Department of Conservation and Land Management, WA
Water Authority of Western Australia

Waroona Reservoir and Catchment Area

Draft Management Plan

MARCH 1988

DEPARTMENT OF CONSERVATION AND LAND MANAGEMENT

WATER AUTHORITY OF WESTERN AUSTRALIA

WAROONA RESERVOIR AND CATCHMENT AREA

DRAFT MANAGEMENT PLAN
(with special reference to recreation)

PROJECT TEAM

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ACKNOWLEDGEMENTS

The names of those who attended the public workshop appear in Appendix C. Their contribution to this plan is gratefully acknowledged, as is the contribution of other members of the public who provided written submissions.

Steering Committee members also provided valuable advice and discussion. The members were Keith Lynch, Chairman (Water Authority), Ian Wood, Jeff Kite (Water Authority), Ron Golding (Shire of Waroona), Charles Lockwood (Shire of Harvey), Dave Smith (Marine and Harbours), Peter Murray (South West Development Authority), and Jim Williamson (CALM). Observers present at Steering Committee meetings included Burt Scott, Ross Doubikin (Water Authority), Bob Chandler, Peter Henderson (CALM), Mike Stoner, Mike Birhsaw, Martin Bowman (consultant team).

Ian Wood was the main contributor from the Water Authority on the project team until he resigned and his place was filled by Jeff Kite. Valuable comments were received from several officers in the Water Authority and CALM. Word processing skills were supplied with diligence and cheerfulness by Debbie Bowra.

PREFACE

This draft management plan has been jointly prepared by the Water Authority of Western Australia and the Department of Conservation and Land Management (CALM), in accordance with the planning process established under the CALM Act, 1984.

Preparation of the plan was initiated by the Water Authority following public and local government representations regarding the future of Waroona Dam for irrigation and recreational use. Preliminary, long term planning of future sources for Perth's water supply identifies the alternative of an enlarged dam at Harvey. The supply pipeline from Harvey would pass near Waroona Dam, and it may be feasible to inject potable water, which presently overflows from the Dam into this pipeline. Although current water supply planning does not include the use of excess water from Waroona Dam for at least twenty (20) years, the Water Authority believes it is desirable to keep all possible options open. Therefore, it was decided that a catchment management plan should be prepared to provide for sustainable recreational use of the reservoir and its catchment, whilst maintaining water quality in accord with long term objectives.

In the initial stages of this proposal, it was resolved that this plan should be termed an 'Area Management Plan' and be given legal status under the CALM Act, 1984. This formal arrangement arose from two principal factors:

(i) the majority of the catchment area for the dam is part of a much larger tract of State forest managed by CALM, and

(ii) there is no statutory mechanism under existing Water Authority legislation which allows implementation of a management plan on CALM land.

The main emphasis of this plan is management of recreational activities, because recreational use of the dam has increased significantly in recent years and, at present, is not adequately managed. Whilst land is used for many other purposes in the catchment area, such as water and wood production, agriculture etc., it is believed that management prescriptions for these uses are adequately addressed in the relevant Regional Management

Plans and the 'timber production strategy' (CALM, 1987 a-d). Therefore, discussion of management for these purposes within this document is brief.

The reader should be aware from the outset that, although recreation management is the primary focus of this plan, recreational use is not the priority land use of the catchment. Water and timber production have priority over recreation.

Finally, it is advised that a similar plan has been prepared for the Logue Brook reservoir and catchment. The plans have been prepared concurrently because the two reservoirs are focal points of recreational activity in the district and have similar uses, problems and management prescriptions.

1.0 INTRODUCTION

1.1 Recreation on Reservoirs and Catchments in Western Au

1.1.1 Regional Context

In recent years, there has been a significant increase in
for recreational use of water supply catchments, particula
or on the water storages. Greater demand is partly reflect
increasing number of requests for special access received l
Authority and partly by the pressure on existing facilities

To put the present situation into a regional perspective, t
enormous land area on the western edge of the Darling Range
now affected by restrictions on public access and recreatio
declaration of catchment areas for water production. A total
square kilometres is contained within these catchments and t
an additional 1300 square kilometres declared as water reser
identify the catchments which have potential for future wate
developments.

The existing controls on recreational use of water catchments
therefore place a significant constraint on large areas of St
forest which are otherwise suited to a wide range of recreati
activities. However, it should also be recognized that constr
water storages has increased recreational opportunity and mus
partially responsible for the existing levels of demand.

1.1.2 Irrigation Water Storages and Catchments

South of Dwellingup, the Water Authority operates a number of
reservoirs which store water principally for irrigation purpose
Fewer access restrictions are applied to these reservoirs in
recognition of the less stringent water quality requirements in
comparison to those for urban/domestic use. The overriding conc
to minimize potential salinity increases. However, as some of tl
reservoirs may be used for public water supply purposes in the i
other aspects of water quality maintenance are also important. A
summary of the present access restrictions is given below:

- Vehicles (including trail bikes and off-road vehicles) are only permitted on public roads, open tracks and designated dam access roads.

- Pedestrian access to all of the catchment and the dam wall is permitted. Access to the water area is also permitted, and activities such as marroning, fishing, canoeing and swimming are conducted on some water areas.

- Camping is not permitted outside designated areas.

- Motor boats are permitted on three reservoirs (Waroona, Logue Brook and Glen Mervyn) and water-skiing is a popular pastime.

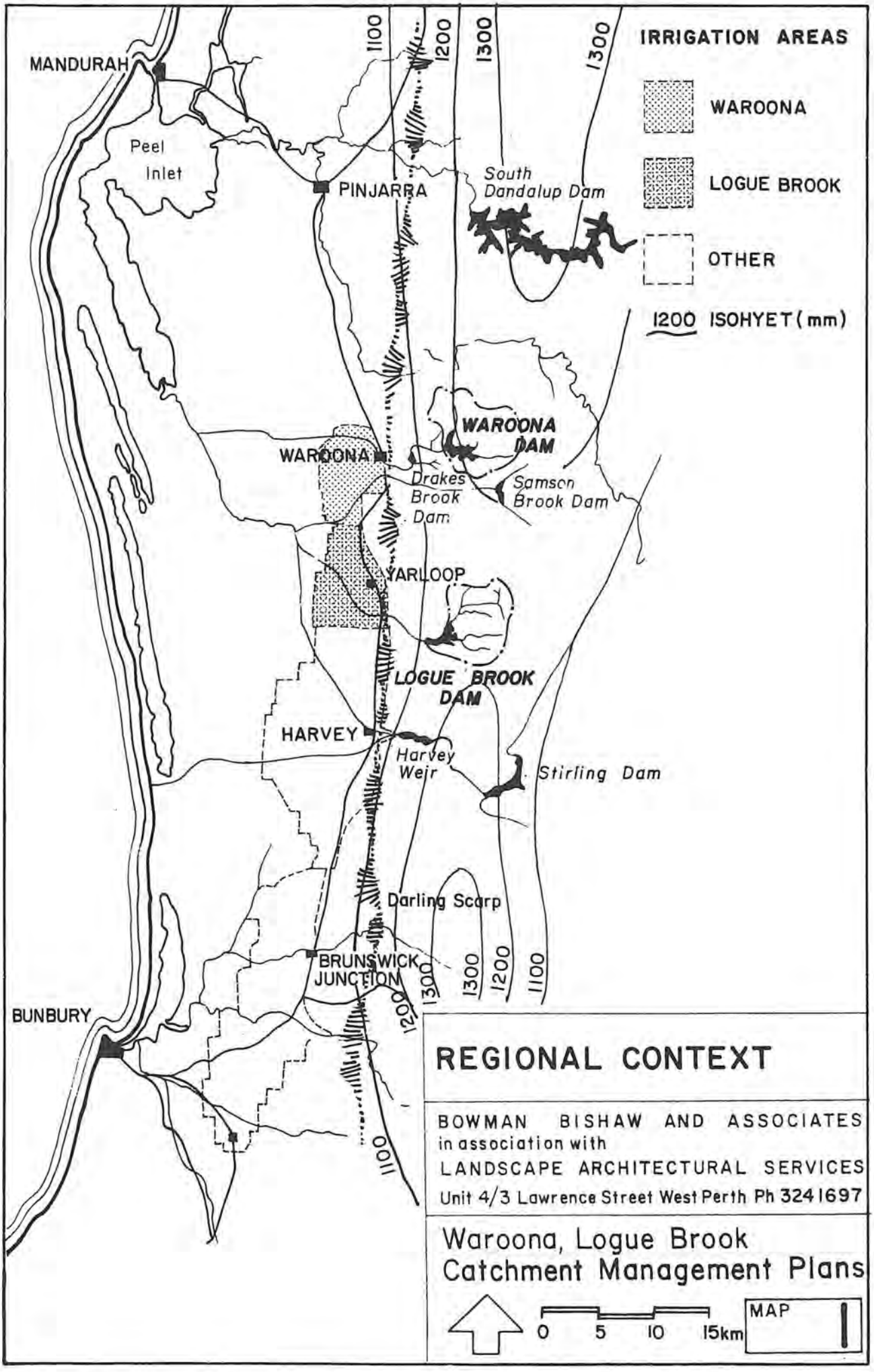
1.2 Waroona Reservoir and Catchment

1.2.1 Location and Historical Perspective

Waroona reservoir is situated approximately 6 km due east of the township of Waroona, on the edge of the Darling Range. It lies wholly within the Shire of Waroona and is approximately 114 km south of Perth by road.

The catchment for the reservoir was proclaimed as part of the Waroona Irrigation District in 1943, under the provisions of the Rights in Water and Irrigation Act. The reservoir was subsequently formed by damming Drakes Brook during the period 1964-1966. Construction of the dam more than doubled the amount of water previously available to the Waroona Irrigation District, which had been formally established during the 1930's. Map 1 shows the location of the reservoir in relation to Mandurah and Bunbury and also shows the principal area to which irrigation water is supplied.

Prior to construction of the dam, much of the land destined to be flooded was developed as pasture and orchards. Since the official opening in 1966, the reservoir has been made available for water-based recreational activities. It has been named 'Lake Navarino'.



REGIONAL CONTEXT

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1.3 The Need for a Management Plan

The preparation of this plan was initiated by the Water Authority, largely in response to the increased recreational demand on the reservoir and catchment. As 'people pressure' on the area increases, effective management will be required to ensure that water quality of the reservoir does not deteriorate and that the overall aesthetics of the area are not spoiled. The need for a management plan may be discussed both in terms of broader, regional land use issues and in terms of issues specific to Waroona reservoir.

Some of these issues are briefly summarized below to emphasize the requirement for recreation management.

i. State forest is to be managed for multiple use. The major uses on the Western Scarp will be for water supplies, sustainable wood production, conservation and recreation. Wood production and water supply are compatible uses, whereas recreation and conservation are conditional to specific time, area or use constraints.

ii. Recent land use studies, which have addressed access to catchments and reservoirs, have consistently indicated that there is a need for improved planning and management to enable a gradual lifting of restrictions on recreational activities without compromising priority purposes.

iii. The Western Australian Water Resources Council has investigated this issue and recommended a number of guidelines to be followed in the planning process if increased recreational use of reservoirs and catchments is to be allowed (WAWRC, 1985). The guidelines include a recommendation that proposals for recreational activities are based on detailed management plans.

iv. A management plan for Waroona reservoir, based on the WAWRC guidelines, is long overdue as active water-based recreation has been allowed since the dam was constructed.

v. An effective management plan and associated monitoring programme for this reservoir may be used as a case study with relevance to other reservoirs and catchments, particularly potable water storages.

vi. A principal requirement of this management plan is to co-ordinate the activities of the various management authorities involved in the area (eg. CALM, Water Authority, Department of Marine and Harbours, Shire of Waroona). Present recreational use traverses the boundaries of responsibility of these authorities.

1.4 Waroona Dam Catchment Management Plan

1.4.1 Scope

The aim of this plan is to formulate management recommendations for the reservoir, foreshore, the complete catchment area and a small area of Crown land below the dam wall. The management recommendations focus on recreational use, with due consideration to the priority land uses of water and wood production.

This document is intended to provide guidelines from which an annual works programme can be formulated. Under the planning procedure required by the CALM Act, this draft plan will be released to the public for review for a period of not less than two months. This is a requirement of the Act.

1.4.2 Plan Structure

This document is separated into five sections, as follows:

- Section A presents a summary of the resource information on which the plan is based, identifies current management activity and evaluates the environmental resources with respect to compatibility of recreational pursuits.

- Section B outlines the overall management objectives for the major land uses in the catchment.

- Section C presents a range of alternative strategies to resolve the recreational issues and outlines alternative administrative structures for day-to-day management.

- Section D gives an outline of management recommendations.

- Section E briefly describes implementation and review of the plan.

SECTION A: BACKGROUND TO MANAGEMENT

2.0 DESCRIPTION OF RESOURCES AND PRESENT LAND USE

2.1 Land Tenure

The Waroona reservoir has a catchment area of approximately 4020 hectares. Land tenure is shown on Map 2 and it is apparent that the majority of land (about 82%) is State forest, vested in the Lands and Forest Commission and managed by CALM.

Other significant features of the land tenure are as follows:

- three parcels of freehold land in the north-western sector which comprise about 8% of the catchment;

- three distinct classes of land fringing the reservoir, listed in order of decreasing shoreline length,
  - land owned by the Water Authority,
  - State forest managed by CALM,
  - Crown reserve vested in the Water Authority;

- a small parcel of land managed by CALM which is leased to the Shire of Waroona for a caravan park.

2.2 Existing Access

Map 3 shows the existing access roads to the reservoir and the numerous roads and tracks throughout the catchment. The only sealed access road is off the South-Western Highway at Waroona, via Nanga Brook and Invarell Roads. Invarell Road forms a loop around the reservoir and links with Western Boundary Road which continues in a general southerly direction along the scarp. Although the majority of the loop is unsealed, it provides good access around the reservoir and numerous tracks have been formed from this road to the water's edge.

Other features of the existing access may be summarized as follows:

LEGEND

- Private Rural
- Water Authority
- C.A.L.M. State Forest
- C.A.L.M. Lane Poole Reserve
- Other Recreation & Parkland
- Catchment Boundary

LAND TENURE WAROONA

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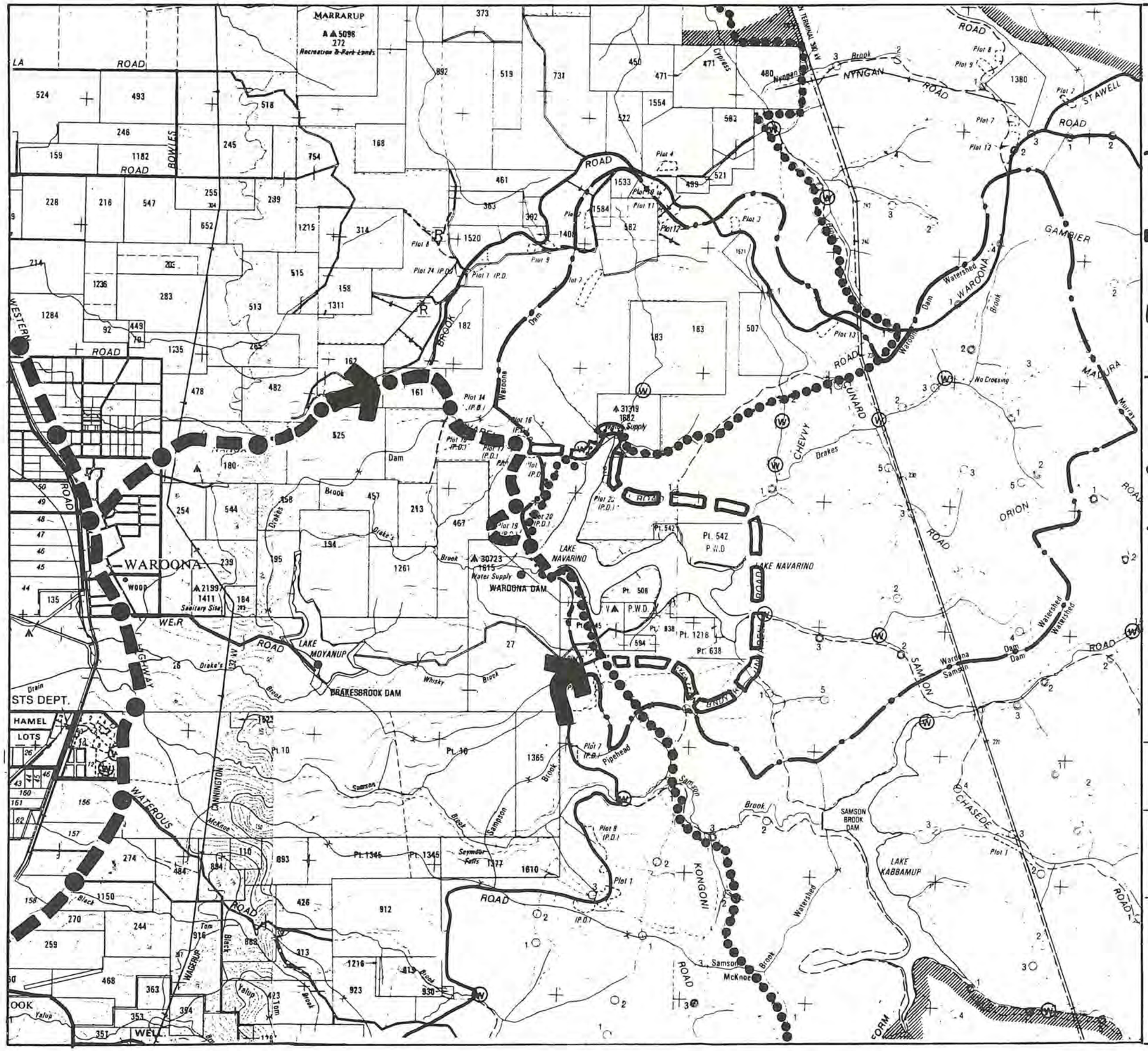
SCALE 1 : 50000

MAP 2

1000m 0m 1km 2km 3km



LEGEND

- Sealed Road
- Ist Class Gravel Road
- Reservoir
  Ring Road
- Major Access
- Minor Tracks
- Bibbulmun Track
- Catchment boundary

ACCESS WAROONA

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SCALE 1 : 50000

MAP 3

1000m 0m 1km 2km 3km

- the numerous tracks, which are typical of the forest, provide unrestricted access to a large proportion of the catchment;

- access across the catchment boundary is also plentiful and unrestricted;

- soil conditions and surface drainage in the area indicates that most tracks would be accessible throughout the year;

- there are apparent inconsistencies in road nomenclature and sign-posting is generally inadequate.

The Bibbulmun track traverses the catchment and represents the major designated bush-walking access in the area.

2.3 Physical and Biological Resources

2.3.1 Climate

The Waroona Dam area has a temperate climate characterised by warm, dry summers and cool, wet winters. Typical features of the climate are summarized as follows:

- The catchment is located in the high rainfall belt of the Darling Scarp, with an annual average rainfall of 1250 mm;

- Approximately 80% of the rainfall falls in the five month period May to September;

- Annual average evaporation (Class A Pan) is about 1700mm and generally exceeds rainfall for about seven months of the year.

- A guide to the likely temperature variations may be gained from records at the Dwellingup meteorological station, located approximately 14km NNE. Mean monthly maximum temperatures vary from 29.9'C in January to 14.8'C in July; mean monthly minimum temperatures vary from 14.9'C in February to 5.2'C in August;

- During summer, winds usually blow from the south-west and south-east, in winter winds come from the western sector with highest occurrences from the north-west. The strongest winds occur mostly from the western sector.

2.3.2 Geology

The main geological element is the Yilgarn Block and the dominant rock type is a coarse-grained porphyritic granite. Gneissic rock may occur along the western edge of the catchment.

A map of the surface geology is given in Map 4. Note that laterite occupies approximately 50% of the land surface, whilst the next most common surficial deposit is pisolitic sandy gravel. This gravel is ferruginous and may be locally re-cemented to form an erosion resistant 'pseudo-caprock'. The gravelly, silty sand is characteristic of the drainage lines.

2.3.3 Landform and Soils

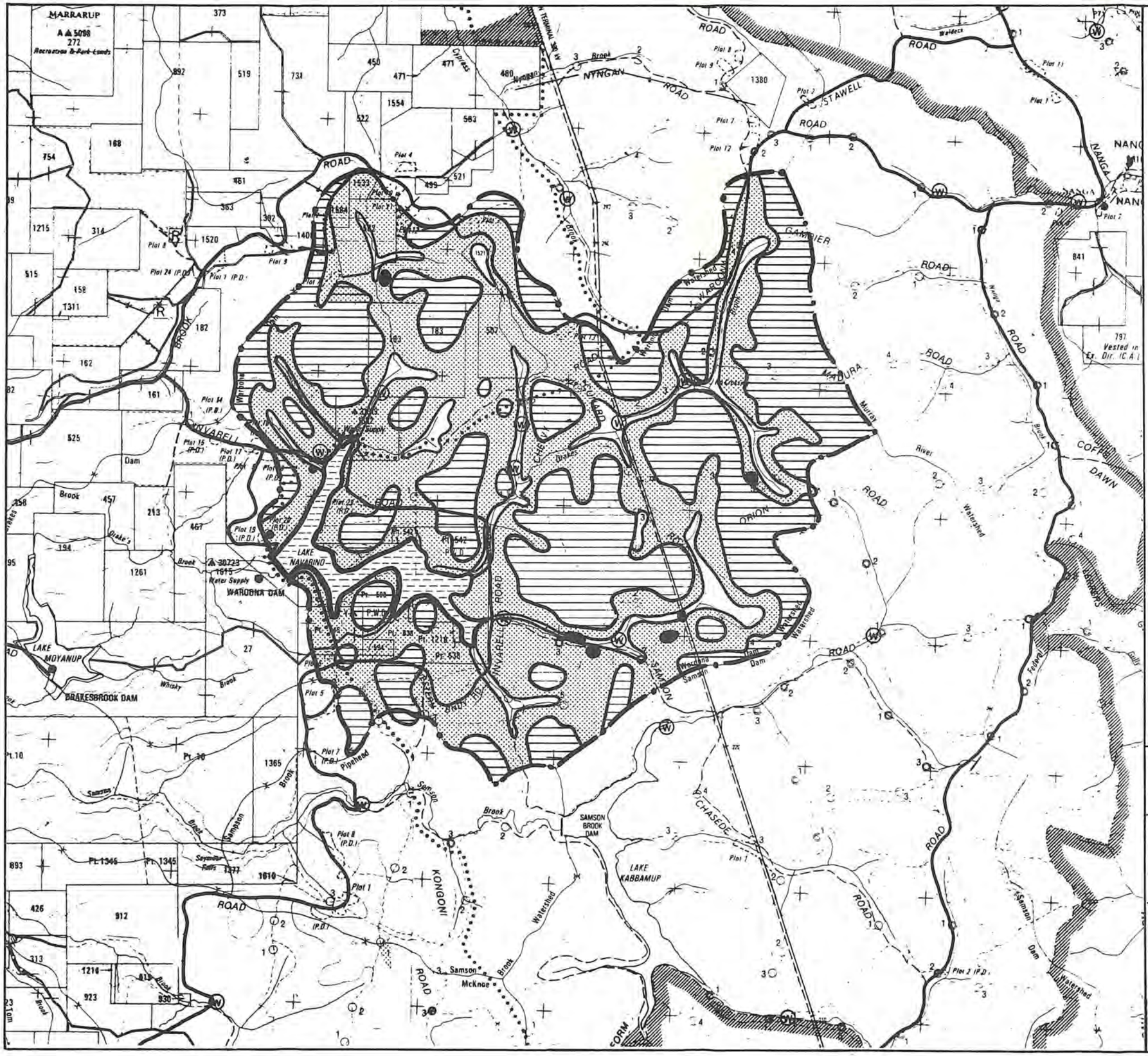
The Waroona dam catchment lies within the broad physiographic unit known as the Darling Plateau, slightly to the east of the steep, rocky slopes which characterize the plateau's western edge (Darling Scarp).

Three landform units are recognized in the area, and these are briefly described below.

i. Murray (22% of the catchment): The reservoir is located in a deeply incised valley typical of the Murray Unit, with slopes between 3% and 15%. Red-brown earths are found on the slopes and gravels together with patchy pseudo-caprock.

ii. Yarragil (36%): The upstream extensions of the major reservoir valley are known as the Yarragil Unit. These upland valleys have more gentle slopes (less than 8%) characterised by sandy gravels, with swampy orange earths in the valley floor.

iii. Dwellingup (42%): The gently undulating, upland areas of the catchment are known as the Dwellingup Unit, which may have a



LEGEND

- LATERITE
- GRAVEL
- GRAVELLY SILTY SAND
- GRANITIC ROCK

SURFACE GEOLOGY WAROONA

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SCALE 1 : 50000

MAP 4

1000m 0m 1km 2km 3km

duricrust 'caprock' on the ridges. The shallow depressions are generally sands and gravels.

2.3.4 Hydrology

The reservoir was formed by damming Drakes Brook. The brook and its tributaries flow predominantly in a westerly direction with their headwaters in swampy areas located between the dissected laterite ridges. There are four principal feeder streams which have perennial pools and/or swampy areas.

The average annual runoff of the catchment is 11.5 million cubic metres giving a catchment yield equivalent to 25% of rainfall, though in some years it may be as high as 30%.

2.3.5 Vegetation

Map 5 is a vegetation map of the catchment. This map was reproduced from the original mapping of vegetation complexes by Heddle et.al. (1980).

The vegetation complexes relate closely to the landform units described in Section 2.3.3 and are summarised below:

- Dwellingup Complex - comprises primarily jarrah (*Eucalyptus marginata*) and jarrah-marri (*E. calophylla*) open forest, often with an understorey tree layer of sheoak (*Allocasuarina sp.*) and bull banksia (*Banksia grandis*).

- Yarragil Complex - mixed open forest of jarrah-marri with admixtures of yarri (*E.patens*) and bullich (*E.megacarpa*).

- Murray Complex - peripheral vegetation of the reservoirs, mostly jarrah-marri higher on the slopes with occasional yarri on the lower slopes. (Approximately one-third of this complex was removed to form the Waroona reservoir).

In addition, there is a small area of the Cooke complex on the eastern boundary of the catchment. This complex has a range of vegetation

from open jarrah-marri forest on deep soils to heath, herbland and lichens on granite soils.

Swampy areas along the feeder streams may have a fringing woodland of paperbark (Melaleuca preissiana) and swamp banksia (B. littoralis).

2.3.6 Fauna

A reasonably extensive inventory of fauna found in the jarrah forest has been compiled over the years. Surveys have been conducted in nearby areas, such as for the Willowdale bauxite mine (Alcoa, 1978) and the Harris River project (Water Authority, 1984). The reader is referred to these reports and to the resources document for the Lane Poole Reserve (CALM, 1986 a) for an indication of the fauna likely to be found in the catchment.

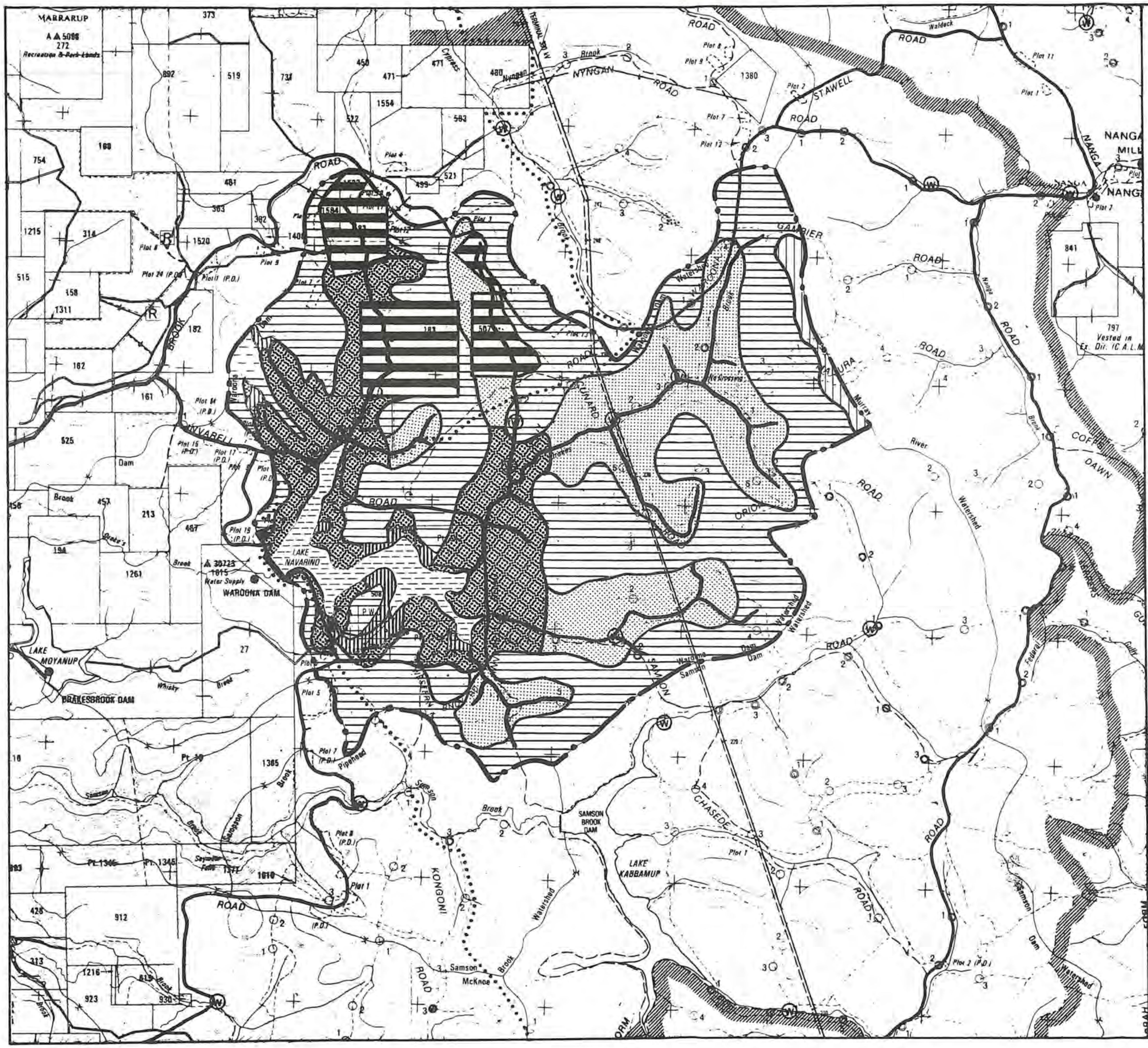
2.3.7 Landscape

The landscape or scenic resources of the Waroona dam catchment are typical of the Darling Plateau. Overall, there are three principal landscape types which summarize the scenic value and appeal of the area:

i. Reservoir and foreshore - The expanse of open water with fringing forest is the main attraction. Waroona dam has two flooded valleys with several minor embayments where 'feeder' streams enter. The fringing forest is a relatively healthy example of the Murray complex, with dense stands of jarrah in some areas. There are still some large cleared areas on the southern side, formerly utilized for pastoral purposes, which provide open space variation. However, the appeal of these areas diminishes in summer, when the pasture dies.

ii. Open forest - The jarrah-marri association and undulating topography.

iii. Wetlands - There are numerous streams in the catchment which have quite different vegetation associations.



LEGEND

- MURRAY COMPLEX
- YARRAGIL COMPLEX
- DWELLINGUP COMPLEX
- COOKE COMPLEX
- PASTURE
- CLEARED LAND
- CATCHMENT BOUNDARY

VEGETATION - WAROONA

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Waroona, Logue Brook
Catchment Management Plans

SCALE 1 : 50000

MAP 5

1000m 0m 1km 2km 3km

2.4 Characteristics of Recreational Use

2.4.1 Recreational Demand

The System 6 Tourism and Recreational Sub-committee Report (DCE, 1979) predicted a trebling of demand for outdoor recreation in the System 6 area by the year 2000. Given that recreation will generally focus on sites near, or adjacent to a water body, it is reasonable to assume that the recreational capacity of Waroona Dam will eventually be fully utilized. The Western Australian Water Resources Council predicted a similar trend of increasing demand for water based recreation (WAWRC, 1985).

This is supported by a recent assessment of demand trends for the nearby Murray River valley and Lane Poole Reserve, which gave a strong indication that there has been a significant increase in recreational use since the mid-1970's (CALM, 1986, a).

Other factors, such as the area's proximity to Perth and Bunbury, its ready accessibility and recreational attractions and facilities combine to support heavy usage. Local anecdotal evidence collected during the study suggests that the available facilities and recreational opportunities are already used to capacity (and beyond) at certain times of the year.

2.4.2 Water-based Activities

There is no doubt that the reservoir is the focal point of recreational activity at Waroona Dam. Direct contact activities such as water-skiing, canoeing, sailing, windsurfing, swimming, marroning and fishing are popular. Whilst the majority of these activities are pursued throughout the year, there is a definite peak season during the warmer months of the year.

Waroona Dam is a popular water-skiing location. The configuration of the reservoir (i.e. two flooded valleys) is such that at most times an area of water can generally be located which is relatively sheltered from wind disturbance. Although there are restrictions on

the areas where water-skiing may occur, there are no time restrictions on this activity. The only activities which may be restricted to particular months of the year are marroning and fishing. The closed season is set by the Fisheries Department and may vary from year to year. In 1987/88 there was no open season, but in previous years it has been from December 15 to May 1.

The edge of the reservoir is popular for a host of other activities. These do not involve direct contact with water, but stem from the attractive 'natural' forest environment and the enhancement of this by the aesthetic features of the reservoir.

Picnicking and sightseeing are pursued by most visitors to the area. Trail bike riding is commonplace, particularly around the exposed reservoir banks.

'Wild camping' (ie. vehicle-based camping in non-designated areas) also occurs in the catchment but is discouraged by the Shire, particularly near to the reservoir. Campers are directed to the on-site caravan park and camping ground.

It is obvious from the incompatible nature of some of the activities described above and the pressure of numbers during peak periods that conflicts will arise between different interest groups. Resolution of these conflicts is addressed in this management plan.

2.4.3 Land-based Activities

Whilst the majority of recreational use is concentrated on the reservoir and forest foreshore, there are a variety of activities conducted in the upper catchment which also require consideration. The majority are represented by the following list:

- sightseeing (usually vehicle-based)
- driving off-road vehicles
- horse-riding
- bushwalking
- picnicking
- camping.

In addition, there may be occasional illegal hunting of feral pigs and kangaroos.

2.5 Land Use (Other than Recreation)

The priority land uses for the catchment are water and wood production, which are recognised as highly compatible activities following the development of effective management prescriptions by CALM. The following section briefly describes these activities. Conservation and agriculture are also discussed, followed by a summary of other more minor land uses.

2.5.1 Water Production and Irrigation Use

The Waroona reservoir has a capacity of 15 million cubic metres when full. On average, about 50% of this volume is released for irrigation purposes on the nearby coastal plain during the summer season. The water storage is replenished each winter when rainfall on the catchment generates runoff. For average conditions, this is estimated to total about 11 million cubic metres.

The economic livelihood of a large number of farmers in the Waroona Irrigation District depends on a reliable supply of good quality water from this reservoir. The current water allocation (i.e. maximum volume allowed each season) is 14,000 m3 per rated hectare. An average of about 7 waterings are generally applied during the main irrigation period, (October to April). This water is predominantly utilized to support summer pasture for beef production and dairying. Land is also irrigated to produce fodder crops, vegetables and fruit.

2.5.2 Wood Production

The catchment has been cut over to supply jarrah sawlogs to local timber mills. The forest in the catchment is now in various stages of regrowth. There is likely to be irregular, small-scale logging within the catchment. These operations will involve removal of 'wasting resources', i.e. areas of forest that have succumbed to dieback disease. Major logging operations are unlikely to be programmed within the next 25 to 30 years. Logs may also be harvested to provide

charcoal for a proposed silicon industry. This proposal has been subject to an Environmental Review and Management Plan as well as other specific investigations.

2.5.3 Conservation

The System Six Study did not identify any specific areas of the catchment that should be set aside as a conservation reserve. However, many of the streamzones are considered to have high conservation value with respect to maintenance of water quality. It is fortunate that these have generally been protected by catchment management practices. In addition, CALM have developed an overall strategy for conservation, environmental protection and recreation which will be applied to this catchment (CALM, 1987, e).

2.5.4 Agriculture

Within the boundaries of the Waroona Dam catchment several private land holdings exist which are developed for agricultural purposes. Reference is made to Map 2 which shows their location. Not all of the lots have been cleared of native vegetation.

These agricultural land holdings have been in occupation and operation over the past 14 years. Farming practice has generally been development of pasture for beef cattle and more recently for dairying on dryland pastures. Typically, each dairying operation runs approximately 30 head of dairy cattle.

Superphosphate is applied to pasture areas at the traditional rate of about 200 kg per hectare (1 bag per acre). Approximately 30 tonnes per annum is applied over the 150 ha of pasture.

One of the land holdings within the catchment is used for market gardening, utilizing moist soils adjacent to drainage lines. A small dam is used for flood irrigation and pesticides and fertilizers are routinely applied. In addition to market gardening, beef cattle are produced for local abattoirs. As these land holdings are within a proclaimed Irrigation District, the Water Authority has considerable control over existing and future developments due to the need for the

occupier to obtain approval for any water diverted for private use.

Within farming allotments and areas of the catchment adjacent to agricultural land holdings, nutrients and animal faeces may enter the drainage lines and feeder streams to the reservoir. Research by Loch et. al. (1981) indicates that nitrogen concentration in these drainage waters are likely to be significant, whereas excess phosphorous will be taken up by the soil and concentrations are expected to be low.

Some effluent runoff is produced by washing down of animal sheds but would probably be largely absorbed by soil and vegetation. Bacteriological infection could result if animals were to directly defecate into feeder streams.

2.5.5 Other Land Uses

i. Power Transmission

A high voltage SEC transmission line passes through the catchment to the west of the reservoir. The easement is maintained in a cleared condition to avoid interference with the towers and transmission lines.

ii. Gravel Extraction

Gravel has been extracted from an area located along the eastern bank of the northern reservoir arm. The location of this pit and resultant operations is responsible for some minor erosion taking place along roadways and nearby banks. The pit detracts somewhat from the visual qualities of the foreshore environment; however, the uneven and varying depth of the gravel pit is an attraction for trail bike riders.

3.0 ROLE OF MANAGEMENT AUTHORITIES

One of the prerequisites in formulating a catchment management programme is to review the existing management activities so that any

inadequacies may be addressed.

This is done in the following section by describing the present activities of the five state government and local government authorities with management responsibility in the catchment (i.e. CALM, Water Authority, Shire of Waroona, Department of Marine and Harbours and Department of Fisheries).

3.1 CALM

3.1.1 Management Structure and Purpose

CALM are responsible for management of State forest, which comprises the majority of the Waroona Dam catchment (refer Map 2). There is a Regional and District management heirarchy in the CALM organisation.

The Waroona Dam catchment mostly falls within the Northern Forest Region's Dwellingup District, with a small portion at the southern end being the responsibility of the Central Forest Region's Harvey District.

There are regional management plans for both forest regions, which recognize and outline management strategies for the following purposes for State forest:

- Production of water and wood
- Protection of water catchments
- Wildlife conservation
- Recreation
- Public utilities
- Mineral production where appropriate.

The supporting papers to the regional management plans contain a comprehensive description of objectives and strategies which are utilized by CALM in management of land for these purposes (CALM, 1987, c). The reader is referred to this document for further detail.

3.1.2 Management Activities

Essentially, management of State forest in the catchment involves:

. Protection from disease
. Protection from fire
. Wood production
. Provision and maintenance of recreational facilities.

The activities are appropriately modified considerating the comprehensive catchment protection requirements and conservation.

i. Disease: A proportion of the catchment contains forest infected by dieback disease. Management involves identifying the areas which are disease-free and restricting vehicular access to these areas.

ii. Fire: Prescribed burning is conducted for the purpose of fuel reduction. The aim is to maintain fuel (forest litter) levels below about eight tonnes per hectare to enable control of wildfires. In practice, this results in areas being burnt about every six to seven years.

iii. Wood: Previous harvesting of sawlogs in the catchment means that widespread logging is not likely to occur for perhaps 20-30 years. (Some small pockets of dieback affected forest may be logged sooner). As finance becomes available, some silvicultural treatments may be carried out to enhance the growth of harvestable trees.

iv. Recreation: In the past, CALM have provided management advice and assistance in relation to clearing of forest and development of picnic sites around the reservoir. They control land clearing in the caravan park through the lease arrangement. Day-to-day management of public use is limited. There is a specific allocation of funds in the annual works programme of the District Office to manage recreational activity. However, this is a limited budget and is largely consumed by works outside the catchment.

3.2 The Water Authority

3.2.1 Management Structure and Purpose

Execution of the Water Authority's statutory management responsibilities at the Waroona Reservoir is achieved under the directions of the Regional Operations Engineer, based in Bunbury.

The District Officer, under the direction of the Regional Operations Engineer, has responsibility to provide the annual irrigation water allocations to the Waroona Irrigation District by management of the water resource and infrastructure at the reservoir.

3.2.2 Management Activity

Management of the infrastructure at Waroona Dam is conducted from the Waroona Depot under the direction of the District Officer. Work programmes include the following tasks:

i. Release of irrigation waters as required;

ii. Maintenance of the water release mechanism and spillway;

iii. Stream gauging, collection of water samples and recording of meteorological data;

iv. Provision of the small water supply to the caravan park and recreation site below the dam wall;

v. Maintenance of the toilet facilities and barbecue sites, and

vi. Collection of rubbish from approximately 30 bins located at picnic sites around the reservoir.

3.3 Shire of Waroona

3.3.1 Management Responsibility

The Shire's broad local government responsibilities essentially

require administration of the Health Act and maintenance grading of roads servicing the dam. The Shire also accepts some responsibility for maintenance of picnic sites around the dam.

In addition to the above, Council has specific responsibility for the caravan park through two leases:

. land on which the caravan park stands is leased from CALM and expires in August 1992;

. the caravan park buildings are leased from the Water Authority and application for renewal of the lease (which expired on July 31st, 1987) is pending the recommendations of this management plan.

Although Council sub-leases the caravan park to a commercial operator, they have contributed to upgrading of the effluent disposal system in the past.

The caravan park is currently registered for 40 bays, which is significantly below requirements during peak season.

Council is keen to expand the capacity of the caravan park and to provide a range of accommodation types at the site.

3.3.2 Management of Recreation Use

Council employs a part-time Ranger who has devoted approximately one-third of his time to patrolling the catchment in each of the past four years. Apart from information dissemination to the public, the Ranger primarily seeks to control off-road vehicle use (mainly trail bikes) and illegal camping. Under the Health Act, camping within 14 km of the caravan park other than on Crown land is prohibited.

3.4 Fisheries Department

3.4.1 Management Responsibility

The Fisheries Department are responsible for the management of fishing in all inland waters. Waroona Dam has been a popular location

for trout since it was first stocked in the mid-1960's. The Research Branch maintains the trout fishery by an annual stocking programme from the Pemberton Fish Hatchery. The status of fish stocks is monitored occasionally by netting. Members of the W.A. Trout and Freshwater Angling Association currently assist the Department in relation to trout stocking practice (Fink, pers comm).

3.4.2 Fisheries Management

Management of the fishery is carried out by enforcing legal controls over all fishing activities. Patrols are conducted by Mandurah and Bunbury regional staff as well as by a mobile patrol unit dedicated to patrolling inland waters of the South West portion of the State. The main inspection effort is conducted upon marron fishing activity, with checks on other activities conducted on an opportunistic basis.

In the case of Waroona Dam, the majority of controls enforced are specifically related to the catch (see the Department of Fisheries pamphlet: Recreational Fishing - A Guide to the Rules).

i. Marron Fishing -

- A recreational fishing licence is required.
- A closed season prohibiting marron fishing is set by the Fisheries Department and must be observed.
- Minimum legal size, bag limit and the means of capture must be observed.

ii. Trout and Perch -

- A Recreational Fishing Licence is not required.
- There is a closed fishing season from 1 May to 31 August.
- Minimum legal size, bag limit and the means of capture must be observed.

Waroona Dam has been a very popular fishing place for trout and marron. Member's records from the W.A. Trout and Freshwater Angling Association show that during the 70's more than half the trout caught in the South West were from Waroona. This situation has now changed with the appearance of redfin perch.

3.5 Department of Marine and Harbours

3.5.1 Management Responsibility

The Department of Marine and Harbours undertakes administration of boating activity on the reservoir in accordance with the Marine and Harbours Act (1981).

The Department's responsibility for management of boating activity includes licensing and zoning surface areas of water which are suitable for specific water-based activities. There are zones established for boating, water-skiing and also gazetted speed restriction areas on the reservoir.

The Department does not have power to designate areas which are suitable for swimming. In areas where swimming occurs, boating may be prohibited based on safety requirements.

3.5.2 Management Activity

The Department patrols boating operations and activities at the reservoir. Patrol officers/inspectors are deployed from the Mandurah Office. Patrols occur during peak periods or during weekends at intervals of once or twice per month. Inspections during other times of the year are conducted when other duties allow. Inspections do not follow a set pattern.

The Department has the power to issue infringement notices for non-compliance with zoning and speed regulations. It also has the discretionary power to close down areas to boating activity if the condition of the area is considered a hazard to recreational safety.

4.0 EVALUATION OF RECREATION AND ENVIRONMENTAL COMPATIBILITY

Before management decisions are made, it is important to evaluate the acceptability of the present recreational uses within the catchment. This approach recognizes that direct contact recreation has been allowed on the reservoir since construction some 21 years ago. Therefore, this section gives a brief overview of the principal environmental issues, assesses the impact of recreation on water quality, identifies the environmentally sensitive areas in the catchment and discusses recreational carrying capacity.

4.1 Principal Environmental Issues

4.1.1 Reservoir Water Quality

Based on the limited water quality data available, the water currently appears to be suitable for potable supply with treatment by chlorination alone. As economically viable fresh water sources in W.A. are limited, there is considerable value in maintaining water quality within potable standards.

The primary purpose of the reservoir is to supply irrigation water to farmers on the coastal plain. Water quality requirements for irrigation use are not as stringent as requirements for drinking water and, for this reason, public access to the water body has been allowed since the dam was constructed. It is perhaps an indication of the resilience of the catchment and reservoir that water quality still appears to be of a potable standard.

The caravan park currently draws its water requirements from the reservoir without treatment.

4.1.2 Catchment Protection

Protection of the catchment is an important issue because it is the source of water to the reservoir. The water that enters the reservoir is of good quality indicating that dieback disease in the catchment has not impaired it, and that past logging practice was satisfactory. The acceptability of existing and proposed recreation activity needs

to be assessed within the constraints of the ability of the catchment to supply water of consistent quality in the long term.

4.1.3 Public Health

At present, the public health issue is not of major significance because the reservoir water is predominantly used for irrigation. However, the caravan park currently draws its water from the reservoir without treatment and there is a small water supply to recreational facilities below the dam wall. In addition, the health risks associated with direct-contact recreation need to be considered. The relatively small size of the reservoir coupled with the fact that recreational use peaks in summer when water levels are lowest, indicates that there may be some health risk to users of the water body. This aspect is discussed further in the Section on bacteriological water quality (4.2.2).

4.2 Impact of Recreational Use on Water Quality

It is generally recognized that the recreational activities conducted both in the Waroona Dam catchment and on the reservoir may, in combination with other land uses, impair water quality in relation to five main considerations::

- turbidity
- bacteriological quality
- hydrocarbons and other chemical contaminants
- nutrients
- salinity.

These water quality parameters are evaluated in Sections 4.2.1 to 4.2.5, within the following framework of review:

i. Review of existing data base
ii. Discussion of current knowledge (based on research results, experience elsewhere, on-site observations)
iii. Key conclusion.

The ability of the reservoir to recover from a 'contamination' episode is discussed in terms of its flushing rate (i.e. the degree of water replacement each year) and implications for management of water quality are presented.

4.2.1 Turbidity

Turbidity or 'cloudiness' in the water arises from suspended clay particles and organic material. Turbidity may result from soil erosion in the catchment or disturbance to reservoir sediments and banks from activities such as water-skiing, etc.

i. Review of Data Base: In 1979, the method of measuring turbidity at the reservoir was standardized to record data as Nephelometric Turbidity Units (NTU's). Since that time, turbidity values have been generally less than 5.0 NTU and typically, less than 2.0 NTU. These low values demonstrate good water clarity. Although the data has not been statistically tested, there appears to have been a slight reduction in turbidity (i.e. improvement in water clarity) since 1980. Further interpretation of the data is difficult given that the frequency of measurements has diminished in recent years.

ii. Discussion: Turbidity is only an issue if the reservoir water is to be used for domestic supply. Particulate matter in the water causes turbidity and interacts with the chlorination process. This may prevent or cause difficulty in adequately disinfecting the water and may result in sediment accumulation within pipes.

There is no doubt that widespread clearing of vegetation in the catchment will increase erosion and stream sediment loads to the reservoir. However, extensive clearing will not occur and turbidity which arises from the current level of erosion and occasional logging is only a temporary phenomenon.

This study has not had the benefit of direct observation or measurement of the impact of boating activity on reservoir turbidity levels. Again, it can only be assumed from the available data that any artificially induced turbidity is

temporary in extent. Activities which occur on the reservoir slopes, such as boat launching, car and trail bike use and gravel mining may enhance erosion potential and contribute to sediment movement, but the long term impact on turbidity levels appears to be negligible.

iii. Key Conclusion: The present levels of activity do not appear to result in long term turbidity impact which would affect either irrigation or potable use of the water. The possibility that short term (i.e. days or weeks) increases in turbidity could occur requires further investigation.

4.2.2 Bacteriological Quality

The introduction of disease-causing bacteria and viruses to the reservoir may occur as a result of recreational use, agriculture and feral animals. There are two principal transfer mechanisms:

- direct transfer from the human body during water-contact activities such as swimming, water-skiing, fishing and marroning;

- indirect transfer from the foreshore and catchment due to lack of toilet facilities, inadequate sewage disposal and putrescent litter accumulations.

i. Review of Data Base: There is no data available to assess the bacteriological quality of the reservoir.

ii. Discussion: It is generally accepted that the majority of harmful bacteria and viruses introduced directly to the water would die off relatively quickly. A safety margin of 1-2 months is usually applied. If water in the reservoir has a detention time in excess of this period, the risk of infection through potable use is considered slight.

In the case of indirect bacterial contamination from the catchment, the soil plays an important role in purification. Viruses are efficiently removed from wastewater during

transmission through soils. As a general rule, bacterial removal and purification is best in soils with high clay content, such as those in the catchment. For transmission in surface runoff, the combined effects of dilution, sedimentation and bacterial die-off would help to mitigate any health risk.

Whilst the conventional view is that most bacteria and viruses would die off in a few hours or days once they leave their host, recent overseas research indicates that this assumption is not necessarily valid. Research in coastal areas receiving sewerage effluent has demonstrated much longer survival times (up to 17 weeks) for some organisms. A suggestion has been made that some organisms may even enter a comatose state and stay dormant until they are ingested.

iii. Key Conclusion: There is only a remote possibility of health risk to 'downstream' users whilst the water is predominantly utilized for irrigation purposes. However, there may be a health risk to recreational users themselves, particularly during peak season when water levels are low. This could not be confirmed without detailed bacteriological monitoring of the water and possibly supplementary epidemiological investigation of users would be required. Should water from the reservoir be used for domestic supply chlorination, at least, would be used to treat bacteriological contaminants.

4.2.3 Hydrocarbons and other Contaminants

The concern with hydrocarbon pollution arises from motor boat use of the reservoir and vehicles on the reservoir banks. Contamination may occur from unburnt fuels, lubricating oils, lead and phenols. It is common for boat engine exhausts to be directed below the water line.

i. Review of Data Base: No regular monitoring has been conducted with respect to oil and fuel contamination. A 'one-off' study conducted by Murdoch University (Murdoch University, 1985) found no evidence of contamination.

ii. Discussion: Peak boating activity occurs as the water level

declines during summer. There is anecdotal evidence of minor hydrocarbon slicks around ski boats when beached on the reservoir's edge. These would derive from minor fuel spillages and leaks. It is believed that the majority of spillage is lost to the atmosphere by evaporation and the residual material dispersed to insignificant levels by dissolution, sedimentation and emulsification.

iii. Key Conclusion: Occasional minor fuel spillages do not appear to provide the basis for a constraint to motor boat activity on the reservoir as they do not affect irrigation use of the water.

4.2.4 Nutrients

Recreational use may introduce nutrients to the reservoir principally as a result of inadequate disposal of sewage and detergent waste. Additional quantities of nitrogen and phosphorus may stimulate productivity of algae and consequent trapping of nutrients within the reservoir.

i. Review of Data Base: There is insufficient data available on which a statement of the nutrient status of the reservoir could be prepared.

ii. Discussion: Waroona Dam is considered to be about the most productive reservoir fishery in the region. This may be largely due to a higher nutrient content. The sediments were enriched with nutrients because the reservoir basin had been utilized for pasture prior to flooding. In addition, 8% of the catchment is freehold and a significant proportion of this land is cleared for agricultural use. However, there is no evidence that present levels of nutrient input are excessive and no algal blooms have been recorded.

iii. Key Conclusion: Sensible management of sewage disposal in the catchment will minimize the risk of increasing nutrient inputs to the reservoir due to the influx of visitors.

4.2.5 Salinity

Salinity is generally the main issue with respect to irrigation water quality from catchments receiving less than 1,100mm of rainfall per year. However, the catchment is located in a high rainfall area (greater than 1,200mm/yr) which is an important mitigating factor because the potential for salt mobilisation is relatively low.

i. Review of Data Base: The salinity or total soluble salts (TSS) content of the water is determined by routine conductivity measurements. TSS data were examined for the period 1974 to 1986. These data indicate that the water is fresh and, at all times, TSS values have been below the NHMRC's guideline of 1,000mg/1 for drinking water (NHMRC, 1987). Within the 13 year period 1974-1986, TSS levels increased from an initial value of about 110mg/1 to about 150 mg/1 during the interval 1977 to 1981, before returning to 1974 levels. This temporary increase is mainly attributed to a period of below average rainfall, rather than any disturbance to the catchment. Rainfall during the period 1975 to 1979 was only 75% of the long term average, and the consequent lower water inputs and relatively higher evaporation rates would have tended to increase the salinity of the impounded water.

ii. Discussion: There is indisputable evidence that large scale, permanent clearing of the forest will cause increases in stream salinity. This is particularly so for catchments that have a lower rainfall than Waroona Dam. Also, the partial clearing which occurs during logging may cause minor, short term increases in stream salinity. The magnitude of the effect will partly depend on the proportion of the catchment that is logged. At present, approximately 5% of the Waroona catchment is permanently cleared and some areas of dieback affected forest may have equivalent effects to partially cleared land.

Intense recreation pressure in the form of off-road vehicles, and perhaps horse-riding, may result in permanent vegetation loss if allowed to continue for long periods without appropriate

controls. However, it is not anticipated that this would occur to the extent that stream salinities are significantly affected.

iii. Key Conclusions: Not withstanding that the catchment is relatively small, the existing data base indicates that loss of vegetation due to logging, dieback infection and recreation impact has not resulted in sustained stream salinity increases. The high rainfall status of the catchment also tends to mitigate the effect of clearing.

4.2.6 Flushing Rate of Reservoir

In comparison to reservoirs normally utilized for recreation, Waroona Dam is a very small water body and may be seen to have higher risk of water quality impact.

Therefore, it was considered important to define a 'recovery time' for the reservoir in the event that water quality deteriorates as a result of direct-contact recreation. Recovery time is a particularly important factor in recreation and water resource planning if, in the future, it is considered desirable to utilize excess water for urban, domestic use.

The recovery time from water borne pollutants may be directly related to the gross flushing rate of the reservoir (i.e. the length of time it would take to progressively dilute all of the water in the reservoir with fresh water from the catchment). The calculation of flushing time is given in Appendix A. It is estimated that a minimum of 2 years of average rainfall would be required to flush the reservoir. The calculations show that the capacity of the reservoir is relatively small in relation to its catchment yield. This is reflected in the almost annual occurrence of overflow.

4.2.7 Implications for Management

No major changes to existing recreational use are considered necessary to maintain water quality in the reservoir to the standards required for irrigation purposes. Evaluation of the available data

base has identified some areas of uncertainty which need to be addressed before the effect of the recreational activity on the suitability of the water for domestic supply can be determined.

Maintenance of water quality is recognized as the single most important management goal. If the source water to the reservoir is maintained at current quality, then it appears that the existing water-based activities may continue without long-term detriment to water quality.

4.3 Identification of Environmentally Sensitive Areas in the Catchment

Uncontrolled and intense pressure from recreational use has the potential to cause permanent degradation to the catchment. Whilst some impact from recreational use must be accepted, this can be minimized through careful planning and management. The primary aim is to maintain a good vegetation cover.

In practical terms, this means that there would be restrictions on access within three broad zones in the catchment, identified as follows:-

i. stream zone vegetation;
ii. areas which are protectable from dieback infection, and
iii. areas which have steep slopes or soils with high erosion potential.

In addition to these zones, the foreshore vegetation should be given special consideration because of the intensity of use in this zone.

4.3.1 Stream Zone Vegetation

Maintenance of a vegetation buffer within the stream zone is important, amongst other things, in reducing sediment loads to the reservoir. The boundaries of stream zone vegetation are easily identifiable, by both ground survey and by aerial photographic interpretation (see Map 9).

Given the role of the stream reserves in protection of water quality, it follows that the sensitivity to disturbance increases within close proximity to the reservoir. This relatively simple zoning exercise is recommended for the management plan.

CALM's specification for logging operations in forest adjoining water courses defines the minimum width of stream reserves, within which logging may not occur. The width of stream reserves vary with the type of stream and the distance from a water reservoir. A stream reserve is usually defined by the extent of the stream zone vegetation. In addition, for all second and third order water courses within 3 km of a reservoir, the stream reserve must have a minimum width of 100m on each side of the water course, and a minimum of 50m for other streams. Outside the 3 km zone the minimum widths must be 50m and 25m respectively. These specifications should be applied in planning for active recreational facilities.

4.3.2 Areas Protectable from Dieback

It is CALM policy that areas of forest which are not presently infected with dieback should, wherever possible, be kept free of the disease. Consequently, the areas of the catchment which are free of dieback and considered protectable from the disease are classified as environmentally sensitive in this management plan.

There is no recent detailed mapping of dieback occurrence in the catchment, although it is known to be widespread. Map 6 illustrates the best available knowledge of dieback occurrence. This has been compiled from broadscale mapping conducted in 1976, supplemented by a recent field survey which delineated areas considered to be protectable.

As a first step in protecting these areas, access tracks should be considered for closure. Other protection measures should be introduced where appropriate.

4.3.3 Areas Susceptible to Erosion

The degree of soil erosion is a function of many factors, including:

. soil type and natural erodibility
. vegetation cover
. slope
. disturbance, intensity of use
. intensity of rainfall.

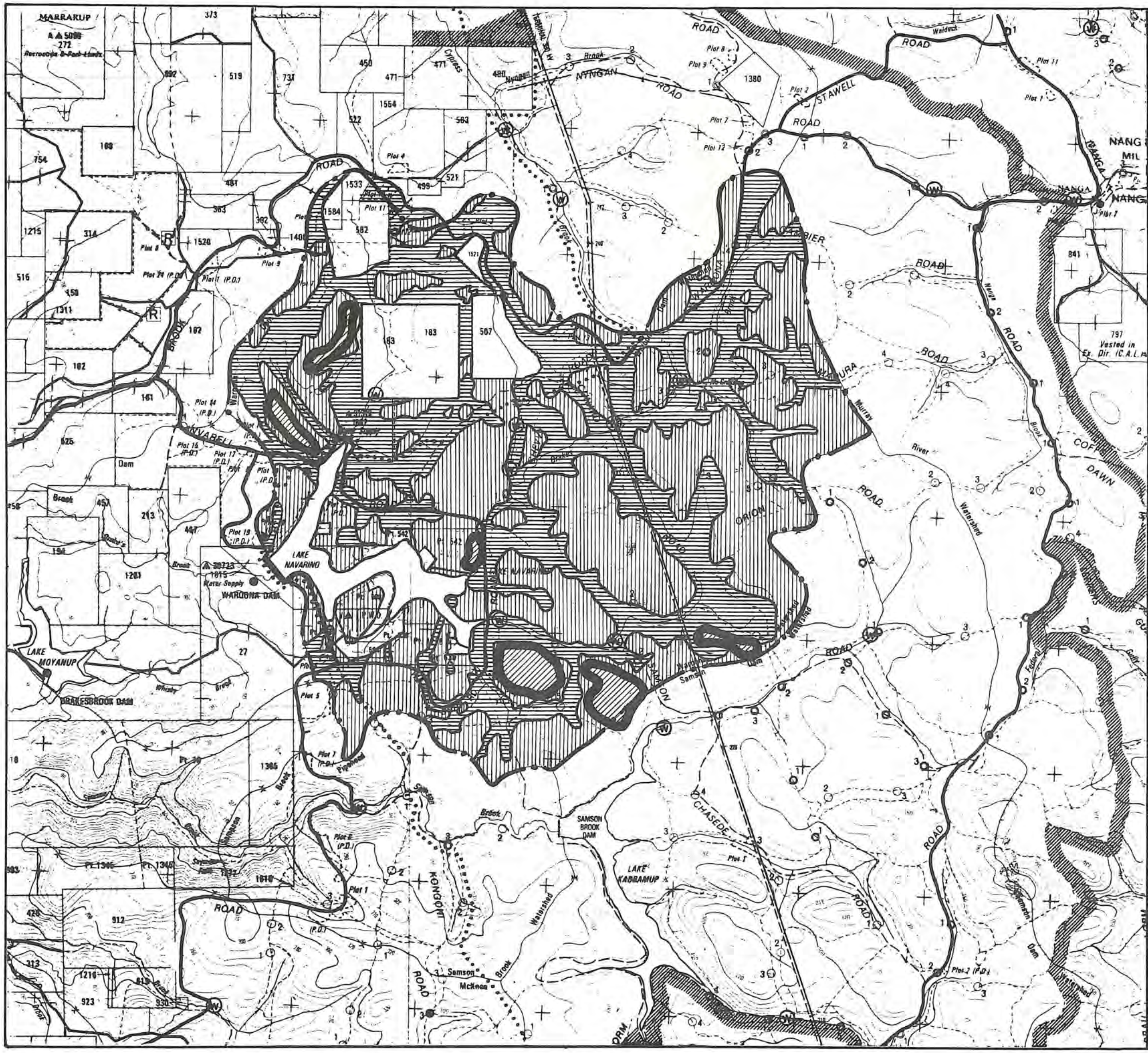
One of the most important factors is the soil type. However, a detailed soil survey was beyond the scope of this study, so it has not been possible to identify the areas of high erosion risk based on this parameter. The landform mapping conducted for this investigation could be used with future survey work to provide better information.

Inspection of the catchment did not reveal widespread or large scale erosion. Minor erosion is apparent at numerous locations around the reservoir and on the banks below the high water mark. (Only a small portion of the banks could be inspected during the study because of the rising water levels).

Review of the water quality data base indicates that present levels of erosion are not causing elevated turbidity levels in the reservoir. The degree of sedimentation (i.e. infilling of the basin) that has occurred is considered to be very slight at current levels of erosion and sediment loading to the reservoir.

4.3.4 Foreshore Zone

The foreshore zone, i.e. the area of forest close to the water's edge, is classified as a sensitive area due to the intensity of human use which it receives. Whilst this area is not severely degraded, expansion of the present prime sites and formation of additional sites and access tracks is bound to occur in the absence of proper controls. As a general principle, the number of sites and degree of access should be minimized to prevent deterioration in the amenity of the area and to protect the long term integrity of this vegetation unit. This unit is important as a buffer against water quality degradation.



LEGEND

DIEBACK PRESENCE CONFIRMED, 1976

NO KNOWN INFECTIONS, 1976 (FIELD CHECKS REQUIRED)

1987 SURVEY - PROTECTABLE AREAS WILL BE DEFINED WITHIN THESE ZONES.

DIEBACK WAROONA

BOWMAN BISHAW AND ASSOCIATES
in association with
LANDSCAPE ARCHITECTURAL SERVICES
Unit 4/3 Lawrence Street West Perth Ph 324 1697

Waroona, Logue Brook Catchment Management Plans

SCALE 1 : 50000

MAP 6

1000m 0m 1km 2km 3km

4.3.5 Implications for Management

The overview of environmentally sensitive areas in the previous sections may be used to guide the management of recreational use. Wherever possible, stream zones and areas protectable from dieback infection should be managed by keeping these areas closed to all forms of active recreation. Closing of selected access tracks is considered the primary means by which this can be achieved.

4.4 Assessment of Carrying Capacity

Prior to assessing carrying capacity, it is necessary to distinguish between the inherent 'carrying capacity' of the reservoir and the 'design capacity' of facilities and procedures which assist the utilization of resources.

Whilst the reservoir's 'carrying capacity' for some activities is clearly very high, the 'design capacity' of the support facilities do not always adequately cater for use at full 'carrying capacity'. This is particularly evident at peak periods.

Temporary but unsightly litter accumulations, overcrowding at the caravan park, overloading of wastewater disposal facilities and overflow of camping to non-designated areas are symptomatic of usage exceeding design capacity.

In contrast, available facilities cater well for non-peak periods. It is also clear that both the carrying capacity and design capacity of the resources for particular activities are inter-dependent. For example, carrying capacity of the reservoir for passive recreation will be influenced, if not directly determined by, management policy for power boat activity.

In the discussion which follows, whenever existing recreational facilities are mentioned, the location may be seen on Map 7.

4.4.1 Water Ski and Power Boat Activity

Discussion with rangers and local enthusiasts indicate the reservoir

has a maximum capacity to accommodate approximately twenty to thirty boats in the water at one time. This number is often reached during peak periods in summer.

There are two principal launching areas which can physically accommodate a large number of boats. Congestion on the water is apparently the limiting factor. This is exacerbated as summer progresses due to the large drop in water level following releases for irrigation.

4.4.2 Unpowered Water Craft

In exclusive operation, the reservoir would accommodate a very large number of sailing craft and canoes, probably in the order of several hundred.

The carrying capacity for unpowered craft is obviously very high, however the design capacity, as influenced by management policy, may be much lower and inversely proportional to power boat use.

4.4.3 Overnight Accommodation

i. Camping and Caravans

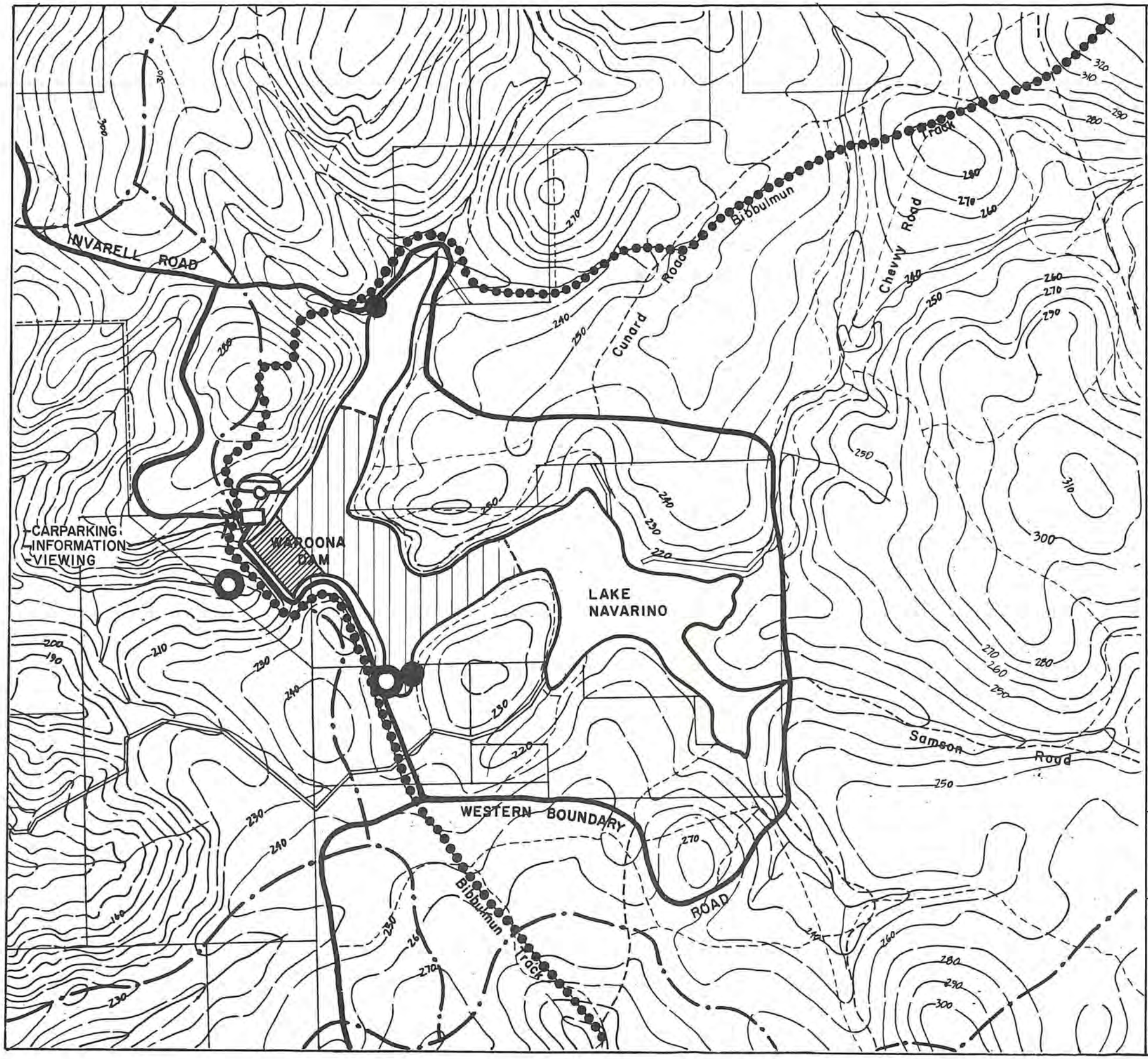
The existing caravan park is the only place where camping is officially permitted within the catchment. The park has 40 registered bays for caravans and tent camping.

ii. "Wild-camping"

The forested catchment has an inherent carrying capacity for 'wild camping' which is difficult to quantify. As wild camping is not officially permitted, by definition the catchment has no design capacity for this activity.

4.4.4 Picnic and Barbecue Activity

There are only two picnic/barbecue sites around the perimeter of the dam which are designated by provision of facilities. These could



LEGEND

- BOAT LAUNCHING AREA
- PICNIC AREA
- RESTRICTED AREA
- CARPARK
- CARAVAN PARK
- WALKING TRACK — MAJOR / MINOR
- GAZETTED WATER SKIING AREA

EXISTING RECREATION FACILITIES WAROONA

BOWMAN BISHAW AND ASSOCIATES
in association with
LANDSCAPE ARCHITECTURAL SERVICES
Unit 4/3 Lawrence Street West Perth Ph 324 1697

Waroona, Logue Brook Catchment Management Plans

SCALE 1 : 20000

MAP 7

500 300 0m 500 1000

accommodate approximately 100-150 visitors at one time, depending on the sizes of the individual groups.

However, picnic and barbecue activity is commonly pursued at the water's edge, particularly when marroning and fishing is conducted. This means while cleared land adjacent to the reservoir and the exposed banks provide enormous carrying capacity, litter and broken glass in makeshift campfires creates aesthetic and safety problems.

It is clear that the design capacity of support facilities does not adequately cater for demand.

4.4.5 Ablution Facilities

Outside the caravan park, toilet facilities and a water supply have only been installed below the dam wall. There has been a clear indication from user groups and interested parties contacted during the study that the present toilet facilities around the reservoir are totally inadequate.

4.4.6 Off-road Vehicle Activities

The necessity of maintaining a good vegetation cover throughout the catchment to prevent erosion and preserve water quality imposes a limited capacity for off-road activity whether by motor vehicle, or on horseback.

It is simply not possible at this time to define the number or frequency of off-road activities the catchment could sustain without impairment of water quality and without causing significant sedimentation in the dam.

Therefore, it is believed that off-road activity should be minimized wherever possible, expecially in stream zone areas and within the foreshore vegetation zone. Carrying capacity for off-road (and off-track) activity should be viewed as minimal for management purposes.

4.4.7 Bushwalking

Whilst the catchment area has a very high apparent capacity for bushwalking, the possibility that intensive use may have undesirable effects on water quality and vegetation cover needs consideration and should be monitored by future managers. Bushwalking on established trails could be conducted at intensive levels of use and should be encouraged in relation to large or regular organized events.

4.4.8 Fishing

Virtually the whole of the reservoir provides physical opportunities for fishing activity. On the other hand, the sustainable yield of the trout and redfin fishery, in relation to previous fishing effort and stocking practice, has not been clearly identified.

Opportunity for enjoyable fishing is clearly impaired by day-time power boat activity. Trout fishing enthusiasts now favour weekday excursions, when quiet waters are more likely to be available.

Therefore, whilst the physical carrying capacity of the reservoir for fishing is clearly very high, for much of the time the design capacity is partly determined by concurrent power boat activity and at peak periods would be comparatively small.

4.4.9 Marroning

Like fishing, marroning opportunities are plentiful but may be impaired by temporary turbidity imparted by boat wash. However, from a management perspective the capacity of the reservoir to sustain marroning is more closely related to the availability of litter collection facilities. Unsightly litter and discarded animal flesh baits are common at peak marroning season. This reflects both the inadequacy of facilities and the unfortunate habits of some enthusiasts, rather than the capacity of the fishery or of the reservoir banks to accommodate this activity. Physical capacity is obviously very high and could readily accommodate at least several hundred marroners. The sustainable yield of the fishery may be the principal constraint.

SECTION B: MANAGEMENT OBJECTIVES

5.1 The CALM Act

Under the CALM Act, State forest is to be managed to ensure the multiple use and sustained yield of the forest resource for the satisfaction of long term social and economic needs.

The management objectives for this catchment reflect the priority use determined by CALM's northern forest region management plan. For the Waroona Dam catchment area these are for production of water and wood.

5.2 Water Production

Provision of a reliable, good quality water supply to the Waroona Irrigation District is a primary objective of the reservoir and catchment. In determining the water quality standards which should be maintained, it is recommended that the reservoir is managed to provide water to potable standards.

This objective recognizes the following factors:

- it appears that the water is currently suitable for domestic use with simple chlorination as the only treatment required, however monitoring is required to confirm this;

- there is often an excess of water produced during the winter, non-irrigation months which is not presently utilized;

- planning for Perth's long term water requirements identifies utilization of this excess water as a possible cost-effective supplement to the Metropolitan supply scheme.

5.3 Wood Production

Production of wood is another primary objective of the catchment. The majority of the catchment consists of jarrah-marri open forest which is in various stages of regeneration. Management of the forest

includes the use of silvicultural techniques where appropriate, to maximize the production of harvestable sawlogs and other forest products.

Provided that existing management techniques such as stream zone protection are maintained, wood production is considered compatible with the water production objective.

5.4 Recreation

The recreation objective must recognize the primary land uses within the catchment and be consistent with the previously described objectives. To this end, both CALM and the Water Authority have formulated guidelines to assist planning and management of recreational use.

CALM management guidelines may be briefly reiterated as "Provide and allow for the widest range of recreational opportunities consistent with:

- the purpose and vesting for the land;
- the ability of the natural system to sustain the activity without impairment;
- the ability of the Department to supervise the activity where land values may be 'impaired' (CALM, 1987, c).

In addition, the Water Authority guidelines in relation to tourism and recreation are to:

- ensure that developments are designed to minimize the risks of soil erosion, stream turbidity and bacteriological pollution;
- keep the affected area to the minimum size necessary to achieve the desired recreational goal and ensure that disturbed ground is stabilized;

- direct development away from the vicinity of the dam outlet works;

- prevent continuously disturbing activities such as trail bikes and off road vehicles, (Water Authority, 1987).

The overall thrust of these guidelines is that recreational use is endorsed but that the types of activities and level of use should not conflict with the primary land uses. Practical recreational management objectives within the catchment are a blend of the above guidelines.

SECTION C IDENTIFICATION OF ISSUES AND DISCUSSION OF OPTIONS

6.0 SUMMARY OF RECREATION ISSUES AND STRATEGIES

A summary of recreational issues is given below prior to presentation of alternative recreational management strategies. Recreational issues have been considered from two perspectives:

- characterisation of the reservoir and catchment in terms of different recreational settings followed by a broad assessment of the compatibility of all recreational activities with each particular setting;

- identification of conflicts between different activities and user groups.

The issues identified from the latter perspective are discussed when the alternative management strategies for each activity are presented in sections 6.3 and 6.4.

6.1 Recreational Settings

To assist in the evaluation of recreational issues, a brief description of recreational settings within the catchment is provided. These arise from the landscape assessment presented in Map 8.

6.1.1 Water-based Recreational Settings

Four distinct zones of water-based recreational settings have been identified (Map 8).

i. Open Water: The expansive open stretches of water in the reservoir are the focal point for all land within the viewshed. From the open water, views of other recreational settings are plainly visible.

ii. Foreshores and Fingers: This setting includes the shallow water margins (particularly in the 'fingers' at the entry point of

PLEASANT VIEWS OVER RURAL SETTING

STREAM FLATS-POSSIBLE INTERPRETATION AREA

INVARELL ROAD

CARAVAN PARK IN RUNDOWN CONDITION.

DAM INTERPRETATION AREA POORLY MAINTAINED. ACCESS TO PICNIC AREA POOR.

PLEASANT PICNIC AREA

CLEARED LAND

SECLUDED OPEN WATER - PLEASANT FOREST BACKDROP

SECLUDED OPEN WATER

AROONA DAM

LAKE NAVARINO

VIEWS FROM DAM WALL

CLEARED LAND

STREAM FLATS IN NEED OF REHABILITATION AND REVEGETATION

WESTERN BOUNDARY ROAD

VISUALLY PROMINENT CLEARED LAND POSSIBLE SITE FOR REVEGETATION, DEVELOPMENT ETC. SUCH AS PASSIVE RECREATIONAL FACILITIES - CAMPING, TRAILS.

Bibbulmun Track

Canary Road

Canary Road

LEGEND

LAND BASED RECREATIONAL SETTING

TRACKS

WATER VIEW SHED

FOREST

WATER BASED RECREATIONAL SETTING

OPEN WATER

SHALLOWS & FORESHORES

DAM AREA

FEEDER STREAM

MAJOR LOOKOUTS, VIEWS

LANDSCAPE ASSESSMENT & RECREATIONAL SETTINGS WAROONA

BOWMAN BISHAW AND ASSOCIATES
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Unit 4/3 Lawrence Street West Perth Ph 324 1697

Waroona, Logue Brook
Catchment Management Plans

SCALE 1 : 20000

MAP 8

500 300 0m 500 1000

feeder streams), the exposed banks and a narrow band of foreshore supporting a fringe of Murray Complex vegetation. The interface of water and land is the most popular recreational setting.

iii. Dam Wall Area: The dam structure and impounded water is an impressive sight and a feature for the initial arrival experience. There are long views of the water body with a forest backdrop to the east, whilst to the west the outlet stream and the steep valley slopes are the main points of interest.

iv. Feeder Streams: These settings include some of the most interesting and dense vegetation associations. Difficulty of access within the streams results in a low level of use.

6.1.2 Land-based Recreational Settings

The overall forest setting varies with topography and vegetation type. Variation in these factors alter the appeal of the forest. For example, there are lower valley slopes with restricted viewsheds and relatively exposed ridges with occasional long sweeping views. In those areas of forest which do not have a view of the reservoir, the recreational settings and the opportunities provided are essentially no different to forest outside the catchment.

6.2 Compatibility of Recreational Activities and Settings

Table 1 is a compatibility matrix which summarizes the recreational issues in terms of the impact of each activity on the various settings which were identified in the landscape assessment of section 6.1. It is clear that there are both land-based activities and water-based activities which impinge on the setting in which they take place and even on adjoining settings.

The principal issues which arise from development of the matrix are:

i. Land-based activities: off-road driving, off-trail horseriding and hunting all have the potential to affect the inherent qualities of all other settings.

ii. Water-based activities: power boating affects the majority of settings near the reservoir by virtue of its noise and has the greatest impact on the most popular setting within the catchment i.e. foreshores and fingers.

6.3 Water-based Management Strategies

Recreational development strategies for specific water-based activities are presented in this section. Water-skiing, swimming, canoeing/sailing, fishing and marroning are considered to be the main active recreational pursuits.

6.3.1 Water-Skiing

i. Issues

On a reservoir as small as Waroona Dam, it is inevitable that power boat and water-ski activity will somewhat limit opportunity for concurrent passive recreational pursuits as well as other water-based activities such as fishing, canoeing, sailing and swimming.

Availability of space, safety, noise and wave/wash disturbance are key factors.

Turbulence and wave action generated by the launching and operation of power boats clearly have potential to create shore line erosion and turbidity.

The available evidence suggests that whilst turbid conditions may be induced near the shoreline, particularly during peak periods, this is temporary. Apparently, boat wash has not resulted in serious erosional damage to the shoreline.

ii. Alternative Strategies

Three alternative strategies for future management are evident:

. Maintain the status quo.

TABLE 1. COMPATIBILITY OF RECREATION ACTIVITIES WITHIN SETTINGS

SETTINGS / ACTIVITIES	OPEN WATER	FORESHORES & FINGERS	FEEDER STREAMS	DAM WALL AREA	FOREST
LAND-BASED ACTIVITIES					
SIGHT SEEING	✓	✓	✓	✓	✓
OFF-ROAD DRIVING	○	■	■	■	■
OFF-ROAD RIDING	○	■	■	■	■
BUSH WALKING	○	✓	✓̸	✓	✓̸
PICNIC & BBQ	○	✓	■	✓	✓̸
HUNTING	■	■	■	■	■
WATER-BASED ACTIVITIES					
POWER BOATING	✓̸	■	○	■	○
CANOEING	✓̸	✓	■	■	○
SAILING	✓̸	✓	○	■	○
FISHING	✓̸	✓	✓̸	■	○
MARRONING	✓̸	✓	✓̸	■	○
SWIMMING	✓̸	✓	○	✓̸	○

KEY

✓ Compatible

■ Incompatible

○ No Relationship

✓̸ Compatible with Conditions

- Permit skiing to continue but with new restrictions, routine policing and infringement penalties.
- Prohibit all skiing.

Maintenance of the status quo would effectively mean that water-ski activity would be virtually unrestricted, apart from the minor restrictions imposed by the gazetted water-skiing area. Due to the inherently intrusive nature of this activity on other users, maintenance of the status quo will effectively mean that water-skiing is the priority recreational activity on the reservoir.

The second alternative is to allow water-skiing to continue, but with additional constraints to improve the opportunity for concurrent alternate activities. A list of suggested conditions is given below. It is important to note that past experience has demonstrated that restrictions will be of little value unless they are routinely policed.

a) Time Constraints

- Skiing only permitted between sunrise and sunset i.e. no twilight activity.
- Skiing prohibited on nominated weekends (e.g. following the start of the trout season).
- Skiing prohibited for longer periods during the year (but in rotation with the nearby Logue Brook Dam).

b) Spatial Conditions

- Total ban on power boats in the vicinity of stream inflow zones and within a set distance of the shoreline in specific areas, except near launching zones.
- Restriction on the number of boat launching areas.
- Adopt designated take-off and landing areas, remote from boat launching sites.

Prohibition of water-skiing is the third alternative that must be considered. Whilst it is understood that prohibition would receive support from some user groups, it would be a harsh judgement given the lack of alternative inland locations that are suitable and available for this use. The significant demand for inland water-ski areas is demonstrable and well known.

In comparison, whilst the suitability of the reservoir for other activities such as fishing, picnicking, marroning and canoeing may be limited by boating and skiing, there are other reservoirs where these activities can be conducted in the absence of power boat or ski activity.

Further, no firm evidence that power boat activity and skiing is detrimental to water quality has been identified. Therefore, prohibition on the basis of potential for water quality impact would be difficult to justify.

6.3.2 Canoeing and Sailing

i. Issues

Canoeing and sailing are commonly practiced activities on many water supply storages overseas and in the Eastern States. These activities are also frequently allowed on potable supply reservoirs, without apparent adverse effects. Consequently, they are deemed to have high compatibility with this irrigation reservoir.

The reservoir is a relatively sheltered water body and is thus ideally suited to beginners at both canoeing and sailing, and these activities have low compatability with power boat use. Conflicts obviously arise with power boat operators, particularly in regard to safety.

ii. Alternative Strategies

There is an obvious need for some degree of separation between powered and non-powered craft.

At present, the gazetted ski area leaves a reasonable proportion of the reservoir free for other uses.

Enforcement of boat access restrictions may be sufficient to cater for canoeing and sailing. Alternatively, water-skiing could be further restricted to the benefit of non-powered craft. The layout of Waroona Dam in two distinct valleys suggests the option of restricting water-skiing to one flooded valley and allowing only canoeing and sailing on the other.

6.3.3 Swimming

i. Issues

The attraction of such a large body of fresh water for swimming is undeniable and swimming is compatible with water quality requirements for irrigation. Although there are potential conflicts in terms of safety and public health which arise from:

. interaction between swimmers and power boats;
. bacteriological contamination affecting both swimmers and water-skiiers.

To date, there have been no recorded accidents involving power boats and swimmers, nor is there any information on which to assess the health risk.

ii. Alternative Strategies

There are three strategies that are available to manage swimming. These are:

1. Prohibit swimming: This option would be difficult to justify on water quality grounds unless widespread and prolonged bacterial infection was detected and the reservoir was required for potable water.

   A prohibition on swimming would also involve the prohibition of water-skiing.

2. Maintain the status quo: this option allows for swimming to occur entirely at the individual's discretion, anywhere on the reservoir.

3. Tolerate without encouragement: swimming may be conducted in relative safety outside of the gazetted ski areas. Place "swim at own risk" signs in these areas. Also discourage swimming in water-ski zones.

6.3.4 Fishing

i. Issues

Fishing is considered compatible with the water quality objectives. The principal conflict arises from other users of the reservoir, particularly the disruption by power boats in preferred fishing areas.

It is noted that there are about seven other dams within a 50 km radius which have been stocked with trout.

ii. Alternative Strategies

Apart from a total ban on power boats and water-skiing, there is limited scope to resolve the disruption to fishing enthusiasts. Active enforcement of gazetted ski areas is required. Some adjustment of these areas may help to provide a reasonable compromise. There is also the possibility of nominating selected periods during the year for priority fishing, i.e. temporary bans on water-skiing. However, enforcement of this proposal would be cumbersome.

Intensive management of the fishery may be required if trout stocks are seriously reduced. The present status of the fishery is not clearly defined. If a consistently high fishing effort were to cause a decline in the fishery then the management alternatives would be to institute a longer closed season or to prohibit boat fishing and fly fishing at night.

The trout management problem at Waroona Dam has been exacerbated by the appearance of redfin perch and the fishery has become largely overrun by this more competitive species. Perhaps management of the trout fishery is no longer an efficient utilization of funds or effort.

6.3.5 Marroning

i. Issues

Marroning is a popular pastime and is generally considered to be compatible with the irrigation water quality objective. Conflicts which have been identified include:

- occasional anti-social behaviour of some groups, sometimes late at night, creates a disturbance to other users.

- the creation of temporary stone fireplaces which are later inundated as water level rises, represents a hazard to skiers and swimmers.

- rotting animal carcasses and other organic material used as baits are often left in the shallows. These are unsightly and possibly result in bacteriological contamination.

ii. Alternative Strategies

- Prohibition: A total ban on marroning would be difficult to justify.

- Create marron fishing zones: This option could be introduced if the effects of marroners on other recreationalists becomes a significant issue. The aim of specific zones would be to ensure that water-ski areas are free of makeshift fireplaces and that passive recreational areas are free of unsightly animal flesh baits.

- Additional controls and policing: Allow marroning to occur without areal restrictions but actively discourage the use of

animal flesh baits and makeshift fireplaces. More litter collection activity and/or enforcement of litter removal would be required.

6.4 Land-based Management Strategies

6.4.1 Overnight Accommodation

i. Issues

Camping is one of the principal issues which this management plan needs to address. The Waroona Dam caravan park is the only area where camping is allowed, but this has inadequate capacity and consequently, there is a demand for suitable 'spillover' locations. Wild camping is a common occurrence.

Present policy of the management organisations with respect to camping is summarised as follows:-

- The Water Authority does not permit camping within any water supply catchments, with the exception of the Waroona and Logue Brook Dam's caravan parks;

- The Shire of Waroona must abide by the Health Act which stipulates that camping within a 14km radius of a caravan park is not allowed;

- CALM's recreational policy for State forest allows for vehicle-based camping at designated sites, whilst back pack camping is almost totally unrestricted. (There are no designated sites within the catchment other than at the caravan park, which is on land leased from CALM).

'Wild camping' throughout the catchment is generally considered to be incompatible with water quality objectives because of the uncertainty that toilet waste and potentially putrescent litter will be given adequate disposal.

In addition, the constant collection of firewood involves trampling and disturbance to the forest adjacent to camp sites, which may result in permanent degradation to the more intensely utilized areas such as the reservoir foreshore.

It is considered that suitable camping areas could be nominated to allow partial deregulation of camping, consistent with water quality objectives, if the areas are provided with appropriate toilets, such as the sealed vault systems, and with a firewood supply. There is also substantial scope to provide more facilities and accommodation capacity at the existing caravan park site. Sewage disposal from this site is not an issue in relation to water quality in the reservoir because the leach drain system is located outside of the catchment.

ii. Alternative Strategies

- Relocation of the caravan park outside of the catchment was considered early in the study, but could not be justified on the basis of perceived water quality impact for the reason mentioned above.

- Retain the caravan park as is and continue regular policing of the catchment to send illegal campers elsewhere (e.g. Hoffmans Mill).

- Develop a 'spillover' camping site below the dam wall to avoid water quality conflicts. However, there is only limited space available in this area.

- Upgrade the caravan park to provide more capacity and a range of accommodation types, particularly isolated camping areas in natural settings to attract people who would otherwise avoid caravan parks.

- Develop camping sites within the catchment in accordance with CALM recreational policy. Integrate these sites with the caravan park to prevent conflict with commercial interests.

6.4.2 Barbecue and Picnic Activity

i. Issues

Barbecuing and picnicking activities are compatible with catchment protection, provided the activities are conducted in settings designed to cope with its effects. The demand for this activity routinely exceeds the design capacity of the existing facilities.

Lack of toilet facilities is the main issue of concern. Promiscuous defecation will create health and water contamination risk. Other conflicts relate to the conservation of foreshore vegetation and general litter problems. The need for well designed facilities is especially apparent during summer, when the bushfire risk is a major problem.

ii. Alternative Strategy

Provide adequate facilities at barbecue and picnic sites to allow sustained use, such as:

- suitably designed toilet facilities
- constant supply of firewood or coin operated gas barbecues
- rubbish bins with regular collection, or a centralized bin area.
- provision of signs to encourage users to take their rubbish when they leave.

6.4.3 Scenic Driving

i. Issues

Scenic driving on the existing loop road and established forest tracks has no major undesirable effects. The unsealed road mostly reduces vehicle speed, which is desirable, but has some need for upgrading of drainage. Signs are also inadequate and should be upgraded.

ii. Alternative Strategies

. Improved control of drainage through routine earthworks and maintenance is necessary.

. Upgrading of signs should be conducted in accordance with CALM standard designs.

6.4.4 Off-Road Activity

i. Issues

Off-road activities will inevitably cause some damage to vegetation. Widespread and uncontrolled off-road activity obviously conflicts with forest conservation objectives and may indirectly affect water quality due to increased sediment loads to the reservoir.

The noise produced by trail bikes and associated disturbance to passive recreation areas is a key issue. There is also a safety risk which arises from trail bike activity.

ii. Alternative Strategies

. Prohibit and police all off-road vehicle activities.

. Prohibit vehicles only from off-road activity but discourage horse-riding except on trails. Monitor the condition of frequently used areas.

. Allow off-road activities to continue as per present patterns of use.

6.4.5 Bushwalking

i. Issues

Whilst the impact of bushwalking is generally accepted to be low, there are locations within the catchment where some control and

monitoring is appropriate, such as areas which are now free of dieback, stream zones and feeder stream inlets.

ii. Alternative Strategies

- Encourage the use of marked trails to reduce the general level of disturbance to vegetation in sensitive areas.

- Discourage bushwalkers from stream zone areas.

Note: The interrelationships between the various recreational activities are summarized in the compatibility matrix given in Table 2.

7.0 OPTIONS FOR IMPROVING ADMINISTRATION

Whilst development of management plans has been the primary concern of this investigation, there has also been a need to examine how the implementation of management activity could be best achieved. It is clear from the descriptions of present management activity that although responsibilities are identifiably assigned to relevent authorities, there is no formal co-ordinating structure which enables adequate 'on-site' management on a day-to-day basis.

Three broad alternative strategies for improving administration were identified and are presented here for consideration:

1. Formalize the existing structure as a consultative committee co-ordinated and chaired by the Water Authority.
2. Allocate administrative responsibility for co-ordination to CALM.
3. Allocate administrative responsibility to the Shire of Waroona.

A fourth consideration is that management responsibilities for specific recreational activities could be delegated to private user groups.

Evaluation of these three options has been conducted largely at the

TABLE 2 COMPATIBILITY OF RECREATIONAL ACTIVITIES

ACTIVITY (GROUP A) \ ACTIVITY (GROUP B)	SIGHTSEEING	OFF-ROAD DRIVING	OFF-ROAD RIDING	HORSE RIDING	BUSH WALKING	PICNIC & BBQ	HUNTING	NATURE STUDY	POWER BOATS	CANOES	SAILING	LAUNCH & RECOVERY	FISHING	MARRONING	SWIMMING
SIGHT SEEING	✓	■	■	■	✓	✓	■	✓	■	✓	✓	✓	✓	✓	✓
OFF-ROAD DRIVING	△	✓	■	■	△	△	■	△	△	△	△	△	△	△	△
OFF-ROAD RIDING	△	■	✓	△	△	△	■	△	△	△	△	△	△	△	△
HORSE RIDING	△	■	■	✓	△	△	■	△	△	△	△	△	△	△	△
BUSH WALKING	✓	■	■	■	✓	✓	■	✓	△	△	△	△	✓	✓	△
PICNIC & BBQ	✓	■	■	■	✓	✓	■	✓	■	△	△	■	✓	✓	✓
HUNTING	■	■	■	■	■	■	✓	■	■	△	△	△	△	△	△
NATURE STUDY	✓	■	■	■	✓	✓	■	✓	■	△	△	△	✓	✓	△
POWER BOATS	✓	△	△	△	△	△	△	△	✓	■	■	✓	■	■	■
CANOES	✓	△	△	△	△	△	△	△	■	✓	✓	■	✓	✓	✓
SAILING	✓	△	△	△	△	△	△	△	■	✓	✓	■	✓	✓	✓
LAUNCH & RECOVER	△	△	△	△	△	△	△	△	✓	✓	✓	✓	■	■	■
FISHING	✓	△	■	△	△	△	△	△	■	✓	✓	■	✓	✓	■
MARRONING	✓	△	■	△	△	△	△	△	■	✓	✓	■	✓	✓	■
SWIMMING	✓	△	△	△	△	△	△	△	■	✓	✓	■	■	✓	✓

KEY

✓ Compatible

■ Incompatible

△ No effect/requires monitoring

The Table is to be read by considering the effect of Group B activities on Group A.

conceptual level and there have been no detailed discussions with any of the organizations involved. However, each option appears sufficiently attractive to warrant consideration. The results of the preliminary appraisal are presented below under the headings; rationale, management structure and methodology and perceived constraints.

7.1 Water Authority Co-ordinates Consultative Committee (Preferred Option)

i. Rationale

It is believed that improvements in communication and co-ordination between the existing management organisations could satisfactorily overcome the majority of deficiencies. There has been some informal co-operation in the past, for example. in the provision of facilities, which has been successful.

With this option, the Water Authority should assume overall responsibility for the co-ordination role. This recognizes that water production is the priority land use in the catchment.

ii. Management Structure and Methodology

A consultative committee comprising members of each management authority is required. This committee would have the responsibility to ensure that preparation of a co-ordinated works programme for recreational management is carried out each year. Joint funding of new facilities and maintenance requirements would be a prerequisite in financial management of the works programme. There would need to be clear identification of responsibility for funding and commitment to conduct the various tasks nominated during the year. The overall aim would be to have consistent management within member authorities on the committee. It is envisaged that this consultative committee would include consideration of the caravan park in its annual works programme.

iii. Perceived Constraints

The consultative committee arrangement is recognized as cumbersome, and it relies on the premise that an agreeable working arrangement can be maintained. At this stage the probability that suitable compromises may be formulated has not been determined.

Each management organisation has different policies and priorities and must work within the charter of its relevant legislation, regulations and by-laws.

Another important constraint is the perceived inability of the present authorities to provide an on-site manager. This is particularly relevant during the early stages of plan implementation, when a constant policing and public education programme will be necessary.

At present, the Shire ranger would be the most frequent recreation manager on site, but he is only part-time and has responsibilities throughout Waroona Shire.

7.2 CALM as Managers

i. Rationale

Nomination of CALM as the principal managers of all recreational activities recognizes that the majority of the catchment is State forest and current CALM policy obligates them to managing the area for multiple use. CALM has the ultimate right of veto on the types of recreational activities which may occur in areas of State forest.

ii. Management Structure and Methodology

As overall recreational managers, CALM would need to extend their responsibility to the reservoir itself, on behalf of the Water Authority. This is not perceived to be a constraint because CALM are already 'de-facto' water managers as a result of their catchment protection prescriptions developed in association with the Water Authority.

Planning and allocation of funds for recreational management would form part of the annual works programme at the District Office. Liaison should be maintained with the Water Authority and Council during this period. Again, joint funding is considered essential to the success of this plan to help overcome the limited resources available.

For on-site management, it is suggested that regular ranger presence could be established in conjunction with the management plan and staffing proposals for the nearby Lane Poole Reserve, whose westerly extension is close to the Waroona catchment.

Given that catchment protection is a major requirement of the management plan, CALM rangers are ideally suited as recreational managers because they have training in environmental management.

iii. Perceived Constraints

The primary constraint is that CALM's total commitments throughout the forest regions, coupled with their present level of resources, indicate that implementation of this proposal could not be given high priority. The requirement for more regular on-site management of day-to-day recreational use would possibly not be easily fulfilled from the District Office.

There is also a perceived difficulty in extending the present duties of CALM rangers to embrace management of such activities as water-skiing on the reservoir. The scope of existing responsibilities of CALM rangers has only recently been resolved, following the initial amalgamation of several State Government agencies to form CALM.

Extension of CALM's responsibility to the reservoir would also involve inclusion of a large tract of foreshore land which is presently owned by the Water Authority. CALM have no jurisdiction over this land and it would probably best be transferred to the CALM estate.

It is also believed that the present boundary between the Northern and Central Forest Regions could usefully be adjusted so that all of

the Waroona Dam catchment lies within the Central Forest Region. This plan could then be implemented in conjunction with the Logue Brook Dam plan, from the same district office at Harvey.

7.3 Shire of Waroona As Managers

i. Rationale

The rationale in nominating the Shire as recreation managers arises from three principal factors:

- The majority of recreation policing work in the catchment in recent years has been conducted by the Shire ranger;

- Waroona Dam represents a significant recreational resource in the Shire's present inventory of recreational attractions; local residents benefit from recreating at the reservoir and commercial interests derive indirect benefit from both regular users and tourists from outside the Shire who are attracted to the area, and

- It is the Shire residents who utilize the reservoir water for irrigation and therefore they should have a direct interest in maintenance of water quality.

ii. Management Structure and Methodology

Both the Water Authority and CALM would maintain the 'right of veto' with respect to activities and overall use of the land and water for which they are responsible. They would have an overall supervisory role and would provide management advice to the Shire on request. Development strategies and annual works programmes would need to be approved by the Water Authority and CALM at Regional Office level.

Policing of recreational activities and maintenance and upgrading of facilities would be provided for within the Shire's annual works programme. Assistance with funding would be required from both CALM and the Water Authority. This is consistent with the recreational policies of these organisations and such collaboration would also

recognize the substantial public use of the catchment from users who reside outside of the Shire's boundaries.

iii. Perceived Constraints

At present, the Shire of Waroona has only a part-time ranger's position which is fulfilled by an employee who also conducts other non-ranger duties in Waroona itself.

Consequently, the ability of the Shire to provide a constant policing presence, particularly during periods of high activity, is presently limited.

Also, the ranger may only operate under the Shire by-laws and powers delegated under the Public Health Act. Control of boating activity, for example, is outside the scope of the ranger's powers. Ideally the ranger should be delegated broad powers from the complete range of applicable legislation and be specifically trained in recreational and environmental management.

7.4 Private User Group Involvement

The two private sector management options which are discussed below are suggested as a means of providing supplementary management presence in the area. This approach appreciates the limited resources and other priorities of the government and local government organisations involved.

It is not intended that the private sector assume responsibility for management requirements other than for specific recreational activities, particularly the control and policing aspects. CALM, the Water Authority and the Shire of Waroona would maintain their presence in the area, provide guidance, as and when required, and monitor the impact of recreational use.

7.4.1 Club Management

i. Rationale

The rationale for delegating management responsibility for specific

activities to a club, such as a water-ski or fishing club, is that this form of control has worked well elsewhere. It is a well established and successful practice in the United Kingdom and has been successfully implemented in the Eastern States, eg. Malpas Dam near Armadale in New South Wales. A relevant local example is the management of water-skiing at Lake Preston by the Bunbury Water-Ski Club.

ii. Management Structure and Methodology

It is envisaged that club management could be progressively introduced as the management plan develops. Management initiatives would commence via CALM, the Water Authority or the Shire in accordance with an overall zoning plan. Once the appropriate changes to existing practice are formalized, and commonly observed by users, responsibility for dominant activities, such as water-skiing, could be progressively transferred to an existing club or new club specifically formed for this purpose.

The club would be responsible for policing of safety and zoning restrictions, garbage removal and maintenance of ablution facilities. Boats which use the reservoir would need to be registered through the club. The club would need to maintain a continual presence at the reservoir.

To carry this concept further, more clubs could be required to manage the other activities which occur. As this may become cumbersome, an Aquatic Council could be established to oversee all water-based activities. This was proposed at Malpas Dam in Northern New South Wales.

iii. Perceived Constraints

It is apparent that club management has been most successful where activities have been progressively introduced to a previously unused water resource. Consequently, there may be some difficulty in introducing a system of club management at Waroona Dam where patterns of use are already firmly entrenched.

In many instances the club has overall control of access to either the whole reservoir or a specific area. The present users may well object to the need to join a club or to having their activity structured through a club. The authority of club officials may be ignored by some users.

7.4.2 Extension of Caravan Park Operator's Role

i. Rationale

The rationale for the operator of the caravan park to assume wider responsibilities for recreation management is primarily related to two factors:

- the operator is in permanent residence at the caravan park and therefore provides a base for a higher frequency of on-site management activity around the entire reservoir;

- the operator has a direct interest in maximizing use of the caravan park and would benefit from patrolling the area to enforce the restrictions on 'wild camping' by directing people to the caravan park.

ii. Management Structure and Methodology

One option in giving the caretaker jurisdiction over the reservoir is to extend the present lease area for the caravan park around the whole reservoir. The area could be extended by defining a zone which encompasses all land within (say) 500m of the high water mark. This should not be interpreted as a recommendation to develop more of the reservoir fringe with accommodation facilities. It is merely a means of extending the operator's responsibilities to assist with management of the area.

At present, land for the caravan park is leased by the Shire from CALM. If the extended caravan park lease option were to be adopted, conditions and requirements could be imposed on the lease, in accordance with the objectives of this management plan.

One of the major benefits of the special purpose lease option is the greater level of control over wild camping, which has been a problem in the past.

The lease could stipulate a prescribed fee structure for camping which is specifically aimed at discouraging camping outside of the central caravan park area or nominated spill-over areas for peak periods, such as below the dam wall. That is, the caretaker could patrol the reservoir fringe area each evening or morning and levy a significantly elevated fee on groups of campers who are camping outside of designated sites. The elevated fee would represent a fine to discourage ad hoc camping around the reservoir.

iii. Perceived Constraints

The ability of the existing caravan park operation to support a broader management role in the form of additional personnel requires clarification.

Perhaps the major constraint is that management of both the central caravan park and the broader lease area would require more than one person, especially during peak periods.

The final constraint is an important aspect when considering the role of the private sector in management of the area. Unless there is adequate reward to conduct prescribed management duties, there will be no incentive to provide the service.

The renewal of existing leases, establishment of additional conditions, and the consideration of additional future leasing arrangements must be consistent with the management objectives of this plan.

8.0 IDENTIFICATION OF THE PREFERRED DEVELOPMENT OPTION

Sections 6.0 and 7.0 describe the alternative recreational management strategies and administrative structures which have been considered during the study. The various management strategies presented may be

related to one of three broad development alternatives for recreational use. These three alternatives are listed below to enable identification of the preferred option, prior to presenting specific management recommendations in Section D of this plan.

A: Prohibit or severely restrict active recreation on the reservoir surface and banks.

B: Allow for significant development of recreational use and associated facilities on the reservoir and within the catchment.

C: Maintain and cater for the present demand for recreational and environmental use. Provide recreational and environmental management prescriptions that resolve the identified problem areas.

When considered within the context of the designated priority uses which are of water production and wood production, the investigation concluded that alternative C should be the preferred option. The key conclusions which resulted in discarding alternatives A and B are listed below, followed by an outline of some provisos which are inherent to adoption of alternative C.

Alternative A

1. There is a demonstrably higher demand for active recreational activities in the region. This area has a key role in satisfying that demand, particularly in relation to power boat and skiing activity. Apart from Logue Brook Dam and the very small Glen Mervyn Dam, there are no other inland water bodies available for water-skiing in the region.

2. There is little real evidence of irrecoverable environmental or water quality deterioration resulting from recreation on the reservoir or in the catchment. Whilst there is a small amount of revegetation that could be usefully conducted, this work is straightforward.

3. Importantly, the available water quality data indicates that reservoir water routinely complies with recommended standards for both irrigation water and potable use.

Alternative B

1. The recreational resources often reach capacity at peak periods. Further development would inevitably attract higher peak period demand as well as routine day to day use. This would exacerbate user conflict which has already reached problem status and requires careful management and policing.

2. Further development, particularly capital development within the catchment, will reduce the flexibility of future water supply alternatives.

Alternative C (Preferred Option)

1. On the basis of available data the investigation has concluded that the reservoir and catchment environment could sustain the present levels of recreational use provided that:

   i. The existing administrative procedures are co-ordinated and formalized through a permanent Consultative Committee comprising representatives of the current administrative agencies. The Committee should be chaired by the Water Authority, at least for the duration of this Area Plan, as within this time-frame water production will remain the dominant priority use.

   ii. A comprehensive monitoring programme of water quality, and environment and user requirements needs to be commenced as soon as reasonably possible.

   iii. Management prescriptions to resolve problem areas that have been identified, require institution and policing.

   iv. Management prescriptions must be flexible so that

adjustments to patterns and type of use can be made if monitoring results indicate such needs exist.

2. There is also a fall back situation for water quality management that should be noted.

If monitoring shows that active recreation on the reservoir is causing unacceptable water quality deterioration, drastic restriction or prohibition would enable recovery to desirable standards within a short time-frame. This is because the annual water yield from the catchment is high in relation to the volume of the reservoir, enabling rapid dilution and displacement of contaminated water. Maintenance of the ability of the catchment to provide good quality water is implicit in this suggestion. The protection of stream zone and foreshore vegetation in particular, and forest vegetation and soil stability in general, therefore, has paramount importance.

SECTION D - MANAGEMENT RECOMMENDATIONS

9.0 OUTLINE OF MANAGEMENT RECOMMENDATIONS

9.1 Introduction

In this section, the recommendations for each of the activities conducted on the reservoir or within the catchment are presented. Each recommendation is preceded by a short statement of the objective of management and the rationale. In the final plan, following any amendments due to public submissions, the recommendations will become management prescriptions.

Effective management of the resource will depend to a large extent on how effectively people are managed. The most appropriate means of establishing an integrated management plan is through zoning. A zoning plan has been prepared which should form the basis for future management (Map 9). This zoning plan provides an overview of the detailed management recommendations which follow. For example, the land adjacent to the reservoir is intensively used for recreation and has been identified as a restricted land zone. This implies that some activities may be restricted in specific areas, as management must take into account such factors as the high levels of recreational use, the capacity of existing facilities and the ability of an area to sustain particular uses.

9.2 Recreation

It is important to recognize that the development of management recommendations for recreation has been constrained by two principal factors:-

1. Budget limitations and scheduling of the investigation for completion during the winter months restricted the opportunities for the study team to directly observe recreational activity. This is particularly the case for peak use periods which normally occur during summer and at Easter.

PROHIBITED WATER ZONE

OTHER RESERVE

SEEN AREA BOUNDARY

LEGEND

- RESTRICTED WATER ZONE
- OPEN WATER ZONE
- PROTECTABLE AREA
- RESTRICTED LAND ZONE
- FOREST PRODUCTION ZONE
- SEEN AREA ZONE - (WATER VIEW SHED-MAP 8)
- WATER CATCHMENT BOUNDARY
- PRIVATE LAND HOLDING ZONE
- STREAM VEGETATION ZONE

ZONING WAROONA

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Waroona, Logue Brook Catchment Management Plans

SCALE 1:50000

MAP 9

1000m 0m 1km 2km 3km

2. The available water quality data base for assessment of recreational impacts was limited.

Much of the background data, on which management recommendations are based, has necessarily been pieced together from anecdotal evidence obtained from discussions with recreational users and local administrators. A public work shop held at Waroona during the course of the investigation also provided useful information (Appendix C).

It is therefore recommended that management should be sufficiently flexible so that modifications to permitted recreational practice can be implemented if future monitoring indicates that such needs exist.

Recommendations for the major recreational issues are listed below in approximate priority order. A conceptual strategy plan for recreational development is presented on Map 10, and this is referred to in the following sections where appropriate.

9.2.1 Power Boats and Water Skiing

Objective: To ensure that power boat and water ski activity is carried out in a safe manner with due regard to other users of the dam.

Rationale: There is both significant demand and limited resources for inland water-skiing in this region.

Whilst popular passive recreational pursuits are often incompatible with water-skiing, there are a number of alternative venues in the locality where these activities can be pursued in isolation.

Further, there is no evidence to indicate that power boats and skiers have caused deterioration of water quality beyond the limits of its designated use.

Investigation indicates that the intensity of power boat use and skiing is largely self-controlling, as capacity is usually evident to users.

Recommendations: Water-ski and power boat activity at Waroona Dam should be permitted with the following conditions and changes to current practice.

- The presently gazetted water-ski area will remain as is, however policing needs to be regularly conducted.

- Power boat speed outside the gazetted area will be limited to 8 knots.

- Skiing and boat operation at speeds greater than 8 knots will only be permitted between sunrise and sunset, for safety reasons. This will also improve opportunities for night fishing and marroning.

- Policing will initially be conducted by a ranger but, if possible, future responsibility for enforcement of regulations should rest with a water-ski club.

- Launching and recovery of boats will only be conducted at the sites shown on Map 10. Public education and appropriate instruction signs will be necessary to assist adaptation to this procedure.

- Launching areas will be kept free of picnic/barbecue facilities and activities, to limit congestion and reduce risk to complementary swimming activity in the nearby waters. These activities should be conducted away from boat launching areas.

- Appropriate toilet facilities and adequate litter bins will be provided at each designated launching site, as funds become available.

9.2.2 Camping and Caravans

Objectives: To provide serviced caravan sites at suitable locations. To allow for camping areas at suitable locations.

Ski Picnic Area

Ski boat launching site

Passive Water Recreation

Active water recreation area

Fishing

Passive Water Recreation

Upgraded Caravan Park

Arrival Area Information

Fishing Canoeing

WAROONA DAM

LAKE NAVARINO

Upgraded Picnic Area

Prohibited Area

Ski boat launching area

Ski picnic area

WESTERN BOUNDARY

Minor boat launching site

ROAD

Proposed Deregulated Camping Area

Track

Bibbulmun

Road

Cundar

Chevy

Road

Samson

Road

LEGEND

- PROPOSED PASSIVE RECREATION ZONE.
- SCENIC ROAD
- MAJOR ROAD ACCESS
- WALK TRAILS
- TRAILER PARKING
- BOAT LAUNCH & RECOVERY
- BOAT SPEED RESTRICTION AREA
- OPEN WATER - SKI AREA

CONCEPTUAL STRATEGY PLAN - WAROONA

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Waroona, Logue Brook
Catchment Management Plans

SCALE 1 : 20000

MAP 10

500 300 0m 500 1000

Rationale: It is apparent that for part of the year there are adequate facilities at the Waroona caravan park; however, at peak periods facilities are inadequate. There is clear demand for caravan sites and camping areas, both serviced and within natural settings with minimal facilities.

It is believed that significant demand for serviced sites derives from boat owners and that provision of additional facilities may encourage higher peak period boat and ski activity. As peak period boat activity already reaches the apparent reservoir capacity, it is believed that large-scale development of serviced sites at the present Waroona caravan park should not occur.

In contrast, whilst there is obviously significant demand for camping sites within the forest environment, 'wild-camping' is not permitted under the Health Act.

Recommendations:

- Large-scale development of serviced accommodation within the Waroona caravan park will not be permitted. However, there is a requirement for additional facilities and some expansion will be allowed up to a limit of sixty serviced bays.

- Wild camping will not be permitted; however, a 'deregulated' camping area within a remote natural setting will be developed within the catchment to cater for about twenty camp sites. A suggested site is shown on Map 10.

- This facility will be developed in consultation with CALM and the Water Authority and it is preferable that the site is periodically relocated. Development of facilities such as toilets and litter bins will be conducted in accordance with CALM recreation policy.

9.2.3 Effluent Disposal

Objective: To ensure that there is no opportunity for direct entry of sewage to the reservoir.

Rationale: A well-designed leach drain system could likely operate properly at most times with satisfactory attenuation of contaminants within the clay sub-soils. However, there will always be a risk that peak period use will overload the infiltration capacity of the system with consequent potential for direct entry of sewage to the reservoir.

Recommendations:

- Septic waste will be disposed to properly designed leach drains with adequate capacity to deal with peak period usage.

- Appropriately designed toilet facilities will be installed at each designated barbecue site, deregulated camping area and boat launching sites, and will be serviced and maintained as required.

9.2.4 Parking and Vehicle Access at the Reservoir's Edge

Objectives: To provide parking that allows views of the reservoir but does not spoil those views or cause erosion.

To provide only essential access to the water's edge so that disturbance is minimised, erosion does not occur, and the scenery is not degraded.

Rationale: Management must balance an obvious demand for the seeking of isolated sites and for parking and recreating near the waters edge, with problems that arise. Factors which support a continuation of the present use include:

a) With the exception of feeder stream inlet areas, the clay/gravel soils that form the reservoir banks are mostly stable and firm. The banks appear to be resilient to a high level of pedestrian and low speed vehicle access, as no erosional problems of major proportions are evident.

b) There is no available evidence that indicates vehicle access on

the reservoir banks has permanent or significant undesirable effect on water quality.

c) Utilization of the banks will tend to reduce activity within the vulnerable forest foreshore zone.

In contrast, unruly vehicle activity poses a clear safety risk for pedestrian access to the water's edge and may result in some erosion and temporary turbidity. Continued, unrestricted access has potential to result in the development of more tracks through the forest foreshore zone and consequent undesirable vegetation disturbance.

Recommendations:

- The use of exposed bank areas for vehicle circumnavigation and scenic and pleasure driving will be discouraged.

- Movement between foreshore sites around the reservoir will only be allowed via the ring road.

- Parking on the water's edge near access track outlets will be allowed to continue so that further development of parking areas within the forest foreshore area can be minimized.

- Strict vehicle speed control will be introduced for bank areas.

- Unlicensed vehicle activity will continue to be prohibited.

- The existing access tracks will be rationalized so that only those with suitable slope, angle of approach and access to popular locations are retained.

- Unnecessary tracks and those exhibiting any significant erosion or excessive loss of adjacent vegetation will be closed off and revegetated.

- At many locations, the ring road and access tracks require storm water drains and silt traps to be constructed and properly maintained.

- Public education will be conducted to assist user adaptation to the new procedures, particularly in relation to use of the banks for vehicle transit between sites.

- Consideration will be given to the establishment of parking facilities outside the forest foreshore zone, near launching sites and picnic/barbecue facilities for trailer parking at times of high water level and during periods of peak demand.

- Any new parking areas will be chosen in consultation with CALM, and will have a minimum level of development.

9.2.5 Picnic and Barbecue Sites

Objective: To provide adequate picnic and barbecue facilities while ensuring minimal impact on catchment values.

Rationale: Picnic and barbecue events are a popular activity, particularly during summer and in association with 'day trip' excursions to the reservoir and catchment. Facilities are presently inadequate.

Recommendations:

- Firewood will be provided at existing designated sites to protect the foreshore zone from extensive wood removal. Alternatively, gas barbecues may be introduced.

- More barbecue facilities will be provided at a number of strategic sites around the reservoir.

- Parking areas will be separated from the immediate vicinity of barbecue facilities and pedestrians given easy and well marked access from the ring road.

- Each designated area will be provided with an appropriate toilet.

- Refuse collection procedures will be co-ordinated and formalized and removal will be conducted as often as necessary to prevent excessive accumulation, particularly during peak periods.

- Makeshift fireplaces constructed on the banks of the reservoir during low water level will be removed at the end of each summer, before the water level rises. In the event that funds to conduct this work are unavailable, construction of fires on the reservoir shores will be prohibited.

9.2.6 Off-road Activity (Including vehicles and horses)

Objective: To protect the biological, physical and scenic environment of the catchment by directing potential off-road activity to nominated roads and tracks.

Rationale: Whilst the catchment will have some capacity for sustaining off-road activity, it is not possible to predict with any certainty what this may be. As the priority use of the catchment is for water production, it is important that risk to vegetation coverage is minimized. Therefore, the capacity of the catchment for off-road vehicles of any type should be regarded as minimal.

Recommendations:

- All vehicle activity outside gazetted roads and existing forestry tracks will be prohibited.

- Horse riding will be restricted to forestry tracks and existing roadways.

9.2.7 Bushwalking

Objective: To provide opportunity for bushwalking consistent with catchment protection objectives.

Rationale: Bushwalking is generally agreed to have minimal unacceptable impact. However, there are some sensitive zones within the catchment where control measures may be required.

Recommendations:

- Bushwalking will continue to be permitted throughout the catchment.

- Where appropriate, scenic walks will be marked out in the vicinity of picnic and barbecue areas to enhance the recreational facilities.

9.2.8 Non-Powered Water Craft

Objective: To ensure that non powered water craft activity is carried out in a safe manner with due regard to other users of the dam.

Rationale: For most of the year non-powered water craft, such as sail boats and canoes, could successfully share the water body with skiers and power boats. Protection from boat wash and collision risk would usually be possible outside the gazetted skiing area. At peak periods, capacity for all craft will be limited by space and, therefore, largely self-regulating.

Recommendation:

- Non-powered water craft should be permitted in all areas of the reservoir, except near the dam wall and outlet tower. Launching and recovery of trailable craft should occur at designated sites.

9.2.9 Swimming

Objective: To allow swimming in designated areas as long as there is no unacceptable degradation of water quality.

Rationale: Swimming has obvious popularity and should be permitted if possible in non water-ski areas, except near the dam wall. However, the lack of bacteriological water quality data, in relation to health risk, limits proper definition of management requirements.

Recommendations:

- Intensive monitoring of bacteriological water quality at popular swimming areas needs to be conducted over the duration of a summer peak period week and over at least one year at monthly intervals.

- Swimming will be permitted in presently designated areas at least until the results of monitoring are available.

9.3 Information

Objectives: To provide an information program that incorporates public use, interpretation, resource protection and visitor safety.

Rationale: The protection of resource values and enhancement of the public's care and enjoyment of an area can only occur when both the user and the manager are aware of each other's objectives and needs. When this occurs, resource degradation is reduced, visitor satisfaction is increased, visitor safety is improved and management costs are reduced.

There are four categories of information that are important for visitors to the catchment:

1. Public use - descriptive information that provides visitors with an outline of recreational opportunities. This information can also help those planning a visit to the catchment.

2. Interpretation - information that assists visitors to understand the catchment area and the processes influencing it.

3. Resource Protection - information that describes the major resource features of the area and the management guidelines that have been adopted to protect them.

4. Visitor Safety - information that advises visitors of potential hazards, particularly regarding water-skiing.

Careful consideration must be given to the mechanisms used to distribute this information.

Recommendations:

- Sign requirements will be identified and satisfied.

- Regular liaison with known user groups and relevant commercial interests will be maintained by personal contact and written material.

- This information program will be linked to other regional and departmental programs to ensure that consistent standards are maintained and the area is not promoted beyond its capacity to cope with visitor use.

9.4 Resource Management

Whilst the primary aim of this plan is to develop effective management of recreational use, it also needs to consider management of other land uses in the area, particularly for the priority uses of water and wood production. Management recommendations for both the priority land uses and other minor land uses are outlined below. In addition, recommendations are given for landscape protection in relation to the possible impact that some land uses may have on landscape values.

9.4.1 Water Supply

Objective: To provide a reliable water supply to the Waroona Irrigation District and to prevent adverse long-term deterioration in water quality.

Rationale: For the duration of this ten year plan, water supplied by the reservoir will primarily be used for irrigation purposes. The only other consumptive use will be the continuation of the small scale supply to the caravan park. Therefore, the recommendations detailed in this section only relate to management of the resource for these purposes. However, it should be noted that the overall

emphasis of the management plan is on catchment protection and maintenance of water quality to ensure options for domestic supply in the long term are not precluded. Specific prescriptions relating to the use of the resource for large scale domestic supply will be incorporated into subsequent revisions of this plan, if and when required.

Recommendations:

- Irrigation waters will continue to be supplied to the Waroona irrigation system as required by farmers in accordance with current procedures.

- Water quality monitoring will be upgraded, as outlined in Appendix B, to enable greater understanding of the effect of recreation on water quality.

- The supply of water to the Waroona caravan park will be upgraded to incorporate disinfection.

9.4.2 Forest Management

Objective: To enable a level of hardwood production from the area of State forest that is sustainable indefinitely, consistent with requirements such as protection of water catchment, conservation and provision of recreational opportunity.

Rationale: CALM has a suite of management prescriptions which deal specifically with forest management. Most of these are outlined in the Regional Management Plans (CALM, 1987,a). Existing policies cover areas such as harvesting techniques for forest products, dieback management, fire management, mining control, weed control, stream zone protection, feral animal control, forest track maintenance and rehabilitation. These policies deal adequately with the management issues which could arise within the State forest components of the catchment, and which are relevant to this management plan. Catchment management practices may be reviewed to allow for probable demand for residue timber for charcoal, and the water and wood production

benefits which may be gained from thinning the forest. The catchment does not fall within Alcoa's present 25 year mining plan.

Recommendations:

- CALM forest management prescriptions will be routinely applied within the catchment area.

- Future logging activity will not visually impair recreational activities.

- Any mining activity within the catchment will be conducted according to CALM management prescriptions and closely supervised. Particular attention will be given to minimization of turbid runoff from mine areas.

9.4.3 Landscape Management

Objective: To maintain the visual amenity of the areas of principal recreational activity so that the recreational experience is not adversely affected.

Rationale: Visual quality of the catchment landscape, particularly within the viewsheds available from the reservoir surface, foreshores and scenic drive, is a fundamental component of the recreational resource and, therefore, requires careful management.

Recommendations:

- The visual effects of any works conducted within the 'restricted zone' (marked on Map 9) will be evaluated by CALM prior to implementation.

- Future forest product harvesting from within the restricted zone will utilize methods that have minimal visual effects on the reservoir viewshed.

9.4.4 Firewood

Objective: To ensure that firewood collection activity does not result in permanent or large scale deterioration in vegetation cover.

Rationale: The continuous collection of firewood from the forest foreshore zone will ultimately cause a depletion of dead wood and will be accompanied by persistent trampling of undergrowth and tree seedlings. These effects are not yet serious but will inevitably occur, particularly as the level of use increases.

Recommendations:

- The cost effectiveness of coin-operated gas barbecues will be investigated if provision of regular, adequate wood supply proves difficult.
- If gas barbecues are not successful, then firewood will be routinely provided, particularly during peak periods.

9.4.5 Gravel Extraction

Objective: To minimise the effect of the extraction of gravel on conservation values, landscape values, water quality and rehabilitation potential.

Rationale: Extraction of gravel from the banks of the reservoir is sometimes conducted but is considered to be incompatible with a number of other uses, principally in regard to visual acceptability and bank stability.

Recommendations:

- The extraction of gravel will not be allowed on the banks of the reservoir, or anywhere within the viewshed available from the reservoir surface and foreshore zone.

- Alternative locations for the extraction of gravel will be chosen in consultation with CALM and the Water Authority.

9.4.6 Beekeeping

Objective: To facilitate beekeeping subject to the need to minimise conflict with other land use objectives of the catchment area.

Rationale: Beekeeping has occurred on the catchment area for many decades; however, with increased recreational use, bees may be a potential hazard to visitors.

Recommendations:

- Continue to manage beekeeping as outlined in CALM's regional management plan for the northern forest region (CALM, 1987,a).

9.4.7 Public Utilities

Objective: To limit the development of public utilities to those considered essential by Government and for which there is no reasonable alternative location.

Rationale: Public utilities and landscape recreation values are generally considered compatible.

Recommendations:

- Liaise with and advise service authorities to ensure their operations are in sympathy with the environment and other land uses.

- Continue to manage public utilities as outlined in CALM's regional management plan for the northern forest region (CALM, 1987,a).

9.5 Forest Resource Protection

CALM is responsible for the protection of State forest from such agencies as fire and disease which may have an adverse effect on sustainable timber yield and other land uses.

9.5.1 Fire

Objective: To use fire as a management tool to achieve land management objectives in accordance with land use priorities.

Rationale: CALM has a responsibility to protect community and environmental values from damage, or destruction by wildfire on land it manages.

Recommendation:

- Apply fire management principles consistent with CALM's regional management plan for the northern forest region (CALM, 1987,a), bearing in mind the recreational value of the catchment.

9.5.2 Dieback

Objective: To minimise the damage caused by dieback disease.

Rationale: Although jarrah dieback occurs throughout the catchment there are still several areas that are apparently healthy, dieback free and hence protectable.

Recommendations:

- The apparently healthy, protectable areas in the catchment will be accurately mapped.

- Ensure that activities in the catchment do not spread dieback to these areas.

9.6 Administration

Objective: To develop a workable structure to enable effective administration of this management plan and the successful initiation of management recommendations as funds become available.

Rationale: Since the reservoir was constructed, recreational use of the area has occurred without a management plan. This recreational

activity does not recognize the existing boundaries of responsibility of the various management authorities involved. In addition, there is no formal structure which correctly assigns responsibility for recreational management. Consequently, a number of inadequacies are apparent, particularly in regard to provision of facilities and policing of regulations on a day-to-day basis.

Recommendations:

i. Consultative Committee

. The Water Authority will be responsible for co-ordinating management of recreational activity.

. A consultative committee will be formed with membership drawn from the Water Authority, CALM, Department of Marine and Harbours and the local Shire.

. The consultative committee will convene as directed by the Water Authority and adopt a programme to implement the management plan.

. In addition, the consultative committee will investigate the potential for private involvement (e.g. club management) to supplement management of specific activities.

ii. Finance

. Funding of the annual works programme will be obtained jointly from the four organisations represented on the consultative committee.

. A minimum annual committment will be agreed upon to ensure consistent progress with implementation of the plan.

. There will be a clear definition of priorities for each annual works programme to ensure more efficient utilization of funds.

- As the availability of finance is anticipated to restrict implementation of the plan, the user pays principle will be introduced as a means of raising additional funds for management. Consideration will be given to introducing an entrance fee.

- Equitable design of a fee system will require determination of appropriate levels of discount for specific groups of people such as local Shire rate-payers, long-term users of the caravan park, and adjacent land-holders who are regular users.

iii. Staff

- Site inspections by the local Shire ranger and personnel from the Water Authority Depot and CALM District Office will be co-ordinated whenever possible to maximize the on-site management presence.

- All government and local government personnel who routinely visit the area in the normal course of their duties (e.g. Fisheries and Marine and Harbours inspectors) will be familiarized with the management plan to ensure that advice to recreationalists is consistent.

9.7 Surveys, Research, Monitoring

Objectives: To plan and implement an integrated programme of survey, research and monitoring to provide information that will help manage the catchments and, where appropriate, to involve other organisations and volunteers in the programme.

Rationale: Meeting the survey, research and monitoring needs of this plan will involve the integration of surveys and research in the catchment, involving specialist and regional or district staff. Where appropriate, other government departments and local groups may become involved, although no work in the catchment will be carried out without approval by CALM.

Recommendations:

- An integrated programme of survey, research and monitoring will be designed and commenced during the period of the plan.

- Water quality monitoring has the highest priority and a programme will be conducted in accordance with the outline suggested in Appendix B.

SECTION E: IMPLEMENTATION AND REVIEW

Implementation of this plan should commence immediately the final plan is approved. Priority should be given to the recommendations for recreational management, as long as they remain consistent with the overall management objectives for water supply and wood production.

Three broad phases of work are required to initiate the plan for its first year of operation:

i. Establish the administrative structure, nominate key personnel and schedule initial meetings.

ii. Determine plan priorities and draft an annual works programme in accordance with the available budget.

iii. Nominate responsibility for specific tasks within the consultative committee and establish regular liaison as these are implemented.

The Water Authority have commenced an upgraded water quality monitoring programme. As the water quality data will be a valuable tool for management when the plan is implemented, this action is endorsed.

The proposed duration of this plan is ten years however, the need for revision will be considered after five years.

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APPENDIX A

CALCULATION TO ESTIMATE GROSS FLUSHING RATE

1. Reservoir and Catchment Characteristics

Reservoir capacity (m3)	$14,940 \times 10^3$
Surface area when full (m2)	$1,440 \times 10^3$
Area of catchment (km2) = A	40.2
Pan evaporation (mm/yr)	1,720
Average rainfall (mm/yr) = R	1,250
Average annual percentage runoff	25%

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2. Water Inputs: (m3)

Runoff (A x R x 0.25) - to be conservative only use 85% of rainfall	$10,680 \times 10^3$
Direct rainfall (applied to 80% of maximum surface area)	$1,440 \times 10^3$
TOTAL	$12,120 \times 10^3$

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3. Water Outputs: (m3)

Evaporation (applied to maximum surface area)	$2,480 \times 10^3$
Irrigation releases not considered (see comments below)	

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4. Gross Flushing Rate

The gross flushing rate (in volumes per year) is estimated from the following equation:

(a) Total inputs - evaporation

Volume	(Vols/yr)	0.64

Note that this equation assumes total mixing of the water column.

Evaporation is deducted in the flushing equation because it does not remove contaminants from the water.

Flushing time - inversion of equation (a) (rounded up to next whole year) 2 years

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5. Comments on Mixing Assumption

i. The liklihood of either 100% or no mixing occuring is remote. Therefore, an appropriate safety factor should be applied to the flushing time derived above.

ii. Releases of irrigation water will enhance the flushing rate because it will increase the degree of water replacement each year. The volume of water released for irrigation has been briefly reviewed. For the period 1978/79 to 1985/86, the irrigation water releases may be summarized approximately as follows:

Water Release (as % of total reservoir volume)

Mean	Range
50%	36 - 62%

APPENDIX B

WATER QUALITY MONITORING PROGRAM

A monitoring programme to assess the impact of recreational activities on the water quality of both the reservoir and its feeder streams will be required to validate or allow adjustment of the recreational management prescriptions. Water quality monitoring should include the following work:

i. Turbidity (Water Clarity)

Specially scheduled turbidity measurements are required to supplement the existing data base. Data review shows no long term sustained increases in reservoir turbidity. However, a programme of intensive surveys is required to measure summer peak use and early winter run off to evaluate the significance of identified turbidity inducing processes.

Shoreline turbidity profiles should be determined before and after peak skiing activity. These will enable both the production and settlement of turbidity to be measured and will identify the significance of short term levels.

Monitoring surveys which compare wind induced conditions to power boat effects would also be useful.

Simple jar tests to evaluate the capacity of sediment at the shoreline for erosion and suspension by wave activity, would also be usefully conducted. Slope and sediment characteristics vary along the banks of the reservoir. Simple tests could be employed to identify areas which have potential to give rise to turbidity.

ii. Total Soluble Salts (Salinity)

The current monitoring programme for total soluble salts (TSS) appears to be adequate.

Further monitoring of inflowing streams during periods of low flow could be conducted to determine the proportion of salt loading to the reservoir from groundwater seepage.

iii. Bacteriological Water Quality

Measurement of bacteriological water quality is essential but will be limited by cost and the requirement to generate a large number of readings to be statistically relevant. Although recordings will determine the level of contamination, it will be difficult to pinpoint the source unless comprehensive samples are collected and analysed. Monitoring will need to include the peak periods of human use, such as Easter, long weekends, the start of the marron season and at lowest summer water level.

The bacteriological quality of water near the outlet structure should also be measured, to determine whether peak period use has any identifiable effects.

It will be necessary to correlate bacteriological water quality with rainfall in the catchments to account for variations caused by weather.

iv. Hydrocarbons

Analysis of water quality for hydrocarbons should compare water quality before, during and after peak level boating activity. Water quality at the dam outlet should also be measured.

v. Pesticides

Pesticide residues should be measured in water and sediment.

vi. Nutrients

A twelve month monitoring period for nutrients in stream inflow would generate sufficient data to broadly assess the nutrient status of the reservoir. Analysis should include standard forms of nitrogen and phosphorus.

Streams draining the agricultural area also require nutrient analysis. Sampling should include periods of both high and low flow as well as stream flow resulting from the first winter rains.

APPENDIX C

WAROONA AND LOGUE BROOK

CATCHMENT MANAGEMENT PLANS

SUMMARY OF PUBLIC WORKSHOP

HELD 10 SEPTEMBER, 1987

1. INTRODUCTION

The Steering Committee preparing the Waroona and Logue Brook Reservoirs Catchment Management Plans held a public workshop on September 10, 1987 at the Memorial Hall, Waroona. The aim of the workshop was to identify the major issues, as preceived by the different groups of people using the catchments, to be considered in the preparation of the plans. The participants were also asked to consider and suggest ways to resolve some of the management conflicts arising from their activities in the catchments.

The workshop was attended by 25 people with representation as follows:

GROUP	NO. OF REPRESENTATIVES
Recreation	3
Commercial	2
Local Authorities	8
Government Authorities	9
Members of Parliament	1
Consultants	2
	25

This report outlines the proceedings of the workshop. It does not attempt to make any judgements whatsoever, nor does it imply endorsement of the statements and suggestions noted from the workshop.

2. STRUCTURE OF THE WORKSHOP

The workshop was held in two sessions. In the morning a series of talks were given by representatives of various interest groups and in the afternoon groups were formed to discuss their individual concerns and perceived issues related to management of the catchments.

The afternoon session was divided into two periods. In the first period the workshop participants were invited to nominate the issues that they considered needed to be addressed in the preparation of the plans. The

issues nominated were recorded on a master list by the Chairman. Each person was then asked to select from the master list five issues they considered of most importance. Four groups of pre-determined memberships were then formed and the individual lists of issues collated by the group facilitators. Following discussion to clarify nomenclature and meaning, the issues were ranked using a voting system and five key issues, in order of priority, identified for each group.

In the second session each group was given a specific question relating to one of their five key issues and asked to develop options and strategies for its resolution. These were then summarised.

3. SUMMARY OF TALKS

3.0 Chairman's Introduction. Jim Williamson, Manager, Planning Branch, Department of Conservation and Land Management

Most of the lands in catchment areas of Logue Brook and Waroona Dam are state forest vested in the Lands and Forest Commission and managed by CALM. The water storages and some of the adjacent lands are owned and managed by the Water Authority.

Others with management responsibilities for these areas are the Department of Marine and Harbours, and the Shires of Waroona and Harvey. These five bodies are all represented on the steering committee, chaired by the Water Authority, preparing management plans for the catchments. In view of their joint management of the lands the Water Authority and CALM agreed to prepare joint management plans for the catchments. Because CALM's planning procedure is now well established and includes public participation, it was agreed that it would be appropriate to produce area management plans under the CALM Act, one for Waroona and one for Logue Brook.

This wookshop is part of the public participation process involved in preparing these draft plans. The draft plans will be made available for public comment for two months, then amended in the light of that comment before forwarding to the Minister for Conservation and Land Management.

In today's workshop the morning session will provide facts and a wide range of views on the major issues associated with the project. In the afternoon session you will list the major issues and rank them according to your perception of their relative importance. You will then form groups to work out solutions to some of these issues. The workshop technique is a proven one and as the day unfolds I know we will all benefit greatly from the discussions and interchange of ideas.

3.1 Water Authority of Western Australia - Ian Wood, Environmental Officer

Background

To assist the Water Authority in the management of the State's water resources, Government established the Western Australian Water Resources Council. At the request of the Minister for Recreation the Council has reviewed access policies for recreation on water supply catchments and reserves in Western Australia. The Council concluded that the Authority should plan for increasing levels of activity on its catchments and recommended that detailed management plans be prepared for each catchment. On the advice of the Water Authority's Operations Branches, preparation of management plans for Waroona and Logue Brook catchments has been given a high priority.

In 1985 Murdoch University were commissioned to collect the baseline environmental data necessary for the preparation of the management plans. The report of the study also made a number of recommendations regarding future management of the catchments including:

i) need to provide additional facilities at both reservoirs including low development camping areas;

ii) disturbed and dieback affected areas should be rehabilitated;

iii) need for public education and improved sign posting;

iv) vehicle access to be rationalised;

vi) need for increased ranger presence.

Following completion of the Murdoch study, Bowman Bishaw and Associates (Environmental Consultants) were commissioned to prepare the detailed management plans. The objectives for the management plans are as follows:

i) primary - to maintain the quality and quantity of water obtained from the reservoirs;

ii) secondary - to define management responsibilities for the catchments;
- to enable, where appropriate, existing recreational activities to continue and in some instances increase.

The proposed timetable for preparation of the plans is:

First draft prepared	15/10/87
Two month public review period	19/11/87 - 13/1/88
Plans revised considering public comment	13/1/88 - 29/4/88
Plans approved by Minister for Conservation and Land Management	18/5/87

Future Developments

Although the Waroona and Logue Brook reservoirs currently only supply water for irrigation purposes, it is possible that in the future they may be needed for domestic supply. However, only water in excess of the requirements for irrigation will be used and based on current timing, these sources will not be used for domestic supply within the next 20 years.

The possibility of using the sources for domestic supply changes the emphasis for catchment management because the water quality criteria for domestic water supply is far more stringent than for irrigation waters. Therefore, if water quality deteriorates the water may need to be treated. The cost of treating water is very expensive and the cost increases as quality decreases. The cost of treating water from Waroona and Logue Brook may well make the sources uneconomical and alternative sources (with associated environmental and social costs) may need to be developed.

Furthermore a general principle of water resources management is that the water quality of a catchment should never intentionally be degraded. Such a principle is particularly relevant in Western Australia, one of the driest states in the driest continent.

With respect to recreation on water supply catchments the following five main types of pollutants are of concern to the Water Authority:

i) Turbidity

Turbidity is of greatest concern because it has the potential to reduce the effectiveness of chlorination in removing bacterial contaminants. Degradation or wholesale removal of vegetation cover, the use of off-road vehicles and many other activities which impact on the reservoir banks have the potential to increase turbidity.

ii) Bacteriological Contaminants

Human activity has the potential to spread bacteria and viruses which may cause disease. The risk of contamination is directly related to the amount of human activity on and around the water body. Of particular concern is the disposal of sewage within the catchments.

iii) Nutrients

Increased nutrient concentrations may lead to algal blooms and, consequently, coloured turbid water. The major sources of nutrients are likely to be agricultural activities and sewage disposal.

iv) Miscellaneous Substances

The use of power boats may lead to contamination of the water with petrol, oil or grease which can be tasted at very low levels and are difficult to treat using conventional processes. Herbicides and pesticides may be of concern if used within the catchments because of the toxicity of some of these substances at relatively low levels.

v) Salinity

If the vegetation cover is removed or degraded, possibly by the

spread of dieback, salinities may increase. However, because of the high rainfall over the catchments salinity is unlikely to become a problem.

The Water Authority has no pre-conceived ideas regarding future management of recreation on the catchments. Initial findings of the consultants' work suggests that most activities will be able to continue with appropriate management. The scope for increasing certain activities is also being considered. However, if the reservoirs are required for domestic supply at some time in the future, some activities such as power boating and swimming may need to be discontinued or more tightly controlled.

3.2 Logue Brook Water-Skiing - Jim Houlahan, Harvey Resident

Water-skiing at Logue Brook needs to be better controlled. The formation of a ski club has been initiated in an effort to introduce self regulation of water-skiing on the reservoir. Water-skiers utilising the reservoir have been contacted and have expressed their support.

The development of a club should achieve the following objectives:

i) unite all skiers on the reservoir and establish a contact person for liaison with the managing authorities;

ii) establish methods within the club of dealing with non-compliance with regulations;

iii) establish a plan for peaceful coexistence with other users of the reservoir;

v) install a mobile slalom course and ski jump and to organise competitive events.

The majority of users of Logue Brook Reservoir and the managing authorities will benefit from the proposed ski club. However, to be successful it will require the full co-operation of all concerned.

Discussion

- area of reservoir to be used by skiers
- local people shouldn't have to pay to use the reservoir
- potential safety problems without control
- regulations and policing may get out of hand
- permanent caretaker to collect fees.

3.3 Department of Marine and Harbours - Dane Smith, Marine Inspector

The Department of Marine and Harbours has responsibility for maintaining order and safety on all the State's waterways. To achieve this the Department has the authority to prohibit certain activities in certain areas, set speed limits and gazette areas for specific activities. This has been done at Waroona and Logue Brook by gazetting water ski areas which cover large areas of the reservoirs, the balance of the water area being available for use by canoeists, swimmers, windsurfers, fishermen etc.

Gazetted areas are detailed on signs and marked with buoys. Ensuring compliance, however, is difficult. The Department of Marine and Harbours is responsible for the whole State and resources are limited. The Department has recently increased the number of patrols of the Waroona and Logue Brook catchments and in the last year the catchments were visited 13 times.

The Department is concerned about the blatant disregard for signs and marker buoys shown by a small percentage of water skiers.

Discussion

- need for better demarcation of gazette areas
- water skiing doesn't affect trout
- people utilising the reservoirs should advise the Department if signs or buoys are removed or defaced
- controls on noise emissions should be implemented.

3.4 Waroona Shire - John Whitehouse, Shire President

At the commissioning ceremony for the Waroona Dam in 1966, the then Minister for Works said that he hoped water sports on the dam would flourish and that Local Authority and the Tourist Development Auhtority would co-operate in its further development. These thoughts are still in line with the thoughts of the Waroona Shire Council and the Waroona community today.

The Waroona Shire Council has the following three main concerns about the future of the Waroona Dam.

i) Irrigation Water Supplies

The Council met earlier this year with the Minister for Water Resources, Mr Ernie Bridge, to discuss the future of the dam. The Council tabled a number of submissions from local irrigators expressing concern about any reduction in the availability of irrigation waters and demonstrating the necessity that the dam be retained as a source of irrigation water for the Waroona District. Mr Bridge advised that there were no plans at present to use Waroona Dam for metropolitan water supply.

ii) Recreation

The Waroona Dam is a valuable attraction to visitors to the Waroona District and as a recreation area for members of the Waroona Community. Its main attraction being the variety of activities permitted. The Council views all activities currently permitted as important recreational uses of the area. The Waroona Chamber of Commerce has also advised of the value of tourism from the dam.

iii) Waroona Caravan Park

The Waroona Caravan Park site is leased by Council from the Water Authority. The Council then leases the park to the present proprieters. Council's lease expired on July 31, 987 and an application to the Water Authority for a 5 year extension was not accepted. The lease has however, been extended for a twelve month period pending the recommendations of the management plan.

The Council is aware tht the facilities of the caraven park (the old construction camp) are quite basic and not comparable to modern purpose built parks. This is considered to be a reflection on the short-term lease arrangements rather than the present proprieters.

Council would like the park excised from State Forest and vested under its control so that a long-term lease with development guidelines could be offered. It sees the need to upgrade the tourist facilities at the dam as a high priority. The present park site is considered ideal.

Other aspects which should be considered in the plan include youth camps, boat launching areas, walk trails, sign posting, designating gazetted areas, and ranger services.

Discussion

- caravan park should not be moved
- caravan park could be moved closer to the water body and still dispose of sewage off the catchment
- "wild" camping could be permitted behind the existing caravan park site.

3.5 Harvey Shire - Alan Snow, Shire Ranger

Harvey Shire Ranger is responsible for enforcement of camping regulations, Litter Act, Bushfires Act and the policing of Navigable Waters Regulations on behalf of the Department of Marine and Harbours.

The major problem in carrying out these duties is the fragmentation of law enforcement responsibilities between the managing authorities. There is a need for greater co-operation between the authorities at a grass roots level.

Law enforcement problems tend to arise in the summer months, particularly on long weekends. The area becomes extremely over-crowded and all facilities are stretched beyond their capabilities. The area cannot be adequately patrolled and policed with the existing resources. The ski area is far too crowded and it is only through luck that serious

accidents have been avoided. Motorcycle riding and off-road vehicle driving within the catchment is also a problem.

Greater co-operation between the managing authorities will assist in overcoming these problems. The formation of a ski club such as that situated at Lake Preston will assist in the control of water-skiing on the reservoir.

Discussion

- major problem is lack of camping facilities
- off road vehicles cannot be controlled because legislation only covers coastal strip
- need to upgrade and standardise sign posting.

3.6 Department of Conservation and Land Management - Peter Henderson, District Manager, Harvey

The land areas of the Logue Brook Dam Catchment and the majority of Waroona Dam Catchment are managed by the Department of Conservation and Land Management. The land is managed as State Forest. State Forest is managed in accordance with the Regional Management Plans.

The primary purposes of State Forest are for the Protection of Water Catchments, and Water and Timber Production. The forests are also managed to provide for wildlife conservation and public recreation.

The Logue Brook Dam Catchment is managed by Harvey District, whilst most of Waroona Dam Catchment is currently managed by Dwellingup District.

Management of State Forest involves:

i) Protection from disease
ii) Protection from fire
iii) Timber production
iv) Provision of recreation facilities.

All modified to suit catchment protection requirements and conservation.

i) Disease

A proportion of both catchments contains forest infected by dieback disease. Management involves finding out which areas are free of disease and restricting access by vehicle or machine to these areas.

ii) Fire

Both catchments are within large aircraft prescribed burn cells. These areas are burnt regularly for the purpose of fuel reduction. The aim is to maintain fuel levels below eight tonnes per hectare, which in practice results in the areas being burnt about every five years. This maintains the forest fuels at low enough levels for wildfire to be readily controlled.

iii) Timber Production

Sawlog production in the catchment areas has been completed and logging is not likely to occur for perhaps 20-30 years. Some small pockets of dieback affected forest may be logged sooner. Dead log material may be used in the proposed charcoal/silicon project. As finance becomes available some silvicultural treatments may be carried out to enhance the growth of the forest.

iv) Recreation Facilities

Recreation facilities are currently provided within the catchments by CALM, WAWA and the Shires.

The main issues of concern from CALM's viewpoint are:

i) Management of public use:

- what facilities are required and where?
- who will provide and manage them?
- how do we propose to cater for the large numbers of people attracted to the Dams?

ii) The value of the dams for waterbird use.

iii) Rationalisation of access within the catchments:

- dieback control

iv) Use of trail bikes and off-road vehicles:

- where should they go?
- an area is needed.

Discussion

- off-road vehicles have less impact on reservoir banks than in catchments
- domestic and commercial firewood cutting
- long-term effect of CALM's prescribed burning
- CALM compliance with Health Act
- tracks should be closed.

3.7 The Western Australian Trout and Freshwater Angling Association - Mike Bishaw on behalf of Andrew Fink, Association President

During the 1970's the Waroona Dam was responsible for the boom in trout fishing in Western Australia. The reservoir banks and substrate are very fertile and maintained good populations of marron and trout of above average size. Members record card statistics show that over half the trout caught in Western Australia came from the Waroona Dam during the 1970's. Logue Brook Dam is not as productive as Waroona.

Both reservoirs are regularly stocked with trout by the Fisheries Department. The Association advises the Fisheries Department regarding appropriate stocking levels. The Association is currently working with Fisheries to develop a management plan for trout fishing in Western Australia and suggested stocking plans for Waroona Dam have been acknowledged by CALM.

From the mid 1970's to the present date other recreational persuits on the reservoirs have increased dramatically. Members of the Association are in constant conflict with water skiers and trail bike riders.

Therefore members usually avoid using the dams during the weekends to reduce the risk of being disturbed.

The Association believes that with the exception of telephone and toilet facilities everything else is adequatly catered for at the dams. The

management plans need to consider the impact of various user groups on the environment ie. water quality, bank erosion, wildlife, and immediate forest areas.

Discussion

- fishermen should pay to use the dams
- closed seasons need to be reviewed.

3.8 Forest Edge Recreation Camp - Margaret Hewton

The Forest Edge Camp is situated on Waroona Locality 457 downstream of the Waroona Dam. The major drawcard of the camp is its close proximity to the Waroona Dam. Most groups staying at the camp utilise the dam and catchment for activities ranging from raft building, swimming, water skiing, windsurfing, fishing, horse riding, bush walking, etc.

The camp currently attracts groups averaging 50 people for 300 days of the year. The majority of groups come from schools and activities are generally conducted Monday to Friday. However some conflicts do arise with overcrowding and when water-skiers disregard gazetted areas.

Discussion

- need to completely ban power boats, not only skiing, from some areas
- Waroona dam would benefit from the formation of a ski club
- require greater policing of gazetted areas
- horse riding is popular in catchment
- designate areas for off-road vehicle use.

4. WORKSHOP SESSIONS

A description of the approach to the workshop sessions is given in Section 2. From the first period of discussion and the identification and rating of issues, the following main areas of concern were identified by each of the four groups.

GROUP RANK	A	B	C	D
1	Recreation facilities	Environment/Water quality	Water quality	Water quality
2	Co-operation between authorities	Recreation facilities	Planning/ management	Recreation facilities
3	Water-irrigation/ quality	Co-operation between authorities	Carrying capacity	Carrying capacity
4	Recreation management	Public information	Co-operation between authorities	Administration
5	Public Health requirements	Recreation zoning	Irrigation	Private Land

Three of the four groups rated maintenance of water quality as the primary issue to be addressed in management of the catchments. The upgrading of recreation facilities, particularly camping facilities, were also generally rated highly along with the need to increase co-operation between the managing authorities. A full list of all issues raised by the workshop participatns is given later.

During the second session of the workshop each group was asked to consider a specific question related to one of the major issues they identified. The following summarises the discussion of the questions by each group.

GROUP A

Question: "Are the recreation facilities in these areas adequate for the demand and if not, what changes should be made?"

The group generally agreed that the existing facilities are inadequate. It was suggested that the following changes/developments and associated factors need to be considered:

i) Accommodation
- provide accommodation ranging from "wild" camping to chalet style
- concentrate development in specific areas
- limit access to development sites
- provide public information regarding accommodation facilities
- collection of fees for camping

ii) Information/Signposting
- adoption of consistent standards and style
- information centre for pamphlet distribution

iii) Zoning of areas for water based activities
- power/non-power activities
- zoning by time ie. daily or weekends etc

iv) Water-Skiing
- gazetting of launching zones
- non-launching take off zones

v) Toilets
- strategic location
- user contribution to funding

vi) Walk Trails
- sign/posting
- highlight scenic attractions

vii) Horse Trails
- rotational ie. change route after a number of years of use to enable rehabilitation

viii) Picnic Facilities
- BBQ's - provision of gas or wood fuel

- public toilets
- encourage users to take their rubbish home.

GROUP B

Question: "Should there be a limit to the amount of recreation in the catchments and, if so, at what level and on what basis should limits be set?"

It was considered that if appropriately managed and catered for, recreation need not be limited. However, given that the major attraction of the catchment is the water body and the 'natural' surroundings, the level of activity should be limited to maintain these values.

It was suggested that the amount of activity on the catchments would be limited by the facilities provided. From a planning and management perspective limits should be set on the provision of facilities to ensure maintenance of the "natural" values and water quality. Any additional facilities should be centred in designated areas within and outside the catchments. The access to these areas needs to be limited.

GROUP C

Questions: "Is it reasonable to limit recreational use to maintain water quality and, if so, what sort or restrictions will be required?"

The group agreed that it was reasonable to limit recreational use to maintain water quality. In addressing the second half of the question the following potential problems and possible solutions were identified.

PROBLEMS	SOLUTIONS
Oil pollution	Formation of self controlling boating clubs.
	Monitoring programmes.
Meat baits	Public education.
	Management and policing.
Rubbish and litter	Planning for acceptable activity levels.
	Provision of adequate bins.

PROBLEMS	SOLUTIONS
	Restrict access to particular areas.
	Restrict access at night.
	Reduce wild camping.
	Increase camping facilities.
Dieback	Close tracks to protectable areas.
Sewerage	Dispose of all sewage off the catchments.
	Use of sealed vault toilets.
Erosion	Restrict use of off-road vehicles.
Swimming	No need to limit until water required for domestic supply.

GROUP D

Question: "How can co-operation between the managing authorities best be achieved?"

The group suggested that the following breakdown in management responsibilities would assist in co-ordinating management of the catchments:

a) Primary responsibilities
   i) Water Authority
      - supply of water
      - monitoring of water quality
   ii) CALM
      - timber production
      - protection of water catchments
      - wildlife protection
      - provision of facilities for public recreation.

b) Secondary responsibilities:
   i) Shires
      - provision of facilities for day use eg. boat launching ramps
      - provision of facilities for overnight use eg. Caravan Park
      - recovery of costs from users.

ii) Department of Marine and Harbours

- control of activities on the water bodies.

The spatial extent of each organisation's responsibilities would be as follows:

i) Water Authority - primarily dam wall and associated works.

ii) Marine and Harbours - the water body.

iii) Shires - Caravan Parks and defined areas of intensive activity around the water bodies.

iv) CALM - remainder of catchment.

5. CONCLUSIONS

The workshop provided a forum for a wide range of users and stakeholders in the catchments. The morning session provided the Working Group with a cross-section of the specific concerns of various user and management groups. The afternoon provided an opportunity for all participants to be involved in the expression of their individual concerns and then discuss and rank these in relation to others. All of these individual issues have been recorded and will provide a valuable input into the development of the draft management plans. The discussion of issues which received the highest overall ranking by groups provided an opportunity for participants to take into account the checks and balances which arise in land use and management planning. The strategies which were proposed will receive further consideration in preparation of the plans.

A number of significant issues arose from the workshop. These included general recognition of the need to protect the catchments and maintain water quality. The need for greater co-operation between the managers of the catchments was also highlighted. Other issues included: provision of additional tourist facilities, particularly for camping, increased public information and education, maintenance of irrigation water supplies, and determination of the recreation carrying capacity of the catchments.

The workshop produced a great deal of information and the ideas obtained will provide valuable input to the preparation of the management plans.

WORKSHOP SPEAKERS AND PARTICIPANTS AND THEIR AFFILIATION

Mike Bishaw	Speaker	Consultant Planner
Ross Doubikin	Participant	Water Authority, Harvey
Ron Golding	Participant	Waroona Shire Clerk
Percy Hainge	Participant	Waroona resident
Mrs Hainge	Participant	Waroona resident
Jim Houlahan	Speaker	Harvey resident
Peter Henderson	Speaker	CALM, Harvey District Manager
Jim Iseppi	Participant	Waroona Shire Councillor
Beryl Jones	Participant	M.L.C.
Keith Lynch	Participant	Water Authority, Mandurah District Engineer
Charles Lockwood	Participant	Harvey Shire Engineer
Peter Murray	Participant	Mandurah S.W.D.A.
Murray Robinson	Participant	Waroona Shire Ranger
Mike Stoner	Participant	Consultant Landscape Architect
Don Spriggins	Participant	CALM Central Forest Region, Regional Manager
Alan Snow	Speaker	Harvey Shire Ranger
Bert Scott	Participant	Water Authority, Waroona
Dane Smith	Speaker	Marine and Harbours, Mandurah
Margaret Hewton	Speaker	Forest Edge Recreation Camp
Wally Tweedie	Participant	Waroona Shire Health and Building Inspector
Alan Taylor	Participant	Harvey Shire Councillor
John Whitehouse	Speaker	Waroona Shire President
Jim Williamson	Chairman	CALM, Manager Planning Branch
Frank Wood	Participant	Waroona farmer
Ian Wood	Speaker	Water Authority, Environmental Officer

WORKSHOP PROGRAMME

TIME	TOPIC AND SPEAKER	
0900 - 0910	Registration	
0910 - 0925	Introduction	Jim Williamson, Manager Planning Branch, CALM
0925 - 0940	WAWA	Ian Wood, Environmental Officer, WAWA
0940 - 0950	Water Skiing Logue Brook	Jim Houlahan, Harvey
0950 - 1000	Questions	
1000 - 1030	Morning Tea	
1030 - 1040	Marine & Harbours	Dane Smith, Marine Inspector Mandurah
1040 - 1050	Waroona Shire	John Whitehouse, President Shire of Waroona
1050 - 1100	A Ranger's View	Alan Snow, Harvey Shire
1100 - 1110	CALM	Peter Henderson, District Manager, CALM, Harvey
1110 - 1120	Fishing	Mike Bishaw, Consultant, for Andrew Fink, President WA Trout and Fresh Water Angling Association
1120 - 1130	Tourist Development	Margaret Hewton, Forest Edge Recreation Camp, Waroona
1130 -1200	Questions	
1200 - 1300	Lunch	
1300 - 1345	Workshop Session 1	
1345 - 1515	Workshop Session 2	
1515 - 1530	Afternoon Tea	
1530 - 1635	Workshop Session 3	
1635 - 1700	Review and Chairperson's Summary	

ISSUES RAISED BY ALL PARTICIPANTS DURING THE WORKSHOP

Access road
Administration
Aquatic sports
Bauxite mining
Bibulmun track
Boat launching facilities
Bushfires
Camping facilities
Camping regulations
Caravan Park upgrading
Carrying capacity
Conflict resolution
Caravan Park relocation
Co-operation between managers
Day use areas
Dieback
Drug cultivation
Education
Erosion
Extra policing
Fees
Firewood
Fish stocking
Fishing
Fishing methods
Funding
Gold mining
Historical signposting
Improved signs
Information
Irrigation
Logging control and cleanup
Long-term water supplies
Maintenance responsiblities
Marroning
Mining
Off-road vehicles
Ongoing management
Pay increase for rangers
Penalty levels
Picnic areas
Pigs
Policing at night
Pollution
Private land
Promotion of area for tourism
Public awareness
Public conveniences
Public health
Public sector involvement
Public water supply
Revegetation of cleared areas
Revenue
Rotational use
Rubbish disposal
Scenic drives
Shire involvement
Single use on each dam
Ski club formation
Special recreation areas
Tourism
Track closures
Water bird habitat
Water quality
Water safety
Wildlife conservation
Zoning