

Big Brook Dam Recreation Plan



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WATER RESOURCES DIRECTORATE
Environmental Management Section

Big Brook Dam Recreation Plan

**An issue plan for management of recreation
at Big Brook Dam jointly prepared by the
Water Authority of Western Australia and the
Department of Conservation and Land Management**

Water Authority of Western Australia

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A view of Big Brook Dam looking in a north-easterly direction. The photograph was taken in June 1988 soon after the spillway overtopped. The main day use area can be seen in the background.

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1. INTRODUCTION

1.1 Background and purpose of the issue plan

This report outlines management strategies for the Big Brook Dam and Reservoir areas and fulfills the recommendations of the Environmental Protection Authority's (EPA) assessment report. The intended duration of this issue plan is ten years; however, the need for revisions will be considered after five years. In the EPA's report (October 1985) three main recommendations were made with respect to acceptance of the dam construction on environmental grounds. These are:

(i) With respect to the reservoir environment:

'The EPA recommends that the Water Authority of WA, in conjunction with the Department of Fisheries and Department of Conservation and Land Management, establish a monitoring programme to determine the effect of the proposed dam on migratory species of aquatic fauna and the effectiveness of remedial measures proposed in the PER¹. The results of the monitoring programme should be provided on

a regular basis to appropriate government departments.'

(ii) With respect to the downstream environment:

'The EPA recommends that consideration be given by the Water Authority to the construction of a fish trap immediately below the existing Pemberton Weir.'

(iii) With respect to recreation:

'The EPA recommends that a management plan be prepared by the Water Authority of WA, with the assistance of and local groups, which would ensure that recreation activities on and adjacent to the proposed dam are facilitated in appropriate ways and at appropriate places.' [sic]

This report is chiefly comprised of four sections. Section 2 provides a brief description of the Big Brook Dam and the surrounding area. Details on the environmental and recreational management of the site are contained in section 3. Sections 4 and 5 describe, respectively, the maintenance and monitoring that will or has been undertaken. Historical details of the water supply system and trout hatchery in the Pemberton area are contained in Appendix A. Dam statistics are listed in Appendix B.

1 Public Environmental Report (Public Works Department, May 1985)

2. DESCRIPTION OF DAM AND ENVIRONS

2.1 Location and purpose of the dam

The Big Brook Dam (see frontispiece) was constructed to enable an unrestricted water supply to the trout hatchery and to supplement the town water supply. The dam is located (see Figure 1) approximately 250 km south of Perth, Western Australia, and 6.4 km north of Pemberton on the Big Brook, a tributary of the Lefroy Brook. The Big Brook Arboretum is situated 3.7 km west of the Big Brook Dam. The dam, which was built in 1986, is 7 metres high and creates a reservoir (see Figure 3) with an effective storage of 630 000 m³. Reservoir volume and surface area versus depth curves are shown in Figure 2. Other dam statistics may be found in Appendix B. For most of the year the Big Brook Dam has little effect on the streamflow to the Lefroy Weir (also known as the Pemberton Weir) as the dam overflows during the winter months. During the summer and autumn months, water is released from the dam to supplement the flow into the Lefroy Brook and the Lefroy Weir.

The dam has a floating offtake that can be raised or lowered to allow the selection of water with optimum quality, particularly since the oxygen levels and the temperature of the water can vary considerably with depth. This facility is necessary as a water temperature above 21°C and an oxygen deficiency can increase the incidence of trout loss through disease.

A fish trap has been incorporated into the downstream face of the dam to catch brown and rainbow trout moving upstream to spawn. The trapped trout are then egg-stripped and released by Fisheries Department officers.

2.2 Land Tenure

Big Brook State Forest (Figure 1) has security of tenure equivalent to 'A' class and is vested in the Lands and Forests Commission. A 'C' class reserve vested in the Pemberton/Northcliffe Tourist Bureau adjoins Big Brook Forest on the western edge of Pemberton townsite. The area to the south of the reservoir, bounded by The Arboretum, the Rainbow Trail, and the dam (see Figure

1), will be managed with a priority for scientific study and education.

The Department of Conservation and Land Management (Southern Forest Region) Regional Management Plan (December 1987) shows that the proposed land use management priority allocated to the majority of Big Brook State Forest is water production with compatible secondary uses for wood production and recreation. (Also see the Southern Forest Draft Management Plan April 1987 and supporting papers.)

2.3 Catchment and land-use

Big Brook is a short fourth order stream, formed by the confluence of Four Mile Brook and Five Mile Brook. It is a tributary of Lefroy Brook and has a catchment area of 115 km² (see Figure 1).

The main land uses in the Big Brook Catchment are agriculture and forestry. Approximately 20% of the catchment is cleared land which supports varied uses ranging from dairying to orcharding, with the dominant agricultural use being pasture for grazing and hay production.

2.4 State Forest

The Big Brook Dam is located within the Big Brook State Forest which was harvested by the clearfell method during the late 1920s and regenerated in the early 1930s. Logging during this period was carried out by axe and hand saws with the logs transported to the mills by steam locomotive. Some of the old stumps display the notches used for the axemen's planking and many of the current roads follow old railway formations. Big Brook Arboretum, which was started in 1929 was planted to assess the potential of exotic tree species. Rainbow Trail was converted to a scenic drive in 1969/70 by the Forests Department, as was Tramway Trail in 1971/72. The Arboretum has, for some time, been a popular recreation site for tourists and local residents. In addition, the Big Brook State Forest is a valuable 'demonstration forest' illustrating the success of karri regrowth forests and multiple use management principles (see 'Big Brook Karri Forest—Forestry in Action', Forests Department of W.A., 1984.)

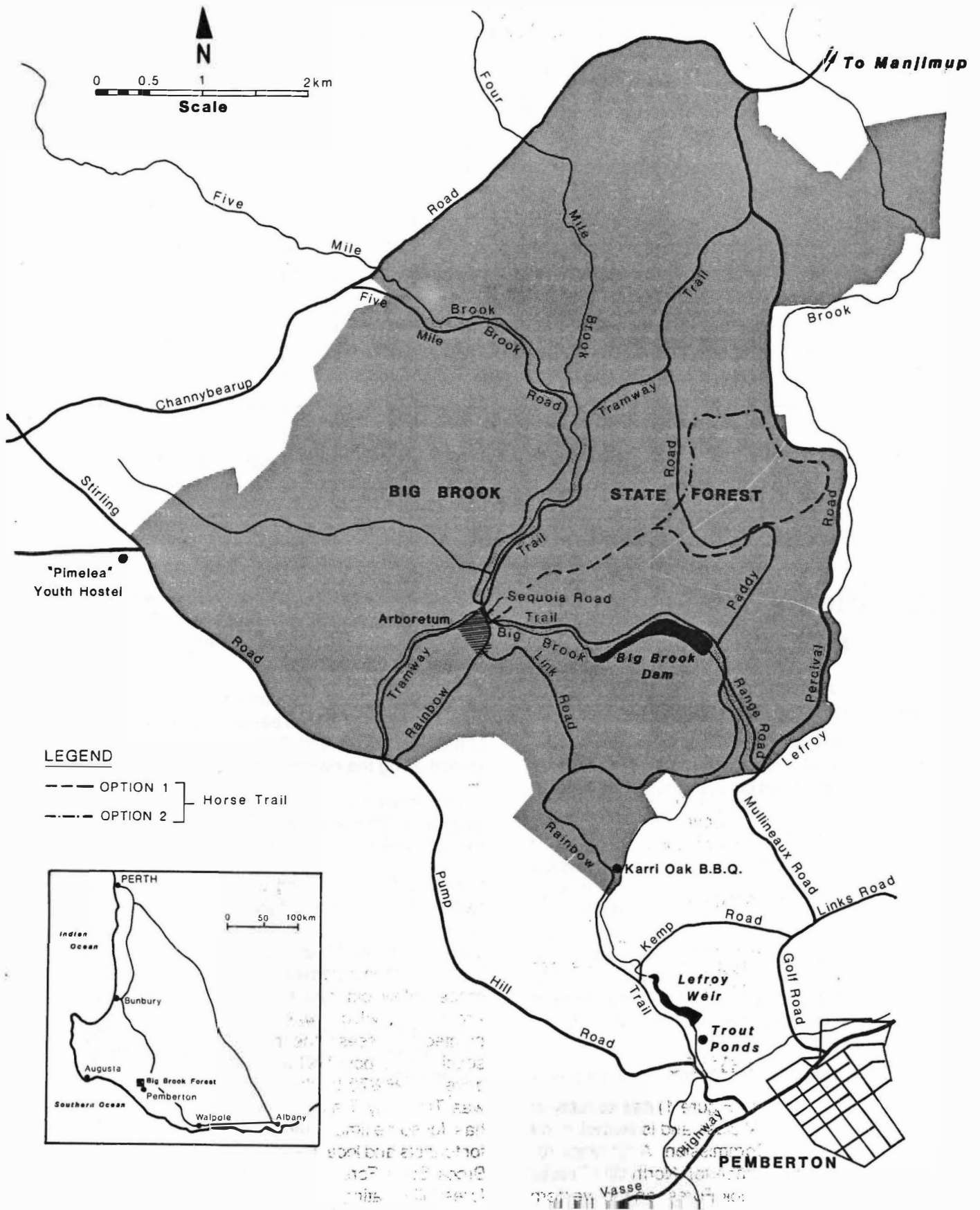


Figure 1: Locality plan

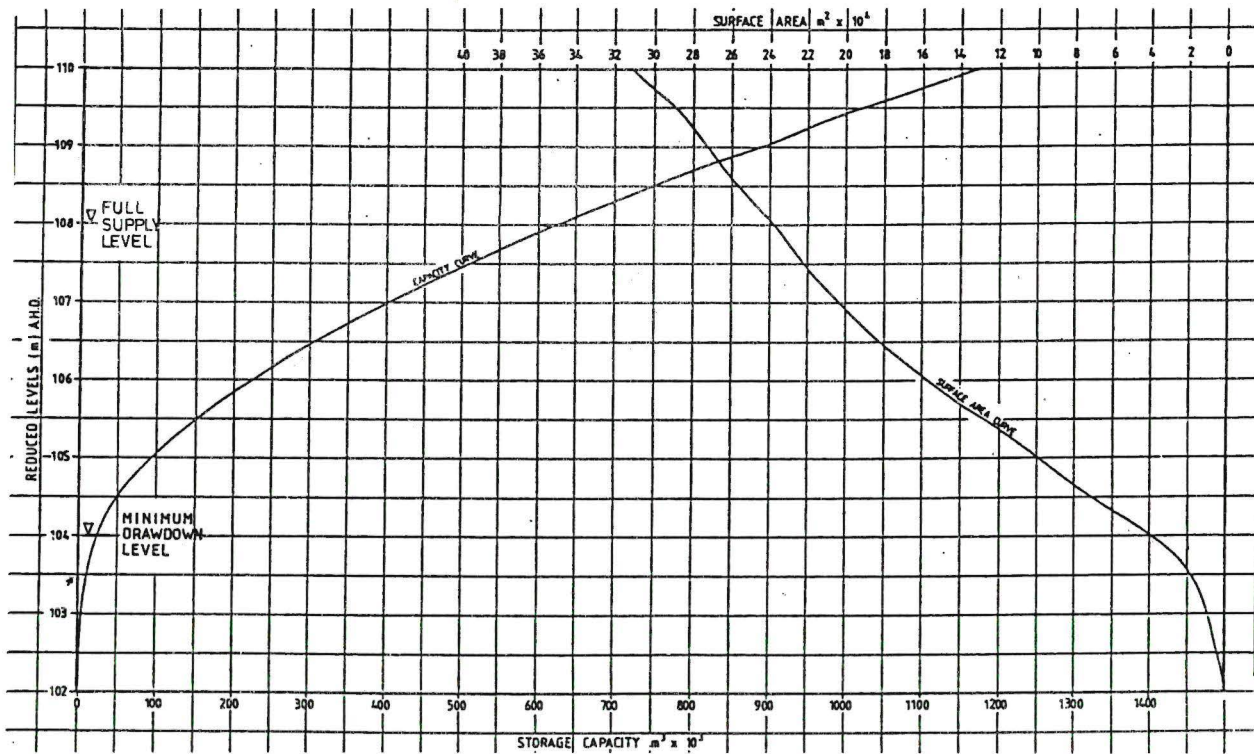


Figure 2: Capacity and surface area curves.

2.5 Biophysical environment

The Big Brook catchment forms part of the southern extremity of the Darling Plateau.

The soils are generally yellow podzolics on the upper slopes with brownish red loams or sandy loams overlying a red clay subsoil below. Associated soils are sandy colluvium in gullies and alluvium along major streams.

The dominant vegetation is karri (*Eucalyptus diversicolor*) with the typical understorey of karri oak (*Allocasuarina decussata*), karri wattle (*Acacia pentadenia*), and karri hazel (*Trymalium spatulatum*). Much of the forest is regrowth following clearfelling in the 1930s. There are small areas where logging was not carried out and some of these areas can still be seen on the south-western side of the dam.

Within the riverine landscape the dominant tree is

Warren River cedar (*Agonis juniperina*), with peppermint (*A. flexuosa*), paperbark (*Melaleuca microphylla*) and associated swamp vegetation forming the understorey.

The Arboretum has numerous tree species from other countries and from eastern Australia. Some of the *Acacia* spp. and *Pinus* spp. wildlings have spread along the riverine landscape.

Weeds have also infested the area, particularly blackberry (*Rubus fruticosus*) and bidgie widgee (*Acaena nova-zealandia*).

Following detailed observation during the preparation of the PER, no rare or endangered species were located on the site. There was some uncertainty regarding the distribution of the flowering plant *Hydrocotyle hirta* but this plant is now considered to be widespread throughout the karri forest.

A more detailed biophysical description of the Big Brook area is contained in the PER (Public Works Department, 1985).

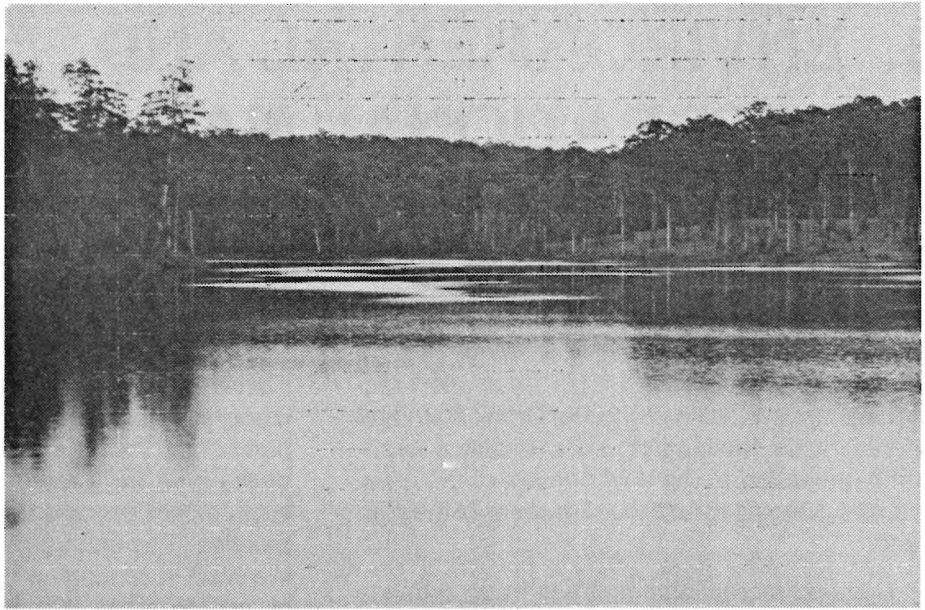


Figure 3: A view of Big Brook Reservoir looking west from the Dam wall.



Figure 4: Native fish monitoring in Big Brook.

3. ENVIRONMENTAL AND RECREATIONAL MANAGEMENT

3.1 Objectives of management

The primary aim of this issue plan is to allow recreational opportunities at the Big Brook Dam and reservoir while maintaining water quality and ensuring protection to the environment of the area. Overall strategies to fulfill the objectives of the plan are to:

- (1) Develop recreational facilities in accordance with the master plan.
- (2) Establish a monitoring and maintenance programme to ensure appropriate protection of the environment in the area.
- (3) Develop appropriate recreation facilities that are accessible to all people and allow a level of use which does not impair the water quality.
- (4) Integrate the development with other facilities in the Pemberton area.

In addition, educational and interpretative (e.g. birdwatching) opportunities will be encouraged.

3.2 Management responsibilities

There are a number of authorities which have responsibilities for different aspects of the management of the Big Brook Dam area. The success of the area as a recreation asset depends to a large extent on co-operation between these authorities. The main organisations and authorities involved in managing the area are listed in the preceding table together with their respective responsibilities.

3.3 Master plan (by CALM)

A master plan, which has been prepared in accordance with the requirements of the Shire of Manjimup, the Department of Conservation and Land Management, the Environmental Protection Authority and the Water Authority, details the ultimate development proposed in the area. The plan shows access to the site and the location of facilities and major focal points (see Figure 5—inside back cover).

Management responsibilities	
Organisation	Responsibility
Conservation and Land Management (CALM)	Management of State Forest including the recreation area surrounding the Big Brook Reservoir.
Water Authority of W.A.	Management of the Big Brook Dam and Reservoir. Monitoring of the water quality and reservoir levels.
Fisheries Department	Management of trout and marron stocks in the Big Brook Reservoir. Monitoring of the fish trap and the monitoring of trout and marron stocks in the Big Brook Reservoir.
Shire of Manjimup	Management of Shire access to the area and co-ordination of the various local interest groups.
Pemberton Tourist Bureau	Dissemination of information relating to the recreational and environmental attractions in the Big Brook area.

3.3.1 Vehicle access

Vehicle access to the dam will be (see Figure 1)

- one way from Pemberton along Rainbow Trail; an approximate distance of 6.4 km
- two way from Pemberton via Golf Links Road, Mullineaux Road, Percival Road and Range Road; approximately 4.5 km
- two way from Manjimup via Paddy Road, off Tramway Trail
- one way from the The Arboretum via Link Road and Rainbow Trail

The re-aligned Rainbow Trail to the north-east of the dam will be two way from the dam wall to Casuarina Corner. Beyond Casuarina Corner,

Rainbow Trail extends 'one way' from to The Arboretum and onto Stirling Road. This arrangement allows flexibility of vehicle movement around the major recreation sites and permits visitors to return to Pemberton or Manjimup via the above mentioned routes. A loop road, namely Link Road, has been built from The Arboretum so that visitors may reach the dam from The Arboretum. Minor tracks leading onto Rainbow Trail will be signposted accordingly, with disused tracks being ripped and revegetated. Log bollards will be erected along Rainbow Trail from the dam to the northern end of the parkland area near Casuarina Corner to prevent vehicular access between the road and the reservoir.

Two gates have been built to allow Water Authority and Fisheries Department vehicles access to the gauging station and the fish trap. Other than for management purposes and emergencies, no vehicular access will be allowed on the old Rainbow Trail on the southern side of the reservoir.

Access to The Arboretum will be via two routes. Visitors may reach The Arboretum using Rainbow Trail via the dam or from Sequoia Road via Tramway Trail.

Funds permitting, it is likely that Rainbow Trail from the dam wall to the Arboretum will be upgraded to facilitate two way access by 1990. A proposed realignment of this route adjacent to Casuarina Corner is shown on the master plan (Figure 5). This option will necessitate widening Range Road but will retain the character of Rainbow Trail between Pemberton and the dam.

3.3.2 Car parks

Seven areas (see Figure 5) have been allocated for parking around the dam with one located at The Arboretum. The capacity of these ranges from 3 to 70 vehicles. Totem signs will give adequate warning of all parking areas. The details of these car parks (in increasing distance from the dam heading in a north-westerly direction) are as follows:

A six bay parking area (site A, Figure 5) has been constructed below the dam wall on Range Road to cater for those users who wish to peruse the dam wall or walk around the western side of the dam.

A parking area (site B, Figure 5) for 7 cars and 2 buses has been built on a loop-off Rainbow Trail approximately 200 m north-east of the dam wall. This is to cater for the short stop visitors who want to overview the dam wall and immediate area without leaving their vehicles. An information board will be built at this site. Once sufficient

screening has grown, the buses will park in a parallel carpark on Rainbow Trail instead of using the loop carpark. Users who know the area may bypass the loop. This site will be used as an unloading point for canoes and sailboards.

A car parking area (site C, Figure 5) with a capacity for approximately 65 cars and 5 buses has been constructed at the main day-use picnic area. If required in the future this area may be extended to accommodate in excess of 80 cars. Stands of karri oak (*Allocasuarina decussata*) screen the car park from the picnic facilities.

A roadside pull-over bay suitable for 3 cars will be built (1989/90) at an elevated vantage point (site D, Figure 5) with views to the dam wall and the western arm of the reservoir.

A 10-15 bay car park will be constructed (possibly 1989/90) at the secondary picnic area (site E, Figure 5) known as Casuarina Corner. This car park will, in the short-term, double as a turn around point for visitors wishing to return along the two way section of Rainbow Trail to the main day-use area.

A roadside pull-over bay suitable for 4 cars will be built (1989/90) on Rainbow Trail (site F, Figure 5) in the forested area at the northern end of the dam. This car park will service a short walk trail to a lookout.

A 10-12 bay parking area (site G, Figure 5) will be constructed (possibly 1990/91) at the headwater of the reservoir at a site known as Island Bend. Earth mounds will be used to screen the vehicles from activity areas.

Parking capacity at The Arboretum picnic area will be for 2 buses and 12 cars.

3.3.3 Walk trails and the Bibbulmun Track

A system of walk trails will link the dam and The Arboretum. The grades in these trails will be suitable for access by disabled persons. Surface treatment will be upgraded, with the aim of sealing the main loop by 1990, to allow easy access along the trails by wheel chairs. As seen on the master plan (Figure 5), the walk trail will circumnavigate the reservoir with much of the trail on the southern side following the original alignment of the Rainbow Trail. Wherever possible, pedestrian access and vehicular access have been separated. Pedestrians will only need to cross Rainbow Trail once, near The Arboretum. Bollards will be erected along the walk trail to restrict any unauthorised use of the area by vehicles.

A small footbridge will be built at the headwaters of the reservoir in accordance with the requirements for all purpose pedestrian access. Pedestrian movement at the dam wall will be monitored and modifications to trails made if necessary.

Seating will be provided at selected vantage points along the walk trails at intervals of not more than 500 m. Three sheltered seating arrangements will also be constructed along the trail.

The Bibbulmun Track will be realigned to pass through the Big Brook Dam recreation area and The Arboretum.

3.3.4 Activity areas

At the dam, the facilities range from a large group use area to a small informal picnic site. The sites for the three picnic areas have been selected to take advantage of various features and so that each is visually independent of the other. The area between the dam and the Rainbow Trail extending from the dam wall to Casuarina Corner has generally been cleared of all understorey vegetation to create a parkland setting.

In addition to the proposed activity areas, a further site (Site H, Figure 5) has been allocated for any future development of day-use facilities.

In more detail, the activity sites are:

MAIN DAY USE-AREA

To cater for the majority of users and particularly larger groups, the major day-use area (Site I, Figure 5) has been designed to incorporate approximately 3.5 ha. The large car park sited some 60-90 m to the east will service this site.

Facilities provided to accommodate the range of users anticipated will include a large toilet block, a sheltered barbecue area, 15 picnic tables, 8 barbecues (2 round campfire type and 6 standard), a sandy beach area and possibly some simple bush style play structures. Picnic facilities will not be located close to areas with large surface run-offs nor within 30 m of the reservoir when it is at its full supply level. Additional planting of karri oak (*Allocasuarina decussata*) will be undertaken within areas subject to large surface run-offs and to provide screening.

A small structure will be erected within this facility area to house the plaque commemorating the opening of the Big Brook Dam.

CASUARINA CORNER

Facilities at this site (Site J, Figure 5) have been designed and located to cater for families and

small groups. It is not intended that large groups such as coach tours will use this area.

The intention is to construct a toilet block at this site by 1990 but this will be determined by recreational use patterns in the vicinity. Facilities are likely to include 8 picnic tables, 6 barbecues, a sheltered barbecue and informal log seating. This picnic area will be linked to the walk trail by a path extending from the car park.

ISLAND BEND

A small informal picnic area will be developed at this site (Site K, Figure 5). It will be the last of the three picnic sites at the dam to be built. Facilities will cater for picnics only. No barbecues will be provided but a small shelter will be constructed. It is anticipated that visitors seeking privacy will use this site. In addition, fishermen are likely to use this area as it provides parking close to the walk trail on the western bank. Due to the regular sighting of various species of water fowl in this section of the dam, it is likely that bird observers will also favour this site.

DAM WALL

No facilities will be located at the dam wall with the exception of the walk trail. The land around the spillway and the bridge below the dam has been graded to complement the structure (see frontispiece). To improve the visual amenity of the area, plantings of karri have been undertaken to rehabilitate a borrow pit. Some additional planting of riverine species will be undertaken to improve the appearance of the cleared area with other plantings being used to provide screenings and to control vehicular access.

A large log displaying features from earlier logging techniques is currently located at the dam wall. The final siting for this feature is yet to be decided, however, it is likely to be placed on the northern side of the main day use area. Offers of period machinery to complement this log have been made by a neighbour and this may be incorporated into a display featuring a steam hauler and cable log snagging.

THE ARBORETUM

The Arboretum is to be developed as a major day-use area. A number of walk trails with information boards will be constructed in the plantation. Other facilities will include a toilet block, a sheltered barbecue and picnic tables.

OTHER FEATURES

Two informal lookouts (Sites L and M, Figure 5) will be built adjacent to Rainbow Trail. One will

afford extensive views from the parking area (site D) while the other will link with a short walk to an elevated vantage point. This trail will not necessarily be accessible by disabled persons as the landform is steep (greater than 1:7).

A small amphitheatre (see Figure 5) will be built (possibly 1991/92) between Casuarina Corner and the main day-use area. This will be used by school groups, forest tours and for specific education/information programmes. It is believed that the amphitheatre will have regular use as there is no such facility in the Region at present.

3.3.5 Toilet blocks

Within 5–7 years, depending on the user requirements, it is anticipated that four toilet blocks will be constructed within the area. The facility at the main day-use area has been completed. The capacity of the toilet blocks yet to be built will vary, depending on the site. These will be located at the major activity areas including The Arboretum.

Specifications for the construction of the outflow control will be in accordance with the Water Authority and Manjimup Shire Health Regulations.

3.3.6 Water based recreation and fishing

Swimming, canoeing, sailboarding and fishing from boats or shoreline are allowed on the reservoir, however, power craft are not permitted. In order to limit hydrocarbons such as petrol and oil entering the reservoir, no provision has been made for a boat ramp. Visitors will need to carry their craft from either of the car parks, a distance of up to 120 m.

A beach (see Figure 5), approximately 50 metres long by about 20 metres wide, will be located at the major day-use area.

FISHING

All fishing activities are managed by the Fisheries Department. Fishing will be restricted by closed seasons encompassing the trout and marron spawning season. Fishing seasons will be displayed on signs on each major road approach to the dam.

Marron

To maintain water quality, marron fishing is to be confined to the use of 'dry-bait' such as pelleted stock feeds (e.g. chicken pellets). Neither offal nor boats are to be used for marroning.

Trout

Fishing for trout is restricted to the use of artificial lures (e.g. 'spinners' and artificial flies). Fishing from unpowered boats is permitted. Stocks of Rainbow Trout will be maintained by the Fisheries Department by stocking from the Pemberton Fish Hatchery.

3.3.7 Horse riding and pets

Horse riding is permitted in the majority of State Forest. However, it will not be promoted in the recreation zone around Big Brook Dam. A marked horse trail linking Diamond Tree to The Arboretum is being established (see Figure 1). The trail will not enter the parkland recreation area around the dam but there will be loading facilities and possibly holding yards on the northern side of The Arboretum.

Pets will be allowed in most of the catchment area but will not be permitted in the reservoir. Dogs within the facility areas must be on a leash.

3.3.8 Camping

Camping will be prohibited within the immediate dam area. It is envisaged, subject to water quality, that some camping will be facilitated by 1991/92 at The Arboretum once appropriate facilities have been developed. It is likely that the camping areas will complement the horse trail and yard facilities.

3.3.9 Information

Information boards and brochures will be prepared to ensure that users of the site have sufficient knowledge to make maximum use of the area. A location map/plan will be erected at the car park near the dam, at The Arboretum and at the start of Rainbow Trail. It is anticipated that small information boards will be located within The Arboretum and along the trails providing details on points of interest. A brochure is currently being prepared for the area.

4. MAINTENANCE

4.1 Parkland area

The 16–17 ha open parkland area extending from the dam to Casuarina Corner and bounded by the Rainbow trail and the eastern shore of the reservoir has had pasture grasses sown to further enhance the desired character. It is anticipated that slashing will be required 4–5 times per year. More intensive maintenance may be required in the vicinity of the major picnic area. This is likely to include additional mowing and fertiliser applications. Consideration will be given to occasional irrigation of this main picnic area in the high use period, however, this will depend on available funding.

4.2 Tree planting

Tree planting will be carried out to enhance views, provide screening and to direct vehicular movement.

As far as practicable, tree species in the dam area will be endemic to the forest and be planted in harmony with the existing plant associations. In The Arboretum, various species will be selected to supplement existing stands or to provide additional variation. Existing tree stands within The Arboretum will be treated in accordance with accepted silvicultural practices to enhance stand appearance and to demonstrate growth potential.

4.3 Noxious weeds and pests

There are a number of plants which are either declared noxious weeds or are pests. These include blackberry (*Rubus fruticosus*), bidgee widgee (*Acaena nova-zealandia*), pine wildlings (*Pinus radiata*), and black wattle wildlings (*Acacia melanoxylon*).

It is intended to eradicate the blackberry and the bidgee widgee from the area. This work will be undertaken by the Agriculture Protection Board (APB) in conjunction with CALM and in consultation with the Water Authority and the Fisheries Department.

Wildlings of pine and exotic wattles will be restricted to vegetated areas which have been substantially modified such as The Arboretum. In

other areas wildlings will be removed as funds become available.

4.4 Fire

The main forest area surrounding the dam and The Arboretum will be burnt on a five to seven year rotation in accordance with existing fire control measures adopted in this category of State Forest.

The forested area bordered by Tramway Trail, Rainbow Trail and Stirling Road; the cleared parkland area; and the Warren River cedar stands between the dam and The Arboretum will not be programmed for burning. A strip of land approximately 20 m wide on the eastern side of Rainbow Trail from the dam wall to Casuarina Corner will be cleared of large fallen logs and debris to reduce maintenance and management associated with future prescribed burning activities.

4.5 Erosion control and rehabilitation

Particular attention will be given to recreational use patterns in the area to ensure that erosion of banks, walk trails, roads and picnic facilities does not occur to the level where water quality is reduced.

Outflow areas from culverts will be planted with karri oaks (*Allocasuarina decussata*) to assist in soil binding and to slow surface water flows. Similar treatments will be undertaken in the major surface water run-off areas.

Banks, batters, disused roads, borrow areas and gravel pits will be rehabilitated. Some banks around the dam are likely to slump into the dam. If slumping does occur the bank will be revegetated in accordance with Water Authority requirements.

4.6 Timber harvest

Future harvesting of the Big Brook State Forest will include the thinning of the existing karri regrowth followed by the clearfelling of the mature crop at an approximate age of 100 years. All future harvesting operations will be signposted and access to some minor roads may be restricted to ensure visitor safety.

To maintain the visual amenity of the reservoir area, no harvesting activities will take place within 200 m of Rainbow Trail, and clearfelling operations will be restricted to an area outside a ridgeline buffer extending eastwards from the dam. The area to the south-west of the dam was

set aside as an example of unthinned karri regrowth and will therefore not be harvested in the future. Roadside buffers on other access roads will be managed to maintain the visual quality of such roads.

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5. MONITORING

5.1 Hydrologic

The Water Authority monitors the water level in the Big Brook reservoir on a continuous basis. Water releases and overflows are also monitored at the Rainbow Trail gauging station. The minimum level to which the reservoir will be drawn down to is 104 m AHD. This level is 2 m above the reservoir bed and represents 4% of the full supply volume.

5.2 Water quality

Dissolved oxygen and temperature at various depths in the Big Brook Reservoir are monitored twice a year between February and May. This programme ensures that water of optimum quality is released into the Lefroy Weir.

The minimum drawdown level set for the reservoir will limit water quality problems relating to warming of the water and pollutant dilution. Should the levels in Big Brook Reservoir fall to or near the minimum supply level, bacteriological analysis of the water will be performed and swimming and recreation in the reservoir will be suspended.

The quality of the town water supply is protected in several ways. The dissolved oxygen content of the water is raised as the water released from Big Brook Reservoir travels along Big Brook to the Lefroy Weir. The water in Lefroy Weir dilutes any incoming pollutants and provides a residence time in which most harmful organisms will die. Full water treatment consisting of coagulation, filtration and chlorination plus bacteriological analysis of the water is carried out prior to distribution to the town water supply.

5.3 Aquatic fauna

5.3.1 Native fish

In May 1987, a study by Murdoch University commenced on the effect of the Big Brook Dam on the migration of native fish. In all there were fifteen sampling sites chosen along Lefroy Brook and Big Brook and their feeder streams. Seven sampling runs (see Figure 4) were conducted, these being mainly in winter and spring when pre-spawning migrations are undertaken by several species of fish.

Eight different species were captured during the study, these being the western minnow (*Galaxias Occidentalis*), mud minnow (*Galaxiella munda*), nightfish (*Bostokia Porosa*), western pygmy perch (*Edelia vittata*), rainbow and brown trout (*Salmo gairdneri* and *Salmo trutta*), redfin perch (*Perca fluviatilis*) and pouched lamprey (*Geotria australis*). For all of the native fishes, numbers were usually greatest in spring but these mainly consisted of young fish under 30 mm in length.

Several of the native species were restricted in their distribution. Mud minnows were largely limited to the area above Big Brook Dam due to this being a suitable habitat. Nightfish were effectively present at all sites except for the Big Brook Reservoir. Large numbers of small (ie less than 30 mm) western pygmy perch were found in the upper reaches of the Big Brook Reservoir during November. Apparently the young perch are swept downstream following spawning and congregate in the upper reaches of the Big Brook Reservoir. Since trout numbers also build up below the dam during November, there is a possibility that the trout may prey on the western pygmy perch. The western minnow was only found below Lefroy Weir despite there being ideal sites above Lefroy Weir. This may be a result of predation by trout in the past.

The pouched lamprey breed in freshwater but feed predominantly at sea. The larval stage spends approximately 3 to 4 years in the soft substrates of freshwater streams before metamorphosis. In general, only areas upstream of Big Brook Dam are suitable for colonisation by larval lampreys. The study indicated that migrating adult lampreys have not been able to negotiate the Big Brook Dam and thus spawn in the upper reaches. This was attributed to the lampreys not being able to get past the expansion joints in the dam wall.

Since the Big Brook Dam regularly overtops during July and August there should be little problem for the recently metamorphosed lampreys in reaching the ocean.

5.3.2 Trout and marron

The Fisheries Department regularly monitors the fish trap and trout and marron stocks in the Big Brook Reservoir. This monitoring has shown that very few trout are attracted to the fish trap because of the approaches. Trout are having some

difficulty in jumping into the pool adjacent to the trout trap at low flows because of a concrete lip running across the brook between the downstream sidewalls.

5.3.3 Management strategy

The expansion joints in Big Brook Dam will be filled in to allow the pouched lamprey to negotiate the dam wall. Since the lampreys usually move at night, rocks will be cemented into the pool at the base of the dam to allow the lampreys to rest during the day.

Native fish species will be monitored in the future and should a species be eradicated upstream of the Big Brook Dam, artificial recolonisation will be considered.

To correct the approaches to the fish trap, a cut will be made in the lip of the concrete apron near the trap. Below this cut a pool will be created by concreting in a few small boulders. To further attract the trout once runoff is initiated, water will be released from an 200 mm valve in addition to the 100 mm valve currently being used. The increased efficiency of the trout trap should result in decreased numbers of trout immediately below the dam wall which in turn will lessen the risk of trout preying on native species.

The Water Authority has some control of water released upstream of Big Brook Dam. This water

will be managed so that it duplicates flows in a 'standard' year as closely as possible.

5.4 Reporting

The results from the aquatic fauna monitoring programme will be provided to the Fisheries Department and the Environmental Protection Authority on a regular basis.

REFERENCES

- PUBLIC WORKS DEPARTMENT, (1985), *Pemberton Trout Hatchery Water Supply—Big Brook Dam*. Public Environmental Report.
- DEPARTMENT OF CONSERVATION AND ENVIRONMENT, (1985), *Big Brook Dam—Pemberton. Report and Recommendations of the Environmental Protection Authority*.
- DEPARTMENT OF CONSERVATION AND LAND MANAGEMENT, (1987), *Southern Forest Region Draft Management Plan and Supporting Papers*.
- DEPARTMENT OF CONSERVATION AND LAND MANAGEMENT, (1987), *Regional Management Plan 1987–1997, Southern Forest Region*.
- FOREST DEPARTMENT OF WESTERN AUSTRALIA, (1984), *Big Brook Karri Forest. Forestry in Action*.

APPENDIX A—HISTORICAL DETAILS

Public Water Supply

The Lefroy Weir (also known as the Pemberton Weir) was constructed on Lefroy Brook in 1947/48 to supply water to the town of Pemberton. The Lefroy Weir generally overtops for all but the summer months, and Pemberton Town Water Supply is taken from 'run of the river' for most of the year. It is fully treated at the associated treatment works prior to distribution. The weir has a usable storage of 66 000 cubic metres and that storage is only required to meet summer demands when river flows are inadequate. Sand-bagging has been used in the last 10–15 years to improve supply security by increasing storage to approximately 89 000 cubic metres. This is not a completely reliable method due to the activities of vandals and the need to place the sandbags when the weir has practically ceased to flow. In addition, the removal of sandbags by vandals or by overtopping is a danger to children frequenting pools downstream of the weir, and warning signs have been erected.

A review of the water supply demand in the area was carried out in 1984 and concluded that the existing weir was inadequate for the town water supply. The report also concluded that at times there would be insufficient water available to guarantee a reserve supply for the town and in these instances restrictions on the supply of water to the Trout Hatchery would be imposed. To enable an unrestricted water supply to the hatchery, a dam on Big Brook was constructed in 1986.

Pemberton Trout Hatchery

The Pemberton Trout Hatchery was established on Lefroy Brook in 1952 by the Pemberton-

Warren Trout Acclimatisation Society. It was taken over by the Department of Fisheries in 1971 and expanded and improved for marron breeding and research.

The Pemberton Trout Hatchery is a major tourist attraction in the Pemberton area with 30 000 paying tourists (\$1.00 per person), plus non-paying school children being guided through in a full viewing year. The revenue from entrance fees is an important part of the Pemberton Tourist Bureau income. The tourist service relies on a full complement of fish stocks in all main outside ponds, and when stocks have been substantially reduced by necessity or mortality, the hatchery has had to close to tourists. This has occurred in 1962, 63, 71, 74, 81 and 82.

The trout hatchery also supplies commercial and private buyers with rainbow trout eggs and fry. There are six licensed trout farmers at present and demand in 1985 was in excess of 500 000 eggs and fry for the spring time.

In addition to commercial applications, the hatchery carries out a widespread annual stocking programme for sport fishing in rivers and dams open to licensed inland fishermen. This stocking of public waters is necessary as river conditions are not very suitable for spawning of trout. In 1984, 488 000 fry and 10 000 yearlings were released into south-west public fishing waters for local and tourist anglers. In the 1983–84 season, approximately 27–300 Inland Fishing Licences were issued at \$6.00 each. The trout hatchery also provides ponds for research assisting commercial marron fishing.

The hatchery takes its water supply through an independent off-take from the Lefroy Weir.

APPENDIX B—DAM STATISTICS

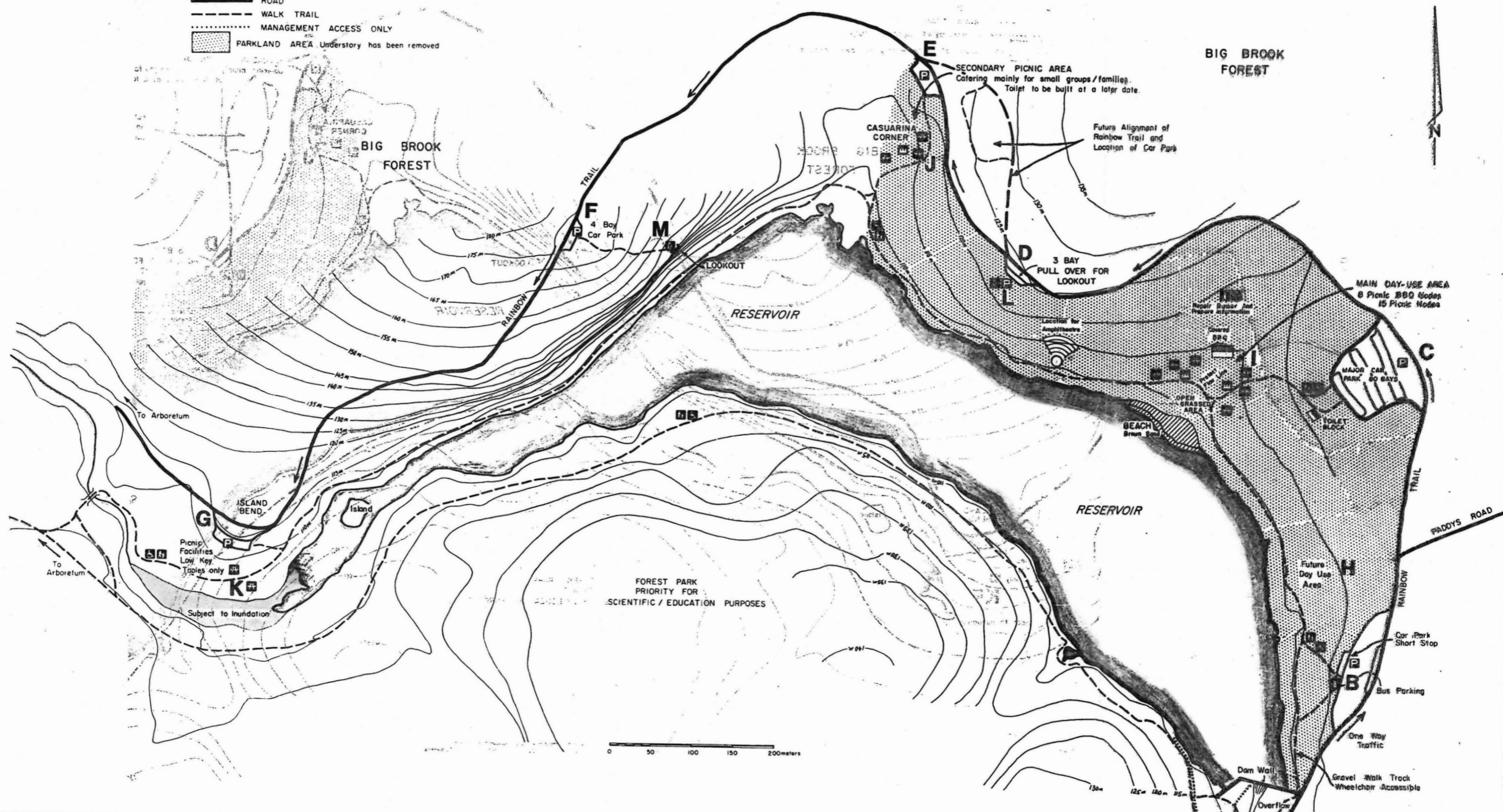
Big Brook Dam

LOCATION	south west
DIVISION	Warren
RIVER BASIN	Manjimup
MAP NAME	2129
MAP No.	1:100 000
SCALE	N 6191850 E 410500
A.M.G. CO-ORDINATES	1986
YEAR OF CONSTRUCTION	Pemberton Trout Hatchery water supply
USE	115 square kilometres
CATCHMENT AREA	24 hectares
RESERVOIR AREA AT FULL SUPPLY LEVEL	Concrete and earth
TYPE OF DAM	8 metres
HEIGHT	12 metres
LENGTH	550 concrete (cubic metres)
VOLUME OF MATERIAL IN DAM	9500 earth (cubic metres)
SPILLWAY DETAILS	Overflow section on dam
TYPE	None
CHUTE	None
SLOPBOARDS	None
CREST SHAPE	Ogee
TERMINAL STRUCTURE	Stilling pool
LENGTH	20.0 metres
DESIGN CAPACITY	139.0 cubic metres per second
MAXIMUM CAPACITY	139.0 cubic metres per second
PERCENTAGE OF MAX. PROBABLE FLOOD	28%
STORAGE IN RESERVOIR	

	A.H.D. R.L.	GAUGE BOARD R.L.	VOLUME (thousand cubic metres)
TOP OF DAM	110.30	110.30	1266.2
SPILLWAY CREST	108.00	108.00	625.2
OUTLET PIPE INVERT	103.10	103.10	0.2
RIVER BED	102.00	102.00	0.0
LOCAL B.M.	C075		
R.L.	123.892		
DATUM	A.H.D.		

LEGEND

- ROAD
- - - WALK TRAIL
- MANAGEMENT ACCESS ONLY
- ▨ PARKLAND AREA Understory has been removed



BIG BROOK DAM RECREATION MASTER PLAN RECREATION MAY 1987

DEPT CONSERVATION & LAND MANAGEMENT
PEMBERTON DISTRICT



NOTES,
SEATING ALONG WALK TRAIL AT INTERVALS OF 500 METRES
COVERED SHELTERS PROVIDED EVERY 1000-1500 METERS

FIGURE 3