier soils alongside these clay flats.

Site H: This sandy ridge was *Banksia* Low Woodland but the area appears to have been cleared in the past. Regrowth has occurred. An unusual form of *Conospermum triplinervium* occurred in a small population on this ridge. The presence of undulate leaves on some of the individulas in the population indicate that the population may be hybridising with *Conospermum undulatum* (E. Bennet pers. comm). *Conospermum undulatum* is a rare taxa confined to the Forrestfield area that has been recommended for Declared Rare Flora (Gibson et al 1994).

Site I: Scattered *Eucalyptus calophylla, Melaleuca presissiana* and *Eucalyptus rudis* over *Hakea varia, Aotus gracilima, Melaleuca teretifolia, Eutaxia virgata* and *Astartea* aff. *fasciculatis* Dense Heath B over *Lepyrodia muirii* and *Lepidosperma longnitudinale* Sedges. The most significant weeds in the ara are **Lepidosperma laevigatum* and **Eragrostis curvula.*
Condition: Excellent with areas of severe localised disturbance.

Site J: *Banksia menziesii, Banksia attenuata* and *Banksia ilicifolia* Low Forest A over scattered shrubs over **Ehrharta calycina* and **Briza maxima* Open Grass and *Phlebocarya ciliata* Herbs and *Lyginia barbata* Very Open Low Sedges.
Condition: Good

Site K: *Pericalymma ellipticm* and *Astartea* aff. *fascicularis* Heath B over Sedges. The area of the site is fringed with a Low Woodland of *Melaleuca preissiana.*, scattered individuals also occur in the community.
Condition: excellanr to Very Good.

Site L: *Eucalyptus marginata* Very Open Woodland over *Banksia attenuata* and *Banksia menziesii* Low Woodland A over Low Heath C. The community appears closely related to the site located in Dianella Open Space. *Conostylis aurea* .is present which is often associated with Floristic Community Type 20a.
Condition: Excellent.

Table 1: Expected Floristic Community Types and their status (Gibson et al 1994)

Expected Floristic Community Type (Sites)	Mapped Unit (Tingay)	Gozzard (1986)	Res. Status	Cons. Status
4 (C,D,F&I)	Mp	Cps, S10	well	low risk
7 (G)	MpPe	Mgs1	well	vulnerable
10a (5, pos. 2)	MpPe	S10, Cps	well	vulnerable
13 (1)	Mr	S8	well	low risk
20a (4&7, pos. 3)	Ba	S8	unreserved	endangered
21c (J)	Ba Bm	S8	poorly res.	susceptible
23a (6&L)	Ba	S10, S8	well	low risk

For example the area mapped as *Banksia attenuata* Low Woodland differs floristically from east to west. Those to the east (possibly Site 3, probably Sites 4 and 7) appear to be Floristic Community Type 20a (Gibson et . al.1994) while those to the south (Site 6) and west (Site L) appear to be Floristic Community Type 23a. The affinities of the wetter sites are less apparent before analysis but it is expected that the sites will represent Floristic Community Type 10a (Site 5 and possibly 2) and Floristic Community Type 13 (Site 1). Floristic Community Types 4, 7 and 22 appear to be present but this were not sampled either because of lack of time or because the unit was in poor condition and could not be sampled at the time of survey (7).

Christine

Please send copy of report (attached) and Map (please make a copy to send) to Linda Taman. Address highlighted on Fax cover sheet

✓ done CF

NATIVE ENVIRONMENTAL SYSTEMS

10 Nevis Ct, Caversham WA 6055
PH: 9377 5621 Fax: 9377 5321 Mobile 0418 928 905
Email: ltaman@bigfoot.com

FAX COVER SHEET

FAX TO: Bronwen Keighery

FAX NO: 9485 1187

FROM: Linda Taman

MESSAGE:
Dear Bronwen

Following on our conversation re Perth Airport, I would like to have a draft of suggested fire compartments ready by Thursday 3rd June. Is it possible to get some information from you by the end of this week? I am away all day Wednesday and Thursday morning.

Thanks
Linda Taman.

Copy to V. English CALM
+ Report 21/6/99

Facsimile Message

ATTENTION:	Linda Taman (9377 5321)
ORGANISATION:	Native Environmental Systems
FROM:	Bronwen Keighery
DATE:	31 May 1999
TELEPHONE:	(08) 9222 7028 Fax. (08) 9485 1187
PAGES:	3 including this sheet
SUBJECT:	**Perth Airport Bushland**

MESSAGE:

Linda
Attached is a mud map of the approximate locations of significant flora and TEC's at Perth Airport. I will send you a copy of the report in which details the sections of the bushland in which these are found. Perth's Bushplan includes most of this information. However the *Macarthuria* was found after too late to be included. I had thought I may have seen it on the west side of the Airport.

The significant taxa have the following attributes

Conospermum undulatum R	Shrub, resprouts
Macarthuria keigheryi ®	Perennial shrub, disturbance opportunist, reseeder (possible resprouts)
Eucalyptus marginata subsp. *elegantella* (1)	Tree, resprouts
Myriophyllum echinatum (3)	Annual herb of wetlands
Stylidium longitubum (3)	Annual herb of wetlands
Haemodorum loratum (3)	Bulbous perennial herb
Schoenus benthamii (3)	Tufted perennial herb, in Type 7 wetlands
Conostephium minus (4)	Shrub, resprouts
Villarsia submersa (4)	Tuberous perennial herb of open water (aquatic)
Verticordia lindleyi subsp. *lindleyi* (4)	Shrub, reseeder

Significant flora

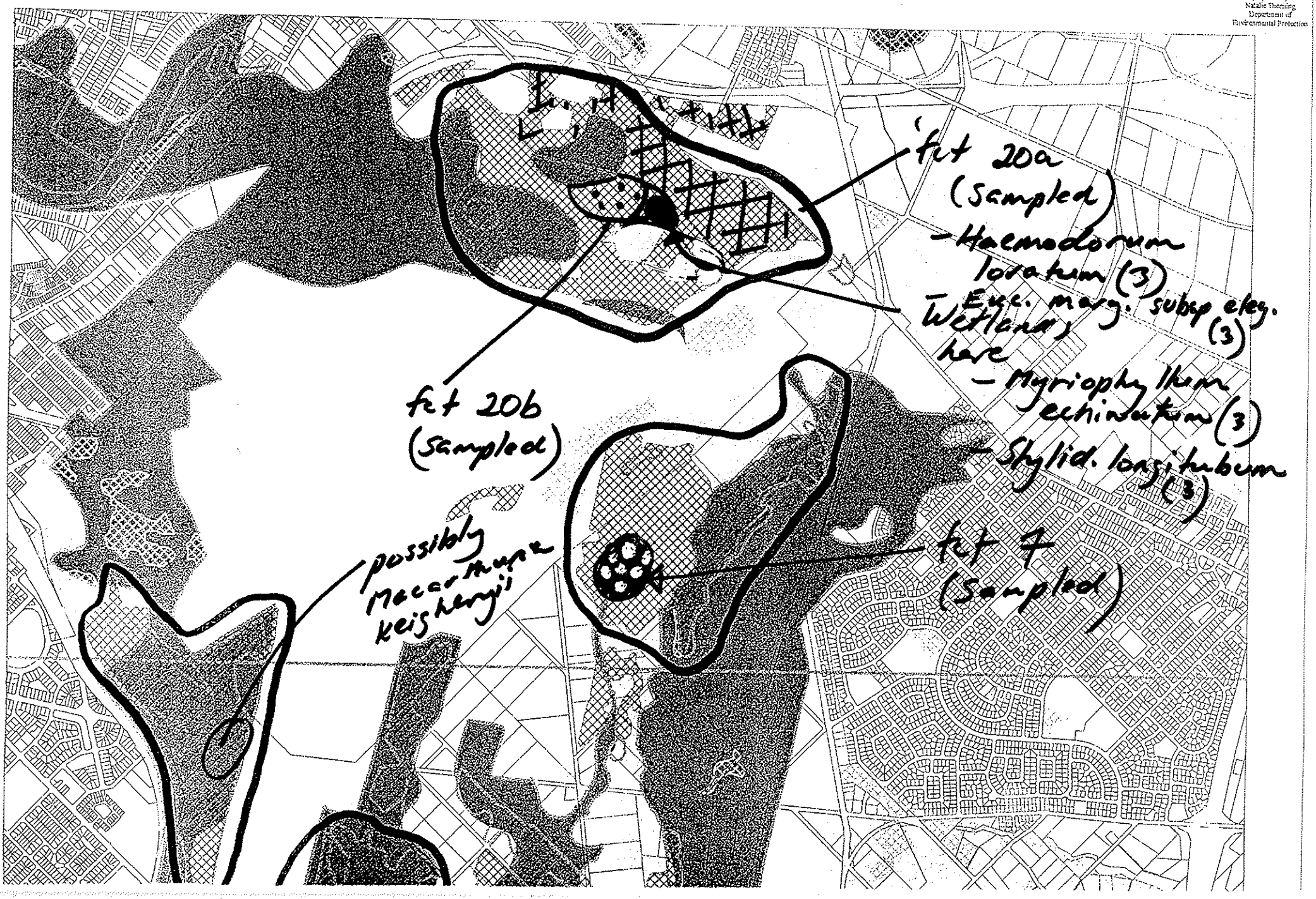
Banksia telmatiaea	Shrub, reseeder

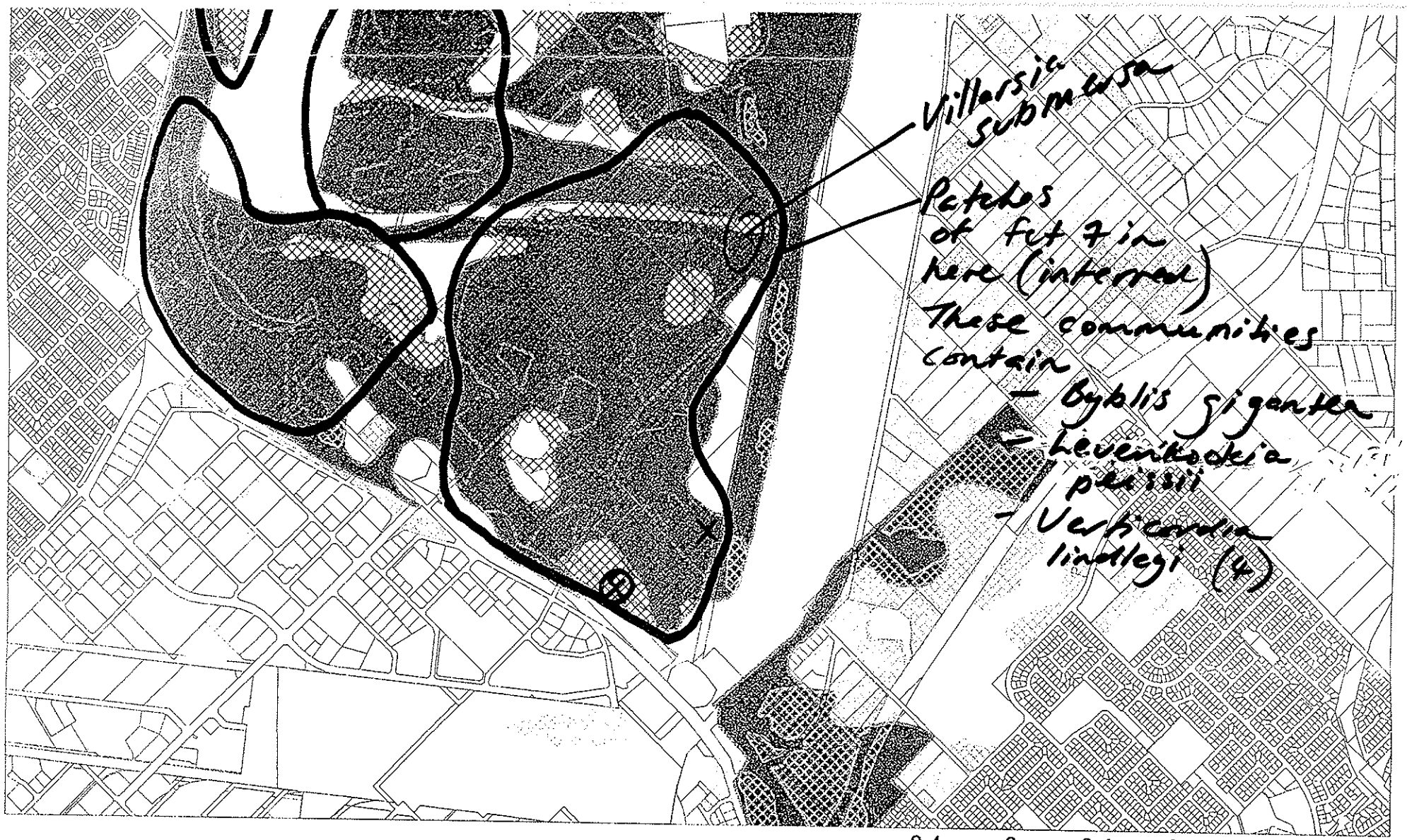
Platysace juncea (uncommonly recorded on the Swan Coastal Plain in the PMA)
Byblis gigantea (rarely recorded on the Swan Coastal Plain in the PMA) - Perennial shrub, disturbance opportunist, reseeder
Conospermum triplinervium (hybrids with *C. undulatum*)
Levenhookia preissii (rarely recorded on the Swan Coastal Plain) Annual herb of wetlands, disturbance opportunist
Cheilanthes austrotenuifolia (uncommon on the Plain, associated comminutes that are heavily cleared)
Verticordia nitens (only currently recorded population south of Gnangara in the Perth Metropolitan Area)
Villarsia violifolia (uncommon on Plain)

At the host Bronwen

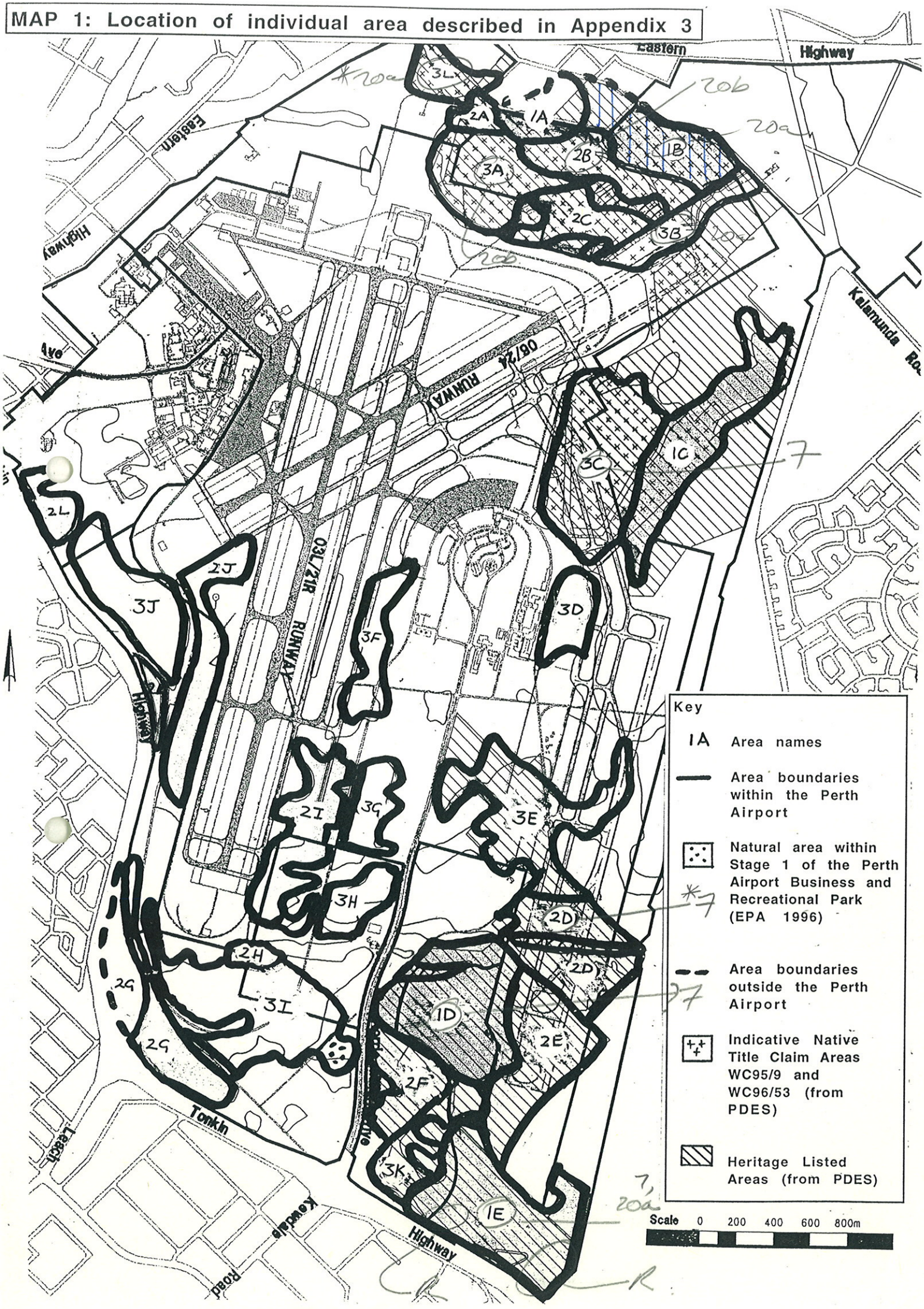
MAP 2 : Regionally Signi[illegible]cant Remnant Vegetation at Perth [illegible]irport

prepared by
Natalie Thorning
Department of
Environmental Protection




Villersia submersa
Petales of fut 7 in here (internal)
These communities contain
- Byblis gigantea
- Levenhookia pusilla
- Verticordia linaleyi (4)
0.4 0 0.4 0.8 Kilometres
1:25000
Cadastral Boundaries
remnant vegetation proposed for Perth's Bushplan in Perth Airport
Remnant Vegetation
Wetland Management Catagories
Conservation
Multiple Use
Resource Enhancement
Not Assessed
Verified conservation wetlands 1997
X Conospermum undulatum
Macarthuria keigheryi
N
boundary encompassing bushland/wetland priority areas identified by DEP for protection and management for conservation values (DEP May 1998)

MAP 1: Location of individual area described in Appendix 3



9377 5321

Facsimile Message

Department of Environmental Protection
Westralia Square, 141, St Georges Terrace, Perth, Western Australia, 6000.
Facsimile: (08) 9322 1598 Telephone: (08) 9222 7000

ATTENTION: Linda Taman
ORGANISATION: Native Environ Systems
FROM: Bronwen Keighery
DATE: 27/9/99
TELEPHONE: (08) 9222 7028 Fax. (08) 9485 1187
PAGES: including this sheet
SUBJECT: Perth Airport Tracks

MESSAGE:

Linda

I have attached the relevant pages from your report and my own. Hope this clears up the confusion.

Also the Bushplan Site description lists for 15 – this is in the area of the Villersia Submersa and possibly in 21 (Five Mile Swamp). Area at 20 (eastern corner) is degraded to completely degraded.

Cheers Bronwen

6 & 23 are mistakes
See attached corrected
sheets from original
report.

All TEC's

The spread of floristic communities across compartments is as follows:

Compartment	Floristic Communities									
	4	5	6	7	11	12	20a	20b	23	23a
A	X	X		X	X		X			
B	X	X				X				X
C	X	X		X					X	X
D	X	X			X		X			X
E	X									X
F	X				X	X				X
G					X	X				
H	X									X
I		X	X	X						X
J					X					
K							X			
L		X				X		X		X

Although most floristic communities are located in more than one compartment, floristic communities 6, 20b and 23 are located in one compartment only. Of these, 20b is considered an endangered floristic community. Every effort should be made to ensure that fire in compartment L is contained at the point of origin, and that the entire compartment is not burnt in a fire event. Although floristic communities 6 and 23 are not considered to be endangered, they are only represented in one area at Perth Airport, and fire should be contained at point of origin in compartments I and C wherever possible.

Declared Rare Flora, priority Flora and significant flora are distributed amongst compartments according to the following table (which uses information from the DEP report on Perth Airport ,1998), and using the key below (the number given in the key for Priority Flora indicates the priority rating) :

These can be named they will be rare in Perth's Bushplan which is a much more public document.

Declared Rare Flora	*R*
Priority Flora	
Myriophyllum echinatum	*3a*
Stylidium longitubum	*3b*
Haemodorum loratum	*3c*
Schoenus benthamii	*3d*
Conostephium minus	*4a*
Villarsia submersa	*4b*
Verticordia lindleyi subsp. *lindleyi*	*4c*
Significant Flora	
Levenhookia preissii (rarely recorded on the coastal plain)	*a*
Byblis gigantea	*b*
Dasypogon obliquifolius	*c*

with different category ratings. In general, the highest category bushland has been used to determine the fire control rating, unless the bushland within the highest category is only present over a small area. Consideration was also given to the proposed future development of Perth Airport when ranking compartments.

The relationship between the two rankings is outlined below:

- Compartments which contain Category 1 bushland areas as defined by DEP (1998), and which are listed as Conservation Zones by Westralia Airports Corporation are all given a Priority 1 rating for fire control
- Compartments which contain Category 1 bushland areas as defined by DEP (1998), but which are scheduled for development in the near future are given a Priority 2 rating for fire control
- Compartments which contain Category 2 bushland areas have been given a Priority 1 or 2 rating for fire control.
- Compartments which contain Category 3 bushland areas have been given a Priority 1 or 2 rating for fire control
- Compartments which contain only Category 4 areas have been given a Priority 2 or 3 rating for fire control

2.3 *Description of compartments and their values*

There are 7 compartments which are listed as Priority 1 for fire control, 5 for Priority 2, 10 which are listed as Priority 3 and 8 which are rated Priority 4 (See Map 2). The Priority 1 and 2 compartments are those with the highest natural values, and a brief description of each of these compartments is given below:

Compartment	Attributes
A (DEP 1E)	This area has been listed on the interim listing for the National Estate. Most of the vegetation is in excellent to very good condition, and contains eight vegetation associations (Ba, EcMp, Mr,Pe,Mp, Ac, Sedgelands and mixed shrublands), with five floristic community types (4,5,7,11,**20a**). Declared Rare Flora are found in this area, as well as Priority Flora *Schoenus benthamii* and *Verticordia lindleyi.* In addition three significant taxa are present, *Levenhookia preissii, Byblis gigantea* and *Dasypogon obliquifolius.*
B (DEP 1E, 2F, 3K)	This area has been listed on the interim listing for the National Estate. The vegetation varies in condition from excellent to good condition, and contains four vegetation associations (MpPe, Ba, Pe, Ac) and four floristic community types (4, 5, 12, 23a)
C (DEP 1D,2E) 2D also	This area has been listed on the interim listing for the National Estate. There is a large variation in vegetation condition, with areas rated as excellent down to degraded. It contains twelve vegetation associations (Mp, MpPe, EmBaAf, EcMp, Ec, Bm, Bl, Ba, Mr, Pe, sedgelands and mixed shrublands) with five floristic communities (4, 5, 23, 23a, **?7).** Three Priority Flora are located in the compartment, *Verticordia*

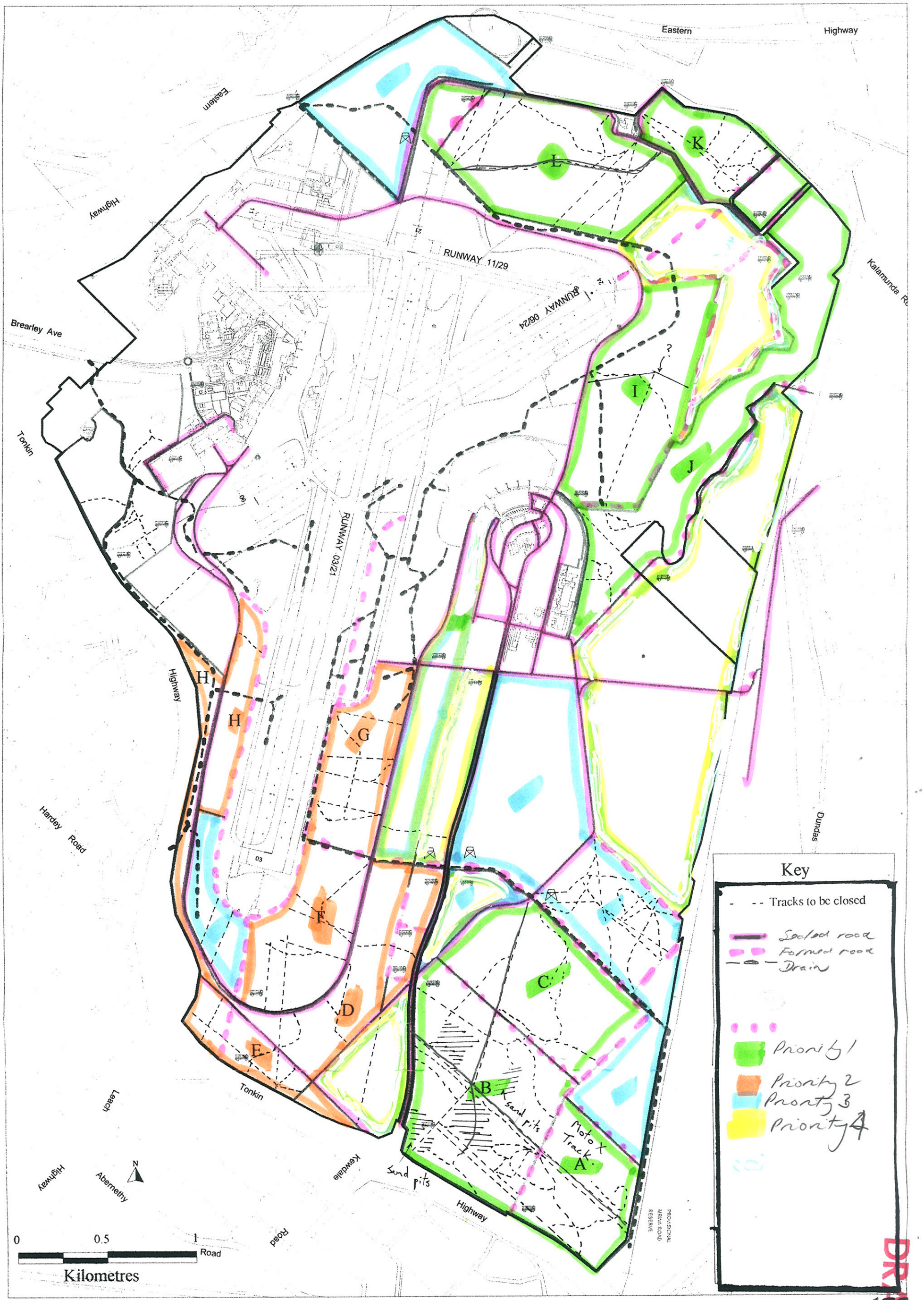
- Not all TEC's are bold

AREA 3C

Value	Score	Comment
Natural Attributes		
Bushland/Vegetation Condition		
bushland	80%	
range vegetation condition	2-3-4	
Vegetation Complex	SR	
Mapped Vegetation Units		
wetland and/or upland units	wetland/ upland	50% wetland
number of vegetation assoc.	5(8)	Ba, EmBa, Ec, Pe, MpPe and mixed shrublands, Mr, *Verticordia densiflora* Heath)
Floristic Community Types with Threatened Ecological Communities in BOLD		
expected no	3	
types	~~6~~, ~~7~~, 23a	plot 5 (fct 7), plot 6 (fct 23a)
Flora		
Declared Rare Flora		
Priority Flora	2	*Verticordia lindleyi*, *Myriophyllum echinatum*
significant taxa	>5	*Banksia telmatiaea* and taxa associated with the eastern side of the SCP
diversity	43, 57	plot 5, plot 6
Fauna		
Birds, reptiles	diverse	bird plot records 30
Western Swamp Tortoise habitat	yes	sixth most suitable group
Quenda habitat	yes	
other		only area both tree frogs recorded, How 1995
Wetland Classification		
diversity types	1	sumpland
% conservation category		
% resource enhancement category	100%	90% after verification
% verified conservation category	10%	of original resource enhancement
National/Regional Significance		
Interim List National Estate	100%	
Suitable for National Estate		
Nationally significant wetland		
System 6	yes	
Masterplan - conservation	40%	NE Conservation Area, Category 2 - Buffer; 60% aviation
Bushland Patch Rank %		
Perth's Bushplan	yes	

AREA 2E (2.5)

Value	Score	Comment
Natural Attributes		
Bushland/Vegetation Condition		
bushland	70%	
range vegetation condition	4/3 - 5	
Vegetation Complex	SR	
Mapped Vegetation Units		
wetland and/or upland units	wetland/ upland	80% wetland
number of vegetation assoc.	5	Mp, EmBaAf, EcMp, Ec, MpPe
Floristic Community Types with Threatened Ecological Communities in BOLD		
expected no	4	
types	5, 4, ~~23~~, 23a	
Flora		
Declared Rare Flora		
Priority Flora	1	*Verticordia lindleyi*
significant taxa		
diversity		
Fauna		
Birds, reptiles		
Western Swamp Tortoise habitat		
Quenda habitat		
Wetland Classification		
diversity types	2	sumpland, dampland
% conservation category	100%	
% verified resource enhancement category	30%	of original conservation category
% verified conservation category	40%	of original conservation category (other 30% cleared)
National/Regional Significance		
Interim List National Estate		
Suitable for National Estate		
Nationally significant wetland		
System 6		
Masterplan - conservation	?	90% aviation; 10% development (4)
Bushland Patch Rank %		
Perth's Bushplan		



MAP 4 Tracks to be closed for Perth Airport

Bronwen,
This is fairly urgent M.
(Fortunately, beyond my expertise!!) M.

CMPS&F

A GROU
ACN 00

FACSIMILE TRANSMISSION

CMPS&F PTY LIMITED, PERTH OFFICE

TO	
COMPANY	
FAX NO.	
FROM	tomorrow to 8/1
	csimile 93259897
JOB/FILE NO.	RW1166/OVW3431
DATE	7 December 1998 **NO. OF PAGES** 7 (incl this page)
SUBJECT	**FLORA INFORMATION - PERTH AIRPORTRESERVE**

Dear Malcolm and Bronwyn

As discussed on Thursday, please find following flora species information for quadrants 3, 4 and 8 in the Perth Airport Reserve. The location of these sites is shown on the attached map. Please let me know if you require additional information in order to assess the community type.

21/12/98

Regards,

Kaye Dixon

Direct to
Ecologia 9221599
Attn: Kelly M

Sent 23/12/98
See Advice File.

Privileged and confidential information may be contained in this facsimile. If you are not the addressee, you may not use, copy or deliver this facsimile to a third party. If you receive this facsimile by mistake, please notify CMPS&F Pty Limited immediately by telephone or fax on the above numbers.

200 Adelaide Terrace PERTH WA 6000 Australia
PO Box 6311 EAST PERTH WA 6892

Site 8: ***Banksia attenuata* and *B. menziesii* over dense mixed shrubland**

Date:	14.10.98
Location:	120 m NW of airport fence corner
Topography:	Hill crest
Slope:	Gentle
Surface soil:	White-grey sand (Bassendean)
Leaf litter:	<15 cm deep, 70-100% cover, distribution general
Wood litter:	Sparse
Condition:	Excellent
Disturbance details:	Minimal weed invasion
Fire History	Old

Total vegetation cover: 85%

trees 5-15 m	10-30%:	*Banksia attenuata, Banksia menziesii*
Trees <5 m	10-30%:	*Banksia attenuata, Banksia menziesii, Allocasuarina fraseriana*
Shrubs 1-2 m	2-10%:	*Stirlingia latifolia, Acacia pulchella, Jacksonia restioides*
Shrubs 0.5-1 m	30-70%:	*Conostylis setigera, Conostylis* sp. 1, *Patersonia occidentalis, Xanthorrhoea preissii, Hibbertia hypericoides, Allocasuarina humilis, Acacia sphacelata, Leucopogon* sp. 1, *Gompholobium tomentosa, Pimelea ?preissii*
Shrubs 0-0.5 m	0-2%:	*Gompholobium tomentosa, Pimelea ?preissii, Hovea trisperma, Bossiaea eriocarpa, Leucopogon ?pulchella, Petrophile linearis, Phyllanthus calycina, Scaevola paludosa* P2, *Synaphea ?spinulosa, Macarthuria keigheryi* DRF
Herbs/ climbers	2-10%:	*Trachymene pilosa, Stylidium brunonianum subsp. brunonianum, *Gladiolus caryophyllaceus, Anigozanthos humilis, Burchardia umbellata, Corynotheca micrantha, Drosera stolonifera, Isotropis cuneata, Levenhookia* sp. 1, *Pterostylis vittata, Stylidium diuroides, Stylidium miniatum, Stylidium repens, Thysanotus patersonii*
Grasses	0-2%:	**Briza maxima, Amphipogon amphipogonoides*
Sedge-like plants	10-30%:	*Mesomelaena stygia, Desmocladus fascicularis, Lepidosperma squamatum, Lyginia barbata*

Site 3: **Sparse *Melaleuca preissiana* over moderately dense *Pericalymma ellipticum* and mixed shrubs**

Date:	14.9.98
Location:	Wetland between Wittenoom Rd. & Tonkin Hwy, Kewdale
Topography:	Dampland
Slope:	flat
Surface soil:	peaty sand
Leaf litter:	0-2 cm depth, 30-70% cover, distribution mainly under shrubs
Wood litter:	Negligible
Condition:	Excellent
Disturbance details:	Minimal weed invasion
Fire History	Old

Total vegetation cover:	98%	
Trees <5 m	0-2%:	*Melaleuca preissiana*
Shrubs 1-2 m	2-10%:	*Pericalymma ellipticum, Eutaxia virgata, Pericalymma ellipticum*
Shrubs 0.5-1 m	10-30%:	*Pericalymma ellipticum, Calothamnus lateralis, Melaleuca acerosa, Stirlingia latifolia*
Shrubs 0-0.5 m	10-30%:	*Hibbertia stellaris*
Herbs/ climbers	10-30%:	*Caladenia longicauda, Stylidium brunonianum* subsp. *brunonianum, Thysanotus multiflorus*
Sedge-like plants	10-30%:	*Meeboldina cana*

Site 4: **Open *Melaleuca rhaphiophylla* woodland and *Melaleuca viminea* shrubland over sparse aquatic herb Villarsia albiflora**

Date:	14.9.98
Location:	Seasonal swamp between Wittenoom Rd. & Tonkin Hwy, Kewdale
Topography:	Dampland / Palusplain
Slope:	Flat
Surface soil:	Peaty White-grey sand
Leaf litter:	<1 cm deep, 10-30 % cover, distribution mainly under shrubs
Wood litter:	Sparse
Condition:	Excellent
Disturbance details:	Minimal weed invasion
Fire History	Old

Total vegetation cover:	85%	
Trees <5 m	10-30%:	*Melaleuca rhaphiophylla*
Shrubs >2 m	10-30%:	*Melaleuca viminea*
Shrubs 1-2 m	0-2%:	*Melaleuca viminea*
Herbs/ climbers	10-30%:	*Villarsia albiflora, *Hypochaeris glabra, Trachymene pilosa*
Sedge-like plants	10-30%:	*Meeboldina cana, Lepidosperma longitudinale*

APPENDIX C: Site Description of Fora Assessment Sites for the Tonkin Hwy - Abernethy Road On Ramp Survey Area

Explanation of codes:

* = Introduced species
† = Priority species
subsp. = sub species
var. = variety

VEGETATION CONDITION

Pristine	Vegetation pristine; no disturbance evident at all.
Excellent	Strata essentially intact: some signs of human non native disturbance; e.g. feral scats, litter, minor tracks.
Good	One or more strata significantly impacted; e.g. grazing, some weeds, some vegetation removal.
Poor	One or more strata severely impacted; e.g. dense weed invasion, substantial logging or tracks.
Degraded	native vegetation largely or totally removed.

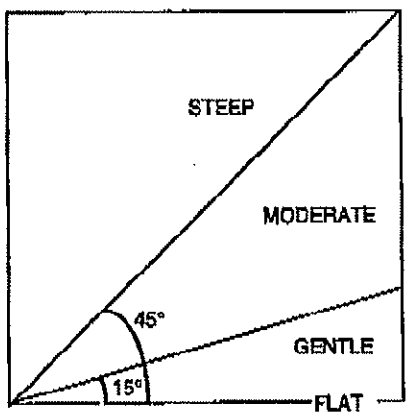
DENSITY (Vegetation, leaf litter, woodlitter)

Scattered	0-2% total cover
Sparse	2-10%
Open	10-30%
Moderately dense	30-70%
Dense	70-100%

FIRE HISTORY

Recent	0-2 years (completely devoid of vegetation or vegetation re-seeding/reshooting. Eucalypts and shrubs may have juvenile foliage from rootstock and/or branches. Shrubs, spinifex, herbs and grasses may evident as seedlings)
Moderate	2-5 years (burn scars on shrubs and trees still obvious, shrubs and spinifex may not be fully mature but species composition resembles original vegetation)
Old	5 years + (Vegetation mature but burn scars evident on trees, no evidence of fire damage on shrubs, grasses, herbs and spinifex)
None evident	No burn scars evident. Vegetation mature.

SLOPE



APPENDIX B: Species by Site Matrix for the Tonkin Hwy - Abernethy Road On Ramp Area

Species	Site			Transect				Opportunistic
	3	4	8	T2	T3	T4	T5	
Isotropis cuneata			1					
Jacksonia restioides						*		
Johnsonia pubescens				*				
Lepidosperma longitudinale		2						
Lepidosperma squamatum			1					
Leucopogon ?pulchella			1					
Leucopogon sp. 1			1					
Levenhookia sp. 1			1	*				
Lobelia rhombifolia					*			
Lyginia barbata			1					
Macarthuria keigheryi DRF			1					
Macrozamia reidlei								X Site 8
Meeboldina cana	4	2						
Melaleuca acerosa	2				*			
Melaleuca preissiana	2							
Melaleuca raphiophylla		2						
Melaleuca viminea		3						
Mesomelaena stygia			2					
Patersonia occidentalis			1					
Pericalymma ellipticum	4							
Petrophile linearis			1					
Phyllanthus calycinus			1					
Pimelia ?preissii			1		*			
Platytheca galioides								Near S2
Pterostylis vittata			1					
Scaevola ?paludosa P2			1					
Schoenus curviflorus						*		
Sphaerolobium linophylla					*	*		
Stirlingia latifolia	1		2					
Stylidium brunonianum subsp. *brunonianum*	1		1				*	
Stylidium bulbifera							*	
Stylidium diuroides			1					
Stylidium miniatum			1					
Stylidium repens			1					
Stylidium schoenoides					*			
Synaphea ?spinulosa			1					
Thysanotus multiflorus	1			*				
Thysanotus patersonii			1					
Trachymene pilosa		1	1					
Verticordia drummondii					*			
Villarsia albiflora		2						
Xanthorrhoea preissii			2*					

APPENDIX B: Species by Site Matrix for the Tonkin Hwy - Abernethy Road On Ramp Area

Species	Site			Transect				Opportunistic
	3	4	8	T2	T3	T4	T5	
**Briza maxima*			1					
**Ehrharta calycina*								X Site 8
**Euphorbia terracina*								X Site 8
**Gladiolus caryophyllaceous*			1					
**Hypochaeris glabra*		1						
**Lupinus costenii*								X Site 8
**Sonchus oleraceous*								X Site 8
Acacia pulchella			2					
Acacia saligna								X Site 8
Acacia sphaecelata			1					
Allocasuarina fraseriana			2					
Allocasuarina humilis			2					
Amphipogon amphipogonoides			1			*		
Anigozanthos humilis			1					
Banksia attenuata			3					
Banksia menziesii			3					
Bossiaea eriocarpa			1			*		
Burchardia umbellata			1					
Caladenia denticulata				*				
Caladenia longicauda	1							
Calothamnus lateralis	2							
Chamaexeros serra				*			*	
Comesperma virgatum					*	*		
Conostephium pendulum					*			
Conostylis setigera			1		*			
Conostylis sp. 1			1					
Corymbia calophylla								X Site 8
Corynotheca micrantha			1		*	*		
Crassula colorata						*		
Daviesia decurrens					*			
Desmocladus fascicularis			1					
Drosera sp. 1					*			
Drosera stolonifera			1					
Eremaea pauciflora				*				
Eutaxia virgata	1			*				
Gompholobium tomentosa			1					
Hakea sulcata							*	
Helipterum cotula				*				
Hibbertia huegelii					*			
Hibbertia hypericoides			3					
Hibbertia stellaris	1							
Hibbertia subvaginata				*			*	
Hovea trisperma			7					

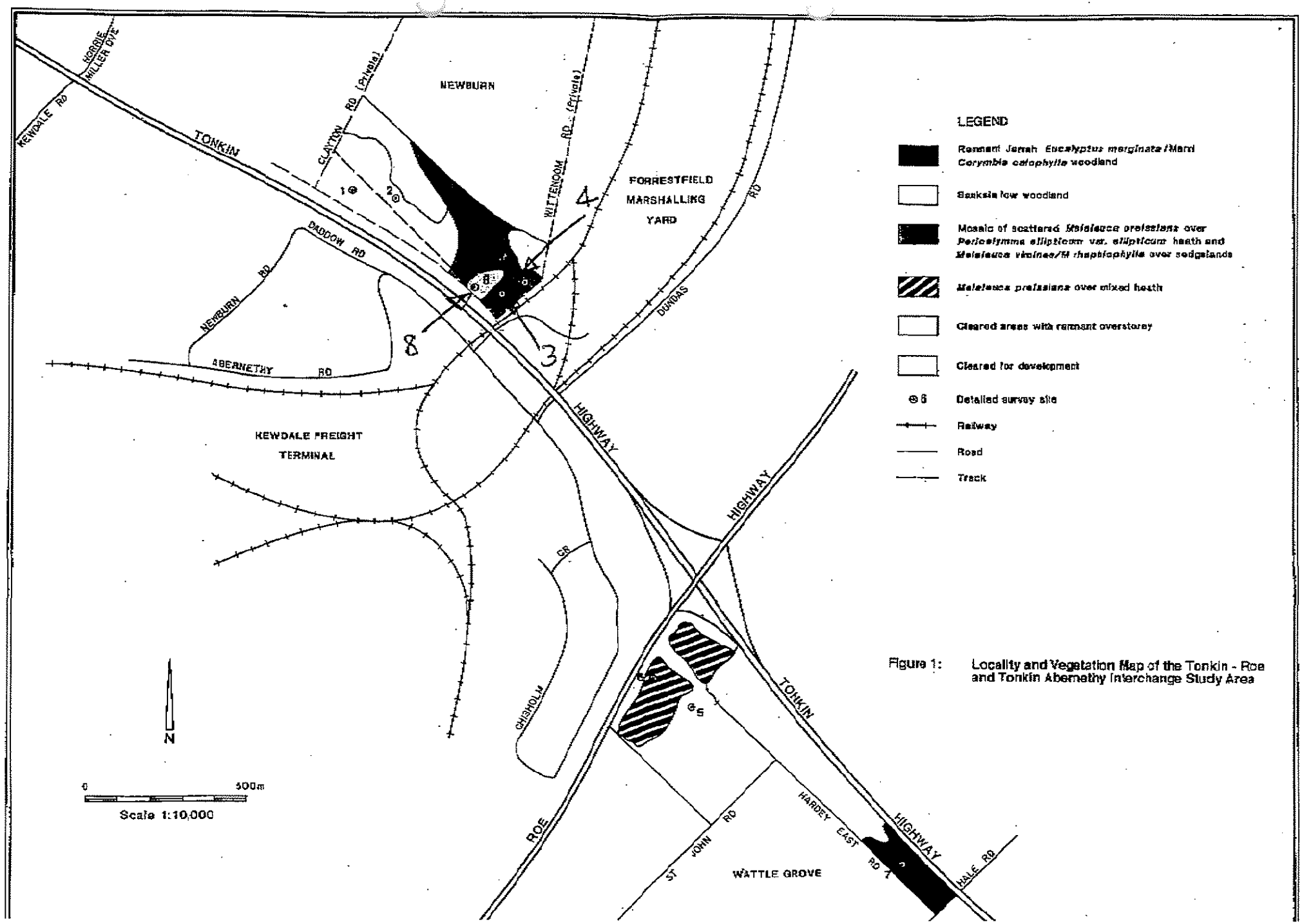


Figure 1: Locality and Vegetation Map of the Tonkin - Roe and Tonkin Abernethy Interchange Study Area

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WESTRALIA AIRPORTS CORPORATION
PERTH
INTERNATIONAL
AIRPORT

Our Ref:

6 January, 2000

Mr David Nunn
Manager, Environmental Planning Branch
Ministry for Planning
Albert Facey House
469 Wellington Street
PERTH WA 6000

Dear David,

Perth International Airport – Cummins Engine Company Development

Further to our telephone conversation yesterday, please find attached copies of the flora study reports prepared by Alan Tingay and Associates.

I trust the reports are of interest and assist with your assessment process.

Yours sincerely,

Jim Davies,
Manager, Planning and Environment

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FEDERAL AIRPORTS CORPORATION

PERTH AIRPORT
RARE AND ENDANGERED
FLORA AND FAUNA

ALAN TINGAY & ASSOCIATES

JUNE 1997

REPORT NO: 97/31

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1. INTRODUCTION

In response to a request from Environment Australia, the Federal Airports Corporation (FAC) has prepared an inventory of endangered and vulnerable species and ecological communities which occur at Perth Airport. This report has been prepared in particular to list species occurring at Perth Airport which are protected under the Commonwealth Endangered Species Protection Act, 1992.

Other flora and fauna which are considered significant or may become endangered or threatened at a national level are also identified in the report. The lists used to determine threatened or significant fauna at a national level include priority lists for flora and fauna maintained by the Endangered Species Advisory Committee, and international agreements between Australia and Japan, and Australia and China for the protection of migratory birds.

At the state level, species declared threatened and specially protected under provisions of Western Australia's Wildlife Conservation Act (1950), or listed on the Department of Conservation and Land Management's (CALM) priority flora and fauna lists have also been included.

In order to compile a comprehensive and accurate list of flora and fauna occurring at Perth Airport numerous recognised and published sources were consulted. The composite species lists based on these sources are provided in Appendices 1, 2 and 3.

2. COMMONWEALTH ACT AND AGREEMENTS

2.1 Endangered Species Protection Act 1992

Provisions of the Endangered Species Protection Act, 1992 allow flora and fauna species to be listed and protected on Schedule 1 and ecological communities to be protected on Schedule 2. The most recent amendments to Schedules 1 and 2 are dated May 1996. Currently there are no ecological communities contained in Schedule 2.

Schedule 1 is separated into three parts. Part 1 contains species that are 'endangered', Part 2 lists 'vulnerable' species and Part 3 identifies species which are presumed extinct.

To assist with the preparation of this inventory of rare flora and fauna, Environment Australia have provided the FAC with a list of Schedule 1 species which have been recorded at some time within areas which include Perth Airport. These areas (grid cells) cover one degree latitude and longitude, and therefore provide a broad geographic reference and include species which are most unlikely to have ever occurred at the airport. The centroid of the one degree cells in latitude and longitude relevant to Perth Airport are 31.5 S 115.5 E; 31.5 S 116.5 E; 32.5 S 115.5 E; and 32.5 S 116.5 E.

2.1.1 Endangered and Vulnerable Flora (Schedule 1)

Based on the sources consulted, over 300 species of native flora have been recorded at Perth Airport (Appendix 1). The composite species list does not include any taxa currently listed on Schedule 1 of the Commonwealth Endangered Species Protection Act, 1992.

It has been suggested that the aquatic species *Hydrocotyle lemnoides*, which is listed as vulnerable, is present at the airport however, this has not been confirmed. Surveys of the airport by two separate parties, including the swamp where this species supposedly occurred, identified the species in question as *Villarsia capitata*.

The list of Schedule 1 vascular plant species by one degree grid cells indicates several endangered and vulnerable species have been known to occur within a broad geographic area which includes Perth Airport. These comprise the following:

Acacia anomala	V
Acacia aphylla	V
Anthocercis gracilis	E
Aponogeton hexatepalus	V
Asterolasia grandiflora	V
Asterolasia nivea	V
Caladenia huegelii	V
Caladenia integra	V
Darwinia acerosa	V
Darwinia carnea	E

Diuris purdiei	V
Dryandra mimica	E
Dryandra serratuloides	V
Eucalyptus argutifolia	V
Eucalyptus granitlcola	E
Gastroloblum hamulosm	E
Grevillea cirsiifolia	V
Grevillea flexuosa	E
Grevillea saccata	V
Hemiandra gardneri	V
Hydrocotyle lemnoides	V
Pimelea rara	E
Spirogardera rubescens	V
Stylidium plantagineum	V
Stylidium scabridum	E
Thelymitra stellata	V
Thomasia montana	V
Verticordia hughanii	E

E = endangered; V = vulnerable

The majority of these species are either not known from the Perth region or have specific habitat requirements such as granite outcrops or lateritic soils associated with the Darling Scarp to the east of Perth. Hence, most of these species are unlikely to occur in the vicinity of Perth Airport.

The Perth Airport has been subject to extensive flora and vegetation surveys and assessments by various groups. None of the species listed above has been recorded at the site during these studies. The airport may however, support isolated local populations of additional species which have not yet been recorded and are perhaps more difficult to detect, such as annual and ephemeral species.

2.1.2 Endangered and Vulnerable Fauna (Schedule 1)

No fauna species listed as endangered or vulnerable under the Commonwealth Endangered Species Protection Act, 1992 are contained in the species lists for Perth Airport presented in Appendices 2 and 3. These lists are based on survey information collected over about the past 10 years. However one species listed on Schedule 1, the Western Swamp Tortoise, has been recorded at the site within the past 30 years.

The Western Swamp Tortoise (or Turtle) (*Pseudemydura umbrina)* is listed as endangered and is considered one of Australia's most endangered vertebrate species. This species is believed to have occurred within what are now the present boundaries of the airport but there has been no confirmed sightings in this area for more than 25 years. In 1970 a juvenile was caught near a swamp which may have been in the vicinity of the present main runway.

A trapping survey to determine the presence and abundance of the Western Swamp Tortoise was carried out in the spring and summer of 1995-1996 but failed to locate the species. A habitat assessment of wetland areas at Perth Airport

involving monitoring water levels, water chemical analyses and a survey of invertebrate composition and biomass, was made at the same time and indicated that some of the swamps could provide suitable habitat for this species.

Endangered and vulnerable fauna identified by Environment Australia as occurring within the relevant one degree reference cells comprise the following species:

Pseudemydura umbrina	Western Swamp Tortoise	E
Ctenotus lancelini	Lancelin Island Striped Skink	V
Leipoa ocellata	Malleefowl	E
Charadrius rubricollis	Hooded Plover	V
Dasyurus geoffroii	Western Quoll	E
Myrmecobius fasciatus	Numbat	E
Perameles bougainville	Western Barred Bandicoot	E
Macrotis lagotis	Bilby	V
Pseudocheirus occidentalis	Western Ringtail Possum	E
Bettongia lesueur	Burrowing Bettong	E
Lagorchestes hirsutus	Rufous Hare-wallaby	E
Petrogale lateralis	Black-footed Rock-wallaby	V
Lagostrophus fasiatus	Banded Hare-wallaby	E
Pseudomys shortridgei	Heath Rat	E

E = endangered; V = vulnerable

Based on past and/or present distributions of each of these species, only the Western Swamp Tortoise may occur near Perth Airport. Most of these species have not been known to occur in the Perth area, are only known from fossil records in the region or now have very restricted or isolated distributions at locations remote from Perth Airport. Systematic surveys of Perth Airport in recent years have not detected any evidence of these species.

2.2 Endangered Species Advisory Committee Priority Lists

Priority lists are maintained by the Endangered Species Advisory Committee (ESAC) which contain flora and fauna species considered to be at risk. Some of the species included on these lists are yet to be included on Schedule 1 of the Endangered Species Protection Act, 1992. The lists were developed primarily to assist ESAC in determining priorities for funding applications to prepare and implement recovery plans for these species.

2.2.1 Flora

The list of flora species considered to be at risk is based largely on the information gathered from around Australia as part of the Rare or Threatened Australian Plants (ROTAP) project. This project was aimed at identifying species at risk and determining the conservation status of each.

None of the species contained in the current ESAC priority flora list (dated 10 December 1996) are contained in the list of species recorded at Perth Airport.

2.2.2 Fauna

The list of fauna recorded at Perth Airport does not contain any of the species considered to be at risk and included on the ESAC priority lists (dated 11 April 1997).

2.3 International Agreements for Migratory Birds

The composite list of fauna recorded at Perth Airport contains two species which are protected by international agreements between Australia and Japan (Japan Australia Migratory Bird Agreement) and, Australia and China (China Australia Migratory Bird Agreement). These agreements relate specifically to migratory birds.

The species recorded at Perth Airport which are protected by these agreements are the Great Egret (*Ardea alba*) and the Rainbow Bee-eater (*Merops ornatus*). Both of these species are listed in the agreement with Japan while only the Great Egret is covered by the agreement with China. These species occur throughout Australia and are common seasonal visitors to the south-west corner of Western Australia.

3. STATE ACT

3.1 Wildlife Conservation Act 1950

Fauna and flora in Western Australia are afforded protection under provisions of the Wildlife Conservation Act, 1950. Flora species are given added protection by being declared rare under provisions of the Act and listed on the Schedule of Endangered Flora. Threatened fauna may be declared 'in need of special protection' and listed on Schedules 1 to 4 of the Act. Schedule 1 lists species which are considered rare or likely to become extinct; Schedule 2 identifies species presumed extinct; Schedule 3 contains migratory birds protected by agreements between Australia and Japan; and Schedule 4 species are fauna in need of special protection for other reasons .

3.1.1 Declared Rare Flora

The composite species list of native flora for Perth Airport does not include any species which are declared rare and contained on the Schedule of Endangered Flora (dated October 1996).

A search of the CALM database and Western Australian Herbarium records did not identify any species of declared rare flora which have been recorded at, or in close proximity to, Perth Airport.

3.1.2 Declared Threatened Fauna

The fauna at Perth Airport includes two species contained in Schedules 1 to 4 of the Western Australian Wildlife Conservation Act, 1950 (dated April 1996). These are the Short-billed Black Cockatoo (or Carnaby's Cockatoo) (*Calyptorhynchus latirostris)* and the Southern Brown Bandicoot (also referred to as the Quenda in Western Australia) *(Isoodon obesulus fusciventer).* Both of these species are declared as 'rare or likely to become extinct' (Schedule 1).

The Short-billed Black Cockatoo is a relatively common visitor to the Perth Metropolitan Region during spring and summer, and a seasonal visitor to the Perth Airport. This species is considered threatened because of concern over the reduction in nesting habitat (hollow trees) and food resources in the wheatbelt regions of Western Australia.

The Southern Brown Bandicoot is locally abundant at Perth Airport. Surveys in September and November 1993 detected 30 individuals. The bandicoot population at the airport has probably benefited from the fox control measures implemented by the FAC. The Southern Brown Bandicoot is listed as threatened fauna largely because of concern that the species is declining in numbers and distribution in Western Australia as a result of continuing habitat loss and predation pressures.

The Western Swamp Tortoise (*Pseudemydura umbrina)* is believed to have occurred within the present boundaries of Perth Airport within the past 30 years (see Section 2.1.3). In addition to its listing under Schedule 1 of the

Commonwealth Endangered Species Protection Act, 1992 this species is listed on Schedule 1 of the Western Australian Wildlife Conservation Act, 1950.

In addition, sightings of the Freckled Duck (*Stictonetta naevosa*) at Munday Swamp are referred to in Australian Heritage Commission documentation. The presence of this species was not confirmed during systematic surveys of Munday Swamp around the same time as the reported sightings. The habitat at Munday Swamp however is considered to be suitable for this Schedule 1 species and it may be an occasional visitor to Perth Airport in low numbers.

Two other Schedule 1 taxa may occur in the Perth area given their known distributions. These are Western Long-billed Corella (*Cacatua pastinator pastinator)* and Long-billed Black Cockatoo (or Baudin's Cockatoo) (*Calyptorhynchus baudinii).* Neither of these species is expected to be present at Perth Airport however the Long-billed Black Cockatoo may be a rare visitor to the site at certain times.

Also, the Peregrine Falcon (*Falco peregrinus*) (Schedule 4) may occur as an occasional visitor to the site. This species occurs as an uncommon resident or nomad throughout much of Australia and is a scarce visitor to parts of the coastal plain in the Perth Metropolitan Region.

None of the other species listed on Schedule 1 to 4 have been recorded at Perth Airport in recent times or is expected to be present.

3.2 CALM Priority Lists

The Department of Conservation and Land Management (CALM) maintains lists of flora and fauna which have few, poorly known populations or populations which are not well protected or require monitoring. These lists may include species which are being considered for inclusion on Schedules 1 to 4, or which have recently been deleted from declared rare or threatened lists.

3.2.1 Priority Flora

The composite flora list for Perth Airport includes six species identified on the latest CALM priority flora list (dated 21 October 1996). These are *Scaevola paludosa* (Priority 2), *Haemodorum loratum* (Priority 3), *Myriophyllum echinatum* (Priority 3), *Schoenus benthamii* (Priority 3), *Stylidium longitubum* (Priority 3) and *Verticordia lindleyi* subsp. *lindleyi* (Priority 4).

Priority 2 species are described as taxa which are known from one or a few populations (generally <5), at least some of which are not believed to be under immediate threat. Priority 3 are also poorly known taxa but are known from several populations with at least some of these not under immediate threat. Priority 4 species are considered rare taxa which have been adequately surveyed and are not currently under threat from any identifiable factors.

Another priority species *Conospermum undulatum* (Priority 4) has been reported to occur at the airport however, the presence of this species has not been confirmed during surveys of the site. Recorded by DEP

A search of CALM's database of threatened and priority flora identified seven species which are known to have occurred within the vicinity of the airport. These include the following:

Conospermum undulatum	P4 (Now delisted as Rare)
Conostephium minus	P4
Eucalyptus marginata subsp. *elegantella*	P2
Isopogon drummondii	P3
Olax scalariformis	P3
Platysace ramosissima	P3
Verticordia lindleyi subsp. *lindleyi*	P4

The WA Herbarium specimen data suggests an additional seven species have been recorded in the area. These comprise:

Aotus cordifolia	P3
Eryngium subdecumbens	P1
Haloragis tenuifolia	P1
Lambertia multiflora	P3
Macarthuria keigheryi	P1
Myriophyllum echinatum	P3
Synaphea acutiloba	P3

With the exception of *Verticordia lindleyi* subsp. *lindleyi*, *Myriophyllum echinatum* and possibly *Conospermum undulatum*, the species contained in both of the lists above have not been detected at the Perth Airport in any of the extensive surveys undertaken at the site.

3.2.2 Priority Fauna

Two priority fauna species have been recorded during the recent surveys at Perth Airport. These are the Keeled Legless Lizard (*Pletholax gracilis*) and Dusky Moorhen (*Gallinula tenebrosa*). Both of these species are Priority 4 taxa. Priority 4 species are described as 'taxa in need of monitoring'. These species are not considered threatened or in need of special protection however may be declining significantly and may become threatened if circumstances change.

The distribution of this species of legless lizard is confined to the coastal sand plain along the central coast in Western Australia between Eneabba to the north of Perth and Jandakot to the south. Within Australia, the Dusky Moorhen is known to occur within the south-west corner of Western Australia and throughout eastern Australia.

4. SUMMARY

Based on the species lists of flora and fauna prepared from several sources of information, no taxa included on Schedule 1 of the Commonwealth Endangered Species Protection Act, 1992 are present at Perth Airport.

The Western Swamp Tortoise (*Pseudemydura umbrina*) is believed to have occurred in the area however, there has been no confirmed sightings of this species for over 25 years. This species is listed on Schedule 1 of the Endangered Species Protection Act, 1992 as endangered.

The species lists for Perth Airport do not include any of the taxa identified as being at risk at the national level and contained in the Endangered Species Advisory Committee priority lists.

Two species protected by international agreements between Australia and Japan and, and Australia and China have been recorded at the airport. These are the Great Egret (*Ardea alba*) and the Rainbow Bee-eater (*Merops ornatus*).

At the state level, no flora species which are declared rare under provisions of the Wildlife Conservation Act, 1950 have been recorded at Perth Airport. Two fauna species of declared 'in need of special protection' (Schedule 1) in Western Australia were recorded during surveys of the airport. These are the Short-billed Black Cockatoo (*Calyptorhynchus latirostris*) and Southern Brown Bandicoot (or Quenda) (*Isoodon obesulus fusciventer*). The presence of a third species of Schedule 1 fauna, the Freckled Duck (*Stictonetta naevosa*), at the airport has not been confirmed.

The species recorded at Perth Airport include six flora species and two fauna species which are listed on the Western Australian Department of Conservation of Land Management (CALM) priority flora and fauna lists. These comprise *Scaevola paludosa, Haemodorum loratum, Myriophyllum echinatum, Schoenus benthamii, Stylidium longitubum, Verticordia lindleyi* subsp. *lindleyi,* Keeled Legless Lizard (*Pletholax gracilis*) and Dusky Moorhen (*Gallinula tenebrosa*).

APPENDICES

APPENDIX 1

FLORA RECORDED AT PERTH AIRPORT

APPENDIX 1

FLORA RECORDED AT PERTH AIRPORT

This flora list for Perth Airport has been derived from the following sources:

Alan Tingay & Associates. (1994). Flora and Vegetation of Perth Airport, Report 94/18. Report for the Federal Airports Corporation.

Dixon K.W. (1983). Existence and Significance of Flora and Vegetation in the Perth Airport International Terminal Building Site. Ph.D. Thesis.

Department of Environmental Protection (1995). System 6 Update: Site Based Flora List M52 Perth Airport (Sites 1-7). B.J. Keighery, 31 March 1995.

FLORA RECORDED AT PERTH AIRPORT

Acacia huegelii
Acacia pulchella
Acacia saligna
Acacia sessilis
Acacia stenoptera
Acacia willdenowiana
Adenanthos cygnorum
Agrostis plebeia
Alexgeorgea arenicola
Allocasurina humilis
Allocauarina fraseriana
Amphipogon turbinatus
Angianthus sp
Anigozanthos humilis
Anigozanthos humilis x manglesii
Anigozanthos manglesii
Anigozanthos viridis
Aotus gracilima
Aphelia cyperoides
Arnocrinum preissii
Astartea fascicularis
Asteridia pulverulenta
Astroloma pallidum
Astroloma stomarrhena
Baeckea camphorosmae
Banksia attenuata
Banksia grandis
Banksia ilicifolium
Banksia littoralis
Banksia menziesii
Banksia telmatiaea
Baumea articulata
Baumea juncea
Beaufortia squarrosa
Bolboschoenus caldwellii
Boronia ramosa
Borya scirpoidea
Bossiaea eriocarpa
Bossiaea ornata
Brachyscome iberidifolia
Brachyscome ?maryonii
Buchardia umbellata
Burchardia multiflora
Burnettia nigricans
Byblis gigantea
Caladenia arenicola
Caladenia ferruginea
Caladenia fimbriata
Caladenia flava
Caladenia longicauda
Caladenia paludosa
Calandrinia calyptrata
Calandrinia corrigioloides
Calectasia cyanea
Calothamnus lateralis
Calytrix angulata
Calytrix aurea
Calytrix flavescens
Calytrix fraseri
Cartonema philydroides
Cassytha flava
Cassytha racemosa
Centrolepis alepyroides
Centrolepis aristata
Centrolepis drummondiana
Centrolepis glabra
Centrolepis mutica
Chamaescilla corymbosa
Cheilanthes austrotenuifolia
Comesperma confertum
Conospermum stoechadis
Conostephium pendulum
Conostephium preissii
Conostylis aculeata
Conostylis aurea
Conostylis festucacea subsp. festucacea
Conostylis juncea
Conostylis setigera
Corynotheca micrantha
Cotula coronopifolia
Crassula colorata
Crassula pedicellosa
Cyathochaeta avenacea
Cyathochaeta clandestina
Cyperus difformis
Dampiera linearis
Danthonia caespitosa
Dasypogon bromeliifolius
Daviesia decurrens
Daviesia divaricata
Daviesia hakeoides
Daviesia incrassata
Daviesia physodes
Daviesia triflora
Dianella divaricata
Diuris carinata
Diuris laxiflora
Diuris longifolia

Diuris magnifica
Drosera erythrorrhiza
Drosera gigantea
Drosera glanduligera
Drosera macrantha subsp. macrantha
Drosera menziesii
Drosera paleacea
Drosera pluchella
Drosera stolonifera subsp. stolonifera
Dryandra nivea
Eragrostis elongata
Eremaea pauciflora
Eriostemon spicatus
Eucalyptus calophylla
Eucalyptus marginata
Eucalyptus rudis
Eucalyptus todtiana
Euchilopsis linearis
Eutaxia virgata
Exocarpos sparteus
Gahnia trifida
Gnaphalium candissimum
Gompholobium tomentosum
Goodenia micrantha
Gratiola peruviana
Haemodorum laxum
Haemodorum loratum
Haemodorum paniculatum
Haemodorum spicatum
Hakea lissocarpha
Hakea prostrata
Hakea sulcata
Hakea varia
Hardenbergia comptoniana
Helipterum cotula
Hemiandra pungens
Hibbertia aurea
Hibbertia huegelii
Hibbertia hypericoides
Hibbertia racemosa
Hibbertia stellaris
Homalosciadium homalocarpum
Hovea trisperma
Hyalosperma cotula
Hybanthus calycinus
Hydrocotyle alata
Hypocalymma angustifolium
Hypolaena exsulca
Isoetes drummondii
Isolepis cernua
Isolepis marginata
Isolepis oldfieldiana
Isotropis cuneifolius
Jacksonia densiflora
Jacksonia furcellata
Jacksonia lehmanni
Jacksonia prostrata
Jacksonia sternbergiana
Johnsonia pubescens
Juncus holoschoenus
Juncus pallidus
Kingia australis
Kunzea recurva
Lagenifera huegelii
Laxmannia squarrosa
Lechenaultia expansa
Lechenaultia floribunda
Lepidosperma angustatum
Lepidosperma gladiatum
Lepidosperma leptostachyum
Lepidosperma longitudinale
Lepidosperma scabrum
Lepidosperma tenue
Leptocarpus aristatus
Leptocarpus canus
Leptocarpus roycei ms
Leptoceras menziesii
Leptomeria cunninghamii
Leptomeria empetriformis
Lepyrodia muirii
Leucopogon australis
Leucopogon conostephioides
Leucopogon sprengelioides
Leucopogon squarrosus
Levenhookia preissii
Levenhookia pusilla
Levenhookia stipitata
Lobelia alata
Lobelia tenuior
Lomandra collina
Lomandra hermaphrodita
Lomandra preissii
Loxocarya fasciculata
Loxocarya flexuosa
Loxocarya pubescens
Lyginia barbata
Lysinema ciliatum
Macarthuria australis
Macrozamia riedlei
Melaleuca acerosa
Melaleuca lateritia
Melaleuca pauciflora
Melaleuca preissiana
Melaleuca rhaphiophylla

Melaleuca scabra
Melaleuca seriata
Mesomalaena tetragona
Mesomelaena graciliceps
Mesomelaena pseudostygia
Microtis atrata
Microtis media
Monotaxis grandiflora
Myriophyllum crispatum
Myriophyllum echinatum
Nemcia capitata
Neurachne alopecuroidea
Nuytsia floribunda
Olearia elaeophila
Opercularia vaginata
Patersonia occidentalis
Pericalymma ellipticum
Persoonia saccata
Petrophile linearis
Petrophile seminuda
Phlebocarya ciliata
Phlebocarya filifolia
Pimelea angustifolia
Pimelea sulphurea
Platytheca galioides
Podolepis gracilis
Podolepis lessonii
Podotheca angustifolia
Podotheca crysantha
Pogonolepis stricta
Polypompholyx multifida
Polypompholyx tenella
Poranthera microphylla
Potamogeton drummondii
Prasophyllum drumondii
Prasophyllum ovale
Pronaya fraseri
Pterochaeta paniculata
Pterostylis recurva
Pterostylis vittata
Quinetia urvillei
Regelia ciliata
Restio leptocarpoides
Restio sinuosus
Restio stenostachyus
Samolus repens
Scaevola paludosa
Schoenus benthamii
Schoenus brevisetis
Schoenus clandestinus
Schoenus curvifolius
Schoenus elegans
Schoenus grandiflorus
Schoenus odontocarpus
Schoenus tenellus
Scholtzia involucrata
Senecio quadridentatus
Siloxerus humifusus
Sowerbaea laxiflora
Sphaerolobium sp
Stackhousia pubescens
Stipa compressa
Stipa semibarbata
Stirlingia latifolia
Stylidium aff. repens
Stylidium brunonianum
Stylidium bulbiferum
Stylidium calcaratum
Stylidium despectum
Stylidium dichotomum
Stylidium longitubum
Stylidium obtusatum
Stylidium piliferum
Stylidium pulchellum
Stylidium repens
Stylidium schoenoides
Styphelia tenuiflora
Synaphaea petiolaris
Synaphaea spinulosa
Tertaria octandra
Thelymitra flexuosa
Thysanotus multiflorus
Thysanotus patersonii
Thysanotus sparteus
Thysanotus thyrsoideus
Thysanotus triandrus
Trachymene pilosa
Tribonanthes australis
Tribonanthes longipetala
Tricoryne elatior
Tricoryne tenella
Triglochin centrocarpum
Triglochin procerum
Triglochin striata
Tripterococcus bunonsis
Typha domingensis
Utricularia violacea
Velleia trinervis
Verticordia densiflora
Verticordia lindleyi subsp lindleyi
Verticordia nitens
Villarsia albiflora
Villarsia capitata
Villarsia violifolia

Viminaria juncea
Wahlenbergia preissii
Waitzia suaveolens
Xanthorrhoea brunnis
Xanthorrhoea preissii
Xanthosia huegelii

APPENDIX 2

VERTEBRATE FAUNA RECORDED AT PERTH AIRPORT

APPENDIX 2

VERTEBRATE FAUNA RECORDED AT PERTH AIRPORT

The list of vertebrate fauna recorded at Perth Airport is derived from the following sources:

Alan Tingay & Associates (1994). A Report of a Fauna Survey of the Perth Airport, Report 93/78. Report for the Federal Airports Corporation.

How R.A. (1995). Objection Assessment of Faunal Values for Perth Airport. Report for the Australian Heritage Commission.

John Dell (pers. comm.) (1994). Results of Western Australian Museum surveys, December 1986 to April 1990.

Robson and Chester (1989). Report on the Aquatic Fauna of Munday Swamp as an Indicator of Environmental Quality. Murdoch University.

Storey A.W., Vervest R.M., Pearson G.B. and Halse S.A. (1993). Wetlands on the Swan Coastal Plain Volume 7, Waterbird Usage of Wetlands of the Swan Coastal Plain, Environmental Protection Authority and Water Authority of Western Australia.

VERTEBRATE FAUNA RECORDED AT PERTH AIRPORT

FISH	
Gambusia affinis	Mosquitofish
Edelia vittata	Western Pygmy Perch
Galaxias occidentalis	Western Minnow
AMPHIBIANS	
MYOBATRACHIDAE	
Crinia glauerti	Glauert's froglet
Crinia insignifera	Sandplain froglet
Heleioporus eyrei	Moaning frog
Limnodynastes dorsalis	Western banjo frog/Pobblebonk
Myobatrachus gouldii	Turtle frog
Pseudophryne guentheri	Guenther's toadlet
HYLIDAE	
Litoria adelaidensis	Slender tree frog
REPTILES	
CHELIDAE	
Chelondina oblonga	Long-necked Tortoise
PYGOPODIDAE	
Delma fraseri	Fraser's legless lizard
Delma grayii	Gray's legless lizard
Lialis burtonis	Burton's legless lizard
Pletholax gracilis	Keeled legless lizard
AGAMIDAE	
Pogona minor	Western bearded dragon
VARANIDAE	
Varanus gouldii	Gould's monitor
Varanus tristis	Black-tailed monitor
SCINCIDAE	
Bassiana trillineata	South-western cool skink
Cryptoblepharus plagiocephalus	Snake-eyed, fence or sun skink
Ctenotus fallens	West coast ctenotus
Ctenotus gemmula	Jewelled ctenotus
Ctenotus impar	South-western odd-striped ctenotus
Ctenotus leseurii	Western limestone ctenotus
Hemiergis quadrilineata	Two-toed earless skink
Lerista elegans	West coast four-toed lerista
Menetia greyii	Common dwarf skink
Tiliqua rugosa	Shingleback/Bobtail/Sleepy lizard
TYPHLOPIDAE	
Ramphotyphlops australis	Southern blind snake

ELAPIDAE

Drysdalia coronata	Crowned snake
Neelaps bimaculatus	Black-naped snake
Pseudonaja affinis	Dugite/Spotted brown snake
Rhinoplocephalus gouldii	Gould's snake

BIRDS

ANATIDAE

Oxyura australis	Blue-billed Duck
Biziura lobata	Musk Duck
Cygnus atratus	Black Swan
Tadorna tadornoides	Australian Shelduck
Chenonetta jubata	Australian Wood Duck
Anas superciliosa	Pacific Black Duck
Anas rhynchotis	Australasian Shoveler
Anas gracilis	Grey Teal
Malacorhynchus membranaceus	Pink-eared Duck

PODICIPEDIDAE

Tachybaptus novaehollandiae	Australasian Grebe

PHALACROCORACIDAE

Phalacrocorax melanoleucos	Little Pied Cormorant
Phalacrocorax sulcirostris	Little Black Cormorant
Phalacrocorax carbo	Great Cormorant

PELECANIDAE

Pelecanus conspicillatus	Australian Pelican

ARDEIDAE

Egretta novaehollandiae	White-faced Heron
Ardea alba	Great Egret

THRESKIORNITHIDAE

Threskiornis molucca	Australian White Ibis
Threskiornis spinicollis	Straw-necked Ibis
Platelea flavipes	Yellow-billed Spoonbill

ACCIPITRIDAE

Elanus axillaris	Black-shouldered Kite
Accipiter fasciatus	Brown Goshawk
Accipiter cirrhocephalus	Collared Sparrowhawk
Aquila audax	Wedge-tailed Eagle
Hieraaetus morphnoides	Little Eagle

FALCONIDAE

Falco berigora	Brown Falcon
Falco cenchroides	Nankeen Kestrel

RALLIDAE

Porphyrio porphyrio	Purple Swamphen
Gallinula tenebrosa	Dusky Moorhen

Fulica atra	Eurasian Coot
RECURVIROSTRIDAE	
Himantopus himantopus	Black-winged Stilt
Cladorhynchus leucocephalus	Banded Stilt
CHARADRIIDAE	
Elseyornis melanops	Black-fronted Dotterel
COLUMBIDAE	
Streptopelia senegalensis	Laughing Turtle-Dove
Streptopelia chinensis	Spotted Turtle-Dove
Phaps chalcoptera	Common Bronzewing
Ocyphaps lophotes	Crested Pigeon
CACATUIDAE	
Calyptorhynchus latirostris	Short-billed Black Cockatoo
Cacatua roseicapilla	Galah
PSITTACIDAE	
Barnardius zonarius	Australian Ringneck
Purpureicephalus spurius	Red-capped Parrot
Neophema elegans	Elegant Parrot
CUCULIDAE	
Cuculus pallidus	Pallid Cuckoo
Chrysococcyx basalis	Horsfield's Bronze-Cuckoo
Chrysococcyx lucidus	Shining Bronze-Cuckoo
HALCYONIDAE	
Dacelo novaeguineae	Laughing Kookaburra
Todiramphus sanctus	Sacred Kingfisher
MEROPIDAE	
Merops ornatus	Rainbow Bee-eater
MALURIDAE	
Malurus splendens	Splendid Fairy-wren
PARDALOTIDAE	
Pardalotus punctatus	Spotted Pardalote
Pardalotus striatus	Striated Pardalote
Gerygone fusca	Western Gerygone
Acanthiza apicalis	Inland Thornbill
Acanthiza chrysorrhoa	Yellow-rumped Thornbill
MELIPHAGIDAE	
Anthochaera carunculata	Red Wattlebird
Anthochaera chrysoptera	Little Wattlebird
Lichenostomus virescens	Singing Honeyeater
Lichmera indistincta	Brown Honeyeater
Phylidonyris novaehollandiae	New Holland Honeyeater

Phylidonyris nigra	White-cheeked Honeyeater
Phylidonyris melanops	Tawny-crowned Honeyeater
Acanthorhynchus superciliosus	Western Spinebill
Epithianura albifrons	White-fronted Chat
PETROICIDAE	
Petroica goodenovii	Red-capped Robin
NEOSITTIDAE	
Daphoenositta chrysoptera	Varied Sitella
PACHYCEPHALIDAE	
Pachycephala pectoralis	Golden Whistler
Pachycephala rufiventris	Rufous Whistler
DICRURIDAE	
Grallina cyanoleuca	Magpie-Lark
Rhipidura fuliginosa	Grey Fantail
Rhipidura leucophrys	Willie Wagtail
CAMPEPHAGIDAE	
Coracina novaehollandiae	Black-faced Cuckoo-Shrike
Lalage sueurii	White-winged Triller
ARTAMIDAE	
Artamus cinereus	Black-faced Woodswallow
Artamus cyanopterus	Dusky Woodswallow
Cracticus torquatus	Grey Butcherbird
Gymnorhina tibicen	Australian Magpie
CORVIDAE	
Corvus coronoides	Australian Raven
MOTACILLIDAE	
Anthus novaeseelandiae	Richard's Pipit
DICAEIDAE	
Dicaeum hirundinaceum	Mistletoebird
HIRUNDINIDAE	
Hirundo neoxena	Welcome Swallow
Hirundo nigricans	Tree Martin
Hirundo ariel	Fairy Martin
SYLVIIDAE	
Acrocephalus stentoreus	Clamorous Reed Warbler
Cincloramphus mathewsi	Rufous Songlark
Cincloramphus cruralis	Brown Songlark
ZOSTEROPIDAE	
Zosterops lateralis	Silvereye

MAMMALS

TACHYGLOSSIDAE	
Tachyglossus aculeatus	Echidna
PERAMELIDAE	
Isoodon obesulus	Southern Brown Bandicoot
MURIDAE	
Mus musculus	House Mouse
Rattus rattus	Black Rat
CANIDAE	
Vulpes vulpes	Fox
LEPORIDAE	
Oryctolagus cuniculus	Rabbit

APPENDIX 3

INVERTEBRATE FAUNA RECORDED AT PERTH AIRPORT

APPENDIX 3

INVERTEBRATE FAUNA RECORDED AT PERTH AIRPORT

The list of invertebrate fauna recorded at Perth Airport is derived from the following sources:

Part A:

Robson B.I. and Chester E.T. (1989). Report on the Aquatic Fauna of Munday Swamp as an Indicator of Environmental Quality. Murdoch University.

Part B:

Halse S.A. and Storey A.W. (1996). Aquatic Invertebrate Surveys and Water Quality of Perth Airport Swamps. In: Survey of the Western Swamp Tortoise and its Habitat at the Perth Airport, G. Kuchling and A.A. Burbidge, 1996.

INVERTEBRATE FAUNA RECORDED AT PERTH AIRPORT (PART A)

WESTRALIA AIRPORTS CORPORATION
PERTH INTERNATIONAL AIRPORT

PLATYHELMINTHES		
Turbellaria	Planarian sp.	Flatworm
ANNELIDA		
Hirudinea	Glossiphoniidae sp. 1	Leach
	Glossiphoniidae sp. 2	Leach
	Hirudinea sp. 1	Leach
Oligochaeta	spp.	Aquatic earthworms
MOLLUSCA		
Gastropoda	Fortissia sp.	Limpet
	Lymnaea columnella	Aquatic snail
	Physa acuta	Aquatic snail
	Physastra georgiana	Aquatic snail
ARACHNIDA		
Hydracarina	Acercella falcipes	Water mite
	Arreneurus balladoniensis	Water mite
	Hydrachna sp. 1	Water mite
	Hydrachna sp. 2	Water mite
	sp. 1	Water mite
Araneae	sp. 1	Aquatic spider
	sp. 2	Aquatic spider
CRUSTACEA		
Amphipoda	Perthia acutitelson	
Cladocera	Macrothricidae sp.	Water flea
	Moinidae sp.	Water flea
Copepoda	Calanoida sp. 1	
	Cyclopoida sp. 1	
	Harpacticoida sp. 1	
Isopoda	Paramphisopus palestris	
Decapoda	Cherax preissii	Koonac
	Cherax quinquecarinatus	Gilgie
Ostracoda	Alboa worooa	
	Cupricelus salluus	
INSECTA		
Odonata		
Anisoptera	Hemicordulia tau	Dragonfly larvae
	Orthetrum calledonicum	Dragonfly larvae
	Procordulia affinis	Dragonfly larvae
Zygoptera	Austroagrion coeruleum	Damselfly larvae
	Austrolestes annulosus	Damselfly larvae
	Ischnura aurora	Damselfly larvae
	Ischnura heterosticta	Damselfly larvae
	Xanthagrion erythroneurum	Damselfly larvae
Collembola	sp.	Springtail
Coleoptera (adults)		
Curculionidae	sp. 1	Aquatic beetle
Hydrophilidae	Helochares sp.	Aquatic beetle
	Paracymus pygmaeus	Aquatic beetle
	Dytiscidae sp. 1	Aquatic beetle
Dytiscidae	Dytiscidae sp. 2	Aquatic beetle
	Hyphydrus elegans	Aquatic beetle
	Liodessus sp. 1	Aquatic beetle
	Sternopriscus sp. 1	Aquatic beetle
	Sternopriscus sp. 2	Aquatic beetle
(larvae)	sp. 3	Aquatic beetle
Dytiscidae	Hyphydrus sp.	Aquatic beetle
	sp.	Aquatic beetle
Gyrinidae	sp. 1	Aquatic beetle
Hydrophilidae	sp. 2	Aquatic beetle
	Borosus sp.	Aquatic beetle

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Diptera (larvae)		
Ceratopogonidae	sp. 1	Biting midge
Chironomidae	Chironomus tepperi	Midge
	Chironomus griseipositus	Midge
	Chironomus sp. 1	Midge
	Chironomus sp. 2	Midge
	Dicrotendipes conjunctus	Midge
	Polypedilum nubifer	Midge
	Procladius villosimanus	Midge
	Tanytarsus fuscithorax	Midge
Stratiomyidae	sp. 1	Soldierfly larva
Tabanidae	sp. 1	Marchfly larva
Tipulidae	sp. 1	Cranefly larva
	sp. 2	Cranefly larva
Ephemoroptera	Cloeon fluviatile	Mayfly larvae
	Cloeon sp.	Mayfly larvae
	Tasmanocoenis tillyardi	Mayfly larvae
Hemiptera		
Corixidae	Agraptocorixa birtifrons	Waterboatman
	Micronecta robusta	Waterboatman
	Sigara mullaka	Waterboatman
Hebridae	sp. 1	Waterbug
Notonectidae	Anisops thienemanni	Backswimmer
	Anisops sp. 1	Backswimmer
	Anisops sp. 2	Backswimmer
	Notonecta handlirschi	Backswimmer
Veliidae	sp.	Aquatic bugs
Hesoveliidae	Hesovelia sp.	Aquatic bugs
Lepidoptera	sp. 1	
	Pyralidae sp.	
Trichoptera	Ecnomidae sp. 1	Caddisfly larvae
	Oecetis sp.	Caddisfly larvae
	Triplectides australis	Caddisfly larvae

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INVERTEBRATE FAUNA RECORDED AT PERTH AIRPORT (PART B)

WESTRALIA AIRPORTS CORPORATION
PERTH INTERNATIONAL AIRPORT

ORDER	FAMILY	SPECIES
Cnidaria	Hydridae	*Hydra sp*
Mollusca-Gastropoda	Succineidae	*Succinea sp*
	Ancylidae	*Ferrina petterdi*
	Planorbidae	*Physastra sp.*
Turbellaria		*Turbellaria spp*
Annelida - Oligochaeta		*Oligochaeta sp.*
Oribatida		*Oribatida spp.*
Hydracarina	Eylaidae	*Eylais sp. A*
	Pionidae	*Acercella falcipes*
		Piona marleyi
		Pionidae sp.
	Limnesiidae	*Limnesia sp. A*
	Arrenuridae	*Arrenurus sp. A*
Mesostigmata		*Mesostigmata sp.*
Concostraca	Limnadiidae	*Eulimnadia sp.*
	Lynceidae	*Lynceus sp.*
Cladocera	Chydoridae	*Archepleuroxus baylyi*
		Chydorus sp
		Biapertura sp
		Biapertura aff affinis
		Biapertura aff setigera
		Dunhevedia aff crassa
		Gen nov sp nov
		Pleuroxus sp
		Aff Pseudochydorus sp
		Alona aff diaphana
	Macrothricidae	*Macrothrix sp*
	Daphniidae	*Ceriodaphnia sp*
		Daphnia carinata
		Simocephalus sp A
		Scapholegeris kingi
		Daphniopsis sp
		Simocephalus sp B
	Moinidae	*Moina sp*
Ostracoda	Cyprididae	*Alboa worooa*

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ORDER	FAMILY	SPECIES
Ostracoda	Cyprididae	*Cypretta sp. 272*
		Cypretta ceylo
		Cypretta aff. kaddaiensis
		Cypretta sp. 441
		Cypericercus sp. 442
		Bennelongia australis
		Bennelongia sp. 277
		Candonocypris novaezelandiae
		Ilyodromus sp. 255
		Sarscypridopsis aculeata
		Strandesia sp. 436
		Eucypris virens
Copepoda	Centropagidae	*Boeckella robusta*
		Boeckella bispinosa
		Boeckella geniculata
		Boeckella sp.
		Calamoecia attenuata
		Calamoecia tasmanica
		Hemiboeckella andersonae
	Cyclopoidae	*Microcyclops sp. EB1*
		Mesocyclops sp. EB1
		Paracyclops chiltoni
	Canthocamptidae	*Canthocamptus australicus*
Decapoda	Parastacidae	*Cherax tenuimanus*
Amphipoda	Ceinidae	*Austrochiltonia subtenuis*
Isopoda	Phreatoicidea	*Paramphisopus palustris*
	Tanypodiinae	*? Parachironomus sp.*
		Ablabesmyia ?notabilis
		Chironomus aff. alternans
		Chironomus tepperi
	Orthocladiinae	*Corynoneura scutellata*
		Cricotopus sp.
		Dicrotendipes ?conjunctus
		Larsia ?albiceps
		Limnophyes pullulus
	Chironominae	*Orthocladiinae ?sp.V44*
		Orthocladiinae sp.

ORDER	FAMILY	SPECIES
Isopoda	Phreatoicidea	
	Chironominae	*Paramerina levidensis*
		Tanytarsini
	Tanytarsini	*Tanytarsus sp.*
	Culicinae	*Aedes macintoshi*
		Anopheles annulipes
		Culex australicus
		Aedes alboannulatus
	Chaoborinae	*Promochlonyx australiensis*
	Stratiomyidae	*Stratiomyidae spp.*
	Ceratopogonidae	*Ceratopogonidae spp.*
	Ephydridae	*Ephydridae sp.*
	Muscidae	*Muscidae sp.*
Lepidoptera	Pyralidae	*Pyralidae sp*
Odonata - Zygoptera	Coenagrionidae	*Ischnura aurora/heterosticta*
		Ischnura sp.
	Lestidae	*Austrolestes io*
		Austrolestes analis
		Austrolestes annulosos
Odonata - Anisoptera	Aeschnidae	*Aeschnidae sp.*
		Anax papuensis
	Libellulidae	*Libellulidae sp.*
		Diplacodes bipunctata
Ephemeroptera	Baetidae	*Cloeon sp.*
Hemiptera	Notonectidae	*Anisops hyperion*
		Anisops thienemanni
		Anisops sp.
	Corixidae	*Agraptocorixa sp.*
		Micronect robusta
Coleoptera	Dytiscidae	*Allodessus bistrigatus*
		Antiporus femoralis
		Bidessus sp.
		Homeodytes scutelaris
		Hyphydrus sp.
		Liodessus ?inornatus
		Megaporus sp (1)
		Paracymus pygmaeus

ORDER	FAMILY	SPECIES
Coleoptera	Dytiscidae	*Rhantus sp. A larva*
		Rhantus sp. 1 larva
		Rhantus suturalis
		Sternopriscus browni
		Sternopriscus sp. (1)
		Dytiscidae sp. ?(SAHV020)
	Haliplidae	*Haliplus gibbus/fuscatus*
	Hydrophilidae	*Hydrophilidae sp. (1)*
		Berosus approximans
		Berosus sp (1)
		Enochrus sp. (SAHV23)
		Hydrochus sp. (SAHV34)
	Helodidae	*Helodidae sp.*
	Scirtidae	*Scirtes sp.*
	Curculionidae	*Curculionidae sp.*
	Carabidae	*Carabidae sp.*
	Limnichidae	*Limnichus sp.*
		Coleoptera sp(1)
Trichoptera	Leptoceridae	*Triplectides australis*
		Leptoceridae sp.H
	Hydroptilidae	*Hellyethira malleoforma*
		Hellyethira ?simplex

Westralia Airports Corporation Pty Ltd A.C.N. 077 153 130
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OBJECTION ASSESSMENT OF THE PERTH AIRPORT

ABORIGINAL VALUES

A REPORT TO THE AUSTRALIAN HERITAGE COMMISION

PREPARED BY

AUSTRALIAN ARCHAEOLOGICAL SURVEY CONSULTANTS
(AASC)
(HUYS & JOHNSTON)

0CTOBER 1995

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1.0 INTRODUCTION

In February 1993 the Perth Airport Bushland, was placed in the Interim List of the Australian Heritage Commission' (AHC) Register of the National Estate (RNE). The nomination concentrated mainly on the significance of the natural environment of the area but also included a small section relating to the Aboriginal cultural significance of Munday Swamp which is also located in the Perth Airport boundaries (See Appendix 1). In February 1993 an objection was received from the Federal Airports Corporation (FAC) regarding the Perth Airport Bushland nomination and the intention of registering the area in the RNE (See Appendix 2).

As a result of the objection the Minister of Environment Sport and Territories has appointed independent assessors to assess the national estate values of the areas nominated. Mr Dave Johnston from Australian Archaeological Survey Consultants Pty Ltd has been appointed to assess the Aboriginal cultural values of the area in question.

The Aboriginal cultural values Assessor was required in his brief to attend the Perth Airport Objection meeting in Perth and to meet with various Aboriginal custodians. Background research was to be carried out at the AHC and the Aboriginal Heritage Section of the Aboriginal Affairs Department. This report contains the results of the above mentioned meetings and independent research. In consideration of the objection, the report aims to assist and advise the Commission in the assessment of the Aboriginal cultural values for the Perth Airport Bushland, in terms of national estate significance.

2.0 BACKGROUND INFORMATION ON THE NYUNGAH HERITAGE OF THE PERTH REGION

2.1 General Background

The south-west of Western Australia was, at the time of European colonisation, inhabited by a number of socio-linguistical groups which formed a distinct social and cultural block. The people referred to themselves as Nyngan / Nyungah, a term of identification which is still used today by south-west Western Australian Aboriginal people. Traditionally the area around Perth was part of the territory of the Whadjug (Berndt 1979:82). The Whadjug, in common with other coastal Ngungah groups, had matrilineal moieties with four matrilineal exogamous clans (McDonald et al 1989: 7). The names of these clans had totemic associations. However, ritual affiliations were through an individual's father (McDonald et al 1989: 7). It seems that there were probably local patrilineal desent groups, which focused on specific totemic sites in defined stretches of country (Berndt 1979:82).

Within the Whadjug, there were a number of identified group territories at the time of contact. The Helena area is variously recorded as the land of the Beeloo occupied by a group headed by Munday and the land of Bi-nan under the leadership of Yurgan or Yagan (Makin 1970; McNair and Rumley 1981). However, as Hallam (1984:7) points out, early observers focused on discrete territories and patrilineal relationships rather than on overlapping sets of ritual and social connections and rights based on a membership of both matrilineal and patrilineal groupings.

Colonisation resulted in the decimation of the Nyungah population and the destruction of Aboriginal social organisation around Perth and subsequently throughout the south-west (McDonald et al 1989: 8). Policies of the forced exclusion of Nyungahs from particular areas, their concentration in settlements (eg. Carrolup and Moore Rivers), restrictions on movement and labour and so on resulted in the attenuation of traditional links with country and sites (*ibid*). Consequently, much of the traditional mythological and ritual association with lands has been lost (*ibid*). However, there still is a considerable degree of knowledge of traditional mythological and ceremonial sites. In some cases the sites are known but the mythology lost, while in others the mythology might be remembered but the actual location of the site unknown (*ibid*). Colonisation of the south-west has strengthened the sense of commonality between those who survived and forged a stronger Nyungah identity (*ibid*).

2.2 Previous Archaeological Work on Nyungah Sites at the Perth Airport

There have been extensive archaeological surveys carried out at or near the Munday Swamp area (Reynolds 1989). Initially the airport area was looked at during the Swan Coastal Plain Survey (in Hallam 1983). The study focused on 'prehistoric' Aboriginal settlement patterns on the Swan Coastal Plain. Sites located were assigned to a broad chronology of four occupational phases based on the tool technologies and lithic types represented in their assemblages. These four occupation phases are:

* EARLY - pre 5000BP: characterised by the presence of fossiliferous chert, sources of which were available only at periods of sea level lower than present. (Glover 1975; Quilty 1981)
* Middle - 5000BP to 1000BP: characterised by extensive use of backed blade technology and mylonite as a raw material.
* Late - 1000BP to contact: sites contain mostly chips of one major raw material, quartz.
* Final - Contact to present: characterised by the use of introduced materials, such as glass. (Anderson 1983a ; Hallam 1983)

There have also been a number of archaeological investigations of the Perth Airport area carried out by Hallam (1983, 1986), Anderson (1983a,b,c, 1984) and Strawbridge (1984), for the Department of Housing and Construction, Department of Transport and Construction. Although the main emphasis of these reports was archival based, the ethnographic aspect of Munday Swamp was recorded in some detail by Anderson (1983a) and again by O'Connor et al (1985).

In 1989, areas within Perth Airport, excluding Munday Swamp, that were proposed for development were resurveyed (McDonald and Murphy 1989). That study identified 2 new sites in addition to the 54 already recovered. All of the researchers agree that sand ridges along the margins of permanent and ephemeral swamps were the favoured locations of Aboriginal groups camping in the area. This allowed people access to both swamp and bushland resources whilst avoiding the damp and mosquitos of the lower lying ground (McDonald and Murphy 1989).

2.2.1 Munday Swamp and Surrounds

The Western Australian Aboriginal Affairs Department (AAD) has the following sites at Munday Swamp and surrounds recorded in its Site Register.

* Site: S 2219 (Munday Swamp)
Munday Swamp is an area where ceremonial activities took place associated with the hunting of turtles. The swamp was also important for supplying other animal and plant resources, and is still being utilised by local Aboriginal people today. Munday Swamp is of ethnographic, archaeological and historic significance. In a report on the survey of Aboriginal areas of significance in the Perth Metropolitan and Murray River regions, O'Connor et al (1985) stated:

> It is in the opinion of the researchers that Munday Swamp is an Aboriginal Site of outstanding importance and that steps should be taken to have it declared a Protected Area in accordance with Section 19 of the Act. It is also a recommendation of this report that the Dept. of Aboriginal Sites should contact the landowners on whose property this ancient Aboriginal resource is now located, with a request that they allow Aboriginal people rights of access to the site.

Section 2.3 below outlines in more detail the Aboriginal significance of Munday Swamp. The current boundary for the Perth Airport interim listing (Area B) includes a large section of the registered site boundary (AAD, WA), however, both boundaries differ somewhat in shape and size. The AAD's boundary for the Munday Swamp site extends into the area that is currently the RNE Perth Airport interim listing (Area A).

* Site S1800
Site S1800 is located in a cleared paddock immediately east of Munday Swamp. It is a large site consisting of four main artefact concentrations (Site S1800.1, .2, .3, .4) each situated on and around a sand dune. The western edge of one of the artefact concentrations (Site S1800.1) falls within the eastern edge of the current RNE Perth Airport interim listing (Area B). A large number of artefacts made from silcrete, quartz and chert are recorded for this site. At least 20% of the artefacts are made from fossiliferous chert, including very large side scrapers (more than 10cm x 5cm). The presence of fossiliferous chert suggests that this site is an 'Early Phase' (Pre 5000BP) site. Other archaeological evidence suggests that the site continued to be used up to the present. Artefacts made from silcrete and quartz include steep scrapers, adzes, fabricators, basal grindstones and several ovoid mullers on river cobbles with flattened surfaces.

The site has been given an A+ Rating in the AAD Site Register.

* Site S1808

Site S1808 is a large site spread over a wide area immediately west of Munday Swamp. Test pitting has recorded nearly 2000 artefacts from the main artefact concentrations at this site. Strawbridge (1984) recorded 1,249 artefacts from sub-Site S1808.2 and recommended that it be preserved. A large part of Site S1808 falls within the current Perth Airport RNE interim listing.

* Sites S1792 & S1793

Site S1792 (311 artefacts recorded) and Site S1793 (67 artefacts recorded) are located immediately north of the current Perth Airport RNE interim listing. Both sites however, lie within the Aboriginal Affairs Department's overall boundary for the Munday Swamp site (S2219) and are obviously associated with it. Strawbridge 1984 recommended that Site S1792 be permanently preserved, as there was research potential in the archaeological deposits present.

The locations of sites in the Site Register at the Western Australian Aboriginal Affairs Department are confidential. That Department can advise on exact boundaries of sites.

2.3 Previously Recorded Nyungah Significance of Munday Swamp

A number of reports and documented sources record the significance of Munday Swamp to the local Nyungah people:

Survey for Aboriginal Sites in the Proposed International Terminal Complex Area, Perth Airport, WA (Anderson 1983a: 12-14)...

> Of the persons contacted in Perth for the purpose of gathering ethnographic data, 7 were able to offer information relevant to the general Perth Airport area. While none actually specified a point within the survey boundary, 6 referred to a permanent water body (called Poison Gully on maps) which in one part of its length forms a wider swamp area. These features lie just east of the survey area.
>
> All of the seven informants were associated in some way with Allawah Grove, South Guilford, an Aboriginal Reserve just south of Kalamunda Rd, near its junction with the Great Western Highway. Aboriginal people lived at Allawah Grove for varying periods from before the Second World War until the late 1960's. (It was used by the Army during the war, and in the early post-war period as a migrant centre.) Some of the information obtained is recollections of childhood excursions into the Poison Gully area, or has been communicated to the informant by other persons, and as such is fragmentary and not always clear, especially with reference to exact locations.
>
> Informant A, (male, aged 67 years), who was at Allawah Grove Reserve from 1964 to 1968, recalls going with his wife into the swamp in the Poison Gully area for several purposes - hunting, and obtaining reeds from the swamp for brooms, jarrah for cloths props and paperbark from the *Melaleuca* trees for his wife's bark painting. He also

mentioned that an old uncle had warned him to avoid certain parts of the swamp as dangerous for Aboriginal people, but could not remember just where these places were or what dangers were to be avoided.

Informant B (male. aged 50 years) who lived in a camp in bushland in the vicinity of the present Newburn Rd when there were only tracks in the area, hunted turtles and ducks in the swamp and also set snares for the brush kangaroo. Informant C, his wife (aged 46 years), who lived at Allawah Grove, recalls going to the swamp with her great grandmother to catch turtles when she was a small girl. She said that the swamp was called Monday Swamp. She described how the turtles were first cooked in the ashes of a fire beside the swamp, then cut up with its broken breastplate and eaten on the spot.

Informant C also related how her great grandmother would always stop before approaching too near Monday Swamp, speaking in her own dialect to ensure that turtles would be caught there, and also to avoid "trouble". This aspect was reinforced by Informant B, who said that all the old people went through this procedure when in the vicinity of the swamp. He added that Aboriginal people also came from further afield than Allawah Grove to Monday Swamp for turtles. They camped nearby for a few days and had what he described as a "turtle feast".

The other three informants who referred to the Poison Gully area supported the statements of those already quoted. Informant D, who introduced "bark painting' to the women at Allawah Grove, recalls that the paperbark was obtained from the swamps to the southeast. Informant E stated that the Poison Gully swamp area was purely a hunting area where he caught brush kangaroos and goannas fifty years ago. There was nothing of a sacred or religious nature associated with it. Informant F also went, with adult males, to hunt near Monday Swamp when about 9 years old. They travelled 5-6 miles to arrive there and camped overnight. To ward off dangers or trouble they were "put through the smoke"; i.e. they stood in the smoke of a small fire lit expressly for the purpose.

The ethnographic evidence thus indicates that the swamp to the east of the actual survey area was used regularly until the late 1960's for various economic purposes. That this was so for earlier periods has been shown by the discovery of very large archaeological sites near Poison Gully. Although no one has associated the area with any religious significance, the eerie nature of the swamp seems to have stimulated the need to ward off trouble or danger. No specific ethnographic sites except Monday Swamp itself have been located, but the lack of precision of the information allows the possibility that such sites could have existed within the vicinity of the swamp areas to the west; i.e. within the survey area.

North Lake Draft Management Plan (Murdoch University 1986: 162-163)...

The importance of wetland species appears to have been reflected in the spiritual and cultural traditions of the Aboriginal people of the south west. Early European accounts refer to complex kinship categories with totemic identifications to local animals and plants. These kinship beliefs define important spiritual and personal relations to the non-human species of the natural environment. Similar spiritual and personal relations are indicated by the oral record of the late Mrs Ollie Worrell who at Munday Swamp would "Call out in Nyungah...". It has been argued that such personal and spiritual relations to non-human nature provide the basis for an environmental ethic of constrained and respectful use of nature (O'Connor et al 1985: 98-100).

Report on the Ethnographic Survey of Four Alternative Water Supply Sources (O'Connor and Bennell 1987: 11)...

> Likewise, the fact that nearby Munday Swamp (WA Museum Site No. S2219) was used as a pre-contact tortoise-fishing ground and the location of the nearby ancient camp was known to Mrs Worrel and passed onto the present generation; as was the ritual invocation specific to the area, and the ritual procedure to be followed before the tortoise flesh could be consumed.

An Aboriginal Site Survey of the Bushmead Rifle Range, Helena Valley. A Report to the Australian Property Group. Dept. of Administration Services, WA (McDonald et al 1989: 8-13)...

> Colonisation and displacement has also lead to the establishment of new links to country and sites. These are based on historical and biographical association. These new relationships can be categorised as follows:
>
> a) Habitual - regular camping and utilisation of bush resources, work on particular properties ECT.
> b) Biographical - places associated with individuals life events.
> c) Places where specific historic events occurred.
>
> (See Trigger 1983; Henderson 1983) It should be noted however, that such associations create important spiritual links with the area and specific sites. Such links are more than mere sentimental attachments. Rather, the life cycle, especially but not only, events of conception, birth and death, creates spiritual attachments for individuals and their kin to particular sites. The spirits of the deceased are believed to inhabit the trees and earth of the camps and other locations. As Baines notes with regard to a site not too far away in the Swan Valley.
>
> > The springs and watercourses are the evidence of the spiritual presence and the generative potential of the place of home. Yet the land means more than this. For the Nyungah landscape is an updating and contemporising of history. To destroy the matrix of the inter-relationships and affinities held in the particular constellation of trees and watercourses, camps and track, is to destroy not only the signs and evidence of past lives, but also to deny a survival dimension and expression of the meaning to present and future ones.
> >
> > (Baines 1988: 248-249)
>
> Nyungah associations with sites are thus a mixture of mythological / spiritual and historical / social associations.
>
> The Helena Valley contains a number of significant sites. The Helena River (Mandoon) is itself a site. Some distance to the east of the rifle range along the Helena River is Mundjalline. This is an area of swamps and pools and has mythological and ceremonial significance. The area was inhabited by the Wagyl, who formed the course of the lower Helena River from Mundjalline and Guildford.
>
> ...The other (B) had only a vague recollection of the site. However, he thought that it was related to a mythological cycle associated with Munday Swamp and other sites in the Hellena area. In this myth a woman from the Murray River area moved across the country to the Helena River creating watercourses, lakes and swamps, including Munday Swamp.

Report on an Investigation into Aboriginal Significance of Wetlands and Rivers in the Perth-Bunbury Region (O'Connor et al 1989:39-40)...

> Munday Swamp was an area of ancient Aboriginal usage. Knowledge that it had been used as a turtle-fishing ground in pre-contact times was handed on to the present generations by Mrs Ollie Worrel, who appears to have been the last living person who knew the ritual invocation specific to the area. As one Aboriginal man explained:
>
> "...she used to call out in Nyungah before fishing the turtle there...to apologise to the spirits and to ensure a good catch." (O'Connor, Bodney and Little, *op.cit.*).
>
> The same person recalled that when turtle had been cooked in hot ashes, it was required that they should be prepared for eating in a special way: the sharp piece of shell from the front of the breastplate was broken off and the flesh carved with this. A stone or steel knife should not be used for this purpose.
>
> The Melaleuca scrub at the north-western end of this peaceful area offered summer shade and coolness to turtle fishers, who occasionally camped there for extended periods. As was the case with Brook, the trees surrounding Munday Swamp offered a supply of paperbark for painting in more recent years.
>
> At present, Munday Swamp lies on private property beside Perth Airport's perimeter fence. Concern that permission had to be sought to gain access to this ancient Aboriginal resource was expressed by most informants who spoke of the area. Another cause for concern was that the water level in the lakes had risen steeply in the recent years, perhaps due to new drains being laid in the extended Airport precinct. This higher water level may threaten the continued existence of the turtle population.

File Note 10/10/1994 (Aboriginal Affairs Department 1994)

> Corrie Bodney said today that at Munday Swamp (S2219), "there are still ceremonial practices:
> a) talking to the spirits (Moorats) before hunting; and
> b) ritual before food is served and a ritual process for the serving of food before it is eaten."

3.0 RESULTS OF MEETINGS AND CORRESPONDENCE / LIAISON

3.1 Perth Airport Objection Meeting

Date: 21 August 1995

Attendance: AHC representatives
Natural environment values Assessors
Aboriginal cultural values Assessor
FAC representatives
Representatives of Alan Tingay & Associates, Environmental Consultants to FAC

Results of Meeting / Issues Arising: FAC representatives put forward reasons for their objection to the RNE listing of parts of the Perth Airport grounds. AHC representatives and the Independent Assessors were able to gain a clear understanding of what the objection issues are.

* In regard to the objection of the Aboriginal cultural values section of the Perth Airport RNE interim listing, the FAC representatives restated their concern. This concern is that, from their research, there does not appear to be evidence to suggest that Munday Swamp was/is an area of 'religious significance' to the Nyungah people. The Statement of Significance for the nomination states that, "Munday Swamp is of religious significance to Aboriginal people".

* Speaking to the Aboriginal cultural values Assessor, the FAC representatives indicated that if recorded evidence of Aboriginal 'religious' values associated with Munday Swamp were obtained, then the FAC's objection to the Aboriginal cultural values section of the Perth Airport nomination would be readdressed.

* A site inspection occurred after the meeting for the benefit of the Assessors and AHC staff. The four areas within the Perth Airport's grounds which are interim listed on the RNE were inspected.

3.2 Meeting with Mr Corrie Bodney and Ms Violet Mippy

Date: 22 August 1995

Attendance: Mr Corrie Bodney and Ms Violet Mippy.
Aboriginal cultural values Assessor.

Results of Meeting / Issues Arising: Mr Corrie Bodney and his wife Ms Violet Mippy took the Assessor on an inspection of Munday Swamp. It was pointed out to the Assessor that Ms Mippy's great grandmother Mrs Ollie Warrell (nee Nettle) was the 'grandmother' to many people who lived in the region (The spelling of Mrs Warrell's surname varies. The Assessor has used the spelling provided by the Nyungah Circle of Elders). It was Mrs Ollie Warrell who knew the spiritual associations of Munday swamp and who taught her children, grandchildren and great grandchildren how to hunt and cook turtles there, 'in the right way'.

* Mr Corrie Bodney although not related to Mrs Ollie Warrell's family, had come to Munday Swamp when he was young. Mr Bodney pointed out the Nyungah names for many of the plants and wildlife in the vicinity of the swamp.

* The Informants told the Assessor that they and their family had been visiting the swamp for years for the purpose of hunting turtles and more recently for obtaining paper bark for bark paintings and other art works.

* The Munday Swamp area is of spiritual significance to the informants. Nyungah people have long been associated with the swamp. The informants explained how on arrival to the area, they must shout out 'in language', to the spirits. "This practise had been passed down by the older people." The Assessor witnessed part of this process, done to inform the spirits of the groups presence in the area.

* The informants were particularly concerned about the protection of the area. Mr Bodney had been working for a number of years with staff of the then Aboriginal Sites Department in trying to get Munday Swamp listed by the State government as a Protected Area under the Aboriginal Heritage Act 1972-1980. AAD is still pursuing this course of action.

* Both informants want the Munday Swamp area listed on the RNE but feel strongly that the area immediately to the east, which has a number of associated sites (containing large numbers of artefacts) should be included in the listing. Mr Bodney specifically requested

copies of the AHC's nomination form so that they could nominate a more appropriate portion of the Munday Swamp site complex.

* Both Informants expressed their concern about the road drainage waters flowing directly into the swamp which has dramatically changed the natural fluctuations of the water level in the swamp.

3.3 Meeting with The Nyungah Circle of Elders

Date: 24 August 1995

Attendance: Mr Robert Bropho, Mr Wayne Hume, Mr Theo Michael, Mr Victor Isaacs, Ms Mingi Wanjurri - Nungala, Mr Pat Hume, Ms Lorna Hume, Ms Tully McHenry and Ms Margaret Jeffries.
Aboriginal cultural values Assessor.
Mr Patrick Egan, AAD
Mr Brian Wyatt, AAD

Results of Meeting / Issues Arising: The members of the Nyungah Circle of Elders expressed their concern that drains from the nearby roads and suburbs were running into Munday Swamp.

* The Assessor was informed that it was well known that Mrs Warrell (maiden name - Nettle) was long associated with Munday Swamp and that she was a spiritual woman.

* There was unanimous agreement that the Munday Swamp area should be left alone, that it should be protected from further development and the actions of surrounding development. The area emphasises 'the roots of association' for many of their group through their family relationship with the late Mrs Ollie Warrell.

* Mr Bropho explained that an old man (now deceased) had told him that the area where the Mundaring Weir is located is an important spiritual place and that the Helena River was an important associated passage way. Munday Swamp is associated with that passage way and was known as a turtle hunting ground. Mr Bropho said the significance of Munday Swamp had been told many times. The Elders group expressed the point, 'what more evidence do people want'. 'They are our human records'.

* The Nyungah Circle of Elders expressed the unanimous view that those sites still existing in the Perth region should be protected and that Nyungahs have access to them.

All were adamant that Munday Swamp and the associated sites be acknowledged and protected. The listing of Munday Swamp on the RNE is therefore welcomed by the Elders.

* The Nyungah Circle of Elders were later to send the Assessor copies of documentation relating to Munday Swamp (Appendix 3).

3.4 Correspondence with Mr Ken Colbung

Following an initial letter and phone call to Mr Colbung, a meeting with the Assessor was organised for the 24 August 1995. During the initial telephone conversation, Mr Colbung informed the Assessor that Mr Corrie Bodney should be consulted. Unfortunately, Mr Colbung had a number of important meetings arise during the week of the 24th and the Assessor was unable to meet with him. Mr Colbung informed the Assessor however, that it would be more appropriate to speak to Mr Bodney about Munday Swamp than himself. The Assessor informed Mr Colbung that he had spent the day with Mr Bodney and his wife, Ms Mippy.

3.5 Correspondence with Mr Cedric Jacobs

Following an initial letter and phone call to Mr Jacobs, a meeting was organised with the Assessor for the 25 August 1995. In a telephone conversation on the morning of the 25th August 1995, Mr Jacobs apologised to the Assessor that he was going to be unable to make the meeting later that day but said that the Assessor should speak with Mr Corrie Bodney and that he would be happy for Mr Bodney's views to also represent his. The Assessor informed him that the meeting with Mr Bodney and Ms Mippy had occurred on the 22 August.

4.0 OBJECTION ASSESSMENT OF THE PERTH AIRPORT BUSHLAND (ABORIGINAL CULTURAL VALUES)

Is the database information produced by the Commission accurate and comprehensive?

The database information for the Aboriginal cultural values of the Perth Airport nomination as it stands is not comprehensive. The statement, "Munday Swamp is of religious significance to Aboriginal people", although correct, requires additional information.

Munday Swamp has been and still is an important turtle hunting area to Nyungah people. The area is also of spiritual significance to Nyungah people in that ceremonial and ritual activities took place with the hunting of turtles and their preparation for eating. These activities are still carried out today

Comment on those grounds for objection which relate to the national estate significance of the place.

The objection to the Aboriginal component of the Perth Airport nomination questions the accuracy of the statement that, "Munday Swamp is of religious significance to Aboriginal people." At the Objectors meeting held in Perth on the 21/8/95, the Objector explained that they were unaware of any evidence that suggested that Munday Swamp was of religious significance to Aboriginal people. The Objector requested that evidence be presented to prove and substantiate the current nomination statement of significance relating to Aboriginal values.

It appears that the Objector's questioning of the 'religious value' of Munday Swamp to Aboriginal people, stems from the conclusions made by Anderson in his 1983a report entitled, "Survey for Aboriginal Sites in the Proposed International Terminal Complex Area, Perth Airport, Western Australia". In his report, Anderson states:

> Informant E stated that the Poison Gully swamp area was purely a hunting area where he caught brush kangaroos and goannas fifty years ago. There was nothing of a sacred or religious nature associated with it.
>
> (Anderson 1983a: 13-14)

Anderson concludes that;

> Although no one has associated the area with any religious significance, the eerie nature of the swamp seems to have stimulated the need to ward off trouble or danger.
>
> (Anderson 1983a:14).

Contrary to Anderson's conclusions, the evidence from other ethnographic and later Aboriginal liaison work (eg. O'Conner et al 1985) and the views of the Nyungah people expressed in the recent meetings with the Assessor, indicate strongly the spiritual associations and attachments the Nyungah people still have with the Munday Swamp area today. The ethnographic evidence presented in Section 2.3 of this report clearly indicates that ceremonial / ritual practices did occur at Munday Swamp associated with turtle hunting, and that these practices are still carried out today. This was confirmed by the Nyungah representatives the Assessor met with (See Section 3 above).

Anderson's (1983) report actually refers to 'avoidance areas' or areas of danger and what people had to do to prevent possible trouble :

> ...an old uncle had warned him to avoid certain parts of the swamp as dangerous for Aboriginal people...

and:

> To ward off dangers or trouble they were 'put through the smoke' ; i.e. they stood in the smoke of a small fire lit expressly for the purpose.
>
> (Anderson 1983a:14)

These activities are consistent with ceremonial / ritual practices.

It is extremely rare for a site with spiritual and ritual associations to survive in a metropolitan area. It is particularly rare that such a site should be still used in its spiritual and ritual capacity. This makes the site extremely significant to the local Nyungah community for spiritual, cultural and social reasons. These values are also of national estate significance. Each group of the Nyungah community was in agreement that Munday Swamp should be preserved and recognised as a Nyungah place of great significance.

It is the opinion of the Assessor, that there are national estate grounds for listing Munday Swamp in the RNE. The site does have spiritual significance to the Nyungah people in that ceremonial / ritual activities took place with the hunting of turtles and their preparation for eating. These activities are still carried out. Munday Swamp is also associated with the Helena River, a very important spiritual passage way. The Assessor would suggest that the word 'religious' be replaced with the word 'spiritual' in the

statement of significance, and more information provided as to why the area is of spiritual significance. The word 'religious' in the Assessor's opinion, takes on too many preconceived ideas and connotations.

Are the boundaries of the proposed area appropriate, given the significance of the place? What adjustments to the boundary, if any, are needed to define the significant area accurately and closely?

Given the Aboriginal significance of the place, the boundaries are not appropriate. To incorporate the Aboriginal values of the area, boundaries need to be expanded.

The proposed boundary does not include the associated significant archaeological sites that provide physical evidence of the long term Aboriginal use of Munday Swamp. The more significant sites should be included in the nomination boundary, particularly Site S1800 located in the paddock immediately east of the swamp. Indeed, the Munday Swamp site complex could be nominated on national estate grounds for its Aboriginal significance alone, as Mr Corrie Bodney would like to see happen. The boundary defined for the Munday Swamp Aboriginal archaeological site complex, on the AAD Site Register is a more appropriate boundary for the nomination. Consultation with the AAD is required to access this boundary.

Given the definition of the "National Estate" contained in the *Australian Heritage Commission* Act and the criteria illuminating that definition, does this place, in your opinion, warrant entry in the Register?

It is the opinion of the Assessor, that on Aboriginal values alone, Munday Swamp warrants entry in the Register of the National Estate. Munday Swamp is an extremely important Aboriginal site of great social significance to Nyungah people. It also has historic and scientific significance. All of the Nyungah people with whom the Assessor met expressed the wish for the site to be preserved and managed so that future generations can enjoy and appreciate its beauty, richness and history.

Although hunting has been recorded as occurring in other areas within the Perth Airport boundaries, past ethnographic records and the recent interviews with Nyungah informants have not identified any other areas which contain the significance that the Munday Swamp area holds.

Do you have any comments on the integrity of the place, or other views of a technical nature, which may assist the Commission in deciding whether the place should be entered in the Register of the National Estate.

Munday Swamp is important to Nyungah people ethnographically and is an important archaeological site. There are extensive and dense artefact scatters surrounding Munday Swamp which indicate continuous occupation for at least the last 5000 years. The Swamp would have provided one of the primary resource areas for the local occupants. The archaeological evidence certainly suggests that people have camped and utilised the resources of this area for a very long time.

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APPENDIX 1

Register of the National Estate
Detailed Place Report for External Use

Identification

Name of Place:	Perth Airport Bushland
Other Names:	Nil
Database No:	018220
File No:	5/12/004/0002
Principal Group:	Natural Environment

Status

Legal Status:	Interim List	01/02/1993
Admin Status:	IL objection received	01/02/1993

Location

Nearest Town:	Perth Airport
Distance (km):	Nil
Direction from town:	Nil
Area (ha):	210.00
Address:	Nil
Local authorities:	Belmont City Kalamunda Shire Swan Shire

Property Information
Federal airports corporation land metropolitan cemeteries board land reserve 21697, location 11256. Town Lot 2803, lot 1 and 6246.

Location/Boundaries
Approximately 210ha on the eastern side of Perth Airport comprising: (i) the areas bounded by straight lines joining the following AMG points: 50JMK02976774, 03316770, 03386786, 03426786, 03506754, 03636751, 03656756, 03606758,03616763, 03756778, 03876769, 04176762, 04246756, 04086735, 04166726, 04006715,03906730, 03786721,03536721, 03666740, 03366742, 02966772 to the commencement point, (Ii) 04576644, 04566612, 04236599, 04266590, 04086564,03936552, 03926542, 03866534, 03846513, 03746513, 03746535, 03606543, 03366543,03246554, 03346582, 03666606, 03906597, and the commencement point, (iii) 03236302, 03146279, 03206248, 03006239, 02916244, 02826222, 02696233, 02746250, 02586262, 02506243, 02396250, 02416286, 02666311, 02986315 and the commencement point, AND (iv) 03546147, 03526136, 03406117, 03196127, 03286142, 02966142, 02686159, 02616176, 02706176, 02816190, 02786199, 02866212 and the commencement point.

Description
The area now occupied by Perth International Airport was originally a mixture of open forest, woodlands and a variety of different wetland types (lakes, sumplands and damplands). A large portion of the eastern side of the site is either seasonally or permanently inundated. The airport lies primarily within the area occupied by the Southern Rivers vegetation complex, which comprises Marri (EUCALYPTUS CALOPHYLLA)-Jarrah (E. MARGINATA)-BANKSIA woodland on the elevated areas with Swamp Gum Swamp Paperbark fringing woodland along

Description (continued)

watercourses; although a small area of Guildford vegetation complex occupies the northwestern corner of the airport site. The national estate area comprises Munday Swamp and four discrete areas of remnant bushland. The northernmost of these four areas is referred to here as 'Area A', the bushland adjacent to Munday Swamp is referred to as 'Area B', whilst the two sumpland/dampland areas in the south east of the airport site are referred to as 'Area C' and 'Area D'. Much of Area A comprises BANKSIA low open forest, with local occurrences of Jarrah and ALLOCASUARINA FRASERANA and patches of A. HUMILIS, or Jarrah/Marri/BANKSIA open forest, with areas of pasture. However, there is also a wetter area dominated by MELALEUCA species (inc. M. RHAPHIOPHYLLA), with RESTIO STENOSTACHYS amongst the vegetation along the edge. The BANKSIA forests have an unusually high proportion of the yellow-flowered form of B. MENZIESII. Area B is a mix of modified BANKSIA woodland/open forest and a wetter area of PERICALYMMA ELLIPTICUM heath with MELALEUCA PREISSIANA. The largest community within Area C is LEPTOSPERMUM ELLIPTICUM low scrub. The top stratum of this community also contains MELALEUCA PARVIFLORA and M. PREISSIANA with NUYTSIA FLORIBUNDA and, in wetter situations, BANKSIA LITTORALIS. The second stratum is similar, but with HAKEA VORIA and ADENANTHOS CYGNORUM. The lowest stratum is poorly developed unless it is burnt, in which case it can develop a rich ground flora including SCHOENUS CURVIFLORUS, LYGINIA BARBATA and LEPTOCARPUS spp, with VERTICORDIA DENSIFLORA, DAVIESIA INCRASSATA and D. PREISSII. However, the eastern portion of Area C supports a BANKSIA low woodland on ridges or slight rises. The top stratum of this community is BANKSIA ATTENUATA, B. MENZIESII, ALLOCASUARINA FRASERANA and Jarrah up to 10 metres in height, with BANKSIA ILICIFOLIA, B. GRANDIS and NUYTSIA FLORIBUNDA. A middle stratum of JACKSONIA FLORIBUNDA, J. LATIFOLIA and STIRLINGIA LATIFOLIA overlies a rich understorey of XANTHORREA PREISSII, PERSOONIA SACCATA, CONOSTEPHIUM Pendulum, HIBBERTIA HYPERICOIDES, LYGINIA BARBATA, PETROPHILELINEARIS and MESOMALEANA TETRAGONA. In the north of Area C is a small area of tall dense heath in very good condition. Scattered mature BANKSIA LITTORALIS to 10 metres, mature ACACIA SALIGNA and a variety of MELALEUCA species overly a sedge and rush understorey. Area D is likely to support similar vegetation communities to Area C. The diversity of vegetation at Perth Airport provides a variety of habitats for fauna. Whilst the only native mammal recorded is the endangered Quenda or Southern Brown Bandicoot (ISOODON OBESULUS), found in both Areas A and B, surveys have recorded 70 species of birds, five ground frogs, two tree frogs and a total of 18 reptile species. The reptile fauna includes 3 legless lizards, 8 skinks, 1 dragon lizard and a monitor, as well as 4 elapid snakes and a blind snake. One of the front-fanged snakes found in Area B adjacent to Munday Swamp, RHINOPLOCEPHALUS GOULDII, is uncommon in the Perth metropolitan area. Munday Swamp is of religious significance to Aboriginal people. Aboriginal people also camped in the MELALEUCA scrub at the northwestern end of the swamp where they fished for tortoise. In more recent years they have used the paperbark for bark painting. ****

Condition

The vegetation communities associated with Munday Swamp remain in good condition, despite the channelling of drainage water from the adjacent cleared land into the swamp. Within the balance of the four sub-areas, the wetland communities are generally in better condition than the woodland and open forest situated on the more freely draining soils higher in the landscape. In particular, the heath and open low forest communities in the south of the site (Areas C and D) appear to be in quite [illegible] condition. Dixon has described Area C as having experienced [illegible] disturbance [illegible] years or more. The condition of the vegetation in the northern area - Area A - and adjacent to Munday Swamp Area B is more patchy. A little over half of Area A (primarily the eastern

Condition (continued)

portion) remains in relatively good condition. The vegetation communities in the balance of Area A and in Area B are in poor condition, with many areas showing the impact of dieback, weed invasion, rabbits and excessively frequent fire. However, these areas remain of value for fauna. Indeed, it is the disturbed PERICALYMMA ELLIPTICUM swamps and Jarrah/Marri/BANKSIA open forests in the western portion of Area A which have recorded a particularly high reptile and amphibian diversity, whilst the only location at the airport where the uncommon snake RHINOTHOCEPHALUS GOULDII is found is Area B. ****

AHC Official Statment of Significance

Munday Swamp and the four bushland remnants at Perth Airport are valuable remnants of the Southern Rivers vegetation complex, more than 90% of which is now cleared or heavily degraded. Munday Swamp itself is important as an unusual wetland type (a 'coloured' wetland), as an unusual vegetation community (MELALEUCA RHAPHIOPHYLLA closed woodland on a lentic wetland), as waterbird breeding habitat (in the top 10% of metropolitan wetlands) and as a habitat for an unusually diverse invertebrate fauna (71 species recorded) and the only significant population of galaxids remaining in the Perth metropolitan area. The area supports a rich vertebrate fauna, particularly amongst the reptiles, and contains populations of the endangered Quenda or Southern Brown Bandicoot. Munday Swamp is of religious significance to Aboriginal people. ****

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• • • End Of Report • • •

APPENDIX 2

305.

From the Managing Director
William A. Swingler

2 Lord Street
Locked Bag No 28 Botany NSW 2019 Australia
Telephone: (02) 316 2701 Facsimile: (02) 316 9153

Federal Airports Corporation

28th January, 1993.

Ms Sharon Sullivan,
Executive Director,
Australian Heritage Commission,
GPO Box 1567,
CANBERRA, ACT, 2601.

Dear Ms Sullivan,

I refer to the inclusion of sections of the Federal Airports Corporation Perth and Jandakot Airports on the Interim List of the Register of the National Estate. Under the provisions of the Australian Heritage Commission Act 1975, the FAC wishes to register its objection to the proposed listing of parts of Perth and Jandakot Airport in the Register of the National Estate.

The FAC is currently assessing the areas identified in the interim listing in terms of their biological values and the FACs potential future development requirements and, as you would know, Jandakot Airport is in the process of completing an Environmental Impact Statement. It is probable that as a result of these investigations we will suggest alternative boundaries to some of the areas. I am not able to provide such details at this time.

I understand however, that supporting information which is provided within twelve months of the close of the objection period, would normally be considered by the AHC in its assessment of a place, so long as an objection was lodged within the formal objection period.

I would appreciate if you would confirm the receipt of this objection and that the submission of supporting information after the close of the formal objection period is acceptable.

Meantime, I will endeavour to ensure that the information supporting this objection is provided to you as soon as it is available.

Yours sincerely,

W.A. SWINGLER.

RW - Pls acknowledge + say we will accept later submission of supporting material, KB.
but point out our deadline!

APPENDIX 3

STATEMENT OF FACTS CONCERNING
MUNDAY SWAMP AND THE AIRPORT AREA

Old Jimmy Sandy and Auntie Betty Mum's sister, Lionel Nannup, Jamesy Sandy, Shirley Nannup, Old Tooty Michael and Old Johnny Michael and Old Nyinda Tommy Bropho, and all their families and a few other Nyungahs were at South Guildford Native Reserve.

Corrie Bodney was never there or his mother Melva who was from the York area, or his father Bill who was the son of a Jamaican.

That International Airport, they should have it on their files a deal was made to transfer the Nyungah people from the South Guildford Native Reserve to Widgie Road Reserve north of Lockridge by the Native Affairs Department with the Airport people or Federal Government to clear the way for the Airport expansion. We had no say. They just moved us away.

It was a long time ago. It was when the Japanese were going to invade the North. They should have this on their files.

The Commonwealth or State Government or Airport people should not say they have a good relationship with Bodney because he had nothing to do with the area. The Commonwealth has no obligation to Bodney with a good relationship. He's not qualified to demand that the Commonwealth Airport has to abide by his demands.

That Big Corroboree Place, 3 miles downstream this way, where were those Nyungahs coming from? Who brought all those quartz tools between the railway line and Munday Swamp? They were thousands of generations.

Mr Bodney was quoted as saying there were 100 Ballaruk people. He is saying he is the only custodian from 17 years of age. He is getting himself into a trap.

Miriam Spratt said that her and Edna Bropho (Nettle) and Kenny Spratt: that Old Ollie Warrell (who was a Nettle) is their Grandmother and Corrie Bodney is just an in-law married in to the family. Old Ollie used to go through all that area with the other Old People and her children and her grannies.

Ballarak doesn't mean a tribe or a family or one mob. It was a skin name of Nyungah people scattered throughout the entire south-west if not further and only concerned marriage rules. It is in the old records. Bodney found the name in white man's books.

Mr Bodney should be investigated by the Fraud Squad. He is downgrading all Nyungah people and all Aboriginal people. He is working in company with white advisers. One only has to read his and Barrie Machin's evidence to the Liquor Licensing Court. That speaks for itself.

Robert C Bropho Barry Padbitt Peter Nan

With the compliments of the
Nyungah Circle of Elders
19.2.95

Harvey Bropho

Edna Bropho Kare Spratt

Kathleen Kenny

Miriam Spratt

Arthur Stack

Eric Clarkson

SWAN VALLEY NYUNGAH COMMUNITY
ABORIGINAL CORPORATION
C/o Post Office Guildford
Western Australia 6055
T : 09 279 1636

09 279 6706
09 377 3550TF 09 377 3559

To:
Justice Robert French
The Native Title Tribunal
and to Alan Padgett

We are putting in writing what we told you Mr Alan Padgett because you said you did not take notes and you did not understand all the names and serious things being spoken to you by us and after the meeting with you, you said to us that at the moment all you had was Mr Bodney's story.

THIS IS OUR FORMAL OBJECTION TO THE CLAIM BY MR BODNEY FOR THE MUNDAY SWAMP AND AIRPORT AREA.

Representing:
Edna Bropho (Nyungah Elder and Granddaughter of Ollie Nettle), Miriam Spratt (Nyungah Elder and Granddaughter of Ollie Nettle), Louis Nettle (Chairperson of community and Greatgrandson of Ollie Nettle), Lena Spratt (Greatgranddaughter of Ollie Nettle), Lewis Taylor (Great-great-grandson of Ollie Nettle).

We're worried about this Bodney making these false claims. He's only a person married in to the family. We are the granddaughters and greatgrandsons of the Old Lady, Ollie Nettle.

Old Ollie and Peula, they're two sisters.

He's saying Ballaruk. Ballaruk doesn't exist. It's not a tribal name. It means many colours. He has no ties with that area personally.

It is important you hear what we know. We are the granddaughters of the Old Lady who taught and passed on the Knowledge and the Beliefs about that area to us as her granddaughters this making us the first and foremost custodians.

Bodney is married to Violet. Her father is Alf Mippy. He is Alf Layland. By Blackfella Law he should be called Alf Layland but he took his father's name. With the coming of his daughter (Violet) she took the father, Mippy's, name. (Violet Mippy is Violet Bodney).

We saw Clara Layland and travelled with Clara Layland and know her camping grounds in the metropolitan area (Swan River and Swan Valley and Coastal Plain areas). She was the mother of Isobel Bropho (Layland) and Alf Mippy and other sons and daughters and the grandmother of Robert Bropho and Violet Bodney and many more.

Violet's got a large family by Bodney.

Ollie Nettle, the granddaughters and all the family travelled over to Munday Swamp getting turtles.

This man is not linked to the Munday Swamp and Airport area except being married in. His sister is Betty Coomer. Her father is Jack Coomer. (Bodneys father is Bill Bodney). Melva is his mother who he based his claim on. All them years (before she lived with Bill Bodney), Melva was living in the north with Jack Coomer (away from this area). Bill Bodney was the son of a Jamaican.

Melva hardly had any close connection with our time growing up (in this area). Bill Bodney - (we don't like to bring this up but it is in the records) - was ordered to stay away from Aboriginal people - he had a bad record messing around with young girls so there was less connection with Nyungah life and culture. The reason that it affects his claim is by this restriction put on his father means his mother was restricted away from close contact with other Nyungah people.

This man is erupting a lot of peace of mind of people in the Valley.

By the Native Title Law you're listening to what he is saying. This Old Lady is Ollie Nettle, the Grandmother of the people here, who taught us all these things out there and who was a traditional custodian of the Munday Swamp area. This was inherited on to the granddaughters by the First Traditional Law of the Land.

We used to go to Munday Swamp when we was young (in the 40's) even when we were living at Allawah Grove (in the 60's). We went there catching turtles. Our Grandmothers are Peula Nettles and Ollie Nettles, 2 sisters.

Violet's mother was reared up by Grandmother, Ollie, and Old Girl took her and reared her up like she reared me up and she reared up some other children.

It is not Corrie's country, nothing at all, not there, his mother had nothing to do with that area, he just married in through Violet.

On his mother's side, she was of the York-Pingelly area with Rosie Allen and Old Bob Allen. He makes sure and keeps quiet - he doesn't speak about Jack Coomer, he is a man from the north. To have a son Johnny Coomer, then Chrissie and Betty, Johnny is miles older than Corrie, she (Melva) had very little time here. We believe he is making up his story, what he has learnt from white man's books.

Corrie's own brother, Toopy (William) Bodney, he says " I don't know where he got this Ballaruk from". He's said it publicly many times.

He's trying to set himself up as the man, (the only one) .....He said he wanted $1 million for East Perth (a very traditional Nyungah area beside Claise Brook, being destroyed now). He said to the Nyungahs at the Sacred Area where the Swan Brewery still stands "Get what you can while you can and get it quick!". He has left this area. He lived with our people at Widgie Road after we were removed from the Airport Area (called South Guildford Reserve) in the 40's (for use by the Army) and long term plans for the International Airport. They made plans - transfer them to the other Reserve, Widgie Road. Corrie was never around the South Guildford Reserve, never camped there.

We've lost Widgie Road Reserve now and we've lost the other Reserve at South Guildford. We've been in this area a long time, all our lives. He's only been here for 7 years, start to wedge his way in and build up power.

Old Ollie Nettle, she was the leader going into that Swamp (Munday Swamp) and doing ceremonies with turtles and things.

A lot of other Nyungah people are concerned at Bodney's claims.

He goes around and he threatens people. He is abusive. His wife threatens people. A lot of people get scared.

We don't want him to have any part of it (Munday Swamp and Airport Area).

If this man succeeds, he'll hold the gun at that International Airport, milliopns and millions of

dollars. We don't want that, (makes it bad for all Nyungahs with genuine claims).

The granddaughters have knowledge on the Sacred area. Bodney's not an initiated man. He doesn't respect our Law. He doesn't maintain our traditions which is to protect these things. He's a person wants to sell things .... most of the knowledge he's coming up with, he's gone to Battye Library, got this information out of books which is interpretated on by white fellas from what has been told to them by Blackfellas. He knows nothing about fishtraps down here until we started to speak about it.

The Liquor Licensing Court - he got up in the witness stand. He was with Multiplex. He told a lot of wrong things about the sacredness of the area (of Goonininup) and he was paid to do that. Before that he and his wife were with us (on opposing development on our Sacred Grounds at Goonininup) but he changed course so he is changing all the time. Our Law is the one thing right through.

This last ceremony we did at the Sacred Area (on 12.3.95), he got information before it was made public. Also the letter we sent in to you on 19.2.95, he got information and started ringing up the people who put their names to it. The Nyungah people are trying to do the right thing with the Government and developers - we are not against development, we just want Our Things protected - rather than that, a power group gives the go-ahead.

Corrie Bodney, he's not a spokesman. Greed, you know. Moneywise. Not trying to help the people but to destroy it.

Louis Nettle was a kid picking up turtles and ducks. His Old Grandmother used to take him there and his brother. There's others with claims on that (Munday Swamp).

Our claim is to protect not sell it.

We'd sooner that way than making people pay (and Nyungahs suffer).

He's Whadjuk now. Before that he was Ballaruk and before that Nyungah.

Bodney went bad when Rory O'Connor came on the scene. The power of anthropologists is built up by mining companies and Governments and they will overpower people like us. He will destroy all Sacred Sites.

O'Connor's wife has said to a number of people that Rory vowed to destroy all important Sacred Sites in Western Australia.

We are a nation of people and we're entitled to make our claims and stand up and protect what is ours.

He reckons there's no Waugal.

We was the last family to go from that area. They wanted to push us out with all our 10 children.

We used to have gilgies from there.

This man has not been through any initiation or any law. We must ask ourselves ... he's got to say "I've been through the ceremony here".....He's named Cyril Warmdine, Jimmy Cooper, Johnny Damper Coomer who is his brother through one mother, different fathers. Jimmy Gidgup and Harold were reared up in Carolup Mission in 1915 with Isobel Bropho RIP. He claims Jimmy, Harold, Jimmy Cooper gave him that right as a custodian. None of these people were tribal lawmen. It is unheard of, anyone giving away that right. And not to a teenage boy of 17 or 18 or even 20. And all you are allowed to do is to protect the Sacred Places. It is against our Law - you're not allowed to sell it or agree to anything harming it.

If he (Bodney) says I claim this area (Munday Swamp and Airport) through my mother, in Aboriginal law of the land there's Women's Laws that men don't know nothing about.

We've stood time and again to preserve and save things although the powers to be - their laws is stronger than our stands.

This mob travelled to Parliament House Canberra (in 1977) to see Mr Viner, the then Minister for Aboriginal Affairs for our land to be returned and for better living conditions.

We maintain that stand of saving things and sharing things with poorer class white people

Our claim is entirely different. We don't look for money but this saving and protecting and preserving.

We hope something can be done because it makes things bad for the rest of us.

What we'd like is to dismantle this claim. It makes a lot of eruption and bad feeling of whites against blacks and our people are the ones who suffer from that. We want to go forward in harmony.

---O---

Lena Spratt

Edna Brophy

Louis Taylor

Miriam Sprattle

Louis J Kettle

SWAN VALLEY NYUNGAH COMMUNITY

Objection Assessment of Faunal Values for Perth Airport

Report for the Australian Heritage Commission

R. A. How
Western Australian Museum
October 1995

This assessment of the faunal values for four sites at Perth Airport listed on the Interim Register of the National Estate is made on the grounds of :-

- Examination of the Detailed Place Report provided to support the proposed listing:
- Examination of the reports provided by the consultants to the Federal Airports Corporation outlining grounds for objection:
- Examination of the data available in these reports, relevant literature and subsequent surveys:
- Re-evaluation of the faunal values of Perth Airport and the Swan Coastal Plain from the most recent data sources as expanded on in the *Attachment*.

The assessment addresses five points.

1. is the database information produced by the Commission accurate and comprehensive?;

The faunal information produced by the Australian Heritage Commission for the four areas at Perth Airport proposed for listing on the Register of the National Estate is accurate given the data available at the time of the proposal.

There has been, however, a marked increase in surveys documenting the vertebrate species and assemblages in urban bushland remnants of the Perth metropolitan region during the past few years. Most of these data have been acquired since the Perth Airport nomination was prepared. These new data permit a complete re-evaluation of the distribution and abundance of all species and assemblages throughout the region; circumstances that have also been acknowledged and evaluated by Tingay and Associates (1994a) in their *Report of a Fauna Survey of the Perth Airport* to Federal Airports Corporation. Their report provides faunal data for the objection to the listing of the western section of Area B to the Register of the National Estate. Alterations to the boundaries on the four proposed areas are outlined in Tingay and Associates (1993) and a detailed assessment of the flora, vegetation and its condition is documented in Tingay and Associates (1994b), *The Flora and Vegetation of Perth Airport*.

The *Attachment* provides an interpretation of the vertebrate fauna of Perth Airport in the light of recent surveys there and on other urban bushland remnants in the Perth region.

2. comment on those grounds for objection which relate to the national significance of the place.

The only substantial objection, based on faunal values, to the currently proposed listing of four areas at Perth Airport on the Register of the National Estate is that pertaining to the western side of Area B.

The faunal data, however, supports the proposed listing of all of Area B on the Register of the National Estate.

The fauna of Area B has been documented through observations of the avifauna and sampling of the aquatic invertebrates and fish of Munday Swamp, pitfall trapping of Site 4 by the Western Australian Museum and by both cage and pitfall trapping of Site B by Tingay and Associates (1994a).

The faunal values of Munday Swamp are exceptional, as acknowledged by the Interim Listing documentation and the Federal Airports Corporation (Tingay and Associates 1994a).
The faunal information from the two vertebrate trapping sites in the western part of Area B, adjacent to Munday Swamp, indicate that :-

- The area has the most diverse frog fauna of all Perth Airport sampling sites and is the only area on the Airport where both species of tree frog have been recorded.
- The terrestrial bird fauna is rich and Site 4 is the only location at Perth Airport where both species of Songlark have been observed.
- The endangered native mammal species, the Quenda, occurs on this area as well as most other areas of native vegetation on Perth Airport.
- Gould's Snake, *Rhinoplocephalus gouldii*, is now determined to be more widely distributed on bushland remnants on the Swan Coastal Plain than was recognised by the proposed listing document.
- This is one of only two locations on the Swan Coastal Plain in the Perth region where the skink, *Ctenotus impar*, has been recorded in recent times on bushland remnants.

3. are the boundaries of the proposed area appropriate, given the significance of the place? What adjustments to the boundary, if any, are needed to define the significant area accurately and closely?;

The minor alterations proposed for the boundaries of Areas A, B (additional to the major proposal dealt with in Section 2, above), C and D, as outlined by Tingay and Associates (199?), are intended to conform more to current management features. It is not possible to reconcile the boundary changes proposed by Tingay and Associates (*op cit.*) and the map provided with the Detailed Place Report for the interim listing.

The objection in relation to the southern boundary of Area D (as outlined in Tingay and Associates 1993) relates to the inclusion of an area of moderately disturbed vegetation. Faunal data are not available for this proposed alteration but, judging from the level of disturbance to the vegetation of the proposed inclusion, it would be doubtful if any significant faunal values would be added by its inclusion in Area D. There are no faunal data for any of the other small areas affected by these proposed boundary changes.

In the context of remnant bushland over the whole of Perth Airport, ecological considerations of the fauna and its demographic and habitat requirements indicate that major modifications to the four currently proposed areas would be beneficial (see 5 below).

4. *Given the definition of the "National Estate" contained in the Australian Heritage Commission Act and the criteria illuminating that definition, does the place, in your opinion, warrant entry in the Register?;*

On the basis of criteria for listing on the Register of the National Estate, the faunal values of the four areas at Perth Airport warrant entry to the Register of the National Estate.

A2. Importance in maintaining existing processes or natural systems at the regional or national scale.

- Munday Swamp is a regionally important wetland with a high diversity of aquatic invertebrates and dense stands of *Melaleuca rhaphiophylla* Woodland supporting a variety of wideranging waterbird species, many of which breed there.
- Perth Airport contains the only known populations of the Crowned Snake, *Notechis coronatus*, in the Perth region.

A3. Importance in exhibiting unusual richness or diversity of flora, fauna, landscapes or cultural features.

The avifauna of Perth Airport, in particular the four areas nominated, is diverse in the regional context. The reptiles represent one of the few remaining diverse assemblages in the Southern Rivers and Guildford Vegetation Complexes that are now drastically reduced in areal extent.

B1. Importance for rare, endangered or uncommon flora, fauna, communities, ecosystems, natural landscapes or phenomena, or as wilderness.

Perth Airport contains:

- One of the few lake populations of the Western Pygmy Perch, *Edelia vittata*, and the Western Minnow, *Galaxia occidentalis*, within the Perth region.
- Extensive and abundant populations of the threatened native Quenda, *Isoodon obesulus*.
- The only recorded location of the Western Swamp Tortoise, *Pseudemydura umbrina*, south of the Helena River. This remains an important location for potential reintroduction of this critically endangered species even though the species has not been recorded here for more than 20 years.
- A lizard assemblage that is different to those of most other bushland remnants in the urban area and which contains the locally uncommon skink, *Ctenotus impar*.

C1. Importance for information contributing to a wider understanding of Australian natural history, by virtue of its use as a research site, teaching site, type locality, reference or benchmark site.

The detailed documentation of the biota of Perth Airport by numerous surveys over the last few years has increased its value as a research site and underlines its importance as a benchmark locality for the fauna associated with the Guildford and Southern Rivers Vegetation Complexes; vegetation complexes that are now greatly reduced in extent.

5. ***do you have comments on the integrity of the place, or other views of a technical nature, which may assist the Commission in deciding whether the place should be entered in the Register of the National Estate?***

All of Area A and extensive parts of both Area B and Area D have been modified by fires during the past two summers. The extent and severity of the fires has altered the structure and composition of the vegetation of those areas and this in turn will have altered the faunal composition. Although *in situ* faunal data is not available from the burnt areas after the fires at Perth Airport, it can be assumed from other urban studies (Dell and How 1995) that many species of ground fauna will be lost, temporarily, from these areas. Successful recolonisation of burnt habitats by fauna is greatly facilitated if unburnt areas are adjacent (Dell and How *op. cit.*). The current proposed listings are isolated and provide no acknowledgment of the pathways required for faunal movement between preferred habitats or for recolonisation after fire.

Larger areas are nearly always better for the conservation of biological diversity than several smaller areas of the same total size (Saunders *et al.* 1991). The four areas proposed for listing on the Register are both relatively small and isolated and would have their value for faunal conservation considerably enhanced if areas of *slightly disturbed* or *disturbed* bushland adjacent were added to them.

It is the recommendation of this assessor that further substantial areas of remnant bushland at Perth Airport be considered for addition to the Register of the National Estate such that the habitats and processes essential to the long-term survival of faunal assemblages on the Airport are enhanced.

The Federal Airports Corporation has already recognised the considerable conservation values of native bushland at Perth Airport through the views expressed by its consultants Tingay and Associates (1993) who state "It is the conclusion of this study that the boundaries used to define the areas of bushland entered on the interim list of the Register of the National Estate do not contain the full extent of the vegetation worthy of listing". Areas have been identified (Tingay and Associates 1994b) - additional to those proposed for interim listing - that have significance for the conservation of natural communities and their processes and these areas and linkages between them should be the first assessed for their regionally and nationally important conservation values.

All but one of the eight faunal sampling sites that have been monitored during all seasons are located within the four areas proposed in the interim listing. There is, therefore, little site-specific survey data for extrapolation as to the faunal values of other locations on Perth Airport. However, the *Attachment* indicates that vertebrate faunal habitats - as defined by vegetation and landform types - differ markedly in their composite assemblages across the Swan Coastal Plain. The decline by over 90 percent in the extent of the Southern Rivers and 99 percent of the Guildford Vegetation Complexes on the Swan Coastal Plain highlights the need to conserve the faunal species and assemblages of these mosaics as they remain distributed on Perth Airport. Fences, pastures, roads and drains will all prove effective barriers to the free movement of different groups of fauna and, consequently, provide additional isolating mechanisms over and above those posed by distance. Additions of vegetation in the "least disturbed" categories to those areas already proposed would be advantageous to the long term survival of terrestrial vertebrate assemblages.

Attachment

BACKGROUND ON FAUNAL SURVEYS OF THE SWAN COASTAL PLAIN

A detailed summary of the historic data on the vertebrate fauna of the Northern Swan Coastal Plain was prepared by the Western Australian Museum in 1978 and this was supplemented by concurrent surveys of non metropolitan bushland areas (Kitchener *et al.* 1978, Storr *et al.* 1978a, 1978b, Sarti and Allen 1978). Much of these data are now more easily accessible in How and Dell (1993).

The Western Australian Museum commenced a program of vertebrate surveys on Perth urban bushland remnants in 1986 with studies initiated at Perth Airport, Bold Park and in the Cannington area. Meanwhile the avifauna of most wetlands in the region was being monitored by the RAOU in collaboration with the Department of Conservation and Land Management and the Water Authority of Western Australia (Halse *et al.* 1992, Storey *et al.* 1993). Local government councils and interested public groups as well as developers, through ERMP's, were also documenting the vertebrate assemblages on bushland remnants (see references in How and Dell 1994, Tingay and Associates 1994a). The recent summary and analysis of the reptile fauna of the Perth Region by How and Dell (1994) has been extensively cited and re-analysed by Tingay and Associates (1994a) in their report to the Federal Airports Corporation on the fauna of the Perth Airport.

PERTH AIRPORT

At the completion of the 1986-90 survey by the Western Australian Museum of the vertebrate fauna of representative habitats on Perth Airport, it became apparent that the area was diverse by comparison with information available at that time on other urban bushland patches. Recent surveys have been undertaken by Tingay and Associates (1994a) for the Federal Airports Commission and by the Western Australian Museum under a grant from the National Estates Grant Program of the Australian Heritage Commission (How, Harvey, Dell and Waldock 1995). The expansion of systematic faunal surveys of remnant bushlands in the Perth region, referred to above, has also provided valuable new information on the relationship of Perth Airport fauna to that found in other urban bushland remnants on the Swan Coastal Plain.

Methods

The three major surveys of the vertebrate fauna of the Perth Airport have been of different duration and used different techniques. The location of the 19 sampling sites is depicted in Figure 1.

The first Western Australian Museum survey of four sites entailed 93 days of pitfall trapping over 23 trapping weeks between December 1986 and April 1990 and each site consisted of 6 pitfall traps and a drift fence. Bird observations were made at all sites and intervening areas during this period.

Tingay and Associates (1994a) sampled 11 sites, each for four days, in either September or November 1993, using pitfall, Elliot and cage trapping. Each site consisted of 10 fenced pitfall traps and 23 Elliot and cage traps. They noted (p11) "However, cool weather during both the late winter and spring trapping sessions may have meant that fewer individuals of lizards species were active." In addition to the bird observations made during these periods a further six days were spent recording at these and other locations.

The second Western Australian Museum survey of four sites entailed around 58 days of pitfall trapping over 9 trapping weeks between August 1993 and March 1994 with bird observations made during the course of traversing around the sampling sites. Each site had 9 fenced pitfall traps.

Amphibians

Eight species of frogs are recorded from Perth Airport (Table 1.). All these species occupy many other bushland remnants in the Perth region (How and Dell 1993, Tingay and Associates 1994a).

Of the eight sampling sites that have been trapped over all seasons, Site 4, *Verticordia densiflora* Heath, is the richest with six species recorded. Site 4 is the only site where both species of tree frogs, *Litoria adelaidensis* and *L. moorei*, have been recorded, indicating that during the appropriate season and weather conditions these species will move from their preferred swamp habitats into seasonally inundated heaths adjacent.

None of these frog species are on the threatened species schedules and, with the exception of *Myobatrachus gouldii* and *Ranidella glauerti*, most are common and relatively widespread at Perth Airport.

The Turtle Frog, *Myobatrachus gouldii*, has only been recorded from the *Banksia/ Eucalyptus* Woodland at Site 1 (Table 1) and *Ranidella glauerti* only from *Melaleuca rhaphiophylla* Low Woodland at Site F (Tingay and Associates 1994a). Dell (pers comm.) noted the latter species calling frequently during the spring of 1993 from swampy areas adjacent to Site 5.

Birds

There have been 87 species of birds recorded in the bushlands and wetlands of the Perth Airport (Table 2).

The high number of waterbirds is a consequence of the permanent waterbody of Munday Swamp and the extensive areas of seasonally inundated swamps. The survey of waterbird usage of Swan Coastal Plain wetlands, undertaken between 1990-1992, found that Munday Swamp ranked thirteenth for breeding species among the 251 wetlands surveyed (Storey *et al.* 1993). Many species of waterbirds are to be found over extensive areas of Perth Airport during the winter and spring when free standing water is abundant; this accounts for most of the sightings of waterbirds in other habitats.

There are major differences between the species richness of avifauna recorded at the eight sites surveyed over all seasons :-

Site 5.	*Pericalymma ellipticum* Heath	39 spp.
Site 1.	*Banksia/Eucalyptus* Woodland	33 spp.
Site 4.	*Verticordia densiflora* Heath	30 spp.
Site 2.	*Jacksonia* Shrubland.	25 spp.
Site 3.	*Eucalyptus* Woodland	25 spp.
Site 6.	*Adenanthos* Tall Shrubland	24 spp.
Site 8.	*Banksia* Woodland	20 spp.
Site 7.	*Melaleuca/Banksia littoralis* Swamp	11 spp.

Two of the three richest sites for bird species are heaths. However, this may be a reflection of the ease of observation of aerial feeders and species moving between other habitats.

Perth Airport supports populations of four species of the robin and whistler family, the Pachycephalidae. The observations of the Red-capped Robin , *Petroica goodenovii*, at several sites and the Golden Whistler, *Pachycephala pectoralis*, at a single site, represent important localities for these species that are uncommon on the Swan Coastal Plain. The Splendid Fairy-wren, *Malurus splendens*, and the Broad-tailed and Yellow-rumped Thornbills, *Acanthiza apicalis* and *A. chrysorrhoa*, occur at several sites throughout Perth Airport. The vegetation types essential for the persistence of these species is apparently sufficient to support extensive populations of species that have been lost from most other inner urban bushland remnants. The observations of the Rufous and Brown Songlarks, *Cincloramphus mathewsi* and *C. cruralis*, also represent unusual records for species in urban bushlands on the Swan Coastal Plain.

Three species of birds that have been infrequently recorded at Perth Airport, Brown Falcon (*Falco berigora*), Carnaby's Cockatoo (*Calyptorhynchus latirostris*) and Black-faced Cuckoo-shrike (*Coracina novaehollandiae*), were sighted during the joint Federal Airports Corporation/Australian Heritage Commission inspection of interim listed sites on August 21.

Fish

Three species of freshwater fish have been collected from Munday Swamp (Robson and Chester 1989 in Tingay and Associates 1994a). The Mosquito Fish, *Gambusia affinis*, is a widespread species that has been introduced since European settlement. The other two species, Western Minnow (*Galaxia occidentalis*) and Western Pygmy Perch (*Edelia vittata*), are both native species that are endemic to southwestern Western Australia. Both native species have a relatively wide distribution, although the Western Minnow was collected in only one and the Western Pygmy Perch in none of the six free standing waterbodies sampled on the northern Swan Coastal Plain by Sarti and Allen (1978).

Mammals

Mammals have been the most dramatically affected of all vertebrate groups since European settlement of the Swan Coastal Plain and few native species now survive on urban bushlands (How and Dell 1993).

The Quenda, *Isoodon obesulus*, is the only native mammal trapped on Perth Airport. It is listed as a species which is rare or likely to become extinct on Schedule 1 of the Western Australian Wildlife Conservation Act 1959 (amended 1992). However, this species has been documented as occurring on all systematically surveyed sites at the Airport and has an extensive and viable population in the area (Tingay and Associates 1994a). There are reports that the Echidna, *Tachyglossus aculeatus*, has also been sighted in the northern section of Perth Airport (Tingay and Associates 1994a). The introduced Rabbit, *Oryctolagus cuniculus*, European Fox, *Vulpes vulpes*, and the Black Rat, *Rattus rattus*, have also been recorded in native bushland on the Airport.

Reptiles

Twenty two species of reptile are recorded at Perth Airport (Table 1). There is also a 1970 record of Western Australia's rarest reptile, *Pseudemydura umbrina*, the Western Swamp Tortoise. This record has been promoted by the findings of Tingay and Associates and is now the subject of an intensive search funded by the Federal Airports Corporation through ANCA.

The species richness of reptiles from the eight sites surveyed over all seasons on Perth Airport is:-

Site 1.	*Banksia/Eucalyptus* Woodland	13 spp.
Site 2.	*Jacksonia* Shrubland.	13 spp.
Site 8.	*Banksia* Woodland	13 spp.
Site 6.	*Adenanthos* Tall Shrubland	12 spp.
Site 5.	*Pericalymma ellipticum* Heath	11 spp.
Site 4.	*Verticordia densiflora* Heath	9 spp.
Site 3.	*Eucalyptus* Woodland	9 spp.
Site 7.	*Melaleuca/Banksia littoralis* Swamp	7 spp.

Combining the assemblages known from Sites 1-3, all of which are adjacent and located in Area A, indicates 16 reptile species occur at the location.

Several species of reptile are recorded from only single sampling sites within the Perth Airport area despite of the comparatively extensive survey effort employed there.

- Gould's Snake, *Rhinoplocephalus gouldii*, is known from a single individual captured in the *Verticordia densiflora* Heath at Site 4.

- Fraser's Legless Lizard, *Delma fraseri*, was trapped by Tingay and Associates in November 1993 at Site G, a *Banksia attenuata* Low Woodland/*Adenanthos cygnorum* Shrubland.

- The skink, *Ctenotus impar*, was trapped by the Western Australian Museum in the *Verticordia densiflora* Heath at Site 4. Tingay and Associates caught this species at the same location (= Site B) in September 1993, although in their Appendix E the vegetation was determined as *Banksia* Low Open Woodland and *Pericalymma ellipticum* Heath.

- The black Racehorse Goanna, *Varanus tristis*, has only been recorded in the *Banksia /Eucalyptus* Woodland of Site 1.

Although trapped or observed at four locations within the Perth Airport, the Crowned Snake, *Notechis coronatus*, has not been recorded from other urban bushland remnants. This species is near the northern limit of its distribution and the Perth Airport population represents an important, geographically peripheral, population. The Black-naped Snake, *Simoselaps bimaculata*, although recorded in two sites on Perth Airport is not commonly recorded in urban bushland remnants.

The relationship of the lizard fauna documented from the eight Perth Airport sites trapped over all seasons is presented in Figure 2. This dendrogram is based on an UPGMA cluster of Sorensen's similarity index for the sites (Biodiv 1993). The lizards of Site 7 are least similar to the rest; a consequence of the depauperate nature of the assemblage on this seasonally inundated swamp where pitfall trapping was also only possible for a restricted period of time. Site 4 is also markedly different in its lizard assemblage from all other sites and it is the sole locality for the skink, *Ctenotus impar*. The remainder of the sites at Perth Airport form two clusters - a northern group (Sites 1, 2, 3), and a southern group (Sites 5, 6, 8) - but these show a high (>70%) level of similarity (Table 1).

REGIONAL SIGNIFICANCE

The amphibian fauna of Perth Airport is characteristic of areas on the eastern side of the Swan Coastal Plain where permanent and seasonally inundated wetland are most abundant (Storr *et al.* 1978b). Data on the terrestrial invertebrate fauna of Perth Airport and its regional significance has yet to be compiled (How *et al.* 1995).

As indicated by Tingay and Associates (1994a), the avifaunal species richness of Perth Airport is only matched by Whiteman Park (Arnold *et al.* 1991) and Bold Park (How and Dell 1990) in the Metropolitan region and both these areas have extensive wetlands that are frequented by numerous species of waterbirds. The presence of several species that have become rare elsewhere on urban bushland remnants on the Swan Coastal Plain further enhances the status of Perth Airport as an important location for the avifauna. It ranks in the top six percent of wetlands on the Swan Coastal Plain for breeding species (Storey *et al.* 1993).

There are very few native mammals surviving on Perth Airport, as has been shown to be the case for most other areas on the Swan Coastal Plain (How and Dell 1993). However, the abundance of the Quenda, *Isoodon obesulus*, throughout Perth Airport indicates that the area is an important refuge for this species that is now officially recognised as a Threatened Species.

The Western Australian Museum has accumulated distributional data for the herpetofauna on 30 urban bushland areas on the Swan Coastal Plain within 40 km of Perth (How and Dell unpubl.). The important distributional data from this database, as it relates to the regional importance of species at Perth Airport, are :-

- Gould's Snake, *Rhinoplocephalus gouldii*, is now known to occur on 11 other bushland remnants on the Swan Coastal Plain and most of the eight bushlands on the Darling Scarp and Plateau:

- The Crowned Snake, *Notechis coronatus*, has only been recorded from Perth Airport:

- The skink, *Ctenotus impar*, has been recorded from the single site at Perth Airport and also Whiteman Park:

- Three species that are uncommon at Perth Airport, *Delma fraseri*, *Varanus tristis* and *Simoselaps bimaculata*, have been recorded on only six other urban bushland remnants.

The relationships of the lizard assemblage on the eight sites documented at Perth Airport are compared with those of other survey sites and locations in urban bushland remnants in Figure 3. All these have been extensively pitfall trapped in all seasons and the data are from a recently initiated study of ground fauna in urban bushland remnants, funded by the National Estate Grants Program of the Australian Heritage Commission (How *et al.* 1995).

The most dissimilar sites are again those of the two seasonally inundated or waterlogged sites (Sites 7 and 4) of Perth Airport (PA). Figure 3 also highlights the regional biogeographic differences in the lizard assemblages. Sites on the Ridge Hill Shelf at Talbot Road Reserve (TR) are dissimilar to the rest of the sites at locations on the Bassendean, Spearwood and Quindalup Dune Landforms of the Swan Coastal Plain. The remaining six sites at Perth Airport have assemblages that are similar at above the 70 percent level but are markedly different to sites on other urban bushland locations (Figure 3).

Banksia woodlands are represented by Sites at Jandakot (JK1, JK2), Mount Henry (MH1, MH2), Perth Airport (PA1, PA8), Tuart Hill (TH1, TH2), Mount Claremont (MC2), Bold Park (BP3) and Talbot Road Reserve (TR4): the lizard assemblages of this vegetation type differ markedly between these locations (Figure 3).

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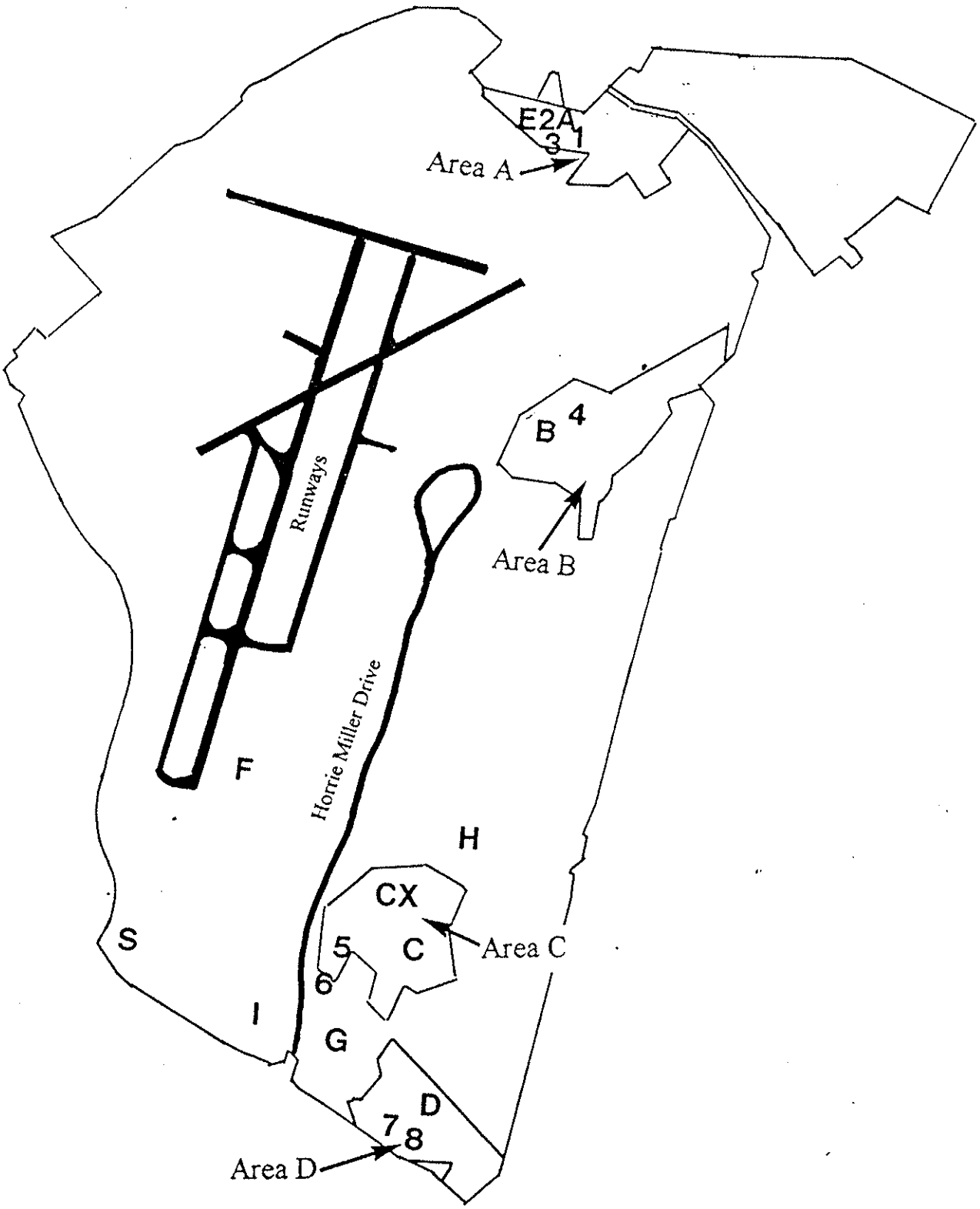
Figure 1. Location of the four areas at Perth Airport proposed for listing on the Register of the National Estate and the principal sampling sites for the three main faunal surveys.


E2A
3
1
Area A
Runways
B
4
Area B
Horrie Miller Drive
F
H
CX
C
5
Area C
6
S
I
G
D
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8
Area D

Figure 2. Similarity of the lizard assemblages at the eight main Perth Airport sampling sites. The dendrogram is based on UPGMA clustering of Sorensen's Index of similarity using presence and absence data.

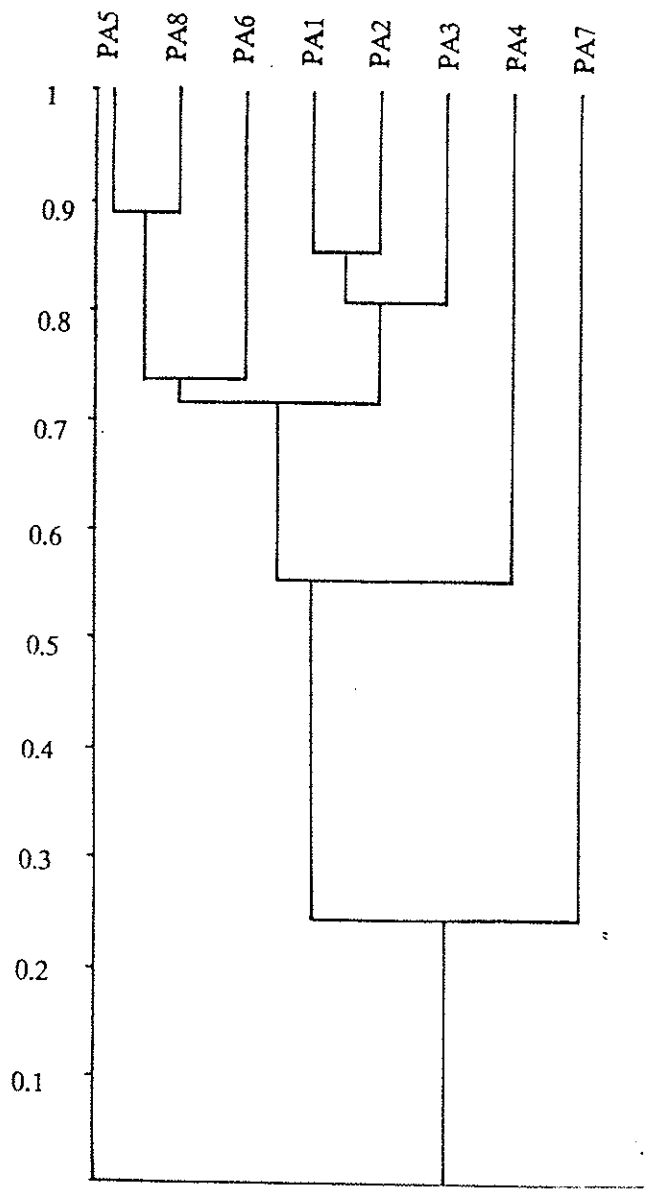
PA5
PA8
PA6
PA1
PA2
PA3
PA4
PA7
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1

Figure 3. Similarity of the lizard assemblages at the sampling sites in Perth's urban bushland remnants. The dendrogram is based on UPGMA clustering of Sorensen's Index of similarity using presence and absence data and includes only sites sampled in all seasons. The bushland areas identified are Bold Park (BP), Jandakot Airport (JK), Mount Claremont (MC), Mount Henry (MH), Perth Airport (PA), Tuart Hill (TH), Talbot Road (TR) and Woodman Point (WP).

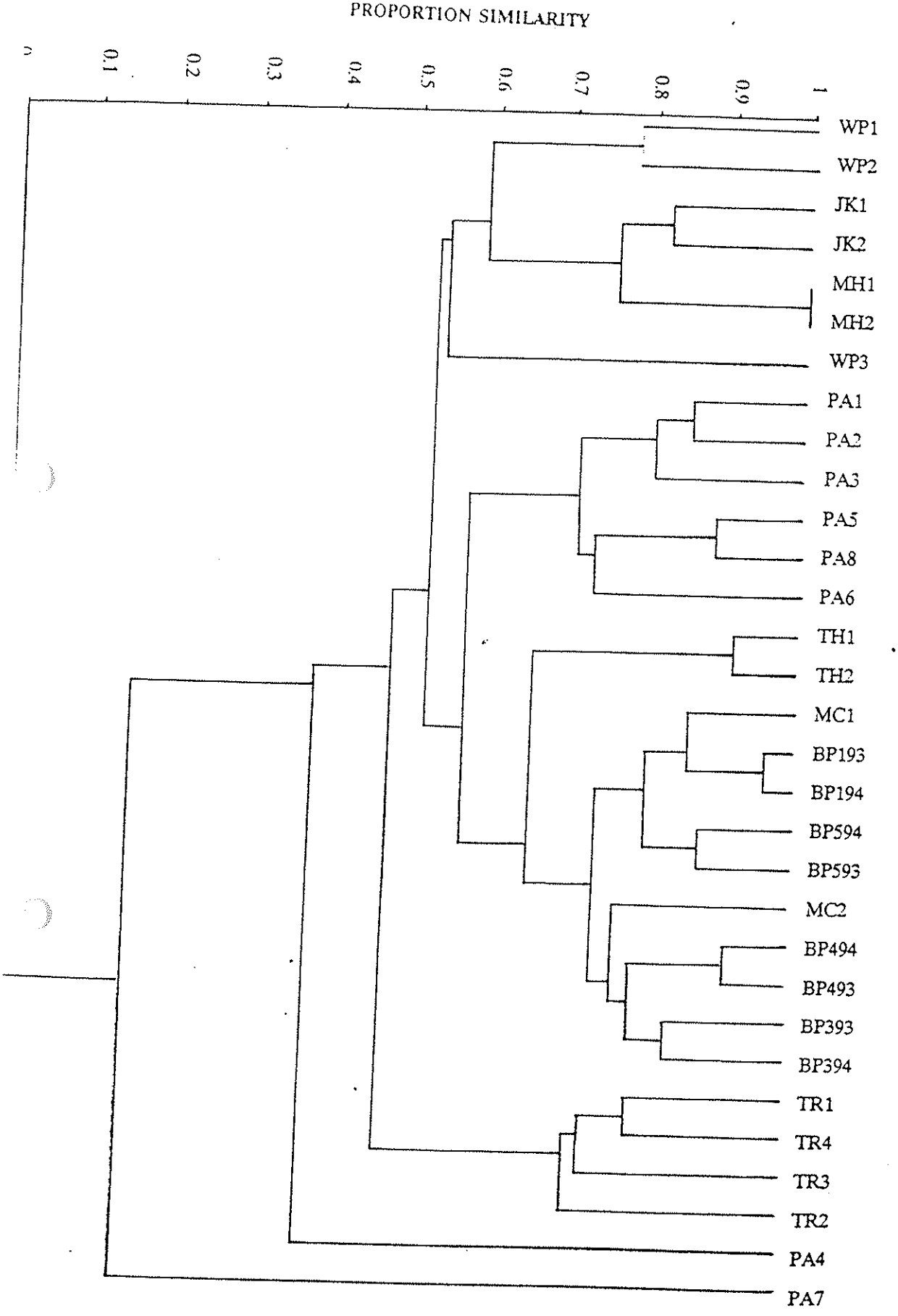
PROPORTION SIMILARITY
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
WP1
WP2
JK1
JK2
MH1
MH2
WP3
PA1
PA2
PA3
PA5
PA8
PA6
TH1
TH2
MC1
BP193
BP194
BP594
BP593
MC2
BP494
BP493
BP393
BP394
TR1
TR4
TR3
TR2
PA4
PA7

TABLE 1. Herpetofauna Of The Perth Airport Region

Herpetofauna from Western Australian Museum sites **1, 2, 3, 4,** (1986-1990), and **5, 6, 7, 8,** (1993-1994). Presence (*1*) or absence (-) is cumulated under **PA** for the eight Western Australian Museum sampling sites and under **TA** for Alan Tingay and Associates 11 sampling sites during September and November 1993. Asterix refers to sightings and plus to records from other sources. Habitat types for the sampling sites are listed at the end.

	SAMPLING SITES AND SURVEYS									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**PA**	**TA**
Pittrap Days	**558**	**558**	**558**	**558**	**522**	**522**	**234**	**405**		**440**
AMPHIBIANS										
LEPTODACTYLIDAE (Ground Frogs)										
Heleioporus eyrei	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*
Limnodynastes dorsalis	*1*	*1*	*1*	*1*	*1*	*1*	-	-	*1*	+
Myobatrachus gouldii	*1*	-	-	-	-	-	-	-	*1*	+
Pseudophryne guentheri	*1*	-	-	*1*	*1*	*1*	*1*	-	*1*	*1*
Ranidella insignifera	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*
Ranidella glauerti	-	-	-	-	-	-	-	-	*	*
HYLIDAE (Tree Frogs)										
Litoria adelaidensis	-	-	-	*1*	-	-	*1*	-	*1*	+
Litoria moorei	-	-	*1*	*1*	-	-	-	-	*1*	+
Amphibian Species	**5**	**3**	**4**	**6**	**4**	**4**	**4**	**2**	**8**	**8**
REPTILES										
CHELIDAE (Tortoises)										
Chelodina oblonga	-	-	-	-	-	-	-	-	*	+
Pseudemydura umbrina	-	-	-	-	-	-	-	-	-	+
PYGOPODIDAE (Legless Lizards)										
Delma fraseri	-	-	-	-	-	-	-	-	-	*1*
Delma grayii	*1*	*1*	*1*	*1*	*1*	-	-	*1*	*1*	+
Lialis burtonis	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	+
Pletholax gracilis	-	*1*	-	*1*	*1*	-	-	*1*	*1*	+
AGAMIDAE (Dragon Lizards)										
Pogona minor	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*
SCINCIDAE (Skink Lizards)										
Bassiana trilineata	-	-	-	-	*1*	*1*	*1*	*1*	*1*	*1*
Cryptoblepharus plagiocephalus	*1*	*1*	*1*	-	-	*1*	*1*	-	*1*	*
Ctenotus fallens	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	+
Ctenotus impar	-	-	-	*1*	-	-	-	-	*1*	*1*
Ctenotus lesueurii	*1*	*1*	-	-	-	*1*	-	*1*	*1*	*1*
Hemiergis quadrilineata	*1*	*1*	*1*	-	*1*	*1*	-	*1*	*1*	*1*
Lerista elegans	*1*	*1*	*1*	-	*1*	*1*	-	*1*	*1*	*1*
Menetia greyii	*1*	*1*	-	-	*1*	*1*	*1*	*1*	*1*	-
Tiliqua rugosa	*1*	-	*1*	*1*	-	-	*1*	*1*	*1*	*1*
VARANIDAE (Goannas)										
Varanus gouldii	-	-	-	-	-	*1*	-	-	*1*	*
Varanus tristis	*1*	-	-	-	-	-	-	-	*1*	+
TYPHLOPIDAE (Blind Snakes)										
Ramphotyphlops australis	*1*	-	*1*	-	*1*	-	-	-	*1*	+
ELAPIDAE (Front-Fanged Snakes)										
Notechis coronatus	-	*1*	-	-	-	*1*	-	*1*	*1*	*
Pseudonaja affinis	-	*1*	-	*1*	*1*	*1*	-	*1*	*1*	*
Rhinoplocephalus gouldii	-	-	-	*1*	-	-	-	-	*1*	+
Simoselaps bimaculata	*1*	*1*	-	-	-	-	-	-	*1*	+
Reptile Species	**13**	**13**	**9**	**9**	**11**	**12**	**7**	**13**	**21**	**22**

HABITATS

1. *Banksia/ Eucalyptus* Woodland
2. *Jacksonia* Shrubland
3. *Eucalyptus* Woodland
4. *Verticordia densiflora* Heath
5. *Pericalymma ellipticum* Heath
6. *Adenanthos* Tall Shrubland
7. *Melaleuca/ Banksia littoralis* Swamp
8. *Banksia* Low Woodland

TABLE 2. Birds Of The Perth Airport Region

Avifauna from Western Australian Museum sites **1, 2, 3, 4**, (1986-1990), and **5, 6, 7, 8**, (1993-1994). Presence (*1*) or absence (-) is cumulated under **PA** for the eight Western Australian Museum sampling sites and survey and under **TA** for Alan Tingay and Associates 11 sites and survey during September and November 1993. Introduced species are prefixed by an asterix. A plus refers to records from other sources. Habitat types of sampling sites are listed at the end of the herpetofauna table.

	OBSERVATION PERIODS AND SAMPLING SITES									
SPECIES	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**PA**	**TA**
Observation Days	**93**	**93**	**93**	**93**	**58**	**58**	**26**	**45**		**c.14**
PODICIPEDIDAE										
Black-throated Grebe *Podiceps novaehollandiae*	-	-	-	-	-	-	-	-	-	+
PELECANIDAE										
Australian Pelican *Pelecanus conspicillatus*	-	-	-	-	-	-	-	-	*1*	+
PHALACROCORACIDAE										
Little Black Cormorant *Phalacrocorax sulcirostris*	-	-	-	-	-	-	-	-	*1*	+
Great Cormorant *Phalacrocorax carbo*	-	-	-	-	-	-	-	-	*1*	+
Little Pied Cormorant *Phalacrocorax melanoleucos*	-	-	-	-	-	-	-	-	*1*	*1*
Darter *Anhinga melanogaster*	-	-	-	-	-	-	-	-	-	+
ARDEIDAE										
Pacific Heron *Ardea pacifica*	-	-	-	-	-	-	-	-	-	+
White-faced Heron *Ardea novaehollandiae*	-	-	-	*1*	*1*	-	-	-	*1*	*1*
Great Egret *Egretta alba*	-	-	-	*1*	-	-	-	-	*1*	*1*
THRESKIORNITHIDAE										
*Sacred Ibis *Threskiornis aethiopicus*	-	-	-	-	-	-	-	-	*1*	*1*
*Straw-necked Ibis *Threskiornis spinicollis*	-	-	-	-	-	-	-	-	*1*	*1*
*Yellow-billed Spoonbill *Platalea flavipes*	-	-	-	-	-	-	-	-	*1*	*1*
ANATIDAE										
Black Swan *Cygnus atratus*	-	-	-	-	-	-	-	-	*1*	+
Mountain Duck *Tadorna tadornoides*	-	-	-	-	-	-	-	-	*1*	*1*
Black Duck *Anas superciliosa*	-	-	-	-	-	-	-	-	*1*	*1*
Grey Teal *Anas gibberifrons*	-	-	-	-	-	-	-	-	*1*	*1*
Blue-winged Shoveler *Anas rhynchotis*	-	-	-	-	-	-	-	-	*1*	*1*
Wood Duck *Chenonetta jubata*	-	-	-	-	-	-	-	-	*1*	*1*
Musk Duck *Bizura lobata*	-	-	-	-	-	-	-	-	-	+
ACCIPITRIDAE										
Black-shouldered Kite *Elanus caeruleus*	-	-	-	-	*1*	*1*	-	-	*1*	*1*
Collared Sparrowhawk *Accipiter cirrocephalus*	-	-	-	-	*1*	-	-	-	*1*	+
Brown Goshawk *Accipiter fasciatus*	-	-	*1*	-	*1*	*1*	-	-	*1*	*1*
Wedge-tailed Eagle *Aquila audax*	-	-	-	-	-	-	-	-	-	*1*
Little Eagle *Aquila morphnoides*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*
FALCONIDAE										
Brown Falcon *Falco berigora*	-	-	-	-	-	-	-	-	*1*	+
Australian Kestrel *Falco cenchroides*	-	-	-	-	*1*	*1*	-	*1*	*1*	*1*
RALLIDAE										
Dusky Moorhen *Gallinula tenebrosa*	-	-	-	-	-	-	-	-	-	*1*
Purple Swamphen *Porphyrio porphyrio*	-	-	-	-	-	-	-	-	-	*1*
Eurasian Coot *Fulica atra*	-	-	-	-	-	-	-	-	*1*	*1*
CHARADRIIDAE										
Black-fronted Plover *Charadrius melanops*	-	-	-	-	-	*1*	-	-	*1*	+
RECURVIROSTRIDAE										
Black-winged Stilt *Himantopus himantopus*	-	-	-	-	-	-	-	-	*1*	*1*
Banded Stilt *Cladorynchus leucocephalus*	-	-	-	-	-	-	-	-	-	+
COLUMBIDAE										
*Spotted Dove *Streptopelia chinensis*	-	-	-	-	-	*1*	*1*	-	*1*	-
*Laughing Dove *Streptopelia senegalensis*	*1*	*1*	-	-	*1*	*1*	-	*1*	*1*	*1*
Common Bronzewing *Phaps chalcoptera*	*1*	-	-	-	-	-	-	-	*1*	+
Crested Pigeon *Ocyphaps lophotes*	-	-	-	-	-	-	-	-	*1*	*1*

SPECIES	1	2	3	4	5	6	7	8	PA	TA
PSITTACIDAE										
Ringnecked Parrot *Platycercus zonarius*	1	1	1	1	-	-	-	-	1	1
Redcapped Parrot *Platycercus spurius*	1	-	1	1	1	-	1	-	1	1
Elegant Parrot *Neophema elegans*	-	-	-	-	1	-	-	-	1	+
Carnaby's Cockatoo *Calyptorhynchus latirostris*	-	-	-	-	-	-	-	-	1	+
*Galah *Cacatua roseicapilla*	1	-	1	1	-	-	-	-	1	1
CUCULIDAE										
Pallid Cuckoo *Cuculus pallidus*	1	-	-	-	-	-	-	-	1	+
Fantailed Cuckoo *Cacomantis flabelliformis*	-	-	-	-	-	-	-	-	-	+
Horsfield's Bronze Cuckoo *Chrysococcyx basalis*	-	-	-	-	1	-	-	-	1	-
Shining Bronze Cuckoo *Chrysococcyx lucidus*	1	1	1	-	1	-	-	-	1	1
ALCEDINIDAE										
*Laughing Kookaburra *Dacelo gigas*	1	-	1	1	-	-	-	-	1	1
Sacred Kingfisher *Halcyon sancta*	1	1	1	1	-	-	-	1	1	1
MEROPIDAE										
Rainbow Bee-eater *Merops ornatus*	1	1	1	1	1	1	-	1	1	1
HIRUNDINIDAE										
Welcome Swallow *Hirundo neoxena*	-	-	-	-	1	1	-	1	1	1
Tree Martin *Hirundo nigricans*	1	-	-	1	1	1	-	1	1	1
Fairy Martin *Hirundo ariel*	-	-	-	-	-	-	-	1	1	+
MOTACILLIDAE										
Richard's Pipit *Anthus novaeseelandiae*	-	-	-	-	1	-	-	-	1	1
CAMPEPHAGIDAE										
Black-faced Cuckoo-shrike *Coracina novaehollandiae*	1	1	1	1	1	-	-	1	1	1
White-winged Triller *Lalage sueurii*	-	-	-	-	1	1	-	-	1	+
PACHYCEPHALIDAE										
Red-capped Robin *Petroica goodenovii*	1	1	1	-	-	-	-	-	1	1
Golden Whistler *Pachycephala pectoralis*	1	-	-	-	-	-	-	-	1	-
Rufous Whistler *Pachycephala rufiventris*	1	1	1	1	1	1	1	1	1	1
Grey Shrike-thrush *Colluricincla harmonica*	-	-	-	-	-	-	-	-	-	+
MONARCHIDAE										
Grey Fantail *Rhipidura fuliginosa*	1	1	1	1	-	-	-	-	1	1
Willy Wagtail *Rhipidura leucophrys*	1	-	1	1	1	1	-	-	1	1
ACANTHIZIDAE										
Western Flyeater *Gerygone fusca*	1	1	1	1	-	-	-	-	1	1
Broad-tailed Thornbill *Acanthiza apicalis*	-	-	-	1	-	-	-	-	1	1
Yellow-rumped Thornbill *Acanthiza chrysorrhoa*	1	1	1	1	1	-	1	-	1	1
MALURIDAE										
Splendid Fairy-wren *Malurus splendens*	-	1	-	1	1	-	-	-	1	1
SYLVIIDAE										
Australian Reed-Warbler *Acrocephalus australis*	-	-	-	-	-	-	-	-	-	1
Rufous Songlark *Cincloramphus mathewsi*	-	-	-	1	1	-	-	-	1	-
Brown Songlark *Cincloramphus cruralis*	-	-	-	1	-	-	-	-	1	-
DAPHOENOSITTIDAE										
Australian Sittella *Daphoenositta chrysoptera*	-	1	1	1	1	-	-	1	1	1
DICAEIDAE										
Mistletoebird *Dicaeum hirundinaceum*	1	1	-	1	1	-	-	-	1	+
PARDALOTIDAE										
Spotted Pardalote *Pardalotus punctatus*	1	1	-	-	-	-	-	-	1	+
Striated Pardalote *Pardalotus striatus*	1	1	1	-	1	-	1	-	1	1
ZOSTEROPIDAE										
Grey-breasted White-eye *Zosterops lateralis*	1	1	1	1	1	1	1	1	1	1
MELIPHAGIDAE										
Brown Honeyeater *Lichmera indistincta*	1	1	1	1	1	1	1	1	1	1
Singing Honeyeater *Meliphaga virescens*	1	1	1	1	1	1	1	1	1	1
White-cheeked Honeyeater *Phylidonyris nigra*	-	-	-	-	1	1	-	1	1	1
Tawny-crowned Honeyeater *Phylidonyris melanops*	-	-	-	-	1	1	-	-	1	+
New Holland Honeyeater *Phylidonyris pyrrhoptera*	-	-	-	-	-	-	-	-	-	1
Western Spinebill *Acanthorhynchus superciliosus*	1	1	1	-	1	1	-	1	1	1
Little Wattlebird *Anthochaera chrysoptera*	1	1	-	1	1	1	-	1	1	1
Red Wattlebird *Anthochaera carunculata*	1	1	-	1	1	1	1	-	1	1

SPECIES	1	2	3	4	5	6	7	8	PA	TA
EPTHIANURIDAE										
White-fronted Chat *Epthianura albifrons*	-	-	-	-	*1*	-	-	-	*1*	*1*
GRALLINIDAE										
Magpie-lark *Grallina cyanoleuca*	*1*	-	-	-	*1*	-	-	*1*	*1*	*1*
ARTAMIDAE										
Black-faced Woodswallow *Artamus cinereus*	-	-	-	-	*1*	*1*	-	-	*1*	*1*
Dusky Woodswallow *Artamus cyanopterus*	-	-	-	-	-	-	-	-	-	*1*
CRACTICIDAE										
Grey Butcherbird *Cracticus torquatus*	*1*	*1*	*1*	*1*	*1*	-	*1*	*1*	*1*	*1*
Australian Magpie *Cracticus tibicen*	*1*	-	*1*	*1*	*1*	*1*	-	-	*1*	*1*
CORVIDAE										
Australian Raven *Corvus coronoides*	*1*	*1*	*1*	*1*	*1*	*1*	-	*1*	*1*	*1*
Species	**33**	**25**	**25**	**30**	**39**	**24**	**11**	**20**	**74**	**82**

315 58

FEDERAL AIRPORTS CORPORATION

THE FLORA AND VEGETATION OF PERTH AIRPORT

ALAN TINGAY & ASSOCIATES

MAY 1994

REPORT NO: 94/18

PERTH AIRPORT NATIVE FLORA

(Revised January 1996)

1 = Alan Tingay & Associates 1992-1994
2 = Dixon, 1983

FERNS

ADIANTACEAE

1 Cheilanthes austrotenuifolia

GYMNOSPERMS

ZAMIACEAE

1,2 Macrozamia riedlei

MONOCOTYLEDONS

POTAMOGETONACEAE

1,2 Potamogeton sp
2 Potamogeton drummondii

JUNCAGINACEAE

1 Triglochin procera
1 Triglochin striata

POACEAE

1 Amphipogon turbinatus
1 Danthonia caespitosa
1,2 Neurachne alopecuroidea
1 Stipa compressa
1 Stipa semibarbata

CYPERACEAE

1,2 Baumea articulata
2 Baumea juncea
1 Bolboschoenus caldwellii
2 Cyperus difformis
2 Gahnia trifida
1 Isolepis cernua
1 Isolepis marginata
1 Lepidosperma angustatum
2 Lepidosperma gladiatum
1 Lepidosperma leptostachyum
1 Lepidosperma longitudinale
1 Lepidosperma tenue
1 Mesomelaena pseudostygia
1 Mesomelaena graciliceps
1,2 Mesomalaena tetragona
1 Schoenus benthamii
1,2 Schoenus curvifolius
1 Schoenus elegans
1 Schoenus grandiflorus
1 Schoenus odontocarpus
1 Tertaria octandra

RESTIONACEAE

1,2 Alexgeorgea arenicola
1 Hypolaena exsulca
1,2 Leptocarpus aristatus
1 Loxocarya fasciculata
1,2 Loxocarya flexuosa
1 Loxocarya pubescens
1,2 Lyginia barbata
1 Restio sinuosus
1 Restio stenostachyus

CENTROLEPIDACEAE

1 Centrolepis aristata

COMMELINACEAE

1 Cartonema philydroides

JUNCACEAE

1 Juncus pallidus
2 Juncus holoschoenus

DASYPOGONACEAE

1 Calectasia cyanea
1,2 Dasypogon bromeliifolius
1 Lomandra preissii
2 Lomandra collina

XANTHORRHOEACEAE

1 Xanthorrhoea brunonis
1,2 Xanthorrhoea preissii

PHORMIACEAE

1 Dianella divaricata

ANTHERICACEAE

1,2 Arnocrinum preissii
1 Chamaescilla corymbosa
1,2 Corynotheca micrantha
1,2 Johnsonia pubescens
1,2 Laxmannia squarrosa
1 Sowerbaea laxiflora
1,2 Thysanotus patersonii
2 Thysanotus multiflorus
1 Thysanotus thyrsoideus
1 Thysanotus triandrus
1,2 Tricoryne elatior

COLCHICACEAE

1 Burchardia multiflora
1,2 Buchardia umbellata

HAEMODORACEAE

1 Anigozanthos humilis
1 Anigozanthos manglesii
1 Anigozanthos humilis x manglesii
1,2 Anigozanthos viridis
1 Conostylis aculeata
1 Conostylis juncea
1 Conostylis setigera
1 Haemodorum laxum
1,2 Haemodorum paniculatum
1,2 Haemodorum spicatum
1,2 Phlebocarya ciliata
1 Tribonanthes australis
1 Tribonanthes longipetala

TYPHACEAE

2 Typha domingensis

IRIDACEAE

1,2 Patersonia occidentalis

ORCHIDACEAE

1 Burnettia nigricans
1 Caladenia arenicola
1 Caladenia ferruginea
1 Caladenia flava
1 Caladenia fimbriata
1 Caladenia longicauda
1 Diuris longifolia
1 Diuris laxiflora
1 Diuris magnifica
1 Leptoceras menziesii
1 Microtis atrata
1,2 Microtis media
1 Prasophyllum ovale
1 Prasophyllum drumondii
1 Pterostylis recurva
1 Pterostylis vittata
1 Thelymitra flexuosa

DICOTYLEDONS

CASUARINACEAE

1,2 Allocauarina fraseriana
1 Allocasurina humilis

PROTEACEAE

1,2 Adenanthos cygnorum
1,2 Banksia attenuata
1 Banksia grandis
1 Banksia ilicifolium
1,2 Banksia littoralis
1,2 Banksia menziesii
1 Banksia telmatiaea
1 Conospermum stoechadis
1,2 Dryandra nivea
1,2 Hakea lissocarpha
1 Hakea prostrata
1,2 Hakea varia
1,2 Persoonia saccata
1,2 Petrophile linearis
1 Petrophile seminuda
1,2 Stirlingia latifolia
1 Synaphaea petiolaris
1,2 Synaphaea spinulosa

SANTALACEAE

1 Exocarpos sparteus
1 Leptomeria empetriformis

LORANTHACEAE

1,2 Nuytsia floribunda

MOLLUGINACEAE

1 Macarthuria australis

PORTULACACEAE

1 Calandrinia calyptrata
1 Calandrinia corrigioloides

LAURACEAE

1 Cassytha flava
1,2 Cassytha racemosa

DROSERACEAE

1 Drosera erythrorrhiza
1 Drosera gigantea
1 Drosera glanduligera
1 Drosera menziesii
1 Drosera sp

CRASSULACEAE

2 Crassula colorata

PITTOSPORACEAE

1,2 Pronaya fraseri

MIMOSACEAE

1,2 Acacia huegelii
1,2 Acacia pulchella
1,2 Acacia saligna
1 Acacia sessilis
1,2 Acacia stenoptera

PAPILIONACEAE

1,2 Aotus gracilima
1,2 Bossiaea eriocarpa
1 Bossiaea ornata
1 Daviesia divaricata
1,2 Daviesia hakeoides
1 Daviesia physodes
1,2 Daviesia incrassata
1 Daviesia triflora
1,2 Euchilopsis linearis
1,2 Gompholobium tomentosum
1 Hardenbergia comptoniana
1 Hovea trisperma
1 Isotropis cuneifolius
1,2 Jacksonia densiflora
1,2 Jacksonia furcellata
1 Jacksonia lehmannii
1 Jacksonia sternbergiana
1 Jacksonia prostrata
1 Nemcia capitata
1 Sphaerolobium sp
1,2 Viminaria juncea

RUTACEAE

1 Boronia ramosa
1,2 Eriostemon spicatus

TREMANDRACEAE

1 Platytheca galioides

POLYGALACEAE

1 Comesperma confertum

EUPHORBIACEAE

1 Monotaxis grandiflora

STACKHOUSIACEAE

1 Stackhousia pubescens
1 Tripterococcus brunonsis

DILLENIACEAE

1 Hibbertia huegelii
1,2 Hibbertia hypericoides
1,2 Hibbertia racemosa
1 Hibbertia stellaris

VIOLACEAE

1 Hybanthus calycinus

THYMELEACEAE

1 Pimelea angustifolia
1 Pimelea sulphurea

MYRTACEAE

1,2 Astartea fascicularis
1 Baeckea camphorosmae
1 Beaufortia squarrosa
1,2 Calothamnus lateralis
1 Calythrix angulata
1,2 Calythrix flavescens
1,2 Calythrix fraseri
1,2 Eremaea pauciflora
1,2 Eucalyptus calophylla
1,2 Eucalyptus marginata
1,2 Eucalyptus rudis
1 Eucalyptus todtiana
1,2 Hypocalymma angustifolium
1 Kunzea recurva
1 Melaleuca acerosa
1,2 Melaleuca lateritia
1,2 Melaleuca preissiana
1,2 Melaleuca rhaphiophylla
1 Melaleuca scabra
2 Melaleuca seriata
1,2 Pericalymma ellipticum

1 Regelia ciliata
1,2 Scholtzia involucrata
1,2 Verticordia densiflora
1 Verticordia nitens
1 Verticordia lindleyi subsp lindleyi P4

HALORAGACEAE

2 Myriophyllum crispatum

APIACEAE

1 Homalosciadium homalocarpum
1 Trachymene pilosa
1 Xanthosia huegelii

EPACRIDACEAE

1,2 Conostephium pendulum
1 Conostephium preissii
1 Leucopogon australis
1 Leucopogon conostephioides
1 Leucopogon sprengelioides
1 Lysinema ciliatum

PRIMULACEAE

2 Samolus repens

MENYANTHACEAE

2 Villarsia albiflora
1 Villarsia capitata
2 Villarsia violifolia

LAMIACEAE

1,2 Hemiandra pungens

LENTIBULARIACEAE

1 Polypompholyx multifida
1 Polypompholyx tenella
1 Utricularia violacea

RUBIACEAE

1 Opercularia vaginata

CAMPANULACEAE

1 Wahlenbergia preissii

LOBELIACEAE

2 Lobelia alata
1 Lobelia tenuior

GOODENIACEAE

1,2 Dampiera linearis
1 Lechenaultia expansa
1,2 Lechenaultia floribunda
1 Scaevola paludosa
2 Velleia trinervis

STYLIDIACEAE

1 Levenhookia pusilla
1,2 Stylidium brunonianum
2 Stylidium bulbiferum
1 Stylidium calcaratum
1 Stylidium despectum
1,2 Stylidium dichotomum
1 Stylidium piliferum
1 Stylidium pulchellum
1,2 Stylidium repens
1,2 Stylidium aff. repens
1 Stylidium schoenoides

ASTERACEAE

1 Angianthus sp
1 Asteridia pulverulenta
1 Brachycome ?maryonii
1 Cotula coronopifolia
2 Gnaphalium candissimum
1 Helipterum cotula
1 Lagenifera huegelii
1 Olearia elaeophila
1 Podolepis lessonii
2 Podolepis gracilis
2 Podotheca angustifolia
1 Pterochaeta paniculata
1 Podotheca crysantha
1 Senecio quadridentatus
1 Siloxerus humifusus
1 Waitzia suaveolens

INSERT

THE FLORA AND VEGETATION OF PERTH AIRPORT

ENDANGERED SPECIES

None of the plants recorded from Perth Airport are listed as endangered or vulnerable species in the Commonwealth Endangered Species Protection Act, 1992.

SIGNIFICANT FLORA

The Western Australian Department of Conservation and Land Management regularly updates their Priority Flora List which lists species not considered rare but of uncertain conservation status.

As a result of more detailed surveys or regular monitoring, species on the list may have their priority code reclassified. Species may also be added or deleted with each new published list.

The species list contained in the Perth Airport Flora and Vegetation report of May 1994 included three Priority flora species according to the CALM Priority list of 28 October, 1992.

Since this report was completed, an updated Priority Flora list has been released. The list was released in May but is dated 2 February, 1994. The three Priority species *Daviesia physodes, Cartonema phylidroides* and *Restio stenostachyus* included in the Perth Airport report have all been deleted from the new Priority list and are therefore no longer under consideration for declaration as rare flora.

In contrast, one species that occurs at Perth Airport, *Schoenus benthamii,* has been added to the 1994 Priority List as a Priority 3 species. Priority 3 species are known from several populations, at least some of which are not believed to be under immediate threat.

Schoenus benthamii is a small sedge up to 0.45m high which occurs on the Swan Coastal Plain and Darling Range usually in winter-west depressions. Its known range extends from Mogumber to east of Walpole. At the airport, *S. benthamii* was found in one location in the northern section on swampy soil amongst a *Melaleuca viminea* Closed Heath with *Pericalymma ellipticum* and *Calothamnus lateralis.*

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APPENDIX

1. Perth Airport Native Flora

1. INTRODUCTION

1.1 Background

Perth Airport is situated approximately 9km east of the Central Business District of Perth. The airport land covers 2,108ha and is under the control of the Federal Airports Corporation (FAC). The land includes infrastructure such as runways and terminals associated with the provision of airport services and large areas which are not developed. Much of the undeveloped land has been cleared as a result of agricultural activities prior to acquisition by the FAC, but significant areas of indigenous vegetation are also present.

The purpose of this report is to provide an assessment of the remaining native flora and vegetation of the Perth Airport. The assessment, in combination with other inputs and planning priorities will assist the FAC in determining appropriate management options for the airport. A separate report dealing with the vertebrate fauna of the Perth Airport has also been prepared for this purpose (Alan Tingay & Associates, 1994).

1.2 Study Objectives

The aims of the study were to:

- Compile a list of the native plant species in the area.
- Identify any rare and endangered species.
- Describe and map the vegetation on the property, and
- Assess the significance of the flora and vegetation.

1.3 Regional Botany

The vegetation of Perth Airport belongs predominantly to the Southern River Complex (Heddle, *et. al.*, 1978). A small area of vegetation in the north-west corner belongs to the Guildford Complex and vegetation in the south-west corner belongs to the Bassendean Complex (Central and South).

The Southern River Complex comprises open woodlands of Marri (*Eucalyptus calophylla*), Jarrah (*E. marginata*), Banksia species on elevated areas and fringing woodlands of Flooded gum (*E. rudis*) and Swamp Paperbark (*Melaleuca rhaphiophylla*) along river courses.

The Guildford Complex is a mixture of open forest to tall open forest of Marri, Wandoo (*E. wandoo*) and Jarrah with minor components including *E. rudis*, and *M. rhaphiophylla*.

The Bassendean Complex (Central and South) ranges from woodlands of Jarrah, *Allocasuarina fraseriana* and *Banksia* species to low woodlands of *Melaleuca* species and sedgelands on damper sites.

These descriptions of the main vegetation types above are necessarily general. This report provides a more detailed description of the variety of vegetation types within Perth Airport and assesses the similarity between each type.

1.4 Previous Studies

The flora and vegetation of all of the land within the boundaries of the Perth Airport have not been described previously. However, there have been three studies covering particular portions of the airport.

In 1983, Dixon surveyed the flora and vegetation within the area of the proposed International Terminal Building site and associated facilities. The study produced a species list and vegetation map for much of the western half of the airport land, particularly surrounding the runway. No declared rare flora or priority flora were recorded. The flora survey was conducted in January and therefore did not contain many annual or ephemeral species.

A description was also made of the vegetation units but the naming of these units did not follow standard practices. It is, therefore, difficult to apply the names over a wider area or to compare the vegetation of the airport with other areas. One of the objectives of the present report is to describe the vegetation of the airport according to contemporary methods.

A series of reports was produced in the 1980s to study the effects of the Great Eastern Highway Bypass on the native flora within the road reserve and nearby wetlands (Backshall & Hart, 1986; Mattiske & Associates, 1989). A small part of the airport land in the north-east section was included in these studies.

2. FLORA SURVEY

2.1 Methods

A list of the native species was made by incorporating the list of Dixon (1983) and adding to this list by conducting field surveys throughout the airport property from September 1992 through to January 1994.

Specimens which were difficult to identify in the field were collected, dried and pressed and later identified and verified at the Western Australian Herbarium.

2.2 Results

A total of 227 native species have been recorded for the airport. The complete list of species is presented in Appendix 1. Recent changes in species nomenclature have been incorporated into the list of Dixon.

The total of 227 species includes 1 fern species, 1 cycad, 84 Monocotyledons, and 141 Dicotyledons. The most common families are the Myrtaceae (28 species), Papilionaceae (20), Cyperaceae (19), Proteaceae (17), Haemodoraceae (12), Asteraceae (11), Orchidaceae (11), and Anthericaceae (11).

2.3 Significant Flora

None of the species recorded on the airport land is gazetted as Declared Rare Flora (Department of Conservation & Land Management, October 1992). However, three Priority species have been recorded as follows:

- *Daviesia physodes* (Priority 2)
- *Cartonema philydroides* (Priority 3)
- *Restio stenostachyus* (Priority 3)

Priority 2 species are those with few poorly known populations on conservation lands.

Priority 3 species are those with several poorly known populations, some on conservation lands.

Daviesia physodes (Papilionaceae) (Priority 2) is a shrub species up to 1.8m tall. Although listed as a Priority 2 species, the Flora of the Perth Region (Marchant *et al.*, 1987) describes this species as widespread and common on the coastal plain and Darling Range and occurring from Geraldton to Augusta and Narrogin. It was also found to be quite common in the Ellenbrook area (Weston *et al.*, 1993).

At the Perth Airport *D. physodes* has been recorded only at one site in a *Banksia attenuata/Allocasuarina fraseriana* Low Woodland on dry sandy soil in the north-east sector.

Cartonema philydroides (Commelinaceae) (Priority 3) is a perennial herb up to 0.3m high which occurs on the Swan Coastal Plain from Wanneroo and Guildford south to Capel with an occurrence also at Kalbarri. It normally grows on deep sandy soils, sometimes near wet areas and seems to favour disturbed sites such as firebreaks.

At the airport, *C. philydroides* has been found in one location only on the northern edge of Munday Swamp. The population is growing in sand between the edge of the *Melaleuca rhaphiophylla* fringing woodland and the firebreak alongside the airside security fence. The condition of the vegetation in this narrow zone is poor to moderate with an abundance of annual Veldtgrass (*Ehrharta calycina*) and other invasive weeds. The population size of approximately fifty individuals occupies an area of about 500m^2 and is highly susceptible to further deterioration of its habitat.

A recent study has recommended a change in status for *C. philydroides* from Priority 3 to Priority 4 (species needing monitoring) (Kelly *et. al.*, 1993).

Restio stenostachyus (*Restionaceae*) (Priority 3) is a rush species up to 0.6m high which occurs in sandy, winter-wet depressions and watercourses from Badgingarra south to Casuarina. It is likely to be more abundant than records indicate.

In the airport land *R. stenostachyus* is fairly common in damp areas growing amongst heath vegetation.

3. VEGETATION SURVEY

3.1 Methods

The vegetation of the airport was described using the system of Specht as modified by Aplin (1979). This system classifies vegetation on the basis of height and cover of the tallest stratum. For example, an area of bushland dominated by trees under 10m tall and with 10-30% canopy cover is classified as a Low Woodland (with the initials capitalised to signify the precise botanical meaning of the terms). All the major strata such as trees and shrubs can be described in this manner.

To further describe the vegetation, the dominant species are included so that a Low Woodland which is dominated by *Banksia attenuata* trees is described as a *Banksia attenuata* Low Woodland association. In many instances more than one species is dominant.

A vegetation map was prepared using information collected during field surveys and from interpretation of a 1:5,000 colour aerial photograph.

To understand the relationships between the different vegetation associations, a computer programme was used. The programme called DECORANA (Detrended Correspondence Analysis) graphically presents the similarity between areas of vegetation so that it is possible to compare the vegetation of one area of *Banksia* Woodland for example to another. In this way, patterns of vegetation change with environmental factors or geographic variation can be determined.

The data set used to run the DECORANA programme was obtained by sampling 28 sites measuring 10mx10m. The sites were chosen to include at least one representative of the main vegetation associations and, for common vegetation types, a number of sites from different locations was selected over the property. Within each 10m x 10m site all native species were recorded.

3.2 Vegetation Associations

A total of 42 vegetation associations were named as a result of this survey. These are listed in Table 1. This list was subjectively divided into eight groupings based on vegetation formations (eg. Woodlands, Low Woodlands, Shrublands, and Heaths) and on the basis of soil moisture conditions, that is, dry, wet and transitional. This classification into groups was done mainly for mapping purposes.

While it is possible to describe different associations based on the dominant species of the tallest one or two strata, it is impossible to accurately map the full array of associations. The reasons for this are twofold. Firstly, closely related associations can intermix with each other making mapping a patchwork mosaic if it were possible at all. Secondly, the diversity of associations is indistinguishable on aerial photography which is the main tool used in vegetation mapping of large areas. The similarities between the vegetation associations and groups are discussed in Section 3.4 below.

3.3 Description of the Vegetation

The vegetation at the airport strongly reflects the underlying Bassendean dune soil types as well as the proximity of the water table to the ground surface. In general, well drained sand on high ground above the direct influence of the watertable supports *Banksia* Low Woodlands and *Eucalyptus* Woodlands while wetter areas support heaths, *Melaleuca* Low Woodlands and reed communities.

The vegetation map for the airport is presented in Figure 1.

Banksia Low Woodlands occur throughout the airport on well drained sands. The dominant species are *Banksia attenuata* and *B. menziesii* but *Eucalyptus todtiana* (Prickly Bark) can be co-dominant in some areas. The understorey is typically a heath less than 1m tall with common species such as *Hibbertia hypericoides, Jacksonia densiflora* and in places *Eremaea beaufortioides*. Dense stands of *Jacksonia sternbergiana* up to 3m tall are also found in the understorey. *Banksia ilicifolia* is usually common close to the transition from dry sands to seasonal wetlands.

The species richness of the *Banksia* Low Woodlands sampled at the airport averages 27 species per 100m^2 with a range of 22-39.

Eucalyptus Woodlands occurring on dry sands are not as abundant as *Banksia* Low Woodlands but are nevertheless spread throughout the site on high ground. Jarrah (*Eucalyptus marginata*) is the most common Woodland tree species. The understorey of Jarrah Woodlands is similar to that of the *Banksia* Low Woodland. Marri (*E. calophylla*) Woodlands also occur on dry sands in a limited distribution in the north eastern section near the radar facility. The understorey of Marri Woodlands differs from other Woodlands and *Banksia* Low Woodlands with *Jacksonia sternbergiana* a common shrub. The litter layer under the Marri Woodlands is also thicker than in other dryland areas.

The species richness of dry *Eucalyptus* Woodlands is similar to *Banksia* Woodlands with an average of 28 species per 100m^2.

Two shrubland associations were recorded on dry sandy sites. *Adenanthos cygnorum* (Woolly Bush) Shrublands are characteristic of disturbed sandy areas, and are particularly common on the western side of the property. *Jacksonia sternbergiana* Shrublands occur as a small stand in the north-east, surrounding a Marri Woodland. This association may indicate a previous Marri Woodland area where the trees have been removed.

At lower elevations which are not wetlands, the vegetation changes from the dry sand types to associations which reflect a higher watertable. Marri Woodlands are common in these transitional areas, usually with a very low understorey of species such as *Dasypogon bromeliifolius* and *Conostylis aculeata*. *Eucalyptus rudis* Woodlands are common in the south-west of the site alongside linear wetlands or drainage lines. Small areas of Shrublands also occur infrequently on transitional soil type on the property.

In areas where the watertable is close to the surface in winter but rarely occurs above the surface, the vegetation varies from *Melaleuca* Low Open Woodlands over Heath to pure Heath stands. *Melaleuca preissiana* (Moonah Paperbark) Low Open Woodlands are

common throughout the airport and usually occur over a dense heath understorey typically of *Pericalymma ellipticum* but also of *Regelia ciliata* and other shrub heath species.

The species richness of *Melaleuca* Low Open Woodland averages 20 species per 100m².

Seasonally damp heaths as a unit, are also common throughout the airport and the variety of heath associations is quite large. The most common is *Pericalymma ellipticum* Closed Heath which occurs most on the western half of the airport. *Astartea fascicularis, Melaleuca lateritia* and *Hypocalymma angustifolium* occur in this association in seasonally waterlogged areas. *Hakea varia* is also commonly associated with *Pericalymma* Heaths and occasionally occurs as a co-dominant or as its own association.

Melaleuca teretifolia Closed Heath associations have a limited distribution in the central western area along a chain of linear wetlands. One area of *M. teretifolia* has *Baumea articulata* in the understorey. Sedges and rushes are not common as a rule in most of the seasonally waterlogged areas.

Melaleuca viminea Open Heaths occur on soils containing a higher clay content. *Regelia ciliata* Open Heaths also seem to occur on clay depressions with a fragmented distribution of small sites in the central north and central south areas. *Banksia telmatiaea,* a low rounded shrub up to 0.5m tall, is another species indicative of clay depressions.

The species richness of heath associations is relatively low with an average of 10 species per 100m².

The areas at the airport which experience the highest water levels support *Melaleuca rhaphiophylla* Low Open Woodlands to Low Woodlands. In places the *M. rhaphiophylla* trees form a dense canopy while in other areas the canopy is sparse. The largest example of the *Melaleuca rhaphiophylla* Low Woodland associations is at Munday Swamp where the paperbark trees are up to 10m tall and form such a dense canopy that few other shrubs occur on the fringes of the swamp. Only *Melaleuca lateritia* occurs frequently in the understorey and only in areas subject to inundation.

Banksia littoralis Low Woodlands to Low Closed Forests occur in the western part of the airport in winter-wet depressions or alongside drainage lines.

The species richness of seasonally inundated Low Woodlands averages 11 species per 100m².

A small stand of *Typha domingensis* Sedgeland occurs within Runway Swamp, an area of open water created in 1975 by the excavation of peat.

Stands of *Baumea juncea* and *Bolboschoenus caldwellii* sedges occur around the margin of some seasonal damp areas but are barely large enough to warrant naming as an association.

3.4 Computer Analysis of the Vegetation

A total of 28 sites was sampled for the computer analysis. The majority of sites were sampled from dry *Banksia* Low Woodlands (9 sites) and seasonally damp heaths (8 sites). This concentration of sites was due to the large variety of associations in these two groupings and the objective of examining any spatial variation. Other vegetation groups sampled included wet Low Woodlands (4 sites), seasonally damp Low Woodlands (3 sites), dry *Eucalyptus* Woodlands (2 sites), dry Shrublands (1 site) and transitional Shrublands (1 site).

Within these 28 sites, 127 species were recorded representing 56.2% of the total species list for the area. The most commonly recorded species were *Patersonia occidentalis* (16 sites) and *Dasypogon bromeliifolius* (15 sites). This indicates the abundance of these species and their tolerance to a variety of environmental factors. On the other hand 63 species (50%) were recorded in only one or two sites indicating either a general scarcity on the site or a preference for a restricted habitat type.

The DECORANA analysis of the 28 sites is shown in Figure 2. In this diagram, sites which are most similar according to their floristic composition are located close together while dissimilar sites are further apart. A general description of each site is given in Table 2.

The DECORANA diagram reveals a concentration of 10 sites on the lower left side. The remaining 18 sites are more spread out along axis 1 and axis 2. The conglomerate of 10 sites includes all 9 sites sampled from dry *Banksia* Low Woodlands plus one dry *Eucalyptus* Woodland. Three sites on dry soil were floristically quite different from the others. These sites included two Shrubland associations and a Marri Woodland on dry sandy soil.

The remainder of sites occur on seasonally waterlogged or inundated soils. Of these the three *Melaleuca preissiana* sites occur closest to the dry sites, indicating that sites with *M. preissiana* may have deeper water tables than the other sites distributed further to the right of the diagram.

Interestingly, the eight heath sites are spread widely on the diagram indicating that these sites are floristically dissimilar as a group. Only the three *Pericalymma ellipticum* Closed Heath sites have some degree of similarity. The difference in heath sites may reflect different soil types, eg. sand and clay, or some subtle difference in hydrology.

3.5 Vegetation Condition

The condition of the native vegetation was assessed using the following terminology which places an emphasis on the degree of disturbance and extent of weed invasion.

U Undisturbed - No obvious signs of damage caused by the activities of man.

SD Slightly Disturbed - Some slight signs of damage cased by the activities of man, eg. presence of non-aggressive weeds, vehicle tracks.

D Disturbed - Signs of damage caused by the activities of man including some impact on the vegetation structure such as caused by grazing, fire, and logging. Mainly non-aggressive weeds possibly with some more aggressive ones.

OD Obvious Disturbance - Obvious impacts of man such as grazing, partial clearing, and frequent fires. Vegetation structure slightly altered but able to regenerate. More aggressive weeds such as Veldtgrass probably present.

SeD Severely Disturbed - Severely impacted by grazing, fire or clearing with little scope of regeneration to normal structure. Usually with a number of weed species including aggressive species.

Deg Degraded - Areas that are completely or almost completely without native species in the structure of the vegetation. Includes areas that are parkland cleared with their flora comprising weed or crop species with isolated native trees or shrubs.

The condition of the vegetation at the airport ranges from Slightly Disturbed to Degraded. No areas could justifiably be considered as undisturbed due to the presence of weeds and the large number of tracks throughout the area.

A significant proportion of the area is Severely Disturbed as a result of clearing for a wide range of activities including grazing, sand excavation, and the requirements of airport operations. Nevertheless, there still remains a large amount of remnant vegetation which is only Slightly Disturbed. The least disturbed areas are located both inside and outside of the public exclusion (airside) fence as are the degraded areas. This suggests that public access is not the main determinant of vegetation quality at the airport.

Low lying areas subject to seasonal inundation or waterlogging have been disturbed or degraded either by large scale clearing and pasture growth, or trampling and grazing by cattle and horses. Apart from the effects of grazing, seasonally damp and wet heaths and woodlands are largely intact, due mainly to the limited uses of such areas for most activities. The closed canopy of most heaths in wetlands also tends to limit weed invasion.

In contrast, the condition of dryland vegetation types has been affected as a result of the variety of uses suitable in dry areas. The openness of *Banksia* and *Eucalyptus* Woodland canopies also renders these areas susceptible to weed invasion.

4. VEGETATION DESCRIPTION

Banksia Woodland (Dry)

Banksia Low Woodlands occur on dry sands throughout the airport. They are dominated by *Banksia attenuata* and *B. menziesii* up to 6m to 10m high with *Allocasuarina fraseriana* and *Eucalyptus todtiana* occasionally co-dominant.

The understorey contains a variety of dominant shrub species including *Jacksonia densiflora* and *Hibbertia hypericoides* as well as *Xanthorrhoea preissii, Eremaea pauciflora, Acacia pulchella* and *Calythrix fraseri*. There is no apparent explanation for the variation in understorey dominants. *Adenanthos cygnorum* is more common in the understorey in areas that have been disturbed.

Eucalyptus marginata (Jarrah) Woodland

Eucalyptus marginata Woodlands occur on dry sandy soils and are in continuum with the dry *Banksia* Low Woodlands. Jarrah Woodlands usually contain *Banksia attenuata* and *B. menziesii* in the sub-canopy. *Allocasuarina fraseriana* is more common in the Jarrah Woodlands than in the *Banksia* Low Woodlands. The understorey composition is very similar to the *Banksia* Low Woodlands with *Jacksonia densiflora* and *Hibbertia hypericoides* dominant.

Eucalyptus calophylla (Marri) Woodland (Dry)

Woodlands dominated by *Eucalyptus calophylla* occur on dry sands in isolated patches in the north of the site. Marri Woodlands are less common than the Jarrah Woodlands.

In the understorey, *Jacksonia sternbergiana* is dominant up to 5m tall with an open low shrub layer of *Hibbertia hypericoides* and other species. The litter layer under *Eucalyptus calophylla* Woodlands is much thicker than under other woodlands.

Adenanthos cygnorum Shrubland

Adenanthos cygnorum (Woolly Bush) Shrublands occur on sandy soils and represent regrowth of areas which have been totally cleared of *Banksia* or *Eucalyptus* trees. They are most common in the southern half of the site.

Due to the disturbed nature of these areas they also usually contain a proliferation of introduced grass species such as *Ehrhata* spp (Veldtgrass) and *Avena fatua* (Wild Oats). Native shrubs typical of *Banksia* Low Woodlands also exist in these modified areas.

Jacksonia sternbergiana Shrubland to Closed Scrub

A small area dominated by *Jacksonia sternbergiana* occurs in the north of the airport. In one part the *J. sternbergiana* shrubs are dense and up to 2m to 3m tall forming a Closed Scrub over a low cover of *Hibbertia hypericoides* shrubs. This particular vegetation type occurs next to a *Eucalyptus calophylla* (Marri) Woodland which has *J. sternbergiana* in the understorey and may actually represent an area previously cleared of Marri trees.

Another area nearby contains *J. sternbergiana* shrubs 1.5m to 2m tall and less dense with an understorey dominated by *Regelia ciliata, Allocasuarina humilis* and the sedge *Mesomelaena tetragona.*

Eucalyptus calophylla (Marri) Woodland (Transitional)

Eucalyptus calophylla Woodlands frequently occur in the northern and eastern sections of the airport at an elevation below *Banksia* Low Woodlands but above wetland vegetation. These transitional sites between dryland and wetland soils are usually narrow and elongated around wetlands and along ephemeral watercourses.

The understorey of the transitional Marri Woodlands is quite different to that under dry Marri Woodlands and is a mixture of dryland species and wetland species. *Acacia saligna* and *Melaleuca preissiana* trees are common as a sub-canopy over a very low stratum of lilioid species such as *Dasypogon bromeliifolius* and *Conostylis aculeata.*

Eucalyptus rudis (Flooded Gum) Woodland

Eucalyptus rudis Woodlands occupy similar habitats as the *E. calophylla* transitional Woodlands but tend to favour the margins of linear drainage lines rather than around wetlands. *Acacia saligna* and *Melaleuca preissiana* are common smaller trees in the understorey.

There are very few *E. rudis* Woodlands remaining in good condition on the airport. Most areas have been used for grazing and while *E. rudis* trees may remain in these areas, the understorey consists almost exclusively of pasture species.

Banksia Low Woodland (Transitional)

Banksia Low Woodlands which occur on lower dune slopes where the water table is close to the surface in winter commonly include *Banksia ilicifolium* in the tree layer. *Melaleuca preissiana* trees may also be present near the transition to wetland vegetation.

The understorey of these transitional *Banksia* Low Woodlands is similar to dry *Banksia* Low Woodlands with *Jacksonia densiflora* and *Calythrix fraseri* common dominants. However, *Dasypogon bromeliifolius* and *Patersonia occidentalis* are more common in these areas.

Melaleuca preissiana Low Open Woodland to Low Woodland

There are large, flat, low-lying, sandy soil areas on the airport where the water table is close to the surface during winter but rarely occurs above ground. These areas are dominated by heaths with emergent *Melaleuca preissiana* (Moonah Paperbark) trees in a Low Open Woodland to Low Woodland formation. The heath understorey usually consists either of a dense 1.2m to 1.3m tall cover of *Pericalymma ellipticum* or a lower 0.4m to 0.5m tall cover of *Hypocalymma angustifolium.* Other common shrub species include *Dasypogon bromeliifolius, Patersonia occidentalis, Verticordia densiflora* and *Stylidium* sp.aff. *repens.*

The main distribution of *Melaleuca preissiana* Low Open Woodlands is in the south-east corner and west of the main runway.

Jacksonia furcellata Open Shrubland

An area of sandy soil to the south-east of the main runway contains *Jacksonia furcellata* shrubs 1.5m to 2m tall and with less than 10% cover over a low 0.5m tall understorey with *Hypocalymma angustifolium* and *Patersonia occidentalis* common. The presence of these sub-shrubs indicates that the watertable is close to the surface in winter. Occasional Jarrah trees emerge above the *Jacksonia* shrubs.

This site has a very light coloured sandy soil and is probably never inundated or waterlogged near the surface.

Leptospermum laevigatum High Shrubland

One small area of dry sand to the south-east of the runway has been degraded in the past and since regenerated with *Leptospermum laevigatum*, shrubs up to 4m tall. *Leptospermum laevigatum* is an introduced species from eastern Australia that rapidly colonises disturbed sandy sites.

Acacia saligna Shrubland to Open Scrub

A stand of *Acacia saligna* Open Scrub up to 3m tall occurs to the north on sandy soils prone to waterlogging. The understorey consists of a variety of wetland heath species including *Astartea fascicularis, Hakea varia* and in places *Regelia ciliata.*

This area of *Acacia saligna* includes significant occurences of couch grass (*Cynodon dactylon*) which suggests that the area has been previously disturbed, perhaps even by chaining.

In the south-eastern section *Acacia saligna* is dominant in small patches, again on waterlogged soils. These stands of *A. saligna* appear more natural in association with other transitional vegetation types such as *Eucalyptus rudis* and *E. calophylla* Woodlands.

Kunzea ericifolia High Open Shrubland

Kunzea ericifolia shrubs up to 3m to 4m and with less than 10% cover dominate a small stand on the western portion of the airport. This stand is subject to waterlogging and contains a low shrub layer of *Hypocalymma angustifolium, Patersonia occidentalis* and *Dasypogon bromeliifolius.*

Pericalymma ellipticum Closed Heath

Dense heaths dominated by *Pericalymma ellipticum* are a common feature of low-lying sandy areas on the airport property where the water table is close to the surface in winter. The *P. ellipticum* shrubs are typically 1.0m to 1.3m tall and dense (>70% cover). Other co-dominant shrub species include *Hakea varia* and *Astartea fascicularis* with *Acacia pulchella* occasionally dominant.

Due to the density of shrub cover there is very little cover of species under the main canopy. *Stylidium* sp.aff. *repens* and the sedge *Restio stenostachyus* can occur where gaps in the shrub layer allow sub-shrubs to become established.

Hakea varia Heath to Closed Heath is a variation of the *P. ellipticum* unit, occurring in similar habitats but with a slightly different dominant species composition.

Astartea fascicularis Closed Heath is also a variant which occurs in very small stands in the south of the airport.

Melaleuca teretifolia Closed Heath to Closed Scrub

Small pockets of wetland in the south of the airport are dominated by *Melaleuca teretifolia* shrubs up to 4m tall. In one area the understorey consists of an open understorey of *Baumea articulata* with *Restio stenostachyus* also common. The occurrence of *Baumea articulata* suggests that this stand is frequently inundated in winter. The creeper *Cassytha racemosa* is also present in *M. teretifolia* stands.

In other areas *Melaleuca teretifolia* occurs as a Low Closed Heath with *Hakea varia* on waterlogged soils.

Melaleuca viminea Open Heath

Several seasonally damp areas have a clay soil either at the surface or very close. These areas contain Open Heaths usually with *Melaleuca viminea* shrubs dominant from 1.5m to 3m tall. Common species in this unit include *Thysanotus triandrus, Verticordia densiflora* and *Restio stenostachyus*.

Two small stands of *M. viminea* Open Heath occur or orangey clay soil in the south-east and north of the site. These areas contain *Banksia telmatiaea*, a low 0.5m spreading *Banksia* species found in winter-wet depressions on the eastern side of the Swan Coastal Plain.

Regelia ciliata Low Open Heath

A small stand of *Regelia ciliata* Low Open Heath occurs in the north on grey sandy soils prone to waterlogging. The *R. ciliata* shrubs are up to 0.5m tall and have around 50% cover.

Other species present in this unit include *Dryandra nivea, Hakea varia, Daviesia hakeoides* and *Hypocalymma angustifolium*.

Banksia littoralis Low Woodland to Low Closed Forest

Banksia littoralis communities occupy shallow drainage lines and wetlands with peaty sands that are frequently inundated. This unit is only found in the southern half of the airport.

The *B. littoralis* trees, up to 6m tall, vary in density from an open canopy Low Woodland to a more closed canopy Low Closed Forest. As a result, the understorey is variable with

shrubs such as *Hakea varia* and *Melaleuca teretifolia* common in open areas and a sparse cover under closed canopies. Species indicating wet conditions are common including *Lepidosperma longitudinale, Calothamnus lateralis* and *Melaleuca lateritia*.

Melaleuca rhaphiophylla Low Open Woodland to Low Closed Forest

Melaleuca rhaphiophylla occurs as a Low Open Woodland 2m to 4m tall over heath in some areas which are only occasionally inundated. In wetter areas, *M. rhaphiophylla* forms a Low Closed Forest up to 10m tall and greater than 70% cover. In these areas the understorey is scarce but contains species that tolerate inundation such as *Lepidosperma longitudinale* and *Melaleuca lateritia*. *Restio stenostachyus* is also frequently found in these areas.

Munday Swamp is the largest example of a *M. rhaphiophylla* Low Closed Forest on the airport. Here it occurs fringing and within the swamp where trees are standing in water for several months each year.

Typha domingensis Sedgeland

Runway Swamp was excavated in 1975 for extraction of peat to a depth of 2.5m. The margins of the swamp have naturally revegetated with *Typha domingensis* colonising areas of open water. Aquatic plants have also proliferated in the swamp including *Potamogeton* and *Myriophyllum* species.

5. CONSERVATION SIGNIFICANCE

The System 6 Report published by the Environmental Protection Authority (EPA) (Department of Conservation & Environment, 1983) is the principal planning guide for conservation areas in the Perth Metropolitan Area. Perth Airport is affected by recommendations contained in the System 6 Report. Specifically System 6 Area M52 includes all land at Perth Airport owned by the Commonwealth of Australia. The recommendation for M52 in the System 6 Report is that the Commonwealth of Australia should retain as much uncleared land as possible. Management considerations considered important for the M52 area include: "*the retention, where possible, of uncleared vegetation; and encouraging, where possible, the growth and regeneration of local indigenous flora*".

In 1992 the Australian Heritage Commission placed parts of the bushland on Perth Airport in the interim list of the Register of the National Estate. Four areas were identified by the AHC as having significance on the basis that they included:

- Vegetation of the Southern River Complex. This vegetation complex has been cleared or is heavily degraded over much of its original area on the Swan Coastal Plain.

- Munday Swamp which is regarded as an important and unusual wetland type because of its significance to the Aboriginal people, vegetation, value to waterbirds, and diverse invertebrate fauna, and because it contains the only significant population of Galaxid fish remaining in the Perth Metropolitan Area.

- Areas of bushland which are considered to support a rich vertebrate fauna, particularly reptiles, and which contain populations of the endangered Southern Brown Bandicoot.

The Perth Airport also has significance for the protection of the three species listed on the CALM Priority Flora List - *Daviesii physodes, Cartonema phylidroides* and *Restio stenostachyus*. Other species not on the list but uncommon on the Swan Coastal Plain such as *Jacksonia lehmannii* and *Lechenaultia expansa* also add signifiance to the area.

The total flora of the airport also has value given the relatively small area of Bassendean Dune flora protected in reserves in the Perth Metropolitan Region. While most of the species are not considered threatened at present they may become so with increasing development in this region.

Most of the vegetation types present are typical of the vegetation of Bassendean dunes. However, the airport land has significance for a number of vegetation associations that are uncommon. Of particular importance is the *Melaleuca rhaphiophylla* Woodland located in and around Munday Swamp. This is purported to be one of only two locations for this association in the Perth region (Australian Heritage Commission, 1992). *Melaleuca rhaphiophylla* is normally associated with riverbanks and drainage lines rather than with lakes as at Munday Swamp.

Other vegetation associations with restricted distribution or which are poorly represented include the small patches of Heath dominated by *Regelia ciliata* and *Melaleuca viminea*,

Eucalyptus rudis Woodlands and *Banksia littoralis* Low Woodlands along drainage lines, and shrublands on dry sites dominated by *Jacksonia sternbergiana* and *Jacksonia furcellata.*

The significance of the vegetation of the airport as a whole can be assessed according to the conservation of similar vegetation within reserves. The vegetation of the airport belongs predominantly to the Southern River Vegetation Complex. According to Burbidge and Rolfe (cited in Australian Heritage Commission, 1992) only 8.6% of the original 58,343ha of the Southern River complex remains uncleared. Furthermore, of the three main System 6 areas which include this complex (Whiteman Park, Perth Airport and Jandakot Airport) only Whiteman Park could be considered to be securely protected. A reserve with both dryland and wetland vegetation types exists at Anstey Road, Forrestdale and the north eastern portion of the proposed Jandakot Botanical Park will also include areas of Southern River complex vegetation.

The airport land also includes vegetation from the Bassendean Complex-Central and South and the Guildford Complex.

The area has value therefore as it supports examples of three different vegetation complexes and the transitional zones between each complex. While the computer analysis did not identify any significant differences between the *Banksia* woodland of the three vegetation complexes, other studies have identified a change in the understorey species between complexes.

The area also has research and education potential as a result of the attributes listed above. For example aspects of the ecology of plants on the Swan Coastal Plain which require further study, and could be applied at the airport include:

- The study of understorey variation within *Banksia* Woodland on dry sites.
- Floristic variation in damp heath vegetation and relation to edaphic (soil) factors.
- The relationship between vegetation types and changes in groundwater.

The vegetation of the area also has significance as wildlife habitat (Alan Tingay & Associates, 1994).

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TABLES

TABLE 2

SITE INFORMATION FOR THE DCA ORDINATION ANALYSIS AT PERTH AIRPORT

SITE	VEGETATION ASSOCIATION	VEGETATION GROUPING	SOIL TYPE	NATIVE SPECIES RICHNESS x/100m²
A1	*Banksia attenuata/B.menziesii/Allocasuarina fraseriana* Low Woodland	Banksia Low Woodland	Dry	39
A7	*Eucalyptus todtiana/Banksia menziesii* Low Woodland	Banksia Low Woodland	Dry	30
A9	*Melaleuca viminea* Open Heath	Heath	Damp	15
C1	*Banksia littoralis* Low Open Woodland	Low Woodland	Wet	15
C2	*Banksia menziesii* Low Open Woodland	Banksia Low Woodland	Dry	22
C4	*Melaleuca preissiana* Low Open Woodland	Melaleuca Low Woodland	Damp	20
C6	*Banksia attenuata/B. menziesii* Low Woodland	Banksia Low Woodland	Dry	23
D1	*Banksia menziesii/B. attenuata* Low Open Woodland	Banksia Low Woodland	Dry	24
D3	*Pericalymma ellipticum* Closed Heath	Heath	Damp	11
D4	*Melaleuca preissiana* Low Open Woodland	Melaleuca Low Woodland	Damp	21
D5	*Banksia menziesii/B. attenuata* Low Woodland	Banksia Low Woodland	Dry	25
E1	*Melaleuca viminea* Open Scrub	Heath	Damp	7
E2	*Pericalymma ellipticum* Closed Heath	Heath	Damp	18
H1	*Eucalyptus marginata/Allocasuarina fraseriana* Woodland	Eucalyptus Woodland	Dry	32
H2	*Banksia menziesii/B. attenuata* Low Woodland	Banksia Low Woodland	Dry	26
N1	*Eucalyptus calophylla* Woodland	Eucalyptus Woodland	Dry	23
N2	*Melaleuca rhaphiophylla* Low Open Woodland	Low Woodland	Wet	10
N3	*Melaleuca viminea* Open Heath	Heath	Damp	8
N4	*Regelia ciliata* Open Heath	Heath	Damp	9
N5	*Melaleuca rhaphiophylla* Low Open Woodland	Low Woodland	Wet	12
N6	*Jacksonia sternbergiana* Open Heath	Shrubland	Dry	10
I1	*Melaleuca teretifolia* Open Scrub	Heath	Damp	7
I2	*Jacksonia furcellata* Open Scrub	Shrubland	Transitional	15
I3	*Banksia littoralis* Low Woodland	Low Woodland	Wet	8
I4	*Melaleuca preissiana* Low Open Woodland	Melaleuca Low Woodland	Damp	20
W1	*Banksia attenuata/B. ilicifolium/Melaleuca preissiana/B. menziesii* Low Woodland	Banksia Low Woodland	Dry	22
W2	*Banksia attenuata/B. menziesii* Low Woodland	Low Woodland	Dry	30
W3	*Pericalymma ellipticum* Closed Heath	Heath	Damp	6

FIGURES

metres
0
500

GREAT EASTERN HIGHWAY BYPASS

TONKIN HIGHWAY

Ba
Ba
BaBm
MpPe
Mp
EmEtBaAf
BaBm
Ec
EmEcAf
Ba
Em
EmBmAf
Ec
ErMr
MrAs
Ec2
Js
Ec
AsRc
Ec
Ec
Ec
Ec
Ec
Ec
Js
Rc
Mr
Rc
Ec
Pe
Mr
BaBmAf
MpRc
BaBmAf
Ec
Er
Pe
Mp
BaBmEtAf
ErBl
Ec
Ec
Ec
BaBmEtAf
Ec
BaAf
BaAf
Ec
MpPe
Ba
Ba
Ec
Mr
EmBa
EmBa
Ba
Ba
Ec
Mr
Pe
EmBa
EmBa
Ec
Ec
Em
Mr
EmBaAf
EmBa
EcMr
Er
Em
BmBaEt
EmAf
EmAf
BmAf
Ke
Mp
Mp
Mp
Mp
Mp
Mp
Ec
Pe
BaAf
Pe
BaAf
Em
Mr
Pe

KEY TO VEGETATION FORMATIONS

- Dry Eucalypt Woodlands
- Dry Banksia Low Woodlands
- Dry Shrublands
- Seasonally Damp Melaleuca Low Woodlands
- Transitional Eucalypt Woodlands
- Wet Low Woodlands
- Transitional Shrublands
- Seasonally Damp Heaths
- Wet Sedgelands
- Open Water
- Cleared/Severely Degraded

BaBm — Refer to Table 1 for details of vegetation associations

VEGETATION MAP
PERTH AIRPORT NORTH
FIGURE 1A

ALAN TINGAY & ASSOCIATES

SITES VEGETATION TYPES

A1 *Banksia attenuata/B. menziesii/Allocasuarina fraseriana* Low Woodland

A7 *Eucalyptus todtiana/Banksia menziesii* Low Woodland

A9 *Melaleuca viminea* Open Heath

C1 *Banksia littoralis* Low Open Woodland

C2 *Banksia menziesii* Low Open Woodland

C4 *Melaleuca preissiana* Low Open Woodland

C6 *Banksia attenuata/B. menziesii* Low Woodland

D1 *Banksia menziesii/B. attenuata* Low Open Woodland

D3 *Pericalymma ellipticum* Closed Heath

D4 *Melaleuca preissiana* Low Open Woodland

D5 *Banksia menziesii/B. attenuata* Low Woodland

E1 *Melaleuca viminea* Open Scrub

E2 *Pericalymma ellipticum* Closed Heath

H1 *Eucalyptus marginata/Allocasuarina fraseriana* Woodland

H2 *Banksia menziesii/B. attenuata* Low Woodland

N1 *Eucalyptus calophylla* Woodland

N2 *Melaleuca rhaphiphylla* Low Open Woodland

N3 *Melaleuca viminea* Open Heath

N4 *Regelia ciliata* Open Heath

N5 *Melaleuca rhaphiophylla* Low Open Woodland

N6 *Jacksonia sternbergiana* Open Heath

I1 *Melaleuca teretifolia* Open Scrub

I2 *Jacksonia furcellata* Shrubland

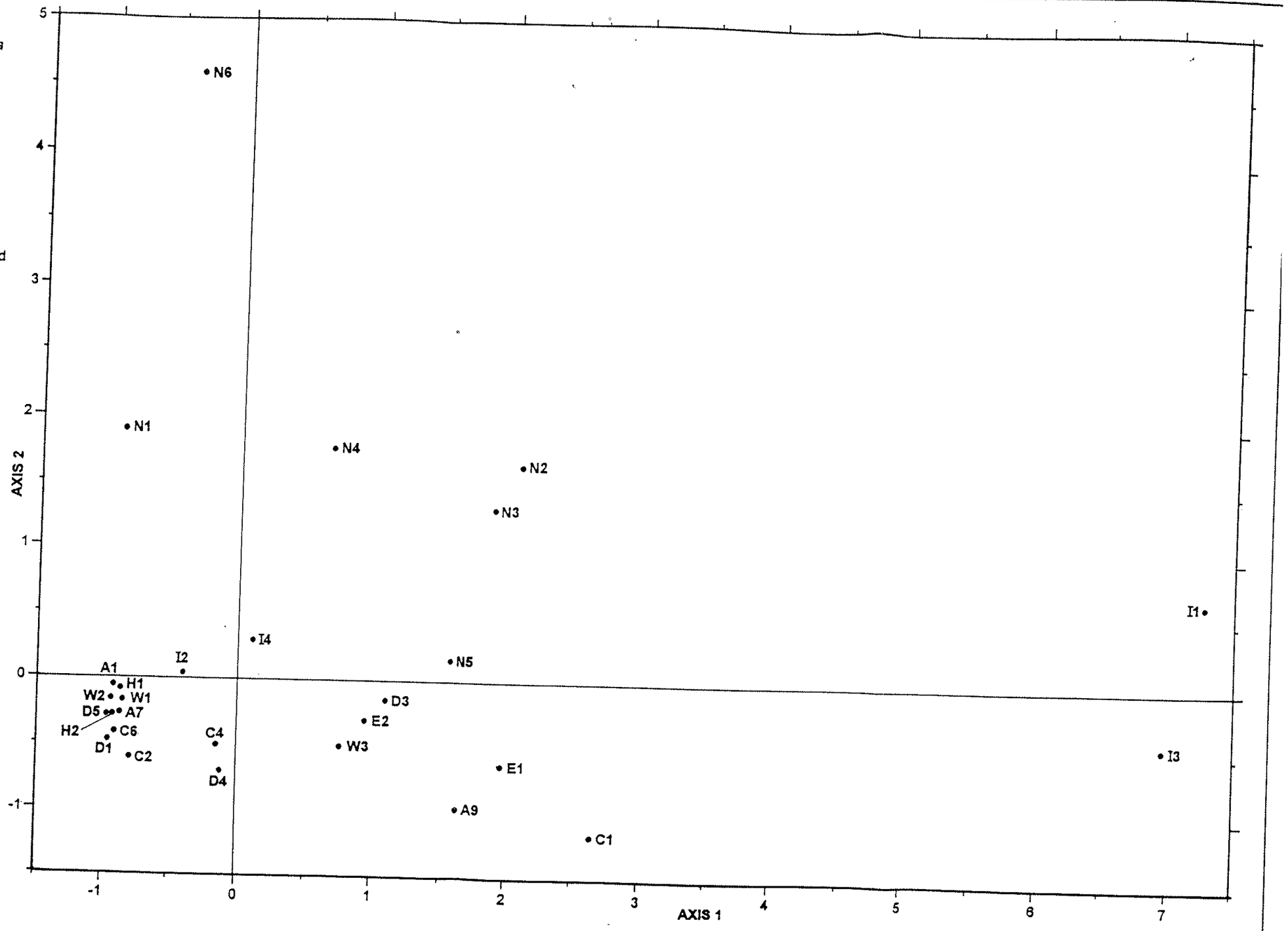
I3 *Banksia littoralis* Low Woodland

I4 *Melaleuca preissiana* Low Open Woodland

W1 *Banksia attenuata/B. ilicifolium/Melaleuca preissiana/B. menziesii* Low Woodland

W2 *Banksia attenuata/B. menziesii* Low Woodland

W3 *Pericalymma ellipticum* Closed Heath



DECORANA ORDINATION OF SAMPLE SITES ACCORDING TO VEGETATION
FIGURE 2

ALAN TINGAY & ASSOCIATES

GREAT EASTERN HIGHWAY BYPASS

metres
0 500

TONKIN HIGHWAY

Ba
Ba
ErMr
MrAs
MpPe
N5
Mp
A9
A1
H1
EmBmAf
H2
Ec
BaBm
N1
Ec
A7
Ba
EmEcAf
EmEtBaAf
Ec2
Js
Ec
N6
AsRc
Ec
Ec
N2
Mr
N3
Ec
As
Ec
Ec
Rc
Pe
Mr
Ec
Ec
Js
Rc
BaBmAf
N4
MpRc
BaBmAf
Ec
Er
Pe
Em
Mp
BaBmEtAf
ErBl
Ec
Ec
BaBmEtAf
Ec
BaAf
BaAf
Ec
MpPe
Ba
Ba
Ec
Mr
EmBa
EmBa
Ba
Ec
Mr
Pe
EmBa
EmBa
Ec
Em
BmBaEt
EmAf
EmAf
BmAf
Ke
Mp
I4
Mp
Mp
Mp
Mp
Mp
Ec
Pe
BaAf
Pe
BaAf
Em
Mr
Pe
Ec
Mr
Em
EmBaAf
EmBa
EcMr
Er

KEY TO VEGETATION QUALITY

- Slightly Disturbed
- Disturbed
- Obvious Disturbance
- Severely Disturbed
- Degraded
- • A1 Vegetation Sample Sites
- Open Water
- BaBm Refer to Table 1 for details of vegetation associations

VEGETATION QUALITY MAP
PERTH AIRPORT NORTH
FIGURE 3A

ALAN TINGAY & ASSOCIATES

APPENDIX

PERTH AIRPORT NATIVE FLORA

1 = Alan Tingay & Associates 1992-1993
2 = Dixon, 1983

FERNS

ADIANTACEAE

1 Cheilanthes austrotenuifolia

GYMNOSPERMS

ZAMIACEAE

1,2 Macrozamia riedlei

MONOCOTYLEDONS

POTAMOGETONACEAE

1,2 Potamogeton sp
2 Potamogeton drummondii

JUNCAGINACEAE

1 Triglochin procera
1 Triglochin striata

POACEAE

1 Amphipogon turbinatus
1 Danthonia caespitosa
1,2 Neurachne alopecuroidea
1 Stipa semibarbata

CYPERACEAE

1,2 Baumea articulata
2 Baumea juncea
1 Bolboschoenus caldwellii
2 Cyperus difformis
2 Gahnia trifida
1 Isolepis cernua
1 Isolepis sp
1 Lepidosperm angustatum
2 Lepidosperma gladiatum
1 Lepidosperma leptostachyum
1 Lepidosperma longitudinale
1 Lepidosperma tenue
1 Mesomelaena pseudostygia
1 Mesomelaena graciliceps
1,2 Mesomelaena tetragona
1 Schoenus benthamii
1,2 Schoenus curvifolius
1 Schoenus grandiflorus
1 Tetraria octandra

RESTIONACEAE

1,2 Alexgeorgea arenicola
1 Hypolaena exsulca
1,2 Leptocarpus aristatus
1 Loxocarya fasciculata
1,2 Loxocarya flexuosa
1 Loxocarya pubescens
1,2 Lyginia barbata
1 Restio sinuosus
1 Restio stenostachyus

CENTROLEPIDACEAE

1 Centrolepis sp

COMMELINACEAE

1 Cartonema philydroides

JUNCACEAE

1 Juncus pallidus
2 Juncus holoschoenus

DASYPOGONACEAE

1 Calectasia cyanea
1,2 Dasypogon bromeliifolius
1 Lomandra preissii
2 Lomandra collina

XANTHORRHOEACEAE

1 Xanthorrhoea brunonis
1,2 Xanthorrhoea preissii

PHORMIACEAE

1 Dianella divaricata

ANTHERICACEAE

1,2 Arnocrinum preissii
1,2 Corynotheca micrantha
1,2 Johnsonia pubescens
1,2 Laxmannia ramosa
1 Laxmannia squarrosa
1 Sowerbaea laxiflora
1,2 Thysanotus patersonii
2 Thysanotus multiflorus
1 Thysanotus thyrsoideus
1 Thysanotus triandrus
1,2 Tricoryne elatior

COLCHICACEAE

1,2 Burchardia umbellata

HAEMODORACEAE

1 Anigozanthos humilis
1 Anigozanthos manglesii
1 Anigozanthos humilis x manglesii
1,2 Anigozanthos viridis
1 Conostylis aculeata
1 Conostylis juncea
1 Conostylis setigera
1 Haemodorum laxum
1,2 Haemodorum paniculatum
1,2 Haemodorum spicatum
1,2 Phlebocarya ciliata
1 Tribonanthes unifolia

TYPHACEAE

2 Typha domingensis

IRIDACEAE

1,2 Patersonia occidentalis

ORCHIDACEAE

1 Burnettia nigricans
1 Caladenia longicauda
1 Caladenia flava
1 Caladenia arenicola
1 Caladenia longifolia
1 Caladenia fimbriata
1,2 Microtis media
1 Prasophyllum ovale
1 Prasophyllum drumondii
1 Pterostylis recurva
1 Pterostylis vittata

DICOTYLEDONS

CASUARINACEAE

1,2 Allocasuarina fraseriana
1 Allocasuarina humilis

PROTEACEAE

1,2 Adenanthos cygnorum
1,2 Banksia attenuata
1 Banksia grandis
1 Banksia ilicifolium
1,2 Banksia littoralis
1,2 Banksia menziesii
1 Banksia telmatiaea
1 Conospermum stoechadis
1,2 Dryandra nivea
1,2 Hakea lissocarpha
1 Hakea prostrata
1,2 Hakea varia
1,2 Persoonia saccata
1,2 Petrophile linearis
1,2 Stirlingia latifolia
1 Synaphaea petiolaris
1,2 Synaphaea spinulosa

SANTALACEAE

1 Exocarpos sparteus
1 Leptomeria empetriformis

LORANTHACEAE

1,2 Nuytsia floribunda

MOLLUGINACEAE

1 Macarthuria australis

LAURACEAE

1 Cassytha flava
1,2 Cassytha racemosa

DROSERACEAE

1 Drosera erythrorhiza
1 Drosera gigantea
1 Drosera glanduligera
1 Drosera menziesii
1 Drosera sp

CRASSULACEAE

2 Crassula colorata

PITTOSPORACEAE

1,2 Pronaya fraseri

MIMOSACEAE

1,2 Acacia huegelii
1,2 Acacia pulchella
1,2 Acacia saligna
1 Acacia sessilis
1,2 Acacia stenoptera

PAPILIONACEAE

1,2 Aotus gracilima
1,2 Bossiaea eriocarpa
1 Bossiaea ornata
1 Daviesia divaricata
1,2 Daviesia hakeoides
1 Daviesia physodes
1,2 Daviesia incrassata
1 Daviesia triflora
1,2 Euchilopsis linearis
1,2 Gompholobium tomentosum
1 Hardenbergia comptoniana
1 Hovea trisperma
1 Isotropis cuneifolius
1,2 Jacksonia densiflora
1,2 Jacksonia furcellata
1 Jacksonia lehmannii
1 Jacksonia sternbergiana
1 Jacksonia prostrata
1 Nemcia capitata
1 Sphaerolobium sp
1,2 Viminaria juncea

RUTACEAE

1 Boronia ramosa
1,2 Eriostemon spicatus

TREMANDRACEAE

1 Platytheca galioides

POLYGALACEAE

1 Comesperma confertum

EUPHORBIACEAE

1 Monotaxis grandiflora

STACKHOUSIACEAE

1 Stackhousia pubescens
1 Tripterococcus brunonsis

DILLENIACEAE

1 Hibbertia huegelii
1,2 Hibbertia hypericoides
1,2 Hibbertia racemosa
1 Hibbertia stellaris

VIOLACEAE

1 Hybanthus calycinus

THYMELEACEAE

1 Pimelea angustifolia
1 Pimelea sulphurea

MYRTACEAE

1,2 Astartea fascicularis
1 Baeckea camphorosmae
1 Beaufortia squarrosa
1,2 Calothamnus lateralis
1 Calythrix angulata
1,2 Calythrix flavescens
1,2 Calythrix fraseri
1,2 Eremaea pauciflora
1,2 Eucalyptus calophylla
1,2 Eucalyptus marginata
1,2 Eucalyptus rudis
1 Eucalyptus todtiana
1,2 Hypocalymma angustifolium
1 Kunzea recurva
1 Melaleuca acerosa
1,2 Melaleuca lateritia
1,2 Melaleuca preissiana
1,2 Melaleuca rhaphiophylla
1 Melaleuca scabra
2 Melaleuca seriata
1,2 Melaleuca teretifolia
1 Melaleuca viminea
1,2 Pericalymma ellipticum
1 Regelia ciliata
1,2 Scholtzia involucrata
1,2 Verticordia densiflora
1 Verticordia nitens

1 Verticordia lindleyi

HALORAGACEAE

2 Myriophyllum crispatum

APIACEAE

1 Homalosciadium homalocarpum
1 Trachymene pilosa
1 Xanthosia huegelii

EPACRIDACEAE

1,2 Conostephium pendulum
1 Conostephium preissii
1 Leucopogon conostephioides
1 Leucopogon sprengelioides
1 Lysinema ciliatum

PRIMULACEAE

2 Samolus repens

MENYANTHACEAE

2 Villarsia albiflora
2 Villarsia violifolia

LAMIACEAE

1,2 Hemiandra pungens

LENTIBULARIACEAE

1 Polypompholyx multifida
1 Utricularia violacea

RUBIACEAE

1 Opercularia vaginata

LOBELIACEAE

2 Lobelia alata

GOODENIACEAE

1,2 Dampiera linearis
1 Lechenaultia expansa
1,2 Lechenaultia floribunda
1 Scaevola paludosa
2 Velleia trinervis

STYLIDIACEAE

1 Levenhookia pusilla
1,2 Stylidium brunonianum
2 Stylidium bulbiferum
1 Stylidium calcaratum
1,2 Stylidium dichotomum
1 Stylidium piliferum
1,2 Stylidium repens
1,2 Stylidium aff. repens
1 Stylidium schoenoides

ASTERACEAE

1 Angianthus sp
1 Brachycome ?maryonii
1 Cotula coronopifolia
2 Gnaphalium candissimum
1 Helipterum cotula
1 Lagenifera huegelii
1 Olearia sp
1 Podolepis lessonii
2 Podolepis gracilis
2 Podotheca angustifolia
1 Siloxerus humifusus

TABLE 1
PERTH AIRPORT NATIVE VEGETATION ASSOCIATIONS

Dry *Eucalyptus* Woodlands

EmBaAf	*Eucalyptus marginata* Open Woodland over *Banksia attenuata, Allocasuarina fraseriana* Low Woodland
EmBa	*Eucalyptus marginata* Woodland over *Banksia attenuata* Low Woodland
Em	*Eucalyptus marginata* Woodland
EmAf	*Eucalyptus marginata* Woodland over *Allocasuarina fraseriana* Low Woodland
EmEtBaAf	*Eucalyptus marginata* over *E. todtiana, Banksia attenuata, Allocasuarina fraseriana* Low Woodland
Ec	*Eucalyptus calophylla* Woodland

Dry *Banksia* Low Woodlands

EmEcAf	*Eucalyptus marginata, E. calophylla* Woodland over *Allocasuarina fraseriana* Low Woodland
Ba	*Banksia attenuata* Low Woodland
Ba MbEt	*Banksia attenuata, B. menziesii, Eucalyptus todtiana* Low Woodland
BaBmEtAf	*Banksia attenuata, B. menziesii, Eucalyptus todtiana, Allocasuarina fraseriana* Low Woodland
BaBm	*Banksia attenuata, B. menziesii* Low Woodland
BaBmBi	*Banksia attenuata, B. menziesii, B. ilicifolium* Low Woodland
BaBmAf	*Bankia attenuata, B. menziesii, Allocasuarina fraseriana* Low Woodland
BaBmAfEm	*Bankia attenuata, B. menziesii, Allocasuarina fraseriana, Eucalyptus marginata* Low Woodland
BmEt	*Banksia menziesii, Eucalyptus todtiana* Low Woodland

Dry Shrublands

Ac	*Adenanthos cygnorum* Shrubland
Js	*Jacksonia sternbergiana* Shrubland to Open Scrub
Ll	*Leptospermum laevigatum* Shrubland

Seasonally Damp *Melaleuca* Low Woodlands

Mp	*Melaleuca preissiana* Low Open Woodland to Low Woodland over mixed Heath
MpPe	*Melaleuca preissiana* Low Open Woodland over *Pericalymma ellipticum* Closed Heath
ErMp	*Eucalyptus rudis* Woodland over *Melaleuca preissiana* Low Woodland
EcMp	*Eucalyptus calophylla* Woodland over *Melaleuca preissiana* Low Woodland

Transitional *Eucalyptus* Woodlands

Ec2	*Eucalyptus calophylla* Open Woodland to Woodland (wet)
Er	*Eucalyptus rudis* Woodland
ErBl	*Eucalyptus rudis* Woodland over *Banksia littoralis* Low Woodland

Wet Low Woodlands

BlMp	*Banksia littoralis, Melaleuca preissiana* Low Wooldand to Low Closed Forest
Bl	*Banksia littoralis* Low Woodland to Low Closed Forest
Mr	*Melaleuca rhaphiophylla* Low Open Woodland to Low Closed Forest

Transitional Shrublands

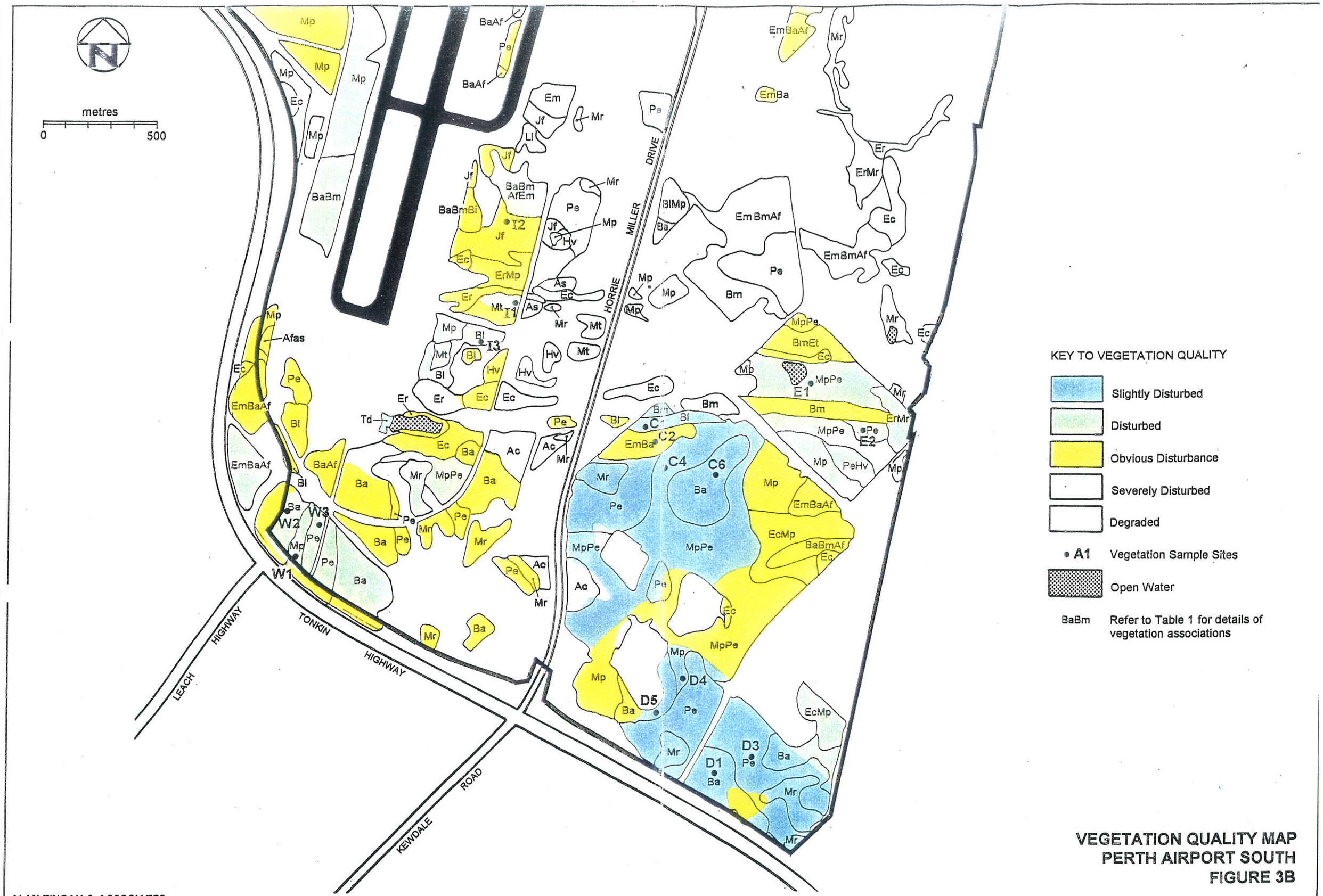
Ke	*Kunzea ericifolia* High Open Shrubland
Jf	*Jacksonia furcellata* Open Shrubland
As	*Acacia saligna* Shrubland to Open Scrub
AsRc	*Acacia saligna* Shrubland over *Regelia ciliata* Low Open Heath

Seasonally Damp Heaths

Rc	*Regelia ciliata* Low Open Heath
Pe	*Pericalymma ellipticum* Closed Heath
PeHv	*Pericalymma ellipticum, Hakea varia* Closed Heath
Hv	*Hakea varia* Heath to Closed Heath
MtHv	*Melaleuca teretifolia, Hakea varia* Closed Heath
Mt	*Melaleuca teretifolia* Closed Heath to Closed Scrub
Mv	*Melaleuca viminea* Open Heath
Afas	*Astartea fascicularis* Closed Heath

Wet Sedgelands

Td	*Typha domingensis* Sedgeland



VEGETATION QUALITY MAP
PERTH AIRPORT SOUTH
FIGURE 3B

ALAN TINGAY & ASSOCIATES

N

metres

0 500

KEY TO VEGETATION FORMATIONS

- Dry Eucalypt Woodlands
- Dry Banksia Low Woodlands
- Dry Shrublands
- Seasonally Damp Melaleuca Low Woodlands
- Transitional Eucalypt Woodlands
- Wet Low Woodlands
- Transitional Shrublands
- Seasonally Damp Heaths
- Wet Sedgelands
- Open Water
- Cleared/Severely Degraded

BaBm Refer to Table 1 for details of vegetation associations

MILLER DRIVE

HORRIE

TONKIN HIGHWAY

LEACH HIGHWAY

KEWDALE ROAD

VEGETATION MAP
PERTH AIRPORT SOUTH
FIGURE 1B

ALAN TINGAY & ASSOCIATES

CMPS&F

TONKIN - ABERNETHY AND TONKIN - ROE INTERCHANGES

SPRING RARE FLORA SURVEY

Comments to Kelli 15/12/98.

NOVEMBER 1998

DRAFT

Prepared by

ecologia

ENVIRONMENTAL CONSULTANTS

1.0 INTRODUCTION

Main Roads Western Australia is proposing to construct an on-ramp onto Tonkin Highway at Abernethy Road in Newburn. As part of the planning study for these roadworks *ecologia* Environmental Consultants conducted a spring rare flora survey of dry and wetland environments following a request by the Department of Environmental Protection. The aims of the study were to provide:

- an inventory of the rare vascular plant species in the study area;
- a review of native plant species considered to be rare and endangered;
- a review of local and regional significance of the plant communities present;
- general physical characteristics of rare plants and flowering times

This document reports the results of the spring flora survey within the proposed impact areas and supplements the winter survey report (*ecologia*, 1998).

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2.0 SURVEY METHODOLOGY

The vegetation and flora of the Tonkin Hwy - Abernethy Road project area was surveyed on the 14th -15th October 1998. The objects of the survey were to:

- determine the presence of Declared Rare or Priority flora through collection and identification of specimens (during spring);
- resurvey Quadrats 3 and 4 to determine the floristic community types present
- place an additional site in Banksia woodland NW of Quadrat 3; and
- further describe the vegetation in the project area.

Nomenclature and taxonomy are based on the Western Australian Herbarium, Hnatiuk (1990) and Green (1985),

The flora survey was confined to the Perth Airport bushland in Newburn that is to be directly or indirectly impacted during construction works. Two 10 x 10 m quadrats at Newburn were resurveyed; Quadrat 3 & 4 from the initial survey of the study area (*ecologia*, 1998). An additional quadrat (Quadrat 8) was located within an area of Banksia woodland at the north western end of the survey area. The survey methodology also included opportunistic flora collection and transects of the area. Observation of disturbance history including fire, disease, distribution of weeds, topography, surface soils and abundance of leaf litter were also recorded.

2.1 VEGETATION ASSOCIATIONS

Vegetation associations were identified according to the composition and density of overstorey and understorey species during the initial survey: Tonkin Hwy Interchanges Fauna and Flora Survey (*ecologia*, 1998). As part of this report these vegetation communities have been compared to those in the Survey of the Southern Swan Coastal Plain (Gibson *et al*, 1994) and allocated a conservation and reservation code (Tables 1 and 2). They were also compared to the ANCA National Reserves System Cooperative Program - Identifying and Conserving Threatened Ecological Communities in the South West Botanical Province (ANCA, 1997) (Table 3).

To support the basis for the vegetation mapping units in the initial report (*ecologia*, 1998) and incorporate the data from the additional quadrat (Quadrat 8) and re-surveys at Quadrats 3 and 4 into these mapping units, the statistical cluster analyses SYSTAT™ (Wilkinson, 1989) was used (Figure 2).

2.2 RARE FLORA

During subsequent visits on the 5 th and 19 th November 1998, population boundaries of DRF and Priority flora were defined in relation to the proposed construction of the Tonkin Hwy - Abernethy Road On Ramp area. Photographs, Australian Map Grid coordinates of populations and distributions in terms of anticipated construction impacts were recorded.

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2.2.1 Previously Recorded DRF and Priority Species

A search of the rare and priority flora databases of the Department of Conservation and Land Management and the Western Australian Herbarium was conducted for an area approximately 10 km by 10 km encompassing the Wattle Grove study area. Two Declared Rare/Extant and two Priority 4 taxa were recorded as detailed below:

Taxon Name	Conservation Code	Life form	No of populations in search area	Flwrg Time
Conospermum undulatum	T	shrub	1	Aug-Nov
Macarthuria keigheryi	T	rush like low shrub	1	July-Sep
Conostephium minus	4	low shub	3	Sep-Oct,Feb-Mar
Verticordia lindleyi subsp. *lindleyi*	4	shrub	1	Nov-Jan

Macarthuria keigheryi were recorded during the current survey.

2.3 CLASSIFICATION SYSTEMS

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2.3.1 Vegetation Conservation Status

Tables 1 and 2 refer to the definition of vegetation communities and their conservation status as determined in The Survey of the Swan Coastal Plain (Gibson *et al*, 1994).

Table 1: Definition of Community Reservation Status

Well Reserved	a community type is well represented if it occurs in two widely separated National Parks or Nature Reserves
Poorly Reserved	a community that is represented in only one National Park or Nature Reserve
Unreserved	a community not represented in a National Park or Nature Reserve

Table 2: Definition of Community Conservation Status

Presumed Destroyed	A community that is totally destroyed or so extensively modified that it is unlikely to re-establish ecosystem processes in the foreseeable future.
Critical	A community with most or all of its known occurrences facing severe modification or destruction in the immediate future.
Endangered	A community in danger of severe modification or destruction throughout its range, if causal factors continue operating.
Vulnerable	A community likely to move into the endangered category in the near future if the causal factors continue operating.
Susceptible	A community of concern because there is evidence that it can be modified or destroyed by human activities, or would be vulnerable to new threatening process.

Low Risk	A community that does not qualify for one of the above categories.
Insufficiently Known	A community for which there is inadequate data to assign to one of the above categories.

Table 3 defines the categories delegated to threatened vegetation communities as determined by the ANCA National Reserves System (ANCA, 1997).

TABLE 3: Definition of Status of Threat to Ecological Communities

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Presumed Destroyed	An ecological community which ha been adequately searched for but for which no representative occurrences have been located. The community has been found be totally destroyed or so extensively modified throughout its range that no occurrence of it is likely to recover its species composition and/or structure in the foreseeable future.
Critically Endangered	An ecological community which has been adequately surveyed and found to have been subject to a major contraction in area and/or was originally of limited distribution and is in danger of significant modification throughout its range or severe modification or destruction over most of its range in the near future.
Vulnerable	An ecological community which has been adequately surveyed and is found to be declining and/or has declined in distribution and/or condition and whose ultimate security has not yet been assured and/or a community which is still widespread but is believed likely to move into a category of higher threat in the near future if threatening processes continue or begin operating throughout its range.
Data Deficient	An ecological community for which there is inadequate data to assign it to one of the above categories and/ or which is not yet evaluated with respect to status of threat.
Lower Risk	A community which has been adequately surveyed and evaluated and available information suggests that it does not qualify for one of the above categories of threat.

2.3.2 Rare Flora

The following criteria have been developed by Hopper et al. (1990) for defining Declared Rare Flora:

- the taxon has been named under conventions of the International Code of Botanical Nomenclature;
- a reasonably thorough search has been made to locate wild populations and determine the number of plants present; and
- less than a few thousand reproductive mature plants are known to exist in the wild.

DRF and Priority species are determined by the Department of CALM. Priority species are those species not designated DRF but whose conservation status warrants their protection. The Priority species are maintained on a "Reserve List" and assigned to one of several priority categories (Table 4).

TABLE 4: Definition of CALM Declared Rare and Priority Flora categories. (After Atkins 1998).

CONSERVATION CODE	CATEGORY
R/T	Declared Rare Flora - Extant Taxa. Taxa which have been adequately searched for and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection.
X	Declared Rare Flora - Presumed Extinct Flora. Taxa which have not been collected, or otherwise verified, over the past 50 years despite thorough searching, or of which all known wild populations have been destroyed more recently, and have been gazetted as such.
1	Priority One - Poorly Known Taxa. Taxa which are known from one or a few (generally <5) populations which are under threat.
2	Priority Two - Poorly Known Taxa. Taxa which are known from one or a few (generally <5) populations, at least some of which are not believed to be under immediate threat.
3	Priority Three - Poorly Known Taxa. Taxa which are known from several populations, at least some of which are not believed to be under immediate threat.
4	Priority Four - Rare Taxa. Taxa which are considered to have been adequately surveyed and which whilst being rare, are not currently threatened by any identifiable factors.

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3.0 VEGETATION AND FLORA

3.1 VEGETATION

The Tonkin Hwy - Abernethy Road Interchange project area is located within the Darling Botanical District System in the Dale Sub-district. A broad scale survey of the vegetation of the region was carried out by Beard (1979) who designated the area Jarrah (*Eucalyptus marginata*) - Marri (*Corymbia calophylla*) forest.

Tingay & Associates (1997) conducted a flora and vegetation survey in June 1997 at the Perth Airport which included part of the current project area bounded by Wittenoom Road and the Tonkin Hwy. This later report described the vegetation as belonging to the Bassendean Complex (Central and South) typified by woodlands of Jarrah *Eucalyptus marginata*, *Allocasuarina fraseriana* and *Banksia* species with low *Melaleuca* woodlands and sedgelands in damper areas.

A species list of the study area and descriptions of each site are included in Appendices A1 and C respectively. A species density by site matrix is detailed in Appendix B1.

The vegetation mapping done during the July 1998 survey (*ecologia*, 1998) was found to be accurate and of sufficient detail. Further detail in the mapping would require aerial photography of a higher level of resolution than is currently available.

The major vegetation associations within the On Ramp survey area as reviewed are described below.

A. Seasonally damp *Melaleuca* low woodlands

This wetland association is relatively extensive in low-lying parts of the study area. It consists of seasonal damplands with an overstorey of Paperbarks *Melaleuca preissiana* and *M. raphiophylla* over Heath *Pericalymma ellipticum* var. *ellipticum* and sedges. It is classified into two types, one of which is a mosaic in which the dense shrub stratum occurs intermittently:

(i) Mosaic of scattered *Melaleuca preissiana* over *Pericalymma ellipticum* var. *ellipticum* heath and *Melaleuca viminea / M. rhaphiophylla* over sedgelands

A mosaic of the following two vegetation types occurs within the Abernethy Road on-ramp study area. Given the aerial photography available and the gross similarity of these two vegetation types, they could not be separated for mapping purposes but were discriminated in the field for site placement as follows:

(a) *Melaleuca preissiana* over *Pericalymma ellipticum* var. *ellipticum* heath

This type is characterised by a scattered overstorey of *Melaleuca preissiana* over an open to very dense heathland which, although dominated by *Pericalymma ellipticum* var. *ellipticum*, contained a relatively large number of other species at much lower densities. Scattered *Banksia menziesii*, *Banksia littoralis* and *Corymbia calophylla* are also present. Other low shrub species present include *Astartea fascicularis*, *Calothamnus littoralis*, *Hypocalymma angustifolia*, *Melaleuca acerosa*, *Melaleuca scabra*, *Scholtzia involucrata*, *Verticordia densiflora* and *Verticordia lindleyi*. Herbs typically present include *Haemodorum spicatum*, *Patersonia occidentalis* and *Dasypogon bromeliifolius*. Site 3.

Within the Survey of the Swan Coastal Plain (Gibson *et al*, 1994) this community type was best classified as:

9: *Dense shrublands on clay flats*

Reservation Status: Well reserved

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Conservation Status: Vulnerable

The ANCA National Reserves System Cooperative Program (1997) classified this community type as:

'Dense shrublands on clay flats'

Assessed Category: Vulnerable

(b) *Melaleuca viminea* and *M. rhaphiophylla* over sedgelands

This type is characterised by a moderately dense, low overstorey of *Melaleuca viminea* and *Melaleuca rhaphiophylla* over sedgelands dominated by *Lepidosperma longitudinale* with *Meeboldina canus* and *Meeboldina scariosa*. Site 4a and 4b.

No comparable community type was found within the Survey of the Swan Coastal Plain (Gibson *et al*, 1994).

No comparable community type was found in the ANCA National Reserves System Cooperative Program (1997). Possibly 'Peat Swamps of the Swan Coastal Plain' which constitutes an Assessed Category of 'Data Deficient'.

B: <u>Banksia low woodland</u>

i. *Banksia attenuata/B. menziesii* over mixed low shrubs

Banksia Woodland within the most north-western portion of the study area is in relatively good condition and adjoins an area of bushland within the airport reserve. The Woodland is dominated by *Banksia attenuata* and *B. menziesii* and has a relatively diverse shrub layer including *Xanthorrhoea preissii* (Balga), *Xanthorrhoea brunonis, Acacia pulchella var. pulchella, Adenanthos cygnorum, Eremaea pauciflora* and *Eriostemon spicatus*. The open ground cover was dominated by the sedge-like plants *Lepidosperma squarrosa, Alexgeorgea subterranea, Dasypogon bromeliifolius, Lyginia barbata* and *Patersonia occidentalis*. Sites 1, 2 and 8.

Within the Survey of the Swan Coastal Plain (Gibson *et al*, 1994) this community type is classified as:

20a: *Banksia attenuata* woodlands over species rich shrublands

Reservation Status: Unreserved
Conservation Status: Endangered

The ANCA National Reserves System Cooperative Program (1997) most closely represented this community type as:

'*Banksia attenuata woodlands over species rich dense shrublands*' (based on Survey of the Swan Coastal Plain (Gibson *et al*, 1994) Category 20a)

Assessed Category: Endangered

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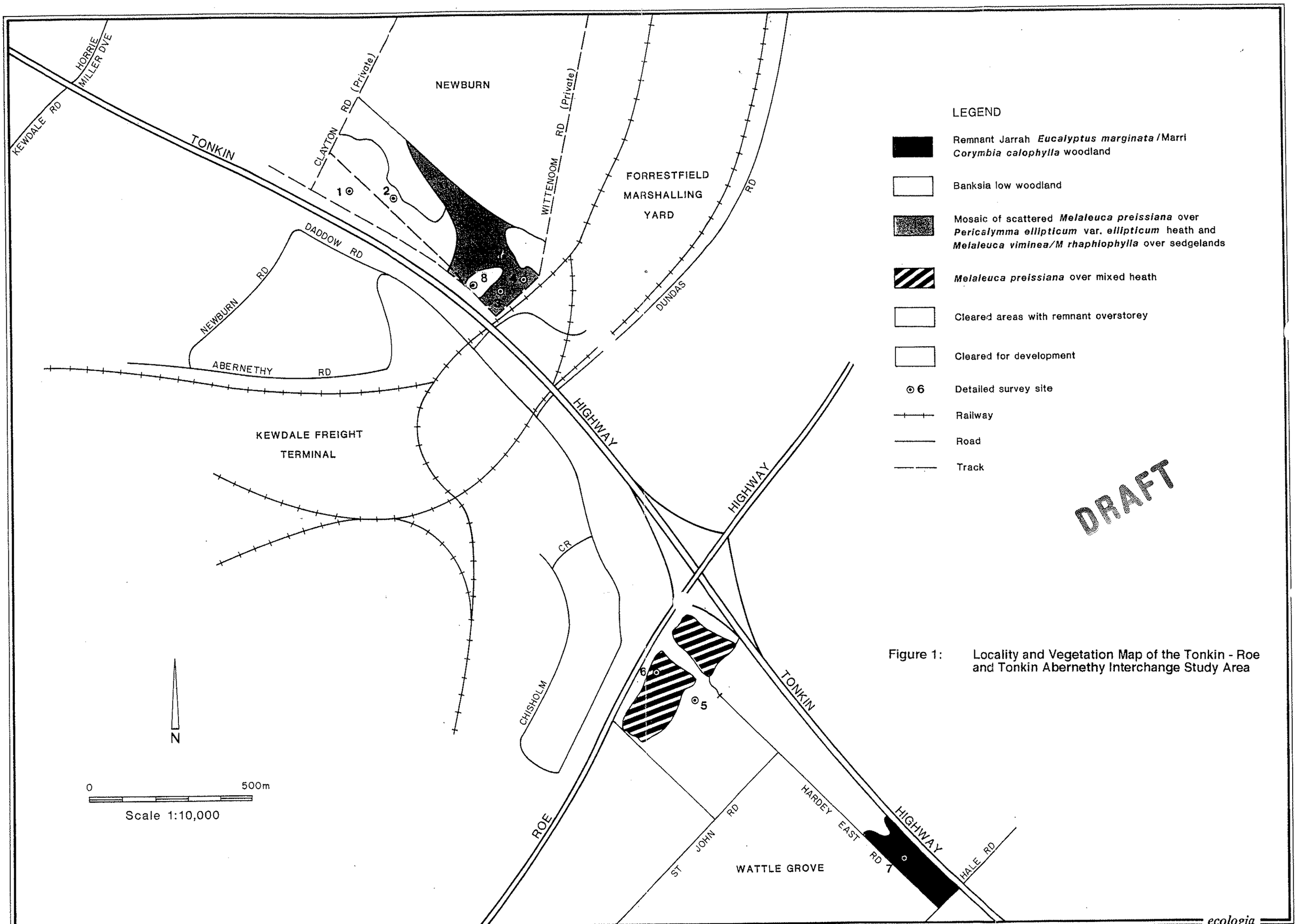

Figure 1: Locality and Vegetation Map of the Tonkin - Roe and Tonkin Abernethy Interchange Study Area

3.2 FLORA

3.2.1 Declared Rare Flora and Priority Species

One DRF, *Macarthuria keigheryi* and one Priority 2 species *Scaevola ?paludosa,* species were identified within the Tonkin-Abernethy Interchange On Ramp project area. *Macarthuria keigheryi* and *Scaevola ?paludosa* exist north west of the proposed on-ramp.

***Macarthuria keigheryi* DRF**

Macarthuria keigheryi is a sprawling subshrub with few, reduced, alternate leaves with a flowering period from September - December and February - March. Unlike other local *Macarthuria* species *M. keigheryi* has hairy stems, leaves and inflorescences. Within the study area it was identified from Site 8 in Banksia Low Woodland at low density (0-2%) along the western boundary track 200 m north west of the corner of the airport fence road. A further survey confirmed the presence of this species at 120 metres from the corner of the boundary fence north along the western side. The southern end of the population is 30 m north west of the proposed construction impact area (Appendix D).

Nine individuals were found scattered throughout the Banksia Woodland NW of the corner of the airport fence.

Previous localities for *Macarthuria keigheryi* listed by Atkins (1998) are Mullering Brook, Cooljarloo, Kewdale and Forrestfield.

***Scaevola paludosa* Priority 2**

Perennial herb-shrub, variable - hairy to glabrous, leaves 25-110 X 2.5-20 mm, fleshy, acuminate tip, narrowly ovate to narrowly elliptic and a long tapered petiole which is dilated at the base. Occasionally tufts of hairs in the axils. (This collection has sparse white appressed hairs and broad leaves). Flowering is from September to December.

Within the study area it was identified from Site 8 in Banksia Low Woodland at low density (0-2%) with the entire population comprising approximately 80 individuals; along the western boundary track 200 m north west of the corner of the airport fence road. The southern end of the population is approximately 70 m north west of the proposed construction impact area (Appendix D).

Atkins (1998) lists the known distribution of *Scaevola paludosa* as Recherche Archipelago, Cape Le Grande National Park, Moore River and Shark Bay. The Bushland Plants of Kings Park (Bennett, 1988) lists it as widespread within Kings Park and the Flora of the Perth Region (Marchant *et al*, 1987) lists the species as occurring on sandy soils of the coastal plain and Darling Range, extending north to Eneabba and south to near Williams.

See Appendix D for plant specimens and location details.

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3.2.2 Introduced Flora

Weed invasion within bushland is low with frequency from 0-10% with species such as **Briza maxima, *Ehrharta calycina, *Gladiolus caryophyllaceous, *Hypochaeris glabra* and **Sonchus oleraceous*. Unusually these species aren't dominant indicating that bushland is in excellent condition with dense native vegetation and low disturbance. Tracks in the study area are worst affected with species such as **Lupinus costenii* and **Euphorbia terracina.*

4.0 ENVIRONMENTAL IMPACTS AND MANAGEMENT

4.1 MINIMIZE CLEARING

The impact area of the Tonkin Hwy - Abernethy Road Interchange is 30 m south east of both DRF flora and bushland declared as an unreserved, endangered community type *'Banksia attenuata woodlands over species rich shrublands'* (ANCA, 1997) (Gibson *et al*, 1994) (Site 8, Figure 1). Disturbance of bushland outside of the direct impact area must be prevented and the 30 m vegetation buffer is to remain intact to prevent slow degradation of the DRF population and endangered vegetation community due to weed invasion and exposure.

Assurances have been given that Main Roads Western Australia will construct exclusion fences prior to any works at the Tonkin Hwy - Abernethy Road Interchange to minimize the extent of damage to surrounding bushland. Care is to be taken in erection of this fence by minimizing clearing, restraint in parking equipment and dumping of cleared vegetation on the remaining bushland side. Under no circumstance should the bushland side of the fence be utilized.

4.2 MINIMIZE SOIL DISTURBANCE

Minimising the extent to which soils are translocated locally is an important measure in the control of the spread of weed species and also soil pathogens such as *Phytopthora* spp. (dieback) and *Armillaria* spp. Should it be necessary to import soil during construction, the status of the soil with respect to plant and microbial pathogens should be evaluated to prevent introduction of new species. Evaluation of the current status of the study area with respect to dieback infection was beyond the scope of the survey, however Banksia woodlands containing DRF and Priority species such as that present on the north western edge of the Abernethy Road extension are particularly vulnerable to *Phytophthera* infection.

Minimisation of local soil translocations is also necessary given the P4 (species to be contained) status of two introduced species already present within the study area, **Oxalis pes-caprae* and **Homeria flaccida*. Soil from the construction area should not be removed from the construction site other than to approved dumping sites.

4.3 SECONDARY IMPACTS

The constant whittling of bushland not only slowly reduces the area remaining it increases the area of remnant bushland exposed to slow degradation. The damage to bushland is not likely to be limited to the direct impact zone in erection of the Tonkin Hwy - Abernethy Road On Ramp. Secondary impacts in adjacent bushland such as the introduction of dieback or new weed species may take years to become apparent but are none the less important.

The following recommendations should be implemented to reduce the damage.

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4.3.1 DIEBACK SURVEY AND MANAGEMENT PLAN

The presence of dieback (*Phytophthora/Armillaria* spp.) is likely due to the frequency of vehicle use in the area, however *Phytophthora* dieback is difficult to diagnose in the field and its symptoms are similar to other causes of dieback such as waterlogging, insect attack, drought and other fungal diseases. The Tonkin Hwy - Abernethy Road On Ramp area should be tested for dieback prior to construction and in the absence of this disease the following precautions taken to prevent its introduction:

- restrict earthworks to when soil is dry to minimise the amount of soil sticking to machinery, boots and equipment;

- encourage personal responsibility in regards to transfer of mud on work boots and tools;
- clean machinery (including undercarriage) using compressed air or a high pressure hose before transferring to the survey area;
- careful stockpiling so soil is re-used from where it was taken, rather than being moved along the railway corridor; and
- minimise the off road use of contractors/employees private vehicles.

4.3.2 WEED MANAGEMENT

The Tonkin Hwy - Abernethy Road On Ramp is being constructed to accommodate the delivery of grain from the wheatbelt. It is inevitable that serious weed species such as **Arctotheca calendula* (Dandelion), **Avena spp.* (Oats), **Lupinus spp.* (Lupins) *etc.* will be introduced from vehicles. The population of DRF *Macarthuria keigheryi* is located below the on ramp, within about 30 m and the population of *Scaevola paludosa* within about 70 m. These are distances well within the range of airborne seed dispersal from the height of the on ramp.

In addition to erection of an exclusion fence around the ramp area, heavy duty plastic or fine shadecloth should line the fence up to the top and be buried into the soil at the base to minimize the dispersal of weed seeds from vehicles.

4.4 IMPACT TO RARE FLORA

The population of DRF species *Macarthuria keigheryi* is not to be directly affected in any way during the course of construction in the Tonkin Hwy - Abernethy Road area. If any individuals are to be affected an 'Application to Take' must be completed and approved by the Department of Conservation and Land Management. 'To take' in terms of the Wildlife Conservation Act (Section 23F) includes to 'gather, pluck, cut, pull up, destroy, dig up, remove or injure the flora or to cause or permit the same to be done by any means'

The fine for infringing the act is $10 000 per plant affected.

4.5 FURTHER SURVEYS

Further survey work will be required before approval of construction on the Tonkin - Roe Hwy Interchange to determine the distributions of the DRF species *Conospermum undulatum*. It is likely that individuals will be destroyed if construction proceeds and an 'Application to Take' will need to be submitted to the Department of Conservation and Land Management for appraisal.

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5.0 STUDY TEAM

The Tonkin Highway Interchange Spring Flora Survey described in this document was planned, coordinated and executed by:

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West Perth WA 6005

Project Staff

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M. Fitzgerald		Administrative Assistant

DRAFT

PERMITS

The Declared Rare and Priority Flora assessment was carried out under the authorisation of the following licence issued by the Department of Conservation and Land Management to:

K. McCreery, *ecologia* Environmental Consultants

Flora Survey: "Licence For Scientific Or Other Prescribed Purposes", Licence No.SL004792. Valid from 6 February 1998 to 5 February 1999.

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APPENDIX A

Species List for the Tonkin Hwy - Abernethy Road On Ramp Area

APPENDIX A1: List of dominant flora species collected from the Tonkin Hwy - Abernethy Road Interchange area.

Classification and nomenclature according to Census of Australian Vascular Plants 1990., R.J. Hnatiuk Australian Government Publishing Service

Key: * = introduced species
† = flora of interest

FAMILY	SPECIES
ZAMIACEAE	*Macrozamia riedlei*
POACEAE	*Amphipogon amphipogonoides* **Briza maxima* **Ehrharta calycina*
CYPERACEAE	*Lepidosperma longitudinale* *Lepidosperma squamatum* *Lyginia barbata* *Mesomelaena stygia* *Schoenus curvifolius*
RESTIONACEAE	*Desmocladus fascicularis* *Meeboldina cana*
DASYPOGONACEAE	*Chamaexeros serra* *Dasypogon obliquifolius*
XANTHORRHOEACEAE	*Xanthorrhoea preissii*
ANTHERICACEAE	*Corynotheca micrantha* *Johnsonia pubescens* *Thysanotus multiflorus* *Thysanotus patersonii*
COLCHICACEAE	*Burchardia umbellata*
HAEMODORACEAE	*Anigozanthos humilis* *Conostylis setigera* *Conostylis* sp. 1
IRIDACEAE	**Gladiolus caryophyllaceus* *Patersonia occidentalis*
ORCHIDACEAE	*Caladenia denticulata* *Caladenia longicauda* *Pterostylis vittata*
CASUARINACEAE	*Allocasuarina fraseriana* *Allocasuarina humilis*
PROTEACEAE	*Banksia attenuata* *Banksia menziesii*

	Hakea sulcata
	Petrophile linearis
	Stirlingia latifolia
	Synaphea ?spinulosa
MOLLUGINACEAE	†*Macarthuria keigheryi* DRF
DROSERACEAE	*Drosera* sp. 1
	Drosera stolonifera
MIMOSACEAE	*Acacia pulchella*
	Acacia saligna
	Acacia sphacelata
	Crassula colorata
PAPILIONACEAE	*Bossiaea eriocarpa*
	Daviesia decurrens
	Eutaxia virgata
	Gompholobium tomentosa
	Hovea trisperma
	Isotropis cuneata
	Jacksonia restioides
	**Lupinus cosentinii*
	Sphaerolobium linophylla
TREMANDRACEAE	*Platytheca galioides*
POLYGALACEAE	*Comesperma virgatum*
EUPHORBIACEAE	**Euphorbia terracina*
	Phyllanthus calycina
DILLENIACEAE	*Hibbertia huegelii*
	Hibbertia hypericoides
	Hibbertia stellaris
	Hibbertia subvaginata
THYMELAEACEAE	*Pimelea ?preissii*
MYRTACEAE	*Calothamnus lateralis*
	Corymbia calophylla
	Eremaea pauciflora
	Melaleuca acerosa
	Melaleuca preissiana
	Melaleuca rhaphiophylla
	Melaleuca viminea
	Pericalymma ellipticum
	Verticordia drummondii
APIACEAE	*Trachymene pilosa*
EPACRIDACEAE	*Conostephium pendulum*
	Leucopogon ?pulchella
	Leucopogon sp. 1
MENYANTHACEAE	*Villarsia albiflora*

LOBELIACEAE	*Lobelia rhombifolia*
GOODENIACEAE	*†Scaevola ?paludosa* P2
STYLIDIACEAE	*Levenhookia* sp. 1 *Stylidium brunonianum* subsp. *brunonianum* *Stylidium bulbifera* *Stylidium diuroides* *Stylidium miniatum* *Stylidium repens* *Stylidium schoenoides*
ASTERACEAE	*Helipterum cotula* **Hypochaeris glabra* **Sonchus oleraceus*

APPENDIX B

Species by Site Matrix for the Tonkin Hwy - Abernethy Road On Ramp Area

APPENDIX B: Species by Site Matrix for the Tonkin Hwy - Abernethy Road On Ramp Area

Species	Site			Transect				Opportunistic
	3	4	8	T2	T3	T4	T5	
**Briza maxima*			1					
**Ehrharta calycina*								X Site 8
**Euphorbia terracina*								X Site 8
**Gladiolus caryophyllaceous*			1					
**Hypochaeris glabra*		1						
**Lupinus costenii*								X Site 8
**Sonchus oleraceous*								X Site 8
Acacia pulchella			2					
Acacia saligna								X Site 8
Acacia sphaecelata			1					
Allocasuarina fraseriana			2					
Allocasuarina humilis			2					
Amphipogon amphipogonoides			1			*		
Anigozanthos humilis			1					
Banksia attenuata			3					
Banksia menziesii			3					
Bossiaea eriocarpa			1			*		
Burchardia umbellata			1					
Caladenia denticulata				*				
Caladenia longicauda	1							
Calothamnus lateralis	2							
Chamaexeros serra				*			*	
Comesperma virgatum					*	*		
Conostephium pendulum					*			
Conostylis setigera			1		*			
Conostylis sp. 1			1					
Corymbia calophylla								X Site 8
Corynotheca micrantha			1		*	*		
Crassula colorata						*		
Daviesia decurrens					*			
Desmocladus fascicularis			1					
Drosera sp. 1					*			
Drosera stolonifera			1					
Eremaea pauciflora				*				
Eutaxia virgata	1			*				
Gompholobium tomentosa			1					
Hakea sulcata							*	
Helipterum cotula				*				
Hibbertia huegelii					*			
Hibbertia hypericoides			3					
Hibbertia stellaris	1							
Hibbertia subvaginata				*			*	
Hovea trisperma			7					

APPENDIX B: Species by Site Matrix for the Tonkin Hwy - Abernethy Road On Ramp Area

Species	Site			Transect				Opportunistic
	3	4	8	T2	T3	T4	T5	
Isotropis cuneata			1					
Jacksonia restioides						*		
Johnsonia pubescens				*				
Lepidosperma longitudinale		2						
Lepidosperma squamatum			1					
Leucopogon ?pulchella			1					
Leucopogon sp. 1			1					
Levenhookia sp. 1			1	*				
Lobelia rhombifolia					*			
Lyginia barbata			1					
Macarthuria keigheryi DRF			1					
Macrozamia reidlei								X Site 8
Meeboldina cana	4	2						
Melaleuca acerosa	2				*			
Melaleuca preissiana	2							
Melaleuca raphiophylla		2						
Melaleuca viminea		3						
Mesomelaena stygia			2					
Patersonia occidentalis			1					
Pericalymma ellipticum	4							
Petrophile linearis			1					
Phyllanthus calycinus			1					
Pimelia ?preissii			1		*			
Platytheca galioides								Near S2
Pterostylis vittata			1					
Scaevola ?paludosa P2			1					
Schoenus curviflorus						*		
Sphaerolobium linophylla					*	*		
Stirlingia latifolia	1		2					
Stylidium brunonianum subsp. *brunonianum*	1		1				*	
Stylidium bulbifera							*	
Stylidium diurioides			1					
Stylidium miniatum			1					
Stylidium repens			1					
Stylidium schoenoides					*			
Synaphea ?spinulosa			1					
Thysanotus multiflorus	1			*				
Thysanotus patersonii			1					
Trachymene pilosa		1	1					
Verticordia drummondii					*			
Villarsia albiflora		2						
Xanthorrhoea preissii			2*					

APPENDIX C

Site Description of Fora Assessment Sites for the Tonkin Hwy - Abernethy Road On Ramp Survey Area

APPENDIX C: Site Description of Fora Assessment Sites for the Tonkin Hwy - Abernethy Road On Ramp Survey Area

Explanation of codes:

* = Introduced species
† = Priority species
subsp. = sub species
var. = variety

VEGETATION CONDITION

Pristine	Vegetation pristine; no disturbance evident at all.
Excellent	Strata essentially intact: some signs of human non native disturbance; e.g. feral scats, litter, minor tracks.
Good	One or more strata significantly impacted; e.g. grazing, some weeds, some vegetation removal.
Poor	One or more strata severely impacted; e.g. dense weed invasion, substantial logging or tracks.
Degraded	native vegetation largely or totally removed.

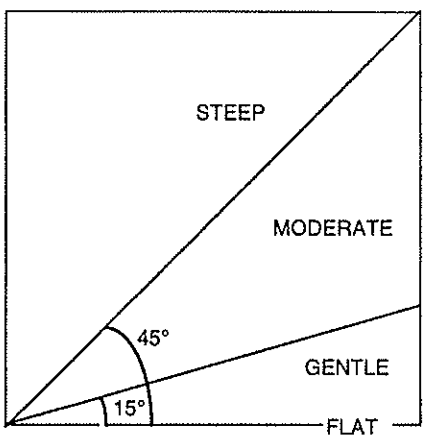
DENSITY (Vegetation, leaf litter, woodlitter)

Scattered	0-2% total cover
Sparse	2-10%
Open	10-30%
Moderately dense	30-70%
Dense	70-100%

FIRE HISTORY

Recent	0-2 years (completely devoid of vegetation or vegetation re-seeding/reshooting. Eucalypts and shrubs may have juvenile foliage from rootstock and/or branches. Shrubs, spinifex, herbs and grasses may evident as seedlings)
Moderate	2-5 years (burn scars on shrubs and trees still obvious, shrubs and spinifex may not be fully mature but species composition resembles original vegetation)
Old	5 years + (Vegetation mature but burn scars evident on trees, no evidence of fire damage on shrubs, grasses, herbs and spinifex)
None evident	No burn scars evident. Vegetation mature.

SLOPE



Site 3:		**Sparse *Melaleuca preissiana* over moderately dense *Pericalymma ellipticum* and mixed shrubs**
Date:		14.9.98
Location:		Wetland between Wittenoom Rd. & Tonkin Hwy, Kewdale
Topography:		Dampland
Slope:		flat
Surface soil:		peaty sand
Leaf litter:		0-2 cm depth, 30-70% cover, distribution mainly under shrubs
Wood litter:		Negligible
Condition:		Excellent
Disturbance details:		Minimal weed invasion
Fire History		Old
Total vegetation cover:	98%	
Trees <5 m	0-2%:	*Melaleuca preissiana*
Shrubs 1-2 m	2-10%:	*Pericalymma ellipticum, Eutaxia virgata, Pericalymma ellipticum*
Shrubs 0.5-1 m	10-30%:	*Pericalymma ellipticum, Calothamnus lateralis, Melaleuca acerosa, Stirlingia latifolia*
Shrubs 0-0.5 m	10-30%:	*Hibbertia stellaris*
Herbs/ climbers	10-30%:	*Caladenia longicauda, Stylidium brunonianum* subsp. *brunonianum, Thysanotus multiflorus*
Sedge-like plants	10-30%:	*Meeboldina cana*

Site 4:		**Open *Melaleuca rhaphiophylla* woodland and *Melaleuca viminea* shrubland over sparse aquatic herb Villarsia albiflora**
Date:		14.9.98
Location:		Seasonal swamp between Wittenoom Rd. & Tonkin Hwy, Kewdale
Topography:		Dampland / Palusplain
Slope:		Flat
Surface soil:		Peaty White-grey sand
Leaf litter:		<1 cm deep, 10-30 % cover, distribution mainly under shrubs
Wood litter:		Sparse
Condition:		Excellent
Disturbance details:		Minimal weed invasion
Fire History		Old
Total vegetation cover:	85%	
Trees <5 m	10-30%:	*Melaleuca rhaphiophylla*
Shrubs >2 m	10-30%:	*Melaleuca viminea*
Shrubs 1-2 m	0-2%:	*Melaleuca viminea*
Herbs/ climbers	10-30%:	*Villarsia albiflora, *Hypochaeris glabra, Trachymene pilosa*
Sedge-like plants	10-30%:	*Meeboldina cana, Lepidosperma longitudinale*

Site 8:		***Banksia attenuata* and *B. menziesii* over dense mixed shrubland**
Date:		14.10.98
Location:		120 m NW of airport fence corner
Topography:		Hill crest
Slope:		Gentle
Surface soil:		White-grey sand (Bassendean)
Leaf litter:		<15 cm deep, 70-100% cover, distribution general
Wood litter:		Sparse
Condition:		Excellent
Disturbance details:		Minimal weed invasion
Fire History		Old
Total vegetation cover:	85%	
trees 5-15 m	10-30%:	*Banksia attenuata, Banksia menziesii*
Trees <5 m	10-30%:	*Banksia attenuata, Banksia menziesii, Allocasuarina fraseriana*
Shrubs 1-2 m	2-10%:	*Stirlingia latifolia, Acacia pulchella, Jacksonia restioides*
Shrubs 0.5-1 m	30-70%:	*Conostylis setigera, Conostylis* sp. 1, *Patersonia occidentalis, Xanthorrhoea preissii, Hibbertia hypericoides, Allocasuarina humilis, Acacia sphacelata, Leucopogon* sp. 1, *Gompholobium tomentosa, Pimelea ?preissii*
Shrubs 0-0.5 m	0-2%:	*Gompholobium tomentosa, Pimelea ?preissii, Hovea trisperma, Bossiaea eriocarpa, Leucopogon ?pulchella, Petrophile linearis, Phyllanthus calycina, Scaevola paludosa* P2, *Synaphea ?spinulosa, Macarthuria keigheryi* DRF
Herbs/ climbers	2-10%:	*Trachymene pilosa, Stylidium brunonianum subsp. brunonianum, *Gladiolus caryophyllaceus, Anigozanthos humilis, Burchardia umbellata, Corynotheca micrantha, Drosera stolonifera, Isotropis cuneata, Levenhookia* sp. 1, *Pterostylis vittata, Stylidium diuroides, Stylidium miniatum, Stylidium repens, Thysanotus patersonii*
Grasses	0-2%:	**Briza maxima, Amphipogon amphipogonoides*
Sedge-like plants	10-30%:	*Mesomelaena stygia, Desmocladus fascicularis, Lepidosperma squamatum, Lyginia barbata*

APPENDIX D

Rare Flora Report Forms and Specimens

DEPARTMENT OF CONSERVATION AND LAND MANAGEMENT

RARE FLORA REPORT FORM

TAXON: Macarthuria keigheryi — POPULATION No.:

File No. Head Office: — File No. District:

DRF ☑ — Proposed DRF ☐ — Priority Species No. ☐ — Geog. Restr. ☐

New Population ☑ — Routine Inspection ☐ — Re-survey ☐ — Opportunistic Survey ☐

FROM: Erdacon Env. Cons. — TITLE: Neil McKenzie — SURVEY DATE: 5.11.92

REGION: South West — DISTRICT: Perth — SHIRE: Belmont

District Site Ref.: — MAP REF.:

LAND STATUS: Nature Res. ☐ — Water Res. ☐ — Gravel Res. MRD ☐ — Gravel Res. Shire ☐

National Park ☐ — Railway Res. ☐ — Rd. Verge MRD ☐ — Rd. Verge Shire ☐

State Forest ☐ — Private ☐ — VCL ☐ — Shire Reserve ☐

Other ☐ — State: Systems 6 Wetland

LOCALITY: Perth Airport - Newburn

AMG 6028: 51E 0403kE 6461 25?N

LATITUDE: — LONGITUDE: — ALTITUDE: — ASPECT:

LANDFORM: Hilltop ☐ — Flat ☐ — Drainageline ☐ — Swamp ☐ — Ridge ☐

Outcrop ☐ — Breakaway ☐ — Slope ☐ — Gully ☐ — Valley ☐

Riverbank ☐ — Lake Edge ☐ — Low Plain ☐ — Sand Dune ☐ — Cliff ☐

Firebreak ☐ — Other: Sandy rise in low lying area

ROCK TYPE: Laterite ☐ — Granite ☐ — Dolerite ☐ — Limestone ☑ — Other:

ROCK FORM: Sheet ☐ — Boulder ☐ — Fluviatile Gravel ☐ — Concretionary gravel ☐

SOIL TYPE: Sand ☑ — Loam ☐ — Clay ☐ — Peat ☐ — Gravel ☐

SOIL COLOUR: Red ☐ — Brown ☐ — Yellow ☐ — White ☐ — Grey ☐

SOIL CONDITION: Perm. wet ☐ — Moist ☐ — Dry ☑ — Saline ☐ — Other: Bassendean sand

VEGETATION CLASSIFICATION (Muir's): Needlebed (Eucalypt)/low heath

ASSOCIATED SPECIES: Banksia menziesii, Actinostachys pleiosperma, Eucalyptus todtiana (mixed shrub/heath over), Stylidium sp., Tribonanthes hypogaeoides

No. OF PLANTS: Allocasuarina humilis, Acacia cuticularis, Mesomelaena stygia

Estimated ☐ — Actual ☑ — Mature: 9 — Seedlings: — Dead: — Area Occupied: 50 x 30 m

REPRODUCTIVE STATE: in bud ☑ — flower ☑ — immature fruit ☑ — dehisced ☐ — vegetative ☑

POLLINATORS: Native bees ☐ — honey bees ☐ — mammals ☐ — birds ☐ — insects ☐

Other observations:

CONDITIONS OF POPULATION: Recently burnt ☐ — diseased ☐ — disturbed ☐ — undisturbed ☐

Other ☐ — State: Good - excellent condition 2-10 weeds, non, dieback present in excellent condition - pitcher on new growth

POTENTIAL THREATS: Firebreaks ☐ — mining ☐ — recreational activities ☐ — 'disease' ☐ — weeds ☑

grazing ☐ — clearing ☐ — prescribed burning ☐ — Other: ☑ — State: Tracks (new) can come from re-cuts (increased) slow clearance + from excessive weeds

FIRE HISTORY: Not known ☑ — Burnt in 19___ — Summer ☐ — Autumn ☐ — Winter ☐ — Spring ☐

Next control burn: Year: — Month:

VOUCHER SPECIMEN: Retained ☐ — W.A. Herb. ☑ — Other ☐ — State:

ATTACHED: Map ☑ — Mudmap ☐ — Illustration ☐ — Photo ☑ — Field Notes ☑

ACTION: Taken:

Required: by District ☐ — S.O.H.Q. ☐ — State:

FENCING REQUIREMENT Airport fence to be reinstated to 30 m with 2 pop wire

ROADSIDE MARKERS:

OTHER COMMENTS: Individuals flagged nearby with blue pipe tape

COPY SENT TO: Regional Office ☐ — District Office ☐ — Other ☐ — State:

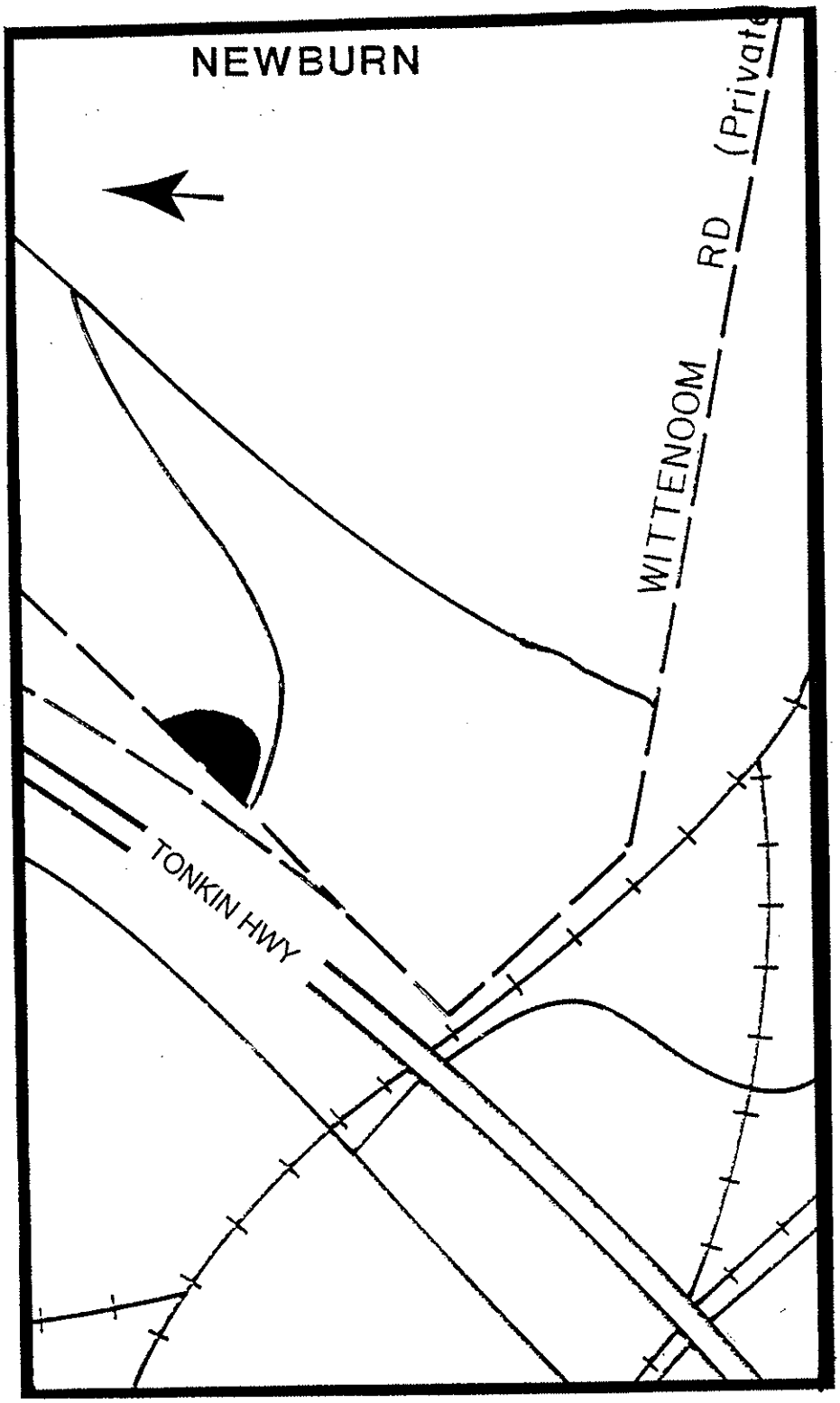
SOHQ TO SEND COPY TO: Regional Office ☐ — District Office ☐ — Other ☐ — State:

Signed: Neil McKenzie — Date: 24.11.92

NOTE: More than one box, in any section, may be ticked.

RECORDS: PLEASE FORWARD TO ADMINISTRATIVE OFFICER, FLORA, WILDLIFE ADMINISTRATION

Distribution of *Macarthuria keigheryi* DRF



DEPARTMENT OF CONSERVATION AND LAND MANAGEMENT

RARE FLORA REPORT FORM

TAXON: Scaevola calliclasa POPULATION No.:

File No. Head Office: File No. District:

DRF ☐ Proposed DRF ☐ Priority Species No. 2 Geog. Restr. ☐

New Population ☑ Routine Inspection ☐ Re-survey ☐ Opportunistic Survey ☐

FROM: Ecologia Env. Cons. TITLE: Ken McCreen SURVEY DATE: 5.11.99

REGION: South West DISTRICT: Perth SHIRE: Belmont

District Site Ref.: MAP REF.:

LAND STATUS: Nature Res. ☐ Water Res. ☐ Gravel Res. MRD ☐ Gravel Res. Shire ☐
National Park ☐ Railway Res. ☐ Rd. Verge MRD ☐ Rd. Verge Shire ☐
State Forest ☐ Private ☐ VCL ☐ Shire Reserve ☐
Other ☐ State: System 6 wetland reserve

LOCALITY: Perth Airport reserve - Newburn 32cm NW of corner/South fence/near Tonkin Hwy and Witteveen Rd
Est 402.3N3 446247 (AMG coordinates only)

LATITUDE: LONGITUDE: ALTITUDE: ASPECT: NE

LANDFORM: Hilltop ☐ Flat ☐ Drainageline ☐ Swamp ☐ Ridge ☐
Outcrop ☐ Breakaway ☐ Slope ☐ Gully ☐ Valley ☐
Riverbank ☐ Lake Edge ☐ Low Plain ☐ Sand Dune ☐ Cliff ☐
Firebreak ☐ Other: rise to low lying creek

ROCK TYPE: Laterite ☐ Granite ☐ Dolerite ☐ Limestone ☑ Other:
ROCK FORM: Sheet ☐ Boulder ☐ Fluviatile Gravel ☐ Concretionary gravel ☐
SOIL TYPE: Sand ☑ Loam ☐ Clay ☐ Peat ☐ Gravel ☐
SOIL COLOUR: Red ☐ Brown ☐ Yellow ☐ White ☐ Grey ☑
SOIL CONDITION: Perm. wet ☐ Moist ☐ Dry ☑ Saline ☐ Other: Bassen-
deep sand

VEGETATION CLASSIFICATION (Muir's): Wood and over low heath

ASSOCIATED SPECIES: 8 mazes, 9 other rare plus frequent over diverse shrubs incl. Xanthorrhoea, Lambertia hypericifolia,

No. OF PLANTS:
Estimated ☑ Actual ☐ Mature: 80 Seedlings: Dead: Area Occupied:

REPRODUCTIVE STATE: in bud ☑ flower ☑ immature fruit ☐ dehisced ☐ vegetative ☑

POLLINATORS: Native bees ☐ honey bees ☐ mammals ☐ birds ☐ insects ☐

Other observations:

CONDITIONS OF POPULATION: Recently burnt ☐ diseased ☐ disturbed ☐ undisturbed ☐

Other ☑ State: good condition low weeds (2-3%)

POTENTIAL THREATS: Firebreaks ☐ mining ☐ recreational activities ☐ 'disease' ☐ weeds ☐

grazing ☐ clearing ☐ prescribed burning ☐ Other: ☐ State slight deterioration due to close proximity to tracks

FIRE HISTORY: Not known ☐ Burnt in 19 Summer ☐ Autumn ☐ Winter ☐ Spring ☐

Next control burn: Year: Month:

VOUCHER SPECIMEN: Retained ☐ W.A. Herb. ☑ Other ☐ State:

ATTACHED: Map ☐ Mudmap ☑ Illustration ☐ Photo ☑ Field Notes ☑

ACTION: Taken:

Required: by District ☐ S.O.H.Q. ☐ State:

FENCING REQUIREMENT:

ROADSIDE MARKERS:

OTHER COMMENTS:

COPY SENT TO: Regional Office ☐ District Office ☐ Other ☐ State:

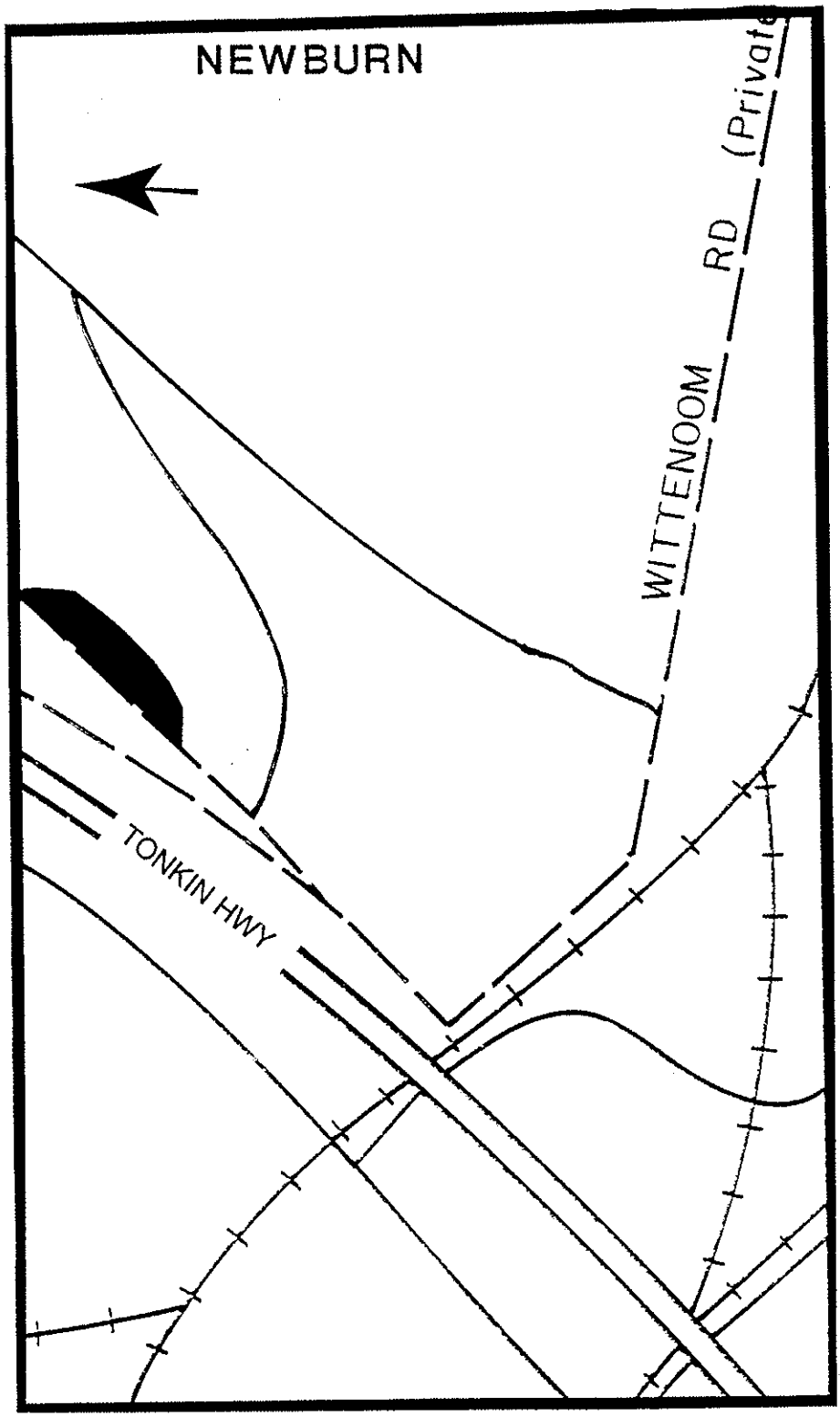
SOHQ TO SEND COPY TO: Regional Office ☐ District Office ☐ Other ☐ State:

Signed: Ken McCreen Date: 12.11.99

NOTE: More than one box, in any section, may be ticked.

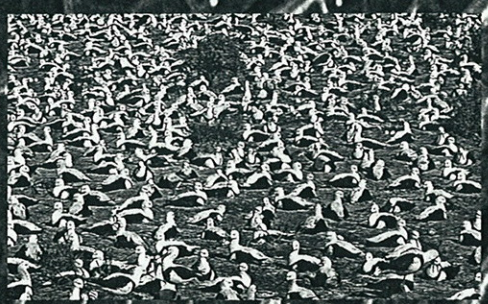
RECORDS: PLEASE FORWARD TO ADMINISTRATIVE OFFICER, FLORA, WILDLIFE ADMINISTRATION

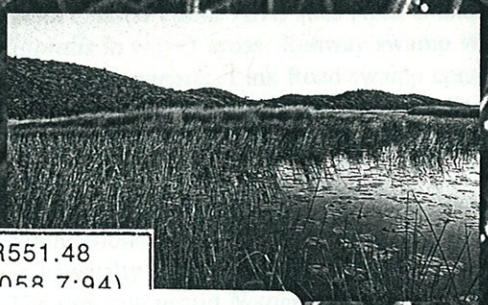
Distribution of Scaevola paludosa Priority 2



second edition

A Directory of Important Wetlands in Australia





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between the Commonwealth, State and Territory Governments,
onservation and better management of Australia's wetlands.

BRIDGET HG.

SURVEY OF THE WESTERN SWAMP TORTOISE AND ITS HABITAT AT THE PERTH AIRPORT

Report to the **FEDERAL AIRPORTS CORPORATION** and the **AUSTRALIAN NATURE CONSERVATION AGENCY**

by

Dr Gerald Kuchling, Chelonia Enterprises.
Principal Investigator, Western Swamp Tortoise Recovery Team

and

Dr Andrew A. Burbidge, Director, Western Australian Threatened Species and Communities Unit, W. A. Department of [illegible] Management.
Chairman, Western Swamp Tortoise [illegible]

for the **Western Swamp Tortoise R[illegible]**

Full document available on request

Includes the study:

AQUATIC INVERTEBRATE SURVEYS AND WATER QUALITY OF PERTH AIRPORT SWAMPS

by

Dr Stuart A. Halse (CALM Science and Information Division) and
Dr Andrew W. Storey (Wetland Research & Management).

JANUARY 1996

CHELONIA ENTERPRISES
PO Box 1359, Subiaco
WESTERN AUSTRALIA 6008

Aquatic Invertebrate Surveys and Water Quality of Perth Airport Swamps

S.A. Halse[1] and A.W. Storey[2]

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Introduction

The Western Swamp Tortoise, *Pseudemydura umbrina*, is listed as endangered under Schedule 1, Part 1 of the Commonwealth Endangered Species Protection Act 1992 and there are legal obligations on landholders and developers to provide information about likely impacts of proposed developments on the tortoise. A business and recreational park is proposed at the southern end of Perth Airport, subject to environmental review. Because a Western Swamp Tortoise was captured in the vicinity in 1970 and the species may still occur in the area, the Western Swamp Tortoise Recovery Team was commissioned to evaluate (1) the abundance of tortoises on Airport land and (2) the suitability of swamps on Airport land as habitat for tortoises. The information will be used to assess likely impacts of proposed developments on the Western Swamp Tortoise.

This report focuses on the suitability of the swamps on land at Perth Airport for Western Swamp Tortoises, as judged by water quality, the abundance of potential food items and similarity with other swamps where tortoises are known to occur. In addition, the conservation value of the airport swamps for aquatic invertebrates is examined briefly. Information on abundance of tortoises and a more comprehensive evaluation of the potential of the Airport swamps as tortoise habitat are provided in a larger document, of which this report forms part.

Methods

Wetlands sampled

Nine of the ten wetlands selected for measurement of water quality and collection of invertebrates contained water and were sampled on 12 September and 8 November 1995 (Swamps A2, A3, A10, A12, A14, A33, A34, A37, A42) (Fig.1). Swamp A13 was dry on both occasions. The codes used as wetland names in this report differ from those in the main document (Table 1).

Water quality measurements

Measurements and water samples were taken from a representative site in each wetland for all parameters except depth, which was estimated in the deepest part of the wetland. The parameters and methods of measurement are listed in Table 2.

Invertebrate sampling

A single invertebrate sample consisting of a 50 m sweep with an FBA-type pond net was taken from each site on each sampling date

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3/7/2001

Dan Seketa with Atas unit (foreground)
Ec unit (background) after Tinjoy 1994

Dan Seketa on Atas unit (Tinjoy)

3/7/01

Em Ba AF unit (Tinga 1994)

'Ambush Hill' to Domestic Term/
Int. Terminal commuting Road