

SYSTEM 6 STUDY

**CONSERVATION RESERVES
AND
NATIONAL PARKS COMMITTEE
REPORT**

AUGUST 1978



**DEPARTMENT OF
CONSERVATION
AND ENVIRONMENT**

Types of Reserves

National Parks

State Forest, Special Management Priority
Areas and Forest Parks

Nature Reserves

Regional Parks, Urban Parks and Small
Reserves

Aquatic Reserves

The Importance of Size

Staffing and Funding

Management

The National Parks Authority of Western
Australia

The Western Australian Wildlife Authority

The Forests Department of Western
Australia

Current and Future Needs

Education and Information

Ongoing Programmes

ACKNOWLEDGEMENTS

WORKS CITED

- APPENDIX I : THE REPRESENTATION OF VEGETATION
COMPLEXES IN SYSTEM 6
- APPENDIX II : THE OCCURRENCE OF VERTEBRATE FAUNA
IN SYSTEM 6
- APPENDIX III : RESERVES LARGER THAN 20 HA NOT
MENTIONED IN THE PROPOSALS

AREA A

- A.1 Cowalla Bridge Reserve C22164
- A.2 Moore River National Park
- A.3 Bartletts Well

- A.4 Reserves C18352 and C15928
- A.5 Beermullah Lake
- A.6 Yurine Swamp
- A.7 Lake Muckenburra
- A.8 Reserve A24436
- A.9 Two Rocks Open Space
- A.10 State Forest No. 65 : Management
Priority Areas
- A.11 Proposed Yeal Nature Reserve
- A.12 Lakes Nambung, Bambun and Mungala, Wallering
Swamp and Lake Chandala
- A.13 Yanchep National Park
- A.14 Mound Springs, Muchea
- A.15 Commonwealth Airfields
- A.16 Neerabup National Park

AREA B

- B.1 Quins Hill
- B.2 Reserve C25591 (Moore River)
- B.3 Reserve C15816 (Moore River)
- B.4 Reserve C3345 (Moore River)
- B.5 Lake Wannamal
- B.6 Reserves C965, C27028 (Udumung Brook)
- B.7 Reserve C539 (Boonanarring Brook)
- B.8 Boonanarring Brook area
- B.9 Gingin Brook
- B.10 Geological sites, Gingin
- B.11 Reserve C32807 (Mt Byroomanning)
- B.12 Needonga and Chittering Lakes

- B.13 Reserve C42 (Burroloo Well)
- B.14 Reserve C4070 (North of Bullsbrook)
- B.15 Reserve C1654 (Bullsbrook)

AREA C

- C.1 Bindoon Army Training Area
- C.2 Julimar S.M.P.A.
- C.3 Reserve C22096 (Culham)
- C.4 Reserve C3156 (Bindoon Spring)
- C.5 Reserve C19904 (West Toodyay)
- C.6 Beelaring and Goonaring Springs
- C.7 Avon Valley National Park
- C.8 Walyunga National Park
- C.9 Reserves C32400, C20014 and C3307 (Clackline)
- C.10 Reserves C4623, C11619, C14275 and C14276 (Bakers Hill)
- C.11 Reserves C30393 and C25860 (Berry Brow Road)
- C.12 Reserve C29269 (North-west of Chidlow)
- C.13 Reserves C4967 and C17100 (Chidlow)
- C.14 Lake Leschenaultia
- C.15 Reserve C14278 (East of Wooroloo)
- C.16 Reserve C25033 (The Lakes)
- C.17 Reserves C30667, C30681 and C30797 (The Lakes)
- C.18 Reserve C30363

AREA D

- D.1 Gunapin S.M.P.A.
- D.2 Sullivan S.M.P.A. and Reserve C34442
- D.3 Russell S.M.P.A.

- D.4 Dale S.M.P.A.
- D.5 Eagle Hill S.M.P.A.
- D.6 Boyagarring S.M.P.A.
- D.7 Lupton S.M.P.A.
- D.8 Cooke S.M.P.A.
- D.9 Windsor S.M.P.A.
- D.10 Serpentine S.M.P.A.
- D.11 Gooralong S.M.P.A.
- D.12 Serpentine National Park
- D.13 Karnet S.M.P.A.
- D.14 Gobby Road, Keysbrook (Location 1494)
- D.15 Reserves C14629, C19413 and C21038
- D.16 Duncan S.M.P.A.
- D.17 Gyngoorda S.M.P.A.
- D.18 Wandering S.M.P.A.
- D.19 Brookton and Albany Highways

AREA E

- E.1 John Forrest National Park
- E.2 Reserve A12453 (Parkerville)
- E.3 Reserve C12085 (Parkerville)
- E.4 Reserves along abandoned railways
- E.5 Reserve C34103 (Sawyers Valley)
- E.6 Greenmount Hill National Park
- E.7 Reserve A1847 (Darlington)
- E.8 Reserve C18130 (Sawyers Valley)
- E.9 Reserve C32727 (Darlington)

- E.10 Helena Valley
- E.11 Reserve C22865 (Kalamunda)
- E.12 Reserve C20641 (Bickley)
- E.13 Reserve C10601 (Carmel)
- E.14 Reserve C21172 (Munday Brook)
- E.15 Proposed Darling Scarp National Park
- E.16 MRPA Proposed Park, Bedfordale
- E.17 Bungendore Park, Bedfordale
- E.18 Churchman Brook
- E.19 Reserves C19662 and C32728 (Karragullen)
- E.20 Reserve C5704 (Wungong)
- E.21 Reserve C29880 (Forrestfield)
- E.22 Wattle Grove

AREA F

- F.1 Coastal Strip
- F.2 Sorrento-Mullaloo Reefs
- F.3 Wildlife Research Centre Nature Reserve
- F.4 Joondalup and Goollelal Lakes Area
- F.5 Wanneroo Wetlands, Eastern Chain
- F.6 Lake Jandabup
- F.7 Ellen Brook and Twin Swamps Nature Reserves
- F.8 Whiteman Park (Mussel Pool)
- F.9 Reserve at Marangaroo
- F.10 Warwick - Girrawheen Woodland
- F.11 Star Swamp
- F.12 Carine Swamps

- F.13 Carienup Swamp
- F.14 Lake Gwelup
- F.15 Reserves near Karrinyup Road
- F.16 Dianella Region Open Space
- F.17 Bennett Brook
- F.18 Swan River, Guildford to Walyunga National Park
- F.19 Jane Brook
- F.20 Swan River backwater, South Guildford
- F.21 Hazelmere Lakes
- F.22 Helena River, Guildford to Darlington
- F.23 Perth and Jandakot Airports
- F.24 Swan River saltmarshes downstream of Garratt Road Bridge
- F.25 Swan River Foreshores: Maylands Peninsula
- F.26 Jackadder Lake
- F.27 Herdsman Lake
- F.28 Bold Park
- F.29 Swanbourne
- F.30 Lake Claremont
- F.31 Kings Park
- F.32 Wading-bird Habitats on the Swan River Estuary
- F.33 Point Heathcote
- F.34 Peppermint Grove
- F.35 Point Resolution
- F.36 The Chine
- F.37 Chidley Point
- F.38 Blackwall Reach
- F.39 Minim Cove (Fossil Deposit)

- F.40 Buckland Hill
- F.41 Cantonment Hill
- F.42 Harry Sandon Park (Attadale)
- F.43 Wireless Hill
- F.44 Booragoon Lake
- F.45 Mt. Henry
- F.46 Salter Point
- F.47 Clontarf Foreshore
- F.48 Bull Creek
- F.49 Canning River from Riverton Bridge to Nicholson Road Br
- F.50 Canning River above Nicholson Road Bridge
- F.51 Kenwick Swamp (University Research Area)
- F.52 Wetlands beside Eudoria Street, Gosnells
- F.53 Sir Frederick Samson Park
- F.54 North Lake and Bibra Lake
- F.55 Coogee Beach Reserve

AREA G

- G.1 Rottnest Island
- G.2 Carnac Island
- G.3 Garden Island
- G.4 The Islands of Shoalwater Bay
- G.5 The Islands of Warnbro Sound
- G.6 Aquatic Reserves
- G.7 Lake Coogee and Market Garden Swamps
- G.8 Mt. Brown, Mt. Brown Lake and Brownman Swamp
- G.9 Lake Yangebup
- G.10 Lake Kogolup

SUMMARY OF RECOMMENDATIONS

INTRODUCTION

Terms of Reference

The Committee and its Work

 Composition of the Committee

 Supporting Staff

 Editorial Sub-committee

 Information Assembled

 Procedure

Physical Environment

 General

 Geology

 Soils and Landforms

Biological Environment

 Flora

 Fauna

Special Considerations

 Darling Scarp

 Coastal Land and Offshore Islands

 Wetlands

 Conservation of Flora on Verges

 Geological Sites

 Landscape Conservation

Land Use

 Urban Development

 Mining and Quarrying

 Water Supply Catchments

 Off-road Vehicles

- G.11 Thompson Lake
- G.12 Banganup Lake
- G.13 Lake Forrestdale
- G.14 Lake Richmond (Rockingham)
- G.15 Lakes Coo loongup and Walyungup
- G.16 The Quarantine Station and Explosives Reserve
- G.17 Part of Reserve C24784 (Hope Valley Road)
- G.18 Reserve C25886 (North of Orton Road, Peel Estate)
- G.19 Reserve C31874 (South of Orton Road, Peel Estate)
- G.20 Reserve C2457 (Cardup)
- G.21 Reserve C28167 (South of Orton Road, Peel Estate)
- G.22 Leda
- G.23 Port Kennedy
- G.24 Reserve A24309 (Naval Base)

AREA H

- H.1 Keysbrook
- H.2 Madora
- H.3 Goegrup Lake Chain
- H.4 Peel-Harvey Estuary
- H.5 Lake McLarty and Lake Meälup
- H.6 Yalgorup National Park
- H.7 State Forest No.16 - Special Management Priority Areas
- H.8 Reserve A23172 (Harvey River)
- H.9 Reserve C22199 (West of Hamel)
- H.10 Reserve C12049 (West of Wagerup)
- H.11 Reserve C12632 (West of Cookernup)

- H.12 Reserve C24472 (Old Coast Road)
- H.13 Reserve C2547 (West of Harvey)
- H.14 Reserve C2517 (Wellesley River)
- H.15 Myalup Swamp and Mialla Lagoon
- H.16 Benger Swamp
- H.17 Leschenault Estuary
- H.18 Laporte Egret Swamp
- H.19 Brunswick, Collie and Wellesley Rivers
- H.20 Anglesea Island
- H.21 South Bunbury
- H.22 Reserves A23000, C28825, C28836 (Dalyellup)
- H.23 North Waroona

AREA J

- J.1 Teesdale S.M.P.A.
- J.2 Plavins S.M.P.A.
- J.3 Bell S.M.P.A.
- J.4 Federal S.M.P.A.
- J.5 Samson S.M.P.A.
- J.6 Surface S.M.P.A.
- J.7 Nalyerin S.M.P.A.
- J.8 Trees S.M.P.A.
- J.9 Stene S.M.P.A.
- J.10 Reserve C22977 (Near Harvey)
- J.11 Reserves C15515 and C25727
- J.12 Reserves C22797 and C14564

AREA K

- K.1 Dardanup S.M.P.A.
- K.2 Lennard S.M.P.A.
- K.3 Westralia S.M.P.A.
- K.4 Bennelaking S.M.P.A.
- K.5 Muja S.M.P.A.
- K.6 Goonac S.M.P.A.
- K.7 Noggerup S.M.P.A.
- K.8 Preston S.M.P.A.
- K.9 Donnybrook (Reserves and vacant Crown land)
- K.10 Reserve C29121 (Wilga Townsite)
- K.11 Mullalyup S.M.P.A.
- K.12 Reserve A25446 (Powalup)
- K.13 Greenbushes S.M.P.A.
- K.14 Nollajup S.M.P.A.
- K.15 Dalgarup S.M.P.A.
- K.16 St. John Brook S.M.P.A.

TERMS OF REFERENCE

The terms of reference of the Conservation Reserves and National Parks Committee were:

"To report to the Conservation and Land-Use Committee on existing and required conservation reserves and national parks generally, taking account of:

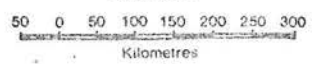
- (i) the E.P.A. policies and philosophies expressed, particularly in the Preamble to the two "red books";
- (ii) public and other submissions received during the course of the System 6 Study;
- (iii) information and comments derived from the Ecosystem and Land-Use Inventory Committee and the Commercial and Productive Use Committee."

In accordance with the above terms of reference, the Conservation Reserves and National Parks Committee recommends in this Report to the Conservation and Land-Use Committee a system of reserves which, if adopted, will provide for biological and environmental conservation in the area known as System 6 (Fig.). 1101



THE 12 WESTERN AUSTRALIAN
C.T.R.C.'s SYSTEMS

SCALE



THE COMMITTEE AND ITS WORK

Composition of Committee

The Conservation Reserves and National Parks Committee was appointed early in 1977 as a sub-committee of the System 6 Committee and first met on 6 April, 1977. It comprised:-

P.R. Wycherley (Chairman), O.B.E., B.Sc., Ph.D., F.L.S., F.I.S.P., F.R.A.I.P.R., Director, Kings Park and Botanic Gardens.

R.T. Appleyard, M.A., Ph.D., F.A.S.S.A., Professor of Economic History, University of Western Australia.

B.E. Balme, D.Sc., Reader in Geology, University of Western Australia.

E. Bettenay, M.Sc.Agr., Senior Principal Research Scientist, Commonwealth Scientific and Industrial Research Organisation.

E.R. Biggs, B.Sc.(Hons), F.I.M.M., C.Eng., M.Aus.I.M.M., Environmental Geologist, Geological Survey, Department of Mines.

A.A. Burbidge, B.Sc.(Hons), Ph.D., Senior Research Officer, Wildlife Research Branch, Department of Fisheries and Wildlife.

J.R. Ellis, B.Econ., Department of Economics, University of Western Australia.

A.S. George, B.A. Botanist, Western Australian Herbarium, Department of Agriculture.

J.J. Havel, M.Sc., Dip.For., Dip.Ed., Superintendent, Forests Department.

E.M. Mattiske, B.Sc.(Hons), Ph.D., Forests Department.

R.J. Powell, B.Sc., Dip.Ed., Department of Fisheries and Wildlife.

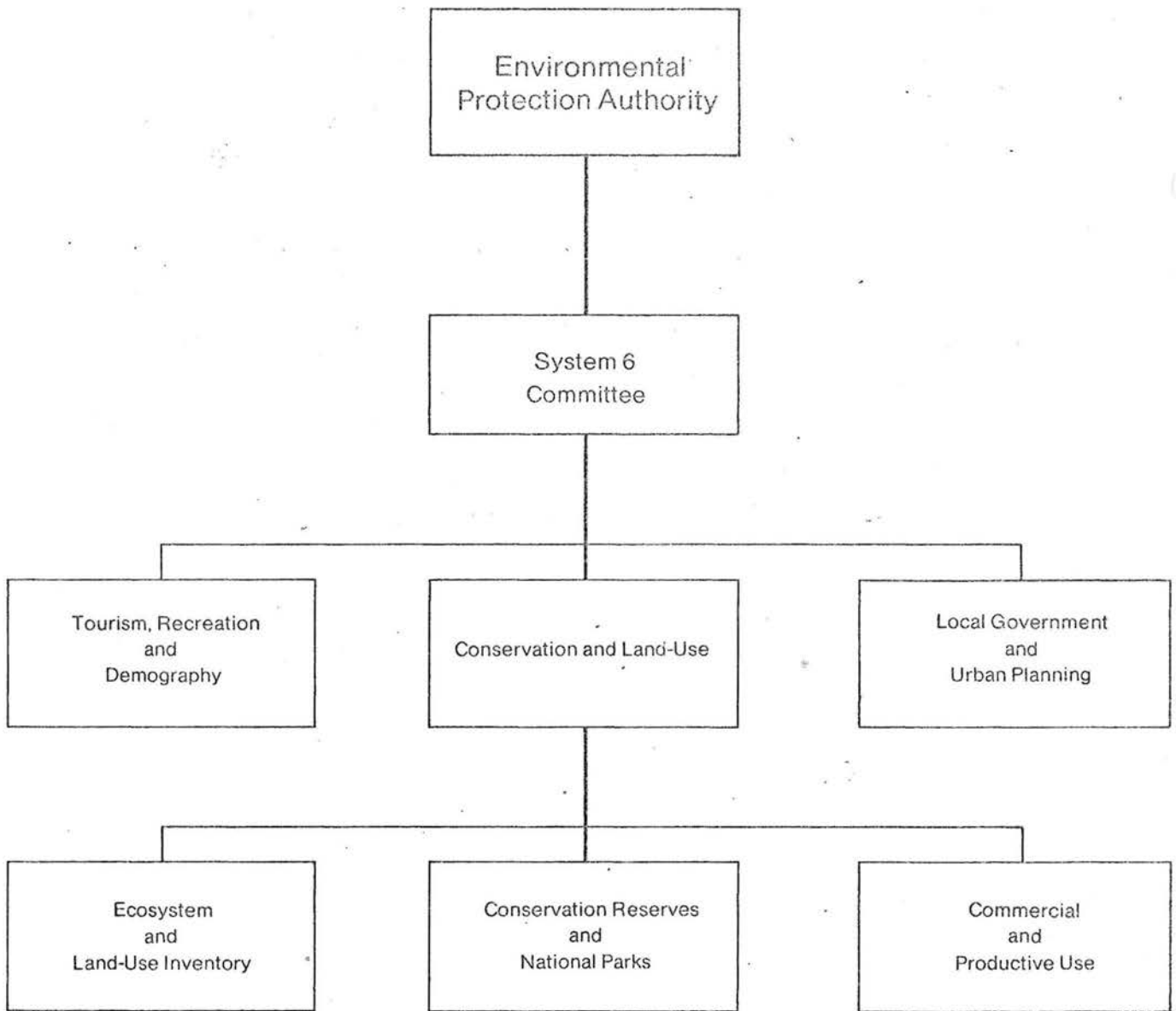
F.G. Smith, D.Sc., B.Sc.(For.), N.D.B., Director National Parks Authority.

R. Archer, B.Sc.(Hons), for Mr E.R. Biggs.

M. Churchward, M.Sc.Agr., for Mr E. Bettenay.

The Committee's position relative to the other committees in the System 6 Study is shown in Fig. .

SYSTEM 6
ORGANISATION CHART



Supporting Staff

Mr B.M. Stewart, Dip.Cart., was Professional Assistant for the Committee. The Committee's Secretary was Mr P.S. Albert, B.A.(Hons), Dip.Ed., until 9 March 1978, and thereafter Ms C.A. Mackin, B.A.(Hons). The typing of the Report was done by staff of the Department of Conservation and Environment.

Editorial Sub-committee

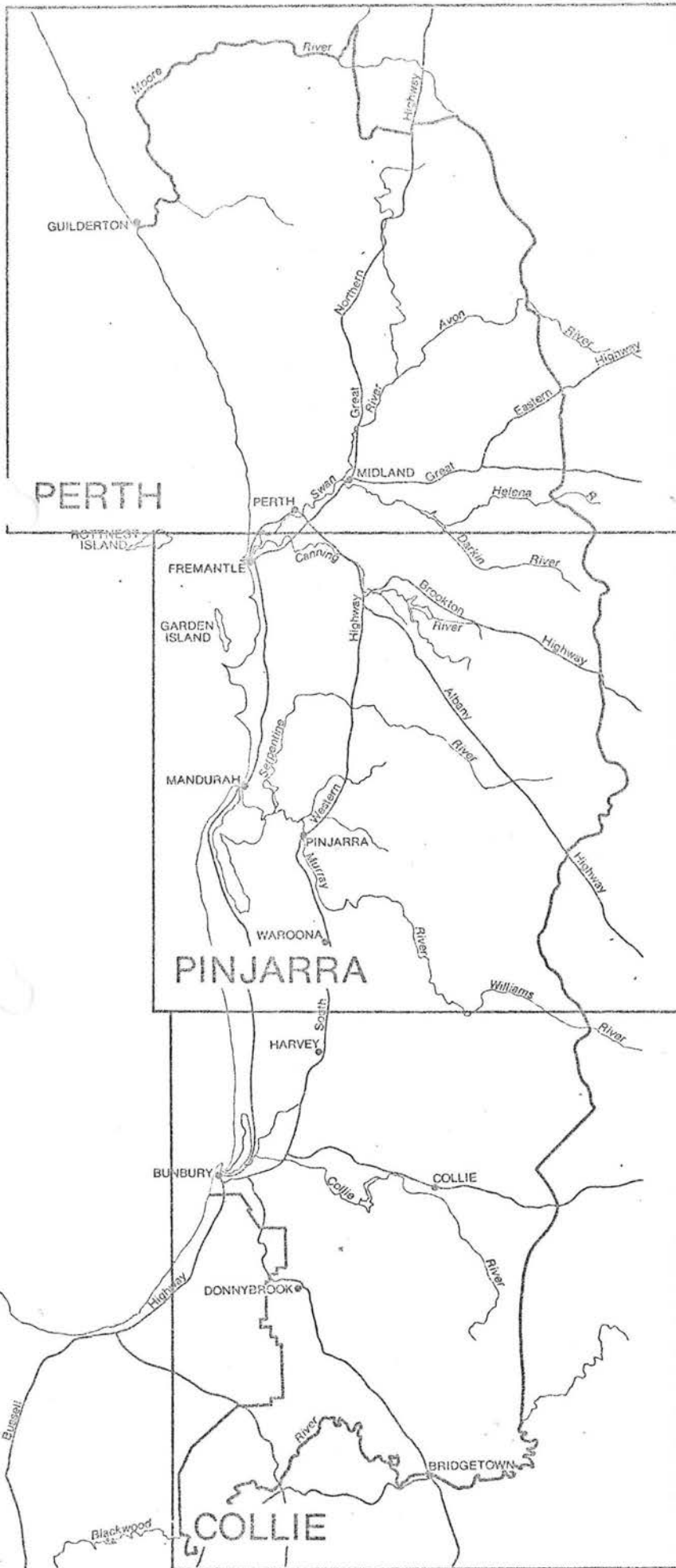
An Editorial Sub-committee of three members (R.J. Powell, A.S. George and E.M. Mattiske) was set up on 1 December 1977 to write up new proposals and to amplify and edit the preambles of existing proposals and the introductory sections of the Report.

Information Assembled

In order to fulfil its terms of reference the Ecosystem and Land-Use Inventory Committee compiled, with the help of various Government Authorities and Departments, the following maps. These are available for consultation at the Department of Conservation and Environment.

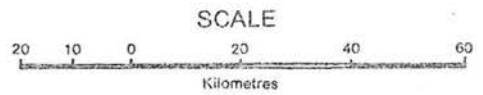
1. Three (3) sheets covering System 6 (Perth, Pinjarra and Collie) of a total of twelve (12) maps in the series at a scale of 1:250 000, showing:
 - (i) Geology and Mineral Resources
 - (ii) Soils and Landforms
 - (iii) Vegetation and Rainfall
 - (iv) Land Use and Hydrogeology
(Data includes:- water resource catchment boundaries, surface and underground water supplies, cleared and uncleared land, National Parks, reserves, dams, reservoirs and populated towns, State Forest, etc.).

The portions of System 6 covered by the Perth, Pinjarra and Collie sheets are shown in Fig. .
2. Jarrah dieback distribution (clear film overlay at 1:250 000 scale).
3. Study area overlays at 1:250 000 scale.
4. Index to Lands Department lithos at 1:250 000 scale.
5. Index to Forest Department management priority areas at 1:250 000 scale.



MAP INDEX
1:250,000 SERIES

for
Geology and Mineral Resources
Soils and Landforms
Vegetation
Land Use and Hydrogeology



6. Local Authority and statistical areas at 1:250 000 scale.
7. Reserves (larger than 20 ha) and National Parks.
8. Water quality and quantity (scale 1:1 000 000).
9. Lateritic areas in System 6 (scale 1:500 000).
10. M.R.P.A. maps showing existing and proposed reserves, regional open space and corridors (scale of 40 and 80 chain to one inch).
11. Forestry Maps
 - (i) Management priority areas (scale 1:500 000)
 - (ii) Forest areas of the South West (scale 1:500 000)
 - (iii) Forest quarantine areas (scale 1:500 000)
 - (iv) Land boundary maps (scale of 80 chain and 1:50 000).

The following information was also assembled:

12. Schedule of existing reserves and National Parks.
13. Description of existing reserves for flora and/or fauna.
14. Population statistics.

Procedure

ms 3
The Committee divided System 6 into ten Study Areas (Fig.) using public interest and natural and demographic factors as a basis for division.

Each member of the Committee was responsible for one Study Area and was required to master all available and relevant information on the area, read and take account of the views expressed in public submissions related to the area, review the adequacy of reserves of more than 20 ha and conduct field investigations where necessary, and finally to formulate proposals for the area.

The Committee considered that the proposals formulated by individual members for each Study Area should provide for biological and environmental conservation and for recreation, to be implemented by the establishment of Conservation Reserves, National Parks and Regional Parks.

Representative examples of biological communities were identified in each Study Area and were put forward as proposals for reserves. In cases where the reservation for conservation of the only example of a biological community conflicted with other land

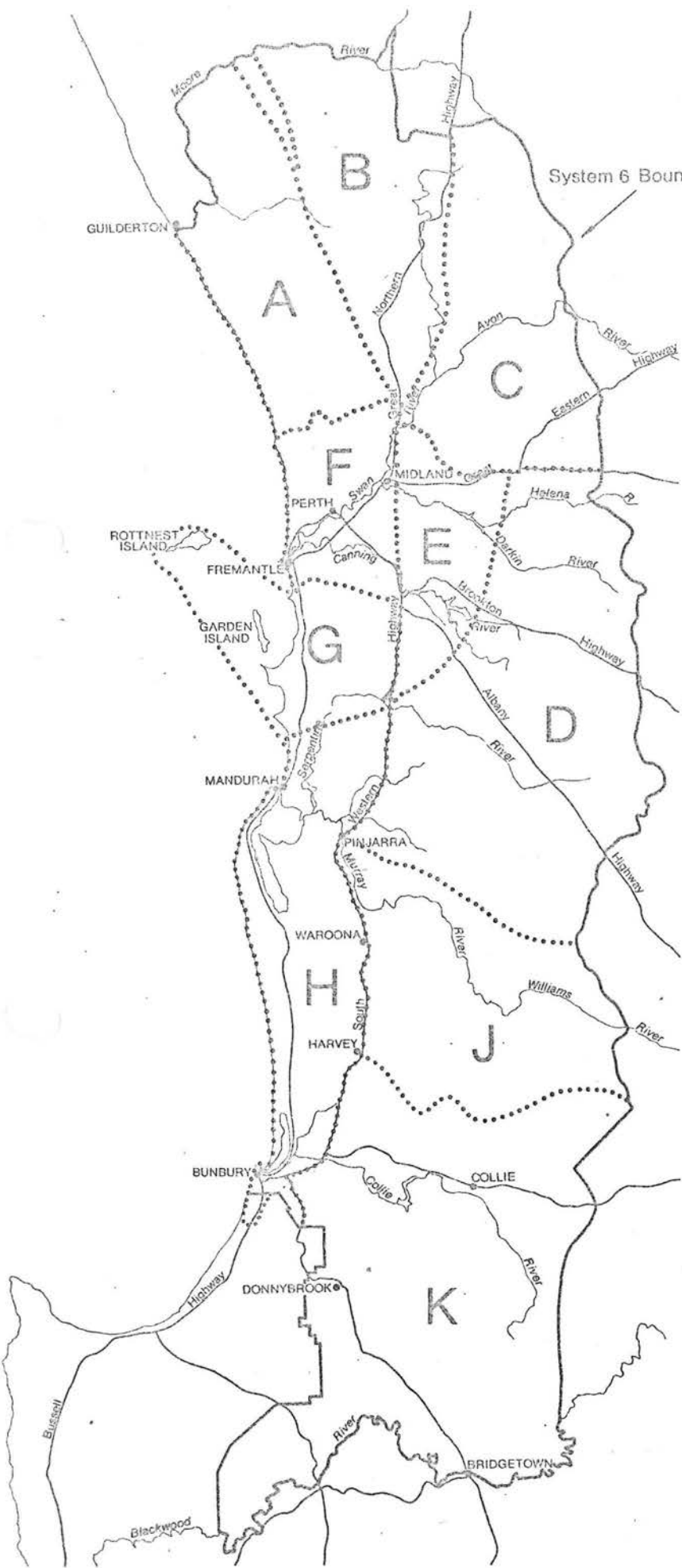
uses (e.g. mining), the Committee considered that the proposal should be put forward with the justification of uniqueness so that the conflict could be resolved at a higher level of the System 6 enquiry. However, in cases where alternative examples of a biological community were available for recommendation for reservation, the Committee considered that the proposals should be ranked according to priority, pressure of other uses, chances of survival and feasibility of management. Areas suited more to landscape protection than biological conservation were identified and put forward as either National Parks or Regional Parks (see p.).

The Committee considered that recreation of low impact on the environment could be provided for in proposals for National Parks, Regional Parks, and to a lesser extent in reserves for biological conservation.

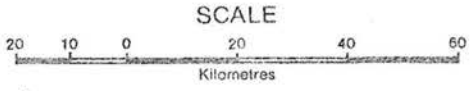
Areas not suited to biological or environmental conservation but suited to recreation of high impact were identified and referred to the appropriate Committee accordingly.

Each Study Area was reviewed in detail by the Committee. Where the differing views of members required clarification and resolution, for example Serpentine National Park, a sub-committee was formed to investigate and make a recommendation for the area.

The Report was then compiled, and reviewed in successive drafts by the whole Committee. It was submitted to the System 6 Committee on



CONSERVATION RESERVES
AND
NATIONAL PARKS COMMITTEE
STUDY AREAS



PHYSICAL ENVIRONMENT

General

System 6 is geographically diverse (Fig.). Its eastern part is the Darling Range, extending eastwards from the Darling Scarp to the more dissected country associated with the Swan-Avon, Murray-Hotham and Blackwood-Arthur Rivers, together with portions of the Dandaragan Plateau, extending northwards to the Moore River, and the Donnybrook Sunkland, extending southwards to the Blackwood River. The western part is the Swan Coastal Plain which extends from the Scarp to the Indian Ocean. Consequently, System 6 is diverse in its geology, soils, landforms and climate, and this is reflected in the vegetation and fauna, and in the patterns of land use and population. For the purpose of mapping, System 6 has been referred to as the Darling System.

The climate of System 6 is typically Mediterranean, with hot, dry summers and cool, wet winters. The mean average rainfall varies from 600mm in the east to some 1400 mm in the central part of the Darling Range. Those areas receiving over 1250 mm annual rainfall include Churchman Brook, Collie and Dwellingup.

Mean winter temperatures range from 10°C to 16°C, and mean summer temperatures from 16°C to 24°C. Maximum temperatures may exceed 40°C and are associated with easterly winds in summer. The most frequent winds are easterlies, but the strongest, with recorded gusts exceeding 100 kph, are the westerlies of the winter depressions.

The effective growing season based on the Prescott formula $P = 0.54 \times E^{0.7}$ (Bureau of Meteorology 1966) varies from 7 months to less than 6 months.

Geology

The geology of the Darling System is depicted on maps at scale 1:250 000 which were specially prepared for the System 6 Study (Geological Survey of W.A. 1978; no. 1 in list on page above).

The System is divided geologically into two distinct, unequal portions by the major topographic and structural line of the Darling Scarp. The Scarp is the present surface expression of a major fault zone which now extends for some 1 000 km from near Point d'Entrecasteaux to north of the Murchison River.

To the east of the Scarp, the Darling Range consists principally of a Shield of Precambrian high-grade metamorphic and igneous rocks, mainly granites, gneisses, amphibolites and intrusive basic dykes. West of the Scarp, Mesozoic sediments of marine and continental origin form both the Dandaragan and the

Blackwood Plateaux, and the Swan Coastal Plain consists of Quaternary deposits overlying great thicknesses of older Phanerozoic sediments.

In the main the rocks in the Shield area are very old, some older than 3 000 million years. There are also small areas of younger, Permian and Cretaceous rocks filling valleys and basins, as at Collie (Geological Survey 1973; Churchward and Bettenay 1973). The whole area of the Darling Range has been extensively laterized, resulting in the formation of superficial iron and aluminium crusts and deep, chemically weathered clay zones, frequently to a depth of 50 m. Locally the aluminous crusts are sufficiently rich to comprise commercially important bauxite deposits. As a consequence of the deep weathering, outcrops of unweathered rock are not extensive, and are associated mainly with dissection along scarps and major valleys and with a few monadnocks such as Mt. Randall and Mt. Cooke.

The Darling Scarp is most conspicuous east and south-east of Perth, where it rises to some 300 m. It reflects the line of the Darling Fault which, because of erosion of the original fault scarp, lies some hundreds of metres to the west. The magnitude of the faulting was not recognised until geophysical investigations of the Perth Basin began in 1935. This major crustal fracture has had a complex history but has effectively behaved as a steeply dipping normal fault with a maximum downthrow of over 15 000 m to the West. As a structural line of weakness the Darling Fault Zone may have a history extending back to the Precambrian but it is mainly a Mesozoic structure. Displacements during the Triassic, Jurassic and Early Cretaceous created highlands along the western margin of the Yilgarn Block and these provided source materials for the great thicknesses of sedimentary rocks that form the Perth Basin. These initial huge movements on the Darling Fault Zone coincided with the beginning of the break-up of the Palaeozoic continent of Gondwanaland. In a sense, therefore, the Darling Scarp represents the linear margin of a sundered continent. Possibly its western counterpart is the east coast of India, which is geologically similar in many ways to south-western Australia.

Theoretically the Darling Fault Zone might be expected to be seismically active. This is apparently not so, for there is evidence of only minor displacement along its present line during the past 100 million years. Modern seismicity occurs along a linear zone lying east of the Darling Fault and extending through Brookton, Beverley, York, Northam, Bolgart and Yericoin. From evidence obtained following the Meckering Earthquake of 1968, movement is complex and suggests compressional rather than tensional stresses within the western part of the Yilgarn Block.

West of the Scarp, unlithified or weakly lithified sediments shape the low, undulose plain which is underlain by a variety of unconsolidated sediments and more competent sedimentary rocks. Many of the industrial minerals and building supplies used in System 6 are obtained from this area. Reserves of potable artesian water, among the State's most important natural resources, are found beneath the plain. Commercial hydrocarbon deposits, if any are found, will also be confined to this area.

Soils and Landforms

As with geology, the distribution of characteristic soil-landform units (Mulcahy, Churchward and Dimmock 1972) in the Darling System is depicted on maps specially prepared for the System 6 Study (Churchward and McArthur 1978; No. 1 in list on page above). These maps have relied heavily on previously published work.

The soils of the Darling Range, particularly those shown as Lateritic Uplands and Minor Valleys on the maps, reflect the lateritic nature of their parent materials, and are mainly sands and gravelly sands. In common with other lateritically derived soils they are infertile, having both poor physical properties and deficiencies of major and minor plant nutrients. The Dandaragan Plateau and Donnybrook Sunkland have similar lateritic soils of low fertility.

Shallower and more fertile soils are found only in more dissected zones, shown associated with Major Valleys and Scarps on the map.

On the Swan Coastal Plain most of the soils shown as fluviatile on the map suffer from both chemical infertility and winter water-logging. The exceptions are the younger alluvial soils, which largely occur as terraces associated with the major rivers.

The western margin of the Plain consists of dune sands, designated Aeolian Deposits on the map. These vary from extremely leached and impoverished grey sands to youthful calcareous sands fringing the coast. Between these two extremes lies a zone of neutral yellow sands, over aeolianite limestone, which are somewhat more productive because of better water relationships.

BIOLOGICAL ENVIRONMENT

Flora

By reference to all available botanical and ecological work, the Committee reviewed the adequacy of conservation of flora in System 6 (Appendix I) to ensure adequate reservation, where feasible, of the variety of plant communities. All submissions were considered in terms of the adequacy of coverage of plant communities, so that the maximum diversity of both the floristic and structural components of the flora was included.

The first major attempt at describing the flora was by Diels (1906), who delineated botanical districts in south-western Australia. One of these districts was the Darling District (which corresponds largely to System 6): the coastal plain north and south of Perth and the adjacent western margin of the Plateau. The adjacent districts described were the Irwin District to the north, the Avon District to the east, and the Warren District to the south. Since then several workers have developed both the structural and, to a lesser degree, the floristic classification of the Darling District.

As part of System 6 investigations, the staff of the Forests Department of W.A. prepared a vegetation map of the area (No. 1 in list on page above). It consists of three sheets at 1:250 000 (Perth, Pinjarra, Collie) that illustrate the "vegetation complexes" as determined by Heddle, Loneragan and Havel (1978). The term "vegetation complexes" was adopted to define the varying groups of plant communities within the Darling System. Those vegetation complexes mapped represented a compromise between the broad-scale approach based on structural formations, as used by Smith (1974) on the Collie 1:250 000 vegetation map, and the detailed mapping of vegetation types incorporating understorey species, as used by Havel (1968, 1975 (a), (b)) on sections of the Northern Swan Coastal Plain and the Darling Range. The vegetation complexes are associated with the previously mentioned soil-landform units (Churchward and McArthur 1978). They also reflect the climatic conditions: in places more than one vegetation complex occurs on the one soil-landform unit. Mapping units were determined by combining field investigations and ground surveys with the interpretation of aerial photographs, and by the review of previous investigations of vegetation.

On the Swan Coastal Plain the distribution of vegetation is determined mainly by the soils. The predominant vegetation includes the coastal dune complex along the coast; open-forest of Tuart (*Eucalyptus gomphocephala*), Jarrah (*E. marginata*) and Marri (*E. calophylla*) on the Karra-katta and Cottesloe Soil-Landform Units woodland of

Jarraah with a well defined second storey of Slender Banksia (*B. attenuata*), Menzies' Banksia (*B. menziesii*) and Holly-leaved Banksia (*B. ilicifolia*) on the Bassendean Unit; and open-forest of Marri, Wandoo (*E. wandoo*) and Jarraah on the Forrestfield and Guildford Units. The decreasing rainfall in the northern section of System 6 is reflected in the replacement of Jarraah and Sheoak (*Casuarina fraserana*) by Pricklybark (*E. todtiana*) on the Northern Swan Coastal Plain. Other significant vegetation on the Coastal Plain includes the localized occurrences of low open-forest of Swamp Sheoak (*C. obesa*); wetland fringing woodland of Flooded Gum (*E. rudis*) and the paperbark *Melaleuca raphiophylla*; low open-forest of Salt-water Paperbark (*M. cuticularis*); closed-scrub of *Melaleuca* spp.; and the rare occurrences of Salmon White Gum (*E. lane-poolei*), Rottneest Cypress (*Callitris preissii*), Rottneest Tea Tree (*M. lanceolata*), Fremantle Mallee (*E. foecunda*) and Limestone Marlock (*E. decipiens*).

On the Darling Plateau the dominant vegetation is open-forest of Jarraah and Marri, with localised occurrences of Mountain Gum (*Eucalyptus haematoxylon*), Butter Gum (*E. laeliae*), Bullich (*E. megacarpa*), Yarri (*E. patens*) and Flooded Gum. The variation in the understorey was accounted for in the definition of the different vegetation complexes. In the lower rainfall areas of the north and east, open-forest of Jarraah and Marri is replaced by woodland of Wandoo with localised occurrences of York Gum (*E. loxophleba*) and Powderbark (*E. accedens*). On the sandier soils, with varying levels of soil moisture, open-forest of Jarraah and Marri is replaced by low open-woodland of *Banksia* spp., such as Slender Banksia, Holly-leaved Banksia and Swamp Banksia (*B. littoralis*), and low open-forest of *Melaleuca* spp. including the paperbark *M. preissiana*, Robin Redbreast Bush (*M. lateritia*) and *M. viminea*.

On the sedimentary geological provinces (the Collie Basin, the Dandaragan Plateau and the Donnybrook Sunkland) the structural characteristics of the vegetation are mostly similar to the adjacent Precambrian regions; but there are very distinctive and unique floristic differences.

The Committee considered the feasibility of reserving rare or threatened plant species.

The Committee recognised the uniqueness of a large part of the flora, and the need to review previous measures taken to preserve it, taking account of pressures, both current and predicted for the future. In sum, a system of reserves is clearly needed to preserve the following sorts of vegetation:-

1. Representative flora of the various geological regions:
 - i) the Swan Coastal Plain. The Committee recognised that the long history of settlement had left few areas of the Plain undisturbed, and that it would hence be possible at best to reserve remnants of the variety of indigenous plant communities, including special attention to the wetland communities.
 - ii) the Darling Scarp and Plateau. Land here is in increasing demand for water supply, forestry, agriculture, mining, recreation etc. Conflicts arise especially in the area of high rainfall.
 - iii) the three other geomorphological regions: Collie Basin, Donnybrook Sunkland and Dandaragan Plateau. Land here too is in demand for forestry, agriculture, mining and recreation.
2. Threatened and rare plant species throughout the region, where it was not feasible to preserve them simply by reserving a whole plant community in which they occur.

The floristics of System 6 show many features of interest. Many of the species are widespread and common; some are locally abundant but occur only within System 6; some have their main distribution elsewhere with isolated populations in System 6; while others are rare and known from few localities.

Plant species restricted to the coastal plain within System 6 include: *Acacia truncata*, *Banksia laricina*, *Boronia purdieana* (typical form), *Brachyloma preissii*, *Conostylis pauciflora*, *Diuris purdiei*, *Dodonaea hackettiana*, *Drakaea jeanensis*, *Eremaea purpurea*, *Grevillea crithmifolia*, *G. obtusifolia*, *Hydrocotyle lemnoides*, *Jacksonia sericea*, *Lysinema elegans*, *Prasophyllum drummondii* and *Stachystemon vermicularis*.

Several species restricted to System 6 occur on both the coastal plain and the Dandaragan Plateau: they include *Verticordia nitens* and *Isopogon drummondii*.

The small legume *Ptychosema pusilla* is known from only one locality, on the Dandaragan Plateau near Gingin.

Species restricted to System 6 and occurring only on the Darling Scarp and Plateau include: *Acacia anomala*, *A. aphylla*, *A. horridula*, *A. oncinophylla*, *Adenanthos teges*, *Agonis grandiflora*, *Anthocercis gracilis*, *Astroloma ciliatum* (erect form),

Beaufortia macrostemon, *Calothamnus rupestris*, *Conospermum scaposum*, *Darwinia pimelioides*, *Diplolaena andrewsii*, *Dryandra praemorsa*, *Eucalyptus laeliae*, *Gastrolobium epacridioides*, *Grevillea drummondii*, *G. endlicherana*, *G. ripicola*, *G. wilsonii*, *Hakea aristata*, *H. myrtoides*, *H. stenocarpa*, *Halgania corymbosa*, *Hibbertia miniata*, *Hibbertia* sp. nov., *Isopogon asper*, *Lasiopetalum cardiophyllum*, *Lhotskya brevifolia*, *Petrophile biloba*, *Synaphea acutiloba*, *S. pinnata*, *Tetratheca nuda*, *T. pilifera*, *T. similis*, *Thysanotus* undescribed, *Thysanotus* sp. nov., *Tribonanthes brachypetala*, *Trymalium angustifolium* and *Verticordia acerosa* (typical form). One of these species - *Acacia anomala* - may already be extinct (Court 1978).

Species with their main area of distribution in System 6 include: *Calytrix glutinosa*, *Darwinia citriodora*, *Diplopeltis huegelii*, *Scaevola platyphylla*, *Thomasia glutinosa*, *Patersonia rudis* and *Schoenolaena juncea*.

Species that have isolated populations in System 6, away from their main areas of occurrence, include: *Actinostrobos acuminatus*, *Avicennia marina*, *Banksia sphaerocarpa*, *Eucalyptus foecunda*, *Gyrostemon ramulosus*, *Lachnostachys albicans*, *L. verbascifolia*, *Pittosporum phylliraeoides*, *Pityrodia bartlingii*, *Stylidium imbricatum* and *S. preissii*.

System 6 supports a rich lichen flora, 105 species having been recorded. There is a great range of habitats and substrates, from the coastal limestone to granitic outcrops. These lichens play an important role in vegetational succession on rock outcrops. Some species are widespread and common, e.g. *Xanthoria ectanea* and *X. parietina*. Others are rare, including *Parmelia notata*, known only from Snake Rock, and a new species of *Buellia*, from Snake and Sullivan Rocks. Several species common elsewhere are rare here, for example *Verrucaria maura* (a marine lichen), *Ephebe lanata* and *Spilonema paradoxum*. The granite outcrops of the Darling Range are especially important for their populations of lichens.

Fauna

Animals are ultimately dependent on plants. The Committee has therefore taken the general view that if the various vegetation complexes and plant species of System 6 are adequately conserved then the animals that depend on them will also be conserved. This view is, of course, an oversimplification; and special consideration must be

given to some species and groups of animals. Water-birds, for example, require a range of different wetlands in different parts of the south-west, since many species breed inland and spend the summer on coastal lakes and estuaries.

Data on the distribution of many animals, particularly invertebrates, are limited, and in the absence of detailed information the assumption that animals will be conserved if adequate areas of the various plant formations are protected must be made.

Appendix II gives the conservation status of mammals, birds, reptiles, frogs and Principal and Secondary fresh-water fishes that occur, or occurred, in the System. Where a species is restricted to System 6, or is rare both within System 6 and elsewhere, the Committee made a special examination of its conservation status and habitat requirements to see if reservation were necessary. Notes on the rare species will be found in the Appendix.

The appendix lists 378 vertebrates includes 42 species of mammal, 235 species of bird, 76 species of reptile, 16 species of frog and 19 species of fish. Of these, 5 species of mammal, 5 species of bird and 6 species of freshwater fish have been introduced by Europeans.

Although there are a number of vertebrates that are endemic to the south-west of Western Australia there are only two species, both reptiles, which are restricted to System 6: the Western Swamp (or short-necked) Tortoise (*Pseudemydura umbrina*) and the Lined Skink (*Lerista lineata*).

The number of invertebrate species is very much greater than the number of vertebrates. The lack of knowledge, however, of both the taxonomy and distribution of many species precludes their listing.

SPECIAL CONSIDERATIONS

Apart from seeking to establish a representative system of reserves for flora and fauna, the Committee gave special consideration to certain features and kinds of locality which were thought to have particular value and particular problems. These were: the Darling Scarp, Coastal land and offshore islands, wetlands, road verges, geological sites and areas of attractive scenery.

The Darling Scarp

The Darling Scarp is the dominant physiographic feature of System 6. It is a granitic escarpment facing west and aligned almost due north-south. It is prominently developed for a distance of about 200 km, between Muchea in the north and Dardanup in the south, and is most conspicuous immediately to the east of Perth, where it rises abruptly to a maximum height of about 300 m and forms the western edge of the great plateau of the Yilgarn Block.

The Scarp is scenically important both for its views across the coastal plain and conversely as seen from the plain. Further, as discussed in the introductory section on Flora, it supports vegetation and plants found nowhere else even within the South West.

A proposal has been made to build a scenic drive along the Scarp east of Perth. However, there are strong reasons why it should be dropped. There are already numerous points accessible to vehicles along the Scarp. Major roads pass up Red Hill, Greenmount, Kalamunda Hill, the Crystal Brook valley, Mills Road valley, Roleystone and Bedfordale. Lesser roads provide access to the Helena Valley, the Zig Zag, Lesmurdie Falls, Bickley valley and Canning Hills Road, while views across the coastal plain are also obtained from roads in Swan View, Kalamunda, Lesmurdie, Gosnells and Armadale. Already there are significant detractions from the natural attributes of the Scarp. The earth-works needed for a new scenic drive would be extensive and would add a further scar throughout the length of this part of the Scarp. There would be great destruction of native flora, a disruption of fauna, and a high risk of erosion.

Roads should be excluded entirely from two valleys which are still relatively undisturbed. These are the valley south of Crystal Brook and the Ellis Brook valley. No further roads should be constructed in the Bickley valley and the Mills Road valley. These valleys and other sections of the Scarp are included in the proposals elsewhere in this Report (E.6, E.10 and E.15).

RECOMMENDATION

- R.1 The Committee recommends that no scenic drive be constructed along the face of the Darling Scarp.

Coastal Land and Offshore Islands

In its *Guidelines for an environmental protection policy on the coastal zone in Western Australia* (Environmental Protection Authority 1977) the E.P.A. defined the Coastal Zone as extending seaward to the 30 m depth contour line and inland 1 km from high-water mark. The guidelines acknowledged that this definition would probably require extension to islands, tidal estuaries, reefs, salt marshes and fragile dune systems; the Committee supports the idea except where it is more convenient to treat these areas as part of the river systems or established reserves.

Parts of the Coastal Zone have already been drastically altered by industrial developments, such as port installations, and by residential and recreational constructions. The foreshores are used for a variety of aquatic activities, both commercial and recreational, such as bathing, surfing, fishing and boating. The great popularity of these pursuits, and the increased incidence in recent years of off-road vehicles, has brought the sand dunes, which form an important natural protective barrier and wildlife habitat, under heavy pressure. The vulnerability of the sand dunes in the Coastal Zone is increased because, like river foreshores, the ratio of perimeter to area is generally high.

The E.P.A. has proposed the appointment of a Coastal Resource Planner with staff and a Coastal Planning Committee to advise on and co-ordinate the management of the Coastal Zone. While the Committee agrees that the zone's foreshore reserves and other existing reserves should be extended it also believes that legal reservation must be backed by physical protection and controlled access, which are costly measures.

Islands off the coast share many of the problems of the mainland Coastal Zone. Access to the larger habitable islands and activities on them can, however, be brought under control.

The absence from the islands of mainland predators has enabled certain marsupials to establish significant populations: the Quokka on Rottnest Island and the Tammar on Garden Island. The islands also support breeding colonies of sea birds. Sea Lions use Carnac Island and other islands as resting places.

In the past, protection of coastal land and offshore islands by reservation, co-ordinated management by government and local authorities and the provision of advice and assistance by Government Departments such as Conservation and Environment, Public Works and Agriculture have received a large measure of public support; the same means are supported by this Committee.

Wetlands

In addition to estuaries and marine embayments, wetlands may be divided into two main kinds: (i) streams and rivers; (ii) swamps and lakes. Both kinds have been greatly altered from their natural condition.

Much waterside vegetation has been cleared, or else modified by various human activities or, in rural areas, by grazing and trampling by stock. The river systems of the Swan-Avon, Murray, Collie and Blackwood have become progressively more brackish (Peck and Hurle 1973). Swamps and lakes have been severely modified, some to the extent of destruction. Apart from some original fresh-water bodies now being saline, polluted or affected by eutrophication, an alarmingly high proportion has been destroyed by landfill or drainage. The predicted expansion of Perth, and the associated demands for water, recreation, etc., will put increasing pressure on the remaining wetlands.

The Wetlands Advisory Committee, set up by the E.P.A., recommended in its report (1977) that the remaining wetlands should be protected and conserved, and unless adequate representatives are preserved, certain species of flora and fauna must inevitably be lost. Even considerably disturbed wetlands are important as drought refuges for water-birds and breeding grounds for tortoises and other aquatic animals.

Wetlands are scenically important and provide centres of interest in parks and landscapes. A wide variety of recreational activities is carried on in or around wetlands: fishing, feeding the birds, shooting waterfowl, picnicking, boating and water-skiing; not all of them are compatible with each other or with wildlife conservation.

The extraction of peat, minerals (including sand, clay, gypsum, diatomite and salt) and of water itself conflicts with recreation and wildlife conservation. Extractive industries are seldom compatible with other uses, but are not necessarily always adverse in the long term: the deepening of wetlands and a reduction in (but not total elimination of) vegetation improves their value for water sports and as drought refuges for birds, thus in some measure counteracting the probable lowering of the water table by the pumping of water from bores for public supplies.

The recharging of wetlands must be included among the legitimate uses of bore-water, despite the urgency of water conservation.

The Committee endorses the recommendations of the Wetlands Advisory Committee, in particular that as many wetlands as possible should be reserved, that in each case the reserve should contain the water, the fringing vegetation and a buffer zone, that funds should be provided to fence these reserves and that stock should be watered by pumping water outside the reserve or by strictly limiting and controlling their access. Access by the public may also need to be regulated.

The use of wetland reserves for conservation of flora and fauna, or as parts of National, Regional or Urban Parks should be encouraged. Wetlands reserved for the conservation of flora and fauna contribute to the landscape, and recreation of low impact is often also compatible. Conversely, water-birds can use wetlands primarily set aside as features in landscape parks or for recreation, especially if these wetlands are large enough to be zoned.

After mining, wetlands may be used as areas for recreation or as landscaped parks.

The *Guidelines to the conservation and management of wetlands in Western Australia* (Department of Conservation and Environment 1977 (a)) should be consulted when management programmes are being established for new or old wetlands; particular problems should be referred to the Department for their advice. Midges and mosquitoes, for example, may give rise to conflict between the aims of conservation and of recreation. That problem may be solved by the adjustment of water levels and flow rates, or it is possible to use suitable insecticides in approved ways without undue risk to fish or wildlife.

The Committee has recommended as many wetlands as possible for reservation as complete units either vested in one authority or jointly in two authorities for one purpose, although subsidiary uses should be encouraged where they are consistent with the primary purpose.

Conservation of Flora on Verges

Road and railway verges are often important for conservation of flora and fauna, for their scenic qualities and for safety. They may also be used as easements for electric cables, telephone lines, gas pipes and water pipes. Besides pressure from these uses, the flora on road verges may be cleared for firebreaks or for road widening and is further threatened by frequent burning, weed infestation, herbicides and insecticides. The microhabitat may be altered by the increase of sunlight and wind, by water runoff from roads and by the drift of fertilisers. These tend mainly to reduce the plant cover and eliminate species, leading to the degradation of verges to weed strips.

Although many verges have become degraded beyond the point of usefulness to conservation, there are still many that are important. Examples occur along the major roads leaving Perth, along coastal roads and those in the Darling Range, and along the railway line between Mooliabeenee and Mogumber. The case can be extended to cover verges throughout the State.

Rare species of plants may grow on verges, for example the Orange Hibbertia (*H. miniata*) near Bindoon, a fringed lily (*Thysanotus glaucus*) at Forrestdale, an unnamed variety of Cat's Paw (*Anigozanthos humilis*) at Mogumber, and a Grevillea (*G. monticola*) on the Brookton Highway.

Some of the problems can be reduced by:

1. wider verges in areas where new roads are planned;
2. offset roadways in road reserves: the siting of a road on one side of the reserve leaves a wider verge that is better able to resist weed infestation and damage from fertilisers and herbicides; the marginal road also doubles as a firebreak on that side;
3. firebreaks sited outside the verge where possible;
4. infrequent burning of verges;
5. power, telephone and water lines constructed so as to cause the least disturbance, or siting outside the verge;
6. mechanical control of plants likely to affect overhead power lines, etc.;
7. consultation between the relevant authorities.

In these respects the Committee endorses recommendations made by the Road Verges Committee and adopted by the Government in 1971.

The Road Verges Committee does not have the means to implement its recommendations. The Committee believes that a service should be set up to carry out research on road verges and small reserves and their management. Such a service would also be available to local authorities in managing small reserves under their control. A recommendation to set up a Flora Research and Conservation Advisory Service is made in the Section on Regional Parks, Urban Parks and Small Reserves. Meanwhile, those administering such areas should consult the Department of Conservation and Environment.

Geological Sites

The W.A. Sub-committee of the Committee of National Parks and Nature Reserves of the Australian Academy of Science (1962) reported that 24 sites containing geological features should be protected. These were type sections of geological formations, important features that are used for the teaching of geology, and unique geological features of special scientific interest.

The Conservation Through Reserves Committee (1974) wrote:

"It is clear that the number of sites known to the Sub-committee could now be increased many times but the Conservation Through Reserves Committee does not have this information at present.

Moreover, the preservation of geological sites presents special problems of reservation and management. Some sites have deteriorated and, in a State with important geological resources, the preservation of principal reference features is urgent.

Sites such as fossil localities are particularly vulnerable to over-collection and the Conservation Through Reserves Committee takes the view that the Environmental Protection Authority should obtain information from a special committee to enable action to be taken."

Consequently, the Conservation Through Reserves Committee recommended that the Environmental Protection Authority seek the approval of the Minister for Mines for a committee to be set up with representatives from the Mines Department, tertiary education institutions, learned geological societies, the Western Australian Museum and commercial mining interests. The Committee pointed out that the Director of the Geological Survey Branch, Department of Mines, would be an appropriate Convenor, and recommended that the task of the proposed Geological Sites Committee should be to:

- i) prepare an inventory of geological sites in Western Australia which merit protection;
- ii) allocate priorities for the preservation of the sites;
- iii) review legislative provisions and recommend new legislation if necessary;
- iv) advise on management technique and the appropriate authority to control geological reserves where these are not already contained within national parks and reserves and protected thereby.

The Committee endorses the Conservation Through Reserves Committee's recommendations regarding geological sites, and, furthermore, stresses that the formation of the proposed Geological Sites Committee is a matter of urgency.

Landscape Conservation

A number of submissions urged the protection of landscape, including areas of attractive scenery, both natural and man-made, where most of the land is privately owned.

RECOMMENDATION

- R.2 The Committee recommends that the Environmental Protection Authority investigate the subject of landscape conservation independently of the establishment of an adequate system of conservation reserves.

LAND USE

The Committee has taken the view that wherever possible new conservation reserves and national parks should be in land not already alienated, such as vacant Crown land, State Forest, or existing reserves with a variety of vestings and purposes. The degree to which land is already committed to uses other than reservation has imposed a major constraint on the Committee's selection.

Half of System 6 is uncleared (see Fig.), and therefore appears to offer considerable opportunity for reservation. However, it must be remembered that a good deal of the uncleared land has been much altered from its virgin condition through logging and other activities and through repeated fires. Furthermore, a large proportion is committed to State Forest Water Supply Catchments; these occupy an almost continuous block of land east of the Darling Scarp and south of the Perth - York Road. There is, of course, a considerable degree of compatibility between water supply, limited timber production, National Parks and recreation.

Significant areas of uncleared land on the coastal plain are hard to find, owing to urbanisation and extensive clearing for agriculture both with and without irrigation. Appreciable areas of State Forest north of Perth have been converted to pine plantations. Moreover, forest management and conservation must be reconciled with the management of underground water resources.

Urban Development

Although System 6 encompasses more than just the Perth Metropolitan Region, the latter is a major portion of System 6. The direction and size of Perth's growth affects both Perth itself and the rest of System 6. The State Treasury estimates a population of 1 405 000 for the Perth Metropolitan Region by the year 2000.

The future expansion of Perth is planned to take place in corridors (Fig.), which are intended to provide easy access to the countryside for the urban dweller and to help control urbanization. Four growth paths (corridors) are envisaged; the two main corridors, in terms of capacity for both population and industry, are the South-West and the North-West corridors. By the year 2000, the corridors are expected to carry a total population of 1 020 000, with the South-West Corridor having 370 000 people, the North-West Corridor 300 000, the Eastern Corridor 130 000 and finally the South-East Corridor with 220 000 (T.S. Martin and Associates 1974, Table C8).

Between these corridors lie the green space or non-urban wedges. These wedges should provide an opportunity for conservation in the general sense. Reserves established in these non-urban areas would appear to present fewer management problems than those in the urban corridors themselves, and thus where reserves are of a fragile nature they will stand a better chance of survival if located in the wedges.

Mining and Quarrying

Mining is an important industry in System 6. Bauxite deposits are at present extracted at Jarrahdale and near Pinjarra, and more extensive developments have been predicted. The State's only productive coalfield lies in the Collie-Muja Basin, near the southern boundary of System 6, and tin is mined from deep leads at Greenbushes. Quarrying is most intensive in the Perth Metropolitan Region and adjacent areas. Crystalline rocks and shales are extracted along the face of the Darling Scarp, clay pits are worked principally in the Guildford district, and Pleistocene deposits provide a source of sand, clay, limestone and diatomite in coastal areas.

The Conservation Through Reserves Committee discussed, in the Introduction to their report (C.T.R.C. 1974), the relation of mining to environmental conservation. They took the view that most mining activities, if appropriately controlled and managed, were less destructive of the natural environment than certain other forms of land use, such as agriculture and intensive forestry. Modern deep-mining operations, for example, may have virtually no permanent destructive effect on natural ecosystems. Large-scale open-cut mining and quarrying are disruptive locally, although their environmental impact can to some extent be predicted and controlled. However, shallow strip-mining, which is used when the resource is concentrated in a thin superficial zone, creates much greater ecological problems, chiefly because of the large lateral extent of the operational areas. This is the technique used to recover bauxite from lateritic deposits in the Jarrah forest regions of System 6. A re-planting programme controlled by an interdepartmental committee is being carried out at present. However, there is no prospect at present of restoring the original vegetation in areas that have been stripped for bauxite. For this reason it is imperative that adequate reserves be set aside to conserve representative examples of existing biological communities, especially of the unique Jarrah forest.

Apart from the areas already being mined, tenements under the Mining Act and the Special Agreement Act are held over much of System 6; the largest is Mineral Lease 1SA, which covers 1 880 836 ha and is held by Alcoa of Australia for bauxite extraction. Other mineral claims embrace bauxite

in the Darling Range, heavy mineral sands at Bunbury, Pinjarra and Gingin, tin near Greenbushes and vanadium near Wundowie. Coal-mining leases are held in the Collie and Wilga areas and Petroleum Tenements are in force over the whole of that area of System 6 lying west of the Darling Scarp. Extractive Industries Licences, which govern quarrying and similar activities, are issued by local authorities under the Local Government Act.

In its recommendations on Conservation Reserves (Systems 1, 2, 3, 5), the Environmental Protection Authority (1976) expressed the view that the existing legal rights of industries over areas of Crown land must be accepted. For this reason the Authority excised from its recommendations on reserves all areas subject to mining and petroleum tenements.

Some rationalisation should be possible in the realistic implementation of the EPA's policy. Most mining tenements are never developed and may be held for many years, or traded or exploited in part only. Meanwhile their biological characters are liable to deterioration or destruction as a result of lack of management. If any such areas have qualities that merit their reservation as conservation reserves they should be managed with this ultimate purpose in mind. To achieve this they should be placed under the control of the appropriate conservation authority. This body would then act jointly with the holder of the mining or petroleum tenement to formulate a management programme designed to reconcile exploration and development for mining with conservation.

The Committee recommends later in this report that Special Management Priority Areas specified in these proposals be exempted from mining.

RECOMMENDATIONS

The Committee recommends that:

- R.3 proposed areas for conservation reserves that are subject to mining or petroleum tenements be placed under the control of the appropriate conservation authority;
- R.4 the conservation authority and the holder of the tenement formulate management plans for those areas.

Water Supply Catchments

The bulk of the water currently utilized in the southern portion of Western Australia comes from catchments situated within System 6, whence it is piped to the eastern goldfields, the northern and central wheatbelt, the metropolitan area and the coastal plain south of Pinjarra. The water resources of System 6 are therefore of key importance to the entire southern half of the State; most of them are already utilized.

There are two sources of water: surface run-off from the plateau country; and ground water stores under the coastal plain. On the Darling Plateau, the quantity of water yielded per unit area generally decreases eastward from the Darling Scarp, reflecting a decrease in rainfall and a flattening out of the landscape. The quality of water also deteriorates in the east owing to increasing salinity (Dimmock, Bettenay and Mulcahy 1974). Salinity is increased by the replacement of indigenous vegetation, which is perennial and woody, by introduced pastures or cereal crops (Peck and Hurle 1973); in the major Wellington Catchment further clearing of wooded land has been subjected to stringent controls, and restrictions on land use also apply in the catchments supplying the metropolitan area. In this way, catchment protection, which affects much of the total area of System 6, fosters the conservation of flora and fauna. On the other hand, the flooding of valleys for storage reservoirs will adversely affect the flora and fauna, as will the extraction of groundwater under the coastal plain if it lowers the water-table.

In its Red Book dealing with Systems 1, 2, 3 and 5, the EPA (1976) recognised the importance of the water resource. The principles established were that:

- a) responsible management of water for the total benefit of the region is of paramount importance;
- b) when new reserves and forests are proclaimed, water use must be listed as one of the purposes where appropriate;
- c) proposals to exploit a water supply must include environmental assessment and provision for later review of the effect on the environment.

Off-road Vehicles

Off-road Vehicles involve an example of a new, recreational form of land use, of extreme impact on the environment.

In this report, the term Off-road Vehicle (ORV) refers to any vehicle being used elsewhere than on a public road, whether or not the vehicle has been specifically designed for such use. The Committee considered the use of ORVs for recreation.

The increasing popularity of the sport, the use of suitable planned venues, and the characteristics of ORVs and their mobility create problems that have received wide attention throughout Australia in the news media, in publications and at seminars and public inquiries. The problems arise from the physical and social effects of ORVs.

Physical effects are:

1. damage to the vegetation: plants are knocked down and destroyed; tracks are formed and as a consequence no plant regrowth occurs;
2. damage to the soil - through compaction, churning, destruction of vegetation, leading to erosion;
3. spread of weeds: seeds are caught up in mud on vehicles, in radiator grilles or beneath vehicles, and dropped elsewhere;
4. damage to fauna: soil microfauna and ground-dwelling animals are killed, and all fauna disturbed.

Social effects are:

1. noise: many ORVs are extremely noisy and disturb people such as residents nearby, bush-walkers, bird-watchers, etc.;
2. dust -owing to soil disturbance in dry weather: it affects nearby residents as well as adjacent vegetation;
3. danger to other people in the area: the risk of injury to bush-walkers, horse-riders, etc., is high.

Advertisements for ORVs constitute a further problem, as they have projected an image of 'bush-bashing' vehicles, pitting 'man against nature'.

In System 6 the impact of ORVs is especially severe. The areas desired for use by ORVs often coincide with some of the most ecologically fragile areas. Large tracts of coastal dunes, especially within and near to Perth, have increasingly been used by ORVs. Frequent use of dune areas can result in increasingly large blow-outs, and restoration measures have commonly been ruined by continued use. Areas of the Darling Scarp and State Forest are also frequently used.

ORVs contribute to erosion and to the spread of the dieback disease, caused by the root-rotting fungus *Phytophthora cinnamomi* which is transported in soil picked up by vehicles (DCE 1976(b)).

The indiscriminate use of ORVs has caused considerable deterioration of the vegetation generally in the tracts of semi-wilderness near or within the urban areas.

Moreover, since 80% of W.A.'s population is concentrated in System 6, ORVs interfere with people much more severely than in other parts of the State. In the forest, the sight and sound of ORVs, or even the unexpected sight of vehicle tracks, detracts greatly from the visitor's experience of a "virgin forest" and hence reduces the value of the forest to him/her for recreation. All the social effects listed above are intensified.

Thus from the stand-point of conservation, it is easy to make a case for banning ORVs altogether from the coastal, forest and semi-wilderness areas, not only in System 6 but in the whole of Western Australia. The Committee, however, considers that that is not the solution, as ORVs offer a valuable form of recreation and have been established in Western Australia for a number of years.

The Committee therefore supports the concept of controlled use of ORVs, which underlies a bill currently before the State Parliament. This law will:

1. require all ORVs to be registered;
2. ban ORVs from all public land (reserves, vacant Crown land, forests, etc.);
3. provide for the setting aside of ORV areas in which their use is allowed, the choice of areas to be made by a special advisory committee, which will include representatives of ORV users;

4. impose on the vehicles standards of safety and restrictions on noise;
5. allow exemptions for special classes of user, for example paraplegics, and provide for the traversing of prohibited areas by authorised groups for special purposes at the Minister's discretion;
6. provide for enforcement by police, the Road Traffic Authority, park rangers, forestry officers, Shire rangers, etc.

The proposed law has been discussed with user groups and at a Seminar held at the University of Western Australia (DCE 1976(a)).

The Committee regards the protection of public land and the creation of special areas for ORVs as essential aspects of the proposed law. The Committee also considers that the user groups should not only assist in the selection of areas but should also be involved in the management and restoration of the areas chosen.

The Committee endorses the principles contained in the proposed Off-road Vehicle law.

RECOMMENDATIONS

The Committee recommends that:

- R.5 the proposed Off-road Vehicle law provide for groups that use Off-road Vehicles to be involved in the management and restoration of areas selected for Off-road Vehicles;
- R.6 the proposed Off-road Vehicle law not inhibit the use of Off-road Vehicles for purposes connected with work, such as mining, agriculture, construction, scientific research, etc., though in compliance with certain conditions;
- R.7 the Department of Conservation and Environment and the Department of Local Government conduct an educational campaign aimed to make users of Off-road Vehicles more aware of the effect of their vehicles on the environment, and take steps to discourage harmful advertising of Off-road Vehicles.

Fig.

CURRENT LAND USE IN SYSTEM 6

Area	Km ² †	% System 6
System 6	26 000	100
Uncleared* (includes alienated land)	13 000	50
Water catchments*	12 000	46
State Forest*	10 000	38
Vacant Crown land (1974)	400	1.5
Main reserves and National Parks	50	0.2

* there is a large degree of overlap among these categories.

† 1Km² = 100 ha

TYPES OF RESERVES

National Parks

National Parks are established as the reserves under the Lands Act for, to quote the long title of the National Parks Authority Act, "the conservation of the natural environment, the preservation and enhancement of natural beauty, and the provision of access and facilities for public recreation".

National Parks are vested in and managed by the National Parks Authority, established under the National Parks Authority Act, 1976. This Authority is the successor of the former National Parks Board, appointed under the Parks and Reserves Act in 1953, which in turn succeeded the State Gardens Board, established in 1920.

To merit consideration as a National Park, an area of land (or land and water) should fulfil the following criteria:-

- i) It should be outstandingly beautiful, interesting and/or diverse in natural features.
- ii) It should be big enough to allow continuous and effective management of the plant and animal communities to be combined with public use.
- iii) It should be capable, under appropriate management, of offering a wide range of opportunities for non-urban enjoyment, with the proviso that the necessity to preserve its natural features takes precedence over such activities.
- iv) It should be compact enough in shape (that is, its ratio of boundary length to area should be low enough) to withstand the deleterious effects of incompatible neighbouring land use.

The natural features mentioned in (i) above could be:-

- examples of scenic beauty;
- ecological communities illustrating the characteristics of a physiographic system;
- habitat that supports a unique, outstanding, concentrated, rare, endangered or relic flora or fauna;
- outstanding geological formations or features that illustrate geomorphic processes or natural phenomena;
- substantial fossil evidence of the development of life on earth.

The 10th formal Assembly of the International Union for Conservation of Nature and Natural Resources held at New Delhi in 1969 approved a definition of the term "national park" in the following terms:

- 1) where one or several ecosystems are not materially altered by human exploitation and occupation, where plant and animal species, geomorphological sites and habitats are of special scientific, educative and recreative interest or which contains a natural landscape of great beauty; and
- 2) where the highest competent authority of the country has taken steps to prevent or eliminate as soon as possible exploitation or occupation in the whole area and to enforce effectively the respect of ecological geomorphological or aesthetic features which have led to its establishment; and
- 3) where visitors are allowed to enter, under special conditions, for inspirational, educative, cultural and recreative purposes.

(From 1975 United Nations List of National Parks and Equivalent Reserves).

State Forest, Special Management Priority Areas and Forest Parks

State Forest occupies a high proportion (38%) of the total land area within System 6. This is particularly so in two sectors on the Swan Coastal Plain north of Perth, and in the Darling Range south-east from Perth. The importance of State Forest is heightened by the fact that in many districts it is virtually the sole remaining unalienated land. The Forests Department of Western Australia, which is the largest land manager within System 6, has recognised its responsibility to perpetuate natural ecosystems under its control and has provided a network of Special Management Priority Areas (S.M.P.A.s) to ensure this, the management priority being the conservation of flora and fauna. The selection of these areas was based on ecological surveys, and on consideration of the main factors threatening the survival of native flora and fauna, in particular the dieback disease caused by the fungus *Phytophthora cinnamomi* which affects a large number of forest species.

Whenever possible the S.M.P.A.s comprise a central core area and a surrounding buffer zone. Exploitation and mechanised access are prohibited in the core to prevent the introduction of dieback disease; they are permitted in the buffer zone, but only under close supervision so as to minimise any adverse effects.

The specifications for a Forest Park developed by the Environmental Protection Authority (1976) are the same as the Forests Department's management specification for the cores of the S.M.P.A.s. In order to reconcile these concepts, the Committee recommends that the cores of S.M.P.A.s be designated Forest Parks. S.M.P.A.s are not all for conservation of flora and fauna. They are also set aside to give protection to ongoing research programmes in the fields of hydrology, fire ecology and pathology where special management of an area is required over a long period, or to retain areas of exceptional value for outdoor recreation, in particular along major rivers. State Forest and the included S.M.P.A.s and Forest Parks cannot be alienated except with the approval of both Houses of Parliament, and have the added protection that their management is prescribed by Working Plans, which are subject to approval from the Governor in Council. The principles governing the management of State Forests are embodied in the Forest Act 1918-1976.

The concept of Forest Park developed by the EPA (1976) has been defined as follows:

"We suggest that a 'Forest Park' should be an area of forest which is kept unavailable for the commercial production of timber, except in the ordinary course of forest management and to such limited extent as would enable the Conservator for the betterment of the park to cut and remove timber for the purpose of tree regeneration, in any areas containing trees which have been damaged or which have deteriorated through age, fire or disease."

The Authority further recommended that the Conservator of Forests should continue to have the care and management of Forest Parks, and that they should be devoted to such purposes as the preservation of flora and fauna and the preservation of forest, both for silvicultural study and research and for its aesthetic and scenic value. The Conservator should also be empowered to set aside areas of Forest Park for the purpose of recreation, and to grant leases for the provision of tourist facilities.

In order to ensure that the Forest Parks would be managed in accordance with this concept, the EPA further recommended: "... that the Forests Act should be amended to provide that the provisions of a Working Plan, so far as it relates to a Forest Park, shall be deemed and take effect as if it were a regulation and so be unalterable, except in the manner required in the Interpretation Act for the amendment of regulations made under an Act of Parliament".

That would provide an opportunity for the Houses of Parliament to reject any planning provisions they considered inappropriate, and thus would place Forest Parks under the scrutiny of Parliament.

Recognizing the need for future investigation and possible development of water resources, the EPA added a rider that, when Working Plans for Forest Parks are being drawn up, the possible future utilization of water resources should be considered, in full consultation with the Director of Engineering of the Public Works Department. There is a parallel situation with some other forms of land use within System 6. The area is traversed, for instance, by a number of major power lines, linking the power-generating centre at Muja with the metropolitan area and the regional centres; the question of whether power lines should run through National Parks, Nature Reserves and Forest Parks therefore requires resolution. Similarly, although the Working Plans secure Forest Parks from timber-felling by the Forests Department they afford no protection against the mining of bauxite, which is covered by special Acts that override the Forests Act; it is therefore imperative that the security of Forest Parks with respect to the exploitation of mineral resources be clarified.

In this report the Committee endorses a number of the Forests Department's proposals for Forest Parks in the Darling Range and elsewhere. Wherever possible, areas have been selected so as to preclude conflicts with economic uses of the forest. However, a fully representative system of Forest Parks in the Darling Range must of necessity include some areas that contain minable bauxite. There is obviously little point in excluding commercial forestry from these areas if they are to be damaged by some other use, such as bauxite mining or the construction of major roads or power lines.

Areas of State Forest set aside to conserve flora and fauna or for research or recreation are not restricted to S.M.P.A.s. The Forests Department also provides picnic and lookout spots and walking-trails throughout the forest as a whole. The conservation of flora and fauna likewise, takes place throughout the State Forest, though outside the S.M.P.A.s it does not have the same priority.

RECOMMENDATIONS

The Committee recommends that:

- R.8 the cores of Special Management Priority Areas be made Forest Parks;

R.9 the Environmental Protection Authority take whatever action is necessary to prevent damage of Forest Parks and other conservation reserves by incompatible forms of land use such as the construction of major roads or power-lines, or mining.

Nature Reserves

A Nature Reserve is an area of Crown land, which has been declared a reserve under the Land Act, 1933, for the conservation of flora, or of fauna, or of both.

Nature reserves may be set aside for a number of reasons, for example:

1. to preserve areas of unaltered natural ecosystems in order to conserve the animals and plants of that region and to provide areas for scientific research;
2. to protect the habitat of a rare or endangered species of plant or animal;
3. to protect breeding colonies of birds or other animals such as seals;
4. to protect areas of special scientific interest, for example where a plant or animal occurs outside its normal range or where there are unique or unusual assemblages;
5. to provide areas where people can see what the countryside looked like before European settlement;
6. to provide areas which people can visit to watch birds, photograph wildflowers, etc.

Many nature reserves are vested in the Western Australian Wildlife Authority. This Authority may, with the approval of the Minister for Fisheries and Wildlife, classify part or the whole of a nature reserve as "limited access area", "shooting or hunting area" or "prohibited area". Only in a very few cases has the Wildlife Authority prohibited public access to reserves, for example, part of the Two Peoples Bay Nature Reserve, where the Noisy Scrub Bird breeds, and Dorre Island which harbours a number of extremely rare animals.

Regional Parks, Urban Parks, and Small Reserves

Areas termed 'parks' or 'reserves' vary greatly in size, purpose and managing authority in which a reserve may be vested or by which a park may be owned. In order to avoid confusion, it is desirable to restrict the use of the term 'National Park' to those actually vested in and/or managed by the National Parks Authority.

It is necessary, therefore, to find another term to describe parks that are comparable in purpose to National Parks but which are managed by, and either owned by or leased to or vested in other authorities. The term 'Regional Park' is used here, albeit without any official definition, sometimes emphasising conservation of the landscape, sometimes recreation. Most of these Regional Parks have or will have several purposes, incorporating:

- (i) conservation of the landscape, often including bushland and/or wetland, thus contributing to the conservation of the flora and fauna or, in the case of wetland, at least providing summer refuges for water-birds; and
- (ii) artificially landscaped or developed areas with provision for recreation mainly of an informal or passive character of low impact on the environment.

Existing or proposed examples include Kings Park; the extended Bold Park including the Perry Lakes; the Cockburn Lakes; and the coastal strip in the Shire of Wanneroo. The term "Regional Park" indicates that these parks are expected to attract visitors from further afield than the immediate locality.

There is no sharp distinction between regional parks, urban (including suburban) parks, and other small reserves serving purely local needs of those within walking distance. Although serving several purposes, the last are usually smaller than regional parks. In general their major role is to cater to recreation, and they have often been more intensively developed by horticultural landscaping to provide either camping and parkland areas or playing-fields for formal sports. In some cases, however, these reserves provide important habitats for fauna and support remnants of native flora, including rare species. For instance, reserves such as that at Shenton Park include lakes that are important refuges for water-birds and breeding-sites for tortoises. Rare species of plants, such as the aquatic herb *Hydrocotyle lemnoides* at Ellen Brook and the unnamed clawflower (*Calothamnus* sp.) at Kenwick Swamp, are often contained in small reserves.

Although the formation of new urban parks and small reserves falls outside the terms of reference of this Committee, the Committee has nevertheless recommended that the opportunity to conserve these remnants of native flora and to provide wildlife refuges be drawn to the attention of the authorities in which these reserves are vested. In some cases the Committee has

also recommended that replanting of species native to the area be undertaken and/or that special management plans be drawn up.

The Committee recognises, however, that at present there is neither the provision of nor the means to provide advice on the management of native flora in regional parks, urban parks and small reserves. For this reason, the Committee considers that (1) the Environmental Protection Authority should draw up guidelines for the conservation and management of regional parks, urban parks, and small reserves, and (2) a Flora Research and Conservation Advisory Service be set up under the control of the Western Australian Herbarium, to which requests for advice on management and conservation of native flora may be referred by the Department of Conservation and Environment.

Such a service would carry out research on the flora not only of these parks and small reserves but also on road and railway verges and easements. As mentioned in the introductory section Conservation of Flora on Verges, these small areas are often important for conservation, but research is needed to determine the important areas and how they should be managed.

The Committee also considers that the Parks and Reserves Act 1895-1972 should be reviewed with respect to the purpose and management of regional parks, urban parks and small reserves. At present the Act applies to most Regional Parks and Urban Reserves, because either the Park is administered by a Board appointed by the Governor under the Act, as for example Kings Park, or because Section 310 of the Local Government Act confers on Councils the powers of Boards with respect to reserves vested in them. The Parks and Reserves Act is in need of revision in certain respects when compared with more recent legislation such as the Environmental Protection Act 1971-1975, the Wildlife Conservation Act 1950-1976 and the National Parks Authority Act 1976.

The deficiencies of the Parks and Reserves Act concerning the powers of authorised persons to enforce the by-laws for the protection of parks may be resolved by legislation reintroduced into Parliament. Compared with the other Acts mentioned and other Acts dealing with the constitution, powers, responsibilities and duties of public bodies, the Parks and Reserves Act is deficient in that it does not specify the number of Board members, their term of office or that any of them should be appointed to represent any specific areas of expertise or public interest. There is no definition of the powers and duties of chief executives for the Board or managing authority and no requirement to prepare a management programme for each reserve vested in it (c.f. National Parks and Wildlife Authorities).

The Parks and Reserves Act contains anomalies:

- (i) Section 5(1) (c), elaborating the general powers of Boards, empowers them to do all such things as are calculated to adapt such parks and reserves to the purposes of public recreation, health and enjoyment; conservation is not mentioned. The only mention of it is made in section 8(i), which lists the following among the purposes for which by-laws may be made: the management and conservation of the park land and reserves, including zoological gardens; and "Prohibiting damage or injury to and destruction of trees, shrubs, plants and flowers in the park lands and reserves";
- (ii) Section 5(1) (d) empowers Boards to "Establish and maintain zoological gardens therein"; curiously enough it does not mention botanic gardens. The Zoological Gardens have operated under a separate Act since 1898, which was revised in 1970, whereas the Western Australian Botanic Garden in Kings Park is administered under the Parks and Reserves Act, and its legality has in consequence been challenged - albeit unsuccessfully - on that ground. These examples must suffice in the present context.

RECOMMENDATIONS

The Committee recommends that:

- R.10 the Parks and Reserves Act 1895-1972 be either (1) revised, or (2) replaced by specific acts that relate individually to the main parks and reserves administered under the present Act, plus amendments to the Local Government Act to provide the necessary powers to local authorities;
- R.11 the Environmental Protection Authority draw up guidelines for the management of regional parks, urban parks and small reserves;
- R.12 a Flora Research and Conservation Advisory Service be set up under the control of the Western Australian Herbarium, to which requests by vesting authorities on the management and conservation of native flora may be referred by the Department of Conservation and Environment; such a service should also undertake research into the conservation of road and railway verges and easements.

Aquatic Reserves

The Fisheries Act was amended in 1975 to provide for the declaration of aquatic reserves within Western Australian waters in much the same way as reserves are declared above low-water mark under the Land Act.

Aquatic reserves may be proclaimed Class A and may be for a variety of purposes, including National Park, Conservation of Flora and Fauna, or Recreation. They may be vested in a body corporate, such as a Minister of the Crown, the National Parks or Wildlife Authorities, or a Local Authority.

THE IMPORTANCE OF SIZE

Any reserve surrounded by alienated land can be likened in many ways to an off-shore island. The biological diversity of such islands varies according to their size: the larger the island the more diverse the animal and plant communities it can support. The same applies to reserves surrounded by alienated land: unless they are large enough, animal and plant species will disappear until the diversity strikes a new equilibrium in keeping with its size.

The ways in which species disappear are not fully understood. Their disappearance may be due to a number of factors including fire, disease, drought, etc.; or it may be that the population of a given species that can be supported by a particular reserve is too small to be viable.

However, once a species has vanished and there is no means of natural recolonisation, it will have vanished for ever. It is difficult to predict the minimum area that a reserve must cover to ensure that its full diversity is maintained; it is vitally important, however, that the area be as large as is practically possible, so that minimum reduction of diversity occurs if and when all adjoining land is alienated, and so that it is capable of withstanding calamities such as fire or drought.

Any portion of a reserve adjoining alienated land will suffer 'edge effects', which will tend to reduce diversity and vitality while increasing the incidence of exotic species in that portion of the reserve. These effects will decrease with distance from the alienated land in most cases.

These effects and their causes are various, and may include:

- i) Higher incidence of fire (including fires used to protect the bulk of the reserve and the alienated land) and increased disturbance from the making of firebreaks and boundary zones.
- ii) Use of fertilizers and herbicides on the adjoining land.
- iii) Alterations to drainage patterns.
- iv) Introduction of exotic plants and animals (including straying of domestic stock).

- v) Introduction of pathogenic organisms.
- vi) Abnormally high populations of some animals (e.g. kangaroos, which find food and water on cleared land and shelter on the reserve).
- vii) Abnormally low populations of some animals (e.g. where any of the above effects reduce an element of the habitat essential to those animals).

There are numerous other edge effects and ramifications of the effects mentioned. Any increase in area of a reserve whereby the ratio of boundary to area with alienated land is reduced will necessarily reduce the proportion of that reserve subjected to edge effects and thus increase the value of that reserve as a conservation unit.

Many of the edge effects penetrate a reserve far more deeply along drainage lines than at other points. Obvious examples are (i) alteration of drainage patterns (through altering, after clearing, the total precipitation reaching the ground; run-off volumes; run-off rates, etc.), (ii) alteration of water quality (through increased turbidity, presence of pollutants such as fertilizers or insecticides), and (iii) siltation and erosion. Siltation may follow erosion (either within the reserve or outside it) induced by increased run-off rates or damage to streamside vegetation through clearing, pollutants, etc.

In proposing reserves and parks, the Committee was conscious of the need to make them as large as possible, but was constrained by the pressures of other land uses. As a result, many of the reserves proposed fall well below the desirable minimum size, but have been considered because without them a species or ecosystem may disappear.

An ideal reserve should include complete drainage systems but this is rarely possible. Nevertheless, the greater the portion of a drainage line that is within a reserve, the greater the section of that drainage line that is not significantly affected is likely to be.

Soil is a major factor in the distribution of plant species. Since plants, in turn, largely affect the distribution of animals, different biological communities are associated with different soils. All too frequently, land that is good for agriculture is alienated while less fertile land is left for reserves. With such alienation, destruction of species and whole communities that do not occur on the remaining land may take place. To represent effectively all aspects of an area, a reserve must include land with both good and poor agricultural potential. It is important, therefore, that, where land is recommended for the extension of a park, the portion with good agricultural potential not be excised from it, if the park is to represent all the communities of the region.

STAFFING AND FUNDING

Management

Setting a conservation reserve aside is a vital first step towards the conservation of biological communities. The next step, which is equally important, is management, since without it much of the initial investment made when an area is reserved will be lost.

Management falls into two main categories: management of people who use the reserve and management of ecosystems. The aims of "people management" are to provide access, facilities and information without spoiling the beauty or assets of the area by allowing the public use to damage it. Biological management aims to maintain the full diversity of an area so that all the plants and animals within it persist. Effective management depends on the provision of adequate funds and trained staff.

In this report the Committee has recommended that conservation reserves be controlled by three State Government bodies as well as some Local Authorities. All of these suffer from limitations in staff and funds available to manage parks and reserves. Data to illustrate the resources that Local Authorities can devote to these ends are not readily available. They spend roughly \$50 000 000 a year on parks and recreation reserves, including intensively managed sports-grounds. The Kings Park Board's annual budget is about \$1 000 000. The following outlines the resources of the three State Government bodies.

The National Parks Authority of Western Australia

The National Parks Authority was set up under the National Parks Authority Act 1976. In June 1977 it controlled 48 National Parks and 20 other reserves, with a total area of about 3 870 000 ha. It employs 3 professional and 76 other staff, including 61 rangers. Most National Parks are outside System 6 but the staff is concentrated within it because of the heavy public use of National Parks near Perth. The 1976-77 budget was \$1 677 000, of which \$1 379 000 was a Treasury grant. The development, management and operation of National Parks are funded mainly from the Treasury.

The National Parks Authority also collects its own revenue from rents, vehicle entrance fees, camping fees, hire of boats and boat trips, cave entrance fees and sundry other fees for the use of park facilities. It has long been held that those who use the parks and many of the specialised

facilities and services should pay something towards the cost of providing them, and such fees are collected wherever practicable. The money is used for the development, management and maintenance of facilities in National Parks. Such revenue amounted to \$219 358 in 1976-77.

Grants are also made by Main Roads Department for specific road maintenance and road construction work in National Parks.

The 1975 United Nations List of National Parks and Equivalent Reserves suggests these formulae for estimating the number of staff likely to suffice in a given park, under average conditions:-

- i) for parks in regions with a population density of less than 50 inhabitants per square kilometre :
a minimum of one person working full time per 10 000 ha;
- ii) for parks in regions with a population density greater than 50 inhabitants per square kilometre :
a minimum of one such person per 4000 ha.

Parks with highly developed recreation areas, such as Yanchep, John Forrest and Matilda Bay, require far more staff. Leaving them aside, however, even to staff the other existing and previously recommended National Parks at the lower U.N. rate would require 520 people working full time on management and supervision.

The Western Australian Wildlife Authority

The W.A. Wildlife Authority was set up under the Wildlife Conservation Act 1950-77. In August 1977, 398 nature reserves, with a total area of 8 228 500 ha, were vested in it and a further five hundred and seventy nine nature reserves, with a total area of 158 000 ha, were controlled under the provisions of the Wildlife Conservation Act. Most of the area of nature reserves is in fairly remote regions but there are many small reserves in the south-west. Relatively few lie within System 6. The W.A. Wildlife Authority is serviced by the Department of Fisheries and Wildlife.

In June 1977 there were 5 operations staff and 5 research staff working full time on reserve management. These were supplemented by 25 wildlife officers and research and administrative staff who also have other duties. It is not possible to state accurately the amount of funds expended in reserve management and research but in 1976-77 it was probably something like \$250 000.

It is not possible to lay down rigid standards of staffing, but if the U.N. formulae quoted above were taken as a guideline, more than 800 staff would be needed.

The Forests Department of Western Australia

The Forests Department of W.A. was set up under the Forests Act 1918-70. Under the direction of the Conservator of Forests it controls and manages 1 852 000 ha of State Forest and 117 000 ha of Timber Reserves. It has a staff of 72 professional foresters, 316 technical staff and 90 clerks and draft wages employees. Almost all staff are stationed in the south-west corner of the State, many within System 6. Its budget in 1976-77 was about \$15 000 000.

The creation of Special Management Priority Areas (or Forest Parks) within State Forest does not in most cases actually add to the amount of land controlled by the Forests Department. It does, however, mean that more intensive management and research will be needed for S.M.P.A.s; the Forests Department, which has already had to cut back on staff, will be hard pressed to provide these.

Current and Future Needs

It is clear that both the National Parks Authority and the Wildlife Authority are unable to provide an ideal amount of management for the areas they already control. Both the National Parks Authority and the Department of Fisheries and Wildlife have prepared plans for an increase in the numbers of management staff. Both organisations received special allocations of staff for this purpose in 1977-78 and the Department has a four-year plan for further reserve management personnel which has received Government approval.

The fact that money and staff are not yet adequate for the development and implementation on management plans for all conservation reserves at this time does not mean that further conservation reserves should not be declared, as a result of this study. The Committee believes that the dedication of conservation reserves should proceed without delay and that management will gradually develop as the community accepts its importance.

Western Australia is a large State with a comparatively small population. It will never be able to provide for reserve management the number of staff per unit area that is considered normal in some countries overseas or in some of the other States. However, the relatively small

population also means that the amount of "people management" needed is less. Many of the larger, remote National Parks and Nature Reserves need little management at present because they are infrequently visited and are surrounded by unused and unaltered country. The most pressing management problems are associated with reserves near centres of population, in the coastal zone, or which are surrounded by or adjacent to land subject to agricultural or urban use; many of the reserves reported on here fall into this category.

The management of Regional Open Space and Regional Parks in the Metropolitan Area is a special problem. Several Authorities, of both State and Local Government, have expressed reluctance to accept vesting of metropolitan reserves or Regional Open Space unless provided with funds, especially in the case of "linear" areas, such as river foreshores or fragile coastal dunes, which require the protection of a long perimeter relative to their area. The responsibility to manage such areas has so far fallen on Local Government Authorities. Raising money to manage such areas must be regarded as an activity of major importance, and ideas such as lotteries should not be dismissed without serious consideration.

In a few cases the Committee has recommended that reserves in the Metropolitan Region be jointly vested in a Local Authority and the W.A. Wildlife Authority. It has done this where a reserve or proposed reserve has high value for wildlife conservation but lies in an urbanised area where its use for recreation must also be considered and where intensive patrolling may be necessary. In such cases the Committee has assumed that the Local Authority will provide the day-to-day management and any recreational facilities that may be necessary, while the Wildlife Authority will provide expert advice and take part in developing plans and policy. In such cases no action would be taken without approval of both Authorities. Such an arrangement exists now for a few reserves, for example Lake Joondalup, and the Committee believes that it works well.

The Committee recognises that the recommendations contained in this report will add significantly to the responsibilities of various Authorities, especially the National Parks Authority, the Wildlife Authority, the Forests Department and some Local Authorities.

RECOMMENDATION

- R.13 The Committee recommends that the Environmental Protection Authority examine proposals put forward by the National Parks Authority, the Western Australian Wildlife Authority, the Forests Department and various Local Authorities for increased funds for the management of conservation reserves throughout the State, and that it make recommendations to the Government as to priorities and the rate of growth which is desirable for those bodies.

EDUCATION AND INFORMATION

The long-term survival of much of our natural landscape, its soils, plants and animals, depends to a large extent on people's awareness of them. When people know what is there, why it is there and why it is important, they will be likelier to keep it and care for it. That there is a desire for this kind of knowledge and empathy is shown by the popularity of the television series *In the Wild*, which has made Harry Butler a household name in Australia. Such spread of knowledge of our natural environment is a basic step in educating people and must be further encouraged, not only in schools but also beyond.

An understanding by people is important in securing reserves and in managing them thereafter. The task is three-fold: first, to record what we have, second, to find out how it exists, and third, to learn how to manage the environment so that it can survive. At each step those in official positions are too few for the work involved. Amateur workers contribute significantly, and more should be encouraged to participate. In management especially, local people with special knowledge of or interest in their district should be actively involved.

Education is the duty of many bodies directly or indirectly concerned with the environment. The Education Department has a fundamental role in creating interest in the environment among students. Other bodies include the Commonwealth Scientific and Industrial Research Organisation, Department of Agriculture, Department of Conservation and Environment, Department of Fisheries and Wildlife, Forests Department, Kings Park Board, Lands and Surveys Department, Main Roads Department, Metropolitan Water Supply Sewerage and Drainage Board, Mines Department, National Parks Authority, Public Works Department, State Electricity Commission, Swan River Management Authority, Telecom Australia, Town Planning Department and Western Australian Museum.

Many of these bodies already have avenues for both obtaining and providing information. The Museum, for example, publishes journals and brochures and has many honorary associates. The Forests Department publishes "Forest Focus" and has initiated nature-trails. The Department of Conservation and Environment publishes reports and invites comment. The Department of Fisheries and Wildlife issues publications and has a system of honorary wildlife officers. All this and more is done now. However, there is a need for better dissemination of knowledge and better co-ordination between the bodies involved. For example, the Main Roads Department and the State Electricity Commission need advice

on the biological importance of new routes for roads and powerlines; the Museum and the W.A. Herbarium should be advised of projects involving clearing of land in time to make collections of animals and plants before they disappear for ever. This kind of communication is possible now, but with the pressure of work it often does not happen.

RECOMMENDATION

- R.14 The Committee recommends that the Department of Conservation and Environment foster communication between the various Government Departments and Authorities concerned directly or indirectly with the environment, such as those listed in paragraph 3 of this section, and that the Conservation and Environment Committee play a more active role in educating the public.

ONGOING PROGRAMMES

The Committee has recommended further investigation of certain problems, such as the conservation of reef communities, so that reservations may be proposed on a sound scientific and practicable basis. Other research may also in future increase our knowledge of the ecology of plant and animal species, and thus may make changes desirable in the State's system of reserves. Moreover, the availability of land for reserves may alter. Regional Open Space and private land will be acquired progressively, but not always as originally envisaged. New mining tenements may be taken out and others relinquished; areas replanted after mining may become available, at least for recreation. A third possible change is in the condition of uncleared land, under the influence of present practices: the effects of the extraction of ground water will become evident, for example, and the extent of dieback may change with variations in forest management.

Although the present recommendations are made with long-term objects in view, it is desirable also to provide for periodic review of their working in practice. Some government body should be responsible for such a review and for recommending readjustments as necessary.

RECOMMENDATION

- R.15 The Committee recommends the continuation, in some form, of the Conservation Through Reserves Committee and the System 6 Committee to carry out, for the whole of Western Australia, the functions of:
- (i) monitoring the condition of reserves and the effects of the present recommendations;
 - (ii) assessing how well the overall aims are being achieved;
 - (iii) from time to time, when necessary, recommending readjustments.

ACKNOWLEDGEMENTS

The Committee wishes to express its gratitude to the many organisations and individuals who have assisted in the production of this report. Data have been willingly provided, and many unpublished data have been used without specific acknowledgement in the text. The Committee especially wishes to thank the following:

Claremont Teachers College
Commonwealth Department of Army
Commonwealth Department of Defence
Commonwealth Department of Transport
Commonwealth Scientific and Industrial Research
Organisation
Department of Agriculture
Department of Fisheries and Wildlife
Forests Department
Kings Park Board
Lands and Surveys Department (Cartographic Section)
Metropolitan Region Planning Authority
Mines Department
Murdoch University
National Parks Authority of Western Australia
Public Works Department
University of Western Australia
Western Australian Museum

The Committee would also like to thank all those representatives of local government authorities in System 6 who have contributed generously with information and in discussion. The Committee emphasises, however, that the recommendations in this report are the Committee's, and do not necessarily represent those of the local authorities or the other bodies listed or commit them or their officers in any way.

The Committee is also grateful to the following, who made submissions:

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YUNDERUP DELTA SOCIETY
ZOOLOGICAL GARDENS

MAY, 1978

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APPENDIX 1

THE REPRESENTATION OF VEGETATION COMPLEXES IN SYSTEM 6

The Vegetation Complexes are defined in relation to the landforms, soils and rainfall of the Darling System (Heddlé, Loneragan and Havel 1978).

REGION: DARLING PLATEAU

MAPPING UNIT	VEGETATION COMPLEXES	≤ 40 ha		40-400 ha		400-4 000 ha		4 000-40 000 ha		COMMENTS
		COMPONENT		COMPONENT		COMPONENT		COMPONENT		
		Major	Minor	Major	Minor	Major	Minor	Major	Minor	
1	DWELLINGUP & HESTER (HIGH RAINFALL) -CENTRAL & SOUTH			D15, J12	K12	J1, J2, J11, K3, K7, K8, K13, K15	D13, J4, J5, K9	J6, K2, K11	D9, J7,	
2	DWELLINGUP (MED. TO HIGH RAINFALL).	E2, E7, E8, E13		E3, E4, E5, E6, E16, E19	E9, E14, E18, E20	C8, C14, D10, D11, D12, D13, E1, E10, E15, E17, J3		D4, D5, D8	D9, J6, J7, J8	
3	DWELLINGUP & YAL- ANBEE (LOW TO MED. RAIN- FALL) - NORTH							C7		Restricted occurrence.
4	DWELLINGUP, YALAN- BEE & HESTER (LOW TO MED. RAIN- FALL)				C17	J3, K14		C7, D4, D16, J7, J8, J9, K6	D1, D3, D8	

REGION: DARLING PLATEAU

MAPPING UNIT	VEGETATION COMPLEXES	≤ 40 ha		40-400 ha		400-4 000 ha		4 000-40 000 ha		COMMENTS
		COMPONENT		COMPONENT		COMPONENT		COMPONENT		
		Major	Minor	Major	Minor	Major	Minor	Major	Minor	
5	YALANBEE & DWELL- INGUP			C6,C18	C12,C13, C15	C10,D17 K5		C1,C2, C7,D1, D3,D7, D18,K4	D2,J9	
6	YALANBEE		C4	B6,C3, C6	C5,C11, C15	C9,C10, D6	D17	C1,C2, D1,D2, D7,D18	C7,D3	
7	COOK						C9,C10, D17,J4	C7,D5, D7,D8, D9,D16, D18	C1,C2, D3,D4	
8	GOONAPING					K5		D1,D2, J6,J7	D3,J8, K11	
9	WILGA	K10					K7		K6	Little in State Forest.

REGION: DARLING PLATEAU

MAPPING UNIT	VEGETATION COMPLEXES	≤ 40 ha		40-400 ha		400-4 000 ha		4 000-40 000 ha		COMMENTS
		COMPONENT		COMPONENT		COMPONENT		COMPONENT		
		Major	Minor	Major	Minor	Major	Minor	Major	Minor	
10	YARRAGIL (MIN. DEVELOPMENT SWAMPS)			D15,E4, E5		D13,E1, E10,J2, J4,J5, K3	C14,D12, E15,J1	K2,K11,	J6	
11	YARRAGIL (MAX. DEVELOPMENT SWAMPS)			E14,E19	E16,E20	E15	D10,J3	D4,J6, J8	D5,D16, J7	
12	SWAMP				C6	K5		D1,D2, D8,D9, D16,J6, J7,J8, K6	C2,D3, D4,J9, K4	
13	PINDALUP & YARRAGIL	C4	K10	C16,C17, C18	C6	K5	D17,E10, J3	C1,C2, C7,D1, D2,D3, D9,D16, J7,J8, J9,K4, K6	D4,D8, J6	

REGION: DARLING PLATEAU

APPING UNIT	VEGETATION COMPLEXES	≤ 40 ha		40-400 ha		400-4 000 ha		4 000-40 000 ha		COMMENTS
		COMPONENT		COMPONENT		COMPONENT		COMPONENT		
		Major	Minor	Major	Minor	Major	Minor	Major	Minor	
14	COOLAKIN			C11	B6,C6	D17	C10,D6	C1,C2, C7,D7, D18,J9	D1	
15	CATTERICK		K10			K7,K8, K15				
16 a	YARRAGIL & CATTERICK					K15				Northern occurrence of Karri forest.
17	HELENA (MED. TO HIGH RAINFALL)			D15,E18, F50		D12,J1	D11,E15	K2		
18	HELENA (LOW TO MED. RAINFALL)	E11		E12		C8,E10			C7	
19	BRIDGETOWN			K12		K13	K15		K11	Largely developed for agriculture and pine plantations.

REGION: DARLING PLATEAU

MAPPING UNIT	VEGETATION COMPLEXES	≤ 40 ha		40-400 ha		400-4 000 ha		4 000-40 000 ha		COMMENTS
		COMPONENT		COMPONENT		COMPONENT		COMPONENT		
		Major	Minor	Major	Minor	Major	Minor	Major	Minor	
20	MURRAY (MED. TO HIGH RAINFALL)			E18, E20	E14, E16, E19	D10, D11, D13, J2, J4, J11, K3	D12, E15, E17, J1, J3	D5, K2		
21	MURRAY & BINDOON (LOW TO MED. RAINFALL)	B13, E2		C12, C13, C15, E3, E4, E9		E1, J3,	C14, E10	D4	C2, C7, D1, J6	
22	BALINGUP (MED. TO HIGH RAINFALL)					K15	K13	K11		Largely developed for agriculture and pine plantations.
16b	BALINGUP (HIGH RAINFALL)									Kari forest -Sta forest & agriculture.
23	WILLIAMS-AVON-BROCKMAN-MUMBALLUP						D6, K9			Mostly developed for agriculture.
24	NOONING			B12						Mostly developed for agriculture.

REGION: SWAN COASTAL PLAIN

MAPPING UNIT	VEGETATION COMPLEXES	≤ 40 ha		40-400 ha		400-4 000 ha		4 000-40 000 ha		COMMENTS
		COMPONENT		COMPONENT		COMPONENT		COMPONENT		
		Major	Minor	Major	Minor	Major	Minor	Major	Minor	
29	FORRESTFIELD		F22, F52		F50					Mostly developed
30	ABBA									Only road verges remain.
31	COONAMBIDGEE								A2	Mostly developed for agriculture.
32	GUILDFORD	E22, F51, H23	F7, F24, F49	G20	F50		A15			Mostly developed
33	SWAN	F7, F17, F18, F19, F20, F21, F22, F24, F25, F46, F47, F48, F49, F52	F33, F34, F35, F36, F37, F45	F50	F38					Owing to its linear occurrence, only small areas can be reserved.
34	DARDANUP									Mostly developed for agriculture.

REGION: SWAN COASTAL PLAIN

MAPPING UNIT	VEGETATION COMPLEXES	≤ 40 ha		40-400 ha		400-4 000 ha		4 000-40 000 ha		COMMENTS
		COMPONENT		COMPONENT		COMPONENT		COMPONENT		
		Major	Minor	Major	Minor	Major	Minor	Major	Minor	
42	SOUTHERN RIVER		F21,F49	E21,G13, H9	F50	F8,F23				Mostly in agricultural holdings
43	BASSENDAN-NORTH		A7,A8	A4,F5, F6	A10.4, A15	A10.3	A2, A2(ext.), A10.2, A11			
44	BASSENDAN-CENTRAL/SOUTH	F44,F48, G21,H10	F46,F47, F49,G10	G12,G17, G18,G19, H3,H11	F54,H13,	F8,F23	G11, H7-1			
45	BASSENDAN-NORTH TRANSITION				F5,F6		A15	A2, A2(ext.)		
46	BASSENDAN-CENTRAL SOUTH TRANSITION								A11	A.11 includes northernmost occurrence of Jarrah on Bassendean sands.

REGION: SWAN COASTAL PLAIN

MAPPING UNIT	VEGETATION COMPLEXES	≤ 40 ha		40-400 ha		400-4 000 ha		4 000-40 000 ha		COMMENTS
		COMPONENT		COMPONENT		COMPONENT		COMPONENT		
		Major	Minor	Major	Minor	Major	Minor	Major	Minor	
47	KARRAKATTA-NORTH						A10.1, A10.3		A10.2	47 & 48 mostly developed for agriculture, forestry and residential holdings
48	KARRAKATTA-NORTH TRANSITION							All		
49	KARRAKATTA CENTRAL-SOUTH	F16, F42, F43, F45, H12	F3, F12, F13, F14, F26, G10, F30	F9, F10, F28, G22, H22	F5, F6, F27, F54,	F31, H7-1, H7-2	F4, G11, H21		H6	
50	CALADENIA							A2 (ext.)		Restricted.
51	COTTESLOE-NORTH					A10.1, A10.3, A13	A9		A10.2	Mostly developed for agriculture.
52	COTTESLOE-CENTRAL/SOUTH	F3, F29, F33, F34, F35, F36, F37, F39, F40, F41, F53, F55, G8	F11	F28, F38, G7, G22	G16, H5	A16, H7-3	A10.3, A13, F4, H7-1, H7-2		H6	

REGION: DANDARAGAN PLATEAU

MAPPING UNIT	VEGETATION COMPLEXES	≤ 40 ha		40-400 ha		400-4 000 ha		4 000-40 000 ha		COMMENTS
		COMPONENT		COMPONENT		COMPONENT		COMPONENT		
		Major	Minor	Major	Minor	Major	Minor	Major	Minor	
58	MOGUMBER-NORTH			B2		B1				58 - 66 are all poorly represented, being mostly developed for agriculture.
59	MOGUMBER-SOUTH	B14								
60	KARAMAL-NORTH						B1			
61	KARAMAL-SOUTH					B9		B8		
62	CULLALA			B4					B8	
63	WANNAMAL			B5						
64	MOONDAH			A3	B7	B9		B8		
65	REAGAN			B7	A3, B15			A2 (ext .)	B8	
66	GINGIN				B7				B8	

REGION: DONNYBROOK SUNKLANDS

MAPPING UNIT	VEGETATION COMPLEXES	≤ 40 ha		40-400 ha		400-4 000 ha		4 000-40 000 ha		COMMENTS
		COMPONENT		COMPONENT		COMPONENT		COMPONENT		
		Major	Minor	Major	Minor	Major	Minor	Major	Minor	
70	KINGIA					K1, K9, K16				70 - 75 mostly forest (native & exotic). Represented in System 1.
71	MUNGARDUP						K1, K16			
72	DARRADUP						K16			
73	JARRAHWOOD					K1, K16				
74	PRESTON									
75	CARTIS						K1			

The following recommendations were not included in Appendix 1, owing to either their aquatic nature or difficulties in assigning to them areas of vegetation complexes : B10, F1, F2, F32, G6, H1, H2, H19.

APPENDIX II

THE OCCURRENCE OF VERTEBRATE FAUNA IN SYSTEM 6

The attached lists of the vertebrate fauna of System 6 have been compiled by the Western Australian Wildlife Research Centre with the assistance of the Western Australian Museum.

Species which occur, or occurred, in System 6 are listed. After each species are two numbers. The first relates to its status in System 6 while the second, in brackets, relates to its status elsewhere in Australia.

Three categories are given:

1. Abundant
2. Infrequent
3. Rare

Where (0) is shown, this means that the species does not occur elsewhere: i.e. it is restricted to System 6. The categorisation used is arbitrary and could be open to some misinterpretation. It is not meant to be anything but a rough guide.

Where a species is listed as rare both within and outside System 6 it is asterisked, and notes on its status can be found at the end of the lists.

The list excludes those pelagic sea-birds that do not breed in System 6 and includes only Principal and Secondary fresh-water fishes. Principal fresh-water fishes are those that spend their complete life-cycles in fresh water. Secondary fresh-water fishes are those that generally spend a significant part of their life-cycles in marine or estuarine environments but may spend all or part of their lives in pure fresh water; estuarine species which only occasionally enter fresh water are excluded.

A list of 378 vertebrates includes 42 species of mammal, 235 species of bird, 76 species of reptile, 16 species of frog and 19 species of fish. Of these, 5 species of mammal, 5 species of bird and 6 species of freshwater fish have been introduced by Europeans.

The number of invertebrate species is very much greater than the number of vertebrates. The lack of knowledge, however, of both the taxonomy and distribution of many species precludes their listing.

MAMMALS

MARSUPALIA

Macropodidae

Western Grey Kangaroo (<i>Macropus fuliginosus</i>)	1 (1)
Euro (<i>Macropus robustus</i>)	3 (1)
Western Brush Wallaby (<i>Macropus irma</i>)	1 (2)
* Tammam (<i>Macropus eugenii</i>)	3 (3)
Quokka (<i>Setonix brachyurus</i>)	2 (2)
Brush-tailed Rock Wallaby (<i>Petrogale penicillata</i>)	extinct (2)
* Woylie (<i>Bettongia penicillata</i>)	extinct (3)
* Boodie (<i>Bettongia lesueur</i>)	extinct (3)
* Gilberts Potoroo (<i>Potorous tridactylus gilberti</i>)	extinct (extinct)

Phalangeridae

Brush Possum (<i>Trichosurus vulpecula</i>)	1 (1)
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Petauridae

Ringtail Possum (<i>Pseudocheirus peregrinus</i>)	2 (2)
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Burramyidae

South-west Pigmy Possum (<i>Cercartetus concinnus</i>)	2 (2)
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Tarsipedidae

Honey Possum (<i>Tarsipes spencerae</i>)	2 (1)
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Peramelidae

Quenda (<i>Isoodon obesulus</i>)	2 (2)
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Dasyuridae

Western Native Cat (<i>Dasyurus geoffroii</i>)	2 (2)
Common Wambenger (<i>Phascogale tapoatafa</i>)	2 (1)
Mardo (<i>Antechinus flavipes</i>)	2 (2)
Fat-tailed Dunnart (<i>Sminthopsis crassicaudata</i>)	3 (1)
Common Dunnart (<i>Sminthopsis murina</i>)	2 (1)
White-tailed Dunnart (<i>Sminthopsis granulipes</i>)	3 (2)
Numbat (<i>Myrmecobius fasciatus</i>)	2 (2)

RODENTIA

Muridae

Southern Bush Rat (<i>Rattus fuscipes</i>)	1 (1)	
Black Rat (<i>Rattus rattus</i>)	1 (1)	Introduced
Water Rat (<i>Hydromys chrysogaster</i>)	2 (3)	
Ashy Grey Mouse (<i>Pseudomys albocinereus</i>)	3 (2)	
Mitchells Hopping Mouse (<i>Notomys mitchellii</i>)	3 (1)	
House Mouse (<i>Mus musculus</i>)	1 (1)	Introduced

LAGOMORPHA

Leporidae

Rabbit (<i>Oryctolagus cuniculus</i>)	1 (1)	Introduced
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CHIROPTERA

Vespertilionidae

Greater long-eared Bat (<i>Nyctophilus timoriensis</i>)	2 (2)	
Lesser long-eared Bat (<i>Nyctophilus geoffroyi</i>)	1 (1)	
White Striped Bat (<i>Tadarida australis</i>)	1 (1)	
Little Flat Bat (<i>Tadarida planiceps</i>)	2 (2)	
Goulds Wattled Bat (<i>Chalinolobus gouldii</i>)	1 (1)	
Chocolate Bat (<i>Chalinolobus morio</i>)	2 (1)	
Little Bat (<i>Eptesicus pumilis</i>)	1 (1)	
Tasmanian Pipistrelle (<i>Pipistrellus tasmaniensis</i>)	2 (1)	

Pteropodidae

Red Flying Fox (<i>Pteropus scapulatus</i>)	3 (1)	
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CARNIVORA

Canidae

Dingo (<i>Canis familiaris</i>)	3 (1)	
Fox (<i>Vulpes vulpes</i>)	1 (1)	Introduced

Felidae

Cat (<i>Felis catus</i>)	1 (1)	Introduced
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Otariidae

Australian Sea Lion (<i>Neophoca cinerea</i>)	2 (2)	
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MONOTREMATA

Tachyglossidae

Echidna (<i>Tachyglossus aculeatus</i>)	1 (1)	
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BIRDS

STRUTHIONIFORMES

Emu (*Dromaius novaehollandiae*) 2 (1)

SPHENISCIFORMES

Little Penguin (*Eudyptula minor*) 2 (1)

PROCELLARIIFORMES

Wedge-tailed Shearwater (*Puffinus pacificus*) 1 (1)

Little Shearwater (*Puffinus assimilis*) 2 (1)

White-faced Storm Petrel (*Pelagodroma marina*) 2 (1)

PODICEPIFORMES

Australian Little Grebe (*Podiceps novaehollandiae*) 1 (1)

Hoary-headed Grebe (*Podiceps poliocephalus*) 1 (1)

Great Crested Grebe (*Podiceps cristatus*) 2 (2)

PELECANIFORMES

Australian Pelican (*Pelecanus conspicillatus*) 1 (1)

Darter (*Anhinga rufa*) 1 (1)

Black Cormorant (*Phalacrocorax carbo*) 1 (1)

Little Black Cormorant (*Phalacrocorax sulcirostris*) 1 (1)

Pied Cormorant (*Phalacrocorax varius*) 1 (1)

Little Pied Cormorant (*Phalacrocorax melanoleucos*) 1 (1)

CICONIFORMES

White-necked Heron (*Ardea pacifica*) 2 (1)

White-faced Heron (*Ardea novaehollandiae*) 1 (1)

Cattle Egret (*Ardeola ibis*) 3 (2)

White Egret (*Egretta alba*) 1 (1)

Little Egret (*Egretta garzetta*) 3 (2)

Reef Heron (*Egretta sacra*) 3 (1)

Nankeen Night Heron (*Nycticorax caledonicus*) 1 (1)

Little Bittern (*Ixobrychus minutus*) 2 (2)

Black Bittern (*Dupetor flavicollis*) 3 (1)

Brown Bittern (*Botaurus poicilopticus*) 2 (2)

White Ibis (*Threskiornis molucca*) 2 (1)

Straw-necked Ibis (*Threskiornis spinicollis*) 1 (1)

Glossy Ibis (*Plegadis falcinellus*) 3 (1)

Royal Spoonbill (*Platalea regia*) 3 (2)

Yellow-billed Spoonbill (*Platalea flavipes*) 3 (2)

ANSERIFORMES

Magpie Goose (<i>Anseranas semipalmata</i>)	3	(1)
Black Swan (<i>Cygnus atratus</i>)	1	(1)
* Freckled Duck (<i>Stictonetta naevosa</i>)	3	(3)
Mountain Duck (<i>Tadorna tadornoides</i>)	1	(1)
Black Duck (<i>Anas superciliosa</i>)	1	(1)
Grey Teal (<i>Anas gibberifrons</i>)	1	(1)
Chestnut Teal (<i>Anas castanea</i>)	3	(2)
Blue-winged Shoveller (<i>Anas rhynchotis</i>)	1	(1)
Pink-eared Duck (<i>Malacorhynchus membranaceus</i>)	2	(1)
White-eyed Duck (<i>Aythya australis</i>)	2	(2)
Wood Duck (<i>Chenonetta jubata</i>)	2	(1)
Musk Duck (<i>Biziura lobata</i>)	1	(1)
Blue-billed Duck (<i>Oxyura australis</i>)	2	(2)

FALCONIFORMES

Black-shouldered Kite (<i>Elanus notatus</i>)	1	(1)
Letter-winged Kite (<i>Elanus scriptus</i>)	3	(2)
Black Kite (<i>Milvus migrans</i>)	3	(1)
Square-tailed Kite (<i>Lophoictinia isura</i>)	3	(2)
Whistling Kite (<i>Haliastur sphenurus</i>)	1	(1)
Brown Goshawk (<i>Accipiter fasciatus</i>)	2	(1)
Collared Sparrowhawk (<i>Accipiter cirrocephalus</i>)	2	(1)
Little Eagle (<i>Haliaetus morphnoides</i>)	2	(2)
Wedge-tailed Eagle (<i>Aquila audax</i>)	2	(1)
White-breasted Sea-eagle (<i>Haliaetus leucogaster</i>)	3	(1)
Spotted Harrier (<i>Circus assimilis</i>)	2	(2)
Swamp Harrier (<i>Circus approximans</i>)	2	(2)
Osprey (<i>Pandion haliaetus</i>)	2	(1)
Peregrine Falcon (<i>Falco peregrinus</i>)	3	(2)
Little Falcon (<i>Falco longipennis</i>)	2	(2)
Nankeen Kestrel (<i>Falco cenchroides</i>)	1	(1)
Brown Falcon (<i>Falco berigora</i>)	2	(1)

GALLIFORMES

Mallee Fowl (<i>Leipoa ocellata</i>)	3	(2)
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GRUIFORMES

Stubble Quail (<i>Coturnix pectoralis</i>)	2	(1)
Brown Quail (<i>Synoicus australis</i>)	2	(1)
Painted Quail (<i>Turnix varia</i>)	3	(2)
Little Quail (<i>Turnix velox</i>)	3	(1)
Banded Land-Rail (<i>Rallus philippensis</i>)	2	(2)
Marsh Crake (<i>Porzana pusilla</i>)	2	(2)
Spotted Crake (<i>Porzana fluminea</i>)	2	(2)
Spotless Crake (<i>Porzana tabuensis</i>)	2	(2)
Black-tailed Native Hen (<i>Tribonyx ventralis</i>)	2	(1)
Dusky Moorhen (<i>Gallinula tenebrosa</i>)	1	(1)
Swamphen (<i>Porphyrio porphyrio</i>)	1	(1)
Coot (<i>Fulica atra</i>)	1	(1)
Australian Bustard (<i>Otis australis</i>)	3	(2)

CHARADRIIFORMES

Painted Snipe (<i>Rostratula benghalensis</i>)	3	(2)
Pied Oystercatcher (<i>Haematopus ostralegus</i>)	2	(1)
Sooty Oystercatcher (<i>Haematopus fuliginosus</i>)	2	(1)
Masked Plover (<i>Vanellus miles</i>)	3	(1)
Banded Plover (<i>Vanellus tricolor</i>)	1	(1)
Red-kneed Dotterel (<i>Charadrius inctus</i>)	3	(1)
Hooded Dotterel (<i>Charadrius cucullatus</i>)	3	(2)
Red-capped Dotterel (<i>Charadrius alexandrinus</i>)	1	(1)
Black-fronted Dotterel (<i>Charadrius melanops</i>)	1	(1)
Double-banded Dotterel (<i>Charadrius bicinctus</i>)	3	(2)
Large Dotterel (<i>Charadrius leschenaultii</i>)	2	(1)
Eastern Golden Plover (<i>Pluvialis dominica</i>)	2	(2)
Grey Plover (<i>Pluvialis squatarola</i>)	1	(1)
Ruddy Turnstone (<i>Arenaria interpres</i>)	2	(1)
Little Whimbrel (<i>Numenius minutus</i>)	3	(2)
Whimbrel (<i>Numenius phaeopus</i>)	2	(1)
Eastern Curlew (<i>Numenius madagascariensis</i>)	2	(1)
Little Greenshank (<i>Tringa stagnatilis</i>)	3	(2)
Greenshank (<i>Tringa nebularia</i>)	1	(1)
Wood Sandpiper (<i>Tringa glareola</i>)	2	(2)
Common Sandpiper (<i>Tringa hypoleucos</i>)	1	(1)
Grey-tailed Tattler (<i>Tringa brevipes</i>)	2	(1)
Terek Sandpiper (<i>Xenus cinereus</i>)	3	(2)
Knot (<i>Calidris canutus</i>)	1	(1)
Great Knot (<i>Calidris tenuirostris</i>)	2	(2)
Sharp-tailed Sandpiper (<i>Calidris acuminata</i>)	1	(1)
* Pectoral Sandpiper (<i>Calidris melanotos</i>)	3	(3)
Red-necked Stint (<i>Calidris ruficollis</i>)	1	(1)
Curlew Sandpiper (<i>Calidris ferruginea</i>)	1	(1)
Black-tailed Godwit (<i>Limosa limosa</i>)	3	(2)
Bar-tailed Godwit (<i>Limosa lapponica</i>)	1	(1)
Black-winged Stilt (<i>Himantopus himantopus</i>)	1	(1)
Banded Stilt (<i>Cladorhynchus leucocephala</i>)	1	(1)
Red-necked Avocet (<i>Recurvirostra novaehollandiae</i>)	1	(1)
Southern Stone Curlew (<i>Burhinus magirostris</i>)	3	(2)
Australian Pratincole (<i>Stiltia isabella</i>)	3	(1)
Oriental Pratincole (<i>Glareola maldivarum</i>)	3	(1)
Pacific Gull (<i>Larus pacificus</i>)	3	(1)
Silver Gull (<i>Larus novaehollandiae</i>)	1	(1)
Whiskered Tern (<i>Chidonias hybrida</i>)	2	
Caspian Tern (<i>Hydroprogne caspia</i>)	2	(2)
Gull-billed Tern (<i>Gelochelidon nilotica</i>)	3	(1)
Roseate Tern (<i>Sterna dougalli</i>)	2	(1)
Bridled Tern (<i>Sterna anaetheta</i>)	1	(1)
Fairy Tern (<i>Sterna nereis</i>)	1	(1)
Crested Tern (<i>Sterna bergii</i>)	1	(1)

COLUMBIFORMES

Domestic Pigeon (<i>Columba livia</i>)	1	Introduced
Spotted Turtle dove (<i>Streptopelia chinensis</i>)	1	Introduced
Senegal Turtledove (<i>Streptopelia senegalensis</i>)	1	Introduced
Common Bronzewing (<i>Phaps chalcoptera</i>)	1	(1)
Brush Bronzewing (<i>Phaps elegans</i>)	3	(2)
Crested Pigeon (<i>Ocyphaps lophotes</i>)	2	(1)

PSITTACIFORMES

Purple-crowned Lorikeet (<i>Glossopsitta porphyrocephala</i>)	2	(1)
White-tailed Cockatoo (<i>Calyptorhynchus funereus baudinii</i>)	1	(1)
Red-tailed Cockatoo (<i>Calyptorhynchus magnificus</i>)	2	(1)
Long-billed Corella (<i>Cacatua tenuirostris</i>)	3	(2)
Galah (<i>Eolophus roseicapillus</i>)	1	(1)
Regent Parrot (<i>Polytelis anthopeplus</i>)	3	(1)
Western Rosella (<i>Platycercus icterotis</i>)	2	(1)
Port Lincoln Parrot (<i>Barnardius zonarius</i>)	1	(1)
Red-capped Parrot (<i>Purpureicephalus spurius</i>)	1	(2)
Elegant Parrot (<i>Neophema elegans</i>)	3	(1)
Rock Parrot (<i>Neophema petrophila</i>)	2	(1)

CUCULIFORMES

Pallid Cuckoo (<i>Cuculus pallidus</i>)	1	(1)
Fan-tailed Cuckoo (<i>Cacomantis pyrrhophanus</i>)	2	(1)
Horsfield Bronze Cuckoo (<i>Chrysococcyx basalis</i>)	2	(2)
Golden Bronze Cuckoo (<i>Chrysococcyx lucidus plagosus</i>)	2	(2)

STRIGIFORMES

Barn Owl (<i>Tyto alba</i>)	2	(1)
Masked Owl (<i>Tyto novaehollandiae</i>)	2	(2)
Boobook Owl (<i>Ninox novaeseelandiae</i>)	1	(1)
Barking Owl (<i>Ninox connivens</i>)	3	(1)

CAPRIMULGIFORMES

Tawny Frogmouth (<i>Podargus strigoides</i>)	1	(1)
Owlet Nightjar (<i>Aegotheles cristatus</i>)	1	(1)
Spotted Nightjar (<i>Eurostopodus guttatus</i>)	3	(1)

APODIFORMES

Spine-tailed Swift (<i>Hirundapus caudacutus</i>)	3	(1)
Fork-tailed Swift (<i>Apus pacificus</i>)	3	(1)

CORACIIFORMES

Laughing Kookaburra (<i>Dacelo gigas</i>)	1	Introduce
Red-backed Kingfisher (<i>Halcyon pyrrhopygra</i>)	3	(1)
Sacred Kingfisher (<i>Halcyon sancta</i>)	1	(1)
Bee Eater (<i>Merops ornatus</i>)	1	(1)

PASSERIFORMES

Atrichornithidae

* Noisy Scrub Bird (<i>Atrichornis clamosus</i>)	extinct	(3)
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Hirundinidae

White-backed Swallow (<i>Cheramoeca leucosternum</i>)	2 (1)
Welcome Swallow (<i>Hirundo neoxena</i>)	1 (1)
Tree Martin (<i>Petrochelidon nigricans</i>)	1 (1)
Fairy Martin (<i>Petrochelidon ariel</i>)	2 (1)

Motacillidae

Australian Pipit (<i>Anthus novaseelandiae</i>)	1 (1)
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Grallinidae

Magpie Lark (<i>Grallina cyanoleuca</i>)	1 (1)
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Campephagidae

Ground Cuckoo-Shrike (<i>Pteropodocys maxima</i>)	3 (2)
Black-faced Cuckoo-Shrike (<i>Coracina novaehollandiae</i>)	1 (1)
White-winged Triller (<i>Lalage sueurii</i>)	2 (1)

Timaliidae

Chestnut Quail-Thrush (<i>Cincolosoma castanotum</i>)	3 (2)
White-browed Babbler (<i>Pomatostomus superciliosus</i>)	3 (1)
* Western Whipbird (<i>Psophodes nigrogularis</i>)	3 (3)

Maluridae

Splendid Wren (<i>Malurus splendens</i>)	1 (1)
Variiegated Wren (<i>Mulurus lamberti</i>)	2 (1)
Purple-backed Wren (<i>Malurus assimilis</i>)	2 (3)
Red-winged Wren (<i>Malurus elegans</i>)	2 (1)
White-winged Wren (<i>Malurus leucopterus</i>)	2 (1)
Southern Emu Wren (<i>Stipiturus malachurus</i>)	3 (2)
* Western Bristle-Bird (<i>Dasyornis brachypterus longirostris</i>)	extinct (3)

Sylviidae

Reed Warbler (<i>Acrocephalus australis</i>)	1 (1)
Little Grassbird (<i>Megalurus gramineus</i>)	1 (1)
Rufous Songlark (<i>Cinclorhamphus mathewsi</i>)	3 (1)
Brown Songlark (<i>Cinclorhamphus cruralis</i>)	3 (1)

Acanthizidae

White-tailed Warbler (<i>Gerygone fusca</i>)	1 (1)
Weebill (<i>Smicrornis brevirostris</i>)	1 (1)
Broad-tailed Thornbill (<i>Acanthiza apicalis</i>)	1 (1)
Yellow-tailed Thornbill (<i>Acanthiza chrysorrhoa</i>)	1 (1)
Brown Thornbill (<i>Acanthiza pusilla</i>)	2 (2)
Western Thornbill (<i>Acanthiza inornata</i>)	2 (2)

Spotted Scrub-Wren (<i>Sericornis frontalis maculatus</i>)	2 (1)
Shy Heath-Wren (<i>Hylacola cauta</i>)	3 (2)
Redthroat (<i>Pyrrholaemus brunneus</i>)	3 (2)
Field Wren (<i>Calamanthus fuliginosus</i>)	3 (2)
Brown Flycatcher (<i>Microeca leucophaea</i>)	2 (1)
Scarlet Robin (<i>Petroica multicolor</i>)	1 (1)
Red-capped Robin (<i>Petroica goodenovi</i>)	1 (1)
Hooded Robin (<i>Petroica cucullata</i>)	2 (1)
Western Yellow Robin (<i>Eopsaltria griseogularis</i>)	2 (1)
White-breasted Robin (<i>Eopsaltria georgiana</i>)	2 (1)
Grey Fantail (<i>Rhipidura fuliginosa</i>)	1 (1)
Willy Wagtail (<i>Rhipidura leucophrys</i>)	1 (1)

Monarchidae

Restless Flycatcher (<i>Myiagra inquieta</i>)	3 (1)
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Pachycephalidae

Rufous Whistler (<i>Pachycephala rufiventris</i>)	1 (1)
Golden Whistler (<i>Pachycephala pectoralis</i>)	2 (1)
Western Shrike-Thrush (<i>Colluricincla harmonica rufiventris</i>)	1 (1)
Crested Bell-Bird (<i>Oreoica gutturalis</i>)	2 (1)
Western Shrike-tit (<i>Falcunculus frontatus leucogaster</i>)	3 (2)

Ephthianuridae

White-fronted Chat (<i>Ephthianura albifrons</i>)	2 (1)
Crimson Chat (<i>Ephthianura tricolor</i>)	3 (1)

Sittidae

Black-capped Sittella (<i>Neositta pileata</i>)	1 (1)
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Climacteridae

Rufous Tree-creeper (<i>Climactoris rufa</i>)	2 (1)
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Dicaeidae

Mistletoe-bird (<i>Dicaeum hirundinaceum</i>)	2 (1)
Spotted Pardalote (<i>Pardalotus punctatus</i>)	1 (1)
Striated Pardalote (<i>Pardalotus substriatus</i>)	1 (1)

Zosteropidae

Western Silvereye (<i>Zosterops lateralis gouldi</i>)	1 (1)
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Meliphagidae

Brown Honeyeater (<i>Lichmera indistincta</i>)	1	(1)
Black Honeyeater (<i>Certhionyx niger</i>)	3	(2)
Western Spinebill (<i>Acanthorhynchus superciliosus</i>)	1	(1)
Singing Honeyeater (<i>Meliphaga virescens</i>)	1	(1)
Yellow-plumed Honeyeater (<i>Meliphaga ornata</i>)	1	(1)
Brown-headed Honeyeater (<i>Melithreptus brevirostris</i>)	2	(1)
White-naped Honeyeater (<i>Melithreptus lunatus</i>)	2	(1)
New Holland Honeyeater (<i>Phylidonyris novaehollandiae</i>)	1	(1)
White-cheeked Honeyeater (<i>Phylidonyris niger</i>)	1	(1)
White-fronted Honeyeater (<i>Phylidonyris albifrons</i>)	3	(1)
Tawny-crowned Honeyeater (<i>Gliciphila melanops</i>)	2	(2)
Yellow-throated Miner (<i>Manorina flavigula</i>)	1	(1)
Little Wattle-bird (<i>Anthochaera chrysoptera</i>)	1	(1)
Red Wattle-bird (<i>Anthochaera carunculata</i>)	1	(1)

Spermestidae

Red-eared Firetail (<i>Emblema oculata</i>)	3	(2)
Zebra Finch (<i>Taeniopygia guttata</i>)	2	(1)

Fringillidae

Goldfinch (<i>Carduelis carduelis</i>)	2	(introduced)
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Artamidae

Black-faced Wood-Swallow (<i>Artamus cinereus</i>)	1	(1)
Dusky Wood-Swallow (<i>Artamus cyanopterus</i>)	2	(1)

Cracticidae

Pied Butcher-bird (<i>Cracticus nigrogularis</i>)	2	(1)
Grey Butcher-bird (<i>Cracticus torquatus</i>)	1	(1)
Magpie (<i>Gymnorhina tibicen dorsalis</i>)	1	(1)
Grey Currawong (<i>Strepera versicolor</i>)	1	(1)

Corvidae

Australian Raven (<i>Corvus coronoides</i>)	1	(1)
Australian Crow (<i>Corvus orru</i>)	3	(1)
Little Crow (<i>Corvus bennetti</i>)	2	(1)

REPTILES

CHELONIA

Cheloniidae

<i>Caretta caretta</i> Loggerhead Turtle	3 (1)
<i>Chelonia mydas</i> Green Turtle	3 (1)

Dermochelyidae

<i>Dermochelys coriacea</i> Leathery Turtle	3 (2)
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Chelidae

<i>Chelodina oblonga</i> Long-necked Tortoise	1 (1)
* <i>Pseudemydura umbrina</i> Short-necked Tortoise	3 (0)

SQUAMATA

SAURIA

Gekkonidae

<i>Crenadactylus ocellatus</i>	2 (2)
<i>Diplodactylus alboguttatus</i> Spotted Striped Gecko	2 (1)
<i>Diplodactylus pulcher</i> Beautiful Gecko	3 (1)
<i>Diplodactylus spinigerus</i> Western Spiny-tailed Gecko	1 (1)
<i>Diplodactylus vittatus</i> Festooned Gecko	1 (1)
<i>Gehyra variegata</i> Spotted Dtella	3 (1)
<i>Gehyra</i> sp.	2 (1)
<i>Heteronotia binoei</i> Bynoe's Gecko	3 (1)
<i>Oedura reticulata</i> Reticulated Velvet Gecko	2 (1)
<i>Phyllodactylus marmoratus</i> Marbled Gecko	1 (1)
<i>Phyllurus milii</i> Barking Gecko	2 (1)

Pygopodidae

<i>Aclys concinna</i>	3 (2)
<i>Aprasia pulchella</i> Pretty Worm Lizard	1 (1)
<i>Aprasia repens</i> Fry's Worm Lizard	1 (1)
<i>Delma fraseri</i> Fraser's Scale Footed Lizard	1 (1)
<i>Delma grayii</i> Gray's Scale Footed Lizard	2 (2)
<i>Lialis burtonis</i> Burton's Snake-Lizard	1 (1)
<i>Pletholax gracilis</i> Slender Snake-lizard	2 (2)
<i>Pygopus lepidopodus</i> Common Scaly-Foot	2 (2)

Agamidae

<i>Amphibolurus adelaidensis</i> Sandhill Dragon	2 (1)
<i>Amphibolurus minor</i> Dwarf Bearded Dragon	1 (1)
<i>Amphibolurus ornatus</i> Ornate Dragon	2 (1)

Varanidae

<i>Varanus gouldii</i>	Bungarra	2	(1)
<i>Varanus tristis</i>	Race-horse Goanna	2	(2)

Scincidae

<i>Cryptoblepharus plagiocephalus</i>	Wall Lizard	1	(1)
<i>Ctenotus fallens</i>		1	(1)
<i>Ctenotus gemmula</i>		2	(2)
<i>Ctenotus labillardieri</i>		1	(1)
<i>Ctenotus lesueurii</i>		1	(1)
<i>Ctenotus impar</i>		2	(2)
<i>Ctenotus schomburgkii</i>		3	(1)
<i>Egernia kingii</i>	King's Skink	1	(1)
<i>Egernia luctuosa</i>		3	(2)
<i>Egernia napoleonis</i>	Napoleon's Skink	1	(1)
<i>Egernia pulchra</i>		2	(1)
<i>Hemiergis initialis</i>		1	(2)
<i>Hemiergis peronii</i>		1	(1)
<i>Leiolopisma trilineatum</i>	Swamp Skink Lizard	2	(1)
<i>Lerista distinguenda</i>		1	(1)
<i>Lerista elegans</i>		1	(1)
* <i>Lerista lineata</i>		3	(0)
<i>Lerista lineopunctulata</i>		1	(1)
<i>Lerista praepedita</i>		1	(1)
<i>Menetia greyi</i>		1	(1)
<i>Morethia lineocellata</i>		1	(1)
<i>Morethia obscura</i>		1	(1)
<i>Sphenomorphus australis</i>		3	(1)
<i>Omolepida branchialis</i>		2	(1)
<i>Tiliqua occipitalis</i>	Western Blue-Tongue	2	(2)
<i>Tiliqua rugosa</i>	Bob-tail Lizard	1	(1)

SERPENTES

Typhlopidae

<i>Typhlina australis</i>		1	(1)
<i>Typhlina bituberculata</i>		2	(1)
<i>Typhlina pinguis</i>		2	(2)

Boidae

<i>Liasis childreni</i>	Children's Python	3	(1)
<i>Python spilotus</i>	Carpet Snake	2	(2)

Elapidae

<i>Acanthophis antarticus</i>	Death Adder	3	(1)
<i>Brachyaspis curta</i>	Bardick	2	(2)
<i>Demansia affinis</i>	Dugite	1	(1)
<i>Demansia nuchalis</i>	Gwardar	3	(1)
<i>Demansia reticulata</i>	Whip Snake	2	(1)
<i>Denisonia coronata</i>	Crowned Snake	2	(1)
<i>Denisonia gouldii</i>	Little Whip Snake	1	(1)
<i>Notechis scutatus</i>	Tiger Snake	1	(1)
<i>Pseudechis australis</i>	Mulga (King Brown) Snake	3	(1)
<i>Pseudonaja modesta</i>	Ringed Brown Snake	2	(1)
<i>Rhinoplocephalus bicolor</i>		3	(2)
<i>Vermicella bertholdi</i>	Bandy Bandy	1	(1)
<i>Vermicella bimaculata</i>	Western Black-naped Snake	2	(2)
<i>Vermicella calonotos</i>	Western Black-striped Snake	2	(3)
<i>Vermicella fasciolata</i>	Narrow Banded Snake	2	(2)
<i>Vermicella semifasciata</i>	Half-ringed Snake	2	(2)

FROGS

Leptodactylidae

<i>Crinia georgiana</i>	Quacking Frog	1	(1)
<i>Geocrinia leai</i>		1	(1)
<i>Heleioporus albopunctatus</i>	Spotted Burrowing Frog	2	(1)
<i>Heleioporus baryceragus</i>	Darling Range Burrowing Frog	2	(2)
<i>Heleioporus eyrei</i>	Moaning Frog	1	(1)
<i>Heleioporus inornatus</i>	Chocolate Frog	2	(1)
<i>Heleioporus psammophilus</i>		2	(1)
<i>Limnodynastes dorsalis</i>	Western Banjo Frog	1	(1)
<i>Myobatrachus gouldii</i>	Turtle Frog	1	(1)
<i>Neobatrachus pelobatoides</i>	Humming Frog	2	(1)
<i>Pseudophryne guentheri</i>	Guenther's Toadlet	1	(1)
<i>Ranidella glauerti</i>	Glauert's Frog	1	(1)
<i>Ranidella insignifera</i>		1	(1)
<i>Ranidella pseudinsignifera</i>		1	(1)

Hylidae

<i>Litoria adelaidensis</i>	Slender Tree Frog	1	(1)
<i>Litoria moorei</i>	Green and Gold Tree Frog	1	(1)

FISHES

Geotriidae

<i>Geotria australis</i>	Wide-mouthed Lamprey	3	(3)
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Salmonidae

<i>Salmo gairdneri</i>	Rainbow Trout	3	(2)	Introduced
<i>Salmo trutta</i>	Brown Trout	2	(2)	Introduced

Galaxiidae

<i>Galaxias occidentalis</i>	Western Minnow	1	(1)
<i>Galaxiella munda</i>		3	(1)

Cyprinidae

Carassius auratus Goldfish 2 (2) Introduced
Carassius carassius Carp 3 (2) Introduced

Plotosidae

Tandanus bostocki Fresh-water Cobbler 2 (2)

Poeciliidae

Gambusia affinis Mosquito Fish 1 (1) Introduced

Atherinidae

Atherinosoma elongata Elongate Hardyhead 2 (2)
Atherinosoma presbyteroides Swan River Hardyhead 3 (2)

Percichthyidae

Bostockia porosa Nightfish 1 (1)

Teraponidae

Amphitherapon caudavittatus Yellow-tailed Trumpeter 2 (2)

Kuhliidae

Edelia vittata Western Pigmy Perch 1 (1)

Percidae

Perca fluviatilis Red-fin Perch 2 (2) Introduced

Mugilidae

Aldrichetta forsteri Fresh-water Mullet 2 (2)
Mugil cephalus Yellow-eye Mullet 2 (2)

Gobiidae

Favonigobius suppisotus Big-mouthed Goby 2 (2)
Pseudogobius olorum Swan River Goby 1 (1)

THE RARE ONES

Mammals

Tammar (*Macropus eugenii*). Once found on the coastal plain and in the Darling Range. Within System 6 it occurs only on Garden Island and in the eastern Darling Range within State Forest. Also occurs on other islands and on Nature Reserves in the Wheatbelt.

Woylie (*Bettongia penicillata*). Now extinct in System 6. Only known from three localities elsewhere - Tutanning Nature Reserve, Dryandra Forest and the Perup Fauna Priority Area.

Boodie (*Bettongia lesueur*). Extinct on the Australian mainland. Now found only on four W.A. Islands - Barrow, Boodie, Bernier and Dorre.

Gilbert's Potoroo (*Potorous tridactylus gilberti*). Believed to be extinct. Another sub-species is relatively common in eastern Australia.

Birds

Freckled Duck (*Stictonetta naevosa*). This rare duck depends on fresh-water swamps. It breeds in such places as Benger Swamp and its persistence will depend on the reservation and maintenance of this type of habitat.

Pectoral Sandpiper (*Calidris melanotus*). This trans-equatorial migratory wading bird is only rarely recorded in Western Australia. Common elsewhere in the world.

Noisy Scrub Bird (*Atrichornis clamosus*). Once occurred in wet gullies along the Darling Scarp but now only found at Two Peoples Bay Nature Reserve, east of Albany.

Western Whipbird (*Psophodes nigrogulatis*). Once known from the coastal plain near Perth this species is now restricted to the south-eastern wheatbelt and south coast where it occurs in the Two Peoples Bay Nature Reserve and the Fitzgerald National Park.

Western Bristlebird (*Dasyornis brachypterus longirostris*). One of our rarest birds. It formerly occurred near Perth and southwards along the coastal plain but is now restricted to the south coast where it occurs in the Two Peoples Bay Nature Reserve and the Fitzgerald National Park.

Reptiles

Western Swamp (Short-necked) Tortoise (*Pseudemydura umbrina*).

This species is near extinction. It has been recorded only from a very small region of the coastal plain from Pearce RAAF base to Guildford Airport. Now largely restricted to two Nature Reserves in the Upper Swan-Bullsbrook Area where its numbers are declining.

Lined Skink (*Lerista lineata*). Found only on Rottnest and Garden Islands and in a few southern suburbs of Perth. Although it should persist on the islands it may not survive on the mainland.

A

A.1 COWALLA BRIDGE RESERVE C21164

This 40 ha reserve is situated on the Moore River at Cowalla Bridge, about 17 km downstream from Regans Ford. It is vested in the Shire of Gingin for the purpose of Stock Route. The reserve lies within the Moore Soil-landform Unit (Churchward and McArthur 1978).

Although the reserve straddles the Moore River the portion north of the river is largely cleared and is apparently being farmed. There are some remaining trees of Flooded Gum (*Eucalyptus rudis*) and the paperbark *Melaleuca raphiophylla*.

South of the river is a low open-forest of Acorn Banksia (*B. prionotes*) associated with the tall shrub *Kunzea vestita*. Other species present are Pricklybark (*Eucalyptus todtiana*), Flooded Gum (mostly near the river), Slender Banksia (*B. attenuata*), Menzies' Banksia (*B. menziesii*), Holly-leaf Banksia (*B. ilicifolia*), *Jacksonia furcellata*, Blackboy (*Xanthorrhoea preissii*) and Christmas Tree (*Nuytsia floribunda*).

The fence line on the western side is in poor condition, and there are signs of moderately heavy grazing, indicating that cattle are wandering onto the reserve.

Despite its small size the reserve is valuable. It differs from other reserves between Gingin and the Moore River in that its vegetation is largely of a single storey; there is a dense layer 2-6 m tall and little or no ground cover.

If domestic animals were kept out of the entire reserve the vegetation would probably regenerate and cover the cleared portion. Trees such as Flooded Gum and Acorn Banksia have an ability to colonise readily and regenerate rapidly. The latter is regenerating well in the southern portion of the reserve despite the grazing.

RECOMMENDATION

The Committee recommends that reserve C21164 be made a Class A reserve for Conservation of Flora and Fauna, vested in the Western Australian Wildlife Authority.

A.2 MOORE RIVER NATIONAL PARK

Reserve A28462 lies south of the Moore River and east of the Brand Highway. It is for the purpose of National Park and comprises 17 542 ha. It is vested in the National Parks Authority.

More than 95% of the Park contains soils of the Bassendean Soil-landform Unit (Churchward and McArthur 1978). They vary from deep, dry, pale grey sands to water-saturated sands and peats, and their vegetation has been classified into types G, H, I, J and K (Havel 1968). All types are represented in the Park.

Pale grey sands are the most plentiful in the Park; their characteristic vegetation (types G and H) is a low woodland of Banksia (*B. attenuata*, *B. menziesii* and *B. ilicifolia*), Pricklybark (*Eucalyptus todtiana*) and Christmas Tree (*Nuytsia floribunda*). Common understorey species that grow on the vegetation types G and H are *Leucopogon conostephioides*, *Scholtzia involucrata*, *Eremaea pauciflora*, *Melaleuca scabra*, *Boronia purdieana*, *Astroloma xerophyllum*, Blackboy (*Xanthorrhoea preissii*) and *Dasypogon bromeliaefolius*.

In the central northern part of the Park is a high, undulating area of dry dunes where the vegetation is a low open-woodland of only *B. attenuata* and *B. menziesii*. Here there is some pale yellow sand underlying the grey sand, which has resulted in the occurrence of some species which normally are restricted to the yellow sands of the Karrakatta Soil-landform Unit, such as Blueboy (*Stirlingia latifolia*), *Jacksonia floribunda* and *Eremaea fimbriata*.

Types I and J occur on dark grey, humic sands, and consist of low woodland or low open-woodland where Holly-leaf Banksia (*B. ilicifolia*) is common, and where, in seasonally flooded areas, Swamp Banksia (*B. littoralis*) and the paperbark *Melaleuca preissiana* dominate. These types are common in two low-lying strips known as Nine-Mile Swamp and Six-Mile Swamp that run north and south through the Park. In the south of Nine-Mile Swamp are a few areas of Marri (*Eucalyptus calophylla*) which grows as woodland or in association with Flooded Gum (*E. rudis*) as open-forest. Morrison (*Verticordia nitens*) and Blackboy are commonly seen in the understoreys. Also present is the stunted Rose Banksia (*B. laricina*), which is practically restricted to this National Park.

Type K, less common in the Park than the other types, is characteristic of water-saturated sands and peats in the more permanent swamps. It varies from closed-heath or closed-scrub to low open-woodland of the paperbark *Melaleuca raphiophylla* to closed-forest of *M. raphiophylla* and Flooded Gum. Species of the heath or scrub include *M. viminea*, *M. polygaloides*, *Leptospermum ellipticum*, *Regelia ciliata* and *Actinostrobilus pyramidalis*. In areas of deeper inundation, sedge communities of *Baumea* spp. occur.

On the extreme eastern side, near the Brand Highway, the reserve contains about 500 ha of a different landform, the Coonambidgee Unit, consisting of pale grey sands. Its vegetation is low open-woodland of *Banksia*, similar to that of types G and H of the Bassendean Unit, but more open in structure.

Visitor Interest

Wild flowers of popular appeal are plentiful in the Park. The principal ones are Golden Kangaroo Paw (*Anigozanthos pulcherrimus*), Winter Bell (*Blancoa canescens*), Rose Banksia and at least five species of *Verticordia*. Among the last is the Morrison (*V. nitens*) which in early summer makes a vivid orange display in the Banksia woodland. Other plants of interest are *Astroloma stomarrhena*, *Conostylis juncea* and *Actinostrobilus pyramidalis* and a local variety of *Hovea*. A feature of the area is the number of species of myrtles, smokebushes (*Conospermum*) and native buttercups (*Hibbertia*).

Vacant Crown Land

Adjoining the Park on its southern boundary is a 4000 ha piece of vacant Crown land. The southern half of it is mapped as the Caladenia Unit and is characterised by a pattern of low dunes of yellow sand with intervening lakes. The lakes are well defined, rounded and permanent.

The vegetation of the drier areas consists of low woodland of *Banksia* (*B. attenuata*, *B. menziesii*, *B. ilicifolia*), Prickly-bark and Christmas Tree - similar to that of the Bassendean types G and H in the National Park. The soils, however, consist of yellow and pale yellow sands (types D, E and F) as well as the pale grey sands of types G and H. On the yellow and pale yellow sands grow understorey species whose presence indicates types D, E and F: *Mesomelaena stygia*, *Synaphea polymorpha*, *Calothamnus sanguineus*, *Calectasia cyanea*, *Pimelea sulphurea* and *Acacia sphacelata*. Other species common in the understorey include *Eremaea pauciflora*, *Conostephium pendulum*, *Andersonia* sp., *Eriostemon spicatus*, *Petrophile linearis*, *P. macrostachya*, *Hibbertia hypericoides*, *Stirlingia latifolia*, *Hovea trisperma*, *Burtonia conferta* and *Xanthorrhoea preissii*.

There are 7 small, round lakes containing open water. Their fringes are vegetated with closed-sedgelands of Jointed Twig Rush (*Baumea articulata*) and *Leptocarpus* sp. Surrounding the sedgelands are some patches of low closed-forest of the paperbark *Melaleuca raphiophylla* and low woodlands of the paperbark *M. preissiana* and *Banksia* spp., principally Swamp Banksia and Holly-leaf Banksia. Where Holly-leaf Banksia dominates, the understorey contains Rose Banksia, White Myrtle (*Hypocalymma angustifolium*) and *Hovea pungens*. Near some of the lakes there are also woodlands of Marri (*Eucalyptus calophylla*)

The frogs *Ranidella glauerti*, *R. insignifera* and *Pseudophryne guentheri* are found in the lakes. The presence of *R. glauerti* indicates that a lake is semi-permanent.

The Caladenia Unit is limited in extent, and consists of a single area north of Gingin Brook; this land contains the only portion of it in Crown land. The land would be a valuable addition to the National Park both in preserving an area of the Caladenia Unit and in providing the Park with greater diversity. Not only are the yellow and pale yellow sands of this land, and their associated flora, different from those of the Park but also the wetlands are different from the ill-defined, swampy areas that occur in the Park. Moreover, semi-permanent lakes, such as those contained in the vacant Crown land, are important as summer refuges for water-birds.

There has been some interest in the possibility of mining diatomite from the lakes in this land. There have been requests that part of the area be made available for agriculture.

Adjoining Reserve C33032

This reserve, situated on the eastern side of the Brand Highway about 12 km south east of Regans Ford, was set aside as a Stopping Place for Travellers. It has an area of 75 ha and is unvested.

Although the reserve is adjacent to the Moore River National Park much of it is of a distinct character, containing elements of the Reagan Unit. It occupies higher ground on the Gingin Scarp. Towards the southern end is a woodland of Wandoo (*Eucalyptus wandoo*), growing in gravelly soil. Nearby is an area of yellow sand, which supports scattered trees of Pricklybark, Marri and *Banksia attenuata* with some Couch Honeypot *Dryandra nivea* and Blackboys in the understorey.

On white sand along the southern border there is a closed-heath with scattered, emergent Christmas Trees. The white sand along the eastern edge, however, supports a low woodland, with trees of *Banksia menziesii*, *B. ilicifolia*, Pricklybark and Christmas Tree and an understorey that includes *Oxylobium capitatum*, *Hovea pungens*, *Conostephium pendulum*, *Leucopogon* spp., *Blancoa canescens*, *Calytrix* spp., *Eremaea* spp., *Hibbertia hypericoides*, *Stirlingia latifolia* and *Adenanthos cygnorum*.

Red Gully Road runs along the northern boundary; near it is Red Gully Creek which flows through the reserve. The vegetation here, which contains the paperbark *Melaleuca preissiana* and some Flooded Gum, is akin to that of much of the Moore River National Park.

The reserve has been used as a metal dump, and there is a registered apiary site in the Wandoo woodland.

The reserve provides a striking contrast with the adjacent Moore River National Park. The Committee considers that its addition to the Park is desirable since it would increase the biological diversity. It also provides fine views over the Park and the adjacent coastal plain.

RECOMMENDATION

The Committee recommends that:

1. the total area of vacant Crown land south of the Moore River National Park, as shown in Fig. , be added to the Park;
2. reserve C33032 be cancelled and its area added to the Moore River National Park;
3. any mining for diatomite proceed only if agreement is reached between the National Parks Authority and the mining company.

A.3 BARTLETTS WELL

Bartletts Well is situated just east of the Brand Highway and is about halfway between Gingin and Regans Ford. It is contained in a 117 ha reserve, C1224, vested in the Shire of Gingin for the purpose of Camping.

The reserve is very diverse for its size and contains three landforms - the Gingin, Moondah and Karamal Soil-landform Units (Churchward and McArthur 1978).

The Gingin Unit is represented in the south-western part of the reserve, where there is a woodland of Marri (*Eucalyptus calophylla*). The understorey contains *Hakea trifurcata*, *H. lissocarpha*, *Persoonia saccata*, *Conospermum triplinervium*, *Calothamnus quadrifidus*, *Jacksonia sternbergiana*, *Daviesia* spp., *Acacia saligna*, *Hibbertia hypericoides* and *Casuarina humilis*.

On the western side the ground slopes uphill to the north, and this section represents the Moondah Unit. Its soil of orange to red sand supports a low woodland of Pricklybark (*Eucalyptus todtiana*) and *Banksia* (*B. attenuata* and *B. menziesii*), with a few *Casuarina huegeliana*. Blackboys (*Xanthorrhoea preissii*) and *Zamias* (*Macrozamia riedlei*) occur in the understorey.

The higher ground of the northern part of the reserve contains the gravels of the Karamal Unit and supports a woodland of Wandoo (*Eucalyptus wandoo*) and Jarrah (*E. marginata*). The understorey includes *Hakea lissocarpha* and *Conostephium* spp.

Western Grey Kangaroo (*Macropus fuliginosus*) as well as a diversity of bird species have been recorded in the reserve.

RECOMMENDATION

The Committee recommends that reserve C1224 be made a Class A reserve for Conservation of Flora and Fauna, vested in the Western Australian Wildlife Authority.

A.4 RESERVES C18352 AND C15928

These adjoining reserves are located near the south-east corner of the Moore River National Park. Reserve C18352, of 75 ha, is set aside for Government Requirements. Reserve C15928, of 20 ha, is for Water and both are vested in the Shire of Gingin.

In the southern portion of C18352 is a low, swampy area of sand, with a tall shrubland of Christmas Trees (*Nuytsia floribunda*), *Banksia* aff. *sphaerocarpa*, Silky Bloodflower (*Calothamnus sanguineus*), *Viminaria juncea*, Snakebush (*Hemiandra pungens*), *Melaleuca* spp. and Blackboy (*Xanthorrhoea preissii*). On deeper soils is low woodland of the paperbark *Melaleuca raphiophylla*, Swamp *Banksia* (*B. littoralis*) and Menzies' *Banksia* (*B. menziesii*) and the shrubs *Actinostrobos pyramidalis*, *Melaleuca teretifolia*, *Jacksonia furcellata* and *Daviesia* spp. On the deepest soils is a woodland of Marri (*Eucalyptus calophylla*) with an occasional Slender *Banksia* (*B. attenuata*).

The north-west portion of the reserve contains vegetation typical of the Bassendean Soil-landform Unit (Churchward and McArthur 1978). It is covered with a low woodland of Holly-leaf *Banksia* (*B. ilicifolia*) with a shrub layer which includes Woollybush (*Adenanthos cygnorum*), Blueboy (*Stirlingia latifolia*) and Buttercups (*Hibbertia hypericoides*). Around a swamp at the northern end are stands of *Melaleuca raphiophylla*, *Viminaria juncea* and *Leptospermum ellipticum*.

Western Grey Kangaroos (*Macropus fuliginosus*) are plentiful.

The southern part of this area, including much of reserve C18352, contains an interesting vegetation with characteristics of the Yanga and Mungala Units, but especially noteworthy for the occurrence of Swamp Cypress (*Actinostrobos pyramidalis*).

RECOMMENDATION

The Committee recommends that reserves C18352 and C15928 be amalgamated as a Class A reserve for Conservation of Flora and Fauna, vested in the Western Australian Wildlife Authority.

A.5 BEERMULLAH LAKE

Beermullah Lake is located about 20 km north-west of Gingin. It comprises reserve C22223, of 101 ha, for Recreation, vested in the Shire of Gingin.

The lake is permanent and is thus important as a summer drought refuge for waterfowl. During an inspection on the afternoon of 30 April 1975, the following birds were recorded: Black-tailed Native Hen (*Tribonyx ventralis*), Black Duck (*Anas superciliosa*), Grey Teal (*Anas gibberifrons*), Mountain Duck (*Tadorna tadornoides*), Little Grebe (*Podiceps novaehollandiae*), Swampphen (*Porphyrio porphyrio*), Pied Cormorant (*Phalacrocorax varius*) and Swamp Harrier (*Circus approximans*).

Fishes that inhabit Beermullah Lake are the Hardyhead *Atherinosoma* sp., Swan River Goby (*Pseudogobius olorum*) and the introduced Mosquito Fish (*Gambusia affinis*).

People use the lake for water skiing; a survey is presently being undertaken to determine the extent of use and what seasons are most popular.

During summer, algal growth in the lake is a problem and has been described as being a health hazard to users of the lake. It is believed to be caused by nutrients which enter the lake, both via a feeding stream and by runoff from immediately surrounding agricultural land.

Various measures have been suggested in combatting the problem. If the foreshore, as far as 30 metres from high-water mark, could be revegetated (by excluding stock) a smaller amount of nutrients would enter the lake. By irrigating the foreshore vegetation with water from the lake one might decrease the lake's nutrients still further. The diversion of a stream that flows into the lake, to cause it to flow through a swamp before it enters the lake, might also be helpful.

As a further consequence of the devegetation of the lake's foreshore, aeolian dunes have built up on the western side of the lake. Regeneration of foreshore vegetation may also combat the erosion.

The Department of Fisheries and Wildlife and the Shire of Gingin have been discussing the lake during the past two years, and are endeavouring to ensure that the lake is protected both as a recreation area and as a habitat for water-birds.

RECOMMENDATION

The Committee recommends that:

1. reserve C22223 be made a Class A reserve for Conservation of Flora and Fauna and Recreation, vested jointly in the Shire of Gingin and the Western Australian Wildlife Authority;
2. reserve C22223 be extended, by purchase of land when available, to 30 m from high-water mark;
3. the Shire of Gingin and the Western Australian Wildlife Authority confer and agree on the zoning of skiing in the lake and the revegetation of the lake's shores.

A.6 YURINE SWAMP

Yurine Swamp is a small, seasonal swamp 16 km north-west of Gingin. It is contained in reserve C9676, of 30 ha and vested in the Western Australian Wildlife Authority for the purpose of Conservation of Flora and Fauna.

A bitumen road divides the reserve into an eastern portion, which contains the swamp, and a larger, western portion. The swamp is surrounded by a tall stand of the paperbark *Melaleuca raphiophylla*, and this eastern portion also contains Flooded Gum (*Eucalyptus rudis*), Swamp Banksia (*B. littoralis*), Woollybush (*Adenanthos cygnorum*) and *Jacksonia furcellata*.

The western portion contains mixed stands of Marri (*Eucalyptus calophylla*), Pricklybark (*E. todtiana*), Slender Banksia (*B. attenuata*) and Menzies' Banksia (*B. menziesii*). Acorn Banksia (*B. prionotes*) also occurs, mostly near the road, in an area of deep yellow sand. The understorey species include Blackboy (*Xanthorrhoea preissii*), *Hakea trifurcata*, *H. costata*, Blueboy (*Stirlingia latifolia*), One-sided Bottlebrush (*Calothamnus quadrifidus*), Stinkwood (*Jacksonia sternbergiana*), Common Hovea (*H. trisperma*), Prickly Moses (*Acacia pulchella*), and *Drosera* spp.

Yurine Swamp has been popular with duck shooters, and the reserve is classified as a shooting and hunting area to enable duck-shooting to take place during an open season.

The Committee endorses the present purpose and vesting of reserve C9676.

RECOMMENDATION

The Committee recommends that reserve C9676 be reclassified as Class A.

A.7 LAKE MUCKENBURRA

At Lake Muckenburra, about 12 km west of Gingin, are two reserves. Reserve C20366, vested in the Shire of Gingin for the purpose of Recreation, contains the lake and a surrounding strip of land. Reserve C25431, an unvested reserve for the purpose of Public Utility, adjoins the Recreation reserve on its southern, western and eastern sides. The reserves have areas of 55 ha and 121 ha respectively.

Much of the area contains vegetation typical of the Bassendean Soil-landform Unit (Churchward and McArthur 1978), with Banksia (*B. attenuata*, *B. menziesii* and *B. ilicifolia*) and Pricklybark (*Eucalyptus todtiana*). Additionally there are some groups of Marri (*E. calophylla*), and in some areas are Blackboys (*Xanthorrhoea preissii*) and Zamias (*Macrozamia riedlei*).

South of the lake is a low, swampy area with tall shrublands of *Melaleuca viminea* and *Regelia ciliata*, and low open-woodlands of Swamp Banksia (*B. littoralis*), the paperbark *Melaleuca preissiana* and Christmas Tree (*Nuytsia floribunda*).

White dunes border the lake. They are covered with an open-scrub of *Melaleuca teretifolia*, *Viminaria juncea*, *Jacksonia furcellata* and Woollybush *Adenanthos cygnorum* with a few trees of Flooded Gum (*Eucalyptus rudis*) and the paperbark *Melaleuca raphiophylla*. On top of the dunes grows *Zamia* (*Macrozamia riedlei*) and near the lake is a dense stand of Jointed Twig Rush (*Baumea articulata*).

The following birds have been recorded: Yellow-rumped Thornbill (*Acanthiza chrysorrhoa*), Grey Fantail (*Rhipidura fuliginosa*), Willie Wagtail (*Rhipidura leucophrys*), Tree-martin (*Petrochelidon nigricans*), New Holland Honeyeater (*Phylidonyris novaehollandiae*), Singing Honeyeater (*Meliphaga virescens*), Black-faced Cuckoo-shrike (*Coracina novaehollandiae*), Reed-warbler (*Acrocephalus stentoreus*), Musk Duck (*Biziura lobata*) and Black Swan (*Cygnus atratus*). A nest of the Long-necked Tortoise (*Chelodina oblonga*) was also found.

One or two trail bike tracks were the only signs of recreative use of the reserve.

Wetlands are an important resource on the Coastal Plain, and in this context Lake Muckenburra should be protected.

RECOMMENDATION

The Committee recommends that:

1. reserve C20366 be made a Class A reserve for the Conservation of Flora and Fauna and Recreation, vested jointly in the Shire of Gingin and the Western Australian Wildlife Authority.

2. to minimise disturbance of the reserve's vegetation, the area be zoned to confine active recreation to the waters of the lake in reserve C20366;
3. reserve C25431 be made a Class A reserve for the Conservation of Flora and Fauna, vested in the Western Australian Wildlife Authority.

A.8 RESERVE A24436

About 2.5 km north of Wabbling Hill is reserve A24436 for Protection of Flora. It is 113 ha in size and is vested in the National Parks Authority.

On the eastern side is a low sand dune with vegetation typical of the Bassendean Soil-landform Unit (Churchward and McArthur 1978). Here grows a low woodland of Banksia (*B. attenuata* and *B. menziesii*) and Pricklybark (*Eucalyptus todtiana*) with *Stirlingia latifolia*, *Leucopogon* sp., and *Conostephium pendulum* in the understorey.

A small area in the south contains vegetation that typifies the younger Cottesloe and Karrakatta Units. Species such as *Hakea costata*, *Hibbertia racemosa* and *Jacksonia sternbergiana* indicate the Cottesloe Unit (type C of Havel 1968). The proximity of the limestone outcrops of Wabbling Hill may account for the presence on the western side of the reserve of other species of those Units, such as Parrot Bush (*Dryandra sessilis*) and *Casuarina fraserana*, among other species typical of the Bassendean Unit.

In the greater part of the reserve, including the western and central portions, also grow the following trees and tall shrubs: *Melaleuca preissiana*, *Eucalyptus rudis*, *Regelia ciliata*, *Kunzea vestita*, *Banksia ilicifolia*, *B. attenuata*, *B. menziesii*, *B. prionotes*, *B. littoralis*, *Hakea trifurcata*, *Adenanthos cygnorum*, *Conospermum triplinervium*, *Nuytsia floribunda*, *Jacksonia furcellata*, *Acacia saligna* and *Exocarpos sparteus*. The smaller shrubs include *Verticordia nitens*, *Stirlingia latifolia*, *Hypocalymma angustifolium* and *Conospermum* sp.

The extent to which the above species intermix is interesting, for some of them are characteristic of the wet and moist soils (types I, J and K) of the Bassendean Unit and others the dry soils (types G and H). The area appears to have undergone a major hydrological change in geologically recent times, and as yet has not reached stability.

The dynamic state of the vegetation is of scientific interest. The Forests Department is monitoring the changes in the vegetation; the study of this area is important in understanding the effects of groundwater extraction. Other depressions in the Yanchep area with similar characteristics, for example Lake Pinjar, have all been alienated.

In the eastern part of the reserve is a small experimental plot of pines. They are fairly old and not many have survived.

The National Parks Authority harvests foliage of the Flooded Gum (*Eucalyptus rudis*) from this reserve as food for Koalas at Yanchep National Park.

RECOMMENDATION

The Committee recommends that, when the vacant Crown land within Wabbling Special Management Priority Area (15.3) is added to the S.M.P.A. (see A.10), reserve A24436 be proclaimed State Forest and also added to the S.M.P.A., provided that the National Parks Authority be allowed to obtain Koala food from the area of the reserve.

A.9 TWO ROCKS OPEN SPACE

The Metropolitan Region Planning Authority's proposed Two Rocks Open Space extends eastwards in a broad band from the Indian Ocean just north of Two Rocks to near Wanneroo Road. It occupies about 2000 ha.

The eastern third of the Open Space lies in the Cottesloe Soil-landform Unit (Churchward and McArthur 1978); most of it contains an open-woodland of Tuart (*Eucalyptus gomphocephala*), with associated Banksias (*B. attenuata*, *B. grandis*, *B. menziesii* and *B. prionotes*). The understorey has been modified, and in some places eliminated, by grazing. Low woodlands of *B. attenuata*, *B. menziesii* and Pricklybark (*E. todtiana*) also occur, and woodlands of Limestone Marlock (*E. decipiens*) occur in small patches.

The remaining area consists of undulating topography, and is mostly characteristic of the Quindalup Unit. The hilltops are largely covered by an open-heath dominated by *Melaleuca acerosa*, with *Phyllanthus calycinus*, *Conostylis candicans* and *Leucopogon* spp. The large valleys and some of the hillsides support vegetation more typical of the Cottesloe Unit: they contain open-woodlands of Tuart and low open-woodlands of Banksia (chiefly *B. attenuata*). Blackboys (*Xanthorrhoea preissii*) are common in the under-storeys, and the shrubs *Hakea trifurcata*, One-sided Bottlebrush (*Calothamnus quadrifidus*) and *Grevillea vestita* are conspicuous. On some of the hillsides, limestone appears at the surface; the associated vegetation is a closed-heath of Blackboy, Prickly Moses (*Acacia pulchella*), Spider-net Grevillea (*G. thelemanniana*), *Jacksonia sericea*, *Diplopeltis huegelii*, Couch Honey-pot (*Dryandra nivea*) and Rough Daisy-bush (*Olearia rudis*).

The proposed Two Rocks Open Space contains a much larger area of the Quindalup Unit than any existing or proposed conservation reserve between Perth and the Moore River, and also provides a good example of the transition between the Quindalup and the Cottesloe Units. Along the eastern half of its northern boundary it adjoins the Forests Department's Caraban Special Management Priority Area.

Much of the Open Space has been modified by grazing although the effects are more pronounced in the east. Some of the vegetation in the western half, chiefly the closed-heath growing on limestone, is also affected. Over most of the Open Space, however, the vegetation could probably be returned to a natural state. In other respects the area is little disturbed; there appears to be only one track in the dunes area of the Quindalup Unit. The Tuart trees in the area are healthy.

The Committee endorses the Metropolitan Region Planning Authority's proposal to purchase when available the Two Rocks Open Space.

RECOMMENDATION

The Committee recommends that:

1. owing to the area's significance in conserving the fragile landscape of the Quindalup Soil-landform Unit, at least 1500 ha of the Open Space be set aside as a Class A reserve for Conservation of Flora and Fauna, and vested in the Western Australian Wildlife Authority;
2. in zoning the area, the Metropolitan Region Planning Authority consult the Environmental Protection Authority.

A.10 STATE FOREST NO.65: SPECIAL MANAGEMENT PRIORITY AREAS

CARABAN

Caraban S.M.P.A. is located about 60 km north of Perth, along the western edge of the State Forest. It has a core area of 1461 ha and a buffer of 1505 ha, on the eastern and southern sides.

Purpose

The main purpose of Caraban is to conserve the coastal vegetation types characteristic of the Cottesloe Soil-landform Unit, together with a small sample of the Quindalup Unit (Churchward and McArthur 1978).

General Features

Caraban resembles Ridges in some respects, but differs in the inclusion of the only area of Quindalup Unit within State Forest. The bulk of the area consists of limestone ridges interspersed with sandy depressions, which characterise the Cottesloe Unit.

The cover ranges from shrublands to open-woodland of Tuart (*Eucalyptus gomphocephala*). Apart from construction of access tracks and fire-lines, there has been virtually no disturbance other than periodic prescribed burning. The area is so far free of dieback infection, limestone mining and recreational pressure. It could, in the future, be affected by industrial development.

Vegetation

The vegetation consists of an intricate mosaic of coastal vegetation types A, B, C, D and E (Havel 1968) which reflects largely the depth over limestone. The shrub flora is particularly rich.

Types A and B are characteristic of limestone outcrops, type B occurring where there is a deeper layer of soil overlying the limestone. The main indicators of type A are Chenille Honey-myrtle (*Melaleuca huegelii*), *M. cardiophylla*, Spider-net Grevillea (*G. thelemanniana*), *G. vestita* and Parrot Bush (*Dryandra sessilis*).

The main indicators of type B are *Jacksonia hakeoides*, Tree Smokebush (*Conospermum triplinervium* var. *linearis*), One-sided Bottlebrush (*Calothamnus quadrifidus*) and *Melaleuca acerosa*.

Type C tends to occur downslope from A and B, and has weakly leached sandy soils of moderate depth. It has a well developed tree stratum which includes Tuart (*Eucalyptus gomphocephala*), Limestone Marlock (*E. decipiens*), Sheoak (*Casuarina fraserana*) and Banksias (*B. attenuata*, *B. menziesii* and *B. grandis*).

Type D is indicated by the presence of Telegraph Sedge (*Mesomelaena stygia*). *Synaphea polymorpha*, Silky Bloodflower (*Calothamnus sanguineus*), *Eremaea pauciflora* and Rough Honey-myrtle (*Melaleuca scabra*), characteristic of deep yellow sands with a moderately leached surface.

Type E is characteristic of deeper, somewhat more leached sands, and tends to occur in broad depressions. Its tree stratum consists mostly of *Banksia attenuata*, with scattered emergents of Jarrah (*Eucalyptus marginata*). The shrub indicator species are Blackboy (*Xanthorrhoea preissii*), *Eremaea fimbriata*, *Synaphea polymorpha* and Blueboy (*Stirlingia latifolia*).

Only a small proportion of the Quindalup Unit is represented. Further representation could be obtained by the purchase of adjacent private land (Swan Location 3165 - Dewars). This 344 ha piece of land would provide more than 2 km of additional common boundary between Caraban and the Metropolitan Region Planning Authority's proposed Two Rocks Open Space Area.

The Committee endorses the proposal by the Forests Department for that Department to manage Caraban Special Management Priority Area for the conservation of its coastal vegetation types and associated fauna.

RECOMMENDATION

The Committee recommends that the Forests Department purchase when available Swan Location 3165 for addition to Caraban Special Management Priority Area (15.4).

WABLING

Wabling S.M.P.A. lies 8 - 10 km north-east of Yanchep National Park and about 60 km north of Perth. The core, of 963 ha, is located in the north-west around Wabling Hill, and is composed of State Forest (543 ha), vacant Crown land (307 ha) and reserve A24436 (113 ha), for Protection of Flora, vested in the National Parks Authority. The south-eastern portion is all buffer, and comprises 1501 ha of State Forest.

Purpose

The main purpose of Wabling is to preserve the steep environmental and vegetational gradient between the limestone outcrops of Wabling Hill and the leached dunes of Tick Flat.

General Features

Wabling is very variable from the point of view of geomorphology, soils and vegetation. Parts of the area have been lightly logged, and some local mining of limestone for road construction has also taken place. There is no known occurrence of dieback. Recreational pressure is so far insignificant, but could develop at Wabling Hill, in the north-western sector.

Vegetation

Wabling contains a full set of vegetation types found in the Cottesloe, Karrakatta and Bassendean Units, including the transition between them: types A, B, C, D, E, F, G, H, I, J and K. (See Caraban, above, and Melaleuca, following).

Wabling includes reserve A24436 (see A.8). This interesting area includes a range of seral stages, and appears to have undergone a major hydrological change in recent times.

The Committee endorses the proposal by the Forests Department for that Department to manage Wabling Special Management Priority Area (15.3) for the conservation of flora and fauna.

RECOMMENDATION

The Committee recommends that:

1. the area of vacant Crown land shown in Fig. be proclaimed State Forest and be included in Wabling Special Management Priority Area (15.3);
2. at the time the vacant Crown land is added, reserve A34436 also be proclaimed State Forest and added to the S.M.P.A., provided that the National Parks Authority be allowed to continue to obtain Koala food from the area of the reserve;
3. the mining of limestone within the S.M.P.A. be restricted to areas where it has already commenced;
4. recreation not be excluded, but that vehicular access be confined to all-weather roads such as Wabling and Military Roads.

RIDGES

Ridges S.M.P.A. is located about 50 km north of Perth. It consists of buffer only, with an area of about 1260 ha. It adjoins the Yanchep National Park on the Park's eastern side.

Purpose

The main purpose of Ridges is to supplement and enlarge the adjacent Yanchep National Park, and to create a buffer between it and the extensive pine plantations within the region.

General Features

Ridges resembles Caraban and the western portion of Wabling. It is wholly located within the Cottesloe and the Karrakatta Units and consists of high ridges with a core of coastal limestone, interspersed with broad sandy flats and swampy depressions. There is no surface run-off. The cover ranges from heath and scrub on limestone outcrops, through woodlands of *Banksia* and *Eucalyptus* species to

shrublands and sedgeland in swamps.

The area has been partially logged for Jarrah (*Eucalyptus marginata*), but in view of the paucity of logs of adequate size and quality the impact has been low. Some localised mining of limestone for road construction has also taken place, and portions of the area are covered by mining leases. As yet, no dieback has been recorded in the area. As the access into the area consists of the relatively rough Yeal Swamp Road, there has been little recreational use so far.

Although types D, I and J are restricted in extent, the latter in particular is important as it contains an outstanding development of mature woodland of the paperbark *Melaleuca preissiana*.

RECOMMENDATION

The Committee recommends that:

1. an area of Ridges Special Management Priority Area (15.2) that adjoins pine plantations be retained by the Forests Department and managed as a buffer strip; the Forests Department and the National Parks Authority should confer to determine the width of the strip;
2. the remainder be added to Yanchep National Park (See A.13, Yanchep National Park).

MELALEUCA

Melaleuca S.M.P.A. consists of core only, with an area of 3208 ha, and is located about 40 km north-east of Perth. It is adjoined by State Forest to the south and west. In the east the land has been alienated for agriculture and to the north is the R.A.A.F. training area.

Purpose

The main purpose of Melaleuca is to conserve the coastal vegetation types characteristic of the Bassendean Unit.

General Features

The area consists of low dunes interspersed with shallow lakes and swampy depressions which typify the Bassendean Unit.

The soils over most of the area consist of deep, light grey sands. In the swamps the sands are replaced by water-saturated peats. There is a gradual transition between these extremes.

Most of the area is covered by low woodland or low open-forest of *Banksia* (*B. menziesii* and *B. attenuata*).

The area is relatively undisturbed except for a few tracks and for localised changes associated with the removal of peat. At the moment recreational pressure is low, but as the populations grow in the northern suburbs or Perth it will probably increase.

The drainage is into local depressions and swamps. A series of water bores is being installed west of this area by the Metropolitan Water Supply, Sewerage and Drainage Board. The bores are likely to alter the hydrological balance in areas of the Bassendean Unit north of Melaleuca.

Vegetation

This area is particularly significant as it is the main remaining undisturbed example of the Bassendean Unit within State Forest. All the vegetation types which typify the Bassendean Unit (viz. G, H, I, J and K) are well represented.

Most of Melaleuca is covered by vegetation of type G. The overstorey of this type is dominated by *Banksia* (*B. menziesii* and *B. attenuata*). Type G is found on the strongly leached, deep, dry, pale grey sands found on the ridges.

Type H is restricted to the flats which are dry at the surface but moist at greater depths. It is indicated by the presence of *Leucopogon conostephioides*, *Scholtzia involucrata*, Blackboy (*Xanthorrhoea preissii*) and *Dasypogon bromeliaefolius*.

Type I is characterised by its dark grey humic surface with an organic deposition horizon at depth, and occurs on moist flats. *Melaleuca seriata* and *Adenanthos obovatus* as well as Blackboy and *D. bromeliaefolius* indicate its presence.

The swamps are surrounded by type J, with wet, dark grey humic sands subject to seasonal flooding. Typical species are White Myrtle (*Hypocalymma angustifolium*) and *Pultenaea reticulata*.

Type K is characteristic of water-saturated sands and peats in the more permanent swamps. The indicator species include the paperbark *Melaleuca raphiophylla*, *Astartea fascicularis*, *Calothamnus lateralis*, *Regelia ciliata* and species of *Typha* and *Baumea*.

Fauna

The Western Australian Naturalists' Club, which is currently doing a biological survey of Melaleuca Park, has remarked on the richness of the area. Bird species are particularly numerous because of the wide range of habitats available; the swamp complexes are particularly important. Many species

of birds which were once common in swamp-side vegetation on the coastal plain are fairly numerous in similar situations at Melaleuca Park. These include Splendid Wren (*Malarus splendens*), Spotted Scrub-wren (*Sericornis maculatus*), Brown Thornbill (*Acanthiza pusilla*), Western Thornbill (*Acanthiza inornata*), Golden Whistler (*Pachycephala pectoralis*) and Scarlet Robin (*Petroica multicolor*). Many other species of birds are present also. The interesting Swamp Skink Lizard (*Leiolopisma trilineatum*), rare elsewhere on the Swan Coastal Plain, is common at Melaleuca Park.

The Committee endorses the proposal by the Forests Department for that Department to manage Melaleuca Special Management Priority Area (15.1) for the conservation of its coastal vegetation types and associated fauna.

RECOMMENDATION

The Committee recommends that:

1. owing to its ecological importance, Melaleuca Special Management Priority Area (15.1) be protected by zoning whereby recreation will be confined to the proximity of Neaves Road, which should remain the sole means of vehicular access;
2. access on foot into the remainder of the area not be encouraged;
3. no further mining of peat be allowed in the area.

A.11 PROPOSED YEAL NATURE RESERVE

This proposed Nature Reserve lies between Yanchep, Muchea and Gingin. Apart from two existing reserves at the north-eastern side of the area (C31241, of 337 ha, for Conservation of Flora and Fauna, vested in the Western Australian Wildlife Authority, and C33784, of 114 ha, for Government Requirements, not vested) the area is vacant Crown land. The total area proposed is about

For convenience, the description of the area is divided into the area to the north and west of the Gingin airfield and the L-shaped area south of the airfield.

The Area North and West of the Gingin Airfield

Most of the area is characteristic of the Bassendean Soil-landform Unit (Churchward and McArthur 1978), and all of the vegetation types (G, H, I, J and K of Havel 1968) of this area are well represented. The deep, pale grey sands of types G and H are the most widespread, and carry a low woodland of *Banksia* (*B. attenuata*, *B. menziesii*, and *B. ilicifolia*), Christmas Tree (*Nuytsia floribunda*) and Pricklybark (*Eucalyptus todtiana*). The commonest species in the understorey include *Leucopogon conostephioides*, *Scholtzia involucrata*, *Eremaea pauciflora*, *Melaleuca scabra*, *Boronia purdieana*, *Astroloma xerophyllum* and *Dasypogon bromeliaefolius*.

Moist, dark grey, humic soils (type I) also cover large areas. The vegetation remains a low woodland, but Holly-leaf *Banksia* (*B. ilicifolia*), the least common *Banksia* in types G and H, is the commonest of the three in Type I. In the understorey, Blackboys (*Xanthorrhoea preissii*) are especially abundant, and *Zamia* (*Macrozamia piederlei*) are commoner than elsewhere.

Type K, consisting of water-saturated sands and peats, occurs through most of the area but is commonest in the east. The vegetation consists of closed-forest of the paperbark *Melaleuca raphiophylla*, sometimes associated with Flooded Gum (*Eucalyptus rudis*), with an understorey of *Lepidosperma* spp. and Bracken (*Pteridium esculentum*). Surrounding the forest is closed-scrub of *Astartea fascicularis*, *Agonis linearifolia* and *Regelia ciliata*. Where there is semi-permanent water, sedgelands of *Cladium* (*Baumea* spp.) are found.

Type J often surrounds type K, and covers an extensive area north of the R.A.A.F. airfield. In this area are woodlands and open-woodlands of Marri (*Eucalyptus calophylla*), and low woodlands of the paperbark *Melaleuca preissiana* and Swamp *Banksia* (*B. littoralis*) with some Holly-leaf *Banksia*. In their understoreys grow the brightly flowered pea plant *Euchilopsis linearis* and the myrtle *Hypocalymma angustifolium* - both indicators of damp soils. Devil's Pins (*Hovea pungens*) is another conspicuous plant of these areas. Associated with the woodlands are areas of closed scrub of *Kunzea vestita*, *Pultenaea reticulata* and the wattle *Acacia saligna*.

Much of the portion of the proposed reserve west of the airfield is more typical of the Karrakatta Unit, with yellow and pale yellow sands with associated vegetation types D and F. The vegetation is of a similar structure to that of the Bassendean types G and H, and the same species dominate in the upper storey. In the understorey, however, are some species characteristic only of yellow sands: examples are Telegraph Sedge (*Mesomelaena stygia*), Silky Blood-flower (*Calothamnus sanguineus*), Pimelea (*P. sulphurea*), Smokebush (*Conospermum stoechadis*) and Star of Bethlehem (*Calectasia cyanea*).

The Area South of the Gingin Airfield

This area lies north-west of the Commonwealth Bombing Range and south-west of the proposed Pacminex site. It contains an outstanding association of landforms, soils and vegetation.

In the centre of this portion is a swampy tract with an unusual association of plants, rather akin to the Tick Flat area (Reserve A24436: see A.8).

An area of low, undulating dunes extends eastward from that area, and supports a woodland of Jarrah (*Eucalyptus marginata*), and Marri (*E. calophylla*) with a well defined second storey of Sheoak (*Casuarina fraserana*) and Bull Banksia (*B. grandis*). The area, in fact, supports the northernmost extension of Jarrah on the Bassendean Unit of the Swan Coastal Plain. Consequently, it is of prime interest in studies of the natural distribution of Jarrah, one of Australia's most important species for commercial timber.

Moreover, the understorey species are also interesting. Although they are predominantly those of the Bassendean Unit, some of them, such as Blueboy (*Stirlingia latifolia*), *Jacksonia floribunda* and *Eremaea* aff. *fimbriata*, indicate the presence of the yellow sands of the Cottesloe and Karrakatta Units. As the soils are, in fact, a series of layers of yellow and grey sands, the area is scientifically very interesting, and consequently worthy of preservation.

Directly west of the low, undulating area, and extending into the proposed reserve, is an area of the Karrakatta Unit with typical yellow sands. The vegetation is similar to that west of the airfield.

In the south-west corner is a small area typical of the Bassendean Unit. The understorey here contains *Boronia purdieana*, which is strongly perfumed like the common Scented Boronia.

In the northern part of this area is a series of high dunes. These have the relief complexity of the youthful Quindalup Unit and comprise numerous steep-sided parabolic dunes. They rise some 40 m above the generally featureless plain of Bassendean Sands to the north and south.

The high dunes represent two transitional areas between the Karrakatta and the Bassendean Units. The vegetation of these transitional areas has a similar upper storey to that of those Units, but the understoreys contain unusual combinations of the species typical of those Units, and indicate the occurrence of layering of yellow and white sands, obvious from soil profiles.

One of the transitions characterised by pale yellow sands is also present in the Moore River National Park. The other, however, which is characterised by yellow sands, and occupies a larger area of the proposed reserve, is restricted to the area between Lake Pinjar and Muchea and is not currently represented in any conservation reserve.

The proposed Yeal Nature Reserve is the only large area of Bassendean Unit recommended as a Nature Reserve. It lies between Melaleuca Park and the Moore River National Park. Like those areas, it will protect the flora and fauna typical of the Bassendean Unit. Unlike those areas, it will also protect areas of the Karrakatta Unit, including outstanding areas of transition between the two. In its Bassendean Unit flora, this proposed reserve is to some degree intermediate between the Moore River National Park and Melaleuca Park, having different understorey species. As mentioned above, the area contains the northernmost extension of Jarrah on the Bassendean Unit of the Coastal Plain.

The best area of high dunes occurs to the west of the low undulating area, within the Commonwealth Bombing Range. Should the Commonwealth no longer require the whole of its present area the southern portion of the proposed reserve should be extended eastwards.

The Metropolitan Water Board has sunk bores and intends to construct roads and pipelines in the proposed Yeal Nature Reserve as part of the Yeal Groundwater Scheme. Concern is felt that the lowering of the water-table resulting from the extraction of water will affect the native vegetation and its associated fauna. The effect will probably be especially obvious in the swamp. Broken Hill Pty. Ltd. has proposed that it mine some of the swamps for diatomite, and the Western Australian Wildlife Authority has agreed to mining under strict conditions, since a deepening of the swamps may minimise the impact of groundwater extraction.

RECOMMENDATION

The Committee recommends that:

1. the area shown in Fig. be set aside as a Class A reserve for the Conservation of Flora and Fauna, vested in the Western Australian Wildlife Authority;
2. the Commonwealth be advised of the conservation value of the high dunes within the Bombing Range; should the Commonwealth not require all of the present area, the southern portion of proposed reserve should be extended eastwards to incorporate further areas of high dunes.

A.12 LAKES NAMBUNG, BAMBUN AND MUNGALA, WALLERING SWAMP
AND LAKE CHANDALA

Wallerling Swamp and Lakes Nambung, Bambun and Mungala are located about 8 km south of Gingin, just west of the Brand Highway. They are included in two reserves, C24257 and C26756. Reserve C24257, which comprises, in three separate parts, Lakes Nambung, Bambun and Mungala, is an unvested reserve for Conservation of Fauna. Its area is 82 ha. Reserve C26756 occupies 19 ha and contains Wallering Swamp. It is vested in the Western Australian Wildlife Authority for the purpose of Conservation of Flora and Fauna.

Lake Bambun is a large, deep lake (up to 6 metres) which contains water throughout the year. Flooded Gum (*Eucalyptus rudis*) and the paperbark *Melaleuca raphiophylla* occur around the edge, and Jointed Twig Rush (*Baumea articulata*) grows in parts of the lake. On January 30, 1978, when the lake was surveyed, hundreds of ducks were present. Pink-eared Duck (*Malacorhynchus membranaceus*) was the most abundant species, with more than 100 recorded, and Blue-winged Shoveler (*Anas rhynchotis*) was the second most abundant. Black Duck (*A. superciliosa*), Grey Teal (*A. gibberifrons*), Blue-billed Duck (*Oxyura australis*) and Musk Duck (*Biziura lobata*) were all plentiful. A number of waders, including about 25 Banded Stilt (*Cladorhynchus leucocephalus*), were present, and about 60 Straw-necked Ibis were seen overhead.

Fishes that inhabit Lake Bambun are Swan River Goby (*Pseudogobius olorum*), Nightfish (*Bostockia porosa*), Western Minnow (*Galaxius occidentalis*) and the introduced Mosquito Fish (*Gambusia affinis*). Western Minnow and Nightfish normally inhabit streams; the flooding of Lennard Brook into the lake in winter and spring probably explains this occurrence.

Lakes Nambung and Mungala are shallower, semi-permanent wetland areas which are particularly rich in aquatic life and serve as a food source for many water-birds.

Lake Chandala, also known as Lake Mandowin and Reedhead Swamp, is located 7.5 km north of Muchea, on the eastern side of the railway line. The wetland is roughly circular in shape with an area of 128 ha. It is seasonal, and is dry by mid-January.

Tingay and Tingay, 1976, classified the vegetation into three major formations. In the centre of the wetland is low closed-forest of *M. raphiophylla* and Flooded Gum. Many of the trees are of great age but there is evidence that a fire occurred fewer than twenty years ago, resulting in patches of immature trees. Surrounding the low closed-forest is an extensive area of closed-scrub of *M. hamulosa* and regrowth of *M. raphiophylla* and Flooded Gum. Some Robin Redbreast Bush (*M. lateritia*) and Broom Honey-myrtle (*M. uncinata*) are present, and rushes occur especially in the east. Small areas of herbland of samphire (*Arthrocnemum halocnemoides*) surround and intrude into the southern and western parts of the closed-scrub.

Lake Chandala supports a nesting colony of the Straw-necked Ibis (*Threskiornis spinicollis*) - the largest of only three known nesting colonies in Western Australia and has been reported to contain more than 90% of the State's breeding population. The lake has been the site of intensive banding programmes of Straw-necked Ibis nestlings by the CSIRO and members of the RAOU. The colony may move to one of the other lakes in the future. Wallering Swamp was an important nesting site until 1963, when a fire destroyed its vegetation and subsequent grazing prevented regrowth.

Water from Chandala Brook and various drains flows through the lake in winter and spring, providing a diversity of habitats for fishes. All of the above species that inhabit Lake Bambun and the native Pygmy Perch (*Edelia vittata*) occur in Lake Chandala. An unconfirmed sighting of the introduced Goldfish (*Carassius auratus*), an ecologically damaging species, gives cause for concern.

At present there is insufficient reserved land to form a buffer zone around Lakes Nambun, Bambun and Mungala to protect them from eutrophication. Stock are badly damaging the Flooded Gums and paperbarks around the edges of the lakes and preventing their regeneration. The fringing strips around the lakes should be purchased when available to protect the vegetation.

The Department of Fisheries and Wildlife owns a portion of Lake Chandala (see Fig.) and proposes to purchase further land as it becomes available; the Committee endorses their policy.

The Committee endorses the present purpose of reserves C24257 and C26756.

RECOMMENDATION

The Committee recommends that:

1. reserve C24257 and C26756 be reclassified as Class A;
2. reserve C24257 be vested in the Western Australian Wildlife Authority;
3. the Department of Fisheries and Wildlife negotiate with the owners of the land surrounding Lakes Nambun, Bambun and Mungala with the aim of extending the three areas of reserve C24257 to at least 30 m from the lakes and/or fencing them.

A.13 YANCHEP NATIONAL PARK

Yanchep National Park (Reserve A9868) is located alongside Yanchep Road, about 50 km north of Perth. It is vested in the National Parks Authority for the purpose of Protection and Preservation of Caves and Flora and for Health and Pleasure Resort. It is a Class A reserve and has an area of 2789 ha.

Vegetation

The Park's vegetation is characteristic of the Herdsman, Cottesloe and Quindalup Soil-landform Units (Churchward and McArthur 1978). The Herdsman Unit is represented by the vegetation of Loch McNess and other smaller wetlands to the south, such as Yonderup Lake and Wilgarup Lake.

Loch McNess is a large, permanent lake, containing about 55 ha of open water. The fringing vegetation consists of closed-sedgelands. In the deeper water they are characterised by *Scirpus validus* and Jointed Twig Rush (*Baumea articulata*); in the shallow areas, in which the water level is just above the peat surface, are "sedge meadows" dominated by *B. juncea*. In adjacent areas are low open-forests of the paperbark *Melaleuca raphiophylla*, sometimes associated with Flooded Gum (*Eucalyptus rudis*). Beyond these are low woodlands of Swamp Banksia (*B. littoralis*) with the associated shrub *Viminaria juncea*.

The Cottesloe Unit covers most of the remaining area. To the north and west of Loch McNess are areas of open-forest of Tuart (*Eucalyptus gomphocephala*) surrounded by areas of Tuart woodland. East and south of the Loch are some woodlands of mixed Tuart and Jarrah (*E. marginata*) with one or two patches of Marri (*E. calophylla*). Woodland of pure Jarrah occupies only a few hectares, and consists of only three small patches in the northern part of the Park.

Associated with the eucalypt woodlands are low woodlands of Banksia of greatest extent in the north. They contain principally Slender Banksia (*B. attenuata*) and Menzies' Banksia (*B. menziesii*) but also include Sheoak (*Casuarina fraserana*) and Pricklybark (*Eucalyptus todtiana*). Scattered throughout the Park are limestone outcrops, whose vegetation consists of closed-scrub and closed-or open-heath. The principal species are Parrot Bush (*Dryandra sessilis*), Spider-net Grevillea (*G. thelemanniana*), Blackboy (*Xanthorrhoea preissii*), *Melaleuca acerosa*, *M. huegelii* and *Hakea trifurcata*. Near the edges of some of the outcrops, and elsewhere in the Park, are occasional pockets of low woodland of Limestone Marlock (*E. decipiens*).

The Quindalup Unit is restricted to the north-western portion of the Park, principally to a small section of 82 ha that juts out to the west (Swan Location 7953). It consists of sand dunes, and its vegetation is largely open-heath of *Melaleuca acerosa* with an occasional *Anthocercis littorea*. There are a few patches of closed-heath of *Acacia cochlearis* and some

Low woodland of Banksia is also common, consisting mostly of Slender Banksia and Menzies' Banksia but also including Bull Banksia (*B. grandis*) and Pricklybark (*Eucalyptus todtiana*). Less common is open-woodland of Tuart.

In lower lying areas is low woodland of the paperbark *Melaleuca preissiana* and Holly-leaf Banksia (*B. ilicifolia*) with the shrub Woollybush (*Adenanthos cygnorum*) and a ground layer of *Verticordia nitens*. *M. preissiana* also occurs as large, old trees, forming open-woodland. These species are all either rare or absent in Yanchep National Park.

This section of State Forest is significant for its Jarrah; it is the northernmost sizable occurrence of Jarrah in the Karrakatta Unit of the Coastal Plain. Comparatively little Jarrah occurs in Yanchep National Park and most of that is mixed with Tuart or Marri.

The addition of this area would have two main benefits:

1. it would enlarge an important National Park thus allowing it to cater better for the growing recreational demands of the Perth Metropolitan Area without significantly reducing the value of the Park as a conservation reserve;
2. it would include areas of different soils and vegetation in the Park, thus making it more representative of the region.

DEVELOPMENT OF NORTH-WEST CORRIDOR

Yanchep National Park lies along the eastern boundary of the proposed North-West Corridor of the Perth Metropolitan Region. There are proposals to adjust the boundaries of the Park to allow the Mitchell Freeway to run along its western boundary. These proposals would add Pipidinny Swamp and some adjacent land to the Park but would cut off most of the only area of Quindalup Unit occurring within Yanchep National Park.

RECOMMENDATION

The Committee recommends that:

1. the area of State Forest No. 65 shown in Fig. , except for a strip to be retained by the Forests Department and managed as a buffer to protect adjacent pine plantations, be added to Yanchep National Park; the Forests Department and the National Parks Authority should confer to determine the width of the strip;
2. the Environmental Protection Authority ask the State Energy Commission to consult with it before the construction of any major powerlines takes place in the immediate vicinity of Yanchep National Park;

A.14 MOUND SPRINGS, MUCHEA

The Mound Springs near Muchea occur on Swan Locations 1518 and 2667 on the southern edge of the townsite. They provide a habitat for certain species of plants which are rare in System 6, including *Drosera pulchella*, a fern ally (*Lycopodium carolinianum*) and an unusual liverwort (*Galeobryum* sp.).

Location 2929, on the northern edge of Muchea, contains a plant population of a newly discovered species of *Darwinia*.

RECOMMENDATION

The Committee recommends that:

1. the Western Australian Herbarium survey the flora of Muchea Mound Springs (Swan Locations 1518 and 2667), Swan Location 2929 and Crown land within the Muchea Townsite (Figs. 10(b) and 10(c));
2. it discuss the conservation of these areas with the landholders and prepare a report on the conservation of the flora of this area for the Environmental Protection Authority and the Western Australian Wildlife Authority.

A.15 COMMONWEALTH AIRFIELDS

The Commonwealth Department of Defence has two airfields on the Swan Coastal Plain north of Perth - one at Bullsbrook, of 656 ha, and the other south-west of Gingin (707 ha). Both airfields contain natural vegetation, and are thus important refuges for flora and fauna.

The airfield at Bullsbrook covers areas of the Yanga, Guildford and Beermullah Soil-landform Units (Churchward and McArthur 1978); the Yanga Unit is poorly represented in existing or proposed conservation reserves.

The airfield near Gingin covers an area of the Bassendean Unit.

RECOMMENDATION

The Committee recommends that:

1. the Department of Conservation and Environment encourage the Commonwealth Department of Defence to retain, where possible, uncleared areas within the two airfields; before the Commonwealth develops new projects that require further land to be cleared, the Department of Conservation and Environment should determine whether there exist alternative sites which are less significant biologically but which could serve the same purpose;
2. in advising the Commonwealth Department of Defence, the Department of Conservation and Environment consult whenever necessary the Western Australian Herbarium.

A.16 NEERABUP NATIONAL PARK

Neerabup National Park consists of two Class A reserves vested in the National Parks Authority: A27575, for the purpose of National Park, and A24581, for Sanctuary for Fauna. Their areas are respectively 1078 ha and 116 ha. The National Park is long and narrow and extends from near Lake Joondalup northwards to near Lake Carabooda. It lies mostly to the west of Wanneroo Road.

The Park lies entirely within the Cottesloe and Karrakatta Soil-landform Units (Churchward and McArthur 1978), the former occupying the larger area. Although its long axis is roughly parallel to the coast, the northern portion (north of Quinns Road) contains much distinctive vegetation.

South of Quinns Road the plant formation is mainly woodland. Jarrah (*Eucalyptus marginata*) occurs commonly as a woodland or low woodland, associated with Sheoak (*Casuarina fraserana*), Slender Banksia (*B. attenuata*) and Menzies' Banksia (*B. menziesii*). Tuart (*E. gomphocephala*) occurs mainly as open-woodland, in some places mixed with Jarrah. The commonest species in their understoreys are Stinkwood (*Jacksonia sternbergiana*) and Buttercups (*Hibbertia hypericoides*).

In the south-west corner is a limestone quarry which carries an open-woodland of pure Tuart with an understorey of mainly Parrot Bush (*Dryandra sessilis*) with some *Acacia cyclops* and *Olearia axillaris*. Tuart is regenerating well in the area. Associated with the open-woodland is a closed-scrub of Tree Smokebush (*Conospermum triplinervium*).

In the south-east is a large limestone outcrop, which supports a closed-heath of Parrot Bush (*Dryandra sessilis*) with some *Anthocercis littorea*, *Hakea trifurcata* and Blackboy (*Xanthorrhoea preissii*).

Pricklybark (*Eucalyptus todtiana*) and Marri (*E. calophylla*) occur to a limited extent in the southern half of the Park; the former occurs in some low woodlands with Slender Banksia and Menzies' Banksia or in open-woodlands of Tuart, the latter as a small patch of woodland surrounded by Jarrah woodland in the extreme south.

The area north and west of One Tree Hill differs from the area south of Quinns Road both in the structure of the vegetation and in the species present. Apart from a small patch of Tuart woodland on the western boundary, its structure is low woodland, low open-woodland or heath.

The low woodland and low open-woodland is of Sheoak, Slender Banksia, Menzies' Banksia, Bull Banksia (*B. grandis*), Christmas Tree (*Nuytsia floribunda*) and Pricklybark. Jarrah is present

in a few, fairly pure patches. The understorey is diverse; the species include *Hakea trifurcata*, *H. lissocarpa*, *H. costata*, *H. prostrata*, *Casuarina humilis*, *Calothamnus quadrifidus*, *C. sanguineus*, *Petrophile serruriae*, *P. macrostachya*, *P. linearis*, *Hibbertia hypericoides*, *Jacksonia sternbergiana* and *Acacia pulchella*.

Most of the heath occurs in an extensive area of limestone hills to the north-west of One Tree Hill. The vegetation is mostly an open-heath of *Acacia lasiocarpa*, *A. truncata*, *Templetonia retusa*, *Dryandra sessilis*, *Calothamnus quadrifidus*, *Grevillea thelemanniana*, *Hakea costata* and *Xanthorrhoea preissii*. Some patches of closed heath of *Acacia* sp. also occur.

On the eastern side of Wanneroo Road, just north of One Tree Hill, is Reserve A24581, for Sanctuary for Fauna. It contains Lake Nowergup on its eastern side. The Western part of the lake is fringed with Jointed Twig Rush (*Baumea articulata*), but that is replaced by Bulrushes (*Typha orientalis*) around the lake's northern shore. Bordering the sedgeland is a woodland of Flooded Gum (*Eucalyptus rudis*) and Swamp Banksia (*B. littoralis*). There is some low open-forest of the paperbark *Melaleuca raphiophylla*, particularly in the south. Only patches of it remain in the east, on private land, where much has been cleared. Most of the remainder of the reserve contains open-woodlands of Tuart associated with woodlands of Jarrah.

The area that now comprises Neerabup National Park was originally set aside as a Stock Route, which accounts for its long, narrow shape. The shape makes management difficult: there is a long perimeter in relation to the total area. It also makes the development of recreational facilities, in a National Park sense, difficult because a considerable amount of development at one place would virtually cut the Park into two. There is an increasing demand for recreation to the north of Perth, and the best way of catering for this at Neerabup would be to enlarge the Park to a more regular shape.

Adjoining Land

At the southern end of the Park are adjoining areas of uncleared bush. On the eastern side is a continuous uncleared area which comprises Swan Location 998, the western portion of Swan Location 618, and the portion of Perthshire location 107 north of Burns Beach Road.

Much of the land supports open-woodlands of Tuart associated with low woodlands dominated by Sheoak with some Jarrah, Slender Banksia and Menzies' Banksia.

Just north of Burns Beach Road is an unnamed wetland, with low open-forest of the paperbark *Melaleuca raphiophylla* surrounded by a low woodland of Banksia species including the Holly-leaf Banksia (*B. ilicifolia*).

In the east, near Wanneroo Road, is another small wetland where *M. raphiophylla* grows taller, to form closed-forest. The surrounding vegetation of Tuart, Marri and Jarrah forms an open-forest - a structure not represented in the Park. The open-forest merges from pure Marri to a mixture of Marri, Jarrah and Tuart to pure Tuart.

In contrast with the eucalypt formations in the Park the open-forest contains no *Banksia* understorey. It is bounded on the west by a steep limestone hill, at the base of which is an old lime kiln, of scenic interest. The hill supports an open-woodland of Tuart.

Opposite those locations is a 300 ha piece of land, the Metropolitan Region Planning Authority's proposed Burns Beach - Mindarie Open Space (portion of Swan Location 1370), which joins the National Park to the Indian Ocean via a proposed coastal reserve.

The area is mostly uncleared. Although the small, eastern portion contains an open-woodland of Tuart and represents the Cottesloe Unit, most of it contains vegetation of the Quindalup Unit.

The addition of the above two areas to Neerabup National Park would form a reasonably large, more regularly shaped area at the south of the Park in which facilities for recreation could be developed without destroying the essential character of the area, and would also allow the National Park to represent better the various ecosystems in the region.

The Park would then include the Quindalup Unit, at present not represented in the Park, and a better sample of wetlands and their associated vegetation. Moreover, it would contain areas of open- and closed-forest, vegetation structures not included in the existing Park.

Correspondingly, the Park would be enhanced as a study area; the Burns Beach-Mindarie strip would provide a transect of vegetation from the ocean through the Quindalup Unit to the Karrakatta Unit.

Development of North-West Corridor

The Neerabup National Park lies on the eastern boundary of the proposed North-West Corridor of the Perth Metropolitan Region. Already an area of 33 ha has been excised from the southern end of the National Park and added to the Joondalup Sub-Regional Centre. There are proposals to adjust the boundaries of the Park to allow the Mitchell Freeway to run along its western boundary, and in one place it is proposed to build the Freeway within the Park.

If the Committee's proposals for adding land to the Park are accepted, especially in relation to the Burns Beach-Mindarie Open Space area, then it is inevitable that the Freeway and other major roads run through the Park. Care should be taken that the impact of these roads is minimised, and that the minimum number of roads necessary are built.

RECOMMENDATION

The Committee recommends that:

1. the purpose of A24581 be changed from "Sanctuary for Fauna" to "National Park";
2. the areas shown in Fig. , and comprising Swan Location 998, the western portion of Swan Location 618, the portion of Perthshire Location 107 north of Burns Beach Road and portion of Swan Location 1370, be purchased when available and added to the Park;
3. the Metropolitan Region Planning Authority consider the detailed siting of the proposed Primary Highways and the proposed extension to the Mitchell Freeway to minimise the impact on the National Park and the Burns Beach-Mindarie Open Space: the Committee suggests that the number of Primary Highways could be reduced from two to one in the Open Space; alternatively, the impact could be lessened by providing bridges and tunnels for pedestrians and equestrians at appropriate intervals, or by using trenching and partial re-roofing methods such as the "cut and fill" technique.

B

B.1 QUINS HILL

In the Quins Hill area along the Mogumber West road is the last extensive uncleared area of the Mogumber Soil-landform Unit (Churchward and McArthur 1978). The Unit carries closed- and open-heaths which are remarkably rich in plant species and are the closest to Perth of the northern heathlands. Composition varies greatly between soil types which range from laterite on hilltops to deep sand in valleys. The families Proteaceae, Myrtaceae, Papilionaceae and Epacridaceae are all well represented, but there are species of many others as well.

There are many species of *Banksia*, including *B. sphaerocarpa*, *B. burdettii* and three unnamed species. *Dryandras* are common, especially in lateritic soil, and include *D. carlinoides*, *D. kippistiana* and *D. shuttleworthiana*. Smokebushes include *Conospermum stoechadis*, *C. incurvum* and *C. acerosum*, and there are species of *Grevillea*, *Hakea*, *Isopogon*, *Lambertia*, *Persoonia*, *Petrophile* and *Synaphea*.

The Myrtaceae are represented by species of *Baeckea*, *Calotlammus*, *Beaufortia*, *Calytrix*, *Eremaea*, *Hypocalymma*, *Melaleuca* and *Verticordia*. Eucalypts are uncommon in the heaths, but several species occur in the valleys (especially Pricklybark, *E. todtiana*, and Marri, *E. calophylla*), while Wandoo (*E. wandoo*) occurs on Quins Hill.

The principal genera of Papilionaceae are *Chorizema*, *Daviesia*, *Gastrolobium*, *Jacksonia*, *Mirbelia*, *Oxylobium* and *Sphaerolobium*.

The Epacridaceae flower mainly in winter and include species of *Andersonia*, *Astroloma*, *Conostephium*, *Leucopogon*, *Lysinoma* and *Styphelia*.

Other families which should be mentioned are Mimosaceae (wattles), Haemodoraceae (kangaroo paws, cottonheads), Droseraceae (sundews), Rutaceae (boronias, etc.), Rhamnaceae, Thymeleaceae (banjines), Lamiaceae (snakebushes), Goodeniaceae (Lechenaultias, etc.) and Stylidiaceae (trigger plants).

Several rare species occur here, e.g. *Stachystemon axillaris*, *Cryptandra humilis*, the summer flowering *Dampiera carinata* and an unnamed prostrate species of *Banksia*.

Kangaroo Paws, both Yellow (*Anigozanthos pulcherrimus*) and Black (*Macropidia fuliginosa*) are common, the former in deep sand of the valleys and the latter on the higher gravelly slopes.

In the sandy valleys there is sometimes a low open-woodland of Pricklybark with some taller Marri in places. Acorn *Banksia* (*B. prionotes*), Slender *Banksia* (*B. attenuata*) and Menzies' *Banksia* (*B. menziesii*) are usually associated with this formation.

Quins Hill itself is a lateritic hill with both low open-woodland of Wandoo and tall shrubland in which a native cypress, *Callitris morrisoni*, and Broombush Honey Myrtle (*Melaleuca uncinata*) are prominent. The uncommon *Stirlingia simplex* occurs here.

At every season there are wildflowers in bloom in this area. In late summer, the scarlet *Beaufortia squarrosa* and the orange *Banksias* (*B. prionotes* and *B. burdettii*) flower, while heaths (*Leucopogon* spp. and *Astroloma* spp.) flower during winter.

The greatest number of species flowers in spring when the area is popular with wildflower tourists and complements the Great Northern Highway displays between Bindoon and New Norcia. During late spring and early summer there are still colourful species in flower, e.g. Yellow Kangaroo Paw and Native Foxglove (*Pityrodia verbascina*).

The Mogumber Unit supports an important segment of the State's vegetation, containing a great diversity of species, some restricted to the area. It is important both scientifically and aesthetically, and a representative section should be conserved if possible. No suitable area of Crown land is available. In the Quins Hill area there are four freehold blocks- Swan Locations 5429, 5431, 5432 and 5433. Location 5433 is substantially uncleared, while the other three are partially cleared. If these locations become available for purchase, the Government should acquire those that could be reserved for the conservation of the flora and fauna.

RECOMMENDATION

The Committee recommends that, should one or more of Swan Locations 5429, 5431, 5432 and 5433 become available for purchase, at least one be acquired and proclaimed a Class A reserve for the Conservation of Flora and Fauna, vested in the Western Australian Wildlife Authority; priority should be given to Location 5433.

B.2 RESERVE C25591 (MOORE RIVER)

Reserve C25591, of 40 ha, for Public Utility and Water, not vested, lies on the north side of the Moore River, about 7 km upstream from Regans Ford.

The reserve is comparatively inaccessible; the Committee has not examined it closely. Situated as it is, however, it probably contains representative areas of the Mogumber and Moore Soil-landform Units (Churchward and McArthur 1978). Inclusion of a good sample of the Mogumber Unit would make the reserve especially valuable to conservation, since the Unit is poorly represented in conservation reserves in System 6.

RECOMMENDATION

The Committee recommends that the Department of Fisheries and Wildlife and the Public Works Department investigate the conservation and water values of reserve C25591 and report to the Environmental Protection Authority.

B.3 RESERVE C15816 (MOORE RIVER)

Reserve C15816, of 36 ha, lies between Mogumber Road West and the Moore River, just north of Quins Hill. It is for Water and is vested in the Shire of Gingin.

Along the river the vegetation is fringing woodland of Flooded Gum (*Eucalyptus rudis*) and the paperbark *Melaleuca raphiophylla*, and represents the Moore Soil-landform Unit (Churchward and McArthur 1978).

The uplands to the south represent the Mogumber Unit. They carry closed-heath of Scrub Sheoak (*Casuarina humilis*), *Banksia sphaerocarpa*, Blackboy (*Xanthorrhoea preissii*), Common Smokebush (*Conospermum stoechadis*), Telegraph Sedge (*Mesomelaena stygia*) and Sephamore Sedge (*M. tetragona*) with species of *Eremaea*, *Calothamnus*, *Verticordia*, *Calytrix*, *Daviesia* and *Dryandra*.

Between the two, on a steep, sandy rise, is woodland of Marri (*Eucalyptus calophylla*) with a well defined second storey of Slender Banksia (*B. attenuata*), Menzies' Banksia (*B. menziesii*), Acorn Banksia (*B. prionotes*), Holly-leaf Banksia (*B. ilicifolia*) and Pricklybark (*E. todtiana*). It displays the influence of the Cullala Unit on an area typical of the Mogumber Unit.

Although the Mogumber Unit is only a minor component of the reserve, it is significant, since the Unit is poorly represented in conservation reserves in System 6.

RECOMMENDATION

The Committee recommends that the Department of Fisheries and Wildlife and the Public Works Department investigate the conservation and water values of reserve C15816 and discuss its future with the Shire of Gingin.

B.4 RESERVE C3345 (MOORE RIVER)

Situated about 4 km north-west of Mogumber is reserve C3345, of 259 ha, for Preservation of Flora, not vested. It is inaccessible from the Mogumber West Road, to the south.

The reserve lies at the junction of the east branch of the Moore River and the main stream. The river runs in a valley some 15-20 m deep, the sides of which represent the Moore Soil-landform Unit (Churchward and McArthur 1978) and support woodland of Wandoo (*Eucalyptus wandoo*), Marri (*E. calophylla*) and Flooded Gum (*E. rudis*). In the winter and spring the river contains many extensive pools of water.

The remainder of the reserve is of low sand dunes typical of the Cullala Unit. The vegetation consists mainly of low open-forest of Slender Banksia (*B. attenuata*), Menzies' Banksia (*B. menziesii*) and Pricklybark (*E. todtiana*) with some Christmas Tree (*Nuytsia floribunda*); there is also some open woodland of Marri with a well defined second storey of pricklybark, Slender Banksia, Menzies' Banksia and Holly-leaf Banksia (*B. ilicifolia*). On the deeper sand, the understory bears some similarity to that of the Mogumber Unit but is none-the-less distinctive; the species include Blueboy (*Stirlingia latifolia*), Silky Bloodflower (*Calothamnus sanguineus*), Scrub Sheoak (*Casuarina humilis*), *Eremaea* spp., *Conospermum* spp., *Calytrix* spp., *Verticordia* spp., *Daviesia* spp., *Oxylobium* spp. and *Dryandra* spp.

Reserve C3345 is one of the few reserves in System 6 that contain representative areas of the Cullala Soil-landform Unit and is easily the largest of all such areas. The reserve also contains the largest area of the Moore Unit. It offers a good variety of habitat for wildlife, especially passerine birds.

RECOMMENDATION

The Committee recommends that reserve C3345 be made a Class A reserve for Conservation of Flora and Fauna, vested in the Western Australian Wildlife Authority.

B.5 LAKE WANNAMAL

At Lake Wannamal is reserve A9838. The reserve covers about 80 ha and is vested in the Western Australian Wildlife Authority for the purpose of Conservation of Flora and Fauna.

The northern portion of the reserve supports low open-forest and low closed-forest of York Gum (*Eucalyptus loxophleba*), Marri (*E. calophylla*), Swamp Sheoak (*Casuarina obesa*) and the paperbark *Melaleuca raphiophylla*. A dense understorey includes species such as Jam (*Acacia acuminata*), Prickly Moses (*A. pulchella*), Harsh Hakea (*H. prostrata*), *H. incrassata*, Couch Honeypot (*Dryandra nivea*), *D. fraseri*, *D. sp. aff. hewardiana*, *Baeckea crispiflora*, Stinkwood (*Jacksonia sternbergiana*) and *Phyllanthus calycinus*. *Leptospermum erubescens* extends further southwards, into the lake.

No vegetation is present in the southern portion of the lake, and the surrounding vegetation is generally sparse. It includes Flooded Gum (*E. rudis*), *M. raphiophylla*, *M. tereiifolia* and *M. viminea*.

The lake is semi-permanent and provides a summer refuge for water-birds. Forty-four species of birds have been recorded from the lake. When it was inspected in February 1971, Grey Teal (*Anas gibberifrons*) were particularly numerous, numbering about 1500. About 100 Mountain Ducks (*Tadorna tadornoides*) and 30 Black Swans (*Cygnus atratus*) were also sighted.

Also recorded from the Lake is the Freckled Duck (*Stictonetta naevosa*), one of Australia's rarest waterfowl. The dense vegetation in the northern end of the lake, and extending northwards along a string of swamps in private land, provide a refuge for this and other species.

The lake, classified under the Wildlife Conservation Act as a Shooting and Hunting Area, is popular with duck-shooters. The northern end of the lake, however, is closed to duck-shooting.

The Committee endorses the present class, purpose and vesting of reserve A9838.

RECOMMENDATION

The Committee recommends the purchase when available of the land shown in Fig.

B.6 RESERVES C965, C27028 (UDUMUNG BROOK)

These two reserves are at the junction of the Great Northern Highway and Hay Flat Road, east of Wannamal. C965, of 163 ha, is for Recreation and is vested in the Shire of Chittering. C27028, of 39 ha, is for Gravel and is unvested.

The upper section of Udumung Brook passes through the northern section of the area. The soil is red loam, but this changes to gravelly loam and then laterite as the land rises gently to the south.

The vegetation is woodland of Wandoo (*Eucalyptus wandoo*) in the lower part, with Marri (*E. calophylla*) and Powderbark (*E. accedens*) in the higher area. A highlight of the understorey is the representation of *Dryandra* species. Both *D. carduacea* and *D. polycephala* form dense stands; each is typical of the district but becoming very much reduced due to clearing. Two undescribed species of *Dryandra* occur here also. There is a good population of the Hooded Smokebush (*Conospermum glumaceum*), a relatively uncommon species. Likewise the Black Kangaroo Paw (*Macropidia fuliginosa*) occurs here; although common in heaths north of the Moore River, it is rare on the Darling Plateau.

An unusual occurrence is that of the Tiled Triggerplant (*Stylidium imbricatum*) which otherwise is known only from the south coast.

The reserves are generally in good condition. Some gravel has been extracted from both, but there has been little weed infestation and with management the disturbed areas will probably regenerate.

The reserves should be retained as examples of the local vegetation, and, because of the important species present, deserve the protection of Class A status. They should be managed for flora conservation by the Western Australian Wildlife Authority.

RECOMMENDATION

The Committee recommends that reserves C965 and C27028 be made Class A reserves for Conservation of Flora and Fauna, vested in the Western Australian Wildlife Authority.

B.7 RESERVE C539 (BOONANARRING BROOK)

Reserve C539 for the purpose of Water and Stopping Place is situated on Boonanarring Brook, about 10 km north-west of Gingin. It is vested in the Shire of Gingin and covers 109 ha.

The reserve contains representatives of the Reagan, Moondah and Gingin Soil-landform Units (Churchward and McArthur 1978). The Reagan Unit can be seen in the north-eastern part of the reserve. Here there is sandplain which contains closed-heath with a large number of species, including *Casuarina humilis*, *Calothamnus quadrifidus*, *Eremaea* sp., *Hakea costata*, *Petrophile macrostachya*, *Dryandra nivea*, *Daviesia juncea*, *Hibbertia hypericoides*, *Hibbertia* sp., *Mesomelaena stygia*, *Patersonia* sp., *Leucopogon* sp., *Lysinema ciliatum*, *Drosera* sp. and *Xanthorrhoea* sp. Christmas tree (*Nuytsia floribunda*) is the only tree except for some banksia woodland around the margins.

The Moondah Unit is represented by the creek valley and by the orange sand in the southern part of the reserve. The creek valley is of white sand and supports fairly dense patches of the paperbark *Melaleuca preissiana* and also Marri (*Eucalyptus calophylla*), Flooded Gum (*E. rudis*), Menzies' Banksia (*B. menziesii*) and Zamia (*Macrozamia riedlei*). Near the edge of the stream are some Bull Banksia (*B. grandis*). On the orange sand is a woodland of Slender Banksia (*B. attenuata*) and Pricklybark (*E. todtiana*) with an understorey of Smokebush (*Conospermum* spp.) Scrub Sheoak (*Casuarina humilis*), Blackboy (*Xanthorrhoea* sp.), *Hakea lissocarpa* and *Conostephium* sp.

There is a fairly large gravel pit in the north-west corner which contains vegetation of the Gingin Unit. It consists mainly of a woodland of Marri with an understorey largely of *Hakea trifurcata* and Blackboy with a few Black Gin (*Kingia australis*).

RECOMMENDATION

The Committee recommends that:

1. on the basis that a large conservation reserve will be created a little way to the north east (see B.8), reserve C539 be left with the Shire; and the Department of Lands and Surveys review its purpose;
2. if this reserve is mined, it be restored for recreational use when mining has ceased.

B.8 BOONANARRING BROOK AREA

This is an area of 8000 ha of vacant Crown land lying to the north of Gingin. It represents a major geomorphological subdivision, the Dandaragan Plateau, which is bounded on the west by the Swan Coastal Plain and on the east by the Darling Scarp. The area is undulating with a few deeper valleys such as that of the Boonanarring Brook itself.

The land carries a representative sample of the vegetation of the Plateau where a transition occurs between the woodlands of the Muchea-Gingin area and the heaths of the Mogumber area. On the lateritic uplands there is open-forest of Jarrah (*Eucalyptus marginata*) and Marri (*E. calophylla*) with an understorey of Bull Banksia (*B. grandis*). Small areas of Wandoo (*E. wandoo*) occur. On sandier soils there is low woodland and low open-woodland of Slender Banksia (*B. attenuata*) and Menzies' Banksia (*B. menziesii*) with some Jarrah, Marri, Pricklybark (*E. todtiana*) and Christmas Tree (*Nuytsia floribunda*). Several small pockets of Flooded Gum (*E. rudis*) occur where the water table is close to the surface.

In some parts the trees are few or absent, and the structure approaches the low heath of the Mogumber area.

The shrubby understorey illustrates the transitional nature of the vegetation. Typical heath species include *Petrophile ericifolia*, *Hakea incrassata*, *H. costata*, *Lambertia multiflora*, *Baeckea grandiflora*, *Synaphea* aff. *spinulosa*, etc. Species representative of the woodland are *Hakea rusCIFolia*, *Petrophile linearis*, *Jacksonia floribunda*, *Calytrix flavescens*, *C. angulata*, *Lechenaultia floribunda*, *Adenanthos cygnorum* etc.

An uncommon species in the area is *Lysinema elegans*, a heath known otherwise only from the Jandakot area.

Other species recorded:

Xanthorrhoea preissii, *Macrozamia riedlei*, *Hakea prostrata*, *Petrophile surruriae*, *Jacksonia sternbergiana*, *Stirlingia latifolia*, *Dryandra sessilis*, *D. nivea*, *Conospermum stoechadis*, *Calytrix fraseri*, *Conostephium pendulum*, *Lysinema ciliatum*, *Melaleuca scabra*, *Verticordia nitens*, *Leptospermum ellipticum*, *Mesomelaena tetragona*, *M. stygia*, *Hakea varia*, *H. obliqua*, *Pityrodia bartlingii*, *Calothamnus sanguineus*, *Eremaea pauciflora*, *Scaevola paludosa*, *Hakea trifurcata*, *Casuarina humilis*, *Verticordia serrata*, *Conostylis* spp.

In the south-east of the area are two adjoining reserves - C22602 (405 ha) for Water, not vested, and C24559 (486 ha) for Water catchment, not vested. They contain lower-lying land poorly represented in the remainder of the Boonanarring Brook area and should be included in the proposed reserve. This action would also rationalise the boundaries of the new reserve.

RECOMMENDATION

The Committee recommends that:

1. the area shown in Fig. be made a Class A reserve for Conservation of Flora and Fauna, vested in the Western Australian Wildlife Authority;
2. reserves C22602 and C24559 be cancelled and their areas added to the reserve recommended above.

B.9 GINGIN BROOK

Gingin Brook is a perennial fresh stream. Its source lies in a valley between sandy hills. Several million litres of water flow daily from springs in peat banks, a unique occurrence in South-Western Australia. The effect on the vegetation is very marked, the low woodland on the sandy slopes changing within a few metres to dense swamp thicket and paperbark low closed-forest. Within the swamp and stream formations a number of unusual plants occur. The trees are typical swamp species - the paperbark *Melaleuca raphiophylla* and Flooded Gum (*Eucalyptus rudis*) - but a tall shrub layer includes the tea tree *Leptospermum firmum*, Tall Boronia (*Boronia molloyae*), *Albizia lophantha* and *Agonis linearifolia*. The *Leptospermum* once grew near Perth but apart from the Gingin population is now known only from the south coast. The plants on Gingin Brook are unusually tall and robust. Likewise the *Boronia* is typically a more southern species, its nearest population to Gingin being at Wungong.

Other species more typical of wetter areas are the Twining Bladderwort (*Utricularia volubilis*), a helmet orchid (*Corybas dilatatus*) and the fern *Cyclosorus gongyloides*. The *Utricularia* is an uncommon species known from a few localities between Gingin and Albany, while the *Corybas* is common in the forests of the extreme South-West, the next locality to Gingin being Collie.

The *Cyclosorus* on the other hand is a tropical fern, the Gingin populations being a remote southern outlier.

Several aquatic species are common in the Brook, including the floating fern *Azolla filiculoides*, Water Starwort (*Callitriche stagnalis*), Water Buttons (*Cotula coronopifolia*) and Water Ribbons (*Triglochin procera*).

The woodland on the surrounding hills is dominated by Marri (*Eucalyptus calophylla*) and Banksia (*B. menziesii*, *B. attenuata* and *B. grandis*). A small legume, *Ptychosema pusillum*, occurs here and is unknown from any other locality.

Gingin Brook is unusual botanically and geologically. At present the area of conservation value lies in freehold land, almost along the boundary between lots 5 and M784. For adequate protection an area should be reserved which will include the hills immediately around the source. This will provide a buffer to protect the vegetation of the brook and will also protect the immediate catchment area. The vegetation of the brook should also be protected from grazing on its east bank, but the landowner should be allowed to extract water from the brook for pastoral and domestic purposes.

RECOMMENDATION

The Committee recommends that:

1. negotiations be undertaken with the owners of Lots 5 and M784 of Swan Location 1373 with a view to purchasing those sections marked in Fig. ;
2. upon acquisition, the area be made a Class A reserve for Conservation of Flora and Fauna, vested in the Western Australian Wildlife Authority;
3. a fence be constructed at Government expense so as to protect the natural vegetation of Gingin Brook along its east bank within Lot 784;
4. the owner of Lot M784 be allowed to extract water from Gingin Brook for pastoral and domestic purposes.

B.10 GEOLOGICAL SITES, GINGIN

The hills that surround Gingin contain exposures of Early Cretaceous chalk and greensand that virtually replicate the classic successions of Western Europe. They are of great scientific and educational interest. All the important, well-exposed sections are on private land.

RECOMMENDATION

The Committee recommends that the proposed Geological Sites Committee examine what measures should be taken to conserve the deposits.

B.11 RESERVE C32807 (MT. BYROOMANNING)

Reserve C32807 (181 ha) is for Conservation of Flora and is not vested. It lies on a rocky lateritic ridge on the eastern side of the Brockman Valley at Bindoon. The vegetation is open-woodland with a mixture of Wandoo (*Eucalyptus wandoo*) and York Gum (*E. loxophleba*) and, as understorey species, Jam (*Acacia acuminata*) and Manna Wattle (*A. microbotrya*). Very little of this association occurs in conservation reserves and for this reason reserve C32807 should be retained.

RECOMMENDATION

The Committee recommends that the purpose of reserve C32807 be changed to Conservation of Flora and Fauna and that the reserve be vested in the Western Australian Wildlife Authority.

B.12 NEEDONGA AND CHITTERING LAKES

Needonga and Chittering Lakes are on the water course of the Brockman River, and are divided by the Great Northern Highway, about 15 km ESE. of Gingin. Needonga Lake and most of Chittering Lake are incorporated in reserve C29538, of 231 ha, vested in the Western Australian Wildlife Authority for Conservation of Fauna. Parts of Chittering Lake (see Fig.) and its fringing wetland vegetation are in adjoining, freehold land.

The lakes are bordered by low closed-forest of the paperbark *Melaleuca raphiophylla*.

Before 1975, the numbers of water-birds using the lake had been steadily diminishing. The lakes were becoming shallower by siltation and drainage. By mid-summer they were dry.

In September 1975, the Department of Fisheries and Wildlife constructed a sand-bag weir at the outlet to Lake Chittering. The weir retained a large area of water throughout the following summer. The lake was 3 km² in area and over 0.5 m deep, and supported many birds. There was a colony of 50 White Egrets (*Egretta alba*) and a large population of water-fowl that included Black Duck (*Anas superciliosa*), Grey Teal (*A. gibberifrons*), Wood Duck (*Chenonetta jubata*), Mountain Duck (*Tadorna tadornoides*) and Musk Duck (*Biziura lobata*). During the past summer large populations of Egret, Brown Bittern (*Botaurus poiciloptilus*), Straw-necked Ibis (*Threskiornis spinicollis*), White-headed Stilt (*Himantopus himantopus*) and ducks and swans (family *Anatidae*) used Lake Chittering, and nearly all of the species of water-birds found in the general area were seen on the lake.

The Department has now erected a permanent structure to retain water in the lakes during summer. On 13 November 1977, several hundred ducks were seen on the lakes, and 19 species of water-birds were recorded. The lakes are now an important summer refuge for these birds and should be afforded Class A protection.

In managing the reserve, the destruction of wetland vegetation by grazing is a problem.

The Committee endorses the vesting of reserve C29538 in the Western Australian Wildlife Authority.

RECOMMENDATION

The Committee recommends that:

1. reserve C29538 be reclassified as Class A and that its purpose be changed to Conservation of Flora and Fauna;
2. parts of Lake Chittering and its fringing wetland vegetation that are not included in reserve C29538 (Fig.) be purchased when available and added to the reserve;
3. if any special planning scheme near the lake comes into effect, the portions of land adjoining the lake which contain wetland vegetation be added to reserve C29538.

B.13 RESERVE C42 (BURROLOO WELL)

Reserve C42 is situated on the west side of the Great Northern Highway about 2 km south of its junction with Chittering Road. It is unvested and designated as a Resting Place for Stock. Despite its small size (11 ha) the reserve has biological importance, especially as it is in an area that is becoming increasingly cleared. It slopes down to a creek that contains water only after rains.

The vegetation, on a brown sandy loam, is open-woodland of Marri (*Eucalyptus calophylla*) with a few Wandoo (*E. wandoo*) and Jarrah (*E. marginata*). The understorey is quite varied; representative species are *Bossiaea eriocarpa*, Couch Honey-pot (*Dryandra nivea*), *Hibbertia spicata*, Prickly Bitter-pea (*Daviesia pectinata*), *Scaevola glandulifera*, *Loxocarya* sp. and Blue Lechenaultia (*L. biloba*). Towards the creek the soil is more a gravelly clay, and here the shrubs include White Myrtle (*Hypocalymma angustifolium*), Fuchsia Grevillea (*G. bipinnatifida*), *Baeckea camphorosmae* and *Grevillea vestita*.

In the centre of the reserve are thickets of *Adenanthos drummondii*, Stinkwood (*Jacksonia sternbergiana*) and *Acacia saligna*, while at the south end is a dense stand of Swishbush (*Viminaria juncea*).

A number of perennial and ephemeral herbs are present, e.g. *Stylidium*, spp., *Borya nitida*, *Haemodorum* sp., *Actinotus leucocephalus*, *Isotoma hypocrateriformis*, *Stackhousia brunonis* and *Conostylis setigera*.

Other species recorded:

Casuarina humilis, *Verreauxia reinwardtii*, *Phyllanthus calycinus*, *Gonocarpus pithyoides*, *Ptilotus manglesii*, *Waitzia* sp., *Podolepis canescens*, *Burchardia umbellata*, *Kennedia prostrata*, *K. coccinea*, *Oxylobium capitatum*, *Glischrocaryon aureum*, *Dianella revoluta*, *Lomandra* sp., *Thomasia grandiflora*, *Comesperma calymega*, *Tricoryne elatior*, *Hakea lissocarpa*, *H. undulata*, *Grevillea synapheae*, *G. pilulifera*, *Agrostocrinum scabrum*.

The vegetation is in good condition with little invasion of weeds. It should be maintained as an example of the flora of the district.

RECOMMENDATION

The Committee recommends that the purpose of reserve C42 be changed to Conservation of Flora and Fauna, and that the reserve be vested in the Western Australian Wildlife Authority.

B.14 RESERVE C4070 (NORTH OF BULLSBROOK)

Reserve C4070 is an area of about 18 ha set aside for camping and is unvested. It is situated on the Great Northern Highway about 20 km north of Bullsbrook. Despite its small area the reserve carries a rich flora.

On an open, sandy loam and clay flat is an open-woodland of Marri (*Eucalyptus calophylla*), Christmas Tree (*Nuytsia floribunda*) and Bull Banksia (*B. grandis*), with some Wandoo (*E. Wandoo*) towards the south side. The flat is low-lying and becomes wet in winter. There is a dense or open shrub layer with *Leptospermum ellipticum*, *Verticordia densiflora*, *V. acerosa*, *Hibbertia* sp., *Dryandra nivea*, etc. In winter there is a wide variety of herbs including *Drosera* spp., *Stylidium* spp., orchids, *Angianthus* spp., and other composites.

The western side of the reserve is a slightly higher sandy rise with low woodland of Slender Banksia (*B. attenuata*), Menzies' Banksia (*B. menziesii*) and Pricklybark (*Eucalyptus todtiana*). Typical shrubs are Woollybush (*Adenanthos cygnorum*), Scrub Sheoak (*Casuarina humilis*), *Astroloma stomarrhena*, *Dasypogon bromeliaefolius*, Pixie Mops (*Petrophile linearis*), *Conostephium* (3 spp.), *Eremaea pauciflora* and Blueboy (*Stirlingia latifolia*).

Other species recorded:

Caustis dioica, *Patersonia occidentalis*, *Leucopogon conostephioides*, *Lechenaultia floribunda*, *Synaphea* aff. *spinulosa*, *Alexgeorgea arenicola*, *Melaleuca* ? *scabra*, *Jacksonia floribunda*, *Gompholobium* sp., *Eucalyptus marginata*.

The vegetation should be conserved as a sample of the flora in this district. There is no other reserve there with this association of species.

RECOMMENDATION

The Committee recommends that the purpose of reserve C4070 be changed to Conservation of Flora and Fauna, and that the reserve be vested in the Western Australian Wildlife Authority.

B.15 RESERVE C1654 (BULLSBROOK)

Reserve C1654 lies to the east of the Great Northern Highway just north of Bullsbrook. It covers 119 ha and is for Travellers and Stock Purposes, unvested.

The north-west corner of the reserve is a low swamp flat, wet in winter, with some slight sandy rises. The wettest area has a tall closed-heath of *Melaleuca viminea* with emergent paperbarks (*M. raphiophylla*). There are open, slightly saline areas with tall or low heath of *Melaleuca* species including *M. uncinata* and *M. seriata*. Emergent above these are stands of Swamp Cypress (*Actinostrobus pyramidalis*). Other low shrubs are *Kunzea recurva*, *Hakea varia*, *Eriostemon spicatus* and *Astartea fascicularis*. Herbs and sedges are mixed with the shrubs and include *Gahnia trifida*, *Scaevola longifolia*, *Anigozanthos viridis*, *Samolus repens*, *Leptocarpus aristatus*, *Goodenia filiformis*, *Stylidium* spp., *Angianthus* spp. and, in the wettest parts, *Cotula coronopifolia* and *Triglochin turrifera*. The most saline areas support the samphire *Salicornia quinqueflora*.

Towards the south end of the reserve is a woodland of the paperbark *Melaleuca preissiana*, passing into a low woodland of Banksia (*B. menziesii* and *B. attenuata*) in sand.

The swamp vegetation is unusual and no similar example is known in other conservation reserves. The *Actinostrobus* population differs from others of the species in that the plants remain small, rarely reaching 4 m. The *Melaleuca uncinata* is also unusual in that, although the species is widespread especially in the wheatbelt, it is rare on the coastal plain and not known from any other swamp habitat.

A narrow strip of freehold land between the reserve and the Highway should be acquired to improve the representation of the vegetation and to increase its protection along the western edge of the reserve.

RECOMMENDATION

The Committee recommends that:

1. reserve C1654 be made a Class A reserve for Conservation of Flora and Fauna, vested in the Western Australian Wildlife Authority;
2. private land as shown in Fig. be purchased when available and added to the reserve.

C

C.1 BINDOON ARMY TRAINING AREA

The Bindoon area is located 80 km north-east of Perth. It includes the Bindoon Army Training Area (Department of Army) and the adjacent reserves C29100, of 1300 ha, for Buffer Strip, not vested, and A27595, of 124 ha, for Ecological Purposes and Flora, not vested. The total area is 18 588 ha.

The area consists of lateritic uplands and dissected lateritic slopes, with moderately incised valleys. The uplands support open-forest of Jarrah (*Eucalyptus marginata*) and Marri (*E. calophylla*) and the valleys open-woodland of Wandoo (*E. wandoo*). The area includes extensive stands of *Dryandra polycephala*, *Dryandra drummondii*, *Conospermum polycephalum* and species of *Synaphea*, all of which are not well represented in the areas to the south in the State Forest.

The Bindoon Army Training Area was reviewed in relation to the flora and fauna so that if the Department of Army discontinue training in the area the land might become available for conservation. If this occurs, then reserves C29100 and A27595 could be included in the area to be conserved. Reserve C29100 would continue to serve as a buffer strip.

Reserve A27595 lies south of Calingiri Road, to the east of its junction with Old Plains Road. A low hill occupies the centre of the reserve with the land falling away on all sides.

The soil is coarse gravel with some admixture of red-brown clayey sand. The vegetation is mostly woodland of Jarrah, Marri and Wandoo. Species of tall shrubs include *Dryandra carduacea*, *D. sessilis* and *Hakea prostrata*. There is quite a varied understorey of low shrubs such as *Hakea lissocarpha*, *H. incrassata*, *Casuarina humilis*, *Verticordia pennigera*, *Hibbertia* spp., *Calothamnus sanguineus*, *Dryandra fraseri* and *Synaphea* sp.

Some felling of timber has occurred along the eastern and southern boundaries, and there may have been disturbance in the north-west although the vegetation is regenerating.

RECOMMENDATION

The Committee recommends that:

1. if the Department of Army discontinue training in the Bindoon Army Training Area, the land be purchased from the Commonwealth of Australia;
2. after revestment, this land together with reserves C29100 and A27595 be added to State Forest No. 61.

C.2 JULIMAR S.M.P.A.

Julimar S.M.P.A. (2.1) is located 25 km north-west of Toodyay. It is composed of State Forest (27 710 ha) and reserves C13971 (24 ha) and C20210 (65 ha), both for water, not vested, with a total area of 27 799 ha.

It is managed by the Forests Department for the Conservation of Flora and Fauna and for Recreation. The proposal also includes reserve C22097 (142 ha) for Government Requirements, not vested.

Julimar consists of lateritic uplands and dissected lateritic slopes. The valleys are moderately incised. A range of vegetation types is found here, those that cover the area are H, M and Y (Havel 1975 (a) and (b)). The minor types are G and A, which occur in relatively small and localised areas.

Type H occurs on the gravelly sands and consists of open-forest of Jarrah (*Eucalyptus marginata*) and Marri (*E. calophylla*). This vegetation type is found in the drier, eastern and northern fringes of the Darling Range.

Types M and Y both consist of woodland of Wandoo (*E. wandoo*), although type M also includes some Jarrah and Powderbark (*E. accedens*). Type M occurs on the middle and upper slopes of the valleys; Powderbark grows on the ridges in conjunction with Wandoo. Type Y occurs on the moister valleys and gullies. Its main plant species include such moisture-indicators as White Myrtle (*Hypocalymma angustifolium*) and *Baeckea camphorosmae*.

Type G is very localised, being restricted in occurrence to the granite outcropping in Julimar. The vegetation varies, depending on the depth of soil, from stands of Wandoo and Drummond's Gum (*Eucalyptus drummondii*) to *Borya nitida*, lichens and mosses. There are significant occurrences of Rock Sheoak (*Casuarina huegeliana*) in the eastern parts of Julimar. Type A occurs in swampy areas. It is usually associated with type Y, already described. The main indicator species include *Hakea ceratophylla*, *H. varia*, *Leptocarpus scariosus* and *Hypocalymma angustifolium*.

Several species of mammal are known from Julimar, including the Tammar (*Macropus eugenii*), a rare marsupial. Other species include the Western Grey Kangaroo (*M. fuliginosus*), the Brush Wallaby (*M. irma*), the Brush Possum (*Trichosurus vulpecula*), the Pigmy Possum (*Cercartetus concinnus*), the Honey Possum (*Tarsipes spencerae*) and some bats. It is possible that the Numbat (*Myrmecobius fasciatus*) occurs there.

About 50 species of bird have been recorded in Julimar, which has a large population of some birds that are becoming rarer in the South West; examples are Rufous Tree Creeper (*Climacteris rufa*), Black-capped Sittella (*Neositta pileata*) and Splendid Wren (*Malurus splendens*). The White-tailed Black Cockatoo (*Calyptorhynchus baudini*) is known to use the area as a breeding-ground. Some reptiles occur here at the northern limit of their range, for example the Skinks *Ctenotus labillardieri* and *C. delli*.

In the past the area has been logged. In the mid 1920s, nearly half was alienated under conditional purchase leases, but reverted to the Crown during the Depression. Most of the logging, followed by regeneration treatment, took place between 1950 and 1970. Other commercial activities in the area include beekeeping (based mainly on Wandoo) and harvesting of *Dryandra polycephala* for dried floral arrangements. Julimar is covered by bauxite mining leases held by Pacminex and Alcoa.

Although Julimar is relatively close to Perth, it has not as yet been developed for recreation. Recreation is at present limited to bush-walking and scenic drives. This situation, however, is expected to change in the near future. There is increasing demand to use trail bikes in sections of the forest.

There are sporadic occurrences of dieback disease in Julimar.

The Committee endorses the proposal by the Forests Department to manage Julimar Special Management Priority Area (2.1) for the Conservation of Flora and Fauna and for Recreation.

RECOMMENDATION

The Committee recommends that:

1. reserves C13971, C20210 and C22097 be cancelled and be proclaimed State Forest to be included in Julimar Special Management Priority Area for the Conservation of Flora and Fauna and for Recreation;
2. the Forests Department consider the allocation of an area of State Forest No.61, possibly 1000 ha in the south-west corner, to be clearly defined and supervised for the use of trail-bike riders.

C.3 RESERVE C22096 (CULHAM)

This reserve (386 ha) is for Conservation of Flora and Fauna and is vested in the Western Australian Wildlife Authority.

It is undulating land dissected by steep-sided gullies. The soil is gravel and yellow-brown sand with large lateritic boulders in the gullies.

The vegetation is predominantly open-woodland of Wandoo (*Eucalyptus wandoo*) and Marri (*E. calophylla*) with a dense understorey. Some Christmas Tree (*Nuytsia floribunda*), Snottygobble (*Persoonia elliptica*) and Bull Banksia (*B. grandis*) are present. Parrot bushes (*Dryandra sessilis* and *D. carduacea*), Blackboys (*Xanthorrhoea preissii*) and Zamia (*Macrozamia riedlei*) are common. Species in the understorey include *Acacia celastri-folia*, *Adenanthos drummondii*, *Calothamnus sanguineus*, *Bossiaea eriocarpa*, *Hypocalymma angustifolium* and *Petrophile serruriae*.

The reserve is undisturbed.

The Committee endorses the Class, purpose and vesting of reserve C22096.

C.4 RESERVE C3156 (BINDOON SPRING)

This reserve (40 ha) is a Resting Place for Travellers and Stock vested in the Shire of Toodyay. It straddles the Bindoon-Dewars Pool Road and is unusual in being an area of sandy soil in contrast to the predominant heavy soils of the district. Bindoon Spring occurs in the reserve. The land is undulating, and falls in a general south-easterly trend.

The predominant vegetation is low woodland of Slender Banksia (*B. attenuata*), Bull Banksia (*B. grandis*) and Christmas Tree (*Nuytsia floribunda*), with smaller trees such as Parrot Bush (*Dryandra sessilis*), wattles (*Acacia saligna* and *A. microbotrya*) and Spearwood (*Kunzea vestita*). There are a few emergent Marri (*Eucalyptus calophylla*) and Wandoo (*E. wandoo*). Blackboys (*Xanthorrhoea preissii*) and Zamia (*Macrozamia riedlei*) are common. Other representative species are *Grevillea vestita*, *Lechenaultia floribunda* and *Conostylis candicans*.

A sand pit has been opened in the south-west of the reserve but, although still used, it has some regeneration in the older section. Apart from weed infestation along the boundary, the reserve is in good condition. It is an unusual inland outlier of vegetation containing species typical of the coastal plain. There is nothing of value to stock.

The Committee considers that the purpose of the reserve should be altered to Conservation of Flora and Fauna; provision could still be made in the management for limited use by visitors if desirable. Extraction of sand from the reserve should cease immediately.

RECOMMENDATION

The Committee recommends that:

1. the purpose of reserve C3156 be changed to Conservation of Flora and Fauna and that the reserve be vested in the Western Australian Wildlife Authority;
2. extraction of sand from the reserve cease immediately.

C.5 RESERVE C19904 (WEST TOODYAY)

Reserve C19904 (93 ha) is for Timber and is not vested. It lies on the south side of Chittering Road.

The area is undulating. Although it has been somewhat disturbed by felling of timber and opening of gravel pits, it still contains a substantial amount of vegetation. The upper slopes support woodland of Marri (*Eucalyptus calophylla*) and Bull Banksia (*B. grandis*). Further down the slope the trees are Powderbark (*E. accedens*) and Wandoo (*E. wandoo*). Blackboys (*Xanthorrhoea preissii*) and Zamia (*Macrozamia riedlei*) are common and there are thickets of the parrot bushes *Dryandra carduacea* and *D. sessilis*. Shrubs in the understorey include *Hakea lissocarpha*, *H. ruscifolia*, *Grevillea pilulifera*, *Adenanthos drummondii*, *Darwinia citriodora* and *Bossiaea eriocarpa*. There are also occurrences of York Gum (*E. loxophleba*) with Jam (*Acacia acuminata*) and Manna Wattle (*A. microbotrya*). This type of vegetation has now mostly been cleared in the region.

The Committee considers the area worthy of reservation for conservation of its flora, especially the York Gum association.

RECOMMENDATION

The Committee recommends that the purpose of reserve C19904 be changed to Conservation of Flora and Fauna, and that the reserve be vested in the Western Australian Wildlife Authority.

C.6 BEELARING AND GOONARING SPRINGS

Along Toodyay Road, about 24 km south-west of Toodyay, are two small reserves for Conservation of Flora and Fauna, vested in the Western Australian Wildlife Authority. These are reserve C529, of 40 ha, which lies on the north side of the road, and reserve C659, of 53 ha, at the junction of Toodyay Road and Morangup Road. The vegetation of both reserves is diverse, and different from the typical associations of the district. Although reserve C659 is bisected by Morangup Road it is otherwise relatively undisturbed.

Reserve C529 is almost level but with a slight slope to the south-east. The soil is red loam with some gravel. Woodland of Jarrah (*Eucalyptus marginata*) and Marri (*E. calophylla*) occurs, with a dense understorey that contains good stands of *Dryandra carduacea*, a fire-sensitive species which should be conserved in several reserves to ensure its survival. Other species include Blackboy (*Xanthorrhoea preissii*), *Adenanthos drummondii*, *Leptospermum erubescens*, *Trymalium ledifolium*, *Acacia saligna*, Prickly Poison (*Gastrolobium spinosum*), *Leucopogon oxycedrus* and *Baeckea camphorosmae*. The reserve is believed to contain species of Lambstail (*Lachnostachys* spp.) which are rare in System Six.

Reserve C659 rises from the main road in a north-westerly direction. There are two distinct associations. The lower slope, on a yellow-red loam with some gravel, supports open-forest of Jarrah and Marri with the paperbark *Melaleuca preissiana*. Tall shrubs include the wattles *Acacia saligna* and *A. celastrifolia*, Swishbush (*Viminaria juncea*), *Trymalium spathulatum*, *Melaleuca polygaloides* and *Kunzea recurva*.

The higher slope is more gravelly, and the vegetation is open-woodland of Jarrah and Marri with an open understorey. Representative species are *Dryandra carduacea*, *Gastrolobium spinosum*, *Grevillea wilsonii*, *Leptospermum erubescens*, *Hemiandra pungens*, *Daviesia* spp., *Hakea gilbertii* and *Calytrix brachyphylla*.

Each reserve contains a spring: Beelaring Spring is in reserve C529 and Goonaring Spring is in reserve C659. The springs discharge fresh water into streams for most of the year, and are largely responsible for the diverse flora and fauna in the reserves. An Honorary Wildlife Officer has recorded as many as 80 species of birds in the area. The streams contain a crustacean of the Koonac group (*Cherax* sp.), the species not able to be positively confirmed, as well as Native Minnow (*Galaxias occidentalis*).

The catchment areas for the two springs are privately owned. A proposal to subdivide the land into farmlets was opposed by the Environmental Protection Authority on the ground that widespread clearing would adversely affect the quality of the water from the springs, thereby reducing the biological and aesthetic importance of the reserves.

The Department of Fisheries and Wildlife has found some evidence of salination in reserve C529, which it attributed to recent clearing within its catchment.

The Committee endorses the present purpose and vesting of reserves C529 and C659 and supports the Environmental Protection Authority's opposition to the subdivision of the catchment.

C.7 AVON VALLEY NATIONAL PARK

The present Avon Valley National Park consists of reserve A30192 which includes Swan Location 28391 and 6401 but from which is excised 53 ha for Standard Gauge Railway, leaving a total of 4377 ha as National Park, vested in the National Parks Authority. It is a narrow strip 3 - 4 km wide extending for 10 km along the Avon River. There is an enclave of freehold land on one side of the river for a further 3 km.

Formerly the Avon Valley Army Training Area, the land was acquired from the Commonwealth of Australia in exchange for Crown land which now forms the Bindoon Army Training Area. Besides the National Park, the remainder of the land acquired has been set aside as follows:

- a. Class A reserve 30191 (1991 ha) for Conservation of Flora and Fauna, vested in the Western Australian Wildlife Authority;
- b. Class A reserve 30193 (5143 ha) for Timber, vested in the Conservator of Forests; this reserve provides a source of timber for Wundowie activities;
- c. Avon Location 28217 - vacant Crown land; this location was left as vacant Crown land because of the numerous mining leases granted over the land (Pacminex Project).

The sides of the Avon Valley here slope steeply from the undulating plateau of 275 m to 300 m above sea level down to 60 m to 90 m at the valley bottom. The soil-landform units are described as Murray in the north-eastern part and Helena in the south-west. Yalanbee occurs on both sides of the valley on the plateau, with some Coolakin on the south side and Michibin on the north side (Churchward and McArthur 1978).

The vegetation consists primarily of open-forest of Jarrah (*Eucalyptus marginata*) and Marri (*E. calophylla*) on the uplands and an open-woodland of Wandoo (*E. wandoo*) in the valleys and on the slopes. The understorey of the Jarrah-Marri forest varies considerably from predominantly *Grevillea wilsonii* and *Adenanthos barbiger* to *Synaphea petiolaris* and *Daviesia pectinata*. In addition the occurrence of shallow soils is reflected in such indicators as *Grevillea bipinnatifida*, *Hakea undulata*, *H. trifurcata* and *H. elliptica*. One of the significant minor occurrences in this National Park is Wandoo in the major valleys: such an occurrence is normally restricted to the low rainfall areas in the east and north of the Darling Ranges. Flooded Gum (*E. rudis*) occurs along river banks. The river valley forms the division between the Darling vegetation complex on the south side and the Chittering complex on the north side. The latter is characterised by a greater proportion of Wandoo woodland, and a reduced proportion of Jarrah forest.

Proposed Additions

Reserve A30191 is for Conservation of Flora and Fauna, vested in the Western Australian Wildlife Authority. It lies at the junction of Plunkett Road and Sapper Road.

The area is gently undulating with shallow gullies, the soil varying from sandy loam to gravel. The vegetation is mainly woodland of Jarrah, Marri and Wandoo. Other trees are Bull Banksia (*B. grandis*) and Rock Sheoak (*Casuarina huegeliana*). Shrubs in the understorey include *Grevillea bipinnatifida*, *Leptospermum erubescens*, *Calytrix aurea*, *Labichea sunctata*, *Hibbertia* spp., *Petrophile striata* and *Daviesia* spp.

Perennial herbs are common; examples are *Ptilotus manglesii*, *Conostylis setosa*, *Stylidium* spp., *Lepidosperma angustatum* and *Lomandra* spp. Over 70 species have been recorded in the reserve.

Reserve A30193 is for Timber and is vested in the Conservator of Forests.

The area is undulating, lateritic upland carrying woodland of Jarrah, Marri, Christmas Tree (*Nuytsia floribunda*) and Bull Banksia. Dense stands of a parrot bush (*Dryandra carduacea*) occur in the understorey, as well as both Blackboys (*Xanthorrhoea preissii*) and Black Gin (*Kingia australis*), the latter being at the northern limits of its occurrence in the forest areas.

Shrubs of the understorey include *Adenanthos drummondii*, *Bossiaea eriocarpa*, *Styphelia tenuiflora*, *Leucopogon* spp., *Grevillea* spp., *Acacia* spp., and *Dryandra nivea*. There are perennial herbs such as *Patersonia rudis*, *Helichrysum bracteatum* and *Conostylis setosa*.

An important occurrence is that of the fringed lily *Thysanotus anceps*, a rare species known from only a few localities in the Darling Range north-east of Perth.

Some tree-felling has occurred but most of the reserve is undisturbed.

Avon Location 28217 is an undulating area of lateritic and sandy upland with moderate dissection by gullies. It contains an open-forest of Jarrah and Marri, with Wandoo woodland in the gullies. *Dryandra carduacea* and *D. sessilis* are common. The understorey is characterised by species such as *Adenanthos barbigerus*, *Kunzea recurva*, *Hibbertia quadricolor*, *Baeckea camphorosmae* and *Styphelia involucrata*.

Freehold land: The following properties lie in the Avon valley and on the steep slopes on both sides, and are surrounded on three sides by the existing National Park and adjoining reserves:

Avon Locations 579 and 580, which adjoin the National Park in the valley and stream system flowing into the Avon River;

Location M1451, which extends along the western bank of the Avon River for about 6 km and up the sides of the valley to the top of the plateau;

Location 150, on the eastern bank of the Avon River;

Location 929, also on the eastern bank of the river;

Location M1517, which extends along the south-easterly bank of the Avon River.

These private properties restrict public access to the Park and increase the difficulties of management, including fire protection and controls.

The proposed additions to the Avon Valley National Park provide a greater diversity of plant communities by the subsequent inclusion of the Avon River and its deeply dissected valleys and areas of granite with their associated heath communities. In the proposed National Park one of the significant features of the flora is the quantity and quality (relatively undisturbed) of the flora in the Avon Valley. Along most other major river systems the plant communities have been irreversibly destroyed by either agricultural development or by flooding as a result of dam construction. The extended boundary of the National Park will simplify the management of the area considerably.

RECOMMENDATION

The Committee recommends that:

1. reserves A30191 and A30193 be cancelled and their areas added to the Avon Valley National Park;
2. Avon Location 28217 be added to the Park;
3. Avon Locations 150, 579, 580 and 929, and Lots M1451 and M1517 be purchased when available and added to the Avon Valley National Park.

C.8 WALYUNGA NATIONAL PARK

Walyunga National Park consists of reserve C2065 which has an area of 172 ha after excision of 4 ha for Standard Gauge Railway. The reserve is for National Park and is vested in the National Parks Authority. In addition to this is portion of Swan Location 1316 and portion of Swan Location 2, Lot 1 which are controlled and managed as National Park, and have an area of 1618 ha. The total area of the Park is thus 1790 ha.

The Park is situated along the Darling Escarpment and is deeply dissected by the Swan River. At its highest point it is 250 m above sea level, dropping very steeply to 30 m at the river. Wooroloo Brook, in a deep valley, joins the Swan River in the Park.

The Helena Soil-landform Unit occupies most of the area, with a little Dwellingup in the east, and some Darling Scarp and a touch of Forrestfield in the west (Churchward and McArthur 1978).

The Park is covered with woodland and open-forest except for the granite outcrops. Jarrah (*Eucalyptus marginata*) is commonest on the lateritic uplands with Marri (*E. calophylla*) on deeper soils. The understorey is characterised by *Grevillea wilsonii* and *Adenanthos barbigerus*. On the valley slopes, Wandoo (*E. wandoo*) replaces Marri and Jarrah, while along the river Banks Flooded Gum (*E. rudis*) occurs. Surprisingly, there are pockets of Flooded Gum on some slopes high above the valley floor, presumably sustained there by seepage.

The shallow soils in the Park, especially around granite outcrops, support examples of the rich Darling Scarp flora.

Owing to its small size this National Park is very vulnerable to external influences. Fortunately, to the east, land between the park boundary and O'Brien Road has not been cleared except for one small patch near the road. The area also contains the deep, picturesque valley of Wooroloo Brook. To the north-west a small area adjoining the fork on top of and on the face of the escarpment is uncleared. To the north, extensive clearing has taken place, but in the Swan, Avon and Brockman Valleys, between Walyunga and Avon Valley National Parks, the slopes are still more or less in their natural state.

The proposed additions to Walyunga National Park include uplands which support primarily open-forest of Jarrah and Marri with an understorey of such species as *Grevillea wilsonii*, *Dryandra nivea*, *Hakea stenocarpa*, *Isopogon dubius*, *Trymalium ledifolium*, *Gastrolobium calycinum*, *Hibbertia montana* and *Adenanthos barbigerus*. The gullies, like parts of the Avon Valley National Park, support an open-woodland of Wandoo with large areas of heath to open-heath on the shallow and granitic soils. The Darling Scarp, which has a unique flora and is inadequately represented in reserves, is a minor component of this area. The vegetation of the Scarp consists of low open-woodland of Wandoo and Marri, ranging to open-heath and herblands on the granitic soil.

RECOMMENDATION

The Committee recommends that:

1. as they become available, Lots 119, 120, 121, 122, 123 and 1 (between the eastern boundary of the Park and O'Brien Road) be purchased and added to the Park;
2. the small area of undisturbed bush adjoining the Park to the north-west within Lots 6 and 7 be purchased when available and added to the Park;
3. any properties or parts thereof within the Swan, Avon and Brockman River Valleys between the Walyunga and Avon Valley National Parks be purchased when available and added to the National Park system;
4. if Lots 123 and 1 are purchased, then, provided that the Shire of Swan is agreeable, reserves C26864 and C26865 (both currently for Recreation, vested in the Shire of Swan - Guildford) be cancelled and their areas added to Walyunga National Park;
5. Walyunga National Park be reclassified as Class A and be vested in the National Parks Authority.

C.9 RESERVES C32400, C20014 AND C3307 (CLACKLINE)

These are adjacent reserves just north of Clackline. Reserve C32400 (459 ha) is for Conservation of Flora and Fauna, vested in the Western Australian Wildlife Authority; reserve C20014 (130 ha) is for Timber, unvested; reserve C3307 (6 ha) is for Water, unvested. Adjacent to these reserves are three areas of vacant Crown Land (Fig.); adjoining the southernmost area are two small reserves for Railway: C1494, of 4 ha, vested in the Commissioner of Railways; C8518, of 0.9 ha, not vested.

The western part is gently undulating but towards the eastern end the land is dissected into steep-sided valleys and ridges. The soils include yellow-brown sand, white sand, gravel, clay and granitic outcrops.

Although the vegetation is chiefly woodland, the trees vary with soil type. They include Jarrah (*Eucalyptus marginata*), Marri (*E. calophylla*), Wandoo (*E. wandoo*), Powderbark (*E. accedens*), Brown Mallet (*E. astringens*), Rock Sheoak (*Casuarina huegeliana*), Christmas Tree (*Nuytsia floribunda*) and Bull Banksia (*B. grandis*).

Large shrubs present are Snottygobble (*Persoonia elliptica*), Parrot Bushes (*Dryandra sessilis*, *D. carduacea*), *Hakea prostrata*, *Acacia saligna* and *Grevillea vestita*. The low shrubs include such species as *Adenanthos drummondii*, *Hakea undulata*, *Gastrolobium calycinum*, *G. parvifolium*, *Verticordia serrata*, *Conospermum stoechadis*, *Calytrix flavescens*, *Leptospermum erubescens* and *Petrophile serruriae*. Two species of Blackboy, *Xanthorrhoea preissii* and *X. reflexa*, are present.

A rare species of orchid, *Caladenia triangularis*, not known from any other conservation reserve, has been found in reserve C32400.

The occurrence here of Brown Mallet is unusual, since the species otherwise is found in the Great Southern between Brookton and Katanning.

The southern piece of vacant Crown land and the adjoining reserves C1494 and C8518 contain a portion of Clackline Brook, which is vegetated with Flooded Gum (*E. rudis*) with an understorey of introduced grasses. Springs provide the river bed with permanent pools which are an important source of water for the animals that inhabit the reserves and vacant Crown land to the north west; there is only one small water-hole in reserve C32400.

This portion of Clackline Brook is the major section of the stream in Crown land in the district along which most of the original trees remain.

Schools, both in the area and in Perth, use the Railway reserves, the adjoining vacant Crown land and the Flora and Fauna reserve for ecological studies.

Some of the Crown land around reserve C32400 is subject to mineral claims which are utilised by Clackline Refractories Limited for the production of refractory clay, and the reserve was only declared after long negotiations between various Government Departments and a Ministerial inspection. Although the Department of Fisheries and Wildlife sought to have the remainder of reserve C20014 (that part remaining after the declaration of C32400), reserve C3307 and adjoining vacant Crown land included in the reserve, these areas were excluded because of their mining potential, even though the Clackline Refractories were agreeable to a larger reserve on condition their rights were protected.

The Committee does not wish to limit the mining of the area in any way but notes that the area mined in any one year is small and that much of the land within the claims will not be affected. The Committee believes it would be sensible to consolidate the land into one reserve so it can be managed as a unit, with the proviso that mining in the area outside the present boundaries of reserve C32400 can proceed unimpeded.

RECOMMENDATION

The Committee recommends that:

1. reserve C32400, C20014 and C3307, the vacant Crown land shown in Fig. . and portions of reserves C1494 and C8518, to include the portion of Clackline Brook and a 30 m buffer zone on its southern side, be consolidated into a Class C reserve for Conservation of Flora and Fauna, vested in the Western Australian Wildlife Authority;
2. mining of Crown land adjacent to the present boundaries of reserve C32400 continue unimpeded.

C.10 RESERVES C4623, C11619, C14275, C14276 (BAKERS HILL)

This is a group of reserves around Bakers Hill on the Great Eastern Highway. Reserve C4623 (45 ha) is for Forest (Wandoo), unvested; C11619 (46 ha) is for Recreation, vested in the Shire of Northam; C14275 (1980 ha) and C14276 (619 ha) are for Timber (State Forest), unvested. There is some vacant Crown land adjacent to reserve C14275.

Reserve C4623 is undulating and has a woodland of Jarrah (*Eucalyptus marginata*) and Wandoo (*E. wandoo*) on gravel and gravelly loam. Blackboys (*Xanthorrhoea preissii*) and Zamia (*Macrozamia riedlei*) are common. Other understorey species are Parrot Bush (*Dryandra sessilis*), Prickly Poison (*Gastrolobium spinosum*), *Pimelea suaveolens*, *Hakea* spp., *Hibbertia* spp., *Stylidium* spp. and *Grevillea synapheae*. A rare fringed lily, *Thysanotus anceps*, known from only a few other localities north-east of Perth, occurs here. Coates Road passes through the reserve: the area to the east is in good condition but that to the west is disturbed, containing a gravel pit and many vehicle tracks.

Reserve C11619 consists of the upper slopes of a rise sloping to the north-west. Here a gravelly loam supports woodland of Jarrah and Wandoo with the latter predominating in the eastern part of the reserve. The understorey is quite diverse with species such as *Dryandra carduacea*, *Isopogon dubius*, *Gastrolobium spinosum*, *Acacia nervosa*, *Dryandra bipinnatifida*, *Lechenaultia biloba*, *Anigozanthos manglesii*, *Helichrysum bracteatum* and *Ptilotus manglesii*. The reserve is undisturbed.

Reserve C14275 is in two sections separated by freehold land. The western section, next to Wundowie townsite, is relatively flat and supports woodland of Jarrah and Bull Banksia (*B. grandis*) with an admixture of Wandoo in some places. In gravelly soils, the understorey contains such species as *Dryandra carduacea*, *Bossiaea eriocarpa*, *Leptospermum erubescens*, *Grevillea wilsonii*, *Daviesia rhombifolia* and *Hakea lissocarpa*. Some areas are sandy, and the shrubs include *Adenanthos cygnorum*, *Conospermum stoechadis* and *Jacksonia furcellata*. *Thysanotus anceps* also occurs here. There has been more tree-felling in parts of this section, as well as extraction of gravel and sand.

The eastern section of reserve C14275 rises gently towards the south. Here also there is woodland of Jarrah, Bull Banksia and Wandoo with some Marri (*E. calophylla*). There are dense stands of *Acacia saligna* and *Dryandra carduacea*. The understorey shows some difference from that of the western section in the presence of such species as *Gastrolobium spinosum*, *Adenanthos ? drummondii*, *Dryandra sessilis* and *Pimelea suaveolens*. The area is undisturbed.

Reserve C14276 lies on the south side of Great Eastern Highway at its junction with Inkpen Road. It is gently undulating and contains both gravelly and sandy soils. The vegetation is woodland of Jarrah, Marri, Wandoo and Bull Banksia with a low heath understorey. There is Powderbark (*Eucalyptus accedens*) in places. Blackboys and Zamia are common. Representative shrub species are *Dryandra sessilis*, *D. carduacea*, *Hakea prostrata*, *Astroloma pallidum*, *Hibbertia montana*, *Gastrolobium spinosum*, *Patersonia rudis* and *Ptilotus manglesii*.

There are also stands of the Rock Sheoak (*Casuarina huegeliana*) in the area.

The Committee considers that this group of reserves provides an opportunity to reserve substantial areas for conservation of the flora and fauna of the district.

RECOMMENDATION

The Committee recommends that:

1. reserves C4623, C11619, C14275 and C14276 be made Class A reserves for Conservation of Flora and Fauna, vested in the Western Australian Wildlife Authority;
2. the vacant Crown land (Avon Location 2769) adjacent to reserve C14275 be included in that reserve.

C.11 RESERVES C30393 AND C25860 (BERRY BROW ROAD)

These two reserves lie at the junction of Berry Brow Road and Golgongine Road, south-south-east of Bakers Hill. Reserve C30393 (260 ha) is for Government Requirements, and reserve C25860 (70 ha) is for Public Utility. Both are unvested.

The reserves straddle the watershed between streams flowing into the Avon Valley and streams of the Helena catchment. They occupy high, undulating country, the highest parts being lateritic with some breakaway edges, while the slopes are gravelly. Fine views can be obtained across the surrounding valleys. Although timber has been cut many years ago, regeneration of the tree species is good, and the understorey also is in good condition.

The vegetation of the highest parts is low open-woodland of Wandoo (*Eucalyptus wandoo*), Jarrah (*E. marginata*), Marri (*E. calophylla*) and Powderbark (*E. accedens*). The understorey is dense in some parts, open in others. Shrubs include *Hakea trifurcata*, *Petrophile serruriae*, *Leptospermum ? erubescens*, *Gastrolobium villosum*, *Bossiaea ornata*, *Grevillea synapheae*, *Petrophile striata*, *Hibbertia* spp., *Grevillea uncinulata*, *Hypocalymma angustifolium*, *Thomasia* sp. and *Xanthorrhoea preissii*. On the lateritic breakway occur species such as *Zamia (Macrozamia riedlei)*, *Hibbertia montana* and Silky Bloodflower (*Calothamnus sanguineus*).

On heavier soils there is admixture of York Gum (*E. loxophleba*) and Jam (*Acacia acuminata*). Some areas of granitic soil carry Rock Sheoak (*Casuarina huegeliana*).

The reserves are worth retaining for the conservation of flora. Their vegetation represents the Yalanbee, Michibin and Coolakin vegetation complexes. York Gum, Jam and Rock Sheoak occur on land that is suitable for agriculture; little remains uncleared.

RECOMMENDATION

The Committee recommends that the purpose of reserves C30393 and C25860 be changed to Conservation of Flora and Fauna, and that the reserves be vested in the Western Australian Wildlife Authority.

C.12 RESERVE C29269 (NORTH-WEST OF CHIDLOW)

Reserve C29269 lies north-west of Chidlow. It covers 106 ha, is for Parkland and Recreation and is vested in the Shire of Mundaring.

The reserve is gently undulating and contains open-forest on yellow-brown sand mixed with gravel. Jarrah (*Eucalyptus marginata*) and Marri (*E. calophylla*) are the dominant trees, with some Bull Banksia (*B. grandis*). In the understorey are shrubs such as *Hypocalymma angustifolium*, *Adenanthos barbigerus*, *Bossiaea pulchella*, *Hakea lissocarpa*, *Hibbertia* spp. and *Pimelea suaveolens*. Blackboys (both *Xanthorrhoea preissii* and *X. gracilis*) and *Zamia (Macrozamia riedlei)* are present.

There has been some disturbance through tree-felling but the reserve otherwise is in good condition. It abutts the western part of reserve C4967 (see C.13).

The Committee endorses the class, purpose and vesting of reserve C29269.

RECOMMENDATION

The Committee recommends that the Shire of Mundaring retain as much as possible of the natural vegetation of reserve C29269, and to this end seek the advice of the proposed Flora Research and Conservation Advisory Service, or, prior to its formation, the Department of Conservation and Environment.

C.13 RESERVES C4967 AND C17100 (CHIDLOW)

These are adjacent reserves just north of Chidlow. Both are for timber and are not vested.

The eastern (Fig.) and western parts of reserve C4967 are gently undulating with some dissection by seasonal creeks. Soils are gravel and yellow-brown sand. The vegetation is open-forest to woodland. On the uplands the trees are Jarrah (*Eucalyptus marginata*) and Marri (*E. calophylla*) with some Bull Banksia (*B. grandis*), Sheoak (*Casuarina fraserana*), Parrot Bush (*Dryandra sessilis*) and Snottygobble (*Persoonia elliptica*). In the understorey are species such as *Adenanthos barbigerus*, *Synaphea petiolaris*, *Hakea lissocarpa*, *Dryandra nivea*, *Grevillea synapheae*, *Xanthorrhoea preissii*, *Bossiaea ornata* and *Daviesia pectinata*. Herbaceous species are *Conostylis setosa*, *Ptilotus manglesii*, *Patersonia rudis* and *Stylidium* spp.

There has been some disturbance with tracks and a gravel pit but the reserve generally is in good condition.

Reserve C17100 (64 ha) is similar in landform and vegetation. Additional species recorded in the understorey are *Leucopogon conostephioides*, *L. propinquus* and *Acacia urophylla*.

RECOMMENDATION

The Committee recommends that:

1. the purpose of reserve C17100 and of both the eastern and western parts of C4967 (Figs. and) be changed to Parkland and Recreation and that they be vested in the Shire of Mundaring;
2. the Shire of Mundaring retain as much as possible of the natural vegetation of reserves C4967 and C17100;
3. for advice on management, the Shire consult the proposed Flora Research and Conservation Advisory Service or, prior to its formation, the Department of Conservation and Environment.

C.14 LAKE LESCHENAULTIA

Lake Leschenaultia lies in reserve C23165, of 168 ha, for Recreation, vested in the Shire of Mundaring. It is adjoined on its south-western side by State Forest No.68, of about 330 ha; within it is reserve C25433, of 4 ha, for Rubbish Depot, vested in the Shire of Mundaring.

The lake was created artificially by a dam built in 1912 across Crooks Brook to provide water for steam engines, using the government railway through Chidlow. It has an area of 40 ha and is up to 9 m deep at the northern end behind the dam wall; the water level varies seasonally by about 1 m.

Five creeks flow into the Lake. Crooks Brook drains Chidlow townsite and enters the south-eastern corner. One creek flows from the north-west and drains farmland. Another two lie mostly within the State Forest, one of them draining through the rubbish depot (reserve C25433). The fifth drains farmland to the south, flowing into the western end of the lake. The creeks run during winter but are dry in summer.

The reserves and State Forest contain five principal vegetation associations. The lateritic uplands, which cover most of the area, carry open-forest of Jarrah (*Eucalyptus marginata*) with smaller amounts of Marri (*E. calophylla*). Small trees of the understorey are principally Bull Banksia (*B. grandis*), Sheoak (*Casuarina fraserana*) and Snottygobble (*Persoonia elliptica*) and a variety of small plants are present. South of the lake is woodland of Jarrah which contains dying trees (cause uncertain), with a different assortment of smaller plants, including Scrub Sheoak (*C. humilis*) and *Acacia baxteri*.

Confined to the depressions is open-forest of Wandoo (*E. wandoo*), Marri and Yarri (*E. patens*). The understorey species are largely different and include Drummond's Wattle (*A. drummondii*), *A. saligna*, Pepper-and-salt (*Eriostemon spicatum*), *Eryngium bipinnatifidum*, *Hibbertia gracilipes*, White Myrtle (*Hypocalymma angustifolium*), Rose Banjine (*Pimelea rosea*) and *Scaevola* aff. *paludosa*.

In muddy depressions which are waterlogged in winter are two associations of closed-scrub vegetation. One is dominated by *Acacia saligna*, with *Hakea varia*, *Polypompholyx multifida*, *Sowerbaea laxiflora*, *Stylidium* sp. and *Tribonanthes uniflora*. The other is dominated by *Melaleuca microphylla*, with scattered emergent Flooded Gums, often in mallee form. Also present are *Astartea fascicularis*, *Baeckea camphorosmae* and *Viminaria juncea*.

Sedgeland of Jointed Twig-rush (*Baumea articulata*) and *Leptocarpus aristata* extend into the water around most of the lake's edge. The broadest and most diverse areas are towards the south-western end of the lake. Three other sedges - *B. juncea*, *Cyperus vaginatus* and Bulrush (*Typha orientalis*) - are also present, and other associated plants are *Crassula colorata*, *Drosera heterophylla*, *Lobelia alata*, *Schoenolaena juncea*, *Triglochin procera*, *Villarsia albiflora* and the paperbark tree *Melaleuca preissiana*.

A number of exotic plants are established in the area but are mainly restricted to the creeks and the surrounds of the lake.

The Darling Range branch of the Western Australian Naturalists' Club has identified 70 species of birds in reserve C23165. A number of the species present are uncommon in surrounding lands, for example Rufous Tree-creeper (*Climacteris rufa*), Reed Warbler (*Acrocephalus australis*), Western Yellow Robin (*Eopsaltria griseogularis*), Western Rosella (*Platycercus icterotis*) and Splendid Wren (*Malurus splendens*).

Native water-birds that regularly use the lake and surrounding sedgeland are Coot (*Fulica atra*), Little Black Cormorant (*Phalacrocorax sulcirostris*), Little Pied Cormorant (*P. melanoleucos*), Pied Cormorant (*p. varius*), Black Duck (*Anas superciliosa*), White-eyed Duck (*Aythya australis*), Hoary-headed Grebe (*Podiceps poliocephalus*), Little Grebe (*P. novaehollandiae*), White-faced Heron (*Ardea novaehollandiae*) and Western Swampheaven (*Porphyrio porphyrio*). Introduced species are Mallard (*Anas platyrhynchos*) and the domestic duck, Khaki Campbell. Many species have been recorded to breed on the lake.

The variety of habitat is important for the area's diversity of bird species. Some species remain in one habitat, for example the Splendid Wren and the Spotted Scrub-wren (*Sericornis maculatus*) are associated with the thickets of *Acacia* and *Melaleuca*.

Native mammals identified in reserve C23165 are Western Brush Wallaby (*Macropus irma*), Western Grey Kangaroo (*M. fuliginosus*) and Quenda (*Isoodon obesulus*). Foxes, rabbits, cats and mice also inhabit the reserve. A variety of reptiles and amphibians are present. Marron (*Cherax tenuimanus*), Native Minnow (*Galaxias occidentalis*) and two introduced fishes - Mosquito Fish (*Gambusia affinis*) and Redfin Perch (*Perca fluviatilis*) - inhabit the lake.

The State Forest contains an Aboriginal site. It is typical of the sites in the Darling Range used by Aborigines and gives clues on their life style prior to European settlement. Many similar sites have been destroyed by land development.

The lake is important for recreation such as swimming, picnicking and nature study. Being the only substantial body of water in the Darling Range east of Perth that is accessible to the public for recreation, it is particularly well used in the summer. The Eastern Hills Primary and High Schools, which are situated beside the south-western corner of State Forest No. 68, use the area for wildlife studies. A field station is envisaged for the future, so that other schools can study the area. The Darling Range Branch of the Western Australian Naturalists' Club has been surveying reserve C23165 continually since August 1977 and intends to extend its investigations into the State Forest.

With the increasingly large numbers of visitors to Lake Leschenaulta, keeping the area clean and preventing fires are growing problems. Concern has also been expressed that the water quality of the lake could deteriorate; several of the creeks are reported to contain a prolific algal growth. The creek draining farmland south of the lake and Crook's Brook, which drains Chidlow townsite, are also a source of weeds. The Department of Conservation and Environment should investigate the possible pollution of the lake and how the lake's catchment should be managed.

The Committee endorses the vesting of reserve C23165.

RECOMMENDATION

The Committee recommends that:

1. reserve C23165 be reclassified as Class A and that its purpose be changed to Parkland and Recreation;
2. State Forest No.68 and reserve C25433 be added to reserve C23165;
3. reserve C23165 be managed to conserve the flora and fauna and to provide for education and appropriate recreation; the Shire of Mundaring should seek the advice of the Wetlands Advisory Committee and the proposed Flora Research and Conservation Advisory Service;
4. the Department of Conservation and Environment investigate the possible pollution of the lake and the management of its catchment.

C.15 RESERVE C14278 (EAST OF WOOROLOO)

Reserve C14278 (95 ha) is for Timber, State Forest. It lies on the south side of Great Eastern Highway opposite El Caballo Blanco, near Wooroloo. The land slopes gently upwards from the highway to a broad lateritic ridge. Two areas have been used for extraction of gravel, and timber has been cut, but the reserve is otherwise in good condition. It contains a low woodland of an interesting assemblage of species: Wandoo (*Eucalyptus wandoo*), Powderbark (*E. accedens*), Marri (*E. calophylla*) and Jarrah (*E. marginata*).

The understorey is mostly low and open, including species such as Blackboy (*Xanthorrhoea preissii*), *Synaphea* sp., Prickly Moses (*Acacia pulchella*), Harsh Hakea (*H. prostrata*), *Daviesia* sp., *Dampiera lavandulacea*, Couch Honey-pot (*Dryandra nivea*), Honeybush (*Hakea lissocarpa*), *Gastrolobium* sp., *Acacia nervosa*, *Grevillea synapheae*, *Billardiera lineatus*, Parrotbush (*Dryandra sessilis*) and *Hibbertia* sp. Small trees present are Snottygobble (*Persoonia elliptica*) and Bull Banksia (*B. grandis*).

Little of this vegetation is in reserves along the Great Eastern Highway: the region is becoming increasingly cleared. This reserve should be retained for Conservation of Flora.

RECOMMENDATION

The Committee recommends that:

1. the purpose of reserve C14278 be changed to Conservation of Flora and Fauna, and that the reserve be vested in the Western Australian Wildlife Authority;
2. no further extraction of gravel or timber from the reserve be allowed.

C.16 RESERVE C25033 (THE LAKES)

Reserve C25033, of 121 ha, is Exempt from Sale and is not vested. The reserve is in two sections each occupying a ridge, the intervening valley being cleared for agriculture. It lies just north of the Lakes, where the Great Southern Highway leaves the Great Eastern Highway.

The southern section is the lower and consists mostly of gravelly soil supporting forest and woodland of Jarrah (*Eucalyptus marginata*) with some Marri (*E. calophylla*) and Wandoo (*E. wandoo*). In places the understorey is low consisting of such species as *Hibbertia* sp., Semaphore Sedge (*Mesomelaena tetragona*) and *Acacia barbinervis*. Of special note is a good population of *Adenanthos teges*, a rare mat plant of horticultural potential. In other parts there is quite a dense growth of small trees such as Sheoak (*Casuarina fraserana*) Bull Banksia (*B. grandis*), Parrot Bush (*Dryandra sessilis*) and scattered Snottygobble (*Persoonia elliptica*). At the western end are good stands of *D. carduacea*. Some areas are sandy, and here Common Smokebush (*Conospermum stoechadis*) and Blueboy (*Stirlingia latifolia*) occur. At the north-western corner, next to Great Eastern Highway, is a granite outcrop supporting species typical of these habitats.

The northern section lies along a high lateritic ridge with low open-woodland of Wandoo and Marri with open areas mostly of low shrubs. The shrubs are *Petrophile striata*, *Hakea stenocarpa*, *H. incrassata*, *Beaufortia macrostemon*, Couch Honeypot (*Dryandra nivea*), *D. armata*, Scrub Sheoak (*Casuarina humilis*), *Daviesia rhombifolia*, *D. longifolia*, *Acacia nervosa*, *Hakea undulata*, and *Melaleuca trichophylla*.

Although in two sections, the reserve contains vegetation well worth conserving, especially the population of *Adenanthos teges*.

RECOMMENDATION

The Committee recommends that reserve C25033 be made a Class A reserve for Conservation of Flora and Fauna, vested in the Western Australian Wildlife Authority.

C.17 RESERVES C30667, C30681 AND C30797 (THE LAKES)

These adjacent reserves lie on the west side of the Great Eastern Highway, just north of the Lakes. Reserve C30667 (56 ha) is for Conservation of Flora and Fauna and is vested in the Western Australian Wildlife Authority. Reserve C30681 (24 ha) is for Conservation of Flora and Fauna and is unvested. Reserve C30797 (15 ha) is for Government Requirements and is not vested; it adjoins reserve C30667 on its eastern side.

The reserves occupy a broad lateritic ridge with a few rather sandy areas on the west side. The east side slopes down towards the Highway.

The vegetation is open-woodland of Jarrah (*Eucalyptus marginata*) with some Marri (*E. calophylla*). There is a dense lower storey of trees that include Parrotbush (*Dryandra sessilis*), *D. carduacea*, Snottygobble (*Persoonia elliptica*), Sheoak (*Casuarina fraserana*) and Bull Banksia (*B. grandis*). A low shrub layer contains such species as Couch Honeypot (*Dryandra nivea*), Buttercups (*Hibbertia hypericoides*), *Hakea stenocarpa*, *Leucopogon oxycedrus*, *Styphelia tenuiflora*, Slender Blackboy (*Xanthorrhoea gracilis*) and *Daviesia rhombifolia*. In the sandy areas are shrubs such as *Leptospermum ellipticum* and Blueboy (*Stirlingia latifolia*).

The vegetation is somewhat different from that of reserve C25033 to the south east (see C16: The Lakes) and should be retained. The addition of reserve C30797 to reserve C30667 would increase the viability of the flora and fauna.

The Committee endorses the class, purpose and vesting of reserve C30667.

RECOMMENDATION

The Committee recommends that:

1. reserve C30681 be vested in the Western Australian Wildlife Authority;
2. reserve C30797 be cancelled and its area be added to reserve C30667.

C.18 RESERVE C30363

Reserve C30363 (121 ha) is for Government Requirements, and is not vested. It lies to the north of Great Southern Highway, about 10 km east of The Lakes. The area is gravelly and undulating, with a low-lying central belt of sandy soil. Inkpen Road passes through the reserve from north to south.

Much of the gravel area supports woodland of Jarrah (*Eucalyptus marginata*) and Marri (*E. calophylla*). Timber has been cut here but regeneration is good. The shrubs of the understorey include Harsh Hakea (*H. prostrata*), *Jacksonia furcellata*, *Zamia* (*Macrozamia riedlei*), *Phyllanthus calycinus*, *Agrostocrinum scrabrum*, Buttercups (*Hibbertia hypericoides*), *H. montana*, *Bossiaea eriocarpa*, *Acacia microbotrya*, and Honeybush (*Hakea lissocarpa*).

In the sandy area the woodland is mostly Marri. The understorey includes *Conostylis aculeata*, Stinkwood (*Jacksonia sternbergiana*), Harsh Hakea and Buttercups.

Although the vegetation of this reserve contains species of widespread distribution, the sandy area within it is unusual in that most of the district consists of lateritic soils. The reserve should be retained to conserve the flora.

RECOMMENDATION

The Committee recommends that the purpose of reserve C30363 be changed to Conservation of Flora and Fauna and that the reserve be vested in the Western Australian Wildlife Authority.

D.1 GUNAPIN S.M.P.A.

Gunapin S.M.P.A. (2.3) is located 45 km east of Armadale on the eastern boundary of the State Forest. The S.M.P.A. is composed of State Forest and occupies a total area of 13 497 ha; the core area of 5882 ha is Gunapin Forest Park. It is managed by the Forests Department for the Conservation of Flora and Fauna.

Gunapin includes a large range of soils, landforms and vegetation representative of the drier areas on the eastern fringes of State Forest in System 6. The area is somewhat similar to Sullivan (D.2), Surface (J.6) and Nalyerin (J.7), but has several significant features of its own, notably the presence of Swamp Sheoak (*Casuarina obesa*).

Gunapin comprises the lateritic uplands of the Dwellingup and the Yalanbee Soil-landform Units (Churchward and McArthur 1978) and valleys of chiefly the Goonaping, Pindalup and Yarragil Units.

The valleys, which form part of the headwaters of the Darkin River, are more varied. On the Goonaping Unit is woodland of *Banksia* spp., and the swampy valley floors of the Pindalup and Yarragil Units support a variety of vegetation.

In fact, Gunapin contains the biggest area of swamps in State Forest. The vegetation is unsurpassed for its range of structures and number of species, including some of restricted occurrence. Moreover, the swamps provide water and shelter for animals: the Forests Department's highest fauna counts have been for the valleys of the eastern areas of State Forest.

Gunapin is outstanding for the range of vegetation types (Havel 1975 (a) and (b)) that it covers in undisturbed or mildly disturbed conditions. The several structural variants of vegetation type A are remarkable examples, but types J, G, H, M and Y are also well represented. There are also minor occurrences of types B and F.

Plants that indicate type A are *Hakea varia*, *Hakea ceratophylla*, *Leptospermum ellipticum*, *Synaphea petiolaris*, and sedges and rushes such as *Mesomelaena tetragona*, *Lyginia tenax*, *Leptocarpus scariosus* and *Lepidosperma angustatum*. The structural and floristic variants of this broad type found in the Gunapin swamp are low closed-forest of the paperbark *Melaleuca raphiophylla*, open-woodland of the paperbark *Melaleuca preissiana* and Swamp Banksia (*B. littoralis*), open-woodland of Swamp Sheoak (*Casuarina obesa*), low open-woodland of the conifer *Actinostrobus pyramidalis*, closed-shrubland of *Melaleuca incana* and *M. viminea*, and other shrubland and sedgeland.

Type J occurs on leached grey sands. It consists mainly of low woodland of Slender Banksia (*B. attenuata*), Menzies' Banksia (*B. menziesii*) and Christmas Tree (*Nuytsia floribunda*), with a wealth of shrubs belonging to the families Proteaceae (e.g., *Conospermum stoechadis*, *Stirlingia latifolia*) and Epacridaceae (*Styphelia tenuiflora*, and several *Leucopogon* spp.).

Along the margins of the swamps type Y is well developed. It consists of open-woodland of Wandoo (*Eucalyptus wandoo*) with a low understorey of *Hakea lissocarpa*, White Myrtle (*Hypocalymma angustifolium*) and *Baeckea camphorosmae*. At its upper margin it merges into type M, which is mixed woodland of Wandoo and Jarrah (*E. marginata*), with a shrub storey of *Hakea lissocarpa*, *Gastrolobium calycinum* and *Zamia* (*Macrozamia riedlei*). Interspersed on the upper slopes are stands of Rock Sheoak (*Casuarina huegeliana*), which with the lichens, herblands and shrublands associated with granite outcrops are collectively type G. Type H, which is common in many other reserves, dominates the uplands.

Portions of Gunapin S.M.P.A. were logged between 1950 and 1970. Along the south-eastern boundary there is an extensive area of cleared private land which is now under pasture. There is no record of dieback in the area, but some of the vegetation represented here has proved highly susceptible to the disease elsewhere.

Owing to the susceptibility of some of the vegetation to dieback and to the S.M.P.A.'s outstanding importance for flora and fauna, recreation should be limited to bush-walking.

The Committee endorses the proposal by the Forests Department to manage Gunapin Special Management Priority Area (2.3) for the Conservation of Flora and Fauna.

D.2 SULLIVAN S.M.P.A. AND RESERVE C34442

Sullivan S.M.P.A. (2.4) is located about 12 km north of Westdale, on the eastern fringes of System 6. It is composed of State Forest (6335 ha). The core, of 3300 ha, is Sullivan Forest Park. The S.M.P.A. is managed by the Forests Department for the Conservation of Flora and Fauna. Reserve C34442, of 1896 ha, is vested in Western Australia Wildlife Authority for Conservation of Flora and Fauna.

Sullivan and reserve C34442 resemble Nalyerin (J.7) and to a lesser extent parts of Gunapin (D.1) and Surface (J.6). The core of the S.M.P.A. and Dababerry Swamp, in C34442, are situated on the swampy valley floors associated with the Goonaping Unit (Churchward and McArthur 1978). The most outstanding feature is the swamp vegetation, which includes low open-woodland of Slender Banksia (*B. attenuata*) and Menzies' Banksia (*B. menziesii*), low open-forest of the paperbark *Melaleuca preissiana* and Swamp Banksia (*B. littoralis*), and sedgelands. A significant occurrence in the swamps are the stands of *Actinostrobus pyramidalis* and *Casuarina acuarina*.

The lateritic uplands support mostly open-woodland of Wandoo (*Eucalyptus wandoo*) with Jarrah (*E. marginata*) and Marri (*E. calophylla*) on the more undulating areas and Powder Bark (*E. accedens*) on the dissected slopes.

The dominant vegetation types are A, H and Y (Havel 1975 (a)) while types B, J, F and M are more restricted in area. Type A includes the swamp vegetation.

Two areas of vacant Crown Land (see Fig.) of total area ha, if added to reserve C34442, would incorporate in the reserve the immediate catchment of Dababerry Swamp.

The Committee endorses the purpose and vesting of reserve C34442 and the proposal by the Forests Department to manage Sullivan Special Management Priority Area (2.4) for the Conservation of Flora and Fauna.

RECOMMENDATION

The Committee recommends that:

1. reserve C34442 be re-classified as Class A;
2. the Crown land to the south and east of reserve C34442 (see Fig.) be included in C34442;
3. the Crown land to the north of Kempton Road and south of the Watershed Catchment Road (see Fig.) be proclaimed State Forest and included in Sullivan Special Management Priority Area (2.4).

D.3 RUSSELL S.M.P.A.

Russell S.M.P.A. (2.5) is located 42 km east of Armadale to the north of the Brookton Highway. The area is composed of State Forest and occupies a total area of 5702 ha; the core area, of 2658 ha, is Russell Forest Park. It is managed by the Forests Department for the Conservation of Flora and Fauna and for Recreation.

Russell is somewhat similar to Duncan (D.16), Gyngoorda (D.17), Wandering (D.18) and Stene (J.9). It differs from them in that it includes the largest remaining area of woodland of uncut Wandoo (*Eucalyptus wandoo*).

Russell includes lateritic uplands of the Dwellingup and the Yalanbee Soil-landform Units (Churchward and McArthur 1978), which support a range of vegetation from open-forest of Jarrah (*E. marginata*) and Marri (*E. calophylla*) to open-woodland of Wandoo. Significant areas of shallow lateritic soils and granite outcrops associated with the Cook Unit are also present in Russell and support a range of vegetation from open-woodland of Jarrah to low open-forest of Rock Sheoak (*Casuarina huegeliana*), shrubland and lithic complex. Most of the valleys in Russell are of the Pindalup Unit, and support open-woodland of Wandoo. Small areas of the Goonaping Unit and associated swamps are also present.

The dominant vegetation types are H, M and Y (Havel 1975 (a) and (b)). The types A, D, E, F, G, J, L and Z are also present but occur over smaller areas.

Type H, of the uplands, is open-forest of Jarrah and Marri, largely devoid of smaller trees, and with a shrub storey of *Hakea cyclocarpa*, Prickly Bitter-pea (*Daviesia pectinata*), *Isopogon dubius* and *Styphelia tenuiflora*.

Type M is primarily a mixed forest of Wandoo, Jarrah, Marri and Powder Bark (*E. accedens*) on the upper slopes. The plants that are associated with this type include *Hakea lissocarpha*, *Gastrolobium calycinum* and *Zamia (Macrozamia riedlei)*. Type Y, of the lower slopes and valley floors, is open-woodland of Wandoo with a shrub and sedge storey of *Hakea lissocarpha*, White Myrtle (*Hypocalymma angustifolium*), *Mesomelaena tetragona* and *Baeckea camphorosmae*.

The core area of Russell remains unlogged and relatively undisturbed although logging has taken place in the Buffer. Dieback is restricted to a few peripheral gullies and depressions. Owing to Russell's location near the Brookton Highway, it is predictable that recreation will increase in future.

The Committee endorses the proposal by the Forests Department to manage Russell Special Management Priority Area (2.5) for the Conservation of Flora and Fauna and for Recreation.

D.4 DALE S.M.P.A.

Dale S.M.P.A. (2.6) is located 25 km east of Armadale in the low-to-medium rainfall area of State Forest. The area is composed of State Forest and Freehold Land held in the name of the Conservator of Forests (Pt. Loc. 10383). It occupies a total area of 6272 ha; the core area, of 2968 ha, is Dale Forest Park. The S.M.P.A. is managed by the Forests Department for the Conservation of Flora and Fauna and for Recreation.

Dale includes a large range of soils, landforms and vegetation that typify the low-to-medium rainfall area.

The lateritic uplands of the Dwellingup Unit (Churchward and McArthur 1978) support open-forest of Jarrah (*Eucalyptus marginata*) and Marri (*E. calophylla*).

The vegetation in the valleys includes open-forest of Jarrah and Marri, woodland of Wandoo (*E. wandoo*) and woodland of Flooded Gum (*E. rudis*) and the paperbark *Melaleuca raphiophylla*.

The shallow soils and granite outcrops of the Cook Unit support open-woodland of Jarrah, shrubland, herbland and lithic complex.

Dale includes a large range of vegetation types. The dominant ones are G, H, M and P (Havel 1975 (a) and (b)), but also present on a restricted scale are A, D, E, J, F, L, Y, R and Z.

Types G and L are especially significant because they are uncommon in State Forest. Type G is associated with the granite rocks and includes open-woodland of Jarrah, shrubland and herbland. Common plant species include *Grevillea bipinnatifida*, *Hakea undulata*, *Hakea trifurcata* and *Borya nitida*. Type L is also important since it occurs on highly fertile soils that are most suitable for agriculture, and most of the land has been cleared. It is open-woodland of Wandoo with an occasional admixture of Yarri (*E. patens*) and occurs on loamy soils in medium-to-low rainfall zone of the Darling Plateau. The associated shrub species are *Hakea lissocarpha*, *Diplolaena drummondii* var *microcephala*, *Hibbertia lineata* and White Myrtle (*Hypocalymma angustifolium*).

On the uplands, vegetation of type P is particularly well developed. The understorey is of Sheoak (*Casuarina fraserana*) and the shrub storey includes *Adenanthos barbigerus* and *Grevillea wilsonii*. Elsewhere in the State Forest, type P has been strongly affected by dieback; that is also true of vegetation types D and E, which occur here in limited but highly significant stands.

Although Dale has been logged in the past, a significant section of the core is still uncut. The dieback disease is present in several of the peripheral gullies.

Recreation is important in Dale. Mt Dale is currently used by the public for picnics and scenic walks. Access to most of the remainder is restricted by quarantine, which has been imposed owing to the vulnerability to dieback of large portions of the area.

The Committee endorses the proposal by the Forests Department to manage Dale Special Management Priority Area (2.6) for the Conservation of Flora and Fauna and for Recreation.

RECOMMENDATION

The Committee recommends that the Freehold land (Pt Loc. 10383) in the name of the Conservator of Forests be proclaimed State Forest and included in Dale Special Management Priority Area (2.6).

D.5 EAGLE HILL S.M.P.A.

Eagle Hill S.M.P.A. (8.1) is located 18 km south-east of Armadale in State Forest to the north of the Albany Highway. The area is composed of State Forest and occupies a total area of 4338 ha; the core area, of 1590 ha, is Eagle Hill Forest Park. It is managed by the Forests Department for the Conservation of Flora and Fauna and for Recreation (in restricted areas).

Eagle Hill includes the lateritic uplands of the Dwellingup Soil-landform Unit and, on the shallower soils and granite rocks, the Cook Unit (Churchward and McArthur 1978). The uplands support open-forest of Jarrah (*Eucalyptus marginata*) and Marri (*E. calophylla*).

The shallower soils and granite rocks (which are part of the Cooke-Randall chain of monadnocks) associated with Eagle Hill support a lithic complex, with the occurrence of Butter Gum (*E. laeliae*).

The valleys range from the deeply incised valley of the Canning River, characteristic of the Murray Unit, to some poorly drained upland depressions of the Yarragil Unit. These valleys support open-forest of Jarrah and Marri with some Yarri (*E. patens*) on the lower slopes of the main valley.

There is a range of vegetation types (Havel 1975 (a) and (b)) in Eagle Hill. The most extensive are types T, S and P which are characteristic of the lateritic uplands. Types C, D, W and Q, characteristic of the valleys, and types R and G, characteristic of rocky slopes, although occurring in smaller areas, are equally important. Butter Gum, a tree of restricted occurrence, is present in the S.M.P.A. amongst the vegetation of type G. Types Q and C, which include stands of Yarri, are important because they have been strongly affected by the damming of valleys and clearing for pine plantations and for agriculture.

The main features of Eagle Hill are some uncut and relatively undisturbed stands of Yarri along the Canning River valley, the stands of the rare Butter Gum, some extensive stands of Black Gin (*Kingia australis*) and a wide range of plant species associated with this north-western extension of the Cooke-Randall chain of monadnocks.

The proximity of the S.M.P.A. to both the Albany Highway and Ashendon Road should result in an increase in use of the area for recreation. The zoning of recreation in Eagle Hill will enable both Conservation of Flora and Fauna and the provision for some recreation.

The Committee endorses the proposal by the Forests Department to manage Eagle Hill Special Management Priority Area (8.1) for the Conservation of Flora and Fauna and for Recreation (in restricted areas).

D.6 BOYAGARRING S.M.P.A.

Boyagarring S.M.P.A. (8.5) is located 60 km south-east of Kelmscott on the eastern fringes of System 6. The area is composed of vacant Crown land and occupies a total area of 1480 ha, all of which is core. Boyagarring is managed by the Forests Department for the Conservation of Flora and Fauna and for Recreation.

Boyagarring is similar in some respects to Lupton (D.7) as it includes a large range of soils, landforms and vegetation. The area consists of undulating upland with dissected lateritic slopes, and rocky slopes of the Yalanbee Soil-landform Unit (Churchward and McArthur 1978). These uplands support open-woodland of Wandoo (*Eucalyptus wandoo*) with localized occurrences of Powder Bark (*E. accedens*).

The valleys in Boyagarring are restricted in size with minor inclusions of the Coolakin, Michibin and Williams Units. These are nevertheless significant, as most of the valleys in the region have been developed for agriculture.

The main vegetation types are M and Y (Havel 1975 (a) and (b)); A, L, H, Z and G also occur but are restricted.

Types M and Y are both woodland of Wandoo. Type M occurs on the middle and upper slopes. A variation of it is the admixture of Powder Bark on the ridges. Type Y is found on the lower valley slopes and gullies. It reflects the moister conditions, its main indicator species being such moisture-tolerant species as White Myrtle (*Hypocalymma angustifolium*) and *Baeckea camphorosmae*.

Of the remaining vegetation types, type G, although restricted in occurrence, warrants mention for its low woodland of Rock Sheoak (*Casuarina heugeliana*), which grows on the periphery of granitic outcrops.

Boyagarring has been lightly cut for timber. On the fringes there has been some invasion of introduced plant species, presumably owing to the surrounding agricultural land. No dieback is recorded in Boyagarring.

To date, recreation has not been significant in the area.

The Committee endorses the Forest Department's proposal to manage Boyagarring Special Management Priority Area (8.5) for the Conservation of Flora and Fauna and for Recreation.

RECOMMENDATION

The committee recommends that the vacant Crown land be proclaimed State Forest and included in Boyagarring Special Management Priority Area (8.5).

D.7 LUPTON S.M.P.A.

Lupton S.M.P.A. (8.8) is located 27 km west of Brookton, on the eastern fringes of the State Forest. Although it lies in System 4 it is near the eastern boundary of System 6. The S.M.P.A. is all core. Its area is 2770 ha, which consists of the north-eastern part of reserve C26666, of 8638 ha, for timber, not vested. It is managed by the Forests Department for the Conservation of Flora and Fauna and for Recreation.

Lupton, like Boyagarring (D.6), contains landforms and vegetation types that are more characteristic of System 4. The lateritic uplands of the Yalanbee Soil-landform Unit (Churchward and McArthur 1978) support mostly open-woodland of Wandoo (*Eucalyptus wandoo*), mixed with Powder Bark (*E. accedens*) on the ridges, and Jarrah (*E. marginata*) on the more undulating areas. The valleys of the Coolakin and Michibin Units are typical of the eastern fringe of System 6 and support woodland of Wandoo but with stands of *Acacia acuminata*, *Acacia microbotrya* and Rock Sheoak (*Casuarina heugeliana*).

Most of the area is covered by the three vegetation types H, M and Y (Havel 1975 (a) and (b)), with minor occurrences of types A and G.

Types M and Y consist of open-woodland of Wandoo but differ markedly in the composition of their understoreys. Type M is found on the middle and upper slopes, while type Y occurs on the lower slopes and gullies. Consequently the plants in Y reflect moisture conditions in the gullies; they include White Myrtle (*Hypocalymma angustifolium*) and *Baeckea camphorosmae*. A variant of type M, found also in Boyagarring (D.6), is the admixture of Powder Bark on the ridges.

Type H occurs on the gravelly sands on the uplands and middle slopes. It consists of open-forest of Jarrah with an occasional Marri (*E. calophylla*). Some intermingling of the vegetation types H and M occurs.

Although the occurrence of type G is limited in Lupton, it is significant in that it includes species of the Wheatbelt around the granite rocks: *Casuarina heugeliana*, *Acacia microbotrya* and Jam (*A. acuminata*). Type A is restricted in occurrence to a few small areas.

No dieback is recorded in Lupton indicating the drier conditions and relatively infrequent use by people. Despite Lupton's ecological similarity to Dryandra and Perup Special Management Priority Areas (System 4), both of which are particularly rich in the rarer fauna species such as the Woylie (*Bettongia penicillata*) and the Tamar (*Macropus eugenii*), faunal surveys in Lupton have so far proved disappointing.

The significant features of Lupton are the extensive stands of Wandoo and Powder Bark and the associated fauna which is representative of the drier area of the eastern fringes of System 6.

The Committee endorses the Forests Department's proposal to manage Lupton Special Management Priority Area (8.8) for the Conservation of Flora and Fauna and for Recreation.

RECOMMENDATION

The Committee recommends that:

1. the north-eastern part of reserve C26666 (Fig.) be proclaimed State Forest;
2. the remainder of reserve C26666 and the area of vacant Crown land to the north (Fig.), be proclaimed State Forest and included in Lupton Special Management Priority Area (8.8).

D.8 COOKE S.M.P.A.

Cooke S.M.P.A. (8.2) is located 20 km east of Jarrahdale, in the State Forest to the north of the Albany Highway. The area is composed of State Forest and a portion of reserve C335, of 40 ha, for Watering and Stopping Place for Teams, vested in the Shire of Wandering. The total area is 4695 ha; the core area, of 1750 ha, is Cooke Forest Park. The S.M.P.A. is managed by the Forests Department for the Conservation of Flora and Fauna and for Recreation.

Cooke S.M.P.A. contains a chain of monadnocks of which Mt Cooke is the largest. The dominant landforms of the S.M.P.A. are the slopes and crests of the monadnocks, and comprise the Cook Soil-landform Unit. Other landforms are the lateritic uplands of the Dwellingup Unit, and the poorly drained valleys of the Pindalup Unit (Churchward and McArthur 1978) and the associated swampy valley floors.

The vegetation consists mainly of open-forest of Jarrah (*Eucalyptus marginata*) mixed with Marri (*E. calophylla*) and of the lithic complex on the granitic outcrops. The drier parts of the valleys support open-woodland of Wandoo (*E. wandoo*) and open-forest of Jarrah and Marri; in the moister parts the vegetation is dominated by species of *Melaleuca* and other plant species characteristic of swamps.

The vegetation found in Cooke is mostly of types P, H, G and Z (Havel 1975 (a) and (b)). Other types occurring over smaller areas are A, B, C, E, J, M, R, T, W, Y and S.

Type G, although localised in distribution, is important in Cooke. It is associated with the granitic outcrops on Mt Cooke and their extension to the north-west, and consists of a variety of plant communities, including lichen-covered rocks, herbfields of *Borya nitida*, thickets of *Grevillea bipinnatifida*, *Hakea undulata* and *Hakea trifurcata* and low open-woodland of Butter Gum (*Eucalyptus laeliae*).

Types H and P consist of open-forest of Jarrah and the occasional Marri. Type P is restricted to lateritic gravels with a sandy matrix on the lower slopes of the monadnocks and adjacent uplands. The main species that indicate type P are *Grevillea wilsonii*, *Adenanthos barbigerus* and Sheoak (*Casuarina fraserana*). Type H is similar to P but differs in the composition of the shrub storey, which consists of *Hakea cyclocarpa*, *Hakea ruscifolia*, *Isopogon dubius* and *Patersonia rudis*.

Type Z, the only other vegetation type that covers significant areas, is found on the gravelly soils on the flanks of the monadnocks. The main indicator species include *Zamia (Macrozamia riedlei)*, *Hakea lissocarpha*, *Phyllanthus calycinus* and *Leucopogon capitellatus*.

Cooke's periphery, parts of which have been selectively cut, has been badly affected by dieback. Some dieback areas have been virtually clear-cut. The vegetation types of the gullies and of the lower slopes of the valleys have been severely affected.

In the past, Cooke has been used for both production forestry and recreation. The latter is important owing to Cooke's proximity to Albany Highway. Facilities include barbecues and picnic tables, but the area is used for bush-walking and rock-climbing as well as picnicking.

Cooke S.M.P.A. is important chiefly for an area of uncut Jarrah forest on the uplands and for its monadnocks, with the extensive stands of the rare Butter Gum (*E. laeliae*).

The Committee endorses the proposal by the Forests Department to manage Cooke Special Management Priority Area (8.2) for the Conservation of Flora and Fauna and for Recreation.

RECOMMENDATION

The Committee recommends that the portion of reserve C335 as shown in Fig. be proclaimed State Forest and included in Cooke Special Management Priority Area (8.2).

D.9 WINDSOR S.M.P.A.

Windsor S.M.P.A. (8.6) is located 20 km south-east of Jarrahdale, and lies on the south-western side of the Albany Highway, opposite Cooke S.M.P.A. (D.8). The area is composed of State Forest and occupies a total area of 4225 ha; the core area, of 1910 ha, is Windsor Forest Park. It is managed by the Forests Department for the Conservation of Flora and Fauna and for Recreation (in restricted areas).

Windsor includes a variety of soils, landforms and vegetation. It is similar to Cooke (D.8) and Eagle Hill (D.5) in that it partly consists of the Cooke-Randall series of monadnocks. In other respects, the vegetation in Windsor is similar to that of Bannister Hill in Gyngoorda (D.17) and Duncan (D.16).

The dominant landforms of Windsor are the granitic outcrops of the Cook Soil-landform Unit and the lateritic uplands of the Dwellingup Unit (Churchward and McArthur 1978). These landforms support a variety of vegetation including open-forest of Jarrah (*Eucalyptus marginata*), open-woodland of Wandoo (*E. wandoo*) and the lithic complex on the granite rocks.

The broad, gently sloping valleys of the Pindalup Unit and the associated swampy valley floors support a range of vegetation that includes open-woodland of Wandoo, swamp complex and mixed stands of Jarrah, Marri (*E. calophylla*) and Yarri (*E. patens*) in localised areas.

The main vegetation types (Havel 1975 (a) and (b)) found in Windsor are H, G and D, but a large number of other types are also represented and include A, B, C, J, M, P, R, Y and Z.

The dominant vegetation is type H, which consists of open-forest of Jarrah and, less consistently, Marri. It occurs on the lower and middle slopes of the area. In the gullies along the Serpentine River, it is replaced by type D, which consists of an open-forest of Jarrah and Marri with the occasional Yarri. The moister conditions in Type D are reflected by the presence of such species as White Myrtle (*Hypocalymma angustifolium*), *Baeckea camphorosmae* and *Leptocarpus scariosus*. Both these types have been affected by the presence of the dieback fungus (*Phytophthora cinnamomi*).

Type G, associated with the granite outcrops, occurs over significant areas in Windsor. As in Cooke (D.8), this type covers a range of vegetation from lichens to low open-woodland of Wandoo (*E. wandoo*) and open-forest of Jarrah. To date no Butter Gums (*E. laeliae*) have been recorded in Windsor. The open-forest of Jarrah on lateritic gravel on the top of the range in Windsor is similar to that on Bannister Hill in Gyngoorda (D.17), and warrants conservation.

Types A and Y occur at the bottoms of the valleys. Despite this restricted occurrence they are important since they provide shelter and water for animals. The Forests Department's fauna counts have been highest in the valleys of the eastern areas of State Forest.

In the past, Windsor has been used primarily for production forestry and catchment protection (of the Canning and Serpentine Dams). Logging operations have been carried out both prior to 1920 and in the 1950s. Some dieback-affected valley sites have been clear-cut recently to salvage the timber.

Windsor is bounded by three main roads (Solus Road, North East Road, and the Albany Highway), all of which are open to the public. To date, recreation has been limited to bush-walks and scenic drives. It is probable the use of the area will increase in the future.

The significant features of Windsor are the swamp vegetation (and associated fauna) and the range of vegetation associated with the granite outcrops and gullies.

The Committee endorses the Forests Department's proposal to manage Windsor Special Management Priority Area (8.6) for the Conservation of Flora and Fauna and for Recreation (in restricted areas).

D.10 SERPENTINE S.M.P.A.

Serpentine S.M.P.A. (8.7) is located 2 km south of the township of Jarrahdale. The area is composed of State Forest and occupies a total of 1496 ha; the core area of 475 ha is Serpentine Forest Park. Serpentine S.M.P.A. is managed by the Forests Department for the Conservation of Flora and Fauna and for Recreation (in restricted areas).

Serpentine is similar to Gooralong (D.11). It consists of deeply dissected lateritic uplands of the Dwellingup Soil-landform Unit and moderately incised valleys of the Yarragil and Murray Units (Churchward and McArthur 1978). The uplands support open-forest of Jarrah (*Eucalyptus marginata*) and Marri (*E. calophylla*), while the gullies support a mixture of Yarri (*E. patens*), Jarrah and Marri.

Most of the area is covered by the vegetation types S, P and Q (Havel 1975 (a) and (b)); minor types include C, S, G and T.

Types S and P both occur on the slopes in Serpentine (type S on the middle and upper slopes, type P only on the middle slopes) and both consist of open-forest of Jarrah and Marri; they differ in the floristic composition of the shrub storey. The plant indicators of type S include *Adenanthos barbigerus*, *Zamia (Macrozamia riedlei)*, *Leucopogon capitellatus* and *Phyllanthus calycinus*, while those of type P include *Grevillea wilsonii*, *Casuarina fraserana* and *Leucopogon oxycedrus*.

Type Q occurs along the edge of the Pipehead Dam. It consists of open-forest of Marri and Yarri. The shrub indicators of this type include White Myrtle (*Hypocalymma angustifolium*), *Trymalium spathulatum* and *Chorizema ilicifolium*.

The other types in Serpentine are restricted in occurrence. The most northerly pocket of Mountain Gum (*Eucalyptus haemotoxylon*) and a suspected hybrid (see D.14) occur on the Darling Scarp just east of Kingsbury Lookout.

Cutting and regeneration was carried out in Serpentine during the 1940s. The area is now covered by a series of tracks. Parts of the area have been affected by dieback. One such area, south of Kingsbury Drive, has been clear-cut as salvage following an outbreak of the disease.

Day Road and Kingsbury Drive provide scenic drives through the forest, and are the main access roads to the Pipehead Dam and Serpentine Dam respectively. As such they are frequently used. Facilities for recreation are limited, and except for bush-walking and scenic drives, the use of this area of the forest has been restricted to production forestry and catchment protection. Restrictions are necessary to minimise the spread of dieback and the pollution of the Pipehead Dam.

Serpentine is important for the inclusion of dieback-free areas in the western portion of the Jarrah forest, which is highly susceptible to the disease. Moreover, it includes some forest of Yarri, Jarrah and Marri, which elsewhere has been severely reduced in occurrence by the damming of valleys and the clearing of land for agriculture.

Adjacent to the S.M.P.A. is Freehold Land in the name of the Crown (Pt. Loc. 537 of 87 ha) which should be included in the S.M.P.A. to consolidate the buffer area.

The Committee endorses the Forests Department's proposals to manage Serpentine Special Management Priority Area (8.7) for the Conservation of Flora and Fauna and for Recreation (in restricted areas).

RECOMMENDATION

The Committee recommends that a portion of Cockburn Sound Location 537 (at present held as Freehold Land in the name of the Crown) be proclaimed State Forest, and be included in Serpentine Special Management Priority Area (8.7).

D.11 GOORALONG S.M.P.A.

Gooralong S.M.P.A. (8.4) is located 4 km west of Jarrahdale. The area consists of State Forest, reserve B988, of 30 ha, for Rockingham-Jarrahdale Timber Co., not vested, reserve B990 of 32 ha, for Camping, vested in the Shire of Serpentine-Jarrahdale Cockburn Sound Locations 178, 306, 333 and 624 (H.R.H. Freehold land in the name of the Crown) and Cockburn Sound Location 68. It occupies a total area of 705 ha; the core area, of 232 ha, is Gooralong Forest Park. Gooralong S.M.P.A. is managed by the Forests Department for the Conservation of Flora and Fauna and for Recreation.

Gooralong is mostly surrounded by private property and adjoins the Serpentine National Park (D.12), which it supplements. It includes the lateritic uplands of the Dwellingup Soil-landform Unit and the sharply incised valleys of the Helena and Murray Units (Churchward and McArthur 1978).

The vegetation on the uplands consists of open-forest of Jarrah (*Eucalyptus marginata*) and Marri (*E. calophylla*). In the gullies Yarri (*E. patens*) mixes with the Jarrah and Marri.

The dominant vegetation types are S and T (Havel 1975 (a) and (b)) which reflect the higher rainfall of this area. Smaller areas of vegetation types C, D, G, P, R and W are also present.

Vegetation types S and T occur on the middle and upper slopes of the valleys of this deeply incised landscape. They are similar in that they both consist of open-forest of Jarrah and Marri but differ in the floristic composition of the shrub storey, which reflects underlying edaphic differences.

Although the valley types are restricted in area, their occurrence here is important because of the poor representation of this vegetation in other reserves in the high rainfall areas (as a result of clearing and damming).

The significant features of Gooralong are the uncut and relatively undisturbed forest of Jarrah, Marri and Yarri. The Jarrah on the eastern edge of Gooralong is uncut, but the undergrowth is disturbed and in part overgrown by alien species. Other parts of Gooralong have only been cut over once, when the first mechanical sawmill in Western Australia was established at Jarrahdale in 1872. Consequently this forest is relatively undisturbed by recent logging. Dieback has been recorded in Gooralong, but is mainly restricted to the valleys.

As the area is readily accessible and close to Perth it is well used by the public. Recreation includes camping and bush-walking; additionally, schools use it for teaching and the army has used it for training. A number of tracks pass through the S.M.P.A. The area's use will be maintained but controlled, to minimise abuse.

The Committee endorses the proposal by the Forests Department to manage Gooralong Special Management Priority Area (8.4) for the Conservation of Flora and Fauna and for Recreation.

RECOMMENDATION

The Committee recommends that:

1. reserves B988 and B990 be cancelled and proclaimed State Forest and be included in Gooralong Special Management Priority Area (8.4);
2. Cockburn Sound Locations 178, 306, 333, 624, (Freehold land in the name of the Crown) be proclaimed State Forest and included in Gooralong Special Management Priority Area (8.4);
3. Cockburn Sound Location 68 be purchased when available and be proclaimed State Forest and included in Gooralong Special Management Priority Area (8.4).

D.12 SERPENTINE NATIONAL PARK

Serpentine National Park, reserve A28862, is located 5 km south-west of Jarrahdale, on the Darling Scarp. It is a small National Park of 635 ha, vested in the National Parks Authority.

To the south and east of the National Park are four adjoining reserves: C32202, of 302 ha, for Conservation of Flora and Fauna, not vested; C26079, of 14 ha, for Gravel, not vested; C26080, of 129 ha, for Gravel, vested in the Shire of Serpentine-Jarrahdale; C32201, of 43 ha, for Government Requirements, not vested.

The National Park is similar in soils, landforms and vegetation to parts of Gooralong S.M.P.A. (D.11). The main landforms are the Dwellingup, Darling Scarp and Helena Soil-landform Units (Churchward and McArthur 1978); the Murray and Yarragil Units occur in smaller areas.

The principal vegetation types are P, S, R and G (Havel 1975 (a) and (b)); other types are present in smaller areas.

Types P and S occur on the lateritic uplands of the Dwellingup Unit. Both consist of open-forest of Jarrah (*Eucalyptus marginata*) and Marri (*E. calophylla*) with an understorey of Bull Banksia (*B. grandis*) and Snottygobble (*Persoonia longifolia*) but differ in the composition of the ground storey. Type P is distinguished by the presence of Wilson's Grevillea (*G. wilsonii*) and the greater occurrence of *Lechenaultia biloba*; type S is indicated by the presence of *Leucopogon capitellatus* and *L. propinquus*.

Types R and G occur in the Darling Scarp and in the valleys of the Helena Unit. Type R consists mostly of open-forest of Jarrah and Marri. Type G is a variety of vegetation that includes low open-woodland of Wandoo (*E. wandoo*) with some Marri and Butter Gum (*E. laeliae*), shrublands and lithic complex on bare rocks.

Included in the recorded fauna is the Water Rat (*Hydromys chrysogaster*).

Serpentine National Park is important for the inclusion of two rare trees: Butter Gum, on the slopes, and Salmon White Gum (*E. lane-poolei*), at the foot of the Scarp. The latter species occurs mostly in land partly cleared for agriculture.

Cockburn Sound Location 262, which adjoins the Park, provides scenic views and supports extensive stands of Rock Sheoak (*Casuarina huegeliana*).

The National Park has extensive common boundaries with privately owned agricultural lands which has resulted in frequent, uncontrolled fires and problems associated with goats, sheep and exotic plant species. The fires have seriously damaged the native flora and have opened the way for the invasion of exotic species.

The Committee recognises that the greatest need is to consolidate the area, and reduce the ratio of boundary to area. As the common boundaries with State Forest are limited, the consolidation must occur mainly through the purchase, when it becomes available, of privately owned land.

The Committee endorses the current status and vesting of reserve A28862.

RECOMMENDATION

The Committee recommends that:

1. in view of the limited manpower of the National Parks Authority in the area, the assistance of the Forests Department be requested to protect the park against wildfires;
2. if any of the freehold land separating the Serpentine National Park from the Gooralong, Serpentine and Karnet Special Management Priority Areas is offered for sale and acquired, consideration be given by the Forests Department and the National Parks Authority to rationalise the boundaries and the management of the entire complex;
3. Serpentine National Park be consolidated by the inclusion of the following pieces of land, in order of priority (private land to be purchased when available):
 - i) Cockburn Sound Locations 361, 69, being freehold land in the name of the Crown;
 - ii) State Forest (No. 22): the section abutting Cockburn Sound Locations 361 and 436;
 - iii) Cockburn Sound Locations 299, 260, 262 and 331, being freehold;
 - iv) Cockburn Sound Location 463 (acquisition from the State Energy Commission);
 - v) Reserves C32202, C26079, C26080 and C32201;
 - vi) Cockburn Sound Locations 436, 347, 261, 143, 79, 425, 251-257 (inclusive), 272, 274, being freehold;
 - vii) Cockburn Sound Locations 107, 242, 245 and 363, being freehold.

D.13 KARNET S.M.P.A.

Karnet S.M.P.A. (3.8) is located 8 km south of Jarrahdale, south of the Serpentine River and west of the main dam. The area is composed of State Forest and Cockburn Sound Location 308, at present held as Freehold Land in the name of the Crown. It occupies a total area of 3688 ha; the core area, of 1247 ha, is Karnet Forest Park. The S.M.P.A. is managed by the Forests Department for the Conservation of Flora and Fauna and for Recreation (in restricted areas).

Karnet includes a large variety of soils, landforms and vegetation and is similar to Gooralong (D.11) and Serpentine ((D.10). It consists of the deeply dissected lateritic uplands of the Dwellingup Soil-landform Unit and the moderately incised valleys of the Yarragil and Murray Units (Churchward and McArthur 1978).

The uplands support open-forest of Jarrah (*Eucalyptus marginata*) and Marri (*E. calophylla*), while in the gullies Yarri (*E. patens*) mixes with the Jarrah and Marri. There is also a small area of the Darling Scarp in Karnet that includes a small patch of uncut forest and a few isolated specimens of Butter Gum (*E. laeliae*).

Most of the area is covered by the vegetation types P, S and Q (Havel 1975 (a) and (b)); there are also smaller areas of types C, G, D and H. Types P and S both consist of open-forest of Jarrah and Marri. Type P occurs on the middle slopes and upland valleys, whereas type S occurs on the middle and upper slopes and the ridges. The main plant species that characterise type P include *Adenanthos barbigerus*, Sheoak (*Casuarina fraserana*), *Grevillea wilsonii* and *Leucopogon oxycedrus*, whereas those that characterise type S include *Zamia (Macrozamia riedlei)*, *Leucopogon capitellatus* and *Phyllanthus calycinus*).

Type Q occurs in major valleys, and consists of open-forest of Jarrah, Marri and Yarri.

The importance of Karnet is that it includes a representative range of vegetation from the western margin of the State Forest including the Darling Scarp, in the high rainfall area. This vegetation includes forest of Jarrah and Marri, on the uplands, and forest of Marri and Yarri and woodland of Butter Gum, in the valleys; the last species is fairly rare.

A large part of Karnet has been logged in the past. The area is bisected by Scarp Road, and there are numerous tracks in the buffer zone, which is also strongly affected by dieback and subsequent salvage logging. The core area is relatively free of disturbance.

Recreation in the area includes driving for pleasure, picnicking and bush-walking. Since most of Karnet lies within a gazetted water catchment, recreation has to be zoned and strictly controlled.

The Committee endorses the proposal by the Forests Department to manage Karnet Special Management Priority Area (3.8) for the Conservation of Flora and Fauna and for Recreation (in restricted areas).

RECOMMENDATION

The Committee recommends that Cockburn Sound Location 308 (at present held as Freehold Land in the name of the Crown) be proclaimed State Forest and included in Karnet Special Management Priority Area (3.8).

D.14 GOBBY ROAD, KEYSBROOK (LOCATION 1494)

Cockburn Sound Location 1494 is located along Gobby Road on the Darling Scarp to the south of Perth and east of the township of Keysbrook. It occupies an area of 93 ha and adjoins, in the east, an area of State Forest of 12 ha.

Most of the area is of open-woodland or low open-woodland. Although the most widespread species are Wandoo (*Eucalyptus wandoo*), Marri (*E. calophylla*) and Jarrah (*E. marginata*), there occur a total of six species of *Eucalyptus*, which do not normally all associate together in the one community. Three of the species are rare: Salmon White Gum (*E. lane-poolei*), Butter Gum (*E. laeliae*) and Mountain Gum (*E. haematoxylon*). The area also contains a suspected natural hybrid. Species in the understorey include *Boronia spathulata*, *Darwinia citriodora*, *Hakea trifurcata*, *Petrophile biloba* and *Thysanotus patersonii*.

The location also incorporates granite outcrops, which support a lithic complex.

The area offers magnificent scenic views of the dissected Scarp, and the coastal plain. Of historical interest is the original whim track along which sawlogs were hauled from the Jarrah forest of the Darling Plateau to the plain. The logs were snigged down the spur of the scarp and ridgehill to an old railway siding.

Even without its outstanding points of interest, described above, the area is important in its location on the Darling Scarp, a major geomorphological feature that is poorly represented in conservation reserves in System 6.

Although this area is freehold and has been partially developed with rough grazing and a dam, the Committee recommends its purchase when available, so that it can be managed to conserve the unique combination of plant species.

RECOMMENDATION

The Committee recommends that Cockburn Sound Location 1494 be purchased when available and be proclaimed State Forest for the conservation of the scientific and historical aspects of the area and for the education of the public.

D.15 RESERVES C14629, C19413 and C21038

In the Darling Scarp east of North Dandalup are the following reserves: C14629, of 110 ha, for Timber for Settlers; C19413, of 40 ha, for Timber; C21038, of 61 ha, for Parkland and Recreation. None of the reserves is vested.

Despite their small size, these areas are important: little scope is left to conserve representative areas of the unique flora of the Darling Scarp. Since these reserves lie within or adjacent to State Forest, it is desirable that they be included in the State Forest, to be managed as a Forest Park by the Forests Department for the Conservation of Flora and Fauna and for Recreation.

All three areas include, to a varying degree, the lateritic uplands of the Dwellingup Soil-landform Unit (Churchward and McArthur 1978) which support open-forest of Jarrah (*Eucalyptus marginata*) and Marri (*E. calophylla*).

The Darling Scarp vegetation, however, is the significant feature of these three reserves. The vegetation ranges from low open-woodland of Wandoo (*E. wandoo*) with admixtures of Marri and the rare Butter Gum (*E. laeliae*) to heath and herbland on the granite rocks; reserves C19413 and C21038 include substantial stands of Butter Gum.

Associated with the granite outcrops are a range of plant species including *Andersonia aristata*, *Calytrix angulata*, *Darwinia citridora* and *Verticordia acerosa*. A similar vegetation occurs on the slopes of the deeply incised valleys of the Helena Unit.

Open-forest of Jarrah and Marri is restricted to the lateritic soils, and occurs in the valleys of the Yarragil Unit. The shrub species include *Adenanthos barbigerus*, *Bossiaea ornata*, *Zamia (Macrozamia riedlei)* and *Boronia spathulata*.

RECOMMENDATION

The Committee recommends that reserves C14629, C19413 and C21038 be cancelled and be proclaimed State Forest, for the Conservation of Flora and Fauna and for Recreation, and managed by the Forests Department as a Forest Park.

D.16 DUNCAN S.M.P.A.

Duncan S.M.P.A. (3.5) is located 8 km west of North Bannister and extends as far south as Mt. Wells. The area is composed of State Forest, vacant Crown land (Pt. Location 527), Murray Locations (Pt. 526 and Pt. 527) at present held as freehold in the name of the Crown and three reserves: C528, of 39 ha, for Water, unvested; C334, of 40 ha, and C601 (portion), of 19 ha, both for Watering and Stopping Place for Teams, under the control of the Shire of Wandering. It occupies a total area of 9935 ha; the core area, of 4542 ha, is Duncan Forest Park. Duncan is managed by the Forests Department for the Conservation of Flora and Fauna and for Recreation (in restricted areas).

Duncan resembles parts of other Special Management Priority Areas, such as Gyngoorda (D.17) and Windsor (D.9), but it contains a wider range of landscape and vegetation.

The dominant landforms of Duncan are the granitic outcrops and shallow soils of the Cook Soil-landform Unit and the lateritic uplands of the Dwellingup Unit. These units support a range in vegetation which includes open-forest of Jarrah (*Eucalyptus marginata*), open-woodland of Wandoo (*E. wandoo*) and the lithic complex on the granite rocks. The broad, gently sloping valleys of the Pindalup and Yarragil Units and their associated swamps support a range of vegetation that includes open-woodland of Wandoo, open-forest of Jarrah and Marri (*E. calophylla*) and a swamp complex.

The dominant vegetation types are D, H and Y (Havel 1975 (a) and (b)). Other vegetation types represented in Duncan but restricted in area are A, F, G, M, P and Z.

Type H occurs on the lower and middle slopes, and consists of open-forest of Jarrah and, less consistently, Marri. The main plants that indicate it include *Mesomelaena tetragona*, Prickly Bitter-pea (*Daviesia pectinata*) and *Hakea ruscifolia*.

Type D also occurs in the valleys, and consists of open-forest of Jarrah and Marri. The main indicator species include *Baeckea camphorosmae*, White Myrtle (*Hypocalymma angustifolium*), *Leptocarpus scariosus* and *Mesomelaena tetragona*. In most areas, including portions of Duncan, type D has been severely affected by dieback, but there is a significant area of it that is not as yet affected by the disease to the east of the monadnocks. Its preservation is of great importance.

Type Y is significant as it includes an area of uncut Wandoo in the northern section of the S.M.P.A. It occurs along the lower slopes of the valleys and gullies.

Type G, in Duncan, incorporates a variety of vegetation that includes stands of Rock Sheoak (*Casuarina huegeliana*) and low herbland of *Borya nitida*, lichens and mosses. Also included near Mt. Wells are stands of Drummond's Gum (*E. drummondii*), which are restricted in occurrence in State Forest.

Type A is a swamp complex ranging from thickets of *Melaleuca* spp. to woodlands of the paperbark *Melaleuca preissiana* and *Hakea varia*. Type F occurs on the eastern edge of the granitic outcrops. It is as yet not affected by dieback in this area.

Logging, followed by regeneration treatment, occurred between 1930 and 1960 in the south and between 1940 and 1960 in the north. A small area has been uniformly cut as a salvage operation following dieback.

So far, the area has been used infrequently for recreation.

The Committee endorses the proposal by the Forests Department to manage Duncan Special Management Priority Area (3.5) for the Conservation of Flora and Fauna and for Recreation (in restricted areas).

RECOMMENDATION

The Committee recommends that reserves C334, C528 and C601 be cancelled and be proclaimed as State Forest as part of Duncan Special Management Priority Area (3.5).

Gyngoorda S.M.P.A. (3.4) is situated on the eastern fringes of State Forest, and lies on the eastern side of the Albany Highway, between Bannister and North Bannister, and on the western side of Wandering Road, to the south and east. The area is composed of State Forest and occupies a total area of 3453 ha; the core area, of 2025 ha, is Gyngoorda Forest Park. Gyngoorda is managed by the Forests Department for the Conservation of Flora and Fauna and for Recreation.

Gyngoorda includes a variety of soils, landforms and vegetation, and is similar to Russell (D.3) and Windsor (D.9). The dominant landforms are the granitic outcrops of the Cook Soil-landform Unit and the lateritic uplands of the Yalanbee Unit (Churchward and McArthur 1978). These upland units support open-forest of Jarrah (*Eucalyptus marginata*), open-woodland of Wandoo (*E. wandoo*) and a lithic complex on the granite rocks.

The valleys of the Pindalup, Coolakin and Michibin Units vary in their degree of dissection. In the main, they support woodland of Wandoo, with only localised patches of swamp vegetation.

The dominant vegetation types are H and M (Havel 1975 (a) and (b)) but many other types occur in small areas of Gyngoorda; these are Z, G, P, A, D, E, J and Y.

Type H consists of open-forest of Jarrah with the occasional Marri (*E. calophylla*). It occurs on the uplands, and covers by far the greater part of Gyngoorda. Common plant species include Blueboy (*Stirlingia latifolia*), Prickly Bitter-pea (*Daviesia pectinata*) and *Hakea ruscifolia*.

Type M occurs on the upper and middle slopes in Gyngoorda. It consists of open-woodland of Wandoo. Powder Bark (*E. accedens*) also occurs in Gyngoorda but is restricted to several ridges.

Most of the other types are poorly represented: duplication of them is needed in other areas.

The accessible portion of the forest in Gyngoorda has been cut over in 1950-70, and consequently there is a network of access tracks within it. There is a developed picnic spot beside the Albany Highway. Recreation is likely to increase. Private land cleared for agriculture adjoins the S.M.P.A. to the south and east.

Gyngoorda is important chiefly for the granitic outcrops of Bannister Hill and because it includes the vegetation of the lower rainfall areas.

The Committee endorses the proposal by the Forests Department to manage Gyngoorda Special Management Priority Area (3.4) for the Conservation of Flora and Fauna and for Recreation.

D.18 WANDERING S.M.P.A.

Wandering S.M.P.A. (3.10) is located just west of Wandering. It is located in System 4 but is near the eastern boundary of System 6. The S.M.P.A. is composed of portions of Timber reserves 145/25 and 160/25, and reserve C18534, of 445 ha, for Timber, not vested. The total area is 4334 ha, all of which is core. Wandering is managed by the Forests Department for the Conservation of Flora and Fauna and for Recreation.

Wandering is similar to Stene (J.9), Russell (D.3) and Gyngoorda (D.17). The dominant landforms are the lateritic uplands of the Yalanbee Soil-landform Unit (Churchward and McArthur 1978) and the granitic outcrops of the Cook Unit. Here upland units support open-woodland of Wandoo (*Eucalyptus wandoo*), which on the ridges is mixed with Powder Bark (*E. accedens*). Over smaller areas the Wandoo is replaced by open-forest of Jarrah (*E. marginata*) and some Marri (*E. calophylla*).

The granitic outcrops support a range of vegetation that includes low woodland of Rock Sheoak (*Casuarina huegeliana*), *Acacia microbotrya* and Jam (*Acacia acuminata*) and herblands of *Borya nitida*.

The valleys of the Coolakin and Michibin Units support mostly open-woodland of *E. wandoo*, but there are significant occurrences of Yarri (*E. patens*). Most of Wandering is covered by the three vegetation types H, M and Y (Havel 1975 (a) and (b)). Types A, L and G occur in small areas. Type H occurs on the gravelly sands of the lower and middle slopes. It is open-forest of Jarrah and Marri, with Prickly Bitter-pea (*Daviesia pectinata*), *Hakea ruscifolia* and Blueboy (*Stirlingia latifolia*) common in the understorey. Types M and Y both consist of open-woodland of Wandoo but differ markedly in the floristic composition of their understoreys. Type M is found on the middle and upper slopes, whereas type Y occurs on the lower slopes and in the gullies.

Types L and G are important: type L has been severely affected by agricultural development in System 6, and type G includes species of the Wheatbelt, such as Rock Sheoak, *Acacia microbotrya* and Jam. Type A is restricted to a few swamps.

Despite some low intensity logging which took place in the area between 1950 and 1970, Wandering's vegetation is relatively undisturbed. There are only a few tracks and there is no known occurrence of dieback. The S.M.P.A. is not used much for Recreation, owing to the inaccessibility of the area and its distance from large populations.

The Committee endorses the Forests Department's proposal to manage Wandering Special Management Priority Area (3.10) for Conservation of Flora and Fauna and for Recreation.

RECOMMENDATION

The Committee recommends that the portions of Timber reserves 145/25 and 160/25 as shown in Fig. and reserve C18534 be cancelled and included in Wandering Special Management Priority Area (3.10).

D.19 BROOKTON AND ALBANY HIGHWAYS

The Brookton and Albany Highways pass through an extensive area of State Forest between the Darling Scarp and the agricultural areas to the east. For many travellers they provide the best opportunity to see the natural vegetation of the Darling Plateau and especially the forests of Jarrah (*Eucalyptus marginata*), Marri (*E. calophylla*) and Wandoo (*E. wandoo*) in extensive areas. On the Great Northern and Great Eastern Highways and the Toodyay Road the forests are already decimated by clearing, and the highways further south pass through forests of different plant associations.

Although there has been some replacement of natural vegetation with introduced *Eucalyptus* and pines, the forests of the Brookton and Albany Highways remain relatively intact over long distances. There are many wildflowers to be seen in the understoreys, their composition changing with different soil types and with rainfall.

The Committee considers it important that the natural vegetation be retained along these highways both for its appeal to visitors and for scientific study. Some of the plants here are rare, for example, on the Brookton Highway, *Grevillea monticola*, *Xyris* sp. and *Acacia oncinophylla*, and on the Albany Highway *Grevillea drummondii* and *Dryandra praemorsa*. The several sandy areas traversed are of special interest in supporting outlying populations of species found otherwise on the coastal plain, for example, Menzies' Banksia (*B. menziesii*), Summer Starflower (*Calytrix flavescens*) and Blueboy (*Stirlingia latifolia*).

RECOMMENDATION

The Committee recommends that:

1. the Forests Department be requested to designate a strip 1 km wide on each side of Brookton Highway and Albany Highway where they pass through State Forest.
2. that these strips be managed for the conservation and display of their flora.

AREA D

LIST OF RESERVES OVER 20 HA NOT LISTED IN THE RECOMMENDATIONS

<u>Reserve No.</u>	<u>Area (ha)</u>	<u>Vesting</u>	<u>Purpose</u>
335	40	Wandering Shire	Watering and Stopping place for teams.
22433	370	Aboriginal Land Trust	Use and benefit Aboriginals
25634	22	Murray Shire	Gravel
8756	36	-	Water
A4596	65	-	Timber and Parkland
909	32	-	Water
14581	31	-	Timber and Camping
13139	40	-	Water
5913	40	-	Canning Reservoir Water Shed
23229	1025	W.S.S.D.	Water
527	40	-	Water
904	41	-	Stopping Place
11509	88	-	Rifle Range
16634	Unknown	-	Serpentine Catchment
6203	90745	Minister for Works	Reservoir and Catchment

E

E.1 JOHN FORREST NATIONAL PARK

The Park consists of reserves A2994, A2995, A7537, and A8164, with a total area of 1578 ha. It is one of Perth's best known parks, within easy reach of the metropolitan area. In 1975-76, 22 422 cars entered the main parking areas; this would be no more than half of the total number of visitors who drive through without using the intensively developed area. There are picnic facilities and scenic drives. Although dieback disease is present, there are still good examples of the vegetation of the western edge of the plateau. The predominant formations are open-forest and woodland of Jarrah (*Eucalyptus marginata*) and Marri (*E. calophylla*). In doleritic soil on some slopes especially along the scarp, Wandoo (*E. wandoo*) is the dominant species. In the valleys, some granitic outcrops occur, but the scarp flora is poorly represented. The Park is not considered large enough to be a viable national park in terms of visitor use and landscape conservation.

The area recommended for addition extends from the northern edge of the park to Toodyay Road and covers about 100 ha. It is land owned by the Metropolitan Region Planning Authority and is largely uncleared. There are good examples of the landforms and flora of the scarp. Several winter creeks flow through the area (notably Jane Brook), and there are several granite slopes. The vegetation contains further areas of Jarrah, Marri and Wandoo but, more importantly, extensive examples of the shrublands around granite outcrops on the Scarp. Some of the plants are restricted to the scarp near Perth and are poorly represented in reserves. They include *Acacia oncinophylla*, *Calothamnus rupestris*, *Darwinia thymelioides*, *Isopogon asper*, *Synaphea acutiloba*, *S. pinnata* and a large flowered variant of *Thysanotus multiflora*. There is a good stand of Rock Sheoak (*Casuarina huegeliana*) on Red Hill.

Public access to the area is already available on the Red Hill road, whence views are obtained across the vineyards of the Swan Valley.

The Metropolitan Water Board has preliminary plans for a small pipehead dam on Jane Brook from which water will be supplied direct to the Mirrabooka Treatment Plant. The environmental effects of this should be examined before a decision is made to proceed, since some of the restricted Scarp flora could be destroyed if flooded.

RECOMMENDATION

The Committee recommends that the areas shown in Fig. be added to John Forrest National Park and consolidated in the Class A reserve.

E.2 RESERVE A12453 (PARKERVILLE)

Reserve A12453 is for Parkland and Recreation. It covers 22 ha and is not vested. It lies on a steep hillside between Richardson Road and Falls Road and contains an interesting granite outcrop surrounded by open-forest of Jarrah (*Eucalyptus marginata*) and Marri (*E. calophylla*). The vegetation is also represented in John Forrest National Park just to the west.

The reserve should be retained as an area for passive recreation and education, and should be managed to conserve the natural vegetation as far as possible.

RECOMMENDATION

The Committee recommends that the reserve be vested in the Shire of Mundaring and be managed for long-term conservation of the natural flora.

E.3 RESERVE C12085 (PARKERVILLE)

The reserve is on the west side of Brooking Road. It is for Education Endowment, covers 65 ha and is unvested. It is an area of typical Jarrah (*Eucalyptus marginata*) forest and appears to contain nothing unrepresented in John Forrest National Park.

The Committee endorses the present status and purpose of reserve C12085.

E.4 RESERVES ALONG ABANDONED RAILWAYS

Sections of the old railways between Midland and Chidlow via Parkerville, and between Midland and Mount Helena via Glen Forrest, have been set aside as reserves for Parklands. They are C31196, C32436, C32483 and C32484. All are vested in the Shire of Mundaring.

They are already useful, and will become more so, for passive recreation such as walking and riding. Remnants of the indigenous vegetation survive and should be retained wherever possible. Any future planting should use only local native species, so as to maintain the "Hills" character of these long corridors.

The Committee endorses the class, purpose and vesting of reserves C31196, C32436, C32483 and C32484.

E.5 RESERVE C34103 (SAWYERS VALLEY)

The reserve occupies an area between Sawyers Road and Johnston Street. It is an unvested reserve for Government Requirements and covers 55 ha.

The vegetation is representative of the Jarrah-Marri open-forest of the plateau surface and contains a rich understorey in which prominent species are Snottygobble (*Persoonia elliptica*), Blackboy (*Xanthorrhoea preissii*), Zamia (*Macrozamia riedlei*), *Pimelea spectabilis*, *Grevillea synapheae*, *Adenanthos barbigerus*, *Hakea amplexicaulis*, Royal Robe (*Scaevola striata*), *Hibbertia* spp. and *Leucopogon* spp. It is in good condition, and should remain so with correct management.

The reserve is valuable in representing the vegetation of the district and in providing a fauna refuge and a place of enjoyment for local residents and visitors. Much of the district is being progressively developed, and areas of natural bush will become more important and valuable for conservation as this continues. The reserve is the haunt of a number of bird species as well as Western Brush Wallabies (*Macropus irma*) and Western Grey Kangaroos (*M. fuliginosus*).

RECOMMENDATION

The Committee recommends that:

1. reserve C34103 be made a Class A reserve for Parkland, vested in the Shire of Mundaring;
2. it be managed for long-term conservation of the natural flora and fauna.

E.6 GREENMOUNT HILL NATIONAL PARK

This is reserve A25313, for National Park, of 56 ha, vested in the National Parks Authority. It occupies a spur between two valleys on the Darling Scarp. The soils are lateritic and granitic, and the vegetation is low woodland of Jarrah (*Eucalyptus marginata*), Wandoo (*E. wandoo*) and Sheoak (*Casuarina fraserana*) with heath on shallow granitic soils. Extensive views are obtained across the Coastal Plain, into the Helena Valley and northwards along the Scarp edge.

On the south side of the park a steep slope descends to Coulston Road. It has some rugged outcrops of granite with their associated rich shrub flora, and there are stands of Marri (*E. calophylla*) and Wandoo. The vegetation here is in very good condition. The rock outcrops and southern aspect provide habitats different from those in the rest of the proposed area. Along the creek on the north side of Coulston Road is reserve C8120 for Recreation, 18 ha, vested in the Shire of Mundaring. Here the creek is lined with Flooded Gum (*E. rudis*). Just to the west of this reserve is an abandoned quarry.

The park is too small to be viable as a National Park. It is, however, excellently located and has real conservational value. For some time, the Kings Park Board has sought an area in the hills where native flora suited to heavy soils can be grown. Greenmount Hill appears suitable for this purpose, especially if it can be enlarged by the addition of adjoining land. It will then contain part of the plateau surface, granitic and loamy slopes of northern, southern and western aspects as well as a portion of a natural creek.

The land west of the park and part of that to the south is at present owned by the Metropolitan Region Planning Authority. A portion between the park and reserve C8120 is freehold. If all these areas could be amalgamated they would provide the Kings Park Board with the opportunity to expand their work on cultivation of the State's flora.

RECOMMENDATION

The Committee recommends that:

1. the purpose of reserve A25313 be changed to Kings Park Annexe and that the reserve be placed under the control of the Kings Park Board;
2. land owned by the Metropolitan Region Planning Authority as shown in Fig. be added to the reserve;
3. reserve C8120 be cancelled and its area added to reserve A25313;
4. should it become available, the remaining freehold land between reserves A25313 and C8120 be purchased and added to reserve A25313.

E.7 RESERVE A1847 (DARLINGTON)

Reserve A1847, of 7 ha, for National Park, vested in the Shire of Mundaring, lies on a steep hillside of southern aspect between Dalry Road and Darlington Road. It supports a very good sample of Jarrah-Marri woodland and associated understorey.

The reserve should be retained and the vegetation should be preserved where possible for passive recreation and enjoyment rather than for scientific purposes. The current purpose is anomalous in view of the size of the reserve, and should be altered to Parkland, a more appropriate purpose.

RECOMMENDATION

The Committee recommends that the purpose of reserve A1847 be changed from National Park to Parkland, that the reserve remain vested in the Shire of Mundaring and that it be managed for the long-term conservation of the natural flora.

E.8 RESERVE C18130 (SAWYERS VALLEY)

This reserve of 20 ha is on the south side of the Great Eastern Highway just east of Sawyers Valley. It is for Timber, and unvested.

The vegetation is open-forest with some Marri (*Eucalyptus calophylla*) and smaller trees such as Bull Banksia (*B. grandis*), Sheoak (*Casuarina fraserana*) and Snottygobble (*Persoonia elliptica*). Typical species of the understorey in the reserve are Couch Honey-pot (*Dryandra nivea*), *Bossiaea aquifolia*, *Hakea lissocarpa*, *Labichea punctata*, *Adenanthos barbigerus*, *Hibbertia* spp., and *Conostylis* spp.

The understorey is quite varied but appears to have suffered from too-frequent burning in that lignotuberous and rhizomatous species predominate. These are plants that regenerate from fire-resistant stocks. Those that are killed by fire and regenerate from seed appear low in numbers and require long periods between burns - perhaps 15 years or more - to allow an adequate build up of seed.

In view of the clearing which has already occurred along the Highway (and there will doubtless be more), the reserve is important as a representative of the natural landscape and vegetation. It should be retained for these features since the Highway is a main route for traffic entering and leaving the city.

RECOMMENDATION

The Committee recommends that:

1. the purpose of reserve C18130 be changed to Parkland and that the reserve be vested in the Shire of Mundaring;
2. the reserve be managed for the long-term conservation of the natural flora.

E.9 RESERVE C32727 (DARLINGTON)

This area is reserve C32727 (57 ha) for Parks and Recreation, not vested. It is a good example of the lateritic upland of the Western Plateau, representing the Dwellingup Soil-landform Unit (Churchward and McArthur 1978).

The vegetation is open-forest of Jarrah (*Eucalyptus marginata*) and Marri (*E. calophylla*). Smaller trees are Bull Banksia (*B. grandis*) and Snottygooble (*Persoonia elliptica*), as well as some Sheoak (*Casuarina fraserana*) in the south-western section.

The understorey contains typical species such as *Adenanthos barbigerus*, *Macrozamia riedlei*, *Grevillea wilsonii*, *Dryandra sessilis*, *Bossiaea ornata*, *Hakea amplexicaulis*, *Xanthorrhoea preissii* and *X. gracilis*.

The reserve is in good condition and is little disturbed by tracks. It should retain its present purpose but be vested in the Shire of Mundaring, who should manage it so as to retain the natural vegetation where possible.

RECOMMENDATION

The Committee recommends that reserve C32727 be vested in the Shire of Mundaring, who should seek the advice of the proposed Flora Research and Conservation Advisory Service or, prior to its formation, the Department of Conservation and Environment.

E.10 HELENA VALLEY

There is a need for recreation and conservation reserves in the Helena Valley below Mundaring Weir. It is the only large river valley through the Scarp near Perth which retains substantial areas of uncleared land and which has no highway or railway through it. There are the pipehead dam, the pipeline and its access roads, an unsightly power line, some freehold land in the valley and further settlement on parts of the rim, but much of the land is uncleared. A geological profile from lateritic upland to granitic river bed is evident. Scenically, the valley has much to offer both from within and from the rim. Already the relative seclusion and scenic attraction draw visitors to the limited points of access and along walking- or riding-trails. The opportunity exists to create a large reserve which will protect the water catchment and contain areas for conservation of flora and fauna as well as for recreation. The proposal also includes the Gooseberry Hill National Park where the Zig Zag is a popular route for visitors. It thus extends from the Scarp face almost as far as Mundaring Weir.

A range of vegetation types occurs in the valley. Forests and woodlands are variously dominated by Jarrah (*Eucalyptus marginata*), Marri (*E. calophylla*), Wandoo (*E. wandoo*) and Flooded Gum (*E. rudis*). There are areas of heath, especially in granitic soils where many plant species typical of the Darling Scarp are found. Some sections have been burnt too frequently and will need careful management to maintain their floristic diversity but other parts are still in excellent condition, for example the upper slopes and plateau of reserve C22897 south of Darlington.

Several species should be specially mentioned. About 2 km below Mundaring Weir is the only known population of *Acacia aphylla*, an unusual wattle characterised by leafless, spinescent branches. The rare, orange-flowered *Grevillea drummondii* is found at the top of the valley's north side about 3 km below the Weir. Near reserve C22897 is a population of *Isoetes* sp., a small aquatic fern inhabiting pools on granite rocks: it is the closest locality to Perth for the species. The Lesser Bottlebrush (*Callistemon phoeniceus*), which generally occurs in drier, inland regions, grows along the bed of the Helena River.

A small dam and pumpback system to Mundaring Weir has been established in the valley, the dam being sited south of Darlington. The catchment for this dam has been given a Zone 1 classification (prohibited for public use) in the report by the Committee on Purity of Water, but the Committee condoned bush-walking in some areas. This classification is satisfactory in view of the valley's importance to conservation, since management for water purity should require minimal disturbance of the environment. Recreation in the proposed park should be concentrated on the areas downstream from the small dam, on the Zig Zag area and on some parts of the valley rim, to be determined by the managing authority.

The concept of the Helena Valley as a National Park rests on the large area available for reservation where there has been little development, where excellent valley and scarp scenery remain, and where there is scope for recreation and conservation.

The basis for the proposed Park is as follows:

- a) reserve A21314 (374 ha) for National Park, vested in the National Parks Authority;
- b) reserve C22897 (496 ha) for Parklands, not vested;
- c) reserve C23118 (299 ha) for Parklands, not vested;
- d) reserve C19897 (25 ha) for Parklands, vested in the Shire of Mundaring;
- e) reserve A24182 (24 ha) for Park, not vested;
- f) reserve A30200 (33 ha) for National Park, vested in the National Parks Authority;
- g) reserve C32890 (17 ha) for Water Supply, vested in the Minister for Water Supplies;
- h) reserve C20765 (4 ha) for Recreation and Bird Sanctuary, vested in the Shire of Mundaring;
- i) reserve C23537 (11 ha) for National Park, not vested;
- j) reserve A23981 (37 ha) for Park, vested in the Shire of Mundaring;
- k) that part of reserve C5342 west of Mundaring Weir Road, for Camping, vested in the Minister for Works;
- l) an area of State Forest No. 54 west of Mundaring Weir Road;
- m) the following freehold land: Locations 119, 120, 982, 999, 1345 and 1722;
- n) land owned by the M.R.P.A.

The amalgamation of all these would provide an unbroken park between Gooseberry Hill and Mundaring Weir Road just below the Weir itself. The freehold land is required to provide continuity up the valley, as well as to facilitate management by including several small enclaves at present surrounded by reserved land.

The management of the new park should be co-ordinated by a committee including local interests, the Public Works Department and a fauna expert from the Department of Fisheries and Wildlife.

RECOMMENDATION

The Committee recommends that:

1. the following reserves be cancelled and their areas consolidated into a Class A reserve for National Park vested in the National Parks Authority: A21314, C22897, C23118, C19897, A24182, A30200, C32890, C20765, C23537, C23981 and that part of C5342 west of Mundaring Weir Road;
2. an area of State Forest No. 54 as shown in Fig. be excised from the State Forest and incorporated in the National Park;
3. land owned by the Metropolitan Region Planning Authority as shown in Fig. be incorporated in the Park;
4. the following freehold land be purchased when available and incorporated in the Park: Swan Locations 119, 120, 982, 999, 1345 and 1722;
5. the National Parks Authority set up an advisory committee for the Park, to include representatives of the Public Works Department, the Shire of Kalamunda, the Shire of Mundaring, the Department of Fisheries and Wildlife and the Western Australian Herbarium.

E.11 RESERVE C22865 (KALAMUNDA)

The reserve lies to the south of Mundaring Weir Road about 2 km east of Kalamunda. From the road it rises up a gravelly slope to the general level of the Darling Plateau. It is surrounded on all sides by freehold land. The reserve is for Parks and Recreation and is vested in the Shire of Kalamunda. It covers 36 ha.

The vegetation is open-forest and woodland, dominated by Jarrah (*Eucalyptus marginata*) and Marri (*E. calophylla*) with Sheoak (*Casuarina fraserana*) and Bull Banksia (*B. grandis*) as smaller trees. There is quite a rich understory of typical forest species such as Couch Honeypot (*Dryandra nivea*), *Hakea amplexicaulis*, *Bossiaea ornata*, *Grevillea synapheae*, Pink Myrtle (*Hypocalymma robustum*), Blue Lechenaultia (*Lechenaultia biloba*), *Scaevola* spp., *Stylidium* spp., *Ptilotus manglesii* and *Gompholobium* spp.

The natural vegetation has been removed in several small parts of the reserve, probably to allow extraction of gravel. Two of these have been replanted with pines.

The reserve is worth retaining for its present purpose. The increasing settlement at Kalamunda is reducing areas of natural vegetation: remaining areas will become more valuable as samples of the indigenous flora. For this reason reserve C22865 should be managed to retain as far as possible the vegetation. If areas of it are developed for recreation, etc., then the parts already disturbed should be used.

RECOMMENDATION

The Committee recommends that:

1. reserve C22865 retain its present purpose and class, and that it be vested in the Shire of Kalamunda;
2. the reserve be managed primarily to conserve the natural vegetation.

E.12 RESERVE C20641 (BICKLEY)

The reserve is for Water Supply, of 60 ha and vested in the Minister for Water Supplies. It lies between Stanhope Road and Aldersyde Road, Bickley, and is traversed in its southern half by an unformed section of Mitchell Road.

The area comprises a lateritic ridge and adjacent upper slopes west of the Bickley valley. There are several gravel pits, and a power line has been constructed in a north-south line through the reserve. The area has also been cut over some years ago.

The remaining vegetation, however, is a good sample of open-forest of Jarrah (*Eucalyptus marginata*), with some Marri (*E. calophylla*). Smaller trees are Bull Banksia (*B. grandis*), Sheoak (*Casuarina fraserana*) and Snottygobble (*Persoonia elliptica*). The understorey is characterised by such species as *Grevillea wilsonii*, Blackboy (*Xanthorrhoea preissii*), *Isopogon sphaerocephalus*, Yellow Flags (*Patersonia xanthina*), *Daviesia* spp., and Coral Vine (*Kennedia coccinea*). Two uncommon species occur here - *Hemigenia pritzelii* and an unnamed species of *Thysanotus*.

For the same reasons as outlined under reserve C22865 (see E.11), the reserve should be maintained primarily for conservation of the flora. It is surrounded by freehold land and contains no streams, nor would its contribution to the lower Helena River catchment area be significant.

RECOMMENDATION

The Committee recommends that the purpose of reserve C20641 be changed to Parklands and that the reserve's vesting be changed to the Shire of Kalamunda.

E.13 RESERVE C10601 (CARMEL)

The reserve is for Timber, of about 20 ha and not vested. It occupies a high lateritic ridge on the east side of Canning Road Beyond the head of Bickley Brook, Carmel. The reserve has been disturbed by tracks, gravel pits and a power line, but the remaining vegetation - open-forest of Jarrah (*Eucalyptus marginata*) and Marri (*E. calophylla*) with a typical understorey - is in good condition. From the highest part, views are obtained across the Bickley Brook valley to the coastal plain.

RECOMMENDATION

The Committee recommends that the purpose of reserve C10601 be changed to Parkland and that the reserve be vested in the Shire of Kalamunda.

E.14 RESERVE C21172 (MUNDAY BROOK)

The reserve straddles Canning Road at Canning Mills and is traversed by Munday Brook. It rises from the creek bed to the lateritic capping of the Darling Plateau. An open-woodland of the paperbark *Melaleuca preissiana* and Yarri (*Eucalyptus patens*) lines the creek and the narrow clay flats alongside.

Common shrubs are *Agonis linearifolia*, Swishbush (*Viminaria juncea*), *Trymalium ledifolium*, *Acacia alata* and *Astartea fascicularis*. An interesting herbaceous flora occurs on open, winter-wet areas near the creek. Typical open-forest of Jarrah (*Eucalyptus marginata*) and Marri (*E. calophylla*) occurs on the higher lateritic slopes.

The reserve is part of the Victoria Reservoir catchment. It is for Water, and vested in the Minister for Water Supplies. This purpose and vesting should remain, since management for water also involves retention of the natural vegetation.

The Committee endorses the class, purpose and vesting of reserve C21172.

The Darling Scarp between Lesmurdie Falls and Turner Road (Roleystone) contains some of the best scarp bushland remaining near Perth. It includes picturesque scenery on the scarp and within the valleys and provides vantage points for panoramic views across the Coastal Plain. Each valley has a winter-flowing stream, and three of them (Lesmurdie, Ellis and Mills Road) have attractive waterfalls and rapids. Wildflowers are in colourful display from August to October, some areas being still relatively undisturbed and of high value for flora conservation. Recreation is already important in the Bickley valley and at Paxwold, where permanent centres are established, while many people visit Lesmurdie Falls and other parts of the area.

One of Perth's most popular parks, Lesmurdie National Park is a feature of the Darling Scarp due east of the city. The central attraction is Lesmurdie Falls, a series of cascades down a picturesque valley. The creek flows only in winter and spring, but is spectacular after heavy rain. The Park contains a good sample of the flora of the Scarp, but this is threatened by visitor pressure: the area is not large enough to be considered a viable conservation reserve.

Most of the Scarp flora is represented in the area under discussion. There are granite outcrops, dolorite dykes, laterite scree and the laterite capping of the western edge of the plateau. A few small "hanging" swamps are present. Vegetation types include the lichen-moss rock flora, the heath around granite outcrops, woodland of Marri (*Eucalyptus calophylla*), woodland of Wandoo (*E. wandoo*), small areas of Rock Sheoak (*Casuarina huegeliana*) and the paperbark *Melaleuca preissiana*, Flooded Gums (*E. rudis*) along the creeks and, on the plateau, open-forest of Jarrah (*E. marginata*) and Marri.

An important occurrence is a population of *Eucalyptus lanepoolei* on Ellis Brook above the waterfall. This is a rare species poorly represented in reserves.

The heath and the understorey of forest/woodlands are rich in shrubs and herbs. Typical scarp species include *Acanthocarpus* sp., *Acacia oncinophylla*, *Agonis grandiflora*, *Anthocercis gracilis*, *Baeckea camphorosmae*, *Calothamnus* sp., *Calytrix glutinosa*, *Conostylis androstemma*, *Darwinia citriodora*, *D. thymelioides*, *Dioscorea hastifolia*, *Grevillea endlicherana*, *Hakea erinacea*, *H. incrassata*, *H. myrtoides*, *H. stenocarpa*, *Isopogon asper*, *Kennedia stirlingii*, *Melaleuca radula*, *Petrophile biloba*, *Synaphea acutiloba*, *S. pinnata*, *Thomasia glutinosa*, *Verticordia acerosa*. The herbs include orchids, triggerplants, lilies, composites (daisies) and small sedges.

On the plateau, there are species such as *Acacia* spp., *Adenanthos barbigerus*, *Astroloma ciliatum*, *Boronia ovata*, *Chorizema dicksonii*, *Dampiera linearis*, *Daviesia cordata*, *Dryandra nivea*, *D. bipinnatifida*, *Grevillea pilulifera*, *G. wilsonii*, *Hakea amplexicaulis*, *Hypocalymma robustum*, *Isopogon sphaerocephalus*, *Lechenaultia biloba*, *Pimelea rosea*, *P. suaveolens* and *Trymalium ledifolium*.

Throughout the area, Blackboys (*Xanthorrhoea preissii*) and *Zamia* (*Macrozamia riedlei*) are common, and there are several stands of Black Gin (*Kingia australis*).

The most important areas floristically are the spur and valley to the south of Crystal Brook, the Ellis Brook valley, and the valley up which Mills Road passes. These areas should be managed primarily for flora conservation, though it would be feasible to plan narrow walking paths which would allow people to view the plants and the scenery. No horse-riding trails should be allowed here.

A large National Park in two sections should be created in this area. Although it will be a relatively long narrow area of irregular shape, management as a single park is preferable since problems will be similar throughout it and an overall policy can be developed without duplication. As with the proposed Helena Valley National Park, the National Parks Authority should hold the vesting of this park but should set up a management committee with involvement of local interests and special expertise as considered necessary.

The concept behind the proposal is that of a Park conserving a significant section of the Darling Scarp directly east and south-east of the city. The important aspects are the scenery, landforms, geology, flora and recreation.

The basis for the proposed National Park is the following land:

- a) reserve A26247 (21 ha) for National Park, vested in the National Parks Authority;
- b) reserve A22515 (35 ha) for National Park, vested in the National Parks Authority;
- c) reserve C22768 (8 ha) for National Park, not vested;
- d) reserve A11681 (178 ha) for Parklands, vested in the Shire of Gosnells;
- e) reserve C7415 (355 ha) for Parks and Recreation, vested in the Shire of Gosnells;
- f) reserve C34155 (51 ha) for Parks and Recreation, vested in the Shire of Armadale-Kelmscott;
- g) reserve C26652 (20 ha) for Gravel, vested in the Shire of Gosnells;
- h) reserve C32064 (5 ha) for Wildflower Sanctuary, vested in the Shire of Gosnells;

- i) reserve A6468 (18 ha) for Parklands, vested in the Shire of Armadale-Kelmscott;
- j) reserve C33603 (4 ha) for Government Requirements, vested in the State Energy Commission;
- k) land owned by the M.R.P.A. (Fig.);
- l) freehold land (Fig.).

High priority should be given to the acquisition, when available, of Location 616 and part of Location 38. Location 616 is uncleared and covers a scenic part of the Mills Road valley in which there are waterfalls and very good flora. Location 339, immediately below 616, would also add a significant uncleared part of the valley to the proposed Park. The north-eastern end of Location 38 covers an even more important area - the waterfall on Ellis Brook, a picturesque feature which must not be destroyed. Although the valley below it contains a disused quarry and access road, the remainder is in good condition apart from some damage by trail bikes. Its inclusion in the proposed Park will provide a buffer zone across the valley and retain an important area of vegetation below the waterfall.

The freehold land recommended for acquisition in the northern section of the proposed Park is needed to give the Park continuity along the face of the Scarp.

RECOMMENDATION

The Committee recommends that:

1. the following reserves be cancelled and their areas consolidated into a Class A reserve for National Park, vested in the National Parks Authority: A22515, A26247, A22768, A11681, C7415, C34155, C26652, C32064, A6468 and C33603;
2. land owned by the Metropolitan Region Planning Authority as shown in Fig. be incorporated in the Park;
3. freehold land as shown in Fig. be purchased when available and incorporated in the Park;
4. the National Parks Authority set up an Advisory Committee for the Park to include representatives of the Shires of Kalamunda, Gosnells and Armadale-Kelmscott, the Department of Fisheries and Wildlife and the Western Australian Herbarium.

E.16 M.R.P.A. PROPOSED PARK BEDFORDALE

A high lateritic ridge between Albany Highway and Carradine Road, Bedfordale, has been proposed by the Metropolitan Region Planning Authority as a reserve for Parks and Recreation. The proposal includes the following reserves: C4127, of 251 ha, for Armadale Common and Timber for Settlers, and C25025 and C25026, of 5.7 and 3.6 ha respectively, for Gravel, all vested in the Shire of Armadale-Kelmscott. Reserves C25025 and C25026 and part of C4127 are largely uncleared.

The soil in the uncleared portion is lateritic and carries open-forest of Jarrah (*Eucalyptus marginata*) and Marri (*E. calophylla*). The understorey contains species typical of the western plateau and upper valley slopes. The vegetation forms a visual backdrop to the rural holdings of the Neerigen Brook valley to the south and the Carradine Road valley to the north. Conversely, views are obtained from the ridge across these attractive valleys.

The remainder of the area is freehold, being parts of Locations 4, 188 and 189. This portion is on the western face of the Scarp and includes granitic outcrops bearing forest of Marri and Wandoo (*E. wandoo*). Parts have been cleared, and grazing has disturbed or destroyed the ground flora in much of the remainder of this portion.

The total area proposed for reservation is about 299 ha.

The Committee supports the proposal but, if priorities must be awarded in the purchase of freehold land, this proposal should be ranked lower than others recommended elsewhere in this report, for example the Helena Valley and Darling Scarp proposed National Parks.

E.17 BUNGENDORE PARK, BEDFORDALE

This reserve south of Albany Highway at Bedfordale (A4561, of 451 ha, for Parklands, vested in the Armadale-Kelmscott Shire) contains mostly uncleared land that represents the forest of the western edge of the Plateau. The higher parts retain the lateritic capping with open-forest of Jarrah (*Eucalyptus marginata*) and Marri (*E. calophylla*). Around the edges this breaks away abruptly to lateritic slopes and granite outcrops, with Wandoo (*E. wandoo*) as the chief vegetation. Some valleys are wet in winter, and in one a soak remains wet through the summer. From the western edge of the plateau one obtains sweeping views across the Coastal Plain to Garden Island, while the southern edge overlooks the rugged Wungong Gorge.

The flora beneath the forest trees includes smaller trees such as Bull Banksia (*B. grandis*), Sheoak (*Casuarina fraserana*), Parrot Bush (*Dryandra sessilis*) and Snottygobble (*Persoonia elliptica*). The ground flora is rich and includes *Adenanthos barbigerus*, *Acacia* spp., *Grevillea wilsonii*, *Isopogon sphaerocephalus*, Pink Myrtle (*Hypocalymma robustum*), *Hibbertia* spp. (including an unnamed species restricted to the top of the Scarp east of Perth), Coral Vine (*Kennedia coccinea*), *Pimelea suaveolens*, *Orthrosanthus laxus*. The orchids include a good population of the blue *Caladenia sericea*.

On the damp, south-facing slope above Wungong Gorge, Bracken (*Pteridium esculentum*) is common, with Mosquito Orchid (*Acianthus reniformis*) growing in the shelter of rocks and Blackboys. Here, too, are a few *Dryandra praemorsa*, an uncommon species of the northern Jarrah forest. *Lasiopetalum floribundum*, typical of wetter forest farther south, is frequent here.

It is clear that this Class A reserve is being poorly managed: although its purpose is Parkland, several large gravel pits have been developed. Rubbish has been extensively strewn around. The area is well worth preserving provided that this situation is rectified. The rubbish could be removed, and the gravel pits could be allowed to regenerate to natural vegetation where feasible (some areas already have some regrowth) or could be developed as picnic spots.

The reserve should be increased by the addition of about 50 ha of vacant Crown land on the eastern side and reserve C10433 (for Gravel, unvested, 1.6 ha).

RECOMMENDATION

The Committee recommends that:

1. reserve A4561 be enlarged by the addition of reserve C10433, and the vacant Crown land as shown in Fig. ;

2. the reserve remain vested in the Shire of Armadale-Kelmscott and be managed primarily for the conservation of flora;
3. there be no further disposal of rubbish on the reserve nor any further extraction of gravel;
4. the existing gravel pits be regenerated to natural vegetation where feasible.

E.18 CHURCHMAN BROOK

Two areas below Churchman Brook Dam, one on each flank of the valley, have been acquired by the Metropolitan Region Planning Authority. They are mostly uncleared and contain open-forest of Jarrah (*Eucalyptus marginata*) and Marri (*E. calophylla*).

More importantly, however, the areas contain the best natural rock faces near Perth. Rock faces, natural and man-made, provide for rock-climbing, an important activity for rescue training and for recreation.

The area extends into the Canning River valley, through which the Brookton Highway passes at Roleystone.

The Metropolitan Region Planning Authority land is not large enough to qualify as a national park, but should be conserved in its natural state. The Climbers Association of Western Australia should be involved in management of the area where the rock faces occur.

RECOMMENDATION

The Committee recommends that:

1. the areas shown in Fig. be declared a Class A reserve for Parklands and Rock-climbing, vested in the Shire of Armadale-Kelmscott;
2. the Shire consult with the Climbers Association of Western Australia in managing the western block of the reserve.

E.19 RESERVES C19662 AND C32728 (KARRAGULLEN)

Reserve C19662, of 75 ha, for Timber, not vested, extends from Brookton Highway across Gardiner Road into the valley of Stinton Creek, with an adjoining section to the south-west.

The higher parts contain the lateritic capping of the Darling Plateau and support open-forest of Jarrah (*Eucalyptus marginata*) and Marri (*E. calophylla*). *Persoonia longifolia* is a common tree in the understorey, and BlackBoys (*Xanthorrhoea preissii*) are also common. Other typical shrubs are *Hakea lissocarpa*, *Bossiaea ornata*, *Daviesia* spp., *Hibbertia* spp., Couch Honeypot (*Dryandra nivea*) and *Astroloma pallidum*. On the slopes are some open areas with a heath of shrubs such as Rough Honey-myrtle (*Melaleuca scabra*), *Baeckea camphorosmae*, *Grevillea pilulifera*, *Petrophile striata* and *Leucopogon* spp.

Stinton Brook has eroded the valley to the granitic basement, providing a marked contrast with the slopes of the valley in both landform and vegetation. The shrubland associated with the granitic rocks contains such species as *Dodonaea attenuata*, *Acacia oncinophylla*, *Verticordia plumosa*, *Casuarina huegeliana*, *Calytrix angulosa*, *Grevillea glabrata*, *Hemiandra* spp., *Jacksonia alata*, etc. *Borya nitida* occurs in the shallow soil, with the Elbow Orchid (*Spiculaea ciliata*). The creek is seasonal but its flow over the rocks is picturesque in winter and spring.

The reserve is diverse in landforms and vegetation. It is not part of the Canning Dam catchment and should be retained for its picturesque nature and for the excellent representation of flora. Too small for consideration as a national park, it should be vested jointly in the Shire of Armadale-Kelmscott and the Western Australian Wildlife Authority.

Reserve C32728 (53 ha) for Government Requirements is to the north of reserve C19662. It represents the lateritic plateau and associated open-forest of Jarrah and Marri.

RECOMMENDATION

The Committee recommends that reserves C19662 and C32728 be made Class A reserves for Conservation of Flora and Fauna, vested jointly in the Shire of Armadale-Kelmscott and the Western Australian Wildlife Authority.

E.20 RESERVE C5704 (WUNGONG)

The reserve lies to the east of the Wungong Brook dam site and south of Bedfordale. It is a dissected area of the Darling Plateau with several streams which form part of the catchment area for the Wungong Dam. The reserve is for Timber, of 253 ha and not vested. Timber is currently being cut in the reserve, and some small areas at the northern end have been cleared, apparently for extraction of gravel.

The predominant vegetation is open-forest of Jarrah (*Eucalyptus marginata*) and Marri (*E. calophylla*) typical of the western plateau. An outstanding feature is the creek-bank vegetation - a fringe of low woodland of the paperbark *Melaleuca preissiana* and Swamp Banksia (*Banksia littoralis*) with a dense understorey of *Agonis linearifolia*. A red Boronia (*Boronia molloyae*) is common and is a northern outlier of a species found mainly near the south coast. Near the creeks are several granite outcrops with their associated vegetation. Some excellent stands of Black Gin (*Kingia australis*) occur on the slopes.

The present timber operation on the higher ground should be allowed to conclude, provided that it does not damage the creeks and adjacent slopes. Thereafter the reserve should be altered in purpose to allow for conservation of flora and for water catchment. This may be best achieved by a vesting in the Metropolitan Water Supply, Sewerage and Drainage Board with management by the Forests Department. Because species such as *Boronia molloyae* are fire-sensitive and require a long interval between fires to regenerate, the reserve should only be burnt at intervals of at least ten years. Research should be undertaken to ascertain the preferred interval.

RECOMMENDATION

The Committee recommends that the purpose of reserve C5704 be altered from Timber to Water Supply, that the reserve be vested in the Metropolitan Water Supply, Sewerage and Drainage Board and that it be managed for water and conservation of the indigenous flora.

E.21 RESERVE C29880 (FORRESTFIELD)

Just east of the Newburn Marshalling Yard are reserve C29880 (65 ha), for Government Requirements, unvested; reserve C31709 (21 ha), for Sewerage Treatment Works and Disposal Site, vested in the Metropolitan Water Board; reserve C33525, for Government Requirements, unvested; and on the south side of these an area included in the proposed Roe Freeway development as shown in Fig.

The whole area includes some of the few remaining uncleared parts of the eastern Coastal Plain near Perth. The soil is sandy and represents the Bassendean Soil-Landform Unit in the southern part, tending towards the Guildford Unit (Churchward and McArthur 1978) at the northern end. The vegetation on the sand is low open-forest of *Banksia* spp. with some admixture of Jarrah (*Eucalyptus marginata*). At the southern end is a swamp flat, wet in winter, on which a low heath occurs.

At the northern end a seasonal creek passes through the area. The soil is a gravelly sand over clay and supports low open-woodland of Marri (*E. calophylla*). The creek-bank vegetation includes shrubs such as *Hakea trifurcata*, *Trymalium ledifolium*, *Diplopeltis huegelii*, *Baeckea camphorosmae*, *Melaleuca trichophylla*, *Acacia pulchella*, *Bossiaea biloba*, *Calytrix aurea*, *Thomasia glutinosa*, etc.

North of the creek is an open flat with a fine population of Black Gin (*Kingia australis*). Over 100 species of indigenous flora occur in the reserves including some of particular importance, for example *Pityrodia bartlingii*, *Conospermum acerosum*, *Isopogon drummondii*, *Kingia australis*, *Alexgeorgea nitens*, *Dasypogon* sp. unnamed and *Lambertia multiflora*. These are rare species on the coastal plain near Perth, and the *Isopogon* and unnamed *Dasypogon* are known from few localities elsewhere. Although the area is relatively small it is well worth preserving for its flora, being the only area available where these plants occur together.

The swamp flats just north of the junction of Maida Vale Road and Hardey Road support low closed-heath with a composition unlike other swamp vegetation near Perth. It is dominated by the tea tree *Leptospermum ellipticum* with admixture of *Hakea sulcata* and *H. ceratophylla*. Green Kangaroo Paw (*Anigozanthos viridis*), Flannel Flower (*Tribonathes* sp.) and cottonheads (*Conostylis juncea*) are common herbs. The legume *Euchilopsis linearis* is also frequent. Emergent Black Gin (*Kingia australis*) are scattered through the area.

Parts of reserve C29880 are in use as a rubbish tip and for soil extraction. The western, uncleared part of the reserve has recently been allocated in two portions to the State Energy Commission and the Western Australian Fire Brigades Board.

A proposed freeway route passes through the reserve along the eastern side of these portions, with an interchange planned where Hardey and Maida Vale Roads now intersect. An area in the centre of reserve C31709 is already in use by the Metropolitan Water Supply but the remainder is uncleared.

Because of the conservation value of the area, the Committee believes that the State Energy Commission, the Fire Brigades Board and the Metropolitan Water Supply should be encouraged to retain as much as possible of the natural vegetation in the reserves. Such action could also provide buffer zones to screen their activities.

RECOMMENDATION

The Committee recommends that:

1. the State Energy Commission and the Western Australian Fire Brigades Board in their portions of reserve C29880, and the Metropolitan Water Supply in reserve C31709, be asked to retain as much as possible of the natural vegetation in those areas;
2. in managing the vegetation and locating developments, the managing bodies be asked to consult the proposed Flora Research and Conservation Advisory Service or, prior to its formation, the Department of Conservation and Environment;
3. reserve C33525 and the remaining land as shown in Fig. be managed by the Department of Main Roads for conservation of its flora; to this end advice should be sought from the proposed Flora Research and Conservation Advisory Service or, prior to its formation, the Department of Conservation and Environment.

E.22 WATTLE GROVE

This is freehold land, being Lot 211 of Canning Location 3. It covers 4.2 ha. The land is almost flat and lies about 2 km west of the foot of the Darling Scarp in Wattle Grove. The soil is pale brown sandy-clay and in winter becomes damp but without surface water. The vegetation is low closed-heath with a few emergents such as Marri (*Eucalyptus calophylla*), Woody Pear (*Xylomelum occidentale*), Christmas Tree (*Nuytsia floribunda*) and Black Gin (*Kingia australis*).

The closed-heath is rich in species and includes several rare plants, especially an unnamed species of *Dryandra*, a low variant of *Jacksonia floribunda* and the Rainbow Plant (*Byblis gigantea*). The last occurs also in Kenwick Swamp (Area F.51), but in a very different association. Other species include *Lambertia multiflora*, *Verticordia densiflora*, *Cyathochaete avenacea*, *Kunzea recurva*, *Daviesia incrassata*, *Conostylis* spp. and *Stylidium* spp.

The land is representative of the Guildford Soil-landform Unit which is poorly represented in conservation reserves. The unnamed *Dryandra* is known from only one other locality, which is not a reserve. The block is in good condition, with little infestation of weeds. It has a maintained firebreak. Although small, it should retain its current condition if properly managed. The Committee considers it worthy of acquisition if it becomes available.

RECOMMENDATION

The Committee recommends that Lot 211 of Canning Location 3 be purchased if it becomes available, and made a Class A reserve for Conservation of Flora and Fauna, vested in the Western Australian Wildlife Authority.

AREA E - RESERVES OVER 20 ha NOT COVERED BY RECOMMENDATIONS

Reserve No.	Area (ha)	Vesting	Purpose
C15955	21	-	Timber (firewood)
A23953	67	Swan-Guildford Shire	Recreation
C6955	23	-	Cemetery
C20990	21	Mundaring Shire	Gravel
C2299	79	-	Railway purpose
A6922	42	Mundaring Shire	Gravel
C31196	75	Mundaring Shire	Parklands
C23093	720	-	Gravel
C7045			Récreation
C22835	166	-	Parks and Recreation
C8006	40	-	Parks and Recreation
C27074	115	Crown Grant/ Slow Learning Childrens Group)	Institutional purposes Slow Learning Childrens Group
A17098	410	-	Recreation and Public Park
C12083	138	-	Education endowment
C23437	33	-	Timber for settlers
C9311	20	-	Camping ground
C18463	283	Minister for WSSD	Water
C26315	30	Shire of Kalamunda	Golf links
C21172	40	Minister for WSSD	Water
C21569	20	National Parks Authority	Recreation
C18341	40	Minister for WSSD	Water
C23592	31	Cockburn Shire	Gravel
C7125	474	Minister for Health	Mental Health

F

F.1 COASTAL STRIP

The coastal sand dunes comprise the Quindalup Soil-landform Unit (Churchward and McArthur 1978), a fragile landform that is easily disturbed. Many areas, however, are subject to high impact from recreation. The Environmental Protection Authority has proposed the appointments of a Coastal Resource Planner and a Coastal Planning Committee to advise on the management of the coastal strip one kilometre wide and extending inland to include fragile dune systems and tidal waters.

Foreshore reserves cover a large amount of the coast in the Metropolitan Region. They are at present vested in the local authorities - the Cities of Perth, Fremantle, Nedlands and Stirling, the Towns of Cottesloe and Cockburn and the Shire of Wanneroo - and the Fremantle Port Authority. An area at Swanbourne abutting the Campbell Barracks is controlled by the Commonwealth of Australia.

The dunes west of West Coast Highway from City Beach to Waterman are controlled or owned by, or vested in, the Cities of Perth and Stirling (except for small portions being acquired); from Marmion to Mullaloo they are mostly vested in the Shire of Wanneroo. Although disturbed, these dunes are still important wildlife habitats. Behind Whitford Beach are enclaves of private land.

North of Mullaloo, the Metropolitan Region Planning Authority has proposed extensions of the foreshore reserve 80 m to 1 km inland, by zoning as Regional Open Space for eventual purchase when available of a coastal strip northward from the Mullaloo sewage outfall through Burns Beach to Two Rocks, but interrupted by the settlements of Burns Beach, Quinns Rock, Yanchep and Two Rocks. The Shire of Wanneroo suggests a minimum width of 400 m, which the Committee prefers: extreme pressures on the fragile landform are inevitable if these linear reserves are narrower. The strip contains special features, including limestone pinnacles, a fresh-water lake only 200 m from the ocean, and the Alkimos wreck.

The Committee welcomes the proposal of the EPA to appoint a Coastal Resource Planner and a Coastal Planning Committee.

The existing foreshore reserves should be retained under their present control and should be extended where possible.

Vehicular access through the dunes and to the foreshores should be restricted to car-parks, boat-ramps, life-saving stations and similar facilities. Well defined paths are desirable for pedestrians in the more fragile or heavily used areas.

South Burns Beach

The area immediately south of Burns Beach (Fig.) deserves special consideration for the conservation of a diverse and relatively undisturbed coastal area. It incorporates both sea-cliffs and sandy beaches, and represents both the Quindalup and the Cottesloe Soil-landform Units (Churchward and McArthur 1978).

The limestone sea-cliffs are picturesque, and support some specialised plant species, such as *Frankenia pauciflora*. The area atop the cliffs is relatively flat, with limestone at the surface. The sea winds keep the vegetation low to form closed-heath, the dominant species being *Spyridium globulosum*, Rats' Tails (*Scaevola thesioides*), *S. crassifolia*, Quandong (*Santalum acuminatum*), *Olearia axillaris*, *Acacia truncata*, Chenille Honey-myrtle (*Melaleuca huegelii*) and Sword Sedge (*Lepidosperma gladiatum*).

In the south, and between breaks in the limestone, are sandy beaches, behind which the foredunes support characteristic species such as *Tetragonia decumbens*, *Cakile maritima* and *Spinifex* spp.

Inland from the cliffs, on deeper soil, is open-scrub of Parrot Bush (*Dryandra sessilis*), *Acacia* (*A. saligna* and *A. pulchella*), *Scaevola crassifolia* and *Anthocercis littorea*, with some patches of closed-scrub of *Acacia rostellifera*.

Beyond the scrub is low woodland of Slender Banksia (*B. attenuata*) and Menzies' Banksia (*B. menziesii*) with an understorey dominated by *Zamia* (*Macrozamia riedlei*), Blackboy (*Xanthorrhoea preissii*), Prickly Moses (*Acacia pulchella*) and Buttercups (*Hibbertia hypericoides*).

The proposed North-West Corridor provides for an area south of Burns Beach to be 'reserved' for Parks and Recreation; apparently the area extends far enough eastwards to incorporate a strip of low woodland of Banksia. The Parks and Recreation area is bordered on the inland side by a proposed Important Regional Road, to the east of which land is to be zoned Urban Deferred.

RECOMMENDATION

The Committee recommends that:

1. the land south of Burns Beach (Fig.) proposed to be 'reserved' in the proposed North-West Corridor for Parks and Recreation extend far enough east to incorporate a strip of low woodland of Banksia in the coastal zone between Burns Beach Road and the blow-out, about 1.4 km to the south, and that it be made a Class A reserve for Conservation of Flora and Fauna, vested jointly in the Western Australian Wildlife Authority and the Shire of Wanneroo;

2. there be a North-West Corridor Foreshore Reserve, as proposed by the Metropolitan Region Planning Authority, from the Mullaloo sewage outfall northwards, except that the minimum width north of Burns Beach should be 400 m; the Reserve should be set aside, as the development of the Corridor proceeds, as a Regional Park for landscape and recreation, and should be managed by the Shire of Wanneroo.

F.2 SORRENTO - MULLALOO REEFS

The shore in this area is a beach, but there is a protecting reef offshore and a series of small reefs between it and the beach. The reefs are biologically rich and to the skin-diver are locally unsurpassed as an underwater spectacle. Because they lie in shallow, protected waters they are generally safe for even novice snorkellers to explore. A rare cowrie shell (*Cupraea (Zoila) venusta sorrentensis*) occurs here, and is much sought after by collectors.

The fishes, rock lobsters and molluscs of the reefs have already been heavily exploited; fears of over-collection have prompted the suggestion of an aquatic reserve within a radius of 3.5 km of Whitford Point, where the taking of any marine organism (apart from the catching of fish with a line) would be prohibited. The Committee believes that this would interfere with established, regulated fisheries (e.g. of rock lobster and abalone) and would be difficult to enforce. However, the Committee believes there is a need for an area of reef to be reserved and protected to conserve reef communities and to act as a study and educational area. At present insufficient data are available to delineate such an area.

RECOMMENDATION

The Committee recommends that the Environmental Protection Authority commission a study of the Sorrento-Mullaloo reef with the aim of recommending a small aquatic reserve where all marine organisms would be protected.

F.3 WILDLIFE RESEARCH CENTRE NATURE RESERVE

The Wildlife Research Centre is located at Woodvale, in Reserve C30809, for Research and Conservation of Flora and Fauna, vested in the Minister for Fisheries and Wildlife. It has an area of 39 ha. A small part of the reserve contains buildings, roads and yards but most is in its natural state.

The vegetation is a mixed woodland of Tuart (*Eucalyptus gomphocephala*), Jarrah (*E. marginata*) and Banksias (*B. menziesii* and *B. attenuata*). The shrub layer is in good condition although there has been some invasion by weeds such as Gladioli (*Gladiolus caryophyllaceus*) and Cape Tulip (*Homeria*). Two species of native mammals occur on the reserve; the Brush Wallaby (*Macropus irma*) and Brush Possum (*Trichosurus vulpecula*). Reptiles include the Race-horse Goanna (*Varanus tristis*), and a number of bird species have been noted.

The reserve protects a vegetation complex which is becoming increasingly cleared as urbanisation proceeds in this part of Perth.

The Committee endorses the purpose and vesting of reserve C30809.

RECOMMENDATION

The Committee recommends that reserve C30809 be reclassified as Class A.

F.4 JOONDALUP AND GOOLLELAL LAKES AREA

Lake Joondalup is a large, fresh-water lake that lies to the west of Wanneroo Townsite, about 30 km north of Perth and 6 km from the Indian Ocean. The lake is about 6 km long and up to 1.2 km wide with the long axis parallel to the coast. Most of the open water of the lake is contained within reserve A31048, for Recreation and the Conservation of Flora and Fauna, of 465 ha, vested jointly in the Shire of Wanneroo and the W.A. Wildlife Authority. Malap Island is reserve A21708, of 4 ha, for Protection of Flora and Fauna, not vested, while Lake Island is freehold.

The vegetation of the lake, islands and shores has been described and mapped by Congdon and McComb (1976). Beds of sedge (*Baumea articulata*) occur in the Lake and near its edge, being replaced by *Typha orientalis* in disturbed areas. The waters are densely populated with benthic stoneworts. Woodlands of the paperbark *Melaleuca rhapsiophylla* border fringing sedge communities. Flooded Gums (*Eucalyptus rudis*) are common in places. The wetland vegetation is surrounded by open-forest and woodland of Tuart (*E. gomphocephala*), Marri (*E. calophylla*), Jarrah (*E. marginata*) and *Banksia* spp., much of which has been cleared.

Lake Joondalup is outstanding for the number and variety of water-birds recorded. Some species which are rare elsewhere in the Metropolitan Region are plentiful, for example Straw-necked Ibis (*Threskiornis spinicollis*), White Ibis (*Threskiornis molucca*), Blue-winged Shoveller (*Anas rhynchotis*), Great Crested Grebe (*Podiceps cristatus*), Red-necked Avocet (*Recurvirostra novaehollandiae*) and White-necked Stilt (*Himantopus himantopus*). Many hundreds of water-birds of many species use the lake as a summer drought refuge.

Although Lake Joondalup has dried occasionally in the past it now appears to be permanent, following rises in the water-table due to clearing and urbanisation.

Lake Joondalup's importance has been recognised by the creation of the existing reserve, and by the declaration of the surrounding area as Region Open Space by the Metropolitan Region Planning Authority. It lies within the North-West Corridor and the Joondalup Sub-regional Centre is to be built near its western bank.

To the south of Lake Joondalup, and draining into it, are Beenyup and Wallubuenup Swamps and Lake Goollelal. These, too, are within the Region Open Space. The design concept for the Open Space, prepared by the Town Planning Department and adopted in principle by the M.R.P.A., provides for recreational use of Lake Goollelal and the management of the swamps and Lake Joondalup for conservation.

At present most of the banks of Lake Joondalup and all the swamps and lakes to the south are privately owned, or are controlled by the M.R.P.A. The Shire of Wanneroo and the W.A. Wildlife Authority, in whom the Lake Joondalup Nature Reserve is vested, have no real control of most of the vegetation, so important to the bird-life. With a rapidly increasing human population in the region, proper management is essential.

The Committee endorses the present status, purpose and vesting of reserve A31048.

RECOMMENDATION

The Committee recommends that:

1. land within the Region Open Space around Beenyup and Wallubuenup Swamps, north-west of Woodvale Drive, be added, as it is acquired by Metropolitan Region Planning Authority, to reserve A31048;
2. Lake Goollelal, when purchased, be declared a reserve for Recreation and vested in the Shire of Wanneroo;
3. reserve A21708 be vested in the Western Australian Wildlife Authority.

F.5 WANNEROO WETLANDS, EASTERN CHAIN

East of the Wanneroo townsite is a chain of wetlands that incorporates Jandabup Lake, Mariginiup Lake, Little Mariginiup Lake, Gngangara Lake, Lake Adams, Badgerup Lake and several smaller wetlands. Jandabup Lake is the largest and most important, and is discussed separately (F.6).

East of Wanneroo Road, in the North-West Corridor, the population is increasing rapidly, with a corresponding increasing demand for recreation. The wetlands can serve a multi-purpose role as areas of Open Space which provide for recreation of low impact on the environment and for the conservation of water-birds, and are valuable features of the landscape.

Most of the lakes contain diatomite. Approval has been given for mining in part of Lake Gngangara, and if successful, mining may be extended to the other lakes. Provided measures are taken to safeguard the environment, mining will not conflict with conservation. By deepening the lakes, it may increase their value as summer refuges for water-birds.

Since the wetlands are separated by roads and other developments they cannot be readily managed as one reserve or Regional Park, although it is desirable to retain as many of them as possible with their foreshores, fringing vegetation and surrounding buffer strips. It is necessary to award priorities, especially if funding may be limiting. They are arranged in roughly descending order of priority.

Mariginiup Lake and Little Mariginiup Lake

Apart from a small foreshore reserve at the southern end of the lake, Mariginiup Lake and the surrounding area are in freehold land zoned Rural. The surrounding properties include market gardens, nurseries, homesteads, paddocks and disturbed bushland.

The lake is a body of semi-permanent fresh water. The margins are fringed with sedgeland of Jointed Twig-rush (*Baumea articulata*), *Cladium junceum* and *Eleocharis sphacelata*; Bulrushes (*Typha orientalis*) are relatively uncommon. The surrounding vegetation includes the shrub *Leptospermum ellipticum* and a few scattered remnants of Flooded Gum (*Eucalyptus rudis*) and the paperbark *Melaleuca rhapsiophylla*; one of the larger groups occurs in the unnumbered reserve.

Mariginiup Lake is useful to water-birds, and offers summer refuge. Its intermediate size, however, and the destruction and disturbance of the surrounding vegetation, reduce its significance as an area solely for conservation.

Little Mariginiup Lake is a seasonal swamp to the north-east of Mariginiup Lake. The area is zoned Rural. Reed beds cover much of the western half. Market gardens extend into the wetland area on the east. The surrounding area has been almost completely cleared.

Lake Gnanagara

Most of Lake Gnanagara is in reserve C27279, of 108 ha, for Recreation, vested in the Shire of Wanneroo. Two further reserves for Recreation incorporate adjoining land: C8399, of 34 ha, and C27278, of 2 ha, both vested in the Shire of Wanneroo. In the north-west, part of the foreshore and the lake itself is not reserved, nor is a small part of the southern foreshore and of the adjoining wetland vegetation.

The fringes of the lake contain sedgelands, with Jointed Twig Rush (*Baumea articulata*) predominating in the north, and *Cladium junceum* and Bullrush (*Typha orientalis*) occurring in the south. Open-forest of Flooded Gum (*Eucalyptus rudis*) and the paperbark *Melaleuca preissiana* occupies the shoreline. Willows (*Salix* sp.) have been planted in the north-west. Considerable stretches of the foreshore have been denuded of vegetation and reduced to sand and mud.

Reserve C8399 contains mostly remnants of woodland of Marri (*E. calophylla*), Pricklybark (*E. todtiana*), *Banksia* spp., Sheoak (*Casuarina fraserana*) and Christmas Tree (*Nuytsia floribunda*).

The southernmost large lake in the chain, Lake Gnanagara is much used for active recreation, and has been developed to cater for this use. Access to the lake from the nearby roads is provided for at only a few places, which has resulted in extensive destruction of the fringing vegetation from vehicles driven along the foreshore. Access roads and amenity areas should be redesigned; this will be facilitated by reserving the remaining portion of the lake and by extending the reserve in areas where there is only a narrow fringing strip. If ordered access to the lake for recreation can be achieved, revegetation and control of erosion of the less-used parts of the foreshore should be possible.

Badgerup Lake and Little Badgerup Lake

Badgerup and Little Badgerup Lakes and their surroundings are in freehold land zoned Rural.

Both lakes contain extensive beds of Bullrush (*Typha orientalis*) and two exotic water plants: Water Hyacinth (*Eichhornia crassipes*) and *Polygonum attenuatum*; Water Hyacinth has been controlled by spraying. The native sedge *Scirpus prolifer* is abundant in Badgerup Lake. Trees have been almost entirely lost from the foreshores and fringes of Badgerup Lake; there is, however, a good stand of the paperbark *Melaleuca raphiophylla* at the southern end of Little Badgerup Lake.

Most of the immediate surroundings have been cleared and only scattered trees remain. Further from the lakes is patchy bushland. There is an area of about 4 ha of market garden between the lakes and the road to the east; there is however, a narrow buffer strip between the market garden and the nearby Badgerup Lake.

Both lakes are semi-permanent and thus serve as summer refuges for water-birds. Badgerup Lake contains the greater expanse of water in summer, although the water in parts of both lakes was more than a metre deep in December 1976.

The presence of introduced plants in these lakes and the deterioration of the natural vegetation in the surroundings reduce the lakes' value for the conservation of flora and fauna. Nevertheless, they would form interesting landscape features as the centre-pieces of parkland for Recreation and provide useful refuges for water-birds.

Wetlands near Lenzo Road

Most of the land in the vicinity of the wetlands near Lenzo Road is freehold. The north-western one of the four main wetlands has an adjoining reserve, reserve C27466, of 4 ha, for Recreation, vested in the Shire of Wanneroo.

Only remnants remain of the area's natural vegetation; many of the surviving trees occur around the fringes of the wetlands. A few strips of market garden lie in the general area, but the main land use appears to be grazing.

The southernmost wetland, 1.5 km due east of Lake Badgerup, and the north-western wetland contain semi-permanent water; the middle and north-eastern ones are more in the nature of seasonal swamps. Three other swamps lie to the south, between Lakes Badgerup and Gnangara, and several more wetlands lie to the north.

This group of wetlands does not have great value for conservation, owing to their small size, the seasonal nature of most of them and the destruction of much of the surrounding vegetation. They are still important, however, as refuges for water-birds. There is need for extensive Parkland for Recreation, in which the wetlands could be preserved as features of the landscape and water-bird refuges. Whether four or up to ten wetlands should be included in the Parkland should be reviewed according to the demand for recreation, the funding available for purchase, and the existence of other needs of greater priority; this area should not be ranked highly.

Emu Swamp

Emu Swamp lies in the south-east corner of the Shire of Wanneroo, on the boundary of that Shire with the Shire of Swan. The centre of the swamp lies 0.5 km east of Uganda Road, in freehold land zoned Rural. To the west of Uganda Road the land is zoned by the Metropolitan Region Planning Authority for Parks and Recreation.

Emu Swamp has been cleared all round; only a few solitary trees or small clumps remain.

The swamp has been converted into a lake of permanent water, and thus serves as a summer refuge for water-birds. The Shire of Wanneroo has suggested that an area of nearly 200 ha, including Emu Swamp and its surrounds be declared Region Open Space, and purchased when available to create a reserve for Parkland for Recreation. The Committee endorses the idea; the Parkland should be managed by the Shire of Wanneroo and the Shire of Swan, and the permanent water should be maintained as a summer refuge for water-birds.

Snake Swamp

Snake Swamp is an area of several seasonal swamps and winter-wet depressions between two north-south ridges that lie south of Gnangara Lake (and Gnangara Road).

The surrounding woodland is very disturbed. Further south is bushland that is in fair condition, although there has been some dumping of rubbish.

Snake Swamp is not of high priority for conservation, as it is neither important for its vegetation nor for water-birds. Possibly, water could be maintained in the swamp throughout the year by pumping water into it, but the borefield of the Gnangara Mound may lower the water level still further. Snake Swamp and the bushland south of it could best be used to satisfy requirements for recreation.

Lake Adams

Lake Adams is the northernmost of the wetlands discussed here. It lies wholly within freehold land zoned Rural and part of a Public Water Supply Area.

The original extent of Lake Adams was about 100 ha, as indicated by the perimeter marked by the few scattered remnants of the fringing trees of Flooded Gum (*Eucalyptus rudis*). The upper limit of the water is now well below the old perimeter; the fall in level has been attributed to the pine plantation in the north, which has removed surface waters in the natural catchment of Lake Adams, and to the Gnangara borefield, which has extracted underground water.

A development company which has purchased Lake Adams has recently embarked on a project that aims to increase the lake's value both as a feature of the landscape and as a summer refuge for water-birds. It has deepened the deeper, western part of the lake and has cleared some of the reed-beds of Jointed Twig Rush (*Baumea articulata*) to provide some open water. Water was maintained in the lake throughout the summer of 1977-78, and the level was increased by pumping bore water into the lake, commencing in March 1978.

RECOMMENDATION

The Committee recommends that:

1. Mariginiup Lake and a buffer strip that extends at least 30 m from high-water mark - and further where appropriate to allow for access and amenities - be declared Region Open Space, and purchased by negotiation when available for a reserve for Parkland and Recreation controlled by the Shire of Wanneroo and managed to preserve the wetland habitat as a refuge for water-birds;
2. Little Mariginiup Lake be treated in the same manner as Mariginiup Lake, in part 1 of this recommendation, but should be afforded lower priority should the allocation of priorities be necessary;
3. the areas of Lake Gnangara and its foreshore not yet reserved and further areas surrounding the lake be declared Region Open Space and purchased when available; they should all be joined in one reserve for Public Recreation managed by the Shire of Wanneroo;
4. Badgerup Lake and Little Badgerup Lake, buffer strips 30 m wide around them and other adjacent areas suitable for recreation be declared Region Open Space, and be purchased when available for a reserve for Parkland and Recreation controlled by the Shire of Wanneroo, and managed to retain the wetlands as refuges for water-birds.
5. the wetlands near Lenzo Road, adequate buffer strips and connecting pieces of land to link the wetlands and provide for recreation be purchased when available and made into one reserve for Parkland and Recreation controlled by the Shire of Wanneroo, and managed to provide for the retention of the wetlands as refuges for water-birds.

F.6 LAKE JANDABUP

Most of Lake Jandabup is in reserve C7349, of 307 ha, for the purpose Conservation of Fauna, vested in the Minister for Fisheries and Wildlife. At the southern edge is reserve C33193, of 26 ha, for Public Recreation, vested in the Shire of Wanneroo.

Lake Jandabup is one of the eastern chain of wetlands in the Shire of Wanneroo. The lake and its fringing wetland vegetation occupy more than 300 ha.

The fringing vegetation includes extensive reedbeds and sedgeland. There are large stands of *Baumea articulata*, and belts of mixed sedges and rushes including *Schoenus* spp., *Leptocarpus canus*, *L. scariosus* and *Eleocharis sphacelata*; the last is rare south of the Kimberley. The aquatic carnivorous plant *Utricularia volubilis* is an uncommon species known from a few localities between Gingin and Albany.

Much of the fringing wetland vegetation of the foreshores and all of the surrounding areas of dry land are in private land; parts close to the water bear market gardens and remnant trees of Flooded Gum (*Eucalyptus rudis*) and the paperbark *Melaleuca raphiophylla*, and on higher ground there are paddocks and homesteads and remnants of the original vegetation that include Marri (*E. calophylla*), Jarrah (*E. marginata*), Pricklybark (*E. todtiana*), *Banksia* spp., Sheoak (*Casuarina fraserana*), the paperbark *Melaleuca preissiana*, Christmas Tree (*Nuytsia floribunda*) and Blackboy (*Xanthorrhoea preissii*).

As the largest body of open fresh water in the Shire of Wanneroo (Lake Joondalup is comparatively brackish), Lake Jandabup is important for water-birds. On 2 February 1977, 45 White Ibis (*Threskiornis molucca*) were seen on the lake; such numbers are rarely seen in the Metropolitan Area. 15 species were present on that day, including 200 Black Duck (*Anas superciliosa*). The presence of good numbers of water-birds during late summer indicates Lake Jandabup's importance as a drought refuge.

A line of bores has been sunk along the eastern side of Lake Jandabup to exploit the ground water resources of this area. Some lowering of the level of water in the lake has been predicted as a result, but the likely extent of this and its precise effects are unknown. Important work is being done at Lake Jandabup in monitoring the effects of pumping on water levels and wildlife.

RECOMMENDATION

The Committee recommends that:

1. Lake Jandabup, its fringing wetland vegetation, its foreshores and a surrounding buffer strip (30 m wide) be declared Regional Open Space; the freehold portion should be purchased when available and added to reserve C7349;
2. reserve C7349 be re-classified as Class A and be vested in the Western Australian Wildlife Authority.

F.7 ELLEN BROOK AND TWIN SWAMPS NATURE RESERVES

Reserves A27620 and A27621, of 65 ha and 155 ha respectively, are for the Preservation of Fauna (Short-necked Tortoise) and are vested in the W.A. Wildlife Authority.

Ellen Brook Nature Reserve is adjacent to the Great Northern Highway and about 2 km north of Upper Swan. The area south of Ellen Brook, which runs through the reserve, has a clay soil with numerous depressions which fill with water during the winter and spring.

The depressions are vegetated with shrubland of Robin Red-breast Bush (*Melaleuca lateritia*) and the sedges *Leptocarpus canus* and *L. aristatus*. Aquatic species include *Chara australis*, *Hydrocotyle lemnoides*, *Myriophyllum* sp. and *Philydrella pygmaea*. Between the depressions is slightly higher ground with shrubs such as *Acacia saligna*, Swishbush (*Viminaria juncea*), *Hakea varia* and Stinkwood (*Jacksonia sternbergiana*). Annuals include *Drosera gigantea*, *Neurachne alopecuroides* and *Verticordia densiflora*. Bladderworts (*Utricularia hookeri* and *Polypompholyx multifida*) are common and at least 14 species of orchids occur.

Along Ellen Brook, Flooded Gum (*Eucalyptus rudis*) and the paperbark *Melaleuca raphiophylla* are plentiful. The land to the north of the Brook, which was once cleared, is covered mainly with exotics but is gradually regenerating to native shrubs.

Twin Swamps Nature Reserve is about 5 km north of Ellen Brook Reserve. Warbrook Road runs along its northern boundary. Low stable sandhills surround swamps in the eastern and southern parts of the reserve while the north-western section is uniformly low lying.

The swamps are dominated by species of *Melaleuca* including *M. viminea*, *M. teretifolia* and *M. raphiophylla*. Aquatics include *Villarsia capitata*, *Triglochin acuta*, *Ruppia maritima* and Duckweed (*Spirodela oligorrhiza*). The sandhills are covered with low woodland of *Banksia*, the main species being Menzies' *Banksia* (*B. menziesii*), Slender *Banksia* (*B. attenuata*) and Holly-leaf *Banksia* (*B. ilicifolia*). Swamp *Banksia* (*B. littoralis*) occurs near the swamps, as does the paperbark *Melaleuca preissiana*. Other trees on the sandhills include Marri (*E. calophylla*), Pricklybark (*E. todtiana*), Christmas Tree (*Nuytsia floribunda*) and Sheoak (*Casuarina fraserana*). The understorey is provided by *Jacksonia furcellata*, *Lepospermum ellipticum* and *Zamia* (*Macrozamia riedlei*) and there is a ground cover of such spreading plants as *Phlebocarya ciliata*, *Dasyogon bromeliaefolius* and *Conostylis* spp.

The low-lying country is covered by shrubland of *Regelia ciliata*. Associated species include *Banksia* sp., Blueboy (*Stirlingia latifolia*) and the Green Kangaroo Paw (*Anigozanthos viridis*).

The Western Swamp (Short-necked) Tortoise (*Pseudemydura umbrina*) is one of the two vertebrates which are restricted to System 6. It has no close relatives amongst other Australian tortoises and is adapted to a specialised habitat (Burbidge 1967).

During the winter and spring the tortoises live in the swamps where they feed on small aquatic animals. In summer and autumn, when the swamps are dry, they aestivate (over summer, in a state of torpor). At the Ellen Brook Nature Reserve they enter naturally occurring tunnels in the clay while at Twin Swamps they hide in deep leaf litter or under fallen branches on the sandhills.

Research carried out since 1963 has shown that the population on Twin Swamps Nature Reserve has declined from over 150 in 1966 to less than 25 today. The decline is believed to be due largely to the recent series of winters of below average rainfall although predation by foxes and dogs may also be a factor. The population at Ellen Brook Nature Reserve appears to have been comparatively stable at around 10 to 25 animals. The present very low number of tortoises gives cause for considerable concern about the future of the species.

The two nature reserves are valuable conservation areas apart from their importance in protecting the only remaining habitat of the Western Swamp Tortoise. They are particularly rich in aquatic plants, and *Hydrocotyle lemnoides* is not known to occur elsewhere. Other rare plants include *Thysanotus tenellus* (Ellen Brook) and *Petrophile media*, *Plagianthus microphyllus* and *Utricularia violacea* (Twin Swamps). Some idea of their floral richness can be gained from the fact that 14 species of Orchidaceae (orchids), 14 species of Liliaceae (lily family) and seven species of Stylidiaceae (trigger plants) have been collected.

The swamps also contain a rich invertebrate fauna. One swamp on Twin Swamps Nature Reserve is the only known locality near Perth for the Shield Shrimp (*Lepidurus apus viridis*).

Ellen Brook contains a good variety of native fishes. Big-mouthed Goby (*Favonigobius suppositus*), Swan River Goby (*Pseudogobius olorum*), Western Minnow (*Galaxius occidentalis*), Westralian Pygmy Perth (*Edelia vittata*), Nightfish (*Bostockia porosa*) and the hardyhead *Atherinosoma* sp. have all been collected recently a short distance upstream from Ellen Brook Nature Reserve.

With the continuing decline in numbers of the Western Swamp Tortoise it appears that more intensive management of the reserves will be necessary. In this context any changes in the use of adjacent land which might affect the small tortoise populations should be carefully examined. The possible extraction of clay adjacent to Ellen Brook Nature Reserve has been of especial concern since it might lower the water-table in the swamps which the tortoises inhabit. Ellen Brook Reserve, in particular, is small and could be easily affected from outside.

RECOMMENDATION

The Committee recommends that:

1. reserve A27620 (Ellen Brook Nature Reserve) be extended by the purchase of adjoining land when available, in order to provide a buffer zone;
2. any major change in land use or proposals for mining or industry within 1 km of either reserve A27620 or A27621 be referred to the Environmental Protection Authority.

F.8 WHITEMAN PARK (MUSSEL POOL)

Over 4000 ha have been acquired by the Metropolitan Region Planning Authority in the Whiteman Park area for the future purposes of education, health, institutions and recreation. The land lies south of Gnangara Road, opposite State Forest No.65.

The W.A. Museum surveyed the area (Western Australian Museum, 1975) and found parts of it to be biologically rich. It recommended that 300 ha of it be set aside as a reserve for Conservation of Flora and Fauna and that limited access be allowed to some further areas; most of the remainder should cater for recreation. The following is derived largely from the Museum report.

Four basic vegetation formations occur in the Whiteman Park area. An open-woodland contains Marri (*Eucalyptus calophylla*) and Jarrah (*E. marginata*) with a second stratum of Slender Banksia (*B. attenuata*), Menzies' Banksia (*B. menziesii*) and Holly-leaf Banksia (*B. ilicifolia*). The understorey includes such species as Blackboy (*Xanthorrhoea preissii*), *Jacksonia floribunda*, *Hibbertia hypericoides*, Purple Flag (*Patersonia occidentalis*) and *Bossiaea eriocarpa*.

The vegetation in areas that are flooded seasonally is characterised by low woodland or low open-woodland of the paperbark *Melaleuca preissiana* with understorey species that include *Leptospermum ellipticum*, *Astartea fascicularis* and *Calothammus lateralis*. An uncommon orchid here is Babe-in-a-Cradle (*Epiblema grandiflorum*).

In low-lying areas that are moist in winter a low heath vegetation occurs; it consists of a shrub layer often dominated by Blackboys with a few emergent Marri and Jarrah trees.

Horse Swamp and the creek that contains Mussel Pool support a swamp vegetation which varies from low woodland of *Melaleuca preissiana* to low closed-forest of the paperbark *M. raphiophylla* and Flooded Gum (*E. rudis*). The understorey comprises dense sedge with occasional shrubs of such species as Wattle (*Acacia saligna* and *A. pulchella*) and *Oxylobium lanceolatum*.

The survey recorded five native species of mammals from the Whiteman Park area. One of them, the Brush Wallaby (*Macropus irma*), was recorded in only one locality, in dense swamp vegetation that provides typical habitat for this animal. The others were Western Grey Kangaroo (*M. fuliginosus*), Short-nosed Bandicoot (*Isoodon obesulus*), Ashy-grey Mouse (*Pseudomys albocinereus*) and Little Bat (*Eptesicus pumilus*). The Ashy-grey Mouse has not been collected on the Coastal Plain since 1843.

Three other native mammals are also likely to occur: these are Pygmy Possum (*Cercartetus concinnus*) and Honey Possum (*Tarsipes spencerae*), which were recorded from the area north of Gnangara Road before it was cleared for the Gnangara Pine plantation, and Brush-tailed Possum (*Trichosurus vulpecula*), which has been trapped in similar vegetation at Guildford and Wanneroo.

Seventy species of birds were recorded - a high number, considering the area's location within the metropolitan area. They include the Painted Quail (*Turnix varia*), which is now extremely rare on the Coastal Plain.

The twenty-five species of reptiles recorded for the Whiteman Park area are typical of those inhabiting the Sand Zone of the Coastal Plain. The area is important for the presence of the goanna (*Varanus gouldii gouldii*), since it is the most northerly record for this sub-species. Further, the overlap in distribution of *V. gouldii rosenbergi* and *V. gouldii gouldii* in the area is especially intriguing; the taxonomic status of these two sympatric sub-species needs to be investigated further, and this area may provide the only known site where such an investigation could be made.

Two species of native fish - Westralian Pygmy Perch (*Edelia vittata*) and Nightfish (*Bostockia porosa*) - occur in the creek. Also present is the introduced Mosquito Fish (*Gambusia affinis*).

The Pygmy Perch appears to need aquatic vegetation as a refuge; it is important to keep adequate areas of the creek in its natural state so that the habitat is not altered in favour of the Mosquito Fish.

Mussel Pool derives its name from the mussel *Westralunio carteri* which may be found in sand among reeds at the water's edge. Mussels of this family have a glochidial larval stage which requires a fish as intermediate host.

The Whiteman Park area is currently being examined by consultants on behalf of the Regional Open Spaces Committee of the Metropolitan Region Planning Authority. The study will take into consideration the Museum report and a report on the hydrology of the area (Bestow 1976). The design will provide areas for passive and active recreation as well as conservation.

The Committee makes no recommendation on this area as it is currently being investigated by the M.R.P.A.

F.9 RESERVE AT MARANGAROO

Reserve A20091, of 77 ha, lies east of Wanneroo Road and north of Warwick Road, in the suburb of Marangaroo. It is for Preservation of Flora and Fauna, and is vested in the Shire of Wanneroo.

The soil is mostly yellow sand, characteristic of the Karrakatta Soil-landform Unit (Churchward and McArthur 1978). It supports open-woodland of Jarrah (*Eucalyptus marginata*) with an understorey of Banksia (*B. attenuata* and *B. menziesii*) and the occasional Sheoak (*Casuarina fraserana*). Common species of the ground storey include Blackboy (*Xanthorrhoea preissii*), Blueboy (*Stirlingia latifolia*), Patersonia (*Patersonia occidentalis*), Bristly Cottonheads (*Conostylis setigera*), Bacon-and-eggs (*Oxylobium capitatum*), Daviesia (*Daviesia pectinata*, *D. nudiflora*, *D. divaricata*, *D. juncea*), Telegraph Sedge (*Mesomelaena stygia*), Pixie Mops (*Petrophile linearis*), Conostephium sp., Pink Myrtle (*Hypocalymma robustum*), Summer Starflower (*Calytrix flavescens*), Eremaea sp., *Scaevola paludosa*, Buttercups (*Hibbertia hypericoides* and *H. huegelii*) and Star-of-Bethlehem (*Calcectasia cyanea*).

In the extreme western portion of the reserve is higher ground, of yellowish-brown sand. It is vegetated with woodland and open-woodland of Tuart (*E. gomphocephala*), with less Banksia and more Sheoak. The understorey is noticeably dissimilar from the remainder of the reserve: although species such as *Hibbertia hypericoides*, *Daviesia nudiflora* and *D. divaricata* remain common, it is largely characterised by different species, such as *Helichrysum cordatum*, *Tetrariopsis octandra*, *Dianella revoluta*, *Corynotheca micrantha*, *Grevillea vestita*, *Hibbertia racemosa*, *Pelargonium capitatum* and *Jacksonia sericea*.

A large portion of the reserve was burnt in 1977-78. The remainder, however, has also been burnt in recent years; the understorey is low and open. The reserve has also been affected by timber-cutting and rubbish-dumping, the latter particularly in the east where car bodies line tracks into the reserve. So far the reserve has retained a good diversity of plant species and there appears to be little invasion of weeds.

The Committee endorses the vesting of reserve A20091 in the Shire of Wanneroo.

RECOMMENDATION

The Committee recommends that the purpose of reserve A20091 be changed to Parkland.

The area consists of freehold land west of Wanneroo Road and south of Warwick Road. A main sewer has been laid through the area, hence part of the land is cleared. Most of it, however, is relatively undisturbed bush; few weeds have invaded it and few tracks run through it.

The vegetation is characteristic of the Karrakatta Soil-landform Unit (Churchward and McArthur 1978) and consists of woodland of Jarrah (*Eucalyptus marginata*) with a few Marri (*E. calophylla*) and an understorey of Slender Banksia (*B. attenuata*) and Menzies' Banksia (*B. menziesii*). The understorey is diverse, some of the common species being Blackboy (*Xanthorrhoea preissii*), which dominates in places, *Dasypogon bromeliaefolius*, Telegraph Sedge (*Mesomelaena stygia*), *Loxocarya flexuosa*, *Conostylis aculeata*, *C. setigera*, *Patersonia occidentalis*, Bacon-and-eggs (*Oxylobium capitatum*), Yellow Pea (*Gompholobium tomentosum*), *Daviesia nudiflora*, *D. divaricata*, *D. juncea*, Blueboy (*Stirlingia latifolia*), Pixie Mops (*Petrophile linearis*), *P. macrostachya*, Buttercups (*Hibbertia hypericoides*, *H. racemosa* and *H. huegelii*), Pink Myrtle (*Hypocalymma robustum*), Pepper-and-salt (*Eriostemon spicatum*), *Scaevola canescens*, *S. paludosa*, Pearl Flower (*Conostephium pendulum*) and Everlastings (*Waitzia* spp.). The climbers *Hardenbergia comptoniana* and *Pronaya elegans* are also present. The shrub *Acacia cochlearis*, which is scattered throughout the area, is usually found nearer the sea, in soils of the Quindalup and Cottesloe Units.

There is evidence that the whole area was burnt three or four years ago. Frequent fires would eliminate some species and encourage weeds; future plans for the area should incorporate the protection of areas retained as bush from fire, trampling and other disturbance.

The Committee endorses the proposals of the Shire of Wanneroo to acquire the land and develop it for parks and recreation, provided some areas of natural vegetation are retained.

RECOMMENDATION

The Committee recommends that:

1. areas of natural vegetation be retained in the landscaping of the land west of Wanneroo Road and south of Warwick Road;
2. to these ends the Shire of Wanneroo seek the advice of the proposed Flora Research and Conservation Advisory Service or, prior to its formation, the Department of Conservation and Environment.

F.11 STAR SWAMP

Star Swamp lies just east of Hope Street, in the suburb of North Beach. It is a wetland of about 4 ha in area, of which somewhat more than half is in Swan Location 218, held in freehold by the City of Stirling. About 320 m north of Star Swamp, between Margaret Street, and Ada Street, is reserve A21406, of about 3.5 ha, for Public Recreation, vested in the City of Stirling. It has been suggested that Star Swamp, reserve A21406 and bush between the two and around Star Swamp be set aside as a reserve for conservation.

The swamp is bordered to the east, north and south by low open-forest of the paperbark *Melaleuca raphiophylla* with an understorey dominated by the sedges *Juncus maritimus* and *Baumea juncea*, with some *Scirpus maritimus*, and the blue-flowered *Lobelia alata*. On the dry side of the forest are the shrubs *Acacia saligna*, *A. cyclops*, *Adriana quadripartita* and *Logania vaginalis*.

The vegetation of the remainder of the basin containing the swamp varies from open-woodland to open-forest of Tuart (*Eucalyptus gomphocephala*). To the south, the open-woodland contains an understorey of Banksia (*B. attenuata* and *B. menziesii*) and a ground storey including Buttercups (*Hibbertia hypericoides*), Pixie Mops (*Petrophile linearis*), Milkmaids (*Burchardia umbellata*), Couch Honeypot (*Dryandra nivea*) One-sided Bottlebrush (*Calothamnus quadrifidus*), Blackboy (*Xanthorrhoea preissii*), Telegraph Rush (*Mesomelaena stygia*), *Jacksonia furcellata* and *Scaevola paludosa*.

To the east the woodland has retained little understorey, but there is some *Pelargonium capitatum*, *Hardenbergia comptoniana* and *Logania vaginalis*. A small patch to the north-east includes Parrot Bush (*Dryandra sessilis*) and Prickly Moses (*Acacia pulchella*).

To the north the understorey species include Bull Banksia (*B. grandis*), *Logania vaginalis*, Stinkwood (*Jacksonia sternbergiana*), *J. furcellata*, *A. saligna*, *A. cyclops* and *Arthropodium capillipes*.

Reserve A21406, and land to the north and south, supports attractive open-forest and woodland of Marri (*E. calophylla*), Tuart, and Jarrah (*E. marginata*). Bull Banksia and the creeper *Hardenbergia comptoniana* are common in this area. The ground storey contains Blackboy, Stinkwood, *Zamia* (*Macrozamia riedlei*), *Arthropodium capillipes*, *Scirpus* sp., *Schoenus* sp., *Craspedia* sp., Cone flower (*Conostylis aculeata*), Yellow Lily (*Tricoryne elatior*), *Pelargonium capitatum*, *Sowerbaea laxifolia* and *Scaevola holosericea*.

The best preserved areas of vegetation are reserve A21406 and surrounding land to the north, south and east and the low open-forest of paperbark around the swamp.

Star Swamp is well used as a teaching resource, especially by North Beach Primary School, of which all classes visit the area several times a year, if not regularly. It is also popular with families and individuals for bush-walking and bird-watching.

Last year several groups of students from the University of W.A. and Claremont Teachers College carried out biological surveys in the area. On 21 August 1977, teachers' college students recorded 28 species of birds. Although the area can only support small numbers of the various bird species, and is thus relatively unimportant for biological conservation, the number of species recorded illustrates its value as a study area.

Star Swamp is one of the few swamps in the Metropolitan Area that is not infected with the bacterium *Salmonella* spp.; most are highly infected.

The Committee supports the Environmental Protection Authority's proposal to reserve Star Swamp and an area of surrounding bush for Conservation of Flora and Fauna, and suggests that reserve A21406 and land stretching north to Mary Street be incorporated in the proposed reserve.

F.12 CARINE SWAMPS

Located between North Beach Road and Beach Road, and east of Okely Road, in the suburb of Carine, are Big Carine Swamp and Little Carine Swamp.

Big Carine Swamp contains water throughout the year. It comprises two main water bodies - a larger northern one, consisting partly of open water and partly of sedgeland of Bulrush (*Typha orientalis*), and a smaller, southern, body of open water. Between the two is an extensive area of low closed-forest of the paperbark *Melaleuca raphiophylla* that is in fine condition. A further area of paperbark occurs around the north-eastern portion of the lake, behind which is an open-forest of Tuart (*Eucalyptus gomphocephala*). Remnants of vegetation exist in other places: some Marri (*E. calophylla*) and Tuart occur to the south and south-east of the lake and clumps of Flooded Gum (*E. rudis*), mainly saplings, line the lake's western side.

Little Carine Swamp is a small, seasonal swamp containing Bulrushes, with one or two remnant clumps of native vegetation nearby.

Big Carine Swamp supports a good variety of water-birds; species that are relatively uncommon in the Metropolitan Area, such as Mountain Duck (*Tadorna tadornoides*), Grey Teal (*Anas gibberifrons*), Great Crested Grebe (*Podiceps cristatus*) and White-headed Stilt (*Himantopus himantopus*), were present on the Lake in early 1977. As a semi-permanent lake, it serves as a summer refuge, and the swamp's dense growth of paperbarks should both afford protection and provide nesting sites for species of water-birds.

The swamps have been acquired by the Metropolitan Region Planning Authority as Region Open Space and leased to the City of Stirling to manage for Public Recreation. They serve as compensating basins.

The Committee endorses the joint management programme of the MRPA and City of Stirling provided that Big Carine Swamp is retained as a drought refuge for water-birds; special consideration should be given to preserving the existing areas of paperbarks.

F.13 CARENIUP SWAMP

Careniup Swamp lies to the east of North Beach Road, opposite Lake Karrinyup Golf Course, in the suburb of Gwelup. Most of it is privately owned.

The swamp is semi-permanent. The soils are rich and peaty, and support an extensive sedgeland of Bulrush (*Typha orientalis*). There are also areas of open water, chiefly in the north. The remainder contains low closed-forest of the paperbark *Melaleuca raphiophylla* and Flooded Gum (*Eucalyptus rudis*).

With its rich soils the swamp can support many water-birds. Wetlands of this sort are now uncommon, as they were readily sought for market gardens. Moreover, as a semi-permanent swamp, it affords summer refuge for water-birds.

The proposed extensions of the Mitchell Freeway will pass on the eastern side of Careniup Swamp, and it may be most opportune to include what remains of the swamp in the purchase of land for the Freeway so that it can be designed as a feature of the Freeway.

Careniup Swamp must be acquired urgently if it is to be available once the Freeway is established.

RECOMMENDATION

The Committee recommends that Careniup Swamp be zoned as Region Open Space and purchased when available, to be set aside as a Regional Park, managed by the City of Stirling.

F.14 LAKE GWELUP

Lake Gwelup is situated west of North Beach Road, and north of Killarney Road, in the suburb of Gwelup. Most of the land enclosed by North Beach Road, Lagonda Drive, Wanstead Street, Finnerty Street, Huntriss Road and Segrave Street has been acquired by the Metropolitan Region Planning Authority as Region Open Space.

Except for a few Flooded Gums (*Eucalyptus rudis*) and paperbarks (*Melaleuca raphiophylla*) most of the land bordering the lake to the west and south has been cleared, but to the north and east a good cover of natural vegetation remains.

The lake is of open water except for a fringing belt of Bulrush (*Typha orientalis*); the belt is broken only in the north, where there are a few clumps of Jointed Twig-rush (*Baumea articulata*). Behind the rushes, in the north and east, are successive belts of paperbark and Flooded Gum. Some of the innermost paperbarks are dead, probably owing to a rise in the water-table, but the rest are healthy, and there are some especially fine old specimens in the north. Under the paperbarks in the east is the rush *Scirpus maritimus*.

To the immediate north and north-east of the lake is a remnant of a former open-forest of Tuart (*E. gomphocephala*) and Marri (*E. calophylla*) with a few Jarrah (*E. marginata*). The trees and shrubs of the understorey include Bull Banksia (*B. grandis*), Swamp Banksia (*B. littoralis*), *Acacia saligna*, *Hakea prostrata*, *Jacksonia furcellata* and Woollybush (*Adenanthos cygnorum*). There is only one large specimen of Swamp Banksia, in the east, and Woollybush is confined to a clump near Lagonda Drive, in the north-east. Most of the ground flora has disappeared; the species present include *Zamia (Macrozamia riedlei)*, Blackboy (*Xanthorrhoea preissii*), Yellow Lily (*Tricoryne elatior*) and *Pelargonium capitatum*.

Further north, between Finnerty Street and Wanstead Street, is a fairly extensive area of saplings of Marri and Jarrah.

Lake Gwelup is a deep, permanent lake. It supports a good variety of water-birds and is important as a drought refuge. It is capable of supporting large numbers of some species; for example over 1500 Coots (*Fulica atra*) and 95 Grey Teal (*Anas gibberifrons*) were present on 2 March 1977, and 450 Black Swans (*Cygnus atratus*) on 30 March 1977. Grey Teal and Black Ducks (*A. superciliosa*) are known to breed on the lake.

Much of the vegetation around Lake Gwelup is regenerating, especially in the east, where there are dense thickets of Flooded Gum saplings 5 - 10 m tall and also regrowth of paperbark, *Acacia saligna* and shrubs such as *Hakea prostrata*. Seedlings, one to two years old, of Flooded Gum are abundant in the north and east, and there are a number of sapling Marris in the north-east, as well as further north. Any control burning should not be allowed to retard natural

regeneration; the managing authority should seek advice from the Department of Conservation and Environment.

The well vegetated areas around the lake provide an attractive setting for walkers, with some fine mature trees as well as regrowth thickets that provide a visual barrier from the nearby suburbs. The area is used for horse-riding.

Local people are concerned about the use of trail bikes in the area.

RECOMMENDATION

The Committee recommends that:

1. the Metropolitan Region Planning Authority lease the land to the City of Stirling for a Regional Park, to be managed to preserve the landscape and provide a haven for water-birds, while allowing for low-impact recreation;
2. in preserving the landscape, the managing authority retain the natural flora and encourage its regeneration, with advice if necessary from the proposed Flora Research and Conservation Advisory Service or, prior to its formation, the Department of Conservation and Environment; if any planting is done, only local species already present in the area should be used.

F.15 RESERVES NEAR KARRINYUP ROAD

Surrounding Saint Mary's Church of England Girls' School, in Karrinyup, is an area of bush that comprises reserve C32559, of 55 ha, for Parkland, reserve C33680, of 44 ha, for Recreation, and land east of the West Coast Highway and south of Hepworth Road, being portion of Swan Location 1533, comprising Lots 5 and 7 and part of Lot 6. The reserves are located respectively west and east of Elliott Road and are both vested in the City of Stirling. On the opposite (northern) side of Karrinyup Road, between Arnott Street and Duart Road, is a further area of bush that comprises reserves C27471 and C33679, of about 18 ha and 4 ha respectively, both for Recreation and vested in the City of Stirling.

Apart from a strip of about 4 ha along the northern side of Karrinyup Road and one of about 12 ha along Jeanes Road, the two areas of bush are 'reserved' by the Metropolitan Region Planning Authority for Parkland and Recreation.

The area south of Karrinyup Road consists of sand dunes, stabilised by vegetation. On the first ridge of dunes east of the West Coast Highway is open-heath of *Pelargonium capitatum*, Swordgrass (*Lepidosperma gladiatum*), *Acanthocarpus preissii*, Grey Cottonhead (*Conostylis candicans*) and *Exocarpus sparteus* with some *Spinifex longifolia* near the road. In the north is an area of closed-heath dominated by *Acacia rostellifera* and *Olearia axillaris*.

Behind the ridge, especially in the south, is tall shrubland of Rottneest Cypress (*Callitris preissii*) and open-heath of *Pelargonium capitatum*, *Anthocercis littorea*, *Acacia lasiocarpa*, Boobialla (*Myoporum adscendens*), *Scaevola crassifolia*, *Olearia axillaris*, Quandong (*Santalum acuminatum*), *Spyridium globulosum* and *Exocarpus sparteus*.

Further east is an extensive area of closed-scrub dominated by *Acacia rostellifera*, with patches of *Anthocercis littorea* and *Scaevola nitida*. Around the hill-tops it is broken by open-heath of species such as *Pelargonium capitatum*, *Melaleuca acerosa*, *Acacia lasiocarpa* and Quandong. There are a few emergent Tuarts (*Eucalyptus gomphocephala*), of which most of the fully developed trees are dead or moribund.

Just east of Elliott Road, the *Acacia rostellifera* gives way to open-woodland of Tuart. The understorey is dominated by *Pelargonium capitatum*, *Acacia lasiocarpa* and *Scaevola holosericea*. It is richest in species around the hill-tops where plants such as Snakebush (*Hemiandra pungens*), Yellow Lechenaultia (*L. linarioides*), One-sided Bottlebrush (*Calothammus quadrifidus*), *Hardenbergia comptoniana*, *Hibbertia racemosa*, *Leucopogon parviflorus*, *Dianella revoluta* and *Tetrariopsis octandra* may also be found. In the far east is some Banksia (*B. attenuata* and *B. prionotes*), Sheoak (*Casuarina fraserana*) and stunted Jarrah (*E. marginata*).

Near Karrinyup Road, on the northern slopes of the dunes, *Casuarina lehmanniana* forms patches of closed-scrub; this species is uncommon in System 6. In the same area *Gyrostemon ramulosus* occurs. This distinctive shrub or small tree has a wide distribution extending north beyond Shark Bay, but is also uncommon in System 6. A further notable occurrence is that of Rottneest Cypress, west of Elliott Road: it was once common along the coast in the vicinity of Perth but has largely disappeared.

Introduced grasses, notably *Lagurus ovatus*, are present in the open-heath and open-woodland vegetation.

The area together with the foreshore reserve C12992 west of the West Coast Highway form one of the few examples in the Metropolitan Area of a transect from the sea to woodland of Tuart.

Much of the area, especially in the east, contains a well established network of trail-bike tracks. They are absent from the closed-scrub of *Acacia rostellifera*, a species that reproduces rapidly by suckering. Much of the area has been adversely affected by frequent fires: the Rottneest Cypress, which characteristically forms closed-scrub, is present as shrubland, with many fire-killed specimens; much of the woodland understorey is open; and species encouraged by fire, such as *Anthocercis littorea*, predominate in places.

Despite the proximity of the two areas, the area north of Karrinyup Road is notably dissimilar in character. It is a fairly flat area of brown sand with limestone near or at the surface, typical of the Cottesloe Soil-landform Unit (Churward and McArthur 1978). The vegetation is chiefly open-woodland of Tuart and woodland of Marri (*E. calophylla*), with some low open-woodland of *Banksia attenuata* and *B. menziesii* in the south-west.

Marri and many understorey species common in this area are absent or uncommon south of Karrinyup Road. These include Scrub Sheoak (*Casuarina humilis*), Prickly Moses (*Acacia pulchella*), Honeybush (*Hakea lissocarpha*), Blackboy (*Xanthorrhoea preissii*), Zamia (*Macrozamia riedlei*), *Jacksonia sericea*, Buttercups (*Hibbertia hypericoides*), Couch Honeypot (*Dryandra nivea*), *Bossiaea eriocarpa*, *Scaevola paludosa*, *S. canescens*, *Astroloma pallidum*, *Conostephium pendulum*, *C. minus*, *Leucopogon propinquus*, *Petrophile macrostachya*, *Acacia cochlearis* and *Logania vaginalis*. The *Hibbertia racemosa* is of a different form from that south of Karrinyup Road, with narrower leaves.

Other understorey species include *Helichrysum cordatum*, *Grevillea crithmifolia*, *Lechenaultia linarioides*, *Calothamnus quadrifidus*, *Rhagodia radiata* and *Tetrariopsis octandra*. Bull Banksia (*B. grandis*) and stunted Jarrah occur in places.

Limestone outcrops at the surface on a low rise near Karrinyup Road. The associated vegetation is closed-heath, the commonest plants being Cockies' Tongues (*Templetonia retusa*), *Melaleuca huegelii*, *Acacia truncata*, Spider-net Grevillea (*G. thelemanniana*) and Quandong.

Except for some moribund Tuarts, the vegetation is in good condition. The understorey is dense in most places and Marri is regenerating prolifically. This is no doubt due largely to the network of firebreaks that have been constructed in the area: only small sections of the area have been burnt recently. Parts of the perimeter are fenced, which probably also helps reduce disturbance. The Committee strongly believes that major portions of the bush should be preserved.

Each year students at Saint Mary's, from Year 7 through to Year 12, use the bush south of Karrinyup Road for biological studies. Students at Scarborough Senior High School also use the area and, to a lesser extent, the bush north of Karrinyup Road.

The Committee endorses the M.R.P.A.'s proposal to purchase land south of Hepworth Road, as described above.

RECOMMENDATION

The Committee recommends that:

1. the purpose of reserve C33680 be changed to Parkland;
2. the purposes of reserves C27471 and C33679 be changed to Parkland and that the reserves be vested jointly in the City of Stirling and the Western Australian Wildlife Authority;
3. the City of Stirling preserve the surviving natural flora in reserves C32559, C33680, C27471 and C33679; to this end, it should consult the proposed Flora Research and Conservation Advisory Service or, prior to its formation, the Department of Conservation and Environment.

Dianella Region Open Space is bounded by Morley Drive, Alexander Drive and Light Street. It has an area of about 35 ha, of which 5 ha are under the direct control of the City of Stirling and the remainder is leased to the City of Stirling.

At present most of the area is uncleared, and carries vegetation characteristic of the Bassendean Soil-landform Unit (Churchward and McArthur 1978). The structure is mostly low open-forest and low woodland, the principal trees being Slender Banksia (*B. attenuata*), Menzies' Banksia (*B. menziesii*), Holly-leaf Banksia (*B. ilicifolia*), Sheoak (*Casuarina fraserana*), Christmas Tree (*Nuytsia floribunda*), Pricklybark (*Eucalyptus todtiana*) and Jarrah (*E. marginata*). Bull Banksia (*B. grandis*), Swamp Banksia (*B. littoralis*), Marri (*E. calophylla*) and the paperbark *Melaleuca preissiana* also occur but are more localised. The understorey is rich; some of the common and widespread species are Purple Flags (*Patersonia occidentalis*), *Hypolaena fasciculata*, *Dasyopogon bromeliaefolius*, Blackboy (*Xanthorrhoea preissii*), Scrub Sheoak (*C. humilis*), Pixie Mops (*Petrophile linearis*), Blueboy (*Stirlingia latifolia*), *Bossiaea eriocarpa*, Yellow Pea (*Gompholobium tomentosum*), Bacon-and-eggs (*Oxylobium capitatum*), *Burtonia conferta*, *Daviesia juncea*, *D. pectinata*, Common Hovea (*H. trisperma*), *Conostephium pendulum*, *C. minus*, Summer Starflower (*Calytrix flavescens*), *C. fraseri*, *Scholtzia involuerata*, Common Dampiera (*D. linearis*) and Pepper-and-salt (*Eriostemon spicatum*).

Most of the vegetation types of the Bassendean Unit (Havel 1968) are represented: only type K is absent. Their boundaries, however, are mostly ill-defined, with characteristic species of several types often growing together. An exception is the woodland of Marri with its understorey dominated by Blackboy in the south-eastern corner, representative of type I.

Some of the Sheoaks and Banksias in the more elevated portions of the Open Space have died recently. The likeliest explanation is the lowering of the water-table in Dianella by a system of open drains combined with the below-average rainfall in recent years. The lowering of the water-table probably also accounts for the mixing of the vegetation types. The vegetation over most of the area is otherwise in good condition and should be able to adjust to further changes in the water-table.

The City of Stirling has prepared plans for the development of the Open Space, which have been approved by the Metropolitan Region Planning Authority. The plan incorporates the provision of sports-grounds and landscaped parkland and the preservation of some of the natural flora (about 10 ha, in the west).

Some development has already taken place, including the construction of an artificial lake and island in the south-west corner. The island has retained some of its natural flora, for example Woollybush (*Adenanthos cygnorum*), Blackboys, Christmas Trees and *Jacksonia furcellata*. It could be planted with local wetland species such as the paperbarks *Melaleuca raphiophylla* and *M. preissiana*, and Swamp Banksia.

The Committee endorses the City of Stirling's plans to retain part of Dianella Region Open Space as natural vegetation.

RECOMMENDATION

The Committee recommends that the City of Stirling consult the proposed Flora Research and Conservation Advisory Service or, prior to its formation, the Department of Conservation and Environment for advice on retaining natural vegetation in the Region Open Space.

F.17 BENNETT BROOK

Bennett Brook is a tributary of the Swan River. It rises in the Mussel Pool (Whiteman Park) area and joins the Swan River at Pyrton. Except for Whiteman Park, which has been acquired by the Metropolitan Region Planning Authority, and reserve C25363, of 133 ha, for Mental Hospital Site, not vested, Bennett Brook flows through private land zoned Rural.

Near Girton Street, and between Benara Road and Patricia Street, the banks are lined with fringing trees. South of Harper Street where Bennett Brook widens out into a swamp of about 30 ha, is dense bush, dominated by the paperbark *Melaleuca raphiophylla* and Flooded Gum (*Eucalyptus rudis*). Elsewhere, clearing has extended right to the water.

The swamp south of Harper Street provides habitat for a good variety of birds. It is semi-permanent, and therefore also serves as a summer refuge for water-birds. Birds such as Banded Land-rail (*Rallus philippensis*) and Little Grass-bird (*Megalurus gramineus*), which inhabit the swamp, are uncommon in the Metropolitan Area. Striated Pardalotes (*Pardalotus substriatus*) and Sacred Kingfishers (*Halcyon sancta*) use hollows in the Flooded Gums (*Eucalyptus rudis*), and White-faced Herons (*Ardea novaehollandiae*) roost in their branches. Other birds of the swamp include Black Duck (*Anas superciliosa*), Grey Teal (*A. gibberifrons*) Chestnut Teal (*A. castanea*), Black-shouldered Kite (*Elanus notatus*), Nankeen Kestrel (*Falco cenchroides*), Dusky Moorhen (*Gallinula tenebrosa*), Swampheaven (*Phorphyrio porphyrio*), Reed Warbler (*Acrocephalus australis*), Willie Wagtail (*Rhipidura leucophrys*), and Mistletoe-bird (*Dicaeum hirundinaceum*). Also inhabiting the swamp are Jewel Beetles (*Castiarina* spp. and *Melobasis* spp.), the former on paperbark trees (*Melaleuca raphiophylla*) and the latter on wattles (*Acacia saligna*).

The 'linear park' proposed by the Metropolitan Region Planning Authority should include the whole of the swamp. Access to the swamp, however, should not be encouraged: paths should pass around the swamp, not through it, so that it remains a haven for water-birds.

The Committee endorses the Metropolitan Region Planning Authority's proposal to declare the banks of Bennett Brook and adjoining buffer strip, including the swamp south of Harper Street, as Region Open Space for Parks and Recreation and eventual formation of a linear park for recreation of low impact on the environment.

F.18 SWAN RIVER, GUILDFORD TO WALYUNGA NATIONAL PARK

The Swan River below Walyunga flows over the Ridge Hill Shelf (Prider 1948) and the Pinjarra Plain (McArthur and Bettenay 1960). This area is zoned Rural, and most of it is privately owned. Vineyards occupy much of the valley, although the actual banks and immediate surroundings of the river are paddocks for horses and stock.

The natural vegetation is reduced to trees along the banks. In places both banks are bare, but for most of the length there are scattered trees along one bank or the other. Above the Swan's confluence with Ellen Brook, the banks are relatively well wooded. Flooded Gum (*Eucalyptus rudis*), Salt Sheoak (*Casuarina obesa*) and paperbarks (*Melaleuca* spp.) occur throughout the reaches of Middle and Upper Swan; in some sections saplings and seedlings are present, but elsewhere animals have prevented regeneration.

To enable more extensive regeneration of the fringing vegetation and to develop the area as a linear park for recreation of low impact on the environment (walking, fishing, etc.), access to the banks will need to be controlled. The Metropolitan Region Planning Authority has proposed that a "linear park" be established, to eventually link Guildford with Walyunga National Park.

Along this section, the Swan is joined by the tributaries Susannah Brook and Ellen Brook. The banks of Susannah Brook are fairly well wooded but do not connect points of interest, as is desirable in a linear park. The same argument applies to Ellen Brook, whose banks have, moreover, been denuded and heavily eroded in places. Ellen Brook is of outstanding significance for its reserve A27621, for the Preservation of Fauna (Short-necked Tortoise), to which access should not be encouraged. The linear park should therefore be confined to the Swan River, except for Jane Brook, Bennett Brook and the Helena River, which are the subject of separate recommendations (F.19, F.17 and F.22 respectively).

The Committee endorses the proposal by the Metropolitan Region Planning Authority to declare the banks and an adjoining buffer strip as Region Open Space for Parks and Recreation.

F.19 JANE BROOK

Jane Brook is a tributary of the Swan River, and flows from John Forrest National Park to its confluence with the Swan River at Middle Swan. Downstream of the National Park, the adjoining land is mostly privately owned paddocks; the zoning is Rural.

The natural vegetation is limited to fringing trees on the banks. Flooded Gum (*Eucalyptus rudis*) is the commonest species; in places there are many seedlings of it, for example near Middle Swan Road, where *Grevillea glabrata* also occurs. A few Swamp Sheoak (*Casuarina obesa*) occur near the confluence with the Swan River, but the species is absent elsewhere along Jane Brook. Paperbarks (*Melaleuca rhapsiophylla* and *M. preissiana*) occur further upstream, especially along the section near Talbot Road.

The Committee endorses the proposal by the Metropolitan Region Planning Authority that the banks and adjoining buffer strip of Jane Brook from the Swan to John Forrest National Park be declared Region Open Space for Parks and Recreation and eventual formation of a "linear park" for recreation of low impact on the environment such as walking, fishing, etc.

This saline backwater in the area bordered by Riverview Avenue, Wilkie Street, Kidman Avenue and the Swan River has pools of open water with a vegetation of *Suaeda australis*, *Atriplex hartala* and *Apium prostratum* and clumps of *Juncus kraussii* and *Scirpus validus*. The backwater is fringed by scattered trees of Flooded Gum (*Eucalyptus rudis*) and Salt-water Paperbark (*Melaleuca cuticularis*); the native undergrowth has been replaced by a sward of *Centella cordifolia*, *Cynodon dactylon*, *Paspalum distichum* and *Stenotaphum secundatum*.

The backwater provides good refuge for birds such as Swampen (*Porphyrio porphyrio*) and Reed Warbler (*Acrocephalus stentoreus*). Sacred Kingfishers (*Halcyon sancta*) perch in the trees. Many other species of birds have been observed in the area.

The area is 'reserved' for Parks and Recreation in the Metropolitan Region Scheme; the Committee endorses this.

RECOMMENDATION

The Committee recommends that access to the backwater be controlled and that other measures, where necessary, be taken to preserve the salt-marsh as wildlife habitat and to promote regeneration of the fringing vegetation; if necessary, advice should be sought from the Department of Conservation and Environment.

F.21 HAZELMERE LAKES

The Hazelmere Lakes lie about 1.5 km south of the Helena River and about 3 km east of the Swan River; each is nearly 10 ha in extent. Both lakes and the surrounding land are entirely in freehold land zoned Rural.

Stock grazing has eliminated almost all the fringing vegetation from the northern lake, but the southern lake is almost completely encircled by the paperbark *Melaleuca raphiophylla* with some Flooded Gum (*Eucalyptus rudis*). The paperbark *M. preissiana* also occurs at the southern end of the southern lake, where the fringing vegetation merges with remnants of the surrounding woodland of Marri (*E. calophylla*), Banksia (*B. attenuata* and *B. menziesii*), Sheoak (*Casuarina fraserana*) and Christmas Tree (*Nuytsia floribunda*).

The lakes support a good variety of water-birds, including waders as well as waterfowl. Red-necked Avocet (*Recurvirostra novaehollandiae*), Banded Stilt (*Cladorhynchus leucocephalus*) and White-headed Stilt (*Himantopus Himantopus*) are three wading birds seen on the lakes that are uncommon in the eastern part of the Metropolitan Area. Water-birds on the northern lake can be readily viewed from the surrounding roads. The lakes retain water for most of the year, and serve to some extent as summer refuges for water-birds.

The surrounding land is occupied by homesteads and paddocks and a cut-flower nursery; in places, buildings stand close to the water. Stock have caused the banks of the northern lake to erode. If the access of stock to the water were controlled, the fringing vegetation should regenerate and protect the banks from further erosion.

The Committee endorses the Special Town Planning Scheme proposed to the Shire of Swan by Planning Consultants to incorporate the southern lake and its fringing vegetation in a reserve for Conservation of Flora and Fauna and for Recreation.

RECOMMENDATION

The Committee recommends that:

1. the southern lake and its fringing vegetation be declared Region Open Space;
2. the attention of owners, occupiers and managers of the Hazelmere Lakes be drawn to the Guidelines for the Management of Wetlands (Environmental Protection Authority 1977).

The lower Helena River from its confluence with the Swan River to the western boundary of the proposed Helena Valley National Park (E.10) at Darlington (boundary between Shires of Swan and Mundaring) runs mostly through land zoned Rural. On the north bank, south of Midland, is some industrial land, and on both banks, south of Guildford, is land reserved for Parks and Recreation.

Except for a portion below Darlington, which is flanked by bushland and orchards, the lower Helena River passes through paddocks that are heavily grazed by stock. In parts, banks bear an almost continuous, but usually single, row of trees; elsewhere there are scattered solitary trees and bare stretches. Often the landward margin of the flood plain is better wooded than the river bank itself.

Flooded Gum (*Eucalyptus rudis*) is the commonest tree along the lower Helena River; the paperbark *Melaleuca raphiophylla* is also frequent along the flatter reaches. Marri (*E. calophylla*) occurs on the boulder-strewn banks below Darlington, where the river descends more rapidly, and Wattle (*Acacia saligna*) is abundant near the Scott Street Bridge. Introduced trees include the Ash *Fraxinus* sp., which has run wild near Guildford, and the Willow *Salix* sp., planted in the Helena Valley area.

On many of the flood-plain flats there is good regeneration of seedlings of Flooded Gum, otherwise the ground flora has been denuded of native species almost everywhere where cattle have access to the river. The ground cover on the flats includes introduced grasses such as *Paspalum distichum* and *Stenotaphrum secundatum* and clumps of Bulrush (*Typha orientalis*). On the steeper and rockier slopes of the upper reaches the following native species are also found: Prickly Moses (*Acacia pulchella*), *Astartea fascicularis*, *Grevillea glabrata*, *Labichea punctata*, *Lobelia alata* and Bracken (*Pteridium esculentum*). In the water are clumps of *Triglochin procera*.

These river banks, flood-plains and fringing flats bear skeletal remnants only of the natural vegetation. Nevertheless they contribute significantly to the landscape, and are areas in which linear recreational parks can be created to provide for walking, fishing, bird-watching and, in general, the enjoyment of the scenery and isolation. If the access of stock to the water is controlled, such usage should enable the maintenance and regeneration of the fringing vegetation which, in turn, will help prevent the banks from eroding.

RECOMMENDATION

The Committee recommends that:

1. the reservation for Parks and Recreation along both banks of the Helena Valley from Guildford to Darlington be extended, as proposed by the Metropolitan Region Planning Authority;
2. access of stock to the river banks be strictly controlled and, as far as possible, eliminated, by provision of alternative watering-points.

Perth and Jandakot Airports comprise lands held in freehold by the Commonwealth of Australia. Both contain vegetation that is typical of the Bassendean Soil-landform Unit (Churchward and McArthur 1978).

Of Jandakot Airport's 615 ha, over half is uncleared. The vegetation is predominantly low open-forest of Banksia (*B. attenuata*, *B. menziesii* and *B. ilicifolia*), Sheoak (*Casuarina fraserana*), Christmas Tree (*Nuytsia floribunda*) and Pricklybark (*Eucalyptus todtiana*); it represents vegetation types G and H (Havel 1968). Type I is well developed in places along Johnston Road, in the east, where *B. ilicifolia* dominates. In the north-east corner is a low-lying area which carries low woodland of the paperbark *Melaleuca preissiana* with Swamp Banksia (*B. littoralis*) and Christmas Tree, and represents type J.

One of the understorey species, *Leucopogon kingianus*, is an unusual heath known from only three other localities, all of which are vulnerable to surrounding development.

The vegetation is in an undisturbed condition, with a dense understorey. This is, no doubt, largely due to the effective system of firebreaks within the airport; none of the airport's vegetation has been burnt recently, in contrast to much of the surrounding bush. One area outside but adjacent to the airport, however, has not been burnt for a considerable time and is one of the best preserved areas of bush in the Metropolitan Area. It is the subject of two Ph.D studies.

Of the airport's fauna, the ant *Iridomyrmex conifer* is noteworthy. Its nest, built in areas of moist soil, harbours many other creatures that range from the tiny *Rodwayea* beetle to the large scarab beetle *Cryptodus* sp. (McMillan 1955). This ant has disappeared from many places around Perth, such as Forrestfield, Manning, Riverton and Bull Creek, and Jandakot is now one of the few places where it can be found.

Although Perth Airport (1469 ha) is more than twice as large as Jandakot, a smaller portion of it is uncleared.

Most of the uncleared vegetation (about 114 ha) is in the north-east near Kalamunda Road, where it includes woodland of Marri (*E. calophylla*), open-woodland of Jarrah (*E. marginata*) and low woodland of Banksia and Sheoak (types G, H and I).

In the east, near the Wittenoom Road railway crossing, are winter-wet flats. An area of 23 ha is vegetated with low closed-forest of the paperbark *M. raphiophylla* and emergent Flooded Gums (*E. rudis*) and some woodland of Marri (types J and possibly K). Many other swamp plants occur.

In the south, along Hardey Road, is about 36 ha of vegetation that includes low closed-forest of *M. raphiophylla* and low woodland of *M. preissiana* and Swamp Banksia (type J) as well as the predominant vegetation of low woodland of *B. attenuata*, *B. menziesii*, *B. ilicifolia*, Christmas Tree and Pricklybark (types G and H).

Most of the remainder of the airport that is undeveloped is partly cleared. Trees of the above species are present in places but the understorey is usually absent.

RECOMMENDATION

The Committee recommends that:

1. the Department of Conservation and Environment encourage the Commonwealth Department of Transport to retain, where possible, uncleared areas within the two airports; before the Commonwealth develops new projects that require further land to be cleared, the Department of Conservation and Environment should determine whether there exist alternative sites which are less significant biologically but which could serve the same purpose;
2. in advising the Commonwealth Department of Transport, the Department of Conservation and Environment consult whenever necessary the Western Australian Herbarium.

Immediately downstream from Garratt Road Bridge, on the Swan River, are areas of salt-marsh and associated woodland that are well worth preserving, especially since most of the fringing vegetation of the Swan River has either been entirely cleared or else consists of only a narrow belt of trees.

The most extensive area of salt-marsh is on the southern (or Belmont) side of the river. There is a smaller area on the north (or Bayswater) side. The principal species are *Salicornia australis* and *Suaeda australis*. On the northern side are also scattered clumps of Swamp Sheoak (*Casuarina obesa*), while on the southern side are also paperbarks (*Melaleuca* spp.) and Flooded Gums (*Eucalyptus rudis*).

Further downstream, near the bend in the river, are sand-bars on the southern side that are fairly well covered with trees and adjacent salt-marshes, while on the northern side is a flat, as well as a salt-marsh, that bear patches of Bulrush (*Typha orientalis*) and paperbarks (especially along creeks); native reeds and introduced grasses also occur. On the landward margin of the flat, Marri (*E. calophylla*) and Wattle (*Acacia saligna*) occur. Willows (*Salix* spp.) have been planted.

The saltmarshes and nearby clumps of trees support a variety of water-birds.

A controlled-access highway is planned to pass along the northern side of the river. The whole area of salt-marshes and associated vegetation north and south of the river has been designated for Parks and Recreation in the Metropolitan Region Scheme. The Committee endorses the classification, and draws to the attention of all the planning and managing authorities, including the Metropolitan Region Planning Authority, the Swan River Management Authority, and the Shires of Bayswater and Belmont, the importance of maintaining extensive and diverse areas of natural vegetation fringing the river.

RECOMMENDATION

The Committee recommends that management programmes for the land bordering the Swan River downstream from Garratt Road Bridge be devised to maintain extensive and diverse areas of natural vegetation; only pedestrian access should be allowed, and the only recreation permitted should be that which has a low impact on the environment (e.g. line-fishing).

The Maylands Peninsula accommodates a number of land uses. The former aerodrome site is vested in the City of Stirling for Public Recreation. The clay pits and residential developments are privately owned. The police stable their horses near the southern promontory where there is a boat-ramp and a carpark. The Clarkson Reserve, for Recreation and vested in the City of Stirling, is at the south-east corner of the peninsula. Further upstream the eastern bank adjoins paddocks, yards, boat-moorings and residential properties including Tranby House and the Tranby-on-Swan development.

Except for a small portion below St. Anne's Hospital, all the foreshores have been declared Region Open Space, and the freehold land included is being purchased when available.

Downstream from the boat-ramp is a strip of saltmarsh between the river bank and the bund surrounding the aerodrome site which consists mainly of *Salicornia australis* and *Suaeda australis* with occasional plants of *Rhagodia* sp. and *Juncus kraussii*. There has been an invasion of the exotic *Aster subulatus*, especially where the level has been raised by land-fill or the drainage improved and the vegetation burnt over. Where the level has been raised further - probably by dumping of dredgings - the saltmarsh has been lost to couch grass (*Cynodon dactylon*) and wild oats (*Avena fatua*). On the higher portions of the river bank are about half a dozen small trees of Swamp Sheoak (*Casuarina obesa*); larger trees of this species occur east of the boat-ramp.

The natural fringing vegetation on the eastern side of the Maylands Peninsula has been reduced to a few reeds, including *Juncus kraussii* and *Scirpus validus* and a broken line of trees, mainly Swamp Sheoak and Flooded Gum (*Eucalyptus rudis*) with one or two paperbarks (*Melaleuca raphiophylla*). Controlled access at specific points to permit regeneration of the fringing vegetation is desirable.

The interior of the Maylands Peninsula has little significance for biological conservation, but obviously great value for recreation, including potential for activities of heavy impact on the environment; off-road vehicles could use the old clay pits when they become available.

The foreshores are important areas for wildlife conservation. In the north-west of the peninsula are extensive reed-beds of *Juncus kraussii*, *Scirpus validus* and *S. maritimus*, on the landward side of which are Bulrushes (*Typha orientalis*) and paperbarks (*Melaleuca* spp.). The reed-beds are feeding-grounds for ducks and Swans, Coots (*Fulica atra*), crakes (*Porzana* spp.), rails (*Rallus* spp.) and Swampheens (*Porphyrio porphyrio*). They could also be useful nesting sites for Reed-warblers (*Acrocephalus stentoreus*) if less affected by wash from power-boats.

In the swampy area, with its thick growth of *Typha orientalis*, just downstream from Bardon Park, the Water Rat (*Hydromys chrysogaster*) has been recorded; the animal is infrequent in System 6 and rare elsewhere in Australia.

Power-boats are, in fact, the main cause of environmental damage in the area, and their wash has also eroded the river bank east of the boat-ramp. Motor vehicles have made tracks along the saltmarsh in this area. The numbers of wading birds that feed here may increase if the area is less disturbed.

In order to preserve the saltmarsh and maintain the diversity in these reaches of the river, dredgings should not be deposited so that they further raise the ground level where the saltmarshes occur. Vehicles should be denied access to the saltmarshes; to cater for fishermen and other users of the area, alternative access for vehicles should be provided on the landward side of the bund.

The Committee endorses the present policies of purchasing when available freehold land on the foreshores and the leasing of it to, or the vesting of it in, the City of Stirling.

The Committee also endorses the management programme of the City of Stirling to retain and protect the foreshore vegetation, while allowing pedestrian access for recreation of low impact on the environment.

The Committee draws attention to the need, in preserving a diversity of habitats on the foreshores of the Maylands Peninsula, to monitor and control the level of the saltmarshes and to provide alternative areas on the landward side of the bund for vehicular access.

F.26 JACKADDER LAKE

Jackadder Lake is located west of Liege Street, in the suburb of Woodlands. It is included in reserve C27766, of about 11 ha, for Recreation, vested in the City of Stirling.

The connection of Jackadder Lake with the Osborne Park Drain has converted the original seasonal swamp to a lake that contains water throughout the year. The lake consists almost entirely of open water. The surrounding area is cleared and grassed, and the only remnant of the original vegetation are a few Flooded Gums (*Eucalyptus rudis*) on the southern side of the lake.

For its size the lake supports large numbers of Black Swans (*Cygnus atratus*), whose numbers may exceed 100 during the summer and autumn months, when they feed in the pastures of nearby Herdsman Lake. At the same time of year the numbers of Black Ducks (*Anas superciliosa*) often reach several hundred.

The relatively uncommon White-eyed Duck (*Aythya australis*) was present on the lake throughout most of the spring, summer and autumn of 1976-77; on 30 March 1977, 25 of them were recorded.

The Committee endorses the policy of the City of Stirling for the management of Jackadder Lake as a small Regional Park for low-impact recreation and as a summer drought refuge for water-birds.

RECOMMENDATION

The Committee recommends that:

1. as far as possible, increases in plant cover be effected solely by the encouragement of natural regeneration, and that any planting of trees and shrubs that is undertaken be of species that would occur naturally at Herdsman Lake;
2. to these ends, the managing authority seek the advice of the Wetlands Advisory Committee and the proposed Flora Research and Conservation Advisory Service.

F.27 HERDSMAN LAKE

Herdsman Lake is mostly Crown land, but much of the margins are privately owned. The area is zoned by the Metropolitan Region Planning Authority as Region Open Space.

Most of the area is vegetated with sedgeland of Bulrush (*Typha orientalis*), and although much of the surrounding vegetation has been cleared there remain some fairly extensive areas of woodland of Flooded Gum (*Eucalyptus rudis*), particularly in the west, where Bracken (*Pteridium esculentum*) forms an understorey. The paperbark *Melaleuca rhapsiophylla* occurs in clumps in many places, and in the north forms areas of low woodland; *Viminaria juncea* and the wattle *Acacia saligna* also occur around the northern part of the lake.

Herdsman Lake is a large lake with a high capacity to harbour waterfowl. For example, during autumn and early winter, over 1000 Black Swans (*Cygnus atratus*) may be present in the area. The bed of the lake is of rich peat and is highly productive (as is evident by the extensive coverage of Bulrushes); nearby lakes, such as Lake Monger, have largely silted up and are less productive, with a much lower carrying capacity. Herdsman Lake's water-level can be controlled so that it carries water throughout the year. As a permanent lake, it would be of outstanding importance as a summer refuge for water-birds.

The lake's value lies also in its position within built-up Perth. It offers great potential for scientists, school children, tourists and the general public to study its birds (101 species are recorded from the area of which 33 species are known to breed here).

The M.R.P.A. proposes to set aside about 340 ha for Parks and Recreation (M.R.P.A. 1976(a)). The plan provides for the conservation of the area's birds (and improving the lake as summer refuge by maintaining water in it throughout the year) as well as for public recreation (including the construction of a display centre for nature study).

The Committee supports the principle of multi-purpose management as proposed by the M.R.P.A. The Committee notes, however, that the M.R.P.A.'s suggestion of 'enhancing' the area by planting a variety of species native to Western Australia but absent from Herdsman Lake is incompatible with the declared main aim - "the preservation of the natural look of the area".

Bold Park is part of the Endowment Lands owned in freehold by the City of Perth subject to the City of Perth Endowment Lands Act. The total area is about 426 ha and includes a golf course, a bowling club, a drive-in cinema, the Perry Lakes Stadium and playing-fields as well as the Perry Lakes themselves, the surrounding grassed areas and the bushland, which includes Reabold Hill. It is 'reserved' for Parks and Recreation under the Metropolitan Region Scheme.

The City of Perth is committed to retaining as bushland about 150 ha of Bold Park south of Oceanic Drive, including Reabold Hill. The City proposes to extend this area westward to West Coast Highway by the addition to Bold Park of about 100 ha of bushland and 15 ha of pine plantation.

These areas are to be excised from the remaining Endowment Land adjacent to Bold Park; they comprise about 191 ha, of which 173 ha are City of Perth Endowment Land and 18 ha are University Endowment Land, although only about half a hectare of the latter is involved. The remainder of this land, which is not incorporated in the extended park, will be utilised for Residential and Community Development and an Important Regional Road. The 100 ha of bushland is to be retained as such, but the 15 ha of pine plantation, quarry and paddock will be utilised for access, parking, picnic areas, amenities and rangers' residences.

Hitherto the funds raised by sale of Endowment Lands have been utilised to finance further capital developments of the Endowment Lands as required by the City of Perth Endowment Lands Act. The City of Perth seeks an amendment to the Act to enable the proceeds from the sale of the remaining Endowment Land for development to be placed in a fund for the future maintenance as well as the capital development of the extended Bold Park. The necessary legislation has not yet been introduced into Parliament.

There is a distinct pattern in the distribution of soils over much of the bush area, with deep, calcareous sands of the Quindalup Soil-landform Unit on the high sharp ridges, and grey, over pale yellow, siliceous sands of the Karrakatta Soil-landform Unit in the interdunal valleys. East of Reabold Hill, along Perry Drive, are dark-brown sands of the Cottesloe Unit (Churchward and McArthur 1978).

Although most of the area west and south-west of Reabold Hill is covered with woodland or open-woodland of Tuart (*Eucalyptus gomphocephala*), four distinctive types of vegetation are present. On the deeper, moister soils of the valleys and depressions are dense stands of Banksia (*B. attenuata* and *B. menziesii*) with a scattering of Tuarts and Sheoaks (*Casuarina fraserana*), and, just north of the pine plantation, a few isolated Jarrahs (*E. marginata*). The understorey is dominated by Blueboy (*Stirlingia latifolia*) and *Pelargonium capitatum*.

On the limestone ridges the tree cover is sparse or absent; sometimes a few Tuarts are present, but the vegetation is mostly closed-scrub or closed-heath, rich in species. The main species that indicate the presence of limestone at or near the surface are Parrot Bush (*Dryandra sessilis*), *Jacksonia hakeoides*, Spider-net Grevillea (*G. thelemanniana*), Yellow Lechenaultia (*L. linarioides*), Chenille Honey-myrtle (*Melaleuca huegelii*), *Acacia cochlearis*, *A. truncata*, Cockies' Tongues (*Templetonia retusa*) and Quandong (*Santalum acuminatum*), but the following are usually also present: Snakebush (*Hemiandra pungens*), Rats' Tails (*Scaevola thesioides*), Yellow Lily (*Tricoryne elatior*), *Diplopeltis huegelii*, *Grevillea crithmifolia*, *Leucopogon parviflorus*, *Acacia lasiocarpa*, *Hibbertia racemosa*, One-sided Bottlebrush (*Calothamnus quadrifidus*) and Geraldton Wax (*Chamaelaucium uncinatum*). (The Geraldton Wax is of a more compact form than specimens in cultivation, with smaller, paler flowers). These areas are less invaded by Veld Grass than elsewhere.

The vegetation of the dry slopes and ridges is intermediate between the above types. It consists of woodland or open-woodland of Tuart with an understorey of *Banksia attenuata* and *B. menziesii*. The ground storey includes Blueboy *Pelargonium capitatum*, *Jacksonia furcellata*, One-sided Bottlebrush, *Grevillea crithmifolia*, *Leucopogon propinquus*, Scrub Sheoak (*Casuarina humilis*), Prickly Moses (*Acacia pulchella*) and *Zamia (Macrozamia riedlei)*.

In the extreme south-west is vegetation characteristic of the Quindalup Unit, including such species as *Olearia axillaris*, *Conostylis candicans*, *Melaleuca acerosa*, *Hibbertia racemosa*, *Anthocercis littorea*, *Schoenus grandiflorus*, *Tersonia brevipes*, *Helichrysum cordatum*, *Scaevola holosericea*, *S. canescens* and *Pelargonium capitatum*. A few Peppermints (*Agonis flexuosa*) occur here, but fires have reduced them to shrubby regrowth.

The upper part of Reabold Hill is covered in vegetation similar to that of the other limestone ridges (see above) except that around the lookout, especially to the north and east, the vegetation is lower and more open, having suffered more from trampling and fire. The vegetation on the northern slope, however, just below and east of the old quarry, is distinctive, and consists of closed-scrub dominated by *Acacia xanthina* with a few emergent Tuarts. Associated species are chiefly *Scaevola nitida* and Chenille Honey-myrtle.

Along the western side of Perry Drive, on soils of the Cottesloe Unit, is open-forest of Tuart, Jarrah, Marri (*E. calophylla*) and Flooded Gum (*E. rudis*). The last species dominates in the area surrounding the small seasonal swamp near the corner of Perry Drive and Stephenson Avenue, with some Swamp Banksia (*B. littoralis*) in the understorey.

North of the swamp, on the eastern slope of the hill, is a thicket of Fremantle Mallee (*Eucalyptus foecunda*), which is rare in the Metropolitan Area and of infrequent occurrence within System 6; another smaller occurrence is north of Oceanic Drive, on a thin strip of land between the quarry and The Boulevard.

Although much of the area between Oceanic Drive and The Boulevard is developed, it contains further areas of bush that are part of Bold Park. Especially significant are the small area described above, of Fremantle Mallee, and the area south-west of the Skyline Drive-in Theatre. The latter area supports low open-forest and low woodland of Limestone Marlock (*E. decipiens*), a species which, although commoner in System 6 than Fremantle Mallee, is none-the-less poorly represented in reserves in the Metropolitan Area. A few trees of Limestone Marlock occur in the bushland that is proposed to be added to Bold Park.

In the grassed area east of Perry Drive, around Perry Lakes, a large number of the original trees have been retained and provide an attractive setting; the chief species are Flooded Gum, Tuart, Marri, Jarrah, Wattle (*Acacia saligna*), Swamp Banksia, Bull Banksia (*B. grandis*) and Slender Banksia (*B. attenuata*). The area's character, however, has been somewhat diminished by the planting of species not natural to the area and by the unnecessary pruning of the lower branches of some of the Flooded Gums.

The birds that inhabit Bold Park are typical of those of the Coastal Plain. They include all the species known from Kings Park plus several others that depend on the additional habitats present in Bold Park, such as the wetlands and the scrub vegetation of the limestone ridges. Altogether, close to one hundred species are recorded from Bold Park.

One bird that has been lost from Kings Park is the Splended Wren (*Malurus splendens*), which inhabits dense vegetation in the western part of Bold Park. The Black-capped Sittella (*Neositta pileata*), which occurs in both, is uncommon in the Metropolitan Area.

The birds of Perry Lakes include Black Duck (*Anas superciliosa*), Grey teal (*A. gibberifrons*), Grebes (*Podiceps* spp.), Swamphen (*Porphyrio porphyrio*), Coot (*Fulica atra*), Moorhen (*Gallinula tenebrosa*), White-faced Heron (*Ardea novaehollandiae*), White-headed Stilt (*Himantopus himantopus*), Black-fronted Dotterel (*Charadrius melanops*) and other water-birds.

The reptiles of Bold Park include Bob-tail Lizard (*Tiliqua rugosa*), Sandhill Dragon (*Amphibolurus adelaidensis*), the bearded dragon *A. minor*, Race-horse Goanna (*Varanus tristis*), King's Skink (*Egernia kingii*) and four species of small skinks, three species of gecko, Little Whip Snake (*Denisonia gouldii*), Bandy Bandy (*Vermicella fasciolata*) and Dugite (*Demansia affinis*).

Bold Park also contains a good variety of insects, including some large, colourful species; one of these is the iridescent Jewel Beetle (*Stigmodera roei*).

Reabold Hill is the highest part of the Coastal Plain near Perth, and Perth people often take visitors there to see the extensive views. The remainder of the bush is popular with bush-walkers, especially the area between Perry Drive and Reabold Hill, where gravel paths have been provided. The grassed area east of Perry Drive is well used for various forms of recreation.

As in Kings Park the two main management problems in Bold Park are due to two interrelated factors: the invasion of veld-grass and the frequency of wild bushfires. In Kings Park there are five resident staff and four fire-fighting vehicles, which have contributed to the success of fire control; in Bold Park there is only one resident ranger and one fire-fighting vehicle, although the City of Perth has more extensive reserves of manpower to call in from a distance. In December 1977 a large area was devastated by a hot bushfire lit in two places by an arsonist. More resident staff and additional fire-fighting vehicles were among the proposals for an extended Bold Park.

Two planned highways affect Bold Park and the proposed extension. An Important Regional Road was planned to extend westward from Underwood Avenue to West Coast Highway. (It has been agreed to re-route this further south to accommodate the bushland extension to the Park). A Controlled Access Highway has been planned to extend northward from the junction of Underwood and Stephenson Avenues over the shoulder of Reabold Hill and across Oceanic Drive.

Although the route of the Important Regional Road running east-west will be adjusted, the Controlled Access Highway continues to be a source of anxiety. The proposed route of the latter will destroy the seasonal swamp and much of the patch of Fremantle Mallee north of it; the western Perry Lake and Reabold Hill will be adversely affected, and pedestrian access and the movement of fire-fighting vehicles will be curtailed.

The Committee endorses the proposal by the City of Perth to extend the bushland area of Bold Park.

RECOMMENDATION

The Committee recommends that:

1. the City of Perth Endowment Act Amendment Bill be introduced into Parliament without further delay;
2. the City of Perth implement its proposals to extend Bold Park and to afford it better fire-protection;
3. the possibility of siting elsewhere the north-south Controlled Access Highway be investigated; if no adjustment is possible, the highway should be built so that damage to biologically significant and scenically attractive features of the Park are minimised.
4. the attention of the City of Perth be drawn to the occurrence of *Eucalyptus decipiens* and *E. foecunda* between Oceanic Drive and The Boulevard, with the object of their preservation in this area as well as in the main bushland area of the extended Bold Park.

Extending north and west of the Cottesloe Golf Course and south-west of the West Coast Highway and Challenger Parade (see Fig.) is a relatively undisturbed area of sand dunes. It consists of a portion of Swan Location 1911 (owned in freehold by the City of Perth subject to the provisions of the City of Perth Endowment Lands Act) and the northern part of the land held by the Department of Defence.

This is the best remaining area of the Quindalup Soil-landform Unit (Churchward and McArthur 1978) close to Perth. The City of Perth portion supports, in equal abundance, closed-heath of *Acacia rostellifera* and open-heath dominated by *Melaleuca acerosa*, *Acacia lasiocarpa*, *Anthocercis littorea*, *Conostylis candicans* and *Pelargonium capitatum*. The tops of the dunes are richer in species than elsewhere, and support Geraldton Wax (*Chamaelaucium uncinatum*) (a more compact form with smaller, paler flowers than specimens in cultivation), One-sided Bottlebrush (*Calothamnus quadrifidus*), Snakebush (*Hemiandra pungens*), Tar Bush (*Eremophila glabra*), Rats' Tails (*Scaevola thesioides*) and *Hibbertia racemosa*.

In the northern part of the area, especially just south of Challenger Parade, are some patches of closed-scrub of Peppermint (*Agonis flexuosa*), a tree widely cultivated but of uncommon natural occurrence north of the Swan River.

In the east, near the corner of McClemans Road and the West Coast Highway, is some woodland of Tuart (*Eucalyptus gomphocephala*) and low woodland of Banksia (*B. attenuata* and *B. menziesii*) with an understorey of Prickly Moses (*Acacia pulchella*), Scrub Sheoak (*Casuarina humilis*), *Daviesia divaricata*, Boobialla (*Myoporum adscendens*) and Zamia (*Macrozamia riedlei*), Quandong (*Santalum acuminatum*) and Yellow Lechenaultia (*Lechenaultia linarioides*) occur here too.

The Department of Defence land contains mainly *Acacia rostellifera*, but here the undisturbed conditions have allowed it to grow taller, to form closed-scrub. The land, however, once supported a woodland of Tuart, as indicated by dead and dying trees; this is also true of the City of Perth portion.

The Variegated and White-winged Wrens (*Malurus lamberti* and *Malurus leucopterus*) occur in the area as do the Spotted Scrub-Wren (*Sericornis maculatus*). The White and Yellow-plumed Honeyeaters (*Meliphaga penicillata* and *Meliphaga ornata*) and the White-backed Swallow (*Cheramoeca leucosternum*) have been recorded here recently. This area is of great significance as a corridor for the movement of birds along the coast and thence inland through reserves such as Bold Park.

Snakes present in the area include the colourful Western Black-striped Snake (*Vermicella calonotos*), the Half-ringed Snake (*V. semifasciata*) and the Little Whip Snake (*Denisonia gouldii*). The Black-striped Snake is infrequent in System 6 and rare elsewhere.

The Turtle Frog (*Myobatrachus gouldii*) occurs in the older dunes. It has unusual habits, spending most of its time underground where it feeds on termites. The genus is endemic to Western Australia.

The jewel beetle *Stigmodera magnetica* is found here on *Myoporum adscendens*, while another jewel beetle, *Melobasis terminata*, is found on *Acacia cyclops*. A species of ant lion (*Stilbopteryx* sp.) which eats other insects dependent on dune vegetation and which has practically disappeared from the Metropolitan Area, is found in the Rifle Range area.

The vegetation in this area of sand dunes owes its relative freedom from disturbance to its lying in the Rifle Range and surrounding zone, where it is protected by warning notices. This is satisfactory at present, but ultimately the area deserves formal protection by reservation, especially if the Department of Defence relinquishes its land.

The Indian Ocean foreshore reserve, along the western margin of this area of the Quindalup Unit recommended for conservation, is intensively used for recreation; access and facilities, however, are inadequate. To the south, the vegetation of the foredunes has been destroyed by off-road vehicles and by people seeking pedestrian access to the foreshore. This seriously threatens the stability of the dune system; the damage would extend further northward if firing over the Rifle Range, with its consequent restraint on access, ceased. Provision of well defined paths, therefore, along the foreshore and foredunes is important to conserve the biologically significant dune vegetation.

There are other risks to the users of the North Swanbourne foreshore arising from the lack of toilets, of surf-life-saving facilities and of access of emergency vehicles.

RECOMMENDATION

The Committee recommends that:

1. the area in Fig. , consisting of part of Swan Location 1911 and part of the Rifle Range land of the Department of Defence, be declared Region Open Space;
2. the present owners and occupiers of the land (City of Perth and Department of Defence) be encouraged to protect and manage these dunes in a manner consistent with the conservation of flora and fauna;
3. if the present owners and occupiers consent to relinquish the land, it should be purchased and the area become a Class A Reserve for Conservation of Flora and Fauna vested in the Western Australian Wildlife Authority, or jointly in the Authority and some other suitable body;
4. well defined paths be provided from the car park south of the Rifle Range to the foreshore;
5. a programme be executed to restore and stabilise the damaged foredunes south of the Rifle Range by planting suitable dune plants, preferably locally indigenous species;
6. the provision of facilities for the health, safety and comfort of the public using the foreshore be referred to the Recreation and Tourism Committee for early action.

Lake Claremont, previously known as Butler's Swamp, is within freehold land held by the Town of Claremont. The Lake adjoins a golf course on the east and playing-fields on the south and south-west.

The waters of the Lake contain Mud Pond Weed (*Potamogeton pectinatus*) and Bulrushes (*Typha orientalis*). The Town of Claremont has been investigating methods of removing some of the Bulrushes to provide more open water for water-birds. In the water are also many stumps of dead trees - probably of the paperbark *Melaleuca raphiophylla* - that are thought to be the result of a rise of 1 m in the water-level that occurred early this century, when the surrounding land was cleared.

Most of the remaining vegetation is around the north-west side of the lake, where the shore is lined with paperbark trees and the rush *Scirpus maritimus*. On the landward side is a woodland of Tuart (*Eucalyptus gomphocephala*), Marri (*E. calophylla*) and Peppermint (*Agonis flexuosa*), of which there are many fine specimens of the last species. The Town of Claremont has provided a picnic area and a cycle track.

Lake Claremont, which is popular with amateur ornithologists, is renowned for the variety of water-birds it supports, including species that are relatively uncommon in the inner Metropolitan Area, such as the Pink-eared Duck (*Malacorhynchus membranaceus*). A number of water-birds breed in the lake.

Moreover, the lake is semi-permanent, and thus provides a summer refuge for water-birds; on 2 February 1977, 210 Grey Teal (*Anas gibberifrons*) were present.

RECOMMENDATION

The Committee recommends that the Town of Claremont manage Lake Claremont as a multi-purpose Regional Park and improve its value as a summer refuge for water-birds.

F.31 KINGS PARK

Kings Park comprises reserve A1720, set aside for the purpose Public Park and vested in the Kings Park Board. The park's area is 402 ha.

About two-thirds of the park is undeveloped bush. Its character has been altered by the cutting of timber and firewood by the early settlers, and more recently by the effects of frequent fires, the invasion of Veld Grass (*Ehrharta calycina*) and infestation of rabbits. Feral cats have eliminated some species of native fauna and reduced the numbers of others. Upsets in the ecological balance have led to severe infestation of Tuart trees (*Eucalyptus gomphocephala*) by wood-borers and of Jarrah (*E. marginata*) by leaf miners; many specimens, especially of the former, are dead or moribund.

Most of the bush consists of low open-forest or low woodland dominated by Sheoak (*Casuarina fraserana*), Slender Banksia (*B. attenuata*) and Menzies' Banksia (*B. menziesii*). Less common trees include Tuart, Jarrah, Marri (*E. calophylla*), Acorn Banksia (*B. prionotes*), Bull Banksia (*B. grandis*), Christmas Tree (*Nuytsia floribunda*) and Wattle (*Acacia saligna*). Common species of the understorey include *Daviesia nudiflora*, Yellow Buttercups (*Hibbertia hypericoides*), Bacon-and-eggs (*Oxylobium capitatum*), Yellow Pea (*Gompholobium tomentosum*), Common Hovea (*H. trisperma*), Pink Myrtle (*Hypocalymma robustum*), Blueboy (*Stirlingia latifolia*), Prickly Moses (*Acacia pulchella*), *Pimelea rosea*, *Scaevola canescens*, *Phyllanthus calycinus*, Milk Maids (*Burchardia umbellata*), Cowslip Orchid (*Caladenia flava*) and Donkey Orchid (*Diuris longifolia*).

The limestone scarp that overlooks the Swan River supports quite a different vegetation. Much of it supports closed-scrub dominated by Parrot Bush (*Dryandra sessilis*). Common associated species include *Melaleuca acerosa*, *Grevillea crithmifolia*, *Casuarina humilis*, *Hakea prostrata*, Stinkwood (*Jacksonia sternbergiana*), and Tree Smokebush (*Conospermum triplinervium*). The Blue Fairy Orchid (*Caladenia deformis*) is restricted in the Park to the scarp. In the rockier parts *Scaevola nitida*, Cockies' Tongues (*Templetonia retusa*) and Chenille Honey-myrtle (*M. huegelii*) dominate the vegetation.

Another component of the closed-scrub is Hackett's Hop Bush (*Dodonaea hackettiana*), an uncommon species restricted to the Metropolitan Area.

Altogether, there are about 250 species of native plants in the bush portion of Kings Park, and about 50 introduced species.

The introduced species include Eastern States eucalypts such as Sugar Gum (*E. cladocalyx*) and Lemon-scented Gum (*E. citriodora*) which are successfully establishing themselves from specimens planted in the past as avenue trees. They are changing the structure of the vegetation to something closer to the original woodland of three storeys, but, as introduced species, are out of place in the bush areas. *Brachychiton populneum* is another escape from cultivation widespread in the bush. Bulbous weeds such as *Romulea* and *Gladiolus* have also invaded large areas.

Ornithologists have recorded more than 60 species of birds in Kings Park, of which about half are regular inhabitants of the Park, either residents or seasonal migrants. Some species such as the Western Silvereye (*Zosterops gouldi*) have maintained large populations throughout the bushland and gardens. The Splendid Wren (*Malurus splendens*), Scarlet Robin (*Petroica multicolor*), and Willy Wagtail (*Rhipidura leucophrys*) disappeared from Kings Park, although an attempt was made to reintroduce the former and there have been occasional recent sightings of the latter. Wattle-birds (*Anthochaera carunculata*) and species of honey-eaters have profited by the planting of the Botanic Garden. Western Magpies (*Gymnorhina dorsalis*) have also increased, following a greater supply of food around barbecue and picnic areas.

The construction of ornamental pools in Kings Park and Botanic Garden has resulted in breeding populations of Black Duck (*Anas superciliosa*) and Wood Duck (*Chenonetta jubata*). The Twenty-eight Parrot (*Barnardius zonarius*) has always been common. The White-tailed Black Cockatoo (*Calyptorhynchus baudinii*) seem to be increasing in number and recently Pink and Grey Galahs (*Cacatua roseicapilla*) have been noted.

The nearby University grounds and Pelican Point provide different environments for birds which supplement those of Kings Park.

The Brush Possum (*Trichosurus vulpecula*) is probably the only native mammal surviving in the Park. Bob-tails (*Tiliqua rugosa*) are conspicuous, and other species of skink are numerous. Dugites (*Demansia affinis*) have been reported.

Kings Park Botanic Garden occupies 17 ha, of which the greater part is devoted to the cultivation and display of the flora of Western Australia, especially the south-west. Altogether, about 3000 species of vascular plants are grown in Kings Park, half of which are Western Australian.

The bushland and Botanic Garden together constitute an important educational and scientific resource. An Advisory Teacher was seconded in late 1975 to the Park's Education Centre to run nature-study programmes, which, during the 1976 and 1977 years respectively, 6000 and 7300 school children attended.

The Park is used regularly for research, some of the principal users being the University of W.A. (Department of Botany and Zoology), the W.A. Institute of Technology (Department of Biology), the Department of Agriculture, the Forests Department and the Commonwealth Scientific and Industrial Research Organisation.

A Regional Park, Kings Park contains numerous landscaped and memorial features, picnic lawns, barbecue fireplaces and playgrounds.

The two larger and more recent playgrounds make extensive use of natural or semi-natural features such as logs and hollow tree-trunks, as well as pools and conventional slides and swings.

Each year there are about two million journeys by motor vehicles through the Park and five million visits by people. The most popular parts of the Park are the look-outs and Botanic Gardens (for tourists) and the playgrounds and picnic areas (for family groups).

The bush, however, is popular with naturalists and walkers, and moreover enhances the developed areas by the setting it provides, creating a sense of isolation and spaciousness.

RECOMMENDATION

The Committee recommends that the Kings Park Board and the Environmental Protection Authority confer with the Minister for Lands on the possibility of new legislation being enacted to meet the special needs and functions of Kings Park in a modern context.

Only three significant areas of wading-bird habitat remain on the Swan River. These are the tidal flats adjacent to the Kwinana Freeway (South Perth), the tidal flats and saltmarsh areas of Point Waylen and Alfred Cove (Attadale) and the tidal flats, marsh and lake of Pelican Point (Crawley).

Alongside the Kwinana Freeway, between South Terrace and Lyall Street is reserve C33803, of 4 ha, for Conservation of Fauna, vested in the Western Australian Wildlife Authority. Stretching along the southern shoreline of the Swan River between Stock Road and North Lake Road is reserve C35066, of 7 ha, for Conservation of Flora and Fauna, also vested in the Western Australian Wildlife Authority. At Pelican Point is reserve A17375, of 25 ha, for Recreation, vested in the National Parks Authority; about 3 ha of the reserve is fenced off as a bird sanctuary.

The vegetation of the area adjacent to the Kwinana Freeway consists largely of a belt of sedgeland of varying width, dominated by Giant Rush (*Juncus pallidus*) and *Scirpus nodosus* with some *Suaeda australis* and *Rhagodia* sp. On the eastern side is some shrubland of the wattle *Acacia saligna*. Some exotic species have become established in the area; the most conspicuous, Poplar and Bamboo, could probably be controlled.

Point Waylen and Alfred Cove are bordered with a belt of samphire (*Salicornia blackiana*), up to 50 m wide in Alfred Cove. The southern portion of Alfred Cove supports extensive areas of sedgeland of *Juncus kraussii*, with a few small patches of Bulrush (*Typha orientalis*). At Pt. Waylen and in the northern part of the cove are areas of closed-heath of *Arthrocnemum* spp. and *Cynodon dactylon*. Near Burke Drive is a narrow belt of low closed-forest of the paperbark *Melaleuca raphiophylla* with an understorey of *Gahnia trifida*; a few Flooded Gums (*Eucalyptus rudis*) border the belt.

A large portion of Pelican Point is covered in sedgeland of *Scirpus nodosus* and Giant Rush, with a few emergent shrubs of wattle (*Acacia saligna* and *A. cyclops*) in places. Near the lake are a few small clumps of Salt-water Paperbark (*M. cuticularis*), a tree of minor occurrence on the Swan River. Further inland, near the fence, is a clump of Swamp Sheoak (*Casuarina obesa*).

These three areas are the only remaining habitat for several thousands of wading birds which migrate to the Swan River each year from their breeding-grounds in northern Eurasia. Twenty-two species of these "transequatorial migratory wading birds" have been recorded on the Swan River, though only a few are plentiful. The most abundant species is the Red-necked Stint (*Calidris ruficollis*) which has its breeding grounds in north-eastern Siberia and western Alaska. In November 1972, 4000 Stint were observed on the tidal flats of the Swan.

The migratory waders of the Swan feed almost exclusively on the invertebrate life (molluscs, worms, crustaceans, etc.) which the tidal flats and marshes provide. If these areas were to be destroyed by dredging or reclamation then existing wader populations could not be maintained. The areas complement each other, depending on tides and weather.

In Alfred Cove there exists an unmodified fossil deposit of sea-shells which is of considerable scientific interest. It can provide precise and reliable data on the extent of the transgression of the sea in this part of the world during the last ice-age. The bed is richly fossiliferous, and has shown that the fauna and the environment of the Swan estuary 6000 years ago were very different from the modern fauna and environment; their interpretation can provide an idea of the climate of the region in earlier times.

The Committee endorses the purposes and vesting of reserves C33803 and C35066.

RECOMMENDATION

The Committee recommends that:

1. the bird sanctuary be excised from reserve A17375 and be made a Class A reserve for Conservation of Flora and Fauna, vested in the National Parks Authority;
2. three aquatic reserves of Class A for Conservation of Flora and Fauna, with boundaries as shown in Figs. , and , be created to incorporate the tidal flats near the Kwinana Freeway at Point Waylen and Alfred Cove, and at Pelican Point; the aquatic reserve at Pelican Point should be vested in the National Parks Authority, while the remaining aquatic reserves should be vested in the Western Australian Wildlife Authority.

F.33 POINT HEATHCOTE

Reserve C32738 extends from the east side of Point Heathcote westwards to The Strand in Waylen Bay. It occupies the shore and the steep slope behind.

The Point itself is a rocky headland of coastal limestone on which a number of native shrubs persist. They include *Acacia cyclops*, *Scaevola nitida*, *Templetonia retusa*, *Grevillea crithmifolia*, *Lepidosperma gladiatum* and *Dianella revoluta*. There is a Tuart tree (*Eucalyptus gomphocephala*) and, on the foreshore, a Salt Sheoak (*Casuarina obesa*).

Along the Waylen Bay slope there is low open-woodland of Banksias (*B. attenuata* and *B. menziesii*) and Sheoak (*C. fraserana*). Other shrubs include Parrot Bush (*Dryandra sessilis*), Tree Smokebush (*Conospermum triplinervium*), Woollybush (*Adenanthos cygnorum*), *Hakea prostrata*, *Eremaea pauciflora*, *Lechenaultia linarioides* and Spearwood (*Kunzea vestita*). There are also Zamias (*Macrozamia riedlei*).

The reserve covers 0.6 ha and is for Recreation, vested in the City of Melville. It should retain this class, purpose and vesting, but the native plants should be conserved by proper management.

RECOMMENDATION

The Committee recommends that:

1. the City of Melville manage reserve C32738 so as to retain as much as possible of the natural vegetation and to encourage its growth and regeneration;
2. any new plantings in the reserves be of local native species of the same plant community;
3. to these ends the City of Melville seek the advice of the proposed Flora Research and Conservation Advisory Service or, prior to its formation, the Department of Conservation and Environment.

F.34 PEPPERMINT GROVE

Reserve A17113 extends along the foreshore of Freshwater Bay northwards from Butler Hump. The reserve occupies about 3.25 ha and is set aside for Recreation. Except for Swan Location 7364, which is leased to the Freshwater Bay Yacht Club, the reserve is vested in the Shire of Peppermint Grove.

The northern end of the reserve - the steep slope between the Scotch College boat shed and The Esplanade - is uncleared, and supports a thriving vegetation, chiefly closed-scrub of mixed species, with emergent Tuarts (*Eucalyptus gomphocephala*). The small area supports 32 plant species, but is significant chiefly for the structure of the vegetation. Few areas of closed-scrub remain in the coastal vegetation of the Coastal Plain; most vegetation that was formerly closed-scrub has had its structure changed by frequent fires. This reserve has apparently remained unburnt for some time, and its specimens of Rottneest Cypress (*Callitris preissii*), wattles (*Acacia xanthina*, *A. rostellifera* and *A. cyclops*), Parrot Bush (*Dryandra sessilis*), Chenille Honey-myrtle (*Melaleuca huegelii*) and Cockies' Tongues (*Templetonia retusa*) are outstanding for their fully developed character. Other common species are *Logania vaginalis* and *Spyridium globulosum* and the creepers *Hardenbergia comptoniana* and *Clematis microphylla*. Less frequent but important species (now rare in the Perth area) are *Dodonaea hackettiana* and Tar Bush (*Eremophila glabra*).

Although both exotic and indigenous shrubs and herbs occur here, the area is none-the-less the best example of natural vegetation by the Swan River downstream from Kings Park, and one of the best examples in the Metropolitan Area of the closed-scrub vegetation characteristic of limestone hills on the Coastal Plain.

The area is also important geologically: it contains one of Australia's major Pleistocene deposits. There are few, if any, sites which contain deposits of comparable age and composition to the emergent shell-bed, a well preserved and informative deposit, near the Scotch College boat shed (Kendrick, pers. comm.).

The Shire of Peppermint Grove has erected a sign at the site that prohibits excavation or removal of material without written permission from that body. Considering, however, the small size and vulnerability of the deposit, further measures may be necessary to preserve it.

The Committee endorses the present status, purpose and vesting of reserve A17113. It draws the attention of the Shire of Peppermint Grove to the significance of the vegetation and of the shell deposit on the reserve, and suggests that the Shire seek advice from the proposed Flora Research and Conservation Advisory Service or, prior to its formation, the Department of Conservation and Environment if required in order to afford greater protection.

F.35 POINT RESOLUTION

Reserve A1624, of 3.5 ha, is situated at Point Resolution. It is for Recreation and is vested in the City of Nedlands, with power to lease.

The shoreline around the point is sandy and rocky, backed by a short steep slope from which jut coastal limestone pinnacles and rocks, often of picturesque form, and many of them revealing the geological structure.

From the Point northwards into Freshwater Bay, much of the natural vegetation persists on the slope. Parrot Bush (*Dryandra sessilis*) is the dominant shrub; other species include *Acacia cyclops*, *Scaevola nitida*, *Jacksonia furcellata*, *Spyridium globulosum*, *Acacia saligna*, *Banksia attenuata* and a few *Acacia xanthina*. A number of plants persist of *Grevillea crithmifolia*, a relatively uncommon species of the coastal limestone between Perth and Mandurah. The sedge *Scirpus nodosus* and the native grass *Sporobolus virginicus* occur along the shore.

Towards the northern end of the reserve, on a sandy flat behind the shore, is a grove of Peppermint (*Agonis flexuosa*); although the species is native to the Perth area, it is not clear whether these trees are natural or planted.

Several exotic tree species are established in the reserve. They include the Fig (*Ficus* sp.) a Pepper tree (*Schinus molle*) and the European Olive (*Olea europaea*). Only the last fits into the landscape of the reserve, and because it is on the river bank and not reproducing it is probably best left there. The two other species, however, are out of place and should be removed.

Three perennial exotic grasses are also established: Veld Grass (*Ehrharta calycina*), Couch Grass (*Cynodon dactylon*) and Buffalo Grass (*Stenotaphrum secundatum*). If the growth and regeneration of the native plants can be encouraged, however, by minimising disturbance by fire and trampling, the thicker cover should cause the grasses to become less prevalent.

The Committee endorses the class, purpose and vesting of reserve A1624.

RECOMMENDATION

The Committee recommends that:

1. The City of Nedlands manage reserve A1624 so as to retain as much as possible of the indigenous vegetation and to encourage its growth and regeneration;
2. any new plantings in the reserve be of local indigenous species from the same plant community;
3. to these ends the City of Nedlands seek the advice of the proposed Flora Research and Conservation Advisory Service or, prior to its formation, the Department of Conservation and Environment.

Along the southern part of Mosman Bay there is a narrow, rocky shore with a dense fringe of the rush *Scirpus nodosus*. Behind this a steep slope rises about 50 m. In places it is sandy, in others the coastal limestone outcrops often as small cliffs. At The Chine, in a cliff by the shore, is a cave of historic interest, for in 1917 it was occupied by Paul ("Bunny") Statham, a draftsman with the Lands Department. He had previously lived in one of the Blackwall Reach caves and travelled by canoe for part of his journey to work.

The steep slope has been disturbed, especially by frequent burning and by pedestrian damage, leading to erosion; but enough natural vegetation remains to be worth conserving. There are scattered Tuart trees (*Eucalyptus gomphocephala*) and thickets of the wattle *Acacia xanthina*. A good population of *Diplopeltis huegelii* occurs on the slope, probably near the type locality. Other species include *Scaevola holosericea*, *Melaleuca acerosa*, Chenille Honey-myrtle (*M. huegelii*), Spider-net Grevillea (*G. thelemanniana*) and *Acanthocarpus preissii*.

The area concerned incorporates reserve C8369 for Recreation, vested in the Town of Mosman Park, and an area of uncommitted reserved land immediately south of Chine Street. The purpose and vesting of reserve C8369 should remain, but it should be managed so as to conserve the natural vegetation where possible and to encourage its growth and reproduction. It is advisable that the area not be burnt. If that is not practicable, fire should be used as sparingly as possible, with an interval of at least five years between burns. Suitably designed footpaths would provide access for pedestrians, reduce erosion and serve as minor fire-breaks.

The Committee endorses the class, purpose and vesting of reserve C8369.

RECOMMENDATION

1. the Town of Mosman Park manage reserve C8369 and the uncommitted reserved land south of Chine Street so as to retain as much as possible of the natural vegetation and to encourage its growth and regeneration;
2. any new plantings in the reserves be of local native species of the same plant community;
3. to these ends the Town of Mosman Park seek the advice of the proposed Flora Research and Conservation Advisory Service or, prior to its formation, the Department of Conservation and Environment.

F.37 CHIDLEY POINT

There are two reserves along the river at Chidley Point: A3346 (4.8 ha) and A25466 (26.1 ha). They are both for Recreation and vested in the Town of Mosman Park.

Although much of the vegetation here has been removed and areas developed for recreation, the remnants should be retained and the growth and regeneration of the flora encouraged by minimising the disturbance caused by fire and trampling. Any plantings should be of local indigenous species that belong to the same community as the surviving species. The surviving trees include some fine Salt-water Sheoak (*Casuarina obesa*), on the river bank, and Slender Banksia (*B. attenuata*) and Parrot Bush (*Dryandra sessilis*) on the sandy slope behind.

Further downstream there is a tall shrubland of species that include *Dryandra sessilis*, *Spyridium globulosum*, *Acacia* (3 species), *Eremophila glabra*, *Calothamnus quadrifidus*, *Scaevola nitida* and *Melaleuca acerosa*. A few Quandong (*Santalum acuminatum*) and Snake Bush (*Hemiandra pungens*) are present; neither occurs elsewhere along the river. The vegetation is in good condition and should be preserved.

The Committee endorses the class, purpose and vesting of reserves A3346 and A25466.

RECOMMENDATION

The Committee recommends that:

1. wherever possible, the Town of Mosman Park retain the native flora of reserves A3346 and A25466 and encourage its growth and regeneration;
2. any new plantings be of local indigenous species that belong to the same community;
3. to these ends advice be sought from the proposed Flora Research and Conservation Advisory Service or, prior to its formation, the Department of Conservation and Environment.

Although the first settlers complained bitterly about makeshift conditions on the sandy Fremantle beaches, almost without exception they marvelled as they moved upstream at the beauty of the Swan River. Especially impressive were the dark limestone cliffs between Arthur's Head and the entrance to Freshwater Bay. The shores of Rocky Bay and the Chine were high, picturesque cliffs, later excavated for building material or for making the breakwaters at Fremantle Harbour. Blackwall Reach is the only relatively untouched area of river limestone left in the region.

The coastal limestone here rises sheer from the river in cliffs about 20 m high; they retain their natural, picturesque, eroded and weathered surface. They are the longest and highest stretch of cliffs on the river, and are a welcome contrast to the highly developed shores downstream, while complementing the opposite bank of the Reach.

A few shrubs cling to the cliff, for example Parrot Bush (*Dryandra sessilis*), *Spyridium globulosum*, *Alyxia buxifolia*, *Olearia axillaris* and the grass *Stipa elegantissima*. Atop the cliffs and reaching back to Honour Avenue is an open-woodland of Tuart (*Eucalyptus gomphocephala*) with Peppermint (*Agonis flexuosa*). Blackboys (*Xanthorrhoea preissii*) are common, together with Parrot Bush.

Blackwall Reach is a significant natural feature of the Swan River and should retain its present character.

The foreshore alongside Honour Avenue, opposite Melville Golf Course, comprises reserve A4813, of 68 ha, for Recreation and Immigrants Home, vested jointly in the Minister for Education and the City of Melville.

RECOMMENDATION

The Committee recommends that portion of reserve A4813 as shown in Fig. be excised and be made a new reserve for Conservation of Flora and Fauna, vested jointly in the Western Australian Wildlife Authority and the City of Melville.

F.39 MINIM COVE (FOSSIL DEPOSIT)

The cliffs bordering the Swan River at Minim Cove, in Mosman Park, expose a richly fossiliferous shell bed that has been the subject of studies by geologists and others for the past 50 years. It was probably deposited towards the latter part of the Pleistocene.

The bed is one of the best preserved and most informative deposits of its age in Western Australia, and is located conveniently close to Perth. Its value to the study and teaching of the history of the Swan River district in the recent geological past is outstanding.

RECOMMENDATION

The Committee recommends that the proposed Geological Sites Committee examine what measures should be taken to preserve the deposits.

F.40 BUCKLAND HILL

This proposal includes the following land:

- i) reserve C9403 (3.5 ha), for Government Requirements, not vested;
- ii) portion of reserve C13374 (4.8 ha), for Water Supply, vested in the Minister for Water Supply;
- iii) portion of reserve C9140 (8.4 ha), for University Endowment, a Crown Grant held in trust by the University of W.A.;
- iv) reserve C27798 (129 m²), for Use and Requirements of the University of Western Australia, a Crown Grant held in trust by the University of W.A.;
- v) reserve C32057 (6214 m²), for Parklands and Recreation, vested in the Town of Mosman Park;
- vi) freehold land, most of which is controlled by the Department of Defence.

Buckland Hill is the only large undeveloped area (apart from Kings Park) along the highway between Perth and Fremantle north of the Swan River. It has significant, though largely intangible, value for its open character, providing relief from the light industry to the south and suburbia to the North.

It was one of several sites considered by Governor Stirling in 1829 as the capital of Swan River Colony. He appeared to be impressed by the notion that high landmarks, especially those overlooking seaway approaches and anchorages, were desirable sites for cities. Buckland Hill, the highest point in the vicinity, was therefore considered, but only briefly, before the present site of the capital was selected.

Remnants of the natural vegetation survive on the north and north-west sides of Buckland Hill. At least twelve species still occur there. There is an open shrubland of species such as Chenille Honeymyrtle (*Melaleuca huegelii*), *Acacia xanthina*, *A. lasiocarpa* and *Grevillea thelemanniana*. Other species include *Diplopeltis huegelii*, *Scaevola holosericea*, *Hybanthus calycinus* and *Beyeria* sp.

The hill on the west side of Stirling Highway opposite Boundary Road also contains some native vegetation on its north side and summit. Here the species include Cockies' Tongues (*Templetonia retusa*), *Acacia cyclops*, Couch Honey-pot (*Dryandra nivea*), Peppermint (*Agonis flexuosa*), *Spyridium globulosum* and *Leucopogon parviflorus*. Victorian Tea Tree (*Leptospermum laevigatum*) has become established here.

In both areas, exotic herbs have become established, and they are now the dominant plant cover over the remainder of the area.

The value of the area is limited in respect of conservation of flora, though that which remains should be protected and its regeneration encouraged.

RECOMMENDATION

The Committee recommends that the open-space character of Buckland Hill be retained; it should not be used for housing or industry, and any development should be designed to retain its present nature as "wide open space".

F.41 CANTONMENT HILL

Cantonment Hill is a significant historical site. Named before almost every other site in the region, it was the eastern end of old Fremantle, as Arthur's Head was the western end. The original road between the two sites was used by settlers to embark at the Cantonment on a ferry for Perth, although strong tides there forced the Governor to move the crossing further up-river. The Cantonment, however, was chosen as the site of the first bridge, and subsequent bridges, across the river at Fremantle. For many years the hill was used as a signal station for vessels entering and leaving the harbour.

The City of Fremantle owns a block of land of about 0.84 ha on the northern side of the hill. The block offers views over the Indian Ocean and the Swan River, including Fremantle Harbour. The site is a prominent one, visible from the Bridge, from Canning Highway and from the river.

The vegetation is a tall open-shrubland of the wattles *Acacia xanthina* and *A. saligna*, Cockies' Tongues (*Templetonia retusa*), *Melaleuca acerosa*, Chenille Honey-myrtle (*M. huegelii*), *Leucopogon parviflorus* and Peppermint (*Agonos flexuosa*). Herbs include *Opercularia vaginata*, *Lomandra glauca*, Yellow Lily (*Tricoryne elatior*), *Loxocarya flexuosa*, *Acanthocarpus preissii* and *Lepidosperma angustatum*. An unusual occurrence is a possible hybrid between *Melaleuca acerosa* and *M. huegelii*.

The block is one of the few pieces of land in Fremantle to retain any natural vegetation. It should be retained as a semi-natural park, the regeneration of the existing vegetation to be encouraged and any replanting to be strictly of species indigenous to the coastal limestone around Fremantle. It is also a natural museum in being an example of the Fremantle landscape at the time of settlement.

RECOMMENDATION

The Committee recommends that:

1. the attention of the Department of Defence and the City of Fremantle be drawn to the natural vegetation on Cantonment Hill, and they be requested to preserve the native flora, encouraging its regeneration and planting only species typical of the local limestone;
2. to these ends the City of Fremantle seek the advice of the proposed Flora Research and Conservation Advisory Service or, prior to its formation, the Department of Conservation and Environment;
3. if the Department of Defence ever relinquishes its part of Cockburn Sound Location 1367, this should be made over to the City of Fremantle for preservation of the landscape and vegetation.

F.42 HARRY SANDON PARK (ATTADALE)

This is reserve C30697, of about 1.1 ha, for Recreation, vested in the City of Melville. It is bounded by Haig Road, Stoneham Road and Bricknell Road.

The area is flat and sandy, and carries a low woodland of Marri (*Eucalyptus calophylla*) with smaller trees of Banksias (*B. attenuata*, *B. ilicifolia*, *B. menziesii* and some *B. grandis*), Sheoak (*Casuarina fraserana*) and *Acacia saligna*. Stinkbushes (*Jacksonia furcellata* and *J. sternbergiana*) are common, as also are Blackboys (*Xanthorrhoea preissii*) and Zamias (*Macrozamia riedlei*), and there is a population of Tree Smokebush (*Conospermum triplinervium*).

Veld Grass (*Ehrharta calycina*) and other weeds occur on the reserve but the vegetation generally is in good condition. A small children's playground has been established at the north end of the reserve.

This and Alfred Cove (see F.32) are the only reserves in Attadale which retain natural vegetation, and the two are quite different. The Committee considers that both reserves should be retained in their natural condition as far as possible.

The Committee endorses the class, purpose and vesting of reserve C30697.

RECOMMENDATION

The Committee recommends that the remaining natural vegetation on reserve C30697 be retained, and that the City of Melville consult the proposed Flora Research and Conservation Advisory Service or, prior to its formation, the Department of Conservation and Environment.

F.43 WIRELESS HILL

A large part of Wireless Hill consists of reserve A29813, of 40 ha, for Public Open Space and Recreation, vested in the City of Melville.

Once used as a telecommunications base, the reserve contains several roads to the summit; following the removal of the service buildings, two lookout towers and a children's playground have been built. Various proposals have been made for development of the reserve.

The reserve is a high, consolidated dune of the Karrakatta Soil-landform unit (Churchward and McArthur 1978). Much of the vegetation has been disturbed to some extent, especially by the removal of timber many years ago. The tree species are slowly regenerating.

In the south-eastern part of the reserve, the woodland is still intact, the trees being Marri (*Eucalyptus calophylla*), Jarrah (*E. marginata*), Slender Banksia (*B. attenuata*), Bull Banksia (*B. grandis*), Menzies' Banksia (*B. menziesii*) and Sheoak (*Casuarina fraserana*).

The understorey contains many shrubby plants including Blueboy (*Stirlingia latifolia*), Jacksonia sericea, Blackboy (*Xanthorrhoea preissii*), Buttercups (*Hibbertia hypericoides*), Couch Honeypot (*Dryandra nivea*), *Scaevola paludosa*, *Daviesia divaricata*, *Persoonia saccata* and Bacon-and-eggs (*Oxylobium capitatum*). Kangaroo Paws (*Anigozanthos manglesii*) and Cats' Paws (*A. humilis*) are common, making good displays in spring.

Around the lookouts, Geraldton Wax (*Chamaelaucium uncinatum*) has been extensively planted.

There is a heavy infestation of Perennial Veld Grass (*Ehrharta calycina*) in the reserve, and it seems unlikely that it can be reduced in the near future since the open habitat encourages its growth. The reserve is of limited value for conservation of flora, although as the only large uncleared area in the district its natural vegetation should be retained where possible. This applies especially to the uncut, south-eastern section.

The Committee considers that development of Wireless Hill should take into account the conservation of the natural vegetation. In this respect the Melville City Council should seek the assistance of the proposed Flora Research and Conservation Advisory Service.

The Committee endorses the class, purpose and vesting of reserve A29813.

RECOMMENDATION

The Committee recommends that wherever possible the City of Melville retain the natural vegetation of reserve A29813, and to this end seek the advice of the proposed Flora Research and Conservation Advisory Service or, prior to its formation, the Department of Conservation and Environment.

F.44 BOORAGOON LAKE

Booragoon Lake lies just north of Leach Highway, in the suburb of Booragoon. It is contained in reserve C25318, of 13 ha, for Public Recreation and Drainage, vested in the City of Melville.

The City of Melville maintains the water level, in part by pumping excess out to Blue Gum Lake and thence to the Canning River. The enriched waters of Blue Gum Lake are not allowed to flow in the reverse direction. Unlike the great majority of Metropolitan lakes, Booragoon Lake's surrounds are well covered in natural vegetation. Around the margin is low woodland and low open-forest of Flooded Gum (*Eucalyptus rudis*) and the paperbark *Melaleuca raphiophylla*. The centre contains dense thickets of *M. teretifolia*.

At one stage the lake was infested with Water Hyacinth (*Eichhornia crassipes*) but this has now disappeared.

Although Booragoon Lake does not support especially large numbers of water-birds it provides habitat for Coot (*Fulica atra*), crakes (*Porzana* spp.), rails (*Rallus* spp.) and Swamphens (*Porphyrio porphyrio*). Ducks nest in the lake, protected by its good cover of vegetation.

The natural appearance of the lake should be preserved; the encouragement of natural regeneration should therefore be preferred to planting, and if any planting is done it should be limited to those species already present.

The Committee endorses the vesting of reserve C25318 in the Shire of Melville.

RECOMMENDATION

The Committee recommends that:

1. the purpose of reserve C25318 be changed to Parkland, Public Recreation and Drainage;
2. as far as possible, the reserve be left in its present condition; the City of Melville should seek the advice of the proposed Flora Research and Conservation Advisory Service or, prior to its formation, the Department of Conservation and Environment.

Mount Henry occupies a prominent headland on the north side of the Canning River 4 km south of its discharge into the Swan River. It consists of Coastal Limestone overlain by sand. The limestone crops out prominently in places.

The area is still well covered with native vegetation though there is some infestation of weeds such as Veld Grass (*Ehrharta calycina*), Cape Weed (*Arototheca calendula*) and Guildford Grass (*Romulea rosea*).

The plants are in general typical of the Karrakatta Soil-landform Unit (Churchward and McArthur 1978). There is an open-woodland of Tuart (*Eucalyptus gomphocephala*), merging into low open-woodland of Marri (*E. calophylla*), Jarrah (*E. marginata*), Christmas Tree (*Nuytsia floribunda*), and Banksias (*B. grandis*, *B. menziesii*, *B. attenuata* and *B. ilicifolia*). Many shrubby species make up the understorey, e.g. *Adenanthos cygnorum*, *Adriana quadripartita*, *Daviesia juncea*, *Dryandra sessilis*, *Eriostemon spicatus*, *Hypocalymma robustum*, *Leucopogon conostephioides*, *Lechenaultia floribunda*, *Oxylobium capitatum*, *Spyridium globulosum* and *Templetonia retusa*. The herbaceous flora is also diverse, containing a number of species in the families Liliaceae, Stylidiaceae, Asteraceae, Haemodoraceae and Droseraceae. Blackboys (*Xanthorrhoea preissii*) and Zamia (*Macrozamia riedlei*) are common. At the base of the hill, near the river, is a small stand of the conifer *Actinostrobus pyramidalis*.

Along the river bank is a different suite of species, such as *Juncus kraussii*, *Scirpus nodosus*, *Suaeda australis*, *Triglochin striata*, *Samolus repens*, *Viminaria juncea*, *Melaleuca cuticularis* and *Sporobolus virginicus*.

In all, over 100 indigenous species occur in the area.

Aquinas College uses it extensively for biological studies; classes visit the area regularly and a number of individual studies have also been made. It also uses Mount Henry for cadet work; its rifle range is situated on the eastern side of the hill. Erosion is a problem, especially on the southern slopes.

Mount Henry is a dominant feature of this part of the Canning River, though on the western side this will be disrupted in the near future by the extension of the Kwinana Freeway. The aesthetic character of the Point is contained in its physical appearance and its natural vegetation. The Committee considers it desirable that it be retained in its semi-natural condition for as long as possible.

RECOMMENDATION

The Committee recommends that:

1. The area outlined in Fig. be declared Region Open Space and purchased when available by the Metropolitan Region Planning Authority;
2. after purchase, it be set aside as a reserve for Parkland and vested in the City of South Perth;
3. for advice in managing the area, the City of South Perth consult the proposed Flora Research and Conservation Advisory Service or, prior to its formation, the Department of Conservation and Environment.

Salter Point is a small peninsula in the Canning River upstream from Mount Henry. In the centre is a lagoon connected to the river by a narrow channel. A dense band of sedges surrounds the lagoon, consisting mainly of *Juncus kraussii* with some *Gahnia trifida*. The soil is semi-saline loam, and in more open areas occur *Suaeda australis*, *Atriplex* spp. and the samphire *Salicornia blackii*. There are several swards of Salt-water Couch (*Sporobolus virginicus*), sometimes mixed with *Samolus repens* and *Scirpus nodusus*. There are several stands of the Salt-water Sheoak (*Casuarina obesa*) while along the river bank are a few paperbarks (both *Melaleuca raphiophylla* and *M. cuticularis*). There is also *Melaleuca viminea*.

Behind the shore is a low sandy rise which is somewhat disturbed but retains a number of native plants including Christmas Tree (*Nuytsia floribunda*), Stinkbushes (*Jacksonia furcellata* and *J. sternbergiana*), *Dasypogon bromeliaefolius*, *Lechenaultia floribunda*, *Lyginia tenax*, Woollybush (*Adenanthos cygnorum*), *Zamia* (*Macrozamia riedlei*) and White Myrtle (*Hypocalymma angustifolium*). There is a solitary *Exocarpos sparteus*.

A narrow fringe of the sedges, samphires and Melaleucas extends north along the river foreshore, but landfill has destroyed it next to Salter Point Parade and in parts of the reserve north of Howard Parade.

However, the north-west corner of the reserve, by the corner of Salter Point Parade and Hope Avenue, contains a dense swamp vegetation dominated by Myrtles, including tea tree (*Leptospermum ellipticum*), *Astartea fascicularis*, *Hypocalymma angustifolium*, *Agonis linearifolia* and *Melaleuca leptoclada*. Other shrubs are *Acacia pulchella*, *A. saligna* and *Viminaria juncea*. There are several stands of Salt-water Paperbark (*Melaleuca cuticularis*). *M. leptoclada* is uncommon, occurring in a few swamps between Perth and Albany.

Reserve C23967, of 7.5 ha, is for Recreation and is vested in the City of South Perth. Although the remaining natural vegetation is limited in extent, it contains an interesting assemblage of species, of which one is uncommon. The lagoon is unique on the Swan and Canning Rivers and is picturesque. Both it and the swamp vegetation by the junction of Salter Point Avenue and Hope Road should be retained in their natural state. Neither should be drained or filled in any way. The fringing vegetation along the river should also be retained, since it contributes significantly to the appearance of the river and protects the banks.

RECOMMENDATION

The Committee recommends that:

1. the City of South Perth retain the remaining natural vegetation in reserve C23967;
2. to this end the Council seek the advice of the proposed Flora Research and Conservation Advisory Service or, prior to its formation, the Department of Conservation and Environment.

The area included here is the strip of uncleared or partly cleared land on the north bank of the Canning River between reserve 23967 and Clontarf Boys' Town. It is of variable width.

The land here is almost flat and, being low-lying and adjacent to the river, is swampy. Several plant communities occur here, and over 30 species of plants have been recorded. There are many groups of Salt-water Paperbark (*Melaleuca cuticularis*) and other paperbarks (*M. raphiophylla* and *M. preissiana*) often with a smaller species, *M. hamulosa*. These stands become very dense towards the eastern end. Sedges such as *Juncus kraussii* are common in the understorey and there are several shrub species such as *Acacia pulchella* and *Hakea varia*.

Some areas are dominated by the sedges *Scirpus nodosus* and *Juncus kraussii*. There are also areas of "samphire" heath where the sedges are mixed with the samphire *Arthrocnemum bidens* and the related *Sueda australis*. Among these occurs *Anthotium humile* var. *junciforme*, an uncommon herb of the Lechenaultia family.

On the shoreline are a few Swamp Sheoak (*Casuarina obesa*) but the bank is mostly protected by a dense growth of *Juncus kraussii*. In some parts, however, there is a low sandy ridge lying just behind the shore.

The variety of vegetation types provides several faunal habitats. Different types of water-body assist in providing the varied habitats, e.g. permanent swamp, tidal marshes, permanent ponds and artificial drains. Many species have been recorded in groups such as Amphipods, Copepods, water-snails and insects.

The area has been somewhat disturbed by drains, sanitary landfill and trail-bikes, but the surviving ecosystem is well worth preserving. There is no similar foreshore vegetation elsewhere on the Canning or Swan Rivers.

The land is currently owned by the Christian Brothers College. Considerable discussion has already been held between the College, the South Perth City Council and the Environmental Protection Authority as to the possibility of preserving the area in its natural state. A report was also made by Dr. T.L. Riggert, then of the Department of Fisheries and Wildlife, who recommended changes in the drainage patterns both to improve the habitat for waterfowl and to reduce the breeding of mosquitoes. The Committee considers that this should be done only after consultation with the Department of Conservation and Environment, for care must be taken to avoid damage to the natural vegetation.

There is agreement among the parties concerned that the area should be retained in its natural state, but the ultimate tenure has not been determined.

The Committee considers that the area should be protected through declaration as Region Open Space, eventually to be acquired and set aside as reserved land.

RECOMMENDATION

The Committee recommends that:

1. the area of Clontarf foreshore as shown in Fig. be declared Region Open Space;
2. the area be acquired when available and reclassified as a Class A reserve for Parkland and be vested in the City of South Perth;
3. subsequent to its declaration as a reserve, the City of South Perth manage it so as to retain the existing natural vegetation and faunal habitat;
4. only the currently disturbed areas be used for recreation.

Two small reserves are involved here. Between Leach Highway and the open water of the river is reserve C29130 (5.4 ha) for Public Recreation, vested in the Town of Canning, while east of the Highway the Creek occupies reserve C32563 (8.2 ha) for Recreation, vested in the City of Melville.

West of Leach Highway the creek is hidden in a dense growth of the paperbark *Melaleuca raphiophylla* and Flooded Gum (*Eucalyptus rudis*), together with the shrubs *Astartea fascicularis*, *Agonis linearifolia* and *Viminaria juncea*. Bracken fern (*Pteridium esculentum*) is also common.

Where the creek widens into the river, it is fringed with a dense growth of *Juncus kraussii*.

Upstream (east) from Leach Highway the creek occupies a narrow gully, with the same species as listed above, although the paperbarks and Flooded Gum are less frequent, and beyond Rossmoyne High School the paperbarks are *Melaleuca preissiana*. In this part of the creek other shrubs are present; one is *Albizzia lophantha*, whose occurrence on the coastal plain is unusual.

The sandy rises on each side of the creek support a low open-woodland of Banksia (*B. attenuata*, *B. menziesii* and *B. ilicifolia*), Sheoak (*Casuarina fraserana*) and Jarrah (*Eucalyptus marginata*). Woollybush (*Adenanthos cygnorum*) and Spearwood (*Kunzea vestita*) are common. Smaller shrubs include *Scholtzia capitata*, *Regelia inops*, *Conostephium pendulum* and *Melaleuca thymoides*.

On the south side of the creek, just east of Leach Highway, is a raised swamp where a number of orchids occur; they include *Diuris laxiflora*, *Prasophyllum* spp., *Caladenia huegelii*, *C. flava*, *Thelymitra pauciflora* and *Pterostylis vittata*. In the creek itself is an uncommon form of *Eriochilus scaber*.

From swampy ground alongside Bull Creek, one of W.A.'s largest dragonflies, *Petalura hesperia*, has been collected. This insect is very rare and hasn't been collected for a number of years. Other areas from which it was known have since been filled or drained; although the actual site of its collection at Bull Creek has since been filled, it may still breed in the area.

Bull Creek is an interesting natural pocket in the midst of suburbia. It serves as a natural drain but contains many species of native plants, and hence is also a ready-made green belt. The area is important in the history of botanical collecting, for the German naturalist Ludwig Preiss made plant collections here in 1838-39.

The Committee believes that this area should be retained for conservation of its flora. The vegetation is too dense to allow for recreation, and opening it up for this purpose would destroy its conservational value.

RECOMMENDATION

The Committee recommends that reserves C29130 and C32563 be cancelled and their area be made a Class A reserve for Conservation of Flora and Fauna, vested in the Western Australian Wildlife Authority.

F.49 CANNING RIVER FROM RIVERTON BRIDGE TO
NICHOLSON ROAD BRIDGE

The Canning River from Riverton Bridge to Nicholson Road Bridge lies in the Town of Canning.

The river and foreshores to varying widths are 'reserved' by the Metropolitan Region Planning Authority for Parks and Recreation; the M.R.P.A. has already purchased land in this area. The following reserves also lie in the area:

C7773, of 17.8 ha, for Parks and Recreation, vested in the Town of Canning;

C26103, of 6.4 ha, for Public Recreation, vested in the Town of Canning;

C20265, of 4.5 ha, for Public Utility, not vested;

C27604, of 1.5 ha, for Recreation, vested in the Town of Canning;

C1289, of 1.0 ha, for Landing Places, under the control of the Town of Canning;

C24717, of 0.4 ha, for Recreation, not vested;

C25474, of 0.3 ha, for Recreation, not vested;

C28740, of 0.3 ha, for Recreation, not vested;

C24973, of 0.2 ha, for Recreation, not vested.

Most of the land is zoned Rural; an area near Wharf Street, on the northern bank, is zoned Urban Deferred.

The total area considered here is about 250 ha, of which more than half consists of relatively little-disturbed, riparian vegetation. This area has been the subject of investigations, including those by Meagher and Le Provost (1975) and Forbes and Fitzhardinge (1977); the latter referred to the area as of major significance for conservation.

It is appropriate to divide the area into two parts with Kent Street Weir as the boundary. The weir, which was built to allow the withdrawal of river-water for irrigation, also prevents saline water from being carried by the tide upstream of it.

Below the weir, halophytic plants such as Swamp Sheoak (*Casuarina obesa*) predominate, whereas they are absent or rare above the Weir.

The grazing of the land to the river banks upstream of the weir has further resulted in differences between the downstream and upstream vegetation.

Below the weir the complex of fringing woodland, 'samphire' heaths and sedgeland constitutes the best surviving example of estuarine vegetation on the Swan and Canning Rivers in the Perth Metropolitan Region. The fact that from the river's surface one's view takes in only water and natural vegetation (all sight of roads being obscured by the trees), and the abundant presence of water-birds, give this stretch the atmosphere of a mini-wilderness.

Blackwell and Cala (in Meagher and Le Provost 1975) have mapped the vegetation. The margins of the river banks and islands carry low open-forest and low closed-forest of Swamp Sheoak and the paperbark *Melaleuca raphiophylla* with a few specimens of Salt-water Paperbark (*M. cuticularis*). About 20 understorey species have been recorded; they consist of sedges, rushes, shrubs, small trees and succulent halophytes. Mistletoe (*Amyema linophylla*) is parasitic on the branches of a number of the sheoaks, and the parasitic vine *Cassytha glabella* is prevalent in the crowns of the *M. raphiophylla*, often matting numbers of trees together.

The main communities of the saline river flats are "samphire" heaths dominated by *Arthrocnemum bidens* and two sorts of sedgeland, one dominated by *Scirpus maritimus* and another by *Juncus kraussii*.

The whole area was originally surrounded by the vegetation characteristic of the Bassendean Soil-landform Unit (Churchward and McArthur 1978), the dominant trees being Marri (*Eucalyptus calophylla*), Jarrah (*E. marginata*), Pricklybark (*E. todtiana*), Sheoak (*Casuarina fraserana*), *Banksia* spp. and Christmas Tree (*Nuytsia floribunda*). Remnants of this vegetation occur on the higher, better-drained land on the periphery of the area considered.

Between the fringing, wetland vegetation and the dry-land vegetation is a transitional area of low open-forest of Flooded Gum (*E. rudis*) and *M. raphiophylla* with the occasional Swamp Sheoak.

Meagher and Le Provost (1975) list 85 species of birds which probably inhabit the area, of which 60 are likely to nest there. 42 species were actually recorded during their survey. Of the 85, 54 are believed to be resident species and 21 are probably migrants; the status of 10 is uncertain. The bird families include cormorants, grebes, ducks (7 spp.), birds of prey (5 spp.), crakes and their relatives, waders (6 spp.), parrots and cockatoos, owls, warblers, whistlers, tree-creepers, pardalotes, honeyeaters and magpies.

For the water-birds, fresh-water soaks that occur near the edge of the wetland are important as a supply of drinking-water.

Although the survey observed no mammals, it was noted that there is suitable habitat for at least three native species : Brush Possum (*Trichosurus vulpecula*), Quenda (*Isoodon obesulus*) and Water Rat (*Hydromys chrysogaster*).

Above Kent Street Weir, the vegetation is largely confined to trees along the banks, the main species being Flooded Gum and *M. raphiophylla*. Bulrushes (*Typha orientalis* and *T. domingensis*) occur in damp, low-lying places near the river. Native water plants include *Hydrilla verticillata*, which forma a dense growth, *Ottelia ovalifolia* and *Azolla* sp.

Below the Footbridge from Willcock Street to Greenfield Street, near Marmot Way, is a backwater or old watercourse with extensive fringing vegetation. The area affords refuge to large flocks of water-birds. The exclusion of saline water from upstream of the weir has made the backwater a valuable drought refuge for many species of water-birds which cannot tolerate saline drinking water.

Another watercourse branches from the Canning River on the south side near Camsell Way and runs back to near Spencer Road, on the other side of Nicholson Road. The vegetation between this course and the main stream, however, has been destroyed.

The Footbridge is thus a convenient, although artificial, boundary to separate the portion of chiefly conservation interest, downstream from it, from the portion upstream, which could more appropriately be allocated to Parks and Recreation.

The Canning River between Riverton Bridge and Nicholson Road Bridge is affected by highway proposals. The Main Roads Department has convened a committee which is investigating the options available to relieve traffic congestion along Albany Highway between Nicholson Road and Manning Road. One of the options being examined is a route to link Spencer Road, at its junction with Nicholson Road, with Chapman Road, to the north-west; it would cross the river just north of Masons Landing (i.e. between River Road and Leige Street).

The South-east Corridor study has investigated alternative routes for north-south arterial roads. One of them would cross the river a short distance upstream from Riverton Bridge. The Committee opposes the construction of any highway through the area below the Footbridge.

Forbes and Fitzhardinge (1977) recommended that:

- i) the whole area between Riverton and Nicholson Road bridges become a wildlife reserve;
- ii) power boats not to be allowed upstream from Riverton Bridge;
- iii) a greater minimum flow of water be maintained in the Canning River; there should be no more dams upriver and the withdrawal of water at Kent Street Weir should cease;

- iv) the Kent Street Weir be removed to allow saline water to penetrate again in order to restore the original fringing vegetation.

The Committee endorses their recommendation to exclude power-boats, since their noise, speed and wake would destroy the atmosphere of peaceful seclusion that characterises this stretch of the river - a seclusion rare and valuable in the metropolitan area - and would disturb the water-birds. It disagrees, however, with recommendation (iv): the vegetation upstream of the Weir already shows its adaption to the reduced salinity by its regeneartion, in areas not too disturbed, of Flooded Gum and *M. rhapsiophylla* and by the absence of Swamp Sheoak. If the weir were removed the intrusion of saline water would probably affect the vegetation adversely and would, moreover, reduce the amount of fresh water available to water-birds. The weir is also a partial deterrent to power-boats. With respect to (i), the Committee believes that only the portion-below the Footbridge is suitable for a wildlife reserve. The Committee's version of recommendation (iii) is given in its recommendation 3, below.

The Committee endorses the Metropolitan Region Planning Authority's 'reserving' the whole area for Parks and Recreation.

RECOMMENDATION

The Committee recommends that:

1. the Canning River between the Footbridge and Riverton Road Bridge together with its banks, islands, river flats and fringing vegetation (Fig.) be made a Class A reserve for Conservation of Flora and Fauna, vested jointly in the Western Australian Wildlife Authority and the Town of Canning; access to the banks should be limited to pedestrians, and power-boats should be excluded;
2. the Canning River between the Footbridge and Nicholson Road Bridge (Fig.) become Parkland for Recreation; the fringing vegetation should be restored and access should be controlled and power-boats should be excluded, the Parkland in this section to be the beginning of a Linear Park extending along the Canning River system through the City of Gosnells;
3. the Kent Street Weir remain to provide a substantial body of fresh water in this district, but that withdrawal of water at the weir and at dams upstream be monitored to maintain a flow of water in the Canning River;

4. no highway be built through the area recommended for Conservation of Flora and Fauna (Fig.);
5. no filling or dumping be allowed anywhere in this area.

The main stream of the Canning River flows from the Canning Dam through State Forest and then through land with a variety of uses and zonings in the Shire of Armadale-Kelmscott and the City of Gosnells. Considered here is the portion between Nicholson Road Bridge and the boundary of the State Forest, together with those parts of the Southern and Wungong Rivers within the City of Gosnells. The river and its banks are 'reserved' as Region Open Space for Parks and Recreation in the Metropolitan Region Scheme and, except for a small portion zoned Urban near Highbury Crescent, are zoned Rural.

Between Nicholson Road Bridge and Royal Street, where Bickley Brook enters from the east, are trees of Flooded Gum (*Eucalyptus rudis*) and the paperbark *Melaleuca rhapsiophylla*. The west bank is fringed with trees. The east bank bears trees fairly thickly near where Yule Brook and Bickley Brook join the Canning, but only thinly between Yule Brook and the railway bridge; elsewhere in this section are scattered trees. Native species have been almost entirely lost from the ground flora, but there are a few tree seedlings near the Spencer Park Golf Course. Growing in the brook that flows through Spencer Park is Watercress (*Rorippa nasturtium-aquaticum*). The weed flora includes species of *Rubus*, *Solanum*, *Ficus*, *Cucumis*, *Inula*, *Conyza* and *Centella*.

Between the confluences with the Canning of Bickley Brook and the Southern River, trees are scattered along both banks. Further south, where the river runs close to the South Western Highway, both banks are fairly well clothed with a line of fringing trees, mainly of Flooded Gum, with occasional paperbarks. The native Water Ribbons (*Triglochin procerum*) grow in the stream. Horses, cattle and sheep have eliminated most of the native ground-cover. Seedlings of *E. rudis* occur locally, and shrubs of *Labiichea punctata*, *Acacia saligna* and *A. pulchella* on the banks, but grasses and weeds (Species of *Cynodon*, *Centella*, *Asclepis*, *Solanum*, *Ricinus*, *Paspalum*, *Rubus* and *Watsonia*) abound.

The Southern River from its confluence with the Canning River to its continuation as the Wungong River, from Verna Street onward, is fairly well clothed with trees of Flooded Gum on both banks, although the native ground flora has been lost over the greater part. *Melaleuca rhapsiophylla* occurs on the Wungong River near the Gosnells boundary and also on the lower part of the Southern River, where *Acacia saligna* occurs also. *Juncus* and *Baumea* species occur in residual patches of reeds and sedges and *Alternanthera nodiflora* grows in the water.

Remnants of woodland of Jarrah (*Eucalyptus marginata*) and Marri (*E. calophylla*) occur in places on the slopes above the banks. Native plants in their understorey, include large clumps of *Cyperus vaginatus* and occasional *Lobelia alata* and *Acacia saligna*. Grasses and weeds, however, species of *Anagallis*, *Ehrharta*, *Briza*, *Cynodon*, *Paspalum*, *Stenotaphrum*, *Mentha*, *Monodenia*, etc., predominate.

The Metropolitan Region Planning Authority has 'reserved' this river system and its banks for Parks and Recreation, and has purchased several parcels of land that adjoin the Canning River, for example between Spencer Road and the river. There are also a number of riverside reserves, mainly for Recreation.

The Authority has proposed 'linear parks' for the Southern and Wungong Rivers and also for sections of the Canning River near Rupert Street and Mills Road, in Gosnells, and for the portion in the Armadale-Kelmscott Shire, extending to the State Forest boundary.

The City of Gosnells has drawn attention to the landscaping about the City offices and Civic Centre in the Mills Road area. It supports the 'linear park' proposals for the whole river system and has proposed the development of Parkland for Recreation in Langford, in the area bordered by Nicholson Road, Spencer Road, Ellison Drive and the Canning River. This is in keeping with the overall 'linear park' concept for the river system.

The creation of 'linear parks' involves the purchase of freehold land when available for the preservation and regeneration of the natural vegetation of the river and its banks, followed by the provision for access on foot, by bicycle and on horseback and for recreation of low impact on the environment. Since the natural vegetation, apart from the aquatic flora, has been reduced to the trees fringing the river, the areas discussed are more suited to landscape conservation and recreation than to biological conservation per se.

RECOMMENDATION

The Committee recommends that:

1. the proposals of the Metropolitan Region Planning Authority and the City of Gosnells for the Canning River from Nicholson Road Bridge to the boundary of the State Forest and for the Southern and Wungong Rivers in the City of Gosnells be joined into one, for the reservation as Region Open Space, purchase when available and consolidation as 'linear' Parkland for Recreation;
2. the 'linear parks' be managed by the appropriate local authorities (the City of Gosnells and the Shire of Armadale-Kelmscott);
3. the area should include the rivers, their banks and the adjoining land to a width of 100 m, or as practicable.

F.51 KENWICK SWAMP (UNIVERSITY RESEARCH AREA)

A block of land bounded by Brook, Bickley and Boundary Roads, in Kenwick, is owned in freehold by the University of Western Australia, and is used for botanical research and teaching. The land is part of Canning Location 382, being Lots 9 to 16 inclusive, 77 and part of 78.

Most of the land is low-lying and seasonally damp or inundated. There is a sandy rise across the block towards the north-eastern end.

A low heath occurs on the swampy flats, where slight changes in elevation (and hence degree of inundation) are reflected in the species composition. In the lowest areas the heath is open with shrubby species such as *Hakea sulcata* and *Petrophile longifolia*. There are many herbaceous species including *Byblis gigantea*, *Utricularia menziesii*, *Polypompholyx multifida*, *Drosera* spp., *Stylidium* spp., *Phylloglossum drummondii*, *Isoetes drummondii*, *Tribonanthes* spp., and several composites.

Where the soil is slightly saline, the samphire *Arthrocnemum halocnemoides* and the unusual *Selenothamnus squamatus* have become established, and there are small meadows of the sedges *Leptocarpus canus* and *L. aristatus*.

On the slightly higher areas the heath is denser. Representative species are *Beaufortia squarrosa*, *Verticordia lindleyi*, *Baeckea tenuifolia* and undescribed species of *Banksia*, *Grevillea* and *Calothamnus*. The last is known only from this area. Emergent above the low shrubs are Swamp Cypresses, *Actinostrobus pyramidalis*.

The sand ridge supports low woodland dominated by *Banksia* (*B. menziesii* and *B. attenuata*), Pricklybark (*Eucalyptus todtiana*) and Woollybush (*Adenanthos cygnorum*). The understorey includes species such as *Jacksonia floribunda*, *Hibbertia* spp., *Conostephium pendulum*, *Hovea trisperma* and *Leucopogon* spp.

Kenwick Swamp is the only surviving area of its kind. Although most of the plants also occur at other localities in the south-west, nowhere else do they occur in the same associations as at Kenwick. As mentioned above, several species are unknown outside the Kenwick area.

The exceptional concentration of unusual plants has attracted and continues to attract botanists, as well as providing a source of research and teaching material for the Botany Department of the University of Western Australia. Many of these plants, such as the carnivorous plants and fern allies, are tiny herbs sensitive to changes in the water-levels.

Because of development of surrounding properties, Kenwick Swamp is threatened by a falling water-table due to drainage and by weed infestation. The latter is accentuated by fire which has become more frequent in recent years and is difficult to control.

With its limited experience in reserve management, the University has a difficult task in conserving this block. The problems of maintaining water levels and controlling fire will require continual attention and the availability of support staff and equipment. The W.A. Wildlife Authority should be involved in the management of the block, because conservation of flora is the prime objective. If the University decides to dispose of it, the land should be acquired by the Government, and declared a conservation reserve. In the meantime the land should be zoned as Region Open Space to ensure that it is not developed.

RECOMMENDATION

The Committee recommends that:

1. the Metropolitan Region Planning Authority zone Kenwick Swamp, as described above, as Region Open Space.
2. should the University of Western Australia wish to dispose of the property, it be acquired, and be made a Class A reserve for Conservation of Flora and Fauna, vested in the Western Australian Wildlife Authority.

F.52 WETLANDS BESIDE EUDORIA STREET, GOSNELLS

North-east of Eudoria Street, in Gosnells, is a wetland and surrounding undeveloped land of more than 12 ha in extent. 8.65 ha of this, in three separate portions, consists of reserve C31993, for Bird Sanctuary and Park, vested in the City of Gosnells and designated Mary Carroll Park. The balance of the area is made up of lots or parts of lots of freehold land. The grounds of the Gosnells Primary School lie in the north-east.

Except for the southern corner, which has been developed for parkland, including a children's playground, the lake is fringed with Flooded Gum (*Eucalyptus rudis*) and the paperbark *Melaleuca raphiophylla*. Some of the paperbark trees are festooned with the parasitic vine *Cassytha* sp. In places are remnants of the transition to woodland of Marri (*E. calophylla*) and *Banksia* spp. There is permanent open water to the north of the centre of the wetland; the remainder is covered with Bulrush (*Typha orientalis*).

The City of Gosnells has discussed with the Department of Fisheries and Wildlife proposals to improve the wetland as a habitat for water-birds, to maintain water-levels and to enable people to see and enjoy the birdlife to better advantage. The Committee agrees with their proposals in principle, and supports the retention of fringing vegetation on the banks and in the water along the northern half of the perimeter. Modification and development should be based on that in the southern corner and limited to the sector of the southern half.

South-west of Eudoria Street, opposite Mary Carroll Park, lies another wetland 5 ha or more in extent. It consists in part of reserve C28361 (2.7 ha) and reserve C29919 (0.9 ha), both for Public Recreation and vested in the City of Gosnells; the balance is composed of parts of various freehold lots.

The wetland is a seasonal swamp. A dense growth of *M. raphiophylla* and Flooded Gum with the occasional *M. preissiana* occurs in the surrounding vegetation, which grades into woodland of Marri and *Banksia*. Bulrushes occur in disturbed places. An infestation of the water with *Salvinia* has been reported during several wet seasons.

The surroundings consist of rights of way and freehold lots, which include houses. There is a playground in part of reserve C29919.

This seasonal swamp forms a contrast to the permanent water in Mary Carroll Park. It provides sanctuary for a variety of birds and is a reservoir of wetland tree species in the area. It should therefore be retained; its purpose should be changed to include Sanctuary for Birds and a management plan should be drawn up.

The Committee endorses the class, purpose and vesting of reserve C31993.

RECOMMENDATION

The Committee recommends that:

1. the wetlands on either side of Eudoria Street, Gosnells, their fringing vegetation and the adjacent land not built upon be declared Region Open Space, and the portion not reserved be purchased when available and added to the existing reserves;
2. after they are joined and enlarged, reserves C28361 and C29919 be reclassified as Class A, and that their purpose be changed to Bird Sanctuary and Park;
3. development and management plans for the wetlands be drawn up to maintain water-levels and to leave substantial areas of the existing vegetation unmodified.

Sir Frederick Samson Park is located between Stock Road and the Applecross Pine Plantation, in the City of Fremantle. It is enclosed by McCombe Avenue, McKenzie Road and a proposed road, Sellenger Avenue, and consists chiefly of reserve C34233, of 8.6 ha, for Public Recreation, not vested, and Cockburn Sound Location 551, lot 629, of 4.6 ha, owned by the City of Fremantle.

The Park lies in a valley. A strip in the south-east, along McCombe Avenue, is cleared land. Most of the remainder is disturbed bush, characteristic of the Karrakatta Soil-landform Unit (Churchward and McArthur 1978). It consists of woodland, principally of Jarrah (*Eucalyptus marginata*), with some Tuart (*E. gomphocephala*) and Marri (*E. calophylla*); there are few understorey trees of *Banksia* spp., or Sheoak (*Casuarina fraserana*). The ground flora is largely dominated by Blackboys (*Xanthorrhoea preissii*), in places mixed with *Zamia* (*Macrozamia riedlei*); other common species include Yellow Pea (*Gompholobium tomentosum*), Red Runner (*Kennedia prostrata*), Bacon-and-eggs (*Oxylobium capitatum*), Stinkwood (*Jacksonia sternbergiana*), *Daviesia divaricata*, Pink Myrtle (*Hypocalymma robustum*), Grey Cottonhead (*Conostylis candicans*), Buttercups (*Hibbertia hypericoides*), *Leucopogon propinquus*, *Pelargonium capitatum*, *Dianella revoluta*, Telegraph Sedge (*Mesomelaena stygia*), *Pimelea* sp. and the climber *Hardenbergia comptoniana*. Yellow Pea occurs in two forms, one with bright yellow and the other with pale yellow flowers. Altogether, over sixty species have been recorded.

The area is being much abused at present. The bush is dissected by off-road vehicle tracks, and a strip cleared for some other purpose runs north-west from the pumping station (location 630; see Fig.). It has also suffered from frequent fires, resulting in a very open understorey with much bare ground and invasion of weeds; the southern portion was burnt in 1977-78. The area has deteriorated noticeably since Spring 1977.

The Park presents one of the few opportunities in Fremantle to set aside an area of bush, and the City Council is considering preserving the vegetation, the plan to include fencing the area to keep out off-road vehicles and providing footpaths through the area.

RECOMMENDATION

The Committee recommends that:

1. the purpose of reserve C34233 be changed to Parkland and Recreation and that the reserve be vested in the City of Fremantle;
2. to this end, the City of Fremantle consult the proposed Flora Research and Conservation Advisory Service or, prior to its formation, the Department of Conservation and Environment.

North Lake and Bibra Lake lie immediately east of North Lake Road and its extension as Forrest Road, on opposite sides of Hope Road. These two lakes and some smaller associated wetlands are the northernmost lakes in the eastern chain of the Cockburn Wetlands. Bibra Lake is contained in reserve A6208, of 103 ha, for Recreation, under the control of the Town of Cockburn. North Lake is freehold. The lakes, their foreshores and some surrounding land have been "reserved" by the Metropolitan Region Planning Authority for Parks and Recreation.

Most of Bibra Lake is open water. In the east are extensive areas of *Melaleuca teretifolia*, which mostly forms pure areas of closed-scrub 3 m tall, but in places it occurs mixed with the paperbark *M. rhapsiophylla*, the latter growing to 8 m tall. Bordering the open water in the north and the south-west are sedgeland of Jointed Twig Rush (*Baumea articulata*) and Bulrush (*Typha orientalis*). In the west, between the lake and the road, is a fringing belt of Flooded Gum (*Eucalyptus rudis*) and *M. rhapsiophylla*. In the north-east, just south of Hope Road and east of Meller Road, is about 20 ha of open-woodland characteristic of the Bassendean Soil-landform Unit (Churchward and McArthur 1978); the dominant trees are Jarrah (*E. marginata*), Menzies' Banksia (*B. menziesii*), Slender Banksia (*B. attenuata*), Holly-leaf Banksia (*B. ilicifolia*) and Bull Banksia (*B. grandis*), while the understorey contains large amounts of Blueboy (*Stirlingia latifolia*), Prickly Moses (*Acacia pulchella*), Zamia (*Macrozamia riedlei*) and Blackboy (*Xanthorrhoea preissii*). Most of the remainder of the area is cleared, much of which is used for summer pasture. The southern end of the lake was used as a rubbish tip, which is now closed.

North Lake, which covers about 23 ha, is also mostly open water. In the north are a few small patches of Jointed Twig Rush. *M. teretifolia* is present but only in small areas. Around the western and southern sides of the lake is a fairly broad band of woodland of Flooded Gum, with which the paperbark *M. preissiana* is associated around the fringes of the lake. Similar vegetation is found around the north-eastern portion of the lake, where *M. rhapsiophylla* is also present. Only in the south-east has extensive clearing taken place right down to the water. East of the lake and north of Hope Road are two areas (about 36 ha and 5 ha) of open-woodland similar to that north-east of Bibra Lake. Only about 13 ha of the woodland north of Hope Road is within the land "reserved" for Parks and Recreation by the M.R.P.A., although the remainder is "reserved" for Public Purposes. East of the open-woodland is low woodland of *M. preissiana* and *M. rhapsiophylla*.

Both lakes are semi-permanent and are important as summer refuges for water-birds. Good numbers of Grey Teal (*Anas gibberifrons*), Pink-eared Duck (*Malacorhynchus membranaceus*), Blue-winged Shoveller (*Anas rhynchos*), Mountain Duck (*Tadorna tadornoides*) and White-eyed Duck (*Aythya australis*) use the lakes; far smaller numbers of those species are seen on most other metropolitan lakes. The lakes' expanses of open water favour such species as Musk Duck (*Biziura lobata*), Blue-billed Duck (*Oxyura australis*), Coot (*Fulica atra*) and Hoary-headed Grebe (*Podiceps poliocephalus*).

Bibra Lake is the more important lake, owing to its larger size and greater variety of habitat. The large expanses of closed-scrub of *Melaleuca teretifolia* and nearby muddy shallows provide ideal habitat for wading birds; species include White-faced Heron (*Ardea novaehollandiae*), White-necked Heron (*A. pacifica*), Nankeen Night Heron (*Nycticorax caledonicus*), White Ibis (*Threskiornis molucca*), Yellow-billed Spoonbill (*Platalea flavipes*), Red-necked Avocet (*Recurvirostra novaehollandiae*), White-headed Stilt (*Himantopus himantopus*) and Black-fronted Dotterel (*Charadrius melanops*). The yellow-billed Spoonbill is uncommon in South-western Australia. The *M. teretifolia* also provides ideal habitat for a number of bush birds, including Willy Wagtail (*Rhipidura leucophrys*), Silvereye (*Zosterops lateralis gouldi*), Splendid Blue Wren (*Malurus splendens*), Singing Honeyeater (*Meliphaga virescens*) and Western Thornbill (*Acanthiza inornata*). This area is of prime importance for preservation since it provides one of the few productive breeding-habitats of the Metropolitan Area.

The lakes will be under increased pressure for recreation as population increases in the area. The western shore of Bibra Lake is already popular. The lakes and surrounding areas should be zoned so that some areas are developed for recreation while the most biologically important are retained as important conservation areas.

Already, part of the area is being misused by the public; the north-eastern portion is being used extensively for trail-bike riding and also to some extent for cutting of wood.

North Lake is threatened as an area for conservation and recreation by the proposed extension of Farrington Road as a dual carriageway around the north of the lake. The Committee endorses the recommendation of the Cockburn Wetlands Study (Newman 1976) that the proposed extension not be built. The proposed Roe Freeway is planned to run between the lakes; the Committee also endorses the Study's recommendation for the modification of the Freeway to reduce its impact on the wetlands in the area.

The Committee endorses the status, vesting and purpose of reserve A6208 and the proposal by the MRPA to include the lakes in Region Open Space for Parkland and Recreation.

RECOMMENDATION

The Committee recommends that:

1. the southern end of Bibra Lake not be used again for dumping of rubbish;
2. the biologically important eastern shores of the lakes be given high priority for conservation; development should be limited to facilities for nature study;
3. the stands of *Melaleuca raphiophylla* on the west and south-west shores of Bibra Lake, be retained;
4. where possible, the regeneration of the natural vegetation be encouraged, such as in the cleared paddocks west of Meller Road, and around North Lake; any planting undertaken should be restricted to the species that occur naturally around the lakes;
5. for advice on the management and the regeneration of the flora, the Town of Cockburn consult the Wetlands Advisory Committee and the proposed Flora Research and Conservation Advisory Service.

Near Coogee Beach is reserve A24306 for Recreation and Purposes Incidental Thereto. It covers 15 ha and is under the control of the Town of Cockburn.

The portion of the reserve south of the caravan park contains vegetation of great significance. Garden Island and the mainland between Coogee Beach and Woodman Point are now the only places in System 6 that contain significant areas of the Callitris Community (Speck 1952), a community once widespread along the coast on the lee side of the coastal dunes. Although the remnant of the community in reserve A24306 is more disturbed than that immediately to the south, in the explosives reserve and the Quarantine Station, reserve A24306 provides the only area that is readily accessible to the Public.

The vegetation consists of low open-forest of Rottnest Cypress (*Callitris preissii*). The Cypress is mostly in pure stands, but in places is mixed with other shrubs that attain a similar height, such as Chenille Honey Myrtle (*Melaleuca huegelii*), *Spyridium globulosum*, *Exocarpus sparteus* and *Acacia cyclops*. Occurring as a sparse understorey, or around the edges of the woodland, are Berry Saltbush (*Rhagodia radiata*), *Leucopogon parviflorus*, *Acacia coclearis*, *Melaleuca acerosa* and *Scaevola crassifolia*.

Burning has been carried out in places around the edges of the forest. In those places the Cypress has been killed, the species being very sensitive to fire. In the absence of fire it regenerates readily.

The Committee endorses the present status and vesting of reserve A24306.

RECOMMENDATION

The Committee recommends that:

1. the Town of Cockburn manage the portion of A24306 south of the caravan park to preserve the Rottnest Cypress, seeking the advice of the proposed Flora Research and Conservation Advisory Service or, prior to its formation, the Department of Conservation and Environment;
2. no species be planted which is not already present in that portion of the reserve.

G

G.1 ROTTNEST ISLAND

Rottnest Island comprises reserve A16713, of 1628 ha, vested in the Rottnest Island Board for the purpose of Public Recreation.

History

"Discovered" in the seventeenth century by Dutch navigators, it was named "Rottenest" by Willem de Vlamingh in 1696. Though settled for agriculture soon after the first settlers reached the Swan River in 1829, the Government resumed all private holdings on Rottnest in 1839, following its establishment as an Aboriginal prison the previous year (Playford and Leech 1977). This new status appears to have greatly affected the island's flora and fauna. Natural vegetation was cleared for farming so that the prison community could be self-supporting; trees were felled for timber and posts; sheep and cattle were introduced as were many exotic plants, mostly grasses and herbs; and prisoners were allowed to hunt quokkas for food, using their traditional burning techniques.

When the island ceased to be an Aboriginal prison it was developed as a holiday resort for the Governor. Quokka shooting was a favourite sport and fire continued to be used to disclose game (Forests Department 1975; Storr 1968). The growth of resort facilities on Rottnest during this century was initially slow, but in recent years, in response to the increasing popularity, a major expansion programme was begun. A second settlement facing Geordie and Longreach Bays was begun in 1976.

The Physical Environment

The greater part of the island is covered by undulating sand hills. A chain of lakes bound by shell beds dominates the north-eastern sector, and covers about a tenth of the island. Many small swamps and soaks, mainly located in interdunal depressions, are scattered around the eastern half of the island. The serrated coastline consists of a succession of exposed limestone headlands and sandy bays, with rock platform extending seaward in many points. Smaller islands with rocky islets dot the surrounding waters.

Vegetation : History

Rottnest Island's vegetation has changed dramatically since human occupation. Early visitors to the island - Volkersen in 1658, Vlaming in 1696, Hamelin in 1801, Freycinet, Guichenot and Leschenault de la Tour in 1803, King and the botanist Cunningham in 1822 - all commented on the almost impenetrable low closed-forest that covered the island. Cunningham noted the abundance of Rottnest Cypress (*Callitris preissii*), the dominant species, and of Rottnest Tea-Tree (*Melaleuca lanceolata*) and *Pittosporum phylliraeoides*.

Since then changes have occurred, chiefly from the combined effects of fire and quokka grazing. Fire gradually eliminated most of the *Callitris* and *Melaleuca* and favoured *Acacia rostellifera*. By the early 1900s the *Acacia* was the dominant plant. Since that time, however, the *Acacia* has become very fragmented, owing to grazing by quokkas, whose numbers increased in the 1930s. Closed-heath of *Stipa variabilis* and *Acanthocarpus preissii* is now by far the most widespread plant community on the island.

Vegetation : Present

The island supports 12 plant communities (O'Connor 1977); the following describes the most significant of them.

Closed-heath of *Stipa variabilis* and *Acanthocarpus preissii* covers most of the island west of the lakes. Other species present are *Poa caespitosa*, *Thomasia cognata*, *Guichenotia ledifolia*, *Conostylis candicans*, *Asphodelus fistulosus*, *Trachyandra divaricata* and, occasionally, *Diplolaena dampieri*.

Within the area covered by the above community are small patches of *Acacia rostellifera*. The *Acacia* forms closed-scrub, with few associated species.

Confined to the eastern end of the island are patches of closed-scrub and low closed-forest of Rottneest Tea-Tree, whose height ranges from 2 or 3 m to 10 m, depending on exposure to the prevailing wind. Little other vegetation can exist under the dense canopy, although around Bickley Swamp partial clearing has resulted in a more open canopy, allowing *Acacia rostellifera* to associate with the Tea-tree. Also confined to the eastern end, on limestone ridges near the major lakes, is closed-heath 1.5-2.0 m tall of Cockies' Tongues (*Templetonia retusa*), in places mixed with *Beyeria viscosa*, *Alyxia buxifolia*, *Pittosporum phylliraeoides* and Rottneest Cypress.

There is some understorey of *Phyllanthus calycinus*, *Westringia rigida*, *Stipa variabilis* and *Acanthocarpus preissii*. Also present is the creeper *Clematis microphylla*.

On the stable dunes around Narrowneck and elsewhere closed-heath occurs, the principal species being *Westringia rigida*, *Olearia axillaris*, *Rhagodia* spp., *Scaevola crassifolia*, *Threlkeldia diffusa* and *Senecio lautus*.

In areas with limestone at or near the surface, such as at Parker Point and in places east of Narrowneck, closed-heath of *Acacia truncata* occurs. Various species associate with the *Acacia*, depending on conditions such as exposure and soil depth; the most significant are *Olearia axillaris* and *Westringia rigida*.

Occurring as a narrow margin of vegetation at the edge of salt lakes is a community of halophytic plants, the chief species being *Salicornia quinqueflora*, *Arthrocnemum arbuscula*, *Atriplex paludosa* and *Gahnia trifida*.

Some areas - sand blowouts - support little or no vegetation. Although blowouts occur naturally, their initiation and spread is helped by fire and by disturbance of the soil. Blowouts occur in 22 locations on the island, and their total area has increased steadily from 8.0 ha in 1941 to 27.75 ha in 1974 (Forests Department 1975).

Fauna

Rottnest Island's avifauna is particularly noteworthy. The variety and abundance of birds are related to the island's multiplicity of habitats : steppe, heath, scrub, samphire, salt-lakes, brackish swamps, fresh-water soaks, sandy beaches, rocky coasts and offshore islands and rocky inlets. The forest and woodland are visited in winter by the Fan-tailed Cuckoo (*Cacomantis falbelliformis*), which is common and breeds on Rottnest Island; by contrast it is only a passage migrant around Perth. The scrub of *Acacia rostellifera* is the habitat of the Golden Whistler (*Pachycephala pectoralis*) and the Red-capped Robin (*Petroica goodenovii*). The latter is replaced by the Scarlet Robin (*P. multicolor*) on the mainland except in the drier country north and east of the Jarrah forest. The Spotted Scrub-Wren (*Sericornis maculatus*) inhabits the dunes, and is most numerous from Narrowneck along the south coast to May Cove. The commonest species in the dunes is the Singing Honeyeater (*Meliphaga virescens*). The open *Stipa-Acanthocarpus* country supports the Pipit (*Anthus novaeseelandiae*), the White-fronted Chat (*Epthianura albifrons*), the Raven (*Corvus coronoides*) and the Kestrel (*Falco cenchroides*).

The Singing Honeyeaters are darker than those of the adjacent mainland, and constitute an endemic race. The changes in the vegetation, especially the reduction of forest and scrub, have been accompanied by the extinction on the island of some species of terrestrial birds and the reduced numbers of others. The Brush Bronzewing (*Phaps elegans*) and the Rufous Whistler (*Pachycephala rufiventris*) have disappeared, and the numbers of Golden Whistler, Red-capped Robin and Spotted Scrub Wren have declined.

The salt lakes near the eastern end of Rottnest Island provide water-bird habitats that are not duplicated on the Swan Coastal Plain (Riggert 1966). These are Government House Lake, Serpentine Lake, Garden Lake, Herschell Lake, Lake Baghdad, Lake Negri and Pink Lake. Government House Lake and, to a lesser extent, Serpentine and Baghdad Lakes are occupied by the Banded Stilt (*Cladorhynchus leucocephalus*) for most of the year (October - April). At the height of the season 2000-5000 birds are present. They feed almost exclusively on Brine Shrimp (*Artemia salina*), whose abundance depends on the salinity of the water. It is important, therefore, to ensure that the salinity of Government House Lake is not altered. All of the salt lakes, and in particular Government House, Serpentine and Baghdad Lakes, support the Mountain Duck (*Tadorna tadornoides*), which breeds in winter and spring (Riggert 1969). The Mountain Duck is dependent upon freshwater seepages and food resources associated with the salt lakes. An island in the middle of Baghdad Lake supports a colony of Fairy Terns (*Sterna nereis*) throughout the summer.

The shores of the above lakes are occupied in summer by huge flocks of birds that breed in northern Asia. The flocks are composed of the following species (in order of decreasing abundance): Little Stint (*Calidris ruficollis*), Curlew Sandpiper (*Calidris ferruginea*), Turnstone (*Arenaria interpres*), Sanderling (*Crocethia alba*), Large Sand Dotterel (*Charadrius leschenaultii*), Sharp-tailed Sandpiper (*Calidris acuminata*), Hooded Dotterel (*Charadrius cucullatus*), Greenshank (*Tringa nebularia*) and Golden Plover (*Pluvialis dominica*) (Hodgkin and Sheard 1959).

Fresh-water and brackish swamps - Barker, Lighthouse, Salmon, Bickley, Aerodrome and Bulldozer Swamps - contain a range of aquatic communities, and also provide important habitats for birds. Bulldozer Swamp is especially important; its fresh water supports the island's entire population of Mountain Ducks during late summer.

Rottnest Island's fauna of marine birds owes its great diversity largely to the surrounding islands and rocky islets on which they breed. The chief islands are Dyer's Island, Green Island and Parakeet Island.

A breeding colony of Rock Parrot (*Neophema petrophila*) exists on Dyers Island. This species was once plentiful on Rottnest but is now extremely rare. The island also supports a large breeding colony of Pied Cormorant (*Phalacrocorax varius*) and breeding colonies of Wedge-tailed Shearwater (*Puffinus pacificus*), Caspian Tern (*Hydroprogne caspia*), Bridled Tern (*Sterna anaetheta*) and Crested Tern (*Sterna bergii*).

Green Island supports breeding colonies of Wedge-tailed Shearwater, Little Shearwater (*Puffinus assimilis*), Red-tailed Tropic-bird (*Phaethon rubricauda*), Caspian Tern and Crested Tern.

Parakeet Island contains breeding colonies of Wedge-tailed Shearwater, Caspian Tern, Bridled Tern and Mountain Duck. Little Shearwaters and Rock Parrot, which used to breed on Parakeet Island, no longer do so because of the number of people who scramble over the islet during the breeding season (Storr 1975).

A number of rocky islets lie close to Rottnest Island. They are important for the breeding of Ospreys (*Pandion haliaetus*), which, in order to be safe from predators (including man), select rocks at sea that are remote from main islands. Their nests on eight rocky islets have been observed by visitors to Rottnest Island. The occurrence of this cosmopolitan bird in the area is of international importance.

Rottnest Island supports two native mammals, the Quokka (*Setonix brachyurus*) and the Australian Sea-Lion (*Neophoca cinerea*). The Quokka is outstandingly suitable for research, especially in the fields of pathology (Muscular dystrophy), immunology, microbiology

epidemiology and cancer, and since the 1950s important studies on the animal - some of them of international significance - have been carried out at the Rottnest Biological Station.

Colonies of Australian Sea-lions visit Rottnest's coastline and offshore islands; they use Dyer Island almost continuously. The population of the animal has been greatly reduced in the Abrolhos Islands and the species has been described as not being very abundant by a world authority (King 1964).

Two of Rottnest's reptiles, the Shingleback Skink (*Tiliqua rugosa*) and the Dugite snake (*Demansia affinis*) are of interest in being morphologically distinct from mainland specimens. Moreover, the Lined Skink (*Lerista lineata*) is a rare reptile found only on Rottnest and Garden Islands and in a few southern suburbs of Perth; its future survival on the mainland is uncertain.

The marine flora and fauna around the shores of Rottnest Island are rich and diverse and the underwater scenery is attractive (see G.6 : Aquatic Reserves).

Use by Public

Large and increasing numbers of people visit Rottnest Island: in 1970, a total of 93 140 visits were recorded, and in 1977, 257 535 visits - an increase of 178 per cent.

Pressures for more transport and accommodation capacity are likely to arise. The recreational value of Rottnest Island for day-trippers can be expected to draw in an ever increasing number of visitors owing to the coastal expansion of Perth along the South-west and North-west Corridors and the enlarged absolute size of the metropolitan population. Especially to those people living near the urban core, the urban expansion of Perth's coastal corridor may cause many previously popular coastal areas, such as Rockingham and Mandurah, to lose their recreational appeal.

Current estimates predict that the population of System 6 will increase to about 1 550 000 by the year 2000. This would represent an absolute growth of about 80 per cent from 1976.

The number of visitors that the island can accommodate at any one time is being increased by the construction of the new settlement at Geordie Bay and Longreach Bay. 2350 persons arrived at Rottnest by ferry on 4th January, 1978 - the greatest number recorded on any single day so far. The operation of the new ferry, larger than any of its predecessors, and the growing numbers of private boats that travel to the island are allowing increasingly large numbers of people to visit the island.

Management Plan

Because of the considerable importance of Rottnest Island and adjacent waters to the community of Western Australia as a recreation, conservation, historic and scientific area, there is a need for a management plan to be established, just as management plans are required by the National Parks Authority and the Western Australian Wildlife Authority. Such a plan should, *inter alia*, define areas for which priority is given to the conservation of flora and fauna, and detail the management regime to be introduced for those specific areas.

The plan may state that for some of the conservation areas, for example offshore islands, the only management required is that they be left in their present state, whilst for others active manipulation may be required, such as the fencing of areas to keep out Quokkas.

The importance of Rottnest Island as an area of natural beauty and historic, recreational and scientific importance is outlined in the above text. What must also be stressed, however, is the fragile nature of the island's natural attributes. Even with the adoption of a management plan, the controlling body must have both the power and expertise to implement and administer such a plan. The section in the Introduction on Regional Parks and Urban Reserves documents the shortcomings of the act under which the Rottnest Island Board is constituted. Thus the recommendation included in the section on Regional Parks and Urban Reserves is relevant to Rottnest Island.

RECOMMENDATION

In view of the considerable importance of Rottnest Island and adjacent waters to the community as a recreation, conservation, historic and scientific area, and in view of the number of public submissions proposing zoning or management changes, the Committee considers that there is a need for the future management of the area to be based on expert advice and multiple land-use plans; to this end, the Committee recommends that special Government legislation be enacted to provide for a Rottnest Island Management Authority, and that the Government seek the advice of the Environmental Protection Authority in drafting the legislation.

G.2 CARNAC ISLAND

Carnac Island is about 3 km north of Garden Island and covers about 19 ha. The island comprises reserve A26646, for Recreation and Conservation of Fauna, vested in the Western Australian Wildlife Authority.

McArthur (1957) identified seven plant communities on the island. The two communities that occupy the greatest areas are open-scrub of *Acacia rostellifera* and open-heath of *Olearia axillaris* and *Scaevola crassifolia*.

Thirty three species of birds are recorded from the island, at least eight of which breed there. The island is noteworthy as the only area of overlap between the breeding ranges of the Little Penguin (*Eudyptula minor*) (northern limit of range) and the Wedge-tailed Shearwater (*Puffinus pacificus*) (southern limit of range). Both make burrows, and the penguins sometimes use those made by the Shearwaters (Watson 1959).

The island contains the greatest concentration of Tiger Snakes (*Notechis scutatus*) in Western Australia, and is internationally important as a source of venom for scientific research.

Australian Sea-lions (*Neophoca cinerea*) commonly nest on the island.

There are limestone reefs around the island which vary considerably in their exposure to waves. The eastern side of the island has a small, shallow bay with seagrass meadows. The western side has extensive exposed intertidal reef-flats. The southern and northern ends have small sheltered rocky bays and narrow fringing reef-flats. Offshore there are several deeply cavernous sublittoral reefs.

Faunistically, the reefs and sublittoral shallows are rich and diverse. As well as species typical of the mainland reefs, there also occur two species of echinoderms (*Austrofromia polypora* and *Plectaster decanu*) which are rare or unknown in reefs around Fremantle and other offshore islands. There is also a rich marine flora.

Study of the reefs' intertidal ecology is important in understanding the distribution of littoral fauna on the mainland reefs.

The island has great value as a place to which people can make day-visits to study marine life. An aquatic reserve has been proposed for the waters surrounding Carnac Island (see G.6).

RECOMMENDATION

The Committee recommends that the present status of Carnac Island remain unchanged, but that the reserve be extended to the Low-water Mark at ordinary tide.

G.3 GARDEN ISLAND

Garden Island lies 45 km south-west of Perth. It has an area of 1214 ha, being 9.5 km long and 1.5-2 km wide at its widest point. The southern tip of the island is only 2 km from Point John on the mainland but for most of its length it lies between 5.5 km and 9 km west of the mainland. The island is owned by the Commonwealth of Australia, which is developing it as a naval base.

History

Though sighted by many early Dutch navigators, Garden Island has never generated the same public interest as Rottnest Island.

In his voyage of exploration in 1827 James Stirling was impressed by the island's potential as a naval station, protecting vessels at anchor in Cockburn Sound. When he returned to the Swan River Colony as its Governor two years later, Stirling selected the whole of Garden Island as part of his land grant. The first settlers landed there and spent the winter of 1829 in huts at Cliff Head before moving to the mainland. The island is therefore a very significant historical site.

Though it remained a fairly popular resort for day-trippers and, to a lesser extent, vacationers, Garden Island's future was decided in 1970 when the Commonwealth Government decided to develop it as a major naval base. A large part of the island has been classified for naval use, although some of the northern and central parts are available for tourists. A causeway has been built linking the mainland to the southern end of the island, but access is restricted to naval officials.

Geology

The island consists of a hard core of travertinized, calcareous dune rock of Pleistocene Age (Fairbridge 1948) which is largely covered by more recent sand dunes.

Flora

Garden Island's vegetation is remarkable for three reasons. First, certain important families on the mainland are either absent (Proteaceae) or represented by few species (Myrtaceae and Fabaceae). Second, pure stands of Rottnest Cypress (*Callitris preissii*) such as occur there, are rare. Third, the structure of much of the vegetation with its single storey and closed canopy is rare elsewhere and contrasts markedly with the three distinct storeys of the woodland communities on the mainland.

More than ninety per cent of the vegetated portion of the island is covered in low closed-forest or closed-scrub of *Acacia rostellifera*, Rottnest Cypress, Rottnest Tea Tree (*Melaleuca lanceolata*) and Chenille Honey Myrtle (*M. huegelii*).

Most of the Cypress and Tea Tree occur in the northern half of the Island. The Cypress and Tea Tree forest north of Collins Point, however, is of different character from that elsewhere (except for a small area of the Tea Tree forest bordering Careening Bay). Here the trees are tall and mature; elsewhere they form sapling-like stands. This results from the island's fire history. In 1956 a fire burnt the central part of the Island, from just north of Careening Bay to Collins Point, killing the fire-sensitive Cypress and Tea Tree, which afterwards regenerated from seed. McArthur (1957) estimated the age of the oldest Cypress trees in the northern part of the island at 40 years, suggesting that the part of the island north of Collins Point has not been burnt for about 60-65 years. This portion of Garden Island is therefore especially important as an example of undisturbed coastal vegetation, and is probably similar to the vegetation seen on Rottneest Island by the early explorers.

There is a proposal to resite the munitions dump, currently on the mainland, just north of Woodman Point, to Garden Island, north of Collins Point.

Over half the island is dominated by *Acacia rostellifera*, which forms closed-scrub 2.5-3 m tall. Other *Acacia* species, principally *A. saligna* and *A. cochlearis*, and Chenille Honey Myrtle are interspersed with *A. rostellifera*. Undergrowth is usually present but is generally restricted to *Stipa variabilis*, *Phyllanthus calycinus* and *Acanthocarpus preissii*.

Rottneest Cypress forms pure stands and mixed stands with Rottneest Tea Tree in the northern part of the island. The undergrowth is very limited, and the ground is carpeted with a thick layer of leaf litter.

Rottneest Tea Tree occurs as pure stands over about seven per cent of the island, where the formation is similar in character to the Cypress formation. It also occurs in association with *Acacia rostellifera* or with the Cypress.

Along the western side of the island are small areas of closed-heath, the dominant plants of the various associations being *Boobialla* (*Myoporum adscendens*), *Acacia cochlearis* and *Pittosporum phylliraeoides*.

On rocky cliffs bordering the sea grow succulent plants such as *Carpobrotus virescens*, *Tetragonia implexicoma*, *T. zeyheri*, *Wilsonia backhousei* and *Nitraria schoberi*, and on sandy beaches grow *Olearia axillaris*, *Calocephalus brownii*, *Angianthus cunninghamii*, *Arctotheca rivea* and *Spinifex hirsutus*.

Fauna

The best known animal on Garden Island is the Tammar (*Macropus eugenii*), a small wallaby that was once widespread in the south-west of Western Australia but which has now become rare. The Tammar, under natural conditions, inhabited the dense scrub which

covered most of the island, although the carrying capacity of the *Acacia rostellifera* scrub was 8½ times that of stands of Rottnest Tea Tree and Rottnest Cypress (Garden Island Report 1974). The population was estimated at about 900 before construction of the naval facility began, and it is estimated that about 700 animals will remain following development.

Concern has been expressed that domestic cats which have become feral on Garden Island may eventually cause the extinction of the Tammam unless measures are taken to control their numbers and prevent further cats crossing the causeway.

Garden Island supports a number of species of land birds. Of importance is the occurrence of a population of the Brush Bronzewing (*Phaps elegans*); this bird has disappeared from Rottnest Island and from much of its former range in the southwest. Two species of reptiles are also important. The Lined Skink (*Lerista lineata*) is known only from Rottnest, Garden Island and a few southern suburbs of Perth, while the Carpet Snake (*Python spilotes*) is another species which is becoming rare on the mainland.

RECOMMENDATION

The Committee recommends that:

1. the Commonwealth manage Garden Island to preserve significant areas of vegetation and to conserve the Tammam; measures should be taken to control the population of feral cats;
2. the outstanding vegetation of the northern end of the island, north of Collins Point, be drawn to the Commonwealth's attention, in particular, that the vegetation be managed to keep it unburnt; the munitions dump should be sited further south where it does not impinge on this area.

G.4 THE ISLANDS OF SHOALWATER BAY

The Shoalwater Bay Islands Wildlife Sanctuary (reserve C24204) is vested in the Western Australian Wildlife Authority and consists of Bird Island, Seal Island, Shag Rock, White Rock and Gull Rock. The total area is about 3 ha. Penguin Island comprises reserve A17070, of 12 ha, for Recreation and Camping, vested in the National Parks Authority. An island between White Rock and the mainland is vacant Crown land.

Penguin Island has a similar flora to the slightly larger Carnac Island (G.2). The central portion of the island supports open scrub of *Acacia rostellifera* and *Olearia axillaris*. In rocky places, such as the southern end, *Rhagodia radiata* and *Frankenia pauciflora* are common.

Storr (1961) has classified the Shoalwater Bay Islands according to six habitats: honeycombed rock with soil restricted to cracks and depressions; talus slope; level or gently sloping rock with a thin mantle of soil; foredunes; windward slope of dunes; and leeward slope of dunes. While Penguin Island incorporates all six habitats, Gull Rock has only the first, Shag Rock and Bird Island have the first three and Seal Island has all except the fifth. Each habitat has its characteristic plants; the flora varies from two species, *Nitraria schoberi* and the introduced *Carpobrotus aequilateralis*, present on Gull Rock to 72 species present on Penguin Island.

The Islands of Shoalwater Bay together with Carnac Island comprise the most northerly nesting area for the Little Penguin (*Eudyptula minor*). Other species of birds which nest there are Bridled Tern (*Sterna anaetheta*), Caspian Tern (*Hydroprogne caspia*), White-faced Storm-Petrel (*Pelagodroma marina*), Silver Gull (*Larus novaehollandiae*), Pied Cormorant (*Phalacrocorax varius*), Welcome Swallow (*Hirundo neoxena*) and the Willie Wagtail (*Rhipidura leucophrys*).

The Islands are close to the mainland and are thus convenient for research (Bridled Terns, Pied Cormorants and Silver Gulls have been banded there) and nature photography.

The Committee endorses the purpose, vesting and status of reserve A17070.

RECOMMENDATION

The Committee recommends that:

1. reserve C24204 be reclassified as Class A;
2. the Department of Fisheries and Wildlife investigate the biological importance of all the other islands in Shoalwater Bay and report to the Environmental Protection Authority.

G.5 THE ISLANDS OF WARNBRO SOUND

Two groups of rocks in Warnbro Sound, known as Tub Rocks and The Sisters, comprise, respectively, reserves C31893 and C31894, for Conservation of Fauna, vested in the Western Australian Wildlife Authority. Both groups are used for Pied Cormorant (*Phalacrocorax varius*) rookeries.

About half a kilometre south of Tub Rocks is Passage Rock, and between Tub Rocks and Penguin Island are First Rock and Second Rock; Passage Rock, First Rock and Second Rock are all vacant Crown land.

RECOMMENDATION

The Committee recommends that:

1. reserves C31893 and C31894 be reclassified as Class A;
2. the Department of Fisheries and Wildlife investigate the biological importance of Passage Rock, First Rock and Second Rock and report to the Environmental Protection Authority.

G.6 AQUATIC RESERVES

The Committee believes that the waters around Carnac Island and parts of Rottneest Island should be set aside as aquatic reserves for scientific research and education. To maintain their biological diversity, there should be restrictions on the collecting of shells and other marine life from these waters. Line fishing should continue to be allowed.

Rottneest Island

The marine fauna and flora around the shores of Rottneest are rich and diverse and contain a number of species not found on the nearby mainland.

West End is of special interest for its intertidal reef-flat faunas. Here there are numbers of tropical creatures not elsewhere found so far south, and a well marked pattern of reef zonation of exceptional value in the teaching of ecological principles.

At the eastern end of the island the sublittoral zone is of particular interest. The underwater caves of Natural Jetty contain an incredible array of colourful invertebrates (and contained many species of fish prior to the advent of spear-fishing). The marine flora of this area is also of special interest, as many species of algae were first described from this locality. Seal Island, off the east side of Rottneest, is a nesting place for Australian Sea-lions (*Neophoca cinerea*).

At Parker Point, on the south-east end of the island, is an outstanding sublittoral reef of the coral *Pocillopora damicornis*. Other corals that occur here are *Montipora* spp. and *Alveoptora* spp. Tropical fishes inhabit the area; the commonest species include Moon Wrasse (*Thalassoma lunare*), Green Moon Wrasse (*T. lutescens*), Hardwick's Wrasse (*T. hardwickei*), Scarlett Banded Wrasse (*Stethojulis bandanensis*), Scribbled Chisel-toothed Wrasse (*Anampses geographicus*), Cleaner Fish (*Labroides dimidiatus*), Blue-banded Orange Parrotfish (*Scarus ghobban*) and Black Blenny (*Cirripectes sedae*). For all these species of corals and fishes, Rottneest Island is their southernmost limit.

The sea floor at Parker Point inside of Pocillopora Reef has deteriorated. Originally it was of white sand, but mooring anchors and debris from boats have trapped seeds of Sea Grass (*Posidonia australis*), which has grown into large mats and covered most of the area.

The waters around Rottneest Island are important for tracking and research. Every year, second and third year Zoology students at the University of Western Australia attend camps on the island where they study, among other things, the aquatic life of the reefs and bays. Many projects have been done by graduate students on Rottneest's aquatic flora and fauna.

Carnac Island

There are limestone reefs around Carnac Island which vary considerably in their exposure to waves. The eastern side of the island has a small, shallow bay with meadows of Sea Grass. The western side has extensive exposed intertidal reef-flats. The southern and northern ends have small sheltered rocky bays and narrow fringing reef-flats. Off-shore there are several deeply cavernous sublittoral reefs.

Faunistically the reefs and sublittoral shallows are rich and diverse. As well as species typical of the mainland reefs, there also occur two species of echinoderms (*Austrofromia polypora* and *Plectaster decanus*) which are rare or unknown in reefs around Fremantle and other off-shore islands. There is also a rich marine flora.

Study of the reefs intertidal ecology is important in understanding the distribution of littoral fauna on the mainland reefs.

The island has great value as a place to which people can make day-visits to study marine life.

RECOMMENDATION

The Committee recommends that:

1. the waters off Rottnest Island from the north-east side of Eagle Bay to, and including, Fish Hook Bay and from Natural Jetty to Parker Point (see Figs.) be made aquatic reserves; the reserves should be set aside for scientific research and education;
2. the waters surrounding Carnac Island between Low-water Mark and the boundaries shown in Fig. be made an aquatic reserve.

G.7 LAKE COOGEE AND MARKET GARDEN SWAMPS

Lake Coogee is situated near Woodman Point, between Cockburn Road and Rockingham Road. The lake and a narrow strip of foreshore comprise reserve C30861, of 63 ha, for Recreation, vested in the Town of Cockburn. Three ephemeral wetlands, not officially named but referred to as the Market Garden Swamps in the Cockburn Wetlands Study (Newman 1976), lie to the north-east of Lake Coogee. They are privately owned, and are surrounded by market gardens. The Metropolitan Region Planning Authority has included the lake and swamps in a proposed Open Space. Zoning of the area is Urban Deferred to the north of Mayor Road and Rural to the south.

Little vegetation remains around Lake Coogee except for a narrow strip 5-10 m wide around the lake. It consists mostly of low woodland and low open-forest of Salt-water Paperbark (*Melaleuca cuticularis*) with some understorey of *Salicornia blackiana*, *S. quinqueflora*, *Gahnia trifida* and *Baumea vaginalis*. Wattles (*Acacia saligna* and *A. cyclops*) and young Tuarts (*Eucalyptus gomphocephala*) are scattered amongst the *M. cuticularis* along the western shores.

The three Market Garden Swamps are all vegetated with the paperbarks *M. cuticularis* and *M. raphiophylla*, the structure varying from low closed-forest (e.g. near the bend in Mayor Road) to low woodland. The predominant understorey species are the salt-marsh reeds *Juncus caespititius* and *Baumea vaginalis*. The swamp bed of the southernmost swamp is almost covered by two water plants, *Ruppia maritima* and *Lamprothamnium macropogon*, while those of the other two are partially covered with the salt-marsh plants *Salicornia* sp. and *Wilsonia humilis*.

Lake Coogee is shallow and extremely saline (almost comparable to sea water). It is also highly eutrophic, the main source of nutrients probably being fertilisers from nearby market gardens.

The population of water-birds includes Grey Teal (*Anas gibberifrons*), Mountain Duck (*Tadorna tadornoides*) and Black Duck (*A. superciliosa*), which loaf on the lake. The Great Crested Grebe (*Podiceps cristatus*) and the Hoary-headed Grebe (*P. poliocephalus*) are also present; the lake's expanse of open, brackish water is ideal for the latter, which appears to breed there. Waders include the White-headed Stilt (*Himantopus himantopus*), the Red-necked Stint (*Calidris ruficollis*) and the White-faced Heron (*Ardea novae-hollandiae*).

A small fish (*Favonigobius suppositus*) that can tolerate high salinity inhabits the lake.

Being small, seasonal and highly eutrophic, the Market Garden Swamps are comparatively unimportant for water-birds, but their vegetation is worth preserving since there are few stands of *Melaleuca cuticularis* in the Metropolitan Area.

The Committee endorses the Metropolitan Region Planning Authority's proposal to purchase when available land surrounding Lake Coogee including the Market Garden Swamps. The Committee also endorses the vesting of reserve C30861 in the Town of Cockburn.

RECOMMENDATION

The Committee recommends that reserve C30861 be reclassified as Class A and that its purpose be changed to Parkland for Landscape and Recreation.

Mt. Brown, Mt. Brown Lake and Brownman Swamp are included in an area of mostly privately owned land in the suburbs of Henderson and Naval Base, south of Lake Coogee and west of Rockingham Road. The land is zoned Industrial.

Mt. Brown is a limestone hill that offers extensive views of the surrounding countryside and the Indian Ocean. At the top of the hill are two small reserves: C24243, of 0.6 ha, for Trig Station (Mt. Brown), not vested; C25049, of 1.8 ha, for Pumping Station and Pipelines, vested in the Minister for Water Supply. The remaining land is freehold.

Mt. Brown and the low limestone hill north of it have low open-heath with many species typical of the coastal limestone. They include Spider-net Grevillea (*G. thelemanniana*), *Melaleuca acerosa*, Chenille Honey-myrtle (*M. huegelii*), Cockies' Tongues (*Templetonia retusa*), Snakebush (*Hemiandra pungens*) (erect), Rats' Tails (*Scaevola thesioides*), *Diplopeltis huegelii* and *Lechenaultia linarioides*. Also present are *Petrophile serruriae*, in its pink-flowered form, Button Runner (*Tersonia brevipes*), which is uncommon near Perth, and *Hemigenia sericea*, a fire-sensitive species restricted to the coastal limestone near Perth, where it is uncommon.

On the slopes and in the valleys is deep sand, which supports low woodland and low open-woodland mainly of Banksias (*B. attenuata* and *B. menziesii*) with some Jarrah (*Eucalyptus marginata*) and Limestone Marlock (*E. decipiens*). The understorey contains species such as Prickly Moses (*Acacia pulchella*), *Jacksonia furcellata*, *Grevillea vestita*, *Calothamnus quadrifidus*, *Hibbertia hypericoides* and Blackboy (*Xanthorrhoea preissii*).

Mt. Brown Lake is north-east of Mt. Brown. It is small (500 m by 200 m), saline and usually dries towards the end of summer, but supports several species of water-birds for most of the time. The Lake is fringed with stands of the paperbark *Melaleuca raphiophylla* and Tussock Sedge (*Baumea vaginale*), while woodland of Tuart (*E. gomphocephala*) and Banksia (*B. attenuata* and *B. menziesii*) and shrubland dominated by Chenille Honey-Myrtle surround the wetland vegetation.

Brownman Swamp contains little open water, being mainly a series of paperbark swamps. Surrounding them are extensive open-forests of Tuart of good quality, containing few of the dead or dying trees found in most metropolitan stands. To the west is woodland of Tuart and Banksia with open-heath and shrubland on low limestone hills.

The Cockburn Wetlands Study (1976) recommended that Brownman Swamp and its surrounds should become a conservation reserve to protect the excellent area of Tuart forest and swamp vegetation. The Study also recommended retention of Mt. Brown Lake and its wetland vegetation as a refuge for water-birds and the use of the surrounding country for recreation.

The Committee draws attention to Mt. Brown and the limestone hill north of it, and believes they are important features worth including in the proposed area. Their open-heath vegetation is rich in species typical of the coastal limestone, and complements the woodland and swamp vegetation of the area. Although other limestone hills are present they are lower and smaller, and in many cases their vegetation has degenerated into shrubland of low species diversity.

The Coogee Air Pollution Study (1974) concluded that this area was not suited for urban use.

RECOMMENDATION

The Committee recommends that Mt. Brown, Mt. Brown Lake, Brownman Swamp and surrounding land as shown in Fig. be zoned Regional Open Space, for eventual purchase; it should become a regional park controlled by the Town of Cockburn with areas zoned for Conservation and for Recreation.

G.9 LAKE YANGETUP

Lake Yangebup is about 800 m x 600 m in size and is located between Bibra Lake and Thompson Lake, in the Town of Cockburn. The lake and surrounding land are privately owned; there is a wool scouring plant on the eastern shore. The land is 'reserved' by the Metropolitan Regional Planning Authority as Regional Open Space for Parks and Recreation.

The surrounding lakeside vegetation has died - Newman (1976) has suggested four possible reasons - and the lake is eutrophic, containing high levels of nitrogen and phosphorus.

Although the loss of vegetative habitat has obviously affected some populations of water-birds, the lake has particular value in that it is used each year by two uncommon species of waterfowl - Pink-eared Duck (*Melacorhynchus membranaceus*) and Blue-winged Shoveller (*Anas rhynchos*). Other species of waterfowl that use the lake are Grey Teal (*Anas gibberifrons*), Black Duck (*A. superciliosa*) and White-eyed Duck (*Aythya australis*).

The Red-necked Stint (*Calidris ruficollis*) is a wader that is seen in great numbers at Yangebup Lake but which is rarely observed in fresh-water environments, and is not recorded from any of the other lakes in the eastern chain of the Cockburn wetlands. Other species of waders include Red-necked Avocet (*Recurvirostra novaehollandiae*) and White-headed Stilt (*Himantopus himantopus*).

The Committee endorses the Metropolitan Region Planning Authority's proposal to purchase Lake Yangebup for Regional Open Space.

RECOMMENDATION

The Committee recommends that, after purchase by the Metropolitan Region Planning Authority, Lake Yangebup be set aside as a reserve for Conservation of Flora and Fauna, and Recreation, vested jointly in the Town of Cockburn and the Western Australian Wildlife Authority.

G.10 LAKE KOGOLUP

Lake Kogolup lies between Lake Yangebup and Thompsons Lake in the Town of Cockburn. Part of the lake is owned by the State Housing Commission; the remainder is privately owned. The whole lake is subject to a mining claim. The present zoning is Rural.

The area supports a wide range of vegetation types: the Cockburn Wetlands Study (Newman 1976) found that all of the vegetation types of the Cockburn wetlands are represented.

The waters of the lake contain sedgelands, mostly of Bulrush (*Typha orientalis*), but with smaller areas of Jointed Twig-rush (*Baumea articulata*) and Spike Rush (*Eleocharis sphacelata*). The occurrence of Spike Rush is noteworthy: it is normally found only in the north west of Western Australia and in the Eastern States.

Bordering the lake are areas of open-forest and woodland of Flooded Gum (*Eucalyptus rudis*) associated with the paperbarks *Melaleuca raphiophylla* and *M. preissiana* or with the undershrub *Acacia saligna*. The rare Hackett's Hop Bush (*Dodonaea hackettiana*) is another shrub of the understorey as are Broom Ballart (*Exocarpus sparteus*), Stinkbush (*Jacksonia furcellata*) and Native Broom (*Viminaria juncea*). Some of the trees of *M. raphiophylla* support dense mats of the parasitic climber Dodder (*Cassytha* sp.).

The surrounding woodland vegetation is varied, since the lake is situated at the junction of two major soil associations, the Karrakatta and the Bassendean Soil-landform Units (Churchward and McArthur 1978). The former is represented on the western side of the lake, and supports open-woodland of Tuart (*Eucalyptus gomphocephala*), Jarrah (*E. marginata*) and Banksia (*B. attenuata*, *B. menziesii* and *B. grandis*) with the understorey dominated by Blackboy (*Xanthorrhoea preissii*), Zamia (*Macrozamia riedlei*), Prickly Moses (*Acacia pulchella*) and *Jacksonia furcellata*.

The latter, represented on the eastern side of the lake, supports open-woodland dominated by Jarrah and the above banksias plus Holly-leaf Banksia (*B. ilicifolia*). Less common trees include Sheoak (*Casuarina fraserana*), Christmas Tree (*Nuytsia floribunda*) and Marri (*E. calophylla*).

The dense vegetation and the relative isolation of Lake Kogolup make it a favourite haunt for birds that prefer seclusion. Some of the water-birds that frequent the area are Nankeen Night Heron (*Nycticorax caledonicus*), White-necked Heron (*Ardea pacifica*), White-faced Heron (*A. novaehollandiae*), White-headed Stilt (*Himantopus himantopus*), Little Greenshank (*Tringa stagnatilis*), White Ibis (*Threskiornis molucca*), Little Grebe (*Podiceps novaehollandiae*) and Hoary-headed Grebe (*P. poliocephalus*).

Bush birds also abound. Birds noted in the Cockburn Wetlands Study were Grey Fantails (*Rhipidura fuliginosa*), Willy Wagtails (*R. leucophrys*), Rainbow Bee-eaters (*Merops ornatus*), Thornbills (*Acanthiza* spp.), Western Silvereyes (*Zosterops gouldi*), New Holland Honeyeaters (*Phylidonyris novaehollandiae*), and Stubble Quails (*Coturnix pectoralis*).

The New Holland Honeyeater and the Stubble Quail are rare in the city though commoner in rural areas. These, and other, uncommon species were seen by the Study in greater numbers at Lake Kogolup than anywhere else in the Cockburn Wetlands.

RECOMMENDATION

The Committee recommends that Lake Kogolup be added to the reserve that contains Thompson Lake, to the south, by adding the area shown in Fig. to reserve A15556.

G.11 THOMPSONS LAKE

Thompsons Lake is located in the Town of Cockburn, north of Russell Road and west of Hammond Road. The lake is contained in reserve A15556, of 509 ha, for Fauna Conservation, Research and Drainage, vested in the Western Australian Wildlife Authority.

The lake is the largest water body of the Cockburn Wetlands. It is circular and contains about 150 ha of semi-permanent open water.

Around the margin of the lake is a narrow belt of sedgeland dominated by Jointed Twig Rush (*Baumea articulata*). In the east the sedgeland is flanked by open-scrub of Stinkbush (*Jacksonia furcellata*) and Prickly Moses (*Acacia pulchella*), and in the south and west by a narrow strip of bare ground.

In low-lying land to the north and east of the lake is a woodland of Flooded Gum (*Eucalyptus rudis*) and the paperbark (*Melaleuca preissiana*). In the north Flooded Gum also forms an open-forest with Orange Wattle (*Acacia saligna*) as an undershrub. Hackett's Hop Bush (*Dodonaea hackettiana*) occurs in this association, complementing the population at Banganup just south of Russell Road. The species is restricted to the Metropolitan Area but is nowhere common. It is fire-sensitive and requires at least five years to produce enough seed to ensure its survival. It is therefore important that a number of populations be reserved so as to reduce the likelihood of eliminating the species by frequent fires.

The lake is situated at the junction of two major Soil-landform Units - the Karrakatta Unit and the Bassendean Unit (Churchward and McArthur 1978). Consequently the vegetation of the dry area of the reserve in the north and east differs from that of the southern and western portion.

The Karrakatta Unit is represented by open-woodland of Jarrah and Banksia of the above species plus Holly-leaf Banksia (*B. ilicifolia*). Less dominant trees include Sheoak (*Casuarina fraserana*), Christmas Tree (*Nuytisa floribunda*) and Marri (*E. calophylla*). Additionally, there is an area near the south-eastern edge of the lake that supports low open-woodland of Banksia. The species include all of the above Banksias plus Swamp Banksia (*B. littoralis*).

The Karrakatta and Bassendean Units also vary in the species in the understoreys.

The Cockburn Wetlands Study (Newman 1976) gave the lake a high rating for biological importance, which it attributed more to the lake's magnitude than to its contrasts in habitat. The lake's bird-life is striking not so much for the diversity of species but for the abundance of each.

Musk Ducks (*Biziura lobata*), Coots (*Fulica atra*), Hoary-headed Grebes (*Podiceps poliocephalus*), Blue-billed Ducks (*Oxyura australis*) and Little Grebes (*P. novaehollandiae*) can be found in the open waters of the lake (the Blue-billed Duck and the Little Grebe are confined mainly to the backwaters). The reed belts support the Swampphen (*Porphyrio porphyrio*) and the Spotless Crake (*Porzana tabuensis*). Large numbers of Black Swans (*Cygnus atratus*), Grey Teal (*Anas gibberifrons*), Black Duck (*A. superciliosa*), Blue-winged Shoveller (*A. rhynchotis*), Mountain Duck (*Tadorna tadornoides*), Pink-eared Duck (*Malacorhynchus membranaceus*) and White-eyed Duck (*Aythya australis*) loaf on the lake. Small wading birds, including the White-headed Stilt (*Himantopus himantopus*) and the Black-fronted Dotterel (*Charadrius melanops*), are also found in Thompsons Lake.

Forty-four species of bush birds have been recorded from the reserve. Species that are particularly abundant include Western Warbler (*Gerygone fusca*), Thornbills (*Acanthiza* spp.), Sacred Kingfisher (*Halcyon sancta*), Rufous Whistler (*Pachycephalus rufiventris*) and Rainbow Bee-eater (*Merops ornatus*). Many birds of prey use the reserve, the most noteworthy being the Wedge-tailed Eagle (*Aquila audax*). Others include Whistling Eagle (*Haliastur sphenurus*), Swamp Harrier (*Circus approximans*), Brown Hawk (*Falco berigora*) and Australian Little Eagle (*Hieraaetus morphnoides*).

As land development proceeds in the area there is likely to develop an increased public demand to use the lake for recreation. Being larger than King's Park, the reserve could probably accommodate both passive recreation and the conservation of flora and fauna. It should not, however, be used for water skiing or power-boat racing: the lake has little vegetational cover for the water-birds to escape during periods of disturbance.

Recent evidence suggests that increasing quantities of pollutant are entering the lake.

RECOMMENDATION

The Committee recommends that the purpose of reserve A15556 be changed to Conservation of Flora and Fauna and that the reserve remain vested in the Western Australian Wildlife Authority.

G.12 BANGANUP LAKE

The lake is situated just south of Thompsons Lake, on the opposite side of Russell Road. It is incorporated in reserve C29241, of 254 ha, for Conservation of Fauna (University marsupial research), vested in the Minister for Fisheries and Wildlife. The land is leased to the University of Western Australia.

Much work has been done recently by the Zoology Department in developing the station for its primary purpose, the breeding of marsupials. A fence has been built around it to enclose the animals and keep out dogs. A warden's cottage, a laboratory, an operating theatre and a large trapping pen have been constructed. Those additions were made with minimal disturbance to the natural vegetation, thus allowing the marsupials to live in conditions similar to those of their natural environment.

Like nearby Thompsons Lake, Banganup Lake lies at the junction of the Karrakatta and Bassendean Soil-landform Units (Churchward and McArthur 1978): the reserves have similar vegetation types. There are more than 350 species of plants in the reserve. They include two uncommon species, Babe-in-a-cradle Orchid (*Epiblema grandiflorum*) on the swamp margin, and Hackett's Hop Bush (*Dodonaea hackettiana*) on the sandy rise near the swamp. The latter is restricted to the Metropolitan Area and, being fire-sensitive, should be conserved wherever possible.

At the time the reserve was fenced the native mammals included Grey Kangaroos (*Macropus fuliginosus*), Brush Wallabies (*M. irma*), Short-nosed Bandicoots (*Isodon obesulus*) and Brush-tailed Possums (*Trichosurus vulpecula*). Quokkas (*Setonix brachyurus*) were introduced in the early 'seventies.

The University of Western Australia uses the reserve extensively for different kinds of research (U.W.A. 1972). The reserve is important for the breeding of marsupials, notably the Quokka, an animal outstandingly suitable for research in the fields of pathology (muscular dystrophy), immunology, microbiology, epidemiology and cancer.

The Committee endorses the purpose and vesting of the reserve.

RECOMMENDATION

The Committee recommends that reserve C29241 be reclassified as Class A.

G.13 LAKE FORRESTDAL

Lake Forrestdale is situated just south-east of the junction of Nicholson Road and Forrest Road, in Forrestdale. Reserve A24781, of 244 ha, for Protection of Flora and Fauna, and Recreation, vested in the Western Australian Wildlife Authority, covers most of the lake and a narrow belt of its surrounding vegetation.

The surrounding vegetation consists mostly of low closed-forest of the paperbark *Melaleuca raphiophylla* with some Spearwood (*Kunzea vestita*) and *Regelia ciliata*. There are also patches of open-forest of Flooded Gum (*Eucalyptus rudis*) with a few Christmas Trees (*Nuytsia floribunda*).

The lake contains water throughout the year and is an important drought refuge for waterfowl. On 30 November 1977, 5000 Grey Teal (*Anas gibberifrons*), 1000 Mountain Ducks (*Tadorna tadornoides*) and 250 Black Ducks (*A. superciliosa*) were present. The lake is also used by a variety of waders, including White-headed Stilt (*Himantopus himantopus*). Long-necked Tortoises (*Chelodina oblonga*) are common. The Department of Fisheries and Wildlife has installed a depth gauge, and is commencing studies on the quantity and quality of the lake's water and bird-life.

The only part of the lake and shoreline not included in the reserve is Lot 7, Commercial Road, of about 1.75 ha. This area supports a dense stand of paperbark.

The Metropolitan Region Planning Authority is considering the lake and the Crown land east of the lake - which supports open-woodland of Jarrah (*E. marginata*), Marri (*E. calophylla*) and Slender Banksia (*B. attenuata*) - as proposed Region Open Space.

The Committee endorses the present purpose, vesting and status of reserve A24781.

RECOMMENDATION

The Committee recommends that:

1. an environmental study of the lake and environs be carried out before permission for any further development in the area is granted; the design plan for the Metropolitan Region Planning Authority's Region Open Space scheme for this area would be dependent on such a study;
2. Lot 7, Commercial Road, be purchased when available and added to reserve A24781.

RECOMMENDATION

The Committee recommends that reserves C9458 and C33659 be made Class A reserves for Conservation of Flora and Fauna, vested jointly in the Western Australian Wildlife Authority and the Shire of Rockingham.

G.14 LAKE RICHMOND (ROCKINGHAM)

Lake Richmond is a permanent, fresh lake which was once part of Cockburn Sound and has been cut-off during the last 4000 years. It is about 15 m deep, though the surface is only about 1 m above sea-level. The fresh water originates from two drains, one of which feeds the lake, the other providing an outlet and flushing it annually, thus preventing eutrophication

The lake is geologically important because of its unusual origin and because around the lake edge, particularly on the eastern side, are well developed stromatolitic structures which show a wide range of growth forms.

The shore carries a meadow of sedges such as *Juncus kraussii*, *Scirpus validus*, *S. nodosus*, *Gahnia trifida*, *Cyperus tenuiflorus* and *Baumea juncea*. Perennial herbs include *Samolus repens*, *Wilsonia backhousei*, *Lobelia alata*, *Haloragis brownii* and the grass *Sporobolus virginicus*. There are scattered shrubs of *Acacia cyclops*, *A. saligna*, *Myoporum caprarioides*, *Anthocercis littorea* and *Adriana quadripartita*. Two aquatic plants in the lake are *Lepilaena preissii* and an alga, *Nitella* sp.

The lake itself supports an unnamed native mollusc (*Physastra* sp.), and two introduced species of fresh-water snail. Several species of fish are present, the largest of which is believed to be a species of mullet.

Long-necked Tortoises (*Chelodina oblonga*) occur near the lake, and other reptiles are Gould's Monitor Dragon (*Varanus gouldii*), Bob-tail lizard (*Tiliqua rugosa*) and another skink (*Otenotus lesueurii*).

A large variety of birds may be seen on and around the lake. An observer recorded 57 species in 1977; water-birds included various species of grebes, cormorants, egrets and ducks. Because the lake is permanent it is a valuable summer refuge for water-fowl.

Birds of prey include the Osprey (*Pandion haliaetus*), a regular visitor with up to 4 birds present at a time, and the Peregrine Falcon (*Falco peregrinus*), which is scarce in the South West.

In spite of surrounding urbanization, Lake Richmond is still unspoilt and is one of the major natural features of the Rockingham district. It is close to schools and has already been extensively used for educational purposes.

Most of it at present is in reserves C9458 (40 ha) and C33659 (13 ha), both of which are for Recreation and vested in the Shire of Rockingham. Because conservation of flora and fauna should be a major purpose of the reserve, the Committee believes that the Western Australian Wildlife Authority should be involved in its management.

The Department stated in conclusion that "the eventual loss of biological viability of this area is not inevitable, particularly if management practices reflecting this philosophy are quickly implemented".

The Committee endorses the current vesting of reserves A24411, A23780 and A18452 in the Shire of Rockingham.

RECOMMENDATION

The Committee recommends that:

1. the purpose of reserve A24411 be changed to Conservation of Flora and Fauna and that the reserve be vested in the Western Australian Wildlife Authority;
2. the purpose of reserve A23780 be changed to Parkland and Recreation and that the reserve be managed to retain the wetlands as refuges for water-birds;
3. reserve A22429 be vested in the Shire of Rockingham;
4. the Metropolitan Region Planning Authority's management plan for the area, when completed, be submitted to the Environmental Protection Authority for review.

G.15 LAKES COOLOONGUP AND WALYUNGUP

These lakes, commonly known as the Rockingham Lakes, are situated just west of Mandurah Road, and are divided by Safety Bay Road. Reserve A24411, of 425 ha, and reserve A23780, of 297 ha, contain Lake Cooloongup and Lake Walyungup respectively; both reserves are for National Park and vested in the Shire of Rockingham. To the north-east of Lake Cooloongup are reserve A18452, of 53 ha, for Recreation and Picnic Ground, vested in the Shire of Rockingham, and reserve A22429, of 50 ha, for Recreation and Parklands, not vested.

Tingay and Tingay (1977) produced a biological survey of the lakes and surrounding Regional Open Space for the Shire of Rockingham. The following is taken largely from their report.

The area supports a diverse variety of vegetation, with thirteen different formations. The lakes contain an ephemeral algae formation and support mixed associations of algae of which Stonewort (*Lamprothamnium macropogon*) is the most extensive and important. Closed-sedgeland of Bare Twig Rush (*Baumea juncea*) surrounds both lakes and also covers an extensive area between the lakes, just west of Mandurah Road. Extending northwards from the northern end of Lake Walyungup is open-sedgeland dominated by Coast Saw-sedge (*Gahnia trifida*).

Surrounding Lake Cooloongup, and to the south-east of Lake Walyungup is tall open-forest of Tuart (*Eucalyptus gomphocephala*). On moist soils west and north of Lake Cooloongup the understorey includes the paperbark *Melaleuca raphiophylla*, Slender Banksia (*B. attenuata*), Blackboy (*Xanthorrhoea preissii*), *Acacia cyclops* and *Jacksonia furcellata*. *Melaleuca raphiophylla* occurs also along the western side of the lakes and between the lakes as closed-forest. On dry land west and south of Lake Walyungup is a large area of tall shrubland and open-heath. The principal species are *Jacksonia furcellata*, *Acacia saligna*, *A. rostellifera*, *A. cyclops*, *A. lasiocarpa*, *Olearia axillaris*, *Scaevola* spp., *Eremophila glabra*, *Phyllanthus calycinus*, *Conostylis candicans*, *Asphodelus fistulosus*, *Hardenbergia comptoniana*, *Kennedia prostrata* and *Anigozanthos humilis*.

Seventy three species of birds have been recorded from the area, of which 29 require wetlands as habitat. Species that are common in the lakes or around their margins are Little Black Cormorant (*Phalacrocorax sulcirostris*), Little Pied Cormorant (*P. melanoleucos*), Hoary-headed Grebe (*Podiceps poliocephalus*), White-faced Heron (*Ardea novaehollandiae*), Black Swan (*Cygnus atratus*), Mountain Duck (*Tadorna tadornoides*), Black Duck (*Anus superciliosa*), Grey Teal (*A. gibberifrons*), Musk Duck (*Biziura lobata*), Coot (*Fulica atra*), Red-capped Dotterel (*Charadrius alexandrinus*), White-headed Stilt (*Himantopus himantopus*), Silver Gull (*Larus novaehollandiae*), Fairy Tern (*Sterna nereis*) and Little Grassbird (*Megalurus gramineus*).

In the summer, waterfowl may be very abundant on Lake Coo loongup, and the lake may then contain 1000 or more Black Swans and similar numbers of Black Ducks, Musk Ducks and wading birds. Grey Teal are also attracted in summer when the lake's mud-flats are exposed.

Lake Walyungup is the more brackish of the two lakes and has been disturbed by mining. It is less important than Lake Coo loongup for water-birds, although Pelicans (*Pelecanus conspicillatus*) and Little Black Cormorants prefer it.

The tall open-forest of Tuart surrounding Lake Coo loongup supports a population of forest birds. Some species, however, show a special preference for the fringes of the lake. These are New Holland Honeyeater (*Phylidonyris novaehollandiae*), Yellow-plumed Honeyeater (*Meliphaga ornata*), Spotted Pardalote (*Pardalotus punctatus*), Western Silvereye (*Zosterops gouldi*) and Splendid Blue Wren (*Malurus splendens*).

Animal life abounds in the waters of Lake Coo loongup. Invertebrates include the water snail *Coxiella striatula*, Pond Snail (*Lenameria proteus*) and Fresh-water Crayfish, or Koonac (*Cherax quinquecarinatus*). Vertebrates include an endemic fish, *Atherinosoma rockinghamensis*, and Long-necked Tortoise (*Chelodina oblonga*).

Reserve A22429 occupies a high ridge on the east side of Mandurah Road. The soil is brown and yellow sand over limestone, and the predominant vegetation is woodland of Tuart. Other trees are Sheoak (*Casuarina fraserana*), Slender Banksia and Jarrah (*Eucalyptus marginata*). Representative species of the understorey include *Acacia cochlearis*, *Dryandra sessilis*, *Grevillea vestita*, *Leucopogon propinquus*, *Hakea lissocarpha*, *Hibbertia hypericoides*, *Clematis microphylla* and *Hardenbergia comptoniana*.

The reserve is somewhat disturbed and has been infested with weeds. It is, however, in a prominent position relative to Lake Coo loongup and thus forms an important backdrop to it; sufficient natural vegetation remains to form a significant adjunct to the wetland of the lake. Consideration should be given to including it in the reserve complex that will include both Lake Coo loongup and Lake Walyungup.

Land to the west of Lake Coo loongup is owned by the Metropolitan Region Planning Authority, as is a parcel of land to the south-west of Lake Walyungup. The western side of Lake Walyungup is privately owned.

The M.R.P.A. undertook a design study of the area (M.R.P.A. 1976(b) in response to which other studies have been carried out (Layton Groundwater Consultants 1976; Tingay and Tingay 1977). The results of the latter studies have been partly summarised by the Department of Conservation and Environment (D.C.E. 1977(b)).

At Woodman Point is the Quarantine Station, which comprises 54 ha of land owned by the Commonwealth of Australia. Adjacent to the Station, and stretching northwards and eastwards, is reserve C24305, of 113 ha, for Explosives Magazine, vested in the Minister for Mines. The area west of Cockburn Road from Woodman Point to Coogee Beach is 'reserved' by the Metropolitan Region Planning Authority for Parks and Recreation.

The vegetation is of outstanding importance as an example of undisturbed coastal vegetation. Garden Island and the coastal strip between Coogee Beach and Woodman Point are now the only places in System 6 that contain significant areas of the Rottneest Cypress (*Callitris preissii*) community (Speck 1952), a community once widespread along the coast on the lee side of the stable dunes. Owing to the low incidence of fire in the Quarantine Station (the last one occurred 27 years ago) the community is well developed there.

As a result of the prevailing south-westerly winds that blow in from Jervis Bay, the vegetation of the Woodman Point peninsula displays a south-to-north trend. South of the road towards the Station it consists mostly of low closed-forest of Rottneest Cypress; north of the road the structure is open-forest and woodland, dominated by Tuart (*Eucalyptus gomphocephala*). North of the peninsula the trend is from west to east, with stands of Cypress along the western side of the explosives reserve.

The low closed-forest is about 5 m tall, on average; its height increases progressively as one goes inland. Rottneest Cypress is the commonest species, and occurs both in pure stands and in mixed stands with Acacia (*A. rostellifera* and *A. cyclops*) and Chenille Honey-myrtle (*Melaleuca huegelii*). *A. rostellifera* sometimes forms small, pure clumps. A few scattered specimens of Quandong (*Santalum acuminatum*) are present, and *Spyridium globulosum* appears in places, mainly around the borders of the forest, near the firebreaks. Climbing over some plants is the creeper *Clematis microphylla*.

There is little understorey, but *Diplolaena dampieri* sometimes occurs as an undershrub among the clumps of *A. rostellifera*, where the canopy is more open. Swordgrass (*Lepidosperma gladiatum*) is found in places where sufficient light reaches the ground.

In disturbed areas associated with the firebreaks are found species that are absent from or uncommon in the forest. These include *Anthocercis littorea*, *Scaevola crassifolia*, *Acanthocarpus preissii*, *Hardenbergia comptoniana* and *Pelargonium capitatum*. *Spinifex longifolia* occurs along the southern edge.

The open-forest and woodland formations, dominated by Tuart, cover the northern portion of the Quarantine Station and the southern part of the explosives reserve. *Spyridium globulosum* is common in the understoreys. The woodlands contain tall stands of *Acacia rostellifera* with some Quandong and Rottnest Cypress.

In disturbed areas associated with the firebreaks are found *Diplolaena dampieri*, *Templetonia retusa*, *Trymalium ledifolium*, *Acacia cochlearis*, *Anthocercis littorea*, *Rhagodia radiata*, *Melaleuca acerosa*, *Phyllanthus calycinus*, *Hemiandra pungens*, *Eremophila glabra*, *Conostylis candicans*, *Tetrariopsis octandra* and *Thysanotus* sp.

Two mammals - the Quenda (*Isoodon obesulus*) and the Western Grey Kangaroo (*Macropus fuliginosus*) - are known to occur within the Quarantine Station.

The Quarantine Station also contains buildings, roads and grassed areas.

It has been announced recently that the Station will close soon.

There is a proposal to develop Jervoise Bay and Woodman Point for industry and intensive recreation (Department of Industrial Development 1976); this threatens the areas of outstanding vegetation between Woodman Point and Coogee Beach. The Committee believes that the vegetation should be preserved.

RECOMMENDATION

The Committee recommends that:

1. the authority that is to manage the area which is now the Quarantine Station be made aware of the significance of the stands of Rottnest Cypress in the area;
2. the authority consult the proposed Flora Research and Conservation Advisory Service or, prior to its formation, the Department of Conservation and Environment;
3. when the present use of reserve C24305 finishes, its purpose be changed to Parkland and Recreation and Conservation of Flora and Fauna, and that the reserve be vested jointly in the Town of Cockburn and the Western Australian Wildlife Authority.

G.17 PART OF RESERVE C24784 (HOPE VALLEY ROAD)

Reserve C24784, of 49 ha, is for Recreation and is not vested. It contains an undulating area of the Bassendean Soil-landform Unit (Churchward and McArthur 1978) which is in an undisturbed condition.

A low open-forest covers the reserve. The upper storey consists of Jarrah (*Eucalyptus marginata*), *Banksia attenuata*, *B. menziesii*, and Common Sheoak (*Casuarina fraserana*). There are tall shrubs such as Stinkwood (*Jacksonia furcellata* and *J. sternbergiana*) and Spearwood (*Kunzea vestita*). In the lower storey are species such as *Calytrix fraseri*, *C. flavescens*, *Brachyloma preissii*, *Conostephium minus*, *Casuarina humilis*, *Stirlingia latifolia*, *Synaphea spinulosa*, *Burtonia conferta*, *Astroloma pallidum*, *Macrozamia riedlei*, *Baeckea camphorosmae*, *Lysinema ciliatum*, *Lechenaultia floribunda* and *Hypocalymma robustum*.

The epacrid *Brachyloma preissii* is a rare species confined to the Coastal Plain near Perth, and is not recorded for any other reserve.

A number of orchid species occur in this Unit, especially species of *Caladenia*, *Prasophyllum*, *Elyranthera*, *Lyperanthus*, *Diuris*, *Thelymitra* and *Eriochilus*.

The reserve is typical of the Bassendean Unit and should be retained as a representative example of the flora and fauna.

RECOMMENDATION

The Committee recommends that reserve C24784 be made a Class A reserve for Conservation of Flora and Fauna, vested in the Western Australian Wildlife Authority.

G.18 RESERVE C25886 (NORTH OF ORTON ROAD, PEEL ESTATE)

Reserve C25886 (154 ha) is for Conservation of Flora and is not vested. It contains an area of the Bassendean Soil-landform Unit (Churchward and McArthur 1978). The vegetation is chiefly low woodland, but the reserve also includes several swampy areas.

The low woodland is dominated by three species of Banksia - *B. attenuata*, *B. menziesii* and *B. ilicifolia* - with some Jarrah (*Eucalyptus marginata*), Sheoak (*Casuarina fraserana*), Christmas Tree (*Nuytsia floribunda*) and Woody Pear (*Xylomelum occidentale*). Tall shrubs of the understorey include Spearwood (*Kunzea vestita*) and Woollybush (*Adenanthos cygnorum*). Both Blackboy (*Xanthorrhoea preissii*) and Zamia (*Macrozamia riedlei*) are common. The smaller shrubs and perennial herbs of the understorey are typical of this Unit.

Swampy areas are dominated by the paperbark *Melaleuca preissiana*, with an understorey of species such as *Adenanthos obovatus*, White Myrtle (*Hypocalymma angustifolium*), *Phlebocarya ciliata* and *Aotus villosa*.

The vegetation is undisturbed and in good condition, and the reserve is large enough to survive for many years. It should be retained as a sample of the Bassendean Unit in the area.

RECOMMENDATION

The Committee recommends that reserve C25886 be made a Class A reserve for Conservation of Flora and Fauna, vested in the Western Australian Wildlife Authority.

G.19 RESERVE C31874 (SOUTH OF ORTON ROAD, PEEL ESTATE)

This reserve (172 ha) is for Government Requirements and is not vested. It covers an area of consolidated dunes of the Bassendean Soil-landform Unit (Churchward and McArthur 1978).

The vegetation is mostly open-woodland of Jarrah (*Eucalyptus marginata*), Sheoak (*Casuarina fraserana*), Christmas Tree (*Nuytsia floribunda*) and Banksia (*B. attenuata*, *B. menziesii* and *B. ilicifolia*). The understorey is rich in species typical of the Unit, with over 60 species recorded.

Like reserve C24784, this reserve is a good habitat for orchids, and is close to a locality near the intersection of Johnson Road and Thomas Road where a considerable amount of research on orchid pollination has been undertaken. It is important to retain representative habitats to support the insect populations involved in the pollination. The purpose of the reserve should be altered to Conservation of Flora and Fauna.

RECOMMENDATION

The Committee recommends that reserve C31874 be made a Class A reserve for Conservation of Flora and Fauna, vested in the Western Australian Wildlife Authority.

G.20 RESERVE C2457 (CARDUP)

Reserve C2457 (75 ha) is for Parkland and Recreation, vested in the Shire of Armadale-Kelmscott. It is a relatively flat area that represents the Guildford Soil-landform Unit (Churchward and McArthur 1978).

A low open-forest covers the reserve. The upper stratum is of Jarrah (*Eucalyptus marginata*), Woody Pear (*Xylomelum occidentale*), Bull Banksia (*B. grandis*) and Slender Banksia (*B. attenuata*). The understorey is quite rich in species, and contains some species of restricted distribution on the Coastal Plain, for example *Astroloma stomarrhena*, *Gompholobium knightianum*, *Hakea ruscifolia*, *H. stenocarpa*, *Labiichea punctata*, *Pronaya elegans* and *Styphelia tenuiflora*.

Little of the Guildford Unit occurs in conservation reserves. It is a significant belt of fluvial deposits stretching in a somewhat broken line between Bullsbrook and Bunbury. Most of it is freehold and cleared, and this reserve is the largest area available for conservation. The Committee believes that its purpose should be changed to Conservation of Flora and Fauna so that it can be managed for long-term preservation of this Unit and its associated flora and fauna.

RECOMMENDATION

The Committee recommends that reserve C2457 be made a Class A reserve for Conservation of Flora and Fauna, vested in the Western Australian Wildlife Authority.

G.21 RESERVE C28167 (SOUTH OF ORTON ROAD PEEL ESTATE)

Reserve C28167 (33 ha) is for Conservation of Flora and Fauna and is vested in the Western Australian Wildlife Authority.

The reserve contains a typical vegetation of the Bassendean Soil-landform Unit (Churchward and McArthur 1978) - low open-forest and low woodland of Jarrah (*Eucalyptus marginata*), Sheoak (*Casuarina fraserana*), Holly-leaved Banksia (*B. ilicifolia*), Slender Banksia (*B. attenuata*) and Christmas Tree (*Nuytsia floribunda*). A low-lying area contains paperbarks (*Melaleuca preissiana*).

The reserve should be retained as a sample of the vegetation in a district which is becoming increasingly cleared.

The Committee endorses the class, purpose and vesting of reserve C28167.

This proposal includes two reserves, an area of vacant Crown land and a freehold lot. Reserve C33581 (217 ha) is for Parks and Recreation and is not vested and reserve C31102 (43 ha) is for Cemetery Site, unvested. The vacant Crown land includes swamplands to the north of Kwinana lot S33 and the west end of C33581 (Fig.).

At the western end of the proposed area is a ridge of limestone representing the Cottesloe Soil-landform Unit (Churchward and McArthur 1978). East from this the land falls away to a north-south line of swamps of the Herdsman Unit, and on the east of the swamps is an area of consolidated dunes representing the Karrakatta Unit.

The limestone ridge carries low open-heath and, on the deeper sand on the eastern slope, woodland of Tuart (*Eucalyptus gomphocephala*). The swamps carry a fringe of low woodland of Flooded Gum (*E. rudis*) and the paperbark *Melaleuca raphiophylla*. Several of the swamps are covered in the centre with closed sedgeland of various species of Cyperaceae. On the Karrakatta Unit the vegetation is mostly low open-forest of Jarrah (*E. marginata*), Banksia (*B. menziesii* and *B. attenuata*), Woody Pear (*Xylomelum occidentale*) and Sheoak (*Casuarina fraserana*).

In each type of vegetation there is a different suite of shrubs and herbs in the understorey. Orchids, especially, are well represented.

The area is valuable for conservation for the following reasons. It is a relatively large area in a district where most of the land is freehold and developments are proposed or already in hand. It is one of the few opportunities south of Perth where in one reserve it is possible to represent the Cottesloe, Herdsman and Karrakatta Units. It contains three swamps.

RECOMMENDATION

The Committee recommends that:

1. reserves C31102 and C33581 be made Class A reserves for Conservation of Flora and Fauna, vested in the Western Australian Wildlife Authority;
2. the area of vacant Crown land and Kwinana lot S33 as shown in Fig. be included in the A Class reserve.

Point Becher, south of Warnbro Sound, is a short peninsula that contains Port Kennedy. The area is all Crown land, including reserve C20716, of 137 ha, for the purpose Excepted from Sale and Government Requirements, not vested.

The peninsula consists of parallel, curving dunes of the Quindalup Soil-landform Unit (Churchward and McArthur 1978), typical of the coastal plain south of Rockingham.

A number of squatters' shacks have been built near the beach, and access tracks have been made through the reserve. Much of the area retains its natural vegetation, which is quite rich in species. Thickets of wattle (*Acacia cyclops*, *A. saligna* and *A. rostellifera*) are common. Other tall shrubs include typical coastal species such as *Alyxia buxifolia*, *Olearia axillaris*, *Exocarpos sparteus*, *Myoporum adscendens*, *Spyridium globulosum*, and *Leucopogon parviflorus*. Both the glabrous and pubescent forms of Snakebush (*Hemiandra pungens*) are present.

There are many perennial herbs, mostly common species such as *Scirpus nodosus*, *Lepidosperma gladiatum*, *Conostylis aculeata*, *Hardenbergia comptoniana* and *Clematis microphylla*. A less frequently seen species occurring here is a climbing milkwort, *Comesperma integerrimum*.

The area has obvious potential for recreation. While this should be encouraged, the conservation value should also be recognised, for there is little similar land available for this purpose between Fremantle and Mandurah.

RECOMMENDATION

The Committee recommends that:

1. the purpose of reserve C20716 be changed to Parkland and Recreation;
2. it be vested in the Shire of Rockingham;
3. the areas shown in Fig. be added to reserve C20716;
4. the Shire retain as much as possible of the natural vegetation;
5. for this purpose the Shire seek the advice of the proposed Flora Research and Conservation Advisory Service or, prior to its formation, the Department of Conservation and Environment.

G.24 RESERVE A24309 (NAVAL BASE)

Reserve A24309, of 56 ha, for Recreation and Camping, not vested, is a narrow reserve lying between Cockburn Road and the shore of Cockburn Sound. The shore here is a limestone cliff up to 6 m high, though there are several sandy beaches at its base. The reserve is gently undulating and has shallow sand overlying the limestone.

The vegetation is mostly low closed- to open-heath but in several areas there are emergent trees of Slender Banksia (*B. attenuata*) and Limestone Marlock (*Eucalyptus decipiens*). At least 50 species of native plants occur here. They include *Acacia truncata*, *A. lasiocarpa*, Parrot Bush (*Dryandra sessilis*), Spider-net Grevillea (*G. thelemanniana*), *Petrophile serruriae*, Coral Vine (*Kennedia coccinea*), *Myoporum adscendens*, *Scaevola holosericea*, *Olearia axillaris* and One-sided Bottlebrush (*Calothamnus quadrifidus*).

A few areas atop the sea-cliff carry a very low heath of *Frankenia pauciflora*, *Atriplex* sp. and *Tetragonia* sp.

Parts of the reserve are already used as picnic areas. At the south end is the Naval Base Caravan Park, while at the north end is Jervoise Groyne with a small marina. Use of the reserve is largely confined to these areas and several access tracks.

Towards the southern end the reserve encloses another reserve, C29767 (4047 m²) for Navigation Beacon Site, not vested. There is no similar section of coastline near Perth. The vegetation is mostly in good condition and in spring makes a colourful display. The Committee considers that the vesting authority should retain it wherever possible.

RECOMMENDATION

The Committee recommends that:

1. the Town of Cockburn retain the natural vegetation on that part of reserve A24309 as shown in Fig.
2. to this end the Town seek the advice of the proposed Flora Research and Conservation Advisory Service or, prior to its formation, the Department of Conservation and Environment.

H

H.1 KEYSBROOK

North of Keysbrook near the South Western Highway are a few partly cleared stands of open-forest, dominated by Marri (*Eucalyptus calophylla*), Wandoo (*E. Wandoo*) and Jarrah (*E. marginata*), characteristic of the Guildford Soil-landform Unit on the Pinjarra Plain (Churchward and McArthur 1978). Among these common species are about 100 trees of the rare Salmon White Gum (*E. lane-poolei*), which is known in only a few good stands in Western Australia. Near watercourses are further communities dominated by the paperbark *Melaleuca raphiophylla* and Flooded Gum (*E. rudis*).

Although the area is actively farmed and much of the original vegetation cleared, the remaining stands of trees are considered worthy of preservation, with emphasis on retaining Salmon White Gum. Present landholders have demonstrated that tree-stands are compatible with effective farm management but some longer-term protection is needed to ensure that future operators do not unnecessarily destroy the rare flora.

One mature specimen and one seedling of *E. lane-poolei* are growing in the railway reserve, and the Committee considers that further plantings of this tree along the reserve would assist preservation of the species.

RECOMMENDATION

The Committee recommends that:

1. the Environmental Protection Authority draw the landowners' attention to the importance of conserving specimens of the rare *Eucalyptus lane-poolei* on their properties;
2. Westrail obtain seedlings of *E. lane-poolei* and plant them within the Keysbrook railway reserve, with advice from the Forests Department.

H.2 MADORA

Some public disquiet has been expressed over the stability and appearance of dunes in the Peelhurst-Singleton-Madora area as a result of housing development. Stability may be affected by excessive or unplanned human use and appearance by widespread subdivision for housing. The Committee suggests that buffer zones of uncleared land be left to preserve some segments of the scenery and vegetation near the main Mandurah road and between areas of housing. A zone 500 m wide is proposed west of Mandurah Road (Road number 10984) to restrict housing to west of the dune ridge, and four east-west zones each 250 m wide are suggested to retain corridors of vegetation from the 500 m zone to the coast. The present practice of excluding housing from a strip adjacent to the shore is commended and should continue.

It is considered that these proposals will be to the benefit of all parties, as an enhanced residential environment has greater monetary as well as aesthetic value. In principle, public access to the reserved land would be unrestricted, but, in practice, some advisory body would have to undertake location and maintenance of paths to avoid dune erosion. This onus would fall initially on the relevant local authority but might later devolve on a more localised committee.

RECOMMENDATION

The Committee recommends that:

1. suitable parcels of land in the Peelhurst-Singleton-Madora area be purchased to enable the land to be left uncleared and set apart as reserves for public open space or passive recreation, boundaries of specific areas to be approximately as shown in Fig. ;
2. the reserves so formed be vested in a suitable body, such as the Shire of Mandurah.

H.3 GOEGRUP LAKE CHAIN

Goegrup Lake (Willie's Lake) is a shallow, brackish-to-saline lake some 6 km from the mouth of the Serpentine River. The Lake has long been recognised as an important breeding and feeding ground for mullet, prawns and crabs.

Parts of the lake and the adjacent foreshores are contained in the following reserves: C26351, of 187 ha, for Public Recreation; C25360, of 29 ha, for Recreation; C25846, of 0.9 ha, for Recreation. None is vested.

In the Serpentine River to the north are three brackish-to-fresh pools, Yalbanberup, Guanarnup and Kerulup Pools, and to the south-east is an interconnected series of brackish-to-salt lakes, Cogrup, Salt, Walyanup, Bulbiba and Road Lakes. This chain of pools and lakes is a major watering and loafing area for waterfowl; many seek fresh water daily from the seepages and waters of the Serpentine River. On separate days in November 1977, 432 birds of 18 species were observed on the river north of Lake Goegrup and over 7000 birds of 23 species on the lakes south-east of Goegrup.

Stands of *Melaleuca hamulosa* and the paperbarks *M. cuticularis*, *M. raphiophylla* and *M. preissiana* thrive on peaty or low-lying areas surrounding the chain of lakes, and add to their scenic value. Swamp Sheoak (*Casuarina obesa*), samphires (*Salicornia* spp.) and Shore Rush (*Juncus maritimus*) add further interest to the water's edge.

About a third of the Goegrup Lake area is privately owned, and landholders reportedly wish to develop the area for public amenities, houses and business premises. Some aspects of those activities could adversely effect the habitats of fish and other wildlife in the lake: for example, there is a proposal to dredge shallow areas for motor-boats. Exclusion of motor-boats in favour of canoeing, rowing and sailing would preserve the serenity of the lake for human enjoyment of its scenery and wildlife.

RECOMMENDATION

The Committee recommends that:

1. an immediate approach by the Environmental Protection Authority be made to the Shire of Murray (the controlling authority for the eastern, unreserved portion of Goegrup Lake) requesting that no dredging be permitted until a detailed examination is made to assess its likely effects;

2. the freehold portion of Goegrup Lake, the Serpentine River north of Kerulup Pool, the chain of lakes south-east through Cogrup to Road Lake and a suitable marginal buffer zone, be purchased when available and, after revestment, be made a Class A reserve for Conservation of Flora and Fauna, vested in the Western Australian Wildlife Authority;
3. reserves C25360, C25846 and C26351 be made Class A reserves for Conservation of Flora and Fauna, vested in the Western Australian Wildlife Authority.

RECOMMENDATION

The Committee recommends that:

1. the Crown land portion of Lake McLarty be made a Class A reserve for Conservation of Flora and Fauna, vested in the Western Australian Wildlife Authority;
2. the Environmental Protection Authority support the negotiations of the Department of Fisheries and Wildlife to acquire the drainage from Lake McLarty;
3. freehold land within Lake Mealup be purchased when available, and after revestment be consolidated with reserve C6627 in a Class A reserve for Conservation of Flora and Fauna, vested in the Western Australian Wildlife Authority.

H.4 PEEL-HARVEY ESTUARY

Peel Inlet and Harvey Estuary, often known collectively as the Peel-Harvey Estuary, support large populations of many water-bird species. It is probably the most important estuary in south-western Australia as a conservation area for water-birds. To date more than 70 species have been recorded on the Estuary, 17 of which are summer migrants from the northern hemisphere. The remainder have their breeding grounds within Western Australia.

Peel-Harvey has the largest Pelican (*Pelecanus conspicillatus*) population of any estuary in the south-west. In November 1976, 1700 birds inhabited the Estuary, some 68% of the total number of pelicans known to occur on all south-west estuaries at that time. In December 1976 the population reached a peak of 2100 birds.

The Estuary also supports very large waterfowl populations. Grey Teal (*Anas gibberifrons*) are the most abundant duck species, numbering more than 20 000 in February 1977. Black Swans (*Cygnus atratus*) are also abundant; a three-day survey of all south-west estuaries in November 1976 showed the Peel-Harvey Estuary supporting more than 5500 birds, some 45% of the total south-west estuarine population at that time. In October 1976, 8000 Black Swans inhabited Peel-Harvey.

Many thousands of resident and migratory wading birds also inhabit Peel-Harvey. Banded Stilt (*Cladorhynchus leucocephalus*) are most abundant, numbering 40-50 000 birds in February 1977. More than 10 000 migratory waders, mainly Red-necked Stint (*Calidris ruficollis*) were also present during the summer of 1976-77.

The most important areas for water-bird habitat are the extensive shallows around the southern and eastern shores of Peel Inlet, and Harvey Estuary south of Herron Point. Austin Bay in the south of Peel Inlet, is included in reserve C28087, of 891 ha, for Fauna - Pelican Breeding, vested in the W.A. Wildlife Authority. Most of the 40-50 000 Stilts recorded in February 1977 were in the south and east of Peel Inlet. Further observations for this area are as follows: 12 000 Grey Teal were recorded in Spring 1976, and the area may support over 10 000 migratory waders, thousands of Black Swans, Mountain Ducks (*Tadorna tadornoides*) and Coots (*Fulica atra*) and flocks of up to 700 Pelicans. Unusual species recorded include Glossy Ibis (*Plegadis falcinellus*), Yellow-billed Spoonbill (*Platalea flavipes*) and Royal Spoonbill (*P. regia*).

In Harvey Estuary south of Herron Point approximately 20 000 Grey Teal have been recorded, and Black Duck (*Anas superciliosa*), Pink-eared Duck (*Malacorhynchus membranaceus*) and Shoveller (*Anas rhynchotis*) number many hundreds. Thousands of Black

H.5 LAKE McLARTY AND LAKE MEALUP

Lake McLarty (Big Lake) and Lake Mealup lie on the eastern side of Harvey Estuary. Lake McLarty is mostly Crown land while Lake Mealup is mostly freehold. Between the northern tip of Lake McLarty and the Estuary is reserve A24739, of 48 ha, and at Mealup Point is reserve A2738, of 34 ha, both of which for Conservation of Flora and Fauna and vested in the Western Australian Wildlife Authority. Within Lake Mealup is reserve C6627, of 18 ha, for Watering Place for Stock, not vested.

These lakes provide fresh water in summer for the birds of Peel Inlet and Harvey Estuary and support a resident bird population.

Although Lake McLarty becomes dry in summer due to a culvert, negotiations to close the drain and retain larger areas of water in summer are under way between the Department of Fisheries and Wildlife and the owner of the Location containing the drain. The construction of a levee will be necessary to protect private land to the west from flooding from the filled lake. This will provide an excellent summer refuge for water-birds.

Lake Mealup is important as a watering-place for water-birds, and the Committee considers that any portion of the lake offered for sale should be purchased for inclusion in a reserve for Conservation of Flora and Fauna.

Reserve A24739 contains, along the shore, a belt of low woodland of the paperbarks *Melaleuca cuticularis* and *M. raphiophylla*. Most of the reserve contains low woodland of Jarrah (*Eucalyptus marginata*), Banksias (*B. grandis*, *B. attenuata*, *B. ilicifolia*), Sheoak (*Casuarina fraserana*) and Christmas Tree (*Nuytsia floribunda*). Some low-lying parts contain Flooded Gum (*E. rudis*) and there are also stands of Spearwood (*Kunzea vestita*). Closed-heath occurs on the reserve, with species such as *Regelia ciliata*, *Leptospermum crassipes*, *Hypocalymma angustifolium* and *Astartea fascicularis*. A rare species found on the reserve is the heath *Brachyloma preissii*.

The fringing vegetation along the margin of the Harvey Estuary, within reserve A2738, is low woodland of *Melaleuca cuticularis* and *M. raphiophylla* with sedges such as *Gahnia trifida*, *Scirpus nodosus*, and *Juncus maritimus*. Other low-lying areas support Swamp Banksia (*B. littoralis*) with shrubs of *Hakea varia*, *Astartea fascicularis*, *Leptospermum crassipes*, *Melaleuca uncinata*, *M. leptoclada* and *M. hamulosa*. There are dense stands of Spearwood. Sandy rises have low woodland of Jarrah, Bull Banksia (*B. grandis*), Slender Banksia (*B. attenuata*), Sheoak and Christmas Tree.

Swans and up to 5000 Coots and 800 Pelicans may be present. Hundreds of Red-necked Avocets (*Recurvirostra novaehollandiae*) and migratory waders use the area, and an unusually large flock of about 60 Crested Grebe (*Podiceps cristatus*) has been recorded. Yellow-billed Spoonbills have been seen in parties of up to 30 birds. The delta of the Harvey River is important in late summer, when thousands of ducks congregate on its banks.

Also important are the tidal flats and shallows around Channel and Creery Islands and areas of shore in the north of Peel Inlet and bordering the main channel from Peel Inlet. Channel and Creery Islands are included in reserve C8185, of about 90 ha, for Public Recreation, vested in the Shire of Mandurah.

The tidal flats and shallows around Channel and Creery Islands are used in summer by many thousands of transequatorial migratory waders. Flocks of Banded Stilts that may number more than 10 000 birds occur as well as large flocks of White-faced Heron (*Ardea novaehollandiae*). Small parties of Little Egrets (*Egretta garzetta*) use the area throughout the year, a rare occurrence in the South West. Hundreds of waterfowl, particularly Black Duck, Grey Teal, and Black Swan frequent the area and Pelicans have nested there.

The areas of shore in the north of Peel Inlet and bordering the main channel from Peel Inlet (See Fig.) contain samphire flats and marshes and are all important for Eastern Curlews (*Numenius madagascariensis*) and Whimbrels (*N. phaeopus*), being one of the few places in the South West where they can always be seen. The lake in the northern shore of Peel Inlet is also important for waterfowl, especially Grey Teal, and waders such as Pied Stilts, Herons and Egrets.

The Peel-Harvey Estuary provides an important nursery area for commercial species of fish; the catch is greater than those of the Swan and Leschenault estuaries combined. The significant species are largely the same as those of Leschenault Estuary (see H.17) of which the most important are Sea Mullet (*Mugil cephalus*), Yellow-eye Mullet (*Aldrichetta forsteri*), Cobbler (*Cnidoglanis macrocephalus*), King George Whiting (*Sillaginodes punctatus*), Western Sand Whiting (*Sillago schomburgkii*) and Tailor (*Pomatomus saltator*).

The value of the Estuary is well recognised in providing an area for human recreation and relaxation. The increasing usage - especially in boating - and the construction of further houses, may conflict with the area's value to conservation. The Committee therefore proposes that some areas of the Peel-Harvey Estuary and shoreline that are important for water-bird feeding and breeding be reserved to lessen human impact in those areas.

A number of reserves larger than 20 ha are situated in areas adjacent to or near the Peel-Harvey Estuary. Reserves B4990 and B24036 adjoin the eastern side of Peel Inlet, reserves C2707 and C7502 lie just south of Peel Inlet, reserves C27528, A2738, A24739, A23756, and A31922 lie along the eastern side of Harvey Estuary and reserves C860 and C2990 lie on the western side of Harvey Estuary. Reserves C2738 and A24739 are discussed under H.5: Lake McLarty and Lake Mealup.

Reserves B4990 and B24036, of respectively 140 ha and 343 ha, are for the purpose Conservation of Flora and Fauna and are vested in the Western Australian Wildlife Authority.

The swampy ground within the reserves and flats adjacent to them are an excellent habitat for a great variety of birds. In some places the flats rise above the normal water-level and are only covered by exceptionally high tides. Here samphire grows, and a chain of samphire islands extends along the edge of the reserves. The islands are important feeding and roosting grounds for wading birds such as Red-necked Stint (*Calidris ruficollis*), Red-capped Dotterel (*Charadrius alexandrinus*), and Sharp-tailed Sandpiper (*Calidris acuminata*), which gather there in large numbers. The low-lying land within the reserves supports large stands of Spearwood (*Kunzea vestita*).

Reserve C7502, of 146 ha, is for Water and is not vested. It lies south of Robert Bay, next to Carraburyup Road.

A large swampy flat occupies the centre of the reserve and carries an open samphire association, the species being *Arthrocnemum halocnemoides* var. *pergranulatum* and an unnamed species of *Arthrocnemum*. Around the margins is a fringe of Salt-water Paperbark (*Melaleuca cuticularis*) and *M. viminea*. Beyond this is closed-heath of *Melaleuca uncinata*, *M. lateriflora*, *Verticordia densiflora* and *Lepidosperma longitudinale* with some emergent *Acacia saligna* and *Actinostrobos pyramidalis*.

The north end of the reserve contains low woodland of Bull Banksia (*B. grandis*), Swamp Banksia (*B. littoralis*), the paperbarks *Melaleuca preissiana* and *M. raphiophylla*, Marri (*Eucalyptus calophylla*) and Christmas Tree (*Nuytsia floribunda*). Blackboys (*Xanthorrhoea preissii*) and Zamia (*Macrozamia riedlei*) are common. Shrubs in the understorey include *Viminaria juncea*, *Jacksonia sternbergiana*, *Astartea fascicularis*, *Melaleuca scabra* and *M. uncinata*.

Reserve C2707, of 98 ha, is for Conservation of Flora and Fauna and is not vested. It lies immediately north-east of reserve C7502, between Carraburyup Road and the Inlet. Many of the above species are also present in reserve C2707, but a greater proportion of reserve C2707 is covered in woodland.

Reserve C27528, of 34 ha, lies on the eastern side of Harvey Estuary, at Stony Point. It is for Recreation and is not vested. The reserve carries open-forest of Tuart (*Eucalyptus gomphocephala*), Jarrah (*E. marginata*) and Marri.

The adjoining reserves A23756 and A31922 lie on the eastern side of Harvey Estuary, south of Big Lake. Reserve A23756, of 1019 ha, is for Conservation of Flora and Fauna, and is vested in the Western Australian Wildlife Authority. Reserve A31922, of 20 ha, situated at Herron Point is for Recreation and is vested in the Shire of Murray.

The fine grey-white sand of reserve A23756 supports woodland and open-woodland of Jarrah, Marri, Bull Banksia and Slender Banksia (*B. attenuata*) with some Peppermint (*Agonis flexuosa*) and Christmas Tree. The understorey includes such species as *Hibbertia hypericoides*, *Acacia huegelii*, *Adenanthos obovatus*, *Petrophile linearis*, *Persoonia saccata*, *Conostylis aculeata*, *Hardenbergia comptoniana* and *Dasypogon bromeliaefolius*.

Several low-lying swampy areas contain low-woodland of Swamp Banksia and the paperbark *Melaleuca preissiana*.

The vegetation of reserve A31922 ranges from low open-forest to low open-woodland. It is dominated by Slender Banksia with admixture of *Casuarina fraserana*, Bull Banksia, Holly-leaf Banksia (*B. ilicifolia*), Christmas Tree, Marri and *Melaleuca preissiana*.

The understorey contains species such as *Adenanthos meisneri*, *Hypocalymma angustifolium*, *Regelia ciliata*, *Melaleuca thymoides*, *Hibbertia* spp., *Bossiaea eriocarpa* and *Dasypogon bromeliaefolius*.

Reserves C2990 (72 ha) and C860 (34 ha) lie on the western side of Harvey Estuary; the former is opposite Herron Point and the latter is at Warrungup Spring. Reserve C2990 is for Recreation and Camping and is vested in the Shire of Mandurah. Reserve C860 is for Water and is not vested.

The vegetation of reserve C2990 is predominantly tall woodland dominated by Tuart with an understorey of Peppermint. Reserve C860 carries open-forest of Tuart, Jarrah and Marri.

The Committee endorses the status, purpose and vesting of reserve A31922.

RECOMMENDATION

The Committee recommends that:

1. reserve C8185, comprising Channel and Creery Islands, be made a Class A reserve for Conservation of Flora and Fauna, vested in the Western Australian Wildlife Authority;
2. the abutting portion of Peel Inlet, as shown in Fig. be created an aquatic reserve of Class A with the same purpose and vesting as C8185;
3. negotiations be undertaken to purchase portions of the freehold land on the mainland near Channel and Creery Islands, and on the banks of the channel to enable the extension, under the Land Act or the Fisheries Act, as necessary, of the Class A reserve Channel and Creery Islands and the aquatic reserve (see Fig.);

4. reserves C2707, C7502, B4990, B24036 and C28087 be made a Class A reserve for Conservation of Flora and Fauna, vested in the Western Australian Wildlife Authority, and that the eastern portion of Peel Inlet, as shown in Fig. , be created an aquatic reserve with the same class, purpose and vesting;
5. freehold lands abutting the southern banks of Peel Inlet (see Fig.) be purchased when offered on the market, and after revestment be included in the Class A reserve for Conservation of Flora and Fauna, vested in the Western Australian Wildlife Authority;
6. the southern portion of Harvey Estuary, as shown in Fig. be made a Class A aquatic reserve for Conservation of Flora and Fauna, vested in the Western Australian Wildlife Authority;
7. freehold land abutting the southern portion of the Harvey Estuary and Wellington Location 2986 be purchased when offered on the market, and after revestment be included in the Class A reserve for Conservation of Flora and Fauna, vested in the Western Australian Wildlife Authority;
8. reserve C17318 (of 2 ha, for Public Utility, not vested) and the southern portion (45 ha) of reserve C2990 be cancelled and the lands included in the Class A reserve for Conservation of Flora and Fauna, vested in the Western Australian Wildlife Authority;
9. the purpose of reserve A20215 be changed from National Park to Parklands and Recreation, and that the reserve be vested in the Shire of Murray;
10. the purposes of reserves C27528 and C860 be changed to Parkland and Recreation and that the reserves be vested in the Shire of Murray and the Shire of Mandurah, respectively.

H.6 YALGORUP NATIONAL PARK

Yalgorup National Park (reserves A11710, A22057, A12189 and C21271) is situated west of the Old Coast Road, about 25 - 50 km south of Mandurah. The reserves are vested in the National Parks Authority for the purpose of National Park. The total area is 11 181 ha.

The Park includes Lakes Preston and Clifton and various areas of land connected by these two bodies of water. Most of the Park is situated near the southern end of Lake Clifton and the northern part of Lake Preston, while a smaller areas adjoins the northern end of Lake Clifton.

The area is dominated by the Yoongarillup Soil-landform Unit (Churchward and McArthur 1978), consisting of plains of shallow yellow and brown sands over limestone. The Cottesloe and Karrakatta Units are also represented, particularly in the north-east of the Park. They are hillier landscapes and comprise, respectively, shallow brown and deep yellow sands over limestone. In the west, patches of the sand dunes of the Quindalup Unit are represented, and west of Martin Tank and south of Lake Clifton are areas of the Vasse Unit, which consists of poorly drained plains with variable, undifferentiated lacustrine, estuarine and marine deposits.

Lands of the Yoongarillup and the Vasse Units, which occur between Mandurah and Bunbury, are mostly cleared for agricultural or for residential holdings. The Vasse Unit is poorly represented in conservation reserves. Yalgorup National Park contains the best remaining representatives of both landforms.

Woodland of Tuart (*Eucalyptus gomphocephala*) is the commonest vegetation in the Park, and occurs on the Yoongarillup and Cottesloe Units. Peppermint (*Agonis flexuosa*) and the wattle *Acacia saligna* occur in the understorey, the former being especially common in the low-lying areas near the swamps and lakes.

In some areas Slender Banksia (*B. attenuata*), Bull Banksia (*B. grandis*) and Sheoak (*Casuarina fraserana*) are prominent. The commoner lower shrubs are Stinkwood (*Jacksonia sternbergiana*), Prickly Moses (*Acacia pulchella*) and *Melaleuca acerosa*. In the north-eastern portion of the Park, on the deeper soils of the Karrakatta Unit, Jarrah (*E. marginata*) and Marri (*E. calophylla*) share the dominance with Tuart.

Where the limestone crops out within the Yoongarillup and the Cottesloe Units, closed- and open-heath occur.

In the north the heath is less defined from the woodland of Tuart than it is in the south. This is because the limestone hills are not so prominent, and especially because the heath and surrounding woodland has been frequently burnt. Fire has allowed coloniser species to dominate both regions, and little regrowth of characteristic shrubs has occurred.

The mobile and the stable dunes of the Quindalup Unit are both represented in the Park. An area of mobile dunes occurs in the extreme north west, near Cape Bouvard. On the windward side of the foredunes are dense stands of *Olearia axillaris*, *Scaevola crassifolia*, *Carpobrotus virescens* and *Scirpus nodosus*, while on the sheltered leeward side Southern Diplolaena (*D. dampieri*) and *Myoporum adscendens* dominate.

The stable dunes carry mostly open-heath vegetation. *Melaleuca acerosa* and *Acacia lasiocarpa* are the dominant plants, and *Phyllanthus calycinus*, *Lepidosperma angustatum* and *Pimelea feruginea* are common. In the more sheltered areas occur closed- or open-scrub dominated by *Acacia rostellifera* or Peppermint, with *A. saligna* and *Jacksonia furcellata*.

Surrounding the lakes is a narrow band of closed-forest of the paperbarks *Melaleuca cuticularis* and *M. raphiophylla*. The former is the commoner species, and where the two occur together it occurs in a band closer to the lake or swamp. Beneath the *M. cuticularis* along the shores of Lake Clifton *Juncus maritimus*, *Cyperus nitens* and *Wilsonia backhousei* form the dominant ground cover. Immediately behind the paperbarks is a narrow band of *Acacia cyclops*, the zonation being particularly noticeable around Lake Preston.

A small stand of Rottnest Tea Tree (*Melaleuca lanceolata*) surrounded by a low woodland of *M. cuticularis* occurs on a rocky island north of the causeway over Lake Preston. Rottnest Tea Tree, although abundant on Garden Island and parts of Rottnest Island, is rare on the mainland within System 6.

The poorly drained soils of the Vasse Unit, south-east of Lake Clifton, support mostly sedgelands, but some patches of free water occur.

In the free water an undescribed species in the family Cyperaceae is common.

In the areas surrounding the water *Melaleuca viminea* and *Leptocarpus aristatus* are by far the most dominant species. Some *Melaleuca cuticularis* occurs throughout the region and dense stands of Blackboy (*Xanthorrhoea preissii*) are also common. Some of the dominant smaller shrubs are *Melaleuca incana* (growing predominantly among the Blackboys), *Scaevola holosericea*, *Acacia pulchella* and *Stackhousia huegelii*. Bracken Fern (*Pteridium esculentum*) is present but rare.

Altogether, some 220 species of plants have been collected from within the Park.

Grey Kangaroos (*Macropus fuliginosus*), Emus (*Dromaius novaehollandiae*) and Brush Wallabies (*Macropus irma*) occur in the Park, and are seen frequently.

The bird-life is varied and abundant. One observer recorded 100 species in two weeks. About 1370 birds of 16 species,

including 265 Black Swans (*Cygnus atratus*), were present on Lake Clifton, and 366 birds of 11 species on Salt Lake.

Serventy (1930) listed 76 species of birds, to which Jenkins (1971) added a further 58 species. From regular observations over a two-mile stretch of Lake Clifton, Jenkins estimated that there were more than 1000 each of Coots (*Fulica atra*) and Musk Ducks (*Biziura lobata*), over 500 Black Swans, over 200 Hoary-headed Grebes (*Podiceps poliocephalus*), more than 100 each of Black Ducks (*Anas superciliosa*) and Grey Teals (*Anas gibberifrons*), and over 50 each of Mountain Ducks (*Tadorna tadornoides*) and Crested Grebes (*Podiceps cristatus*).

In the moulting season, great rafts of flightless Black Ducks occur on Lake Preston.

In 1976 the Western Australian Institute of Technology set up sample plots in the Park to begin a long-term study of its ecology. Students will measure any changes in the vegetation and how they relate to fires and other disturbances.

The greatest public use of Yalgorup National Park occurs in the coastal area near White Hill and Tims Thicket and on the southern end of Lake Preston, which is used for water-skiing. Access to Preston Beach, a popular spot outside the Park, is through the Park. Picnic areas are established at the beginning of the road from the highway to Preston Beach and at the eastern edge of Lake Preston on the same road.

Management of the Park is made difficult by the complex configuration of the boundaries, attributable both the enclaves of private property and to small protrusions of National Park, especially between Lake Clifton and the highway. Private property extends to the shore around most of Lake Preston, where grazing takes place to the water's edge, damaging most of the margins of the lake. Private property also borders much of Lake Clifton.

Tims Thicket

Reserve C24198, of 301 ha, is located at Tims Thicket. It is for Camping and Recreation and is vested in the Mandurah Shire.

The area forms part of an interesting geomorphological complex, of which the remainder is in Yalgorup National Park. Tims Thicket and adjacent areas include calcareous dunes of the Quindalup Unit, some fixed by open-heath or closed-heath and some unvegetated and mobile. Some of the fixed dunes are sparsely vegetated with trees. Inland from the dunes are outcrops of Tamala limestone, partly aeolian, partly marine, and in places thinly or thickly mantled by grey to orange quartz sand.

Depending on the depth of sandy soils, the vegetation ranges from open-heath to tall open-woodland of Tuart and Peppermint. *Acacia truncata* is perhaps the common-east low shrub of the heath. A number of other shrubs, however, are very common, for example *Hakea trifurcata*, Cockies' Tongues (*Templetonia retusa*), *Lysinema ciliatum*, *Casuarina humilis* and *Melaleuca acerosa*. Chenille Honey-myrtle (*M. huegelii*) is abundant in places. Small pockets of *Acacia cochlearis* and Tree Smokebush (*Conospermum triplinervium*) occur where the heath borders woodland. Limestone Marlock (*Eucalyptus decipiens*) forms dense stands in some areas.

Other species recorded include Blackboy, the wattles *Acacia bivenosa* and *A. lasiocarpa*, Parrotbush (*Dryandra sessilis*), *Hakea prostrata*, *Spyridium globulosum*, *Cryptandra* sp., *Rhagodia radiata*, Quandong (*Santalum acuminatum*), Spider-net Grevillea (*G. thelemanniana*), Scrub Sheoak (*Casuarina humilis*), *Olearia axillaris*, *Pimelea ferruginea*, Sword-grass (*Lepidosperma angustatum*), *Conostylis candicans* and *Loxocarya flexuosa*.

Associated with the heath in the northern part of the Park, near the road to Tims Thicket, is an interesting occurrence of Fremantle Mallee (*Eucalyptus foecunda*), close to its southernmost occurrence on the Swan Coastal Plain. It is rare in System 6, being characteristic of dry, inland areas.

The inclusion of reserve C24198 in the National Park would provide valuable consolidation of the Park's northern portion. Negotiations are under way between the National Parks Authority and the Mandurah Shire Council for the exchange of this area for portion of reserve C21271.

RECOMMENDATION

The Committee recommends that:

1. urgent priority be given to the purchase of private freehold lands near Martin Tank and the northern end of Lake Preston within Yalgorup National Park;
2. as suitable freehold land to the west of Yalgorup National Park is offered for sale it be purchased to enable it to be included in the National Park;
3. if the Shire of Mandurah agrees, reserve C24198 be cancelled, and the land be included in Yalgorup National Park.

H.7 STATE FOREST NO.16: SPECIAL MANAGEMENT PRIORITY AREAS

Three S.M.P.A.'s with State Forest No.16 - Clifton, Myalup and McLarty - lie immediately east of the Old Coast Road in an almost continuous chain, extending northwards and southwards from Preston Beach Road.

CLIFTON

Clifton S.M.P.A. (10.1) has a core area of 413 ha and a buffer of 120 ha. It contains forest types of the Cottesloe and Karrakatta Soil-landform Units (Churchward and McArthur 1978) which are progressively being cleared on the Coastal Plain. The shallower sands overlying limestone carry open-forest of Tuart (*Eucalyptus gomphocephala*) with an understorey of Peppermint (*Agonis flexuosa*). The deeper sands carry a mixture of Jarrah (*E. marginata*) and Slender Banksia (*Banksia attenuata*) in an open-forest formation. Both types are relatively undisturbed. Despite its proximity to a main tourist road the area is not subject to any great pressure from recreation. Some dieback, caused by the fungus *Phytophthora cinnamomi*, has been recorded from the depressions in the north-eastern sector.

Peppermint and Woody Pear (*Xylomelum occidentale*) are two tree species of Clifton S.M.P.A. that are absent from the Cottesloe and Karrakatta Units as represented in the State Forest of the Wanneroo Division.

The reserve should be managed to preserve the vegetation. While access to pedestrians should be allowed, vehicles should be excluded to reduce the spread of the dieback fungus.

MYALUP

Myalup S.M.P.A. (10.2) has a core area of 490 ha and a buffer (the western portion, near the Old Coast Road) of 378 ha. It is bordered to the north and south by the Myalup pine plantation.

Myalup bridges the transition between the Cottesloe, Karrakatta and Bassendean Units, and is distinctive in providing a range of vegetation types.

The western portion contains vegetation similar to that of Clifton S.M.P.A., with open-forest of Tuart and Jarrah. The original appearance of the forest, however, has been altered: it was logged and regenerated between 1940 and 1960. The eastern portion contains a swampy area dominated by paperbarks (*Melaleuca* spp.).

The forest provides a corridor for the migration of fauna between Yalgorup National Park and a system of swamps to the east on the Wellesley River flats.

At present the forest receives little use for recreation. Since the dieback fungus has been recorded from the south-eastern corner, vehicles should be excluded from this section to limit its spread. Footpaths and a scenic drive would provide adequately for recreation.

McLARTY

McLarty S.M.P.A. (10.11) consists of a long, narrow strip that stretches between the other two S.M.P.A.'s and forms a visual barrier between the Old Coast Road and the pine plantations of State Forest No.16.

The vegetation is similar to that of Clifton S.M.P.A. and consists of an open-forest of Tuart with an understorey chiefly of Peppermint. Like Myalup, the forest was logged and regenerated between 1940 and 1960.

Access by motor vehicles should be confined to peripheral car-parks to reduce the spread of dieback.

Reserve C11709, of 38 ha, for Water, not vested, breaks McLarty into two parts. The reserve should be cancelled and included in the S.M.P.A. in order to facilitate management.

The Committee endorses the Forests Department's proposal to manage Clifton, Myalup and McLarty Special Management Priority Areas (10.1, 10.2 and 10.11) for the conservation of coastal vegetation types.

RECOMMENDATION

The Committee recommends that reserve C11709 be cancelled and the land added to State Forest No.16 for inclusion in McLarty Special Management Priority Area (10.11).

H.8 RESERVE A23172 (HARVEY RIVER)

Reserve A23172 (59 ha), on the east side of the Harvey River, is for Camping and is vested in the Shire of Waroona.

The northern part of the reserve has been cleared; the following is a description of that vegetation which remains.

Along the river bank is woodland of Marri (*Eucalyptus calophylla*), Jarrah (*E. marginata*) and the paperbarks *Melaleuca raphiophylla* and *M. preissiana*. Here the understorey has mostly disappeared and been replaced by grasses.

Farther from the river the woodland also contains Christmas Tree (*Nuytsia floribunda*) and Banksias (*B. grandis*, *B. attenuata* and *B. ilicifolia*). The understorey here is quite dense; representative species are Spearwood (*Kunzea vestita*), Stinkwood (*Jacksonia furcellata*), Pixie Mops (*Petrophile linearis*), Pink Myrtle (*Hypocalymma robustum*), *Daviesia incrassata*, *Adenanthos obovatus* and *Hibbertia vaginata*.

An interesting area towards the north side of the reserve contains closed-heath on a grey, sandy clay. It is dominated by species of *Melaleuca* (*M. uncinata*, *M. viminea* and *M. lateriflora*), together with *Hakea varia*, *Kunzea recurva*, Swishbush (*Viminaria juncea*) and Swamp Cypress (*Actinostrobus pyramidalis*). This is an unusual association of plants.

The Committee considers that the reserve should retain its present class, purpose and vesting, but that it should be managed so as to retain areas of natural vegetation. Camping could still be permitted in the grassed areas near the river. Two other local reserves (C13987 and C22545) are also for Camping and can cater for this need.

RECOMMENDATION

The Committee recommends that the Shire of Waroona manage reserve A23172 so as to retain significant areas of natural vegetation, and to this aim seek the advice of the proposed Flora Research and Conservation Advisory Service or, prior to its formation, the Department of Conservation and Environment.

H.9 RESERVE C22199 (WEST OF HAMEL)

This reserve (332 ha) is for Timber for Settlers and is not vested. It lies about 7 km west of Hamel and is traversed towards the north end by Buller Road.

The sandy soil supports a woodland of Jarrah (*Eucalyptus marginata*), Marri (*E. calophylla*), Bull Banksia (*B. grandis*) and Sheoak (*Casuarina fraserana*). Blackboys (*Xanthorrhoea preissii*) and Zamia (*Macrozamia riedlei*) are common. The understorey is moderately dense, containing species such as Spearwood (*Kunzea vestita*), *Conostephium pendulum*, *Calytrix flavescens*, *Hypocalymma robustum*, *Persoonia saccata*, *Eriostemon spicatus*, *Dasyopogon bromeliaefolius*, *Stirlingia latifolia* and *Daviesia divaricata*.

In the centre of the reserve is a small swamp that appears to be semi-permanent.

The reserve represents the Southern River Soil-landform Unit, (Churchward and McArthur 1978) and is the only large area of it between Mandurah and Bunbury. The reserve should be retained for conservation of its flora and fauna.

RECOMMENDATION

The Committee recommends that reserve C22199 be made a Class A reserve for Conservation of Flora and Fauna, vested in the Western Australian Wildlife Authority.

H.10 RESERVE C12049 (WEST OF WAGERUP)

This reserve (79 ha) is for Water and Conservation of Flora and Aquatic Life, and is unvested. The area is almost flat but includes a fresh lake which in most years contains water throughout the year.

The lakeside vegetation is low woodland of the paperbark *Melaleuca preissiana* with a dense ground cover of sedges, including Jointed Twig Rush (*Baumea articulata*). The shrubs include *Astartea fascicularis* and *Pultenaea reticulata*. Behind this is open-forest dominated by Jarrah (*Eucalyptus marginata*) and Banksia (*B. attenuata* and *B. ilicifolia*). The understorey is quite dense and rich in species, and includes *Adenanthos meisneri*, *Conostephium minus*, *Calytrix fraseri*, *Persoonia saccata*, *Hibbertia* spp., *Bossiaea eriocarpa*, *Stirlingia latifolia*, *Leucopogon* spp., *Johnsonia acaulis* and *Anarthria prolifera*. The last is an unusual record: the species is known otherwise only from the south coast.

The area represents the Bassendean Soil-landform Unit (Churchward and McArthur 1978).

The Committee endorses the class and purpose of the reserve, and considers that for adequate management it should be vested in the Western Australian Wildlife Authority.

RECOMMENDATION

The Committee recommends that reserve C12049 be vested in the Western Australian Wildlife Authority.

H.11 RESERVE C12632 (WEST OF COOKERNUP)

Reserve C12632 (40 ha) is for Water and Conservation of Flora and Aquatic Life, and is unvested. It lies about 9 km west of Cookernup, on the north side of Riverdale Road.

The reserve represents the Bassendean and the Serpentine Soil-landform Units (Churchward and McArthur 1978).

It contains several low-lying flats of clay and loam which support closed-heath of species such as Robin Redbreast Bush (*Melaleuca lateritia*), *M. polygaloides*, *M. teretifolia*, *Calothamnus lateralis*, White Myrtle (*Hypocalymma angustifolium*), *Adenanthos obovatus* and *Pimelea nervosa*. In some areas there are emergent trees and tall shrubs such as the paperbark *Melaleuca raphiophylla*, Swishbush (*Viminaria juncea*), and Spearwood (*Kunzea vestita*). There are sandy rises on which occur low open-woodland with Jarrah (*Eucalyptus marginata*), Christmas Tree (*Nuytsia floribunda*) and Banksia (*B. attenuata* and *B. ilicifolia*).

The reserve is in good condition. The heath vegetation is unusual in both formation and composition and should be conserved.

RECOMMENDATION

The Committee recommends that reserve C12632 be vested in the Western Australian Wildlife Authority.

H.12 RESERVE C24472 (OLD COAST ROAD)

Reserve C24472 (39 ha) is for Conservation of Flora and Fauna, vested in the Western Australian Wildlife Authority. It lies on the east side of the Old Coast Road, south of the junction with Crampton Road.

The area is relatively flat and contains low closed- to open-forest of Jarrah (*Eucalyptus marginata*), Banksia (*B. grandis* and *B. attenuata*), Snottygobble (*Persoonia longifolia*), Christmas Tree (*Nuytsia floribunda*) and Peppermint (*Agonis flexuosa*). Representative understorey species are Blackboy (*Xanthorrhoea preissii*), *Hakea varia*, *Acacia stenoptera*, *Hibbertia* spp., *Burtonia conferta*, Pink Myrtle (*Hypocalymma robustum*), *Conostylis aculeata* and *Platysace compressa*.

The vegetation is in good condition and should be retained as an example of the Karrakatta and the Yoongarillup Soil-landform Units (Churchward and McArthur 1978) in the region.

The Committee endorses the class, purpose and vesting of reserve C24472.

H.13 RESERVE C2547 (WEST OF HARVEY)

Reserve C2547 (10 ha) is for Public Utility and is unvested. It lies about 8 km west-north-west of Harvey, on the south side of Wellard Road.

The reserve is almost flat and contains low open-woodland and closed- to open-heath. The former is dominated by the paperbark *Melaleuca preissiana*, Peppermint (*Agonis flexuosa*), Flooded Gum (*Eucalyptus rudis*) and Christmas Tree (*Nuytsia floribunda*). Tall shrubs include Swishbush (*Viminaria juncea*) and Spearwood (*Kunzea vestita*). The heath contains shrubs such as *Melaleuca incana*, *Hakea varia*, *Jacksonia spinosa*, *Hypocalymma angustifolium*, *Boronia spathulata*, *Kunzea recurva* and *Leptospermum ellipticum* and sedges of the families Cyperaceae and Restionaceae.

The area is low-lying and in some parts wet in winter. The vegetation is in good condition and should be retained in its natural state since it occurs in a region which is now mostly freehold and cleared. It represents the Serpentine Soil-landform Unit (Churchward and McArthur 1978).

RECOMMENDATION

The Committee recommends that the purpose of reserve C2547 be changed to Conservation of Flora and Fauna, and that the reserve be vested in the Western Australian Wildlife Authority.

H.14 RESERVE C2517 (WELLESLEY RIVER)

This reserve (65 ha) is for Public Utility and is unvested. It lies about 8 km west-south-west of Harvey on the Wellesley River Flats.

The reserve contains a very good sample of low closed-heath with a few areas of the paperbark *Melaleuca rhapsiophylla*. It is low-lying and much of it is wet in winter. The heath contains four species of *Hakea* (*H. marginata*, *H. sulcata*, *H. trifurcata* and *H. varia*) and three of *Melaleuca* (*M. incana*, *M. lateritia* and *M. viminea*); other shrubs are *Kunzea recurva* and *Astartea fascicularis*. Sedges include *Gahnia trifida*, *Leptocarpus* sp., *Chorizandra* sp. and, in the wetter parts, *Baumea articulata*.

This is an unusual association of species and should be conserved. It represents the Serpentine Soil-landform Unit (Churchward and McArthur 1978).

RECOMMENDATION

The Committee recommends that the purpose of reserve C2517 be changed to Conservation of Flora and Fauna, and that the reserve be vested in the Western Australian Wildlife Authority.

H.15 MYALUP SWAMP AND MIALLA LAGOON

These wetlands lie east of the Old Coast Road near the northern end of Leschenault Estuary. Both provide fresh water for water-birds from the Estuary and Lake Preston and therefore are essential to the feeding and living cycle for these birds. Freehold landholders in the area have asked the Public Works Department to investigate the possibility of draining the lake system south of Wellesley Road (Fig.) to provide more agricultural land. The Department of Fisheries and Wildlife is opposed to the idea because of the effect on water-birds.

The Committee endorses the Wetlands Advisory Committee's view that drainage would interfere with watering-places for birds.

Benger Swamp is located some 2-4 km west of Benger railway station.

Stands of the paperbark *Melaleuca raphiophylla* surround the swamp; associated species are Dodder-laurel (*Cassytha racemosa*) and Lesser Bottlebrush (*Callistemon phoeniceus*). Closed-sedgelands of Bulrushes (*Typha orientalis*) occur over wide areas and *Juncus pallidus* occurs in a few isolated clumps. The dominant water-plants are *Lemna minor* and *Spirogyra* spp., with some *Myriophyllum* spp.

The fresh-water swamp is a haven for water-birds, many thousands of which use it as a drought refuge in the early summer, when the swamp is full. Over several years, an observer recorded 37 species of aquatic birds, 11 waders and 43 terrestrial species (Sedgewick 1973). Those which occur in the largest numbers include Australian Pelicans (*Pelecanus conspicillatus*), Little Pied Cormorants (*Phalacrocorax melanoleucos*), Straw-necked Ibis (*Threskiornis spinicollis*), Black Swans (*Cygnus atratus*), Mountain Ducks (*Tadorna tadornoides*), Black Ducks (*Anas superciliosa*), Grey Teals (*A. gibberifrons*), Blue-winged Shovelers (*A. rhynchotis*), Coots (*Fulica atra*), Wood Sandpipers (*Tringa glareola*), Greenshanks (*T. nebularia*) and White-headed Stilts (*Himantopus himantopus*).

Benger Swamp is also one of the few known areas where one of the world's rarest waterfowl, the Freckled Duck (*Stictonetta naevosa*), has bred and reared its young.

Since 1973, when Benger Swamp was all privately owned, the Department of Fisheries and Wildlife has been progressively buying the land. The Department now owns about half of the swamp. Once the swamp has been acquired, the Department will manage it for water-birds. The swamp's drainage system allows areas with different water levels to be created, and the swamp would be managed to ensure that a balanced proportion of open water to vegetation exists to accommodate as many species of waterfowl as possible. If the swamp remained flooded for a longer period of the year it would be more desirable as a drought refuge.

The swamp has a long tradition of use by duck-shooters, naturalists and tourists and is known throughout Western Australia as a prime waterfowl habitat.

The Committee endorses the present policy of the Western Australian Wildlife Authority to acquire the remainder of Benger Swamp and manage it as a habitat for water-birds.

The area under discussion comprises the coastal area west of Australind Road, Scenic Drive and the Old Coast Road and stretching from about 5 km south of Binningup to the mouth of the Collie River. It includes most of Leschenault Estuary, the peninsula between the Estuary and the Indian Ocean and a swampy area extending about 5 km north of the Estuary.

The northern part of the Estuary contains a very extensive area of samphire of *Arthrocnemum* sp. surrounded with closed-sedgeland of *Juncus kraussii*, *Suaeda australis*, *Samolus repens* and *Triglochin striata*. Bordering the sedgeland is low woodland of Salt-water Paperbark (*Melaleuca cuticularis*).

On slightly higher ground is closed-forest of the paperbark *M. raphiophylla*, which extends north of the estuary in swampy land. Here it is surrounded by woodland of another paperbark, *M. preissiana*, and Flooded Gum (*Eucalyptus rudis*). The higher ground has been partly cleared, and supports remnants of tall open-forest of Tuart (*E. gomphocephala*).

The peninsula between the Estuary and the ocean supports low closed-forest of Peppermint (*Agonis flexuosa*) and some open-forest of Tuart, with Cockies' Tongues (*Templetonia retusa*) dominating the understoreys. There are, however, several large blow-outs, some of which are being revegetated with *Olearia axillaris*. Bordering the Estuary is a small grove of White Mangrove (*Avicennia marina* var. *resinifera*).

Although Leschenault Estuary does not support as great a number and variety of water-birds as does the Peel-Harvey Estuary, it is still of considerable importance as a water-bird habitat. More than 50 species of water-birds have been recorded on the Estuary and a number of them have populations in excess of a thousand birds.

Some of the most notable features of Leschenault Estuary's birdlife are:

1. Waterfowl (Ducks and Swans)

The Estuary is an important summer refuge for waterfowl. Populations of Black Duck (*Anas superciliosa*) and Black Swan (*Cygnus atratus*) may each exceed 1000 birds and flocks of many hundreds of Grey Teal (*Anas gibberifrons*) and Musk Duck (*Biziura lobata*) are commonly observed.

The most important areas of waterfowl habitat on the Estuary are the northern end (north of the point at which the scenic drive veers away from the eastern shore) and a 1.5 km segment of the western shore of the Estuary opposite Australind townsite.

During spring and early summer, many hundreds of swans congregate in the shallow, open waters of the northern end. In November 1973, 860 swans (95% of the total estuary population) were sighted in this area.

Other species of waterfowl also congregate in these waters, and in November 1974 about 2000 ducks, mainly Black Duck, Grey Teal and Mountain Duck (*Tadorna tadornoides*), were present.

During mid and late summer each year most of the Estuary's swans move from the northern end to a point on the western shore opposite Australind, where they drink at naturally occurring fresh-water seepages and feed and loaf in adjacent waters. In March 1974, 680 swans (about 70% of the total population) were concentrated in this area. Hundreds of ducks also feed and water here.

2. Pelicans

Of all the estuaries from Perth to Esperance, Leschenault Estuary has the second largest summer population of pelicans (*Pelecanus conspicillatus*). Like the ducks and swans, the pelicans also favour the relatively undisturbed waters at the northern end of the Estuary. Flocks of up to 85 birds have been recorded in this area.

3. Migratory Waders

The mud-flats, marshes and pools of open water which fringe the northern end are also important as habitat for two species of wading birds - the migratory Greenshank (*Tringa nebularia*) and the Pied Stilt (*Himantopus himantopus*). Both occur in hundreds during summer and autumn, and a major portion of the Estuary's Greenshank population is confined to this area.

The shallow waters of the Estuary provide a nursery area for commercial species of fish; in that respect it is roughly equal in importance to the Swan Estuary. Important species include King George Whiting (*Sillaginodes punctatus*), Western Sand Whiting (*Sillago schomburgkii*), Cobbler (*Cnidogobius macrocephalus*), Sea Mullet (*Mugil cephalus*), Yellow-eye Mullet (*Aldrichetta forsteri*), Silver Bream (*Rhabdosargus sarba*), Black Bream (*Mylio butcheri*), Bony Herring (*Fluvialosa vlaminghi*), Smelt (*Craterocephalus* sp.), Tailor (*Promatomus saltator*), Mullaway (*Sciaena antarctica*), Sea Garfish (*Hyphorhampus melanochir*), Flounder (*Pseudorhombus* spp.), Flathead (*Platycephalus* spp.), and Blue Manna Crabs (*Portunus pelagicus*).

Most of the species provide for an estuarine fishery, Cobbler being particularly significant. King George Whiting, Tailor, Mullaway and Mullet contribute to an offshore fishery.

The Estuary and peninsula would be suitable as a National Park. The Estuary is ideal for crabbing and fishing and is a very popular area for boating, but its very shallow water makes it suitable only for man-powered boats and slow-moving, low-powered motor-boats.

The peninsula is an area of great beauty, where stark, mobile dunes alternate with thick forest. It affords scenic views of Leschenault Estuary and the nearby mainland. The Estuary renders the peninsula comparatively inaccessible, except from the northern end, and thus affords effective protection. On the other hand the peninsula is close to Bunbury and would thus be an ideal field study area for students of biology and other environmental studies.

It is an extremely fragile area (already there are numerous blow-outs, some of which transect it) and is therefore unsuited to any sort of housing or industrial development. Access to vehicles should be strictly controlled.

As most of the land surrounding Leschenault Estuary is privately owned, immediate reservation as a National Park is impracticable. The land could, however, be gradually acquired by the State for a National Park over the Estuary, its eastern shore and the peninsula between the Estuary and the ocean. Part of the peninsula is currently being used for the disposal of industrial liquid waste under a long-term agreement with the State, but alternate methods of disposal are being investigated.

RECOMMENDATION

The Committee recommends that:

1. Leschenault Estuary, its eastern shores, the adjacent low-lying land to the north and the peninsula between the Estuary and the Indian Ocean (Fig.) be managed by the Leschenault Estuary Management Authority with advice from a committee including representatives of the National Parks Authority, the Public Works Department, the Western Australian Wildlife Authority and private landholders affected by this proposal;
2. private land within the area, north and west of the Estuary, be purchased when offered for sale, with the ultimate aim of declaring the whole a National Park; immediate consideration should be given to the purchase of land reportedly already offered for sale at the northern end of Leschenault Estuary;
3. Crown land within the area should be managed for the conservation of natural features and the preservation of natural beauty until such time as it is practicable to vest the area in the National Parks Authority;
4. access to fragile dunes be restricted to prevent damage by off-road vehicles.

H.18 LAPORTE EGRET SWAMP

A small swamp (about 1.5 ha) on the eastern shore of Leschenault Inlet supports one of the few Western Australian breeding colonies of the White Egret (*Egretta alba*). The swamp is on land owned by Laporte Titanium (Aust.) Pty Ltd, and surrounded by the company's car park and factory site, Bunbury Golf Club and the Old Coast Road.

The egret colony has bred successfully for a number of years; as a result, Leschenault Inlet has the second largest White Egret population of any estuary in the south-west. Nankeen Night Heron (*Nycticorax caledonicus*), Little Pied Cormorant (*Phalacrocorax melanoleucos*) and Little Black Cormorant (*P. sulcirostris*) also nest in the Swamp.

RECOMMENDATION

The Committee recommends negotiations between the Western Australian Wildlife Authority and Laporte Titanium (Aust.) Pty Ltd, to secure continued maintenance of the small egrets' nesting-swamp adjacent to their Australind factory.

The demand to use rivers for passive recreation is likely to increase as the population of the Bunbury area increases.

The Collie, Brunswick and Wellesley river systems could possibly provide for such usage. They flow mainly through farm land and are lined with Flooded Gums (*Eucalyptus rudis*).

Riverside footpaths and limited open picnic areas would best suit the enjoyment of the tranquil setting. Their provision might be achieved by arrangement with the holders of land bordering the river, the managing authority providing necessary signposts and stiles for the paths and the relevant facilities for the picnic areas.

Details study of these river valleys will probably be needed to delineate which areas, if any, are most suitable for each activity. Local opinion should be sought throughout the investigation and any subsequent implementation stages, to ensure maximum public participation. The management authority should include nominees of the Harvey Shire Council, local landholders, the Western Australian Association of Recreation Personnel and any other directly interested bodies.

RECOMMENDATION

The Committee recommends that the Leschenault Inlet Management Authority investigate the Brunswick, Collie and Wellesley Rivers to select areas suitable for the provision of riverside footpaths and a few picnic sites.

Anglesea Island, in the Town of Bunbury, is important for its mangroves and its birds, and its surrounding waters provide a nursery area for fishes.

Anglesea Island comprises reserve A12636, of 6 ha, for Recreation, and on the northern shore of Leschenault Inlet are reserves C28033, of 8 ha, for Caravan Park, Camping Beach Resort, Recreation and Aquatic Sports, and C28034, of 14 ha, for Recreation. All three are vested in the Town of Bunbury.

Mangroves

Anglesea Island and the northern bank of Leschenault Inlet opposite it are the only localities - apart from one very small grove towards the northern end of Leschenault Estuary - where White Mangrove (*Avicennia marina*) is known to occur in the south of Western Australia. It is thought to be a relic of an earlier, tropical period.

Although mangroves are widespread on Western Australia's north-western and Kimberley coast, they are absent on the mainland south of Shark Bay. The Anglesea Island population provides the only opportunity for residents of the South West to see these strange plants within their own region.

To maintain the viability of the small remnant population of mangroves in the vicinity of Anglesea Island, as much as possible should be conserved; only a small proportion of plants produce fertile seeds in any one year, and recruitment is very low.

Associated saltmarsh plants include Samphire (*Salicornia australis*) and *Suaeda australis* with an occasional Swamp Sheoak (*Casuarina obesa*).

Birds

a) Anglesea Island

The Island's pools of permanent water and low-lying areas of Samphire afford good feeding and roosting areas for water-birds. These include the following species: Greenshank (*Tringa nebularia*), White-faced Heron (*Ardea novaehollandiae*), White Egret (*Egretta alba*), Common Sandpiper (*Tringa hypoleucos*), Sharp-tailed Sandpiper (*Calidris acuminata*), Little Pied Cormorant (*Phalacrocorax melanoleucos*), Black Duck (*Anas superciliosa*), Grey Teal (*A. gibberifrons*), Sacred Kingfisher (*Halcyon sancta*), Nankeen Night Heron (*Nycticorax caledonicus*) and Little Grassbird (*Megalurus gramineus*).

The Greenshank, Common Sandpiper and Sharp-tailed Sandpiper migrate annually from the Northern Hemisphere.

b) Mudflats Adjacent to Koombana Park and Angelsea Island

Fifteen of the nineteen species of migratory and resident wading birds which inhabit Leschenault Inlet depend upon tidal sand and mud-flats for their food supply. They feed upon the worms, molluscs and crustacea found in the mud. Although no quantitative data are available, the tidal flats of Koombana Park and Anglesea Island are certainly the most productive flats of the entire estuary (i.e. Leschenault Estuary plus Leschenault Inlet, which was the Estuary's original mouth) in terms of food supply for wading birds.

Periodic surveys of wading-bird distribution within the Inlet have shown that these particular flats are a most important component of the estuary's ecosystem. At certain times of the year more than 20% of the total number of waders on the estuary may be concentrated on these two small areas. For some species of waders more than 90% of the estuary's total population may be gathered in feeding flocks on the mudflats of Koombana Park and Anglesea Island.

When submerged, these flats are also feeding areas for ducks and swans, herons and egrets.

The high productivity of these areas is also recognised by local and tourist fishermen, who may often be seen digging in the mud for worms.

Fisheries

The tidal flats of Koombana Park and Anglesea Island, together with those of the rest of the estuary, provide nursery areas for commercial and angling species of fish.

Observation and Study Area

From a birdlife point of view, perhaps the area's greatest value is that it gives, right in the heart of Bunbury, a complete representation of each of the major types of water-bird habitat which occur in the estuary. Because of diversity of habitat it is possible to see individuals of at least 43 of the estuary's 54 recorded species of water-birds from one vantage point. This part of the estuary, therefore, rates highly as a sanctuary for bird-watching and as such should be given priority for conservation.

RECOMMENDATION

The Committee recommends that:

1. the purpose of reserve A12636 be changed to Conservation of Flora and Fauna and that the reserve be vested in the Western Australian Wildlife Authority;

2. reserve C28034 and part of reserve C28033 (Fig.) be added to reserve A12636;
3. an aquatic reserve be created on adjoining waters of Leschenault Inlet, the boundaries of which are defined in Fig. .

H.21 SOUTH BUNBURY

Two areas are noteworthy: Big Swamp and the coastal land south of Hastie Street.

Big Swamp

Big Swamp is freehold land in the name of the Town of Bunbury.

The swamp has a diverse avifauna, as many as 69 species having been recorded there. It is an excellent place for local schools to study biology, and is used by numerous natural-history groups.

Concern is felt that sanitary landfill near Big Swamp is changing the swamp's character, both physically and chemically. This use of Big Swamp as a sanitary landfill site must be stopped if the swamp is to retain its usefulness as a water-bird habitat.

The Town of Bunbury has prepared plans for the future development of the area for passive and active recreation. No aquatic recreation should be permitted on Big Swamp as it is incompatible with the prime function of the area: the conservation of wetland habitat.

Coastal Land South of Hastie Street

Minninup Road, south of Hastie Street, runs through attractive bushland. It comprises land owned by or vested in the Town of Bunbury (including part of reserve C670, of 696 ha, for Endowment for Bunbury Town Council) and freehold land.

The vegetation varies from open-heath to tall open-forest. High sand dunes support open-heath, dominated by *Melaleuca acerosa*, *Acacia cochlearis* and *Conostylis candicans* around their tops with some low closed-forest of Peppermint (*Agonis flexuosa*) on their sides. In the valleys and to the east of the dunes Tuart (*Eucalyptus gomphocephala*) occurs; east of the Minninup track it forms tall open-forest and tall woodland with the occasional Jarrah (*E. marginata*) and Marri (*E. calophylla*). Some of the largest Tuarts have been felled in the past, but many fine, old specimens remain. Peppermint and Slender Banksia (*B. attenuata*) are common trees in the understorey. The ground flora is diverse, some of the commonest species being *Hibbertia hypericoides*, *Daviesia divaricata*, *Jacksonia furcellata*, *Hardenbergia comptoniana* and *Zamia (Macrozamia riedlei)*. The area contains the northernmost occurrence of the greenhood orchid *Pterostylis rogersii*.

The high dunes offer extensive views from the ocean to the Darling Scarp.

Off-road vehicles are cutting wide sandy tracks through the dunes, which are fragile and cannot withstand such treatment for long. If this use continues large blow-outs are likely to result, with marked reduction in plant cover.

RECOMMENDATION

The Committee recommends that:

1. the attention of the Town of Bunbury be drawn to the submission referring to Big Swamp and to the land south-west of Bunbury;
2. the Town of Bunbury follow the guidelines outlined in the publication, "Guidelines to the Conservation and Management of Wetlands in Western Australia" Department of Conservation and Environment, Perth, July 1977, and seek further assistance as to how this valuable resource might be managed.

H.22 RESERVES A23000, C28825, C28836 (DALYELLUP)

These three adjacent reserves lie on the west side of the Bussell Highway about 10 km south of Bunbury. Reserve A23000 (140 ha) is for Travellers, Stopping Place and Caravan Park, vested in the Shire of Capel. It is in two sections, with reserve C28836 between them; this reserve (16 ha) and reserve C28825 (15 ha), at the northern end of reserve A23000, are both for Public Recreation and vested in the Shire of Capel. A drain passing through the area occupies reserve C28835. (31 ha), for Drainage, not vested.

The vegetation of these reserves is mostly in good condition and is of open-forest of Jarrah (*Eucalyptus marginata*), Marri (*E. calophylla*), several Banksias (*B. grandis*, *B. attenuata* and *B. ilicifolia*), Woody Pear (*Xylomelum occidentale*), Peppermint (*Agonis flexuosa*) and Snottygobble (*Persoonia longifolia*). The understorey is quite dense and varied. Representative species are *Hibbertia* spp., *Pixie Mops* (*Petrophile linearis*), *Acacia* spp., *Hovea chorizemifolia*, *Leucopogon racemulosus*, *Daviesia* spp., *Melaleuca thymoides*, *Phlebocarya ciliata* and *Patersonia occidentalis*.

During spring these plants provide a colourful display beside the Highway. There is no similar area along the main roads of the district. Part of reserve C28825 has been developed for sporting events, but apart from the drainage reserve the area is otherwise largely in its natural condition.

The Committee endorses the class, purpose and vesting of reserves A23000, C28825 and C28836, and considers that as far as possible the natural vegetation, especially along the Highway, should be retained. Should advice be required, the Shire should contact the Department of Conservation and Environment.

Just north of Waroona there are three reserves covering a narrow strip of land between the South Western Highway and the railway. These are C31437 (13 ha) for Government Requirements, C31438 (6 ha) for Camping, and C31439 (17 ha) for Drainage; none is vested. At the northern end and on the east side of the Highway is reserve A20585 (8 ha) for Stopping Place, not vested.

The area is almost flat with a few shallow depressions that become wet in winter. The vegetation is low woodland and low open-woodland of Marri (*Eucalyptus calophylla*) and Jarrah (*E. marginata*). There are several populations of Black Gin (*Kingia australis*). The depressions carry closed- to open-heath dominated by *Leptospermum ellipticum* and *Hakea ceratophylla*.

This stretch of bushland is important, for it is the only bush left between Pinjarra and Waroona, the only place where uncleared land of the area can still be seen. It is also the only vegetation of its type along the South West Highway. The Committee believes that it should be a reserve for Conservation of Flora. Although narrow, it appears to be retaining the vegetation well.

RECOMMENDATION

The Committee recommends that:

1. reserves C31437, C31438 and C31439 be cancelled and their areas included in A20585;
2. the purpose of reserve A20585 be changed to Conservation of Flora and Fauna and that the reserve be vested in the Western Australian Wildlife Authority.

J

Teesdale S.M.P.A. (3.7) is situated on the Murray River 5 km to the south-west of Dwellingup and downstream from the proposed dam on the Murray. The S.M.P.A. is composed of State Forest and three enclosed Land Act reserves, all of which are for Recreation and Parkland and are vested in the Conservator of Forests; these are A5099 (65 ha), A5100 (81 ha) and A5101 (65 ha). The total area of the S.M.P.A. is 1728 ha; the core, of 1095 ha, is Teesdale Forest Park. It is managed by the Forests Department for the Conservation of Flora and Fauna and for Recreation.

Teesdale includes a variety of soils, landforms and vegetation. The lateritic uplands of the Dwellingup Soil-landform Unit (Churchward and McArthur 1978) occur over most of the area. The valleys, which consist predominantly of loam soils, have been classified on their degree of dissection, and include the Helena, Murray and Yarragil Units. A minor part of the area includes landforms of shallow soils and granite outcrops.

Although many of the vegetation types associated with these soils and soil-landform units are represented in other reserves, Teesdale provides significant areas of upland and valley vegetation which elsewhere are threatened by the dieback fungus (*Phytophthora cinnamomi*), mining, agriculture, forestry and flooding for reservoirs. It is particularly significant in providing the only area of uncut forest of Jarrah (*Eucalyptus marginata*) and Marri (*E. calophylla*) that is both close to the escarpment and in the high rainfall area. Teesdale also includes a substantial area of high quality open-forest of Yarri (*E. patens*) along the valley slopes of the Murray Valley; the forest will not be flooded if the Murray River Dam is constructed.

A range of vegetation types (Havel 1975 (a) and (b)) occurs in Teesdale. The two main types are S and T, while types Q, C and U cover smaller areas. Type S is present mainly on the plateau and upper slopes of the Dwellingup Unit in the high rainfall area. It consists predominantly of open-forest of Jarrah with some Marri. In the understorey the main indicator species are Bull Banksia (*B. grandis*), Snottygobble (*Persoonia longifolia*), Sheoak (*Casuarina fraserana*), Zamia (*Macrozamia riedlei*), *Leucopogon capitellatus*, *L. verticillatus* and *L. propinquus*.

Type T is restricted mainly to the slopes of the deeply dissected gullies. The vegetation consists predominantly of open-forest of Jarrah with a higher proportion of Marri. Bull Banksia and Sheoak are frequent. In the shrub storey the indicator species include Tassel Flower (*Leucopogon verticillatus*), Bracken (*Pteridium esculentum*), *Clematis pubescens*, Zamia, *Phyllanthus calycinus* and Water Bush (*Bossiaea aquifolium*).

Type Q is restricted in Teesdale to the lower slopes of the Murray River and its small tributaries. It is characterised by the dominance of Yarri associated with the less frequent Jarrah and Marri. In this area it has been lightly cut but is relatively undisturbed. The difficulty of penetrating the thick understorey of *Trymalium spathulatum*, Wiry Wattle (*Acacia extensa*), Holly flame pea (*Chorizema ilicifolium*) and White Myrtle (*Hypocalymma angustifolium*) further protects this type from deleterious change.

Type C is restricted to the valley floors and gullies. The vegetation is characterised by the presence of Yarri, Flooded Gum (*E. rudis*) and Marri with the occasional River Banksia (*B. littoralis* var. *seminuda*) and Jarrah. *Agonis linearifolia* and White Myrtle are frequent in the shrub storey.

Type U is of restricted occurrence in Teesdale. The main indicator species are Yarri, Marri, Zamia, *Phyllanthus calycinus* and *Leucopogon capitellatus*.

Teesdale is well used for recreation. It provides access to the Murray River and contains well established barbecue areas and footpaths.

The Committee endorses the proposal by the Forests Department to manage Teesdale Special Management Priority Area (3.7) for the Conservation of Flora and Fauna and for Recreation.

RECOMMENDATION

The Committee recommends that:

1. reserves A5099, A5100 and A5101 be cancelled and be included in Teesdale Special Management Priority Area (3.7);
2. reserve C5098 be cancelled and included in Teesdale Special Management Priority Area (3.7), and private land to the west be purchased when available to consolidate the area; alternatively, in view of the strategic position of Teesdale and the high recreational use already made of it, the Committee recommends that the Forests Department negotiate to provide better access to it.

J.2 PLAVINS S.M.P.A.

Plavins S.M.P.A. (3.6) lies 5 km south-east of Dwellingup and is composed of State Forest. Its area of 3495 ha extends from the Murray River and pine plantations in the west to a watershed ridge in the east, and from private property and Marradong Road in the north to Yarragil Brook in the south. The core area, of 2195 ha, is Plavins Forest Park. Plavins is managed by the Forests Department for the Conservation of Flora and Fauna and for Recreation.

Plavins includes a range of soils, landforms and vegetation which typify the higher rainfall area of the western fringe of the Darling Range. The soils and landforms of Plavins are the lateritic uplands of the Dwellingup Soil-landform Unit and the Murray and Yarragil Units (Churchward and McArthur 1978).

Although the vegetation types are represented in other reserves, Plavins provides a section of forest that is relatively undisturbed and relatively dense; it has been only lightly cut for timber. Further, although the dieback fungus *Phytophthora cinnamomi* has been recorded in this area on the eastern and northern fringes, there have been no severe outbreaks within the core area of Plavins. Despite outbreaks upstream of the reserve in Swamp Oak Brook and Yarragil Brook, as yet there have been no major changes in the structural and floristic composition of the vegetation in the S.M.P.A.

Plavins incorporates a large area of tall open-forest of Jarrah (*Eucalyptus marginata*) and Marri (*E. calophylla*) that is of high quality, unaffected by the dieback disease. It also contains, along Swamp Oak Brook, one of the most extensive stands of River Banksia (*B. littoralis* var. *seminuda*). The vegetation types that typify the Murray Valley (one of the last major valleys not yet flooded for water supply) are well represented.

A range of vegetation types (Havel 1975 (a)) is found in Plavins. The main types are S, T and Q, while types QL, W and C occur over limited areas. Type S is present mainly on the plateau and type T on the adjacent upper slopes of the Dwellingup Unit. The dominant plant species frequent in both types are Jarrah, Marri, Bull Banksia (*B. grandis*), *Lasiopetalum floribundum*, *Zamia* (*Macrozamia riedlei*), *Leucopogon capitellatus*, *L. verticillatus* and *L. propinquus*. In type T other characteristic species include *Chorizema ilicifolium*, Bracken (*Pteridium esculentum*) and the creeper *Clematis pubescens*.

The lower slopes and gullies that represent the Murray and Yarragil Units in this high rainfall area carry vegetation of type Q, characterised by a mixture of Jarrah, Marri and Yarri (*E. patens*), with a dense and tall shrub storey of *Trymalium spathulatum*, Bracken, *Acacia urophylla* and *Chorizema ilicifolium*. Along Swamp Oak Brook, *Diplolaena drummondii* and *Hibbertia lineata* also occur, the association forming an intermediate vegetation, classified as type QL. Type C is restricted to the gullies and creek beds in Plavins. The common plant species include Yarri, *Hakea lasiantha*, *Lepidosperma tetraquetrum*, *Agonis linearifolia* and *Banksia littoralis* var. *seminuda*.

Type W occurs mainly on the Yarragil Unit in this high rainfall area and is characterised by a mixture of Jarrah, Marri and Yarri, with a shrub storey that includes White Myrtle (*Hypocalymma angustifolium*), Semaphore Sedge (*Mesomelaena tetragona*) and *Synaphea petiolaris*.

Owing to Plavins' situation in valleys and on lower slopes, vegetation types Q, QL, C and W would be severely affected if the proposed dam on the Murray River were built. The species in greatest danger from a combination of flooding and dieback disease is River Banksia, which occurs in localised patches in the high rainfall area on the western fringes of the Darling Range, and along the south coast from Albany westwards.

Part of the perimeter of the S.M.P.A. is used extensively for both passive and active recreation.

The Committee endorses the Forest Department's proposal to manage Plavins Special Management Priority Area (3.6) for the Conservation of Flora and Fauna and for Recreation.

Bell S.M.P.A. (10.3), situated on the Murray River, lies about 38 km to the south-east of Dwellingup, on the eastern fringes of the State Forest. It is composed of State Forest and occupies an area of 2590 ha; the core, of 495 ha, is Bell Forest Park. It is managed by the Forests Department for the Conservation of Flora and Fauna.

Although the lateritic uplands of the Dwellingup Soil-landform Unit (Churchward and McArthur 1978) cover most of Bell, there is a variety of soils, landforms and vegetation. The valleys represent the Murray, Yarragil and Pindalup Units. Bell is similar in some respects to parts of Plavins (J.2) but is modified by a drier climate, which provides a range of vegetation complexes both on the uplands and in the gullies.

The most outstanding feature of Bell are the largely undisturbed woodlands of Wandoo (*Eucalyptus wandoo*) and open-forest of Jarrah (*E. marginata*) in the north-east. Also significant are its low closed-forest of the paperbark *Melaleuca raphiophylla* and Flooded Gum (*E. rudis*).

A range of vegetation types (Havel 1975 (a)) is represented in Bell. The types that represent the bulk of the area are types S and T. Vegetation types C, M, Q, Y and W are also represented in this area, but are not extensive.

Types S and T occur on the lateritic uplands of the western area of Bell Forest Park. Both types are characterised by open-forest of Jarrah and Marri but differ markedly in the shrub storey. Dominant plant species that are frequent in both types are Bull Banksia (*B. grandis*), *Lasiopetalum floribundum*, *Zamia (Macrozamia riedlei)*, *Leucopogon capitellatus*, *L. verticillatus* and *L. propinquus*. In type T other characteristic species include *Chorizema ilicifolium*, Bracken (*Pteridium esculentum*) and the creeper *Clematis pubescens*.

The lower slopes and gullies of the Murray and Yarragil Units in the western edge of Bell carry type Q, characterised by a mixture of Jarrah, Marri and Yarri (*E. patens*) with a dense understorey of *Trymalium spathulatum*, Bracken, *Acacia urophylla* and *Chorizema ilicifolium*. Type W occurs on the Yarragil valleys in the western edge of Bell and is characterised by a mixture of Jarrah, Marri and Yarri, with a shrub storey that includes White Myrtle *Hypocalymma angustifolium*, *Mesomelaena tetragona* and *Synaphea petiolaris*. In the major gullies type C occurs along the creeks and rivers and is dominated by Flooded Gum and *Melaleuca raphiophylla*, but River Banksia (*B. littoralis* var. *seminuda*) is present in localised patches.

In the eastern valley systems of the Yarragil and, more consistently, the Murray and Pindalup Units, types Y and M occur. The predominance of the woodlands of wandoo is evident in these valleys. The indicator species of type Y reflect the moister conditions in the gully and include White Myrtle and *Baeckea camphorosmae*. Type M occurs on the middle slopes of these valley systems in Bell and includes such common species as *Hakea lissocarpa*, *Zamia* and *Gastrolobium calycinum*.

The woodlands and forests of the eastern sector are largely uncut; parts were logged early in the century. The western sector has been logged more recently.

The Committee endorses the Forests Department's proposal to manage Bell Special Management Priority Area (10.3) for the Conservation of Flora and Fauna.

J.4 FEDERAL S.M.P.A.

Federal S.M.P.A. (10.4) is located 20 km south of Dwellingup and west of the Murray River. The S.M.P.A. is composed of State Forest and occupies 1412 ha, all of which is core. It is managed by the Forests Department for the Conservation of Flora and Fauna.

Federal comprises a variety of soils, landforms and vegetation. The lateritic uplands of the Dwellingup Soil-landform Unit (Churchward and McArthur 1978) are restricted to the surrounds of Big Brook, which drains north then east to join the Murray River. The valley systems that cover most of the area represent the Murray and Yarragil Units.

Federal provides the only extensive area of lightly logged and relatively undisturbed open-forest of Yarri (*Eucalyptus patens*) in the Special Management Priority Areas. Large areas of Yarri have been cleared for agriculture, logged for timber or flooded by the damming of valleys. River Banksia (*B. littoralis* var. *seminuda*), found in isolated patches in Federal, has also been affected by the flooding of valleys, and is further threatened by the proposed dam on the Murray River.

The dominant vegetation types found in Federal are C, Q and T (Havel 1975); vegetation of types P, S and W occur over smaller areas.

Type T occurs on the middle and upper slopes of the area. This type consists of tall open-forest of Jarrah (*E. marginata*) and Marri (*E. calophylla*) with a shrub storey of *Leucopogon verticillatus*, Bracken (*Pteridium esculentum*), *Acacia urophylla* and *Lasiopetalum floribundum*.

Type C consists of open-forest to tall open-forest of Yarri with an admixture of Bullich (*E. megacarpa*) Marri and Jarrah. It is found on the moist and wet sandy loams along the creeks. The main shrub indicators of type C include *Agonis linearifolia*, *Hypocalymma angustifolium*, *Lepidosperma tetraquetrum* and *Leptocarpus scariosus*. Along Big Brook an occasional River Banksia is associated with this type. Although Bullich is present in Federal, it is restricted to the southern section.

Type Q is found on the lower and middle slopes of the gullies. The vegetation consists of open-forest to tall open-forest of Yarri, Marri and Jarrah. The main understorey species that indicate this type are *Trymalium spathulatum*, Bracken and *Chorizema ilicifolium*.

Type W, although insignificant in area in Federal, is nevertheless important, since elsewhere it has been strongly affected by dieback.

Types P and S are adequately represented in other proposed areas, and their occurrence in Federal is minor.

The Committee endorses the proposal by the Forests Department to manage Federal Special Management Priority Area (10.4) for the Conservation of Flora and Fauna.

J.5 SAMSON S.M.P.A.

Samson S.M.P.A. (10.5) is located about 20 km south of the township of Dwellingup, and is centred along tributaries of the Samson Brook in the catchment south of the Samson Dam. Its area, of 1035 ha, is all core, and is composed of State Forest. Samson is managed by the Forests Department for the Conservation of Flora and Fauna.

Samson contains representative vegetation of the Dwellingup and Yarragil Soil-landform Units (Churchward and McArthur 1978). The lateritic uplands of the Dwellingup Unit support open-forest of Jarrah (*Eucalyptus marginata*) and Marri (*E. calophylla*), while the valleys of the Yarragil Unit support a greater variety of vegetation. The Forest Park is outstanding for its extensive stands of Bullich (*E. megacarpa*), which are the best to be found in the Darling Range.

Samson's vegetation reflects the higher rainfall in that such vegetation types as C, Q, S and T (Havel 1975(a)) dominate the area.

Types C and Q consist of open-forest of Yarri (*E. patens*) with an admixture of Marri and some Jarrah. The understorey species of type C include *Agonis linearifolia*, White myrtle (*Hypocalymma angustifolium*) and *Leptocarpus scariosus*, while those of type Q include *Trymalium spathulatum*, *Chorizema ilicifolium* and *Acacia extensa*.

Types S and T occur on the upper slopes and ridges. The dominant plant species that are frequent in both types are Jarrah, Marri, Bull Banksia (*B. grandis*), *Lasiopetalum floribundum*, *Zamia (Macrozamia riedlei)*, *Leucopogon capitellatus*, *L. propinguis* and *L. verticillatus*. In type T, other characteristic species include *Chorizema ilicifolium*, Bracken (*Pteridium esculentum*) and the creeper *Clematis pubescens*.

Owing to its proximity to the Samson Dam, which is used for water-based recreation such as fishing and canoeing, the area is subject to considerable pressure during some seasons. As there is some dieback in the valleys, access to the core of the area should be controlled to minimise further deterioration of the area's outstanding vegetation.

The Committee endorses the proposal by the Forests Department to manage Samson Special Management Priority Area (10.5) for the Conservation of Flora and Fauna.

J.6 SURFACE S.M.P.A.

Surface S.M.P.A. (10.6) is located 25 km north-east of Collie, and straddles the divide between the Murray and the Collie river systems. It is among the larger reserves in State Forest (and System 6) and occupies an area of 15 125 ha; the core area, of 5480 ha, is Surface Forest Park. Except for small enclaves of private land in the south-east, this S.M.P.A. is composed of and surrounded by State Forest. It is managed by the Forests Department for the Conservation of Flora and Fauna.

The lateritic uplands of the Dwellingup Soil-landform Unit (Churchward and McArthur 1978) support open-forest of Jarrah (*Eucalyptus marginata*) and Marri (*E. calophylla*). The different sorts of valleys - comprising the Murray, Yarragil, Pindalup and Goonaping Units - further account for the diversity of this area.

A remarkable feature of Surface is its extensive area of swamp vegetation (including sedgeland, shrubland and open-woodland of *Banksia* spp.) associated with the valley floors of the Yarragil, Pindalup and Goonaping Units. These, when combined with the swamps of the adjacent S.M.P.A.s (J.7 and J.8), make an excellent refuge for wildlife of the low, medium and high rainfall areas. Swamp Cypress (*Actinostrobus pyramidalis*) and Woody Pear (*Xylomelum occidentale*), which occur in the swamps, are uncommon, and poorly represented in the State Forest on the Darling Plateau. The area includes the largest remaining area of uncut Jarrah forest north of the Blackwood River.

The large range of vegetation types (Havel 1975 (a)) add further to the value of this area. The dominant types include P, R and S, while over smaller areas types A, B, E, F, H, O and T are found in Surface. Types S and R, which occur on the lateritic uplands and partially dissected lateritic slopes, are also dominated by Jarrah.

Types A, B, E, J and F are relatively rare; although Surface includes only small areas of them, their occurrence is important. All are associated with the poorly drained valleys and include the swamps and sands. Common plants of these types include Blueboy (*Stirlingia latifolia*), Christmas tree (*Nuytsia floribunda*) Black Gin (*Kingia australis*), *Adenanthos obovatus* and *Leptocarpus scariosus*.

The very size of Surface and its isolation (which has been accentuated by placing it in quarantine) make the objective of conservation of the native flora and fauna feasible. There are several, not as yet extensive, occurrences of dieback along Trees and Dee Vee Roads.

The Committee endorses the proposal by the Forests Department to manage Surface Special Management Priority Area (10.6) for the Conservation of Flora and Fauna.

RECOMMENDATION

The Committee recommends that the Forests Department negotiate

with the Public Works Department to acquire and include
Location 935 in Surface Special Management Priority Area (10.6).

J.7 NALYERIN S.M.P.A.

Nalyerin S.M.P.A. (10.7) lies about 55 km east of Harvey and about 30 km north-east of Collie. It is composed of State Forest. It occupies a total area of 10 375 ha; the core area, of 2912 ha, is Nalyerin Forest Park. Nalyerin is managed by the Forests Department for the Conservation of Flora and Fauna.

Nalyerin includes the watershed of the Murray and Wellington catchment divide, and a major seasonal lake - Lake Nalyerin. Owing to its variety of soils and variation in rainfall, it incorporates a range of vegetation.

Much of Nalyerin consists of lateritic uplands of the Dwellingup Soil-landform Unit (Churchward and McArthur 1978), which are covered in open-forest of Jarrah (*Eucalyptus marginata*) and Marri (*E. Calophylla*). The understorey species reflect the comparatively low rainfall over most of the S.M.P.A. Pincushion Coneflower (*Isopogon dubius*), Blueboy (*Stirlingia latifolia*), Prickly Bitter-pea (*Daviesia pectinata*) and *Hakea ruscifolia* are typical species over most of the uplands, but on the moister, western fringe they are replaced by species such as Hairy Jugflower (*Adenanthos barbigerus*), *Zamia* (*Macrozamia riedlei*), *Leucopogon capitellatus* and *Grevillea wilsonii*.

The greatest structural diversity of the vegetation occurs in the valley systems. Nalyerin is similar in parts to Surface and Trees Special Management Priority Areas (J.6 and J.8) as it includes extensive areas of swamp vegetation consisting of sedgelands, shrublands and open-woodlands of the paperbark *Melaleuca preissiana* and Swamp Banksia (*B. littoralis*). On the sandier soils of the Goonaping Unit, open-woodland to low open-woodland of Slender Banksia (*B. attenuata*) predominates.

The area's dominant vegetation types are A, B and H (Havel 1975 (a)), but there are also restricted occurrences of types D, F, J, P, Z and Y.

Type A is a swamp complex ranging from sedgelands to open-woodland of paperbark and Swamp Banksia; the shrubs that indicate type A include *Hakea varia*, *Leptospermum ellipticum* and *Leptocarpus scariosus*.

Type B, occurring on moist humic sands, is open-forest of Jarrah with a shrub storey of Basket Flower (*Adenanthos obovatus*), Pixie Mops (*Petrophile linearis*) and *Dasyogon bromeliaefolius*.

Type H dominates the eastern fringes of the Dwellingup Unit in the drier rainfall areas. In Nalyerin this type covers most of the lateritic uplands and slopes. Type H consists mainly of open-forest of Jarrah and, sometimes, Marri. Its main indicator species include Semaphore Sedge (*Mesomelaena tetragona*), Prickly Bitter-Pea, *Hakea ruscifolia*, *Hakea cyclocarpa*, and *Styphelia tenuiflora*.

The occurrence of type F is significant, even though it occurs over small areas, as this type is poorly represented in System 6. Type F consists of open-forest of Jarrah and includes such understorey species as Blueboy, Christmas Tree (*Nuytsia floribunda*) and *Caustis dioica*.

An interesting feature is a stand of Limestone Marlock (*Eucalyptus decipiens*) on the fringes of the southern swamp: the species' main occurrences are on the Cottesloe Unit of the Coastal Plain from the Moore River to Rockingham, and around the Stirling Ranges to the south coast.

The difficulty of access to this Forest Park makes the prime objective of conservation feasible. The Park is near to other conservation reserves: Surface, Trees and Stone S.M.P.A.s (J6. J8. and J.9).

The Committee endorses the proposal by the Forests Department to manage Nalyerin Special Management Priority Area (10.7) for the Conservation of Flora and Fauna.

J.8 TREES S.M.P.A.

Trees S.M.P.A. (4.1) lies about 55 km east of Harvey and about 25 km north-east of Collie, on the tributaries of the Bingham River. The area is composed of State Forest, and occupies 7837 ha; the core, of 2532 ha, is Trees Forest Park. The S.M.P.A. adjoins the Stene property (recently acquired by the Public Works Department), and two reserves for Resting Place, not vested : A4555 (504 ha) and A7675 (194 ha). It is managed by the Forests Department for the Conservation of Flora and Fauna.

Trees includes a large variety of soils, landforms and vegetation. It is similar in parts to Surface and Nalyerin S.M.P.A.s (J.6 and J.7) as it includes areas of swamp vegetation.

The dominant vegetation types of the lateritic uplands of the Dwellingup Soil-landform Unit (Churchward and McArthur 1978) are H and Z (Havel, 1975 (a)), reflecting the lower rainfall over most of Trees. The valleys contain vegetation of more varied structure, which includes sedgelands, shrublands, open-woodland of the paperbark *Melaleuca preissiana* and Swamp Banksia (*B. littoralis*), open-forest of Jarrah (*Eucalyptus marginata*) and Marri (*E. calophylla*) and woodland of Wandoo (*E. wandoo*).

The dominant vegetation types in Trees are D, H and Z (Havel 1975 (a)), but smaller areas of the vegetation types A, M, Y, F and J are also present. Type Z occurs on the valley slopes, and consists of open-forest of Jarrah and Marri. The shrubs which indicate Type Z are Honeybush (*Hakea lissocarpha*), *Leucopogon capitellatus*, and *Zamia (Macrozamia riedlei)*. Type H also occurs over large areas of Trees. It differs from type Z in the floristic composition of the shrub storey : its shrubs of *Hakea cyclocarpa*, *H. ruscifolia* and Prickly Bitter-Pea (*Daviesia pectinata*) are absent from Type Z.

Type D is restricted to the lower slopes and floors of the valleys. It consists of open-forest of Jarrah and Marri with small occurrences of Yarri (*E. patens*). The shrubs that indicate type D, such as *Baeckea camphorosmae*, White Myrtle (*Hypocalymma angustifolium*) and *Leptocarpus scariosus*, reflect the moister conditions of the valley floors.

Trees is significant for its relatively undisturbed areas of uncut Jarrah forest. Another important feature of Trees is the range of vegetation types present that are free from the dieback fungus (*Phytophthora cinnamomi*). The continuation of present quarantine measures would reduce the risk of infection.

The significant features of the Stene property and the two reserves A4555 and A7675 are the open-forest of Jarrah and Marri on the uplands, characteristic of the drier, eastern side of the Darling Plateau; the extensive stands of Wandoo; and the swamp vegetation. These lands, if added to the S.M.P.A., would increase its area by about 4500 ha.

The Committee endorses the proposal by the Forests Department to manage Trees Special Management Priority Area (4.1) for the Conservation of Flora and Fauna.

RECOMMENDATION

The Committee recommends that:

1. reserves A4555 and A7675 be proclaimed State Forest and included in Trees Special Management Priority Area;
2. the Forests Department negotiate with the Public Works Department for the Stene property to be proclaimed State Forest and included in Trees Special Management Priority Area (4.1).

J.9 STENE S.M.P.A.

Stene S.M.P.A. (10.8) lies 40 km north-east of Collie, on the eastern fringes of the State Forest, and consists of a portion of State Forest and part of a Timber reserve under the Forests Act (Pt. Res. 69/25). It occupies an area of 4487 ha; the core, of 1664 ha, is Stene Forest Park. The surrounding land to the east and north has been cleared for agriculture. The S.M.P.A. is managed by the Forests Department for the Conservation of Flora and Fauna.

Stene resembles three other S.M.P.A.s - Wandering (D.18), Russell (D.3) and Gyngoorda (D.16) - in that it is situated in a low rainfall area and that its vegetation consists mainly of woodlands of Wandoo (*Eucalyptus wandoo*) and open-forest of Jarrah (*E. marginata*). Both sorts of vegetation occur on the Dwellingup and Yalanbee Soil-landform Units (Churchward and McArthur 1978).

The Pindalup, Coolakin and Michibin Units (Churchward and McArthur 1978) support mainly woodlands of *E. Wandoo* with some admixture of Rock Sheoak (*Casuarina huegeliana*) and Jam (*Acacia acuminata*). In poorly drained areas minor swamps also occur but are not as extensive as in Surface and Nalyerin (J.6 and J.7).

Because of its isolation, Stene has received little disturbance except that some trucks travel through it. Although a minor sawmill once existed nearby, a portion of the forest is still uncut. As yet, no dieback has been recorded in the area.

An important feature of Stene is the inclusion of the eastern valley systems, which are poorly represented elsewhere in System 6, owing to the degree of agricultural development. Another interesting feature is the significant occurrence of Rock Sheoak, which occurs in shallow soils near granite outcrops.

The main vegetation types in Stene are H, M and Y (Havel 1975 (a) and (b)). Types A, G and Z occur less frequently.

Type H is characteristic of lateritic uplands, and consists of open-forest of Jarrah with an occasional Marri (*E. calophylla*). Its understorey is characterised by the presence of Prickly Bitter-Pea (*Daviesia pectinata*), *Hakea cyclocarpa* and *Styphelia tenuiflora*.

Types M and Y consist of open-woodland of *E. Wandoo*. (The uncut forest of Wandoo in Stene includes both these types.) Type M occurs on the middle and upper slopes of valleys. Its main indicators are Honeybush (*Hakea lissocarpa*), *Zamia (Macrozamia riedlei)* and *Gastrolobium calycinum*.

Type Y is found on the lower valley slopes and gullies. The species that indicate this type reflect the moister conditions, and include White Myrtle (*Hypocalymma angustifolium*) and *Baeckea camphorosmae*.

The Committee endorses the Forests Department's proposal to manage Stene Special Management Priority Area (10.8) for the Conservation of Flora and Fauna.

RECOMMENDATION

The Committee recommends that the purpose of the Timber reserve, created under the Forests Act (Pt. Res. 69/25), be changed to State Forest and that the reserve be included as part of the Stene Special Management Priority Area (10.8).

J.10 RESERVE C22977 (NEAR HARVEY)

Reserve C22977, of 361 ha, is located in the Darling Scarp about 2 km north-east of Harvey, on a tributary of the Harvey River. Its purpose is Common and it is vested in the Shire of Harvey.

The reserve incorporates the unique vegetation of the Darling Scarp. Since the flora of the Scarp varies considerably in floristic composition from north to south, and since a large section of the Scarp has deteriorated already from different forms of land use, it is vital to set aside remaining areas for conservation along the length of the Scarp, even if small.

The vegetation of the Scarp portion of reserve C22977 consists of herblands, shrublands and low open-woodland of Wandoo (*Eucalyptus wandoo*) and Marri (*E. calophylla*) with smaller occurrences of Butter Gum (*E. laeliae*) and Mountain Gum (*E. haematoxylon*).

RECOMMENDATION

The Committee recommends that reserve C22977 be made a Class A reserve for Conservation of Flora and Fauna, vested in the Western Australian Wildlife Authority.

J.11 RESERVES C15515 AND C25727

Reserves C15515 and C25727 are located 5 km and 12 km respectively to the east of Harvey, in the catchments of the Stirling Dam and the Harvey River. Their areas are, respectively, 273 ha and 308 ha, and the purpose of both reserves is Water Supply.

The reserves are largely covered by open-forest of Jarrah (*Eucalyptus marginata*) and Marri (*E. calophylla*) with smaller occurrences of Yarri (*E. patens*) in the gullies. An interesting feature of these reserves is the presence of Peppermint (*Agonis flexuosa*) in several gullies.

A large section of the vegetation in the high rainfall areas of the western fringes of the Darling Ranges is threatened by dieback disease, disturbance from mining, forestry and recreation and by clearing for agriculture. Consequently, the Conservation of Flora and Fauna should be incorporated where feasible in the purposes of reserves in the area.

RECOMMENDATION

The Committee recommends that the Western Australian Wildlife Authority and the Public Works Department ensure that conservation of flora and fauna is given adequate consideration in the management of reserves C15515 and C25727.

J.12 RESERVES C22797 AND C14564

Reserves C22797 and C14564 lie on tributaries of the Harvey River, respectively 8 km and 10 km east of Harvey. C22797, of 301 ha, is for the purpose Conservation of Flora and Fauna; C14564, of 61 ha, is for Timber for Settlers. Neither reserve is vested.

The reserves both support open-forest of Jarrah (*Eucalyptus marginata*) and Marri (*E. calophylla*) with some Yarri (*E. patens*) in the gullies. Vegetation types on the upper slopes and ridges include S, T and, less consistently, O and P (Havel 1975 (a)), while the lower slopes support Q, T and U.

Mining, intensive forestry and agriculture as well as the occurrence of the dieback fungus (*Phytophthora cinnamomi*) threaten large sections of the high rainfall area of the western fringes of the Darling Range.

Consequently, it is important to reserve even small areas such as these, in order to conserve remnants of the flora and fauna.

RECOMMENDATION

The Committee recommends that reserves C22797 and C14564 be made Class A reserves for Conservation of Flora and Fauna, vested in the Western Australian Wildlife Authority.

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K.1 DARDANUP S.M.P.A.

Dardanup S.M.P.A. (4.4) is located 6 km south-east of the township of Dardanup. The S.M.P.A. is composed of State Forest, and reserve C2029 (54 ha), for Quarries, not vested, and is surrounded by alienated land developed for agriculture. It occupies a total area of 1480 ha; the core area, of 600 ha, is Dardanup Forest Park. It is managed by the Forests Department for Recreation and the Conservation of Flora and Fauna.

Dardanup includes the northern extension of the Donnybrook Sunkland, and incorporates the Kingia, Jarrahwood, Mungardup and Cartis Soil-landform Units (Churchward and McArthur 1978). The vegetation associated with these units of the Donnybrook Sunkland is floristically unique.

The uplands of the Kingia Unit support open-forest of Jarrah (*Eucalyptus marginata*) and Marri (*E. calophylla*) with a well defined second storey of Bull Banksia (*B. grandis*), Sheoak (*Casuarina fraserana*), Snottygobble (*Persoonia longifolia*) and Woody Pear (*Xylomelum occidentale*). The ground storey includes Tassel Flower (*Leucopogon verticillatus*), *L. capitellatus*, *Bossiaea ornata*, *Tetratheca viminea*, *Podocarpus drouyniana* and *Styphelia tenuiflora*. The valleys contain a variety of vegetation, including open-forest of Jarrah and Marri, woodlands of *Banksia* spp. and woodlands of the paperbark *Melaleuca preissiana*. The understorey species include *Dasypogon bromeliaefolius*, Black Gin (*Kingia australis*), Semaphore Sedge (*Mesomelaena tetragona*) and Blueboy (*Stirlingia latifolia*).

The Jarrahwood Unit supports open-forest of Jarrah and Marri on the slopes and, in moister areas, woodland of Yarri (*Eucalyptus patens*), Bullich (*E. megacarpa*) and Swamp Banksia (*B. littoralis*), with patches of *Melaleuca preissiana*. The understorey includes Pineapple Bush (*Dasypogon hookeri*), *Hakea lasiantha*, White Myrtle (*Hypocalymma angustifolia*), *Gahnia trifida* and *Agonis linearifolia*.

The Mungardup Unit supports a mixture of open-forest of Jarrah and Marri and woodland of *Banksia* (*B. attenuata*, *B. ilicifolia* and *B. grandis*). Typical understorey species are *Agonis parviceps*, *Pultenaea reticulata*, Basket Flower (*Adenanthos obovatus*) and Black Gin (*Kingia australis*).

Although only present in localised areas on the western fringes of the S.M.P.A., the occurrence of the Cartis Unit in Dardanup is important. This landform is not represented in any other reserve in System 6 and, moreover, is threatened by sand-mining.

The vegetation of the Cartis Unit consists of low open-forest to open-forest of Jarrah, Marri and Mountain Gum (*E. haematoxylon*) with a definite second storey of *Banksia* spp.; the only extensive stands of Mountain Gum in System 6 occur on this landform. Typical species of the understorey include *Melaleuca thymoides*, *Pityrodia bartlingii*, *Pultenaea reticulata*, *Podocarpus dronynianus* and *Leucopogon glabellus*.

Although much of the vegetation represented in Dardanup is susceptible to dieback, this area is relatively free of infection. The occurrence of Mountain Gum in the S.M.P.A. in reasonably large numbers adds to the value of this area.

So far the area has not been used extensively for recreation, but the use should increase in future. Appropriate planning will enable passive recreation which will not spread dieback to be included in this reserve.

The Committee endorses the proposal by the Forest Department to manage Dardanup Special Management Priority Area (4.4) for the Conservation of Flora and Fauna and for Recreation.

RECOMMENDATION

The Committee recommends that reserve C2029 be proclaimed State Forest and included in Dardanup Special Management Priority Area (4.4).

K.2 LENNARD S.M.P.A.

Lennard Special Management Priority Area (4.2) is located 20 km to the west of Collie, along the Collie River, downstream from the Wellington Dam. Lennard is composed of State Forest and reserve C19641, of 2 ha, for School Site, not vested. It occupies a total area of 6562 ha; the core area, of 2379 ha, is Lennard Forest Park. It is managed by the Forests Department for the Conservation of Flora and Fauna and for Recreation.

The characteristic vegetation of this western, high rainfall area includes lightly cut and relatively dieback-free forest of Yarri (*Eucalyptus patens*), Jarrah (*E. marginata*) and Marri (*E. calophylla*). There are also substantial areas of lithic complex and heath on the shallower soils of the granitic outcrops.

The valleys include a number of Soil-landform Units, such as the Helena, Lowdon, Murray and Yarragil Units (Churchward and McArthur 1978). Associated with this variety in soils and landforms is a large range of vegetation complexes (Heddle, Havel and Loneragan 1978). The structures include open-forest, woodland, shrubland and herbland, and on granitic outcrops is a lithic complex.

The area also includes small areas of the Darling Scarp, which carries low open-woodland of Wandoo (*E. wandoo*) and Marri and, on shallow soils, heath and herbland.

Lennard S.M.P.A. incorporates a wide range of vegetation types that are characteristic of the western portion of the Darling Plateau, in the high rainfall area. The types include C, T, S, Q, R, P, G, V and W (Havel 1975 (a) and (b)).

Types S and T occupy primarily the lateritic uplands. Types P and W, which occupy minor gullies and depressions within the uplands, are restricted in the area. Types U, Q, R, G and C occupy the slopes and floors of the main valleys, and reflect the varying degrees of dissection and the removal of the lateritic layers. Type G includes extensive areas of vegetation on the granitic outcrops, and consists of shrublands of *Hakea* spp. and *Grevillea* spp., herblands and a lithic complex, chiefly of *Borya nitida*, lichens and mosses.

An outstanding feature of Lennard is the good representation of types Q and C and their associated plant species of Yarri, Peppermint (*Agonis flexuosa*) and River Banksia (*B. littoralis*, var. *seminuda*). Elsewhere, areas of those species have been largely eliminated or reduced in occurrence by damming of rivers, clearing for agriculture and planting of pines.

Recreation in the area consists mostly of canoeing, marroning and trail-bike riding. The area incorporates footpaths and scenic drives. Army training has been allowed in the past by agreement with the Commonwealth Government. In future, recreation should be controlled by zoning, so as to reduce the impact on the vegetation.

Much of Lennard has been logged; to the west of Wellington Dam small stands have been left uncut. To date, dieback is restricted to the gullies.

Part of Wellington Loc. 51, on both sides of Mornington Road, contains relatively undisturbed areas of Jarrah and Marri, with stands of Bullich (*E. megacarpa*) and Yarri in the gullies. Bullich is another species that, along with its associated understorey, has been destroyed in many areas by agricultural development and flooding of valleys for water supply.

The Committee endorses the proposal by the Forests Department to manage Lennard Special Management Priority Area (4.2) for the Conservation of Flora and Fauna and for Recreation.

RECOMMENDATION

The Committee recommends that:

1. reserve C19641 be proclaimed State Forest and be included in Lennard Special Management Priority Area (4.2);
2. if that part of Wellington Location 51 shown in Fig. becomes available for purchase, the conservation value of the flora and fauna be reassessed; if considered desirable for conservation, it should be added to Lennard Special Management Priority Area (4.2).

K.3 WESTRALIA S.M.P.A.

Westralia S.M.P.A. (4.3) lies immediately west of Collie, on the Collie River, upstream from the Wellington Dam. It is composed largely of State Forest but also includes part of the Rifle Range (reserve C10014, of 107 ha, not vested). The total area is 2131 ha; the core area, of 1090 ha, is Westralia Forest Park. Westralia is managed by the Forests Department for the Conservation of Flora and Fauna.

The lateritic uplands of the Dwellingup Soil-landform Unit (Churchward and McArthur 1978) occur over most of Westralia. Its vegetation is principally of types S and T (Havel 1975(a) and (b)), which are associated with the Dwellingup Unit in the high rainfall area. It consists of open-forest of Jarrah (*Eucalyptus marginata*) and Marri (*E. calophylla*). Other soil-landform units included in Westralia are the Murray and the Yarragil Units.

The vegetation in the valleys consists mainly of a mixture of Yarri (*E. patens*), Jarrah and Marri. The banks of the Collie River support a fringing woodland which, along the lower reaches in Westralia, is affected by the flooding of the Wellington Dam. However, since most of the valleys of the Murray and Yarragil Units in the high rainfall area have been flooded for water supply or developed for agriculture, the small, unaffected area of fringing woodland along the upper reaches in Westralia is important.

The fringes of the reserve contain small areas of the Collie Basin, where grow certain species that are rare on the Plateau, such as Holly-leaved Banksia (*Banksia ilicifolia*) and Woody Pear (*Xylomelum occidentale*).

The dominant vegetation types are S and T, but a large number of other types are present: A, B, J, C, O, Q, U and W. Types S and T are found in the upper and middle slopes of the valleys but they differ in the composition of the understorey.

Types Q and W, although present in small areas, are important as they include Yarri as well as Jarrah and Marri.

In the northern portion of Westralia, at the head of the valleys, is an important sandy area. Types A, B and J occur in this area, which appears to be an extension of the Collie Basin. Holly-leaved Banksia and Woody Pear are species which occur here but rarely elsewhere on the plateau.

Although the prime purpose is conservation, recreation will remain an important use of the reserve. Scenic drives wind through Westralia and the area is popular for picnicking and bush-walking.

The Committee endorses the Forests Department's proposal to manage Westralia Special Management Priority Area (4.3) for the Conservation of Flora and Fauna.

RECOMMENDATION

The Committee recommends that:

1. reserve C10014 be cancelled, proclaimed State Forest and included in Westralia Special Management Priority Area (4.3), and that an alternative area be found for a rifle range by negotiation between the Forests Department, the Shire of Collie and the Collie Rifle Club;
2. Wellington Location 5239, of 2 ha, be excluded from Westralia Special Management Priority Area (4.3).

K.4 BENNELAKING S.M.P.A.

Bennelaking S.M.P.A. (4.7) is situated 40 km east of Collie, on tributaries of the Collie River. It lies in System 4 and on the eastern fringes of System 6, but was not considered in the proposals for System 4.

Bennelaking is composed of State Forest, vacant Crown land and three Land Act reserves: C31088 (4039 ha), for Water Catchment Area, C19766 (80 ha), for Exempted from Sale, and C19218 (1 ha), for Public Utility; none is vested. The total area of the S.M.P.A. is 5635 ha. The proposed core area, of 4487 ha, is located outside the State Forest. The S.M.P.A. is managed by the Forests Department for the Conservation of Flora and Fauna.

Bennelaking provides a representative range of vegetation of the eastern portion of the Collie River system, which elsewhere has been cleared for agriculture.

The lateritic uplands of the Yalanbee Soil-landform Unit (Churchward and McArthur 1978) support open-forest of Jarrah (*Eucalyptus marginata*) and Marri (*E. calophylla*). On the valleys of the Pindalup Unit the vegetation is dominated by open-woodland of Wandoo (*E. wandoo*) with a complex of swamp vegetation on the moister sites that ranges from shrublands to open-woodland of the paperbark *Melaleuca preissiana*.

The dominant vegetation type is H (Havel 1975(a)) but types A, B, E, P, F, Y and Z also occur in the area.

Type H occurs on the lower and middle slopes of the area and consists of open-forest of Jarrah and Marri with indicator species in the understorey that include Semaphore Sedge (*Mesomelaena tetragona*), Prickly Bitter-pea (*Daviesia pectinata*) and *Hakea ruscifolia*. Type Y occurs in the valleys. It consists of woodland of Wandoo with a shrub storey of such species as Honeybush (*Hakea lissocarpha*), White Myrtle (*Hypocalymma angustifolium*) and *Baeckea camphorosmae*.

Types A and B include swamp vegetation that has been largely destroyed in this district by clearing and through increases in soil salinity.

No dieback has yet been recorded within the S.M.P.A., although it is present on adjacent private properties. All future recreation, therefore, except for access by foot, should be restricted to the periphery.

The Committee endorses the proposal by the Forests Department to manage Bennelaking Special Management Priority Area (4.7) for the Conservation of Flora and Fauna.

RECOMMENDATION

The Committee recommends that reserves C31088, C19766 and C19218, Temporary Reserve 2149/26, Pastoral Lease 3114/417 and the area of vacant Crown land shown in Fig. be proclaimed State Forest, as part of Bennelaking Special Management Priority Area (4.7).

K.5 MUJA S.M.P.A.

Muja S.M.P.A. (4.6) is located 35 km south-east of Collie (in System 4, on the fringes of System 6). The area is composed of leases 3116/3155 and 3116/4836 and reserve C19203, of 627 ha, for Water, not vested. The total area is 3411 ha; the core area, of 2227 ha, is Muja Forest Park. Muja is to be managed by the Forests Department for the Conservation of Flora and Fauna.

Muja resembles sections of Goonac (K.6) and includes a variety of soils, landforms and vegetation which typify this eastern, lower rainfall area.

The lateritic uplands of the Yalanbee Soil-landform Unit (Churchward and McArthur 1978) support open-forest of Jarrah (*Eucalyptus marginata*) and Marri (*E. calophylla*). The valleys and swamps of the Goonaping and Pindalup Units provide for great variation in the vegetation.

The valleys contain open-forest of Jarrah and Marri, woodland of Wandoo (*E. wandoo*), woodland of Banksia (*B. attenuata* and *B. menziesii*), and low open-forest of the paperbark *Melaleuca preissiana*, with shrublands and sedgelands on the moister sites.

The dominant vegetation types in the area are H, A and B (Havel 1975(a)). There are also restricted occurrences of types D, Y and Z. Type H consists of open-forest of Jarrah and Marri and includes in the understorey such species as Prickly Bitter-Pea (*Daviesia pectinata*), Pincushion Coneflower (*Isopogon dubius*), *Hakea ruscifolia* and Semaphore Sedge (*Mesomelaena tetragona*). Types A and B are particularly significant in Muja as they contain uncommon and endangered species such as *Casuarina thuyoides*, Swamp Cypress (*Actinostrobus pyramidalis*) and *Banksia meissneri*.

There is a wide range of fauna associated with the swamps. Lake Ngartiminy provides permanent water for water-birds and other wild life.

So far, recreation has been limited to duck-shooting, which should not be encouraged in the future. Recreation should be confined to those activities that do not conflict with the conservation of Muja's flora and fauna.

The Committee endorses the Forest Department's proposal to manage Muja Special Management Priority Area (4.6) for the Conservation of Flora and Fauna.

RECOMMENDATION

The Committee recommends that leases 3116/3155 and 3116/4836 and reserve C19203 be proclaimed State Forest, as part of Muja Special Management Priority Area (4.6).

K.6 GOONAC S.M.P.A.

Goonac S.M.P.A. (4.5) lies 119 km south-east of Collie, in the Wellington catchment. Goonac is composed of State Forest, leases 3116/5394, 3114/419 and 3116/2739 and three non-vested reserves: C12331, of 16 ha, for Water; C11683, of 40 ha, for Water; C20370, of 33 ha, for Rifle Range. The Forest Park itself comprises 2146 ha but when combined with the leases and reserves the area totals 5211 ha. The S.M.P.A. is managed by the Forests Department for the Conservation of Flora and Fauna.

The lateritic uplands of Goonac are of the Dwellingup Soil-landform Unit (Churchward and McArthur 1978) and, more significantly, the Wilga Unit, which is poorly represented in System 6.

The vegetation on the upper slopes consists of open-forest of Jarrah (*Eucalyptus marginata*) and Marri (*E. calophylla*) with understorey species that reflect the variation in soils and landforms of this area and its comparatively low rainfall.

The valley systems of the Pindalup Unit support a variety of vegetation including open-forest of Jarrah and Marri, woodland of Wandoo (*E. wandoo*), low woodland of Slender Banksia (*B. attenuata*), low woodland of Swamp Banksia (*B. littoralis*) and the paperbark *Melaleuca preissiana*, and shrublands.

Of all the vegetation present in Goonac, the dense shrubland in the moister gullies is the most significant as it provides an important refuge on the mainland for the Tammar (*Macropus eugenii*).

The dominant vegetation types in this area are H and D (Havel 1975(a)). Types A, B, C, E, Y and Z cover smaller areas but are nevertheless important.

Type H occurs on the lower and middle slopes of the area and supports open-forest of Jarrah and Marri; the understorey species that indicate it include Semaphore Sedge (*Mesomelaena tetragona*), Prickly Bitter-pea (*Daviesia pectinata*) and *Hakea ruscifolia*.

Type D occurs on the moister lower slopes and floors of the valleys. The indicator species include *Baeckea camphoromae*, White Myrtle (*Hypocalymma angustifolium*) and *Leptospermum ellipticum*.

Although restricted in occurrence, types A, B and C are important as they provide the dense undergrowth and moist conditions that are most suitable for the Tammar.

The prime purpose of the Special Management Priority Area is the preservation of this marsupial. The management steps that should be implemented to maintain the population of Tammar include prohibiting recreation and limiting access to the area, thereby reducing the further spread of dieback.

The Committee endorses the proposal by the Forests Department to manage Goonac Special Management Priority Area (4.5) for the Conservation of Flora and Fauna.

RECOMMENDATION

The Committee recommends that reserves C12331, C11683 and C20370 and leases 3116/5394, 3114/419 and 3116/2739 be proclaimed State Forest and included in Goonac Special Management Priority Area (4.5).

K.7 NOGGERUP S.M.P.A.

Noggerup S.M.P.A. (5.2) lies 25 km south of Collie, on tributaries of the Preston River. Noggerup is composed of State Forest and reserve C17114, for Railway Water Supply, not vested. It occupies a total area of 3387 ha; the core area, of 2473 ha, is Noggerup Forest Park. It is managed by the Forests Department for the Conservation of Flora and Fauna.

Most of the lateritic uplands in Noggerup are of the Dwellingup Soil-landform Unit (Churchward and McArthur 1978). Also represented is a minor but significant area of the gently undulating divides of the Wilga Unit, which is poorly represented in System 6.

The valley vegetation of Noggerup S.M.P.A. occurs on soils of the Catterick and Lowdon Units. It consists predominantly of open-forest of Yarri (*Eucalyptus patens*), Marri (*E. calophylla*) and Jarrah (*E. marginata*) with an admixture of Peppermint (*Agonis flexuosa*) and Flooded Gum (*E. rudis*) in the moister gullies. The composition of the understorey is distinctive.

The dominant vegetation types in Noggerup are S and T (Havel 1975(a) and (b)) but types A, C, O, Q, W, G, and Z occur on a restricted scale. Types S and T both consist of open-forest of predominantly Jarrah with some Marri. Species that indicate type S include Bull Banksia (*B. grandis*), Snottygobble (*Persoonia longifolia*), Sheoak (*Casuarina fraserana*), Tassel Flower (*Leucopogon verticillatus*), *L. propinquus* and Zamia (*Macrozamia riedlei*). In type T, Bull Banksia and Snottygobble are also present, and the indicator species of the shrub storey include Tassel Flower, Bracken (*Pteridium esculentum*), the creeper *Clematis pubescens*, Zamia, *Phyllanthus calycinus* and Water Bush (*Bossiaea aquilifolia*).

An important feature of Noggerup is its woodland of Swamp Banksia (*B. littoralis*), on the moist, poorly drained valley floors; elsewhere it is threatened by the dieback fungus (*Phytophthora cinnamomi*).

Recreation is insignificant at present, and should be limited to bush-walking to prevent the spread of dieback.

The Committee endorses the proposal by the Forests Department to manage Noggerup Special Management Priority Area (5.2) for Recreation and the Conservation of Flora and Fauna.

RECOMMENDATION

The Committee recommends that reserve C17114 be proclaimed State Forest and included in Noggerup Special Management Priority Area (5.2).

K.8 PRESTON S.M.P.A.

Preston Special Management Priority Area (5.1) is located 30 km to the south of Collie and is drained by tributaries of the Preston River. Preston is composed of State Forest, surrounded in parts by land that has been developed for agriculture. It occupies a total area of 2707 ha; the core area, of 660 ha, is Preston Forest Park. It is managed by the Forests Department for the Conservation of Flora and Fauna.

Most of Preston is situated on the lateritic uplands of the Dwellingup Soil-landform Unit (Churchward and McArthur 1978) in the high rainfall areas, which support open-forest of Jarrah (*Eucalyptus marginata*) and Marri (*E. calophylla*). The valley vegetation occurs on the Catterick and Lowdon Units (Churchward and McArthur 1978), and consists predominantly of open-forest of Yarri (*E. patens*), Marri and Jarrah with an admixture of Peppermint (*Agonis flexuosa*) and Flooded Gum (*E. rudis*) in the moister gullies.

The dominant vegetation types are S and T (Havel 1975 (a) and (b)) but types C, Q, O and W also occur.

Types S and T both consist of open-forest of predominantly Jarrah with some Marri. The main species that indicate type S include Bull Banksia (*B. grandis*), Snottygobble (*Persoonia longifolia*), Sheoak (*Casuarina fraserana*), *Leucopogon capitellatus*, Tassel Flower (*L. verticillatus*), *L. propinquus* and Zamia (*Macrozamia riedlei*). In type T, Bull Banksia and Snottygobble are also present, and the indicator species of the shrub storey include Tassel Flower, Bracken (*Pteridium esculentum*), the creeper *Clematis pubescens*, Zamia, *Phyllanthus calycinus* and Water Bush (*Bossiaea aquilifolium*).

Although only comparatively small areas of types C, Q, O and W are present in the reserve, they are significant: their occurrence elsewhere is restricted and has been reduced by flooding of valleys and clearing of land for agriculture.

The significant feature of Preston S.M.P.A. is the substantial area of uncut forest of Jarrah in the north-east corner. The remainder of the area has been logged and regenerated. Some dieback occurs in the eastern portion; consequently, access should be limited to the reserve to minimise the spread of the fungus.

To date recreation is not significant in the area.

The Committee endorses the proposal by the Forests Department to manage Preston Special Management Priority Area (5.1) for the Conservation of Flora and Fauna.

K.9 DONNYBROOK (RESERVES AND VACANT CROWN LAND)

The area concerned lies immediately to the east of Donnybrook Townsite, and incorporates the Timber reserve 153/25, under the Forests Act, of 93 ha, an area of vacant Crown land (Lots 30, 31, and 33) of ha and the following reserves: C2013, of 59 ha, for Timber, not vested; C7859, of 30 ha, for Government Requirements, not vested; C26238, of 27 ha, for Timber, not vested; C2052, of 161 ha, for Government Requirements, not vested; C22860, of 24 ha, for Recreation, vested in the Shire of Donnybrook.

The undulating landscape of the uplands dominates the area. Their gravels and sands support open-forest of Jarrah (*Eucalyptus marginata*) and Marri (*E. calophylla*), which includes Bull Banksia (*B. grandis*), Woody Pear (*Xylomelum occidentale*), Christmas Tree (*Nuytsia floribunda*), *Dasyogon bromeliaefolius*, *Acacia extensa*, *Melaleuca thymoides* and *Hibbertia* spp.

The larger, north-eastern portion of the area, north-east of the South Western Highway, comprises the eastern extension of the Donnybrook Sunkland into the lower reaches of the Preston River valley. As such, this portion is unique, and warrants reservation for the Conservation of Flora and Fauna. Although there have been some past disturbances, they have not influenced significantly the condition of most of this area.

Although recreation has been restricted, so far, to localised areas, it is likely that it will increase in future. Owing to the special value of the north-eastern portion, only passive recreation such as bush-walking should be allowed; the portion to the south-west of the highway, which is less significant biologically, should accommodate most of the recreation.

The dieback disease has been recorded in localised patches of the area.

RECOMMENDATION

The Committee recommends that:

1. reserves C2013 and C7859 be amalgamated as a reserve for the purpose Recreation, vested in the Shire of Donnybrook; it should be managed for the long-term conservation of the natural flora;
2. reserves C2052, C22860, C26238, Timber reserve 153/25 and the area of vacant Crown land in Fig. be proclaimed State Forest and managed for the Conservation of Flora and Fauna.

K.10 RESERVE C29121 (WILGA TOWNSITE)

Reserve C29121, of 32 ha, for Conservation of Flora, not vested, lies about 2 km south-east of Wilga.

The reserve is characteristic of the Catterick and the Wilga Soil-landform Units (Churchward and McArthur 1978). The topography is flat to gently undulating; and the soils are lateritic, with pockets of sand.

Open-forest of Jarrah (*Eucalyptus marginata*) and Marri (*E. calophylla*) with an understorey of Bull Banksia (*B. grandis*) cover the uplands. On the valley slopes, Yarri (*E. patens*) is also present, and Flooded Gum (*E. rudis*) and Swamp Banksia (*B. littoralis*) occur on the floors of the valleys.

The principal vegetation types are H, Q, D, W and C (Havel 1975(a)). Type H occurs on the uplands and is indicated by the presence of Prickly Bitter-pea (*Daviesia pectinata*), *Hakea cyclocarpa* and Hairy Flag (*Patersonia rudis*). Types Q, D and W occur on the slopes of the valleys. Type Q is indicated by White Myrtle (*Hupocalymma angustifolium*) and *Trymalium spathulatum*. Types D and W are similar, and *Dampiera alata* and *Synaphea petiolaris* are typical of both. Type W differs from type D in the greater occurrence of Yarri, White Myrtle and Honeybush (*Hakea lissocarpa*) and the lesser occurrence of *Leptocarpus scariosus* and *Leptospermum ellipticum*, suggesting somewhat drier and more fertile soils. Type C occurs as a narrow belt fringing rivers; it is indicated by Yarri, in the overstorey, and a tall, dense shrub layer of *Agonis linearifolia* and *Grevillea diversifolia*.

The reserve, although small, is important in containing vegetation of types D and W, which elsewhere have been severely affected by the dieback disease. Although the disease is present here, the reserve is mostly in good condition.

The reserve is within the Wilga townsite and is separated from State Forest by private land and a railway line.

RECOMMENDATION

The Committee recommends that the purpose of reserve C29121 be changed to Conservation of Flora and Fauna and that the reserve be vested in the Western Australian Wildlife Authority.

K.11 MULLALYUP S.M.P.A.

Mullalyup Special Management Priority Area (5.4) is located immediately south of Kirup and is drained by the Capel River and Balingup Brook. Mullalyup is composed of State Forest and freehold land in the name of the Conservator of Forests (Wellington Loc. 3463, Pt. Loc. 1666). It occupies a total area of 4134 ha; the core area, of 2139 ha, is Mullalyup Forest Park. It is managed by the Forests Department for Conservation of Flora and Fauna and for Recreation.

Mullalyup includes a range of soils, landforms and vegetation that typify the high rainfall area of the western fringes of the Darling Range. This southern section of System 6 consists of deeply dissected valleys.

The lateritic uplands of the Dwellingup Soil-landform Unit (Churchward and McArthur 1978) support open-forest of Jarrah (*Eucalyptus marginata*) and Marri (*E. calophylla*) with understorey species that reflect the higher rainfall.

The occurrence in Mullalyup of shallow depressions associated with the lateritic surfaces of the Goonaping Unit is significant: such depressions are mainly confined to the central and northern part of the Plateau.

The erosional landscape of the Lowdon Unit and the valleys of the Balingup, Bridgetown and Yarragil Units provide a further variety of vegetation, which includes significant extensive stands of Yarri (*E. patens*) and River Banksia (*B. littoralis* var. *seminuda*), and areas of heath on the granitic outcrops in the east. The heath together with the rapids have considerable aesthetic appeal.

The dominant vegetation types are S and T (Havel 1975(a) and (b)). Types C, G, Q, P, R and W occur over smaller areas but are nevertheless significant. They indicate the large variety of vegetation present in Mullalyup.

Dieback has been recorded on the fringes of the S.M.P.A.; one patch of diseased trees has been cut out in the west. In spite of this, healthy examples of River Banksia are located in the central incised valleys.

In the past, Mullalyup has received little use for recreation. The Bibbulmun track, however, which now passes through the north-west corner, will attract people into the area. Recreational activities that do not conflict with the basic aim of conservation can be allowed in the area.

The Committee endorses the proposal by the Forests Department to manage Mullalyup Special Management Priority Area (5.4) for the Conservation of Flora and Fauna and for Recreation.

RECOMMENDATION

The Committee recommends that Loc. 3463 and Pt. Loc. 1666 (Freehold Land) in the name of the Conservator of Forests be proclaimed State Forest, and included in Mullalyup Special Management Priority Area (5.4).

K.12 RESERVE A25446 (POWALUP)

Reserve A25446, of 67 ha, is situated on the Blackwood River at Powalup, about 10 km south-west of Balingup. It is for Conservation of Flora and Fauna and is vested in the Western Australian Wildlife Authority.

The reserve extends for some 3.5 km along the Blackwood and incorporates mostly the river flats of the Bridgetown Soil-landform Unit (Churchward and McArthur 1978). The vegetation is mostly open-forest of Flooded Gum (*Eucalyptus rudis*) with some paperbark (*Melaleuca raphiophylla*). Some of the Flooded Gums are infested with Mistletoe (*Amyena miguelii*) and the ground vegetation contains much Bracken (*Pteridium esculentum*). On the valley slopes is open-forest of Jarrah (*E. marginata*) and Marri (*E. calophylla*) with some Yarri (*E. patens*).

The Blackwood River is brackish, but Balingup Brook, which enters in the north, is comparatively fresh. Just north-east of where Cedar Road crosses the Blackwood is a seasonal fresh-water swamp; about one third is within the reserve, the remainder being in Wellington Location 94.

The northern part of the reserve has been affected by grazing, but the southern part is in comparatively good condition.

The Committee endorses the class, purpose and vesting of reserve A25446.

RECOMMENDATION

The Committee recommends that the Department of Fisheries and Wildlife negotiate with the owner of Wellington Location 94 in an attempt to include the remainder of the fresh-water swamp between Cedar Road and Balingup Brook in reserve A25446.

K.13 GREENBUSHES S.M.P.A.

Greenbushes S.M.P.A. (5.5) consists of three sections scattered between the Balingup-Nannup Road and Bridgetown. Greenbushes is composed of State Forest, a Timber reserve under the Forests Act (155/25) and freehold land in the name of the Conservator of Forests (Pt. Loc. 947, Pt. Loc. 2240). It occupies a total area of 1351 ha; the core area, of 1100 ha, is Greenbushes Forest Park. It is managed by the Forests Department for the Conservation of Flora and Fauna.

Greenbushes includes the lateritic uplands of the Dwellingup Soil-landform Unit (Churchward and McArthur 1978) and the two major valley systems of the Bridgetown and Balingup Units.

Most of the area supports open-forest of Jarrah (*Eucalyptus marginata*) and Marri (*E. calophylla*) including an area of uncut Jarrah.

Jarrah and Marri are replaced by Yarri (*E. patens*) in the gullies and by woodland of Flooded Gum (*E. rudis*) and the paperbark *Melaleuca raphiophylla* along the streams.

The dominant vegetation types are P, S and T, (Havel 1975(a)) but types C, Q, R and W also occur on a restricted scale.

Type P is characterised by open-forest of Jarrah with the occasional Marri. Plants present in the understorey include Sheoak (*Casuarina fraserana*), Wilson's Grevillea (*Grevillea wilsonii*), Hairy Jugflower (*Adenanthos barbiger*) and *Hovea chorizemifolia*.

Types S and T both consist of open-forest of Jarrah and Marri but differ in the floristic composition of the understorey. The commonest species in type S include *Zamia* (*Macrozamia riedlei*), *Leucopogon capitellatus* and *L. propinquus*. Type T includes such species as Tassel Flower (*L. verticillatus*), Bracken (*Pteridium esculentum*), the creeper *Clematis pubescens* and Water Bush (*Bossiaea aquilifolium*). The other types, although significant in their floristic composition, occur only over limited areas.

Since all three areas that comprise Greenbushes S.M.P.A. are surrounded by private property, recreation is unimportant and is unlikely to increase greatly in the future.

Greenbushes is especially important for its areas of uncut forest of Jarrah and Marri which are representative of the Blackwood region.

The Committee endorses the proposal by the Forests Department to manage Greenbushes Special Management Priority Area (5.5) for the Conservation of Flora and Fauna.

RECOMMENDATION

The Committee recommends that the Forest Act reserve (155/25) and the freehold land in the name of the Conservator of Forests (Pt. Loc. 947, Pt. Loc. 2240) be proclaimed State Forest and included in Greenbushes Special Management Priority Area (5.5).

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Nollajup S.M.P.A. (5.6) lies 7 km south-west of the township of Boyup Brook. It comprises a Timber reserve (206/25) under the Forests Act, and occupies 661 ha, all of which is core. It is managed by the Forests Department for the Conservation of Flora and Fauna.

Nollajup includes the lateritic uplands of the Dwellingup Soil-landform Unit (Churchward and McArthur 1978), which supports open-forest of Jarrah (*Eucalyptus marginata*) and Marri (*E. calophylla*). The forest in the eastern section of Nollajup is uncut. The understorey species reflect Nollajup's location in the drier, eastern portion of System 6. The erosional landscape of the Michibin Unit supports woodland of Wandoo (*E. wandoo*), which also includes an uncut area in the east.

The dominant vegetation types are H and Y (Havel 1975 (a) and (b)), but smaller areas of types A, G and Z also occur in Nollajup.

Types H and Y both occur in valleys; where they appear in the same valley, type Y is found further down the slope than type H. Type H consists of open-forest of Jarrah and Marri. The main species that indicate it include Prickly Bitter-pea (*Daviesia pectinata*), *Hakea ruscifolia* and *Styphelia tenuiflora*. Type Y consists of woodland of Wandoo. The main indicator species include White Myrtle (*Hypocalymma angustifolium*), *Baeckea camphorosmae* and *Dampiera alata*.

Type A, found on poorly drained depressions, is characterised by the occurrence of the paperbark *Melaleuca preissiana*, *Hakea varia* and *H. ceratophylla*. In some areas along the waterways Flooded Gum (*E. rudis*) also occurs.

Types G and Z are localised in occurrence and do not contribute significantly to the vegetation of Nollajup.

Nollajup is surrounded by land that has been developed for agriculture. Recreation is not significant. The dieback fungus has been recorded on the southern edge of the proposed area.

The Committee endorses the Forest Department's proposal to manage Nollajup Special Management Priority Area (5.6) for the Conservation of Flora and Fauna.

RECOMMENDATION

The Committee recommends that the Timber reserve (206/25) be proclaimed State Forest and included in Nollajup Special Management Priority Area (5.6).

K.15 DALGARUP S.M.P.A.

Dalgarup S.M.P.A. (12.1) is located 16 km east of Nannup. The area is situated on the northern fringe of System 2, but was not considered in the proposals for that System. It is composed of State Forest, and occupies a total area of 3552 ha; the core area, of 735 ha, is Dalgarup Forest Park. It is managed by the Forests Department for the Conservation of Flora and Fauna.

Dalgarup includes a variety of soils, landforms and vegetation. Probably the greatest diversity of plants is to be found in the valleys.

The uplands support open-forest to tall open-forest of Jarrah (*Eucalyptus marginata*) and Marri (*E. calophylla*). The valley vegetation ranges from open-forest of Yarri (*E. patens*), Jarrah and Marri to tall open-forest of Karri (*E. diversicolor*).

The dominant vegetation types (Havel 1975(a)) of Dalgarup are S, T and Q. There are also minor occurrences of types C, O, U and W. Karri enters as a component of the overstorey of types T, Q and W. Type T includes such shrub species as *Leucopogon verticillatus*, Bracken (*Pteridium esculentum*), the creeper *Clematis pubescens*, Water Bush (*Bossiaea aquilifolium*) and *Lasiopetalum floribundum*. Type Q includes such plant species as Karri Hazel (*Trymalium spathulatum*), Yarri, *Chorizema ilicifolium* and *Leucopogon propinquus*. Type W includes such plant species as Yarri, White Myrtle (*Hypocalymma angustifolium*), *Lepidosperma angustatum* and *Acacia extensa*.

An important feature of Dalgarup is that it includes the northernmost occurrence of Karri.

The Committee endorses the proposal by the Forests Department to manage Dalgarup Special Management Priority Area (12.1) for the Conservation of Flora and Fauna.

K.16 ST. JOHN BROOK S.M.P.A.

St. John Brook S.M.P.A. (12.2) is located 8 km to the west of Nannup, in the Donnybrook Sunkland. It is composed of State Forest and reserve C13290, for Railway Water Supply, not vested, and surrounds two areas of freehold land (Wellington Locations 6881 and 9946); the total area, all core, is 3260 ha. It is managed by the Forests Department for the Conservation of Flora and Fauna and for Recreation.

St. John Brook includes a variety of soils, landforms and vegetation that represent the Donnybrook Sunkland.

The S.M.P.A. contains two sorts of valleys: broad depressions and those with moderately steep slopes. The former support vegetation that ranges from open-forest of Jarrah (*Eucalyptus marginata*) and Marri (*E. calophylla*) to open-woodland of *Banksia* spp.; the understorey species include *Petrophile linearifolia*, *Dasypogon bromeliaefolius*, *Daviesia incrassata* and Black Gin (*Kingia australis*).

The steeper valleys support woodlands of the paperbark *Melaleuca preissiana* as well as open-forest of Jarrah and Marri; the shrub species include Basket Flower (*Adenanthos obovatus*), Semaphore Sedge (*Mesomelaena tetragona*), White Myrtle (*Hypocalymma angustifolium*) and Pineapple Bush (*Dasypogon hookeri*).

The valleys associated with the main tributaries of the Blackwood River, including St. John Brook, support a fringing woodland of Flooded Gum (*E. rudis*) and Yarri (*E. patens*). The understorey includes *Trymalium spathulatum*, *Agonis linearifolia*, *Pultenaea reticulata*, *Hypocalymma cordatum* and *Gahnia trifida*.

The uplands are covered in open-forest of Jarrah and Marri with a well defined second storey of Bull Banksia (*Banksia grandis*), Sheoak (*Casuarina fraserana*), Snottygobble (*Persoonia longifolia*) and Woody Pear (*Xylomelum occidentale*). The shrub species present include Koolah (*Podocarpus drouyniana*) Drumstick Isopogon (*I. sphaerocephalus*), *Leucopogon capitellatus* and Hairy Jugflower (*Adenanthos barbigerus*).

Recreation in St. John Brook is restricted to localised areas. Owing to the susceptibility of large areas to dieback, the S.M.P.A. should be managed to restrict further spread of the disease.

St. John Brook is valuable as a representative area of the Donnybrook Sunkland. As many of the plant species of this area are not found in the Darling Plateau this region is unique floristically.

The Committee endorses the proposal by the Forests Department to manage St. John Brook Special Management Priority Area (12.2) for the Conservation of Flora and Fauna and for Recreation.

RECOMMENDATION:

The Committee recommends that:

1. reserve C13290 be proclaimed State Forest, and be included in St. John Brook Special Management Priority Area (12.2);
2. the Forests Department purchase Wellington Locations 6881 and 9946, should these become available, to enable their inclusion in St. John Brook Special Management Priority Area (12.2).